Before an Independent Commissioner
appointed by the Timaru District Council

Under	the Resource Management Act 1991
In the matter	of Plan Change 21 to the Timaru District Plan (Broughs Gully Outline Plan)

Statement of Evidence of Elliot Duke

5 July 2017

BACKGROUND AND RELEVANT QUALIFICATIONS

1 My name is Elliot Edward Duke.

2 I am an engineering director with Davis Ogilvie and Partners Limited; a Survey, Engineering and Planning consultancy. I am based in the Christchurch office of Davis Ogilvie, but work closely with the Timaru office where their projects require specific engineering design. I hold the following qualifications and memberships:

(a) Bachelor of Engineering with Honours (Natural Resources).

(b) Chartered Professional Engineer.

(c) International Professional Engineer.

(d) Member of the Association of Consulting Engineers of New Zealand.

(e) Member of the Structural Engineering Society.

(f) Member of the New Zealand Geotechnical Society.

(g) Member of the New Zealand Water and Waste Association.

(h) Member of the New Zealand Green Building Council.

(i) Member of the Infrastructure Sustainability Council of Australia

3 I have 15 years' experience in civil and geotechnical engineering.

4 As a Chartered Professional Engineer, I specialise in the civil and geotechnical aspects of projects; including geotechnical investigations, residential and commercial construction, roading and infrastructure design, stormwater, wastewater, and contaminated site management.

5 I have been involved in a number of large-scale development projects. These include the Cliff Street extension in Redcliffs, the 1500 lot Ravenswood development in Woodend, Bluewater Resort, Lochinvar Run and The Cairns developments in Tekapo, and the Alford Forest Mill brownfield development in Ashburton. I have overseen Geotechnical and Structural investigations for a variety of clients, including the University of Canterbury, Fletchers EQR and the Waimakariri District Council. I am experienced in civil design and construction; from conceptual development work, to working as an expert witness in High Court cases.

SCOPE OF EVIDENCE

6 My evidence is presented on behalf of Timaru District Council ('the Council'). I am familiar with the area subject to this plan change application. The s42A Officers Report prepared by Mr Marcus Langman (Planning Consultant) on behalf of the Council recommends that the proposed plan change application be endorsed for approval, pending consideration of further evidence.

7 Davis Ogilvie carried out preliminary design and infrastructure plans for TDC, and provided the Outline Development Plan (ODP) notified with the proposed plan change. The objective of the ODP is to facilitate a coordinated urban design approach for the provision of infrastructure across a site that is currently zoned residential (Res 1 and Res 4) but held in multiple ownership and currently has significant servicing constraints.

8 This evidence addresses civil engineering design matters specifically in response to Submission 2, being a joint submission from Port Bryson Property Ltd and Hilton Trust Ltd. Namely, the consideration of moving the proposed storm water management area off the submitter's property and how this affects the overall layout and design of the infrastructure for the proposed development area.

9 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014. I have complied with it in preparing this evidence and I agree to comply with it in presenting evidence at this hearing. The evidence that I give is within my area of expertise except where I state that my evidence is given in reliance on another person's evidence. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

SUBMITTERS SUBDIVISION CONSENT PLAN

10 The joint submission of Port Bryson Property Limited and Hilton Trust Ltd ('the submitter') included a proposed subdivision consent situated over Lot 1 DP 77099 and Lot 1 DP 23147 which is within the Outline Development Plan area. This plan is shown in **Figure 1** below.

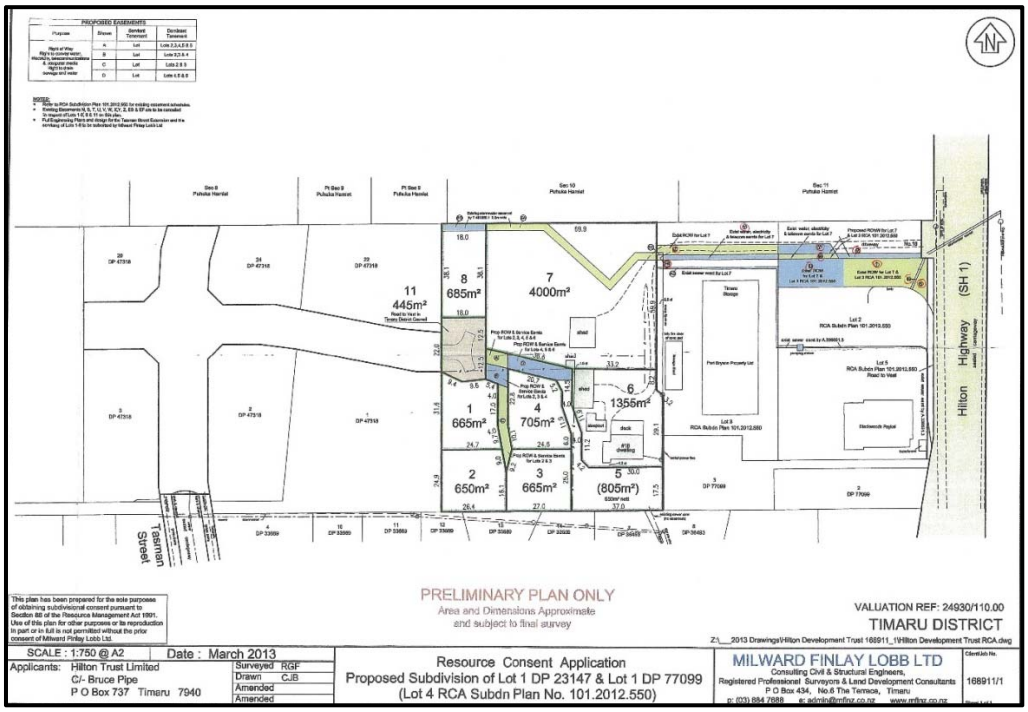

Figure 1: Hilton Trust Limited (Bruce Pipe) – Subdivision Consent Plan

11 The investigation area is depicted by the red dashed line on the layout plans attached to this evidence (PL01-PL03) and also shown on **Figure 2** below. The investigation area is situated at the eastern end (lowest end) of the Broughs Gully catchment. State Highway 1 and the Washdyke Lagoon lie downstream to the east of the site. Similar to the majority of the catchment, the investigation area is typically rolling rural grassland and as the name suggests includes a natural gully running west-east which forms the main drainage channel. There are existing buildings located on the submitter's property as shown their subdivision consent plan.

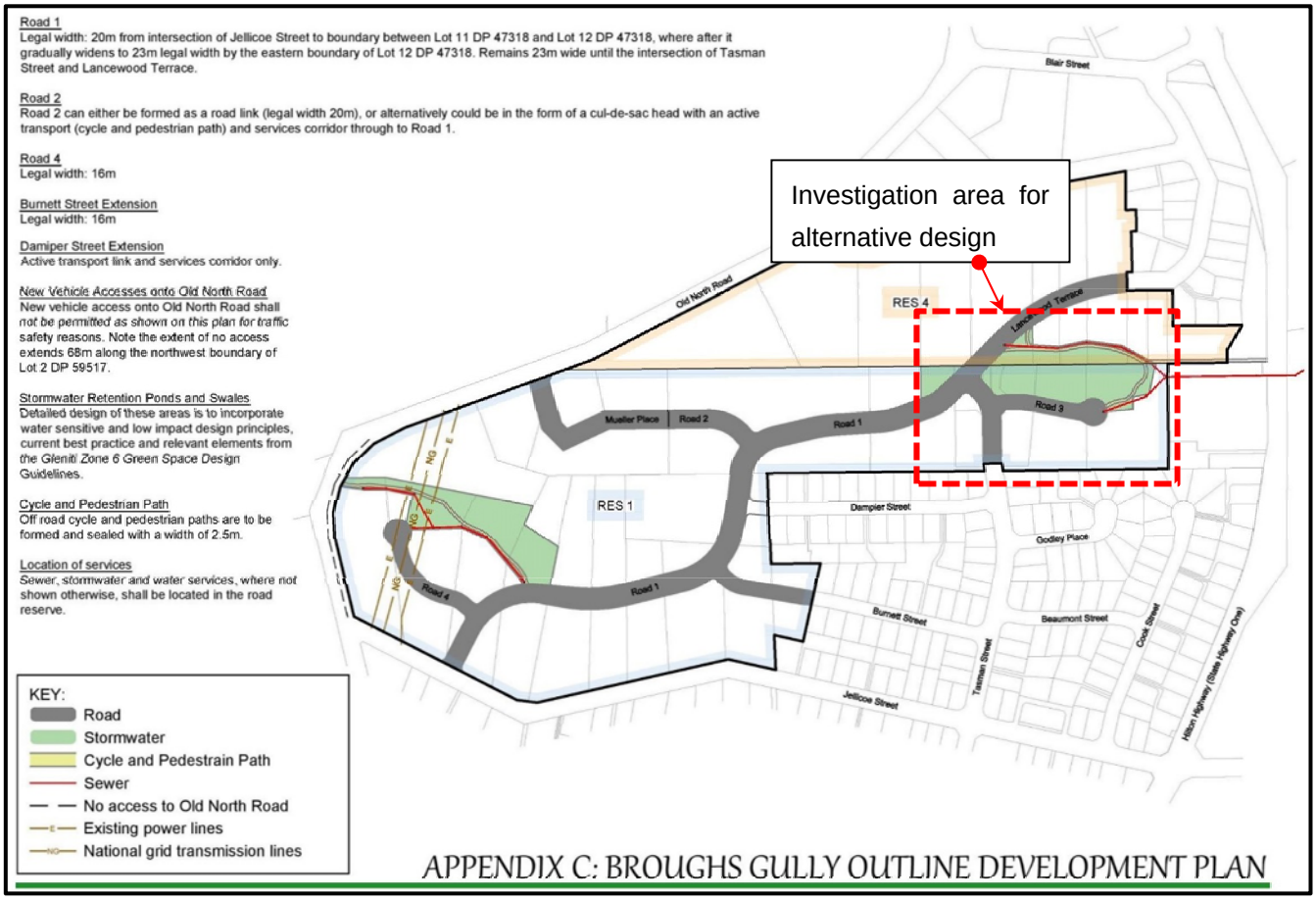

Figure 2: Broughs Gully Outline Development Plan

BACKGROUND TO EXISTING DESIGN

12 An iterative design process was carried out prior to the design team settling on the version included in the proposed plan change, being version 10.

13 The plans attached to this evidence (PL01 – PL05) show the design presented for the proposed plan change 'version 10 layout', compared to the alternative 'version 10a layout' required to evaluate the effects of meeting the submitter's request.

14 It is unnecessary to detail each iteration or alternative design that was considered in the evolution of the proposed version 10 infrastructure layout. However for the benefit of providing a more comprehensive understanding of how version 10 evolved, and some of the alternative designs that were considered, three such iterations are outlined in **Table 1** below.

Table 1: Alternative road/concept layouts considered during the conceptual planning phase.	
Concept	**Notes**
Concept layout V3  	V3 – Early draft layout which focused on utilising the existing titles TDC owned for future road reserve. This layout was very early in the design phase, prior to consideration of likely storm water attenuation requirements and road geometric design.
Concept layout V4  	V4 – An alternative road layout with increased reserve areas for storm water management. Upon assessment, the steep gradient (>12.5%) of the road alignment going up to Lancewood Terrace/Pacific Heights proved problematic, requiring the intersection and road alignments to be amended.
Concept layout V6  	V6 – Permeability for vehicles, cyclists and pedestrians was considered vital, subsequently the gully road was considered the dominant path and needed to connect to the north by continuing uphill to Lancewood Terrace/Pacific Heights. A pedestrian/cycleway link through to SH1 was also considered important. The change in road layout provided a more suitable location for a recreation reserve, aimed at being central, easily accessible and situated on flatter contoured land.

15 Numerous design team meetings and consultation with TDC Transport Unit were carried out during the development of the ODP. Some of the main design considerations and objectives for Lancewood Terrace (road 1) included:

(a) The design team considered Lancewood Terrace (road 1) was more appropriate to be the main through road and services corridor. Tasman Street was considered a less desirable main road.

(b) The road should provide linkage to the north and an alternative to using the SH1 / Jellicoe / Bridge St intersection.

(c) A wide road corridor through the gully (23m legal width as opposed to the TDC plan minimum of 18.0m) in order to provide potential for a central storm water swale, more room for drainage, infrastructure and visual amenity.

(d) The road alignment is constrained by existing contours and should follow the gully where practicable in order to maintain storm water secondary flow characteristics for the catchment.

(e) Strong vehicle, pedestrian and cycle linkages and connections with surrounding roads.

(f) Maximum vertical/longitudinal road gradient 12.5% (1 in 8).

ALTERNATIVE DESIGN

16 To accommodate the submitter's request, the ODP roading and stormwater management areas require amendment. I have considered the impacts of this, and this is addressed below.

17 In order to accommodate an alternative location for storm water attenuation on the west side of Road 1/Lancewood Terrace, the road alignment for; Road 1, Tasman Street, Lancewood Terrace and Road 3 must be amended. The design alternative is shown on Plan View PL03 and Cross–Section comparisons are shown on PL04 – PL05.

18 Based on preliminary design the re-alignment of Lancewood Terrace/Tasman Street extension will increase the maximum grade on the road by 1% (i.e. from 8% to 9%).

19 The vertical low point of Lancewood Terrace/Tasman Street intersection is constrained by the required maximum water level of the alternative storm water management area, to achieve the required attenuation volume.

20 The volume of earthworks within the assessment area subsequently increases substantially as a result (i.e. nearly doubles). This can be seen by the extent of the batters on PL03 and is quantified in the earthworks section below.

EARTHWORKS

21 The original design and layout was aimed at utilising the natural topography as best as possible, hence Road 1 was designed to follow the gully, providing central access, a secondary flow corridor and minimise ground disturbance.

22 The location and design of the original attenuation area provides greater scope for lowering ground level and generating fill while maintaining suitable ground contouring. This has positive environmental and cost benefits by offsetting imported material requirements. This is not an option under the alternative design.

23 Cross-Sections A & C and D & B are shown in similar locations to provide information on the differences between the alternative layout and that originally proposed by TDC (in the ODP). This depicts the increased depth of fill required. More specifically, at the location of maximum fill depth (which is slightly north of section line 'D'), the fill is up to 4.3m deep on the alternative design compared to a maximum of 2.9m on the original design. It is also worth noting that Road 1 slightly west of Section C is up to 1.1m below natural ground level (at the road reserve boundary), any further lowering of Road 1 will compound the adverse height difference and access to allotments south of the Road. As can be seen on plan PL03 this was not an issue on the original design.

24 Preliminary design shows the change in road alignment results in an additional 7,500m^3 of imported fill being required.

STORMWATER

25 The alternative storm water management area design can achieve the same volume of storm water attenuation as shown on the original layout. However the original attenuation location and layout is more desirable due to it being located on a relatively flat area at the bottom of the catchment. The flatter shape of the land (existing topography) and greater surface area provides more scope to increase storage capacity through excavation, should detailed design and modelling confirm that if it is necessary.

26 During the original design, the aim was to keep storage depths as shallow as practicable, to ensure the stormwater management area took the appearance of useable open space. Steep batters and deep storage should be avoided where possible due to maintenance, access and public amenity considerations.

27 The alternative storm water design layout is more constrained by the road design alignment and levels than the original layout. If the storage depth is required to be increased or decreased, this directly effects the required levels of the road, and hence earthworks volumes and road grades.

28 As much as practicable, the original layout aimed at working with the natural secondary flow of the catchment. The alternative design requires more earthworks in order to achieve storage requirements and maintain secondary flows.

LOSS OF RECREATION RESERVE

29 A significant effect resulting from the alternative layout is the loss in recreational reserve area. The gross recreational reserve area would be approximately half that in the original concept (i.e. reducing from 2,030m^2 to 1,120m^2).

30 The useable recreational area (area not affected by the road formation batters) also decreases by approximately two thirds (i.e. 1,430m^2 to 530m^2).

LOSS OF DEVELOPABLE AREA

31 As shown on PL01 the area of developable land (potential allotments) is also affected. The overall developable land within the Outline Development Plan area would decrease by approximately 3,000m^2 under the alternative design. However there are a number of other effects that should be taken into consideration:

(a) The re-alignment of Road 1 will result in the loss of sections on the south side of the road (this may amount to a loss of up to six sections). The original plan change layout aimed at making the most of this north facing land (i.e. double row of sections) which is elevated and of good contour. Loss of these sections could deter the owner of this property from developing, as the feasibility of development has been diminished (i.e. number of sections relative to the extent of road needing to be constructed).

(b) The area on the north side of Road 1 is a steeper south facing slope. So even though additional area is available due to the re-alignment of Road 1, development of this land is limited by: compromised access/road frontage, secondary flow requirements, the storm water attenuation area, and road geometry. Open green space would be considered more appropriate for this land given these considerations.

(c) In regards to the submitter's subdivision plan it is questionable that all of the area shown for proposed Lots 7 and 8 could be considered suitable for development. The northern portion of these proposed Lots are located in a

natural depression at the bottom end of the Broughs Gully catchment. This is a critical secondary flow path that is required to be maintained. Any building and development in this location should be carefully considered to ensure risks of flooding and or displacement/diversion of storm water are managed appropriately.

(d) With some of the lot 7 /8 land being below the proposed Broughs gully stormwater management area, additional onsite stormwater attenuation and treatment will be required, limiting the yield from what is shown on the current scheme plan.

SUMMARY

32 The ODP has been developed to provide the most efficient and effective development for the Plan Change 21 Area, taking into consideration good urban design principals and the engineering constraints.

33 The V10a plan proposed by the submitter could be accommodated, however this would result in:

(a) Lower yield

(b) Reduce development potential for other land owners

(c) Increased earthworks cost

(d) More constrained stormwater management area

(e) Reduced recreational reserve area reduced open space 'available' for public use

Signed: 

Elliot Edward Duke

5 JULY 2017