

The COVID-19 Recovery (Fast-track Consenting) Act 2020

Applications for resource consents for Drury East Stage 1 Precinct by Fulton Hogan Land Development Ltd

Technical advice on flooding and stormwater provided by Nigel Mark-Brown

13 May 2022

This advice replaces an earlier report dated 12 May 2022 and is provided following further review of documents in order to clarify matters raised by the panel.

QUALIFICATIONS AND EXPERIENCE

1. I have the qualification Bachelor of Engineering (Civil) and I am a chartered professional engineer (civil/environmental) and a member of Engineering New Zealand. I have practiced as civil and environmental engineer for 46 years. This includes experience in wide variety of civil engineering work including earthworks for water supply and detention dams and roading, residential and industrial subdivision design, stormwater pipe network and overland flow path design, catchment management planning, stormwater quality management and flood assessment and management including design of detention dams, flood channels and overland flow paths.
2. My relevant stormwater experience includes being co –author of the NZWERF /Ministry for the Environment On Site Stormwater Management Guideline 2004 and author or co-author of a number of papers presented at New Zealand Water stormwater conferences. These include papers on information barriers to wider use of on site stormwater devices, stormwater quality management for metal contaminants and flood hazard evaluation for subdivisions in areas of coastal inundation hazard.
3. I have certification as an independent hearings commissioner with chair endorsement and have sat on a wide range of consent and NoR hearings including large scale infrastructure and subdivision consents over the past 12 years.

CODE OF CONDUCT

4. I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note (2014) and I agree to comply with it. In that regard, I confirm that this advice is written within my expertise, except where I state that I am relying on the evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF ADVICE

5. My advice provides responses to a number of questions that were included in a brief provided to me by the expert consenting panel tasked with making decision on the

applications for resource consents for Drury East Stage 1 Precinct. This brief is available on the EPA website.

6. These questions are on flooding and stormwater matters associated with the applications including matters that arise from the comments on the applications by Auckland Council (Healthy Waters) and Auckland Transport and the associated responses to these comments by the applicant.
7. My advice also includes consideration of the responses to two requests for information that were made on flooding and stormwater as follows:
 - RFI no.1 dated 21/4/22 regarding various flood matters, the response from the applicant provided by way of a memorandum from Woods dated 2/5/22
 - RFI no. 2 dated 29/4/22 on various stormwater management matters, the response provided by way of a memo from Aurecon dated 6/5/22 which included updated conditions in relation to stormwater management and requirements for covenants regarding ownership and operation of private stormwater systems

STRUCTURE OF ADVICE

8. My advice is structured to address the matters contained in the brief in a logical sequence. I include the question from the brief in italics followed by my response and comments.

FLOODING

8. *Does the proposal provide an acceptable approach to flood management that contemplates the impact on the site from the wider catchment and avoids adverse effects outside the site?*
9. There are three aspects of flooding that need consideration as follows:
 - a) Is the overall proposed development at an appropriate topographical level to provide a robust factor of safety against catchment wide flooding including from upstream runoff and from any backwater effects from downstream controls such as future sea level rise and culvert or bridge restrictions?
 - b) Is the proposed development likely to cause increases in flooding outside the proposed development which are significant and need avoiding or mitigating
 - c) Does the layout of the proposed development adequately provide for conveyance of flood water within the proposed development to appropriately avoid nuisance, damage or hazard to assets and people within the development
10. My response to paragraph 9(a) above, based on information provided by the applicant by way of the response to the RFI dated 21 April 2022 and contained within a memo from Woods dated 2 May 2022 is as follows. The main issue is whether the proposed cross-section of the Fitzgerald Stream waterway and adjacent finished ground levels are

appropriate to allow for significant flood events without problematic flooding of roads or building platforms. The applicant has provided 1% and 10% AEP flood levels at several locations on the Fitzgerald Stream. These are based on modelled flood flows for climate change of 3.8°, together with water level calculations based on topographical information on the final stream cross sections, longitudinal stream slope and assumed stream roughness. Inspection of these levels indicates that for cross sections A-A, B-B and D-D the proposed adjoining finished ground levels are generally over 1 m and at least 500 mm above the estimated 1% AEP with 3.8° climate change future flood levels. At cross section C-C it appears finished levels of adjacent proposed superlots are less than 1 m above the estimated flood levels. My opinion is that finished building platform levels should be at least 0.5 m above the estimated future flood levels allowing for climate change of 3.8°. This allowance is greater than that currently required by the Auckland Council Stormwater Code of Practice for building floor levels however I consider it appropriate for designing finished levels of a subdivision with a life that may exceed 100 years and adjoins a significant waterway due to the uncertainties associated with allowing for climate change and assumptions on channel roughness and head losses at culverts and bridges. Also it is relatively easy for the proposed subdivision to achieve a flood freeboard of at least 0.5 metres.

11. The Panel has asked for clarification of my above advice that future flood levels should be calculated allowing for future climate change of 3.8° which is greater than that required in the latest Auckland Council Code of Practice for Stormwater, version 4 dated January 2022.
12. On this matter there is clear signalling to Auckland Council of the need to adapt to a higher climate change provisions of RCP 8.5 as consulted on and adopted as part of the Auckland Climate Action Plan. The implementation of Te-Tāruke-ā-Tāwhiri: Auckland's Climate Plan within the Auckland Design Manual is being assessed by Auckland Council with the view to revising climate change provisions across all Codes of Practice to ensure consistency. This work will be carried out during 2022. RCP is the terminology used to describe climate change representative pathways. The Climate Action Plan has adopted a middle of the road RCP8.5 (Business as usual) scenario which relates to a temperature increase of 3.5-3.8 degrees C (up from 2.1 degrees in the current stormwater code of practice).
13. In addition to my comments in paragraph 10 above I have the following comments on sizing of new culverts on the Fitzgerald Stream under Fitzgerald Road, Fielding Road and other several other proposed new roads. The flood assessment information I have seen does not include any detailed discussion of design parameters for these culverts and allowing for any blockage and /or overland flow over the road crossings in the event of extreme storms. This will be addressed at EPA stage but I consider that design of the road crossings and culverts needs to take into account flood flows allowing for climate change of 3.8°. This design should consider the hazard to road users of road overflow in an extreme effect and effect on upstream flood levels due to culvert obstruction or

blockage. I expect this to be relatively easy to address at the subdivision detailed design stage.

14. I have a further response to paragraph 9(a) as follows. I have a concern that by retaining the existing flow capacity for the culverts on the Fitzgerald Stream at Fitzgerald Road and Fielding Road until the culvert upgrades under Great South Road, Flanagan Road and the railway line are carried out as proposed in the Drury East Stormwater Management Plan, there could in the interim be a significant and /or unacceptable flood hazard on the roads above those culverts. Although the proposed development will not increase flood flows at these locations it appears from the size of the existing culverts and the modelled flood flows that there may be a significant depth and extent of flooding over these roads in a 10% AEP and larger events until the culverts on the Fitzgerald Stream at Fitzgerald Road and Fielding Road are upgraded. This may not be acceptable while the proposed development is carried out with associated increase in traffic on Fitzgerald Road. There may also be a significant risk of blockage or obstruction of the culverts in an extreme flood event due to trees that may wash down from the tree clad upper headwaters of the catchment, increasing flood levels at and upstream of the culvert.
15. My response to paragraph 9(b) above is that based on the Flood Assessment Memorandum from Woods to Fulton Hogan dated 15 November 2021 the flooding effects from the proposed development on assets and land outside the development are minimal and acceptable. This appears reasonable and believable from first principle hydrological considerations as flooding downstream is dominated by the larger upstream catchments contributing to the Fitzgerald Stream and Hingaia Stream.
16. My response to paragraph 9(c) above is that the applicant appears to have adequately provided for overland flows paths (apart from those associated with the road crossings of Fitzgerald Stream as discussed above) within the proposed development which are to generally align with the proposed road locations.
17. *Is a 'holistic' model required in order to assess effects on the proposed stormwater network from the Drury East stage 1 Precinct development in relation to the consented Drury Centre Transport Interchange and both the Fulton Hogan ('Drury East Stage 1 Precinct') and Oyster Capital ('Waihoehoe Precinct') proposals, as well as climate change.*
18. My opinion is that as the applicant has demonstrated that the flooding effects from the proposed development on assets and land outside the development are minimal as set out in paragraph 15 above it is not necessary for the applicant to prepare a holistic model. Flooding of downstream development is and will be dominated by flows from the larger upstream catchments contributing to the Fitzgerald Stream and Hingaia Stream.

19. *Has sufficient information been provided to understand the potential flood risks (including within Drury) as a result of earthworks and development proposed by the Drury East and Waihoehoe proposals?*
20. In the Woods response of 12 April 2022 to Section 6- Stormwater discharge assessment by Healthy Waters as Network operator it is noted that the stormwater flood modelling is conservative as it does not allow for storage associated with topography and proposed pipes. Based on this advice together the consideration of the Flood Assessment Memorandum from Woods to Fulton Hogan dated 15 November 2021 my opinion is that sufficient information been provided to understand the potential flood risks (including within Drury) as a result of earthworks and development proposed by the Drury East and Waihoehoe proposals, apart from my comments on the recommended flood design in paragraphs 12 and 13 above and need to manage interim flooding per paragraph 12 above.
21. *Are there any other issues or concerns that you have in respect of the proposed approach to flood management, and are there changes or conditions that could be proposed (or altered) to address such issues.*
22. I consider that consent conditions for flooding are required to :
- a) Ensure that finished building platform levels be at least 0.5 m above the estimated future 1% AEP flood levels within the Fitzgerald Stream allowing for climate change of 3.8° C.
 - b) Design of the road crossings over the Fitzgerald Stream and associated new culverts allows for future potential culvert blockage and mitigation of hazard due to overland flow over the road crossings for the 1% AEP flows allowing for climate change of 3.8° C.
 - c) Manage the flood risk adjacent to the culverts on the Fitzgerald Stream at Fitzgerald Road and Fielding Road until the culvert upgrades under Great South Road, Flanagan Road and the railway line are carried out as proposed in the Drury East Stormwater Management Plan. This shall be carried out to ensure flood hazard to the public including for travel on roads over stream is acceptable.

STORMWATER MANAGEMENT

23. *Is the stormwater management approach acceptable (or unduly 'homogenised') and what is likely to be the outcome of an 'integrated management approach'?*
24. *Please comment on whether the proposed stormwater mitigation and devices are likely to represent the best, or an acceptable, approach for the site (compared to other possible viable alternatives)?*

25. I address the questions in paragraphs 23 and 24 above together as follows
26. The description of the stormwater management approach in section 5.7.4 of the civil engineering design report prepared by Aurecon Revision 4 dated 17/11/2021 is very general. There is no description of the criteria used to decide on which areas are to be treated by communal bioretention and which by distributed bioretention and it is not clear to me the reasoning behind the location and nature of the proposed devices as shown on drawing WA-0120-rev A. There is a large number of bioretention devices (raingardens) proposed within the road reserve which treat both road and superlot areas. The proposed communal bioretention areas are located on reserve areas adjacent to the Fitzgerald Stream.
27. The comments on the proposal from Auckland Transport include a request the applicant provide evidence including consideration of operation and maintenance and health and safety to demonstrate the proposed solution is the best option. They also note that the applicant should be requested to clarify why more, larger communal devices have not been considered as the priority over a multitude of small devices.
28. AT comments also note that their concerns are in line with concerns Mana Whenua have raised where they express preference for communal green infrastructure as there would be a lesser number of devices providing a cost saving for maintenance
29. The AT comments also raise concern about raingarden “sharp drop offs” which are considered a hazard to pedestrians and need to be mitigated by for example setback between raingardens and footpaths.
30. Excessive drop offs can occur at the edges of raingardens because the surfaces of the raingarden media need to be horizontal whereas the road alignment varies some distance vertically from the horizontal. I note the undulating nature of most of the proposed roads can be expected to result in most of the raingardens requiring internal walls and possibly additional sumps or offsets to adjacent paved areas to minimise the drop offs and mitigate hazard to pedestrians. These issues have not been addressed by the applicant apart from a note on the indicative roadside bioretention device details in drawing CC-0401-A noting that “for steep roads check dams with additional outlet sumps may be required”. I note that mitigation for drop off may be required for a large number of raingardens, not only those on steep roads. I consider these matters need to be addressed as part of the consent application and not left to the EPA approval process as compromises on good design may then occur due to lack of available space within the road reserve to enable well designed rain gardens.
31. I consider the applicant needs to clarify why more, larger communal devices have not been considered as the priority over a multitude of small devices. This is because large communal devices have a number of advantages over smaller distributed devices

including avoiding potential safety due to proximity of pedestrians, less complex design and less onerous operation and maintenance requirements. I note that a number of the catchments shown to have distributed bioretention in drawing WA-0120-A appear to be able to be served by a communal device which could be located adjacent to the Fitzgerald Stream reserve. This may require some adjustment of the proposed subdivision layout but appears to me may be an appropriate “integrated “stormwater management the stormwater catchment plan aims to do.

32. I note that a number of proposed communal bioretention devices are located adjacent to the Fitzgerald Stream. I have not seen any criteria proposed for such devices in terms of flood protection, i.e. for them to be located above the 1% or the 10% AEP flood levels and whether that can be achieved at the proposed locations. In my view detailed consideration is required on flood protection criteria appropriate for the communal devices and whether this can be achieved at the proposed locations of the devices. I consider this can be achieved through an appropriate additional resource consent condition
33. My summary answer to the questions of paragraphs 23 and 24 is:
 - a) I have not seen evidence that the proposed stormwater management approach is the outcome of an ‘integrated management approach’. My view is that the options for more communal devices needs to be further explored and the proposed number of distributed devices (raingardens in the roads) is excessive and will lead to poor outcomes for operation and maintenance.
 - b) I have not seen evidence to demonstrate that the proposed stormwater mitigation and devices are likely to represent the best, or an acceptable, approach for the site (compared to other possible viable alternatives).
34. *Please comment on the issue of whether stormwater assets (such as manholes) should be contained within the carriageway instead of the road berm, and the adequacy of road berms for this purpose.*
35. My opinion is that stormwater manholes should be contained within the berm rather than the carriageway. This is for safety and pavement integrity reasons. I note that this approach is proposed for the Drury Centre Precinct project and for the Waihoehoe Precinct Project and they appear to be relatively similar with respect to proposed road cross sections. I note the typical combined services cross section for the Drury East project shown in Drawing UT-0301-rev B shows a cycle lane which is of sufficient width for stormwater pipes to be located underneath, as is proposed in the Drury Centre Precinct project and for the Waihoehoe Precinct Project.
36. *Should parameters or limits be set for the development of the superlots, and if so are appropriate parameters defined at present?*

The proposed components of stormwater management for the superlots are not clear to me. The stormwater management device catchment plan in drawing WA-0120-A notes there are superlot catchments provided for by each of the proposed bioretention devices. More information is required to explain whether these devices will provide SMAF1 hydrological mitigation for individual lots and superlots and whether individual on site tanks with possible water reuse might be used for this purpose. Also will the bioretention devices provide water quality treatment for the lightly trafficked impervious on lot areas or will on site treatment be required? I consider that that further information is required to be provided to set out clearly the stormwater management approach for each of the 23 subcatchments delineated in Drawing WA-0120-A, for both individual lots and superlots.

37. *Please advise of any other issues or concerns that you may have in respect of the proposed approach to stormwater management, including any potential influence to that approach arising from the Drury Central and Waihoehoe proposals, and whether there are changes or conditions that could be proposed (or altered) to address such issues.*
38. The remaining issues or concerns and options for addressing them are:
- a) Provision of adequate mechanisms for ensuring the operation and maintenance of all private stormwater management devices continues in the future. The applicants reply to RFI no. 2 in the Aurecon memo dated 6/5/22 included provision of a number of proposed additional consent conditions relating to provision of a covenant to require the operation and maintenance of the private stormwater system for private lots is in accordance with the requirements of the Operation and Maintenance Plan as required in other consent conditions. This is well intentioned but I have a concern that if it is purely legal it doesn't give the future land owners clear advice about what the devices are and why they need to be maintained. I think consideration should be given for provision of explanatory information through consent conditions. This could possibly be achieved by way of clarifying the proposed conditions for the Operation and Maintenance Plan to make it clear that it includes all stormwater management devices including private devices on private property including detention tanks and catchpits
 - b) The applicant in its response to RFI no. 2 has provided a considerably revised condition no. 14 for Stormwater management works. I have the following comments on the revised table:
 - For "road corridors reserves" this needs to be clarified: I suggest it be replaced with "impervious areas within road reserves"
 - For the current "road corridors reserves" row under the BPO for stormwater management column I question why the qualifier "where practical" is included for communal bioretention devices. I consider that all communal bioretention devices should include gross pollutant pre-treatment.