Before the Selwyn District Council

under: the Resource Management Act 1991

in the matter of: Proposed Private Plan Change 66 to the Operative District Plan: Maddisons Road, Rolleston

and: **Rolleston Industrial Developments Limited**
Applicant

Statement of Evidence of Timothy Douglas McLeod (Senior Civil Engineer)

Dated: 23 July 2021

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STATEMENT OF EVIDENCE OF TIMOTHY DOUGLAS MCLEOD

INTRODUCTION

1 My full name is Timothy Douglas McLeod and I am a Senior Civil Engineer at Inovo Projects Limited.

2 I hold a Bachelor of Natural Resources Engineering Degree from Canterbury University (BE[NatRes]), and am a Chartered Member of Engineering New Zealand (CMEngNZ) and Chartered Professional Engineer (CPEng).

3 I have over twenty-five years' experience as a Civil Engineer working on a range of infrastructure and land development projects in New Zealand, Australia, the United Kingdom and Guinea, West Africa. I have a working knowledge of topographical survey data capture, digital terrain modelling, and stormwater design and flood model analysis.

4 I am familiar with the application by Rolleston Industrial Developments Ltd for the Proposed Plan Change 66 (PC66) at Maddisons Road, Rolleston. I have also been involved previously as Senior Civil Engineer and Project Manager for the neighbouring IPort Business Park development and the Lyttelton Port Company's Midland Port facility to the south.

CODE OF CONDUCT

5 Although this is not an Environment Court hearing, I note that in preparing my evidence I have reviewed the Code of Conduct for Expert Witnesses contained in Part 7 of the Environment Court Practice Note 2014. I have complied with it in preparing my evidence. I confirm that the issues addressed in this statement of evidence are within my area of expertise, except where relying on the opinion or evidence of other witnesses. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

6 My evidence addresses the following:

6.1 Flood hazard issues raised in the submission by Environment Canterbury (*ECan*) on Proposed Plan Change 66.

6.2 Water supply issues in relation to firefighting water raised in the submission by Fire and Emergency New Zealand (*FENZ*).

7 In preparing my evidence, I have reviewed the following:

7.1 DHI Water and Environment Ltd report "Regional Policy Statement Modelling for SDC – District Plan". November 2019;

7.2 The Section 42A Report prepared by the Council.

SUMMARY OF EVIDENCE

8 The flood depth and therefore flood hazard identified by ECan in their submission has been incorrectly identified due to errors in the terrain model used to generate the 200 year flood model. A step-up in the ground levels due

to change in vegetation across the site has resulted in the flood flow depth being over-estimated.

9 Based on examination of the flood model results upstream and downstream of the PC area, I do not consider the PC66 site to be a high hazard flooding area and that any flooding that may occur can easily and appropriately be mitigated through management of overland flow paths at the time of detailed design.

10 I consider that the Council's existing standards and design processes are sufficient to ensure that adequate water supply for firefighting is achieved in the PC66 area.

FLOOD RISK

11 The PC66 area generally falls to the southeast at a 1-in-180 slope. There are two defined overland flow channels that cross through the PC66 area which are likely former river channels. Any excess rainfall runoff from the up-slope catchment tends to be concentrated in these flow channels.

12 In their submission, ECan have referred to the rain-on-grid flood modelling carried out by Selwyn District Council and identified two well-defined overland flow paths for the 200 and 500 year events, and noted that the water depth and flow speeds in the western channel are such that this would meet the definition of a high hazard area in the Canterbury Regional Policy Statement (CRPS).

13 Figure 1 below highlights the western channel in red as meeting the high hazard criteria (depth > 1m).

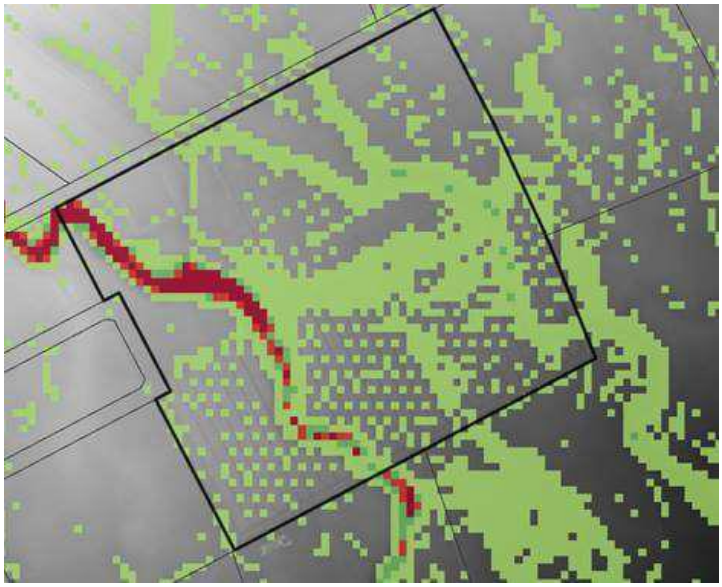

Figure 1: ECan Flood Hazard Map (red = high hazard)

14 "High hazard areas" are defined in the Canterbury Regional Policy Statement as areas subject to inundation events where the water depth (metres) × velocity (metres per second) is greater than or equal to 1, or where depths are greater than 1 metre, in a 0.2% AEP flood event.

15 The flood risk identified by ECan (red areas in Figure 1) has been overestimated due to the methodology used to capture and process the terrain

data and the coarseness of the flood modelling carried out by Selwyn District Council to assess the 1-in-200 and 1-in-500 year flood events.

15.1 The flood model referred to by ECan was carried out by DHI Water & Environmental Ltd. The model build is described in their report 'Regional Policy Statement Modelling for SDC – District Plan' dated November 2019.[1] A number of different ground level datasets were combined together to create the master terrain used in the modelling.

15.2 The dataset used for the Rolleston area was the LiDAR survey data set dated 2016-2017. LiDAR or Light Detection and Ranging is a remote sensing method used to capture topographic survey data using near-infrared laser ranging. Post-processing of captured LiDAR data make adjustments for vegetation height (for example, tall trees cf. grasses) to obtain a more accurate representation of the ground surface.

15.3 The flood model terrain comprises a 2D surface consisting of a 10×10m quadrilateral grid derived from LiDAR data which is on a 1×1m grid. The grid was not modified to allow for flow through culverts under roads or the high overflow point such as roads, railway lines or flood embankments. The DHI report limitations note that the location of hydraulic structures such as culverts was not estimated or included in this modelling, and that ponding may be overestimated in some areas that, in reality, would allow some through flow to occur.

15.4 The flow depth across the site and therefore the flood hazard assessed by ECan (flow depth × velocity) has been over-estimated due to the coarseness of the flood model (10×10m grid) and inaccuracies in the LiDAR dataset. Changes in vegetation across the site from short grass pasture to tall green feed crops have not been correctly identified in the LiDAR height correction algorithms, resulting in ground levels on the downstream half of the site being artificially higher by 0.5 to 1m in the terrain model. This is illustrated by the unusual "checker pattern" of green squares in Figure 1 representing ponded water which correlate with the wheel tracks or "tram lines" left by a travelling irrigator in the tall green crop. The tram lines are obvious in the LiDAR terrain model (1m×1m grid) as shown in Figure 2 below and can also be observed in the aerial photo taken at the same time.

[1] https://www.selwyn.govt.nz/__data/assets/pdf_file/0014/324131/DHI-Regional-Policy-Statement-Modelling.pdf

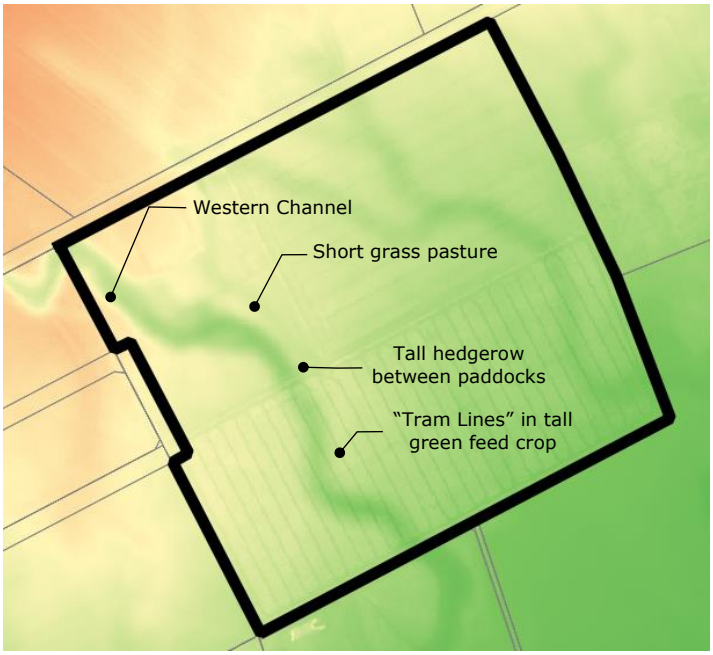

Figure 2: LiDAR Terrain Model showing Tram Lines

15.5 Figure 3 shows the ground profile drawn along the invert of the western channel illustrating the "step-up" of approximately 0.5 to 1m in the LiDAR surface due to the hedgerow and vegetation change between the two paddocks at the time the LiDAR survey was completed. The "tram lines" in the tall vegetation are also obvious. This step-up in the terrain model will have caused ponding and therefore the flood depth upstream to be exaggerated in the flood model by 0.5 to 1m.

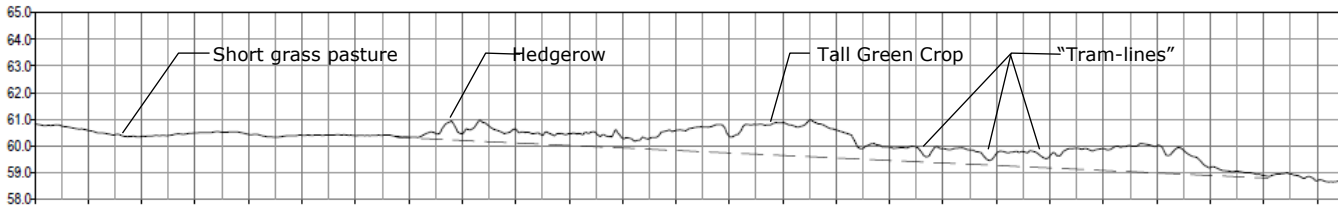

Figure 3: Ground Profile showing Error in Terrain Model

16 Examination of the flood hazard map provided by ECan shows that flood flows upstream and downstream of the PC66 site are not sufficiently fast or deep to meet the CRPS criteria for high hazard. The area of high hazard identified on the PC66 site has, in my opinion, been incorrectly modelled as being greater than 1m and therefore incorrectly identified as meeting the CRPS high hazard criteria.

17 As such, the high flood hazard areas identified by ECan using the SDC flood model should be considered as indicative only and should be used as a tool, rather than a rule. Given the limits on accuracy of the flood model, it is important that flood risk on each site is considered on a case by case basis.

18 I have assessed the flood risk on this site and I do not consider the site to be in a high hazard flood risk area as defined in the CRPS, and that any flooding that may occur can easily and appropriately be mitigated at the time of detailed design through management of overland flow paths by appropriate engineering solutions for flooding and stormwater management.

WATER SUPPLY FOR FIREFIGHTING

19 In the comments prepared for the Section 42A Officer's Report, Mr Murray England, SDC Asset Manager (Water Services) noted:

"*that additional capacity within the network to service this plan change is available and further capacity upgrades are proposed and planned for and therefore future water demand from the proposed plan change can be met"*.

20 Mr England also noted that Council requires that all new subdivisions are to be designed and constructed in accordance with the Selwyn District Council's 'Engineering Code of Practice' which requires that water supply reticulation should comply with SNZ PAS 4509: 2008 Fire Service Code of Practice to meet the requirements for firefighting flows, residual fire pressure and the spacing of hydrants.

21 Design of the earlier stages of the IPort Business Park included making provision for extending water mains into the proposed PC66 area. Design checks were carried out at the time by staff working under my direction to confirm the water mains installed on earlier stages had sufficient capacity to supply the proposed PC66 area to meet firefighting standards for FW4 classification. I therefore agree with Mr England that the Council's existing standards and design processes are sufficient to ensure that adequate water supply for firefighting is achieved in the PC66 area.

RESPONSE TO SECTION 42A REPORT AND SUBMISSIONS

22 In response to paragraphs 79 – 85 of the Section 42A Officers Report:

22.1 I support the conclusion in Paragraph 81 that managing overland flow paths can be addressed at the time of detailed design through the subdivision consent process.

22.2 I do not support the conclusions in Paragraph 84. In my view there is sufficient technical evidence (as described above) that the site does <u>not</u> meet the criteria for high hazard flood area, and therefore the proposed plan change meets the direction of Policy 11.3.1 of the CRPS.

22.3 In light of my conclusion above that the PC66 site does not contain a high flood hazard area, I do not support the conclusion in Paragraph 85 that a high hazard area should be identified on the ODP. Realignment of overland flow paths across the site can be adequately determined during the subdivision design and approval process.

Dated: 23 July 2021

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Timothy Douglas McLeod

BE(NatRes) CMEngNZ CPEng