BEFORE THE BOARD OF INQUIRY

IN THE MATTER OF:	The Resource Management Act 1991
AND:	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

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SUPPLEMENTARY EVIDENCE OF CHRISTOPHER DAVID JAMES

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1 INTRODUCTION

1. My name is Christopher David James. My qualifications and relevant experience are set out in my evidence in chief. I confirm that I have prepared this supplementary evidence in accordance with the Environment Court Code of Conduct for Expert Witnesses (July 2006).

2. I am providing this supplementary evidence to address relevant matters arising from the report prepared for the Board in accordance with section 42A of the Resource Management Act 1991 (RMA) by Nigel Mark-Brown of Environmental Context Limited, and separate requests for further information that were made by the same author. Specifically, I shall address the following matters:

- Responses to requests from Nigel Mark-Brown;
- Removing spoil sites from the water supply catchment;
- Calculation of spoil disposal areas; and
- Calculation methods for earthworks volumes.

2 RESPONSES TO REQUESTS FROM NIGEL MARK-BROWN

3. Nigel Mark-Brown requested various additional design information from Mighty River Power to assist in the preparation of his section 42A report. I provided a response to Mr Mark-Brown via the Turitea Project Co-ordinator on 19 June 2009. The requests and my responses are provided below as a record of the further design information provided as a result of the request.

4. I understood the requests to be:

- Provision of more detailed drawings including to define the boundary of the existing tracks and roads within the site, and the proposed roads (email request from MWH dated 11 June);
- Details of the location and layout of the revised fill disposal site outside the water supply catchment, near turbine zones 67, 68 and 69 (email request from MWH dated 11 June);
- Long sections and representative cross-sections of the proposed main access road, i.e. the main water catchment access road, the northern road adjacent to the northern edge of the water catchment, the road adjacent to Browns Flat and the road leading to turbine # 133 (email request from MWH dated 15 June);
- Photographs of specific parts of the site (email from MWH dated 18 June); and

- Details as to whether the key components of the project include the access road from the last turbine adjacent to Browns Flat to connect to Greens Road, and whether the earthworks for this section of road are included in the total earthworks quantities (email from MWH dated 18 June).

Revised Wind Farm Layout Drawings

5. Before addressing the matters raised by Mr Mark-Brown, it is necessary to clarify that within the 126 turbine zones for which resource consent is sought, there are two different and specific layout options. These are as follows:

- Option 1: 111 3MW type wind turbine machines, plus access tracks, pads; and
- Option 2: 121 2.3MW type wind turbine machines, plus access tracks, pads.

6. While the access tracks and pad locations are slightly different for both these options, all other works and infrastructure on the site are the same (i.e. laydown areas, staging areas, substations, transmission lines, concrete batching plant locations etc).

7. Depending on which option is chosen, some minor amendments to the grades and locations of access tracks are required. Therefore, while the layout plans attached as **Appendix A** (1: 2000 series) are based on Option 1 (3MW layout), should Option 2 be chosen, then some minor re-grading of access tracks would be required.

Access Tracks

8. In order to provide detail of the existing and proposed access tracks, I have provided all civil design drawings at 1:2000 scale (**Appendix A**). There are 89 drawings as part of this set. These drawings also show the spoil sites to avoid repetition. The following points are important to note:

- The access tracks to turbine zones 118 and 119 have been amended to provide separate accesses from turbine zones to their north (zones 110 and 114 respectively). This avoids the need for the double culvert works between turbine zones 115 and 117 (and the associated resource consent from the regional council).
- In general terms, the main road layout (in terms of alignment and grades) is designed to suit the 3MW layout. As already noted, if Option 2 (2.3MW) is pursued, there will need to be some minor realigning and re-grading of some sections of access track (although to avoid over-complicated drawings, these minor amendments have not been shown on the drawings included in Appendix A).

- The access track to Greens Road will be up to 6 metres in width. The earthworks volumes resulting from this area included in the tables attached as **Appendix B**. I note that the up-grade of this farm drive will now only need to be to the standard suitable for normal construction traffic as no heavy haulage will access the site from this direction.

3 LONG AND CROSS SECTIONS

9. Mr Mark-Brown also requested long and cross sections for the site. These are attached as **Appendix C**. I provide the following comments in relation to these drawings:

Long Sections

10. 42 long section drawings are provided in Appendix C. These show the existing ground profile along the proposed road centre, the proposed road centre line level, cut/fill depth on centreline, and vertical and horizontal schematics. The geometric standards used for this design are similar to those employed on other wind farms that Beca has designed and that have been built (for example, West Wind).

Cross Sections

11. Attached as Appendix C are typical cross sections through cut and fills for each named road as requested by Mr Mark-Brown.

Batter Heights

12. The cut and fill batter heights shown on the plans are the height differences between the edge of the road and the top of the cuts/toe of the fills, not the vertical depth of the cut/fill.

4 SPOIL SITES

13. In late May 2009, Mighty River Power requested that all spoil disposal sites be removed from within the Turitea water supply catchment. In addition, the agreement between one landowner (Shilton) and Mighty River Power requires the removal of spoil sites from that property.

14. Alternative spoil disposal areas were therefore required and I investigated alternative sites for spoil disposal using the following general principles:

- Sites that are close to those being removed to minimise haulage. This is particularly important along South Range Road, which has long sections where no spoil disposal can occur;
- Areas with good access;
- Areas with sufficient area to allow the establishment of erosion and sediment control measures;
- A preference for flat areas or shallow gullies;
- Areas able to accommodate the volumes of spoil at least equal to that being removed;
- New disposal areas of a size sufficient to justify their construction (ie. not too small);
- Areas that are not currently in pastoral or other productive land use; and
- Consideration of the end use of the area.

15. Based on the above, I identified a number of potential areas for alternative spoil disposal sites. A visual inspection of all spoil sites (all sites outside the water catchment and the alternative sites proposed to replace those within the catchment) was undertaken by Mr Alexander, Ms Coleman (Beca) and Mr Vaughan (Rileys) on 15, 16 and 17 June. This visual inspection resulted in some revision to the location and volume of spoil disposal sites. I note that these locations have also been discussed with Mighty River Power's ecologists Mr William Shaw and Dr Brian Coffey, as well as Palmerston North City Council's ecologist Dr Paul Blaschke.

16. The civil design drawings at 1:2,000 scale provide the revised locations of all proposed spoil sites. In summary, there are now 32 spoil sites. The attached table (**Appendix D**) provides a summary of the spoil volume at each site as well as the earthworks volumes. The spoil disposal volumes within Appendix D are greater than the volumes submitted in the application because of the changes to the spoil disposal areas and the need to accommodate additional cut to waste (which I discuss further below).

17. In removing the spoil disposal sites from the water supply catchment, I have continued to ensure that the potential volume of spoil sites exceeds the actual volume of spoil that will need to be disposed of. This provides flexibility in the construction process. The reasons for this approach are explained in my evidence in chief and that of Mr Alexander.

5 CALCULATION OF EARTHWORK VOLUMES

18. The refinement of the design required to produce the civil design drawings resulted in an increase in overall earthworks volumes for the site. This is as a result of removing a

number of long trailing fills which were in the water catchment by lowering the road in some places, thereby reducing structural fills but increasing cut volumes. As a result the cut to waste volumes have increased.

19. The earthworks volumes for the site are provided in Appendix D.

6 CALCULATION METHODS FOR EARTHWORKS VOLUMES

20. I have calculated the earthworks volumes for the project using two different methods: a) cross sections end areas, and b) prismoidal method.

21. The volumes by cross sectional end areas have been used to populate the tables provided in Appendix D. This method allows the roads and crane pads to be broken down into a large number of segments and uses cross sections taken through the existing ground and the design model. This method also allows the volume of topsoil to be itemised separately.

22. The prismoidal method has been used to provide a check on the total earthworks volumes for the project and in assessing the earthworks in soils used by Mr Levy. This method compares the existing ground surface against the completed design model as a single entity.

23. The variation between the two methods is in the order of +/- 1.5%.

7 SITE SOILS

24. In Section 10.2.2 of the Section 42A report covering the Review of Construction and Decommissioning Effects, Mr Mark-Brown states that *"most soils to about 1m depth (which are likely to comprise a significant portion of the soils involved in the proposed earthworks) have significant silt and clay content".* To confirm the depth of soils involved in the proposed earthworks, I have attached a spreadsheet showing the expected depth to rock across the site (Appendix E).

25. These have been calculated by splitting the site into three areas (Area A, Area B and the Western Area) based on test pits and geotechnical investigations undertaken by Mr Alexander and his team. Mr Alexander has assigned depths to weathered rock based on the geotechnical investigations for each of the areas.

26. I have undertaken an analysis of the volume of soils to establish the amount of material to be excavated in weathered rock. I did this by calculating the total cut for each area including top soil using the prismoidal method. The top soil volume in cut areas has been calculated by visually assessing the percentage of the earthworks footprint in cut and at an average depth of 0.25 metres.

27. The volume of cut below soils has been calculated using the prismoidal method and by lowering the ground model surface by the average depth of soils assessed by Mr Alexander for each area.

28. The volume of cut in soils has been calculated by subtracting the assessed topsoil volume and the cut below soils volume from the total cut.

Chris James
20 July 2009.