Tonkin+Taylor

Job No: 1012397.1000
20 August 2021

CCKV Dev Co LP & Bayview Nelson Ltd
c/- Landmark Lile Ltd
PO Box 343
Nelson 7040

Dear Mark

**Private Plan Change Request 28 - Maitahi Bayview**
**Response to Request for Further Information**

Please find below our response to the Stormwater and Flood Risk Management, and Infrastructure, requests for further information.

***Stormwater Management and Ecological Effects Management and Flood Risk Management***

***B- Stormwater and flood risk management***

*25) Please provide information to demonstrate:*

*a) That the proposed zoning is feasible from a stormwater and flood risk management perspective and that potential adverse effects beyond the site are able to be appropriately managed through the proposed provisions; and*

We have recently undertaken flood modelling using NCC's Matai River model to assess the effects of the development within the Maitai Floodplain area for a variety of scenarios including the RCP8.5 2130, 1% Annual exceedance Probability (AEP) (100yr) events for a variety of durations. This was based on conservative approach consisting of a vertical face ('glass wall') at the development boundary edge and no cutting within the existing floodplain. The critical duration in terms of peak flood levels for the Maitai river is the 12 hour event adjacent to the site, while further downstream the 24 hour duration event becomes critical.

In general, the modelling provides confidence that engineering solutions could be developed for the stormwater management within the proposed zoning to meet NTLDM requirements, and ways to achieve this have been outlined in Section 6.1 of the Infrastructure PPCR report. It is our understanding and expectation that this would form part of a future resource consent process, as required by the relevant rules and information requirements of the NRMP.

*b) The assumptions underlying the conclusions and recommendations for how the appropriate stormwater management outcomes are going to be achieved in future developments.*

*The above needs to include:*



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i. *Sufficient information to demonstrate that a proposed stormwater management system for the Brooklands/Bayview catchments (north side of the ridge) is feasible, practicable and achievable and how Policy 23 of the NZCPS would be given effect to.*

Our Infrastructure PPCR report provides several of options of how stormwater could be managed in this area to support a plan change request - refer Section 6.2 of Infrastructure PPCR report. Note that subject to confirmation of lot layouts, many of the items referred to in Section 6.1 are also appropriate. We are confident that engineering solutions could be developed for the stormwater management within the proposed zoning to meet NTLDM requirements, however, it is our understanding and expectation that this would form part of a future resource consent process, as required by the relevant rules and information requirements of the NRMP.

ii. *Sufficient information to demonstrate that a proposed stormwater management system for the south side of the ridge/Kaka Hill Tributary catchment is feasible, practicable and achievable.*

Our Infrastructure PPCR report provides a range of options of how stormwater could be managed in this area to support a plan change request - refer Section 6.1 of Infrastructure PPCR report. We are confident that engineering solutions could be developed for the stormwater management within the proposed zoning to meet NTLDM requirements, however, it is our understanding and expectation that this would form part of a future resource consent process, as required by the relevant rules and information requirements of the NRMP.

iii. *Information to confirm that the proposed corridor around the Kaka Stream realignment would be an adequate width to achieve all environmental, ecological and access outcomes (such as waterway capacity, fish passage and habitat) stated in the PPC* objectives, and how the proposed provisions will achieve this.

A typical corridor width of 40 m has been allowed for the Kaka Stream realignment. Our initial calculations indicate that a minimum channel width of approximately 12.3 m would be sufficient to convey the peak flows in the lower portion of the Kaka Valley catchment for a 1% AEP event. The interactions between the flood conveyance and other outcomes will be worked through as part of any future resource consent process.

iv. *An assessment of the geomorphology of the existing waterways and sediment transport, and the potential increase in stream erosion due to increased volume and frequency of runoff, and the effects of this on the proposed system. The assessment needs to cover the existing sediment yield for the catchment for Q20, Q50 and Q100 modelled rainfall events, and the potential sediment yield as a result of the zoning changes and subsequent earth disturbance.*

Our intention for any stormwater management will be to limit modification of the existing channel as much as possible and for stormwater to be managed close to the source. We acknowledge that as a result of an increase in impervious surfaces as a result of the development, the volume and frequency of runoff may increase, however given the proposed land-use change from pastural to residential in addition to some of the proposed planting works in the upper catchment, the sediment yield may decrease as a result of the development.

Given the final stormwater solution and layout is unknown at this stage, a geomorphic assessment of the current catchment and the implication of the development is proposed to be carried as part of any future resource consent process.

v. *The anticipated volume and extent of filling and offset storage proposed within the Maitai River floodplain, including an assessment of the frequency of ponding in this new cut area and implications for vegetation and proposed land uses, as well as the effects of this on wider flood risk (via modelling).*

Refer to our response in item 25 (a) above for details of further modelling work undertaken. Note that this does not include any cutting into the existing floodplain, and it appears unlikely that this will be required. Given that the area of flooding within the development has been reduced, and the extents of flooding in properties upstream of the development are minor, we do not expect any implications on vegetation or existing land use.

vi. *Hydraulic modelling of:*

1. *The existing Kaka Hill Tributary catchment, including overland flow paths, flood levels and flood extents in a 1% AEP event, including consideration of climate change effects.*

We have not undertaken any modelling of the Kaka Hill Tributary catchment (with the exception of our peak flow assessments) yet, as it would normally be done in conjunction with item 2 below, when the proposed development and earthworks/levels have been confirmed are being further developed. As noted in Section 6.1 of our Infrastructure PPCR report, the NTLDM requires any stormwater runoff discharging into a flood zone to be detained to mitigate the effects of any additional volume resulting from the development. A number of options are provided as to how this will be achieved.

2. *The Kaka Hill Tributary and Maitai River with the proposed development, stormwater system (including attenuation), Kaka Hill Tributary realignment, floodplain filling and offset storage, and the effects on flood levels and flood risk at the site and in the wider area.*

Refer response to item 1 above.

3. *The impact on groundwater connectivity and water tables and Maitai River Environmental flows.*

This has been addressed in the Morphum Environmental Ltd report "*Preliminary Structure Plan Environmental Review*", which stated that while the Maitai River Stream baseflow can be impacted through the development of catchments, large catchment areas will remain above the development extent (particularly on east side) which will be undeveloped and retain infiltration/baseflow inputs.

In addition, any areas identified as having high infiltration capacity and are geotechnically suitable, will be investigated for discharging stormwater via infiltration to optimise groundwater recharge and baseflow as part of water sensitive design strategy. Given the final stormwater solution and layout is unknown at this stage, an assessment of the groundwater connectivity and the implication of the development is proposed to be carried out and further detailed at Resource Consent stage.

vii. *Assessment and the proposed mitigation (if any) of the bank erosion and migration of the Maitai Riverbank and how the reserve/esplanade width has been established and would address any potential future changes to the Riverbank.*

This has been addressed in a report prepared for Nelson City Council by Morphum Environmental Ltd in July 2020, titled "*Ecological Restoration Plan, Maitai River*". The report presents three options for consideration with a recommendation that the willows be removed on the inside of the bend, and a channel cut to relocate the river back to its previous alignment. If this was to be implemented,

it is highly likely that it would reduce any pre and post development effects of flooding on properties immediately upstream of this area.

***Infrastructure***

***A – Wastewater***

38. *Please provide the technical information that demonstrates the suitability of the upgrades that are described as necessary for the connection to the NCC wastewater network in Nile Street through to Neal Park Pump Station. This should include assumptions made around other growth occurring in that catchment (including any changes to inflow and infiltration that have been allowed for) and pipe alignments proposed. The information should address the capacity of the Weka Street/Sovereign Street Pump Station and its rising main to Neale Park Pump Station and the availability of suitable land for the additional storage upgrade identified as required. Please also include consideration of septicity issues arising from the additional pumping steps.*

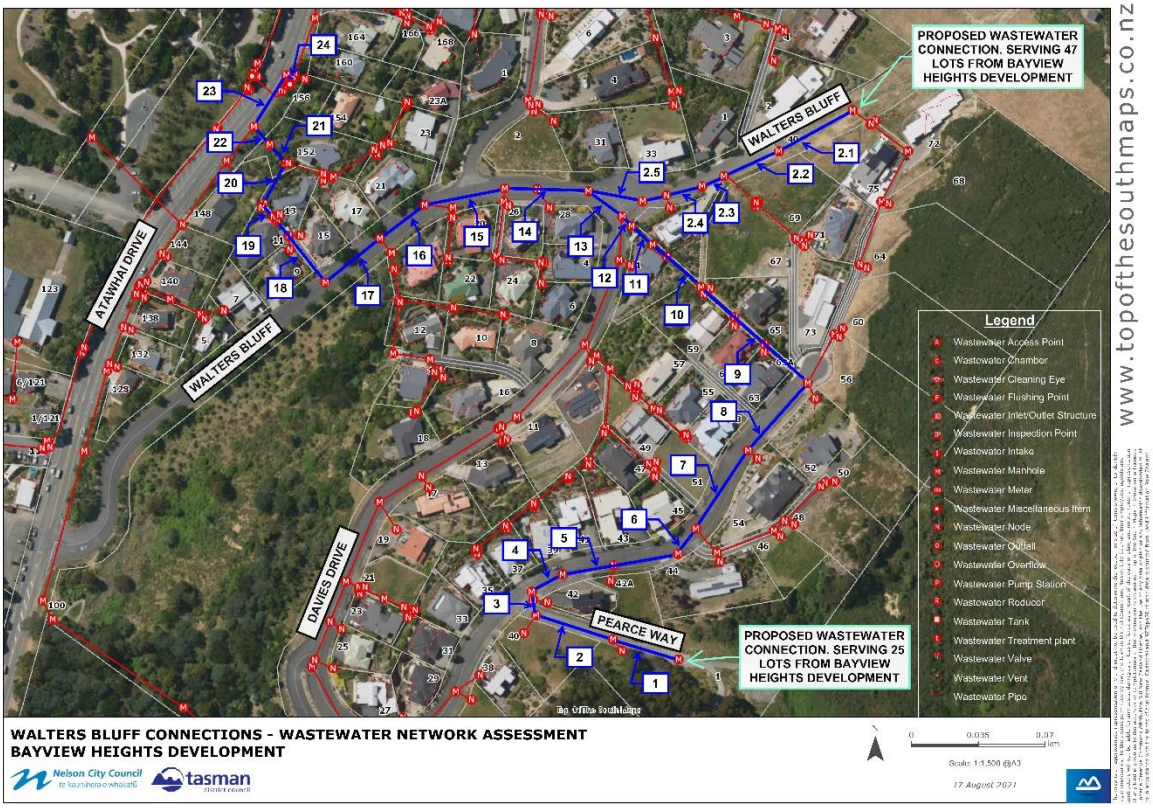
Please refer to the appended Infrastructure Addendum report for additional information requested.

We have been advised by NCC that the Weka Street Pump Station is capable of managing flows for up to 800 lots and would only require additional storage over and above the current 115 $m^3$ available. To accommodate up to 800 lots the additional storage required was estimated to be in the order of 250 $m^3$. To accommodate 350 lots, the additional storage required is estimated to be approximately 110 $m^3$. This tank could potentially be located underneath the road in Sovereign Street.

39. *Please provide the technical information that demonstrates the adequacy of the capacity of the downstream network on the Walters Bluff and Brooklands side of the development (including for a fully developed catchment area). Alternatively, please address other options.*

We have assessed the capacity of the existing wastewater network based on two proposed connection points at (i) Walters Bluff, and (ii) Brooklands. For feasibility purposes, we have based our assessment on 72 lots discharging to Walters Bluff and 55 Lots discharging to Brooklands.

The proposed wastewater connection point for the Walters Bluff network, and the pre and post development downstream network capacity assessment results for this connection point are shown in Figure 1. This indicates that the existing wastewater network from Walters Bluff to the Cemetery Pump Station at 156 Atawhai Drive C (NCC ID: SO6) has sufficient capacity to serve the proposed development of 72 lots.




| Figure Ref | Upstream MH Ref | Downstream MH Ref | Pipe dia. (mm) | Pipe length (m) | Full pipe capacity (l/s) | Water velocity at capacity flow rate ($m^2/s$) | Pipe capacity under NTLDM upper limit velocity[2] (l/s) | Water velocity for NTLDM limited capacities[2] ($m^2/s$) | Useable pipe dia. Under NTLDM[2] (mm) | Exist ADWF[1] (l/s) | Exist PDWF[1] (l/s) | Exist PWWF[1] (l/s) | ADWF[1] (l/s) (Post[3] Development) | PDWF[1] (l/s) (Post[3] Development) | PWWF[1] (l/s) (Post[3] Development) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S404983 | S404984 | 150 | 35.9 | 62.3 | 3.9 | 25.0 | 3.0 | 103 | 0.00 | 0.00 | 0.00 | 0.22 | 0.43 | 1.30 |
| 2 | S404984 | S404965 | 150 | 42.2 | 39.9 | 4.4 | 13.1 | 3.0 | 85 | 0.01 | 0.02 | 0.05 | 0.23 | 0.45 | 1.35 |
| 3 | S404965 | S404964 | 150 | 12.5 | 47.2 | 2.7 | - | - | 150 | 0.03 | 0.05 | 0.16 | 0.24 | 0.49 | 1.46 |
| 4 | S404964 | S404963 | 150 | 18.7 | 39.9 | 3.3 | 29.6 | 3.0 | 129 | 0.03 | 0.05 | 0.16 | 0.24 | 0.49 | 1.46 |
| 5 | S404963 | S404962 | 150 | 61.3 | 52.4 | 3.0 | 52.4 | 3.0 | 150 | 0.03 | 0.07 | 0.21 | 0.25 | 0.50 | 1.51 |
| 6 | S404962 | S404960 | 150 | 16.0 | 50.1 | 2.8 | - | - | 150 | 0.03 | 0.07 | 0.21 | 0.25 | 0.50 | 1.51 |
| 7 | S404960 | S404961 | 150 | 49.3 | 50.0 | 2.8 | - | - | 150 | 0.07 | 0.14 | 0.42 | 0.29 | 0.57 | 1.72 |
| 8 | S404961 | S404953 | 150 | 47.1 | 36.8 | 2.1 | - | - | 150 | 0.08 | 0.16 | 0.47 | 0.30 | 0.59 | 1.77 |
| 9 | S404953 | S404954 | 150 | 75.1 | 58.2 | 4.6 | 15.0 | 3.0 | 80 | 0.14 | 0.28 | 0.83 | 0.36 | 0.71 | 2.14 |
| 10 | S404954 | S404982 | 150 | 33.8 | 63.0 | 6.5 | 5.3 | 3.0 | 47 | 0.14 | 0.28 | 0.83 | 0.36 | 0.71 | 2.14 |
| 11 | S404982 | S404955 | 150 | 14.8 | 41.9 | 6.3 | 4.6 | 3.0 | 49 | 0.14 | 0.28 | 0.83 | 0.36 | 0.71 | 2.14 |
| 12 | S404955 | S404956 | 150 | 6.9 | 39.9 | 4.1 | 15.6 | 3.0 | 93 | 0.14 | 0.28 | 0.83 | 0.36 | 0.71 | 2.14 |
| 13 | S404956 | S404945 | 150 | 22.1 | 51.0 | 3.7 | 27.3 | 3.0 | 109 | 0.39 | 0.78 | 2.34 | 0.61 | 1.22 | 3.65 |
| 2.1 | S413925 | S413926 | 150 | 44.2 | 71.8 | 4.1 | 21.3 | 3.0 | 95 | 0.03 | 0.07 | 0.21 | 0.44 | 0.89 | 2.66 |
| 2.2 | S413926 | S413927 | 150 | 31.6 | 57.4 | 3.2 | 41.8 | 3.0 | 133 | 0.03 | 0.07 | 0.21 | 0.44 | 0.89 | 2.66 |
| 2.3 | S413927 | S411518 | 150 | 12.4 | 68.6 | 3.9 | 24.4 | 3.0 | 102 | 0.07 | 0.14 | 0.42 | 0.48 | 0.95 | 2.86 |
| 2.4 | S411518 | S411519 | 150 | 32.2 | 58.4 | 3.3 | 39.7 | 3.0 | 130 | 0.08 | 0.16 | 0.47 | 0.49 | 0.97 | 2.92 |
| 2.5 | S411519 | S404945 | 150 | 28.9 | 56.4 | 3.2 | 43.9 | 3.0 | 137 | 0.08 | 0.16 | 0.47 | 0.49 | 0.97 | 2.92 |
| 14 | S404945 | S404946 | 150 | 43.8 | 64.8 | 3.7 | 29.1 | 3.0 | 111 | 0.48 | 0.95 | 2.86 | 1.10 | 2.20 | 6.61 |
| 15 | S404946 | S404948 | 150 | 42.9 | 69.1 | 3.9 | 23.9 | 3.0 | 101 | 0.51 | 1.02 | 3.07 | 1.14 | 2.27 | 6.82 |
| 16 | S404948 | S404949 | 150 | 29.1 | 62.9 | 3.6 | 31.8 | 3.0 | 116 | 0.53 | 1.06 | 3.18 | 1.15 | 2.31 | 6.93 |
| 17 | S404949 | S404950 | 150 | 36.8 | 64.6 | 3.7 | 29.3 | 3.0 | 112 | 0.59 | 1.18 | 3.54 | 1.22 | 2.43 | 7.29 |
| 18 | S404950 | S404951 | 150 | 41.6 | 70.3 | 4.0 | 22.7 | 3.0 | 98 | 0.61 | 1.22 | 3.65 | 1.23 | 2.47 | 7.40 |
| 19 | S404951 | S404952 | 150 | 11.0 | 104.3 | 5.9 | 7.0 | 3.0 | 54 | 0.62 | 1.23 | 3.70 | 1.24 | 2.48 | 7.45 |
| 20 | S404952 | S404943 | 150 | 24.2 | 68.1 | 3.9 | 25.0 | 3.0 | 103 | 0.63 | 1.25 | 3.75 | 1.25 | 2.50 | 7.50 |
| 21 | S404943 | S404944 | 150 | 12.9 | 115.9 | 6.6 | 5.1 | 3.0 | 46 | 0.67 | 1.34 | 4.01 | 1.29 | 2.59 | 7.76 |
| 22 | S404944 | S403584 | 150 | 12.6 | 126.1 | 7.1 | 3.9 | 3.0 | 41 | 0.67 | 1.34 | 4.01 | 1.29 | 2.59 | 7.76 |
| 23 | S403584 | S404796 | 200 | 32.0 | 40.6 | 1.3 | - | - | 200 | 0.79 | 1.58 | 4.74 | 1.41 | 2.83 | 8.49 |
| 24 | S404796 | S06 (Pump Station) | 200 | 4.1 | 91.5 | 2.9 | - | - | 200 | 0.79 | 1.58 | 4.74 | 1.41 | 2.83 | 8.49 |

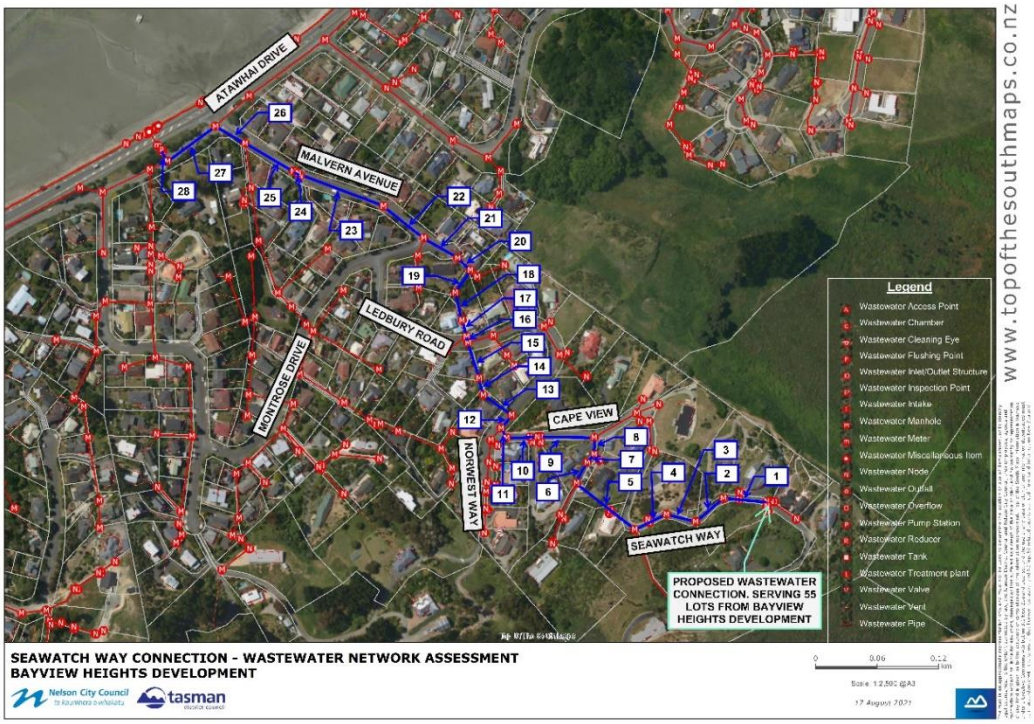
**Notes:**

1. Red denotes pipes that are under capacity according to NTLDM requirements.
2. Upper self cleansing velocity limit is 3 $m^2/s$ (According to building code: E1 Surface Water, referenced in NTLDM).
3. "Post Development" refers to existing wastewater flow + additional wastewater flow from 25 residential units through pipes 1-13, 47 units through pipes 2.1-2.5, and 72 units through pipes 14-24.

*Figure 1 – Walters Bluff wastewater assessment*

The proposed wastewater connection point for Brooklands and the pre and post development downstream network capacity assessment results for this connection point are shown in Figure 2. This indicates that the existing wastewater network down Seawatch Way to the Brooklands Pump

Station at 382 Atawhai Drive (NCC ID: SO5) has sufficient capacity to serve the proposed development of 55 lots.




| Figure Ref | Upstream MH Ref | Downstream MH Ref | Pipe dia. (mm) | Pipe length (m) | Full pipe capacity (l/s) | Water velocity at capacity flow rate ($m^2/s$) | Pipe capacity under NTLDM upper limit velocity[2] (l/s) | Water velocity for NTLDM limited capacities[3] ($m^2/s$) | Useable pipe dia. Under NTLDM[4] (mm) | Exist ADWF[1] (l/s) | Exist PDWF[1] (l/s) | Exist PWWF[1] (l/s ) | ADWF[1] (l/s) (Post[3] Development) | PDWF[1] (l/s) (Post[3] Development) | PWWF[1] (l/s) (Post[3] Development) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S406488 | S406489 | 150 | 43.7 | 47.9 | 4.5 | 14.8 | 3.0 | 83 | 0.03 | 0.07 | 0.21 | 0.51 | 1.02 | 3.07 |
| 2 | S406489 | S406490 | 150 | 35.4 | 55.7 | 3.8 | 27.1 | 3.0 | 107 | 0.03 | 0.07 | 0.21 | 0.51 | 1.02 | 3.07 |
| 3 | S406490 | S406491 | 150 | 29.2 | 48.9 | 3.7 | 26.1 | 3.0 | 109 | 0.03 | 0.07 | 0.21 | 0.51 | 1.02 | 3.07 |
| 4 | S406491 | S406492 | 150 | 34.6 | 57.9 | 3.3 | 40.7 | 3.0 | 131 | 0.04 | 0.09 | 0.26 | 0.52 | 1.04 | 3.13 |
| 5 | S406492 | S406493 | 150 | 72.4 | 50.6 | 5.6 | 7.8 | 3.0 | 58 | 0.06 | 0.12 | 0.36 | 0.54 | 1.08 | 3.23 |
| 6 | S406493 | S406495 | 150 | 22.7 | 49.8 | 2.8 | 49.8 | 2.8 | 150 | 0.08 | 0.16 | 0.47 | 0.56 | 1.11 | 3.33 |
| 7 | S406495 | S406496 | 150 | 10.4 | 65.7 | 4.2 | 19.1 | 3.0 | 90 | 0.08 | 0.16 | 0.47 | 0.56 | 1.11 | 3.33 |
| 8 | S406496 | S406497 | 150 | 16.5 | 63.5 | 3.6 | 30.9 | 3.0 | 115 | 0.09 | 0.17 | 0.52 | 0.56 | 1.13 | 3.39 |
| 9 | S406497 | S403662 | 150 | 52.6 | 44.0 | 4.0 | 18.9 | 3.0 | 98 | 0.13 | 0.26 | 0.78 | 0.61 | 1.22 | 3.65 |
| 10 | S403662 | S403663 | 150 | 33.0 | 49.2 | 4.0 | 21.2 | 3.0 | 98 | 0.15 | 0.30 | 0.89 | 0.63 | 1.25 | 3.75 |
| 11 | S403663 | S403664 | 150 | 10.6 | 49.7 | 4.1 | 20.2 | 3.0 | 95 | 0.16 | 0.31 | 0.94 | 0.63 | 1.27 | 3.80 |
| 12 | S403664 | S403657 | 150 | 16.3 | 41.2 | 2.3 | 41.2 | 2.3 | 150 | 0.20 | 0.40 | 1.20 | 0.68 | 1.35 | 4.06 |
| 13 | S403657 | S403661 | 150 | 34.1 | 51.8 | 3.2 | 43.7 | 3.0 | 138 | 0.21 | 0.42 | 1.25 | 0.69 | 1.37 | 4.11 |
| 14 | S403661 | S403650 | 150 | 17.0 | 39.9 | 6.4 | 4.2 | 3.0 | 48 | 0.21 | 0.42 | 1.25 | 0.69 | 1.37 | 4.11 |
| 15 | S403650 | S403554 | 150 | 36.1 | 39.9 | 3.8 | 20.2 | 3.0 | 106 | 0.23 | 0.45 | 1.35 | 0.70 | 1.41 | 4.22 |
| 16 | S403554 | S403553 | 150 | 6.3 | 14.6 | 0.8 | 14.6 | 0.8 | 150 | 0.30 | 0.59 | 1.77 | 0.77 | 1.55 | 4.64 |
| 17 | S403553 | S403651 | 150 | 16.4 | 20.0 | 1.1 | 20.0 | 1.1 | 150 | 0.31 | 0.63 | 1.88 | 0.79 | 1.58 | 4.74 |
| 18 | S403651 | S403652 | 150 | 27.7 | 39.9 | 6.3 | 4.4 | 3.0 | 49 | 0.34 | 0.68 | 2.03 | 0.82 | 1.63 | 4.90 |
| 19 | S403652 | S403653 | 150 | 26.6 | 39.9 | 3.4 | 28.4 | 3.0 | 126 | 0.34 | 0.68 | 2.03 | 0.82 | 1.63 | 4.90 |
| 20 | S403653 | S403634 | 150 | 17.0 | 39.9 | 5.0 | 8.8 | 3.0 | 69 | 0.36 | 0.73 | 2.19 | 0.84 | 1.68 | 5.05 |
| 21 | S403634 | S403546 | 150 | 38.3 | 39.9 | 3.1 | 35.1 | 3.0 | 140 | 0.40 | 0.80 | 2.40 | 0.88 | 1.75 | 5.26 |
| 22 | S403546 | S403545 | 150 | 50.1 | 39.9 | 3.5 | 25.1 | 3.0 | 118 | 0.44 | 0.89 | 2.66 | 0.92 | 1.84 | 5.52 |
| 23 | S403545 | S403543 | 150 | 94.2 | 39.9 | 2.8 | 39.9 | 2.8 | 150 | 0.51 | 1.02 | 3.07 | 0.99 | 1.98 | 5.94 |
| 24 | S403543 | S403539 | 150 | 54.1 | 37.0 | 2.1 | 37.0 | 2.1 | 150 | 0.53 | 1.06 | 3.18 | 1.01 | 2.01 | 6.04 |
| 25 | S403539 | S403629 | 150 | 33.5 | 36.8 | 2.1 | 36.8 | 2.1 | 150 | 1.16 | 2.33 | 6.98 | 1.64 | 3.28 | 9.84 |
| 26 | S403629 | S403541 | 200 | 57.6 | 16.5 | 0.5 | 16.5 | 0.5 | 200 | 1.16 | 2.33 | 6.98 | 1.64 | 3.28 | 9.84 |
| 27 | S403541 | S403683 | 200 | 9.9 | 94.2 | 3.0 | 94.2 | 3.0 | 200 | 1.16 | 2.33 | 6.98 | 1.64 | 3.28 | 9.84 |
| 28 | S403683 | S05 (Pump Station) | 200 | 2.5 | 75.1 | 2.4 | 75.1 | 2.4 | 200 | 1.16 | 2.33 | 6.98 | 1.64 | 3.28 | 9.84 |

**Notes:**

1. Red denotes pipes that are under capacity according to NTLDM requirements.
2. Upper self cleansing velocity limit is 3 $m^2/s$ and lower limit is 0.65 $m^2/s$ (According to building code: E1 Surface Water, referenced in NTLDM).
3. "Post Development" refers to existing wastewater flow + additional wastewater flow from 55 residential units.

*Figure 2 – Brooklands wastewater assessment*

We have been advised by NCC that the Cemetery and Brooklands Pump Stations are unlikely to need upgrading and would only require additional storage to be provided, over and above the existing

storage. For Cemetery Pump Station this would be in the order of 12 $m^3$ additional storage, and for Brooklands Pump Station in the order of 105 $m^3$ additional storage.

The tank for the Cemetery Pump Station is relatively small and could potentially be located underneath the road in Atawhai Drive. The tank for Brooklands Pump Station could be located in the large grass berm area adjacent to the pump station.

***B – Water***

40. *Please provide the background information referred to in the technical report covering the operation and sizing of the proposed water supply to the development (current and future) and discussions with NCC.*

Please refer to the appended Infrastructure Addendum report for additional information requested.

41. *Please provide information that demonstrates the feasibility of the reservoir sites. This needs to include confirmation that the level of the lower reservoir is suitable for it to be filled without pumping from the existing network and that the height and extent of any structure and associated earthworks that would be required could meet the proposed provisions of the PPC itself.*

Please refer to the appended memo from Jeff Booth Consulting (JBC) titled *Maitahi Development Modelling.* This confirms that a 1,000 $m^3$ reservoir with a top water level of RL 94 m and a bottom water level of RL 90 m can be adequately serviced from the existing rising main in Tasman Street. (i.e. the reservoir will fill from 50% in approximately 5 hours).

Although our Infrastructure PPCR report proposed a 1,300 $m^3$ reservoir at RL 135 m which is different to the modelling undertaken by JBC, we are confident that this is feasible. Should this not turn out to be feasible, there are many options available to service the development such as providing an additional reservoir (which would be filled by pumping from the lower reservoir), or increasing the size of the proposed upper reservoir at RL 230 m.

Yours sincerely

Mark Foley
Project Director

Attached:
1 Maitahi Bayview PPCR, Wastewater and Water Supply Addendum Report, August 2021
2 Jeff Booth Consulting Ltd memo, Maitahi Development Modelling

20-Aug-21
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REPORT

Tonkin+Taylor

# Maitahi Bayview PPCR

## Wastewater and Water Supply Addendum Report

**Prepared for**
CCKV Dev Co LP
**Prepared by**
Tonkin & Taylor Ltd
**Date**
August 2021
**Job Number**
1012397.1000.v2

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## Document Control

| Title: Maitahi Bayview PPCR | | | | | |
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| **Date** | **Version** | **Description** | **Prepared by:** | **Reviewed by:** | **Authorised by:** |
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| 20.08.2021 | 2 | Final response to PPC RFI | MGM | MRF | MRF |
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# 1 Introduction

This report is provided as an addendum to the Infrastructure and Flooding Report prepared by Tonkin & Taylor Ltd in March 2021[1], and shall be used as supporting material for an application for Private Plan Change (PPC) to the Nelson Resource Management Plan under Schedule 1 of the Resource Management Act.

This report provides more in depth detail to the initial Infrastructure and Flooding Report submitted with the PPC application, to address related items in the Request for Further Information (RFI) dated 3 August 2021.

For feasibility purposes, this report is based on a scenario of a 350 lot development in the Kaka Valley. The final number of lots within the development will be determined by future master planning and any resource consent process.

[1] Private Plan Change Request, Infrastructure and Flooding Report, Prepared for CCKL Maitai Dev Co LP & Bayview Nelson Ltd, Prepared by Tonkin & Taylor Ltd, March 2021, Job Number 1012397.1000.v6

# 2 Wastewater

During the course of the wastewater assessment, we have met with Nelson City Council (NCC) staff on the following occasions:

- Tuesday 17 December 2019 with NCC staff (Shane Overend, Phil Ruffell and Warren Biggs)
- Wednesday 8 January 2020 with NCC staff and the Maitahi and Bayview developers
- Monday 24 February 2020 with NCC staff and the Maitahi and Bayview developers
- Thursday 12 March 2020 with NCC staff and the Maitahi and Bayview developers

Discussion points from these meetings have been incorporated into this report where relevant.

## 2.1 Design flows

For feasibility purposes, the wastewater flows for the Kaka Valley have been based on 350 lots. The estimated wastewater peak wet weather flows (PWWF) are based on the current 2019 Nelson Tasman Land Development Manual (NTLDM) and are summarised in Table 2.1 below.

**Table 2.1: Peak wastewater flows from NTLDM**

| Condition | Estimated flow based on 350 lots[1] |
|---|---|
| Average Dry Weather Flow (ADWF) | 3.04 l/s |
| Peak Dry Weather Flow (PDWF) | 6.08 l/s |
| Peak Wet Weather Flow (PWWF) | 18.23 l/s |

*[1] Based on 2.5 person per dwelling and a peak dry weather flow factor of 2 and peak wet weather flow factor of 6 based on an 18-hour day (as per requirement in NTLDM).*

## 2.2 Existing wastewater network

A capacity assessment has been undertaken from Nile Street East/Maitai Valley intersection down to the Weka Street pumping station located at the corner of Weka Street and Sovereign Street.

The existing pipeline comprises:

- **Nile Street/Maitai Intersection down to Milton/Bridge Street intersection** – 150 mm diameter reticulation pipeline.
- **Milton/Bridge Street intersection down to Weka Street pumping station** - a trunk main, with variable diameter. The trunk commences as a 300 mm diameter, then reduces to 150 mm diameter before increasing back to 300 mm then 350, and then 375 mm diameter.

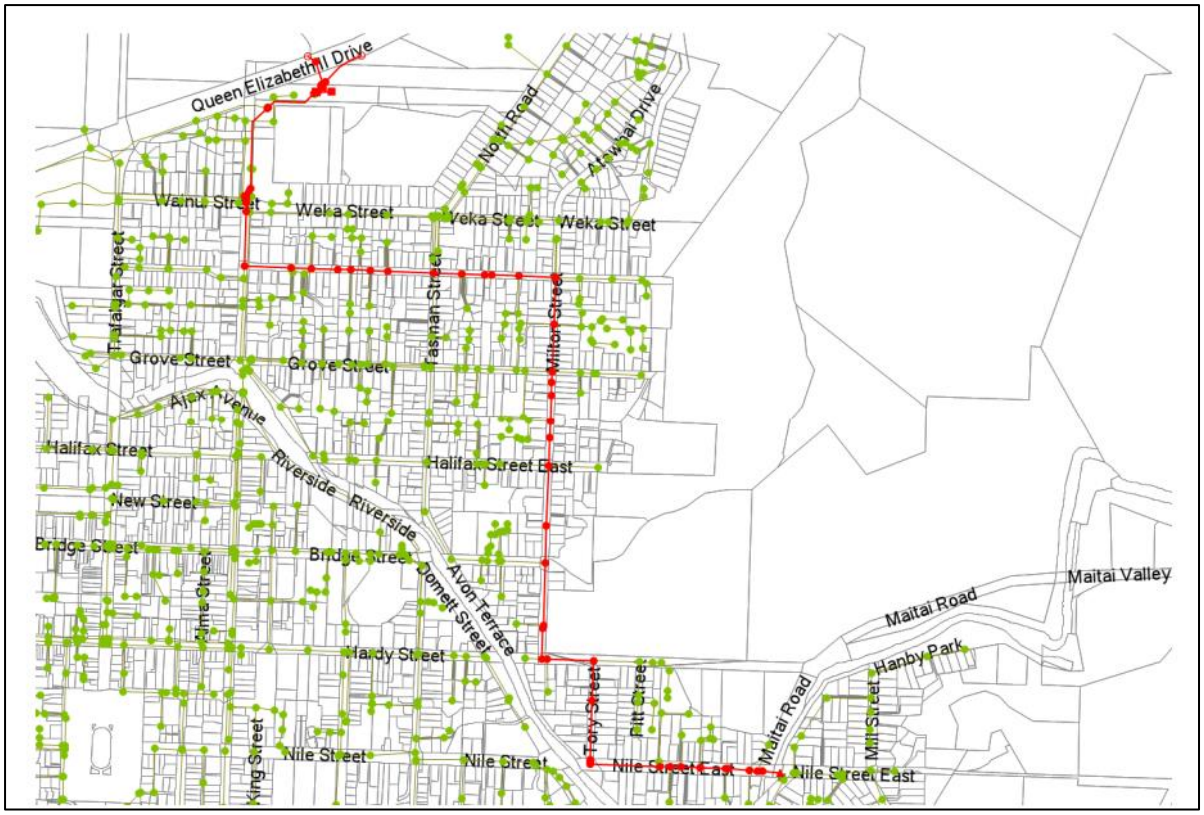


*Figure 2.1 - Downstream flow path from proposed development*[2]

The capacity of the existing pipeline has been assessed on the following basis for this preliminary assessment:

- Diameter of pipeline based on GIS data from www.topofthesouthmaps;
- Invert levels are based on GIS data and simplified for this preliminary assessment to assume a constant grade between manholes at both ends of the intersections.
- Pipe roughness of 1.5 mm as per NTLDM requirement.
- Spreadsheet check of individual pipe capacities (rather than a model of how all pipes interconnect).

We have assessed the development scenario effects on the existing NCC wastewater system using the ADWF, PDWF and PWWFs from the NTLDM for a 350 lot development scenario, as shown in Table 2.2 below.

[2] NCC issued report- Kaka Development - wastewater

**Table 2.2: Development scenario effects on assessment of existing NCC wastewater system**

| Upstream MH Ref | Downstream MH Ref | Pipe diam. (mm) | Pipe length (m) | Pipe capacity (l/s) | Exist ADWF* (l/s) | Exist PDWF* (l/s) | Exist PWWF* (l/s) | ADWF* (l/s) (Exist + 350 lots) | PDWF* (l/s) (Exist + 350 lots) | PWWF* (l/s) (Exist + 350 lots) |
|---|---|---|---|---|---|---|---|---|---|---|
| Nile St/ Maitai intersection (S402437) | Nile / Tory St (S402430) | 150 | 341 | 12.80 | 2.19 | 4.38 | 13.13 | 5.23 | 10.46 | 31.36 |
| Nile / Tory St (S402430) | Tory/ Hardy St (S402402) | 150 | 212 | 11.20 | 2.41 | 4.81 | 14.43 | 5.45 | 10.89 | 32.66 |
| Tory/ Hardy St (S402402) | Hardy/ Milton St (S402400) | 150 | 105 | 9.25 | 2.79 | 5.57 | 16.72 | 5.83 | 11.65 | 34.95 |
| Hardy/ Milton St (S402400) | Milton/ Bridge St (S401866) | 150 | 195 | 11.40 | 3.11 | 6.22 | 18.65 | 6.15 | 12.30 | 36.88 |
| *Milton / Bridge St (S401866)* | *Milton / Halifax St East (S401872)* | *300* | *197* | *56.10* | 3.37 | 6.74 | 20.21 | 6.41 | 12.82 | 38.44 |
| Milton / Halifax St East (S401872) | 159 Milton St (S401861) | 300 | 55 | 49.60 | 3.61 | 7.22 | 21.67 | 6.65 | 13.3 | 39.9 |
| 159 Milton St (S401861) | Milton/ Cambria St (S414046) | 150 | 327 | 12.96 | 4.56 | 9.11 | 27.34 | 7.60 | 15.19 | 45.57 |
| Milton / Cambria St (S414046) | 69 Cambria St (S412936) | 150 | 73 | 9.34 | 4.71 | 9.43 | 28.28 | 7.75 | 15.51 | 46.51 |
| *69 Cambria St (S412936)* | *Tasman / Cambria St (S401830)* | *300* | *173* | *51.90* | 5.00 | 9.95 | 29.84 | 8.04 | 16.03 | 48.07 |
| *Tasman / Cambria St (S401830* | *Cambria/ Collingwood St (S4141100)* | *350* | *388* | *86.70* | 9.46 | 18.92 | 56.77 | 12.50 | 25 | 75 |
| *Cambria/ Collingwood St (S4141100)* | *Weka/ Collingwood St (S414234)* | *375* | *112* | *71.00* | 9.57 | 19.13 | 57.40 | 12.61 | 25.21 | 75.63 |

Notes: * Red notes pipes that are currently under capacity and green indicate sufficient capacity.

It can be seen from the summary results that the majority of the existing pipelines do not have sufficient capacity during peak wet weather conditions, and an extensive upgrade would be required to meet the capacity required under a 350 lot development scenario.

All the existing sections of 150 mm diameter pipework along the flow-path from the proposed development do not have sufficient capacity to meet current flows based on the NTLDM. Therefore, any additional development would require the upgrading of these pipes.

Based on a 350 lot development scenario, all remaining pipework greater than 300 mm diameter, apart from the 375 mm laid at a very shallow grade between Cambria/Collingwood intersection and Weka/Collingwood intersection, have sufficient capacity.

We have been advised by NCC that the Weka Street Pump Station is capable of managing flows for up to 800 additional lots and would only require additional storage over and above the current 115 $m^3$ available.

## 2.3 Connecting to the NCC wastewater network

At this feasibility stage, there are four options for extending the wastewater network to the Development from Nile Street. These include:

1. A new wastewater line from the development to Nile St, connecting to the existing wastewater line from Nile Street to Weka Street
2. A new wastewater line from the development to Nile St, connecting to a new duplicate wastewater line from Nile Street to Weka Street
3. A new wastewater line from the development to Nile St, with permanent on-site storage and off peak pumping
4. A new wastewater line from the development to Nile St with a low pressure pumping system within the development.

### 2.3.1 Option 1 - Connecting to the existing wastewater line at Nile Street

This option consists of extending the wastewater network from Nile Street along Maitai Valley Road to the eastern edge of the Botanical Reserve, along the Dennes Hole walking track, through to the Development. Utilising the Dennes Hole walking track route avoids two river crossings along Maitai Valley Road. A pumping station will be required either adjacent to Maitai Valley Road or within the Development, with a rising main in Maitai Valley Road through to Nile Street. Our initial investigations indicate that it may be feasible to maintain gravity flow from the Development to Maitai Valley Road, allowing the pumping station to be located adjacent to Maitai Valley Road, which would be the preference. However, this will need to be confirmed as part of further detailed investigations.

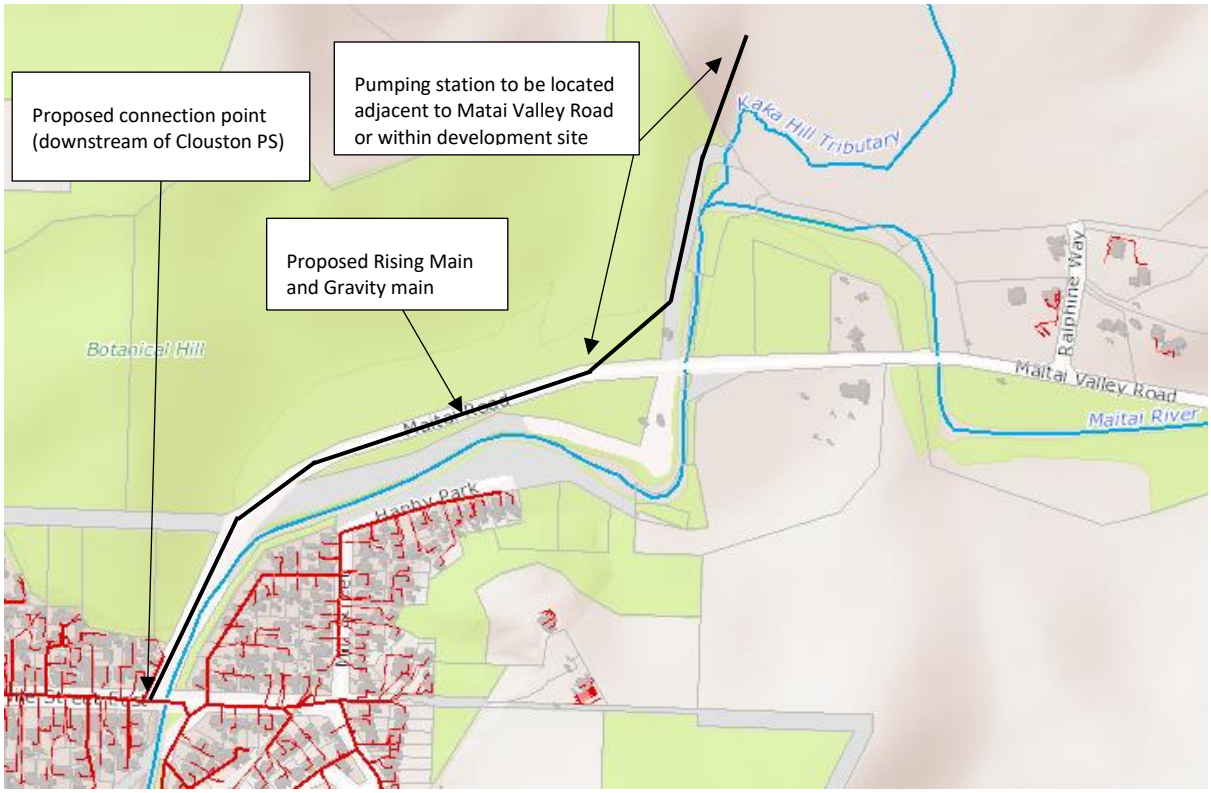


*Figure 2.2 - Option 1 - Proposed rising main along eastern edge of Botanical Hill Reserve*

Connecting to the downstream gravity pipe network will require upgrading of the existing wastewater line to accommodate the additional flow from the Development.

To upgrade the existing wastewater line to accommodate approximately 350 lots would typically consist of replacing all the 150 mm pipes with 300 mm pipes and replacing the last section of 375 mm pipe (which is laid at a very shallow grade) to 450 mm.

To upgrade the existing wastewater line to accommodate up to approximately 800 lots, if this is required to service other nearby developments, would typically consist of replacing all the pipes with new pipes ranging from 300 mm from Nile to Bridge Street, 375 mm from Bridge to Collingwood Street, and 450 mm from Collingwood to Weka Street.

### 2.3.2 Option 2 - Connecting to a new duplicate wastewater line at Nile Street

As for Option 1 above, a new wastewater line and pumping station is required from Nile Street to the Development. As an alternative to replacing and/or upgrading sections of the existing wastewater main from Nile Street to the Weka Street pumping station, an option that can be largely built offline without disrupting existing flows for extended periods of time would be to install a new duplicate wastewater main parallel to the existing wastewater pipeline.

Given the limited capacity in the downstream NCC wastewater system, constructing a duplicate parallel wastewater main will allow the system to accommodate the added flows from the Development without replacing the existing pipes. The existing wastewater mains would remain, including manholes and service connections, and the duplicate main would be cross connected to act as a separate auxiliary main to add capacity to the existing system when it becomes surcharged. Additionally, the duplicate main could help with storage for the Weka Street Pump Station during peak flows.

An alternative to connecting into the Weka Street pumping station would be to extend the new duplicate line through to the Neale Park pumping station. This may require an additional pump at Weka Street and will need to be assessed as part of further investigations.

The proposed alignment for the auxiliary system would follow the gravity wastewater network from the Nile Street/Maitai Valley Road intersection to the Weka Street Pump Station. This alignment maximizes gravity flow, avoids bridge crossings, and appears on preliminary examination to have sufficient space to construct the pipeline while avoiding existing utilities.

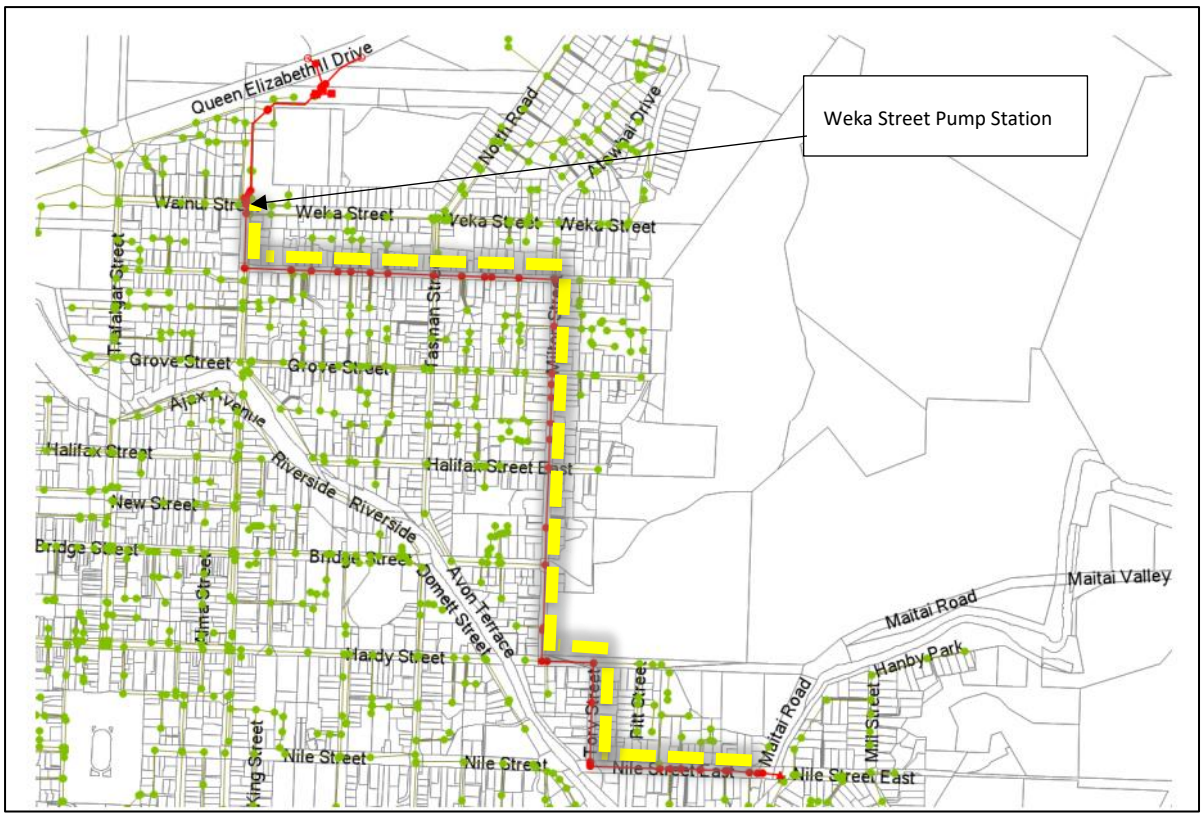


*Figure 2.3 - Proposed Duplicate Parallel Sewer Main Alignment*

The construction of this line could be staged, starting from the Weka Street pumping station. This could potentially provide connection points to the existing wastewater line as the staged construction progresses, to relieve some of the capacity issues on the existing line. Additionally, the duplicate main could help with online storage for the Weka Street Pump Station during peak flows and potentially limit the need for upgrade work to the Weka Street Pump Station

Sizes for the duplicate main are to be further developed with NCC to consider other future development areas that may also contribute flow to the sewer system, however our initial investigations indicate that a 225 mm line could accommodate up to 350 lots and a 300 mm line could accommodate up to 800 lots. This would need to be confirmed through more detailed investigations.

### 2.3.3 Option 3 – Permanent On-site storage and off peak pumping

Given the limited capacity in the downstream NCC wastewater system, providing on-site wastewater storage for the Kaka Valley is a viable alternative that could utilise the existing system without requiring significant improvements. Subject to further discussions with NCC, if upgrading of the existing line is required, this may be limited to the sections of 150 mm pipe.

By having the ability to store effluent in the wastewater network during peak flows, the discharge can be controlled so that it only enters the existing network during times of low flows. The downstream pipeline is already undersized for peak wet weather flows and with the addition of the proposed Development, may also be undersized during peak dry weather flows. This alternative would help prevent further surcharging of the existing network.

The proposed Development could be constructed in stages. Concordantly, the on-site wastewater storage would be added in a staged manner to adequately support the number of active homes in the development. If storage volume is added in a staged manner throughout construction, it will be

oversized for the initial stages and can be continually monitored to ensure that the sizing is adequate, especially during wet weather, and to assess the need for and volume of further storage as the site is further developed. The ability to add more storage in the future will be factored into the design. As this is not a standard solution, there is no NTLDM requirement or guidance for the design of wastewater storage volumes during normal operation. Further assessment of the existing NCC system, modelling and basis of storage requirements will therefore need to be developed to determine the required operational storage volumes (to be then approved by NCC).

Since the downstream NCC wastewater pipeline has an unknown timeline for being upgraded, it is assumed that the on-site storage will be a relatively long-term solution. The storage tanks will be made of resilient material such as fiberglass or durable concrete construction, depending on the most cost-effective approach. The storage tanks will be constructed below ground adjacent to the wastewater pump station, which will be located either within the Development or adjacent to Maitai Valley Road. Consideration will need to be given to cleaning the tanks and controlling odour emissions.

To ensure the wastewater from the proposed Development is only discharged into the downstream system during suitable low flow conditions, flow or water level monitors would likely need to be installed in strategic locations downstream. These flow monitors would have the ability to communicate with the upstream Pump Station as to when the downstream capacity is adequate for pumping and when on-site storage should be utilised. Additionally, the upstream Pump Station can be variable speed controlled to help regulate the outflows to match available capacity and could be programmed to only pump when the Clouston Pump Station isn't pumping (which pumps into the system at the Nile Street/Maitai Valley Road intersection). Further modelling and research would need to be undertaken to design the upstream Pump Station with the appropriate pumping and on-site storage based on the downstream capacity.

Subject to confirmation of the above and based on 50% of PWWF over 12 hours; for 350 lots, we estimate that the storage required may be in the order of 400 $m^3$.

Preliminary recommendations for flow monitor locations, based on modelling results, are shown in the Table 2.3 and Figure 2.4 below:

**Table 2.3: Recommended flow/level monitor locations**

| Intersection | Manhole ID | Downstream Pipe Diameter (mm) |
|---|---|---|
| Nile St/ Maitai Valley Road | S402437 | 150 |
| Tory / Hardy St | S402402 | 150 |
| Milton / Cambria St | S414046 | 150 |

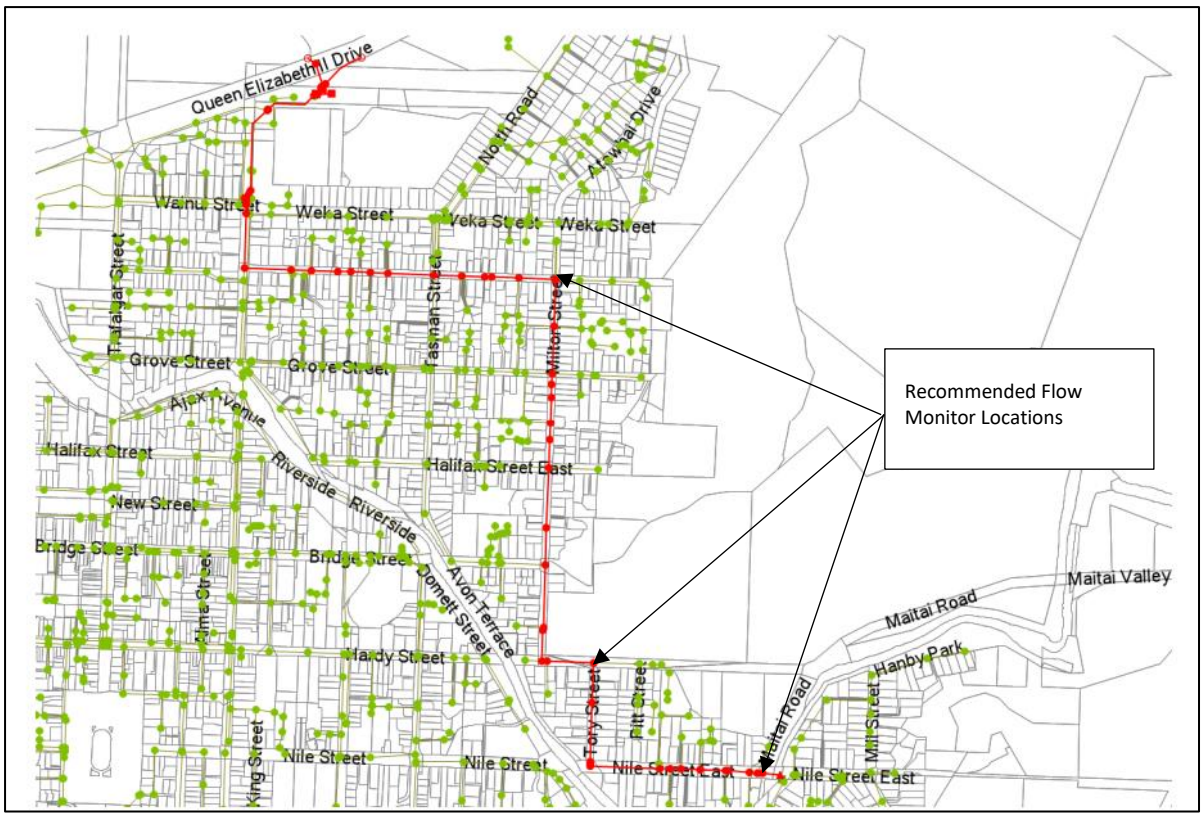


*Figure 2.4 - Recommended flow monitor locations*

### 2.3.4 Option 4 - Low pressure pumping system

As for Option 3, providing a low pressure pumping system for the proposed Development is a viable alternative that could utilise the existing system without requiring significant improvements. Subject to further discussions with NCC if upgrading of the existing line is required this may be limited to the sections of 150 mm pipe.

A low pressure pumping system typically consists of all the wastewater for each household being sent to an underground tank within the property. Typical tank storage is normally in the 700 – 1,000 litre range for each household. A grinder pump located within the tank starts automatically when the tank reaches a certain level and grinds all the solids to a non-clogging slurry suitable for small diameter pipes. Wastewater is then pumped to the Council gravity main via a pressure system. Pipe sizes for each household normally start off at 40 mm OD PE pipe and increase as more households are added to the pressure network.

Pumps typically have a head capacity of approximately 55 m which is enough to pump the wastewater a few kilometres away, depending on the terrain. Pumps typically work an average of 20 minutes per day and have a design life of 25 years, with an annual maintenance cost of approximately $50 per pump[3].

Some of the advantages of a low pressure sewer system include:

- The ability to control the pressure system via a cellular network, giving control to reduce peak flows and hold back pumping during storm events by using the storage in each pump station.
- Reduced requirements to upgrade the downstream wastewater network due to reduced peak flows.

[3] As advised by Ecoflow NZ, 4 March 2020.

- Reduced lengths of gravity sewer and manholes leading to reduced risk of inflow and infiltration.
- Less chance of blockage in the downstream wastewater network as the grinder pumps reduce all waste to a slurry, and any blockage resulting from something like wet wipes, will occur at the household pumping station.
- Normally significantly cheaper to construct than a typical gravity wastewater system.
- Reduced operating costs for Council – there is no Council owned pumping station to maintain and run (assuming pump stations are owned by each house owner).
- The system can be installed in undulating terrain as it does not rely on gravity.
- The maximum size of the pumped rising main connecting to the Council gravity main is unlikely to exceed 150mm, which can often be accommodated in the berm rather than having to be laid under the road pavement.

These systems have been installed in various placed throughout New Zealand including Silverdale in Auckland (up to 15 years old), Grovetown in Marlborough and more recently in Richmond, Tasman. There are various options for ownership and operation of the low pressure system which include Council ownership with an annual maintenance fee to the property owner, or private ownership and maintenance. These would need to be discussed further with NCC if this option was to be considered further.

## 2.4 Other growth considerations

Design of the wastewater system may need to take into consideration future wastewater flows from proposed neighbouring developments. There is a significant area of Bayview Nelson Ltd which drains into the Kaka wastewater catchment area.

We also understand that NCC has long term plans to develop the Orchard Flats area directly across from the Development, currently planned for construction between 2038 and 2048. Orchard Flats will have approximately 228 lots[4].

Further discussions with NCC will be needed to determine the extent of Orchard Flats, and other development areas, and to identify key pump station features for ease of operation.

[4] Email from Alastair Upton (NCC) dated 17 December 2019: 9.39 AM

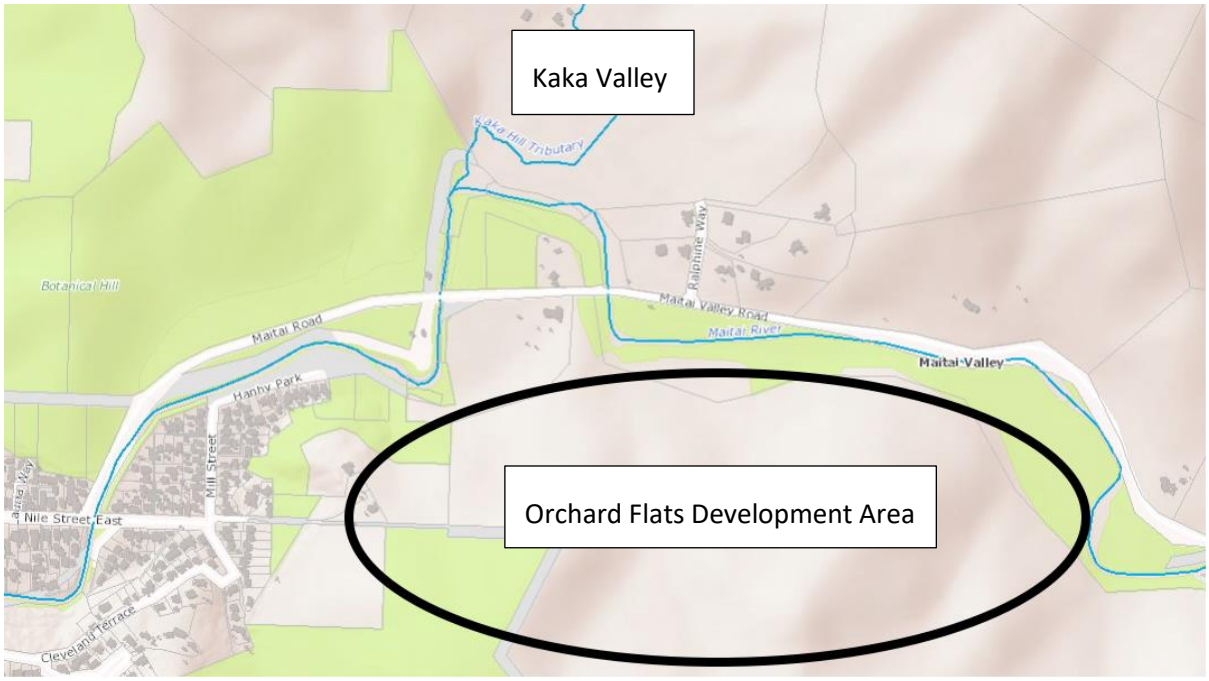


*Figure 2.5 - Orchard Flats development location*

## 2.5 Summary of wastewater assessment

The section of existing wastewater pipeline from Nile Street to the Weka Street pumping station has no spare capacity to cater for the additional flows from the Kaka Valley. To accommodate the additional wastewater flows for the proposed Development. we have identified four potential options, including:

1. A new wastewater line from the development to Nile St, connecting to the existing wastewater line from Nile Street to Weka Street.
2. A new wastewater line from the development to Nile St, connecting to a new duplicate wastewater line from Nile Street to Weka Street.
3. On-site storage with off peak pumping.
4. Low pressure pumping system within the development.

Options 1 and 2 provide robust long term solutions to service the proposed Development and to provide additional capacity in the network for further development.

Option 1 provides additional capacity to the network and addresses capacity issues in the existing wastewater line. However, to provide capacity for future development beyond the Kaka Valley would require replacing the whole length of pipeline, causing significant disruption to the existing network.

Option 2 can be constructed largely off-line, minimising disruption to the existing network, and provide relief to the existing wastewater line which is already at or over capacity during wet weather flows. However, it does not address deficiencies in the condition of the existing wastewater line.

Option 3 provides permanent on-site storage with off peak pumping and could utilise the existing downstream wastewater network without requiring significant improvements.

Option 4 consists of a low pressure pumping system that could utilise the existing downstream wastewater network without requiring significant improvements. This typically consists of all the wastewater for each household being sent to an underground tank within the property, where a

pump located in the tank grinds all the solids to a non-clogging slurry and it is then pumped to the Council gravity main via a pressure system. Although this system has been used successfully in a number of places in New Zealand, implementation of the technology in New Zealand is relatively new, and the feedback we have received from NCC to date, suggests that there would be some reluctance from NCC to adopt this system, as opposed to a traditional gravity wastewater pipeline.

From discussions with Council during the LTP application work we undertook, the advice we received from Council was that their preferred option going forward was for Option 1 – New Wastewater line to replace the existing.

# 3 Water supply

During the course of the water supply assessment, we have met with Nelson City Council (NCC) staff on the following occasions:

- Tuesday 17 December 2019 with NCC staff (Shane Overend, Phil Ruffell and Warren Biggs)
- Wednesday 8 January 2020 with NCC staff and the Maitahi and Bayview developers
- Tuesday 14 January 2020 with NCC staff and water modeler (Phil Ruffell and Vicki Koopal from Jeff Booth Consulting)
- Monday 24 February 2020 with NCC staff and the Maitahi developers
- Tuesday 10 March 2020 with NCC staff (Phil Ruffell and Anne McCormack)

Discussion points from these meetings have been incorporated into this report where relevant.

## 3.1 Existing water supply network

Two potential connection points into the existing NCC water supply network have been identified.

### 3.1.1 Nile Street

There is a 150 mm diameter water main on Nile Street which connects to a 200 mm diameter water main on Tasman Street. This 150 mm water-main continues from the eastern end of Nile Street, to the end of Hanby Park. Beyond this point the line reduces to a 25 mm diameter supply line which crosses the Maitai River to Maitai Valley Road. However, the 25 mm diameter line is of little value to the proposed development due to its limited capacity.

### 3.1.2 Tasman Street

There is a 600 mm diameter trunk water main that runs along the eastern side of Tasman Street, approximately 700 m from the intersection of Nile Street and Maitai Valley Road.

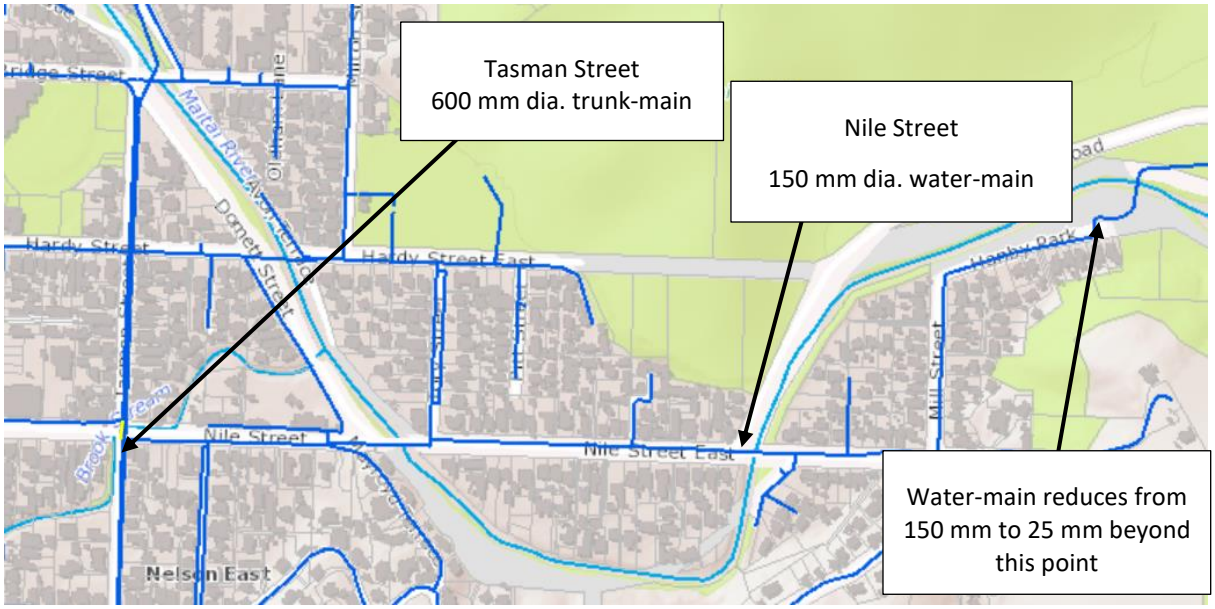


*Figure 3.1 - Existing network layout*

## 3.2 Design flows

### 3.2.1 Domestic demand

The domestic demand flow has been calculated in accordance with the Nelson Tasman Land Development Manual 2019 (NTLDM).

Based on the NTLDM, the peak hour domestic demand for 350 lots is 12.6 l/s.

Other key requirements for peak domestic design flows included in the NTLDM are:

- Head loss must not exceed approximately 20 kPa (2 m head) per kilometre
- Minimum nominal working residual pressure of 300 kPa (30 m head)
- Maximum static water pressure of 900 kPa (90 m head)

### 3.2.2 Firefighting demand

The firefighting flow has been calculated in accordance with the NTLDM and the NZ Fire Service Fire Fighting Water Supplies Code of Practice, (SNZ PAS 4509).

The system should be designed based on two fire hydrants able to supply 12.5 litres per second concurrently (based on residential class FW2) in accordance with SNZ PAS 4509. The standards also require that residual pressures at the hydrants must be greater than 100 kPa (10 m head).

### 3.2.3 Total domestic and fire-fighting demand

The system should be designed for firefighting demand concurrently with 60% of peak flows in accordance with SNZ PAS 4509. The total demand (i.e. peak hour design flow) is therefore based on peak fire demand of 25 l/s plus 60% of the peak domestic demand.

Based on the NTLDM, the peak hour design flow for 350 lots is 32.6 l/s

## 3.3 Water supply modelling

Some initial water supply modelling of different scenarios was carried out with Vicki Koopal of Jeff Booth Limited at a meeting on 14 January 2020 and subsequently report on by Jeff Booth. The scenarios considered are further described in Sections 4.4 and 4.5.

This modelling indicated that the 150 mm diameter watermain on Nile Street would not service a reservoir within the Kaka Valley at RL 90 m without a pump station. NCC were concerned about the length of time to fill the reservoir including filling the reservoir following periodic emptying for maintenance purposes.

Connecting to the higher pressure 600 mm diameter water main at Tasman Street allowed the reservoir to fill without the need for a pump station.

Further modelling of the water supply network with a reservoir at a higher elevation of RL 140 m has not been carried out by Jeff Booth Limited. At this stage an approximate hydraulic check has been carried out that indicates that a 250 mm diameter pipe from Tasman Street could supply a reservoir with a top water level of RL 140 m at a flow rate of approximately 30 l/s. This size pipe would allow a 1,300 $m^3$ reservoir to fill in under 6 hours from a 50% full state. This is in line with NCC's indicated level of performance that was discussed on 14 January 2020.

## 3.4 Connection to Tasman Street water main

This option consists of connecting to the existing 600 mm water main at the Nile Street/Tasman Street intersection and extending a new water main along Nile Street and Maitai Valley Road to the

subdivision with a 250 mm pipe (250 mm pipe size requested by NCC at meeting on 10 March 2020). Based on water main pressures provided by NCC, the 600 mm water main in Tasman Street provides sufficient water pressure to service the subdivision up to approximately RL 110 m while achieving the minimum allowable working pressure of 30 m head. See Table 3.1 below for the measured pressures in the Tasman Street water main and projected serviceable levels.

**Table 3.1: Working water pressures and serviceable levels – Tasman Street**

| Location | Date Inspected | Measured Upstream Pressure** | Approx. Hydraulic Level | Approx. max serviceable RL (30 meters head pressure)*** |
|---|---|---|---|---|
| | | kPa | (M RL) | M |
| Tasman/Queens Garden Pressure Reducing Valve (Elevation: 5.7m*) | 23/07/2019 | 1360 | 144 | 111 |
| | 08/08/2019 | 1350 | 143 | 110 |
| | 09/08/2019 | 1350 | 143 | 110 |
| | 15/10/2019 | 1350 | 143 | 110 |

*NZVD 16 per Top of the South Maps

**Measurements provided by NCC

***Allows for nominal 3m head loss between Tasman Street and new reservoir giving a nominal reservoir water level of RL 140 m. Head losses and maximum levels to be confirmed by hydraulic modelling.

It is noted that the maximum allowable working pressure to housing is 90 m head and that the minimum ground level in the subdivision area is approximately RL 17 m (to be confirmed once flood modelling is completed). The final siting and level of any reservoir will need to allow for maximum and minimum allowable pressures.

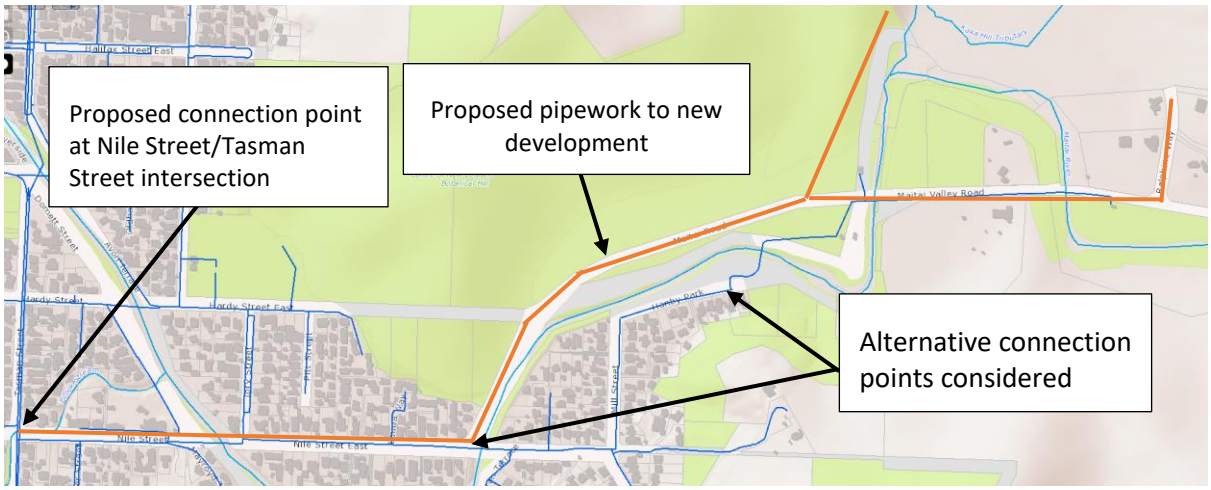


*Figure 3.2 - Proposed connection to existing network*

## 3.5 Connection to Nile Street water main

The other option considered was connecting to the lower pressured 150 mm diameter water main on Nile Street. However, this water main is downstream of the Queens Gardens PRV and has lower

operating pressures than the 600 mm diameter Tasman Street main. Without additional pumping, this water main would only be able to service properties up to RL 55 m with the minimum allowable 30 m head pressure which would constrain the options for supplying the Kaka Valley. See Table 3.2 below for measured pressures in the Nile Street water main and projected serviceable levels.

As noted above, the initial modelling showed that there may also be issues with reservoir filling times.

**Table 3.2: Working water pressures and serviceable levels – Nile Street**

| Location | Date Inspected | Measured Upstream Pressure** | Approx. Hydraulic Level | Approx. max serviceable RL (30 meters head pressure) |
|---|---|---|---|---|
| | | kPa | (M RL) | M |
| Nile/Tory Street Pressure Reducing Valve (Elevation: 7.6m*) | 23/07/2019 | 800 | 89 | 57 |
| | 08/08/2019 | 820 | 91 | 59 |
| | 09/08/2019 | 800 | 89 | 57 |
| | 15/10/2019 | 780 | 87 | 55 |

*NZVD 16 per Top of the South Maps

**Measurements provided by NCC

***Allows for nominal 2 m head loss between Tasman Street and new reservoir. Head losses and maximum levels to be confirmed by hydraulic modelling.

## 3.6 Reservoir elevation

From discussions with NCC at our meeting on Tuesday 10 March 2020, it is our understanding that Council's desire is to locate the reservoir as high as possible to maximise the area it can service. Our estimate of the maximum height that a reservoir can be supplied from the Tasman St without pumping is approximately RL 125 m.

Based on the likely feasible development, it is expected that approximately 350 lots are to be constructed between RL 17 m and RL 90 m, with the majority of the lots below RL 70 m. To ensure the water reticulation system for the development stays within the allowable 30 m min/ 90 m max head pressures per the NTLDM, if a reservoir was to be located at RL 125 m with a top water level of approximately RL 130 m, a pressure reducing valve would be required to service lots below RL 40 m.

Based on the pressures from the Tasman Street water main and initial modelling results from the meeting on 14 January 2020, the reservoir can be filled during off-peak hours without the need for a pump station when connected at Tasman Street. Further modelling results to confirm this will follow.

If connecting to the Nile Street watermain, a pump station would be required to service a reservoir at RL 125 m.

## 3.7 Reservoir storage requirements

From the NTLDM and discussions with NCC, storage should be provided for the following:

- Emergency storage in the event of a failure in the NCC network to accommodate:

- Peak daily water demand; and
- Firefighting storage

### 3.7.1 Reservoir emergency and fire storage requirements

The NTLDM requires that the system including a reservoir is sized to accommodate a peak day design flow of 1,560 litres per dwelling per day (assuming 2.5 person per dwelling) plus firefighting storage.

As this subdivision is likely to be a dead-end rather than a loop that can be supplied from different directions and there isn't existing storage for this development in the system, emergency storage via a reservoir will be required.

Based on 1,560 l/dwelling, the required reservoir storage for emergency domestic demand is as follows:

- 350 lots total = 546 $m^3$

In addition, 45 $m^3$ of storage would be required for fire-fighting purposes.

### 3.7.2 Total reservoir size

The minimum reservoir size required for 350 lots is detailed in Table 3.3 below and accounts for both emergency storage and firefighting storage.

**Table 3.3: Total reservoir sizing**

| Design case | Emergency storage requirement (NTLDM) | Firefighting storage | Total |
|---|---|---|---|
| **350 lots** | 546 $m^3$<br>(350 x 2.5 x 624/1000) | 45 $m^3$ | 591 $m^3$ |

From discussions with NCC at our meeting on Tuesday 10 March 2020, it is our understanding that Council's desire is to install a larger reservoir to service future development and provide options to pump to reservoirs located up on Bayview Nelson Ltd land if this area was to be developed. NCC indicated that a reservoir size in the order of 1,300 $m^3$ would be desirable.

## 3.8 Reservoir recommendations

The location of the reservoir is critical to servicing the Kaka Valley. Given that the majority of the proposed lots are anticipated to be constructed between RL 15 m and RL 70 m, it is possible to locate the reservoir at an elevation that can service the majority of the Kaka Valley within the allowable NTDLM working pressures (between 30 m and 90 m head pressure). A pressure reducing valve may be required to service lots Below RL 40 m.

The recommended elevation to construct a reservoir is with a top water level of approximately RL 140 m. The reservoir could be filled without the need for a pump station if the supply line is connected at Tasman Street and makes maximum use of the pressure available in the system and hence would minimise the need for further pumping to higher elevations, should these be developed.

The final level of the reservoir will need to be confirmed once the proposed subdivision layout has been finalised and is subject to confirmation with further hydraulic modelling.

## 3.9 Reservoir location

For feasibility purposes, two options were considered for locating the proposed reservoir.

**Option 1 -** The first location is on the west side of the development. The reservoir would be connected to the proposed water main in the Maitai Valley Road, which would be extended north along the eastern edge of the Bradford Park/Dennes Hole path. The major advantage of this location is that it avoids the need for two bridge crossings on Maitai Valley Road, and the reservoir could be relatively easily connected to the future NCC reservoir above Atawhai for resilience (NB the Atawhai reservoir isn't currently part of NCC's long-term plan, and timing of construction is uncertain).

**Option 2 -** The second option would be to locate the reservoir on the east side of the Kaka Valley. The reservoir could connect to a water main extended along Maitai Valley Road and through Ralphine Way, which includes two bridge crossings. Or alternatively, it could follow the same route as suggested for Option 1 above.

This reservoir location would be more expensive to connect to the future reservoir above Atawhai.

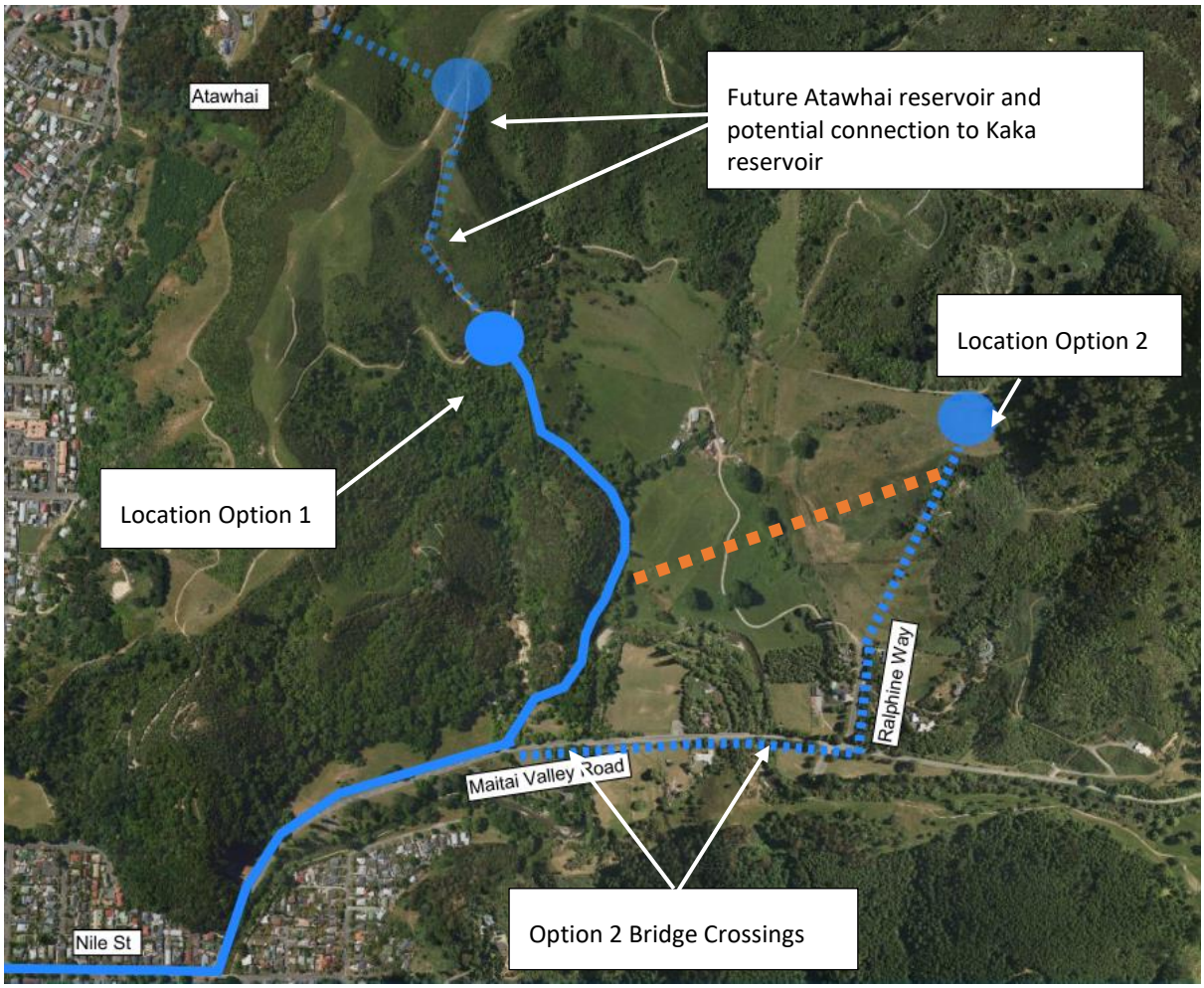


*Figure 3.3 - Potential reservoir locations*

There are numerous other reservoir locations that may be feasible and this will be further assessed during future stages of the project.

## 3.10 Construction staging considerations

Smaller temporary reservoirs may be utilized to defer the construction and cost of a permanent reservoir for the initial stages of development. Below is a table showing the reservoir size requirements assuming 50 homes are constructed annually over seven (7) years.

**Table 3.4: Reservoir sizing for each construction year**

| Year | Total Lots Constructed | Emergency storage requirement (NTLDM) | Firefighting storage | Total |
|---|---|---|---|---|
| **Year 1** | 50 | 78 $m^3$ (50 x 2.5 x 624/1000) | 45 $m^3$ | **123 $m^3$** |
| **Year 2** | 100 | 156 $m^3$ (100 x 2.5 x 624/1000) | 45 $m^3$ | **201 $m^3$** |
| **Year 3** | 150 | 234 $m^3$ (150 x 2.5 x 624/1000) | 45 $m^3$ | **279 $m^3$** |
| **Year 4** | 200 | 312 $m^3$ (200 x 2.5 x 624/1000) | 45 $m^3$ | **357 $m^3$** |
| **Year 5** | 250 | 390 $m^3$ (250 x 2.5 x 624/1000) | 45 $m^3$ | **435 $m^3$** |
| **Year 6** | 300 | 468 $m^3$ (300 x 2.5 x 624/1000) | 45 $m^3$ | **513 $m^3$** |
| **Year 7** | 350 | 546 $m^3$ (350 x 2.5 x 624/1000) | 45 $m^3$ | **591 $m^3$** |

## 3.11 Other growth considerations

Future development of the Bayview Nelson Ltd land could have a number of lots which may be supplied from the proposed reservoir at RL 125 m, by gravity or pumped to a higher level reservoir, which may further influence the size of the reservoir to be constructed.

We also understand NCC has long term plans that include development of the Orchard Flats area directly across the Maitai River from the Kaka Valley, currently planned for construction between 2038 and 2048. Orchard Flats will have approximately 228[5] lots, which could potentially be serviced by the water supply infrastructure installed for Kaka Valley. If those 228 lots were also factored into the design of the Kaka Valley reservoir, the minimum reservoir size would need to be at least 947 $m^3$. The supply pipeline up Maitai Valley Road may also need to consider the Orchard Flats development.

**Table 3.5: Kaka Valley and Orchard Flats reservoir sizing**

| Kaka Valley Total Reservoir Size | Orchard Flats Reservoir Size | Firefighting storage | Total |
|---|---|---|---|
| 546 $m^3$ (350 x 2.5 x 624/1000) | 356 $m^3$ (228 x 2.5 x 624/1000) | 45 $m^3$ | **947 $m^3$** |

[5] Email from Alastair Upton (NCC) dated 17 December 2019: 9.39 AM

Further discussions with NCC will be needed to determine the extent of Orchard Flats, and other development areas that may rely on the Kaka Valley reservoir for emergency storage.

NCC has advised us that concrete is preferred for permanent reservoirs; however alternative materials may be suitable for temporary reservoirs.

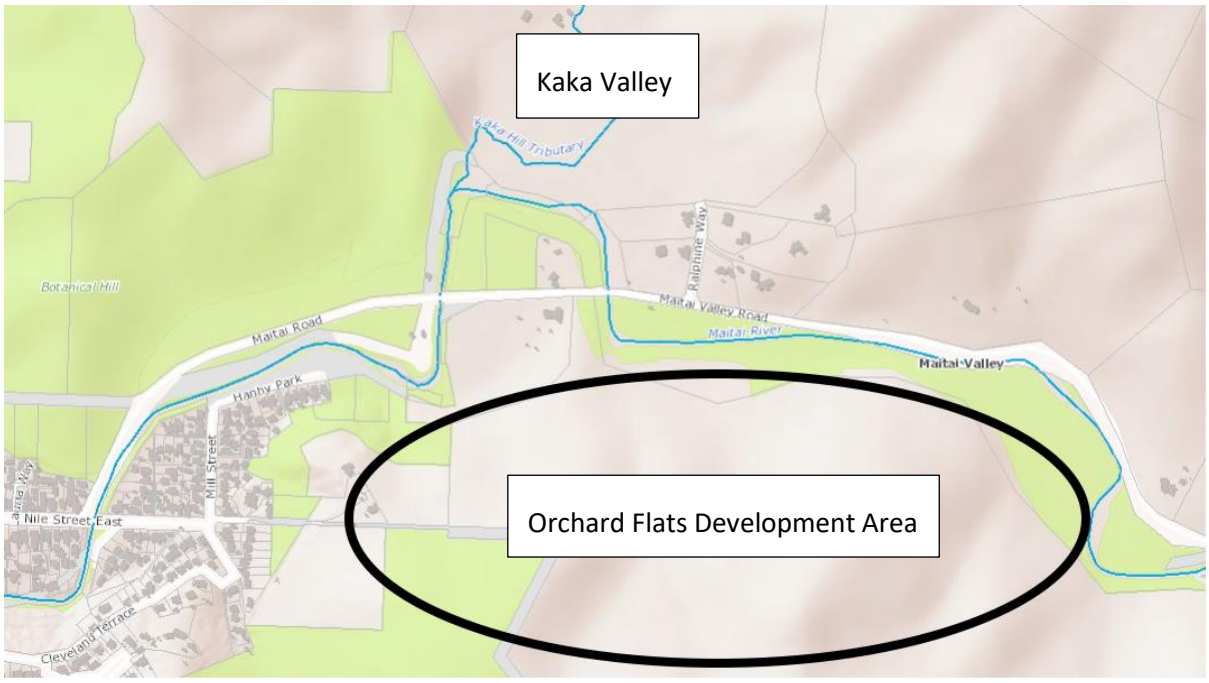


*Figure 3.4 - Orchard Flats development location*

## 3.12 Summary of water supply assessment

Subject to further investigations to confirm the viability, it is recommended that the Kaka Valley is connected to the existing 600 mm diameter water main at Tasman Street with a new 250 mm diameter line constructed along Nile Street and Maitai Valley Road, entering the site along the eastern boundary of the Branford Park Reserve (approximately 1,500 m in length from Tasman Street to the site entrance on Maitai Valley Road).

Based on the development scenario of 350 lots considered in this study, the reservoir size will need to be at least 591 $m^3$. The reservoir will be located with a top water level at approximate RL 140 m which can service the majority of the Kaka Valley within the allowable NTDLM working pressures, with the use of a pressure reducing valve to service zones below RL 50 m.

When connecting to the 600 mm diameter Tasman Street water main, the reservoir can be supplied from the network without pumping.

Reservoir sizing will also need to consider other developments in the local area identified by NCC and the costs associated with incorporating these requirements will need to be agreed with NCC. Council have advised that they would like a minimum reservoir size of 1,300 $m^3$.

Staging of temporary reservoir construction to reduce up-front costs should also be further assessed.

# 4 Applicability

This report has been prepared for the exclusive use of our client CCKV Dev Co LP, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that this report will be used by Nelson City Council in undertaking its regulatory functions in connection with the Maitahi Bayview Development.

Tonkin & Taylor Ltd

| Report prepared by: | Authorised for Tonkin & Taylor Ltd by: |
| --- | --- |
| ..... | ..... |
| Maurice Mills | Mark Foley |
| Senior Civil Engineer | Project Director |

MGM
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# Maitahi Development Modelling

## Model Notes

The model being used for the analysis was constructed and calibrated in 2015 by Nelson City Council (NCC). It has not had any significant pipe changes made since then except for the inclusion of the new trunk main from the Water Treatment Plant to Brook Terrace.

The operation of the model was updated in September 2017 and the closed valve and PRV locations in the model relate to the operation that was occurring then. There is a partially closed valve in North Road and unless otherwise stated the operation of this valve is not changed in the scenario analysis.

The model was constructed in the NCC datum and the elevations are still in that datum. Any levels used in the analysis have been converted from NZVD2016 to the NCC datum by adding 12.4m.

The demand in the model is from 17 February 2015 and is a total of 24,940 m3/day.

## Proposed Subdivison

A subdivision is proposed for Maitai Valley Road near Ralphine Way. A memo from the 20 December 2019 proposed 350 lots in this residential subdivision.

The nearest existing pipework to the proposed subdivision is in Nile Street. This area is part of the main Nelson CBD water supply zone and the nearest PRV supplying the zone is Queens Gardens. There is also a PRV in Tory Street that supplies the Wood zone. The location of these is shown on Figure 1.

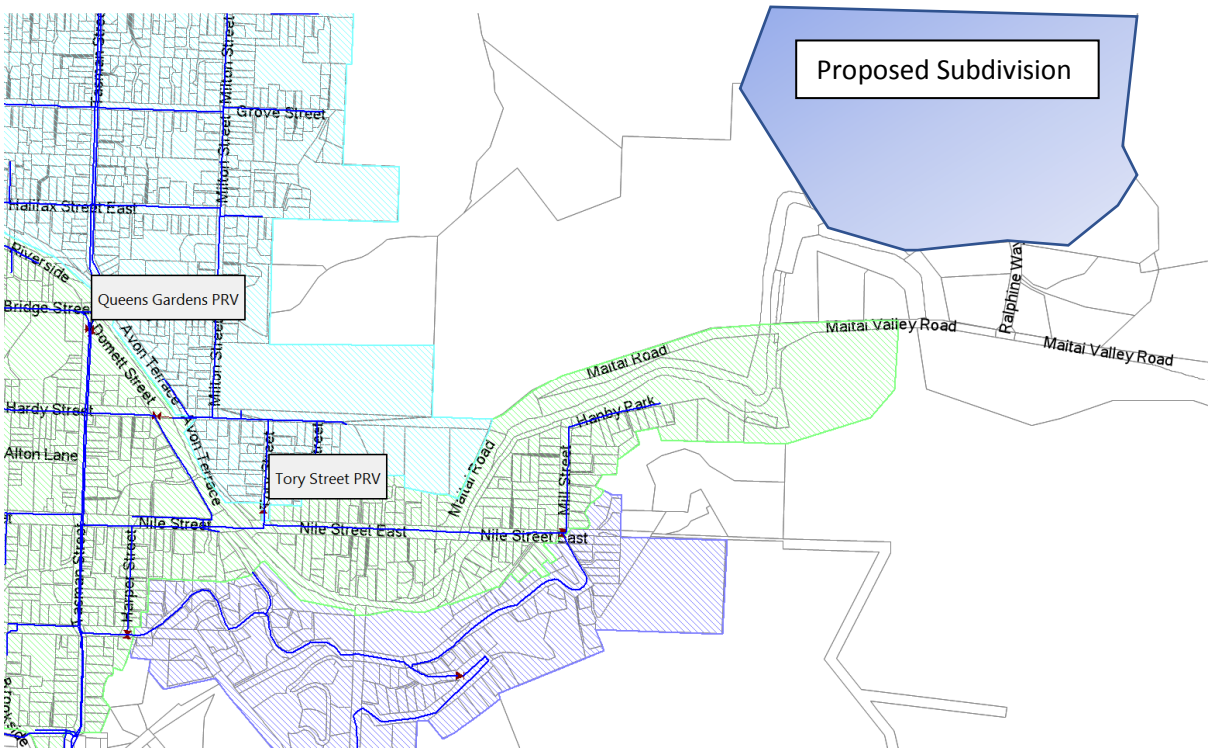


*Figure 1: Maitahi Subdivision Location*

The Queens Garden PRV is set to maintain a pressure of 86m in the model. With an elevation of 19m at the outlet of the PRV, this equates to a head of 105 mAD in the model. Adjusting for the

difference in datum the RL here is 92.6 mAD in terms of NZVD. The upstream pressure at this location is 134.5m.

The Tory Street PRV is set to maintain a pressure of 62m going into the Wood zone. With an elevation of 21m at the outlet of the PRV the RL in this zone is 83 mAD. Again, adjusting for the difference in datum the RL is 70.6 mAD in terms of NZVD. The upstream pressure in the model at the Tory Street PRV ranges between 80m and 85m. Pressure datalogging carried out in February 2019 on a hydrant in Mill Street agrees with this pressure.

## Reservoir on the Eastern Side of the Subdivision

The plan below shows the location of this reservoir and the pipe requirements.

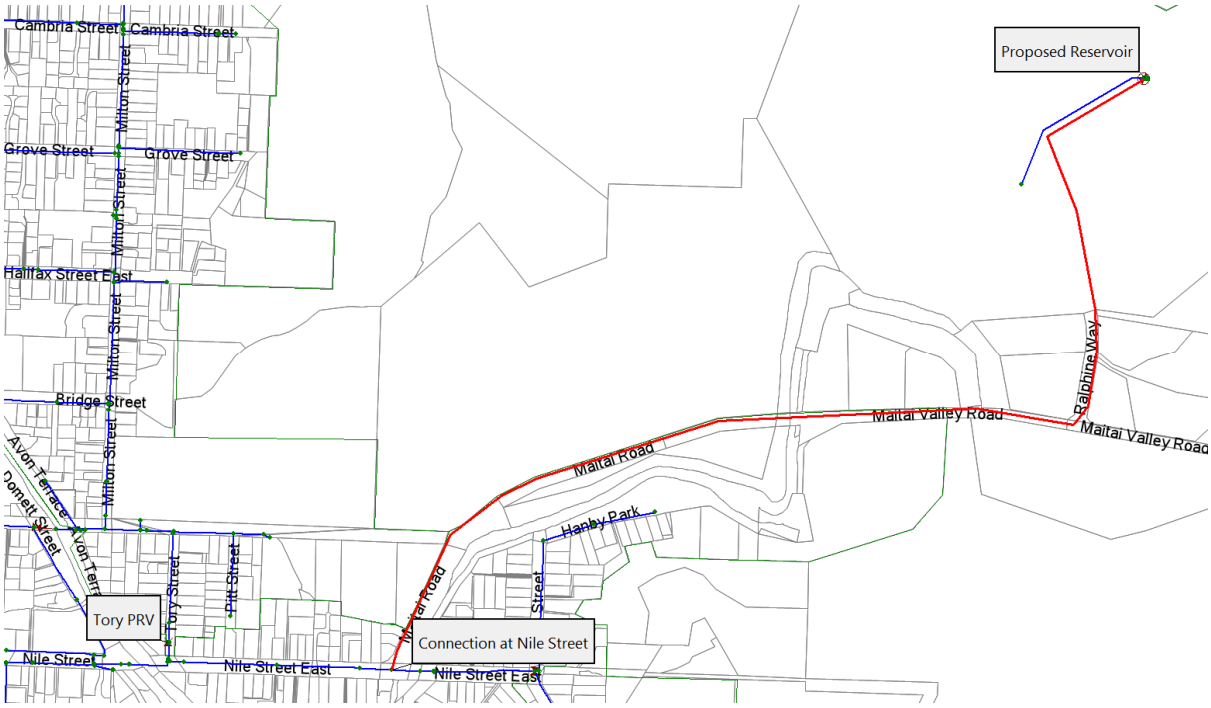


*Figure 2: Eastern Reservoir Site*

The rising main from Nile Street to the reservoir site is approximately 1,900m long. The reservoir is modelled with a volume of 600m3, a top water level of 89m (101.4m in the model) and a bottom water level of 85m (97.4m in the model). The main from Nile Street to the reservoir was modelled as a 200mm dia pipe.

The demand for the subdivision was modelled from a node at the end of a pipe leaving the reservoir. 300 properties were included in the model as it is expected that this number of properties will be supplied from the reservoir, with the remainder being higher and supplied via a pump station.

## Results

With this set up the modelled reservoir will not fill.

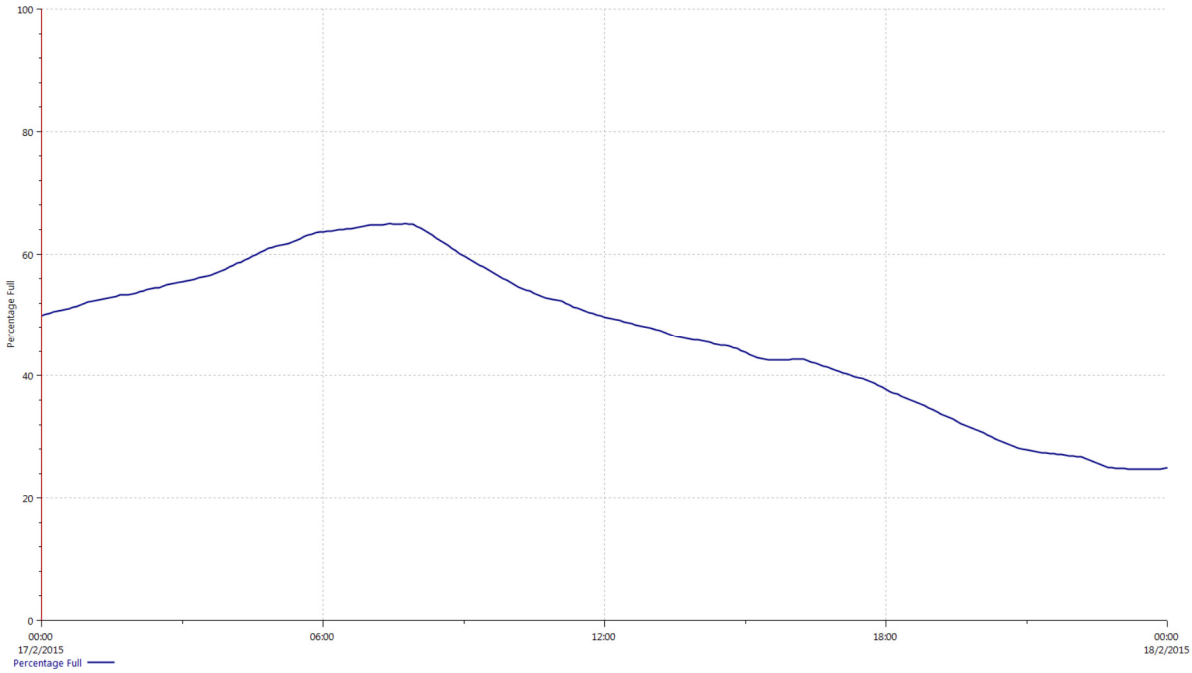


*Figure 3: Eastern Reservoir Level*

## Reservoir on the Western Side of the Subdivision

The plan below shows the location of this reservoir and the pipe requirements.

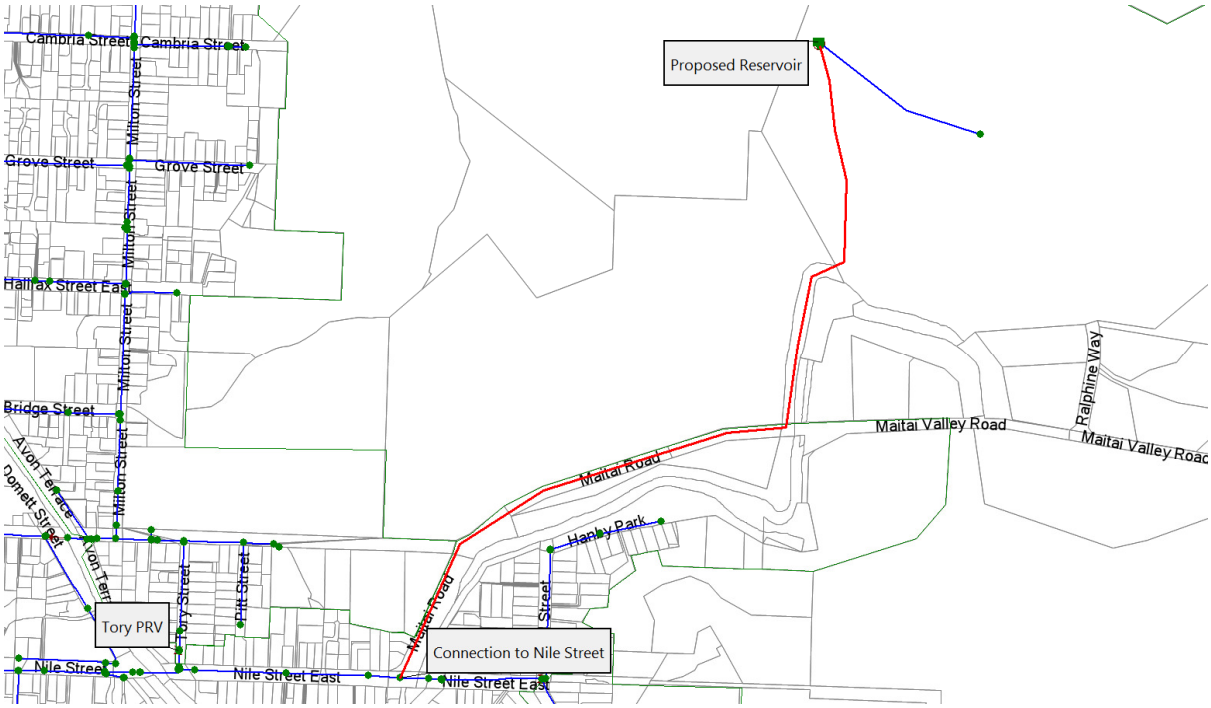


*Figure 4: Western Reservoir Site*

The rising main from Nile Street to the reservoir site is approximately 1,400m long. The reservoir is modelled with a volume of 500m3, a top water level of 89m (101.4m in the model) and a bottom water level of 85m (97.4m in the model). The main from Nile Street to the reservoir was modelled as a 200mm dia pipe.

The demand for the subdivision was modelled from a node at the end of a pipe leaving the reservoir. 300 properties were included in the model as it is expected that this number of properties will be supplied from the reservoir, with the remainder being higher and supplied via a pump station.

## Results

A reservoir on the western side of the subdivision at the proposed RL will not fill (Figure 5).

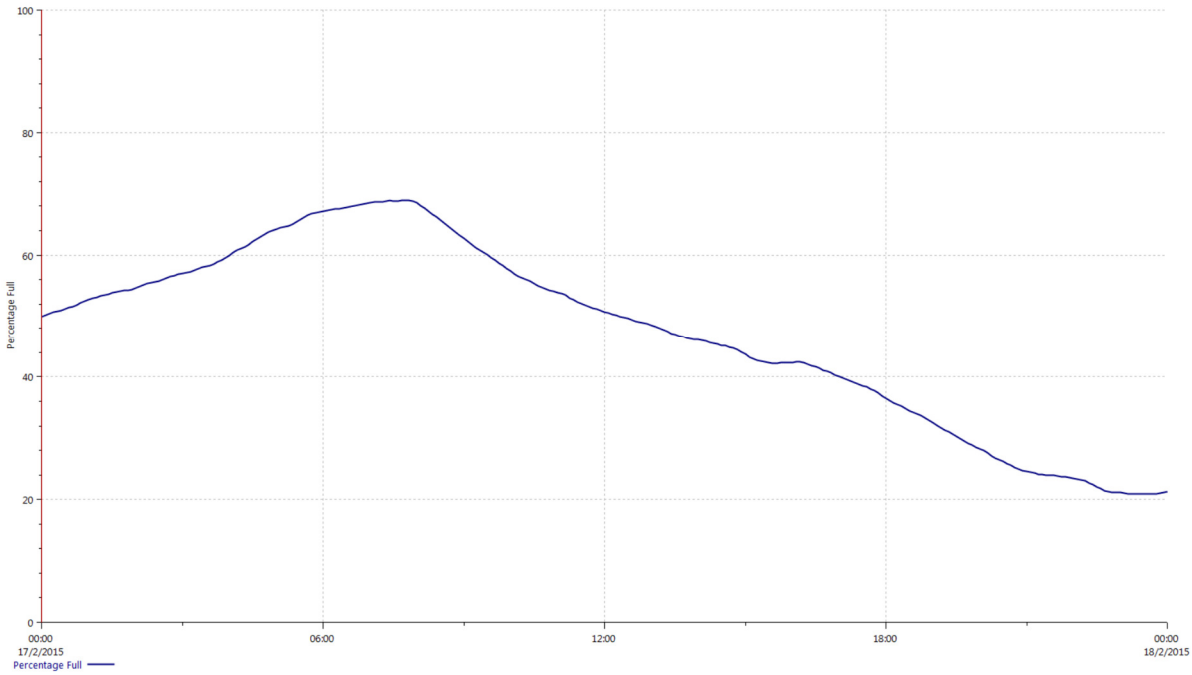


*Figure 5: Western Reservoir Level*

## Supply from Tasman Street

The plan below shows the location of this reservoir and the pipe requirements.

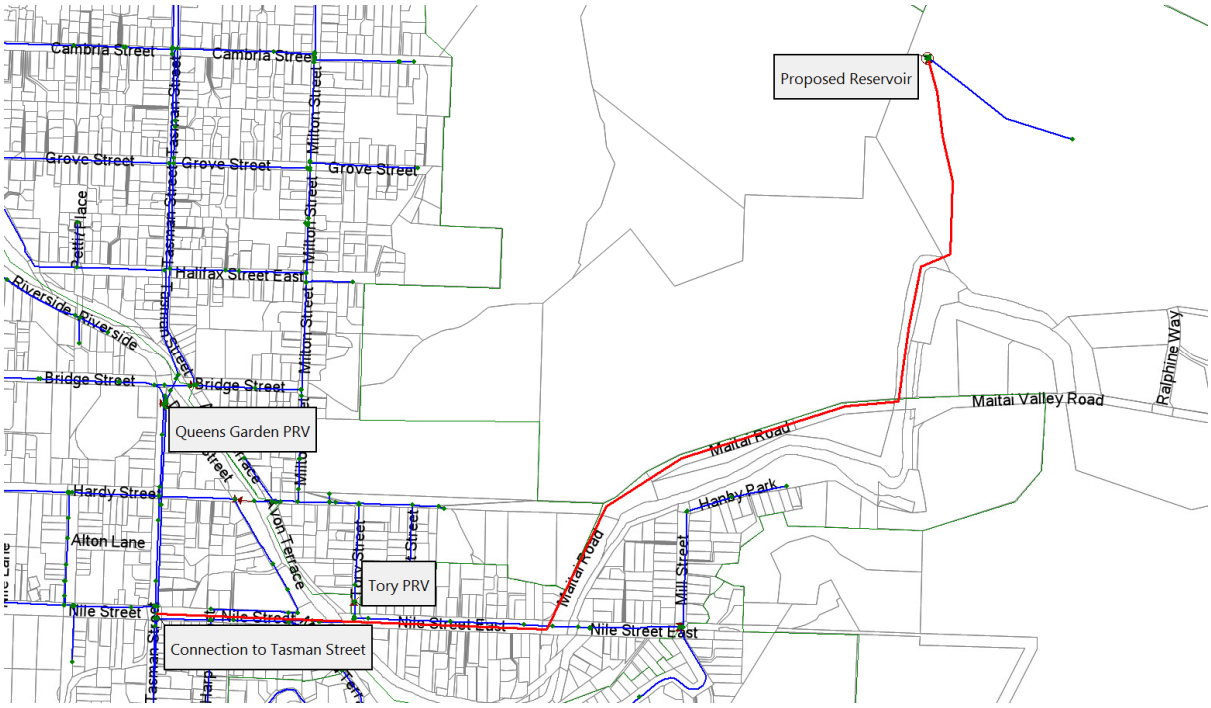


*Figure 6: Western Reservoir Site – Connection to Tasman*

The rising main from Tasman Street to the reservoir site is approximately 2,100m long. The reservoir is modelled with a volume of 1,000m3, a top water level of 94m (106.4m in the model) and a bottom water level of 90m (102.4m in the model). The main from Tasman Street to the reservoir was modelled as a 200mm dia pipe.

The demand for the subdivision was modelled from a node at the end of a pipe leaving the reservoir. 300 properties were included in the model as it is expected that this number of properties will be supplied from the reservoir, with the remainder being higher and supplied via a pump station.

## Results

A reservoir on the western side of the subdivision at the proposed RL will fill from 50% in approximately five hours (Figure 7).

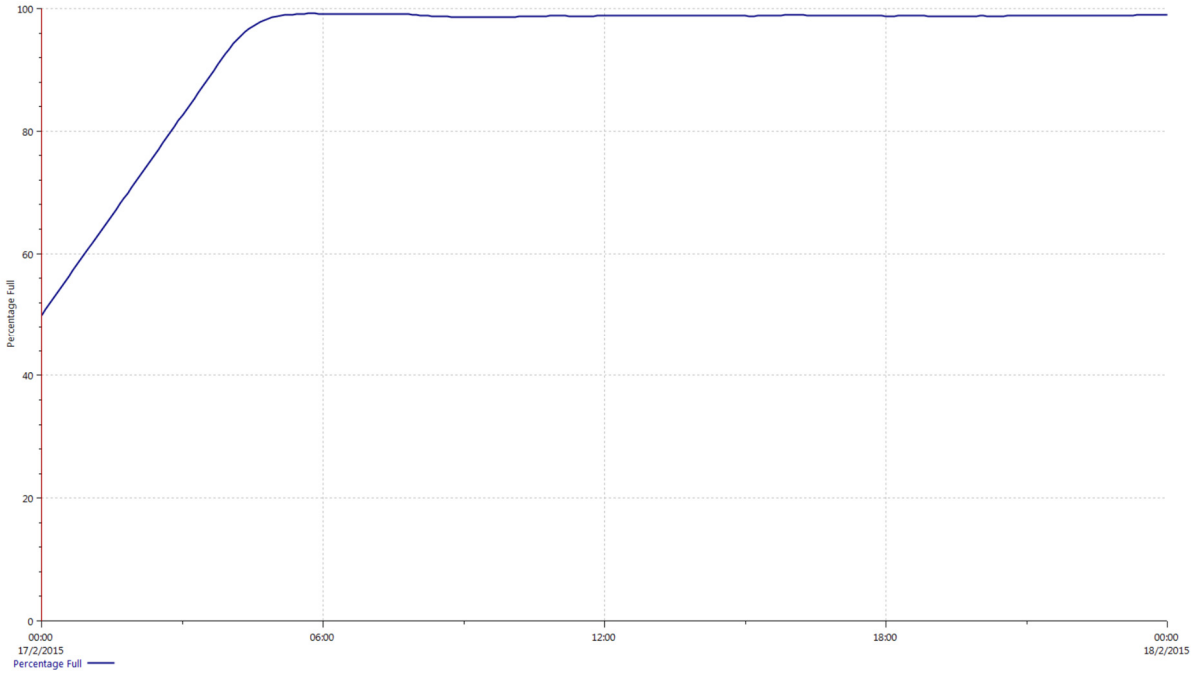


*Figure 7: Western Reservoir Level*

There is not a significant impact on the pressure in the trunk main in Tasman Street when the reservoir is filling.