

## EVIDENCE IN CHIEF OF MICHAEL LAKE - INDEX

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Before the Board of Inquiry  
Hauauru Ma Raki Wind Farm Proposal

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*Under* the Resource Management Act 1991

*In the matter of* Resource consent applications by Contact Wind Limited relating to the Hauauru Ma Raki Wind Farm Proposal

*And*

*In the matter of* Notices of Requirement and a Resource Consent Application by Contact Energy Limited relating to the Hauauru Ma Raki Wind Farm Proposal

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Statement of evidence in chief of ***Michael David Lake***

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Dated: 24 March 2009

Date of hearing: 27 April 2009

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## STATEMENT OF EVIDENCE IN CHIEF OF MICHAEL LAKE

### INTRODUCTION

- 1 My full name is **Michael David Lake**.
- 2 I hold B.Sc(Tech) and M.Sc degree majoring in biology from the University of Waikato. I have 15 years experience in the field of freshwater ecology. The first five years were spent working part-time with the National Institute of Water and Atmospheric Research and the University of Waikato while I completed my studies. Between 1999 and 2004 I worked as environmental consultant based in Melbourne. Since 2005 I have held the position of Technical Support Officer (Freshwater Ecology) for the Waikato Conservancy of the Department of Conservation (DOC). My current work for DOC focuses on the protection of freshwater species and ecosystems. I am responsible for providing technical advice regarding freshwater issues to management and operational staff within DOC. I also participate in national and regional technical groups.
- 3 I am a member of the New Zealand Freshwater Sciences Society and the Australian Society of Fish Biology. I am the leader of the New Zealand Mudfish Recovery Group and a member of the Large Galaxiid Recovery Group.
- 4 I am familiar with the proposal which is the subject of the resource consent applications and notices of requirement. I also confirm that I have visited the general site area on the 9<sup>th</sup> of March 2009. I also made a special site visit to Whitford Quarry on the 18<sup>th</sup> of March, 2009.
- 5 Since 2005 I have undertaken annual fish surveys in rivers and streams along the west coast of the North Island between Kawhia and Mokau. These streams lie within the Mokau Biogeographic Region (Leathwick et al. 2007), which is the same biogeographic region in which the streams affected by the Hauauru Ma Raki (HMR) Wind Farm Site are primarily situated.
- 6 I have read the Environment Court's Code of Conduct for Expert Witnesses, and I agree to comply with it. My qualifications as an expert are set out above. I confirm that the issues addressed in this brief of evidence are within my area of expertise.
- 7 I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

### SCOPE OF EVIDENCE

- 8 My evidence will deal with the following:
  - **Freshwater ecosystems within the HMR Wind Farm site**
  - **Impacts of the proposal on freshwater ecosystems**

- **Riparian rehabilitation as offset mitigation**

## **FRESHWATER ECOSYSTEMS WITHIN THE HMR WIND FARM SITE**

- 9 The condition of freshwater ecosystems is primarily driven by the condition of their catchments. The HMR Wind Farm site encompasses catchments that are, for the most part, highly modified. Pastoral farming is the dominant land use and only relatively small areas of woody vegetation remain.
- 10 Riparian margins on the edges of streams and rivers are largely unprotected and devoid of vegetation types that could buffer waterways from the effects of agricultural land use in the wider catchment.
- 11 The highly modified nature of the landscape and in particular riparian margins means that on a broad-scale aquatic habitat values would be predicted to be relatively low. The assessment made by Gerry Kessels and his team (on behalf of the applicant) are largely consistent with this prediction. However, a number of significant freshwater values were identified in the Assessment of Ecological Effects and Supplementary Assessment of Streams and Seepage Zones (Kessels & Aldridge 2008; Kessels et al. 2008). These include but are not limited to;
  - Threatened and rare fish and macroinvertebrates species;
  - Diverse fish communities in the lower reaches of some streams;
  - A locally important whitebait fishery based on inanga (*Galaxias maculatus*);
  - Eel fishery; and
  - Wetlands and seeps.

## **IMPACTS OF THE PROPOSAL ON FRESHWATER ECOSYSTEMS**

- 12 I have identified a number of potential impacts on freshwater ecosystems that could be caused by the proposed HMR Wind Farm development as a result of the following activities:
  - Water abstraction & storage;
  - Construction of road crossings culverts; and
  - Construction earthworks including the disposal of overburden and construction of storage dams.

### **Water abstraction and storage**

- 13 Water abstraction can have a number of negative impacts on freshwater ecosystems, through decreases in stream depth and width, water velocity, longitudinal connectivity, sediment transport

and dissolved oxygen, and increases in nutrient concentrations and water temperature (MfE 1998). As the water is being pumped out of a waterway aquatic biota can also become removed or trapped against intake structures and screens.

- 14 The applicant proposes to abstract up to 10% of the one in five year low flow or  $Q_5$  from several streams during the construction phase of the project. This flow represents the total allocable flow from these streams under proposed Variation No. 6 to the Waikato Regional Plan. A water take of this size is generally regarded to be at the lower end of the scale in terms of flow modification (Beca 2008). Whilst overall the resulting impacts on aquatic habitat from the proposed takes are likely to be no more than minor, there will be some potential effects. These effects will be most apparent when the streams are experiencing natural low flow events. At these times a take of 10% of  $Q_5$  has the potential to extend low flow periods and thereby exacerbate their effects on instream biota. Habitat availability is at its lowest during low flow periods and the potential for increases in water temperature to impact on instream biota is at its highest.
- 15 The applicant has recognised the potential for water temperatures to impact on freshwater values and has proposed to avoid this impact by ceasing all takes between 12 noon and 5 pm during periods of low flow (determined as being less than 61 litres per second mean annual flow in Naike Stream at Kaawa School Road) and when afternoon stream temperatures exceed 20 degrees Celsius. I support these attempts to avoid potential negative impacts caused by flow abstraction.
- 16 In his evidence Mr Tonks, in consultation with Mr Kessels, also recommended that Contact commit to riparian planting and fencing of a 400 m length of stream (Tonks 2009) to offset any potential increases in stream temperature. I also support this proposal for offset mitigation in principle, however, I do have some issues with how this work will be implemented and will cover this later in my evidence.
- 17 The applicant also proposes to abstract 100% of the flow from the Whitford Quarry Spring as part of their overall take from the Waikaretu Stream. Removal of 100% of flow from this spring will almost certainly lead to the complete extirpation of aquatic life between the spring head and the Waikaretu Stream, a distance of stream estimated to be about 100 m long. As mitigation for this loss Mr Tonks suggests that the applicant undertake fencing and planting either around the Whitford Quarry Spring and stream or at a similar spring or seep area elsewhere in the Waikaretu Stream catchment (paragraph 81, evidence in chief).
- 18 I would support this proposed mitigation but would prefer to see first preference given to the fencing and planting of a seep or spring of similar size elsewhere in the catchment rather than in the Whitford Quarry Spring itself. While abstraction of 100% of flow from Whitford Quarry Spring will only occur during the construction phase of the project there is a great deal of uncertainty as to how quickly

the spring will be able to recover its original ecological values. If fencing and planting at Whitford Quarry Spring occurs then the ecological outcome of this is unknown. I consider that a better approach (i.e. one with more certainty) would be to fence and plant a different spring to ensure the best ecological outcome. The spring system in the Waikaretu Stream known to support the rare aquatic snail *Leptopyrgus manneringi* would appear to provide an appropriate option for protection as suggested by Mr Kessels (Kessels & Aldridge 2008).

- 19 The applicant proposes to supplement water takes from streams using on-site water storage dams and ponds (Millais 2009). Mr Millais estimates that a total of nine storage dams would need to be constructed to meet the water needs of the project. A total of 15 potential storage dam locations have been identified by Mr Millais (refer paragraph 57 of his evidence in chief). Because these dams are to be located on ephemeral streams in small catchments, each one is able to be constructed as a permitted activity under rule 3.6.4.4 of the Waikato Regional Plan. The cumulative impact of constructing nine storage dams should still be taken into account, however as part of the entire project. These storage dams do have the potential to cause adverse environmental effects if located in large ephemeral streams or significant seepage areas. In the Assessment of Ecological Effects Kessels et. al. (2008) recommended that an ecologist and a representative from Environment Waikato be involved in the selection of storage dam sites. I support this recommendation as a way of avoiding adverse effects. I seek to ensure this action is adequately covered in any consent conditions.
- 20 The applicant is proposing to use a maximum screen size of 1.5 mm and a maximum intake velocity of 0.3 m per second for all water takes (Daysh 2009). I support these measures to avoid entrainment and impingement of small native fish.

#### **Construction of culverts**

- 21 The proposed development will result in the construction of 14 road culverts that will cover approximately 430 metres of stream (Kessels & Aldridge 2008). In exhibit GK30 to his evidence Mr Kessels identified that of the 430 m of affected stream, approximately 68 metres consist of perennial streams which flow all year round, while the remaining 362 metres are ephemeral streams. To mitigate for this loss of habitat, Mr Tonks proposes fencing and planting for a total of 100 metres of existing stream length. This level of offset mitigation was based on the fact that most of the lost habitat was over ephemeral streams, seepages and drains.
- 22 In my opinion, improving 100 m of existing stream in exchange for the loss of 430 m of stream habitat is insufficient. I note that, although ephemeral streams do not always carry water flow they do have their own intrinsic habitat values. They are known to support unique invertebrate assemblages (Storey & Quinn 2007) and can support similar invertebrate taxa richness to perennial streams (Parkyn et al. 2005). Immediately after dry spells the stream will

provide pulses of food such as terrestrial insects and carbon sources such as dead vegetation to downstream habitats. During periods of flow, which may be significant in some ephemeral streams, they will also provide habitat to species normally found in perennial streams.

- 23 It is important to note that the proposed fencing and planting will only improve the condition of an already existing stream and not re-create stream habitat that would be more or less lost through being piped through a culvert. The applicant should therefore undertake riparian fencing and planting along a greater length of stream than they intend to cover with culverts. I consider that a minimum length of 500 m of stream (both sides) be fenced and planted to offset the construction of road crossing culverts.
- 24 Road culverts also have the potential to create barriers to movement of aquatic species, particularly the upstream movement of migrating fish (Boubée et al. 1998; Blakely et al. 2006). Mr Kessels has identified the fish passage requirements of all 14 of the proposed road crossings in exhibit GK29 to his evidence and recommends that the applicant ensure adequate passage at each one. Mr Kessels also refers to several key design features for Waikato Wind Farm culverts on page 94 of his Assessment of Ecological Effects (Kessels et al. 2008). I support the incorporation of these features into the design of road culverts within the HMR Wind Farm, however, none of these design features appear to have been included in the draft consent conditions as they appear in the exhibits to the evidence of Mr Daysh (Daysh 2009). If the applicant proposes to construct any structures that will impede fish passage, they will also need to obtain a permit from the Department of Conservation under the Freshwater Fisheries Regulations 1983.

### **Construction earthworks**

- 25 The proposal includes the dumping of spoil at approximately 110 disposal sites through the project area (see C James evidence in chief, paragraph 60). The final location of the disposal sites is to be determined following detailed design, and will be subject to a proposed Earthworks Design and Management Plan (C James, paragraphs 61 and 63). If overburden disposal sites are poorly selected they have the potential to impact on freshwater ecosystems by either directly smothering them or, if placed in close proximity, by contributing excessive sediment loads. Open water systems such as rivers, streams and lakes are easy to identify and avoid. Wetlands (including springs and seeps) tend to be vulnerable as spoil disposal sites, as they are not obvious as ecologically valuable areas to non-technically trained people.
- 26 It is important that wetlands are protected from infilling by overburden because;
- They are biodiversity hotspots, often contain a high degree of local endemism (Scarsbrook et al. 2007), and they are recognised as a national priority for the protection of biodiversity on private land (MFE & DOC 2007). According to the botanical

evidence of Mr Shaw it appears that there may have been some underestimation of the biodiversity value of some wetlands considered in the Assessment of Ecological Effects (Shaw 2009).

- Wetlands also play a key role in intercepting and removing contaminants, especially nitrogen, from surface water (Parkyn 2004). This ecosystem function is a key component of the natural character of wetlands. Section 6(a) of the Resource Management Act requires consent authorities to recognise and provide for the preservation of the natural character of wetlands, lakes and rivers and their margins, and the protection of them from inappropriate use and development. Retaining and fencing wetlands and seeps on farmland forms part of Environment Waikato's recommended practice for reducing nutrient and sediment run-off (Environment Waikato 2008). Wetlands are therefore important habitats to protect even in highly modified catchments like those found in the HMR Wind Farm site.

- 27 General Condition 4.2(m) for the Waikato and Franklin District Council consents requires that as part of the Earthworks Design and Management Plans the applicant will take "Measures for identifying and avoiding as far as practicable, the disturbance of indigenous habitats" with specific reference to seepage areas and if avoidance is not practicable measures be undertaken "whereby replacement wetland and/or indigenous vegetation cover is created on a like-for like basis".
- 28 In my opinion all wetland areas should be avoided at all costs by the applicant. It is extremely difficult to re-create seepage wetlands because establishing the correct water regime is very difficult. The structure and function of a wetland is primarily driven by water levels and fluctuation. Slight variations in this water regime can radically change the character of a wetland, the biotic communities it supports and its ability to process contaminants. Therefore re-creating wetlands on a like-for like basis is far less practicable than avoiding disturbing them in the first place.
- 29 Condition 45 of the general conditions attached to the Waikato Regional Council consents (Exhibit SGD8) allows for the selection of fill sites in seepage areas provided the biodiversity values are deemed low enough. I consider that seepage areas should be avoided as fill sites regardless of their biodiversity value because they still provide an important ecosystem service by removing contaminants from surface water.
- 30 I therefore consider that district council General Condition 4.2(m) and Waikato Regional Council Condition 45 should be amended to require the applicant to remove the flexibility where it is not "practicable" to avoid the identified habitats, and to require all seepage areas to be excluded as fill sites.
- 31 I also note that the Assessment of Ecological Effects Report prepared by Mr Kessels states that protocols should be included in the Environmental Management Plan (see page 75) to ensure that

no ecologically sensitive wetland areas are directly affected by any overburden sites. On page 94 he refers specifically to seven areas of ecological significance including six wetland sites. In my view all of these sites should be completely avoided as fill sites and should all be specifically listed in district council General Condition 4.2(m).

- 32 Given the existing high catchment land use pressures I accept that if best practice sediment control and stormwater discharge management are followed then additional impacts on freshwater ecosystems will be adequately managed.

### **RIPARIAN REHABILITATION AS OFFSET MITIGATION**

- 33 As noted above, in his evidence Mr Tonks has recommended that the applicant undertake riparian fencing and planting to offset the environmental impacts caused by water takes and the construction of stream crossings. This offset mitigation would take the form of fencing and planting of a 500 m by 3 m wide strip along both banks of either the lower Kaawa or Waikorea Streams. This recommendation is incorporated into the proposed district council General Condition 6.17(b).
- 34 As I have covered previously in my evidence I consider that fencing and planting of 900 m of stream is a more appropriate level of offset mitigation to compensate for
- increased stream temperatures (400 metres)
  - construction of 430 m of road crossing culverts (500 metres)
- 35 In my opinion this level of riparian restoration will offer adequate offset mitigation for the effects of the water takes and road crossings provided it is implemented properly. Failure to undertake the riparian restoration in a robust way would result in the failure to achieve the required environmental benefits and therefore the intended offset mitigation proposed. It would also be a waste of the applicant's resources.
- 36 To ensure that the riparian rehabilitation is implemented properly the objectives for the work need to be made explicit. The objectives of a riparian rehabilitation project have a significant bearing on how the work is undertaken. For example riparian planting to reduce instream temperatures requires the planting of tall tree species to provide shade. However, tall tree species would be inappropriate for enhancing inanga spawning sites because they would prevent the establishment of thick swards of grass and rushes upon which the fish prefer to lay their eggs.
- 37 The suggestion from the applicant's consultants is that the riparian restoration would be aimed at improving whitebait fishery through protection and enhancement of inanga spawning grounds in the lower reaches of one or two streams. I agree that this objective is the most appropriate one given the relatively short length of stream rehabilitation that is proposed.

- 38 If the protection of whitebait spawning sites is the objective, then the fencing and planting will need to occur in the tidal section of the stream or streams. The 3 m wide strip set aside for rehabilitation would therefore need to start at the high tide mark.
- 39 A stock-proof, seven wire, post and batten fence should be the minimum requirement for fencing to ensure stock are excluded from the area.
- 40 Prior to any fencing or planting a Riparian Restoration Plan also needs to be developed by a suitably qualified consultant ecologist. The plan should:
- Identify the most appropriate site or sites to undertake restoration to achieve the stated objective. This will require that spawning zones are accurately identified;
  - Include a planting plan that details what species are to be used, where and in what densities;
  - Include a maintenance schedule for ongoing weeding and back planting; and
- 41 I also consider that the applicant should be held responsible for the ongoing maintenance of the rehabilitated riparian zone for the life of the consents. Without proper maintenance plantings can fail to establish and become overtaken by weeds.
- 42 I also consider that all fencing and plantings should be legally protected in perpetuity either through land purchase or a covenant. This also includes the proposed offset mitigation for the water takes and culverts as well as the mitigation for the 100% water take from Whitford Quarry Spring. If this does not occur the rehabilitated riparian zones could easily revert to their pre-rehabilitation condition, should ownership of the properties change.

## **CONCLUSIONS**

- 43 If the HMR Wind Farm proposal is granted I consider that the following changes should be made to the conditions of the consent:
- That best practice design features identified by Mr Kessels on page 94 of the Assessment of Ecological Effects be incorporated into the design of all culverts to be constructed in the HMR Wind Farm; i.e. as follows:
    - a. The culverts shall be installed so that its invert is approximately 300 mm below the existing channel invert;
    - b. The culverts shall be set at a grade of no more than 1 in 300 wherever possible;
    - c. Culvert width shall be sufficient to contain the existing natural channel width plus 0.5 m as a minimum on each side;

- d. Channel beds at upstream and downstream end of culvert shall be protected against erosion and/or aggradation/degradation;
  - e. Overhanging vegetation shall be planted at both ends of each culvert; and
  - f. Boulders shall be fixed to culvert abutments and along edges of channel outlet structure where grades are steeper than 1 in 300.
- District council General Condition 6.17(c) be amended to reflect that fencing and planting of Whitford Quarry Spring will only be undertaken if a spring of a similar size and characteristics can not be found elsewhere in the Waikaretu Catchment, and to reflect that this shall also extend 100m downstream from the spring.
  - That district council General Condition 4.2(m) be amended as follows:
    - a. the words "as far as practicable" be removed so that the applicant is required to avoid wetland and seepage areas when undertaking earthworks or disposing of overburden;
    - b. all seven of the significant sites listed on page 93 of the Assessment of Ecological Effects should be included as bullet points; and
    - c. the un-numbered paragraph which directly follows the 3 bullet points be removed.
  - Remove Waikato Regional Council general condition 45 so that no fill sites may be located in seepage areas.
  - To ensure that the riparian rehabilitation is implemented properly, the following components should also be added to General Condition 6.17(b) for district councils;
    - a. The objective of the works is to protect and enhance inanga spawning sites;
    - b. The requirement for a Riparian Rehabilitation Plan to be developed prior to works;
    - c. The width of the fenced and planted margins will be measured from the high tide mark;
    - d. The applicant must be held responsible for the maintenance of riparian fencing and planting, as specified in the Riparian Restoration Plan, for the life of the consents;
    - e. As a minimum all fencing is to consist of a permanent stock-proof seven wire post and batten construction; and

f. The restored riparian zone is to be legally protected in perpetuity either through land purchase or a covenant.

- To protect significant freshwater sites Mr Kessels recommendation that an ecologist and representative from Environment Waikato be involved in the selection of appropriate storage dam sites should be incorporated into the consent conditions.

44 If these recommended changes to the consent conditions are made then I am satisfied that the potential impacts of the proposed HMR Wind Farm on freshwater ecosystems will have been adequately addressed.

**Michael Lake**  
**24 March 2009**

## ATTACHMENTS TO EVIDENCE IN CHIEF OF MICHAEL LAKE

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