BEFORE THE QUEENSTOWN LAKES DISTRICT COUNCIL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER OF	Queenstown Lakes Proposed District Plan – Upper Clutha Mapping

SUMMARY OF EVIDENCE OF STEPHEN FRANCIS LEARY

ON BEHALF OF HAWTHENDEN LIMITED (SUBMITTER #775)

24th May 2017

1 My name is Stephen Francis Leary. I am a consultant geologist and have been engaged by Hawthenden Limited to provide expert geological evidence in relation to their submission (#775) on the Proposed District Plan and in particular the alignment of the ONL line as it passes through Hawthenden Farm. The following is a summary of my evidence which was pre-lodged on 4th April 2017.

2 For the following descriptions please refer to the geological map, included as Figure 6 in the evidence. The geology of the Queenstown Lakes District is dominated by two main geological units. The mountains and basement rocks are comprised of Permian schist over 250 million years old; while the valleys and basins tend to be filled with glacial, alluvial and lake deposits that have been deposited relatively recently – over the last few hundred thousand years.

3 The two geological units form distinctly different landforms that reflect the geology and geological processes. The schist that comprises the mountains has been carved by glaciers and eroded by streams and landslides, usually leaving the slopes steep, rough and incised by deep gullies and gorges. Whereas the depositional processes that deposited moraine, alluvial and lake sediments on the valley floor, have created landforms that tend to be flatter and smoother.

4 At the Hawthenden farm the geology is relatively simple. The very upper part of the farm is Permian schist and associated landslide debris, while the majority of the farm is comprised of valley floor alluvials with minor terminal moraine tills. Most of the alluvials are within a composite alluvial fan system that has been named the Alpha fan. This fan system started to form as soon as the ice receded from the Mt Alpha face, probably during the Albert Town glacial advance 60 to 80,000 years ago. The retreat of the ice allowed streams to erode material from the mountain face and deposit this as alluvial sediment on the valley floor below. It remains active today and is roughly 3km in width and 2km in length, running from the base of Mt Alpha to the shores of Lake Wanaka at Roys Bay. The contact between the schist of the Mt Alpha face and the alluvial fan sediments is easy to identify as it is both a distinctive break in the slope and also where the surface of the land changes from the rougher and eroded mountain face to the smoother depositional surface of the alluvial deposits below.

5 To the northeast the fan is interbedded with alluvial outwash gravels and runs up against and partially buries the terminal moraine Wanaka is built on. Both the outwash gravels and moraine were deposited during the last glaciation between 15 and 18,000 years ago, the event that also created Lake Wanaka. The final retreat of the ice from this glacial advance has also created two terraces that cut across the

alluvials. As the ice has receded, the water base level in the valley has dropped, and river systems draining the valley or side tributaries have cut down through the alluvial deposits, creating terraces. This glacier related process means that alluvial terraces are a very common feature across the Upper Clutha basin.

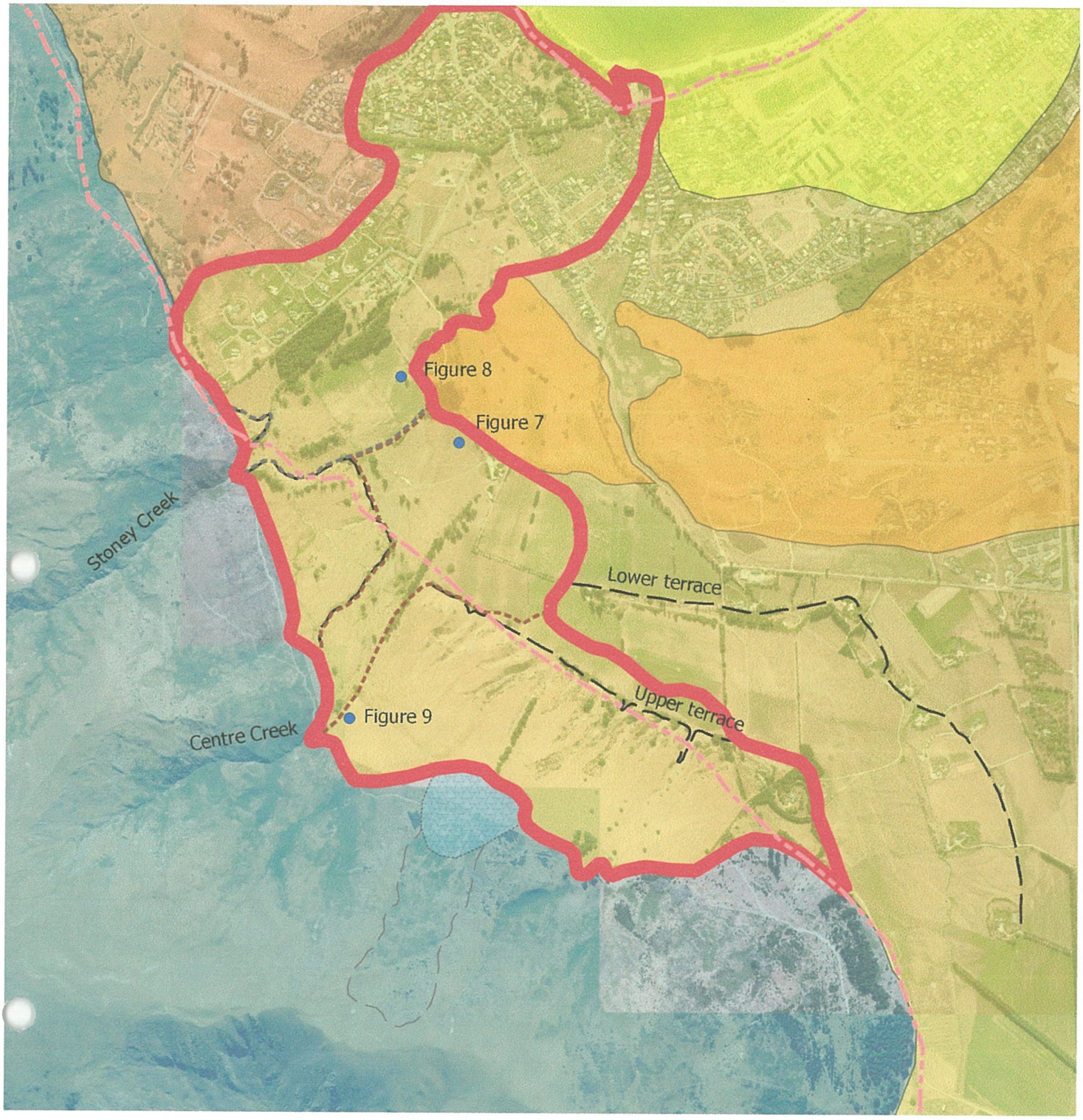
6 Alluvial fans are also very common around the basin margins, forming where the flow velocity of streams and rivers rapidly decreases as they exit the steep mountain slopes onto the flatter valley floor. A summary of the alluvial fans around the Upper Clutha and Wakatipu basins was included as Figures 3 and 4 within the original evidence. There are at least 16 significant sized fan systems within the basins and there are over 2000 within Otago.

7 I think that it is important to note that detailed geological mapping of the area was not conducted before the 2002 Environment Court hearing, and therefore the description of the geology and landforms was not always correct. The hearing focused on a landform described as the Alpha fan, but incorrectly describes the Alpha fan as being restricted to the upper part of the Hawthenden farm – a description that may have caused them to include the entire "landform" as part of the mountain range landscape. But the part of the fan referred to in the hearing is only the upper third of the fan; the fan actually extends to the shores of Lake Wanaka through the Far Horizon, Meadowstone and Sargood Drive subdivisions. The position that was described as the "toe of the fan" during the Environment Court hearing is in fact the upper terrace that cuts across the fan. Mapping by the Institute of Geological and Nuclear Sciences, by the Otago Regional Council and by myself, all agree that the true extent of the fan is the lake edge. This, as well as the fan being clearly composed of typical valley floor alluvials makes the classification of the fan as a geomorphological part of the mountain range very difficult.

8 The upper terrace that cuts across the fan and is roughly followed by the ONL line is neither a unique nor continuous landform feature. This terrace has been eroded and then buried over a length of almost 500m by subsequent fan activity. The fact that there are two terraces also makes it difficult to understand the rational behind using one of these terraces as a landform contact. Geologically there is no difference between the part of the Alpha fan landform that lies above the ONL line and that below.

Stephen Francis Leary

24th May 2017



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Legend

- Schist
- Landslide
- Moraine
- Alluvials
- Undifferentiated alluvials and moraine
- Lake deposits
- Alpha fan (active)
- Stoney Creek alluvial fan apron
- Centre Creek alluvial fan apron
- Alluvial terraces
- QLDC proposed ONL
- Photo locations

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