Memorandum

To	Marne Cole
Copy	Robin Walker, Harry Baxter, James Cassidy, Anand Kumar, Kristina Macnaughtan
From	Mohit Gupta
Office	Hamilton
Date	8 December 2023
File/Ref	3-39633.PP
Subject	Wastewater Modelling Assessment- 3 Kelly Road Stage 1

1 Introduction

Barker & Associates is preparing to lodge a subdivision consent with Waipa District Council (WDC) for their proposed development at 3 Kelly Road, Cambridge. The proposed development comprises of 6-units under the 'compact housing' provisions of the Waipa District Plan as per client-provided data (via email dated 21 August 2023).

The location of the proposed development is shown in Figure 1.

Figure 1: Location of the 3 Kelly Road development

WSP
Hamilton
Level 2, 99 Bryce Street, Hamilton 3204
Private Bag 3057, Waikato Mail Centre, Hamilton 3204

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wsp.com/nz

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2 Scope of Work

Barker & Associates has approached WSP to conduct a hydraulic modelling assessment for Wastewater to ensure there is adequate capacity within the existing wastewater networks to service the development.

The modelling assessment will identify if the proposed development can meet wastewater Level of Service (LoS) criteria and the overall impact it has on the wider Cambridge Wastewater network.

WSP will continue to liaise with WDC throughout the modelling process, including providing results to WDC for review.

The assessment will have two main objectives:

1. Confirm the potential connection for the 3 Kelly development.
2. Understanding how the 3 Kelly development will impact the entire Cambridge wastewater network, with regards to overflows, surcharge, and freeboard, using the RiTS (static) flow criteria.

It is noted that this memorandum should be read in conjunction with OoS (Appendix B), which provides further guidance and detail on assessments undertaken.

3 Scenario Assessment

The following methodology was completed to assess the impact of the proposed development on the wastewater network.

3.1 Scenario 1 – Development to Baseline (Refer to Scenario 2 as per OoS)

- In Stage 1 Scenario 1, the 3 Kelly Road development is incorporated into the baseline 2022 model.
- The PWWF (Refer to Appendix B for flow development) provided for the development site was loaded directly to manhole 1092748 as shown in Figure 3.1.

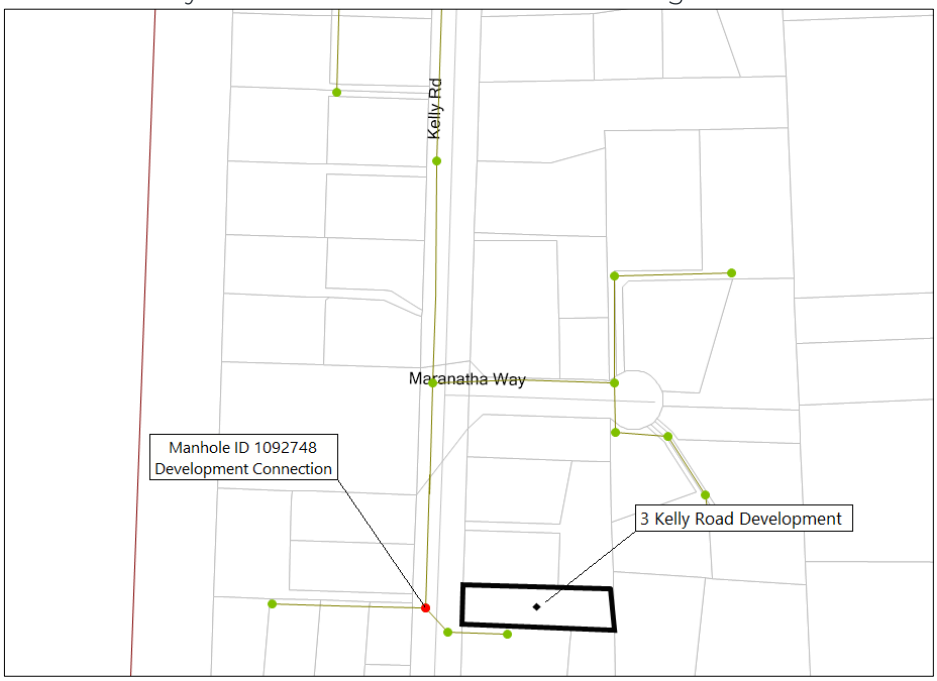

Figure 3.1: Development Discharge point in the baseline model

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3.2 Scenario 2 – Development to Growth Model (Refer to Scenario 4 as per OoS)

- In Stage 1 Scenario 2, the 3 Kelly Road development is incorporated into the Cambridge 2050 Network and Growth.
- The PWWF (1.41l/s) provided for the development site was loaded directly to manhole 1092748 as shown in Figure 3.2.

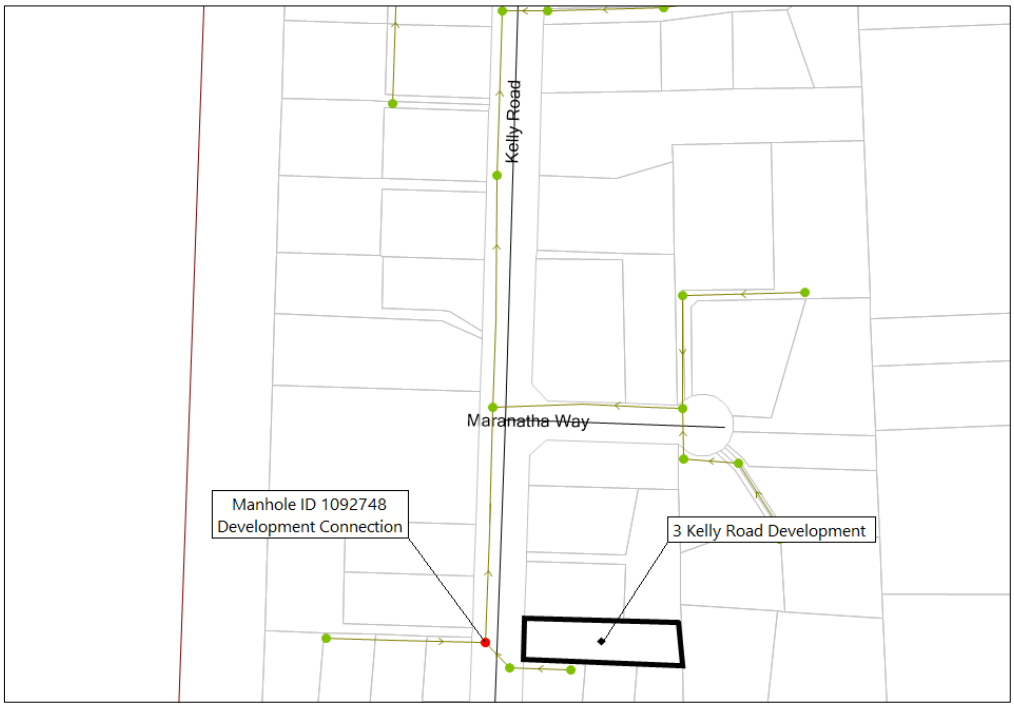

Figure 3.2: Development Discharge point in the Growth Model

3.3 Analysis

The following analysis has been undertaken for Sections 3.1 to 3.2.

- Potential network constraints downstream of the proposed development connection were assessed.
- Assess the level of freeboard available in the network, noting a 300mm freeboard is required as a minimum.
- The assessment of the impact of the proposed development has been undertaken in terms of:
  - ✓ Overflows – Manholes
  - ✓ Surcharge State – Pipes
- Table 3-.3 Gravity Pipe Conditions below summarises the different pipe states.

Table 3-3 Pipe conditions

Surcharge State	Description
<=0.8	Pipe is running at its 80% capacity
> 0.8	Pipe Capacity Exceeded 80% capacity

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4 Assumptions

The following assumptions have been made in completing this work:

- the “Cambridge 2022 base model” and “Cambridge 2050 Network and Growth” for this assessment.
- The provided PWWF discharge of 1.41l/s from the development site has been applied to the network as a static flow.
- As per the OOS, no assessment of the wastewater treatment plant to check if it can accept flow from the development has been undertaken.
- The subcatchment's existing shape had not undergone re-mapping, as the anticipated development's limited scale is unlikely to result in significant interconnected flow.

5 Model Results

5.1 Scenario 1 – Baseline Model (Refer to Scenario 2 as per OoS)

- As shown in Appendix A Figure 5.1, the downstream sewer has available capacity without adding 3 Kelly development in the model result.
- Figure 5.2 provides an overview of the model with 3 Kelly development direct connection with a constant flow contribution of 1.41 L/s (PWWF) to the network. The following are high-level overviews of the model results.
    - Accordingly, it is observed that the downstream Kelly Lane pump station is pushing more flow forward, three pipes are utilising more than 80% of their pipe full capacity.
    - Table 5-2 presents a comparison of the peak flow through the pump before and after the development process.
    - The 3 Kelly development contributes an additional flow of 1.41 l/s, resulting in a surge in the predicted number of surcharged pipes by 3. Primarily, this increase in surcharge is observed along Williams Street, positioned directly downstream of the Kelly Lane PS discharge point.
    - No sewer overflows were predicted in either scenario with or without development.
    - The available freeboard in the study area stands at 2.5 meters above ground level, considerably below the stipulated minimum criterion of 300mm.
    - Table 5-1 provides a high-level overview of the model results discussed above.

Table 5-1 Simulation Results Overview

Scenario	Increase in Number of Overflows (No.)	Increase in Overflow Volume (m^3)	Increase in Number. of Surcharged Pipes (No.)
1: PWWF – 12 l/s	0	0	3

Note: The results shown in the above table are being compared to a "base model" where no 3 Kelly Development was added.

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Table 5-2 Peak flow through the Kelly Lane PS

Scenario	Peak Flow (l/s)
Pre-development	0.6
Post Development (1.41m3/s)	2.0

5.2 Scenario 2- 2050 Growth Model (Refer to Scenario 4 as per OoS)

- As shown in Appendix A Figure 5.3, the downstream sewer has available capacity without adding 3 Kelly development in the model result.
- Figure 5.4 provides an overview of the model with 3 Kelly development direct connection with a constant flow contribution of 1.41 L/s (PWWF) to the network. The following are high-level overviews of the model results.
    - Accordingly, it is observed that the downstream Kelly Lane pump station is pushing more flow forward, three pipes are utilising more than 80% of their pipe full capacity.
    - Table 5-4 presents a comparison of the peak flow through the pump before and after the development process.
    - The 3 Kelly development contributes an additional flow of 1.41 l/s, resulting in a surge in the predicted number of surcharged pipes by 3. Primarily, this increase in surcharge is observed along Williams Street, positioned directly downstream of the Kelly Lane PS discharge point.
    - No sewer overflows were predicted in either scenario with or without development.
    - The available freeboard in the study area stands at 2.5 meters above ground level, considerably below the stipulated minimum criterion of 300mm.
    - Table 5-3 provides a high-level overview of the model results discussed above.

Table 5-3 Simulation Results Overview

Scenario	Increase in Number of Overflows (No.)	Increase in Overflow Volume (m^3)	Increase in Number. of Surcharged Pipes (No.)
1: PWWF – 12 l/s	0	0	3

Note: The results shown in the above table are being compared to a "2050 Growth model" where no 3 Kelly Development was added.

Table 5-4 Volume through the Kelly Lane PS

Scenario	Volume (l/s)
Pre-development	0.6
Post Development (1.41m3/s)	2.0

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6 Conclusions

Based on the assessment detailed above, the following conclusions are made.

- Upon reviewing the post-development scenario in both the Base and 2050 growth models, considering a proposed 3 Kelly Development with a flow discharge of 1.41 L/s at manhole 1092748 on Kelly Street, it is predicted that network surcharge will increase.
- As detailed in sections 5.1 and 5.2, the Kelly Lane Pumping Station discharges an increased flow downstream, leading to a surcharge.
- The freeboard within the study area is at a level of 2.5 meters from the ground, which is below the minimum requirement of 300mm.

Disclaimers and Limitations

This report ('**Report**') has been prepared by WSP exclusively for Powerup Business Consulting ('**Client**') in relation to assess the impact of the C5 development on the current and future Cambridge wastewater networks ('**Purpose**') and in accordance with the Wastewater Modelling Assessment – C5 Development Offer of Service dated 28/07/2022. The findings in this Report are based on and are subject to the assumptions specified in the Report and the Cambridge and Te Awamutu Wastewater Model Build, Calibration and System Assessment Report, July 2019. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

In preparing the models on which this report is based, WSP has relied upon data, surveys, analyses, designs, plans and other information ('**Client Data'**) provided by or on behalf of the Client. Except as otherwise stated in the Report, WSP has not verified the accuracy or completeness of the Client Data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this Report are based in whole or part on the Client Data, those conclusions are contingent upon the accuracy and completeness of the Client Data. WSP will not be liable in relation to incorrect conclusions or findings in the Report should any Client Data be incorrect or have been concealed, withheld, misrepresented, or otherwise not fully disclosed to WSP.

Prepared by:

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Civil Engineer- 3 Waters

Reviewed by:

James Cassidy

Work Group Manager –

Water Resources

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Appendix A

Model Result Maps

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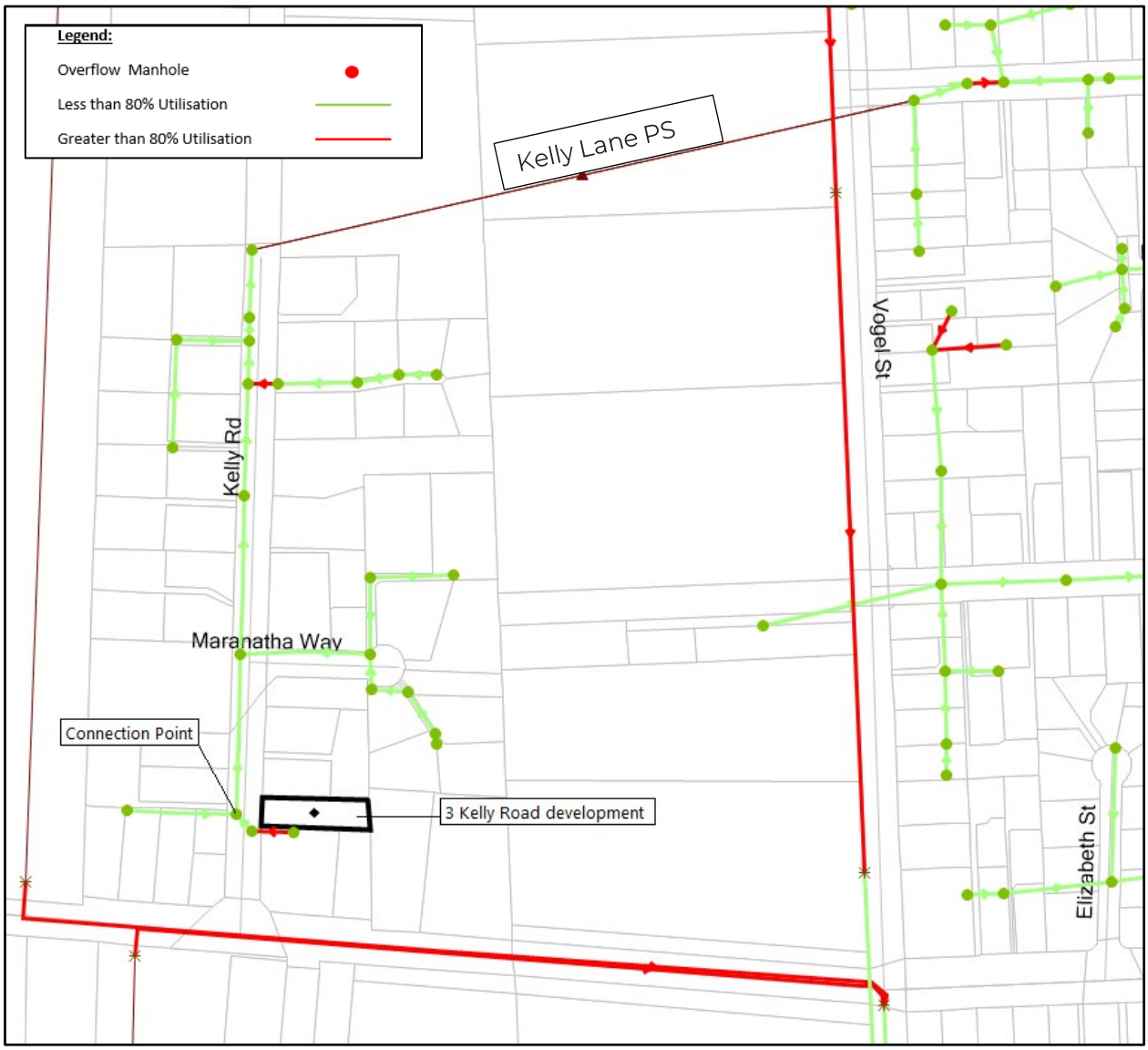

Figure 5.1- Baseline Model without 3 Kelly Development

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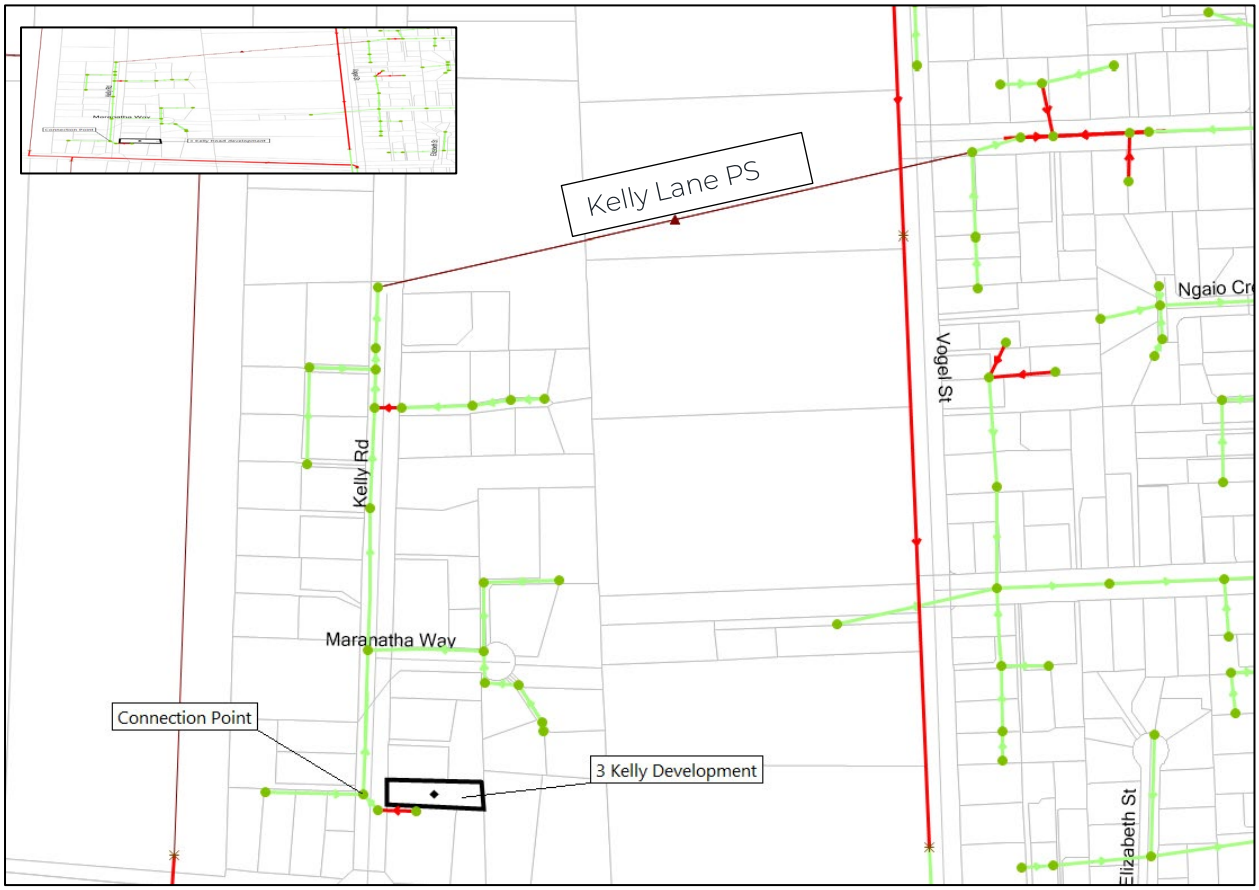

Figure 5.2- Baseline Model with 3 Kelly Development

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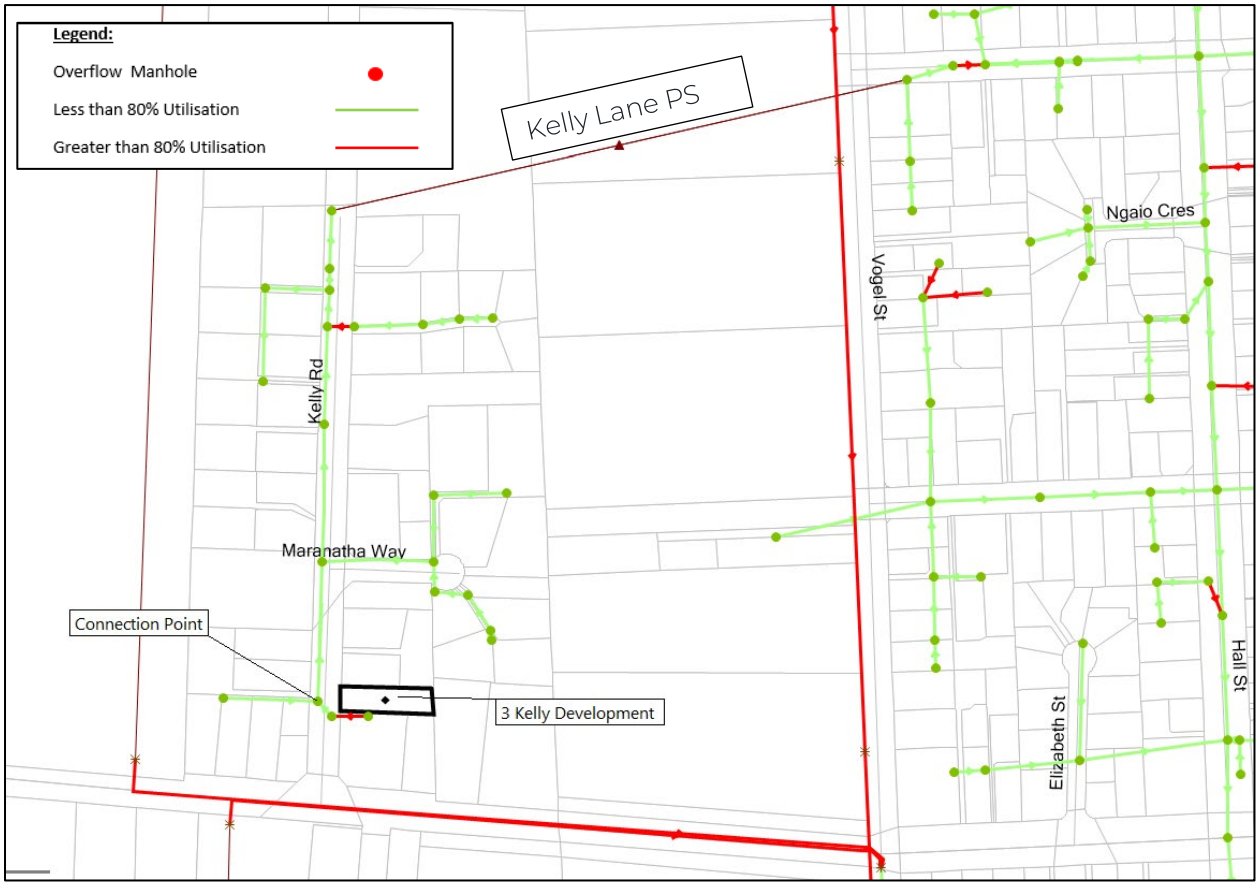

Figure 5.3- 2050 Growth Model without 3 Kelly Development

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Figure 5.4- 2050 Growth Model with 3 Kelly Development

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Appendix B

3 Kelly Offer of Service

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8 December 2023

Barker & Associates Ltd (Cambridge)
5/47 Alpha Street,
Cambridge,
Waikato 3434.

Water and Wastewater Modelling Assessment – 3 Kelly Road Development

Dear Matthew,

Thank you for the opportunity to present our proposal which is detailed below.

1 Introduction

Barker & Associates is preparing to lodge a subdivision consent with Waipa District Council (WDC) for their proposed development at 3 Kelly Road, Cambridge. The proposed development comprises of 6-units under the 'compact housing' provisions of the Waipa District Plan as per client provided data (via email dated 21 August 2023).

The location of the proposed development is shown in Figure 1.

Figure 2: Location of the 3 Kelly Road development

2 Scope of Work

Barker & Associates has approached WSP to conduct a hydraulic modelling assessment for both water and wastewater to ensure there is adequate capacity within the existing water supply and wastewater networks to service the development.

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The modelling assessment will identify if the proposed development can meet water supply and wastewater Level of Service (LoS) criteria, and the overall impact of it on the wider Cambridge water supply network.

WSP will continue to liaise with WDC throughout the modelling process, including providing results to WDC for review.

3 Water Supply

3.1 Background

The proposed development will be serviced by an existing DN 100 PVC main on Kelly Road. As per the client provided data, a hydrant (asset ID: 20150205112600) located 52.2 m North of the proposed development will be tested for residential fire flow criteria (FW2) as shown in Figure 2.

Figure 3: Overview of the water supply network

3.2 Acceptance Criteria

The following criteria will be used for the hydraulic assessment:

- Level of Service (LoS) – Minimum pressure: 200 kPa (20 m) pressure at every connection point as per RITS and WDC guidelines.

- Level of Service (LoS) – Unit Headloss: Unit Headloss (m/km) of the proposed pipe and the existing supply pipe was also investigated as per NZS 4404:2010.
  - 5 m/km for DN ≤ 150 diameter.
  - 3 m/km for DN ≥ 200 diameter.

- Fire flow: New Zealand Fire Service Code of Practice; SNZ PAS 4509:2008 and subsequent amendments, to the satisfaction of the New Zealand Fire Service.

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Table 3-1 below lists the minimum fire flow requirements.

Table 3-1 Fire Flow Requirements as per Fire Fighting Water Supply Code of Practice

Code	Description	Requirements	
		Minimum Fire Flow (L/s)	Minimum Residual Pressure at Required Fire Flow (m)
FW2	Residential	12.5	10

Limitations in the hydraulic modelling software only allow the fire flow analysis for one hydrant at a time. Therefore, WSP has adopted a methodology used for Wellington Water for a similar exercise, as explained below.

For residential fire flows (FW2), the flow from a single hydrant is used to assess the likely flow from two hydrants. If the average flow is greater than or equal to 25 L/s, the flow from one hydrant meets the FW2 requirements.

The use of this approach also creates a buffer to cater to any uncertainty in the models.

Therefore, WSP used the values listed in Table 2 to test the fire hydrants.

Table 3-2: Fire Flow Requirements Used by WSP in this Assessment

Code	Description	Requirements	
		Minimum Fire Flow (L/s)	Minimum Residual Pressure at Required Fire Flow (m)
FW2	Residential	25	10

As per the client-supplied information (AEE.pdf), WSP will conduct the fire flow test on the fire hydrant as shown in Figure 2 above.

3.3 Methodology

Our proposed methodology to provide the water supply hydraulic assessment is as follows:

1. Review the subdivision layout and digitise the proposed network in the model.
2. Calculate the total demand of the proposed network following the steps below:
   - WSP will carry out the residential demand calculations as per RITS (pg. 507)

> The water demand calculations in the subdivision design shall provide for:
> a) A domestic demand of 260 litre/person/day with a peak flow rate of five times this amount for On Demand Supply.

   - WSP will use a 2.7 people/property occupancy rate to calculate demand.
3. Allocate the calculated demand to the model.
4. Run the model to see if the proposed development can meet WDC's LoS requirements as defined in Section 3.2.
5. Run the model for FW2 fire flow criteria.
6. Provide a 1-pager report including the results and findings.

3.4 Water Supply Model Assumptions:

1. The following models will be used in this assessment.
   - 2022 Waipa District Council Operational Model
   - 2050 Waipa District Council Growth Model

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2. The 2022 WDC Operational model includes the proposed Watkins reservoir dedicated inlet main and upgraded pump station (due to be in service in Q3 of 2023).

3. Alpha St WTP is operating 365 days/year in the 2050 growth model.

4. The growth cell demands have been included in the models as detailed below:
    - 2022 Operational Model: Full demands of C1, C2 and C3 growth cells will be included. 1/3 of the C4 growth cell demand will be included. The currently established demands of C6, C8, C9, and C10 growth cells will be included as per current Waipa DC GIS data.
    - 2050 Growth Model: The full demand of master plan growth cells and network upgrades will be included.

- WSP will source contour data available on Waipa GIS to set up the ground elevations of the development.
- WSP has not allowed for any optioneering or network upgrades assessment in this Offer of Service.
- Any additional scope will be undertaken as a project variation.

3.5 Scenarios

Table 5 summarises the WS modelling scenarios, which have been discussed and confirmed with WDC.

Table 3-3 WS Modelling Scenarios

Scenario	Description	Model
1	2022 base model	2022 Operational Model
2	Scenario 1 + proposed development demand	
3	2050 base model	2050 Growth Model
4	Scenario 3 + proposed development demand	

4 Wastewater

WSP will conduct a wastewater assessment for the 3 Kelly Road development, as shown in Figure 2. The assessment will have two main objectives:

3. Confirm the potential connection for the 3 Kelly development.

4. Understanding how the 3 Kelly development will impact the entire Cambridge wastewater network, with regards to overflows, surcharge, and freeboard, using the RiTS (static) flow criteria.

4.1 WW Scope of Work and Methodology:

Our proposed methodology to provide the wastewater assessment is as follows:

7. Digitise the proposed development in the WW model including the proposed connections. Development details were provided by Marne Cole (Barker & Associates Ltd) on 21st Aug 2023 as mentioned under Table 4.1.1.

Table 4.1.1: Development Details

Document Reference	Information

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Appendix 3 District Plan Rules Assessment Appendix 4: 3W Assessment	Site locations and development details. Modelling assumptions

8. Run the WW model as per the scenarios in Table 4.2 with the 5-year ARI design event.
9. Understand the capacity available in the network to identify preferred discharge locations.
10. The results of the work above should be discussed with WDC before moving to the next stage.
11. Static flow is calculated as per RiTS as mentioned in Table 4.1.2 This will be added as a constant flow in the model.

    11.1. Outcome required: Does the WDC wastewater network have the capacity to convey the 3 Kelly without failing LoS?

Table 4.1.2 – Flow from development

Zone	Catchment area (ha)	Total Lots	Pop Equivalent	Peaking factor	PWWF l/s
3 Kelly	0.101	6	120	5	1.41

4.2 WW Scenarios and modelling results analysis:

Table 4.2 summarises the WW modelling scenarios.

Table 4.2: WW Modelling Scenarios

Scenario	Network
1	Wastewater 2022 base model network includes C1, C2 and C3 and 1/3 of the C4 development will be included. The currently established demands of C6, C8, C9, and C10 will be included as per current Waipa DC GIS data.
2	Wastewater 2022 base model network with 3 Kelly development. Identifying the preferred discharge location/s.
3	Wastewater 2050 Growth Model
4	Scenario 3 + Proposed Development

12. Compare the model results of scenarios 1,2,3 and 4 to:

    12.1. Identify current system constraints.
    12.2. Identify impacts on the wastewater network with the 3 Kelly (surcharge and freeboard).
    12.3. Identify new and increased manhole overflow volumes.
    12.4. Identify preferred discharge location/s.

13. Produce 1-pager report including the modelling results.

WW Model Assumptions:

14. WSP will not consider the specific requirements of how the development will connect to the existing wastewater system.
15. The assessment will consider the 5-year 2-hour rainfall as the critical duration.

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16. WSP will use the “Cambridge 2022 base model” and “Cambridge 2050 Network and Growth” for this assessment.
17. No model updates will be made other than those outlined in the scope of work. i.e., representation of development flows.
18. WSP will not model any pipework to service 3 Kelly in the option of discharging the WW flow to the network.
19. The RiTS (static) flow will be used to predict the impact on the network.
20. As this site already contains existing infrastructure, the current population of one dwelling will be accounted for by using an assumed ratio of 1 dwelling to 2.7 people.
21. The subcatchment's existing shape will not undergo digital re-mapping, as the anticipated development's limited scale is unlikely to result in significant interconnected flow.

5 Programme and Outputs

- A one-pager report will be provided for each water supply and wastewater modelling assessments.
- The draft outputs will be delivered to WDC and the client in **5 weeks**, following the acceptance of the offer of service.
- The final outputs will be delivered within **1 week** following the receipt of feedback/comments from WDC or the client.

6 Fee

WSP will undertake the above work under the conditions set out in the IPENZ/ACENZ Short Form Agreement for professional service engagement.

The project will be managed and completed by our Hamilton office. Our fee for the scope as outlined above is **$7,500** (excluding GST) excluding provisional items. It is proposed to be undertaken on a lump sum basis.

7 Conditions of Engagement

If the Offer is accepted, WSP has assumed that the Scope of Work will be performed in accordance with the terms and conditions set out in IPENZ/ACENZ Short Form Agreement for Professional Services Engagement.

8 Information to be Provided by the Client

- AEE pdf including the appendices.

9 Assumptions and Qualifications

In preparing this Offer and calculating the Fees WSP has relied on the following assumptions and qualifications:

- WSP has relied upon the development details provided by Harrison Grierson and other information provided by or on behalf of Harrison Grierson (‘Client Data’). WSP has not verified the accuracy or completeness of the Client Data and reserves the right to amend the Fees to the extent that any Client Data is subsequently found to be incorrect, incomplete, misrepresentative or otherwise not fully disclosed to WSP before its submission of the Proposal.
- COVID-19 - While we will make every effort to adapt our work methodology, we are unable to quantify the impact that COVID-19 may have on the performance of the

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Services. Any additional costs and/or delays to the programme will be treated as a Variation.

The offer set out in this letter is valid for 60 days from the date of its issue. Any changes to the assumptions and qualifications above, or any other matter set out in this Offer of Service, including any amendments to the terms and conditions of contract proposed, may result in an adjustment to the Fees and/or Programme. Global Metal Solutions may confirm its acceptance of the offer by signing this letter in the relevant section below and returning it to me before the expiry of the validity period. If you have any queries, please contact me.

Kind regards,

James Cassidy
Work Group Manager – Water and Wastewater

Offer of Service No:	Approved/Not Approved
Name: _____	Signed: _____
PO Number:	
Comments: _____	

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