

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of a Board of Inquiry appointed under s146 of the Resource Management Act 1991 to consider an application by Mighty River Power Limited for resource consents to construct, operate, and maintain a wind farm at Turitea

REBUTTAL EVIDENCE OF ANDREW WILFRED WATSON

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1. INTRODUCTION

- 1.1 My name is Andrew Wilfred Watson. My qualifications and relevant experience are set out below. I confirm that I have prepared this rebuttal evidence in accordance with the Environment Court Code of Conduct for Expert Witnesses (July 2006).
- 1.2 I am currently Technical Director – Water Supply, with Beca Infrastructure Ltd, which is part of the Beca Group of companies, which provide engineering consultancy and related services to commercial, industrial, local government and other public bodies, and central government clients.
- 1.3 I hold a BE (Civil) degree from the University of Auckland, and a Masters of Engineering Science (Water Engineering) degree from the University of New South Wales. I am a member of a number of professional bodies including the American Water Works Association, Water New Zealand, the Australian Water Association, and the New Zealand Hydrological Society.
- 1.4 I have over 25 years of experience as an engineer, and since 1995 have specialised in water treatment and supply mainly for potable use. Up until 2005 I was a member of the Ministry of Health's Expert Committee on Drinking-Water Quality, and also in a consulting role to the Ministry, providing technical input into the development of the 2000 and 2005 versions of the *Drinking-Water Standards for New Zealand* and the Ministry's other tools to promote safe drinking water.
- 1.5 In the late 1990s, while with my previous employer, I was the project manager and design leader on the design of the \$4 million upgrading of the Turitea Water Treatment Plant (WTP).
- 1.6 I am providing this rebuttal evidence to comment on and respond to some of the primary evidence presented in respect of these applications that relate to potential impacts on the supply of drinking water to the city of Palmerston North. In particular, I will comment on the evidence of Chris Taylor presented on behalf of Palmerston North City Council (PNCC).
- 1.7 Specifically, I shall address the following matters:

- (a) raw water quality and how this could be impacted by the Turitea Wind Farm (Turitea Wind Farm) development;
- (b) the WTP process and how the quality of its treated water could be impacted by the TWF development;
- (c) PNCC's Public Health Risk Management Plan;
- (d) protection of sources of drinking water;
- (e) water quality management from the catchment;
- (f) risks to the public health protection provided by the Turitea WTP.

2. RAW WATER QUALITY

- 2.1 Paragraph 23 (p. 7) of Mr Taylor's evidence states that there is limited data on raw water quality and this is used to justify the Baseline Water Monitoring Programme (BWMP), which started in April 2009. From my involvement in the upgrading of the Turitea WTP in the late 1990s I am aware of historical raw water quality data that I believe will help provide a better understanding of the water quality issues that the upgraded plant was designed to treat for, and provide a preliminary baseline of raw water quality.
- 2.2 On 27 May 2009 I requested a package of information from PNCC to assist in the preparation of my rebuttal evidence. Included in my request was a report, of which I was the lead author, that would have provided a summary of the historical raw water quality. Unfortunately this report could not be located within the timeframe available. From my memory there were a couple of years of turbidity and pH raw water data available, and also data for periodic water column sampling in the upper dam.
- 2.3 I obviously cannot recall the values of the historic raw water turbidity data available at the time of the design of the upgrade, but think that it would have showed that the water was typically of good quality, say 5 to 10 NTU. However, during rainfall events and dam overturning events it could get very elevated, perhaps as high as 50 to 100 NTU. Raw water data for the last 5 years provided by PNCC as part of my 27 May 2009 request shows results that range between 0.6 and 16 NTU. Although this is a reasonably extensive data set of over 100 samples, this does not match with my memory of the historic data.

- 2.4 I recommend that this historical information be located to assist in the establishment of a baseline of raw water quality.

3. TURITEA WTP & TREATED WATER QUALITY

- 3.1 In his evidence (paragraphs 28 to 37, pp 8 – 10), Mr Taylor considers the possible effects resulting from the TWF development on the Turitea WTP performance. There are three water quality issues covered by these paragraphs that I wish to clarify, as the wording of Mr Taylor's evidence may leave the Board of Inquiry with the wrong impression.
- 3.2 The first is about the impact of increased sediment and colour in the raw water. Although Mr Taylor's evidence is circumspect in relation to these two water quality parameters (refer to paragraphs 30 and 31), it does leave the impression that PNCC will be faced with increased waste disposal if sediment and colour do increase as a result of the TWF development. Mr Levy's rebuttal evidence has stated that he predicts sediment to increase by about 2.5% as a result of construction activities, and that in the long term the sediment loading change will be insignificant when compared with the existing. An increase in sediment loading of this order during the construction period would have a minimal impact on the coagulant dose required, and is likely to be barely measureable. I would expect sludge production to increase by around 1 to 1.5%, which should not pose any issues for the WTP.
- 3.3 Mr Levy also considers the case of a hypothetical slip of 100m³ occurring after an extended period of severe weather on a part of the Waters property that drains to the lower reservoir. Following a number of conservative assumptions, he concludes that it could result, assuming both full mixing and that the reservoir is below its spill level during the event, in a concentration of sediment in the reservoir of the order of 160 g/m³. He predicts that this could persist for some days, and gradually reduce to background levels over a couple of weeks. The Turitea WTP is equipped with four horizontal flow clarifiers and eight dual media filters. The clarifiers and filters are designed for high solids loadings, and are capable of handling high suspended solids loads, in excess of the order of 160 g/m³. Coagulant dose rates would need to increase significantly, perhaps double, but with appropriate control as would be required for events that currently occur, the treatment process is capable of maintaining compliance with the Drinking-Water Standards for New Zealand.

- 3.4 The existing sludge handling system at the WTP separates off a supernatant following settling of the clarifier and filter sludges, and discharges this supernatant to the Turitea Stream (subject to it being less than 10 NTU). The sludge solids are pumped via a pipeline to the city sewer network at Summerhill Drive from where it is conveyed to the city's Totara Rd Wastewater Treatment Plant. From a PNCC email from Natasha Simmons of 29 May, this pipeline is recognised by PNCC as being undersized, and in the next 10 years PNCC are planning to upgrade the pipeline to be able carry all the waste process water, also enabling PNCC to abandon the discharge to the stream. I would anticipate that the existing sludge handling system would struggle to cope with the hypothetical slip event if the water quality deteriorated to the extent estimated by Mr Levy for any longer than about 1 or 2 days. Should such an event occur (prior to the PNCC planned upgrade to the sludge pipeline), PNCC would have a number of contingency options, which I have talked through with the Council's Water and Waste Services Manager, Chris Pepper. The first would be to increase the discharge of poorer quality supernatant to the stream from the sludge settlement system. The current consent condition states that "the discharge shall not cause a turbidity increase greater than 4 NTU instream following a zone of reasonable mixing after discharge". Given the extremity of this event, and that it would therefore coincide with both high sediment and high flows in the stream, the impact of such a discharge would be insignificant.
- 3.5 The second option is to ramp back the plant's production of water significantly, to allow the sludge system to cope with the increased solids loading. As long as demand for water in the city is not extreme (and demand would actually be suppressed in such an event), the city can effectively be supplied from the bores, although the high end of the city can really only be supplied from Turitea. This was PNCC's operational response in the 2006 algal bloom incident, and was used until a temporary powdered activated carbon system could be installed and satisfactory results from algal toxin testing were received. The third option, which has not had to be done to my knowledge since the major upgrading, would be to tanker away the surplus wastes.
- 3.6 In relation to colour, Mr Levy predicts that there would be little impact from the TWF development, so accordingly there will be minimal impact on the WTP from this issue.
- 3.7 The second water quality issue is about nutrients (nitrogen in its various forms, and phosphorus). Paragraph 33 of Mr Taylor's evidence states that "The WTP has limited

capacity to reduce nutrient loads". While this is true, nutrients are not typically an issue in water treatment of surface waters. The nutrients for which a Maximum Acceptable Value (MAV) is set by the Drinking-water Standards for New Zealand (DWSNZ) are nitrate (50 mg/L), and nitrite (0.2 mg/L long term, and 3 for short term). Ammonia has a Guideline Value (GV) (i.e. not health-related) of 1.5 mg/L on the basis that a higher concentration than this will cause the water to smell. There is neither an MAV nor a GV for phosphorus. Historically, the raw water data for Turitea shows that nitrate, nitrite and ammonia have not been an issue, and even if these parameters increased significantly they would still not be an issue.

- 3.8 Increased nutrients in the catchment runoff water can of course increase the risk of algal blooms in the reservoirs. Mr Levy has addressed the issue of nutrient yields in his rebuttal and found that in the operation phase the increase will be of the order of 4.2% for nitrogen, and 1.9% for phosphorus. During the construction phase, he estimates increased loadings of a lesser order from the earthworks, but with a nutrient pulse loading in the event of a slip in the earthworks. The factors that led to the 2006 bloom event are reported by GHD (Appendix 1 of Mr Taylor's evidence) to have been related to low rainfall in the catchment, unusual environmental conditions (but these are not described), and unusual management of the supply. The GHD report also states that "algal blooms are not known to have occurred in recent times", and that PNCC's view was that the reservoir "has not been eutrophic in the past", and postulates that the reservoir "may be prone to becoming eutrophic under certain conditions". I do not recall any references to blooms having occurred when I was involved in the upgrade, but I would note that reservoirs that stratify are vulnerable to algal blooms. Although the GHD report makes reference to reservoir water quality modelling being undertaken by PNCC, there are no other references in the more recent material from GHD on such a model. Typically, without a water quality model, it is difficult to predict the impact of increasing nutrients on the incidence of blooms. However, usually a reservoir with nutrient concentrations of the order that are already present in the upper dam, would face a minor increase in the risk of blooms occurring with a minor increase in nutrients.
- 3.9 Following the 2006 incident, PNCC elected to not address the risk of blooms with source or catchment measures as these were considered to "provide little security". Instead, Council adopted treatment as the preferred solution and installed a powdered activated carbon dosing system. Even though the upper dam has the ability to abstract water from

three levels (4 m, 8 m and 12 m deep), and this could provide some flexibility to abstract better quality water during a bloom, I suspect it is of limited effectiveness during a bloom and not effective when overturning occurs. I would note that reservoir destratification has proven successful in a number of water supply reservoirs for reducing the risks of algal blooms occurring, and could be considered by PNCC for Turitea as a risk mitigation measure.

- 3.10 The third water quality issue is about iron and manganese. Iron and manganese were recognised as problem contaminants in the upgrading of the WTP in the late 1990s. Specific treatment for the removal of iron and manganese was added to the treatment process as part of that upgrading – the ability to elevate the pH of the raw water with soda ash and to dose with potassium permanganate. No increase in iron or manganese is expected from the construction activities, and it is likely that these parameters will continue to be associated with reservoir overturning, unless destratification measures are installed.
- 3.11 I therefore disagree with the statement made by Mr Taylor in paragraph 36 of his evidence that the WTP’s manganese reduction capacity is limited.

4. PUBLIC HEALTH RISK MANAGEMENT PLAN

- 4.1 I have reviewed the copy of the draft Public Health Risk Management Plan (PHRMP) for the Palmerston North city water supply dated June 2008 that is appended to Mr Taylor’s evidence (Appendix 4). The draft PHRMP states that having a protected surface catchment provides the barrier to contamination of the raw water source. It notes that the few hectares of farm land that are still associated with the catchment are listed for purchase and conversion. It is silent on the TWF development, which is somewhat surprising given that the design of the project was well advanced at that time.
- 4.2 Mr Taylor states (paragraph 27) that the draft PHRMP has yet to be approved by the Ministry of Health’s Drinking Water Assessor, but that “a few minor changes are necessary in order for the plan to be approved”. In his summary (paragraph 63(d)), Mr Taylor is of the opinion that the PHRMP should be modified on completion of the TWF development.
- 4.3 There is also a section in the GHD report (section 3.2) appended to Mr Taylor’s evidence (Turitea Water Quality Impact Assessment, February 2009) that summarises the PHRMP

for the headworks (dated January 2004), which I presume is one of the hyperlinks referred to in the June 2008 version of the PHRMP but not accessible to readers of the pdf version. The headworks summary refers to a number of improvements to the catchment that are relevant to the TWF development. The improvements of note are:

- 1: Limit the use of poor quality raw water by the treatment plant – actions listed are shutting the WTP down when the incoming turbidity exceeds the capability of the WTP, an extreme rain events contingency plan, monitoring and treating for blue-green algae, and providing more groundwater capacity to allow shutdown of the WTP.
- 2: Reduce and mitigate the risk of contamination or deterioration of the Turitea catchment - actions listed are identifying and controlling hazardous activities in the catchment, implement a District Plan zone, using Health Act to limit inappropriate activities, implementing control procedures so that imported materials and equipment are not contaminated with toxins/pathogens, formulating emergency response plan for chemical spill event, increasing the frequency of catchment fence inspections, purchasing farmland catchment, and establishing native plant cover.
- 6: Mitigate the impact from a flood – action listed is maintaining good bush cover to minimise sediment runoff.

4.4 I endorse the observation in the GHD report that the TWF development will be a major change in catchment activity, and that the PHRMP (and all its supporting plans) will require updating. The PHRMP is where the risks associated with the development should be captured and the measures to treat these risks documented. This is not highlighted as strongly in Mr Taylor's evidence.

5. PROTECTION OF SOURCES OF DRINKING WATER

5.1 In relation to the protection of sources of drinking water required under the Health (Drinking Water) Amendment Act (Section 69U), Mr Taylor's evidence states (paragraph 51) that PNCC risks non-compliance with this section of the Act by allowing wind turbines to be located within its water reserve. He further refers to evidence submitted by the Mayor of PNCC that the Applicant is liable for any changes in catchment status and/or water quality, and implies that this absolves PNCC of any responsibility if it does not comply.

- 5.2 In fact, an examination of the details of Section 69U of the Act shows that a drinking water supplier has certain duties in relation to taking reasonable steps to contribute to the protection of raw water sources from contamination.
- 5.3 For a raw water that usually requires treatment (the case that prevails at Turitea) the Act defines contamination as “the introduction of a substance or organism into that water making it unpalatable or unsuitable for human consumption without further drinking water treatment”. In my opinion, the proposed activities associated with the construction and operation of the TWF development, although they change the risk profile and that new profile needs to be managed, do not need to alter the level of treatment being provided (i.e. further drinking water treatment is not required).
- 5.4 As a networked supplier there is, however, a more general duty on PNCC to protect from pollution all aspects of the drinking water supplied (section 69U(2)).
- 5.5 The examples of “reasonable steps” given in the Act include making submissions on notified resource consent applications. If a submission were to be made from PNCC on this matter, it should probably include suggested wording for consent conditions that cover off the increased risks to the catchment. As discussed in my evidence earlier, the PHRMP is where the risks associated with the development should be captured, and the measures to treat these risks documented. A possible condition wording is therefore: ‘During the detailed design of the TWF the Applicant is to work jointly with PNCC to undertake a detailed risk assessment of source water quality to cover both the construction and long term operation of the project. The risk assessment will include consideration of the currently proposed control measures, as well as develop new controls for any new risks identified during the assessment, with the outputs from the assessment being in a form that allows PNCC to incorporate the findings of the risk assessment into its PHRMP.’
- 5.6 Finally I would note that the level of catchment protection both during and after the TWF development will be superior to that achieved in the majority of water supply catchments in New Zealand.

6. WATER QUALITY MANAGEMENT IN THE CATCHMENT

- 6.1 In paragraph 54 of his evidence, Mr Taylor makes a number of comments on Mr Levy’s evidence in relation to water quality management in the catchment. Mr Levy will respond

to the majority of these, but a few are relevant to the Turitea WTP and the impact the TWF development could have on the WTP.

- 6.2 Sub-paragraph (a)(iii) refers to a need to link Clause 101 of Mr Levy's evidence regarding emergency planning and response to the PHRMP. I endorse this approach, as the PHRMP is where such provisions should be documented.
- 6.3 Sub-paragraph (a)(v) refers to the fact that whether or not a hydrocarbon spill on the surface reservoir can enter the raw water off-take depends upon the reservoir's water level and the draw-off valve in use at the time. I have checked the drawing of the raw water off-take arrangement at the lower dam provided to me by PNCC on 29 May 2009, and it shows a floating-type off-take designed to withdraw water about 1 metre beneath the water surface, with a bellmouth inlet 1.7 m in diameter. Thus hydrocarbons floating on the surface would not enter the off-take.
- 6.4 Sub-paragraph (b)(iii) refers to the fact that Mr Levy did not distinguish between soluble organic matter and sediment in his consideration of sedimentation processes in the reservoir, and that any increase in soluble organic matter may affect the WTP operation. Mr Taylor is correct that soluble natural organic matter (the major contributor to the colour of a natural water) will not be removed by sedimentation processes in the reservoir. Mr Levy's rebuttal evidence predicts that the TWF development will have little effect on the colour of the water, and I therefore think that colour can be disregarded with respect to any impact it could have on the WTP operation.
- 6.5 Sub-paragraph (c)(ii) refers to microbiological contamination arising from sanitary wastewater disposal (Clause 114 of Mr Levy's evidence) not being restricted to bacterial, but that viral and protozoal contamination may also be present. Mr Taylor is correct in this regard. Although viral compliance criteria are not included in DWSNZ, protozoal criteria have been a real focus since the 1995 version of DWSNZ was published. It is worth noting that the upgrading of the WTP in the late 1990s was to meet the anticipated 2000 version of DWSNZ, which required a filtered water turbidity of 0.1 NTU for a plant of the type at Turitea. Since that time, there has been an enhancement introduced into the Standards whereby the risk of protozoa being present in the catchment changes the level of treatment required. The 2007/08 compliance report from MidCentral Health's Drinking Water Assessor records that filtered water turbidity was always less than 0.08 NTU, and that it is providing a level of treatment ten times higher than that required by the current

version of DWSNZ for the existing catchment. Considering the level of risk of microbial contamination, I regard the existing treatment plant as being able to provide ample protection of public health.

- 6.6 There is one other paragraph in Mr Taylor's evidence that is relevant to the matter of water quality management in the catchment. In paragraph 57 he contends that Mr Levy's statement (Clause 145) that "There would be no decrease in the quality of potable water supply to Palmerston North" is bold, and cannot be guaranteed by the Applicant. On the basis of the evidence presented by Mr Levy on the measures that will be taken to manage runoff water quality and his predictions of the potential impacts on water quality, as well as the rebuttal evidence from myself on the capability of the Turitea WTP, it is my opinion that the WTP will be able to treat to the same finished water quality as it does now. While neither I nor the Applicant is in a position to guarantee Mr Levy's statement, my opinion is that it is reasonable.

7. CONCLUSIONS

- 7.1 In relation to raw water quality I believe that useful historical data exists that should be located to assist in the establishment of a baseline of raw water quality.
- 7.2 In relation to the impact of the TWF development on raw water quality and how this could impact on the Turitea WTP, my key conclusions are that:
- (a) During the construction phase the small increase in sediment would not impact on the quality of the treated water, and could increase sludge production by up to 1.5%. During the operational phase there would be insignificant impact on sludge production.
 - (b) If an extreme rainfall event occurred during construction in the part of the catchment that drains to the lower reservoir, and such an event resulted in a slip in the earthworks, then the high concentrations of sediment that could result in the lower reservoir would not impair the quality of the treated water but would challenge the sludge handling system if it persisted for more than one or two days. But PNCC already has a number of operational responses in place to meet such a challenge.
 - (c) The small increase in nutrients that is predicted to result from the TWF development, may lead to a small increase in the risk of algal blooms occurring.

- 7.3 As the TWF development represents a major change in catchment activity, the PHRMP (and its supporting plans) will require updating, and the Applicant is prepared to work with PNCC to undertake a detailed risk assessment of source water quality to form the basis of this updating.
- 7.4 The level of public health protection provided by the existing WTP is in excess of that required by the Drinking-Water Standards for New Zealand, and the quality of the treated water provided by the WTP will not be compromised by the TWF development.

Andrew Watson

12 June 2009