MT MESSENGER BYPASS PROJECT: SUMMARY OF EVIDENCE OF ALASTAIR STEWART MCEWAN (FRESHWATER STRUCTURES) FOR THE NZ TRANSPORT AGENCY

1. My role on the Project is Drainage Design Team Leader. I have held this role since March 2018. My position comprises delivery of design for stream diversions, culverts under the proposed realignment of SH3, road drainage system and treatment of road rainfall runoff. Drainage design of the culverts and streams includes making appropriate provision for fish passage.

2. My evidence addresses the updated position in respect of structures associated with the Project that interact with the freshwater environment (including bridges and culverts), and in particular the refinements to the Project design in that respect since the Transport Agency's evidence was filed on 25 May.

Background

3. Refinements to the design of a number of the Project's freshwater structures have been made since the Transport Agency's evidence in chief was filed on 25 May. These changes have been made primarily to seek to improve the provision of fish passage, taking into account the "*New Zealand Fish Passage Guidelines for Structures up to 4 Metres*", which were published in April 2018.

Design philosophy and approach

4. The fish passage design philosophy, comprises consideration of the relative priority level for fish passage as assessed by the Project freshwater ecologist Mr Keith Hamill in his supplementary evidence, existing site characteristics and constructability. Refer to Mr Hamill's supplementary evidence in terms of the ranking assigned to the various culverts. In selecting the design solution, costs were also taken into account (I took advice on costs from the Project team).

5. The Fish Passage Guidelines have been taken into account in developing the design changes. The Fish Passage Guidelines provide a five-tier hierarchy of design solutions listed below in order of preference (from most to least preferred);

    (a) Bridge;

    (b) Culvert: Stream Simulation (stream within a culvert);

    (c) Culvert: Single barrel circular or box culvert, hydraulic design;

    (d) Culvert: Multi-barrel culvert; and

    (e) Ford over a multi cell culvert.

6. Generally bridges (level one of the fish passage design hierarchy) are extremely expensive and only considered where costs are not likely to be significantly greater than alternative solutions. High and moderate priority streams were considered for stream simulation (level two of the fish passage design hierarchy). Low priority streams were considered for upgrading to hydraulic design, which is level three on the fish passage design hierarchy. These low priority streams were not considered for stream simulation design based on their small catchment size, and therefore lower ecological value and smaller culverts required.

Design description

7. Changes in design approach have been made to eight culverts following the process described above. Culvert 19[1] has been removed.

8. Potential design changes have been considered taking into account advice from Mr Hamill. The revised design makes the following changes:

   (a) For culvert 12, a bridge solution has now been adopted in order to minimise loss of vegetation and better provide for fish passage in this relatively high ecological value location. The location of the bridge is at chainage 2400 of the proposed SH3 alignment. The bridge solution is of a comparable cost to alternative design solutions at this location.

   (b) Culverts 9 and 18 serve large catchments and have been assessed as high priority culverts for fish passage by Mr Hamill. These culverts are relatively short being less than 50 m in length and can be installed with gradients of 1.0% or less. This achieves the second most preferred fish passage design solution under the Fish Passage Guidelines.

   (c) Culverts 8, 14, and 16 are moderate to low priority fish passage culverts. These culverts have been made larger, grades flattened and embedment of culvert invert increased to achieve hydraulic design for fish passage. This solution is the third most preferred solution under the Fish Passage Guidelines.

   (d) Culvert 15 has had its embedment at the outlet increased from 20% to 25%. This culvert has been sized for hydraulic design of fish passage.

   (e) Culvert 17 has been made larger, to increase the culvert diameter to achieve 1.3 x the existing stream bankfull width. The proposed culvert gradient of 14% is based on the existing stream gradient. I note that due to the steep grade, hydraulic design for fish passage cannot be guaranteed.

[1] Refer to drawings MMA-DES-DNG-C0-DRG-1000 to MMA-DES-DNG-C0-DRG-1010 in Volume 2 of the AEE report for culvert numbering system to identify culverts.

9. Culvert 15 is a special case, being assessed as a high-ranking culvert for fish passage, at least 250 m long and 2.5 m in diameter. Constructing a stream simulation solution and ensuring stream simulation is maintained for the life of the Project would be very difficult. Culvert 15 has therefore been sized for hydraulic design of fish passage (the third most preferred option under the Fish Passage Guidelines). In the circumstances I consider this to be an appropriate design solution. For completeness I note that constructing a bridge would be extremely expensive (in the order of $15 million or greater) and therefore a bridge solution was not seriously considered.

10. It is my opinion that design of these culverts is appropriate for the provision of fish passage taking into account the site conditions, culvert lengths and ecological advice provided by Mr Hamill.

Clarifications

11. I omitted to specifically mention in my evidence the minor amendments made to other culverts. The gradients for culverts 1, 3, 5 and 6 have all been reduced to achieve better provision for fish passage. Culverts 1, 3, 4, 6, 20 and 21 have all had embedment increased to 30%, also for improved fish passage design. These culvert design changes are in addition to upgrading culverts 8, 9, 12, 14, 15, 16, 17 and 18 for fish passage as specifically referred to in my evidence.

Corrections

12. I note that drawing number MMA-DES-DNG-C0-DRG-1010 in Volume 2 of the AEE report incorrectly stated the diameter of Culvert 11 is to 750 mm. This is an error and the diameter of Culvert 11 should read “900 mm”.

13. In Table 2 of Appendix 1 from my evidence I stated the diameter of Culvert 18 to be 1650 mm. This is an error and the diameter should read “1350 mm”.

14. At footnote 7 in my evidence I referred to an indicative cost to construct a bridge that would be in the order of $10 to $15 million. The cost value should be amended to “in the order of $15 million or greater”, as stated under paragraph 9 above in this highlights package.