Appendix 3

Requests for Further Information
and
Responses

Waipa DISTRICT COUNCIL

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Te Awamutu 3800

Cambridge Office
07 823 3800
23 Wilson Street
Cambridge 3434

Mitchell Daysh Limited
PO Box 1307
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Hamilton 3240

Digitally Delivered

ATTENTION Abbie Fowler
Dear

Resource Consent Application – Further information request

Application number:	SP/0179/20
Applicant:	3MS Of Cambridge Limited Partnership
Address:	1881 Cambridge Road Cambridge 3434
Proposed activity(s):	Subdivision to create 242 residential lots within the C2 Growth Cell, and associated lots for public assets

In accordance with section 92 of the Resource Management Act 1991 (RMA), the following information is requested to enable me to make an accurate and informed assessment.

Notes:

1. Council officers are available for discussions about any of the matters raised in these questions. These discussions have proceeded prior to this request following provision of RFI questions being sent to you. Council officers remain available for further discussions.

2. The Council may also have resources or information that will assist provision of responses.

The following information is requested:

Plan revisions

1. We understand revision of some aspects of the proposal is being carried out as a number of matters develop or are resolved. These may be accommodated within the assessment and determination procedures as is appropriate for each matter and the stage within these procedures the material becomes available.

Please provide advice at the time you advise of any changes of the manner you believe is appropriate for them to be included in the assessment process to be in accordance with the RMA procedures.

Stormwater matters

1. Please provide and demonstrate technical engineering assessment proving the onsite stormwater management will have sufficient capacity to protect the surrounding locality from potential for stormwater flooding.

2. Please advise, assess and demonstrate the financial effects and what resulting environmental effects will be likely to arise regarding the C2 and C1 and C3 growth cells from, as suggested in the assessment of effects on the environment, development contributions towards stormwater being described as not being applicable to this proposal due to the proposal to manage stormwater on the site.

3. 3Ms propose a SW pond/wetland that is not shown in the C1 C2 C3 Structure Plan and suggest that the costs of operating and managing this facility will be cost neutral to the Council as this will create the potential to reduce the size and scale of the stormwater swale and associated reticulation. Please provide description and demonstrate of how this will be achieved.

4. Please advise whether the development is proposed to be connected to the stormwater network within the C2 growth cell, either temporarily or permanently.

   The reason for this question is the east/west swale separates the land to the south of it from the on-site stormwater reserve and this swale appears on the plans to be wider than what is expected to be required for stormwater purposes. There are also connections from outside the application site to the balance of the C2 cell indicated on the application plans.

5. Please advise how the effects of locating the stormwater drainage and swale network on the adjacent land are going to be mitigated. Please also include description of how you will be able to assist or facilitate its establishment as part of the mitigation of effects.

6. Please advise what the terms of any developer agreement with the Council concerned with mitigating effects on the stormwater network is proposed to include.

7. Please advise what effects proposed infiltration of stormwater through and below the iron pan within the infiltration basin will have on stability ground stability within the application site and outside its boundaries, and where or if it is expected to discharge and effects at that point.

   Note: This should include but not be exclusive of any other matter your assessment may identify as relevant, and confirmation that the soakage pond proposal will not result in additional ground water flows to the C3 terraces and in turn cause erosion and slip and any ground stability risk and effects.

8. Please provide a description of planting and surface and structures development proposals, including surface development and plant species, for the infiltration basin and advise on Management and maintenance requirements they will present.

9. Please provide advice on the risk of instability along the side of the proposed stormwater pond and open swales within the C2 growth cell including but not limited to, lateral spread and bank erosion and how this risk will be avoided.

10. Please provide confirmation in writing from WRC that there are no issues with the stormwater discharge consent arising from the stormwater soakage pond and discharge proposals and particularly that consent for the discharges proposed has been obtained, or alternatively describe how obtaining any consent for these discharges that may be required may be provided for.

11. Please provide the technical report prepared by BECA and referenced in the application that provided the advice your assessment of the hydrological effects of the stormwater soakage pond will have.

12. Please provide the stormwater pond soakage results confirming it is a viable option.

13. Please identify the positions and details of any services connections proposed between the on-site stormwater network and the offsite network.

14. Please advise how assurance of connection to and from the application site and adjoining land that may be proposed or required for stormwater management purposes until and after the on-site facilities are constructed.

15. Please provide assessment and design of any changes to the stormwater network servicing to the C1, C2 and C3 growth cells that may result from the effects of the proposal for on-site management of stormwater and required to mitigate on-site and off-site effects of this.

Reserves

Note: The requests below are subject to the outcome of continuing discussions relating to the sports fields. There are however also a number of questions that would relate to the wider reserves matters that apply to the proposal.

16. Please advise the stage and outcome of any discussions to date and any variations to the application that have arisen from these discussions.

17. We recognise the reserves and particularly the sports fields matters are evolving and there may be further developments after any such information is provided. Please provide advice on how you see these changes being included in the assessment and determination process in a manner that satisfies the provisions of the Resource Management Act.

18. Please provide a revised subdivision scheme plan showing the location and area of the reserve/sports fields land and showing any other changes made to the subdivision proposals to accommodate them, including land use proposals adjoining proposed reserves.

19. Please provide plans showing the development proposals for the reserves proposed to be vested and those proposed to be acquired by the Council.

    We understand these are still being developed and may be affected by present discussions. If there is a need to delay provision of this information to a later stage in the processing of this application, please advise how this might be provided for as part of any resource consent that may issue, or alternatively after this process.

20. Please advise the applicant's understanding of how the proposed reserve acquisition and development will be funded and the terms of the maintenance period associated with the proposed developments.

21. Please provide plans and description of how parking is proposed to be provided for reserves including sports fields and provide traffic engineering assessment of its adequacy.

22. Please provide plans and/or description of how easy, direct and safe pedestrian crossing across Road 20 between the proposed reserves areas will be created.

23. Please provide plans and/or description of how easy, direct and safe pedestrian access from the east west lineal stormwater reserve to the Cambridge Town Belt may be provided or contributed to by the development.

24. Please advise of any discussions with the Ministry of Education and the outcome of these regarding effects removal of the sports fields may have on their proposals.

25. Please provide advice of the outcome of any discussions with the Ministry of Education regarding potential for the school sports fields to be available for public use.

26. Please advise how and what services and utilities the applicant proposes to provide to the sports fields and other recreation and reserves and facilities including under an infrastructure works agreement and the locations of these relative to the reserves.
27. Please provide plans showing the details of proposed landscaping, land shaping, pathways and boardwalks, servicing and other structures and development proposed to be included in the reserves, and swale sites.

28. Please provide advice you will accept a condition requiring preparation of a landscape plan and its approval by the Council after any resource consent issues if this becomes required due to relative timing.

Transportation and Roading

29. Please provide confirmation that public transport will be provided with bus stops and suitable road carriageway width both prior to and after construction of the north/south collector road. Please provide a plan showing the shape, dimensions, and profiles of these relative to the carriageway.

30. Please provide further detail related to design layout, operation and performance of the intersection of Road 10 with Cambridge Road and Chartwell Properties intersection on the opposite side to prove it will operate safely and efficiently. This may require traffic engineering support.

31. The Council remains concerned there is a limit to the traffic that can safely and efficiently use Road 10 and Road 8 without the north/south Collector Road being constructed. Please provide an assessment of this including identification of a limit on the number of lots and development that is appropriate before the north/south collector road and intersection is required.

Urban Design

32. **Swale and road relocation**

Issue:

The rationale for switching the north-south swale reserve from the eastern side of the north-south collector road to the western side of the collector road for the length it extends along adjacent to the western boundary of the application site was raised in our discussions with you in February. You advised the reason for the switch is to '*ensure that the existing house can be retained*.'

Questions:

a. Please identify the house referred to?

b. Please provide urban design analysis of how retention of the house and the changes to the road position and alignment will provide a suitable outcome compared with the benefits of legibility, place-making, cycle/pedestrian convenience of the swale reserve continuing down the one side of the collector road for the structure planned area?

33. **Road 12 pedestrian / cycle connection**

Issue:

The matter of a pedestrian/cycle connection from the cul-de-sac head of Road 13 through to Cambridge Road not being shown as proposed was raised in urban design comments on the proposal in February. The applicant advised this was not proposed as the nature of the land use to the west

was not known and that any walking connectivity through Road 13 can be discussed further with Council.

A pedestrian/cycle connection from Road 13 to Cambridge Road would be supported from an urban design perspective as it is in accordance with S19.5.3.3(b) of the district plan.

Question:

a. Please advise if the applicant would provide a pedestrian and cycle connection between Road 13 and Cambridge Road.

34. **Integration of 3Ms site with adjoining land to the west**

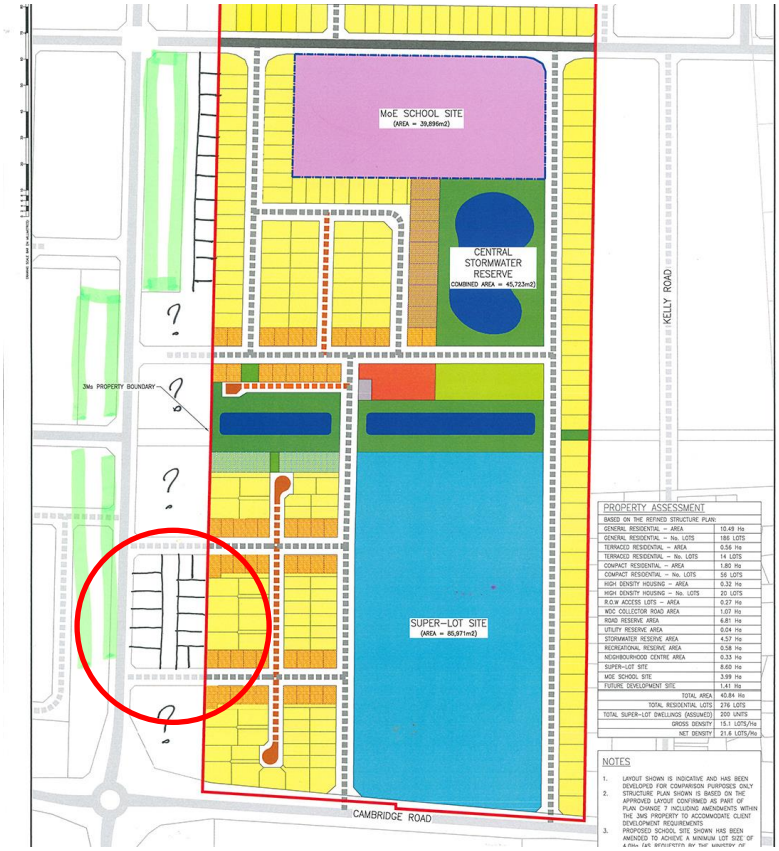
Issue:

Policy 15.3.1.1 of the district plan requires understanding of the constraints and opportunities of a site and the surrounding area to be understood by a site and area analysis. Development and subdivision are required to integrate with and acknowledge the constraints and opportunities of the site and surrounding area.'

The proposed layout within the 3Ms site on its western side, suggests that the adjoining land along the length of the western boundary of the site through to the north-south collector road (as shown to be repositioned in the 3Ms indicative Structure Plan) may not be able to be developed in a manner that would avoid significant use of rear lots, private laneways / JOALs, or single lot depth blocks with, for example, the collector road on the western side and a potential local road on the eastern side. The District Plan discourages rear lots and single lot depth blocks.

This raises the question of the suitability of this outcome on the adjacent land outside the site and what other outcomes may arise from the design approach proposed. No assessment with regard to policy 15.3.1.1 is provided.

At a Friday 19 March meeting with Abbie Fowler, Council's consultant urban designer, Matt Riley, shared his high-level thoughts as for how the land to the west might be developed by a landowner, presenting one option he has tested (see below – Red circle) that would produce undesirable urban design outcomes (eg: single lot depths) or, while potentially having vested north-south local roads, has doubtful viability. This is also an offsite effect.



Question

a. To assist the Council to consider the suitability of the layout of the proposal in this regard, please provide urban design analysis in this regard. The expected analysis should include indicative layout options for the adjoining land to the west of the 3Ms site, showing how it could be developed in a manner that minimises and ideally avoids the use of rear lots and private laneways.

35. **Local Centre**

Issue:

An area of concern is the long, southern length (approximately 70m) of the Local Centre lot 301 to the swale reserve directly to the south. This could produce a poor urban design outcome if a building with a long southern elevation was constructed on the Local Centre lot. Typically, the south side of commercial buildings are hard to 'activate' and become the default location for back of house activities that be unlikely to lend themselves to positive interface with the reserve.

At the 19 March meeting with Ms Fowler, Mr Riley also noted that the Local Centre has a maximum GFA of 550m2 (s19.3.3.1(b)), yet the size of Lot 301 is 3,300m2. He inquired what the balance space would be used for.

Ms Fowler and her colleagues responded that it was intended to be used for outdoor seating / plaza space and that the applicant team were aware of the 'southern boundary' issue and were keen to achieve a building with a positive (and shorter) southerly interface.

Question:

Please advise how certainty can be given to avoiding an inactive frontage along the southern boundary of the Local Centre lot and give further information as to what the 'balance' area of the lot (outside the maximum 550m2 GFA for a building) would be used for. It is noted that it was suggested by Ms Fowler and her colleagues that an indicative concept might be provided. Please advise how this might be provided for in any resource consent including subdivision and land use consent procedures.

36. **East-west swale**

Issue:

The east-west swale reserve outside the application site, as shown on the 3Ms Indicative Structure Plan, narrows significantly. Refer Figure below.

While appreciating that this is outside the application site, it is understood that the Indicative Structure Plan has been provided to show how the proposed development on the application site integrates with the wider C2 Growth Cell.

Question:

a. In that context, please provide comment as to the design rationale for this narrowing of the swale reserve, and how it contributes to overall legibility and placemaking of the wider Growth Cell and is consistent with contemporary practice in terms of CPTED.

37. **Reserves and Community Centre Changes**

The Vision (S19.2.2) within Appendix S19 for the Structure Plan area focuses on sense of place, the development of strong 'gateways', and the provision of quality public open space. This is supported by a range of outcome statements, including that a range of open space for different functions, activities and users is provided.

The alternative reserves layout and removal of the reserves from the structure plan changes the manner in which this proposal compares with the structure plan and achieves the outcome described in the policy.

Associated with relocation of the community centre further to the west, this has the effect of removing it (the centre) from what will become the main collector road access to the C2 cell

and loss of the community centre and reserves facilities being easily and directly accessed as the centre of the obvious central destination and focus of the community.

This may also be expected to cause the local road network providing access to the community centre and reserves to be required to carry higher volumes of traffic with resulting impacts on the amenities of the adjacent residential areas along the routes providing access to these facilities.

Discussions relating to sports fields supply and location is continuing and to date is understood to include consideration of re-placement of them onto the site in the proximity. This will have an influence on the dynamics of the community centre and surrounding residential areas.

Questions:

a. Please advise what the proposals are regarding the sports fields.

b. Please provide advice of agreements regarding the sports fields.

c. Please provide urban design assessment comparing the effects outcome of the proposal and the C2 structure plan. Particular matters any such assessment should include (not exclusive of others that may be identified as applicable) effects on the local road network, accessibility, establishment of a community centre and gateway structure, and management of effects on local roadway and adjacent property amenity and safety, and how to mitigate or the proposal mitigates effects in these regards.

d. Please provide an urban design assessment of the outcomes from continuing discussions compared with the C2 structure plan proposals and particularly the vision statement 19.2.2.

Land Use

Issue:

The subdivision scheme plan includes reference to areas of particular land use types and development. These are identified in a generic manner. The application specifies it is only for subdivision. The nature of the Rural Zone provisions include provision for dwellings and other activities on a lot basis.

The subdivision might therefore be determined as having the effect of allowing land use of a residential nature to occur without the land use consent requirements referred to in the application.

Avoidance of these effects may require restraint on residential development until land use consent or other changes to the district plan provide for residential development on the site.

Questions:

a. Please provide advice on how these effects and procedural implications can be mitigated.

Next Steps

Within 15 working days from the date of this request you must either:

1. Provide the information requested, or
2. Advise Council in writing of the alternative date that you will provide the information by, or
3. Advise council in writing that you refuse to provide the information requested.

A response is due on the: 13th April 2021. Please advise us if you like more time to provide the information requested.

The statutory timeframes for processing your application have been put on hold until the further information requested has been received. Despite this advice the Council is continuing to process your application as far as practicable during this time.

Please make contact if you wish to discuss any of the requests.

When all the information requested has been provided it will be reviewed to ensure it adequately addresses all of the points of this request. If the Council needs to seek clarification on matters in the further information you provide, this will be considered as information required under this letter. The application will remain on hold for this purpose. As advised above, during this time processing will however continue as practicable.

If you do not provide, or refuse to provide the information, the Council is required to notify your application under section 95(C) RMA. If this happens, you will be required to pay the notification fee before we proceed with the notification of your application. In this regard we encourage you to discuss difficulties or concerns you may have with any of these requests with the Council.

Please note that if you are dealing directly with other departments in Council regarding the further information requested, please also send further information to the writer.

If you are not sure how to respond or wish to discuss any matters relating to this request, please contact Mark Batchelor on 027 7009431 for assistance.

Yours Sincerely
Mark Batchelor
Planner
CKL

MITCHELL DAYSH

PO Box 1307, Hamilton 3240
New Zealand
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Reference: MDL000972

26 March 2021

Waipa District Council
Private Bag 2402
Te Awamutu 3840

Attention: Mark Batchelor

Sent via email: Mark.Batchelor@ckl.co.nz

Dear Mark

RE: 3Ms of Cambridge GP Limited – Response to section 92 Request for Further Information

Please find below 3Ms of Cambridge GP Limited ("**3Ms**") responses to some of the further information requests. This letter should be read in conjunction with the letter prepared by Lachlan Muldowney (sent to Waipa District Council on 26 March 2021) which addresses the further information questions that 3Ms considers that are not within the scope of the current subdivision application.

Stormwater Matters

Questions 1, 4, 7, 9, 10, 11 and 12 are currently being addressed by 3Ms stormwater technical experts; McCaffrey Engineering Consultants, Harrison Grierson and Beca. A formal response to the aforementioned questions will be provided by 1 April 2021.

Question 13: Please identify the positions and details of any services connections proposed between the on-site stormwater network and the offsite network.

This information is provided in the Master Plans appended to the resource consent application and assessment of environmental effects (Appendix D).

Reserves

Question 16: Please advise the stage and outcome of any discussions to date and any variations to the application that have arisen from these.

There have been discussions between 3Ms and the Waipa District Council regarding the sports fields. However, no agreement has been reached in this regard. If there are any changes to the 3Ms subdivision proposal, then the plans (including the scheme plan) will be updated accordingly and sent to Council as a formal addendum to the application.

Question 18: Please provide a revised subdivision scheme plan showing the location and area of the reserve/sports fields land and showing any other changes made to the subdivision proposals to accommodate them, including land use proposals adjoining proposed reserves.

An updated scheme plan will be provided if further changes to the proposal are confirmed. The plan submitted to Waipa District Council as part of the application addendum is the current 3Ms proposal (dated 10 March 2021).

Question 19: Please provide plans and description of how parking is proposed to be provided for the reserves and provide traffic engineering assessment of its adequacy.

Specific parking provisions for individual development areas are to be confirmed as part of the final development layout, and through detailed design.

Question 22: Please provide plans and/or description of how easy, direct and safe pedestrian crossing across Road 20 between the proposed reserves areas will be created.

3Ms is proposing that Road 20, between the two reserve spaces on the opposite sides of the road, be a shared space between vehicles and pedestrians, and will be designed in a manner to create a coherent connection between the reserve areas. In addition, there will also be pedestrian crossings in this area (note that plan 17001-C-0207 REVD shows a priority walking / cycling crossing across Road 20).

A full set of plans will be prepared during detailed design, and will show how this shared space will be created.

Question 23: Please provide plans and/or description of how easy, direct and safe pedestrian access from the east west lineal stormwater reserve to the Cambridge Town Belt may be provided or contributed to by the development.

3Ms is proposing the east/west linear reserve within its development including a shared cycle and pedestrian path (which is provided for in accordance with the Structure Plan). This will be provided along the entire length of the reserve, within the 3Ms site. The final plans will be provided during the detailed design phase; however, plan 17001-C-0207 REVD show this shared path connection along the east/west swale within the 3Ms site.

3Ms cannot control any connections beyond the boundary of the site.

Transportation and Roading

Questions 29-31 of the further information request letter are currently being addressed by Mark Apeldoorn and a technical response will be provided by COB 1 April 2021. However, in respect of question 29, it is noted that the responses 3Ms provided to various Council queries on 18 February 2021, included a response to the question regarding public transportation routes. The plan showing

the shape, dimensions and profiles of these relative to the carriageway (as requested) will be provided at detailed design.

Urban Design

Question 33: Please advise if the applicant would provide a pedestrian and cycle connection between Road 13 and Cambridge Road.

3Ms is not proposing to provide a pedestrian or cycle connection, as it is considered that the connections provided through Road 11 and Road 10 are sufficient.

3Ms will be providing the balance of the technical information as soon as possible, as outlined in this letter. Please do not hesitate to contact me directly if any matters in this letter require further clarification.

Yours sincerely,

Abbie Fowler
Associate
Mitchell Daysh Ltd

Cc: Wayne Allan (Wayne.Allan@waipadc.govt.nz); Tony Quickfall (Tony.Quickfall@waipadc.govt.nz

LACHLAN MULDOWNEY
BARRISTER

26 March 2021

Waipa District Council
Private Bag 2402
Te Awamutu 3840

For: Mark Batchelor
By email: mark.batchelor@ckl.co.nz

Dear Mark

RE: Resource Consent Application – Further information request

Application number:	SP/0179/20
Applicant:	3MS of Cambridge Limited Partnership
Address:	1881 Cambridge Road Cambridge 3434
Proposed activity(s):	Subdivision to create 242 residential lots within the C2 Growth Cell, and associated lots for public assets

1. I refer to Waipa District Council's (**Council**) request for further information under s 92 of the Resource Management Act 1991 (**RMA**) sent to Mitchell Daysh on 22 March 2021.

2. Pursuant to s 92A(1) of the RMA 3MS is entitled to provide the information, or provide written notice that it will be provided, or refuse to provide the information. 3MS has considered the request and determined that part, but not all, of the information requested will be provided.

3. In accordance with s 92A(1)(b) I advise that Mitchell Daysh will respond on behalf of 3MS to the following questions within the statutory timeframe (by 13 April):

    a) **Stormwater:** Questions 1, 4, 7, 9, 10, 11, 12, 13, 14;

    b) **Reserves:** Questions 16, 18, 19, 22, 23;

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c) **Transportation and Roading:** 29, 30, 31;

d) **Urban Design:** 33

4. Pursuant to s 92A(1)(c), information will not be provided in response to the remaining questions for the reasons set out below.

Stormwater

5. Question 2 is concerned with the reduction in Council's stormwater capex arising, and the modelling assumptions that determine the HUEs of demand over which the costs of projects in the schedule of assets are proportionately allocated under schedule 13 to the Local Government Act 2002 (**LGA**). Council has that information, not 3MS. More fundamentally however, this is not an environmental effect, and is information outside the scope of s 92.

6. Question 3 is a matter for detailed design. However it is self evident that if 3MS attenuates all stormwater on site and manages the rate of discharge, this will impact the scale and dimensions of the necessary receiving infrastructure. This is a positive effect, and one that 3MS can address in terms of concept drawings in evidence if a hearing is required.

7. Question 5 is misconceived. It assumes a hypothetical situation whereby certain public infrastructure is located on adjacent land. That cannot be assumed, as it is not part of the sub-division application. All that is know is that the public infrastructure is not provided as part of the proposed subdivision. Effects arising from Council locating public infrastructure on any adjacent land is a matter for Council. While it is readily acknowledged that off site effects are a relevant consideration, requiring 3MS to assess effects based on a hypothetical view of the future, involving Council decisions that it has no control or direct input into, is simply too remote and is outside the scope of s 92.

8. Question 6 cannot be answered and gives rise to questions of Council. What effects on the stormwater network, not capable of being addressed through consent conditions, are referred to? As a party to any development agreement, what are Council's contractual requirements?

9. Question 8 is a matter for detailed design. Nevertheless, the application documents provide sufficient information to form a view on the adequacy of the system and the necessary conditions to be imposed in order to ensure its efficacy.

10. Question 15 is misconceived. Like question 5 it assumes a hypothetical situation concerning public infrastructure outside the subdivision area which is not within 3MS control. 3MS has provided sufficient information to evaluate the nature of the proposed infrastructure within the subdivision, and how it integrates with the wider network. The provision of new public infrastructure outside of the subdivision and how it responds to existing development, is a matter for Council, not 3MS.

Reserves

11. Question 17 is process question. Subject to the ordinary natural justice requirements, the consent decision maker decision may take account of all relevant and within scope matters known at the time of the decision. If this information evolves between now and the time of the decision, that can be accounted for. That is a function of the s 42A reporting officer.

12. Question 20 is a matter for Council. It is not information known to 3MS.

13. Question 21 is a matter for detailed design. The integrated transport assessment prepared by Stantec (Appendix G to the application provides sufficient detail addressing transportation effects to determine the application). Consent conditions can be imposed which set the requisite parking standards, and through the detailed design phase those requirements will be met.

14. Questions 24 and 25 are matters that can only be addressed by the Board of Trustees for the school, once established. The Ministry of Education has indicated a general willingness to collaborate on the provision of sport and recreational facilities, but has stressed that the specific arrangements cannot be secured until the Board of Trustees is established and is able to participate in the decision making.

15. Question 26 addresses an issue which is not relevant to the assessment of effects associated with the subdivision application. These are matters concerning the ultimate land use and, as the question indicates, are matters which can be addressed in an infrastructure works agreement. It is not necessary that these issues be addressed in the context of a s 92 request. The consent conditions can impose the requisite standards, and the IWS can then address the question of which party provides any particular element.

16. Question 27 is a matter for detailed design. For the assessment of effects, there is sufficient urban design detail included within Appendix H of the application.

17. Question 28 is a request for 3MS to accept a condition on an *Augiers* basis. It cannot make that commitment until it sees the specific drafting of the condition, and views it in the context of the related conditions. At a first principles level, and subject to s 108AA of the RMA, the proposed condition does not appear to be unreasonable.

18. Question 32, like question 5, relate to a hypothetical situation which is not within 3MS' control, and is not concerned with effects arising from the subdivision. These considerations will be addressed when and if Council makes the provision of this public infrastructure. The exact location of this infrastructure is not yet know. Any assessment of effects relating to its layout is speculative, and does not advance the consideration of the subdivision application.

19. Question 34 suffers from a similar uncertainty. Without knowing how the neighbouring development might proceed, which may or may not include a public infrastructure corridor, it is impossible to establish the integration of the urban form. The subdivision scheme plan enables connectivity and integration, but the final form of that cannot be known until development on the neighbouring land is understood. Nevertheless, the proposal does not negate a good urban design outcome.

20. Question 35 relates to the ultimate land use activity on the identified lot. That is a matter for the land use consent application.

21. Question 36 is a matter best answered by Council. The narrowing of the swale reserve reflects an assumption that Council would be taking the least land necessary to convey stormwater into and out of the swale.

22. Question 37 concerns matters relating to the provision of sports parks. Questions 18 and 19 will address these issues partially. There is currently nothing further to update Council on in respect of any agreements relating to the provision of sports parks. 3MS is satisfied that the AEE which accompanies the application satisfactorily addresses the effects of any departures from the indicative elements of the structure plan.

23. Question 38 concerns land use activities that may or may not occur in the future. The subdivision will not authorise these activities. Any land use activity will either need to meet the performance standards in the plan for permitted activities, or will require a resource consent. Effects arise from the land use activities, not from subdivision. Consent conditions controlling these effects are outside the scope of s 108 and s 108AA of the RMA. PC 13 will ultimately address these issues, and that is firmly within Council's control.

Conclusion

24. 3MS remains very willing to work collaboratively with Council to address any matters that require clarification. It is however keen to ensure that the issues to be addressed are within the scope of the application and do not involve issues that do not squarely relate to the assessment of the application in accordance with the requirements of the RMA.

25. If any matters require discussion please contact me. In the meantime Mitchell Daysh will be in further contact shortly with a substantive response to the remaining questions identified at paragraph 3 above.

Yours faithfully,

Lachlan Muldowney
Barrister

CC: Wayne Allan
By email: wayne.allan@waipadc.govt.nz

MITCHELL DAYSH

PO Box 1307, Hamilton 3240
New Zealand
+64 7 838 2170

Reference: MDL000972

9 April 2021

Waipa District Council
Private Bag 2402
Te Awamutu 3840

Attention: Mark Batchelor

Sent via email: Mark.Batchelor@ckl.co.nz

Dear Mark

RE: 3Ms of Cambridge GP Limited – Response to section 92 Request for Further Information

As detailed in the letter sent to the Waipa District Council ("**WDC**") dated 26 March 2021, 3Ms of Cambridge GP Limited ("**3Ms**") has been seeking additional input from various technical consultants to address matters raised in the s92 letter from WDC. This letter provides a response to the further information requests that were not able to be responded to earlier.

Please note that these responses have been prepared by Beca, Harrison Grierson, McCaffrey Engineering, Stantec and Mitchell Daysh on behalf of 3Ms.

Stormwater Matters

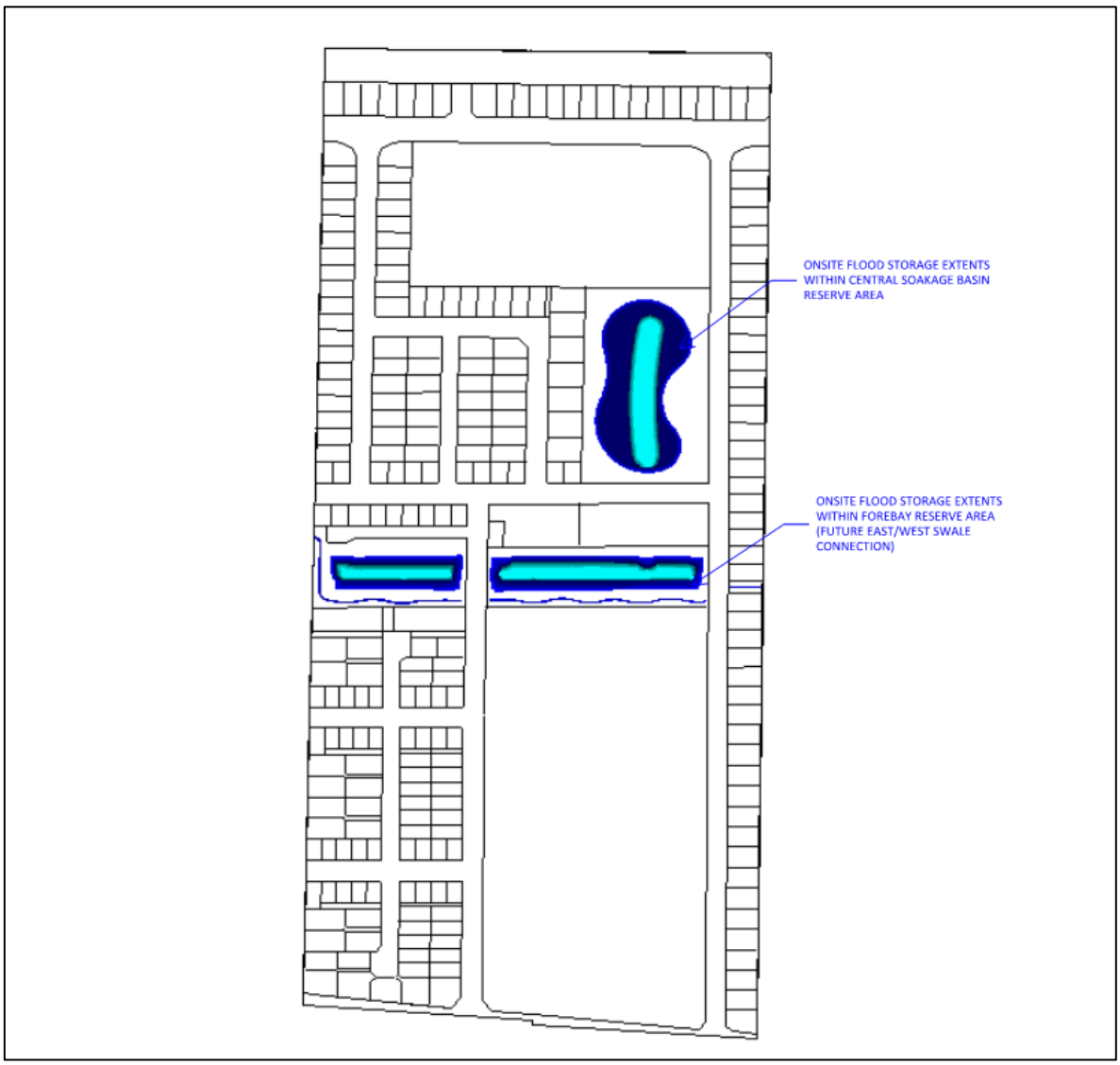
Question 1: *Please provide and demonstrate technical engineering assessment proving the onsite stormwater management will have sufficient capacity to protect the surrounding locality from potential for stormwater flooding.*

The stormwater solution provided within the 3Ms development site has been sized to provide flood storage to accommodate a 24hr/1% AEP storm event within proposed stormwater reserve areas, including more than 300mm freeboard to adjacent areas. The following table provides an assessment of runoff volumes generated by the development.

Storm Event	Storm Duration (h)	Total Runoff (m^3)	Level Without any Soakage (m RL)	Required Storage (m^3)	Level with Soakage (m RL)	Time to Clear (h)
ARI = 2	24	17,614	61.95	10,119	61.12	45
ARI = 10	24	27,786	62.52	18,524	62.01	72
ARI = 50	24	39,383	63.07	30,087	62.64	102

Storm Event	Storm Duration (h)	Total Runoff (m^3)	Level Without any Soakage (m RL)	Required Storage (m^3)	Level with Soakage (m RL)	Time to Clear (h)
ARI = 100	24	44,315	63.29	35,019	62.88	114
Overflow level = RL63.4m						

The following diagram shows the extent of flooding within the proposed reserve area during a 24hr/1% AEP storm event demonstrating there is sufficient capacity to manage all development runoff within the proposed stormwater system. Please note that the flood storage provided has adequate capacity to retain the full 24hr/1% AEP storm event in the event of a total blockage within the proposed soakage system.



Question 4: *Please advise whether the development is proposed to be connected to the stormwater network within the C2 growth cell, either temporarily or permanently. Please advise the timing of any such connections relative to development of the subdivision.*

The reason for this question is the east/west swale separates the land to the south of it from the on-site stormwater reserve and this swale appears on the plans to be wider than what is expected to be required for stormwater purposes. There is also connections form outside the application site to the balance of the C2 cell indicated on the application plans.

3Ms confirms that the proposed development, while initially designed to function as a 'self-contained system' is intended to be permanently connected to the stormwater network within the C2 growth in the future (as outlined in drawing 17001-C-0430). Stormwater from the site, including south of the development is conveyed through the east/west swale (which will act as a forebay) when it is then conveyed to the stormwater basin.

Timing for providing connection to the wide C2 growth cell stormwater network is as follows:

- The eastern (upstream) connection will be installed as part of the initial construction to ensure the required culvert pipe is installed below permanent roading infrastructure (i.e. Road 10). This approach will allow the upstream catchments to be connected to the system at any time.
- Infrastructure for the western (downstream) connection can be installed at any time allowing for east/west stormwater network connectivity through the 3MS site.

Exact timing for the completion of the above connections is subject to WDC delivery of the wider stormwater network.

The land required for the east-west swale is slightly larger than the previous WDC design for the following reasons:

- The batter slopes for the proposed forebay design are flatter than those previously proposed for this section of the east/west swale.
- The stormwater reserve includes additional land expected to be required for mitigation (NB: this was previously shown as general reserve areas for the previous east/west swale) - *refer to response to question 9 below for further details.*
- The invert level in the centre of forebay #1 has been lowered by 700mm to accommodate the upstream pipe networks.

It should be noted that the base of the forebays (east/west swale) are designed to provide pre-treatment prior to discharging runoff into the proposed central soakage basin area to the north. This treatment approach is consistent with the function of the previous design for this section of the east/west swale.

Question 7: *Please advise what effects proposed infiltration of stormwater through and below the iron pan within the infiltration basin will have on stability ground stability within the application site and outside its boundaries, and where or if it is expected to discharge and effects at that point.*

This should include but not be exclusive of any other matter your assessment may identify as relevant, confirmation that the soakage pond proposal will not result in additional ground flows to the C3 terraces and in turn cause erosion and slip and ground stability risk and effects.

An initial assessment of potential mounding (rise in groundwater level) due to stormwater infiltration was provided in the Beca (December 2020) report based on a simple Hantush equation and an anticipated design infiltration rate (100mm / hour). This assessment indicated that under the more typical design events (2-year and 10-year) the extent of mounding is expected to be no more than 80 metres from the centre of the basin, i.e. is limited to wholly within the development site and with groundwater levels adjacent the basin remaining at least 2 m bgl.

3Ms notes that as per the original assessment undertaken for Waipa (Beca, 2019), there will inevitably be additional groundwater discharge towards the C3 area as a result of the soakage basin, but this is considered necessary particularly in the longer term to offset the reduced upgradient groundwater flow to C3 that will arise from the increased impervious cover in C2 (and net reduction in direct rainfall recharge at the surface). However, this is considered to result in an overall net balance of the water budget as opposed to an increase in flow, and the calculated extent of mounding is not expected to result in a noticeable change in groundwater level or steepened flow gradient at the C3 terraces, and hence is not expected to result in any increase in instability.

It is noted that additional site testing has now been completed and has indicated a lower permeability than originally anticipated at the basin location. 3Ms is currently working through the implications for design infiltration rate as part of the detailed design and will be undertaken further (more detailed) assessment including modelling, to confirm that the above assessment remains valid. Whilst some localised increase in mounding can be anticipated as a result of the lower hydraulic conductivity, it is expected that the detailed design process can be used to manage effects to within that already assessed.

Question 9: *Please provide advice on the risk of instability along the side of the proposed stormwater pond and open swales within the C2 growth cell including but not limited to, lateral spread and bank erosion and how this risk will be avoided.*

<u>Slope Stability/Lateral Spread</u>

The initial assessment completed by WDC relating to the wide C2 growth cell stormwater network (within the 3MS site) indicates that, based on the recently measured groundwater levels, lateral spread risks associated within the proposed swale and central basin excavations are ‘less than 50mm lateral movement’ – refer to the plan attached in Appendix A. A detailed assessment of slope stability and liquefaction assessment will be completed as part of the detailed design phase.

Please note that additional land areas/offsets have been provided within the stormwater reserve areas adjacent to basin and forebay/swales to allow for potential mitigation of any risks that may arise through the detailed assessment results. Final mitigations (if any) will be confirmed as part of the final design.

Bank Erosion

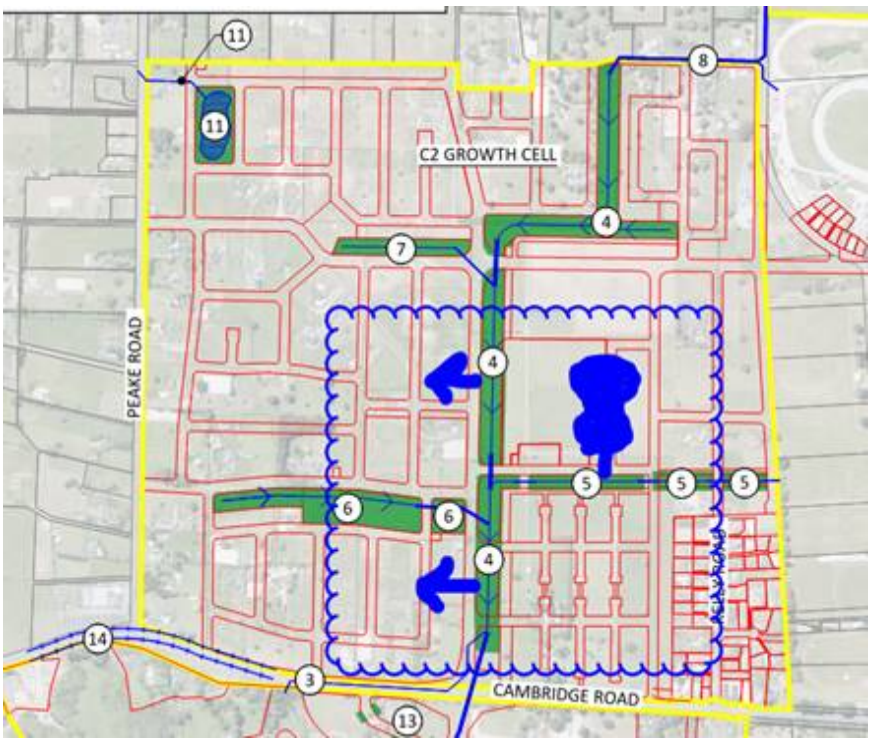
General velocities within the swale and stormwater basin are estimated at less than 0.3m/s. This indicates that standard vegetation planting will be sufficient to mitigate against potential bank erosion during operation as it is well below the allowable 1.5m/s allowed for in Table 8.1 of the WRC Stormwater Management Guideline. In areas of higher velocities (i.e. pipe outlets) scour protection will be used to prevent scour.

Question 10: *Please provide confirmation in writing from Waikato Regional Council that there are no issues with the stormwater discharge consent arising from the stormwater soakage pond and discharge proposals and particularly that consent for the discharges proposed has been obtained. Alternatively, if applicable, please describe how obtaining any consent for these discharges that may be required may be provided for.*

Representatives of 3Ms met with Waikato Regional Council ("**WRC**") on 24 February 2021.

Key notes from the meeting with Brian Richard and Megan Wood are as follows:

- No red flags were raised associated with 3Ms stormwater proposal subject to technical approval from WRC as part of the detailed design process enshrined in the consent held by WDC.
- WRC noted that a mounding assessment for the new location will be required, with 3Ms explaining that this was already being addressed. The results of the assessment will need to be included in WRC technical submission.
- As the WDC stormwater discharge permit lists all the key stormwater assets within a consent condition (see sketch below), WRC would like an application under s127 of the RMA to be lodged along with with the detailed design approval so this list of key assets can be updated to include the stormwater basin within the 3Ms developement. 3Ms understands they will need to pay for the costs associated with the s127 process, but WRC noted that the change would be straightforward.



3Ms will need to continue to engage with WDC regarding the s127 change to consent conditions as WDC is the consent holder and would need to therefore be the applicant of any such process. However, 3Ms can facilitate this.

Question 11: *Please provide the technical report prepared by BECA and referenced in the application that provided the advice your assessment of the hydrological effects of the stormwater soakage pond will have.*

See the attached assessment (Appendix B) but as noted above, further assessment is proposed to be undertaken as part of the detailed design process.

Question 12: *Please provide the stormwater pond soakage results confirming it is a viable option.*

As noted earlier, initial testing has now been completed at the basin location and has returned lower results than initially anticipated, but still within an acceptable range for soakage.

Testing was in the form of constant head tests, with 3 tests conducted in two piezometers (one test at the southern end and two tests at the northern end of basin). The piezometers are screened in the aquifer below the iron pan and into which the soakage is expected. The assessed in-situ hydraulic conductivity ranged from 1x10-5 m/s to 2.9x10-5 m/s; the latter being in the area of the proposed soakage array at northern end of basin. Taking an average of all tests (to account for variability across the site), this would be broadly equivalent to a raw (unfactored) rate of 78 mm/hour.

Further testing in the excavated basin is proposed to be undertaken shortly to confirm the in-situ hydraulic conductivity and assess any variability across the extent of the basin.

As already noted, 3Ms is currently working through implications for the design (factored) infiltration rate as part of the detailed design, whilst the hydraulic conductivity is lower than initially anticipated is in within the wider range of test results reported in the Cambridge area. A hydraulic conductivity of 1x10-5 m/s or higher is considered viable for soakage, for example Hamilton City Council expects soakage (with storage) to be considered where permeability is > 1x10-5 m/s.

Question 14: *Please advise how assurance of connection to and from the application site and adjoining land that may be proposed or required for stormwater management purposes until and after the on-site facilities are constructed.*

The existing open drain that provides connectivity through the 3Ms development site will remain in place at all times with a minor diversion proposed as part of the development works. This diversion will be completed as part of the initial bulk earthworks contract currently underway (and as authorised by a land use consent from WDC for the earthworks)

Future connections to the wider stormwater network within the C2 growth cell can be completed at any time without impacting the existing open drain (i.e. offline construction). Once completed it is proposed that the open drain be disestablished when the east/west and north south swales are commissioned and replaced with a walking/cycling connection in the same location.

Transportation and Roading

Questions 30-31 of the further information request letter are addressed Attachment C, which has been prepared by Stantec.

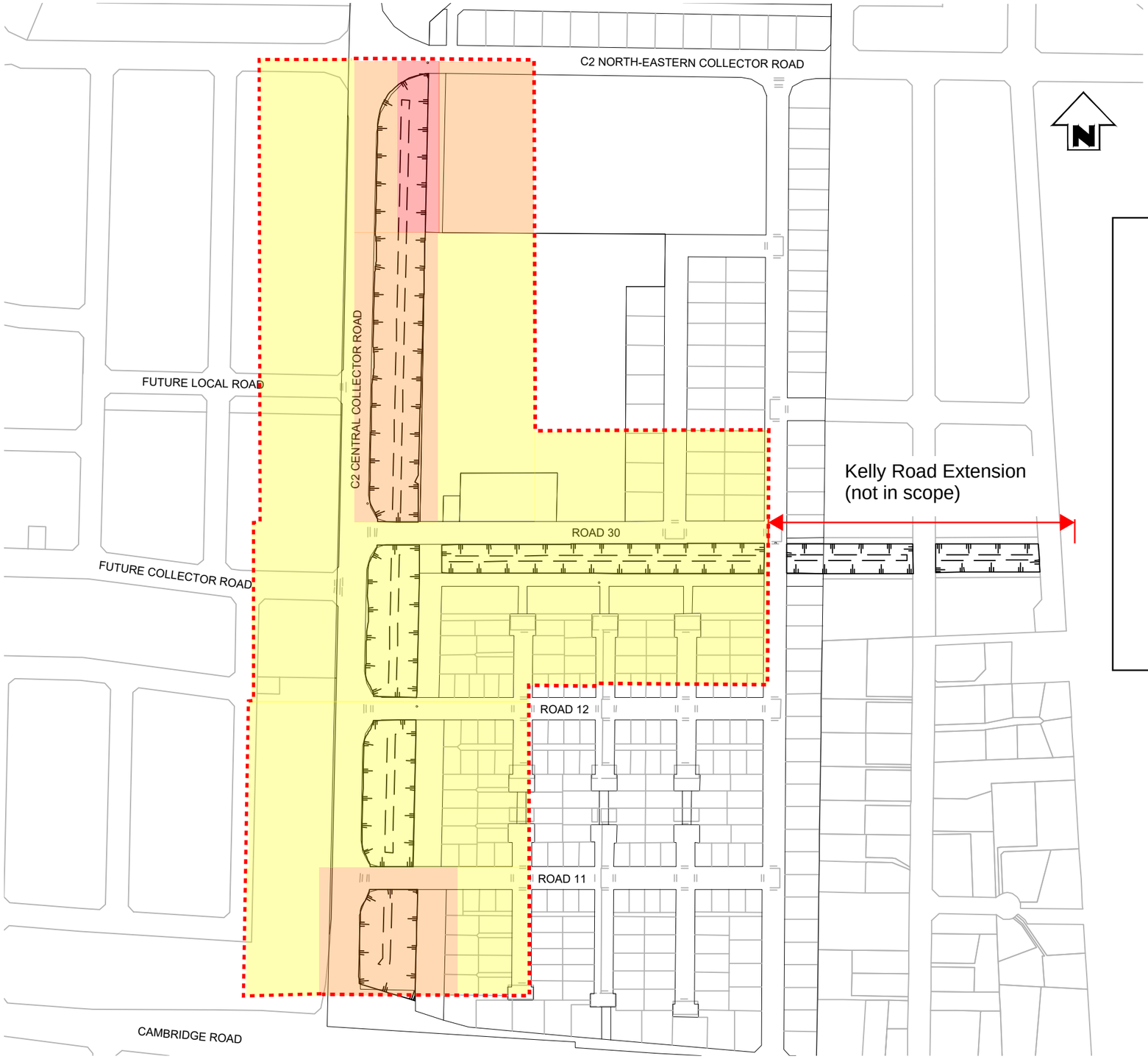
Please do not hesitate to contact me directly if any matters in this letter require further clarification.

Yours sincerely,

Abbie Fowler
Associate
Mitchell Daysh Ltd

Cc: Wayne Allan (Wayne.Allan@waipadc.govt.nz); Tony Quickfall (Tony.Quickfall@waipadc.govt.nz)

ATTACHMENT A – LATERAL SPREADING EFFECTS PLAN



Legend

- More than 100mm lateral movement
- Between 50mm and 100mm lateral movement
- Less than 50mm lateral movement
- Not defined beyond here

40 0 40 80 120 160 200m

SCALE 1 : 4000

SITE PLAN
SCALE 1:4000

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Disclaimer:
Areas and dimensions may be subject to scale error.
Scaling from this drawing is at the users risk.

No.	Revision	By	Chk	Appd	Date
A	For review	JW			06/07/20

Drawing Originator: Beca

Original Scale (A1) 1:4000
Reduced Scale (A3)

Design | Drawn | Dsg Verifier | Dwg Check
* Refer to Revision 1 for Original Signature

Client: Waipa District Council, 3MS

Project: C2 Swale Assessment

Title: Lateral Spreading Effects with Deeper Groundwater

Discipline: GEOTECHNICAL

Drawing No. | Rev.

DO NOT SCALE

BLUEBEAM

ATTACHMENT B – TECHNICAL ASSESSMENT OF GROUNDWATER EFFECTS

3Ms Cambridge Subdivision

Technical Assessment of Groundwater Effects

Prepared for 3MS of Cambridge GP Ltd

Prepared by Beca Limited

1 December 2020

Creative people together transforming our world

Revision History

Revision Nº	Prepared By	Description	Date
0.1	James Botting and Sian France	Draft for Client comment	25/11/20
1.0	James Botting and Sian France	Final	1/12/20

Document Acceptance

Action	Name	Signed	Date
Prepared by	James Botting and Sian France		1/12/20
Approved by	Sian France		1/12/20
on behalf of	Beca Limited		

Contents

Appendices

1 Introduction

1.1 Background

Waipa District Council (WDC) have identified Cambridge as a growth area, with the population expected to almost double in the next 50 years (WDC Plan Change 7, 2017). WDC has been preparing for the increase in housing needs by developing frameworks (Structure Plans) for managing residential development in a series of identified Growth Cells in the Cambridge area (Figure 1).

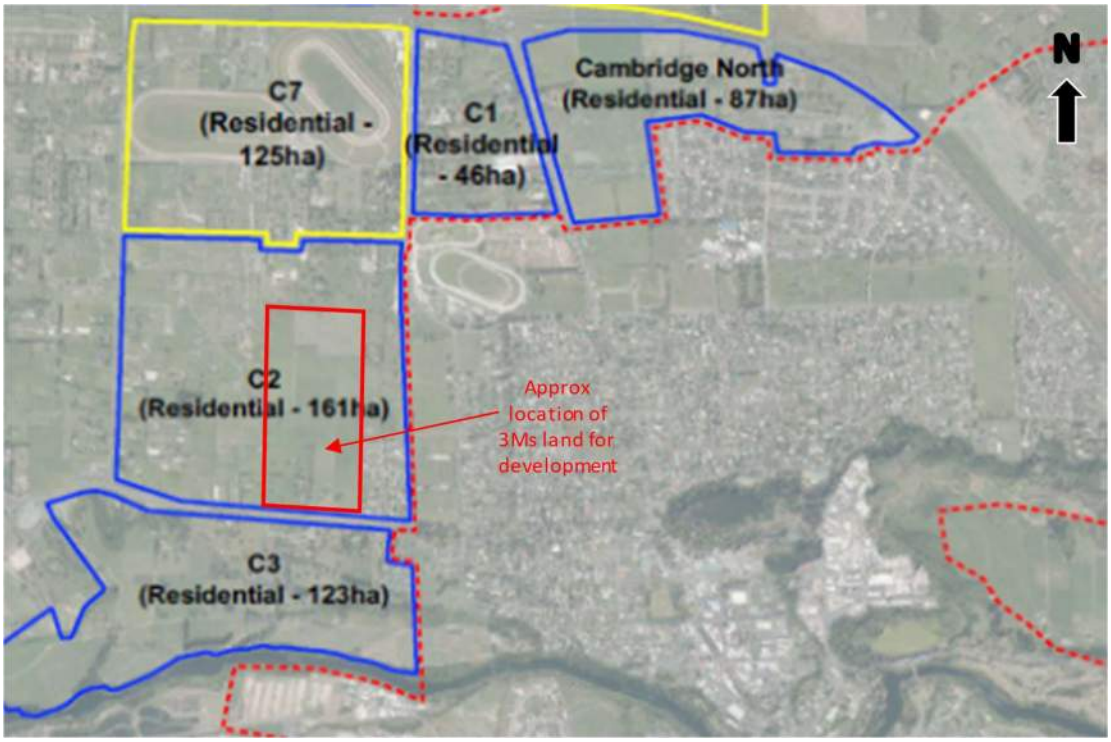


Figure 1: Excerpt from Appendix S1, Waipa District Plan (December 2019) showing planned growth cells for Cambridge and location of 3Ms land (subject of this report)

WDC are currently in the process of preparing consent applications for the major infrastructure in the C2 Growth Cell (herein referred to as “C2”).

3Ms of Cambridge Ltd (3Ms) have a landholding within C2 and would like to commence development this earthworks season, ahead of the current WDC programme. Accordingly, 3Ms have proposed a revised option, with staged development of the land to allow for residential subdivision works to be progressed ahead of WDC consenting.

To support this, 3Ms are seeking consents for the first stage of the development which includes:

- Waipa District Council (WDC) Subdivision for the entire development; and
- Waikato Regional Council (WRC) Construction Consents (entire site) including:
  - Clean fill importation;
  - Groundwater diversion (dewatering); and
  - Temporary water take.

Longer term, WDC are proposing to construct a central stormwater swale which will be used to collect and convey stormwater from C1 and C2 towards the Waikato River. The current Structure Plan also allows for some permanent soakage basins. However, as this long-term stormwater infrastructure will not be consented

or constructed in time to support the initial development, 3Ms are proposing an interim stormwater solution which comprises a single stormwater soakage basin near the middle of the development (the "central stormwater reserve" shown in Figure 2).

3Ms will also partially construct the west-east component of the WDC stormwater swale which will essentially behave as forebays, providing pre-treatment and additional storage.

The soakage basin and forebays are all expected to extend below a perched near-surface groundwater level, hence the need for a dewatering consent.

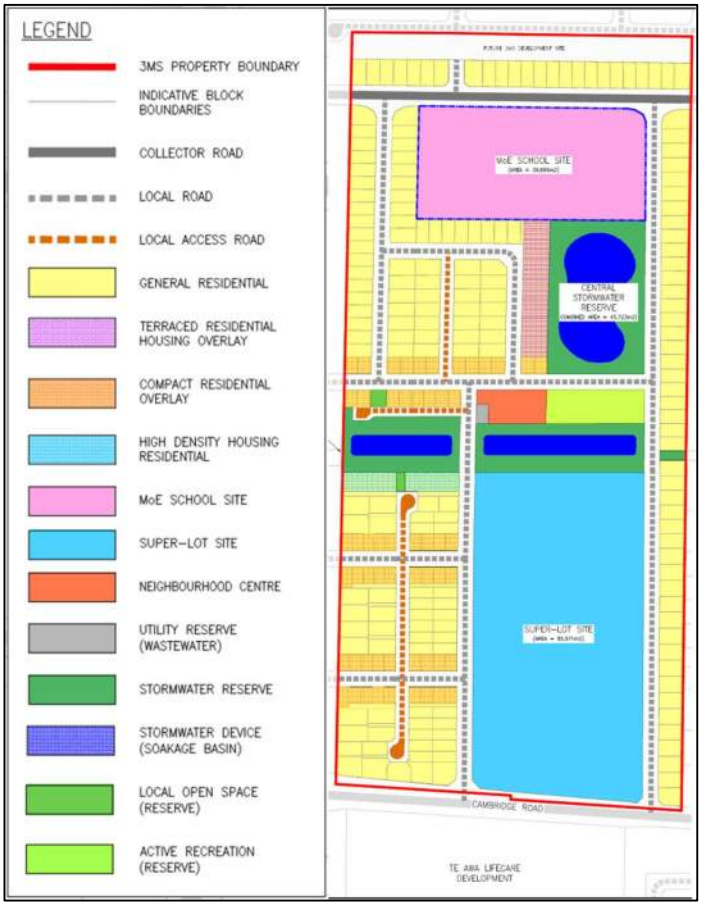


Figure 2: Excerpt from dwg 17001-SK-094 showing approximate development layout. Of relevance for this report is the stormwater reserve (in dark green) and deep excavations to form the basin and pre-treatment devices.

1.2 Scope of this report

Beca Ltd (Beca) have been engaged by 3Ms to undertake a dewatering assessment to support the regional consent application for groundwater take and diversion. This report presents the results of that assessment, specifically:

- An assessment of the potential for drawdown from the permanent diversion of a perched groundwater level into the stormwater reserve basin; and
- An assessment of the potential for adverse effects associated with the take and diversion of groundwater e.g. consolidation settlement, interference effects on shallow groundwater users or surface water bodies and the potential for the mobilisation of contaminants

The quantitative assessment of effects is based on a previously prepared 3D numerical groundwater model for WDC (Beca, 2019).

2 Proposed Works

2.1 Site Location and Description

A summary of key features pertinent to the assessment of effects and parties which might require assessment as potentially affected, is provided below. A description of groundwater conditions is provided in Section 3.

2.1.1 Topography

The 3Ms land parcel is located on a broad, relatively flat alluvial terrace at ~64 m RL.

To the south of Cambridge Road, the topography is marked by a series of four (4) distinct terraces at around 64 m RL, 58 m RL, 40 m to 47 m RL and 38 m RL.

The Waikato River sits approximately 20 m below the lowest terrace (at an estimated level of ~18 m RL, based on LiDAR) and is expected to control the regional groundwater level in the area.

2.1.2 Existing Land use and Buildings

The surrounding area is primarily rural with small properties (e.g. nurseries, lifestyle lots and farms) at low density, i.e. 3rd party owned buildings are generally relatively sparse, with the notable exceptions being:

- The eastern boundary of the 3Ms owned land, which borders the existing residential development on Kelly Road (namely 2 to 48 Kelly Road, and, 1891 to 1895 Cambridge Road are all located within 100 m of the boundary)
- 5 Hunter Lane and 59 Racecourse Road, located along the northern property boundary; and
- 694 Grasslands Drive Road and 1835A Cambridge Road located along the western property boundary.

2.1.3 Existing groundwater and surface water take

A review of the Waikato Regional Council (WRC) consent database undertaken in July 2020 indicated that there are no consented water takes within the 3Ms owned land.

There are also no consented groundwater takes within 1 km of the 3Ms owned land; however, a review of the borehole database suggests that there are several consented wells in the area. It is likely that some, if not all, of these wells will be taking groundwater as a Permitted Activity (in which case there will be no publicly available data but regardless the owners are legally entitled).

The nearest surface water takes are associated with the Waikato River, which is located at a much lower level and not considered to be directly connected to the shallow groundwater levels present on the upper river terraces and in the area of works.

2.1.4 Utilities

Only the current Town Boundary (to the east) has established, extensive infrastructure such as roads and utilities. There are no known piped utilities within the landholding itself however adjacent there is:

- Cambridge Road along the southern boundary;
- Grasslands Drive near the western boundary;
- Kelly Road near the eastern boundary;
- Water pipes along Cambridge Road; and
- Water, wastewater and stormwater lines in and servicing properties on Kelly Road.

2.1.5 Surface Water Bodies

Whilst there are several man-made drains and overland flow paths that run across the 3Ms property and in the surrounding area of Growth Cell 2, there are no naturalised streams.

The man-made drains were likely formed to deal with both surface run-off, but potentially also a shallow perched water level present in parts of this area (see Section 3 for further detail).

To south of Cambridge Road, there is a ~900 m length of unnamed stream which discharges to the Waikato River. It is likely that shallow groundwater contributes some component of baseflow to this stream; however, in the absence of flow gauging it is not possible to quantify the proportion.

2.2 Proposed works that might require a regional Groundwater Consent

The works which may require a groundwater consent include:

- Excavation, construction and operation of a central stormwater basin (up to 4 m deep).
  - The basin will be designed to have a soakage field beneath the invert level.
  - The basin will be designed to accommodate (soak and if necessary, store) a 100-year design event in the interim case. Once the full stormwater system is constructed the basin may only be used for soaking smaller events with overflow to the forebays (swales) or, may not be used at all, but would be kept for amenity purposes rather than infilled (i.e. the diversion is long term). We note this component of the activity is authorised by way of the consent held by WDC for the discharge of stormwater onto land, and to the Waikato River for the entire extent of the C1 and C2/C3 Growth Cells.
  - The basin will be unlined over most, it not all is depth and footprint and hence, where it is below the groundwater table, there will be a permanent groundwater diversion;
- Excavation of a stormwater swale / forebays (up to 4 m deep).
  - The swale will be unlined over most, if not all, of its depth and hence, where it is below the groundwater table, there will be a permanent groundwater diversion;

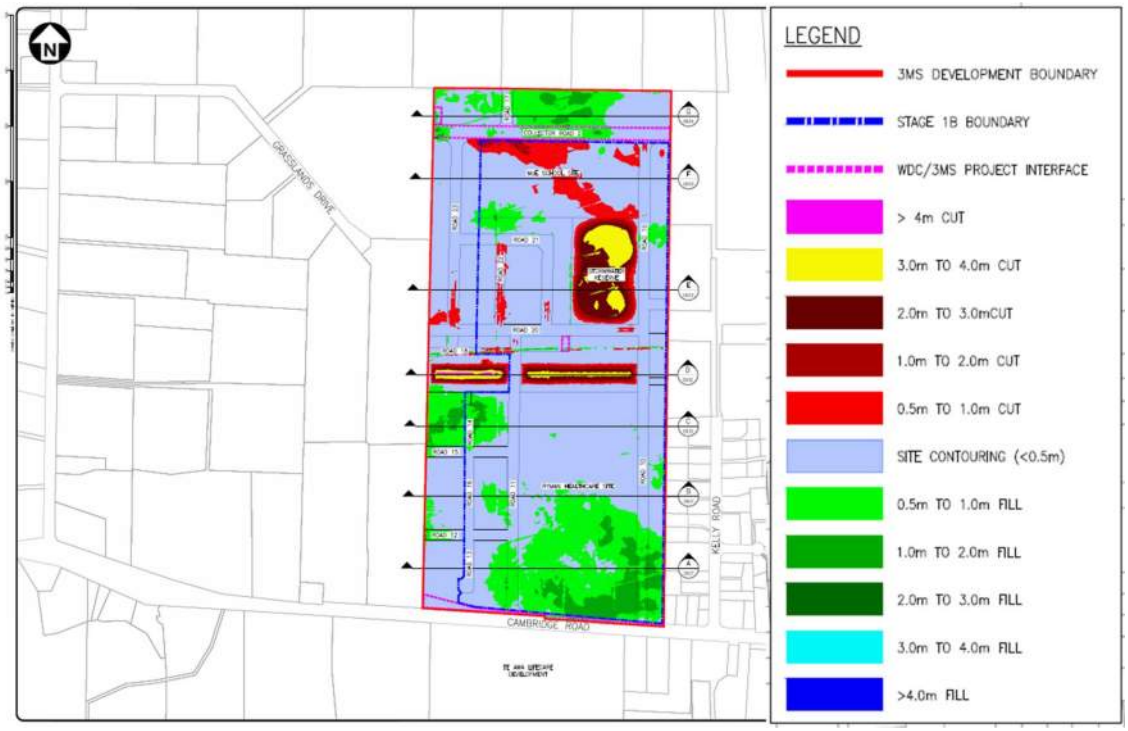


Figure 3: Excerpt from dwg 17001-C-0920 showing approximate final cut/ fill. Of relevance for this report is the stormwater reserve and deep excavations to form the basin and pre-treatment devices indicated in dark red and yellow.

As noted above the soakage component is already authorised by way of the consent held by WDC for the discharge of stormwater onto / into land, and to the Waikato River for the entire extent of the C1 and C2/C3 Growth Cells. Further, as the soakage will be discharging to an underlying aquifer it will not mitigate any drawdown effects of the upper perched level and so for simplicity is **not** included in this assessment

Short-term dewatering associated with the construction of stormwater culverts below proposed roads, water and wastewater networks is being considered separately by WDC.

Other works occurring in as part of Stage One e.g. filling, construction of collector roads etc. are not expected to influence groundwater.

3 Hydrogeological Setting

3.1 Conceptual Groundwater Model

Groundwater flow within the Waikato area is strongly influenced by the depositional history, which has created lateral and vertical variability in grain size (a mixture of pumiceous sand, silts, and gravels interbedded with clay/peats).

The Cambridge area is typically characterised by highly permeable coarse sand and gravels of the Hinuera Formation near the surface which are interlayered with lower permeability silty soils, creating a series of perched groundwater tables above the regional water table.

The regional groundwater table is expected to be controlled by the Waikato River, which based on LiDAR is at ~18 m RL. The groundwater level will rise with distance from the river but based on typical groundwater gradients would still be expected to be in the order of 20 to 30 m RL beneath the proposed areas of work. Whilst there is no specific monitoring of deep wells in this area to confirm this, this has been the observation from the Waikato Expressway – Hamilton Section project where there are multiple, nested piezometer arrangements in the vicinity of deeper incised rivers and streams.

Previous geotechnical and hydrogeological investigations in the Cambridge area have indicated at least three continuous perched aquifers may exist above the regional groundwater level. “Continuous” or extensive perched aquifers are inferred at between 55 m to 61 m RL, 45 m to 50 m RL and 35 m to 40 m RL (Figure 3).

Whilst there is not always a distinct low permeability horizon to explain the perching, it is likely the result of the alternating lower permeability (e.g. silts) and higher permeability layers (e.g. sands and gravels). Again, this is consistent with the groundwater system identified for Waikato Expressway – Hamilton Section.

Shallower, but small / discontinuous perched horizons are inferred (from select piezometers and CPT logs) near surface. The most notable of these discontinuous perched water tables is present through the centre of the 3Ms land along and extending towards Kelly Road, where there is evidence of an iron pan at approximately 2.5 m depth (approximately 61.5 m RL). Piezometers to the north and south of the 3Ms land have generally indicated only a deeper water level is present i.e. the perched iron pan aquifer is not considered to be laterally extensive in all directions. This is consistent with observations of groundwater level in hand augers, test pits and CTPs from more recent investigations (BTW, 2020) which confirms that the shallowest water level is typically deeper than 2 m bgl, and deepens to the north.

Recharge to the aquifer is via rainfall infiltration to the perched water tables, before slowly infiltrating into the deeper aquifers. The flow rate is likely to be very slow, both horizontally and vertically due to the flat topography and presence of lower permeability horizons.

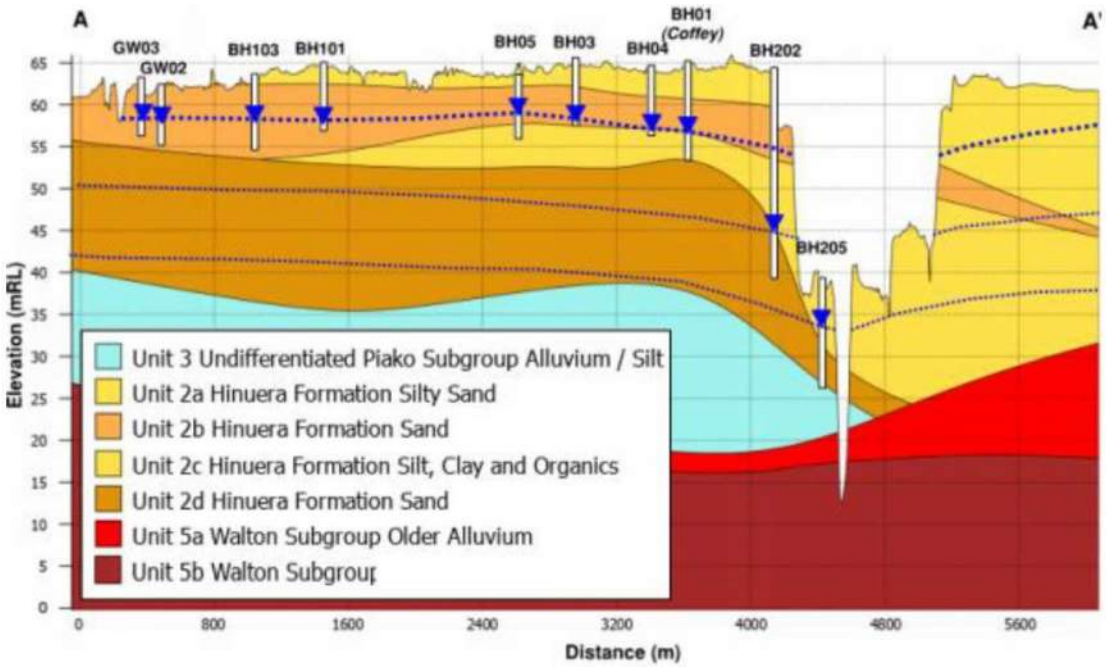


Figure 4: North-south cross section through the Cambridge C2 and C3 growth cells, including the 3Ms owned land. Steeply incised gully is the Waikato River which indicate the vertical exaggeration of the figure.

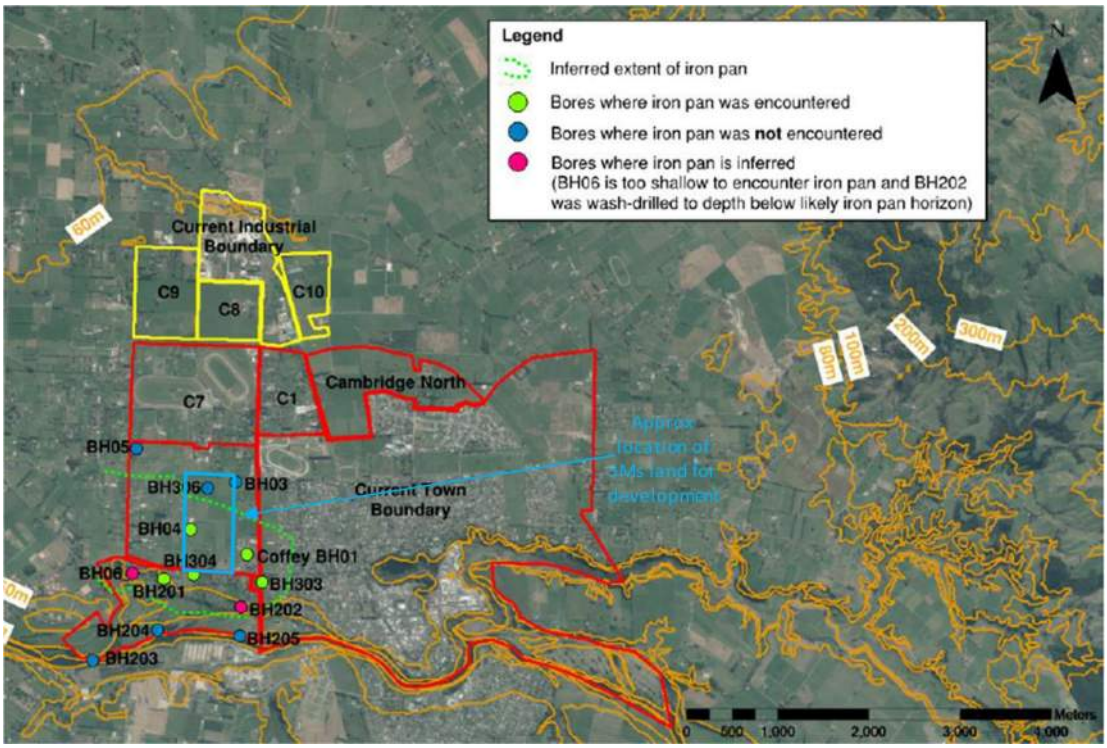


Figure 5: Inferred extent of iron pan and a possible perched aquifer.

3.2 Assumed Groundwater Level for Excavation

A series of site investigations have been previously undertaken in the broader C2 and C3 area to support structure planning.

There are six boreholes located in or close to the 3Ms landholding which are considered to provide the most pertinent information for this application. A summary of groundwater levels is provided in Table 1 (rows are approximately organised north (top of table) to south (bottom of table)). Refer Figure 5 for location.

Borehole logs and piezometer construction details are provided in Appendix A.

Table 1: Summary of available groundwater level data

Bore ID	Screened Depth m bgl [m RL]	Duration of monitoring available	Lowest GWL m bgl [m RL]	Highest GWL m bgl [m RL]	Comments
BH03	1.5 – 4.5 [60.5 – 63.5^{++}]	Jan'17 –May'20 (~1-year logger data)	Dry [-]	Dry [-]	Unsaturated to 58.8 m RL
	5.4 – 7.4 [57.6 – 59.6^{++}]	Jan'17 –Aug'17 (~7 months logger data)	7.3 [57.7^{++}]	6.2 [58.8^{++}]	
BH306	3.0 – 5.5 [58.5 – 61.0^{+}]	Mar'19 – May'20 (~1-year logger data)	5.1 [58.9^{+}]	3.1 [60.9^{+}]	
BH04	1.2 – 2.5 [61.5 – 62.8^{+}]	Jan'17 – Apr'20 (~3 years logger data)	2.2 [61.8^{+}]	0.5 [63.5^{+}]	Shallow perched on an Fe pan @ 61.5m RL
	4.5 – 7.5 [56.5 – 59.5^{+}]		Dry [-]	6.75 [57.2^{+}]	Unsaturated to 57.2 mRL
Coffey BH01	2.7 – 3.7 [60.3 – 61.3^{+}]	Single reading, September 2009	*no data*	0.9 [63.1^{+}]	Shallow perched on Fe pan
	5.7 – 6.5 [57.5 – 58.3^{+}]		*no data*	Dry [-]	Unsaturated to at least 56.3 mRL
	10.0 – 12.0 [52.0 – 54.0^{+}]		*no data*	7.7^{+} [56.3^{+}]	
BH304	3.6 – 6.6 [57.4 – 60.4^{+}]	Mar'19 – May'20 (~1-year logger data)	Dry [-]	Dry [-]	Unsaturated to 57.4 mRL
BH303	4.9 – 7.9 [57.6 – 59.6^{+++}]	Mar'19, Jun'20 (2x manual only)	Dry [-]	*no data*	Unsaturated to 57.6 mRL
	9.8 – 11.8 [57.6 – 59.6^{+++}]	Mar'19 – May'20 (~1-year logger data	9.1 [56.9^{+++}]	8.3 [57.6^{+++}]	

$^{+}$ Based on assumed ground level of 64 mRL

$^{++}$ Based on assumed ground level of 65 mRL

$^{+++}$ Based on assumed ground level of 66 mRL

Indicates a piezometer screened in the upper 3 m of the soil profile

Review of the above data and logs indicates that there is a ***shallow*** perched groundwater level present through the middle part of the 3Ms land, potentially extending as far as Kelly Road likely sitting on an iron pan at around 2.5 m depth. This shallow perched aquifer has a winter high groundwater level of ~63 - 63.5 m

RL, but near the centre of the 3Ms land may only be saturated over a thickness of a few hundred mm during summer months. This is based on the shallow piezometer at BH04 which has a summer low level of 61.8 m (just 0.3 m above the piezometer base / iron pan) and the adjacent deeper piezometer which is unsaturated to at least 7.5 m depth in summer (Figure 6). This is

- Similar to the pattern reported by Coffey (2009) for a multi-level piezometer BH01 in Kelly Road; and is
- Consistent with other piezometers BH303 and BH304 which indicate dry conditions over a depth range of 3.6 to 7.9 m bgl; and is
- Consistent with anecdotal reports from the previous landowners that deep excavations are dry.

A schematic of this shallowest perched level and underlying unsaturated ("dry") zone is provided in Figure 6. The deeper, though likely still perched groundwater water level is reported between 56 mRL to 61 mRL (note that it is this deeper, more consistent groundwater level that is shown in Figure 4).

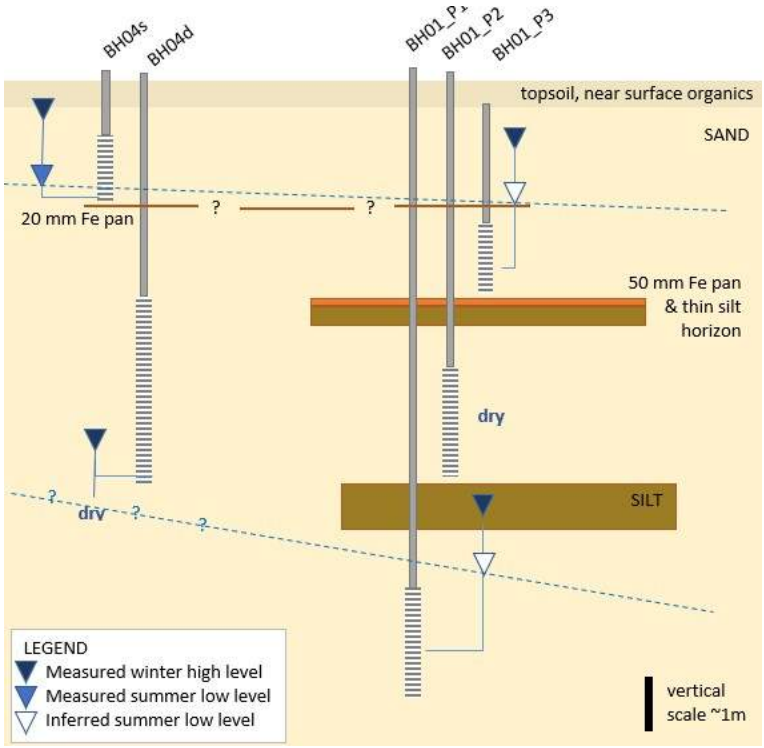


Figure 6: Schematic of iron pan and a possible perched aquifer extending from BH04 to Kelley Road.

Whilst there appears to be a correlation between the centre of the 3Ms site and Kelly Road, we note that a shallow piezometer (BH03) near the northern boundary is dry, suggesting that this shallowest perched level is not extensive over the wider area. Similarly, shallow piezometers along Cambridge Road are dry and bore logs suggest that any iron pan, where present, is much deeper, and, the recent BTW (2020) investigations suggest that any shallow perched aquifer also deepens to the north.

Hence the proposed 4 m deep excavations for stormwater basin and forebays are likely to puncture through the shallowest perched level and discharge into the unsaturated zone below.

Based on the above information a summer water level for the shallowest perched aquifer of 2.2 m bgl (61.8 mRL) has been adopted. This groundwater level is expected to deepen to the east towards Kelly Road and based on the conceptual section above, the saturated thickness of the perched aquifer over summer might be < 0.5 m at BH04 but increasing to 2 m at Kelly Road.

4 Assessment of Groundwater Drawdown

4.1 Existing numerical groundwater model

A steady state numerical groundwater model was developed in the three-dimensional (3D) finite-difference modelling package Groundwater Vistas. A full description of the model (design and construction boundary conditions and calibration, extracted from Beca, 2019) is provided in Appendix B and for brevity is not repeated here.

The original model was developed for WDC (Beca, 2019) to provide a high-level overview of the potential viability and effects arising from the broader Growth Cells development; particularly, the long term swale operation, reduced perviousness at the surface and the beneficial use of soakage to partially offset any adverse effects. We note that such works / effects are not the subject of this current application. However, the underlying model remains applicable and has been modified, where necessary, to specifically allow for the assessment of the 3Ms soakage basin.

Because of the greater depth of the proposed WDC central swale system and in order to consider soakage to the underlying more widespread aquifer below 58 mRL, the model was specifically calibrated to this more extensive and deeper water table. As this water level is > 4 m bgl, inclusion of the proposed 3Ms basin excavation in the model would result in no drawdown.

Where the perched level on the iron pan is not extensive than it may be that there is no drawdown, or that drawdown is limited to the 3Ms land only. However, in order to test an upper bound extent of drawdown assuming an extensive shallow aquifer at 2 m bgl, the basin has been artificially deepened in the model to achieve a maximum drawdown of 2 m.

The below sub-sections set out key changes which have been made to this model for the current assessment and the key commentary regarding the model calibration and remaining uncertainty or limitations

4.2 Changes made to model for this assessment

The following changes have been made to the groundwater model:

- The mesh was refined (from 20 m x 20 m cells to 10 m x 10 m cells) to allow for a more discretised simulation of the proposed works; and
- The extent of No-Flow cells south of Cambridge Road was reduced (as part of a separate package of work to WDC) to eventually allow for assessment of a proposed road cut through this area. This required moving the DRAIN boundary condition (assigned to the model's southern extent) further south;

No changes have been made to hydraulic conductivity, rainfall recharge, surface water bodies or calibration targets. The changes were first added to the existing steady state model and re-run to confirm that they did not result in any changes to the overall model calibration.

4.3 Model calibration

There are 90 groundwater level observations available for calibration which were weighted to reflect the data quality (refer **Appendix B**). The calibration was undertaken in steady state i.e. reflecting long term average groundwater conditions. The scaled RMS error based on the groundwater levels is 4.3%, for a weighted calibration of the 90 data points.

Most of the calculated heads are within 1 m of the observed; however, there are three high confidence level targets, not within the area of works considered here, which have residuals indicating the calculated heads are either greater than or less than the observed by between 1 m and 2 m but overall, the model is

considered to suitably simulate the overall direction and flow of groundwater in the deeper, extensive perched aquifer.

For assessing the potential maximum drawdown of the shallower, perched iron pan groundwater level we have assumed a similar gradient and overall flow direction (towards the river) exists. As outlined in Section 3, the perched level may in fact be less extensive and likely dips towards the south and is non-existent to the north and hence assuming the same, extensive flat gradient as in the underlying aquifer is expected to overestimate the extent of drawdown. The results provide an upper bound for assessing effects and identifying potential mitigation measures, in the unlikely event they are needed.

4.4 Residual uncertainty / limitations

The primary limitation of the groundwater model is that it cannot simulate the multiple perched groundwater levels at the site (Figures 4 and 6). This is due to numerical difficulties in simulating and converging alternating saturated and un-saturated conditions; however, this a limitation of most professional applications of 3D software.

The implications for the model and subsequent assessment of effects, is that the model assumes a fully saturated profile from the calibrated groundwater level down to the base of the model. Based on deeper bores in the area and discussions with the landowners during previous drilling campaigns, it is generally expected that there is a significant unsaturated zone with depth i.e. the perched aquifers are of limited thickness.

Similarly, the model cannot simulate the discrete perched aquifers near surface (without the introduction of very high recharge rates and / or very low permeability layers, which would again make the model numerically unstable). Whilst these perched horizons are expected to be discrete over most areas, there is a more extensive perched aquifer overlying the iron pan in the 3Ms land.

There is no stream flow data for the unnamed stream or for the discharge of springs in the terraces south of Cambridge Road; hence the mass balance, in terms of the calculated absolute values of baseflow to these features must be viewed with some caution. However, the model can be used to provide an indication of the proportionate change in groundwater contribution to the surface water features.

5 Assessment of Effects

5.1 Changes in Groundwater Level

The stormwater basin and forebay / swale excavations immediately south, herein collectively referred to as "the excavations" will be excavated to a maximum depth of approximately 4 m. The shallowest ***continuous*** perched aquifer is expected to be some 6 m to 8 m below ground level, and hence the excavations are well above this and no drawdown or groundwater inflows from this aquifer are expected.

The shallower **perched iron pan aquifer** is inferred from two borehole locations and is not expected to be laterally continuous in all directions, but as the actual extent is not fully known it is considered prudent to consider the potential effects if it is extensive. To account for this the model simulation has considered an artificially deep excavation to simulate the potential drawdown effect of excavations up to 2 m below a perched aquifer (i.e. the excavations were artificially lowered until they were a maximum depth of 2 m below the saturated water table considered in the model).

The drawdown results for this upper bound case (Figure 7 and Figure 8) indicate a maximum drawdown of 2 m immediately adjacent the stormwater basin (where groundwater level is closest to the surface), reducing to generally less than 1.25 m at the site boundaries. Due to the high permeability of the soils, measurable drawdown (taken as 0.25 m) under this upper bound case, extends some distance, ranging 800 m to 1400 m from the excavations.

This drawdown estimate is likely to be overly conservative as the simulation indicates drawdown occurring beyond the iron pan extent, which is unlikely. Figure 7 and Figure 8 show the drawdown contours in the areas outside the known iron pan extent as dashed to note the much lower risk of measurable drawdown eventuating in these areas.

This model is considered to provide an upper bound of effects as it assumes an aquifer of effectively infinite vertical and lateral extent, whereas:

- The borehole logs and groundwater level monitoring indicate a perched water table (above the iron pan) of discrete extent, limited to the 3Ms site and extending towards Kelly Road only; and
- Based on the geology encountered at BH04 (western boundary of 3Ms land), the saturated thickness of the perched aquifer is likely to be only 1.5 m i.e. the swale invert breaks through the base and into an underlying unsaturated zone such that the maximum drawdown would on average only be 1.5 m, and in summer might be less than 0.3 m and hence the consolidation risk is significantly lowered.
- The model assumes the perched iron pan aquifer has a consistent water table depth of ~2 m, when in fact there is evidence that the iron pan lowers to 2.5 m depth (~61.5 m RL) towards Kelly Road and towards Cambridge Road (where present) it is even deeper, well below the swale level.

Some risk remains that drawdown from the swale may result in permanent discharge of the perched iron pan aquifer which would be beneficial in terms of the liquefaction risk for the development. However, it could result in consolidation settlement of any compressible near-surface soils in the area (see Section 5.2).

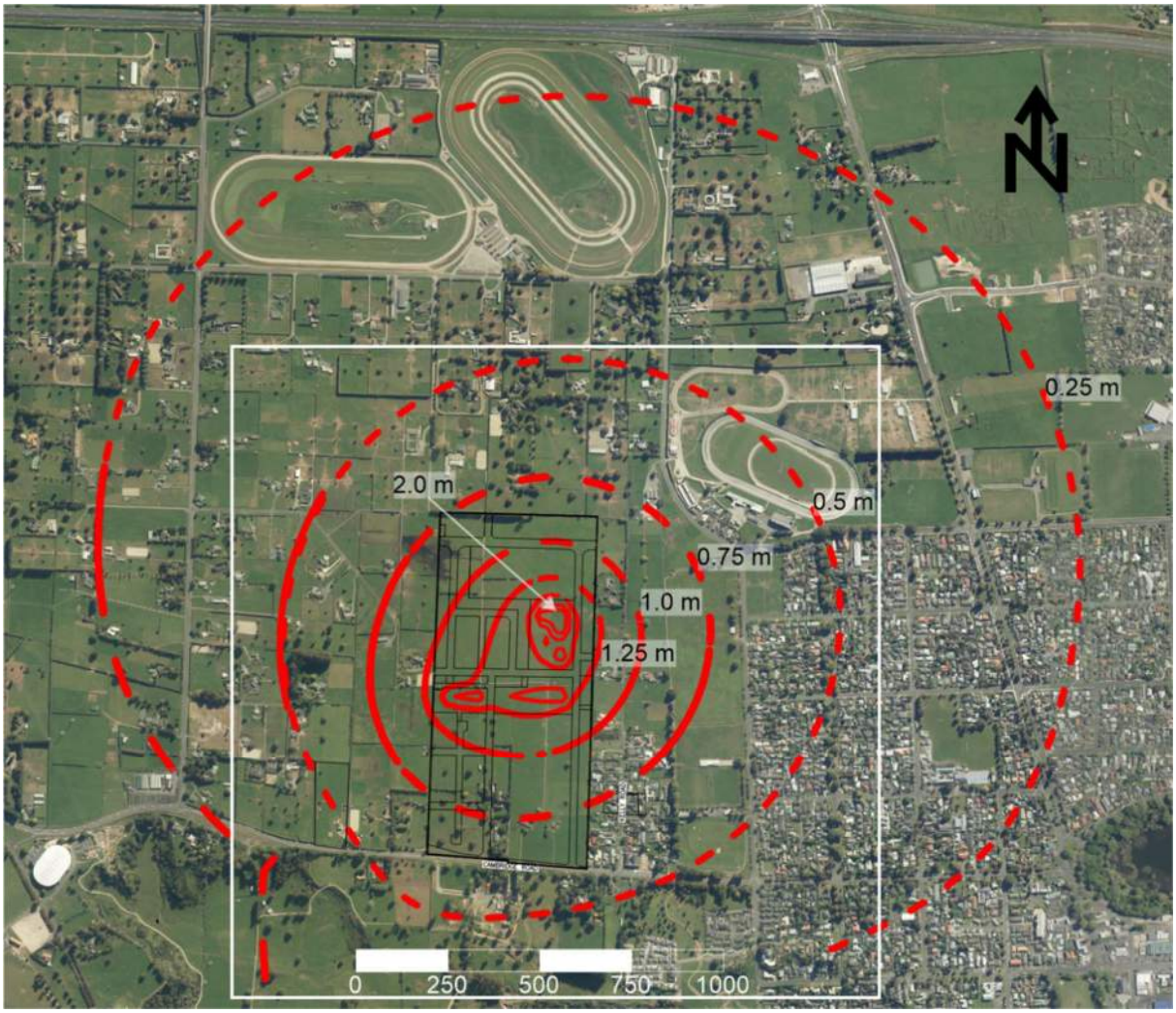


Figure 7: Full extent of calculated drawdown contours (0.25 m intervals) from long term operation of soakage basin and stormwater swales. Drawdown contours are dashed beyond the known extent of the iron pan to note the much lower risk of measurable drawdown eventuating in these areas. Excavations demarcated by blue rectangular polygons in Figure 8 (extent of Figure 8 indicated by white rectangle).

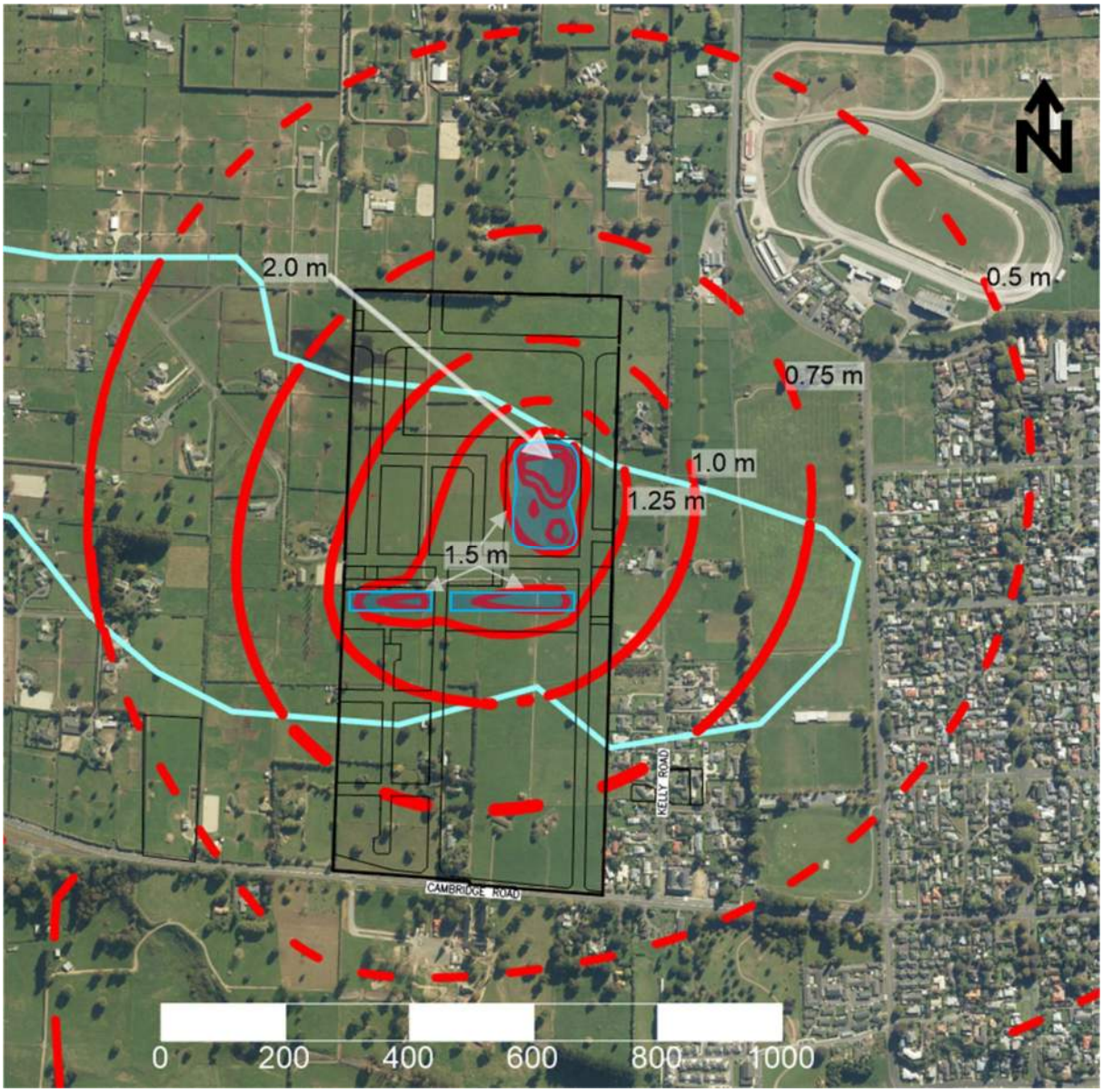


Figure 8: Close up of calculated drawdown contours (0.25 m intervals) from long term operation of soakage basin and stormwater swales. Drawdown contours are dashed beyond the known extent of the iron pan (outlined in light blue and consistent with areas identified by BTW as having a deeper, if any perched level) to note the much lower risk of measurable drawdown eventuating in these areas. Excavations demarcated by blue rectangular polygons.

5.2 Potential for Consolidation Settlement as a Result of Drawdown

Where the groundwater level in silty and clayey soils is drawn down below the naturally occurring low groundwater level there is the potential for some longer-term consolidation settlement of the ground to occur. Depending on the nature of the soils, such consolidation can continue for many years after construction is completed.

Given the relatively large hydraulic conductivities of the sandier soils (in which most drawdown will occur) and assuming that the basin is constructed in advance of subsequent development, it is likely that a significant proportion of drawdown will have occurred and the groundwater level largely stabilised, before any other private or public development of the site begins.

Generally, sandy soils (that are much less susceptible to settlement) dominate the area, and where silty and clayey soils occur, they tend to be thin interbeds within the sandier materials. As the thickness of the layer to consolidate is relatively small, settlement could also be expected to occur relatively quickly. There remains some risk, that if drawdown is transmitted along more sandy horizons, it could be felt by compressible layers at distance resulting in some settlement further away over time; however, as set out in the following sections, the settlement is likely to be very small and unlikely to result in damage.

The linear-based method of settlement calculation has been used to provide a quick and conservative estimate of potential settlement in the following sections, using an assessed coefficient of volume compressibility (m_v) and the calculated drawdowns relative to expected historical low water levels (i.e. summer conditions).

Settlement has been calculated based on:

$$S = m_V \times \Delta P \times t$$

Where S = settlement (mm);

m_V = volume compressibility with dimensions m^2/MN (a range of values between 0.1 and 0.5 was tested);

ΔP = change in pressure (maximum drawdown at base of layer in metres, converted to kN/m^2; and

t = thickness of compressible layers (values of 1 m and 2 m were tested in line with ground models developed by Beca, 2019 based on geotechnical testing and consistent with maximum saturated thickness of the aquifer).

Immediately adjacent to the excavations, where drawdowns of up to 2 m are calculated, a maximum settlement of up to 20 mm could occur (assuming a 2 m thick compressible layer with m_v = 0.5 m^2/MN). This is an upper-bound case assuming the maximum thickness and a high soil compressibility i.e. assumes 2 m of soft silts or clays. Further, such settlement even should it occur is likely to be limited to the area immediately surrounding the basin, adjacent road and green corridors; consequently, it is wholly limited to the development site boundaries.

A maximum drawdown of at the site boundary of 1.25 m is generally calculated. In the unlikely event that such drawdown did occur, this could result in 6 to 12 mm of consolidation settlement (upper bound assuming mv = 0.5 m^2/MN and 1 m to 2 m compressible thickness). This level of total settlement is unlikely to result in any damage to buildings or structures, and as the drawdown and settlement are likely to occur over a broad area with a relatively flat gradient, the risk of differential settlement (which has the potential to do the greatest damage) is considered to be low. However, the upper bound at 12 mm is slightly greater than usual first pass filters for risk of damage (being 10 mm) and so some further investigation and potentially some limited monitoring is recommended at the site boundary to better constrain and track any risk.

In the area of existing (denser) residential buildings, to the east of the 3Ms land on Kelly Road and along Cambridge Road, and in the vicinity of the race track, drawdown is calculated to be less than 1.0 m and expected to result in less than 10 mm of consolidation settlement. In these areas, the potential for damage to buildings or services as a result of the settlement is considered negligible.

Monitoring of groundwater levels before, during and after construction of the basin would be prudent to confirm that the actual drawdowns are within the range described above; particularly, in areas where any private development precedes the excavations. As noted above this should include a series of shallow monitoring wells in the areas of existing buildings to confirm if there is an extensive perched aquifer, in which case some limited survey monitoring may also be warranted (Section 6).

5.3 Groundwater Inflows to Excavations

Assuming a laterally extensive perched iron pan aquifer, modelling suggests that long term groundwater inflows to the basin would be of the order of ~320 m^3/d.

In practice this would not be pumped out of the ground in the long term, but rather would be discharged to the underlying aquifer. Some “take” might occur during initial excavation phases before the iron pan is broken through.

Again, we note that in this scenario the model adopts an aquifer of effectively infinite extent that may yield more groundwater than is realistic long term (i.e. the perched aquifer may be more finite in extent or potentially ephemeral); hence, this estimate is conservative.

5.4 Potential for Impacts on Existing Groundwater Users

As discussed in Section 2.1.3, there are no consented groundwater takes within 1 km of the proposed works; however, a review of the borehole database suggests that there are a number of groundwater wells within and surrounding the Growth area. It is likely that some, if not all, of these wells will be taking groundwater as a Permitted Activity (in which case there will be no publicly available data but regardless the owner is legally entitled).

In the upper bound scenario where a perched iron pan aquifer results in drawdown beyond the development area, results of modelling suggest some of these wells may experience up to 0.75 m of drawdown (Figure 9). However, the bores closest to the site are generally deeper than 20 m, and hence, are expected to be abstracting water from one of the much deeper aquifers, and are therefore, unlikely to be affected by drawdown from the proposed works.

The nearest shallowest bores likely to be taking water (2 No. screened between ~6 m depth and ~14 m depth) are shown within the calculated 0.5 to 0.75 m drawdown contours, however all bores are located within areas where available data suggests the iron pan aquifer is not present. Hence actual drawdown is expected to be much less.

Regardless, we note that the wells are shallow and will have limited available drawdown. They may already be subject to seasonal “drying” and in the unlikely event that drawdown at the upper bound presented here does occur, there is some small risk that this may result in noticeable additional pumping effort or a change in the ability of those users to abstract groundwater (if not monitoring bores and if being used for groundwater abstraction). A summary of the potential effects on all shallow bores within the zone of > 0.5 m drawdown in provided in Table 2.

It is recommended that the consent holder visit these bores prior to works commencing to confirm if they are operational and record the nature of pumping equipment, groundwater level etc., if possible. If it is determined that they could be affected, then it would be prudent to undertake some monitoring of levels either in these bores (where access allows) or via a purpose-built shallow monitoring well nearby.

If these wells do experience any interruption to their supply, then mitigation measures could include either to supplement the owner’s supply up to the permitted rate of 15 m^3 a day (where the effect is short term) or deepen the pump or well (for a long term effect).

Overall, any effects on private well users are likely to be less than minor and can be managed through the monitoring and mitigation measures outlined in Section 6.

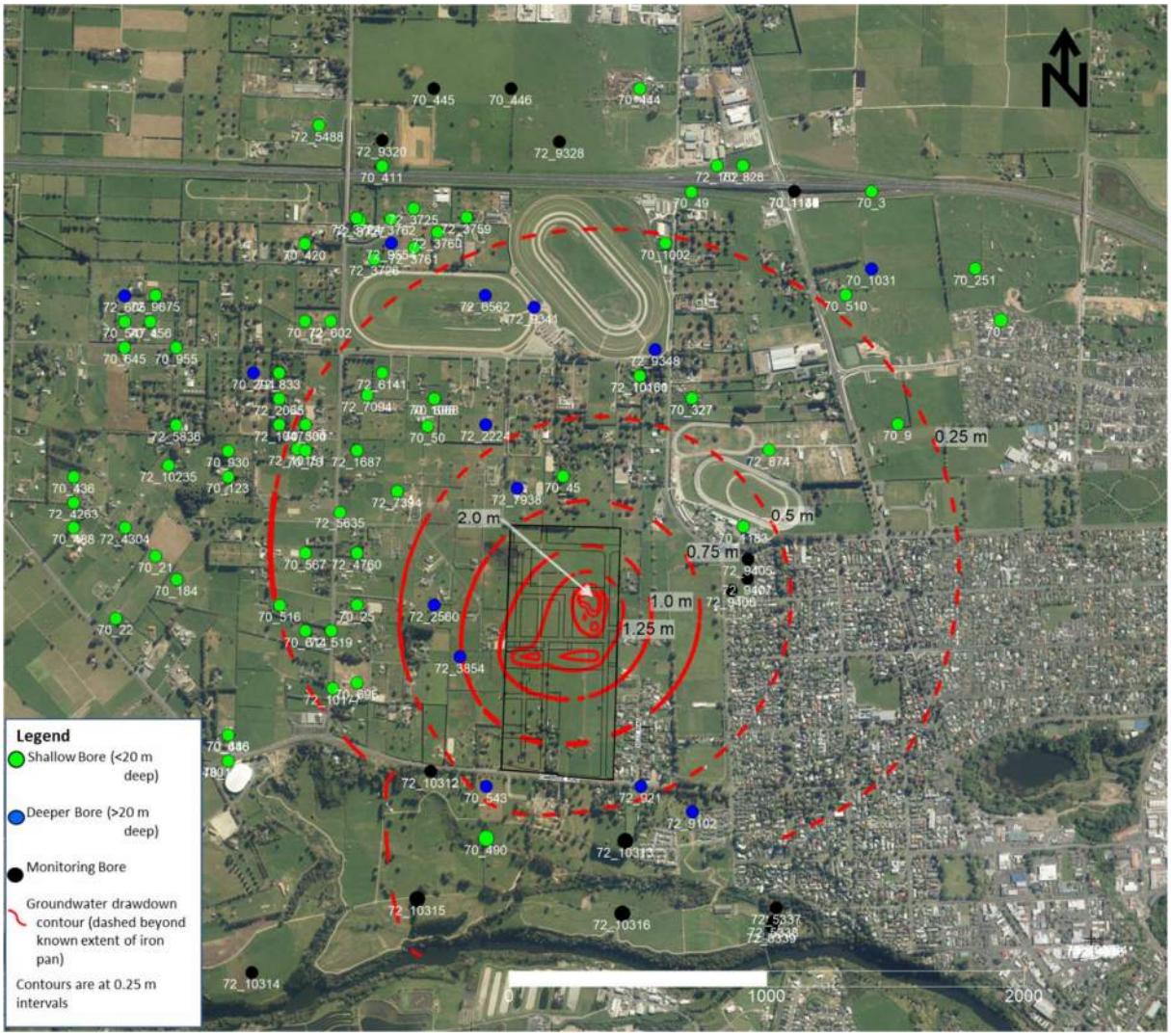


Figure 9: Groundwater Bores on WRC Database within 1 km of predicted extent of drawdown effects from long term dewatering by excavations – upper bound **artificially deep swale scenario**. Drawdown contours are dashed beyond the known extent of the iron pan to note uncertainty / lower risk of drawdown.

Table 2: Expected upper bound drawdown at neighbouring shallow private wells

WRC ID	Easting (NZTM)	Northing (NZTM)	Maximum Calculated Drawdown (m)	Comments
70_45	1815376	5804790	0.75	The well is approximately 450 m from the basin and WRC records report this well to be 7.88 m deep. Monitoring of BH03 at the north-western corner of Consenting Zone 4 between December 2016 and July 2018 recorded groundwater levels between 6 m and 7.27 m below ground level in the deep piezometer (screened depth of 5.40 m - 7.40 m) and absent from the shallow piezometer (screened depth of 1.55 m - 4.55 m). This suggests that seasonal periods of little to no groundwater (i.e. <0.5 m) may already occur and that there is little drawdown available should the maximum predicted drawdown occur. Should this well be in use, there is some risk that permanent dewatering may impact supply. There is no known take consent associated with this well and WRC report the casing is 903 mm in diameter which suggests it is a historical bore and may no longer be used. A site visit should be made by the consent holder to confirm, if possible.
70_1183	1816077	5804591	0.6	The well is approximately 600 m from the basin and WRC reports this well to be 14.3 m deep and screened between 10.9 m and 14.3 m depth. Well 70_1183 is expected to be abstracting water from a deeper aquifer and is unlikely to be affected by drawdown from the proposed works. There is no known take consent associated with this well however this well likely remains in use at its Cambridge Raceway location. A site visit should be made by the consent holder to confirm, if possible.
72_9405	1816094	5804466	0.6	These wells are between approximately 490 m to 570 m from the basin and WRC reports all wells to be 6 m deep and screened between 3.5 m and 6 m depth. Based on the reported construction details (50 mm diameter PVC casing installed December 2016), identification of this site as a historical refuse fill site (Section 5.6), and subsequent subdivision of this parcel based on WRC GIS, it is likely these are groundwater monitoring wells for geotechnical and/or contaminated site investigation purposes. A site visit should be made by the consent holder to confirm, if possible.
72_9407	1816093	5804391	0.6	
72_9406	1816030	5804345	0.7	

5.5 Effects on Surface Water Bodies

As mentioned in Section 2.1.5, whilst there are several man-made drains and overland flow paths in the surrounding area, the nearest naturalised stream is to the south of Cambridge Road.

As described earlier, the model mass balance can be used to consider proportionate changes in the volume of groundwater which is flowing towards the unnamed stream. The model simulation suggests that the diversion of groundwater from the perched iron pan aquifer towards the permanent basin, might result in a 5% reduction in the volume of groundwater flow which discharges to the stream.

Whilst there is no existing stream monitoring to quantify the range of naturally occurring flows, a 5% change in groundwater contribution would likely be unnoticeable against the background range of flows. Further the take itself is not consumptive in the sense that it is not removed from the system, but rather will discharge into the underlying aquifer and still report to the stream i.e. there is likely to be no net change.

Overall, any effects on surface water bodies are expected to be less than minor.

5.6 Potential for Contaminant Migration or Mobilisation

Contaminated sites (or sites appearing on the hazardous activities and industries list, HAIL) recorded in the WRC database and located within 2 km of the proposed works are shown on Figure 10. The contaminated sites are generally located in the rural industrial area to the west and pastural area to the southeast (both of which are hydraulically down gradient from the basin) and are typically described as areas of pesticide bulk storage or use.

The only known contaminated sites hydraulically up-gradient of the proposed works are:

- A historical refuse fill site, located 470 m from the proposed works, that from aerial imagery appears to have been capped between 1967 and 1971 (RetroLens); and
- A historical sawmill located 760 m from the proposed works, (which is noted on WRC record as ‘entered in error’ and which is absent in aerial images).
- An agricultural / industrial retail site located greater than 1 km from the proposed works (fertiliser manufacture or bulk storage).

Overall, the risk of contaminant migration or mobilisation as a result of the basin is considered low.

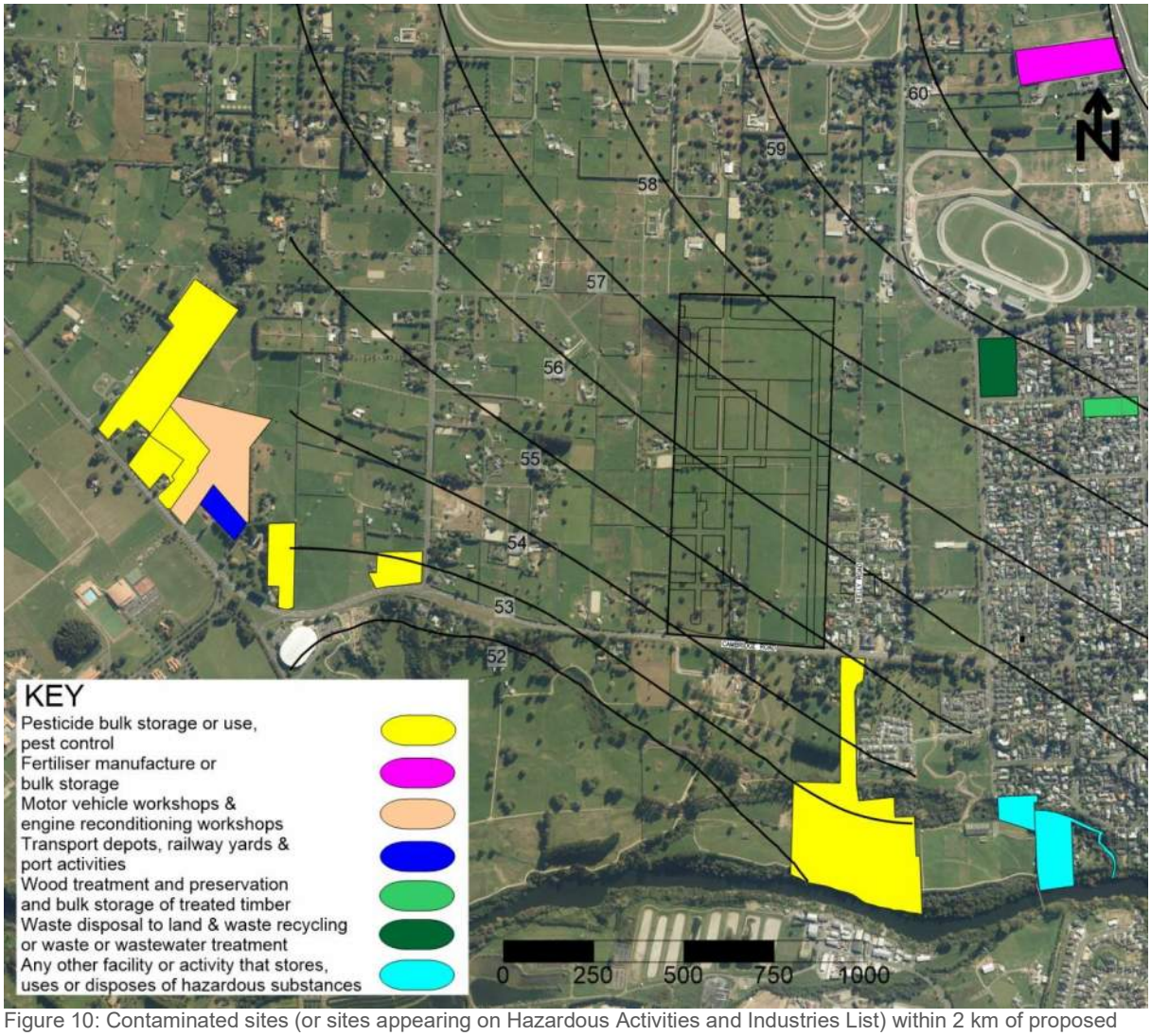


Figure 10: Contaminated sites (or sites appearing on Hazardous Activities and Industries List) within 2 km of proposed works (Source WRC, November 2020). Modelled base case average groundwater level contours are shown in black.

5.7 Basin Mounding Assessment

Whilst the operation of the soakage basin itself is a provided for, an initial assessment of the operation has been undertaken to confirm basin sizing and risk of mounding under expected operational conditions.

The assessment used the Hantush (1967) solution for the growth and decay of groundwater mounds in response to uniform infiltration over a given time period.

A full description of the key assumptions and limitations, as well as calculation inputs is provided in Appendix C. However, the most critical assumptions / limitations are:

- The **site-specific design infiltration rate** which has not yet been confirmed. A design infiltration rate of 100 mm/hour has been adopted. This is comparable to the factored rate adopted for the BIL site in Hautapu recently and is lower than the average rate reported in the SMP (WDC, 2019) but we note that this was based on the average of a range of different test methods and locations. Site specific testing at the basin location is required to confirm the rate; and
- The Hantush solution is a simplified method which **determines the relative height of mounding below a basin but cannot account for any stored volume in the basin itself**. This is significant as the stored volume in the central stormwater basin is calculated to be ~30,000 m^3 with an additional 19,600 m^3 in the

forebays / swales (Harrison Grierson, 2020). This more than exceeds the total runoff volume of the smaller design rainfall events, but also would be sufficient to fully store the 100-year event, such that even if the mound height rises to the invert level (IL) of the basin, any additional stormwater volume is readily accommodated in the basin and the mound height will be less than calculated (Figure 9).

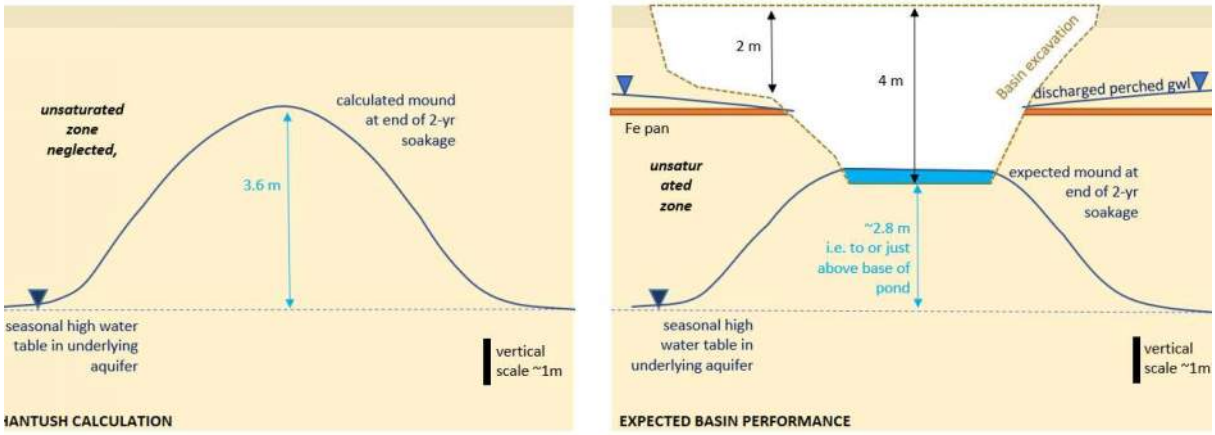


Figure 11: Schematic of Hantush calculation vs expected basin operation

The calculations suggest that any short-term mounding associated with the 2-year and 10-year design events can be readily accommodated within the unsaturated zone and by storage within the basin, such that the groundwater level adjacent the basin remains more than 2 m below the ground surface.

For a larger 100-year event the groundwater mound will rise to a higher level within the basin but will remain fully contained i.e. no surface breakout. In the unlikely event that the water level in the basin reaches the overflow level, then the swales / forebays provide additional storage to allow a slower release of soakage to ground.

We note that the assessment is not based on site specific testing over the footprint of the basin. As noted earlier there is some variability across the area and site-specific testing of the saturated hydraulic conductivity in the lower aquifer is critical to confirming the assumptions presented above. This should comprise at least two tests over the footprint. Testing should be a 4-hour duration constant rate test in a piezometer screened below the deeper groundwater level, or, if undertaken in the unsaturated zone should include a suitable period of pre-soak or multiple (repeat) tests until steady state conditions are reached.

6 Monitoring

Groundwater level monitoring is recommended to confirm that the magnitude and extent of any groundwater drawdown which does occur, is within the upper bound assessment presented in this report. It is anticipated that monitoring would be formalised in a Groundwater Monitoring and Mitigation Plan, that would be submitted to WRC ahead of the start of dewatering.

6.1 Monitoring of Groundwater Drawdown

Drawdown will result in a depression of the groundwater level that will extend outwards from the activity, declining in magnitude with distance from that activity. Drawdown as a result of the long-term diversion of groundwater into the basin will be permanent and as there are two private shallow wells, and some existing residential buildings within the calculated upper bound zone of influence, some limited monitoring is prudent.

It is proposed that groundwater monitoring of purpose-built monitoring wells be carried out to provide early warning if drawdown occurs and / or is likely to extend beyond the site. Proposed monitoring is shown in Figure 12.

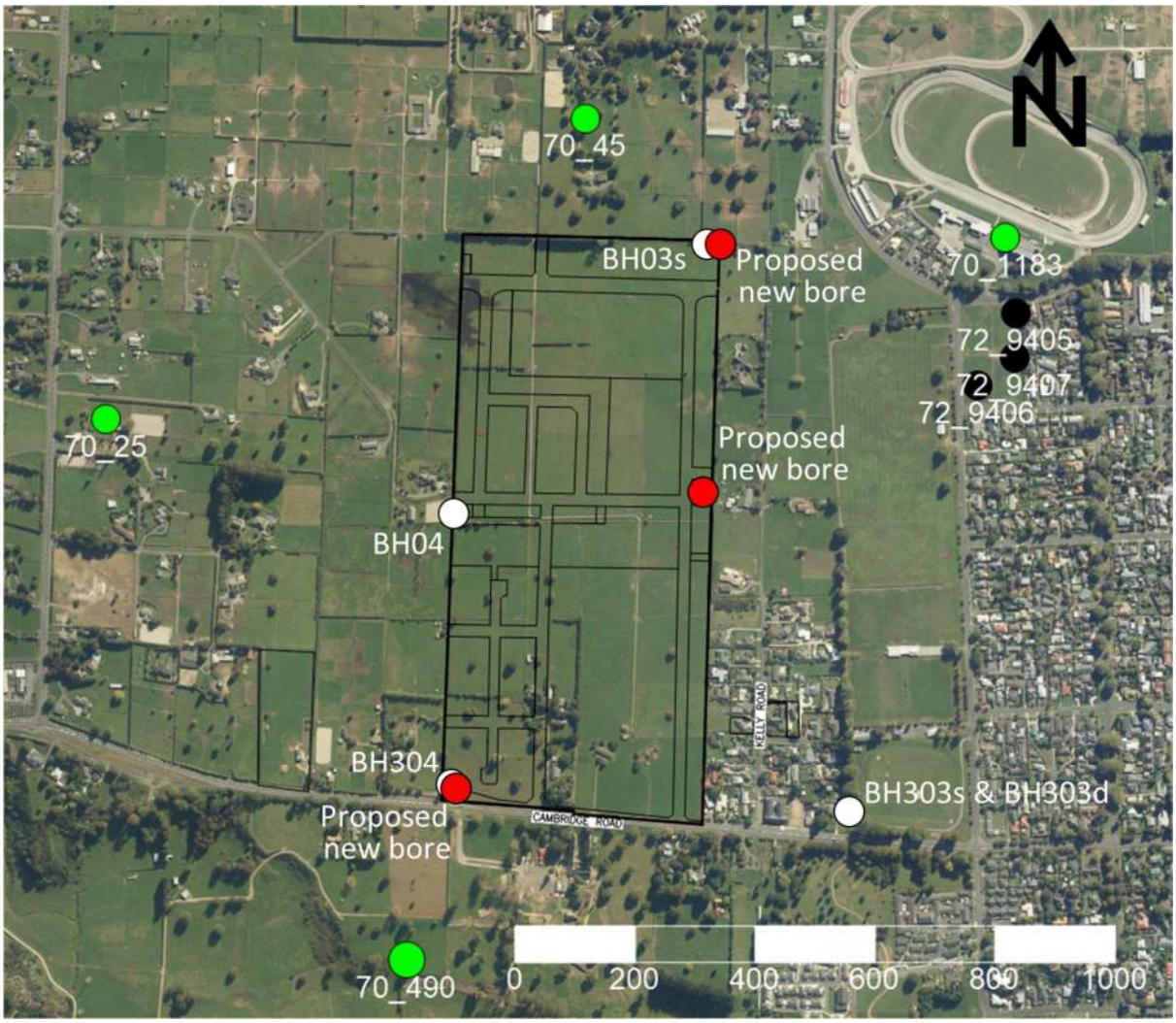


Figure 12: Location of existing private wells (green) and proposed monitoring bores (white existing and red new) for groundwater monitoring.

Existing monitoring wells BH03 and BH04 (both nested shallow and deep pairs) are located on the north and west boundary respectively; monitoring well BH303 (again a paired set) is located approximately 250 metres east of site toward Kelly Road (Figure 12).

Additional dedicated groundwater monitoring wells are proposed to be drilled at targeted locations adjacent to the site boundary to provide coverage where there is a data gap and / or key buildings are present. Alternatively, if the Kelly Road piezometer still exists and is accessible this could be used in lieu of the new bore shown on the eastern boundary.

Manual monitoring on a monthly basis from minimum one month (but preferably longer) before construction commences until active construction is completed, is considered prudent to confirm the extent of any extensive perched aquifer, and if present to confirm that any drawdown does not exceed calculated predictions and to enable prompt supply of water should the bore owner's supply be impacted. Where initial monitoring indicates that there is no perched level than the need for monitoring could be reviewed and potentially removed.

It is proposed that the consent holder liaise with the landowner of the nearest potentially affected private wells (Well ID 70_45 and 70_490) at least one (1) month prior to the commencement of active dewatering to confirm the nature of any take, and then again at least one (1) week prior to works commencing to advise them of the nature of the works and provide an emergency contact (name and all hours phone number) to the bore owner, so that they can notify if they consider that the well is impacted during this time.

The consent holder is to record the date and time of the reported impact and record the action taken in response (e.g. supply of water to the owner or, longer term, deepening of the pump or well).

6.2 Drawdown Induced Ground Settlement

Generally, the predicted drawdown is sufficiently small that it is unlikely to result in adverse ground settlement. This is consistent with our experience at Greenhill Park Subdivision in similar soils, excavation and dewatering depths, where drawdown did not result in any ground settlement which could be attributed to the works.

Considering the groundwater monitoring proposed above, which should serve as an early signal that conditions for potential groundwater induced settlement have been reached, no settlement monitoring is proposed. This should be further reviewed after drilling and initial monitoring of the new piezometers i.e. should they show an extensive perched aquifer and / or compressible soils then some limited ground monitoring at the boundary and pre-construction and post-construction condition surveys may be warranted in the short term.

7 Summary & Conclusions

7.1 Summary of Environmental Effects

Analyses suggest that for the upper bound scenario, where an extensive perched iron pan aquifer exists beneath the site, that the calculated drawdown would still be unlikely to result in significant or damaging consolidation settlement beyond the development area (where there are existing buildings). Any consolidation settlement that does occur within the development area, is likely to occur before private development is completed (subject to construction of the stormwater swale preceding development). Regardless, developers should consider building some flexibility into permanent works such that they could accommodate any small settlements that do occur.

Similarly, the analyses suggest that impacts on any private groundwater wells are likely to be less than minor, but some limited groundwater level monitoring during and following construction would be prudent to confirm that the magnitude and extent of drawdown is as expected or to allow refinement of the analyses, in the unlikely event that it is greater. Groundwater level monitoring will also enable prompt supply of water should the closest shallow private bore owner's supply be impacted (should the bores still be in use).

7.2 Further Recommendations

The results described in this report are based on the site data collected to date and the indicative basin design available at the time of reporting. Should significant changes be made to the design (i.e. changes to depth or extent, etc.) the modelling will need to be re-run to consider the impact this will have on the calculated effects.

Similarly, the modelling should be reviewed immediately prior to construction of the swale to allow consideration of the results from the proposed new bores. This is particularly important noting that the borehole data will aid in constraining the extent of the perched iron pan aquifer.

Water level monitoring should be carried out during, and for a short time following, construction (at selected sites) to confirm that the extent of changes in groundwater level are within the expected range. We also recommend that observation monitoring of the excavations is undertaken during construction to help manage potential risks associated with groundwater inflows and slope stability.

Site specific testing of the permeability to inform design infiltration rate should be undertaken to inform detailed design of the basin.

8 Applicability Statement

This report has been prepared by Beca on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which Beca has not given its prior written consent, is at that person's own risk.

Should you be in any doubt as to the applicability of this report and/or its recommendations for the proposed development as described herein, and/or encounter materials on site that differ from those described herein, it is essential that you discuss these issues with the authors before proceeding with any work based on this document.

9 References

Beca, 2019. Cambridge C1 and C2/C3 Infrastructure: Groundwater Model and Assessment. Prepared for Waipa District Council 29 May 2019.

BTW Company, 2020. 3MS Site - Cambridge (Part of C2 Growth Cell), Geotechnical Suitability Report for 3MS of Cambridge 13 November 2020

Beca

BOREHOLE No: BH 03 deep

MACHINE BOREHOLE LOG

SHEET 1 of 1

PROJECT: Cambridge West — JOB NUMBER: 4284909

SITE LOCATION: West Cambridge — CLIENT: Waipa District Council

CIRCUIT: NZTM — BOREHOLE LOCATION: 1881 Cambridge road. North east corner of farm

COORDINATES: N 5,804,574 m — R L: 65 m — COORDINATE ORIGIN: hhGPS

E 1,815,592 m — DATUM: MSL — ACCURACY: 5

FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	MONITORED WATER LEVEL	INSTRUMENTATION	R L (m)
		80 %	OB			140+	205+		C	0		"Soft", SILT, some organics, minor clay, trace fine to coarse sand; dark brown-black; moist low plasticity. Organics: amorphous, rootlets. [Topsoil]			BH 03	
		100 %	OB						C			"Hard" SILT, minor fine sand, minor clay, trace organics; orange-brown; moist, low plasticity. Organics: rootlets.				
		0 %	OB			UTP			SPTLS	1		Core loss				64
		100 %	SPT					1 1 2 2 2 2 N=8	C			Loose fine to coarse SAND, some fine to medium gravel, minor silt; orange-grey with white staining; moist, non plastic. Gravel: Subangular to subrounded greywacke, pumice.			Cuttings	
		100 %	TT						C	2		2.0m, grey.				63
		60 %	TT						C	3		2.6m, thin bed of medium GRAVEL, subrounded. Pumice. 3.05m, orange-grey.	Hinuera Formation		Bentonite	62
		44 %	SPT					2 2 2 2 2 1 1 N=6	SPTLS							
		100 %	TT						C	4						61
		100 %	SPT					1 0 0 1 1 1 1 N=3	SPTLS	5		"Stiff" CLAY, some silt, trace fine sand; grey-white; moist, high plasticity. MNo flecks. 4.8m, orange.			Sand	60
		100 %	OB						C			"Loose" fine to coarse SAND, some silt, trace fine gravel; orange-grey; moist, non plastic. Pumiceous 5.18m, thin bed of silty CLAY, trace fine sand. 5.28m, thin bed of silty CLAY, trace fine sand.			Gravel	
		80 %	OB						C	6		"Loose", fine to medium SAND, trace silt; grey mottled orange; moist, non plastic. Pumiceous. Subrounded volcanic glass. 5.45m, moderately thin bed of silt clay. 6.1m, moderately thin bed of silt clay.				59
		100 %	SPT						SPTLS							
		100 %	OB					1 2 2 3 4 4 N=13	C	7		Medium dense fine to coarse SAND; grey mottled orange; moist, non plastic. Sand: Subangular to subrounded, quartzose. 6.4m, fine to coarse sand, pumiceous, quartzose. 6.65m, trace fine gravel: SW greywacke. 6.7m, thin bed of "soft" silty CLAY.				58
		100 %	OB						C			"Hard" SILT, some fine to coarse sand; dark grey; moist, low plasticity. 7.0m, saturated.				
	16/12/2016	100 %	SPT					1 2 1 2 1 2 N=6	SPTLS	8		Loose medium to coarse SAND, trace silt, trace fine to medium gravel; grey mottled orange; saturated, non plastic. Sand: subangular, quartzose. Gravel: subrounded, greywacke. END OF LOG @ 8 m			Gravel	57
										9						56

DATE STARTED: 16/12/16 — DRILLED BY: Pro-Drill

DATE FINISHED: 16/12/16 — EQUIPMENT: Fraste SL.G

LOGGED BY: MP/AM — DRILL METHOD: OB/SPT/TT

SHEAR VANE No: Geo1249 — DRILL FLUID: Polymer

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Terminated at target depth.
Groundwater encountered at 7.5m bgl.
Elevation estimated from BD 34 Topo50 map.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

BECA LIB 1.07.3.GLB Log BECA MACHINE BOREHOLE CAMBRIDGE WEST.GPJ <<DrawingFile>> 27/01/2017 09:03 8.30.004 Datgel Lab and In Situ Tool - DGD | Lib: Beca 1.07.3 2015-07-31 Prj: Beca 1.07 2014-12-16

A4 Scale 1:50

Cambridge C1 - C3 Structure Plan

BOX: 1 **DEPTH: 0.0 to 4.4 m**

BOX: 2 **DEPTH: 4.4 to 7.5 m**

Cambridge C1 - C3 Structure Plan

SPT @ 1.5 m

SPT @ 3.5 m

SPT @ 4.5 m

Beca

BOREHOLE No: BH 04 deep

MACHINE BOREHOLE LOG

SHEET 1 of 1

PROJECT: Cambridge West — JOB NUMBER: 4284909

SITE LOCATION: West Cambridge — CLIENT: Waipa District Council

CIRCUIT: NZTM — BOREHOLE LOCATION: 1881 Cambridge road. Along western fence line, middle of farm

COORDINATES: N 5,804,128 m — R L: 64 m — COORDINATE ORIGIN: hhGPS

E 1,815,167 m — DATUM: MSL — ACCURACY: 5

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	MONITORED WATER LEVEL	INSTRUMENTATION	R L (m)
		100 %	OB						C			"Soft" SILT, minor organics, trace clay; dark brown; moist, low plasticity. Organics: amorphous, rootlets.			BH 04	
		100 %	OB						C			"Firm" SILT, minor clay; brown; moist, low plasticity.			Cuttings	
		100 %	SPT						SPTLS	1		Loose fine to medium SAND, minor silt; brown; moist, non plastic. Pumiceous.				63
		100 %	OB						C			1.25m, thin bed of fine sandy SILT, minor clay; light grey; moist, low plasticity. Pumiceous.				
										2		1.52m, thin bed of SILT-CLAY; light grey.				62
		100 %	OB						C			2.35m, thin bed of "firm" SILT, minor clay; dark brown; moist, low plasticity.			Bentonite	
		100 %	SPT					2 2 2 2 2 2 N=8	SPTLS	3		"Hard" silty CLAY; dark orange brown; dry; high plasticity. [Fe Pan]. Loose fine to medium SAND; light grey laminated orange streaks; moist, non plastic.				61
		100 %	OB						C			3.7m, moderately thin bed of fine to coarse SAND, trace fine gravel. Sand: pumiceous, quartzose.			Sand	
16/12/2016		0 %	OB						C	4		3.9m, moderately thin bed of silty fine to coarse SAND, trace fine to coarse gravel. Core loss			Gravel	60
		80 %	SPT					2 3 3 4 4 5 N=16	SPTLS			"Medium dense" fine to coarse SAND, trace fine gravel; grey; wet, non plastic. Sand: pumiceous, quartzose. Gravel: subrounded to subangular, pumice, greywacke.	Hinuera Formation			
		100 %	OB						C	5						59
		100 %	TT						C	6		Medium dense fine to medium SAND, some silt, trace clay; grey; moist, low plasticity.			Gravel	58
		100 %	TT						C			Medium dense fine to coarse SAND, some fine to medium gravel, minor silt; grey; moist, non plastic. Sand: pumiceous, quartzose. Gravel: subangular to subrounded, pumice, greywacke.				
		100 %	SPT					3 4 6 6 6 6 N=24	SPTLS							
19/12/2016		100 %	TT						C	7		7.0m, gravel: subrounded pumice.				57
		100 %	TT						C			7.6m, dark grey. 7.68m, laminations, orange. 7.82m, Interbedded with moderately thin yellow bands.				
		100 %	SPT					3 3 4 3 4 3 N=14	SPTLS	8					Gravel	56
25/01/2017												END OF LOG @ 8.45 m				
										9						55

DATE STARTED: 16/12/16 — DRILLED BY: Pro-Drill

DATE FINISHED: 19/12/16 — EQUIPMENT: Fraste SL.G

LOGGED BY: MP/AM — DRILL METHOD: OB/SPT/TT

SHEAR VANE No: Geo1249 — DRILL FLUID: Polymer

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Terminated at target depth.
Groundwater encountered at 3.82m bgl.
Elevation estimated from BD 34 Topo50 map.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BECA LIB 1.07.3.GLB Log BECA MACHINE BOREHOLE CAMBRIDGE WEST.GPJ <<DrawingFile>> 27/01/2017 09:03 8.30.004 Datgel Lab and In Situ Tool - DGD | Lib: Beca 1.07.3 2015-07-31 Prj: Beca 1.07 2014-12-16

Cambridge C1 - C3 Structure Plan

BOX: 1 **DEPTH: 0.0 to 2.4 m**

NB: box trampled by stock over weekend

BOX: 2 **DEPTH: 2.4 to 5.8 m**

Beca

BH04

4284908/180/CD

Machine Borehole Photos

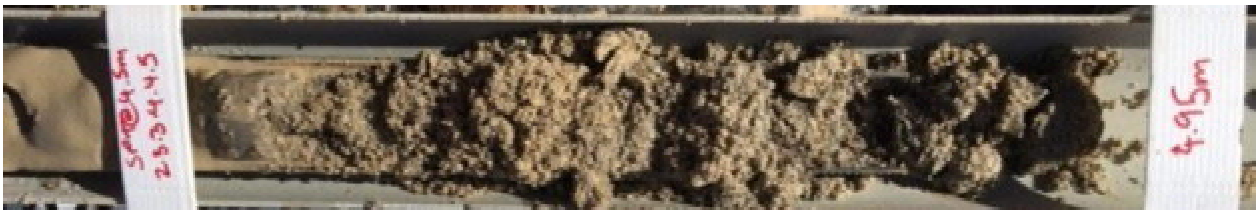
Cambridge C1 - C3 Structure Plan

BOX: 3 **DEPTH: 5.80 to 8.45 m**

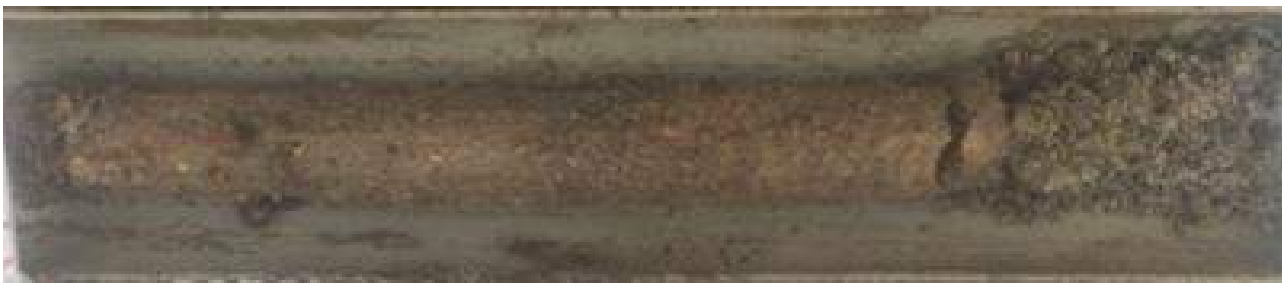
Cambridge C1 - C3 Structure Plan

SPT @ 1.5 m

SPT @ 3.0 m



SPT @ 4.5 m



SPT @ 6.5 m

SPT @ 8.0 m

Beca

BOREHOLE No: BH303 Deep

MACHINE BOREHOLE LOG

SHEET 1 of 2

PROJECT: Cambridge C1-C3 JOB NUMBER: 3208540

SITE LOCATION: C2 - North of 1871 Cambridge Road to 1 Hamilton Road. CLIENT: Waipa District Council

CIRCUIT: NZTM BOREHOLE LOCATION: Refer GI Plan.

COORDINATES: N 5,803,625 m R L: 67 m COORDINATE ORIGIN: hhGPS

E 1,815,814 m DATUM: MSL ACCURACY: ±5m

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	MONITORED WATER LEVEL	INSTRUMENTATION	R L (m)
		70 %	OB						C			'Soft' clayey SILT, minor clay and organics; dark brown; moist, low plasticity. Organics: rootlets [Topsoil].			BH303	
												'Firm' fine sandy SILT, some clay; brown; dry, high plasticity.				
		50 %	OB						C			0.75m, fine to coarse sand.				
		20 %	OB						C	1		1.0m to 1.4m, no recovery.				66
		50 %	OB						C			'Loose' fine to medium SAND; brown speckled black and orange; wet, non plastic. FeO staining.				
		60 %	OB						C	2		1.5m to 1.75m, no recovery. 'Loose' fine to coarse SAND; brown speckled black and orange; saturated, non plastic. 1.95m, moist. 2.48m, very thin (10mm) layer of clayey silt. 2.5m, fine to medium SAND				65
		80 %	OB						C							
		74 %	OB						C	3		2.9m, fine SAND, some silt.				64
		100 %	OB						C C			'Firm' silty CLAY; greyish brown mottled orange and brown; moist, high plasticity. 'Loose' fine to coarse SAND; grey speckled black, white and orange; moist, non plastic. FeO stained. 3.7m, trace fine gravel: subrounded to rounded, SW-UW, pumice.				
		90 %	OB						C	4		'Firm' clayey SILT, trace coarse gravel; grey streaked orange; moist, high plasticity. Gravel: subrounded to rounded, SW-UW, pumice.			Grout	63
		50 %	OB						C			'Loose' fine silty SAND; grey, moist, non plastic. 4.5m -4.75m, no recovery.				
		60 %	OB						C	5		'Loose fine SAND; grey; moist, non plastic. Very thinly (10mm) bedded. 4.9m, some silt. 5.0m - 5.25m, no recovery.	Hinuera Formation			62
		60 %	OB						C			'Loose' silty fine SAND; grey; moist, non plastic. 5.3m, moderately thin (100mm) layer of clayey silt.				
		80 %	OB						C	6		5.8m, very thin (10mm) layer of clayey silt. 'Loose' fine to medium SAND; grey; moist, non plastic. 6.1m, fine SAND.				61
		100 %	OB						C			6.58m, thin (20mm) orange band. FeO stain. 6.6m, thin (50mm) layer of clayey silt. 6.65m, moderately thin (70mm) dark grey band.				
		80 %	OB						C	7		6.2m, some silt. 'Loose' fine sandy SILT; grey; moist, non plastic.				60
		40 %	OB						C			7.5m to 7.8m, no recovery.				
		95 %	OB						C	8		'Loose' fine sandy SILT; grey; moist, non plastic. 'Firm' silty CLAY; grey; moist, high plasticity. 'Loose' silty fine to medium SAND; grey banded orange; moist, non plastic. Thinly (20mm) interbedded with fine sandy SILT.			Bentonite	59
		75 %	OB						C	9		8.9m, very thin (6mm) weakly cemented layer. Iron pan. 9.1m, thin (50mm) layer of medium to coarse gravel; cemented sand, iron pan?. Saturated. 9.5m, moist.			Sand	58

DATE STARTED: 21/3/19 DRILLED BY: Pro-drill (Auck) Ltd

DATE FINISHED: 21/3/19 EQUIPMENT: SLG 02

LOGGED BY: JMW DRILL METHOD: OB

SHEAR VANE No: n/a DRILL FLUID: Water/polymer

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Borehole terminated at target depth. No strength testing undertaken, borehole cored for indicative permeability to inform piezometer install.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BECA LIB 1.07.4.GLB Log BECA MACHINE BOREHOLE CAMBRIDGE C1-C3 LOGS.GPJ <<DrawingFile>> 04/04/2019 09:34 8.30.004 Datgel Lab and In Situ Tool - DGD | Lib: Beca 1.07.4 2016-01-15 Prj: Beca 1.07 2014-12-16

Beca

BOREHOLE No: BH303 Deep

MACHINE BOREHOLE LOG

SHEET 2 of 2

PROJECT: Cambridge C1-C3 JOB NUMBER: 3208540

SITE LOCATION: C2 - North of 1871 Cambridge Road to 1 Hamilton Road. CLIENT: Waipa District Council

CIRCUIT: NZTM BOREHOLE LOCATION: Refer GI Plan.

COORDINATES: N 5,803,625 m R L: 67 m COORDINATE ORIGIN: hhGPS

E 1,815,814 m DATUM: MSL ACCURACY: ±5m

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	MONITORED WATER LEVEL	INSTRUMENTATION	R L (m)
		90 %	OB						C	11		'Loose' silty fine to medium SAND; grey banded orange; moist, non plastic. Thinly (20mm) interbedded with fine sandy SILT.	Hinuera Formation		Gravel	56
		90 %	OB						C			11.1m, moderately thin (150mm) layer of clayey silt.				
										12		END OF LOG @ 12 m				55
										13						54
										14						53
										15						52
										16						51
										17						50
										18						49
										19						48

DATE STARTED: 21/3/19 DRILLED BY: Pro-drill (Auck) Ltd

DATE FINISHED: 21/3/19 EQUIPMENT: SLG 02

LOGGED BY: JMW DRILL METHOD: OB

SHEAR VANE No: n/a DRILL FLUID: Water/polymer

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Borehole terminated at target depth. No strength testing undertaken, borehole cored for indicative permeability to inform piezometer install.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

BECA LIB 1.07.4.GLB Log BECA MACHINE BOREHOLE CAMBRIDGE C1-C3 LOGS.GPJ <<DrawingFile>> 04/04/2019 09:34 8.30.004 Datgel Lab and In Situ Tool - DGD | Lib: Beca 1.07.4 2016-01-15 Prj: Beca 1.07 2014-12-16

A4 Scale 1:50

Cambridge C1- C3

BOX: 1 **DEPTH: 0.0m to 3.7m**

BOX: 2 **DEPTH: 3.7m to 6.5m**

BH303

3208540

Machine Borehole Photos

Cambridge C1- C3

BOX: 3 **DEPTH: 6.5m to 9.0m**

BOX: 4 **DEPTH: 9.0m to 11.5m**

Cambridge C1- C3

BOX: 5 **DEPTH: 11.5 to 12.0m EOH**

Beca

MACHINE BOREHOLE LOG

BOREHOLE No: BH303 Shallow

SHEET 1 of 1

PROJECT: Cambridge C1-C3 JOB NUMBER: 3208540

SITE LOCATION: C2 - North of 1871 Cambridge Road to 1 Hamilton Road. CLIENT: Waipa District Council

CIRCUIT: NZTM BOREHOLE LOCATION: Refer GI Plan.

COORDINATES: N 5,803,623 m R L: 67 m COORDINATE ORIGIN: hhGPS

E 1,815,813 m DATUM: MSL ACCURACY: ±5m

DRILLING						IN-SITU TESTS									
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	MONITORED WATER LEVEL	INSTRUMENTATION	R L (m)
			WB							0		0.0 - 8.2m, borehole wash drilled for piezometer installation.			BH303 Shallow	67
										1					Grout	66
										2						65
										3						64
										4					Bentonite	63
										5					Sand	62
										6						61
										7					Gravel	60
										8						59
										9		END OF LOG @ 8.2 m				58

DATE STARTED: 22/3/19 DRILLED BY: Pro-drill (Auck) Ltd

DATE FINISHED: 22/3/19 EQUIPMENT: SLG 02

LOGGED BY: JMW DRILL METHOD: WB

SHEAR VANE No: n/a DRILL FLUID: Water

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Borehole washdrilled for shallow piezometer install

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

BECA LIB 1.07.4.GLB Log BECA MACHINE BOREHOLE CAMBRIDGE C1-C3 LOGS.GPJ <<DrawingFile>> 04/04/2019 09:35 8.30.004 Datgel Lab and In Situ Tool - DGD | Lib: Beca 1.07.4 2016-01-15 Prj: Beca 1.07 2014-12-16

A4 Scale 1:50

Beca

BOREHOLE No: BH304

MACHINE BOREHOLE LOG

SHEET 1 of 2

PROJECT: Cambridge C1-C3 JOB NUMBER: 3208540

SITE LOCATION: C2 - North of 1871 Cambridge Road to 1 Hamilton Road. CLIENT: Waipa District Council

CIRCUIT: NZTM BOREHOLE LOCATION: Refer GI Plan.

COORDINATES: N 5,803,687 m R L: 64 m COORDINATE ORIGIN: hhGPS

E 1,815,141 m DATUM: MSL ACCURACY: ±5m

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	MONITORED WATER LEVEL	INSTRUMENTATION	R L (m)
	12/03/2019	100 %	OB						C			'Firm' SILT, some organics, minor clay, minor fine sand; dark brown; moist, low plasticity. Organics: rootlets and grass [Topsoil].			BH304	
		100 %	OB						C			'Firm' clayey SILT, some fine sand; dark brown; moist, high plasticity.				
		80 %	OB						C	1		'Loose' silty fine SAND; light brown; moist, non plastic. 0.9m, trace organics; decomposing wood.			Grout	63
		0 %	OB						C			'Loose' fine to medium SAND; brownish grey, speckled black and white; moist, non plastic. 1.45m, fine SAND; grey				
		60 %	OB						C	2		1.5m - 2.0m, no recovery. 2.0m - 2.3m, no recovery.				62
		100 %	OB						C			'Loose' fine to coarse SAND; grey; wet, non plastic. Pumiceous. 2.31m, moderately thin (80mm) layer of silty fine SAND; saturated. 2.53m, moderately thin (100mm) layer of silty fine SAND; wet.			Bentonite	
		40 %	OB						C	3		'Firm' clayey SILT; grey; moist, high plasticity. 2.66m, trace organics; dark brown. Organics: decomposing wood. 2.7m, thin layer (30mm) of silty fine SAND; grey mottled dark grey [Tephra?]				61
		100 %	OB						C			'Loose' fine sandy SILT; brown; moist, non plastic. 3.0m - 3.3m, no recovery.			Sand	
		90 %	OB						C	4		'Loose' fine to medium SAND; brown; wet; non plastic. 3.5m, some silt. 3.53m, moderately thin (160mm) layer of SILT, some clay. 3.9m, fine to coarse SAND; grey speckled black and white. Pumiceous.				60
		100 %	OB						C			'Loose' silty fine SAND; grey; moist, non plastic.	Hinuera Formation			
		60 %	OB						C	5		5.0m to 5.2m, no recovery.			Gravel	59
		600 %	OB						C			'Loose' silty fine SAND; grey; moist, non plastic. 5.35, very thin (10mm) layer of clayey SILT; dark brown; high plasticity.				
		75 %	OB						C	6		5.5m to 5.7m, no recovery. 'Loose' silty fine SAND; grey; moist, non plastic. 5.8m, very thin (15mm) layer of fine to medium pumice, UW, subrounded.				58
		100 %	OB						CC			'Loose' medium to coarse SAND; dark grey speckled black and white; moist, non plastic. Moderately thinly interbedded with fine to medium SAND, some silt, minor clay; black; low plasticity (MnO, Tephra?) 6.5m, trace fine gravel; subrounded, UW-SW, pumice.			Sand	
		60 %	OB						C	7		6.6m, thinly (20mm) banded orange (FeO) and grey. 7.2m, orange speckled white, brown, black and grey. 7.3m, thin (15mm) cemented red layer; iron pan.				57
		0 %	OB						C			7.32m, fine to medium SAND; red. 7.4m, fine to coarse SAND. 7.45m, fine to medium SAND, minor silt; reddish brown.				
		80 %	OB						C	8		7.5m - 8.0m, no recovery. 'Medium dense', fine to medium SAND, minor silt; reddish brown; moist, non plastic. 8.2m, red. 8.3m, thin (15mm) cemented red layer; iron pan. 8.35m, grey specked black and brown.			Bentonite	56
		60 %	OB						C			8.4m, banded blackish brown and brown.				
		100 %	OB						C	9		'Loose' silty fine SAND; yellowish brown; moist, non plastic. 9.0m, moderately thin (100mm) dark grey layer.				55
												'Firm' clayey SILT; brownish grey banded orange; moist, high plasticity. 9.4, grey banded brown, streaked black.			Grout	
												'Medium dense' fine to coarse SAND, trace fine gravel; orange				

DATE STARTED: 12/3/19 DRILLED BY: Pro-drill (Auck) Ltd

DATE FINISHED: 12/3/19 EQUIPMENT: Tractor Rig

LOGGED BY: JMW DRILL METHOD: OB

SHEAR VANE No: n/a DRILL FLUID: Water/polymer

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Borehole terminated at target depth. No strength testing undertaken, borehole cored for indicative permeability to inform piezometer install.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BECA LIB 1.07.4.GLB Log BECA MACHINE BOREHOLE CAMBRIDGE C1-C3 LOGS.GPJ <<DrawingFile>> 04/04/2019 09:35 8.30.004 Datgel Lab and In Situ Tool - DGD | Lib: Beca 1.07.4 2016-01-15 Prj: Beca 1.07 2014-12-16

Beca

BOREHOLE No: BH304

MACHINE BOREHOLE LOG

SHEET 2 of 2

PROJECT: Cambridge C1-C3 JOB NUMBER: 3208540

SITE LOCATION: C2 - North of 1871 Cambridge Road to 1 Hamilton Road. CLIENT: Waipa District Council

CIRCUIT: NZTM BOREHOLE LOCATION: Refer GI Plan.

COORDINATES: N 5,803,687 m R L: 64 m COORDINATE ORIGIN: hhGPS

E 1,815,141 m DATUM: MSL ACCURACY: ±5m

DRILLING						IN-SITU TESTS									
FLUID LOSS	DAILY WATER LEVEL	CORE RECOVERY	METHOD	CASING	RQD	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	MONITORED WATER LEVEL	INSTRUMENTATION	R L (m)
												brown, banded black; moist, non plastic. Gravel: subrounded, SW, pumice.				
												'Firm' clayey SILT; brownish grey banded orange; moist, high plasticity.				
												END OF LOG @ 10 m				
										11						53
										12						52
										13						51
										14						50
										15						49
										16						48
										17						47
										18						46
										19						45

DATE STARTED: 12/3/19 DRILLED BY: Pro-drill (Auck) Ltd

DATE FINISHED: 12/3/19 EQUIPMENT: Tractor Rig

LOGGED BY: JMW DRILL METHOD: OB

SHEAR VANE No: n/a DRILL FLUID: Water/polymer

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Borehole terminated at target depth. No strength testing undertaken, borehole cored for indicative permeability to inform piezometer install.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BECA LIB 1.07.4.GLB Log BECA MACHINE BOREHOLE CAMBRIDGE C1-C3 LOGS.GPJ <<DrawingFile>> 04/04/2019 09:35 8.30.004 Datgel Lab and In Situ Tool - DGD | Lib: Beca 1.07.4 2016-01-15 Prj: Beca 1.07 2014-12-16

Cambridge C1- C3

BOX: 1 **DEPTH: to 3.0m**

BOX: 2 **DEPTH: 3.0m to 6.5m**

BH304

3208540

Machine Borehole Photos

Cambridge C1- C3

BOX: 3 **DEPTH: 6.5m to 9.4m**

BOX: 4 **DEPTH: 9.4m to 10.0m EOH**

BH304

3208540

Machine Borehole Photos

Beca

BOREHOLE No: BH306

MACHINE BOREHOLE LOG

SHEET 1 of 1

PROJECT: Cambridge C1-C3 JOB NUMBER: 3208540

SITE LOCATION: C2 - North of 1871 Cambridge Road to 1 Hamilton Road. CLIENT: Waipa District Council

CIRCUIT: NZTM BOREHOLE LOCATION: Refer GI Plan.

COORDINATES: N 5,804,538 m R L: 64 m COORDINATE ORIGIN: hhGPS

E 1,815,280 m DATUM: MSL ACCURACY: ±5m

DRILLING: FLUID LOSS	DRILLING: DAILY WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: CASING	DRILLING: RQD	IN-SITU TESTS: SV	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	MONITORED WATER LEVEL	INSTRUMENTATION	R L (m)
	11/03/2019	60 %	OB						C			'Firm' SILT, some organics, minor clay, minor fine sand; dark brown; moist, low plasticity. Organics: rootlets and grass [Topsoil].			BH306	
		70 %	OB						C			'Loose' silty fine SAND; orange brown; dry, non plastic.				
		80 %	OB						C	1		'Loose' silty clayey fine to coarse SAND, some fine to medium gravel; orange brown; moist, high plasticity.			Grout	63
		20 %	OB						C			'Loose' fine to coarse SAND, some fine to medium gravel; brown; moist, non plastic.				
		0 %	TT						C			'Loose' fine to coarse GRAVEL, some coarse sand; orange, red, white and black; wet, non plastic. Gravel: subrounded to subangular, SW, pumice and volcanics.			Bentonite	
		0 %	TT						C	2		'Loose; fine to coarse SAND, some fine to coarse gravel; grey; moist, non plastic. Gravel: subrounded to subangular, SW, pumice and volcanics.			Sand	62
		100 %	TT						C			1.4m - 1.9m, no recovery.				
		0 %	TT						C			'Loose; fine to coarse SAND, some fine to coarse gravel; grey; moist, non plastic. Gravel: subrounded to subangular, SW, pumice and volcanics. 1.9m, reddish brown speckled orange; iron staining.				
		0 %	TT						C	3		2.0m - 3.0m, no recovery.				61
		70 %	OB						C			'Loose' fine sandy SILT; grey; moist, non plastic. 3.15m, moderately thin (150mm) layer of fine to coarse SAND, minor fine to coarse gravel; grey speckled orange and white; moist, non plastic				
		100 %	OB						C			3.5m - 4.2m, no recovery.				
		60 %	OB						C	4		4.2m - 5m, no recovery.	Hinuera Formation		Gravel	60
		0 %	OB						C			5.0m - 5.15m, no recovery.				
		0 %	OB						C	5		'Loose' fine sandy SILT, trace organics; grey streaked brown; moist, non plastic. Organics: decomposing wood.				59
		100 %	OB						C			'Loose' fine to medium SAND; grey banded orange and dark grey; moist, non plastic. Sand: pumiceous.				
		100 %	OB						C	6		6.0m, orange band (iron staining).			Sand	58
		0 %	TT						C			'Loose' silty fine SAND; grey; moist, non plastic. Moderately thinly (100mm) interbedded with thin beds (10mm) of clayey SILT; grey; moist, high plasticity [Tephra].				
		50 %	TT						C	7		6.9m, black.			Bentonite	57
												7.0m - 7.3m, no recovery.				
												7.3m - 7.8m, no recovery.				
										8		'Loose' silty fine SAND; grey banded dark grey and orange; moist, non plastic. Thinly (10mm) bedded [Tephra].				56
												'Loose' fine to coarse SAND, minor fine to medium gravel; grey speckled dark grey and orange; moist, non plastic			Grout	
												8.2m to 9.0m, no recovery.				
										9		'Loose' fine to coarse SAND, minor fine to medium gravel; grey speckled dark grey and orange; moist, non plastic				55
												END OF LOG @ 9.5 m				

DATE STARTED: 11/3/19 DRILLED BY: Pro-drill (Auck) Ltd

DATE FINISHED: 11/3/19 EQUIPMENT: SLG 02

LOGGED BY: JMW DRILL METHOD: OB/TT

SHEAR VANE No: n/a DRILL FLUID: Water/polymer

DIAMETER/INCLINATION: -/ 90°

COMMENTS:
Borehole terminated at target depth. No strength testing undertaken, borehole cored for indicative permeability to inform piezometer install.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:50

BECA LIB 1.07.4.GLB Log: BECA MACHINE BOREHOLE CAMBRIDGE C1-C3 LOGS.GPJ <<DrawingFile>> 04/04/2019 09:35 8.30.004 Datgel Lab and In Situ Tool - DGD | Lib: Beca 1.07.4 2016-01-15 Prj: Beca 1.07 2014-12-16

Cambridge C1- C3

BOX: 1 **DEPTH: 0.0 to 6.3 m**

BOX: 2 **DEPTH: 6.3 to 9.5m EOH**

BH306

3208540

Machine Borehole Photos

coffey geotechnics

Machine Borehole No. **MH01**

Engineering Log - Machine Auger Borehole

Sheet 1 of 3
Project No: **GENZTAUC14196**

Client: ***CAMBRIDGE LAND DEVELOPMENTS LIMITED*** — Date started: ***26.8.2009***

Principal: — Date completed: ***26.8.2009***

Project: ***31 KELLY ROAD CAMBRIDGE*** — Logged by: ***MM***

Machine Borehole Location: ***Refer to site plan*** — Checked by: ***MM***

Drill model & mounting: — Easting: m — Slope: -90° — R.L. Surface: m — Vane No:

Hole diameter: 100 mm — Drilling fluid: Water — Northing: m — Bearing: — Datum:

drilling information							material substance										rock mass defects				
stratigraphy	method	support	water	notes samples, tests, etc	RL	depth metres	graphic log core recovery	classification symbol	material: Soil - Soil type; colour, structure. Grading; bedding; plasticity, sensitivity. Secondary and minor components. Rock - Colour, fabric, rock type; discontinuities, additional information.	moisture condition	consistency/ density index	weathering alteration	estimated strength EW VW W MS S VS ES	vane shear (remoulded /peak) kPa 25 50 75 100 125 150 175	recovery %	RQD %	defect spacing mm 30 100 300 1000 3000	defect description: number, type, orientation, shape, roughness, aperture, infill description (refer to defect description explanation sheet) particular / general
	TT	N				0.5			TOPSOIL; dark brown	M					100			
Fill									SILT, with a mixture of clay and occasional medium grained sand; dark brown to orange/brown	W								
Hinuera Formation			Refer Piezometer Readings	Piezometer 3 Screen		1.0			Fine to medium SAND, trace silt; light grey (pumiceous) occasional rootlets up to 15mm thick						90			
						1.5			interbedded silty clay lenses up to 30mm thick, bluish grey Fine grained silty SAND; cream and grey with interbedded silt lenses 15mm thick - 30mm to 100mm spacings									
						2.0			Very fine silty SAND; light bluish grey									
						2.5			SAND, coarse grained with some fine angular gravels; orange and reddish brown									20mm thick iron pan @ 2.3m Partial core loss, casing put down to 3.0m after core loss
						3.0			Coarse grained SAND, with fine pumice gravels						60			0.5m core loss 3.0 to 3.9m
						3.5									45			
						4.0			Silty CLAY; light grey, plastic, trace fine sands	D					90			50mm thick iron pan @ 3.95m
									Silty CLAY; dark brown (lense) to 3.95m	W								
									SILT; cemented, orange brown, (iron pan)									
						4.5			Very fine SAND, with some silt and interbedded silt lenses (15 to 20mm									

method
- **AD** auger drilling
- **OB** open barrel
- **TT** triple tube
- **W** washbore

support
- N nil
- C casing

vane shear (kPa)
- ● remoulded
- × peak
- >>× peak greater than 200kPa
- **UTP** unable to penetrate

classification symbols and soil description
based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- N* SPT - sample recovered
- Nc SPT with solid cone
- Bs bulk sample
- E environmental sample

water
- 10/1/98 water level on date shown
- water inflow
- partial drill fluid loss
- complete drill fluid loss

moisture
- D dry
- M moist
- W wet
- S saturated

consistency/ density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

weathering

UW	unweathered
SW	slightly weathered
MW	moderately weathered
HW	highly weathered
CW	completely weathered
RS	residual soil

rock mass strength

EW	extremely weak
VW	very weak
W	weak
MS	moderately strong
S	strong
VS	very strong
ES	extremely strong

MACHINE BOREHOLE 14196 MBH 270809.GPJ COFFEY.GDT 7.9.09

Form GEO 5.3 Rev.6

coffey geotechnics

Machine Borehole No. **MH01**

Engineering Log - Machine Auger Borehole

Sheet 2 of 3
Project No: **GENZTAUC14196**

Client: **CAMBRIDGE LAND DEVELOPMENTS LIMITED**
Date started: **26.8.2009**

Principal:
Date completed: **26.8.2009**

Project: **31 KELLY ROAD CAMBRIDGE**
Logged by: **MM**

Machine Borehole Location: **Refer to site plan**
Checked by: **MM**

Drill model & mounting: | Easting: m | Slope: -90° | R.L. Surface: m | Vane No:

Hole diameter: 100 mm | Drilling fluid: Water | Northing: m | Bearing: | Datum:

drilling information							material substance										rock mass defects				
stratigraphy	method	support	water	notes samples, tests, etc	RL	depth metres	graphic log core recovery	classification symbol	material: Soil - Soil type; colour, structure. Grading; bedding; plasticity, sensitivity. Secondary and minor components. Rock - Colour, fabric, rock type; discontinuities, additional information.	moisture condition	consistency/ density index	weathering alteration	estimated strength EW VW W MS S VS ES	vane shear (remoulded /peak) kPa 25 50 75 100 125 150 175	recovery %	RQD %	defect spacing mm 30 100 300 1000 3000	defect description: number, type, orientation, shape, roughness, aperture, infill description (refer to defect description explanation sheet) particular / general
Hinuera Formation	TT	N	Refer Piezometer Readings	Piezometer 2 Screen		5.0			thick), light grey Silty CLAY; light grey, no plasticity, with limonite streaks *(continued)*	W					90			
									Medium to coarse grained (pumiceous SAND, with some silt, and interbedded silt lenses									
						5.5			SILT, trace fine sand; greyish cream						90			
						6.0			Interbedded SILT, and very fine SAND lenses; very closely spaced, bluish grey with orange staining						0			200mm core loss 5.8 to 6.0m
									Coarse SAND; bluish grey, with dark blue lithic grains									0.4m core loss 6.0 to 7.5m
						6.5			Fine to medium SAND, with interbedded silt lenses closely spaced (15mm) to (50mm)									
									SILT; light grey, trace fine sand, friable, saturated						73			
						7.0												
						7.5												0.5m core loss 7.5 to 9.0m
						8.0									60			
						8.5			Coarse grained SAND; light bluish grey, with trace silt									
						9.0												

method
- **AD** auger drilling
- **OB** open barrel
- **TT** triple tube
- **W** washbore

support
- N nil
- C casing

vane shear (kPa)
- ● remoulded
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MD	medium dense
D	dense
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UW	unweathered
SW	slightly weathered
MW	moderately weathered
HW	highly weathered
CW	completely weathered
RS	residual soil

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EW	extremely weak
VW	very weak
W	weak
MS	moderately strong
S	strong
VS	very strong
ES	extremely strong

MACHINE BOREHOLE 14196 MBH 270809.GPJ COFFEY.GDT 7.9.09

Form GEO 5.3 Rev.6

coffey geotechnics

Machine Borehole No. **MH01**

Engineering Log - Machine Auger Borehole

Sheet 3 of 3
Project No: **GENZTAUC14196**

Client: **CAMBRIDGE LAND DEVELOPMENTS LIMITED**
Date started: **26.8.2009**

Principal:
Date completed: **26.8.2009**

Project: **31 KELLY ROAD CAMBRIDGE**
Logged by: **MM**

Machine Borehole Location: **Refer to site plan**
Checked by: **MM**

Drill model & mounting: | Easting: m | Slope: -90° | R.L. Surface: m | Vane No:
Hole diameter: 100 mm | Drilling fluid: Water | Northing: m | Bearing: | Datum:

drilling information							material substance										rock mass defects			
stratigraphy	method	support	water	notes samples, tests, etc	RL	depth metres	graphic log core recovery	classification symbol	material: Soil - Soil type; colour, structure. Grading; bedding; plasticity, sensitivity. Secondary and minor components. Rock - Colour, fabric, rock type; discontinuities, additional information.	moisture condition	consistency/ density index	weathering alteration	estimated strength EW VW W MS S VS ES	vane shear (remoulded /peak) kPa 25 50 75 100 125 150 175	recovery %	RQD %	defect spacing mm 30 100 300 1000 3000	defect description: number, type, orientation, shape, roughness, aperture, infill description (refer to defect description explanation sheet) particular / general
Hinuera Formation	TT	N	Refer Piezometer Readings	Piezometer 1 Screen		9.5			SILT; grey, trace very fine sand, no plasticity	W					95			
						10.0			Fine to medium SAND, with some silt; bluish grey						90			
						10.5			SILT; bluish grey, with trace fine sand some clay						90			
						11.0			Medium to coarse SAND, trace silt									
						11.5									85			
						12.0			coarse sand, silt									
						12.5												
						13.0			MH01 terminated at 12.5 metres.									
						13.5												

method
AD auger drilling
OB open barrel
TT triple tube
W washbore

support
N nil
C casing

vane shear (kPa)
● remoulded
× peak
»× peak greater than 200kPa
UTP unable to penetrate

classification symbols and soil description
based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
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10/1/98 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss

moisture
D dry
M moist
W wet
S saturated

consistency/ density index

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weathering

UW	unweathered
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EW	extremely weak
VW	very weak
W	weak
MS	moderately strong
S	strong
VS	very strong
ES	extremely strong

MACHINE BOREHOLE 14196 MBH 270809.GPJ COFFEY.GDT 7.9.09
Form GEO 5.3 Rev.6

B

Appendix B – 3D Groundwater Model Build

9 Groundwater model (from Beca, 2019)

The data collected during the 2019 investigations has been used to update the groundwater model with the following information:

- A better understanding of the iron pan extent and thus its effect on groundwater levels in the C2 area.
- Additional hydraulic conductivity values to inform the aquifer parameters.
- Additional groundwater level data in Hautapu (C10 area) and C2 to calibrate the model.

Changes to the model are noted in the following sections, where applicable.

9.1 Model design and construction

9.1.1 Model code

The Cambridge groundwater model was developed in the three-dimensional (3D) finite-difference modelling package Groundwater Vistas (version 7.17 build 15), a software package developed by Environmental Simulations Inc. which uses the MODFLOW2000 computer code.

MODFLOW was developed by the United States Geological Survey (USGS) and is considered an international standard for simulating and predicting groundwater conditions and groundwater/surface-water interactions. MODFLOW2000 is the third major release of MODFLOW by the USGS and this version is considered robust and is therefore recommended for this model.

9.1.2 Domain and mesh geometry

The model domain comprises the Cambridge growth cells north of the Waikato River and is approximately 30 km2, with a north-south grid alignment. The model is subdivided into 325 rows (east-west) and 325 columns (north-south) to create square grid cells of 20 x 20 m, with 250,072 active cells.

9.1.3 Layer type and properties

The model consists of four layers representing a simplified hydrogeological profile underlying the site. The model layers were defined based on the geological model (Section 8) and the known aquifer parameters of the geological units. A summary of the model layers and the geological units and hydraulic conductivity values they represent is provided in Table 8.

Table 3 Hydrogeological layers and assumed hydraulic conductivity values used in groundwater model

Layer	Geology units	hydraulic conductivity (m/d)		Description
		Horizontal	Vertical	
1	2a/2b	4.5	1.0	Unit 2a is a thin (less than 4 m) low permeable silt layer overlying the relatively more permeable silty fine to coarse sand characteristic of Unit 2b. The Unit 2b sands are likely to be interlayered by silt and clay lenses. The initial horizontal hydraulic conductivity is assumed to be the average of all the hydraulic tests conducted in the area and the vertical hydraulic conductivity is estimated to be 1m/d (anisotropy of ~0.2).
2	2c	0.4	0.2	Low energy layer at approximately 10 to 15 m depth. Unit consists of interbedded silt and sand with clay lenses, and therefore, likely to be of low permeability.

Layer	Geology units	hydraulic conductivity (m/d)		Description
		Horizontal	Vertical	
				The initial hydraulic conductivity is assumed based on hydraulic testing undertaken as part of the Waikato Expressway project (Beca, 2016).
3	2d	5.0	2.5	Unit consists of clean sands and pumiceous gravelly coarse sands; and is therefore likely to have relatively high permeability. The initial hydraulic conductivity is assumed based on hydraulic testing undertaken as part of the Waikato Expressway project (Beca, 2016).
4	3, 5a, and 5b	0.2	0.04	Unit 3 is alluvial sand and silt deposits, whereas Unit 5a and Unit 5b are weathered to slightly weathered volcanics (tephra, ignimbrites). These units are likely to have low hydraulic conductivity. Initial aquifer parameters are assumed based on hydraulic testing undertaken as part of the Waikato Expressway project (Beca, 2016).

All layers have been assigned as unconfined. The connectivity between units (i.e. leakance) is calculated in the MODFLOW2000 package using the vertical hydraulic conductivity.

9.1.4 Stresses and boundary conditions

9.1.4.1 Model boundary conditions

Throughflow to the site (groundwater flow entering and exiting the system from a distant source) is modelled using the general head boundary (GHB). This boundary condition operates by allowing prescribed head values (assigned along the boundary) to vary with the calculated heads. The extent to which the GHB head values vary depends on the conductance assigned to the boundary cells.

The heads along the site boundary to the north, east and west have been assigned based on the estimated groundwater contour levels previously discussed in Section 5.2.1. The GHB conductance parameter, initially set to 10 m^2/d, was modified as part of the model calibration (discussed in Section 9.2).

Along the southern border, groundwater seeps out of the steep riverbanks of the Waikato River and therefore is better simulated using a drain boundary condition. This boundary condition operates by removing water from the system by maintaining the head value prescribed when the adjacent groundwater level is higher, while also allowing surface water heads to fall below the specified heads during drier periods without the boundary continuing to recharge the system. Therefore, unlike the GHB, the drain boundary will only allow groundwater to seep from the Waikato riverbanks and will prevent groundwater from entering the system through the riverbank (which is conceptually unrealistic).

Figure 26 shows the model boundary conditions. We note that the drain boundary is set between 53mRL and 67mRL along the southern border to simulate seepage of the shallowest aquifer (the aquifer of interest). The head prescribed in the drain boundary is therefore at a higher elevation than a significant portion of the C3 growth cell (and the Current Town Boundary to a lesser extent). Consequently, the lower section of C3, which is connected to the lower aquifer systems, is excluded from the groundwater model.

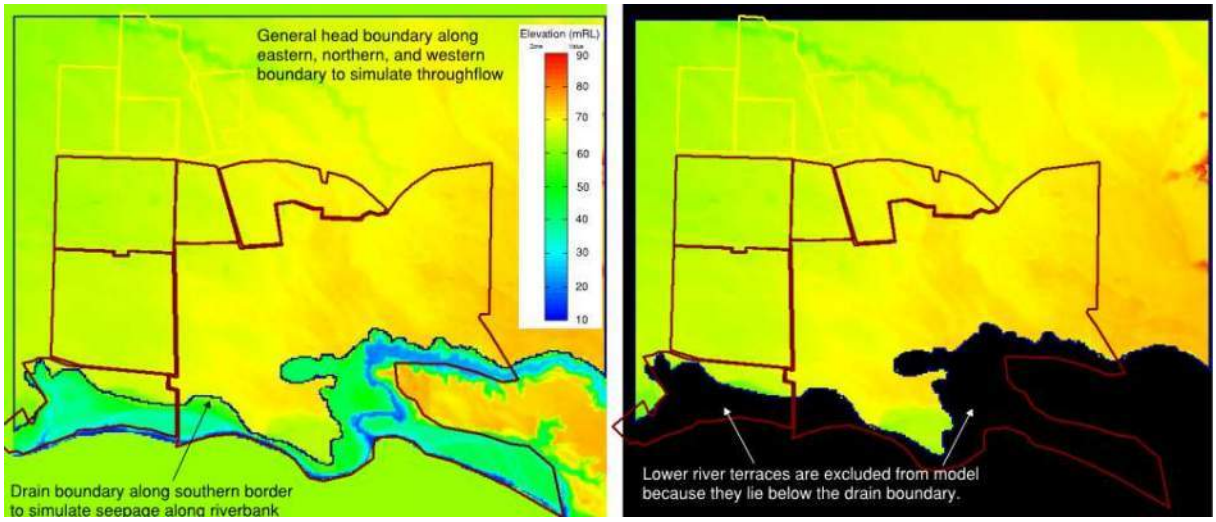


Figure 13 Model screenshots showing location of GHB relative to topography

9.1.4.2 Surface water

Discharge of groundwater to surface water drains and the Mangaone Stream was simulated using the drain boundary which (as discussed in Section 9.1.4.2) maintains the head value prescribed for the water body when the adjacent groundwater level is higher, while allowing surface water heads to fall below the specified head during drier periods (without the boundary continuing to recharge the system i.e. the drain and stream cells can be dry). The drain boundary construction is defined in Table 9.

Table 4 Drain boundaries used in the model

Water body	Description
Mangaone Stream	The heads along the Mangaone Stream are assumed to be at the elevation described by the LiDAR data. The stream is assumed to be 2 m wide based on site observations, and the streambed is assumed to be 1 m in thickness with an initial conductance of 10 m^2/d.
Drainage network	Because the drainage network polyline (sourced from NIWA and the WRC website) does not accurately follow the drain paths, the LiDAR elevation is not considered to be accurate. Therefore, the heads along the drainage network are assumed to be 1 m below the LiDAR elevation. The drainage width is assumed to be 2 m wide and the drainage bed thickness is assumed to be 1m with an initial conductance of 10 m^2/d (as per the Mangaone Stream).

The digitised drains and the drainage network polylines are shown in Figure 27.

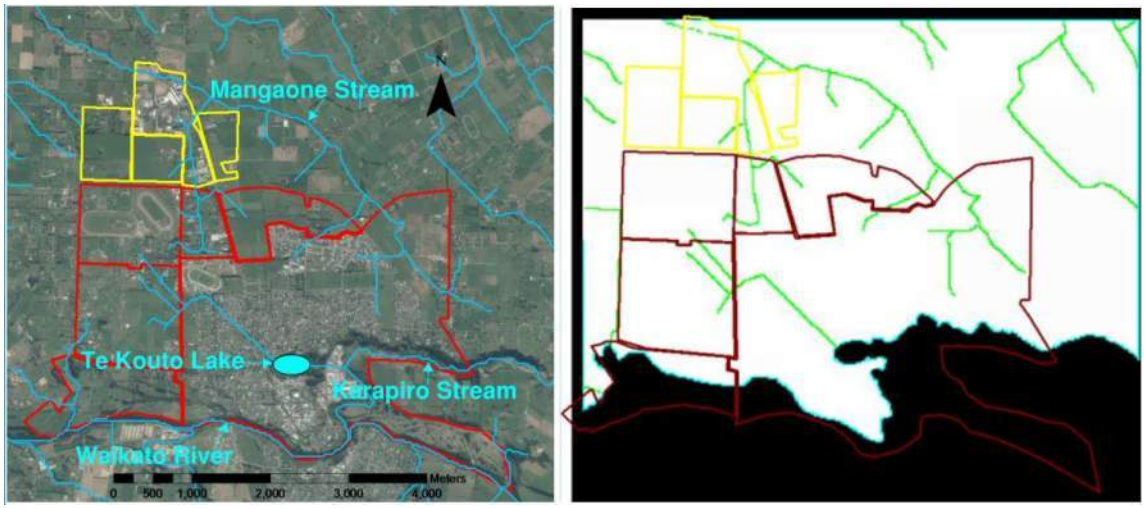


Figure 14 Digitised drains and drainage network polylines used in the model (shown on right hand side in green)

9.1.4.3 Recharge

An average recharge was applied to the top surface of the model. Three recharge zones were defined across the model domain: the rural area, the developed area, and the iron pan area. Recharge to these areas are defined in Table 10.

Table 5 Recharge zones used in the model

Recharge area	Description
Developed	Rainfall is generally prevented from recharging the aquifer in these locations due to infrastructure (e.g. roads, roofs, stormwater system). Recharge is therefore assumed to be 3% to 6% of the average annual rainfall (35mm/yr to 70mm/yr or 0.0001m/d to 0.0002mm/d) to account for impervious cover.
Rural	Estimate of rainfall recharge to the aquifer based on the water table fluctuation method detailed in Section 5.2.2. Recharge is therefore assumed to range between 15% and 30% of the average annual rainfall (175mm/yr to 350mm/yr or 0.0005m/d to 0.001m/d).
Iron pan	There is evidence that the iron pan creates a perched aquifer above the shallow aquifer represented in the model. Long-term monitoring has indicated that the perched aquifer is perennial with a water table which fluctuates seasonally from 0.5m to 1.7m above the iron pan (Section 6.1.3); therefore, it is assumed that rainfall infiltration is prevented from fully recharging the aquifer of interested over the extent of the iron pan. Recharge is assumed to be approximately the same as recharge to the developed area (i.e. 3% to 6%).

Figure 28 shows the areas selected as developed and rural.

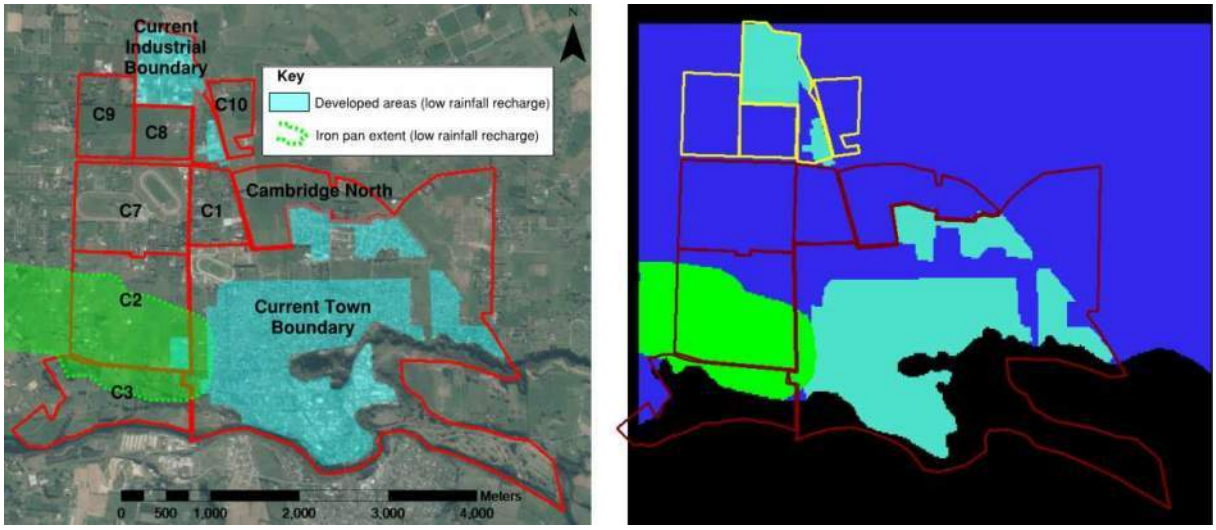


Figure 15 Areas of the model selected as developed (aqua), iron pan extent (green) and rural (remaining area blue)

9.2 Calibration

9.2.1 Calibration approach

The intended purpose of the model is to estimate the effect on groundwater levels due to changes caused by development (e.g. reduced regional recharge, soakage from devices, construction of swales). Therefore, the groundwater levels were the primary focus of the calibration. Often calibrating to a single parameter (such as groundwater head values) can lead to a non-unique result; consequently, the Mangaone Stream baseflow estimate was also used as a secondary calibration.

An iterative trial and error approach was used to calibrate, whereby model parameters were varied between model runs and calibration results were evaluated. The model was calibrated by manually adjusting the parameters listed in Table 11.

Table 6 Parameters used for model calibration

Parameter	Description
Recharge	The rainfall recharge to the rural areas was permitted to vary between the range set by the recharge estimate calculation presented in Table 9 (Section 9.1.4.3).
Hydraulic conductivity	The model layers were initially assigned the hydraulic conductivity values presented in Table 4 (Section 5.2.3). During calibration, the values were permitted to vary within the range set by the in-situ testing results.
Drain conductance	The streambed conductance for Mangaone Stream and the drainage network was initially prescribed a value of 10 m^2/d and was varied during calibration.
GHB conductance	The GHB conductance initially prescribed a value of 10 m^2/d and was varied during calibration.

9.2.2 Calibration to groundwater levels

There are 90 groundwater level observations available for calibration which were weighted to reflect the data quality. Figure 29 shows the groundwater level distribution and confidence level and Table 12 describes the weighting, which is based on how well the data reflects the average annual groundwater level. The weighting varies from 1 representing data providing the highest confidence level to 0.1 for the data providing the lowest confidence.

The 2019 site investigation has provided additional groundwater level information, as follows:

- The Hautapu water levels (BH02pz, BH03pz, BH06pz) have been recorded between Oct 2018 and Apr 2019, and therefore the confidence levels of these target heads have changed from low to high.
- There is one additional bore (BH306) which has only one dip measurement (i.e. low confidence level).

Table 7 Weighting of groundwater level observations

Weighting	Confidence level	Description	Number of data
1	High	Data with continuous records for approximately a year (in some cases longer).	10
0.5	Medium	Data with manual dip records for a minimum of a year.	22
0.25	Low	Data with a single manual reading from bore logs or reports where information provided indicates water level was static (i.e. the water level recorded is taken below ground level, was measured after development of the piezometer, and not as part of hydraulic testing).	7
0.1	Very low	Data (procured from the Waikato Regional Council records) with a single manual reading where there is no information to provide confidence that the water level reading represents static conditions (i.e. whether it was recorded during drilling or after development, if it was recorded during a pumping test, if the recorded level is measured from ground level, or there is incomplete screened interval details).	51

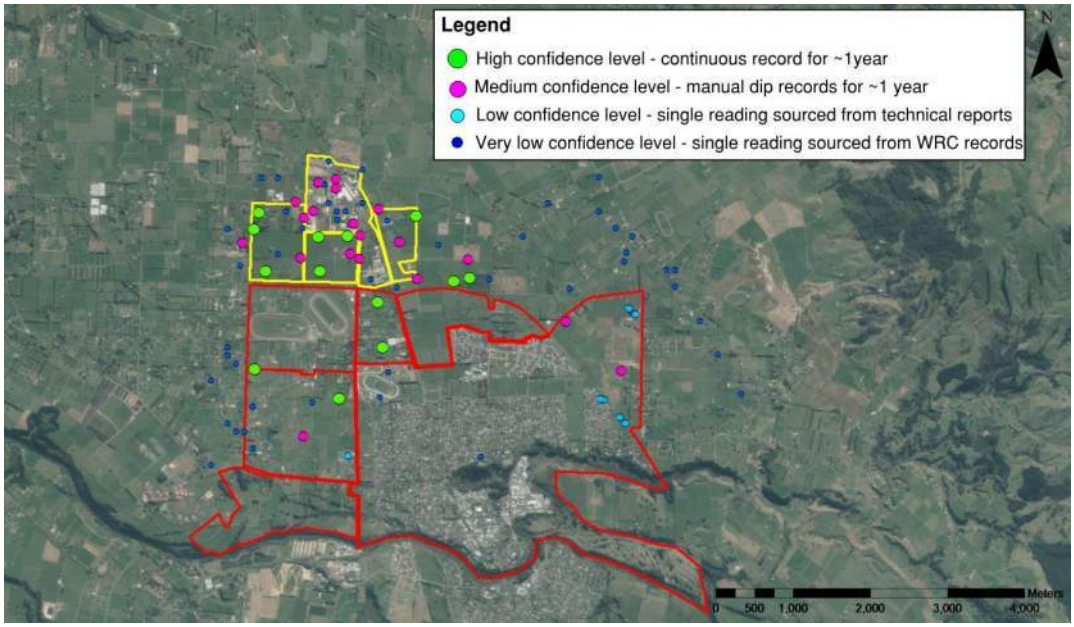


Figure 16 Distribution of target heads with confidence level

The calibration was undertaken in steady state i.e. reflecting long term average groundwater conditions. Figure 30 shows a scatter plot of all the measured head data compared to the corresponding modelled values. The scaled RMS error based on the groundwater levels is 4.3%, for a weighted calibration of the 90 data points.

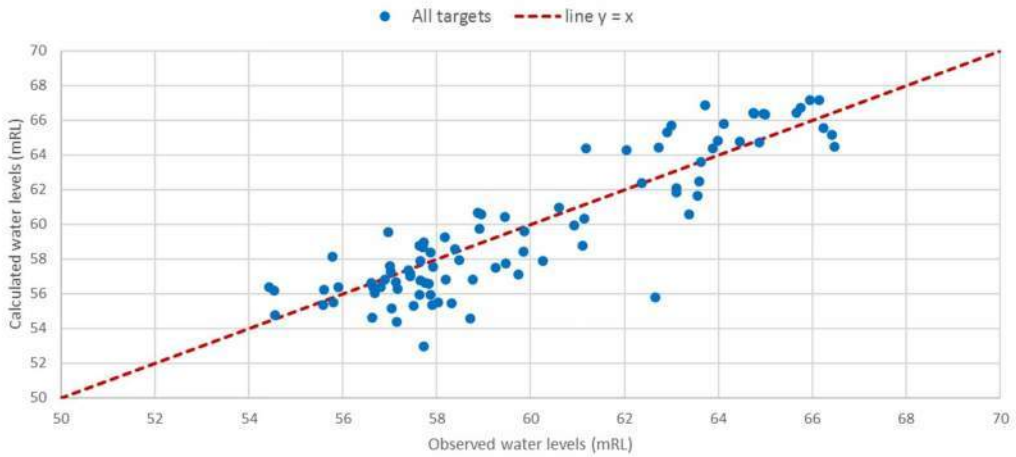


Figure 17 Scatter plot of all measured head data compared to corresponding modelled values

The residuals (difference between observed and calculated head values) versus the observed values are plotted in Figure 31, with the residuals colour coded according to their confidence level (the high confidence level observations are in red).

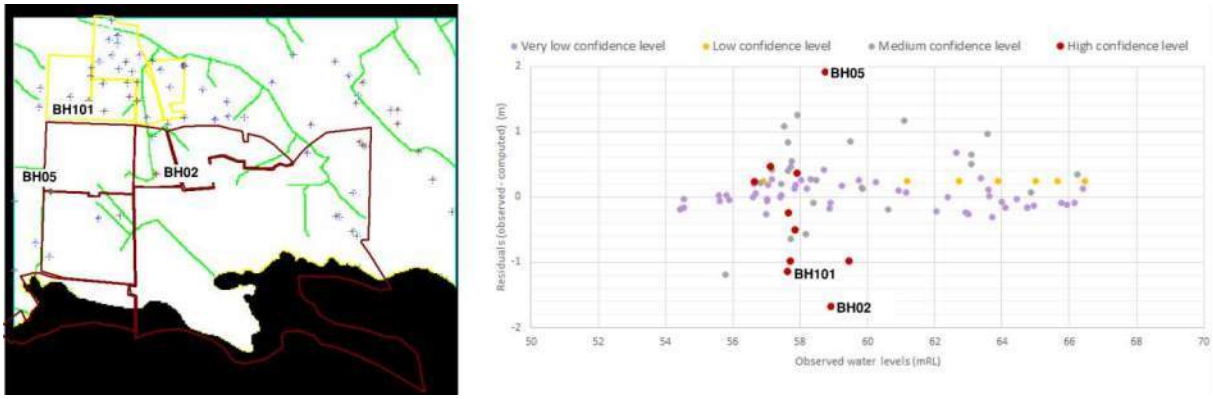


Figure 18 Residuals (difference between observed and calculated head values)

Most of the calculated heads are within 1m of the observed; however, there are three high confidence level targets which have residuals indicating the calculated heads are either greater than or less than the observed by between 1m and 2m. Two of those targets are within the residential growth areas (BH05 in C7 and BH02 in C1) and the remainder are located in the industrial area to the north (BH101 in C8).

The observed average groundwater level at BH05 is approximately 2m higher than the model prediction (58.8mRL observed compared to the modelled 56.9mRL) whereas the observed groundwater levels at BH02 and BH101 are between 1m and 2m less than the model prediction (BH02 water level is observed at 59.2mRL compared to the modelled 60.6mRL and the BH101 observed water level is at 57.6mRL compared to the modelled 58.8mRL). The reason for this is likely due to local hydrogeological variations (which cannot be efficiently simulated in a model of this scale) as evidenced by the long-term monitoring at BH01 to BH05 (Figure 18 in Section 5.2.1) which indicates the water level at BH05 is more responsive to rainfall than the other bores.

The distribution of the residuals is shown on the map in Figure 32.

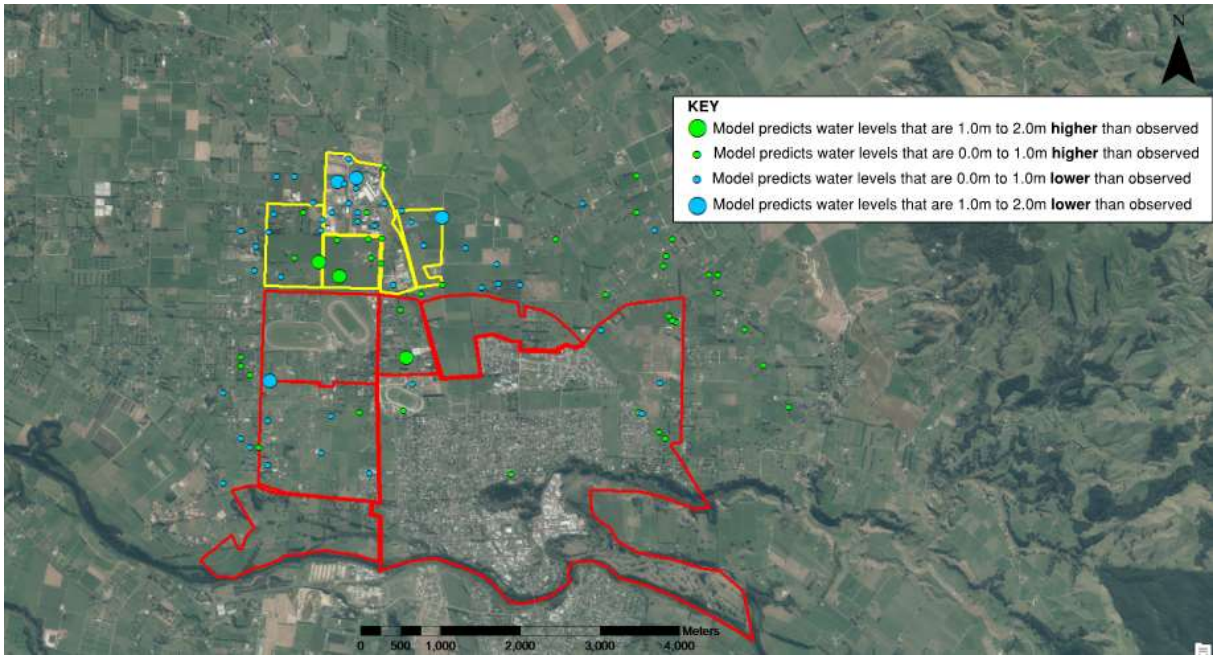


Figure 19 Distribution of residuals (green represent areas where the model over-predicts the groundwater levels and blue is where the model under-predicts)

The variability in groundwater levels (indicating the complexity in the geological depositional history) within the model are evident by the distribution of the observed levels that are either over-estimated or under-estimated by the model (e.g. there is no area where the model consistently under or over predicts). The uncertainty in the model's ability to predict the groundwater levels will affect the accuracy of any simulations used to inform the soakage capacity of the growth cells (as discussed in Section 10).

9.2.3 Calibration to flow data

The model was also calibrated to the baseflow estimate along the Mangaone Stream. The resulting calibration indicates a flow of 0.044m^3/s, an 8% to 12% difference to the assumed average baseflow (0.04m^3/s to 0.05m^3/s). We note that due to the paucity of data, calculating the scaled RMS error is not statistically significant, and therefore, the percent difference is used instead.

9.3 Calibrated model results

9.3.1 Calibrated model parameters

The resulting calibrated model parameters are shown in Table 13.

Rainfall recharge in the growth cells (except where the iron pan is located) is estimated to be 0.0006m/d (approximately 20% of average annual rainfall), which is at the lower end of the expected range (20% to 40%). However, since the recharge estimate is within the calculated range (14% and 27% as shown in Section 5.2.2) it is considered reasonable. Also, conceptually the perched layers above the aquifer likely intercept some of the rainfall, which infiltrates into the ground, reducing the amount of recharge reaching the aquifer.

Recharge to the shallow aquifer over the iron pan extent has been calibrated to be 0.0001m/d (approximately 3% of average annual rainfall), similar to the developed area which was a assigned a recharge of 0.00016m/d (approximately 5% of average rainfall).

The hydraulic parameters for the calibrated model are reasonable and within the range of values calculated from the permeability and soakage testing at the site. While storage values are not relevant to steady state models, an estimate of the specific storage was inferred from the calibrated rainfall recharge (based on the water table fluctuation method discussed in Section 5.2.2).

Table 8 Calibrated model parameters

Unit	Recharge (m/d)	Horizontal K (m/d)	Vertical K (m/d)	Specific Storage
2a/2b	0.0006	4.5	1	0.15
2c	-	0.75	0.25	-
2d	-	10	5	-
3/5a/5b	-	0.2	0.04	-

9.3.2 Head distribution

The simulated distribution of heads is illustrated in Figure 23 and shows contours which approximate the groundwater contours estimated from the available data. As noted in the calibration discussion (Section 9.2), the model generally simulates the groundwater levels; however, there are local variabilities which are not captured in the model. This uncertainty in the model affects the confidence level of the predictive scenario simulations and is discussed further in Section 10.

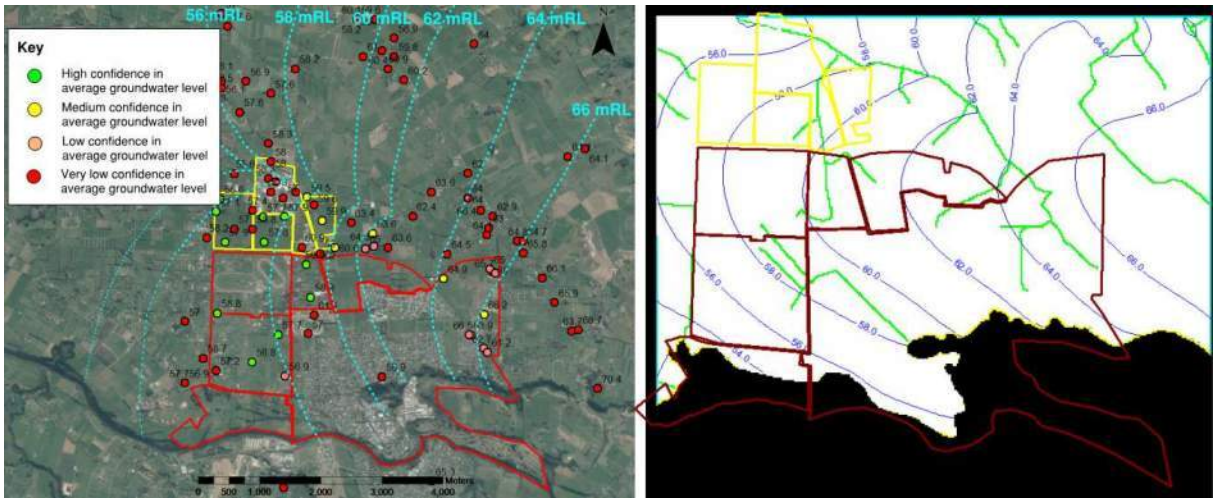


Figure 20 Approximate groundwater level contours estimated from the available data

9.3.3 Groundwater flow budget

The simulated groundwater flow budget for the model calibration in steady state is presented in Table 14. Rainfall recharge is the primary source of flow into the site, accounting for 92% of the inflow budget. Approximately 40% of the groundwater is discharged to the drains, with the Mangaone Stream being the primary watercourse interacting with the aquifer. While the aquifer is not directly connected to the Waikato River, approximately 30% of the groundwater flows towards the Waikato River (also Karapiro Stream and Te Kouto Lake) where it discharges as seepage along its riverbanks.

Table 9 Simulated groundwater flow budget for the model calibration in steady state

Flow component	Flow IN (m^3/d)	Flow OUT (m^3/d)	Net flux (m^3/d)	Budget proportion
Rainfall recharge	11,680	-	11,680	88% (IN)
Evapotranspiration	-	1,670	-1,670	13% (OUT)
Discharge to surface water bodies	-	4,962	-4,962	37% (OUT)
Aquifer throughflow	1,620	2,404	-784	12% (IN); 18% (OUT)
River bank seepage	-	4,264	-4,264	32% (OUT)
Total	13,300	13,300	0.02	-

9.4 Sensitivity analysis

The sensitivity of the model calibration performance to various parameters was established during the calibration process, with the following general comments regarding parameter sensitivity:

- The model is most sensitive to changes in rainfall recharge, followed by stream bed conductance. Figure 30 shows that the best calibration is achieved when recharge is between 15% and 20% of rainfall, while the Mangaone Stream is simulated with a streambed conductance between 20 and 25 m^2/d.
- The aquifer parameters and GHB conductance have less of an impact on model calibration as a whole (Figure 34); however, refinement of the water levels within certain growth cells are affected by these parameters.

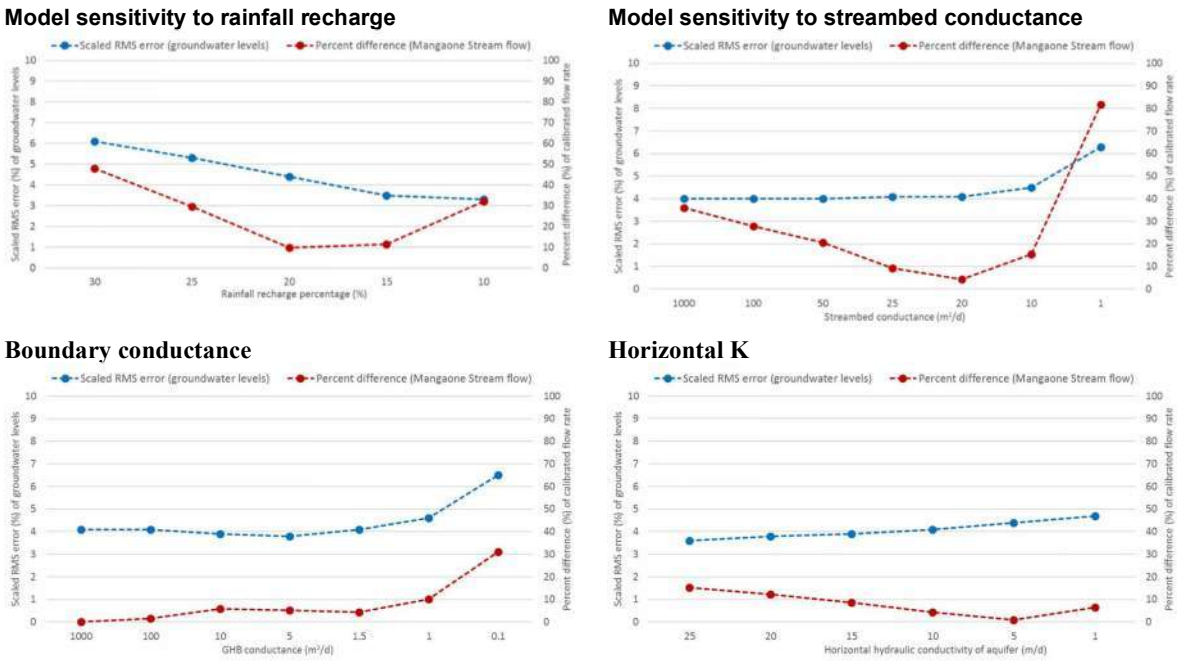


Figure 21 Results of sensitivity analysis

C

Appendix C – Basin Mounding Assessment

Background

Hantush (1967) proposed a solution describing the growth and decay of groundwater mounds in response to uniform infiltration over a given time period. Key assumptions and limitations

- Assumes a water-table aquifer of infinite extent and finite thickness with a horizontal, impermeable base.
- Includes the Dupuit assumptions of horizontal flow and negligible change of transmissivity with a change in head.
- The spreadsheet assumes a flat groundwater table i.e. doesn't account for horizontal flow away from the site.
- No accounting for vertical anisotropy and neglects the unsaturated zone. The height of groundwater mounding is underestimated by the Hantush equation where vertical anisotropy is present and overestimated where an unsaturated zone is present.
- The method doesn't account for storage within the basin itself (with an estimated volume of ~30,000 m^3) nor the additional storage within the forebays (~19,000 m^3).
- It is noted that the spreadsheet provides a total mound height relative to an arbitrary starting water level but cannot account for the actual available height between the water table and basin IL.

Calculation Inputs

Key inputs for each basin and storm are summarised below

Parameter	
BASIN	
Basin Width [m][1]	~100
Basin Length [m][1]	~175
Basin Base Area [m^2][1]	14,000
Basin Soakage Area [m^2]	5,500
Design infiltration rate [mm/hr]	100
Discharge rate [m3/hr][2]	1,400
STORM EVENT	
2-year total inflow to basin [m]	12,037
Time to drain 2-year storm [hr][3]	9 (6)
10-year total inflow to basin [m]	23,213
Time to drain 10-year storm [hr][3]	17 (12)
100-year total inflow to basin [m]	44,315
Time to drain 100-year storm [hr][3]	32 (22)
CALCULATION INPUTS	
Recharge (infiltration) rate of [ft/day]	7.87
Specific yield[4]	0.25
Horizontal hydraulic conductivity [ft/day][5]	34.02
Basin ½ width [ft]	123
Basin ½ length [ft]	246
Infiltration period 2-year event [d]	0.46
Infiltration period 10-year event [d]	0.83
Infiltration period 100-year event [d]	1.62
Initial thickness of saturated zone [ft][6]	32

[1] The analysis uses the basin footprint (being the area of cut greater than 2 m bgl) rather than the smaller soakage field area, as the soakage field would only be accessed via a scruffy dome if water level rises, and

as the basin is not lined, some soakage out of full footprint is expected to occur. Note: if we assume soakage out of forebays (swales) also than total soakage area would be closer to 20,000 m^2.

[2] Total discharge rate (m^3/hr) = basin area (m^2) * design infiltration rate (m^3/hr/m^2)

[3] Time to drain (hr) = total storm volume (m^3) / discharge rate (m^3/hr). The value in brackets is the time to drain if we assume soakage via the forebays (swales) also.

[4] Published value for sand-gravel = 0.15 – 0.3 (Driscoll, 1995)

[5] CHT rate of 1.2×10^{-4} m/s from BIL site; **this is a critical input which needs to be verified for design**. The unfactored test rate is used, as the infiltration rate already incorporates a FoS of 4

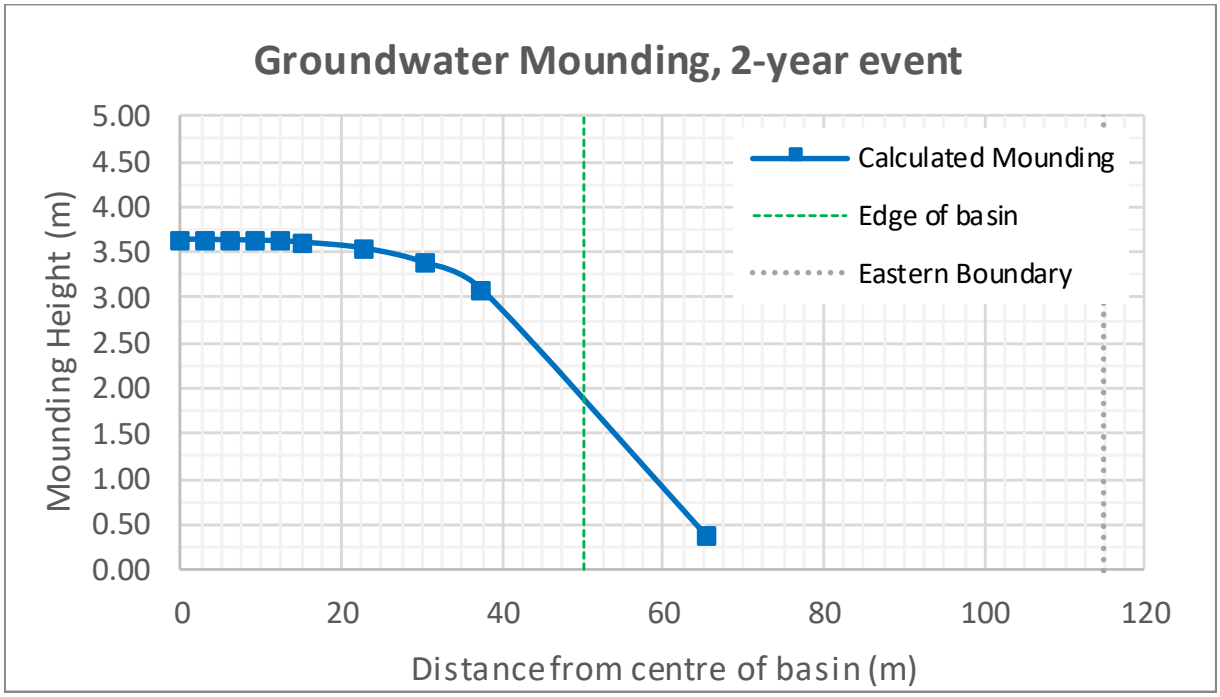
[6] Assume 10 m thickness based on Figure 4 of main report

Results

2-year storm

The assessment suggests that where all soakage is discharged via the basin:

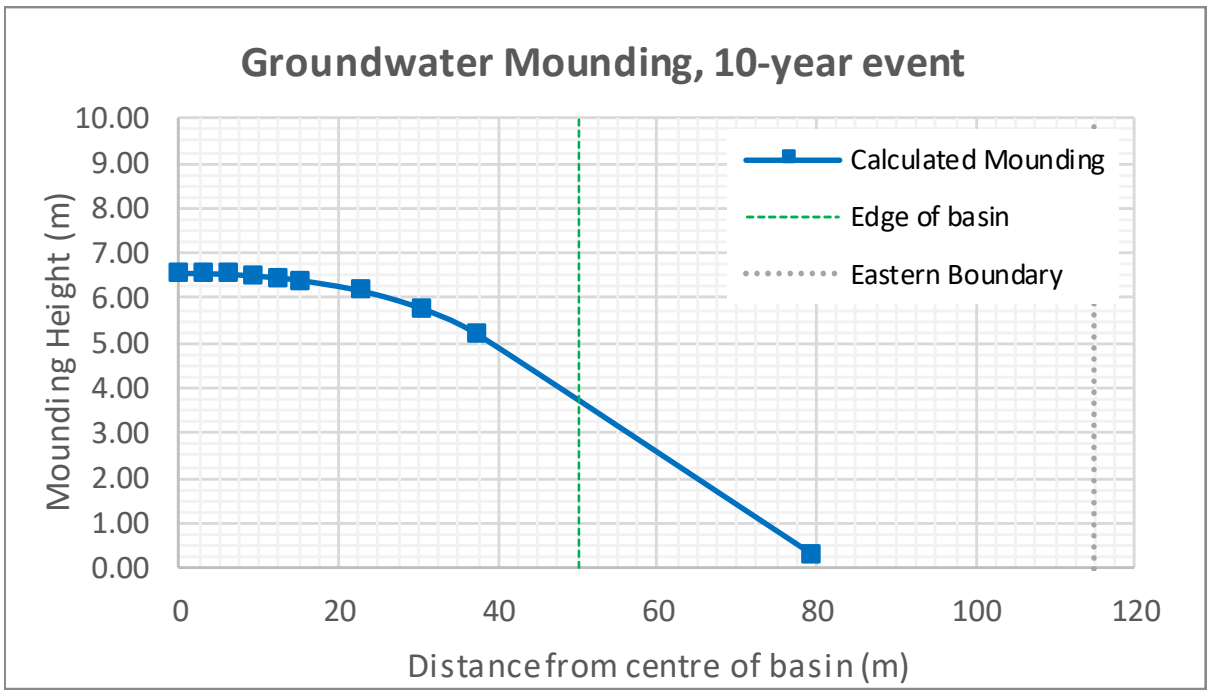
- A maximum mounding height at centre of basin of 3.6 m.
  It is noted that the spreadsheet provides a total mound height relative to an arbitrary starting water level but cannot account for the actual available height between the water table and basin IL. At the basin the deeper groundwater level is a maximum of ~2.8 m below the IL so the analysis indicates that the mound will daylight into the basin; however, the water would then be stored in the basin which has a much greater storage capacity than the ground so the max height of the mound will be smaller. The basin will be partially flooded for a period of time and the infiltration rate may slow down until the water is fully discharged.
- Measurable mounding (i.e. a change in level of 0.25 m) is calculated to extend ~65 m distance from the centre of basin, or ~15 m from the edge of basin
- There would be no measurable mounding at the property boundary



10-year storm

The assessment suggests that where all soakage is discharged via the basin:

- A maximum mounding height at centre of basin of 6.5 m.
  As per above, the maximum mounded height will actually be less, and the basin itself will be partially flooded and may take several days to fully clear.
- Measurable mounding (i.e. a change in level of 0.25 m) is calculated to extend ~80 m distance from the centre of basin, or ~30 m from the edge of basin
- Mounding of up to 4 m could occur at the edge of the basin.
  As noted above it will likely be less when accounting for storage in the basin but regardless even assuming a mound height of 4 m the groundwater level would remain at least 2 m below ground level i.e. no surface breakout / flooding.
- There would be no measurable mounding at the property boundary



The above assumes that all soakage is via the central stormwater reserve and does not account for any incidental soakage out of the unlined forebays (swales) to the south prior to reaching the main basin. This would be expected to provide a more distributed infiltration, over a shorter time period and hence less mounding.

100-year storm

The assessment suggests that where all soakage is discharged via the basin that the mounding would exceed the ground surface, however as noted above the method does not account for storage in the basin which has sufficient storage to fully hold the total storm volume allowing for a slower discharge to ground over time (with further buffer provided by the forebays).

As the results are not realistic in terms of actual operation, they are not presented further

APPENDIX C – STANTEC LETTER: TRAFFIC S92 RESPONSE

Stantec

6 April 2021

Mr M Smith
3Ms of Cambridge
211 Zig Zag Road
RD1
CAMBRIDGE

CC: matt@3msofcambridge.co.nz

Dear Matt,

C2 Growth Area, Cambridge - S92 Response: Traffic

Stantec has been asked to provide technical evaluation and advise in response to two matters set out in the Waipa District Council S92 request as follows:

Transportation and Roading

30. Please provide further detail related to design layout, operation and performance of the intersection of Road 10 with Cambridge Road and Chartwell Properties intersection on the opposite side to prove it will operate safely and efficiently. This may require traffic engineering support.

31. The Council remains concerned there is a limit to the traffic that can safely and efficiently use Road 10 and Road 8 without the north/south Collector Road being constructed. Please provide an assessment of this including identification of a limit on the number of lots and development that is appropriate before the north/south collector road and intersection is required.

These are addressed as follows:

In response to item 30:
Detailed design layout, operation and performance of the intersection of Road 10 with Cambridge Road and Chartwell Properties intersection

A plan has been prepared showing the detailed design layout of the Road 10 and Chartwell Properties intersections with Cambridge Road (**Appendix A**). The plan extends west to include the proposed Road 8 intersection with Cambridge Rad. By way of a summary, the plan shows the following:

- An extension of the existing central painted median west across the site frontage to provide for continuity and integration of the proposed Road 8 and Road 10 intersections with both the Chartwell Properties as well as the Kelly Road intersections;
- Road 10 is shown safely separated from the Chartwell properties intersection by about 81m;
- Sidra modelling (attached) shows the expected right turn queue on Cambridge Road waiting to access Road 10 to be less than 1.0 vehicle 95th percentile back of queue PM peak at 2031, well clear of the Chartwell Properties access road and adequately providing for drivers to taper into the right turn median waiting area ahead of making the turn;
- The painted median has a width of 3.0m safely providing for vehicles waiting on it clear of the adjacent through traffic lanes;

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TEL +64 7 577 0555

- The through traffic lanes are shown as continuing to provide for the current level of service at 3.5m with retention of the road shoulder areas.

By way of further observation it is noted that:

- The location of Road 10 is consistent with the location for an intersection as shown on the C2 area Structure Plan, Appendix S19 – Cambridge C1 and C2/C3 Structure Plans. These also anticipated the Chartwell Properties intersection;
- The location of the proposed Road 10 was known by Council with some certainty, through its engagements with the land-owner, at the time the Chartwell intersection was granted consent to develop and form the new intersection there;
- The proposed Road 10 is separated from Kellv Rd by about 130m;
- Road 8 is also shown separated from Road 10 by a further 230m;
- Safe intersection sight distances in excess of the Regional Infrastructure Technical Specification (RITS) and Austroads Guide to Road Design Part 3: Geometric Design guidelines. These specify safe stopping sight distances in the range 64m to 81m for an operating speed of 60km/h and a range of 83m to 102m for an operating speed of 70km/h. Development of the C2 growth area is expected to be commensurate with relocation of the speed restriction sign across the site frontage creating a 50km/h speed restriction and an expected 60km/h design speed environment. On-site observations have indicated that in excess of 150m is available.
- The ultimate C2 Structure Plan also identified the Road 10 eventually being formed with the planned C2 Collector Road and other wider transport network connections. The Waipa District Council Long Term Plan (LTP) identifies a range of staged transport network improvement projects including staged implementation of the C2 Collector Road and roundabout intersection with Cambridge Rd, being the long term strategic solution for the growth area and indicatively expected to be budgeted for 2021-2023 financial years. Other key local project allocations include:
    - C2/C3 Collector Roads and Green Belt Connection – Land: $11.15M, 21/22-28/29;
    - C2 & C3 Structure Plan roading: $25.14M, 21/22 – 30/31;
    - C1 Structure Plan Roading: $1.5975M, 24/25-26/27; as well as a range of
    - Urbanisation and cycleway project undertakings for Hamilton Road, Victoria Road and Kelly Road.
- Detailed engineering design of the intersections are recommended to be subject to an independent road safety audit. The safety audit recommendations shall be resolved to the satisfaction of Waipa District Council prior to the commencement of physical works on-site;
- A temporary traffic management plan shall be prepared by a suitably qualified person and submitted to Council for approval prior to the commencement of physical works on-site.

On the matters of design layout, operation and performance; and based on the assessments described above, it is concluded the proposed location of Road 10 is aligned with the Structure Plan operational intentions and is able to be safely formed and located as proposed.

In response to item 31:

Capacity performance of the intersection of Road 8 and Road 10 with Cambridge Road

The operational performance expectations for the proposed Road 8 and Road 10 intersections are assessed as follows.

Previous technical assessments of the potential for local trip generation due to both the C2 area as well as other growth areas generating demand effects on the Cambridge Road corridor have been determined by BBO Consultants for Council in consultation with Stantec acting for the applicant. The underlying and broader growth demands have also been factored in to forecast traffic demand expectations out to 2031 on the frontage and through the intersections in a consistent way with the basis of prior demand forecasts for the Structure Plan areas.

Those traffic generation assumptions for the C2 growth area have previously been based on the full site being developed as residential living. Current proposals however have identified that the "Super-Lot Site" proposed by 3Ms is to be developed as retirement living. A refined forecast of local traffic demands has therefore been developed to reflect the current proposal and development expectations.

The trip generation demand assessments are attached as **Appendix B** and are summarised as follows:

- Scenario 1 describes an assessment based on substantial development of the applicant's proposed C2 area on the 2021 transport network;
- Scenario 2 described full development of the applicant's proposed C2 Structure Plan area on the 2021 transport network; and
- Scenario 3 describes full development of the entire C1, C2 and C3 Structure Plan areas on a connected 2031 transport network.

The corresponding AM and PM distributed peak period turning demands at both Road 8 and Road 10 intersections are set out at **Appendix C**.

Modelled intersection performance characteristics for both the AM and PM peak periods for each of the Scenarios are set out at **Appendix D**.

By way of a summary, the following key results have been determined for the most critical of the intersection movements, the right turn from the C2 area onto Cambridge Road.

Table 1: Road 8 Intersection Right Turn Out Performance Summary

Intersection	Development Stage Description	Year	AM Peak Average Delay (s/veh)	PM Peak Average Delay (s/veh)
Road 8 - RT-out	C2 retirement village, 100 new +47 existing dwellings + school	2021	16.4	13.0
Road 8 - RT-out	Further C2 76 dwellings to full development scenario	2021	17.2	13.5
Road 8 - RT-out	Full C2 with Full C1 and C3 plus background growth	2031	35.0	50.2

Table 2: Road 10 Intersection Right Turn Out Performance Summary

Intersection	Development Stage Description	Year	AM Peak Average Delay (s/veh)	PM Peak Average Delay (s/veh)
Road 10 - RT-out	C2 retirement village, 100 new +47 existing dwellings + school	2021	18.1	13.6
Road 10 - RT-out	Further C2 76 dwellings to full development scenario	2021	19.7	14.4
Road 8 - RT-out	Full C2 with Full C1 and C3 plus background growth	2031	42.9	48.5

These results have been further accumulated into a graphical form to show the expected network performance together with other changes on the transport network.

Figure 1: Road 8 Intersection with Cambridge Road - Graphical Summary of Right Turn Out Performance

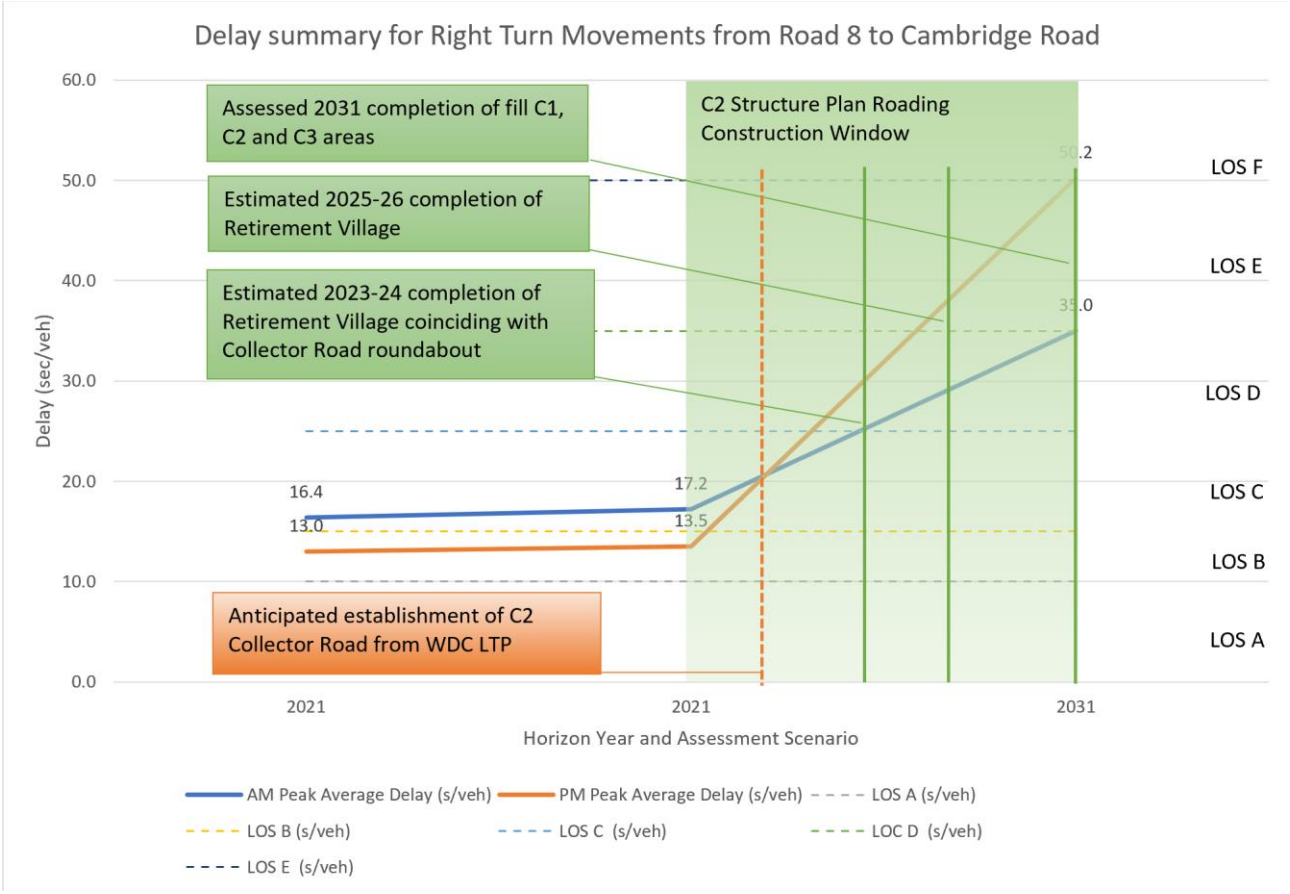
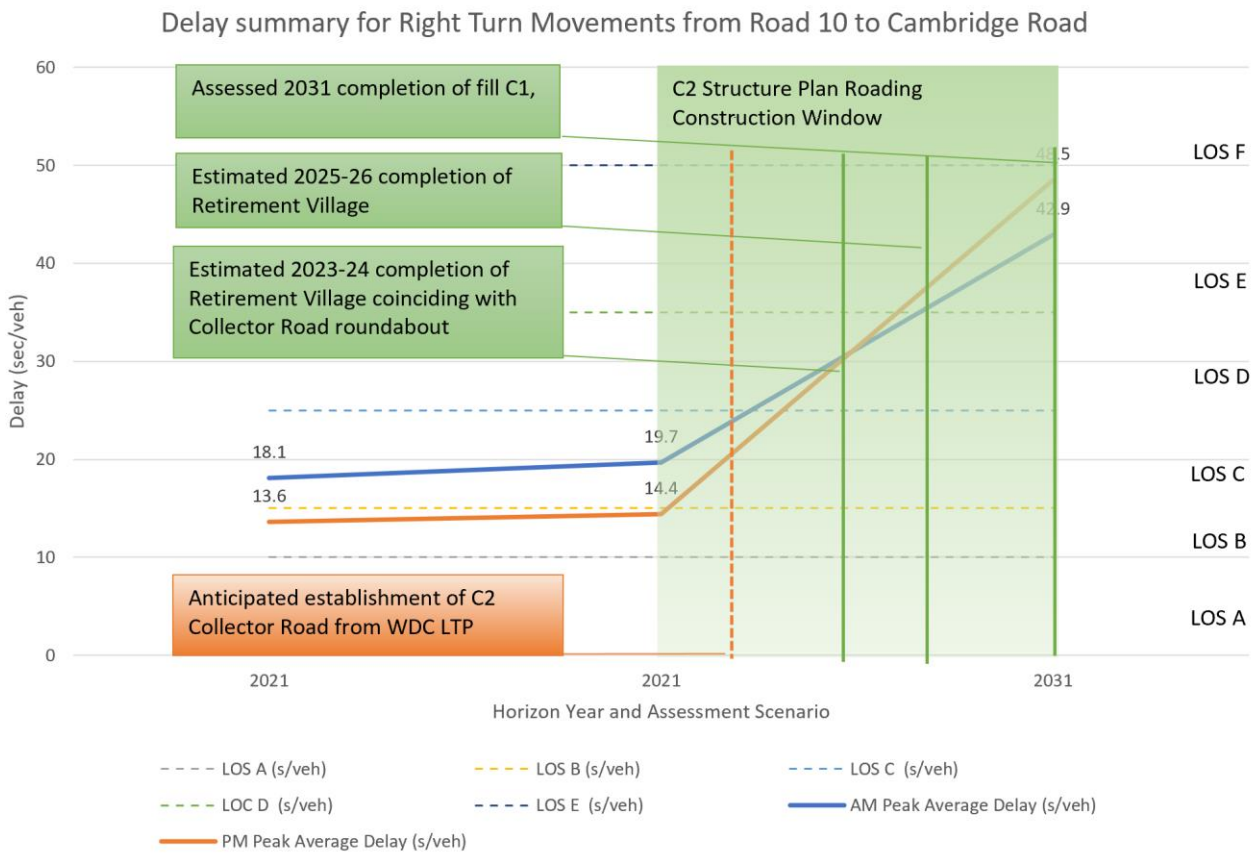


Figure 2: Road 10 Intersection with Cambridge Road - Graphical Summary of Right Turn Out Performance



The data and the graphs show the following features:

- Right turn out performance results for both intersections across all three scenarios;
- Results for both the AM and PM peak periods (s/veh);
- The green band on the graph highlights the 2021-31 period across which the range of works, provisioned within the Waipa District LTP, are expected to occur together with formation of the local road networks and connections comprising the C1, C2 and C3 Structure Plan Growth Cells;
- The green text boxes together with the vertical lines are intended to provide some indicative practical representation of the timeframe by which the C2 and surrounding C1/C3 development may be expected to be progressed / completed, having regard for construction timeframes. Importantly, this does not suggest a proposed development staging, but rather provides some practical context based on what is apparent at this time. It demonstrates alignment between strategic transport network planning and proposed development staging.

The results shown in the data sets and within the two graphs (for both Road 8 and 10 intersections) can be summarised as follows:

- Scenario 1, part development of the applicant's C2 growth area (refer **Appendix B**) indicates delay expectations in the range 13.0 to 18.1 s/veh on the right turn out movements, assuming it was to occur in 2021. This represents an operating level of service performance in the range LOS B to C, a relative efficient but not unencumbered level of service;

- Scenario 2 represents full development of the applicant's proposal, as if it were loaded onto the 2021 network. Again, with delay expectations for the right turn out movement in the range 13.5 to 19.7 s/veh (LOS B to C) an acceptably efficient level of performance is expected for this movement;
- Scenario 3 not only introduces 10 years of wider District growth demands, it further loads potential future and full development expectations for the remaining C2 as well as the C1 and C3 growth areas. The resulting change in traffic demands and local road connected network distributions suggests performance for the right turn out movement in the range LOS E (AM peak) to F (PM peak). In this regard, it is evident the applicant's C2 development proposal alone will readily be able to be accommodated.

  The graphs for Scenario 3 also represent full future trip demands from these growth cells, the results indicate some peak period delay effects, particularly in the PM period. The orange dashed line on the graphs indicates the expected early introduction, through the LTP, of the C2 Collector Road and Roundabout, which will provide the primary access/egress movement capacity for the C2 area. It can therefore be concluded that the applicant's proposal with respect to both Road 8 and Road 10 intersections will perform acceptably at the level of development intensity proposed and with the anticipated local road connectivity.

Conclusions and Recommendations.

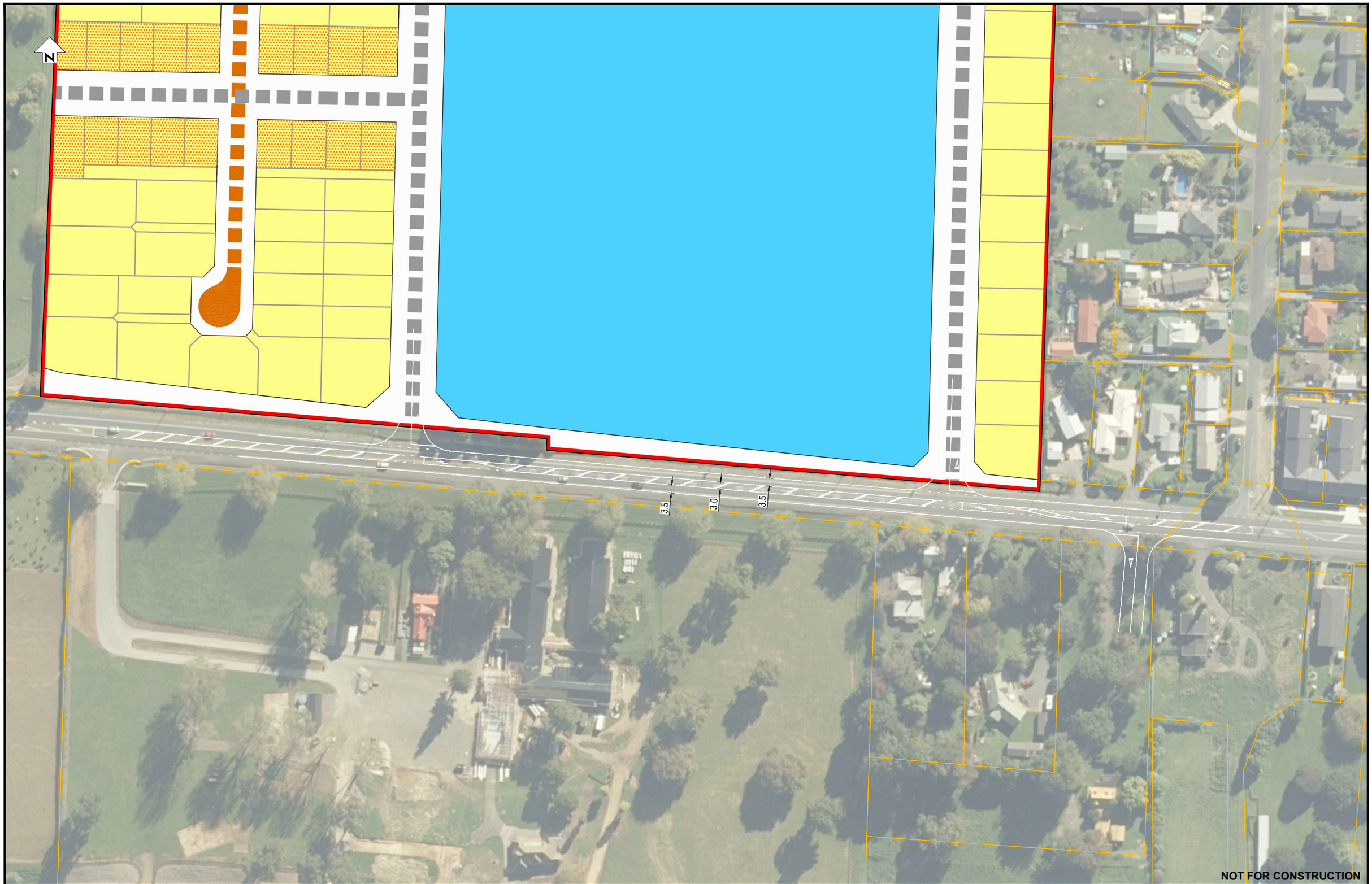
On the bases of these assessments the following conclusions are made:

- On the matters of design layout, operation and performance; and based on the assessments described above, it is concluded the proposed location of Road 10 is aligned with the Structure Plan operational intentions and is able to be safely formed and located as proposed; and
- The capacity and performance expectations for both Road 8 and Road 10 will be sufficient and appropriately timed to safely provide for the activities proposed, including in the first couple of years while construction is progressed and prior to the C2 Collector Road connection and roundabout.

Yours sincerely

Apeldoorn, Mark
Practice Leader: Transport Advisory
Stantec New Zealand

Appendix A: Plan showing the indicative arrangement for the Cambridge Road intersections.



REV	REVISIONS	DRN	CHK	APP	DATE
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
B	EXTEND PROPOSED MEDIAN	MS	-	-	06.04.2021
A	DRAWING CREATED	TL	MS	-	30.3.2021

SURVEYED		
DESIGNED	-	-
DRAWN	MATTHEW SPROULL	06.04.2021
CAD REVIEW	-	-
DESIGN CHECK		
DESIGN REVIEW		
APPROVED		
PROF REGISTRATION:		

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Client:

CAMBRIDGE ROAD RIGHT TURN BAYS
-

CONCEPT DRAWING
-

Status Stamp: **WORKING PLOT**
Date Stamp: **06.04.2021**
Scales: 1:500
Drawing No.: 310204689-01-B-1
Rev.: B

Appendix B: Road 8 and 10 Trip Generation Demand Forecasts

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2021 Part development in C2 Structure Plan area as follows:

According to the 2017 Structure Plan Transport Assessment, C2 and C3 yield is expected to be 1500-2000hh. Therefore adopt 1750hh. 400hh of these is in C3. Therefore, C2 = 1350hh
C1 yield expected to be 275-375hh. Therefore assume 325hh
Neighbourhood centre in C1 is 2.6ha. Assume 40% site coverage and 15 trips per peak pm hour generation

Mode Share Targets by 2041			**Expected = "1", Aspirational = "2"**
Active Modes	**10%**	Expected	1
Public Transport Internally	**5%**	Expected	1
Public Transport Externally	**10%**	Expected	1
Local Trips percentage split	**15%**	Within Zone C1, C2 or C3)	
External trips percentage split	**85%**		

Distribution split	AM		PM	
	In	Out	In	Out
Residential	20%	80%	55%	45%
School	55%	45%	45%	55%
School	70%	30%	45%	55%

2021 Part Development in C2

C1 2031

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	15%	85%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
Residential		1.2	Dwelling	0	0	0	0	0	0	0	**0**	**0**	0	**0**	**0**	0
						0			**0**							
Neighbourhood centre		8	100 sq.m/GFA	-	0	100%	0%	0	0	0	**0**	**0**	0	**0**	**0**	0

C2 2031

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	15%	85%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
3Ms	100	1.2	Dwelling	120	120	18	102	2	11	107	**21**	**86**	107	**59**	**48**	107
Ryman	80	0.4	Care beds	32	32	5	27	0	3	29	**6**	**23**	29	**16**	**13**	29
Ryman	46	0.4	Assisted Suites	18	18	3	16	0	2	16	**3**	**13**	16	**9**	**7**	16
Ryman	202	0.5	Townhouses	101	101	15	86	2	9	90	**18**	**72**	90	**50**	**41**	90
other		1.2	Dwelling	0	0	0	0	0	0	0	**0**	**0**	0	**0**	**0**	0
existing households	47	1.2	Dwelling	56	56	8	48	1	5	50	**10**	**40**	50	**28**	**23**	50
	475			328	328	**328**			**328**		59	234	293	161	132	293
Primary School	300	2	Pupils	600	60	90	510	9	56	536	**295**	**241**	536	**23**	**29**	52
						600			**600**							

C3 2021

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	15%	85%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
Chartwell and St Peters		1.2	dwelling	0	0	0	0	0	0	0	**0**	**0**	0	**0**	**0**	0
Te Awa Lifecare	32	0.4	beds	13	13	2	11	0	1	11						
Te Awa Lifecare	12	0.4	Unit	5	5	1	4	0	0	4	**16**	**16**	32	**16**	**16**	32
Te Awa Lifecare	11	0.5	apartments	6	6	1	5	0	1	5						
Te Awa Lifecare	25	0.5	villas	13	13	2	11	0	1	11						

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2021 Full Development in Applicant's C2 Structure Plan Area

According to the 2017 Structure Plan Transport Assessment, C2 and C3 yield is expected to be 1500-2000hh. Therefore adopt 1750hh. 400hh of these is in C3. Therefore, C2 = 1350hh
C1 yield expected to be 275-375hh. Therefore assume 325hh
Neighbourhood centre in C1 is 2.6ha. Assume 40% site coverage and 15 trips per peak pm hour generation

Mode Share Targets by 2041			**Expected = "1", Aspirational = "2"**
Active Modes	**10%**	Expected	1
Public Transport Internally	**5%**	Expected	1
Public Transport Externally	**10%**	Expected	1
Local Trips percentage split	**15%**	Within Zone C1, C2 or C3)	
External trips percentage split	**85%**		

	Distribution split			
	AM		PM	
	In	Out	In	Out
Residential	20%	80%	55%	45%
School	55%	45%	45%	55%
School	70%	30%	45%	55%

2021 Baseline - Full Development in 3Ms C2 Area

C1 2031

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	15%	85%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
Residential		1.2	Dwelling	0	0	0	0	0	0	0	**0**	**0**	0	**0**	**0**	0
						0			**0**							
Neighbourhood centre		8	100 sq.m/GFA	-	0	100%	0%	0	0	0	**0**	**0**	0	**0**	**0**	0

C2 2031

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	15%	85%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
3Ms	276	1.2	Dwelling	331	331	50	282	5	31	296	**59**	**236**	296	**163**	**133**	296
Ryman	80	0.4	Care beds	32	32	5	27	0	3	29	**6**	**23**	29	**16**	**13**	29
Ryman	46	0.4	Assisted Suites	18	18	3	16	0	2	16	**3**	**13**	16	**9**	**7**	16
Ryman	202	0.5	Townhouses	101	101	15	86	2	9	90	**18**	**72**	90	**50**	**41**	90
other		1.2	Dwelling	0	0	0	0	0	0	0	**0**	**0**	0	**0**	**0**	0
existing households	47	1.2	Dwelling	56	56	8	48	1	5	50	**10**	**40**	50	**28**	**23**	50
	651			539	539	**539**			**539**		96	385	481	265	216	481
Primary School	300	2	Pupils	600	60	90	510	9	56	536	**295**	**241**	536	**23**	**29**	52
						600			**600**							

C3 2021

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	15%	85%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
Chartwell and St Peters		1.2	dwelling	0	0	0	0	0	0	0	**0**	**0**	0	**0**	**0**	0
Te Awa Lifecare	32	0.4	beds	13	13	2	11	0	1	11						
Te Awa Lifecare	12	0.4	Unit	5	5	1	4	0	0	4	**16**	**16**	32	**16**	**16**	32
Te Awa Lifecare	11	0.5	apartments	6	6	1	5	0	1	5						
Te Awa Lifecare	25	0.5	villas	13	13	2	11	0	1	11						

2031 Full Development in C1, C2 and C3 Structure Plan Areas with Background Growth

According to the 2017 Structure Plan Transport Assessment, C2 and C3 yield is expected to be 1500-2000hh. Therefore adopt 1750hh. 400hh of these is in C3. Therefore, C2 = 1350hh
C1 yield expected to be 275-375hh. Therefore assume 325hh
Neighbourhood centre in C1 is 2.6ha. Assume 40% site coverage and 15 trips per peak pm hour generation

Mode Share Targets by 2041			**Expected = "1", Aspirational = "2"**
Active Modes	**10%**	Expected	1
Public Transport Internally	**5%**	Expected	1
Public Transport Externally	**10%**	Expected	1
Local Trips percentage split	**60%**	Within Zone C1, C2 or C3)	
External trips percentage split	**40%**		

	Distribution split			
	AM		PM	
	In	Out	In	Out
Residential	20%	80%	55%	45%
School	55%	45%	45%	55%
School	70%	30%	45%	55%

2041Baseline

C1 2031

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	60%	40%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
Residential	325	1.2	Dwelling	390	390	234	156	23	27	339	**68**	**271**	339	**187**	**153**	339
						390		**390**								
Neighbourhood centre	2.6	8	100 sq.m/GFA	-	2080	100%	0%	208	104	1768	**1238**	**530**	1768	**796**	**972**	1768

C2 2031

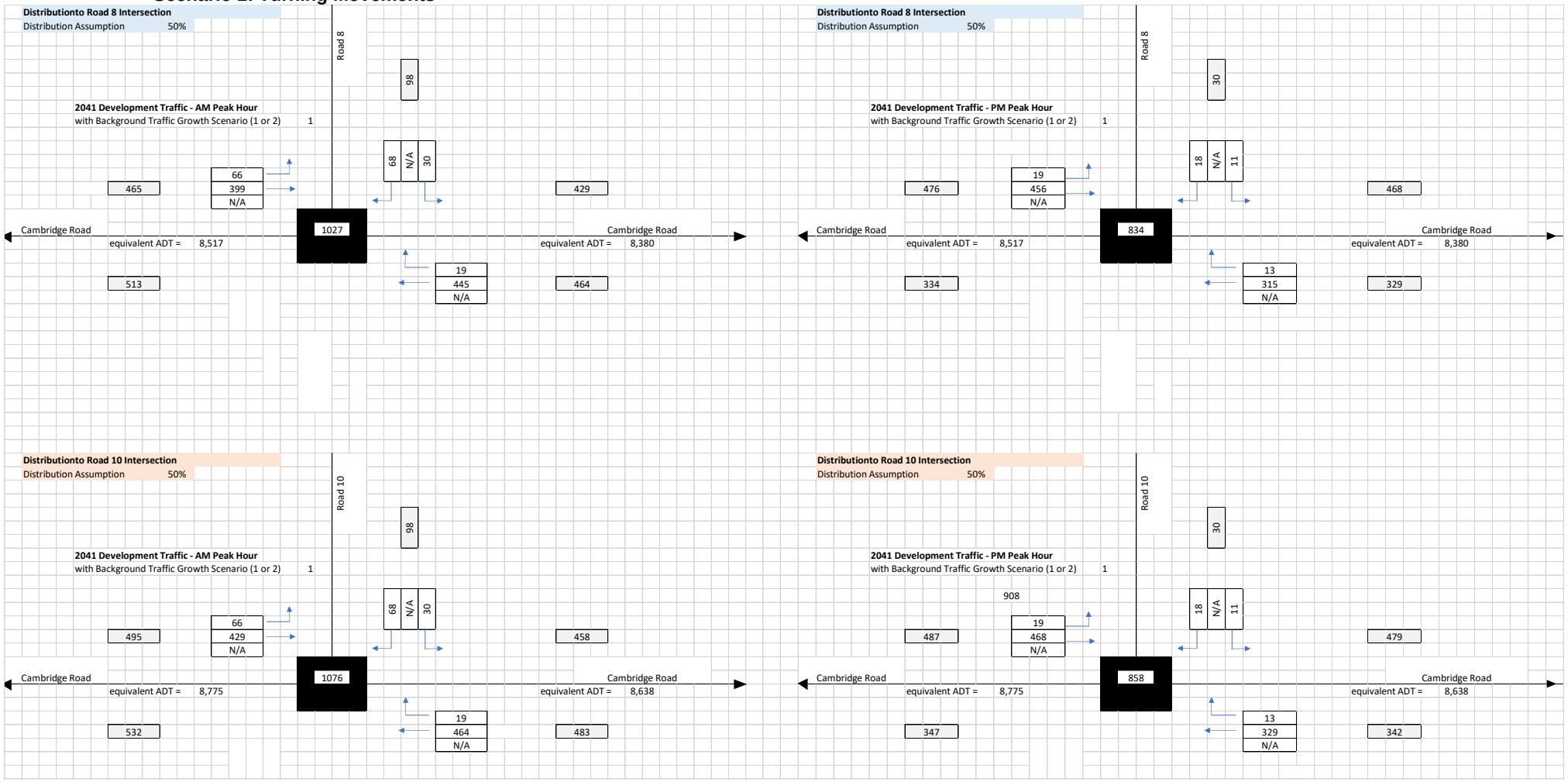
Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	60%	40%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
3Ms	276	1.2	Dwelling	331	331	199	132	20	23	288	**58**	**231**	288	**158**	**130**	288
Ryman	80	0.4	Care beds	32	32	19	13	2	2	28	**6**	**22**	28	**15**	**13**	28
Ryman	46	0.4	Assisted Suites	18	18	11	7	1	1	16	**3**	**13**	16	**9**	**7**	16
Ryman	202	0.5	Townhouses	101	101	61	40	6	7	88	**18**	**70**	88	**48**	**40**	88
other	703	1.2	Dwelling	844	844	506	337	51	59	734	**147**	**587**	734	**404**	**330**	734
existing households	47	1.2	Dwelling	56	56	34	23	3	4	49	**10**	**39**	49	**27**	**22**	49
	1354			1383	1383	**1383**		**1383**			241	962	1203	662	541	1203
Primary School	300	2	Pupils	600	60	360	240	36	42	522	**287**	**235**	522	**23**	**29**	52
						600		**600**								

C3 2021

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	60%	40%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
Chartwell and St Peters	400	1.2	dwelling	480	480	288	192	29	34	418	**84**	**334**	418	**230**	**188**	418
Te Awa Lifecare	32	0.4	beds	13	13	8	5	1	1	11						
Te Awa Lifecare	12	0.4	Unit	5	5	3	2	0	0	4	**15**	**15**	31	**15**	**15**	31
Te Awa Lifecare	11	0.5	apartments	6	6	3	2	0	0	5						
Te Awa Lifecare	25	0.5	villas	13	13	8	5	1	1	11						

Appendix C: The corresponding AM and PM distributed peak period turning demands at both Road 8 and Road 10 intersections

Scenario 1: Turning Movements



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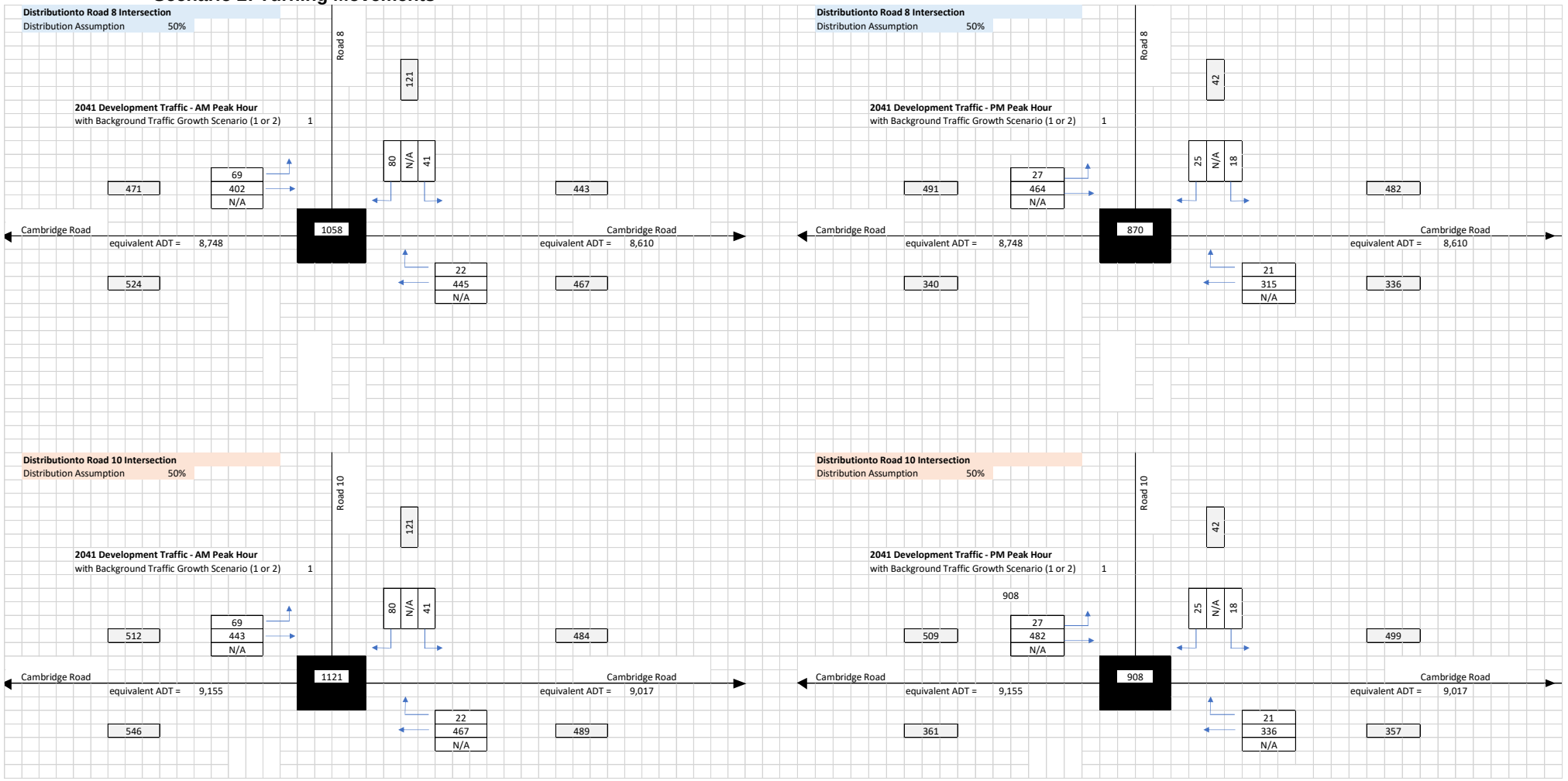
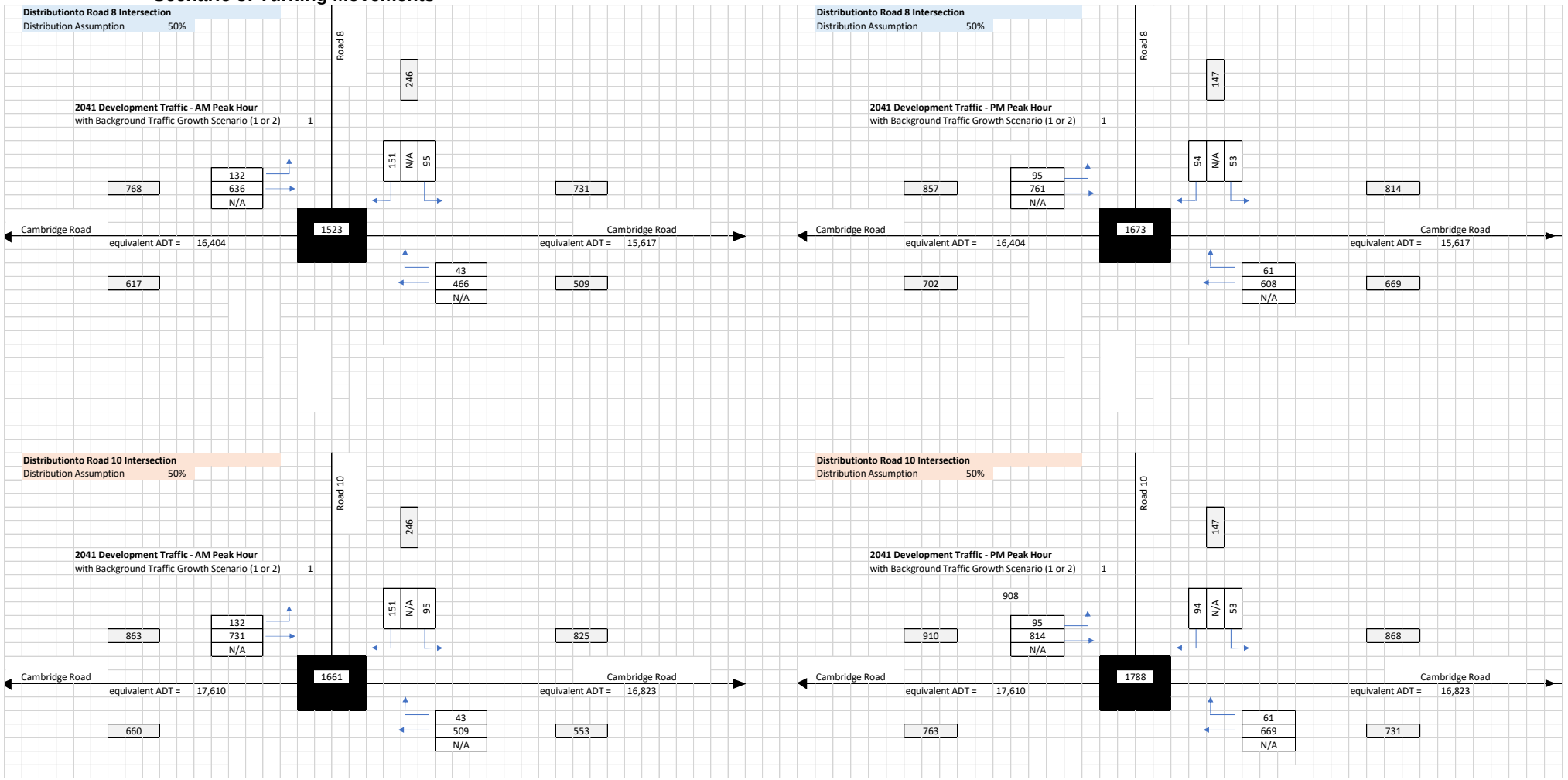
Ref Nos., Parent: 310204689, Child: Task 100

210406 3Ms C2 Growth Cell S92 Response - Traffic.docx

Scenario 2: Turning Movements



Scenario 3: Turning Movements



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Appendix D: Intersection Modelling Results

Scenario 1: Road 8 and 10, AM and PM, 2021 Results

LANE SUMMARY

▽ Site: 101 [Road 8 - Cambridge Rd Int, 2021 AM - Part Dev (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	468	7.0	1871	0.250	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	20	3.0	1050	0.019	100	6.5	LOS A	0.1	0.6	Short	60	0.0	NA
Approach	488	6.8		0.250		0.3	NA	0.1	0.6				
North: Road 10													
Lane 1	32	3.0	1055	0.030	100	6.2	LOS A	0.1	0.8	Full	500	0.0	0.0
Lane 2	72	3.0	312	0.229	100	16.4	LOS C	0.8	6.1	Short	60	0.0	NA
Approach	103	3.0		0.229		13.3	LOS B	0.8	6.1				
West: Cambridge Rd West Appr													
Lane 1	489	6.4	1878	0.261	100	0.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	489	6.4		0.261		0.7	NA	0.0	0.0				
Intersection	1081	6.3		0.261		1.8	NA	0.8	6.1				

LANE SUMMARY

▽ Site: 101 [Road 8 - Cambridge Rd Int, 2021 PM - Part Dev (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	332	7.0	1885	0.176	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	14	3.0	1034	0.013	100	6.6	LOS A	0.1	0.4	Short	60	0.0	NA
Approach	345	6.8		0.176		0.3	NA	0.1	0.4				
North: Road 10													
Lane 1	12	3.0	979	0.012	100	6.5	LOS A	0.0	0.3	Full	500	0.0	0.0
Lane 2	19	3.0	366	0.052	100	13.0	LOS B	0.2	1.3	Short	60	0.0	NA
Approach	31	3.0		0.052		10.5	LOS B	0.2	1.3				
West: Cambridge Rd West Appr													
Lane 1	500	6.8	1883	0.266	100	0.3	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	500	6.8		0.266		0.3	NA	0.0	0.0				
Intersection	876	6.7		0.266		0.6	NA	0.2	1.3				

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LANE SUMMARY

▽ Site: 101 [Road 10 - Cambridge Rd Int, 2021 AM - Part Dev (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	488	7.0	1871	0.261	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	20	3.0	1006	0.020	100	6.7	LOS A	0.1	0.6	Short	60	0.0	NA
Approach	508	6.8		0.261		0.4	NA	0.1	0.6				
North: Road 10													
Lane 1	32	3.0	1015	0.031	100	6.4	LOS A	0.1	0.8	Full	500	0.0	0.0
Lane 2	72	3.0	285	0.251	100	18.1	LOS C	0.9	6.7	Short	60	0.0	NA
Approach	103	3.0		0.251		14.5	LOS B	0.9	6.7				
West: Cambridge Rd West Appr													
Lane 1	521	6.5	1878	0.277	100	0.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	521	6.5		0.277		0.7	NA	0.0	0.0				
Intersection	1133	6.3		0.277		1.8	NA	0.9	6.7				

LANE SUMMARY

▽ Site: 101 [Road 10 - Cambridge Rd Int, 2021 PM - Part Dev (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	346	7.0	1885	0.184	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	14	3.0	1016	0.013	100	6.7	LOS A	0.1	0.4	Short	60	0.0	NA
Approach	360	6.8		0.184		0.3	NA	0.1	0.4				
North: Road 10													
Lane 1	12	3.0	963	0.012	100	6.5	LOS A	0.0	0.3	Full	500	0.0	0.0
Lane 2	19	3.0	349	0.054	100	13.6	LOS B	0.2	1.3	Short	60	0.0	NA
Approach	31	3.0		0.054		10.9	LOS B	0.2	1.3				
West: Cambridge Rd West Appr													
Lane 1	513	6.8	1883	0.272	100	0.3	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	513	6.8		0.272		0.3	NA	0.0	0.0				
Intersection	903	6.7		0.272		0.6	NA	0.2	1.3				

Scenario 2: Road 8 and 10, AM and PM, 2021 Results

LANE SUMMARY

▽ Site: 101 [Road 8 - Cambridge Rd Int, 2021 AM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	468	7.0	1869	0.251	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	23	3.0	1041	0.022	100	6.6	LOS A	0.1	0.6	Short	60	0.0	NA
Approach	492	6.8		0.251		0.4	NA	0.1	0.6				
North: Road 10													
Lane 1	43	3.0	1051	0.041	100	6.2	LOS A	0.2	1.1	Full	500	0.0	0.0
Lane 2	84	3.0	308	0.273	100	17.2	LOS C	1.0	7.5	Short	60	0.0	NA
Approach	127	3.0		0.273		13.5	LOS B	1.0	7.5				
West: Cambridge Rd West Appr													
Lane 1	496	6.4	1877	0.264	100	0.8	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	496	6.4		0.264		0.8	NA	0.0	0.0				
Intersection	1115	6.2		0.273		2.1	NA	1.0	7.5				

LANE SUMMARY

▽ Site: 101 [Road 8 - Cambridge Rd Int, 2021 PM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	332	7.0	1874	0.177	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	22	3.0	1011	0.022	100	6.7	LOS A	0.1	0.6	Short	60	0.0	NA
Approach	354	6.8		0.177		0.5	NA	0.1	0.6				
North: Road 10													
Lane 1	19	3.0	968	0.020	100	6.5	LOS A	0.1	0.5	Full	500	0.0	0.0
Lane 2	26	3.0	353	0.074	100	13.5	LOS B	0.3	1.8	Short	60	0.0	NA
Approach	45	3.0		0.074		10.6	LOS B	0.3	1.8				
West: Cambridge Rd West Appr													
Lane 1	517	6.8	1882	0.275	100	0.3	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	517	6.8		0.275		0.3	NA	0.0	0.0				
Intersection	916	6.6		0.275		0.9	NA	0.3	1.8				

LANE SUMMARY

▽ Site: 101 [Road 10 - Cambridge Rd Int, 2021 AM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	492	7.0	1868	0.263	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	23	3.0	982	0.024	100	6.9	LOS A	0.1	0.7	Short	60	0.0	NA
Approach	515	6.8		0.263		0.4	NA	0.1	0.7				
North: Road 10													
Lane 1	43	3.0	996	0.043	100	6.5	LOS A	0.2	1.2	Full	500	0.0	0.0
Lane 2	84	3.0	273	0.308	100	19.7	LOS C	1.2	8.5	Short	60	0.0	NA
Approach	127	3.0		0.308		15.2	LOS C	1.2	8.5				
West: Cambridge Rd West Appr													
Lane 1	539	6.5	1878	0.287	100	0.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	539	6.5		0.287		0.7	NA	0.0	0.0				
Intersection	1181	6.2		0.308		2.1	NA	1.2	8.5				

LANE SUMMARY

▽ Site: 101 [Road 10 - Cambridge Rd Int, 2021 PM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	354	7.0	1874	0.189	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	22	3.0	985	0.022	100	6.8	LOS A	0.1	0.6	Short	60	0.0	NA
Approach	376	6.8		0.189		0.5	NA	0.1	0.6				
North: Road 10													
Lane 1	19	3.0	945	0.020	100	6.7	LOS A	0.1	0.5	Full	500	0.0	0.0
Lane 2	26	3.0	329	0.080	100	14.4	LOS B	0.3	2.0	Short	60	0.0	NA
Approach	45	3.0		0.080		11.2	LOS B	0.3	2.0				
West: Cambridge Rd West Appr													
Lane 1	536	6.8	1882	0.285	100	0.3	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	536	6.8		0.285		0.3	NA	0.0	0.0				
Intersection	957	6.6		0.285		0.9	NA	0.3	2.0				

Scenario 3: Road 8 and 10, AM and PM, 2031 Results

LANE SUMMARY

▽ Site: 101 [Road 8 - Cambridge Rd Int, 2031 AM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	491	7.0	1873	0.262	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	45	3.0	751	0.060	100	8.5	LOS A	0.2	1.6	Short	60	0.0	NA
Approach	536	6.7		0.262		0.8	NA	0.2	1.6				
North: Road 10													
Lane 1	100	3.0	842	0.119	100	7.6	LOS A	0.4	3.1	Full	500	0.0	0.0
Lane 2	159	3.0	228	0.699	100	35.0	LOS D	3.5	24.9	Short	60	0.0	NA
Approach	259	3.0		0.699		24.4	LOS C	3.5	24.9				
West: Cambridge Rd West Appr													
Lane 1	808	6.3	1876	0.431	100	1.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	808	6.3		0.431		1.0	NA	0.0	0.0				
Intersection	1603	5.9		0.699		4.7	NA	3.5	24.9				

LANE SUMMARY

▽ Site: 101 [Road 8 - Cambridge Rd Int, 2031 PM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	640	7.0	1870	0.342	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	64	3.0	649	0.099	100	9.5	LOS A	0.4	2.6	Short	60	0.0	NA
Approach	704	6.6		0.342		1.0	NA	0.4	2.6				
North: Road 10													
Lane 1	56	3.0	705	0.079	100	8.5	LOS A	0.3	2.0	Full	500	0.0	0.0
Lane 2	99	3.0	146	0.680	100	50.2	LOS F	2.8	20.1	Short	60	0.0	NA
Approach	155	3.0		0.680		35.2	LOS E	2.8	20.1				
West: Cambridge Rd West Appr													
Lane 1	901	6.6	1879	0.479	100	0.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	901	6.6		0.479		0.7	NA	0.0	0.0				
Intersection	1760	6.3		0.680		3.9	NA	2.8	20.1				

LANE SUMMARY

▽ Site: 101 [Road 10 - Cambridge Rd Int, 2031 AM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	536	7.0	1872	0.286	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	45	3.0	689	0.066	100	9.1	LOS A	0.2	1.7	Short	60	0.0	NA
Approach	581	6.7		0.286		0.8	NA	0.2	1.7				
North: Road 10													
Lane 1	100	3.0	776	0.129	100	8.1	LOS A	0.5	3.3	Full	500	0.0	0.0
Lane 2	159	3.0	207	0.766	100	42.9	LOS E	3.9	28.2	Short	60	0.0	NA
Approach	259	3.0		0.766		29.5	LOS D	3.9	28.2				
West: Cambridge Rd West Appr													
Lane 1	908	6.4	1877	0.484	100	0.9	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	908	6.4		0.484		0.9	NA	0.0	0.0				
Intersection	1748	6.0		0.766		5.1	NA	3.9	28.2				

LANE SUMMARY

▽ Site: 101 [Road 10 - Cambridge Rd Int, 2031 PM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	704	7.0	1870	0.376	100	0.2	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	64	3.0	638	0.101	100	9.6	LOS A	0.4	2.6	Short	60	0.0	NA
Approach	768	6.7		0.376		0.9	NA	0.4	2.6				
North: Road 10													
Lane 1	56	3.0	690	0.081	100	8.7	LOS A	0.3	2.0	Full	500	0.0	0.0
Lane 2	99	3.0	148	0.668	100	48.5	LOS E	2.7	19.1	Short	60	0.0	NA
Approach	155	3.0		0.668		34.1	LOS D	2.7	19.1				
West: Cambridge Rd West Appr													
Lane 1	957	6.6	1879	0.509	100	0.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	957	6.6		0.509		0.7	NA	0.0	0.0				
Intersection	1880	6.3		0.668		3.6	NA	2.7	19.1				

Stantec

6 April 2021

Mr M Smith
3Ms of Cambridge
211 Zig Zag Road
RD1
CAMBRIDGE

CC: matt@3msofcambridge.co.nz

Dear Matt,

C2 Growth Area, Cambridge - S92 Response: Traffic

Stantec has been asked to provide technical evaluation and advise in response to two matters set out in the Waipa District Council S92 request as follows:

Transportation and Roading

30. Please provide further detail related to design layout, operation and performance of the intersection of Road 10 with Cambridge Road and Chartwell Properties intersection on the opposite side to prove it will operate safely and efficiently. This may require traffic engineering support.

31. The Council remains concerned there is a limit to the traffic that can safely and efficiently use Road 10 and Road 8 without the north/south Collector Road being constructed. Please provide an assessment of this including identification of a limit on the number of lots and development that is appropriate before the north/south collector road and intersection is required.

These are addressed as follows:

In response to item 30:
Detailed design layout, operation and performance of the intersection of Road 10 with Cambridge Road and Chartwell Properties intersection

A plan has been prepared showing the detailed design layout of the Road 10 and Chartwell Properties intersections with Cambridge Road (**Appendix A**). The plan extends west to include the proposed Road 8 intersection with Cambridge Rad. By way of a summary, the plan shows the following:

- An extension of the existing central painted median west across the site frontage to provide for continuity and integration of the proposed Road 8 and Road 10 intersections with both the Chartwell Properties as well as the Kelly Road intersections;
- Road 10 is shown safely separated from the Chartwell properties intersection by about 81m;
- Sidra modelling (attached) shows the expected right turn queue on Cambridge Road waiting to access Road 10 to be less than 1.0 vehicle 95th percentile back of queue PM peak at 2031, well clear of the Chartwell Properties access road and adequately providing for drivers to taper into the right turn median waiting area ahead of making the turn;
- The painted median has a width of 3.0m safely providing for vehicles waiting on it clear of the adjacent through traffic lanes;

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TEL +64 7 577 0555

- The through traffic lanes are shown as continuing to provide for the current level of service at 3.5m with retention of the road shoulder areas.

By way of further observation it is noted that:

- The location of Road 10 is consistent with the location for an intersection as shown on the C2 area Structure Plan, Appendix S19 – Cambridge C1 and C2/C3 Structure Plans. These also anticipated the Chartwell Properties intersection;
- The location of the proposed Road 10 was known by Council with some certainty, through its engagements with the land-owner, at the time the Chartwell intersection was granted consent to develop and form the new intersection there;
- The proposed Road 10 is separated from Kellv Rd by about 130m;
- Road 8 is also shown separated from Road 10 by a further 230m;
- Safe intersection sight distances in excess of the Regional Infrastructure Technical Specification (RITS) and Austroads Guide to Road Design Part 3: Geometric Design guidelines. These specify safe stopping sight distances in the range 64m to 81m for an operating speed of 60km/h and a range of 83m to 102m for an operating speed of 70km/h. Development of the C2 growth area is expected to be commensurate with relocation of the speed restriction sign across the site frontage creating a 50km/h speed restriction and an expected 60km/h design speed environment. On-site observations have indicated that in excess of 150m is available.
- The ultimate C2 Structure Plan also identified the Road 10 eventually being formed with the planned C2 Collector Road and other wider transport network connections. The Waipa District Council Long Term Plan (LTP) identifies a range of staged transport network improvement projects including staged implementation of the C2 Collector Road and roundabout intersection with Cambridge Rd, being the long term strategic solution for the growth area and indicatively expected to be budgeted for 2021-2023 financial years. Other key local project allocations include:
    - C2/C3 Collector Roads and Green Belt Connection – Land: $11.15M, 21/22-28/29;
    - C2 & C3 Structure Plan roading: $25.14M, 21/22 – 30/31;
    - C1 Structure Plan Roading: $1.5975M, 24/25-26/27; as well as a range of
    - Urbanisation and cycleway project undertakings for Hamilton Road, Victoria Road and Kelly Road.
- Detailed engineering design of the intersections are recommended to be subject to an independent road safety audit. The safety audit recommendations shall be resolved to the satisfaction of Waipa District Council prior to the commencement of physical works on-site;
- A temporary traffic management plan shall be prepared by a suitably qualified person and submitted to Council for approval prior to the commencement of physical works on-site.

On the matters of design layout, operation and performance; and based on the assessments described above, it is concluded the proposed location of Road 10 is aligned with the Structure Plan operational intentions and is able to be safely formed and located as proposed.

In response to item 31:

Capacity performance of the intersection of Road 8 and Road 10 with Cambridge Road

The operational performance expectations for the proposed Road 8 and Road 10 intersections are assessed as follows.

Previous technical assessments of the potential for local trip generation due to both the C2 area as well as other growth areas generating demand effects on the Cambridge Road corridor have been determined by BBO Consultants for Council in consultation with Stantec acting for the applicant. The underlying and broader growth demands have also been factored in to forecast traffic demand expectations out to 2031 on the frontage and through the intersections in a consistent way with the basis of prior demand forecasts for the Structure Plan areas.

Those traffic generation assumptions for the C2 growth area have previously been based on the full site being developed as residential living. Current proposals however have identified that the "Super-Lot Site" proposed by 3Ms is to be developed as retirement living. A refined forecast of local traffic demands has therefore been developed to reflect the current proposal and development expectations.

The trip generation demand assessments are attached as **Appendix B** and are summarised as follows:

- Scenario 1 describes an assessment based on substantial development of the applicant's proposed C2 area on the 2021 transport network;
- Scenario 2 described full development of the applicant's proposed C2 Structure Plan area on the 2021 transport network; and
- Scenario 3 describes full development of the entire C1, C2 and C3 Structure Plan areas on a connected 2031 transport network.

The corresponding AM and PM distributed peak period turning demands at both Road 8 and Road 10 intersections are set out at **Appendix C**.

Modelled intersection performance characteristics for both the AM and PM peak periods for each of the Scenarios are set out at **Appendix D**.

By way of a summary, the following key results have been determined for the most critical of the intersection movements, the right turn from the C2 area onto Cambridge Road.

Table 1: Road 8 Intersection Right Turn Out Performance Summary

Intersection	Development Stage Description	Year	AM Peak Average Delay (s/veh)	PM Peak Average Delay (s/veh)
Road 8 - RT-out	C2 retirement village, 100 new +47 existing dwellings + school	2021	16.4	13.0
Road 8 - RT-out	Further C2 76 dwellings to full development scenario	2021	17.2	13.5
Road 8 - RT-out	Full C2 with Full C1 and C3 plus background growth	2031	35.0	50.2

Table 2: Road 10 Intersection Right Turn Out Performance Summary

Intersection	Development Stage Description	Year	AM Peak Average Delay (s/veh)	PM Peak Average Delay (s/veh)
Road 10 - RT-out	C2 retirement village, 100 new +47 existing dwellings + school	2021	18.1	13.6
Road 10 - RT-out	Further C2 76 dwellings to full development scenario	2021	19.7	14.4
Road 8 - RT-out	Full C2 with Full C1 and C3 plus background growth	2031	42.9	48.5

These results have been further accumulated into a graphical form to show the expected network performance together with other changes on the transport network.

Figure 1: Road 8 Intersection with Cambridge Road - Graphical Summary of Right Turn Out Performance

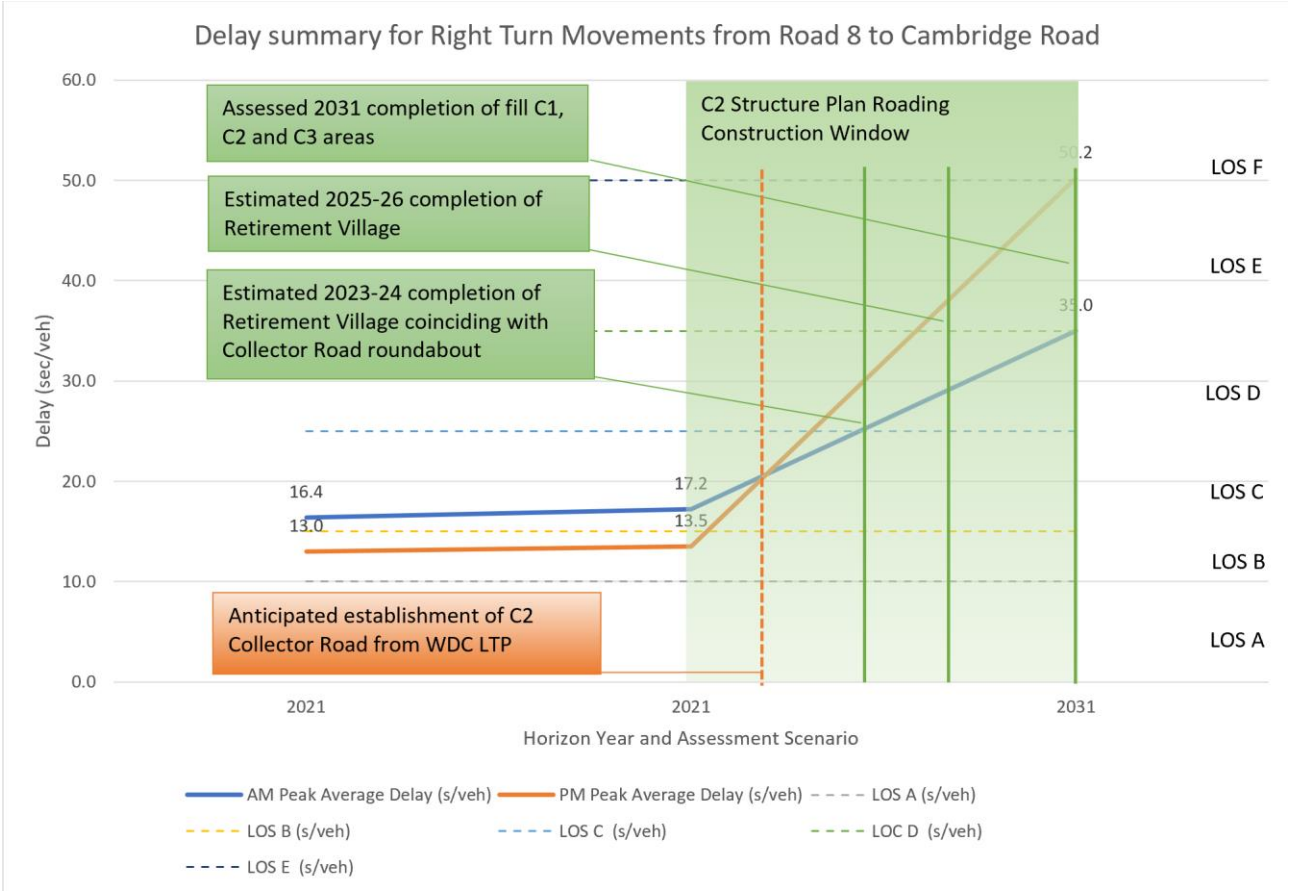
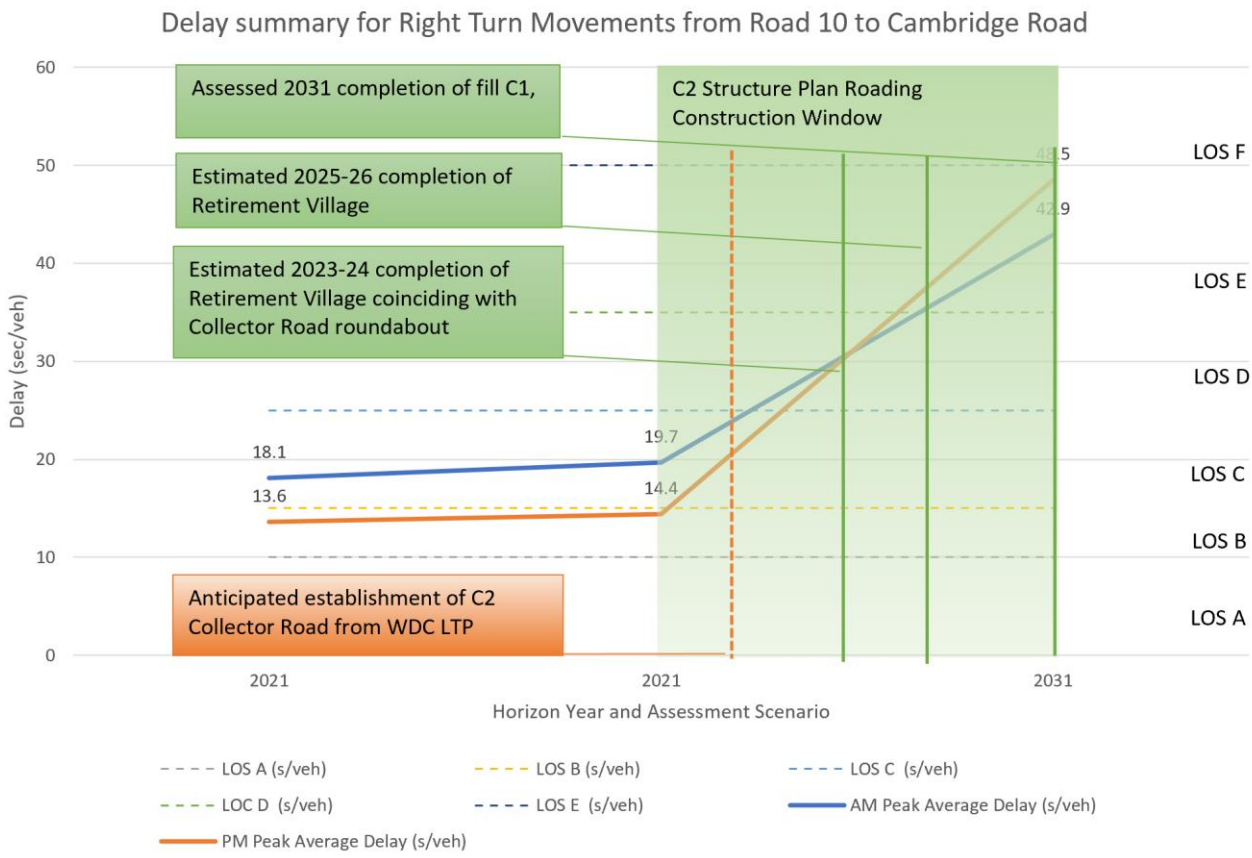


Figure 2: Road 10 Intersection with Cambridge Road - Graphical Summary of Right Turn Out Performance



The data and the graphs show the following features:

- Right turn out performance results for both intersections across all three scenarios;
- Results for both the AM and PM peak periods (s/veh);
- The green band on the graph highlights the 2021-31 period across which the range of works, provisioned within the Waipa District LTP, are expected to occur together with formation of the local road networks and connections comprising the C1, C2 and C3 Structure Plan Growth Cells;
- The green text boxes together with the vertical lines are intended to provide some indicative practical representation of the timeframe by which the C2 and surrounding C1/C3 development may be expected to be progressed / completed, having regard for construction timeframes. Importantly, this does not suggest a proposed development staging, but rather provides some practical context based on what is apparent at this time. It demonstrates alignment between strategic transport network planning and proposed development staging.

The results shown in the data sets and within the two graphs (for both Road 8 and 10 intersections) can be summarised as follows:

- Scenario 1, part development of the applicant's C2 growth area (refer **Appendix B**) indicates delay expectations in the range 13.0 to 18.1 s/veh on the right turn out movements, assuming it was to occur in 2021. This represents an operating level of service performance in the range LOS B to C, a relative efficient but not unencumbered level of service;

- Scenario 2 represents full development of the applicant's proposal, as if it were loaded onto the 2021 network. Again, with delay expectations for the right turn out movement in the range 13.5 to 19.7 s/veh (LOS B to C) an acceptably efficient level of performance is expected for this movement;
- Scenario 3 not only introduces 10 years of wider District growth demands, it further loads potential future and full development expectations for the remaining C2 as well as the C1 and C3 growth areas. The resulting change in traffic demands and local road connected network distributions suggests performance for the right turn out movement in the range LOS E (AM peak) to F (PM peak). In this regard, it is evident the applicant's C2 development proposal alone will readily be able to be accommodated.

  The graphs for Scenario 3 also represent full future trip demands from these growth cells, the results indicate some peak period delay effects, particularly in the PM period. The orange dashed line on the graphs indicates the expected early introduction, through the LTP, of the C2 Collector Road and Roundabout, which will provide the primary access/egress movement capacity for the C2 area. It can therefore be concluded that the applicant's proposal with respect to both Road 8 and Road 10 intersections will perform acceptably at the level of development intensity proposed and with the anticipated local road connectivity.

Conclusions and Recommendations.

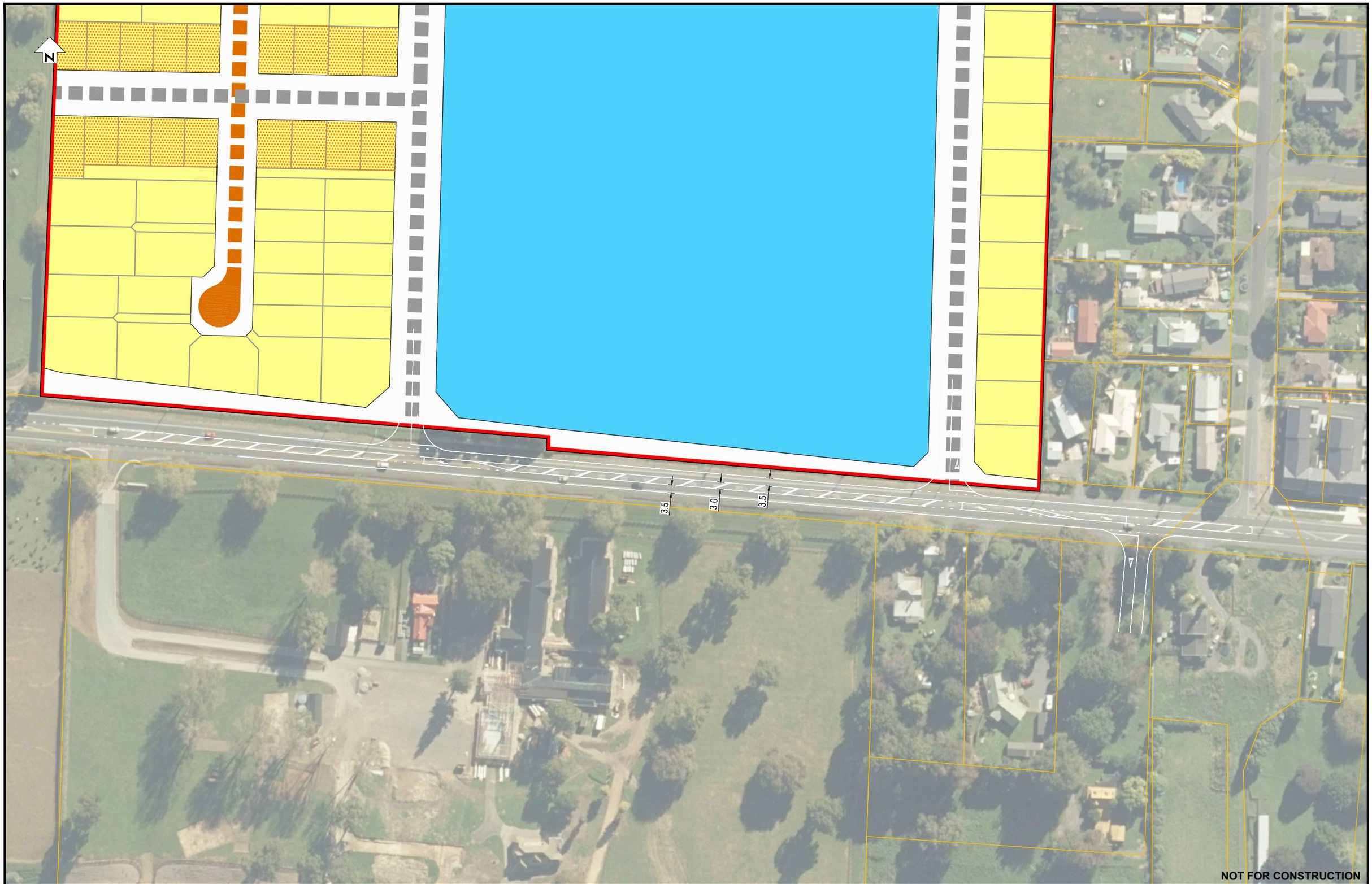
On the bases of these assessments the following conclusions are made:

- On the matters of design layout, operation and performance; and based on the assessments described above, it is concluded the proposed location of Road 10 is aligned with the Structure Plan operational intentions and is able to be safely formed and located as proposed; and
- The capacity and performance expectations for both Road 8 and Road 10 will be sufficient and appropriately timed to safely provide for the activities proposed, including in the first couple of years while construction is progressed and prior to the C2 Collector Road connection and roundabout.

Yours sincerely

Apeldoorn, Mark
Practice Leader: Transport Advisory
Stantec New Zealand

Appendix A: Plan showing the indicative arrangement for the Cambridge Road intersections.



REV	REVISIONS	DRN	CHK	APP	DATE
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
B	EXTEND PROPOSED MEDIAN	MS	-	-	06.04.2021
A	DRAWING CREATED	TL	MS	-	30.3.2021

SURVEYED		
DESIGNED	-	-
DRAWN	MATTHEW SPROULL	06.04.2021
CAD REVIEW	-	-
DESIGN CHECK		
DESIGN REVIEW		
APPROVED		
PROF REGISTRATION:		

Stantec

Client:

CAMBRIDGE ROAD RIGHT TURN BAYS
-

CONCEPT DRAWING
-

Status Stamp: **WORKING PLOT**
Date Stamp: **06.04.2021**
Scales: 1:500
Drawing No.: 310204689-01-B-1
Rev.: B

Appendix B: Road 8 and 10 Trip Generation Demand Forecasts

Stantec

2021 Part development in C2 Structure Plan area as follows:

According to the 2017 Structure Plan Transport Assessment, C2 and C3 yield is expected to be 1500-2000hh. Therefore adopt 1750hh. 400hh of these is in C3. Therefore, C2 = 1350hh
C1 yield expected to be 275-375hh. Therefore assume 325hh
Neighbourhood centre in C1 is 2.6ha. Assume 40% site coverage and 15 trips per peak pm hour generation

Mode Share Targets by 2041			**Expected = "1", Aspirational = "2"**
Active Modes	**10%**	Expected	1
Public Transport Internally	**5%**	Expected	1
Public Transport Externally	**10%**	Expected	1
Local Trips percentage split	**15%**	Within Zone C1, C2 or C3)	
External trips percentage split	**85%**		

Distribution split	AM		PM	
	In	Out	In	Out
Residential	20%	80%	55%	45%
School	55%	45%	45%	55%
School	70%	30%	45%	55%

2021 Part Development in C2

C1 2031

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	15%	85%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
Residential		1.2	Dwelling	0	0	0	0	0	0	0	**0**	**0**	0	**0**	**0**	0
						0			**0**							
Neighbourhood centre		8	100 sq.m/GFA	-	0	100%	0%	0	0	0	**0**	**0**	0	**0**	**0**	0

C2 2031

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	15%	85%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
3Ms	100	1.2	Dwelling	120	120	18	102	2	11	107	**21**	**86**	107	**59**	**48**	107
Ryman	80	0.4	Care beds	32	32	5	27	0	3	29	**6**	**23**	29	**16**	**13**	29
Ryman	46	0.4	Assisted Suites	18	18	3	16	0	2	16	**3**	**13**	16	**9**	**7**	16
Ryman	202	0.5	Townhouses	101	101	15	86	2	9	90	**18**	**72**	90	**50**	**41**	90
other		1.2	Dwelling	0	0	0	0	0	0	0	**0**	**0**	0	**0**	**0**	0
existing households	47	1.2	Dwelling	56	56	8	48	1	5	50	**10**	**40**	50	**28**	**23**	50
	475			328	328	**328**			**328**		59	234	293	161	132	293
Primary School	300	2	Pupils	600	60	90	510	9	56	536	**295**	**241**	536	**23**	**29**	52
						600			**600**							

C3 2021

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	15%	85%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
Chartwell and St Peters		1.2	dwelling	0	0	0	0	0	0	0	**0**	**0**	0	**0**	**0**	0
Te Awa Lifecare	32	0.4	beds	13	13	2	11	0	1	11						
Te Awa Lifecare	12	0.4	Unit	5	5	1	4	0	0	4	**16**	**16**	32	**16**	**16**	32
Te Awa Lifecare	11	0.5	apartments	6	6	1	5	0	1	5						
Te Awa Lifecare	25	0.5	villas	13	13	2	11	0	1	11						

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2021 Full Development in Applicant's C2 Structure Plan Area

According to the 2017 Structure Plan Transport Assessment, C2 and C3 yield is expected to be 1500-2000hh. Therefore adopt 1750hh. 400hh of these is in C3. Therefore, C2 = 1350hh
C1 yield expected to be 275-375hh. Therefore assume 325hh
Neighbourhood centre in C1 is 2.6ha. Assume 40% site coverage and 15 trips per peak pm hour generation

Mode Share Targets by 2041			**Expected = "1", Aspirational = "2"**
Active Modes	**10%**	Expected	1
Public Transport Internally	**5%**	Expected	1
Public Transport Externally	**10%**	Expected	1
Local Trips percentage split	**15%**	Within Zone C1, C2 or C3)	
External trips percentage split	**85%**		

	Distribution split			
	AM		PM	
	In	Out	In	Out
Residential	20%	80%	55%	45%
School	55%	45%	45%	55%
School	70%	30%	45%	55%

2021 Baseline - Full Development in 3Ms C2 Area

C1 2031

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	15%	85%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
Residential		1.2	Dwelling	0	0	0	0	0	0	0	**0**	**0**	0	**0**	**0**	0
						0			**0**							
Neighbourhood centre		8	100 sq.m/GFA	-	0	100%	0%	0	0	0	**0**	**0**	0	**0**	**0**	0

C2 2031

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	15%	85%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
3Ms	276	1.2	Dwelling	331	331	50	282	5	31	296	**59**	**236**	296	**163**	**133**	296
Ryman	80	0.4	Care beds	32	32	5	27	0	3	29	**6**	**23**	29	**16**	**13**	29
Ryman	46	0.4	Assisted Suites	18	18	3	16	0	2	16	**3**	**13**	16	**9**	**7**	16
Ryman	202	0.5	Townhouses	101	101	15	86	2	9	90	**18**	**72**	90	**50**	**41**	90
other		1.2	Dwelling	0	0	0	0	0	0	0	**0**	**0**	0	**0**	**0**	0
existing households	47	1.2	Dwelling	56	56	8	48	1	5	50	**10**	**40**	50	**28**	**23**	50
	651			539	539	**539**			**539**		96	385	481	265	216	481
Primary School	300	2	Pupils	600	60	90	510	9	56	536	**295**	**241**	536	**23**	**29**	52
						600			**600**							

C3 2021

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	15%	85%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
Chartwell and St Peters		1.2	dwelling	0	0	0	0	0	0	0	**0**	**0**	0	**0**	**0**	0
Te Awa Lifecare	32	0.4	beds	13	13	2	11	0	1	11						
Te Awa Lifecare	12	0.4	Unit	5	5	1	4	0	0	4	**16**	**16**	32	**16**	**16**	32
Te Awa Lifecare	11	0.5	apartments	6	6	1	5	0	1	5						
Te Awa Lifecare	25	0.5	villas	13	13	2	11	0	1	11						

2031 Full Development in C1, C2 and C3 Structure Plan Areas with Background Growth

According to the 2017 Structure Plan Transport Assessment, C2 and C3 yield is expected to be 1500-2000hh. Therefore adopt 1750hh. 400hh of these is in C3. Therefore, C2 = 1350hh
C1 yield expected to be 275-375hh. Therefore assume 325hh
Neighbourhood centre in C1 is 2.6ha. Assume 40% site coverage and 15 trips per peak pm hour generation

Mode Share Targets by 2041			**Expected = "1", Aspirational = "2"**
Active Modes	**10%**	Expected	1
Public Transport Internally	**5%**	Expected	1
Public Transport Externally	**10%**	Expected	1
Local Trips percentage split	**60%**	Within Zone C1, C2 or C3)	
External trips percentage split	**40%**		

	Distribution split			
	AM		PM	
	In	Out	In	Out
Residential	20%	80%	55%	45%
School	55%	45%	45%	55%
School	70%	30%	45%	55%

2041Baseline

C1 2031

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	60%	40%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
Residential	325	1.2	Dwelling	390	390	234	156	23	27	339	**68**	**271**	339	**187**	**153**	339
						390		**390**								
Neighbourhood centre	2.6	8	100 sq.m/GFA	-	2080	100%	0%	208	104	1768	**1238**	**530**	1768	**796**	**972**	1768

C2 2031

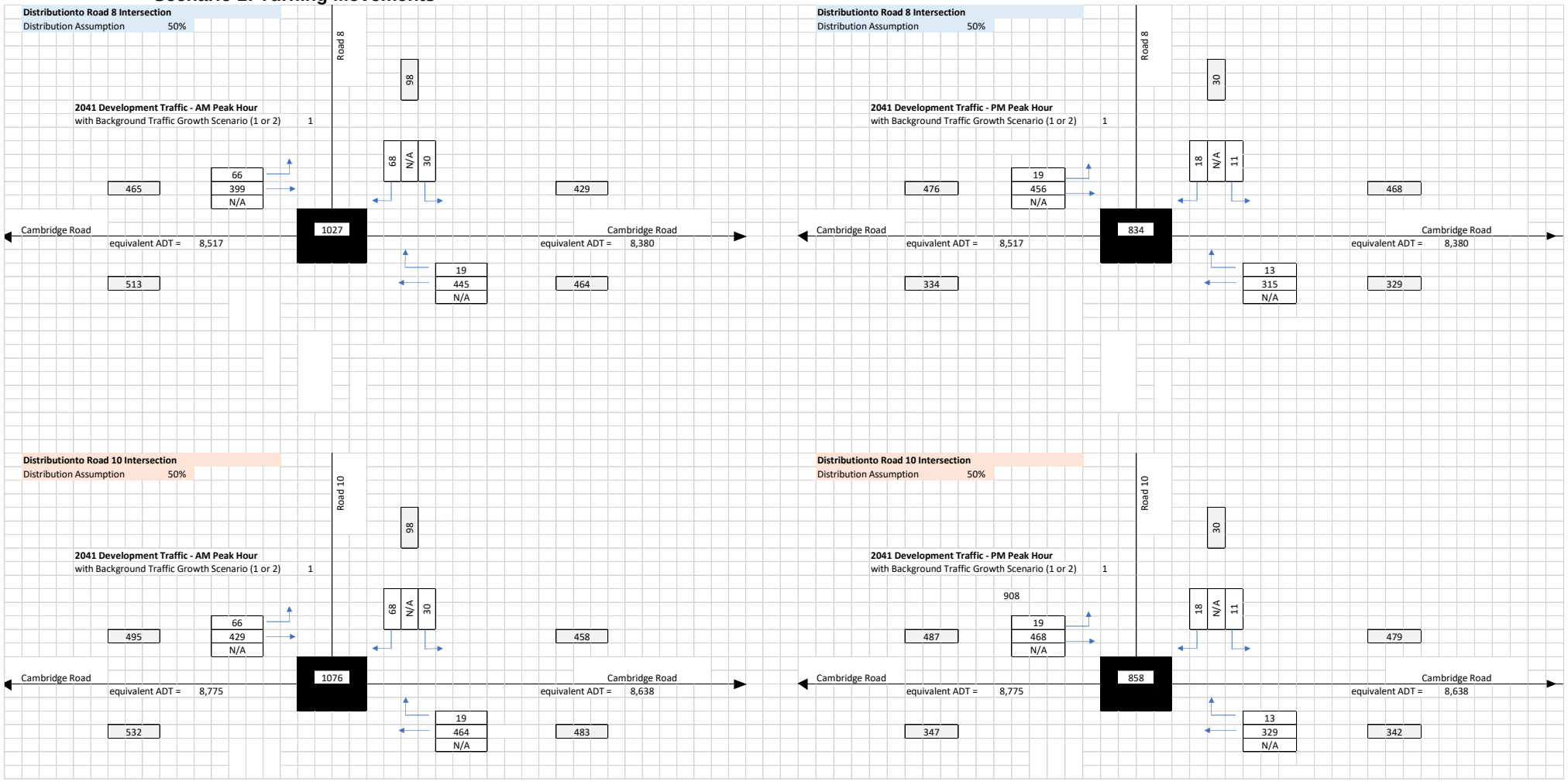
Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	60%	40%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
3Ms	276	1.2	Dwelling	331	331	199	132	20	23	288	**58**	**231**	288	**158**	**130**	288
Ryman	80	0.4	Care beds	32	32	19	13	2	2	28	**6**	**22**	28	**15**	**13**	28
Ryman	46	0.4	Assisted Suites	18	18	11	7	1	1	16	**3**	**13**	16	**9**	**7**	16
Ryman	202	0.5	Townhouses	101	101	61	40	6	7	88	**18**	**70**	88	**48**	**40**	88
other	703	1.2	Dwelling	844	844	506	337	51	59	734	**147**	**587**	734	**404**	**330**	734
existing households	47	1.2	Dwelling	56	56	34	23	3	4	49	**10**	**39**	49	**27**	**22**	49
	1354			1383	1383	**1383**		**1383**			241	962	1203	662	541	1203
Primary School	300	2	Pupils	600	60	360	240	36	42	522	**287**	**235**	522	**23**	**29**	52
						600		**600**								

C3 2021

Land use	Quantity	Peak Hour Trip Rate		Peak Hour Trips		Local Trips / hr	External Trips/hr	Mode Share			Peak Hour Vehicle Trips					
		Rate	Unit	AM	PM	60%	40%	Active Modes	PT	Veh	AM			PM		
								All Peaks			In	Out	Total	In	Out	Total
Chartwell and St Peters	400	1.2	dwelling	480	480	288	192	29	34	418	**84**	**334**	418	**230**	**188**	418
Te Awa Lifecare	32	0.4	beds	13	13	8	5	1	1	11						
Te Awa Lifecare	12	0.4	Unit	5	5	3	2	0	0	4	**15**	**15**	31	**15**	**15**	31
Te Awa Lifecare	11	0.5	apartments	6	6	3	2	0	0	5						
Te Awa Lifecare	25	0.5	villas	13	13	8	5	1	1	11						

Appendix C: The corresponding AM and PM distributed peak period turning demands at both Road 8 and Road 10 intersections

Scenario 1: Turning Movements



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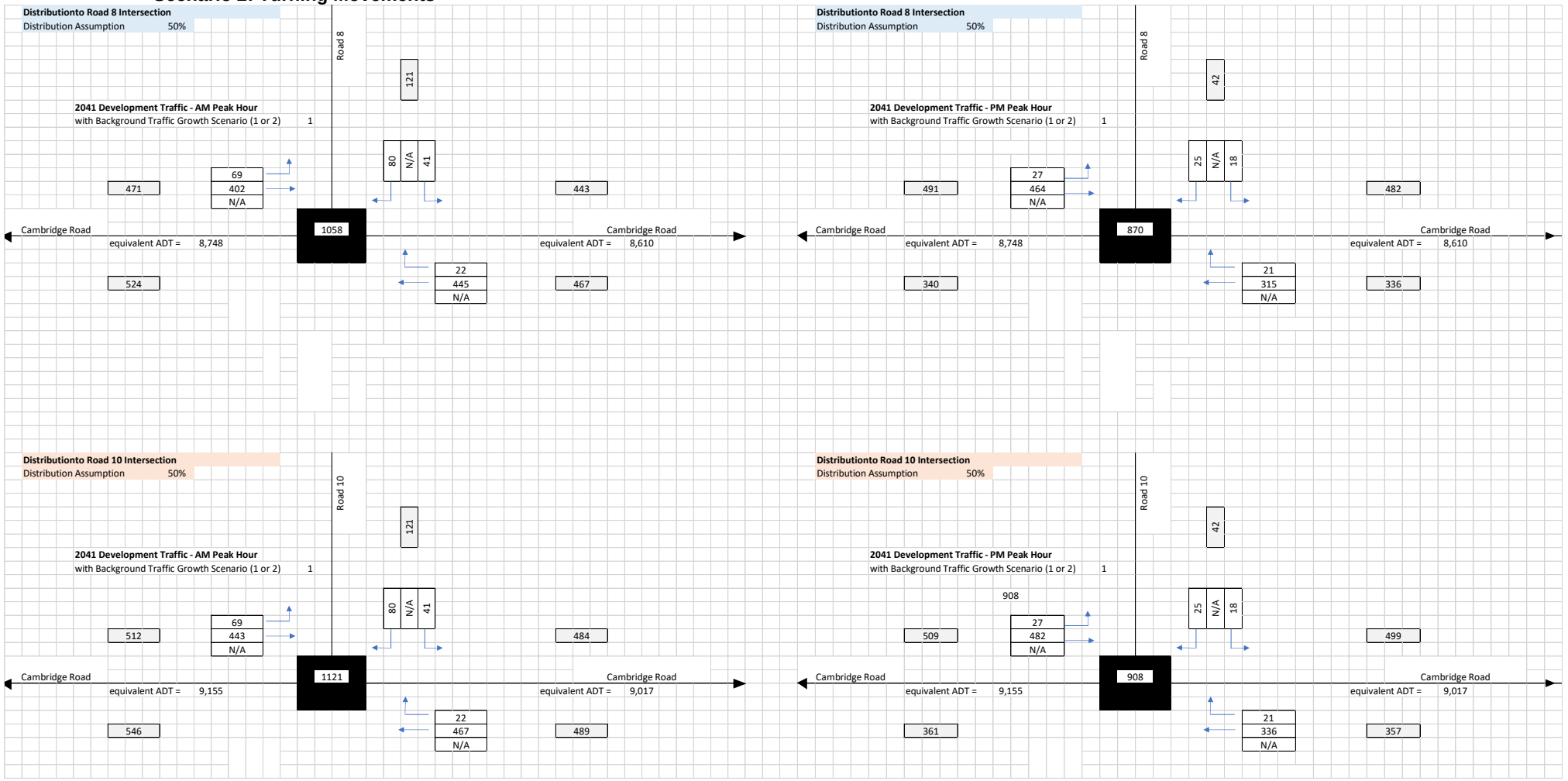
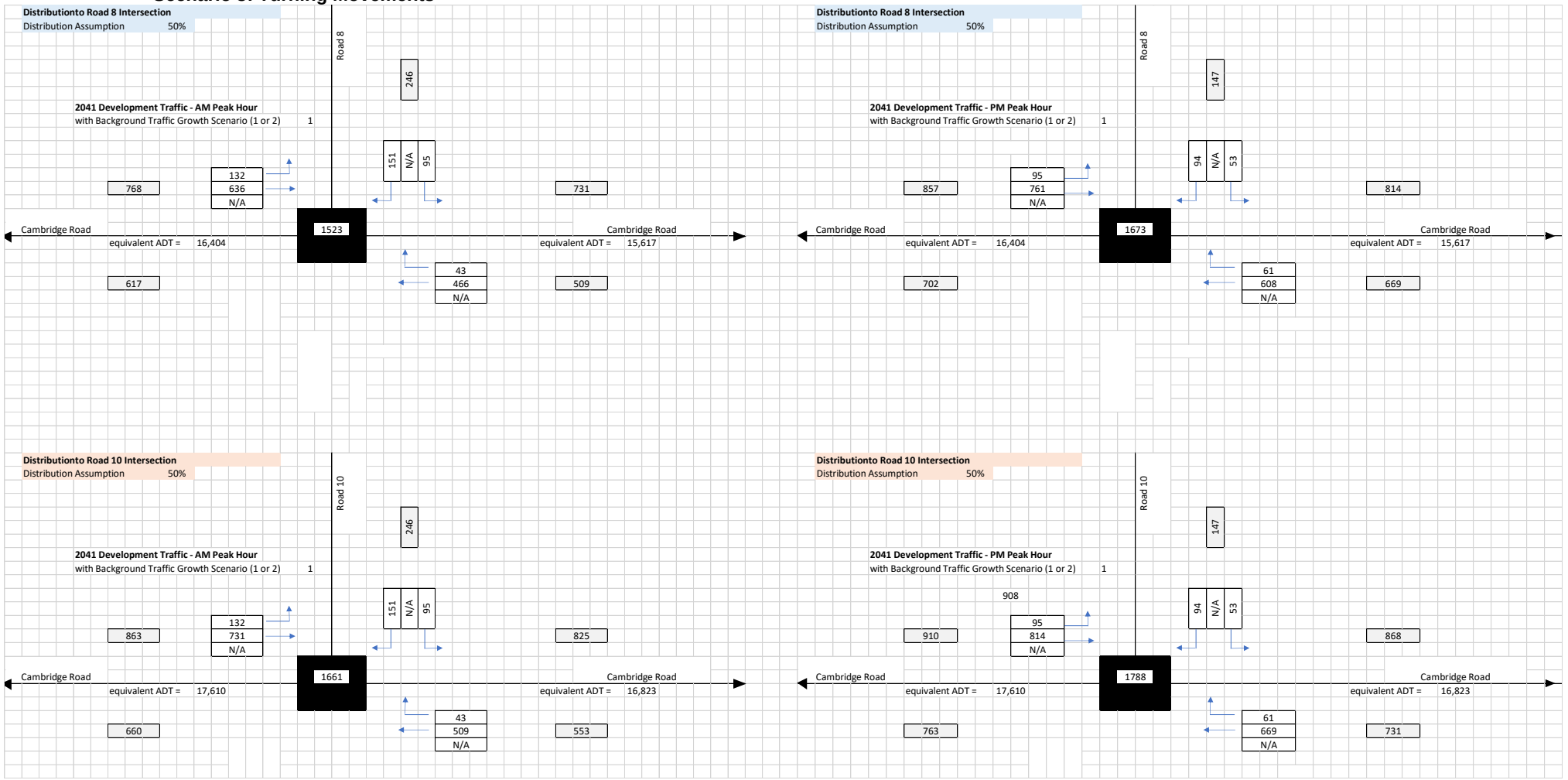
Ref Nos., Parent: 310204689, Child: Task 100

210406 3Ms C2 Growth Cell S92 Response - Traffic.docx

Scenario 2: Turning Movements



Scenario 3: Turning Movements



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Appendix D: Intersection Modelling Results

Scenario 1: Road 8 and 10, AM and PM, 2021 Results

LANE SUMMARY

▽ Site: 101 [Road 8 - Cambridge Rd Int, 2021 AM - Part Dev (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	468	7.0	1871	0.250	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	20	3.0	1050	0.019	100	6.5	LOS A	0.1	0.6	Short	60	0.0	NA
Approach	488	6.8		0.250		0.3	NA	0.1	0.6				
North: Road 10													
Lane 1	32	3.0	1055	0.030	100	6.2	LOS A	0.1	0.8	Full	500	0.0	0.0
Lane 2	72	3.0	312	0.229	100	16.4	LOS C	0.8	6.1	Short	60	0.0	NA
Approach	103	3.0		0.229		13.3	LOS B	0.8	6.1				
West: Cambridge Rd West Appr													
Lane 1	489	6.4	1878	0.261	100	0.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	489	6.4		0.261		0.7	NA	0.0	0.0				
Intersection	1081	6.3		0.261		1.8	NA	0.8	6.1				

LANE SUMMARY

▽ Site: 101 [Road 8 - Cambridge Rd Int, 2021 PM - Part Dev (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	332	7.0	1885	0.176	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	14	3.0	1034	0.013	100	6.6	LOS A	0.1	0.4	Short	60	0.0	NA
Approach	345	6.8		0.176		0.3	NA	0.1	0.4				
North: Road 10													
Lane 1	12	3.0	979	0.012	100	6.5	LOS A	0.0	0.3	Full	500	0.0	0.0
Lane 2	19	3.0	366	0.052	100	13.0	LOS B	0.2	1.3	Short	60	0.0	NA
Approach	31	3.0		0.052		10.5	LOS B	0.2	1.3				
West: Cambridge Rd West Appr													
Lane 1	500	6.8	1883	0.266	100	0.3	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	500	6.8		0.266		0.3	NA	0.0	0.0				
Intersection	876	6.7		0.266		0.6	NA	0.2	1.3				

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LANE SUMMARY

▽ Site: 101 [Road 10 - Cambridge Rd Int, 2021 AM - Part Dev (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	488	7.0	1871	0.261	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	20	3.0	1006	0.020	100	6.7	LOS A	0.1	0.6	Short	60	0.0	NA
Approach	508	6.8		0.261		0.4	NA	0.1	0.6				
North: Road 10													
Lane 1	32	3.0	1015	0.031	100	6.4	LOS A	0.1	0.8	Full	500	0.0	0.0
Lane 2	72	3.0	285	0.251	100	18.1	LOS C	0.9	6.7	Short	60	0.0	NA
Approach	103	3.0		0.251		14.5	LOS B	0.9	6.7				
West: Cambridge Rd West Appr													
Lane 1	521	6.5	1878	0.277	100	0.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	521	6.5		0.277		0.7	NA	0.0	0.0				
Intersection	1133	6.3		0.277		1.8	NA	0.9	6.7				

LANE SUMMARY

▽ Site: 101 [Road 10 - Cambridge Rd Int, 2021 PM - Part Dev (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	346	7.0	1885	0.184	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	14	3.0	1016	0.013	100	6.7	LOS A	0.1	0.4	Short	60	0.0	NA
Approach	360	6.8		0.184		0.3	NA	0.1	0.4				
North: Road 10													
Lane 1	12	3.0	963	0.012	100	6.5	LOS A	0.0	0.3	Full	500	0.0	0.0
Lane 2	19	3.0	349	0.054	100	13.6	LOS B	0.2	1.3	Short	60	0.0	NA
Approach	31	3.0		0.054		10.9	LOS B	0.2	1.3				
West: Cambridge Rd West Appr													
Lane 1	513	6.8	1883	0.272	100	0.3	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	513	6.8		0.272		0.3	NA	0.0	0.0				
Intersection	903	6.7		0.272		0.6	NA	0.2	1.3				

Scenario 2: Road 8 and 10, AM and PM, 2021 Results

LANE SUMMARY

▽ Site: 101 [Road 8 - Cambridge Rd Int, 2021 AM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	468	7.0	1869	0.251	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	23	3.0	1041	0.022	100	6.6	LOS A	0.1	0.6	Short	60	0.0	NA
Approach	492	6.8		0.251		0.4	NA	0.1	0.6				
North: Road 10													
Lane 1	43	3.0	1051	0.041	100	6.2	LOS A	0.2	1.1	Full	500	0.0	0.0
Lane 2	84	3.0	308	0.273	100	17.2	LOS C	1.0	7.5	Short	60	0.0	NA
Approach	127	3.0		0.273		13.5	LOS B	1.0	7.5				
West: Cambridge Rd West Appr													
Lane 1	496	6.4	1877	0.264	100	0.8	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	496	6.4		0.264		0.8	NA	0.0	0.0				
Intersection	1115	6.2		0.273		2.1	NA	1.0	7.5				

LANE SUMMARY

▽ Site: 101 [Road 8 - Cambridge Rd Int, 2021 PM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	332	7.0	1874	0.177	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	22	3.0	1011	0.022	100	6.7	LOS A	0.1	0.6	Short	60	0.0	NA
Approach	354	6.8		0.177		0.5	NA	0.1	0.6				
North: Road 10													
Lane 1	19	3.0	968	0.020	100	6.5	LOS A	0.1	0.5	Full	500	0.0	0.0
Lane 2	26	3.0	353	0.074	100	13.5	LOS B	0.3	1.8	Short	60	0.0	NA
Approach	45	3.0		0.074		10.6	LOS B	0.3	1.8				
West: Cambridge Rd West Appr													
Lane 1	517	6.8	1882	0.275	100	0.3	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	517	6.8		0.275		0.3	NA	0.0	0.0				
Intersection	916	6.6		0.275		0.9	NA	0.3	1.8				

LANE SUMMARY

▽ Site: 101 [Road 10 - Cambridge Rd Int, 2021 AM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	492	7.0	1868	0.263	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	23	3.0	982	0.024	100	6.9	LOS A	0.1	0.7	Short	60	0.0	NA
Approach	515	6.8		0.263		0.4	NA	0.1	0.7				
North: Road 10													
Lane 1	43	3.0	996	0.043	100	6.5	LOS A	0.2	1.2	Full	500	0.0	0.0
Lane 2	84	3.0	273	0.308	100	19.7	LOS C	1.2	8.5	Short	60	0.0	NA
Approach	127	3.0		0.308		15.2	LOS C	1.2	8.5				
West: Cambridge Rd West Appr													
Lane 1	539	6.5	1878	0.287	100	0.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	539	6.5		0.287		0.7	NA	0.0	0.0				
Intersection	1181	6.2		0.308		2.1	NA	1.2	8.5				

LANE SUMMARY

▽ Site: 101 [Road 10 - Cambridge Rd Int, 2021 PM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	354	7.0	1874	0.189	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	22	3.0	985	0.022	100	6.8	LOS A	0.1	0.6	Short	60	0.0	NA
Approach	376	6.8		0.189		0.5	NA	0.1	0.6				
North: Road 10													
Lane 1	19	3.0	945	0.020	100	6.7	LOS A	0.1	0.5	Full	500	0.0	0.0
Lane 2	26	3.0	329	0.080	100	14.4	LOS B	0.3	2.0	Short	60	0.0	NA
Approach	45	3.0		0.080		11.2	LOS B	0.3	2.0				
West: Cambridge Rd West Appr													
Lane 1	536	6.8	1882	0.285	100	0.3	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	536	6.8		0.285		0.3	NA	0.0	0.0				
Intersection	957	6.6		0.285		0.9	NA	0.3	2.0				

Scenario 3: Road 8 and 10, AM and PM, 2031 Results

LANE SUMMARY

▽ Site: 101 [Road 8 - Cambridge Rd Int, 2031 AM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	491	7.0	1873	0.262	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	45	3.0	751	0.060	100	8.5	LOS A	0.2	1.6	Short	60	0.0	NA
Approach	536	6.7		0.262		0.8	NA	0.2	1.6				
North: Road 10													
Lane 1	100	3.0	842	0.119	100	7.6	LOS A	0.4	3.1	Full	500	0.0	0.0
Lane 2	159	3.0	228	0.699	100	35.0	LOS D	3.5	24.9	Short	60	0.0	NA
Approach	259	3.0		0.699		24.4	LOS C	3.5	24.9				
West: Cambridge Rd West Appr													
Lane 1	808	6.3	1876	0.431	100	1.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	808	6.3		0.431		1.0	NA	0.0	0.0				
Intersection	1603	5.9		0.699		4.7	NA	3.5	24.9				

LANE SUMMARY

▽ Site: 101 [Road 8 - Cambridge Rd Int, 2031 PM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	640	7.0	1870	0.342	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	64	3.0	649	0.099	100	9.5	LOS A	0.4	2.6	Short	60	0.0	NA
Approach	704	6.6		0.342		1.0	NA	0.4	2.6				
North: Road 10													
Lane 1	56	3.0	705	0.079	100	8.5	LOS A	0.3	2.0	Full	500	0.0	0.0
Lane 2	99	3.0	146	0.680	100	50.2	LOS F	2.8	20.1	Short	60	0.0	NA
Approach	155	3.0		0.680		35.2	LOS E	2.8	20.1				
West: Cambridge Rd West Appr													
Lane 1	901	6.6	1879	0.479	100	0.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	901	6.6		0.479		0.7	NA	0.0	0.0				
Intersection	1760	6.3		0.680		3.9	NA	2.8	20.1				

LANE SUMMARY

▽ Site: 101 [Road 10 - Cambridge Rd Int, 2031 AM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	536	7.0	1872	0.286	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	45	3.0	689	0.066	100	9.1	LOS A	0.2	1.7	Short	60	0.0	NA
Approach	581	6.7		0.286		0.8	NA	0.2	1.7				
North: Road 10													
Lane 1	100	3.0	776	0.129	100	8.1	LOS A	0.5	3.3	Full	500	0.0	0.0
Lane 2	159	3.0	207	0.766	100	42.9	LOS E	3.9	28.2	Short	60	0.0	NA
Approach	259	3.0		0.766		29.5	LOS D	3.9	28.2				
West: Cambridge Rd West Appr													
Lane 1	908	6.4	1877	0.484	100	0.9	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	908	6.4		0.484		0.9	NA	0.0	0.0				
Intersection	1748	6.0		0.766		5.1	NA	3.9	28.2				

LANE SUMMARY

▽ Site: 101 [Road 10 - Cambridge Rd Int, 2031 PM (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Cambridge Rd East Appr													
Lane 1	704	7.0	1870	0.376	100	0.2	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	64	3.0	638	0.101	100	9.6	LOS A	0.4	2.6	Short	60	0.0	NA
Approach	768	6.7		0.376		0.9	NA	0.4	2.6				
North: Road 10													
Lane 1	56	3.0	690	0.081	100	8.7	LOS A	0.3	2.0	Full	500	0.0	0.0
Lane 2	99	3.0	148	0.668	100	48.5	LOS E	2.7	19.1	Short	60	0.0	NA
Approach	155	3.0		0.668		34.1	LOS D	2.7	19.1				
West: Cambridge Rd West Appr													
Lane 1	957	6.6	1879	0.509	100	0.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	957	6.6		0.509		0.7	NA	0.0	0.0				
Intersection	1880	6.3		0.668		3.6	NA	2.7	19.1				

Item	Matter	3Ms Response
		3Ms wishes to make it clear that the application is for the subdivision of the 3Ms site only. Part A of the application, and Appendix A, clearly set out that the application site is the 3Ms property. The application includes "updated Structure Plans" to demonstrate / illustrate how the outcomes of the Structure Plan can be achieved alongside the 3Ms "go alone" option. These "updated Structure Plans" also include the work that has been done through the Master Planning that Robin Walker has been running and Liam McCaffrey has been working on through his contract with Waipa District Council (i.e. the changes in the C1 Growth Cell). WDC have completed master planning of infrastructure requirements across all growth cells within the C1 and C2/C3 structure plan area to confirm the strategic infrastructure required to service these development areas. There a number of WDC infrastructure assets have been identified as being located within, or adjacent to, the 3MS development site which will need to interface and coordinate with the design of the 3MS development. Specific WDC projects these are as follows; · New C2/C3 Intersection and Cambridge Road Upgrade · C2 Eastern Stormwater Swale · C2 Terminal Wastewater Pump Station and Rising Main The proposed 3MS engineering solution demonstrates how these projects have been integrated into the "updated Structure Plans" and coordinated with the proposed 3MS development. 3Ms is not seeking that this updated "Structure Plan" be enshrined through this consent process, nor can this consent process legally do so given that the application is for a subdivision within the 3Ms land. It is entirely up to Waipa District Council as to how the Structure Plan outcomes can be achieved alongside the 3Ms "go alone" option, and the "updated Structure Plans" provide one such example as to how these outcomes can be achieved. In hindsight this could have been made clearer within the application. The consultation undertaken with landowners on the west of the 3Ms site has been done by 3Ms to smooth the path for Waipa District Council should it want to acquire that land.
Active Reserve / Sports Fields		
Mark Batchelor Meeting Summary Notes		
1	Replacement for the sports fields with a wet land is seen to present difficulties with adequate supply of sports fields for the demand contributed to by the population the 3M development will be part of.	**Response** See responses to Items 10 – 12.
2	Not providing these fields in this growth cell causes the Council to have to find other locations for these in the cell or outside it and this is not assured.	**Response** See responses to Items 10 – 12.
3	As the 3M community will contribute to this demand, there is expectation the fields will become required as it becomes populated.	**Response** Noted. See responses to Items 10 – 12.
4	Work is being done to find alternatives for the sports fields, a few issues are arising from this. Those identified at the meeting are; displaced sports activities from 3M development may present additional effects (traffic, parking, noise, extended hours of use, surface upgrading) from operation of receiving existing fields.	**Response** See responses to Items 10 – 12.
5	Loss of planned distribution of sports fields with convenient locations to surrounding community.	**Response** See responses to Items 10 – 12.
6	Alternative location in another growth cell relies on either successful acquisition or process to change the recipient structure plan for that other growth cell.	**Response** Agreed. However, a change to a Structure Plan is not necessarily required – this could be done by zoning an area active reserve via a district plan change, or by obtaining a resource consent to create the sports fields (where a discretionary activity consent is required if a development is not in accordance with a Structure Plan). Similarly, we consider that there is broad scope as to what "general accordance" with a structure plan means, so there is flexibility to do something slightly different in a Structure Plan area, and still be in "general accordance" with the Structure Plan. We note that the active reserve area shown on the structure plan is zoned "Deferred Residential" rather than "Deferred Reserve". 3MS are applying for a subdivision consent that is in general accordance with the approved structure plan. Whilst we recognise that there may be impacts for other properties (and the Council), that process sits with Council and is outside the scope of this subdivision application. However, 3Ms will be approaching each landowner again to obtain written support / opposition for council acquiring their land to assist the Waipa District Council. **Actions** • 3Ms to meet with Waipa District Council to discuss the playing fields (occurred on 17 February 2021) . 3Ms is keen to discuss whether Waipa District Council would prefer to upgrade existing facilities to provide for the needed playing hours, or whether acquisition a new area for the fields is the preference.

Item	Matter	3Ms Response
		• 3Ms to commence discussions with neighbouring landowners regarding the appetite for their properties to be acquired to provide for the playing fields, on the basis that Waipa District Council would be able to purchase the land in a timely manner.
7	Need to have this resolved as part of this proposal to ensure alternative available and practicable.	**Response** The 3MS proposal contains a significant amount of multifunctional active reserve, including a destination playground, integrated walking and cycling facilities, and significant landscaped areas. 3Ms can only control matters that is within its property boundaries. While there may be challenges acquiring land for sports fields (and other public infrastructure), there is sufficient area within the C2 Growth Cell to provide other areas of reserve (i.e. the sport fields). However, 3Ms will be approaching each landowner again to obtain written support / opposition for council acquiring their land. **Actions** • 3Ms to meet with Waipa District Council to discuss the playing fields (occurred on 17 February 2020). 3Ms is keen to discuss whether Waipa District Council would prefer to upgrade existing facilities to provide for the needed playing hours, or whether acquisition a new area for the fields is the preference. • 3Ms to commence discussions with neighbouring landowners regarding the appetite for their properties to be acquired to provide for the playing fields, on the basis that Waipa District Council would be able to purchase the land in a timely manner.
8	Initial thinking in the discussion was these effects might be a community wide effect.	**Response** 3Ms does not consider this to be a community wide effect. **Action** Further discussions with Waipa District Council regarding alternatives as outlined above.
9	Not sure a playground replaces the particular function and purpose provided by sports fields	**Response** The Structure Plan includes a destination playground as part of the Active Reserve, and its function is not as a replacement for the sports fields. 3Ms is still proposing to include this part of the Active Reserve within its development (i.e. part of the Active Reserve in the structure plan function). While there may be challenges acquiring land for sports fields (and other public infrastructure), there is sufficient area within the C2 Growth Cell to provide other areas of reserve (i.e. the sport fields). **Actions** • 3Ms to meet with Waipa District Council to discuss the playing fields (occurred on 17 February 2020). 3Ms is keen to discuss whether Waipa District Council would prefer to upgrade existing facilities to provide for the needed playing hours, or whether acquisition a new area for the fields is the preference. • 3Ms to commence discussions with neighbouring landowners regarding the appetite for their properties to be acquired to provide for the playing fields, on the basis that Waipa District Council would be able to purchase the land in a timely manner.
Anna McElrea Review of the Application (Summarised)		
10	**Issue - No provision for 2 playing fields, a cricket oval, changing rooms/toilets and carparking.** **Solution / Recommendation** Our clear preference is to retain the 2 sportsfields within C2 in the location shown in the Appendix S19 – Cambridge C1 and C2/C3 Structure Plans and provided for in resource consent (SP/0036/20). The assessment below is of the alternatives to these playing fields which we have been requested to investigate. *Additional upgrades to John Kerkhof Park to cater for playing hours.* It is noted that the application shows compact housing outside of the 3MS site adjoining John Kerkhof Park. While not opposed to this per se, it does increase the risk of reverse sensitivity issues associated with noise and light generated by the sport fields, particularly if upgraded to increase playing hours. This could potentially be addressed through the acquisition of a buffer reserve along John Kerkhof Park. The application makes no provision for road access and parking to the western side of John Kerkhof Park. This would be an important consideration as additional parking will likely be	**Response** 3Ms supports the approach to better utilising the existing sports fields in Cambridge and provide for additional upgrades to John Kerkhof Park. 3Ms (Matt Smith) has other ideas regarding utilisation of parks and reserves and we are happy to have these discussions with Waipa District Council to come up with a solution that provides the increase in playing hours required – these were discussed with Waipa District Council on 17 February 2021. There was an action on Waipa District Council to look at some of the options 3Ms presented. In respect to the point raised starting that the application making no provision for road access and parking to the western site of John Kerkhof Park, the 3Ms site does not back onto the park with other properties separating the 3Ms site from the park. While there is no roading connectivity, there will be walking and cycle paths along the east/west swale through the 3Ms site providing this connectivity. Residents within the C1 and C2/C3 Growth Cells can utilise the pedestrian pathways within the area to access the park. We are happy to work with Waipa District Council regarding the design of the walkways through the site. Waipa District Council could then implement /carry through these designs outside of the 3Ms site if it wishes. We note that the previous 3Ms Scheme Plan provided a 4.6 ha active reserve area (sports field and playground area). The total acquisition costs for Waipa District Council to acquire the land would have been approximately $7,130,000 (at $155/$m^2$). Richard Bax has confirmed that there is a process that Waipa District Council could follow to acquire the land in a timely manner, as needed, noting that Waipa District Council's "desire is to delay capital spend as long as practical, but if we need to secure land early then we can and will". It is also noted that it is not only the C2 Growth Cell who would utilise the sports fields – there would be district wide benefits.

Item	Matter	3Ms Response
	required cater for the increased usage of the playing fields and there will be no capacity for this to be provided within the existing Park. This option would likely generate further traffic issues at the Cambridge Road/Vogel Street intersection and along Vogel, Clare and Williams Streets. To support a high level of walking and cycling access to the fields, a wide accessway from the commercial centre and neighbourhood reserve through to the town belt is required. It is unclear how wide the proposed accessway is but it should be 10 – 12m wide – similar to those provided at St Kilda - with a 3m wide shared path. The costs associated with upgrading the fields to create the required playing hours will be similar to that estimated to develop the playing fields in C2 and will be included as part of the development contributions for C1-C3. There will however be no acquisition cost.	Any development contributions for parks and reserves are a matter for the Development Agreement process, rather than this consent application. 3Ms will work through the DA process with Waipa District Council. **Action** • 3Ms to meet with Waipa District Council to discuss the playing fields – this occurred on 17 February 2020. 3Ms is keen to discuss whether Waipa District Council would prefer to upgrade existing facilities to provide for the needed playing hours, or whether acquisition a new area for the fields is the preference. • Waipa District Council Parks / Reserves team to review the options presented by Matt Smith at the meeting. • Waipa District Council to confirm locational requirements of new sports fields – i.e. anywhere within the C2 Growth Cell? Or further afield? • 3Ms to commence discussions with neighbouring landowners regarding the appetite for their properties to be acquired to provide for the playing fields, on the basis that Waipa District Council would be able to purchase the land in a timely manner.
11	**Issue - Replacement of central large active reserve with 5,151m2 to east of site.** This is a significant reduction to the consented 3.42ha recreation reserve that was aligned to the structure plan and located more centrally within C2; adjoining the main north east arterial road, the school and the commercial centre. It represents a loss of almost 3 ha of public open space from the consented 3MS Plan and approximately 4ha from the quantum of public open space proposed in the Structure Plan. The key implication of this is that there is no sports field provision and the recreation reserve will be located further to the east and not adjacent to the school site or the main arterial road and stormwater swale. In addition to the loss of playing hours, other impacts include: • Reduced size to cater for play provision would mean the site would now only cater for a neighbourhood playground rather than a destination playground and would not be able to accommodate a skate facility. This will significantly increase the level of demand on the Cambridge Skate and Pump Track facility and other planned destination playgrounds and require vehicle transport to this facility. • Reduced size to cater for number of originally proposed large specimen trees. It is noted however that there will be some ability to offset this within the proposed stormwater reserves. • The reserve will be less visually accessible as it is no longer on the main arterial. This new location and reduced size is likely to negatively impact on the sense of place and legibility for C2. • Reduced ability to create strong community focal point. The reserve is still proposed to be located adjoining the commercial centre however its size and location will limit its ability to act as a major community hub for all of C1-C3. This change would trigger the requirement for a neighbourhood reserve to be developed west of the site. As noted in the urban design review, this may lead to smaller, inward looking neighbourhoods that are not knitted together. If this reserve and the proposed reserve to the north west of the site are developed as neighbourhood reserves, the majority of C2 residents will still be within 600m or 7min walk of a neighbourhood reserve rather than a 12.5min walk to a destination playground (see appendix 3). This is the provision level used by Auckland Council for low and medium housing densities. It is reduced to 400m for high density. The provision gap created by this change is for the north eastern section of C3. The proposed reserve distribution would be described as adequate rather than 'generous'; the latter being the aspiration set out in S19.2.3.7 of the Structure Plan which refers to five minute/400m walking circles from parks and open spaces. **Solution / Recommendation** - The perceived reserve size could be increased by integrated landscaping with the adjoining stormwater reserve.	**Response** There is no consented reserve on the site – the subdivision consent referenced created a lot size that would encompass the reserve. The sports fields would still then have had to be rezoned to Reserve Zone, or a land use consent granted to enable the playing fields to be located in the Structure Plan location. The Structure Plan shows an Active Reserve, consisting of sports fields and a playground, notionally within the 3Ms site. A Structure Plan does not require locations to be located exactly as per the Structure Plan. We also note that the underlying zoning of the area is Deferred Residential. This area was not zoned Deferred Reserve as part of Plan Change 7. This 3Ms application is seeking the creation of lots that will enable a large stormwater basin, swale areas and part of the Active Reserve – the playground facilities. This application does not preclude the ability to locate the sports fields (the balance of the Active Reserve shown in the Structure Plan) in the balance of the C2 Growth Cell (noting that 3Ms is seeking further engagement with Waipa District Council in respect of options). In respect of the comment regarding a neighbourhood playground, the application states that 3Ms is proposing a destination playground. The application stated that a water play park would be included, however this function has been removed following the meeting with Waipa District Council on 17 February 2021. This asset will be funded by 3Ms. For clarity, the current 3Ms playground proposal includes: • Playground equipment catering for all ages/abilities with feature tower/structure. • Separate concrete track with mounds for smaller kids to ride scooters/bikes etc • Exercise/ fitness circuit area • A skatepark (following this feedback from Waipa District Council). The below image shows the current playground area from the sketch up model (note more features and equipment to be added and discussed with Waipa District Council). **The design of the playground will need to be approved by Waipa District Council.**

Item	Matter	3Ms Response
	Consider increasing the reserve size to cater for a skate/pump track facility this would enhance the play provision within C1-C3, help create a community hub and reduce the impacts on the existing Cambridge skate/pump track facility. To ensure adequate reserve and play provision, it will now be necessary to develop the reserve to the west of the 3MS site as a neighbourhood reserve with a neighbourhood playground. This wasn't required to meet provision levels when the playground was in a different location and planned to be a destination playground.	 As per the normal process, this is just 3Ms proposal for the assets to be included within the playground area. We are happy to collaboratively work with Waipa District Council in respect of the final configuration of the play facilities. 3Ms will be proposing a large number of specimen trees across the development as a whole, and the landscape design team is currently working on plans. 3Ms is more than happy to share the plans with Council when appropriate. 3Ms does not consider that the size and location would limit the ability of the neighbourhood centre to act as a major community hub. 3Ms anticipates that the integrated reserve network, including the stormwater basin, walking and cycling tracks, fitness circuit, playground, water play part and the café will create a strong focal point. The location of the centre has been moved approximately 250 metres to the east than what is depicted notionally in the Structure Plan. In respect of the recommendations: • The entire 3Ms development will be integrated, including the stormwater reserve area and the active reserve area (the proposed destination playground). This is shown in the following screenshot from the current sketch up model. We have noted Anna McElrea's point from the meeting that pedestrian / cycling connectivity between the playground and stormwater reserve is an important part of making these areas fully integrated:

Item	Matter	3Ms Response

- 3Ms will incorporate a skate park accordance with this recommendation.
- Given that 3Ms is proposing a destination playground therefore we question the need for another neighbourhood playground (as per the below snip from our current sketch up model).

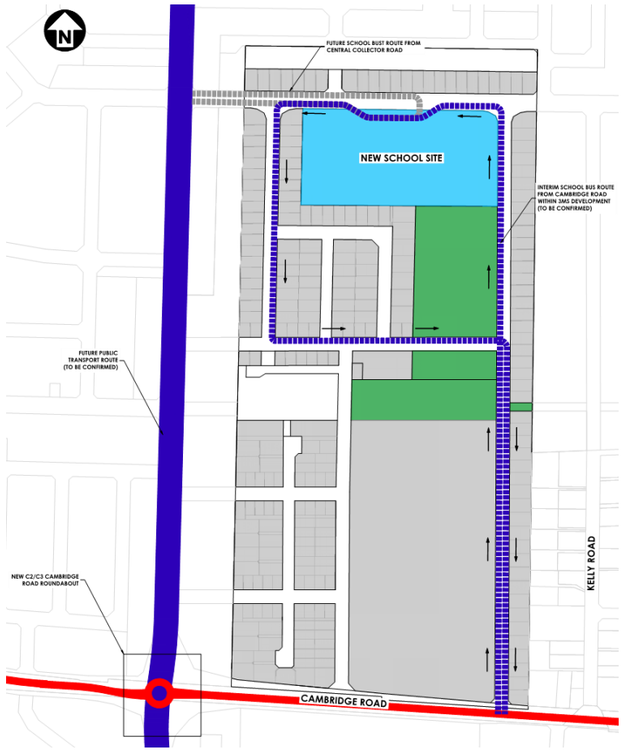
Actions

- Amend 3Ms playground plans to include a proposed skatepark.
- Meeting with Waipa District Council – occurred on 17 February 2021.
- Provide plans with Waipa District Council for approval prior to construction. This will allow for a collaborative approach.

12	**Issue - Addition of 2 new stormwater reserves**	**Response** 3Ms agrees that the reserves areas proposed provide opportunities to increase biodiversity and create significant (inclusive) recreation opportunities.

Item	Matter	3Ms Response
	The 2 new stormwater reserves totalling over 3.5ha provide a significant opportunity to increase the biodiversity within C2 and create recreation opportunities such as a walkways through native vegetation, a fitness trail and places to seek respite from busy urban lives. They could also have significant visual amenity value if well designed and maintained. The proposed location could be seen to meet the requirement to co-locate with areas of public open space in order to create multi-functional features of the Structure Plan areas (S12.2.3.8). It is noted however that there is a reasonable risk that if this approach to stormwater management is approved, it could likely result in similar approaches by other landowners within the wider development which may result in the loss of a catchment management approach and integrated swale network connecting down to the Waikato River. In addition to providing ecological and off-road trail corridors that connect communities to key destinations and the Waikato River, my understanding is that the structure plan approach would be more aligned to mana whenua's preference in managing stormwater. Concerns have been raised about the risks associated with this different approach to stormwater management on the wider area's slope stability – particularly with regards to the terraces and river banks in C3. **Solution / Recommendation -** Address risk that developers of adjoining sites won't take similar individual site approach to stormwater management that would result in a unconnected stormwater reserves rather than the planned holistic and integrated stormwater network envisaged in the Structure Plan. Provide information sought by DEs and Waters with regards to impacts associated with revised stormwater approach on slope stability and erosion.	The second part of this matter, relating to the risks of other land owners also seeking a standalone stormwater option, is trickier to address. As with most Structure Plan areas, there is often a chance that alternative servicing solutions will be sought by individual developers given the location of future public assets has not been fixed through, for example, a formal designation process. While this question is a key question for Waipa District Council as the decision maker for subdivision consents, 3Ms considers that given the nature of the fragmented ownership of the balance of the C2 Growth Cell (being in smaller lots, and in multiple ownership and most of those owners not being developers), it would be more cost and time effective for other development to rely on the public infrastructure and having that public infrastructure in place prior to further development within the C2 Growth Cell. As we see it, this risk can be mitigated in two ways: • Playing emphasis on the staging plan in the Structure Plan whereby the owners to the west of the 3Ms site are in Stage 2 and mostly in Stage 3; and • Waipa District Council constructing the necessary stormwater infrastructure in a timely manner and prior to further development (or alternatively, allowing for some temporary solutions before connections to the swale is formed) in accordance with the Staging Plan. It is also noted that the 3Ms subdivision consent also allows for connectivity through the development via the east/west swale through to the main trunk north/south swale. It is our understanding that tangata whenua support stormwater being managed at source, including discharge to ground (i.e. no direct discharge of stormwater to the Waikato River from the 3Ms development). **Actions** • Further discussions had in respect of this point where needed. As detailed in these responses, 3Ms will continue to work with neighbouring landowners to assist the Waipa District Council with any potential future discussions regarding land acquisition for an infrastructure corridor. • Beca technical hydrogeology assessment to be provided to Council when complete.
13	**Issue - No provision of NS swale and WE swale from NS arterial to the townbelt.** The Structure Plan has a clear north south and east west reserve system connecting residents to key destinations such as the school, town belt, active reserve and Waikato River. The application proposes the north south swale is provided for west of their site and that the east west swale only extends between their property boundary. The proposed changes risk the loss of this clear system if the applicant's proposed layout for beyond their site is not realised. This would appear to be a real risk given the direction this application has taken. There is also a loss of amenity and connection with regards to the walk and cycling connections. These effects are largely localised to C2. **Solution / recommendation** - Provision of swales on either side of the linear reserve connecting through to the north south swale through C2 and the town belt.	**Response** The 3Ms application is for the subdivision of the 3Ms site. Any details shown on the 3Ms integrated structure plan outside of the 3Ms site are examples of how the wider structure plan area could integrated with the 3Ms standalone development. As such, it is not in 3Ms control as to whether there is an east/west swale system outside of the 3Ms site. The 3Ms integrated structure plans in the application include the Master Planning work that has been undertaken by Robin Walker and his team. This process has led to refinements in the stormwater conveyance system such as piping more areas to reduce the cost of acquiring the land (swale footprint plus lateral spread setback area and constructing and maintaining the swale system). This is a matter that will need to be discussed internally with Waipa District Council in respect of the outcomes sought. **Actions** • 3Ms to discuss with Anna McElrea the master planning that we are aware of, and how this has been integrated into the proposal. • Internal discussions within Waipa District Council regarding the Master Planning that has been undertaken (and any impacts on the reserve areas through piping of stormwater swales).
14	**Issue - Amenity and safety** On page 115 of the application, it is noted that there may be some non-compliances with Rule 2.4.2.21 regarding the height and visible permeability of fences. This will be assessed at the individual dwelling level. This is a concern the structure plan clearly outlines under S19.2.3.3. that the provision of low, visually permeable fences is an important design element to maintain and enhance the existing local character of Cambridge. **Solution / Recommendation** - Adhere to the District Plan rules related to fencing or provide mitigation to still achieve the desired amenity and level of casual surveillance.	**Response** This matter is not within the scope of the current application. Any non-compliance with the rules in the District Plan requires resource consent. The merits of any such proposal would be addressed through that resource consenting process. **Action** None for subdivision consent process, but any non-compliance with the rule in the district plan will need to be assessed in the land use consent process (and mitigation provided where needed). 3Ms to keep this concern in mind.
General Engineering		

Item	Matter	3Ms Response
15	**Issue - DA and IWA are required for the trunk water supply and wastewater pump station(s?) with associated rising main(s).** The developer is required to enter into a Development Agreement (DA) and Infrastructure Works Agreement (IWA) with council to provide these key services, including land for the pump station(s). Council will determine in conjunction with the developer the location of the infrastructure and agree payment for the works. The DA will also include the Development Contributions payable by the developer. **Response/solution** - DA and IWA to be entered into between council land the developer as part of the consenting process.	**Response** 3Ms is currently in the process of working through the IWA process with Robin Walker. We have been informed that the IWA cannot be finalised until after the consent process has been completed. In respect of the Development Agreement, 3Ms is concerned that the DA process would muddy and delay the Subdivision Consent process. Should the consent application be granted, 3Ms is happy to commence the DA negotiation process and is happy to accept a consent condition in that regard (i.e. s224c cannot be obtained until the DA is in place). However, during the meeting with Richard Bax and Mark Batchelor, 3Ms agreed to commence this process shortly. **Actions** • "Detach" from the Resource Consent process – these should run parallel. • 3Ms continue to work with Robin Walker regarding the IWA. • Richard Bax stated that 3Ms has received a DA from Waipa District Council. 3Ms review the records and any DA that was provided as part of the previous work that was undertaken and update as necessary.
16	**Issue - A wastewater wet well 7 m deep (over 5.5m required) would require an on- site pump lifting structure.** Council is paying for the wastewater pump station and will be the owner. It needs to be satisfied that the solution provided is the best possible. **Response / Solution -** The developer will need to work with council on the best whole of life solution – and this may be requiring a shallower pump station and another one. These details can be resolved at an engineering design stage.	**Response** Noted. **Action** Will work with council at the engineering design stage.
17	**Issue - Proposed local SW pond, swales and reserves to be vested in council.** Why would council want to maintain them if it has a larger swale solution already and it is still needed anyway? **Response / Solution -** 3Ms do not use a local solution and use the already designed swale option.	**Response** 3Ms considers that there are some refinements that can be made to the wider swale / stormwater system to account for the reduction resulting from 3Ms using an onsite solution. As the council is yet to acquire the corridor required for the stormwater swale (and no apparent timeframes to do so), the 3Ms standalone stormwater basin is the only option to progress the 3Ms development and get sections onto the marked in a timely manner at the present time. Both the 3Ms standalone stormwater solution, and the Structure Plan solution required a degree of maintenance. In the operative Structure Plan Waipa District Council would be required to maintain assets closer to source such as raingardens. With the standalone option, the maintenance of the stormwater system is largely confined to the stormwater basin. 3Ms considers that the standalone option is cost neutral from a maintenance perspective. **Action** 3Ms would like the opportunity to work with Waipa District Council (Robin Walker) to investigate how the stormwater system could be optimised, and have stated this to Council senior managers.
18	**Issue - Page 418 references Waipa DM 2015** No longer in use **Response / Solution -** Delete reference and do not use**.**	**Response** Noted. **Action** None.
19	**Issue - Page 419 references AC TP 10 for SW – should be using WRC guidelines and consent conditions std** No longer use AC TP10. **Response / Solution** - Delete reference and do not use AC TP10, but the WRC guidelines	**Response** Noted. **Action** Any further work will not reference this standard.
20	**Issue - Page 430 6.3.1 – no mention of WRC consent conditions to be met?** Recognise the WRC resource consent and the conditions. **Response / Solution -** Reference C1 C2 C3 WRC resource consent conditions.	**Response** The resource consent obtained from WRC authorising the stormwater management approach in the growth cells is a consent between Waipa District Council and the Waikato Regional Council. Waipa District Council are required under that consent to ensure that private developers comply with the consent – the Stormwater

Item	Matter	3Ms Response
		Management Plan is the key tool for this (i.e. if a proposal complies with the SMP then it is compliant with the consent conditions). Britta Jensen has confirmed that the proposal meets the requirements of the SMP (as detailed in Item 41). Given the size of the proposed stormwater basin as a large asset (which will be public in future, Waipa District Council will need to obtain detailed design approval from the Waikato Regional Council under the conditions of that consent. 3Ms is more than happy to facilitate or be involved in this process. **Action** Following 3Ms discussions with Mark Batchelor and Richard Bax, 3Ms is more than happy to discuss the proposal with Waikato Regional Council and seek that Waipa District Council confirm to WRC that they are happy with 3Ms approaching regional council directly to discuss the consent. Meeting tentatively set for 25 February 2021.
21	**Issue - Public Transportation - a school and development with no bus routes?** Public Transportation is a key to the success of transportation in Cambridge and in particular, new growth cells. **Response / Solution -** Address Public Transportation in C2 growth cell in the application.	**Response** The 3Ms development, when integrated with the wider public transport network planned within the C2 growth cell this will deliver the outcomes sought by the approved structure plan. **Action** Richard Bax explained that the key issues was ensuring that there was an interim solution for public transport until the north/south collector road is formed. The following diagram shows a possible interim school bus route within the 3Ms development, utilising local Road 10, to facilitate School movements ahead of the delivery of the wider collector Roading network by Waipa District Council. The final configuration will be confirmed through the detail design. 
22	**Flood hazard mapping recent modelling work impacts?**	**Response** Flood modelling was undertaken as part of the consenting process for the C1 and C2/C2 Growth Cells stormwater discharge specifically. **Action** None, unless further information is sought by Waipa District Council in respect of this matter.
23	**Issue - What if WDC cannot obtain the collector road and swale land?**	**Response**

Item	Matter	3Ms Response
	The application is based on council providing the swale and stormwater and collector road solutions in a location other than on 3Ms land. **Response / Solution -** This places a large and potentially expensive and time consuming imposition on council. What would it do if it can't get the land and the infrastructure solutions? It would limit completely or partially the 3Ms development	3Ms acknowledges that Waipa District Council will now be required to acquire land from multiple landowners in the C2 Growth Cell, rather than just 3Ms. However, as shown by the experience undertaken with Waipa District Council and 3Ms in respect of land acquisition, it was already an expensive and time-consuming process detailing with just 3Ms. Notwithstanding this, 3Ms is still actively discussing the proposal with neighbouring landowners in an attempt to smooth the way for council acquiring the land and provide assistance to Waipa District Council in this regard. Following the meeting had on 15 February 2021, 3Ms has committed to undertake further discussions with the landowners which the 3Ms "updated Structure Plan" shows as having the north/south infrastructure corridor on their properties. 3Ms will approach each landowner (face to face) to obtain their response to the question of whether they would support Waipa District Council acquiring their land for the public infrastructure. The landowners identified in the resource consent application and AEE will be those 3Ms approaches. If Waipa District Council has any further thoughts on these discussions, we would welcome feedback. While 3Ms will assist in providing Waipa District Council some certainty, the 3Ms "go alone" option that is the subject of this application allows Waipa District Council to work with the adjacent landowners with regards to the land required for public works following the discussions that 3Ms has with them. This allows Waipa District Council to secure the land well in advance of the public capital works locking in the roading / stormwater corridor for the benefit of the adjoining growth cells: • The land parcels to be acquired from the adjacent landowners are smaller requiring WDC to purchase all and not just a portion the individual landowners property. The question of betterment cannot be argued as the before and after value are the same. 3Ms has spoken with many of the landowners who understand that their land might need to be acquired; many of them are looking for certainty so that they can plan their futures. The properties could be purchased with the owners remaining tenants of the properties until such time as WDC requires the land for capital works. • 3Ms has said to senior council staff that it would purchase any surplus land that is adjacent to its boundary if Waipa District Council were to purchase the properties within the next six months at the same cost paid by the Waipa District Council. This would increase the efficiency of the land purchased and reduce WDC's overall land acquisition costs. • The 3Ms "go alone" option is supported by Te Awa Lifecare (who have provided written approval so any effects on them can be disregarded) who are prepared to legally challenge Waipa District Council if the current Structure Plan (the location of the Cambridge Road intersection) is pursued. The 3Ms option addresses Te Awa's concerns and allows them to pursue their commercial activities without WDC spending significant money and resources in dispute with Te Awa. • If a landowner becomes difficult, Waipa District Council will have the time to work through the Public Works process without compromising Cambridge's economic well-being and Waipa District Council's ability to align with its National Policy Statement on Urban Development requirements. The application is not based on council providing the swale / stormwater solution and collector road in a location in other land than on 3Ms. The 3Ms development does not rely on the north/south swale or the collector road – it is standalone. However, council is required to secure an infrastructure corridor in the C2 Growth Cell to be able to effectively service the balance of the C2 (and possibly C1) Growth Cell. 3Ms is happy to assist Waipa District Council in discussions with neighbours to ensure that this does not eventuate. <u>Council not being able to secure the land would not limit the 3Ms development, as outlined in the resource consent application and assessment of environmental effects.</u> **Actions** • 3Ms to continue discussions with neighbouring landowners (those identified in the AEE). • 3Ms to obtain written confirmation from those landowners that they would support or oppose Waipa District Council acquiring their land for public assets. • 3Ms to provide this advice to Waipa District Councill.
24	**Issue - Land is still required from 3Ms for the RBA and wastewater pump station(s?), west/east collector road?** Council and 3Ms will need to reach agreement on the acquisition of land for the wastewater pump stations(s) and potentially land at the Cambridge Road roundabout **Response / Solution -** The standard Public Works Act process for land acquisition is agreed and followed by council and 3Ms.	**Response** Noted. **Action** We are happy to work with the Waipa District Council regarding land acquisition.
25	**Issue - Who manages and runs the CCTV system?** The application says that a CCTV is going to be provided but it is not clear who will operate it. There are requirements regarding privacy of these systems.	**Response** Noted. **Action** 3Ms will work with council as suggested. 3Ms suggests that these discussions are had in the Development Agreement forum.

Item	Matter	3Ms Response
	Response / Solutions - 3Ms will need council agreement before a CCTV system is installed and clarify who and how it will be operated	
26	**Issue - Cambridge Rd NZTA designation status impact?** As Cambridge Road is still designated SH1. **Response / Solutions -** 3Ms to clarify with NZTA and their requirements if any	**Response** 3Ms understands that the revocation process has occurred and as such, Waipa District Council is the road controlling authority. 3Ms is not proposing to speak to Waka Kotahi in respect of this matter. **Action** None.
27	**Issue - 3Ms do not expect to pay SW DC's.** If 3Ms do not pay other developers in the areas of C1 C2 C3 C7 growth cells will need to cover the cost. **Response / Solutions -** The impact of the 3Ms on-site solution is unlikely to have a significant reduction of the SW land, swales and planting costs.	**Response** Noted. However, if 3Ms is not utilising the stormwater infrastructure for its development that the DCs are being levied against, then DC's should not be payable. In respect of the comment regarding the 3Ms on-site solution is unlikely to have a significant reduction of the SW land, swales and planting costs no work has been done to qualify this statement. 3Ms does consider that the public system can be optimised to account for the reduction in stormwater flows (including more piping for example). Further, additional capacity in the public swale system is also enabled through the 3Ms development not utilising the swale system. 3Ms has offered Waipa District Council to undertake this work. Notwithstanding the above, this is a matter for discussion and negotiation within the Development Agreement process and is not within the scope of this subdivision consent application. **Action** • Richard stated that 3Ms has received a DA from Waipa District Council. 3Ms review the records and any DA that was provided as part of the previous work that was undertaken and update as necessary. DA discussions to be progressed in parallel to the resource consent process.
28	**Issue - Who pays for the playground?** The application suggests 3Ms will pay for the playground. **Response / Solutions** - Council staff need to sign off on the design and equipment proposed. As this the developers desire, DC's are till payable for Parks.	**Response** 3Ms will work with Council staff regarding the final design for the playground and the equipment proposed. 3Ms is currently preparing the documentation in respect of what 3Ms proposes for the playground area and will present this to Waipa District Council in due course. This will then trigger the necessary discussions with Council staff. In respect of Development Contributions, this is a matter for discussion and negotiation within the Development Agreement process and is not within the scope of this subdivision consent application. DA discussions will commence shortly. In respect of the last comment regarding the developer's desire, we note that a playground was part of the Active Reserve's function as shown in the Structure Plan. **Actions** • 3Ms to progress the design of the playground and present this to Waipa District Council and commence discussions. Waipa District Council to sign off the final design / equipment of the playground as per standard practice. • Richard stated that 3Ms has received a DA from Waipa District Council. 3Ms review the records and any DA that was provided as part of the previous work that was undertaken and update as necessary. DA discussions to be progressed in parallel to the resource consent process.
Britta Jensen – Water and Wastewater		
29	I can confirm that Waters have looked at water and wastewater and we have no issues with these aspects of the proposal.	**Response** Noted. **Action** None.
Stormwater		
Mark Batchelor Meeting Summary Notes		
30	Effects upstream and downstream on discharge requirements of other growth cells, particularly as the proposal includes ultimate discharge of stormwater to a drainage system serving the other growth cells.	**Response** This proposal does not include the discharge of stormwater from the 3Ms development into the wider public system.

Item	Matter	3Ms Response
		Action None.
31	Ensuring ability (practical and legal) to connect by other growth cells without Council financial contribution being required or some form of restraint on access existing or occurring.	**Response** The 3Ms application is consenting the 3Ms development only. This includes provision for the east/west swale that conveys stormwater from outside of the 3Ms development into the main north/trunk swale. 3Ms is proposing to vest the east/west swale system to convey stormwater into the public system. **Actions** Progress Development Agreement discussions.
32	Effects on financial contributions payable and effects of this on adequacy of funds for balance of SW system development through neighbouring growth cells that fees from the 3M project might contribute towards.	**Response** There may be implications of the 3Ms standalone stormwater option on the DC's payable by other developers in the growth cell, and may be positive, however these cannot be quantified until Waipa District Council confirm location of the stormwater network. 3Ms will not be contributing any stormwater from its development into the public system, and therefore stormwater DCs should not be payable. **Actions** Progress Development Agreement discussions.
33	Need to check soakage capacity of site for onsite soakage.	**Response** 3Ms has now undertaken infiltration testing within the basin location and are currently awaiting test results. We confirm that utilising the lower infiltration rate outlined in the SMP the footprint of the proposed basin is sufficient to meet the requirements of the development. **Action** 3Ms to provide test results to Waipa District Council once they have been received.
34	SW swales or drainage above and below site being relocated onto adjoining land requires this to be assured as being available to accommodate growth cell to growth cell flow before development that displaces this is permitted. Based on the proposal for the 3M site to be ultimately connected to the system serving the wider growth cells.	**Response** As stated above, the 3Ms application does not include the discharge of stormwater from the 3Ms development into the wider public system. There is provision for the east/west swale that conveys stormwater from outside of the 3Ms development into the main north/trunk swale. 3Ms is proposing to vest the east/west swale system. The 3Ms application is not proposing that the north/south stormwater swale system be located on the 3Ms site. 3Ms has presented a possible location of the swale system but the location of this infrastructure is a matter that Waipa District Council will need to determine and finalise. The 3Ms proposal allows WDC to pursue this work over a number of years allowing more time for time for land acquisition associated with the required infrastructure, while the 3Ms development provides much needed sections on the market (assisting Waipa District Council in meeting its NPS-UD requirements). **Action** None, but happy to clarify this matter further where needed.
35	Onsite discharge capacity needs to remain available and adequate for inflowing SW from other growth cells.	**Response** The 3Ms stormwater basin / stormwater approach services the 3Ms development. There is no reliance on the public system outside of the development. **Action** None.
36	Effects on achievement of development on the balance of this and other growth cells of WDC not being able to acquire alternative land for SW network through growth cell. Need to assure this is available.	**Response** The 3Ms application is not proposing that the north/south stormwater swale system be located on the 3Ms site. 3Ms has presented a possible location of the swale system but the location of this infrastructure is a matter that Waipa District Council will need to determine and finalise. The 3Ms proposal allows WDC to pursue this work over a number of years allowing more time for time for land acquisition associated with the required infrastructure, while the 3Ms development provides much needed sections on the market (assisting Waipa District Council in meeting its NPS-UD requirements). 3Ms cannot provide assurances that this is available. However, we have spent considerable time investigating how the same outcomes as enshrined in the Structure Plan can be achieved with the 3Ms development proposed. This has included discussions with neighbouring landowners – these discussions provide the groundwork for any future conversations Waipa District Council

Item	Matter	3Ms Response
		Actions • 3Ms to continue discussions with neighbouring landowners (those identified in the AEE). • 3Ms to obtain written confirmation from those landowners that they would support or oppose Waipa District Council acquiring their land for public assets. • 3Ms to provide this advice to Waipa District Councill.
37	Requirement for Council to maintain swale and pond network compared with pipe network if it is vested.	**Action** Waipa District Council will need to maintain the swale system as per the Structure Plan / WRC consent. As detailed in a response to an earlier comment there is potential for the stormwater system to be refined to include more piped areas (for example) – this would need to be balanced with any reserves / open space desires. Any discussions associated with the vesting / maintenance of the 3Ms stormwater basin can be discussed through the Development Agreement process. **Action** Further discussions with Waipa District Council to address this question where needed.
38	Need to see how proposal compares with WRC consent conditions.	**Response** As detailed in the response to Item 20 and Item 41.
39	Is there a requirement for regional consent or does the swale proposal satisfy or is it in accord with that consent?	**Response** Regional Consent is not required. As detailed in the response to Item 20 and Item 41, the proposal meets the requirements of the Waipa District Council consent. **Action** 3Ms to discuss the proposal with Waikato Regional Council and obtain confirmation that the proposal is within the ambit of the consent.
Tony Coutts High Level Comments		
40	**Issue - Stormwater management** Changing such a massive area of the C2 growth cell from swale conveyance to soakage with limited testing, both onsite and downstream. Soakage approach could potentially inundate the existing/proposed wetlands of C3 and Te Awa. Smaller C2 developers will revert to the same approach due to land yield implications. Upper catchments that were reliant on conveyance now have smaller land yields due to the extra attenuation they will require, this will affect the layouts of their structure plans as a result of this. The river embankments slope stability/erosion may be deteriorated. **Solutions/Recommendations** Revert to the swale conveyance system or some form of allowance for upper catchments that can be negotiated from a DC perspective. Further testing identifying the effects downstream would need to be conservative, given the likelihood that the wider C2 catchment follows this approach.	**Response** 3Ms is not proposing to revert back to the swale system. The application that has been lodged with the Waipa District Council sets out the stormwater soakage (via a soakage basin) is the appropriate solution to service the 3Ms site. 3Ms is currently undertaking further testing on site, and has already undertaken a significant amount of work understanding the hydrogeology of the site, and the proposal. Our technical reports confirms that the stormwater basin is appropriate. We do not consider that it is *likely* that the other developers in the wider C2 catchment with follow the 3Ms approach. 3Ms considers that given the nature of the fragmented ownership of the balance of the C2 Growth Cell (being in smaller lots, and in multiple ownership and most of those owners not being developers), other developments it would be more cost and time effective to rely on the public infrastructure and having that public infrastructure in place prior to further development within the C2 Growth Cell. In any event, any subdivision requires resource consent and Council and the applicant will be able have robust discussions regarding the nature of how developments will be serviced from a stormwater perspective. The public stormwater infrastructure needs to be constructed as soon as possible to provide for other developments. As we see it, this risk can be mitigated in two ways: • Placing emphasis on the staging plan in the Structure Plan whereby the owners to the west of the 3Ms site are in “Stage 3”; and • Waipa District Council constructing the necessary stormwater infrastructure in a timely manner and prior to further development (or alternatively, allowing for some temporary solutions before connections to the swale is formed). Any subdivision within the growth cells, irrespective of the 3Ms go-alone option, requires resource consent from the Waipa District Council. Each of these consents will need to demonstrate how each individual development could be serviced – there is the potential that individual solutions that could be employed to service developments, either as temporary solutions or permanent. The 3Ms development does not change this requirement for resource consent to demonstrate how the individual developments are serviced, and whether or not their developments are in accordance with the Structure Plan. The key issue with this ad-hoc approach would be as to whether the developments would be integrated and provide a coherent growth cell / new urban area. This risk was always present in the C2 Growth Cell where there is not one owner or developer of the land – land ownership is fragmented and aside from the 3Ms land, all remaining landholdings are reasonably small. The 3Ms standalone option does not change the nature of this risk – it was always present particularly as non of the key infrastructure has been designated. Any assessments utilised by 3Ms is inherently conservative. **Action** 3Ms to provide Beca hydrogeological assessments once completed.

Item	Matter	3Ms Response
Britta Jensen Comments		
41	In general, the concept is acceptable and would be in line with the Stormwater Management Plan (SMP) outcomes.	**Response** Noted.
42	**Comment** The WRC Low Impact Design Standards (LIDS) matrix should be reviewed against the outcome that there will be no piped discharged to the river as this is no longer part of the application (and may not happen) As such it is considered that this is likely 12 points not 9 (as per revised guidelines not as per the SMP, which states 13). Despite this I can see that this design can likely achieve 12 points easily. **Recommendations** Note and revise to 12 points for WRC technical assessment. This is needed as there is no certainty that the pipe will occur and as such we are discharging to the small culvert or neighbouring properties – altering the requirements. Please provide general guidance on how 12 points could be achieved.	**Response** The LIDS Matrix has been reviewed and updated in the table below: TABLE 4: Toolbox for 3MS Residential Development TYPICAL COMPONENTS / WAIKATO CATCHMENT - C2 SOUTH (12 POINTS WITH NO EXISTING NATURAL FEATURES TO PROTECT / 3MS APPROACH / POINTS LID DEVICES / TOTAL MINIMUM REQUIRED IS 6 POINTS / / 9 Infiltration devices to reduce runoff volume. / Meeting the capture and infiltration requirements for the 100-year ARI event for 100% of the site. / Sized as part of 3MS consent application / 6 Impervious surfaces reduced from a traditional approach / Inclusion of the stormwater and recreational reserves (2.74 Ha) within the development make up almost 7% of the development. / Included in 3MS consent application / 1 Swales and Filter Strips / Planting of forebays and infiltration basins will treat stormwater runoff for the full development. / Planting of forebays and basin. Positioning of overflows to infiltration beds to maximise filtration / 2 SOURCE CONTROL / TOTAL MINIMUM REQUIRED IS 4 POINTS / / 4 Use of building or site materials that do not contaminate / Residential roofs gutters, downspouts made of noncontaminant leaching materials (assuming 50% or residential and commercial) / Developers Toolbox / 1 Water re-use / Site use for garden watering and for non-potable inside waters uses including laundry and toilets is 3 points / Developers Toolbox / 3 TANGATA WHENUA VALUES / TOTAL MINIMUM REQUIRED IS 0 POINTS / / 2 Planting and infiltration / The infiltration basins allow stormwater to be treated and soak to ground. The planting to be incorporated in the forebays and basin will create wildlife habitats. / Landscape design and planting / 2 TOTAL POINTS / 15 **Action** Waipa District Council to confirm the above table satisfies the recommendation.
43	**Comment** I believe HG have adopted the surface infiltration rates for the soakage basin rather than the bore log infiltration rates. This isn't correct – we would need to adopt the soakage test results (this is documented in the SMP). In accordance with the SMP a 60 mm/hr infiltration rate was adopted for sizing of the basins. This value was based on the risk profile and the limited information available. **Recommendation** Confirmation is required to demonstrate that the infiltration that has been used is still fit for purpose under CMP assessment parameters as a less conservative value has been used but no further testing been undertaken. Other rates would be accepted if a bore log soakage rate within the soakage basin has been undertaken.	**Response** 3Ms has now undertaken infiltration testing within the basin location and are currently awaiting test results. We confirm that utilising the lower infiltration rate outlined in the SMP the footprint of the proposed basin is sufficient to meet the requirements of the development. **Action** 3Ms to provide test results to Waipa District Council once they have been received.
44	**Soakage rates in general** **Recommendation** Limited information is known around the infiltration performance of the basin under the iron pan. There is a risk that the soil structure in this location would not be suitable for soakage. This would mean that the applicant would need to find alternative solutions that would need to be addressed at engineering approval time and this presents a risk to council.	**Response** Testing onsite has shown there is no iron pan layer present in the location for the proposed 3Ms soakage basin. **Action** 3Ms to provide Beca technical hydrogeological assessment once completed.

Item	Matter	3Ms Response
	Considering that we are now at subdivision consent stage and the structure locations are certain – it would be worthwhile getting a soakage and bore log to determine the viability of this option. This will need to be provided prior to subdivision consent.	
45	**Depth of basin** **Recommendation** What is the likelihood that that the depth of basin will be much deeper? Currently it appears to be 2.4 metres deep, but isn't this is likely to be the depth of the iron pan? Is there any certainty around this? This would have impacts around forebays – which may end up being much deeper and we may have issues trying to drain it to the main channel. There may be options to manage this which could be presented to us. I think it is safe to say that basins over 2.5 metres deep may not be acceptable due to safety and the amenity of the structure. A bore log and soakage test would provide certainty around these assumptions.	**Response** Recent testing onsite has shown there is no iron pan layer present in the location for the proposed 3Ms soakage basin and 3Ms are currently awaiting final test infiltration results. Based on the information obtained so far, we confirm that the footprint and depth of the proposed basin is sufficient to meet the requirements of the development. **Action** 3Ms to provide Beca technical hydrogeological assessment once completed.
Transportation		
Mark Batchelor Meeting Summary Notes		
46	Traffic lights instead of round about options arose from the urban design discussion. Concern expressed that there had been significant investment in round about option. Traffic lights were thought in the discussion to possibly have a better outcome from perspectives of flexibility to control and respond to traffic issues arising, effects on amenity of adjoining properties, providing possibility of easier accessibility and exit, pedestrian road crossing safety, amenity and convenience, reference to a pedestrian underpass? comparative costs, traffic lights seen as possibly providing a considerable saving, reduces of avoid need for land acquisition.	**Response** A significant amount of Waipa District Council and 3Ms resources have been placed on the nature of the C2/C3 Intersection and as such, 3Ms has no desire to re-visit this. 3Ms supports the proposal for a well-designed roundabout with underpasses. **Action** None.
47	Distances from other intersections on same side and opposite.	**Response** Separation provided between new intersections on Cambridge Road 10 comply with minimum intersection spacing requirements within the Regional Infrastructure Technical Specification (Table 3-4). **Action** None.
48	Relocation presenting need to ensure land able to be acquired for it within the time frame need is expected to arise.	**Response** 3Ms, St Peters and Te Awa Life Care all support the proposed location of the intersection being moved. 3Ms has had the discussions with the two other landowners and will continue to have those discussions. **Actions** • 3Ms to continue discussions with other landowners whom Waipa District Council would need to acquire land from to construct the roundabout in the location proposed by 3Ms. • 3Ms to obtain written confirmation from those landowners that they would support or oppose Waipa District Council acquiring their land for public assets.
49	Concern expressed that from the perspective of that the 3M development contributes to the need for the intersection upgrade, cumulatively with development of the balance of this cell and others, that in the event of acquisition of land for intersection upgrade is not successful or delayed, traffic problems may become experienced.	**Response** The ITA submitted shows the proposed interim access from Cambridge Road is sufficient to service the proposed 3Ms development without the need for the C2/C3 roundabout intersection to be in place. If the C2/C3 roundabout intersection delivery is delayed beyond 2025 this will result in a very minor increase in queuing at the Road 11 intersection during the AM peak.
50	Desire to have intersection facility ready for growth rather than having to catch up and the risks this presents to ability to achieve effective catch up.	**Response** As above.

Item	Matter	3Ms Response
51	Reference made to NZPSUD re urban land supply required to be adequately serviced at the time of being made available.	**Response** The 3Ms site will be appropriately serviced, as detailed in the application, when the sections are available to the market. **Action** Progress subdivision consent application and associate collaborative approach with the Waipa District Council to get sections on the market.
Tony Coutts High Level Comments		
52	**Issue - Transportation, Intersection** Shifting the collector road intersection means the primary intersections for such a large portion of the growth with have uncontrolled intersection for an undetermined amount of time. The ITA states that by 2025, these intersections will be unsafe. With no guarantee on a timeframe for council to resolve that effect brought on by this application. **Solutions/Recommendations** Moving the intersection back to its original location. Updating the future western intersection to a more controlled intersection. I.e. Traffic lights. Traffic light intersection arrangement controls stacking issues, limits land take on smaller parties making the wider C2 development more economical, and cheaper construction-wise.	**Response** The ITA submitted shows the proposed interim access from Cambridge Road is sufficient to service the proposed 3MS development without the need for the C2/C3 roundabout intersection to be in place. If the C2/C3 roundabout intersection delivery is delayed beyond 2025 this will result in a very minor increase in queuing at the Road 11 intersection during the AM peak. **Action** None.
53	**Issue - Transportation, Retirement village super lot** Not previously implemented as part of the structure plan nor ever assessed. Super lot occupiers have slower reaction speed at busy uncontrolled entrances, creating higher crash risk and affecting all Cambridge/Hamilton commuter traffic. **Solutions/Recommendations** Removal from application. Same as Item 1: Updating the future western intersection to a more controlled intersection. I.e. Traffic lights. This is to control stacking issues with effective light sequences, limits land take on smaller parties making wider development more economical and cheaper construction wise.	**Response** The application is for a subdivision. The application seeks the creation of a super lot. 3Ms, for its effect's assessment, has assumed that the super lot is a retirement village. This application is not seeking to consent a retirement village. A land use consent would need to be obtained to enable such a retirement village, which is not within the scope of this application. 3Ms does not support traffic lights being the form of the intersection. **Action** None.
54	**Issue - Transportation, Parking** Moving the active reserves as part of their subdivision application creates a deterrent for smaller developers having their land yield occupied by a reserve designation, which they were previously consulted otherwise. Potentially Strains existing infrastructure capacity's if existing recreation reserves were to be upgraded. **Solutions/Recommendations** Keep active reserve as per previous.	**Response** 3Ms is proposing significant reserve land within the subdivision. Any subdivision within this area requires consent, and through that process the nature of the reserves (and the requirement of reserves) would be discussed. The reserve land was not designated, was not zoned Deferred Reserve (it was zoned Deferred Residential) and a Structure Plan notionally shows the location of reserve areas – it does not fix the location. The 3Ms application includes an active reserve – the destination playground. **Action** As detailed in the responses to Anna McElrea's question – 3Ms to assist Waipa District Council in respect of alternatives for sports field locations.
Bryan Hudson's Notes.		
55	**Issue -** Pg 114 Alternate stormwater system and reticulation from perimeter of development to pond. Risk that flat hydraulic grades and low head difference in a pond full event means that reticulation is surcharged for extended period, particularly when wider ground water levels are high after prolonged rainfall periods.	**Response** 3Ms has engaged Sian France from Beca to address any potential hydrogeological issues or effects. This report will be provided to council in due course, but in summary, Beca considers that this option is technically feasible. **Action** Provide final technical assessment once completed for WDC review.

Item	Matter	3Ms Response
	Reliance on soakage only may lead to prolonged flooding of roads and secondary flow paths unless pond is constructed quite deep and adequate hydraulic grade is maintained in all pond level conditions. **Recommendation** - Provide a technical response that reassures council that the solution is a whole of life one and councils risks are low. This may need to be peer reviewed	
56	**Issue** - Pg 165 C2 central collector moved west 100m and not constructed for 3Ms development within C2, means no access is provided to C3 until new intersection is constructed. Potential for prolonged delay to C3 access or a separate temporary access arrangement is required, and additional cost imposed on C3 landowner. **Recommendation** - Obtain assurances from C3 landowners/developers that any concerns they have are addressed	**Response** Noted – staging and delivery of access to the C3 Growth cell falls outside the scope of this application. However, it is worth noting that Te Awa Life Care has provided their support of the application (via letter included in the application). St Peters 3Ms-JV support the proposal. **Action** • 3Ms to continue discussions with other landowners whom Waipa District Council would need to acquire land from to construct the roundabout in the location proposed by 3Ms. • 3Ms to obtain written confirmation from those two other landowners that they would support or oppose Waipa District Council acquiring their land for the roundabout in the 3Ms proposed location. • Waipa District Council to progress land acquisition discussions following receiving the information from 3Ms.
57	**Issue** - Pg166, Neighbourhood commercial centre relocated 240m east, no longer near collector or cell centre. Traffic within wider C2/C3 cells must travel further on local streets to access the centre. Potentially encouraging more vehicle travel within the cell rather than walking and cycling. **Recommendation** - Relocate commercial centre to near the north south collector road.	**Response** 3Ms is proposing a neighbourhood centre that partially falls within the area shown as neighbourhood centre in the Structure Plan (30 metres within the Structure Plan area, 60 metres is not). The effect of this change is considered to be negligible. **Action** None.
58	**Issue** - Pg187, Development plan. In absence or prolonged delay in implementation of Cambridge Road / collector roundabout and underpasses there is no safe pedestrian and cycling link between C2/C3. Discourages use of alternate modes or encourages unsafe pedestrian crossing activity on Cambridge Road. **Recommendation** - C2/C3 intersection to be constructed at the time of the 3Ms development and not delayed	**Response** The approved structure plan includes the provision for an at-grade pedestrian/cycle crossing facility on the 3MS frontage with Cambridge Road (approx. RP 0/4.0) in advance of the future C2/C3 intersection. 3MS supports the delivery of this planned crossing in conjunction with the 3MS development to promote safe crossing of Cambridge Road ahead of the C2/C3 intersection construction. 3Ms does not have a view on whether the C2/C3 roundabout should be constructed at the time of the 3Ms development – this application is for the subdivision of the 3Ms site and includes a portion of land adjacent to Cambridge Road to allow for the roundabout to be constructed (likely in an alternative location). It is understood that Waipa District Council is constructing the C2/C3 intersection and is therefore in control of the timing. Te Awa Life Care has provided their support of the application (via letter included in the application). St Peters 3Ms-JV support the proposal. The other landowners, while 3Ms has spoken to them, sought Waipa District Council input. **Action** • 3Ms to continue discussions with other landowners whom Waipa District Council would need to acquire land from to construct the roundabout in the location proposed by 3Ms. • 3Ms to obtain written confirmation from those two other landowners that they would support or oppose Waipa District Council acquiring their land for the roundabout in the 3Ms proposed location. • Waipa District Council to progress land acquisition discussions following receiving the information from 3Ms.
59	**Issue** - Pg187, Development plan. In absence or prolonged delay in implementation of Cambridge Road / collector roundabout there is no safe right turn provision for new local road connections to Cambridge Road. Poor level of service for right turns in and out of new intersections leading to unacceptable delays and crashes for both C2 and C3 cells and Te Awa Lifecare Village. **Recommendation** - C2/C3 intersection to be constructed at the time of the 3Ms development and not delayed	**Response** As above.

Item	Matter	3Ms Response
60	**Issue** - Pg187, Development plan. Te Awa Lifecare Village has a less logical and convenient access via the end of a cul-de-sac rather than to the collector as proposed by the structure plan and Te Awa approved consent. Poor navigability for village visitors. Loss of access visibility. However, has benefits of limited land requirement or construction impacts of Collector intersection on Te Awa. **Recommendation** - C2/C3 intersection to be constructed at the time of the 3Ms development and not delayed	**Response** As above, but it is noted that Te Awa Life Care has provided a letter in support of the application.
61	**Issue** - Pg187, Development plan. Additional local road connection proposed to Cambridge Road opposite Te Awa Lifecare Village (Road 11). Council had intended a solid median on Cambridge Road to make any new intersections to Cambridge Road left in and left out to protect the traffic capacity of Cambridge Road as an arterial, and to reduce traffic conflicts of right turns. Solid median is no longer possible under the proposal, at least not until the collector roundabout is delivered. The eastern intersection becomes the most prominent with access to the super lot, school and proximity for CBD trips and will have highest turning volumes in close proximity to Kelly Road and Chartwell intersections. It is highly undesirable for both LOS and safety to create such a high volume connection. **Recommendation** - C2/C3 intersection to be constructed at the time of the 3Ms development and not delayed	**Response** As above.
62	**Issue** - Pg189, Development plan does not indicate any pedestrian connection along eastern local road 10 toward Cambridge Road but this will likely be a high desire line for access between existing Cambridge town and cell / school/ super lot. Discourages use of alternate modes or encourages unsafe pedestrian crossing activity on Cambridge Road. (Master Plan shows shared paths on Road 10, page 203, but no connectivity to Cambridge Road facilities). **Recommendation** - Add pedestrian connection to road 10	**Response** The proposed development plan includes three eastern linkages along the length of Road 10 to promote pedestrian and cycle connections to the east in the following locations; • Cambridge Road intersection; connection to existing footpath on northern side of Cambridge Road. • Ch 450; off road cycling connection within WDC south-eastern swale corridor. This will provide connectivity to the town belt east of the development. • North-eastern Collector intersection; connection to new cycleway/footpath on southern side of new North-eastern Collector Road. This will provide connectivity to the east via the future WDC roading link to Taylor St. **Action** None, unless further discussions with Waipa District Council are needed in respect of this matter.
63	**Issue** - Pg190, Development plan shows C3 growth cell has a stage one component but no indication of how access will be provided in the absence of the collector roundabout. Potential for prolonged delay to C3 access or a separate temporary access arrangement is required and additional cost imposed on C3 landowner. **Recommendation** - C2/C3 intersection to be constructed at the time of the C3 development and not delayed	**Response** Noted – staging and delivery of access to the C3 Growth cell falls outside the scope of this application. 3Ms does not have a view on whether the C2/C3 roundabout should be constructed at the time of the 3Ms development – this application is for the subdivision of the 3Ms site and includes a portion of land adjacent to Cambridge Road to allow for the roundabout to be constructed (likely in an alternative location). It is understood that Waipa District Council is constructing the C2/C3 intersection and is therefore in control of the timing. Te Awa Life Care has provided their support of the application (via letter included in the application). St Peters 3Ms-JV support the proposal. The other landowners, while 3Ms has spoken to them, sought Waipa District Council input. **Action** • 3Ms to continue discussions with other landowners whom Waipa District Council would need to acquire land from to construct the roundabout in the location proposed by 3Ms. • 3Ms to obtain written confirmation from those two other landowners that they would support or oppose Waipa District Council acquiring their land for the roundabout in the 3Ms proposed location. • Waipa District Council to progress land acquisition discussions following receiving the information from 3Ms.

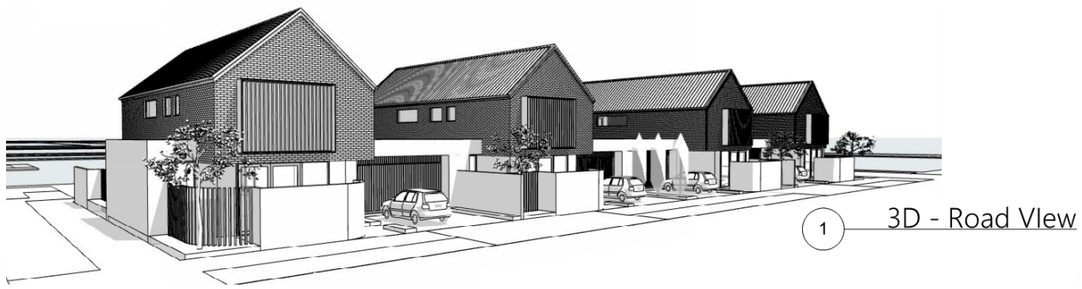
Item	Matter	3Ms Response
64	**Issue** - Pg196 Master Plan shows one lot strip of housing east side of Road 10, creating new vehicle access points close to what will be a very busy intersection with Cambridge Road. Poor safety and usability of vehicle access points close to major intersection. **Recommendation** - Keep lot accesses back from the intersection	**Response** Noted. Access to lot 1 has been positioned on the northern side of the property to maximise the offset from the Cambridge Road intersection. **Action** Sight distance checks for all vehicle access points to be included in engineering submission / detailed design.
65	**Issue** - Pg207 Master Plan shows very close proximity right turn bays for Road 10 and Chartwell access leaving little or no queue space between them. Potential for significant conflict in turning movements. **Recommendation** - Review road 10 location with existing other roads on Cambridge Road so safety is not compromised	**Response** Separation provided between the Road 10 and new intersection for the Chartwell development is ~80m and complies with minimum intersection spacing requirements within the Regional Infrastructure Technical Specification of 45m (Table 3-4, Arterial Road/Opposite side). Based on this spacing there is provision for up to 50m of queuing for right turning movements between the intersections or up to four (4) right-turning cars at each location at any one time. **Action** None, unless further discussions with Waipa District Council are needed in respect of this matter.
66	**Issue** - Pg207,208 Master Plan. Low level lighting shown in planted berm areas. Council experience is that these are frequently vandalised and incur high ongoing repair and maintenance costs. **Recommendation** - Look at other lighting options or systems that are less vulnerable to vandalism	**Response** Noted and 3Ms is happy to work with Waipa District Council on an alternative solution. **Action** 3Ms to work with Waipa District Council regarding lighting options
67	**Issue** - Pg210 Master Plan. Future interface comments. Te Awa Lifecare access shown through median east of roundabout. Poor level of service and safety access option on an arterial road. Potential for queuing and crashes, driver confusion for both ingress and exiting. **Recommendation** - C2/C3 intersection to be constructed at the time of the C3 development including Te Awa access off the collector road in the St Peters School land as per the Structure Plan and not delayed	**Response** Noted – the future location/configuration of the Te Awa Lifecare access shown is indicative only and subject to Waipa District Council design approval as part of the final C2/C3 intersection design. 3Ms does not have a view on whether the C2/C3 roundabout should be constructed at the time of the 3Ms development – this application is for the subdivision of the 3Ms site and includes a portion of land adjacent to Cambridge Road to allow for the roundabout to be constructed (likely in an alternative location). It is understood that Waipa District Council is constructing the C2/C3 intersection and is therefore in control of the timing. Te Awa Life Care has provided their support of the application (via letter included in the application). St Peters 3Ms-JV support the proposal. The other landowners, while 3Ms has spoken to them, sought Waipa District Council input. **Action** • 3Ms to continue discussions with other landowners whom Waipa District Council would need to acquire land from to construct the roundabout in the location proposed by 3Ms. • 3Ms to obtain written confirmation from those two other landowners that they would support or oppose Waipa District Council acquiring their land for the roundabout in the 3Ms proposed location. • Waipa District Council to progress land acquisition discussions following receiving the information from 3Ms.
68	**Issue** - Pg210 Master Plan. Future interface comments. Road 10 intersection retained for all movements in very close proximity to Chartwell intersection. Poor level of service and safety provided in the connection to an arterial road. This is contrary to the Structure plan which had a greater separation between intersections and showed Cambridge Road having a solid median to direct right turns to a safe intersection at the C2/C3 Collector intersection. **Recommendation** - Review road 10 location with existing other roads on Cambridge Road so safety is not compromised	**Response** The proposed layout and location for the Road 10 intersection is consistent with the approved structure plan and complies with minimum intersection spacing requirements within the Regional Infrastructure Technical Specification. The ITA submitted shows the proposed Road 10 intersection operates at LOS C with queue lengths on Cambridge Road. This outcome is consistent with other similar intersections within the surrounding roading network. The proposed interim access from Cambridge Road is sufficient to service the proposed 3Ms development without the need for the C2/C3 roundabout intersection to be in place. If the C2/C3 roundabout intersection delivery is delayed beyond 2025 this will result in a very minor increase in queuing at the Road 11 intersection during the AM peak. The ITA does not suggest that the 3Ms development is reliant on the C2/C3 intersection being in place. It is understood that Waipa District Council is constructing the future Cambridge Road upgrade and will confirm the final design of the Cambridge Road including the extent of any solid median in this location - however 3Ms have a strong preference for Road 10 to remain full access as show in the application. **Action** None.

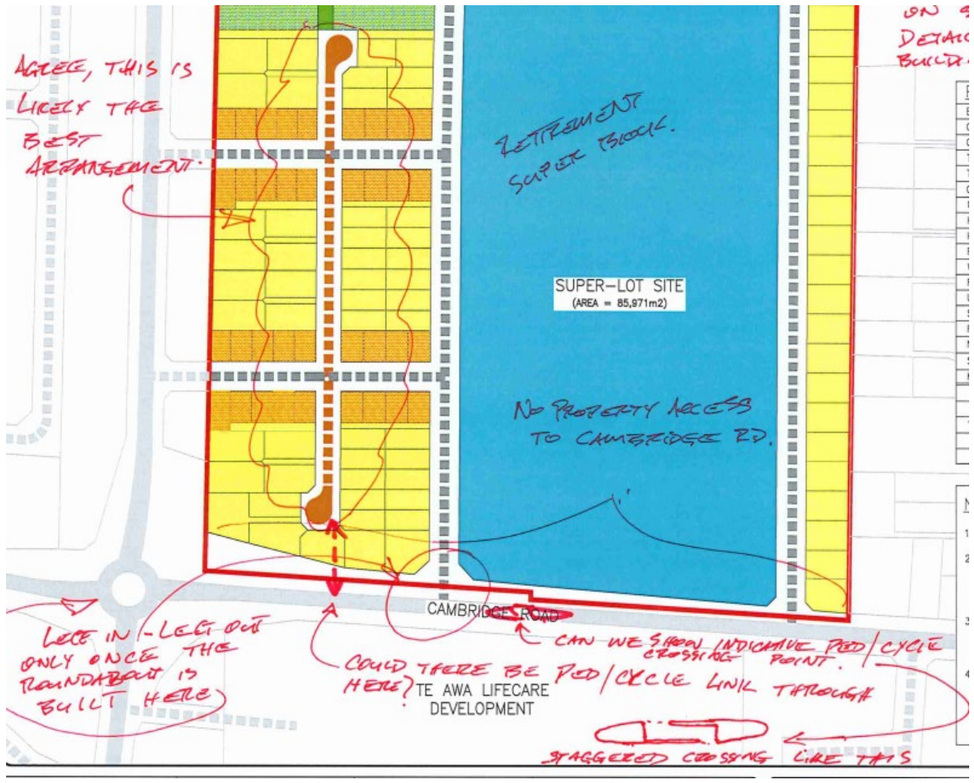
Item	Matter	3Ms Response
Urban Design (Mark Riley)		
69	***Sense of place, legibility and creating an appropriate 'gateway'*** *Relevant Appendix S19 clauses: S19.2.2.1(c) providing a sense of place and (d) enabling the development of strong gateways for Cambridge.* The Operative Structure Plan has a clear organising structure for the C2 Growth Cell of a swale/linear reserve space along the eastern side of a north-south collector road, at the centre point of which is an east-west road with a linear reserve, playing fields, a local centre overlay, and indicative school site. The co-location of all these features at the centre of the Growth Cell creates a strong north-south and complementary east-west axis, with key community facilities at its core. This spatial layout lends itself to a strong visual sightlines, contributes to the legibility of future urban form, and would – in my view - have a 'gateway' like quality when entering Cambridge from the north or west. The changes to the Structure Plan, resulting from the 3Ms proposal, including moving the school and centre east into the 3Ms site, 'switching' the position of the north-south linear reserve mid-length along the north-south collector, and narrowing the width of the east-west linear reserve towards the north-south collector, provide, in my preliminary view, a less clear organising and spatial structure that potentially results in a weakening of sense of place, urban legibility, and gateway qualities from that shown on the Operative Structure Plan. This is at the scale of the wider neighbourhood, with potential effects being at that wider neighbourhood level. **Comment is requested, with reference to S19.2.2.1(c) and (d), in terms of how the 3Ms proposal affects the wider sense of place, legibility and gateway outcomes for the Growth Cells anticipated by Appendix S19.**	**Response** As detailed in the application, 3Ms is seeking a subdivision consent for the 3Ms development only. However, 3Ms has placed significant emphasis on creating a subdivision that integrates with the wider Structure Plan area. In relation to the school site, the Ministry of Education supports the proposed location. 3Ms is providing the east/west connectivity via the swale system. 3Ms considers that the urban design assessment should focus on the 3Ms application itself rather than a comparative exercise against the Structure Plan (which allows for flexibility and does not fix the location of anything).
70	***Strong community focal point*** *Relevant Appendix S19 clause: S19.2.3.3(f) Central focal points and community meeting places; S19.3.3.3 (b) bringing people together as they go about their daily activities.* The 3Ms proposal to move the local centre and active reserve east into the 3Ms site, away from the north-south collector, together with reducing the size of the active reserve (and removing its playing field function) is, in my preliminary view, at the expense of creating a strong community focal point that serves the wider C2 Growth Cell and – in regard to the playing fields – the wider area. This is in part due to the reduced visibility of these features to the wider area and being placed more 'internally' to the 3Ms site adjoining local roads, rather than adjoining the planned primary movement routes. The proposed co-location of the centre and active reserve is positive, and their location within the 3Ms site will serve the future residential community north of Cambridge Road and east of the north-south collector road well – ie: that community within the 3Ms site. However, I am not convinced that this change from the Operative Plan will provide a strong community focal point to the wider neighbourhood – in other words, including the western side of the C2 Growth Cell. In my view, the extent of potential effect of this element of the proposal is at the wider neighbourhood level.	**Response** 3Ms is not removing or reducing the active reserve area. The effect of this application is simply that the playing fields will not be located on the 3Ms site – there is nothing in the 3Ms development that precludes the sports fields being located elsewhere in the growth cell (and as detailed in the responses to Anna McElrea's comments, 3Ms is proposing to approach neighbouring landowners to assist the Waipa District Council in finding a suitable alternative location). 3Ms is proposing to create a large multifunctional reserve, which will include walking and cycling tracks. This area then connects to the active reserve (playground, water play park and skate park), which also connects to the east/west swale. This area also has better connectivity to the east including the town greenbelt (where John Kerkhof Park is located).

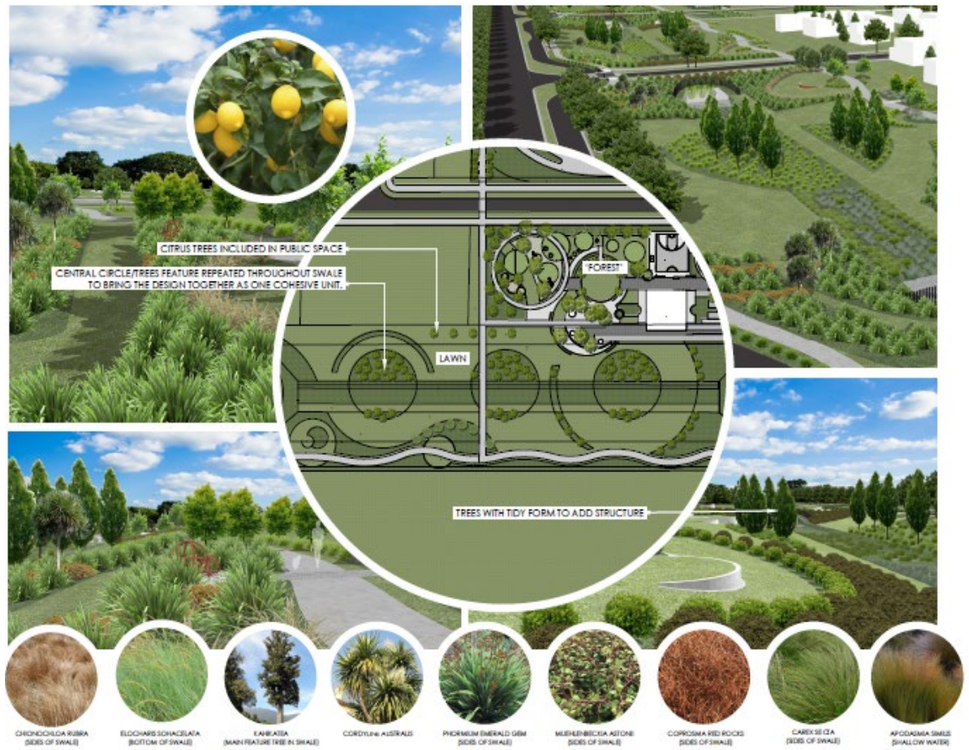
Item	Matter	3Ms Response
	Comment is requested, with reference to S19.2.3.3(f), in regard to the extent which the proposed different location of the active reserve, its reduced size, and the different location of the centre, affect the ability to achieve a strong community focal point at the wider neighbourhood level. **Please note that this issue is strongly tied to (1) – in other words, the success of a community focal point is based not just on its position within a neighbourhood, but also its legibility within that neighbourhood.**	
71	***Strong community focal point*** *Relevant Appendix S19 clause: S19.3.3.3 (a) Centrally located – within a 10 minute walk of the majority of residents.* The proposed shift of the local centre east moves it away from the western part of the C2 Growth Cell, increasing the distance between future residents in that area and the centre. In my view, the extent of potential effect of this element of the proposal is at the wider neighbourhood level. **Comment is requested about effects on convenience of access to the proposed centre location for future residents in the western half of the C2 Growth Cell.** **Please demonstrate walking distances from the western half of the Growth Cell to the centre.**	**Response** 3Ms is proposing a neighbourhood centre that partially falls within the area shown as neighbourhood centre in the Structure Plan (30metres within the Structure Plan area, 60 metres is not). Any increase in walking distance is likely in the vicinity of approximately 50 seconds and is therefore not considered to be significant.
72	***Legibility and connectivity of the open space network*** *Relevant Appendix S19 clauses: S19.6.1.1 A cohesive and integrated public realm network; distinctive places with unique character and identity; (b) creating a centre and sense of identity within Cambridge; (c) developing a green network that connects the Structure Plan community and the rest of Cambridge; S19.6.1.6(a) wayfinding and legibility.* The Operative Structure Plan displays a strong (visually clear, straight and of consistent width) north-south and east-west reserve system through the C2 Growth Cell, which is intended to 'drive' connections south through to the Waikato River (and Te Awa cycle route) and east through to the Town Green Belt. I have some concerns as to whether the 'switch' from east to west midway along the north-south collector road of the linear reserve weakens the sense of connection south to the Waikato River, but my primary concern is a potential weakening of the connection between this north-south linear reserve and the Town Green Belt. This is due to the east-west linear reserve narrowing in width (and therefore visual legibility) immediately adjacent the north-south collector (just to the west of the 3Ms site) and also either side of Road 10, east through to Kelly Road and across to the Town Green Belt. In my view, the extent of potential effect of this element of the proposal is at the wider neighbourhood level. **I appreciate that while some parts of the changes to the Structure Plan, as commented on to the left, are within the 3Ms site (and therefore are what consent is sought for) other parts are outside the 3Ms site.** **Nonetheless, in order to more fully understand the open space connectivity issues – insofar as they relate to legibility of those open space connections – comment is requested on the thinking and urban design rationale behind the proposed changes and what related effects are.**	**Response** The "updated Structure Plans" in the application are illustrations of how, once the 3Ms subdivision is granted, the existing structure plan features could be given effect to under a slightly different spatial alignment. Waipa District Council will be responsible for acquiring the land necessary for the north-south swale and collector road and therefore have the ability to determine the ultimate alignment. The rationale for the 'switch' from east to west midway along the north-south collector road of the linear reserve is to ensure that the existing house can be retained. In respect of the east-west linear reserve narrowing in with immediately adjacent to the north-south collector (outside of the 3Ms site) and to the east of Road 10 (outside of the 3Ms site) shown in the 3Ms "updated Structure Plans", this has been shown as the "updated Structure Plans" integrate the 3Ms development as well as the Waipa District Council master planning. It is understood that through the Master Planning that has been undertaken, more sections of the swale system may be piped (which is why the reserve narrows on the "updated Structure Plans". Ultimately, the width of the swale areas outside of the 3Ms site is a matter for Waipa District Council to determine.
73	***Legibility and connectivity of the open space network***	**Response**

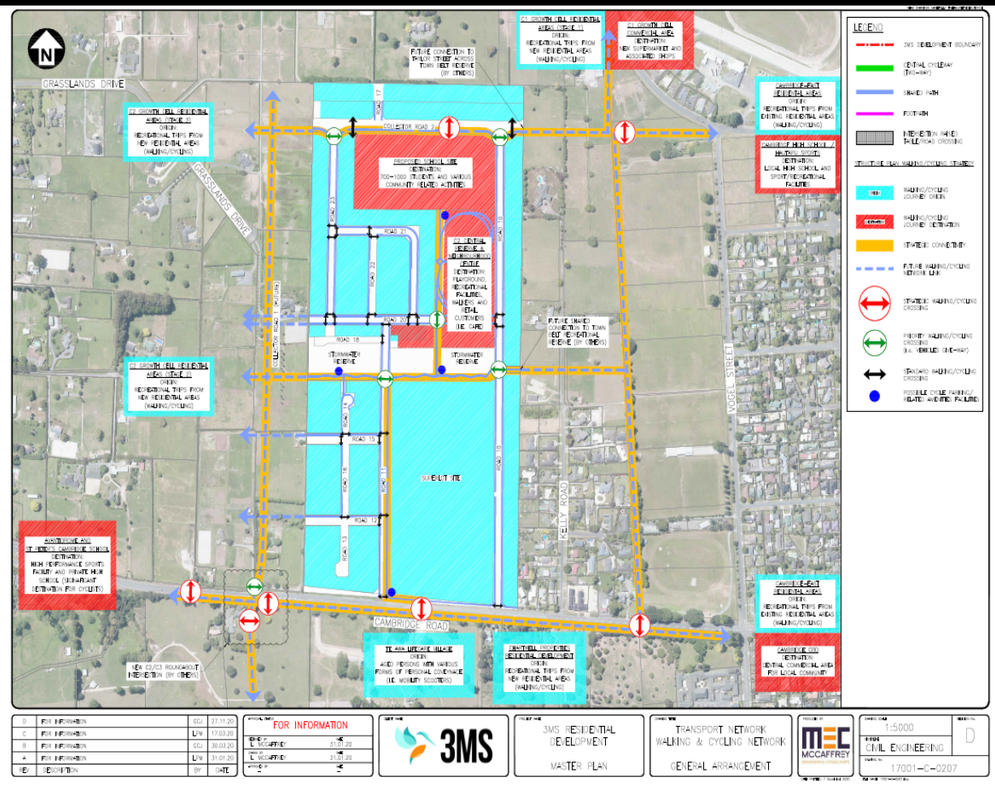
Item	Matter	3Ms Response
	Relevant Appendix S19 clauses: S19.6.1.6 At least 50% of the edges of public open space are surrounded by streets. The east-west linear reserve, as shown in the Operative Structure Plan, is a major structuring element through the area. The legibility of this feature is heightened by a road that extends along the significant majority of its length, east from the north-south collector road. In the 3Ms proposal, while there is a road further to the north of the active reserve and centre and a short cul-de-sac (Road 18) along part of its northern edge, there is no comparable road along most its length. In my view, the extent of potential effect of this element of the proposal is at the wider neighbourhood level. **Please provide comment as to the degree of consistency of this design element with S19.6.1.6 and comment on associated potential effects. Analysis and comment on the wider legibility of the open space network is suggested.**	The east/west linear reserve is connected to the active reserve and neighbourhood centre – it is onecontinuous reserve area. There is a road proposed along the frontage of the active reserve / neighbourhood centre and therefore 50% of the reserve area is surrounded by streets. In terms of the reserve area to the east, cul-de-sac (road 18) is to the north. This reserve is not surrounded by streets but given the level of reserve provided in the 3Ms development, and the wider structure plan area this is not considered to be significant from an effect's perspective.
74	***Overall integration of neighbourhoods*** An overall theme of Appendix S19 is for an integrated urban form in the C1, C2 and C3 growth cells. This is represented in the Operative Structure Plan by the strong structuring elements of the north-south collector, straight and continuous width linear reserve system, and placement of the playing fields, local centre and school at the centre of Growth Cell C2. The result is, in effect, a series of 'sub' neighbourhoods knitted together by these structuring elements. My preliminary view is that the proposed changes by 3Ms will result in a less integrated and cohesive wider neighbourhood and instead may result in a number of smaller, inward looking neighbourhoods that are not knitted together. In my view, the extent of potential effect to which this wider principle is achieved is at the wider neighbourhood level. **While appreciating that this is more of a thematic query, comment would be appreciated on the extent to which the changes proposed by 3Ms will enable an overall integrated urban form to develop. This query builds on – at a higher, thematic level – a number of earlier queries.**	**Response** Refer to all comments above.
75	***Circulation and permeability*** *Relevant Appendix S19 clauses: S19.5.3.3 (a) Supporting a fine grain street network; (b) minimising cul-de-sacs / providing pedestrian and cyclist links to cul-de-sac heads; (c) increasing connectivity and permeability by (i) walkable blocks averaging 200m by 80m and (ii) mid-block spaces and green linkages, particularly where larger block sizes are proposed.* Proposed lot 300, which the AEE describes as being intended for a retirement village, has dimensions in excess of 200m by 380m. This is significantly larger than the block size recommended by S19.5.3.3(c)(i). These dimensions mean that there is a less connected and fine grain street network in the south-east corner of the 3Ms site compared to the Operative Structure Plan. A notable change, for example, is the 'mid-block' east-west road in the Operative Structure Plan through to Road 10 is not provided, affecting permeability / convenience of access for future residents on the eastern side of Road 10. Road 13, the proposed cul-de-sac at the south-western corner of the 3Ms site, has no pedestrian or cycle link through to Cambridge Road. This has potential effects in terms of local connectivity and permeability, maximising choice of routes, including for example, the choice of routes provided for people on the south side of Cambridge Road moving north through the	**Response** Proposed Lot 300 is simply being created as a super lot, and the land use will potentially be a retirement village. Should Lot 300 be developed as a retirement village, the retirement village provider will design the layout. 3Ms does not have control of the movement network through proposed lot 300. Any retirement village land use will likely need to obtain land use consent (which 3Ms will not be responsible for). Through that consenting process, Waipa District Council and the applicant will be able to discuss the layout. There is walking connectivity through the east/west linear reserve to the west of the 3Ms site. In respect of walking connectivity through Road 13, 3Ms does not know the nature of the land use to the west. Any walking connectivity provided through Road 13 can be discussed further with the Waipa District Council (i.e. 3Ms has not precluded this).

Item	Matter	3Ms Response
	3Ms site. A connection in this location would enable an alternative route along Road 13, north to Road 14 and through the lot 505 reserve. In my view, the extent of potential effect of this element of the proposal is at the local neighbourhood level. **Comment is requested on the potential to provide a finer grained movement network through proposed lot 300.** **Comment is requested on why a pedestrian / cycle link has not been provided at the southern end of the Road 13 cul-de-sac head.**	
76	***Positively addressing street and open space frontages*** Proposed Road 18 is a cul-de-sac on the north side of proposed reserve lot 505. This cul-de-sac provides access to single-lot depth compact housing lots which also adjoin, on their northern side, Road 20. Blocks of one lot depth are generally not considered desirable. This is in addition to a cul-de-sac adjoining an open space, and uncertain interface conditions/development options for land outside the 3Ms site, directly to the west of lot 505. My preliminary view is that this is a somewhat awkward arrangement of spaces which may lead to undesirable interface conditions. Future housing development on the compact housing lots will rationally put garaging on their southern sides facing out towards the reserve and orientate themselves to the north away from the reserve. This presents a challenge in achieving positive interface conditions to lot 505. This is heightened by the cul-de-sac nature of Road 18, which has the potential to seem like a private access road – albeit that a green link is shown (lot 506) connecting through to Road 20. On the northern side of the compact housing lots, where they adjoin Road 20, the rationale response is to place private outdoor space in this location. This raises the tension point of how fence heights of an appropriate height can be achieved that both contribute to an attractive streetscape/passive surveillance and to reasonable privacy. The cul-de-sac form of Road 18 is also somewhat awkward in terms of the small space it creates at the north-west corner of lot 505 – to the south of compact housing lot 175 and east of potential housing adjoining the 3Ms site. In addition to positively addressing street frontages, in my preliminary view, there are also possible CPTED / safety concerns from this layout. In my view, the extent of potential effect of this element of the proposal is at the local neighbourhood level. **Comment is requested on the general issues raised by this query.** **A redesigned layout in this area is considered potentially appropriate to address these issues.** **As part of any analysis and potential redesign, it would be helpful if analysis could be shown at a finer grain level showing how development on land immediately to the west of the 3Ms site in this area might develop in an integrated manner.**	**Response** The proposed location provides the following two positive outcomes; • Continuation of consistent compact housing typologies along Road 20; and • The position of public access to reserve lot 505 through Road 18 and a centralised access lot through from Road 20 (opposite the intersection with Road 23). The outcome of this configuration is expected to provide excellent connection between the reserve lot 505 for the adjacent housing lots and the general public.
77	***Positively addressing street and open space frontages*** The proposed local centre lot 301 has a relatively long southern boundary to proposed reserve lot 503. A southerly orientation means that an inactive frontage of any future local centre building (including potential servicing / back of house areas) along this boundary is likely. This	**Response** The main connection between Lots 301 and 503 will be on the eastern boundary where playground and reserve facilities are proposed with the potential for outdoor seating on the northern frontage with Road 20. The rear of Lot 301 is not expected to have a strong connection with lot amenity value with planned public access being provided on the southern side of this reserve.

Item	Matter	3Ms Response
	exacerbates the extent of effects of likely building backs to Road 18, directly to the west (refer earlier query) and the potential challenges of achieving positive frontages to the retirement village lot 300, in terms of its interface to reserve lot 503. The risk is that when moving north along Road 11, or east-west along reserve lots 503 and 505, a series of building 'backs' (both compact housing and local centre lot buildings) will present themselves to view. In addition to positively addressing open space frontages, in my preliminary view, there are also possible CPTED / safety concerns from this layout. In my view, the extent of potential effect of this element of the proposal is at the local and possibly wider neighbourhood level. **Comment is requested on the general issues raised by this query.** **A redesigned layout in this area is considered potentially appropriate to address these issues.**	
78	***Location of compact housing*** *Relevant Appendix S19 clauses: S19.3.2.4 Compact housing within close proximity to active recreation, local open space, local and neighbourhood centres, schools and Cambridge Road.* The 3Ms scheme shows areas of compact housing, whereas the Operative Structure Plan shows no compact housing within Growth Cell C2. I support, in principle, the provision of compact housing on the 3Ms land due to the potential to co-locate with the amenities identified in S19.3.2.4. I have some doubts, however, with the location and orientation of proposed compact housing lots. The compact housing lots adjoining Roads 12 and 15, at the south-west corner of the site, do not adjoin any open space, the local centre, the school, or other amenities that lend themselves so strongly to this intensity of development as compared to compact housing lots further to the north. Furthermore, these lots have a north-south orientation. For compact housing lots on the south side of Road 12 and 15 (equally applying to compact housing lots on the south side of Road 18) this is not an ideal orientation, as it can lead to higher fence heights (or – conversely – insufficient privacy, where lower fence heights are enforced) along the boundary of north facing / street adjoining private open space. Additionally, the compact housing ends at the western boundary of the 3Ms site, with the indicative amended Structure Plan showing a change to General Residential directly to the west. I am not aware of any clear rationale for this. **Further commentary for the rationale and thinking behind the location of areas of proposed compact housing is requested.** **Was thought given to other locations for compact housing – such as on Road 10 opposite the stormwater reserve / school, where it might be more proximate to amenities?**	**Response** Waipa District Council have signalled they are actively encouraging the development of increased density within the C1 and C2/C3 Structure Plan area. 3Ms have responded to this request by the including additional housing typology along key local road connections routes within their development (i.e. Road 12 and 15) through the development of specific, compact housing typologies to suit these locations (see below). 
79	***Layout at south-west corner of the 3Ms site and potential future development form/layout adjoining south-west corner of the site*** The south-west corner of the 3Ms site is notable for its two cul-de-sacs and rear lots (while appreciating that the number of rear lots is low within the context of the total number of residential lots proposed).	**Response** As stated, the number of rear lots is low within the context of the total number of residential lots. It was considered impractical to not have cul-de-sacs and rear lots in this location given the access constraints and the desire to achieve density (to efficiently use the land resource).

Item	Matter	3Ms Response
	It would be desirable to see what design alternatives were explored to avoid the need for any cul-de-sacs or rear lots in this area and if such a 'best practice' layout is not achievable. As part of this design exploration, it would also be desirable to understand – as a consequence of the proposed 3Ms layout - what would the likely lot layout be on the adjoining land directly to the west, to the east of the north-south collector road? Could rear lots be avoided on that land? How would future lots on that land be accessed? These questions are relevant to the overall outcome of achieving positive street frontages and an integrated urban form. **Responses to the queries to the left are requested – noting that, where appropriate, this may require aspects of layout design.** **Please note, testing of potential layouts on adjoining land to the west – demonstrating how this achieves overall Appendix S19 outcomes - is considered particularly important.**	Several different configurations for this area were considered during the development of the lot and roading layout for the development (see notes from internal discussion on this area below). Key considerations were; • Limited access from Cambridge Road in the south (both roads and private accesses); and • Limited crossings of stormwater open swale network in the north. Based on the constraints and technical input from 3Ms transportation expert the current layout was confirmed as the best outcome for this part of the development.  The development of land / lot configuration outside of the 3Ms site is not something that 3Ms can comment on.
80	***Interface to Cambridge Road*** *Relevant Appendix S19 clauses: S19.5.4.5(a) Enhance the overall pedestrian and visual amenity of Cambridge Road, integrated with the surrounding land uses.* The 3Ms scheme shows lots adjoining Cambridge Road that are accessed from Road 13 and a Right of Way. Further to the east along Cambridge Road is the retirement village lot 300. While appreciating that land use consent is not being applied for, how does the lot layout to the south-west corner of the 3Ms site and the typical operational characteristics of retirement villages support the development of positive visual amenity along Cambridge Road? **Please provide a response to the query.**	**Response** While we appreciate where this response is coming from, this application is for subdivision consent and does not include the land use consent for any future retirement village. The amenity related issues associated with the retirement village will be comprehensively addressed as part of any land use consent process required – 3Ms will not be the applicant for that land use consent process and therefore cannot comprehensively address this question. 3Ms considers that this question is out of scope in respect of this application, and will better be addressed through the land use consent process.
81	A primary query is how the 3Ms proposal affects the strength of the wider open space and road network and how the layout of primary elements of these networks (as modified by the 3Ms proposal) contributes to overall neighbourhood (ie: the wider growth area) legibility, sense of place/identity, wayfinding/orientation, provision of a community focal point, and integration	**Response** See responses above.

Item	Matter	3Ms Response
	of urban form – including connections through to existing urban development / the Town Green Belt to the east. In my preliminary view, the proposal is not as strong as the Operative Structure in achieving these outcomes. At a broad level, the proposal has an 'inward' focus, with the spatial layout being more legible to and servicing the needs of the 3Ms proposed subdivision than that of the wider growth area. The analysis provided to date has a leaning towards focusing on the 3Ms site itself rather than an 'outward' focus of analysing how the proposal integrates with the wider growth area. In order to more thoroughly understand these integration issues, information responses that analyse wider integration would be useful.	
82	Specific areas of query are on: (1) whether positive interfaces will be achieved to the north-south collector (through the form of likely development to the west that the 3Ms scheme sets up) and to Cambridge Road; (2) whether positive interfaces will be achieved to the east-west reserve lots; (3) the degree of permeability through the retirement village lot 300 and cul-de-sac road 13.	**Response** (1) While 3Ms appreciates this question, it cannot control other land uses within the growth cell and therefore cannot comprehensively address this question. (2) 3Ms is proposing that the east/west reserve lots have significant amenity and connectivity benefits. The following images provide an overview as to what 3Ms is proposing. 

Item	Matter	3Ms Response
		

(3) The permeability through the super lot / potential retirement village is out of scope of this application.

83	Roundabout versus traffic lights comment	**Response** A significant amount of Waipa District Council and 3Ms resources have been placed on the nature of the C2/C3 Intersection and as such, 3Ms has no desire to re-visit this. 3Ms has received assurances from senior Council staff that the nature of the intersection will not be revisited. 3Ms supports the proposal for a well-designed roundabout with underpasses.