Fast Track Application – 531 & 535 Mill Road, Ōhoka – Wastewater Connection

Prepared for

Carter Group Ltd

June 2026

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Quality Control Sheet

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A	April 2025	Initial Client Review	Eoghan O'Neill	Philip Claassens	Eoghan O'Neill
B	June 2025	Updated Client Review	Eoghan O'Neill	Philip Claassens	Eoghan O'Neill
C	June 2026	Final	Eoghan O'Neill	Philip Claassens	Eoghan O'Neill

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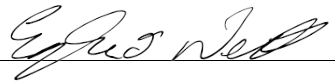
SIGNATURE 

Eoghan O'Neill

Limitations:

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Carter Group Ltd . PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

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Executive Summary

Pattle Delamore Partners Ltd has assessed wastewater servicing options for Carter Group Limited's (CGL) proposed fast-track development at 531 and 535 Mill Road, Ōhoka. The development comprises business, residential, rural-residential areas, and a potential retirement village. The development will connect to existing Mandeville-Ōhoka wastewater system rising main on Mill Rd. The Mandeville-Ōhoka wastewater system currently serves the Mandeville area through the Bradleys Road Pump Station (BRPS) and associated rising main to Rangiora WWTP. There is an existing low pressure sewer system in Ōhoka which connects to the BRPS rising main.

Under normal operating conditions, the existing system demonstrates significant unused capacity, with BRPS pumps operating only 3–4 times daily for an average of 2.36 hours per day, handling an average flow of 269 m^3/day. This indicates substantial capability to accommodate additional flows from new developments. However, the primary constraint on system capacity occurs during severe Inflow and Infiltration (I&I) events. These severe I&I events, typically occur following consecutive heavy rainfall events, which have resulted in extended durations of surface ponding and flooding in the area. This ponding is typically the result of elevated groundwater levels and the slow percolation of ponded water through the soils. These severe I&I events have occurred approximately 3–4 times over the past 10 years. During these events, wastewater flows can increase more than five-fold to over 1,700 m^3/day due to surface flooding and significant inflow and infiltration into the wastewater network. This required the BRPS pumps to operate up to 17 hours per day.

Following comprehensive options assessment and hydraulic modelling, the preferred solution for this development involves constructing a new Ōhoka Pump Station (OPS) located adjacent to the Polo Grounds area, designed to handle 30 L/s capacity. The development will be serviced through a low-pressure sewer system collecting wastewater from 879 residential lots, 250 retirement units, and 1.49 hectares of commercial development, generating a total flow of 669 m^3/day with a maximum flow of 20.57 L/s.

The critical design feature is the inclusion of 251 m^3 of buffer storage at the OPS to manage flows during severe I&I events when BRPS operating windows become severely constrained. The OPS will operate in coordination with BRPS, only pumping when the existing station is not running, ensuring system compatibility and preventing operational conflicts. Additional risk mitigation is provided by over 900 m^3 of storage available in individual household low-pressure sewer tanks throughout the development.

Hydraulic modelling using Bentley Hammer software confirms the proposed solution meets Waimakariri District Council (WDC) Code of Practice requirements, with operating pressures maintained within acceptable limits

during standard operation and transient events. The modelling demonstrates system integrity under both normal operations and emergency scenarios including sudden pump failures.

Future system reliability will be enhanced by WDC's planned drainage improvement projects, with $1.71M allocated for Stage 1 works for completion in 2026 and further funding for Stage 2 signalled in 2032. These projects are specifically designed to manage the effects of significant ponding events and the resultant impacts on I&I in the wastewater network. Upon completion of the above projects, it is reasonable to expect that the worst of the I&I, which is likely the result of direct inflow of surface water into Septic Tank Effluent Pumping Systems (STEP) tanks within the existing Mandeville-Ōhoka wastewater area, will be significantly improved. While is it still reasonable to expect elevated wastewater flows into BRPS following large rainfall events, it is expected that the magnitude of these wastewater flows and the resultant BRPS pumping durations will be greatly reduced.

The recommended wastewater solution provides a practical and compliant approach to servicing the proposed development while efficiently utilizing existing infrastructure. The design accommodates both normal operations and infrequent extreme events through appropriate buffer storage and coordinated pump station operation. Implementation of this solution will result in no adverse impacts that reach the threshold of a "sufficiently significant adverse impact" such that they need to be taken into account in terms of an assessment under s85 of the FTAA2024.

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1.0 Introduction

Pattle Delamore Partners Ltd (PDP) has been engaged by Carter Group Limited (CGL) (the Client) to report on the options for wastewater servicing for the proposed fast-track Application (Fast Track Approvals Act 2024) for the proposed development at 531 and 535 Mill Road, Ōhoka ("the site").

The site is located to the southwest of Ōhoka township and is bordered by Bradleys Road, Mill Road, and Whites Road. The site currently consists of rural land with the proposed development consisting of business, residential, rural-residential areas and potential retirement village area. The site location is indicated in Figure 1 below.

Figure 1: Location of proposed development

The purpose of this report is to:

- make an assessment with respect to the operative capacity of the existing Mandeville-Ōhoka wastewater system;
- provide comment with respect to the capability of the existing infrastructure to facilitate some or all of the wastewater flows from the proposed development, and
- provide recommendations with respect to how best to service the proposed development and the infrastructure required to facilitate this.

2.0 Existing Mandeville-Ōhoka Wastewater System

2.1 Description of Mandeville-Ōhoka Wastewater Network

The Mandeville/Ōhoka area is currently serviced for wastewater via the Bradleys Rd wastewater pump station (BRPS) and associated rising main which connects to Rangiora WWTP. The Bradleys PS is located at 976 Tram Rd, on the corner of Tram Rd and Bradleys Rd. The BRPS receives flow from the existing Mandeville and Swannanoa areas. According to the BRPS design report (CPG, 2012), the pump station receives primary treated effluent from Septic Tank Effluent (STEP) Pumping Systems in these areas. The STEP system involves each connected property having a septic tank which receives wastewater from the house. The septic tank provides primary settlement of wastewater solids which are retained within the tank. Primary treated effluent is then passed through a filter and pumped from the tank via a small diameter pressure pipe network to BRPS.

The BRPS consists of two Mono brand progressive cavity pumps located in a pump station building, operating on a duty-stand-by basis. These pumps are capable of pumping over a large range of discharge pressures with a relatively narrow range of outlet flows. The BRPS also has effluent storage on site which consists of six 30 m^3 plastic tanks and equates to 16 hours of design storage at average dry weather flows (ADWF). The BRPS pumps are designed to pump 21.7 L/s over a pressure range of 7m to 77m depending on the operating conditions in the rising main (CPG, 2012).

The Bradleys Rd PS rising main connects the BPRS to the Rangiora WWTP via Ōhoka. It passes the CGL development site along its western boundary on Bradleys Rd and its northern boundary along Mill Rd. The existing Ōhoka area is connected to this rising main via a low-pressure sewer (LPS) network which collects pumped wastewater from individual lots in Ōhoka and this LPS network connects to the Bradley Rd PS rising main on Mill Rd. It was originally proposed in the CPG design report (CPG, 2012) that a wastewater pump station would be constructed in Ōhoka, at or near Kintyre Lane, and connect into the pressure main on Mill Rd. To date this has not happened, and the area has developed as a single LPS system. The CPG design report indicates that the overall BRPS rising main was designed for a design flow of 30.3 L/s (CPG, 2012).

The rising main is approximately 11.2 km in length, its longitudinal profile drops approximately 2m in elevation from Bradleys Rd PS to Ōhoka and then rises approximately 6m in elevation between Ōhoka and Rangiora WWTP. This approximate 19m net hydraulic gradient means that the pipeline has the ability to operate as both a gravity main and a pumped main. A control valve was installed at the WWTP end of the rising main which is used to control wastewater volumes in the pipeline and ensure that the pipe does not excessively drain out when the pump station is not in operation.

A typical operating cycle for the pump station is that, at a set tank level at BRPS, the control valve in the rising main at the WWTP inlet will open. Flow will commence under gravity from the tanks and will continue for a period of time until a set "low" tank level is achieved. At this time, a pump at BRPS will turn on and will run for a period of time to expel the air which can become entrained within the pipeline over its gravity flow cycle. Once the tank level reaches a set point the pumps will switch off and the control valve closes.

2.2 Capacity of existing wastewater network

2.2.1 Current BRPS Operations

PDP was supplied with raw SCADA data information from WDC's wastewater SCADA system. Total daily flow data was provided for the time period 01/07/2021 through to 07/06/2023. Additional detailed SCADA data, which included BRPS pump start/stop information, instantaneous and volumetric flows for the rising main (measured at the Rangiora WWTP), BPRS discharge pressure and BRPS tank levels was also provided at one-minute intervals. The time period for this detailed SCADA information was 1/7/2022 through to 31/8/2023, which also included a severe Inflow and Infiltration (I&I) event which occurred in July/August 2022.

From a review of detailed SCADA data for pump operations, on average the BPRS pumps operated approximately 3 to 4 times per day. Each pump operation is approximately 30 to 40 minutes in duration, with an approximate average total daily pump operating time of 2.36 hours per day. There are extended periods of up to 6 hours with no pump operations at all. As noted in the previous section, during these "OFF" periods, the BPRS rising main will either receive a small gravity flow from the BRPS tanks if the control valve at the WWTP is open or no flow at all if the control valve is closed.

The average daily flow discharging from the BRPS rising main at the Rangiora WWTP over the time period 01/07/2021 through to 07/06/2023 was 269 m^3/day. It is clear from a review of "normal" operating data that the BRPS rising main has a significant degree of available capacity to convey additional flows from new development areas, including the flows from the proposed development at 531 and 535 Mill Rd.

There are, however, infrequent periods of time when this available capacity is reduced due to severe I&I events. During particularly severe I&I events, the available capacity can be reduced for extended durations. The following sections of this report will focus specifically on these time periods.

2.2.2 Severe I&I Events

Inflow and Infiltration (I&I) of groundwater and surface water into wastewater networks is a universal issue which can restrict the available capacity in

wastewater networks. Systems are typically designed with an allowance for I&I as part of the base design considerations, however, in areas of shallow groundwater and frequent risk of surface flooding, I&I can often be a number of times greater than the design allowances. In parts of the Waimakariri district, particularly Mandeville and Ōhoka , high groundwater levels following extended periods of above average rainfall have led to extended periods of surface flooding, due to undersized drainage networks[1] and failed to badly impacted stormwater infiltration systems. This extended ponding has resulted in extreme levels of I&I entering the STEP wastewater network in Mandeville and the BRPS in the past.

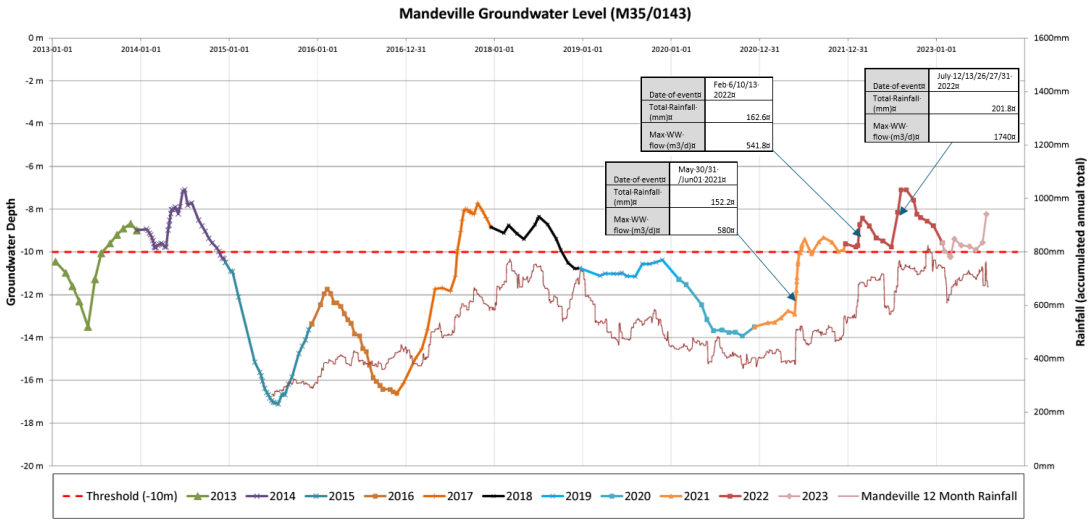

Figure 2 Groundwater levels at M35/0143 and rainfall records (WDC website[2] **)**

Figure 2 above shows the long-term groundwater trend for Bore M35/0143 along with the rolling 12-month total rainfall for the area. The bore is located on Tram Rd approximately 10 km west of Mandeville in an upgradient direction with respect to groundwater piezometric contours. This base graph has been taken from the Waimakariri DC (WDC) website and the accompanying WDC text indicates that the above well data is a good indicator for the shallower groundwater levels which occur further east. When groundwater levels at M35/0143 are at 10m depth below ground level (mbgl) or shallower, this would indicate that groundwater levels in Mandeville are approximately at ground level. These periods generally coincide with occasions when extended surface flooding in the Mandeville areas has occurred.

As can be seen in Figure 2, there is a strong correlation between rainfall and groundwater levels, with groundwater levels responding relatively rapidly to prolonged periods of increased rainfall. The periods of time when the

[1] Flood Response in the Waimakariri District - Purton & Cleary (2015)
[2] https://letstalk.waimakariri.govt.nz/mandeville-resurgence-channel-upgrades/news_feed/faqs

groundwater levels in Bore M35/0143 are less than 10 mbgl strongly align with a series of consecutive heavy rainfall events which were reported in 2014, 2017, 2022 and 2023. These events, particularly the initial 2014 event, resulted in extended durations of surface flooding and significant capacity issues with respect to the wastewater network in Mandeville[3].

2.2.3 Impacts of I&I on BRPS Rising Main Flows

Indicated on Figure 2 above are three significant rainfall events and the associated wastewater peak discharge with each event. For the first two events, high rainfall over a number of days during a week in May 2021 (152 mm) and February 2022 (162 mm) resulted in a peak wastewater discharge of 580 m^3/day and 541 .8 m^3/day respectively. For both of these events, the wastewater flows returned to average levels of flow immediately after the event.

Figure 3, below, shows the third of the events indicated on Figure 2 in more detail. In particular, it shows the relationship between daily wastewater flow in the BRPS rising main and groundwater levels at Bore M35/0143. During this period, a total of 202 mm of rainfall fell across three distinct events on 12/13 July (77 mm), the 26/27 July (94 mm) and on the 31 July 2022 (31 mm). The associated peak wastewater flows immediately following these events was 582 m^3/day, 1269 m^3/day and 1740 m^3/day respectively.

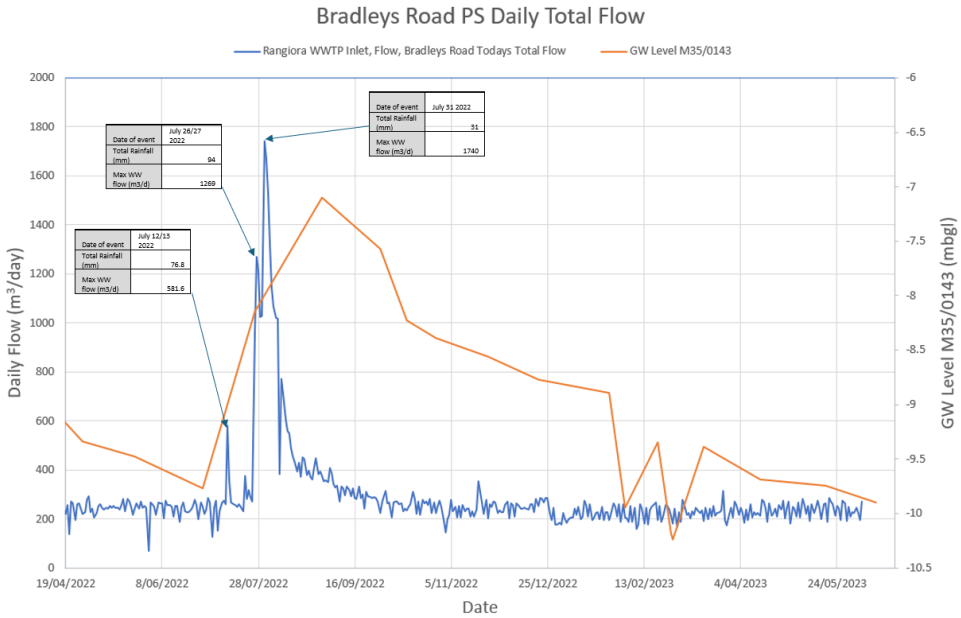

Figure 3 Daily BRPS Rising Main Flows and Groundwater Levels

[3] https://www.waternz.org.nz/Article?Action=View&Article_id=332

It is clear from the information in Figures 2 and 3 that the wastewater flows are significantly impacted by both severe rainfall and high groundwater levels. However, the data in Figure 3 would suggest that the combination of rainfall and high groundwater levels has the most significant impact on wastewater flows from the BRPS rising main.

The daily wastewater flow volumes discharged by the BRPS rising main are tabulated below in Table 1. Wastewater flows were above 900 m^3/day from 26th July to the 7th August before dropping relatively quickly to 600 m^3/day by the 11th August and then gradually dropping back to average flows of approximately 270 m^3/day by early October. It is likely that the more extreme flows of greater than 1000 m^3/day were driven by direct inflows of water from surface flooding and ponding over STEP tank locations in the Mandeville area. Once this surface ponding alleviated, wastewater flows dropped to less elevated levels which were likely primarily driven by infiltration of elevated groundwater to STEP tanks and associated pipework.

Table 1: Daily Wastewater Flows in BRPS Rising Main

Date	Wastewater Flow (m^3/day)
25/07/2022	271.95
26/07/2022	955.5
27/07/2022	1268.9
28/07/2022	1210.85
29/07/2022	1024.15
30/07/2022	1024.8
31/07/2022	1737.1
1/08/2022	1668.5
2/08/2022	1533.1
3/08/2022	1325.6
4/08/2022	1144
5/08/2022	1064.25
6/08/2022	1019.5
7/08/2022	1017.3

Notes:

1. *Raw SCADA Flow data for 8th August indicates a total flow of 381.6 m^3/day. This appears to be a SCADA totaliser error. Calculated flow for this day from SCADA is 789.8 m^3/day.*

2.2.4 Impacts of I&I on BRPS Operation

As noted in Section 2.2.1, under normal operation the pumps at BRPS operate relatively infrequently with an average of only 3 to 4 pump operations a day at a design flow of approximately 21 L/s. This equates to approximately 2.36 hours of pump operations on an average day. The balance of the time, there is either no flow from the pump station or rising main (due to a closed control valve at the WWTP inlet) or the pipeline runs under gravity conditions at relatively low flows once the control valve has been opened. As noted in Section 2.1, both the operation of the control valve at the WWTP inlet and the BRPS pumps are controlled by level settings on the storage tanks at BRPS.

As noted above, during a severe I&I event, such as that which occurred in July/August 2022, the wastewater flows into the network increase significantly with potential for more than a five-fold increase in daily flow volumes. The impact of this is that the BRPS pumps operate for extended periods of time. During the 2022 severe I&I event, the flows in the rising main increased to more than 1000 m^3/day for 13 consecutive days with an associated large increase in the duration of pump operations. Figure 3 above graphs this increase in daily flow volume during the 2022 severe I&I event.

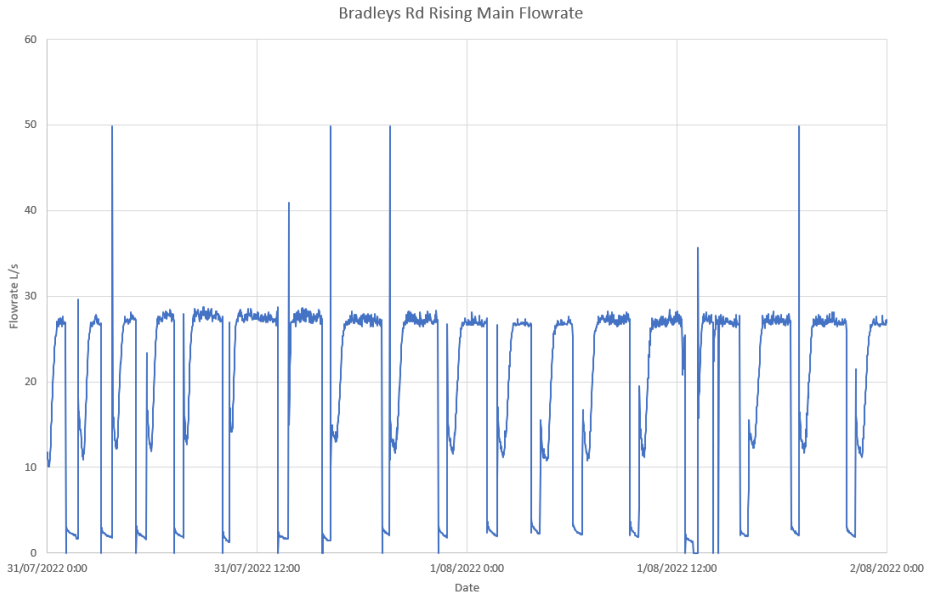

Figure 4 Instantaneous Flowrates During Severe I&I Event

Figure 4 above details the instantaneous flow (L/s) discharging from the BRPS rising main to the Rangiora WWTP for two days (31st July and 1st August 2022) at the peak of the severe I&I event in July/August 2022. The graph indicates that during this peak period, the pump station is operating 8 to 9 times per day for extended durations totalling up to 17 hours per day. In addition to this, during

periods when the pumps are turned off, the pipeline is continuing to operate by gravity and/or receive higher than normal pumped flows from the Ōhoka LPS scheme.

2.2.5 WDC Projects to reduce I&I in Wastewater Network

Significant drainage works were undertaken subsequent to the 2014 flooding event to improve drainage capacity downstream of Mandeville and mitigate the potential for similar levels of flooding. This included upgrades of drainage along Bradleys Rd, Whites Rd, Siena Place and Dawsons Rd. While those works have provided some relief, subsequent consecutive heavy rainfall events have resulted in surface flooding in the Mandeville area in 2022 and 2023. Further works, known as the Mandeville Resurgence Channel Upgrades Project, have been investigated and incorporated into the WDC Annual Plan and Long Term Plan.

Initial community consultation carried out in September 2023 set out a programme for completion of Stage 1 of the Mandeville Resurgence Channel Upgrades Project[4] in March 2025 and completion of Stage 2 in March 2027. However, construction of Stage 1 has yet to commence. Minutes of the WDC Utilities and Roading Committee[5], dated December 2024, indicate that Council and the Ōhoka -Mandeville Drainage Advisory Group held a workshop to discuss the project in December 2024. WDC staff received feedback on both Stage 1 and Stage 2 of the Mandeville Resurgence Project and the minutes indicates that staff will seek to proceed with further consultation in the coming months. Further minutes of the same Committee from 14 April 2026 indicate that the Stage 1A works were to commence in April 2026 and be completed in June 2026.

The draft Long Term Plan (LTP) for the district has a budget of $1.71M allocated to complete Stage 1 of the Mandeville Resurgence Channel Upgrades Project across the 2024/25 and 2025/26 financial years. Stage 2 is currently budgeted for completion in the second half of the LTP period, prior to 2032.

The WDC Wastewater Activity Management Plan (2024)[6] notes the capacity issues that have been experienced in the Mandeville wastewater network, particularly with ingress of extraneous water into the STEP tanks. It states that a *"programme of site by site work to try and prevent stormwater entering the tanks was completed some time ago, but there are two outstanding drainage capital projects due for completion in 2025/26 and 2031/32, which are expected to further improve the situation".*

[4] https://letstalk.waimakariri.govt.nz/mandeville-resurgence-channel-upgrades
[5] https://www.waimakariri.govt.nz/__data/assets/pdf_file/0019/174412/Item-11.1-CONFIRMED-MINUTES-Utilities-and-Roading-Committee-25-February-2025.pdf
[6] https://www.waimakariri.govt.nz/__data/assets/pdf_file/0029/129278/Wastewater-Activity-Management-Plan-2024.pdf

Upon completion of the above projects, it is reasonable to expect that the worst of the I&I, which is likely the result of direct inflow of surface water into STEP tanks, will be significantly improved. While is it still reasonable to expect elevated wastewater flows into BRPS following large rainfall events, it is expected that the magnitude of these wastewater flows and the resultant BRPS pumping durations will be greatly reduced.

3.0 Recommended Wastewater Solution

A detailed options assessment was undertaken to consider the most appropriate solution for connection of the proposed Ōhoka development to the existing BRPS rising main. A memo outlining this options assessment and its conclusions is included as Appendix A of this report. A summary of the investigation and findings is provided below.

3.1 Wastewater flows from proposed Ōhoka development

It is proposed to service the Ōhoka development via a low-pressure sewer (LPS) system which collects and conveys wastewater from the development to the proposed Ōhoka Pump Station (OPS). The OPS is proposed to be located adjacent to the proposed Polo Grounds area. Figure 2 below shows the proposed pump station located within the site, wastewater concept design plans are also included in Appendix B. The OPS will pump wastewater from the development to the existing BRPS rising main on Mills Rd. The OPS will only operate when the pumps at BRPS are not pumping.

Ecoflow Ltd have provided a Preliminary Design for the internal wastewater servicing of the development. This Preliminary Design Report is included in Appendix C. The preliminary design report flow is based on the servicing of 879 residential lots, 250 retirement units and 1.49 ha of commercial development. The total wastewater flow from the site has been calculated by Ecoflow as being 669 m3/day with a maximum wastewater flow from the LPS system calculated to be 20.57 L/s. There are minor difference between the lot numbers in the Ecoflow report and the final lot yield in the application. However, from a wastewater generation perspective, the numbers calculated by Ecoflow are considered to be more conservative.

Figure 5 Proposed Wastewater layout for Ōhoka Development

The OPS pump station design incorporates progressive cavity pumps suitable for wastewater applications, with associated electrical control systems, pressure relief valving, and telemetry connections to the existing Waimakariri District Council SCADA network. The pump station layout and control philosophy will be very similar to that employed at the BRPS in order to allow the pump stations to work together in a complementary fashion.

Emergency storage requirements mandate a minimum of 215 m^3 capacity in accordance with the Waimakariri District Council Engineering Code of Practice, representing eight hours of average dry weather flow storage. The facility will include provision for standby power generation to maintain operations during power outages, with particular consideration given to the low probability but high consequence scenario of extended power failure coinciding with severe I&I events.

3.2 Wastewater Options Assessment

Three key options were considered for connection of the OPS, each with differing volumes of associated buffer storage and pump flows. Buffer storage is required at the OPS in order to manage flows during rare severe I&I events. During such events, the window of availability for pump operation at the OPS become significantly reduced compared to typical days.

The buffer storage requirements for different OPS flow rates were determined through a comprehensive mass balance analysis using SCADA data from the 2022 severe I&I event. The analysis incorporated realistic operational constraints including reduced pumping intervals to accounts for 2-minute communication

intervals between pump stations and an allowance to account for the reduced gravity flows out of the BRPS while OPS operates.

This analysis identified appropriate buffer storage volumes, combined with the pump flow rate, which would provide adequate storage to manage wastewater flows during critical periods while maintaining system operational integrity.

Three connection options were evaluated during the design process:

- Option 1 involving a 25 L/s OPS flow with 502 m^3 of buffer storage;
- Option 2 featuring a 30 L/s OPS flow with 251 m^3 of buffer storage; and
- Option 3 proposing upgrade of the existing Bradleys Road Pump Station flow capacity to 30 L/s.

Following comprehensive technical analysis, Option 2 was selected as the preferred solution, with the Ōhoka Pump Station to be designed at a capacity of 30 L/s to provide operational headroom above the calculated maximum flow requirements.

Detailed hydraulic modelling was conducted using Bentley Hammer software to assess the performance of the recommended solution under both normal operating conditions and transient events. Under normal operation, the system generates a maximum operating pressure of 660 kPa at the OPS connection point, which complies with the Waimakariri District Council Code of Practice requirements. Transient pressure analysis, simulating sudden pump failure events, demonstrates that the system maintains acceptable pressure envelopes ranging from 660 kPa to -35 kPa. These values fall within the operational tolerances of the existing pipeline infrastructure and are compliance with the WDC Engineering Code of Practice (CoP).

4.0 Summary and Conclusions

The existing BRPS rising main conveys wastewater from Mandeville and Ōhoka to the Rangiora WWTP. As described in Section 2, under typical conditions, BRPS pumps operate 3–4 times daily, averaging 2.36 hours of operation. For the vast majority of the time, the BRPS rising main has unused capacity and therefore, could accommodate potential inflows from future developments such as this one at 531 and 535 Mill Road. However, extreme recurring rainfall and resultant high groundwater levels can drastically reduce this available capacity due to extended durations of BRPS pump operation.

This reduction in capacity can be accommodated through the provision of buffer storage at the proposed OPS. The required use of this storage will be relatively infrequent, as the types of events which trigger excess flows into the BRPS are themselves infrequent. The available data indicates that there has been approximately 3 to 4 such events in the last 10 years.

As noted in Section 2.2.5, initial drainage relief works in Mandeville have been completed to alleviate the impacts of these events on surface flooding in the Mandeville area and the resultant impacts on the wastewater system. Further works are planned in 2026 and 2032 which are indicated to provide further significant relief. Analysis of the flow data would suggest that it is only the most extreme effects, i.e. BRPS flows in excess of 1350 m^3/day, that would trigger a need to use the proposed buffer storage at the OPS. It is expected that the proposed drainage improvements would, at very least, eliminate these extreme impacts on the BRPS.

The recommended option, to provide 251m^3 buffer storage at the OPS, will provide the ability to manage wastewater flow from the proposed development in the infrequent event that BRPS flows increase excessively and limit the pumping windows available to the OPS. In addition to this, more than 900 m^3 of further storage is available in the LPS network tanks of the individual household lots of the development which provides significant further mitigation of risk in extreme events. Transient modelling of the BRPS rising main indicates that a design flow of 30 L/s can be pumped through the rising main from the OPS without compromising the requirements of the WDC CoP with respect to the rising main design.

While the above recommended solution will appropriately manage existing flows during severe I&I events, it is noted that a number of significant drainage projects have been identified by WDC to relieve these issues. Upon completion of these projects, it is reasonable to expect that the worst of the I&I into the wastewater network will be significantly improved. While is it still reasonable to expect elevated wastewater flows into BRPS following large rainfall events, it is expected that the magnitude of these wastewater flows and the resultant BRPS pumping durations will be greatly reduced.

In conclusion, the above analysis shows the chosen option provides a practical and acceptable solution for connecting the wastewater system for the proposed development utilising the existing Bradleys Road pump station rising main. The design meets regulatory requirements while providing adequate capacity to manage both normal operations and severe I&I events. The solution balances technical performance with economic efficiency and environmental considerations, making it the optimal choice for this development. If the above recommendations are implemented there are no adverse impacts that reach the threshold of a “sufficiently significant adverse impact” such that they need to be taken into account in terms of an assessment under s 85 of the FTAA2024.

5.0 References

CPG. (2012). Mandeville and Ōhoka Wastewater Scheme Design Report. CPG Ltd, April 2012.

Appendix A: Wastewater Options Memo

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memorandum

TO	Tim Carter	FROM	Eoghan O'Neill
	Carter Group Ltd	DATE	13/06/2025
RE	Options Assessment for Wastewater Connection of Ōhoka Development		

1.0 Introduction

Pattle Delamore Partners Ltd (PDP) has been engaged by Carter Group Limited (CGL) (the Client) to assess the available wastewater servicing/connection options for the proposed development at 531 and 535 Mill Road, Ōhoka ("the site").

The site is located to the southwest of Ōhoka township and is bordered by Bradleys Road, Mill Road, and Whites Road. The site currently consists of rural land with the proposed development consisting of business, residential, rural-residential areas and potential retirement village area. The site location is indicated in Figure 1 below.

Figure 1: Location of proposed development

The purpose of this report is to:

- provide comment with respect to the capability of the existing infrastructure to facilitate some or all of the wastewater flows from the proposed development, and
- provide recommendations with respect to how best to service the proposed development and the infrastructure required to facilitate this.

2.0 Existing Mandeville-Ōhoka Wastewater System

The Mandeville/Ōhoka area is located within the Territorial Authority boundary of Waimakariri District Council (WDC) and is currently serviced by the Bradleys Road Pump Station (BRPS), located at 976 Tram Road. The BRPS receives wastewater from Mandeville and Swannanoa via a Septic Tank Effluent Pumping (STEP) system. Each connected property has a septic tank that provides primary solids separation. The resulting primary treated effluent is filtered and pumped through a small-diameter pressure network to BRPS. The station houses two Mono progressive cavity pumps operating on a duty-standby basis. These pumps deliver 21.7 L/s across a discharge pressure range of 7 m to 77 m. The site also includes six 30 m³ effluent storage tanks, equating to 16 hours of average dry weather flow (ADWF) storage.

Wastewater from BRPS is conveyed to the Rangiora Wastewater Treatment Plant (WWTP) via an 11.2 km rising main. The rising main passes through Ōhoka and along the western and northern boundaries of the CGL development site. The existing Ōhoka area connects to this main via a low-pressure sewer (LPS) network that collects wastewater from individual properties. Although the original 2012 CPG design proposed the construction of an Ōhoka pump station near Kintyre Lane in Ōhoka, it has not been constructed. The 2012 CPG design report states that the rising main was designed for a peak flow of 30.3 L/s.

The main's hydraulic profile includes a 25 m fall from BRPS to Ōhoka and a 6 m rise to Rangiora WWTP, creating a 19 m net gradient. This permits the main to function as both a gravity and pumped system. A control valve at the WWTP end regulates flow and prevents the main from fully draining. During operation, gravity flow initiates when a high-level trigger is reached, followed by pump activation to clear entrained air. The control valve then closes, completing the cycle.

Under typical conditions, BRPS pumps operate 3–4 times daily, averaging 2.36 hours of operation. Following prolonged periods of high rainfall, with resultant high groundwater levels, the wastewater flows into the network increase significantly. Due to extraneous inflow and infiltration (I&I), there is potential for more than a five-fold increase in daily flow volumes during particularly severe I&I events. The impact of this is that the BRPS pumps operate for extended periods of time. During the 2022 severe I&I event, the flows in the rising main increased to more than 1000 m^3/day for 13 consecutive days with an associated large increase in the duration of pump operations. During this peak period, the pump station operated 8 to 9 times per day for extended durations totalling up to 17 hours per day.

A number of significant projects have been identified by WDC to improve drainage within the Mandeville/ Ōhoka area and reduce the occurrence and duration of surface ponding following large storm events. Upon completion of these projects, it is reasonable to expect that the worst of the I&I, which is likely the result of direct inflow of surface water into STEP tanks, will be significantly improved. While is it still reasonable to expect elevated wastewater flows into BRPS following large rainfall events, it is expected that the magnitude of these wastewater flows and the resultant BRPS pumping durations will be greatly reduced.

While operational windows for pumping of additional flow from the proposed development through the existing rising main do exist, they need to be carefully considered in terms of how best to avail of that capacity.

3.0 Options for Connection of Ōhoka Development

3.1 Wastewater Flows From Proposed Development

It is proposed to service the Ōhoka development via a low-pressure sewer (LPS) system which collects and conveys wastewater from the development to the proposed Ōhoka Pump Station (OPS) which is proposed

to be located adjacent to the Polo Grounds area. Figure 2 below shows the proposed pump station located within the site, wastewater concept design plans are also included in Appendix A. The Ecoflow Ltd have provided a Preliminary Design for the internal wastewater servicing of the development. This Preliminary Design Report is included in Appendix B. The preliminary design report flow is based on the servicing of 859 residential lots, 300 retirement units and 1.7 ha of commercial development. The total wastewater flow from the site has been calculated by Ecoflow as being 669 m3/day with a maximum wastewater flow from the LPS system calculated to be 20.57 L/s.

It is proposed that the Ōhoka pump station will be located centrally within the development will connect to the existing BRPS rising main on Mill Rd, see Figure 2 below.

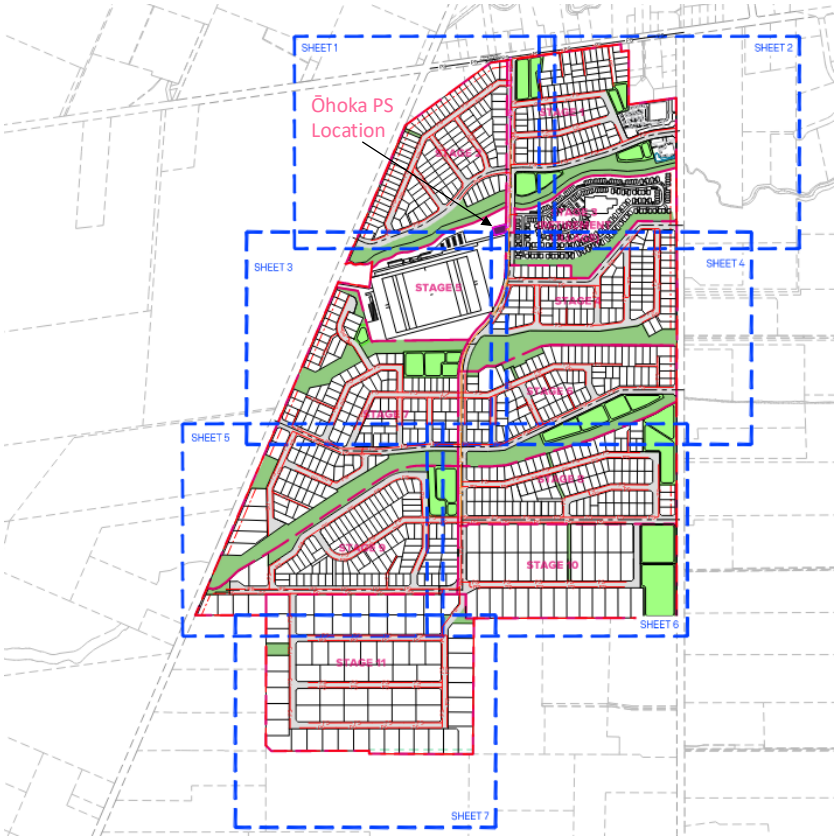

Figure 2 Proposed Wastewater layout for Ōhoka Development

For the purposes of this new fast track consenting process, PDP has investigated a number of options for connection of the proposed development. These options include:

1. Provision of additional buffer storage at the new Ōhoka pump station.
2. Increasing the design flow of the new Ōhoka Pump Station.
3. Upgrading the flow capacity of the Existing Bradleys Rd pump Station

A preferred option will be identified for implementation through the development.

3.2 Option 1: Additional Buffer Storage at OPS

During a severe I&I event, the increased wastewater flows to the BRPS can increase the daily pump hours from an average of approximately 2.36 hours per day to more than 17 hours per day. This significantly

reduces the time windows available for the OPS to operate into the BRPS rising main at times when Bradleys Rd Pump Station is not operational.

The proposed OPS will have a design flow of 25 L/s. The Waimakariri District Council Engineering Code of Practice[1] requires that pump stations are constructed with emergency storage equivalent to 8 hours of Average Dry Weather flow. Based on the proposed total wastewater flow of 645 m^3/day to the OPS, this would equate to a required storage of 215 m^3.

During a severe I&I event, when available pumping opportunities for the OPS to discharge to the rising main are reduced, buffer storage can be used to balance the inflows being received at the OPS. To assess the viability of this, the available raw pump operation SCADA data (pump on/off data and instantaneous flow data) for the 2022 severe I&I event period was assessed. A mass balance exercise was carried out considering the periods of time when the BRPS was non-operational. These "BRPS OFF" time duration windows were then reduced to account for:

- An allowance of 2 minutes for communication interval between the BRPS and OPS.
- An allowance to account for the reduced gravity flows out of the BRPS while OPS operates, which will in turn reduce time period until BRPS tank level will signal BRPS to turn on again. This allowance was calculated based on an average gravity flow of 5.5 L/s from the BRPS, identified from the SCADA data and the additional time the BRPS would need to pump this volume at the BPRS pump flow.

This provided an "OPS ON" time interval within which the OPS can operate, the balance of the time being an "OPS OFF" time interval. Within these time intervals the following parameters were also calculated:

- an accumulated wastewater volume was calculated for the OPS ("OPS Inflow Volume"); and
- a maximum wastewater volume the OPS could pump in the available window at a flow of 25 L/s ("OPS Pump Volume").

A volume balance was then carried out over these OPS ON and OPS OFF time intervals. In a time interval where the OPS Pump Volume exceeds the OPS Inflow Volume, a negative "deficit" wastewater volume is reported for that time interval. In a time interval where the OPS Pump Volume is less than the OPS Inflow Volume, a positive "surplus" wastewater volume is reported for that time interval. The volume balance keeps track of how much storage is needed by adding surpluses and subtracting deficits from each time interval over the period being considered. The total required storage volume at each time interval never goes below zero, a deficit can only reduce the storage volume if there was already a positive net storage recorded in the previous time interval.

Utilising the above methodology, approximately 502 m^3 of buffer storage would be required at the OPS, assuming a pump flow of 25 L/s. As noted above, an emergency storage volume of 215 m^3 is already required to be provided. Emergency storage is required to mitigate the risk associated with events such as a power outage. The emergency storage can provide sufficient time for the Council to react with an alternative power source, such as a portable generator, prior to an overflow occurring. Some councils (e.g. Queenstown Lakes DC) will consider a reduction in the emergency storage requirements if further mitigations, such as a stand by generator, are installed at the pump station.

For the OPS, emergency storage of 215 m^3 is required. The likelihood of an extended power outage coinciding with an extreme I&I event is very low. It is considered appropriate that these should be considered as separate events with respect to storage requirements at the site. Therefore, the total

[1] https://www.waimakariri.govt.nz/__data/assets/pdf_file/0018/134280/Engineering-Code-of-Practice-updated-February-2025.pdf?v=0.0.2

volume for the OPS site should be the larger of either the required emergency storage or the calculated buffer storage.

In this instance, with the OPS design flow set at 25 L/s, a total storage volume of at least 502 m3 is considered sufficient to meet both emergency storage requirements and sufficiently buffer flows from the OPS into the BRPS rising main during rare and extreme I&I events. A stand-by generator at the OPS site will further mitigate any risk associated with the unlikely event of a power outage coinciding with an extreme groundwater resurgence event. Storage would likely be provided in the form of one or more large above ground cylindrical stainless-steel tank with a conical bottom.

In addition to the proposed storage at the OPS, the LPS system itself will incorporate individual tanks on each property with approximately 1 m^3 of emergency storage in each tank. This constitutes more than 900 m^3 of additional storage which could be utilised in an extreme or emergency scenario. This storage could be managed by way of the use of an Iota OneBox[2] controller on each LPS pump station. The installation and maintenance of these devices could be regulated by a consent notice on each title that notifies the purchaser of their obligations.

An alternative and more rudimentary way to activate this storage would be by way of an actuated control valve on the terminal LPS pressure main entering the OPS. Closing this valve would signal to the internal pressure controller at each individual LPS tank that pumping was not available, and the tank controller should try again after a set time interval. The individual tanks would then begin to fill and store wastewater until pumping was available again. The actuated valve at the OPS could open and close depending on available capacity within the OPS tanks. This additional available network storage has not been considered in the storage requirements for these options, but is considered to be a significant additional risk mitigation which is available to manage flows at the proposed development.

3.3 Option 2: Increasing the design flow of the OPS

The buffer storage volume identified in Section 3.2 above could be decreased further through increasing the design flow of the OPS, thereby increasing the volume pumped during each available window. Analysis of this, utilising the same flow balance methodology as outlined previously, indicates that increasing the pump flow to 30 L/s reduces the required buffer storage volume to approximately 251 m^3(from 502 m3). Further increasing the pump station flow to 35 L/s decreases the “buffer” storage requirement to 80 m^3.

Increasing the flow rates as noted above will increase the operating pressures within the pipeline. The maximum operating pressure rating of the pipe is estimated to be 1,000 kPa, the pipeline is predominantly a PN12.5 PVC pipe, however there are sections of PN10 PE pipe along the route also.

To assess rising main operating pressures in more detail, a hydraulic model of the rising main and pump systems has been constructed in Bentley Hammer. Bentley Hammer is an advanced hydraulic modelling software used to analyse and mitigate water hammer and transient pressures in pipeline systems. It is used to simulate surge events, design protective measures, and ensure the reliability of water, wastewater, and industrial systems. The modelling of this and other options is discussed in Section 4.0.

3.4 Option 3: Upgrading the flow capacity of the BRPS

Increasing the flow of the existing BRPS is another option which would increase the duration of the available pump intervals for the new OPS. The BRPS currently pumps approximately 21 L/s. Increasing this to approximately 30 L/s would increase the available time windows by approximately 50 %, effectively negating the need for additional buffer storage in combination with a 30 L/s Ōhoka pump station. The

[2] https://www.ecoflow.co.nz/intelligent-pressure-sewer

advantage of this option is that it has the potential to increase capacity at BRPS for WDC as well as provide capacity for the Ōhoka development.

There are technical challenges associated with this proposed option that would require detailed investigation to resolve. The existing Bradleys Rd pump station building is not very large and there appears to be very limited space for reconfiguration of the pumps. An additional small "assist pump" pump in a new building located externally to the existing pump building may be a possibility. Alternatively, running the pumps at a higher speed may be a relatively simple upgrade option. A review of the pump information would suggest this is a possibility, however upgrades to the electrical and control system would possibly be required to facilitate this. Hydraulic modelling of this option is discussed further in Section 4.0.

4.0 Hydraulic Modelling of the BRPS Rising Main

4.1 Hydraulic Model Construction

A hydraulic model of the existing rising main and BRPS pump station was constructed in the Bentley Hammer software. The model construction was based on the alignment and pipe parameter information as available in the WDC GIS system. Levels for key components of the pipeline were interpolated from the design drawings and long sections contained in the CPG Ltd design report. The BRPS was modelled as per the design plans, pump details and fittings information contained within the CPG Ltd design report. The OPS has been connected to the existing BRPS rising main as per Figure 6 below. The connection point to the rising main is approximately opposite 544 Mill Rd in Ōhoka.

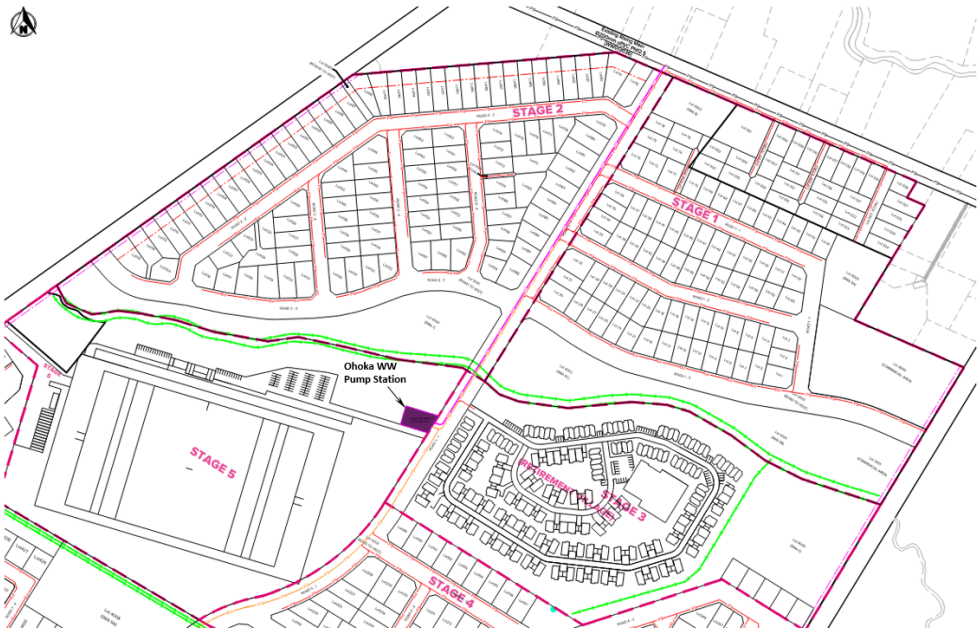

Figure 3: Proposed OPS location and connection to rising main

A number of key assumptions associated with the model build are set out below:

- WDC GIS import of the pipeline run differs from the pipeline position in the provided CPG drawings over the first 477 m (pipeline is on the right of the road berm in GIS, but on left of road berm in drawings).

- WDC GIS import of the pipeline run differs from the pipeline position in the provided CPG drawings over the last 1,000 m (L30 – L33 of drawing set).
- Elevations for the last 1,000 m of pipeline into the Rangiora WWTP were estimated assuming a proportional increase to the end fixed node.
- Total model pipeline chainage is 54 m greater than the CPG drawing set, a 0.5% deviation
- Vertical elevations for nodes along the pipeline were interpolated from drawing set invert levels.
- Stream crossings were modelled as per design drawings.
- Pipeline roughness coefficient of 3 mm used to emulate SCADA data discharge pressure at Bradleys Road.
- Wave speed estimated for PVC pipe at approximately 400 m/s.

4.2 Hydraulic Modelling Scenarios

The base model was constructed, and pump operation was verified against the available existing SCADA data. Following this, a number of modelling scenarios were established to assess the current mode of operation for the BSPS and rising main against the options discussed in Section 3.

The purpose of these scenarios was to assess each option for the impact of the option on normal operating pressures in the pipeline under each scenario as well as during irregular operating conditions which have the potential to generate transient pressure waves in the pipeline. Transient pressure waves in wastewater pressure pipelines occur due to sudden changes in flow e.g. sudden pump stops due to power failure. These waves create rapid pressure fluctuations which travel forward and backwards along the length of the pipeline. These waves can reflect and interact, sometimes amplifying in intensity. Wave amplification increases the risk of pipe bursts, joint failures, and equipment damage, making effective surge analysis and control essential for system protection. Each option discussed below was modelled for both normal operation and sudden pump failure, generating a transient wave.

4.2.1 Current BRPS Operation

The WDC Engineering Code of Practice (CoP) required that wastewater rising mains are designed to withstand a maximum operating pressure that is greater than all of the following:

- 400 kPa (note that this is not the minimum pipeline pressure class);
- 1.5 x (static head + friction head);
- Pump shut off head;
- Positive or negative surge pressures.

As noted in Section 3.3, the BRPS rising main is predominantly a PN12.5 PVC pipe, however there are also sections of PN10 PE pipe along the route. For the purposes of the analysis presented below, the Maximum Operating Pressure (MOP) of the BRPS rising main is therefore assessed to be 1,000 kPa (i.e. PN10 equivalent). The CoP requires that, for each assessed pump flow rate, the MOP of the pipeline material (i.e. 1,000 kPa) is greater than 1.5 times the maximum pressure (i.e. static head + friction head) experienced along the pipeline. The maximum allowable pressure along the pipeline for comparison in each simulation is therefore 667 kPa (i.e. 1.5 x 667 kPa = 1,000 kPa).

Figure 7 below shows the existing pump operation for the BRPS pumps operating at their design flow of 21.7 L/s. The maximum pressure at this flow rate (static head + friction head) along the pipeline is approximately 375 kPa which is less than the CoP requirement.

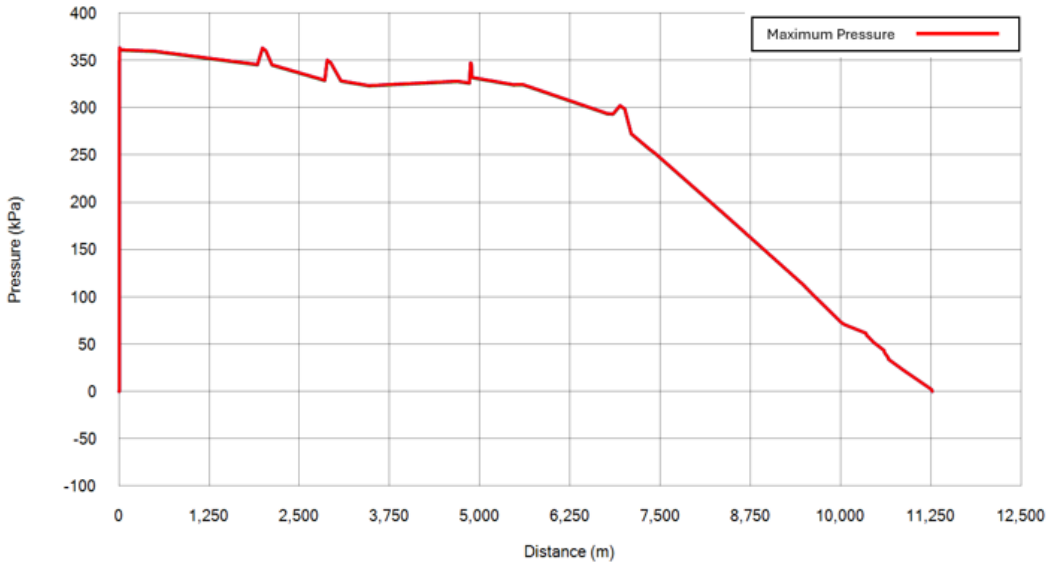

Figure 4 Maximum Pressure Profile of BRPS Rising Main: Current Operation

The BRPS pumps, being progressive cavity pumps, will have a higher pump shutoff head than 1,000 kPa. This is managed at BRPS via a pressure relief valve which circulates flow back into the tanks in the event that a pressure occurs which exceeds the acceptable operating pressure. The OPS would implement a similar system to manage such an event. The pump shutoff head is therefore not considered further in the below analysis for the various options. Figure 8 below indicates the maximum pressure (red line) and the minimum pressure (blue line) which occurs along the length of the BRPS rising main in the event of a sudden pump failure which initiates a pressure transient event in the pipeline. The normal operation pressure profile is also shown as a green line. This graph is shown as a comparison with later transient analyses of the considered options. It can be seen that the transient does not generate increased pressure along the pipeline but the fluctuation between maximum and minimum pressure is significant with some vacuum pressures induced in sections of the pipeline. These are all within the operating allowances of the pipeline and hence comply with the WDC CoP.

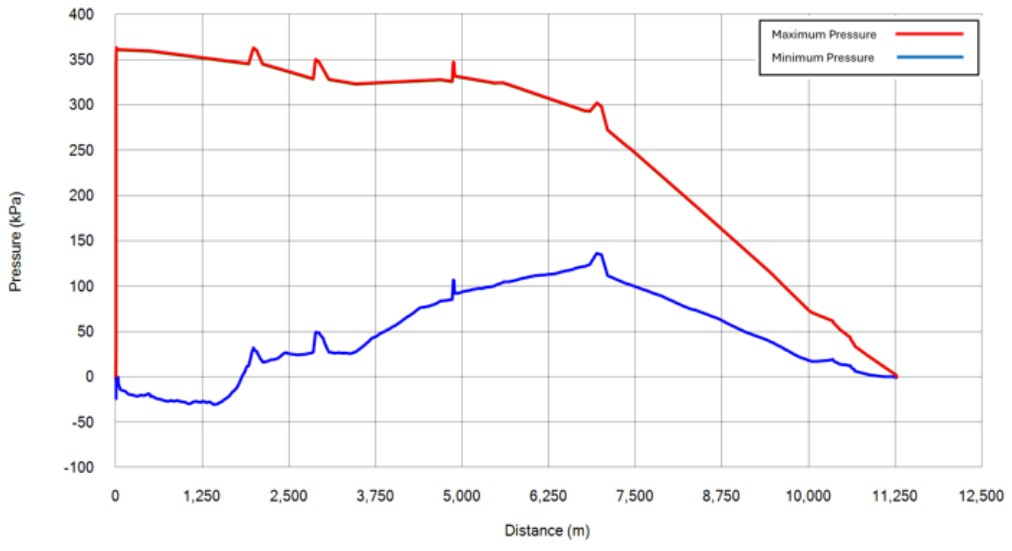

Figure 5 Pressure Profile BRPS Current Operation with Pump Failure

4.2.2 Option 1: Additional Buffer Storage at OPS

Option 1 proposed is the construction of the OPS with a design flow of 25 L/s connected to the existing BRPS rising main. The buffer storage analysis and requirements have been discussed previously, the analysis below considers the implications for the option with respect to the existing rising main and its compliance with the requirements of the WDC CoP.

Figure 9 below displays the maximum pressure along the length of the BRPS rising main when the OPS is in normal operation at a flow of 25 L/s. The maximum pressure along the pipe occurs at the connection point of the OPS to the rising main. The maximum normal operating pressure is 450 kPa which comfortably meets the requirement of the WDC CoP.

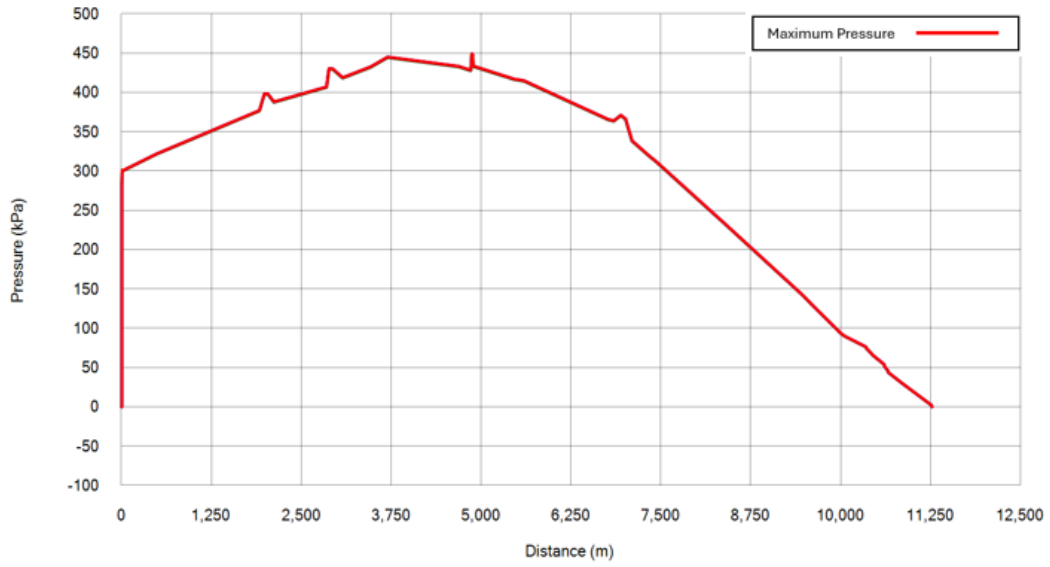

Figure 6 Pressure Profile OPS at 25 L/s in normal operation

Figure 10 below indicates the maximum pressure (red line) and the minimum pressure (blue line) which occurs along the length of the BRPS rising main in the event of a sudden pump failure which initiates a transient pressure event in the pipeline. It can be seen that the pressure envelope of the transient event fluctuates from 450 kPa to -90 kPa. This is within the acceptable envelope of the pipeline and therefore meeting the requirements of the WDC CoP.

It would therefore be possible to connect the OPS to the existing BRPS rising main with a design flow of 25 L/s and meet the requirements of the WDC CoP.

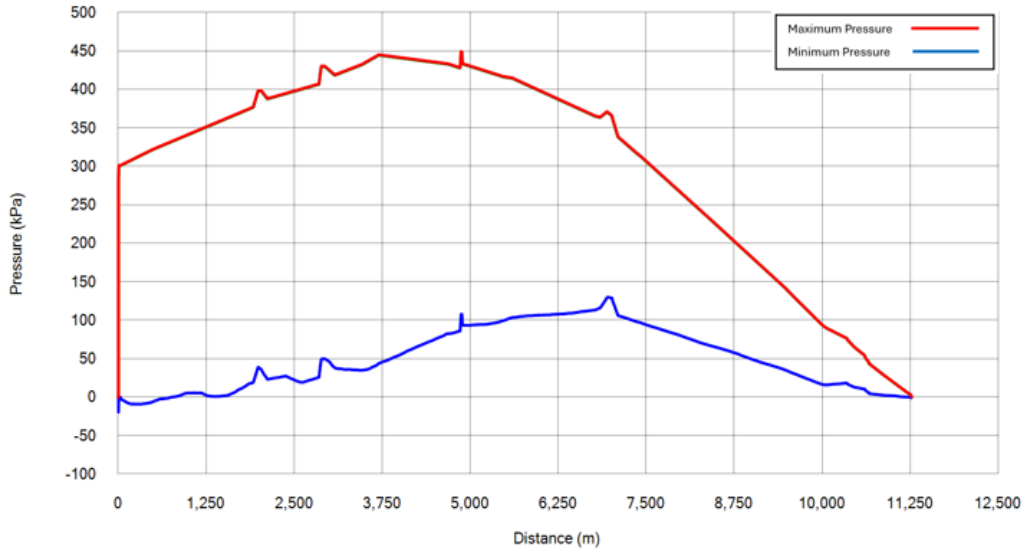

Figure 7: Pressure Profile OPS at 25 L/s with pump failure

4.2.3 Option 2: Increasing the design flow of the OPS

Option 2 proposes the construction of the OPS with an increased design flow of 30 L/s or 35 L/s connected to the existing BRPS rising main. The buffer storage analysis and requirements have been discussed previously, the analysis below considers the implications for the option with respect to the existing rising main and its compliance with the requirements of the WDC CoP.

Figure 11 below displays the maximum pressure along the length of the BRPS rising main when the OPS is in normal operation (green line) and during a pump failure (max and min pressures indicated by red and blue lines respectively) with a pump flow of 30 L/s. The deviation in maximum pressure between normal operation and pump failure modes is minimal, hence the green line is barely visible in the below graph. During normal operation, the maximum pressure along the pipe occurs at the connection point of the OPS to the rising main. The maximum normal operating pressure is 660 kPa which meets the requirement of the CoP. It can be seen that the pressure envelope of the transient event in pump failure mode fluctuates from 660 kPa to a -35 kPa. This is within the acceptable envelope of the pipeline and therefore meeting the requirements of the WDC CoP.

Figure 12 below displays the maximum pressure along the length of the BRPS rising main when the OPS is in normal operation (green line) and during a pump failure (max and min pressures indicated by red and blue lines respectively) a flow of 35 L/s. Again, the deviation in maximum pressure between normal operation and pump failure modes is minimal, hence the green line is barely visible in the below graph. The maximum normal operating pressure is 890 kPa which does exceed permitted the requirements of the WDC CoP.

It would therefore not be possible to increase the design flow at OPS to a maximum flow of 35 L/s as this would exceed the maximum pressure along the length of the BRPS beyond the WDC CoP requirements.

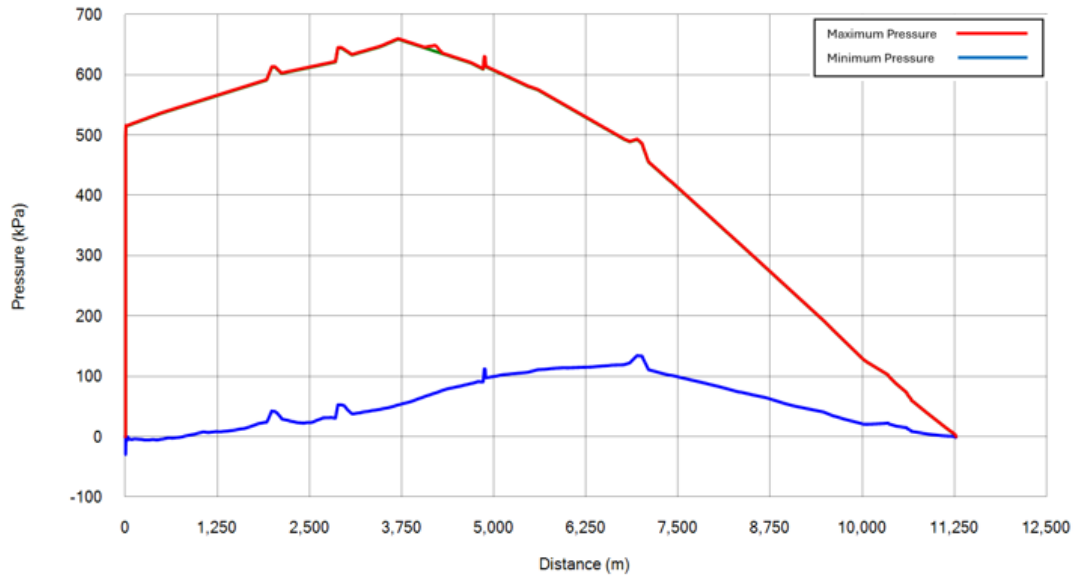

Figure 8: Pressure Profile OPS at 30 L/s in normal operation and pump failure

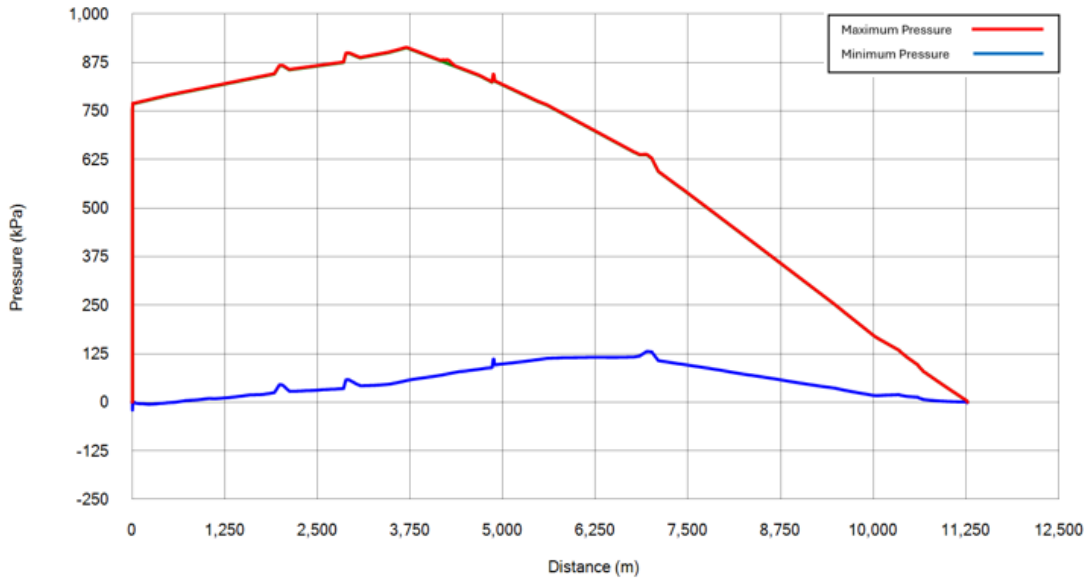

Figure 9: Pressure Profile OPS at 35 L/s in normal operation and pump failure

4.2.4 Option 3: Increasing the design flow of the BRPS to 30 L/s

Option 3 proposes to upgrade the BRPS to increase the design flow of the pump station to 30 L/s. Figure 13 below shows the maximum pressure along the length of the BRPS rising main when the BRPS is in normal operation at a flow of 30 L/s. The maximum pressure is 870 kPa which fails to meet the requirement of the CoP.

This option fails to meet the requirements of the WDC CoP and should not be considered further.

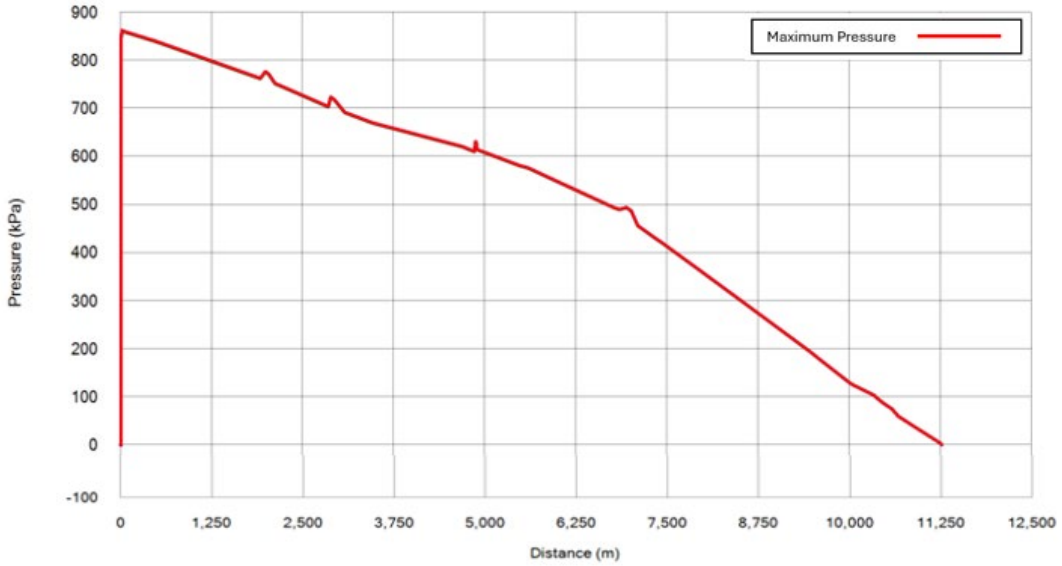

Figure 10: Pressure Profile BRPS at 30 L/s in normal operation

5.0 Recommended Option

From the analysis completed in Section 4, Option 3 will not be compliant with the WDC CoP and will not be considered further. Option 1 (OPS design flow of 25 L/s and 502 m^3 of buffer storage) and Option 2 (OPS design flow of 30 L/s and 251 m^3 of buffer storage) are both options that could be utilised to service the proposed development for wastewater.

Both Options 1 and 2 require the construction of large tanks to provide adequate buffer storage. Both tank sizes will require foundation design for large point loads, however the shallow gravels at the site suggest that this should not require overly complex foundation design or construction. Given the very infrequent use of the buffer storage function of the tanks, it may be beneficial to have multiple smaller tanks (3 to 4 tanks). One tank would operate as a day-to-day buffer tank while the others would sit empty until such a time as they may be required.

With respect to the proposed OPS, an additional 5 L/s of flow to facilitate Option 2 would not have significant cost implications. The progressive cavity pumps required for both Options 1 and 2 are typically quite long pumps and take up a large amount of space within the pump station building. The pumps for Option 2 would be larger, necessitating a slightly longer building footprint. The valve and pipework would be unlikely to be significantly larger between the two options. The electrical demand for the bigger pumps will be larger and therefore the electrical control board will be larger. Overall, the additional pump station costs to facilitate Option 2 are unlikely to be as significant as the additional tank supply costs associated with Option 1.

Overall, both options are considered to be acceptable from a hydraulic perspective. The tanks associated with both options could be large in height necessitating screening to reduce the visual impact or otherwise would need to be shorter but with a larger footprint. The pump station site has been specifically chosen to assist with this as it will not be immediately surrounded by residential development.

Given the lower visual impact on the development, and the likely lower construction costs associated with the larger pump station versus additional storage tanks. It is recommended that **Option 2** (OPS Design Flow of 30 L/s) is taken forward for the proposed development.

This memorandum has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Carter Group Ltd. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the memorandum. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

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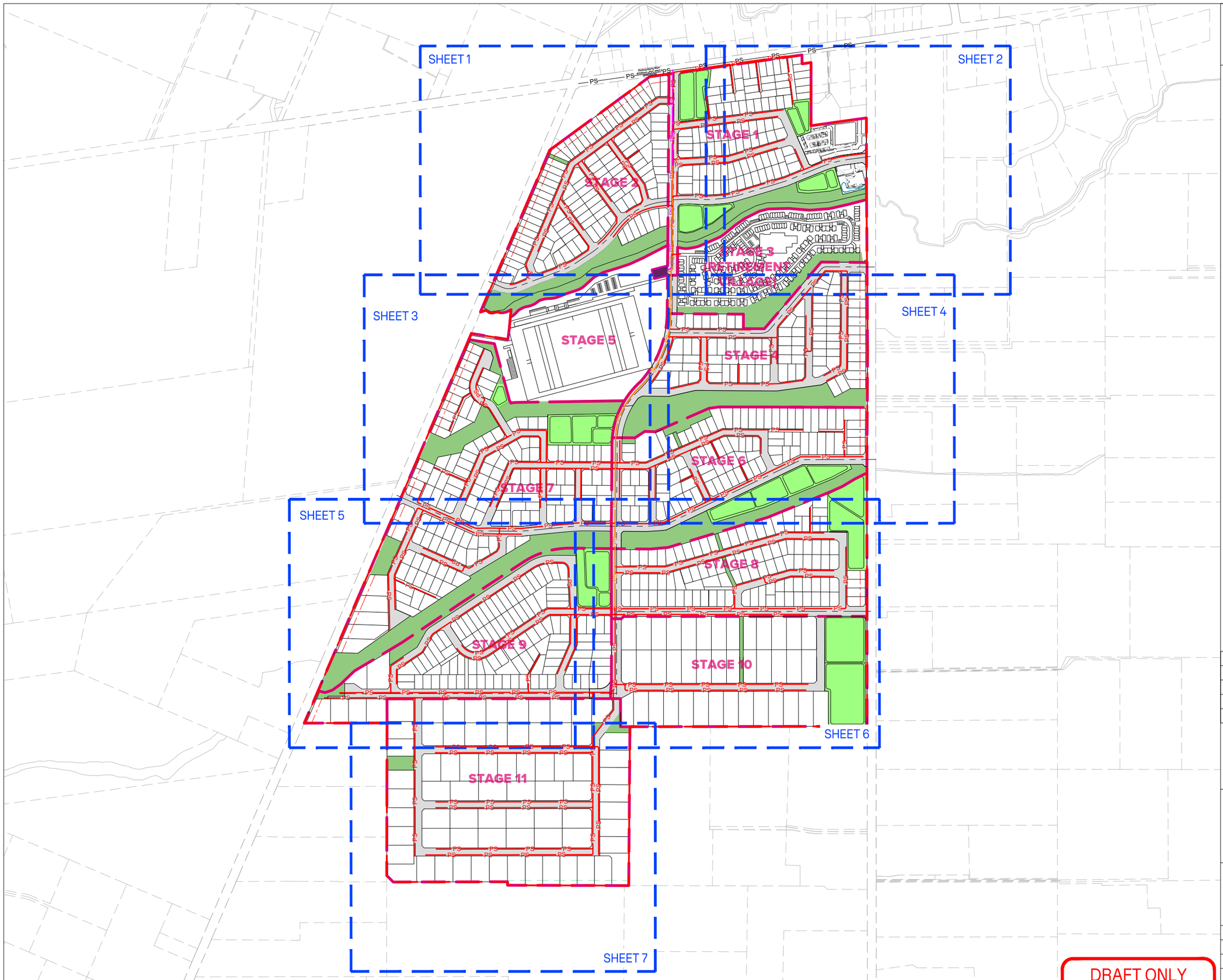
Prepared by

Eoghan O'Neill

Technical Director – Water Infrastructure

Appendix B: Wastewater Concept Drawings



NOTES:

1. ALL WORKS TO BE DONE IN ACCORDANCE WITH WDC ECOP.
2. SUBMAIN TO EXTEND MINIMUM OF 1.0m ALONG FRONTAGE OF LOT BEING SERVICED.
3. WASTEWATER PIPES IN ROWS TO BE LAID IN COMMON SERVICE TRENCH UNDER COMPLIANCE OF A WDC BUILDING CONSENT OR DISCRETIONARY EXEMPTION.

LEGEND:

- STAGE BOUNDARY
- ABUTTAL BOUNDARY
- PROPOSED LOT BOUNDARY
- PROPOSED ROAD
- BANK TOP
- WATER ALIGNMENT
- GROUND DISTURBANCE / IMPERVIOUS SURFACE SETBACK
- MINIMUM RIPARIAN ENHANCEMENT SETBACK
- 15m LANDSCAPING STRIP SETBACK
- STORMWATER MANAGEMENT AREA
- RESERVE / WALKWAYS
- PS — PS — EX WASTEWATER
- PS — PS — PR WASTEWATER - LPS
- PS — PS — PR WASTEWATER - LPS NETWORK
- PS — PS — PR WASTEWATER - PRESSURE MAIN

A	ISSUED FOR FAST TRACK APPLICATION	SS	02/07/2025
REVISION DETAILS		BY	DATE

PROJECT:

MILL ROAD, OHOKA
WAIMAKARIRI
CANTERBURY

DESCRIPTION:

WASTEWATER OVERALL PLAN

	SURVEYED	-	-
	DESIGNED	AO	06/2025
	DRAWN	AA	06/2025
	CHECKED	SS	01/07/2025
	APPROVED	MP	-
SCALE	1:4,000 @A1	1:8,000 @A3	REVISION
STATUS	FOR RESOURCE CONSENT		A
PROJECT	16013		
DWG NO	16013-00-RC-5000		

DRAFT ONLY

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File: C:\12DS\DATA\INOVO-12D\16013-OHOKA_26\03 CAD\001 CURRENT\16013-00-RC-5000.DWG

Synergy Version:

Plot Date: 10:30:28 am,11 July 2025, ANTWAN ANDREA

NOTES:

1. ALL WORKS TO BE DONE IN ACCORDANCE WITH WDC ECOP.
2. SUBMAIN TO EXTEND MINIMUM OF 1.0m ALONG FRONTAGE OF LOT BEING SERVICED.
3. WASTEWATER PIPES IN ROWS TO BE LAID IN COMMON SERVICE TRENCH UNDER COMPLIANCE OF A WDC BUILDING CONSENT OR DISCRETIONARY EXEMPTION.

LEGEND:

- STAGE BOUNDARY
- ABUTTAL BOUNDARY
- PROPOSED LOT BOUNDARY
- PROPOSED ROAD
- BANK TOP
- WATER ALIGNMENT
- GROUND DISTURBANCE / IMPERVIOUS SURFACE SETBACK
- MINIMUM RIPARIAN ENHANCEMENT SETBACK
- 15m LANDSCAPING STRIP SETBACK
- STORMWATER MANAGEMENT AREA
- RESERVE / WALKWAYS
- EX WASTEWATER
- PR WASTEWATER - LPS
- PR WASTEWATER - LPS NETWORK
- PR WASTEWATER - PRESSURE MAIN

A	ISSUED FOR FAST TRACK APPLICATION	SS	02/07/2025
REVISION DETAILS		BY	DATE

PROJECT:

MILL ROAD, OHOKA
WAIMAKARIRI
CANTERBURY

DESCRIPTION:

WASTEWATER PLAN
SHEET 1 OF 7

SURVEYED	-		-
DESIGNED	AO		06/2025
DRAWN	AA		06/2025
CHECKED	SS		01/07/2025
APPROVED	MP		-
SCALE	1:1000 @A1	1:2000 @A3	REVISION
STATUS	FOR RESOURCE CONSENT		A
PROJECT	16013		
DWG NO	16013-00-RC-5001		

0 20 50 100 SCALE (m) 1:1000 @A1 1:2000 @A3

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Synergy Version:

Plot Date: 10:30:30 am,11 July 2025, ANTWAN ANDREA

Appendix C: Ecoflow Preliminary Wastewater Design Report (including 19 May 2026 letter)

Preliminary Design Report

Project Name: Ohoka Development
Prepared by: *Karl Sentch*
Date: *30 May 2025*

Table of Content

Document Control

Ecoflow Project Number	3806
Project Name	Ohoka Development

Revision	2	
Author	Karl Sentch	30/05/2025
Reviewed	Jon McGettigan	30/05/2025

1 Introduction

Ecoflow Ltd have been engaged by Inovo to provide a preliminary design for the proposed low-pressure sewer (LPS) system to service the residential development at Mill Road – Ohoka.

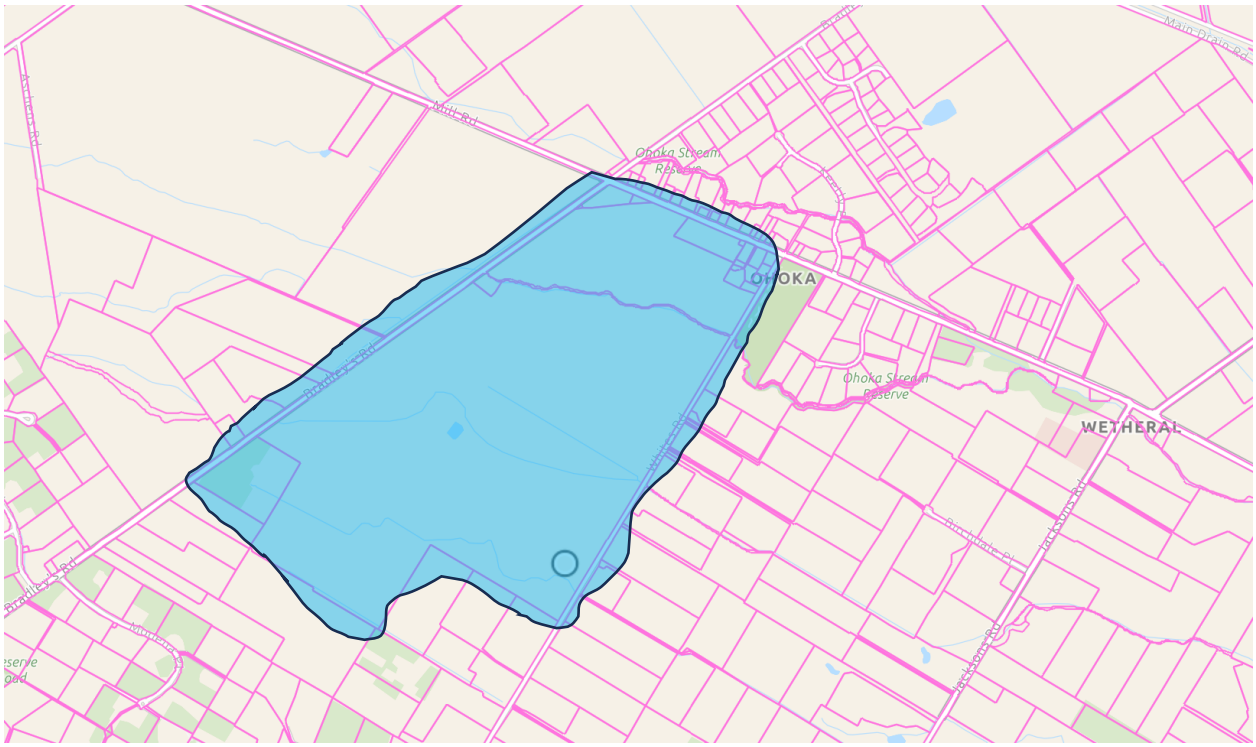
The below design allows for each property to have a pressure sewer grinder pump unit, boundary kit and onsite discharge line to the common reticulation network.

You will find included with this report, the preliminary Hydraulic calculations, Retention Times calculations and Layout drawings.

The construction details and producer statement to be supplied by others.

1.1 Background

The proposed subdivision is made up of approximately 859 residential, 300 unit retirement village and 1.7ha commercial area. The typography of the site is a gentle slope towards the terminal pump station which lends itself very well to seal pressure sewer system.



2 Design Scope

The purpose of this report is to give an indication of the pipe sizes required in order to maintain flushing velocities within the network. We have not taken into account any locations within the ground for placement of the services or the placement of flushing pits, air release valves or isolation valves. These would be located as per WASA-07 recommendations at the detailed design stage by others. Please note the following is a "Preliminary" design report carried out in accordance with the Pressure Sewer Code of Practice WASA-07 (Water Services Association of Australia 2007).

We have taken the following into consideration when completing the hydraulic design:

- The proposed residential lots and typography as provided in cad file
- 300 lot Retirement village = 6 lots per chamber = 50 lots
- 1.7ha = 17 x 1000m^2 sites

Note: The following analysis is based specifically on the pump performance curve of the E/One semi positive displacement pump. The analysis does not apply where other pumps are substituted for this project.

3 Design Parameters

The EOne Design Software is utilising the probability method was used in this preliminary design.

The following design parameters were adopted:

- Pump type = E/One Extreme series semi-positive displacement pump.
  We cannot design for or guarantee the suitability of the network for non-progressive cavity pumps other than Environment One pumps.
- Pump requirements = 230V, 50 Hz single phase
- Friction loss formula is Hazen-Williams with a c factor of 140
- Pipe type is Polyethylene, PE100, PN16, SDR 11 (All diameters measured OD)
- Minimum Scouring velocity of 0.6m/s
- Flushing points and air valves included into design of system
- No Stormwater allowance required in design of system

The design has been developed in conjunction with the following codes:

- Waimakariri District Council Engineering Standards
- WSA 07-2007 Pressure Sewer Code of Australia Version 1.1
- Water New Zealand Pressure Sewer National Guidelines Feb 2020

3.1 Sewer Loadings

The hydraulic design has been based on Waimakariri District Council Engineering Code of Practise ADWF of 250 litres/person/day and 2.7 people/dwelling = 675 litres/dwelling/day.

Number of Lots	Flow/lot (litres)	Total Flow/day (m3)
Approx. 859 residential	675	580
50 retirement	200 x 6 x 50	60
17 commercial	1,728	29
Total		**669 @ 20.57 l/s max**

4 Hydraulic Analysis

As this is design is an early stage preliminary concept, we have designed only for the total build out. Staged build out designs can be supplied when required.

4.1 Peak Flows

The Probability Method was developed and subsequently used to determine peak flow rates in pressure sewerage systems. This method was developed specifically for the EOne semi-positive displacement pump operating characteristics with their near vertical Head vs Quantity (HQ) performance curve.

Ecoflow determine the peak flow rate in each pipe segment and calculate the following:

- Friction head in each segment
- Static head for each pressure sewer unit
- Resulting total dynamic head for each pressure sewer unit

A key assumption in the recommended design procedure is maximum number of pressure sewer unit cores operating daily and the predicted maximum daily number of pumps running at once vs. the number of pumps connected.

As demonstrated in the hydraulic analysis outputs, the probability method determines a peak wastewater flow rate for the equivalent lots connected. *It should be noted that when peak flows are calculated for a pressure sewerage system the duration is only for a short period of say less than a few minutes and might only occur once in a week.*

The di-urnal peaks are also smoothed out somewhat, due to the buffering of operational volume in each of the tanks. i.e., the pump doesn't start every time a toilet is flushed. The operating sump in the tank requires a volume of 40 litres to start the pump, the pump then runs for one minute.

4.2 Maximum Desirable Total Dynamic Head

Design is integrally associated with knowledge of the pumps being used. The prime example of this is the maximum total dynamic head (TDH) that is chosen in the design process. Even though the EOne semi-positive displacement grinder pump can lift to over 100m, the total design dynamic head should be restricted to 56m TDH. Constant operation of the pumps over 56m TDH causes the operational life of the stator to diminish, depending on the mix of static and dynamic head experienced.

4.3 Infiltration Allowance

Infiltration factors are not normally used in the calculation of peak flow in a pressure sewerage system provided there is confidence of the water tightness of the house gravity wastewater pipe network.

The simultaneous pump operations method of determining peak flows does not include a component for excessive infiltration/inflow. It has been standard practice and recommendation, that proactive means be employed to eliminate the potential for significant Inflow and Infiltration. This has typically been accomplished by exercising control over the "watertightness" of the private facilities. This would include inspecting the house plumbing

at the time of house construction / connection and requiring that any faulty drainage works be rectified.

Because the Low-Pressure Sewer networks are constructed with sealed polyethylene PE pipe, and connections carried out with fusion welds, they are not susceptible for groundwater or surface drainage to creep in. Therefore, a completely pressurised collection system will, for all practical purposes, ignore infiltration flows and deliver only the intended wastewater stream to the treatment plant.

4.4 Retention Time Analysis

Pipe diameters have been sized as small as possible to reduce volume and retention times. This also increases the velocity which helps with self-scouring. We have also standardised on pipe sizes to aid in the construction of the network.

4.5 Pressure Sewer Units

The hydraulic analysis and preliminary design have been performed based on the performance of the Environment One (E/One) grinder pump unit on each lot. This design is not guaranteed or valid for installation of any other technology or product.

4.6 Flushing Velocities

A minimum recommended velocity is 0.6m/s to prevents solids build up. We have designed the full build out with a minimum velocity of >0.8 m/s. to ensure scouring velocity is achieved.

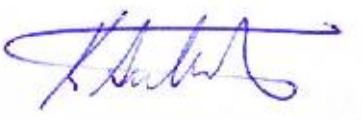
Following best practise, standard flushing points will be required at the head of all branch mains.

5 Air Management

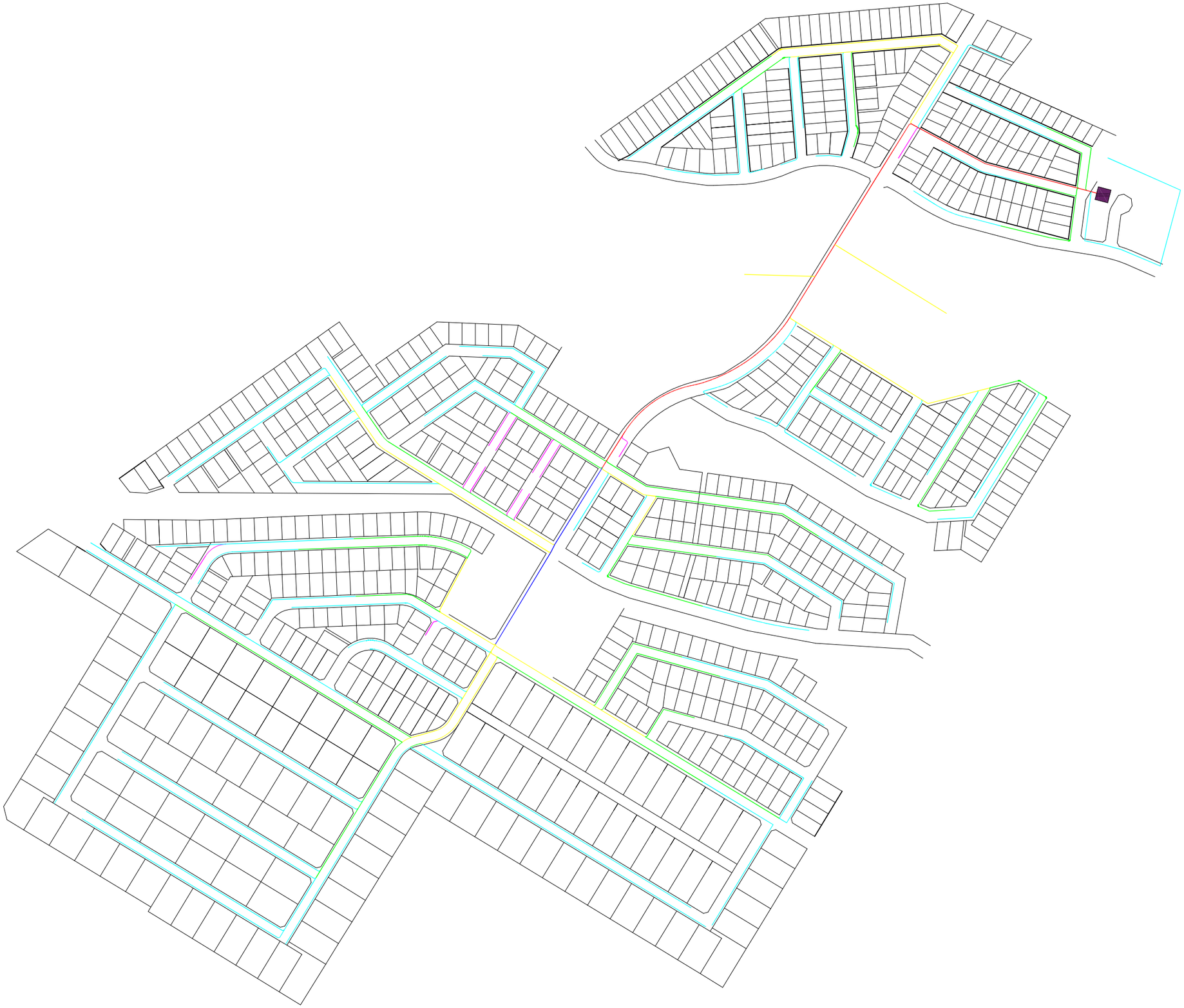
The site has a slight rise across the entire development (approx. 10m). At this early stage it does not appear that any air release / vacuum valves would be required,. But a closer evaluation will be conducted at a construction design stage.

Please feel free to contact us if you have any queries relating to these preliminary designs or require any further information.

Kind Regards,



Karl Sentch



Key:

- 50mm OD Pipe
- 63mm OD Pipe
- 75mm OD Pipe
- 90mm OD Pipe
- 125mm OD Pipe
- 160mm OD Pipe

Notes:

- All LPS Pipes Shall Be PE100 SRD11 PN16
- All LPS Pipe Sizes Are OD
- LPS Laterals from LPS Tank to Main Shall Be 40mm OD
- This Plan is a Preliminary Design Only

  Locations Are Indicative Only

ecoflow
Sewer Made Simple

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CLIENT		

TITLE

Ohoka Development
Low Pressure Sewer – Preliminary Design

Job

REVISION	SCALE		Dwg No.
1	NTS	AT	1

eone SEWER SYSTEMS

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Prepared By:

Mill Road

December 10, 2024

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Liters/Day per Pump	Max Flow Per Pump (lps)	Max Sim Ops	Max Flow (LPS)	Pipe Size (mm)	Max Velocity (MPS)	Length of Main this Zone	Friction Loss Factor (m/100m)	Friction Loss This Zone	Accum Fric Loss (meters)	Max Main Elevation	Minimum Pump Elevation	Static Head (meters)	Total Dynamic Head (m)
This spreadsheet was calculated using pipe diameters for: SDR11PE100											Friction loss calculations were based on a Constant for inside roughness "C" of: 140						
1.00	3.00	9	9	675	.52	3	1.55	63.00	0.76	365.00	1.41	5.15	30.92	10.00	0.00	10.00	40.92
2.00	3.00	6	6	675	.52	3	1.55	63.00	0.76	350.00	1.42	4.96	30.73	10.00	0.00	10.00	40.73
3.00	5.00	0	15	675	.55	4	2.07	63.00	1.01	90.00	2.41	2.17	25.77	10.00	0.00	10.00	35.77
4.00	5.00	6	6	675	.53	3	1.59	63.00	0.78	350.00	1.48	5.19	28.79	10.00	0.00	10.00	38.79
5.00	7.00	0	21	675	.56	5	2.60	75.00	0.89	15.00	1.54	0.23	23.60	10.00	0.00	10.00	33.60
6.00	7.00	6	6	675	.53	3	1.60	63.00	0.78	350.00	1.49	5.22	28.59	10.00	0.00	10.00	38.59
7.00	9.00	0	27	675	.57	5	2.62	75.00	0.89	60.00	1.56	0.93	23.37	10.00	0.00	10.00	33.37
8.00	9.00	9	9	675	.54	3	1.61	63.00	0.79	345.00	1.52	5.25	27.69	10.00	0.00	10.00	37.69
9.00	11.00	0	36	675	.57	6	3.16	75.00	1.08	15.00	2.21	0.33	22.44	10.00	0.00	10.00	32.44
10.00	11.00	8	8	675	.54	3	1.62	63.00	0.79	345.00	1.53	5.29	27.40	10.00	0.00	10.00	37.40
11.00	15.00	0	44	675	.58	6	3.18	75.00	1.09	108.00	2.23	2.41	22.11	10.00	0.00	10.00	32.11
12.00	14.00	9	9	675	.52	3	1.55	63.00	0.76	350.00	1.41	4.92	31.02	10.00	0.00	10.00	41.02
13.00	14.00	4	4	675	.53	3	1.60	63.00	0.78	160.00	1.49	2.39	28.49	10.00	0.00	10.00	38.49
14.00	15.00	8	21	675	.55	5	2.65	75.00	0.91	400.00	1.60	6.40	26.10	10.00	0.00	10.00	36.10
15.00	19.00	0	65	675	.59	7	3.71	90.00	0.89	15.00	1.24	0.19	19.70	10.00	0.00	10.00	29.70
16.00	17.00	9	9	675	.52	3	1.55	63.00	0.76	160.00	1.41	2.25	30.97	10.00	0.00	10.00	40.97
17.00	18.00	9	18	675	.53	4	2.09	63.00	1.02	300.00	2.47	7.40	28.72	10.00	0.00	10.00	38.72
18.00	19.00	7	25	675	.58	5	2.70	75.00	0.92	110.00	1.65	1.81	21.32	10.00	0.00	10.00	31.32
19.00	21.00	2	92	675	.59	8	4.27	90.00	1.02	100.00	1.61	1.61	19.51	10.00	0.00	10.00	29.51
20.00	21.00	9	9	675	.58	3	1.75	63.00	0.86	160.00	1.78	2.84	20.74	10.00	0.00	10.00	30.74
21.00	23.00	0	101	675	.64	8	4.31	90.00	1.03	15.00	1.64	0.25	17.90	5.00	0.00	5.00	22.90
22.00	23.00	9	9	675	.58	3	1.74	63.00	0.85	210.00	1.75	3.68	21.33	10.00	0.00	10.00	31.33
23.00	38.00	1	111	675	.64	8	4.34	90.00	1.04	70.00	1.66	1.16	17.65	5.00	0.00	5.00	22.65
24.00	25.00	9	9	675	.57	3	1.70	63.00	0.83	200.00	1.67	3.34	23.56	10.00	0.00	10.00	33.56
25.00	27.00	0	9	675	.59	3	1.70	63.00	0.83	60.00	1.67	1.00	20.22	10.00	0.00	10.00	30.22
26.00	27.00	2	2	675	.59	2	1.18	50.00	0.94	30.00	2.77	0.83	20.05	10.00	0.00	10.00	30.05
27.00	38.00	4	15	675	.63	4	2.34	63.00	1.15	90.00	3.03	2.73	19.22	5.00	0.00	5.00	24.22
28.00	29.00	9	9	675	.55	3	1.66	63.00	0.81	300.00	1.61	4.83	25.15	10.00	0.00	10.00	35.15
29.00	32.00	2	11	675	.59	4	2.24	63.00	1.10	60.00	2.80	1.68	20.32	10.00	0.00	10.00	30.32
30.00	31.00	9	9	675	.53	3	1.59	63.00	0.78	340.00	1.49	5.05	28.52	10.00	0.00	10.00	38.52
31.00	32.00	3	12	675	.57	4	2.16	63.00	1.06	185.00	2.61	4.83	23.47	10.00	0.00	10.00	33.47
32.00	35.00	0	23	675	.60	5	2.75	75.00	0.94	15.00	1.71	0.26	18.64	10.00	0.00	10.00	28.64
33.00	34.00	9	9	675	.54	3	1.61	63.00	0.79	290.00	1.51	4.38	27.83	10.00	0.00	10.00	37.83
34.00	35.00	5	14	675	.57	4	2.19	63.00	1.07	190.00	2.67	5.07	23.45	10.00	0.00	10.00	33.45
35.00	38.00	0	37	675	.60	6	3.29	90.00	0.79	190.00	0.99	1.89	18.38	10.00	0.00	10.00	28.38

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One.

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Prepared By:

Mill Road

December 10, 2024

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Liters/Day per Pump	Max Flow Per Pump (lps)	Max Sim Ops	Max Flow (LPS)	Pipe Size (mm)	Max Velocity (MPS)	Length of Main this Zone	Friction Loss Factor (m/100m)	Friction Loss This Zone	Accum Fric Loss (meters)	Max Main Elevation	Minimum Pump Elevation	Static Head (meters)	Total Dynamic Head (m)
This spreadsheet was calculated using pipe diameters for: SDR11PE100											Friction loss calculations were based on a Constant for inside roughness "C" of: 140						
36.00	37.00	9	9	675	.57	3	1.70	63.00	0.83	305.00	1.67	5.10	28.49	5.00	0.00	5.00	33.49
37.00	38.00	11	20	675	.60	5	2.92	75.00	1.00	360.00	1.92	6.90	23.39	5.00	0.00	5.00	28.39
38.00	39.00	0	183	675	.65	11	6.07	90.00	1.45	15.00	3.09	0.46	16.49	5.00	0.00	5.00	21.49
39.00	62.00	0	183	675	.65	11	6.07	90.00	1.45	15.00	3.09	0.46	16.03	5.00	0.00	5.00	21.03
40.00	41.00	4	4	675	.58	3	1.75	63.00	0.86	105.00	1.77	1.86	25.93	5.00	0.00	5.00	30.93
40.10	41.00	8	8	675	.57	3	1.71	63.00	0.84	210.00	1.70	3.58	27.65	5.00	0.00	5.00	32.65
41.00	44.00	10	22	675	.60	5	2.92	75.00	1.00	240.00	1.92	4.60	24.07	5.00	0.00	5.00	29.07
42.00	43.00	9	9	675	.60	3	1.79	63.00	0.87	180.00	1.84	3.31	24.12	5.00	0.00	5.00	29.12
43.00	44.00	5	14	675	.62	4	2.42	75.00	0.83	100.00	1.34	1.34	20.81	5.00	0.00	5.00	25.81
44.00	47.00	3	39	675	.63	6	3.57	90.00	0.85	80.00	1.16	0.93	19.47	5.00	0.00	5.00	24.47
45.00	46.00	9	9	675	.59	3	1.78	63.00	0.87	170.00	1.82	3.09	24.70	5.00	0.00	5.00	29.70
46.00	47.00	8	17	675	.61	4	2.41	75.00	0.82	230.00	1.34	3.07	21.61	5.00	0.00	5.00	26.61
47.00	50.00	0	56	675	.63	7	4.18	90.00	1.00	15.00	1.55	0.23	18.54	5.00	0.00	5.00	23.54
48.00	49.00	9	9	675	.59	3	1.78	63.00	0.87	190.00	1.83	3.48	24.30	5.00	0.00	5.00	29.30
49.00	50.00	9	18	675	.62	4	2.43	75.00	0.83	185.00	1.35	2.51	20.82	5.00	0.00	5.00	25.82
50.00	62.00	2	76	675	.64	7	4.20	90.00	1.00	175.00	1.56	2.74	18.31	5.00	0.00	5.00	23.31
51.00	52.00	9	9	675	.58	3	1.74	63.00	0.85	160.00	1.75	2.79	21.52	10.00	0.00	10.00	31.52
52.00	61.00	7	16	675	.60	4	2.35	75.00	0.80	140.00	1.28	1.79	18.73	10.00	0.00	10.00	28.73
53.00	54.00	9	9	675	.56	3	1.67	63.00	0.82	170.00	1.62	2.76	24.78	10.00	0.00	10.00	34.78
54.00	55.00	9	18	675	.58	4	2.27	75.00	0.78	185.00	1.19	2.21	22.02	10.00	0.00	10.00	32.02
55.00	60.00	4	22	675	.63	5	2.89	75.00	0.99	85.00	1.87	1.59	19.81	5.00	0.00	5.00	24.81
56.00	58.00	3	3	675	.53	2	1.06	50.00	0.84	90.00	2.28	2.05	28.75	10.00	0.00	10.00	38.75
57.00	58.00	6	6	675	.53	3	1.60	63.00	0.78	115.00	1.49	1.71	28.41	10.00	0.00	10.00	38.41
58.00	59.00	9	18	675	.54	4	2.15	63.00	1.05	175.00	2.59	4.53	26.70	10.00	0.00	10.00	36.70
59.00	60.00	11	29	675	.61	5	2.82	75.00	0.97	220.00	1.79	3.95	22.17	5.00	0.00	5.00	27.17
60.00	61.00	1	52	675	.64	7	4.00	90.00	0.96	90.00	1.43	1.28	18.22	5.00	0.00	5.00	23.22
61.00	62.00	0	68	675	.65	7	4.03	90.00	0.96	95.00	1.45	1.37	16.94	5.00	0.00	5.00	21.94
62.00	75.00	0	327	675	.66	15	8.52	125.00	1.06	165.00	1.19	1.97	15.57	5.00	0.00	5.00	20.57
64.00	65.00	9	9	675	.55	3	1.64	63.00	0.80	150.00	1.57	2.36	26.19	10.00	0.00	10.00	36.19
65.00	68.00	8	17	675	.56	4	2.22	63.00	1.09	170.00	2.75	4.67	23.83	10.00	0.00	10.00	33.83
66.00	67.00	9	9	675	.56	3	1.67	63.00	0.82	170.00	1.62	2.76	24.74	10.00	0.00	10.00	34.74
67.00	68.00	4	13	675	.58	4	2.25	63.00	1.10	100.00	2.82	2.82	21.98	10.00	0.00	10.00	31.98
68.00	70.00	2	32	675	.60	6	3.36	90.00	0.80	70.00	1.04	0.73	19.16	10.00	0.00	10.00	29.16
69.00	70.00	6	6	675	.58	3	1.74	63.00	0.85	170.00	1.75	2.98	21.41	10.00	0.00	10.00	31.41
70.00	72.00	0	38	675	.60	6	3.38	90.00	0.81	15.00	1.05	0.16	18.43	10.00	0.00	10.00	28.43

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One.

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Prepared By:

Mill Road

December 10, 2024

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Liters/Day per Pump	Max Flow Per Pump (lps)	Max Sim Ops	Max Flow (LPS)	Pipe Size (mm)	Max Velocity (MPS)	Length of Main this Zone	Friction Loss Factor (m/100m)	Friction Loss This Zone	Accum Fric Loss (meters)	Max Main Elevation	Minimum Pump Elevation	Static Head (meters)	Total Dynamic Head (m)
This spreadsheet was calculated using pipe diameters for: SDR11PE100											Friction loss calculations were based on a Constant for inside roughness "C" of: 140						
71.00	72.00	5	5	675	.62	3	1.86	63.00	0.91	110.00	1.99	2.18	20.45	5.00	0.00	5.00	25.45
72.00	74.00	5	48	675	.64	6	3.46	90.00	0.83	160.00	1.09	1.75	18.27	5.00	0.00	5.00	23.27
73.00	74.00	4	4	675	.58	3	1.75	63.00	0.86	245.00	1.77	4.34	20.86	10.00	0.00	10.00	30.86
74.00	75.00	0	52	675	.65	7	4.05	90.00	0.97	200.00	1.46	2.92	16.52	5.00	0.00	5.00	21.52
75.00	89.00	0	379	675	.67	17	9.68	125.00	1.21	15.00	1.51	0.23	13.60	5.00	0.00	5.00	18.60
76.00	78.00	6	6	675	.61	3	1.83	63.00	0.89	90.00	1.92	1.73	22.12	5.00	0.00	5.00	27.12
77.00	78.00	5	5	675	.60	3	1.81	63.00	0.89	140.00	1.88	2.63	23.02	5.00	0.00	5.00	28.02
78.00	80.00	0	11	675	.62	4	2.43	75.00	0.83	15.00	1.36	0.20	20.39	5.00	0.00	5.00	25.39
79.00	80.00	5	5	675	.60	3	1.81	63.00	0.89	150.00	1.88	2.82	23.01	5.00	0.00	5.00	28.01
80.00	82.00	6	22	675	.62	5	3.05	75.00	1.04	190.00	2.07	3.94	20.19	5.00	0.00	5.00	25.19
81.00	82.00	2	2	675	.64	2	1.28	50.00	1.02	45.00	3.24	1.46	17.71	5.00	0.00	5.00	22.71
82.00	84.00	0	24	675	.65	5	3.06	75.00	1.05	15.00	2.09	0.31	16.25	5.00	0.00	5.00	21.25
83.00	84.00	2	2	675	.64	2	1.28	50.00	1.02	45.00	3.26	1.46	17.40	5.00	0.00	5.00	22.40
84.00	86.00	1	27	675	.65	5	3.08	75.00	1.05	65.00	2.11	1.37	15.94	5.00	0.00	5.00	20.94
85.00	86.00	2	2	675	.65	2	1.30	50.00	1.04	45.00	3.34	1.50	16.07	5.00	0.00	5.00	21.07
86.00	88.00	0	29	675	.66	5	3.10	75.00	1.06	15.00	2.13	0.32	14.57	5.00	0.00	5.00	19.57
87.00	88.00	2	2	675	.65	2	1.31	50.00	1.04	45.00	3.36	1.51	15.76	5.00	0.00	5.00	20.76
88.00	89.00	2	33	675	.66	6	3.74	90.00	0.89	70.00	1.26	0.88	14.25	5.00	0.00	5.00	19.25
89.00	115.00	3	415	675	.67	18	10.34	125.00	1.29	136.00	1.71	2.32	13.37	5.00	0.00	5.00	18.37
90.00	91.00	9	9	675	.62	3	1.86	63.00	0.91	165.00	1.99	3.28	20.53	5.00	0.00	5.00	25.53
91.00	94.00	6	15	675	.64	4	2.52	75.00	0.86	210.00	1.46	3.06	17.25	5.00	0.00	5.00	22.25
92.00	93.00	9	9	675	.63	3	1.88	63.00	0.92	175.00	2.02	3.54	19.65	5.00	0.00	5.00	24.65
93.00	94.00	5	14	675	.65	4	2.54	75.00	0.87	130.00	1.48	1.92	16.11	5.00	0.00	5.00	21.11
94.00	97.00	0	29	675	.66	5	3.16	75.00	1.08	20.00	2.22	0.44	14.19	5.00	0.00	5.00	19.19
95.00	96.00	9	9	675	.61	3	1.84	63.00	0.90	155.00	1.95	3.02	21.54	5.00	0.00	5.00	26.54
96.00	97.00	11	20	675	.63	5	3.13	75.00	1.07	220.00	2.17	4.77	18.52	5.00	0.00	5.00	23.52
97.00	101.00	0	49	675	.67	6	3.78	90.00	0.90	70.00	1.29	0.90	13.75	5.00	0.00	5.00	18.75
98.00	99.00	9	9	675	.61	3	1.84	63.00	0.90	215.00	1.95	4.19	21.48	5.00	0.00	5.00	26.48
99.00	100.00	9	18	675	.64	4	2.52	75.00	0.86	175.00	1.45	2.54	17.29	5.00	0.00	5.00	22.29
100.00	101.00	4	22	675	.66	5	3.17	75.00	1.09	85.00	2.23	1.90	14.75	5.00	0.00	5.00	19.75
101.00	103.00	0	71	675	.67	7	4.42	90.00	1.06	15.00	1.72	0.26	12.85	5.00	0.00	5.00	17.85
102.00	103.00	6	6	675	.65	3	1.95	63.00	0.96	160.00	2.17	3.47	16.06	5.00	0.00	5.00	21.06
103.00	105.00	2	79	675	.68	7	4.44	90.00	1.06	70.00	1.73	1.21	12.59	5.00	0.00	5.00	17.59
104.00	105.00	4	4	675	.67	3	2.00	63.00	0.98	100.00	2.27	2.27	13.65	5.00	0.00	5.00	18.65
105.00	115.00	0	83	675	.68	8	5.09	90.00	1.22	15.00	2.23	0.33	11.38	5.00	0.00	5.00	16.38

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One.

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Prepared By:

Mill Road

December 10, 2024

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Liters/Day per Pump	Max Flow Per Pump (lps)	Max Sim Ops	Max Flow (LPS)	Pipe Size (mm)	Max Velocity (MPS)	Length of Main this Zone	Friction Loss Factor (m/100m)	Friction Loss This Zone	Accum Fric Loss (meters)	Max Main Elevation	Minimum Pump Elevation	Static Head (meters)	Total Dynamic Head (m)
This spreadsheet was calculated using pipe diameters for: SDR11PE100											Friction loss calculations were based on a Constant for inside roughness "C" of: 140						
106.00	108.00	6	6	675	.64	3	1.92	63.00	0.94	160.00	2.11	3.37	17.65	5.00	0.00	5.00	22.65
107.00	108.00	2	2	675	.65	2	1.30	50.00	1.04	55.00	3.34	1.84	16.12	5.00	0.00	5.00	21.12
108.00	110.00	3	11	675	.66	4	2.60	75.00	0.89	15.00	1.54	0.23	14.28	5.00	0.00	5.00	19.28
109.00	110.00	3	3	675	.65	2	1.31	50.00	1.04	55.00	3.35	1.84	15.89	5.00	0.00	5.00	20.89
110.00	112.00	1	15	675	.67	4	2.60	75.00	0.89	65.00	1.54	1.00	14.05	5.00	0.00	5.00	19.05
111.00	112.00	3	3	675	.66	2	1.32	50.00	1.05	55.00	3.41	1.88	14.93	5.00	0.00	5.00	19.93
112.00	114.00	0	18	675	.67	4	2.61	75.00	0.89	15.00	1.55	0.23	13.05	5.00	0.00	5.00	18.05
113.00	114.00	3	3	675	.66	2	1.32	50.00	1.05	55.00	3.43	1.89	14.71	5.00	0.00	5.00	19.71
114.00	115.00	2	23	675	.67	5	3.28	75.00	1.12	75.00	2.36	1.77	12.82	5.00	0.00	5.00	17.82
115.00	123.00	0	521	675	.69	21	12.34	160.00	0.93	15.00	0.69	0.10	11.05	5.00	0.00	5.00	16.05
116.00	117.00	9	9	675	.63	3	1.89	63.00	0.93	190.00	2.04	3.88	19.15	5.00	0.00	5.00	24.15
117.00	123.00	9	18	675	.66	4	2.58	75.00	0.88	285.00	1.51	4.32	15.27	5.00	0.00	5.00	20.27
118.00	120.00	6	6	675	.64	3	1.91	63.00	0.94	175.00	2.08	3.64	18.24	5.00	0.00	5.00	23.24
119.00	120.00	4	4	675	.64	3	1.92	63.00	0.94	160.00	2.09	3.35	17.95	5.00	0.00	5.00	22.95
120.00	122.00	0	10	675	.66	4	2.55	75.00	0.87	15.00	1.49	0.22	14.60	5.00	0.00	5.00	19.60
121.00	122.00	9	9	675	.63	3	1.90	63.00	0.93	220.00	2.05	4.52	18.90	5.00	0.00	5.00	23.90
122.00	123.00	8	27	675	.66	5	3.22	75.00	1.10	150.00	2.29	3.43	14.38	5.00	0.00	5.00	19.38
123.00	125.00	0	566	675	.69	22	13.03	160.00	0.98	40.00	0.77	0.31	10.95	5.00	0.00	5.00	15.95
124.00	125.00	2	2	675	.68	2	1.36	50.00	1.08	40.00	3.60	1.44	12.08	5.00	0.00	5.00	17.08
125.00	146.00	4	572	675	.69	22	13.05	160.00	0.98	320.00	0.77	2.46	10.64	5.00	0.00	5.00	15.64
126.00	127.00	9	9	675	.62	3	1.86	63.00	0.91	130.00	1.98	2.57	20.79	5.00	0.00	5.00	25.79
127.00	128.00	6	15	675	.64	4	2.51	75.00	0.86	160.00	1.44	2.30	18.22	5.00	0.00	5.00	23.22
127.10	128.00	8	8	675	.63	3	1.88	63.00	0.92	185.00	2.02	3.74	19.66	5.00	0.00	5.00	24.66
128.00	131.00	3	26	675	.65	5	3.15	75.00	1.08	75.00	2.20	1.65	15.92	5.00	0.00	5.00	20.92
129.00	130.00	9	9	675	.63	3	1.89	63.00	0.92	235.00	2.03	4.77	19.48	5.00	0.00	5.00	24.48
130.00	131.00	2	11	675	.66	4	2.54	75.00	0.87	30.00	1.47	0.44	14.71	5.00	0.00	5.00	19.71
131.00	133.00	0	37	675	.66	6	3.79	90.00	0.90	15.00	1.29	0.19	14.27	5.00	0.00	5.00	19.27
132.00	133.00	8	8	675	.64	3	1.93	63.00	0.94	150.00	2.12	3.18	17.26	5.00	0.00	5.00	22.26
133.00	135.00	0	45	675	.67	6	3.80	90.00	0.91	90.00	1.30	1.17	14.08	5.00	0.00	5.00	19.08
134.00	135.00	9	9	675	.64	3	1.93	63.00	0.95	200.00	2.13	4.25	17.16	5.00	0.00	5.00	22.16
135.00	141.00	7	61	675	.67	7	4.48	90.00	1.07	145.00	1.76	2.55	12.91	5.00	0.00	5.00	17.91
136.00	138.00	8	8	675	.65	3	1.95	63.00	0.96	190.00	2.16	4.11	16.24	5.00	0.00	5.00	21.24
137.00	138.00	6	6	675	.66	3	1.98	63.00	0.97	120.00	2.22	2.67	14.80	5.00	0.00	5.00	19.80
138.00	140.00	0	14	675	.68	4	2.62	75.00	0.90	15.00	1.56	0.23	12.13	5.00	0.00	5.00	17.13
139.00	140.00	7	7	675	.66	3	1.98	63.00	0.97	125.00	2.23	2.79	14.69	5.00	0.00	5.00	19.69

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One.

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Prepared By:

Mill Road

December 10, 2024

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Liters/Day per Pump	Max Flow Per Pump (lps)	Max Sim Ops	Max Flow (LPS)	Pipe Size (mm)	Max Velocity (MPS)	Length of Main this Zone	Friction Loss Factor (m/100m)	Friction Loss This Zone	Accum Fric Loss (meters)	Max Main Elevation	Minimum Pump Elevation	Static Head (meters)	Total Dynamic Head (m)
This spreadsheet was calculated using pipe diameters for: SDR11PE100											Friction loss calculations were based on a Constant for inside roughness "C" of: 140						
140.00	141.00	0	21	675	.68	5	3.28	75.00	1.12	65.00	2.37	1.54	11.90	5.00	0.00	5.00	16.90
141.00	143.00	0	82	675	.69	8	5.15	90.00	1.23	15.00	2.28	0.34	10.36	5.00	0.00	5.00	15.36
142.00	143.00	8	8	675	.66	3	1.99	63.00	0.97	190.00	2.25	4.27	14.29	5.00	0.00	5.00	19.29
143.00	145.00	0	90	675	.69	8	5.16	90.00	1.23	65.00	2.29	1.49	10.02	5.00	0.00	5.00	15.02
144.00	145.00	9	9	675	.67	3	2.00	63.00	0.98	230.00	2.27	5.22	13.75	5.00	0.00	5.00	18.75
145.00	146.00	0	99	675	.70	8	5.18	90.00	1.24	15.00	2.31	0.35	8.53	5.00	0.00	5.00	13.53
146.00	166.00	60	731	675	.70	27	16.46	160.00	1.24	260.00	1.18	3.08	8.18	5.00	0.00	5.00	13.18
147.00	148.00	9	9	675	.64	3	1.91	63.00	0.94	150.00	2.09	3.13	17.58	5.00	0.00	5.00	22.58
148.00	149.00	9	18	675	.66	4	2.59	75.00	0.89	130.00	1.53	1.99	14.45	5.00	0.00	5.00	19.45
149.00	151.00	20	38	675	.67	6	3.97	90.00	0.95	290.00	1.41	4.08	12.46	5.00	0.00	5.00	17.46
151.00	165.00	0	38	675	.70	6	3.97	90.00	0.95	15.00	1.41	0.21	8.38	5.00	0.00	5.00	13.38
152.00	154.00	6	6	675	.64	3	1.93	63.00	0.94	110.00	2.12	2.33	16.85	5.00	0.00	5.00	21.85
153.00	154.00	9	9	675	.63	3	1.88	63.00	0.92	240.00	2.01	4.83	19.35	5.00	0.00	5.00	24.35
154.00	156.00	0	15	675	.66	4	2.53	75.00	0.87	15.00	1.46	0.22	14.52	5.00	0.00	5.00	19.52
155.00	156.00	8	8	675	.64	3	1.91	63.00	0.94	160.00	2.08	3.33	17.63	5.00	0.00	5.00	22.63
156.00	158.00	1	24	675	.66	5	3.18	75.00	1.09	85.00	2.23	1.90	14.30	5.00	0.00	5.00	19.30
157.00	158.00	9	9	675	.65	3	1.94	63.00	0.95	185.00	2.14	3.95	16.35	5.00	0.00	5.00	21.35
158.00	160.00	0	33	675	.67	6	3.83	90.00	0.91	15.00	1.32	0.20	12.40	5.00	0.00	5.00	17.40
159.00	160.00	6	6	675	.66	3	1.97	63.00	0.96	130.00	2.19	2.85	15.05	5.00	0.00	5.00	20.05
160.00	162.00	2	41	675	.67	6	3.85	90.00	0.92	70.00	1.33	0.93	12.20	5.00	0.00	5.00	17.20
161.00	162.00	9	9	675	.65	3	1.96	63.00	0.96	190.00	2.17	4.13	15.40	5.00	0.00	5.00	20.40
162.00	164.00	0	50	675	.68	6	3.86	90.00	0.92	15.00	1.34	0.20	11.27	5.00	0.00	5.00	16.27
163.00	164.00	11	11	675	.66	4	2.66	75.00	0.91	150.00	1.61	2.41	13.48	5.00	0.00	5.00	18.48
164.00	165.00	5	66	675	.68	7	4.55	90.00	1.09	160.00	1.82	2.90	11.07	5.00	0.00	5.00	16.07
165.00	166.00	5	109	675	.70	8	5.25	90.00	1.25	130.00	2.36	3.07	8.17	5.00	0.00	5.00	13.17
166.00	169.00	0	840	675	.72	31	19.09	160.00	1.44	15.00	1.56	0.23	5.10	5.00	0.00	5.00	10.10
167.00	169.00	3	3	675	.70	2	1.41	50.00	1.12	75.00	3.86	2.90	7.77	5.00	0.00	5.00	12.77
168.00	169.00	9	9	675	.69	3	2.07	63.00	1.01	210.00	2.41	5.07	9.94	5.00	0.00	5.00	14.94
169.00	177.00	11	863	675	.72	31	19.16	160.00	1.44	260.00	1.57	4.08	4.87	5.00	0.00	5.00	9.87
170.00	171.00	9	9	675	.70	3	2.10	63.00	1.03	130.00	2.48	3.23	7.89	5.00	0.00	5.00	12.89
171.00	174.00	8	17	675	.72	4	2.84	75.00	0.97	190.00	1.82	3.45	4.66	5.00	0.00	5.00	9.66
172.00	173.00	9	9	675	.71	3	2.14	63.00	1.05	130.00	2.56	3.32	6.19	5.00	0.00	5.00	11.19
173.00	174.00	3	12	675	.73	4	2.87	75.00	0.98	90.00	1.85	1.66	2.87	5.00	0.00	5.00	7.87
174.00	177.00	0	29	675	.74	5	3.57	75.00	1.22	15.00	2.77	0.42	1.21	5.00	0.00	5.00	6.21
175.00	176.00	9	9	675	.71	3	2.13	63.00	1.04	150.00	2.54	3.82	6.45	5.00	0.00	5.00	11.45

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One.

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Prepared By: Mill Road

December 10, 2024

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Liters/Day per Pump	Max Flow Per Pump (lps)	Max Sim Ops	Max Flow (LPS)	Pipe Size (mm)	Max Velocity (MPS)	Length of Main this Zone	Friction Loss Factor (m/100m)	Friction Loss This Zone	Accum Fric Loss (meters)	Max Main Elevation	Minimum Pump Elevation	Static Head (meters)	Total Dynamic Head (m)
This spreadsheet was calculated using pipe diameters for: SDR11PE100											Friction loss calculations were based on a Constant for inside roughness "C" of: 140						
176.00	177.00	3	12	675	.73	4	2.86	75.00	0.98	100.00	1.84	1.84	2.63	5.00	0.00	5.00	7.63
177.00	180.00	0	904	675	.75	32	19.92	160.00	1.50	15.00	1.69	0.25	0.79	5.00	0.00	5.00	5.79
178.00	179.00	9	9	675	.71	3	2.12	63.00	1.04	150.00	2.51	3.77	6.98	5.00	0.00	5.00	11.98
179.00	180.00	6	15	675	.73	4	2.86	75.00	0.98	145.00	1.84	2.67	3.21	5.00	0.00	5.00	8.21
180.00	180.00	0	936	675	.75	33	20.57	160.00	1.55	30.00	1.79	0.54	0.54	5.00	0.00	5.00	5.54
200.00	201.00	12	12	1500	.58	4	2.31	63.00	1.13	500.00	2.97	14.83	30.19	5.00	0.00	5.00	35.19
201.00	202.00	5	17	1500	.58	4	2.31	63.00	1.13	250.00	2.97	7.41	15.36	5.00	0.00	5.00	20.36
202.00	180.00	0	17	1500	.58	4	2.31	63.00	1.13	250.00	2.97	7.41	7.95	5.00	0.00	5.00	12.95

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One.

Prepared By:

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME (HR)
Mill Road

December 10, 2024

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (mm)	Liters per 100 lineal meters	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR11PE100								Liters per Day per Dwelling		675
1.00	3.00	9	63.00	204.28	365.00	745.63	6,075	8.15	2.95	5.22
2.00	3.00	6	63.00	204.28	350.00	714.99	4,050	5.66	4.24	6.51
3.00	5.00	15	63.00	204.28	90.00	183.85	10,125	55.07	0.44	2.28
4.00	5.00	6	63.00	204.28	350.00	714.99	4,050	5.66	4.24	6.08
5.00	7.00	21	75.00	292.25	15.00	43.84	14,175	323.36	0.07	1.84
6.00	7.00	6	63.00	204.28	350.00	714.99	4,050	5.66	4.24	6.00
7.00	9.00	27	75.00	292.25	60.00	175.35	18,225	103.94	0.23	1.77
8.00	9.00	9	63.00	204.28	345.00	704.77	6,075	8.62	2.78	4.32
9.00	11.00	36	75.00	292.25	15.00	43.84	24,300	554.33	0.04	1.54
10.00	11.00	8	63.00	204.28	345.00	704.77	5,400	7.66	3.13	4.62
11.00	15.00	44	75.00	292.25	108.00	315.63	29,700	94.10	0.26	1.49
12.00	14.00	9	63.00	204.28	350.00	714.99	6,075	8.50	2.82	6.04
13.00	14.00	4	63.00	204.28	160.00	326.85	2,700	8.26	2.91	6.12
14.00	15.00	21	75.00	292.25	400.00	1,168.99	14,175	12.13	1.98	3.22
15.00	19.00	65	90.00	418.54	15.00	62.78	43,875	698.86	0.03	1.24
16.00	17.00	9	63.00	204.28	160.00	326.85	6,075	18.59	1.29	4.16
17.00	18.00	18	63.00	204.28	300.00	612.85	12,150	19.83	1.21	2.87
18.00	19.00	25	75.00	292.25	110.00	321.47	16,875	52.49	0.46	1.66
19.00	21.00	92	90.00	418.54	100.00	418.54	62,100	148.37	0.16	1.20
20.00	21.00	9	63.00	204.28	160.00	326.85	6,075	18.59	1.29	2.33
21.00	23.00	101	90.00	418.54	15.00	62.78	68,175	1,085.92	0.02	1.04
22.00	23.00	9	63.00	204.28	210.00	428.99	6,075	14.16	1.69	2.71
23.00	38.00	111	90.00	418.54	70.00	292.98	74,925	255.74	0.09	1.02
24.00	25.00	9	63.00	204.28	200.00	408.56	6,075	14.87	1.61	3.46
25.00	27.00	9	63.00	204.28	60.00	122.57	6,075	49.56	0.48	1.84
26.00	27.00	2	50.00	125.66	30.00	37.70	1,350	35.81	0.67	2.03
27.00	38.00	15	63.00	204.28	90.00	183.85	10,125	55.07	0.44	1.36
28.00	29.00	9	63.00	204.28	300.00	612.85	6,075	9.91	2.42	4.57
29.00	32.00	11	63.00	204.28	60.00	122.57	7,425	60.58	0.40	2.15
30.00	31.00	9	63.00	204.28	340.00	694.56	6,075	8.75	2.74	5.62
31.00	32.00	12	63.00	204.28	185.00	377.92	8,100	21.43	1.12	2.88
32.00	35.00	23	75.00	292.25	15.00	43.84	15,525	354.15	0.07	1.76
33.00	34.00	9	63.00	204.28	290.00	592.42	6,075	10.25	2.34	5.02
34.00	35.00	14	63.00	204.28	190.00	388.14	9,450	24.35	0.99	2.67
35.00	38.00	37	90.00	418.54	190.00	795.22	24,975	31.41	0.76	1.69

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One

Prepared By:

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME (HR)
Mill Road

December 10, 2024

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (mm)	Liters per 100 lineal meters	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR11PE100								Liters per Day per Dwelling		675
36.00	37.00	9	63.00	204.28	305.00	623.06	6,075	9.75	2.46	5.26
37.00	38.00	20	75.00	292.25	360.00	1,052.09	13,500	12.83	1.87	2.80
38.00	39.00	183	90.00	418.54	15.00	62.78	123,525	1,967.56	0.01	0.92
39.00	62.00	183	90.00	418.54	15.00	62.78	123,525	1,967.56	0.01	0.91
40.00	41.00	4	63.00	204.28	105.00	214.50	2,700	12.59	1.91	4.63
40.10	41.00	8	63.00	204.28	210.00	428.99	5,400	12.59	1.91	4.63
41.00	44.00	22	75.00	292.25	240.00	701.39	14,850	21.17	1.13	2.72
42.00	43.00	9	63.00	204.28	180.00	367.71	6,075	16.52	1.45	3.78
43.00	44.00	14	75.00	292.25	100.00	292.25	9,450	32.34	0.74	2.33
44.00	47.00	39	90.00	418.54	80.00	334.83	26,325	78.62	0.31	1.59
45.00	46.00	9	63.00	204.28	170.00	347.28	6,075	17.49	1.37	4.06
46.00	47.00	17	75.00	292.25	230.00	672.17	11,475	17.07	1.41	2.69
47.00	50.00	56	90.00	418.54	15.00	62.78	37,800	602.10	0.04	1.28
48.00	49.00	9	63.00	204.28	190.00	388.14	6,075	15.65	1.53	3.84
49.00	50.00	18	75.00	292.25	185.00	540.66	12,150	22.47	1.07	2.31
50.00	62.00	76	90.00	418.54	175.00	732.44	51,300	70.04	0.34	1.24
51.00	52.00	9	63.00	204.28	160.00	326.85	6,075	18.59	1.29	3.31
52.00	61.00	16	75.00	292.25	140.00	409.15	10,800	26.40	0.91	2.02
53.00	54.00	9	63.00	204.28	170.00	347.28	6,075	17.49	1.37	4.21
54.00	55.00	18	75.00	292.25	185.00	540.66	12,150	22.47	1.07	2.84
55.00	60.00	22	75.00	292.25	85.00	248.41	14,850	59.78	0.40	1.77
56.00	58.00	3	50.00	125.66	90.00	113.10	2,025	17.90	1.34	4.20
57.00	58.00	6	63.00	204.28	115.00	234.92	4,050	17.24	1.39	4.25
58.00	59.00	18	63.00	204.28	175.00	357.49	12,150	33.99	0.71	2.86
59.00	60.00	29	75.00	292.25	220.00	642.94	19,575	30.45	0.79	2.15
60.00	61.00	52	90.00	418.54	90.00	376.68	35,100	93.18	0.26	1.37
61.00	62.00	68	90.00	418.54	95.00	397.61	45,900	115.44	0.21	1.11
62.00	75.00	327	125.00	801.18	165.00	1,321.95	220,725	166.97	0.14	0.90
64.00	65.00	9	63.00	204.28	150.00	306.42	6,075	19.83	1.21	4.15
65.00	68.00	17	63.00	204.28	170.00	347.28	11,475	33.04	0.73	2.94
66.00	67.00	9	63.00	204.28	170.00	347.28	6,075	17.49	1.37	4.14
67.00	68.00	13	63.00	204.28	100.00	204.28	8,775	42.96	0.56	2.77
68.00	70.00	32	90.00	418.54	70.00	292.98	21,600	73.73	0.33	2.21
69.00	70.00	6	63.00	204.28	170.00	347.28	4,050	11.66	2.06	3.94
70.00	72.00	38	90.00	418.54	15.00	62.78	25,650	408.56	0.06	1.88

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One

Prepared By:

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME (HR)
Mill Road

December 10, 2024

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (mm)	Liters per 100 lineal meters	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR11PE100								Liters per Day per Dwelling		675
71.00	72.00	5	63.00	204.28	110.00	224.71	3,375	15.02	1.60	3.42
72.00	74.00	48	90.00	418.54	160.00	669.66	32,400	48.38	0.50	1.83
73.00	74.00	4	63.00	204.28	245.00	500.49	2,700	5.39	4.45	5.78
74.00	75.00	52	90.00	418.54	200.00	837.08	35,100	41.93	0.57	1.33
75.00	89.00	379	125.00	801.18	15.00	120.18	255,825	2,128.72	0.01	0.76
76.00	78.00	6	63.00	204.28	90.00	183.85	4,050	22.03	1.09	3.56
77.00	78.00	5	63.00	204.28	140.00	285.99	3,375	11.80	2.03	4.50
78.00	80.00	11	75.00	292.25	15.00	43.84	7,425	169.38	0.14	2.47
79.00	80.00	5	63.00	204.28	150.00	306.42	3,375	11.01	2.18	4.51
80.00	82.00	22	75.00	292.25	190.00	555.27	14,850	26.74	0.90	2.33
81.00	82.00	2	50.00	125.66	45.00	56.55	1,350	23.87	1.01	2.44
82.00	84.00	24	75.00	292.25	15.00	43.84	16,200	369.55	0.06	1.43
83.00	84.00	2	50.00	125.66	45.00	56.55	1,350	23.87	1.01	2.37
84.00	86.00	27	75.00	292.25	65.00	189.96	18,225	95.94	0.25	1.36
85.00	86.00	2	50.00	125.66	45.00	56.55	1,350	23.87	1.01	2.12
86.00	88.00	29	75.00	292.25	15.00	43.84	19,575	446.54	0.05	1.11
87.00	88.00	2	50.00	125.66	45.00	56.55	1,350	23.87	1.01	2.07
88.00	89.00	33	90.00	418.54	70.00	292.98	22,275	76.03	0.32	1.06
89.00	115.00	415	125.00	801.18	136.00	1,089.61	280,125	257.09	0.09	0.75
90.00	91.00	9	63.00	204.28	165.00	337.07	6,075	18.02	1.33	3.91
91.00	94.00	15	75.00	292.25	210.00	613.72	10,125	16.50	1.45	2.58
92.00	93.00	9	63.00	204.28	175.00	357.49	6,075	16.99	1.41	3.50
93.00	94.00	14	75.00	292.25	130.00	379.92	9,450	24.87	0.96	2.09
94.00	97.00	29	75.00	292.25	20.00	58.45	19,575	334.91	0.07	1.13
95.00	96.00	9	63.00	204.28	155.00	316.64	6,075	19.19	1.25	3.45
96.00	97.00	20	75.00	292.25	220.00	642.94	13,500	21.00	1.14	2.20
97.00	101.00	49	90.00	418.54	70.00	292.98	33,075	112.89	0.21	1.05
98.00	99.00	9	63.00	204.28	215.00	439.21	6,075	13.83	1.74	3.99
99.00	100.00	18	75.00	292.25	175.00	511.43	12,150	23.76	1.01	2.25
100.00	101.00	22	75.00	292.25	85.00	248.41	14,850	59.78	0.40	1.24
101.00	103.00	71	90.00	418.54	15.00	62.78	47,925	763.37	0.03	0.84
102.00	103.00	6	63.00	204.28	160.00	326.85	4,050	12.39	1.94	2.75
103.00	105.00	79	90.00	418.54	70.00	292.98	53,325	182.01	0.13	0.81
104.00	105.00	4	63.00	204.28	100.00	204.28	2,700	13.22	1.82	2.49
105.00	115.00	83	90.00	418.54	15.00	62.78	56,025	892.39	0.03	0.68

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One

Prepared By:

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME (HR)
Mill Road

December 10, 2024

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (mm)	Liters per 100 lineal meters	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR11PE100								Liters per Day per Dwelling		675
106.00	108.00	6	63.00	204.28	160.00	326.85	4,050	12.39	1.94	3.61
107.00	108.00	2	50.00	125.66	55.00	69.12	1,350	19.53	1.23	2.90
108.00	110.00	11	75.00	292.25	15.00	43.84	7,425	169.38	0.14	1.67
109.00	110.00	3	50.00	125.66	55.00	69.12	2,025	29.30	0.82	2.35
110.00	112.00	15	75.00	292.25	65.00	189.96	10,125	53.30	0.45	1.53
111.00	112.00	3	50.00	125.66	55.00	69.12	2,025	29.30	0.82	1.90
112.00	114.00	18	75.00	292.25	15.00	43.84	12,150	277.16	0.09	1.08
113.00	114.00	3	50.00	125.66	55.00	69.12	2,025	29.30	0.82	1.81
114.00	115.00	23	75.00	292.25	75.00	219.18	15,525	70.83	0.34	0.99
115.00	123.00	521	160.00	1,327.32	15.00	199.10	351,675	1,766.34	0.01	0.65
116.00	117.00	9	63.00	204.28	190.00	388.14	6,075	15.65	1.53	3.82
117.00	123.00	18	75.00	292.25	285.00	832.90	12,150	14.59	1.65	2.28
118.00	120.00	6	63.00	204.28	175.00	357.49	4,050	11.33	2.12	3.49
119.00	120.00	4	63.00	204.28	160.00	326.85	2,700	8.26	2.91	4.28
120.00	122.00	10	75.00	292.25	15.00	43.84	6,750	153.98	0.16	1.37
121.00	122.00	9	63.00	204.28	220.00	449.42	6,075	13.52	1.78	2.99
122.00	123.00	27	75.00	292.25	150.00	438.37	18,225	41.57	0.58	1.22
123.00	125.00	566	160.00	1,327.32	40.00	530.93	382,050	719.59	0.03	0.64
124.00	125.00	2	50.00	125.66	40.00	50.27	1,350	26.86	0.89	1.50
125.00	146.00	572	160.00	1,327.32	320.00	4,247.43	386,100	90.90	0.26	0.61
126.00	127.00	9	63.00	204.28	130.00	265.57	6,075	22.88	1.05	3.67
127.00	128.00	15	75.00	292.25	160.00	467.59	10,125	21.65	1.11	2.62
127.10	128.00	8	63.00	204.28	185.00	377.92	5,400	14.29	1.68	3.19
128.00	131.00	26	75.00	292.25	75.00	219.18	17,550	80.07	0.30	1.51
129.00	130.00	9	63.00	204.28	235.00	480.06	6,075	12.65	1.90	3.39
130.00	131.00	11	75.00	292.25	30.00	87.67	7,425	84.69	0.28	1.49
131.00	133.00	37	90.00	418.54	15.00	62.78	24,975	397.81	0.06	1.21
132.00	133.00	8	63.00	204.28	150.00	306.42	5,400	17.62	1.36	2.51
133.00	135.00	45	90.00	418.54	90.00	376.68	30,375	80.64	0.30	1.15
134.00	135.00	9	63.00	204.28	200.00	408.56	6,075	14.87	1.61	2.47
135.00	141.00	61	90.00	418.54	145.00	606.88	41,175	67.85	0.35	0.85
136.00	138.00	8	63.00	204.28	190.00	388.14	5,400	13.91	1.73	2.66
137.00	138.00	6	63.00	204.28	120.00	245.14	4,050	16.52	1.45	2.38
138.00	140.00	14	75.00	292.25	15.00	43.84	9,450	215.57	0.11	0.93
139.00	140.00	7	63.00	204.28	125.00	255.35	4,725	18.50	1.30	2.12

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One

Prepared By:

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME (HR)
Mill Road

December 10, 2024

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (mm)	Liters per 100 lineal meters	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR11PE100								Liters per Day per Dwelling		675
140.00	141.00	21	75.00	292.25	65.00	189.96	14,175	74.62	0.32	0.82
141.00	143.00	82	90.00	418.54	15.00	62.78	55,350	881.64	0.03	0.50
142.00	143.00	8	63.00	204.28	190.00	388.14	5,400	13.91	1.73	2.20
143.00	145.00	90	90.00	418.54	65.00	272.05	60,750	223.30	0.11	0.47
144.00	145.00	9	63.00	204.28	230.00	469.85	6,075	12.93	1.86	2.22
145.00	146.00	99	90.00	418.54	15.00	62.78	66,825	1,064.42	0.02	0.36
146.00	166.00	731	160.00	1,327.32	260.00	3,451.04	493,425	142.98	0.17	0.34
147.00	148.00	9	63.00	204.28	150.00	306.42	6,075	19.83	1.21	3.51
148.00	149.00	18	75.00	292.25	130.00	379.92	12,150	31.98	0.75	2.30
149.00	151.00	38	90.00	418.54	290.00	1,213.76	25,650	21.13	1.14	1.55
151.00	165.00	38	90.00	418.54	15.00	62.78	25,650	408.56	0.06	0.41
152.00	154.00	6	63.00	204.28	110.00	224.71	4,050	18.02	1.33	2.88
153.00	154.00	9	63.00	204.28	240.00	490.28	6,075	12.39	1.94	3.49
154.00	156.00	15	75.00	292.25	15.00	43.84	10,125	230.97	0.10	1.55
155.00	156.00	8	63.00	204.28	160.00	326.85	5,400	16.52	1.45	2.90
156.00	158.00	24	75.00	292.25	85.00	248.41	16,200	65.21	0.37	1.45
157.00	158.00	9	63.00	204.28	185.00	377.92	6,075	16.07	1.49	2.57
158.00	160.00	33	90.00	418.54	15.00	62.78	22,275	354.81	0.07	1.08
159.00	160.00	6	63.00	204.28	130.00	265.57	4,050	15.25	1.57	2.58
160.00	162.00	41	90.00	418.54	70.00	292.98	27,675	94.46	0.25	1.01
161.00	162.00	9	63.00	204.28	190.00	388.14	6,075	15.65	1.53	2.29
162.00	164.00	50	90.00	418.54	15.00	62.78	33,750	537.58	0.04	0.76
163.00	164.00	11	75.00	292.25	150.00	438.37	7,425	16.94	1.42	2.13
164.00	165.00	66	90.00	418.54	160.00	669.66	44,550	66.53	0.36	0.71
165.00	166.00	109	90.00	418.54	130.00	544.10	73,575	135.22	0.18	0.35
166.00	169.00	840	160.00	1,327.32	15.00	199.10	567,000	2,847.84	0.01	0.17
167.00	169.00	3	50.00	125.66	75.00	94.25	2,025	21.49	1.12	1.28
168.00	169.00	9	63.00	204.28	210.00	428.99	6,075	14.16	1.69	1.86
169.00	177.00	863	160.00	1,327.32	260.00	3,451.04	582,525	168.80	0.14	0.16
170.00	171.00	9	63.00	204.28	130.00	265.57	6,075	22.88	1.05	2.29
171.00	174.00	17	75.00	292.25	190.00	555.27	11,475	20.67	1.16	1.24
172.00	173.00	9	63.00	204.28	130.00	265.57	6,075	22.88	1.05	1.90
173.00	174.00	12	75.00	292.25	90.00	263.02	8,100	30.80	0.78	0.86
174.00	177.00	29	75.00	292.25	15.00	43.84	19,575	446.54	0.05	0.08
175.00	176.00	9	63.00	204.28	150.00	306.42	6,075	19.83	1.21	2.10

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME (HR)

Prepared By:

Mill Road

December 10, 2024

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (mm)	Liters per 100 lineal meters	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR11PE100								Liters per Day per Dwelling		675
176.00	177.00	12	75.00	292.25	100.00	292.25	8,100	27.72	0.87	0.89
177.00	180.00	904	160.00	1,327.32	15.00	199.10	610,200	3,064.82	0.01	0.02
178.00	179.00	9	63.00	204.28	150.00	306.42	6,075	19.83	1.21	2.23
179.00	180.00	15	75.00	292.25	145.00	423.76	10,125	23.89	1.00	1.02
180.00	180.00	936	160.00	1,327.32	30.00	398.20	645,825	1,621.87	0.01	0.01
200.00	201.00	12	63.00	204.28	500.00	1,021.41	18,000	17.62	1.36	2.34
201.00	202.00	17	63.00	204.28	250.00	510.71	25,500	49.93	0.48	0.98
202.00	180.00	17	63.00	204.28	250.00	510.71	25,500	49.93	0.48	0.50

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One

19 May 2026

Ecoflow's preliminary design analysis provided to Inovo in May 2025 for the 535 Mill Road is still valid as the total number of connections in the current design is fewer than our modelling work done previously.

Once the final layout in confirmed at the next stage of the engineering detailed design stage, Ecoflow will then revisit and rerun the preliminary hydraulic analysis.

Information provided to Ecoflow by Inovo – 15 May 2026

Comparing the new layout to the previous one from June 2025, each stage has changed by the following amount of houses on the WW network:

Stage	Previous Lot Demand (June 2025)	New Lot Demand (May 2026)	Change
1 (Residential)	100 Lots	100 Lots	0
1 (Commercial)	1.46 Hectares	1.49 Hectares / 2 Commercial Lots	+0.03 Ha
2	118 Lots	118 Lots	0
3	250 Retirement Units	250 Retirement Units	0
4	93 Lots	92 Lots	-1 Lots
5	Sports Field	Sports Field	0
6	95 Lots	94 Lots	-1 Lots
7	146 Lots	147 Lots	+1 Lots
8	105 Lots	102 Lots	-3 Lots
9	111 Lots	114 Lots	+3 Lots
10	39 Lots	40 Lots	+1 Lot
11	76 Lots	72 Lots	-4 Lots
TOTAL	883 Residential Lots 1.46 Ha Commercial 250 Retirement	879 Residential 1.49 Ha Commercial 250 Retirement	-4 Residential Lots +0.03 Commercial Ha +0 Retirement Units

Regards

Loren Madden
South Island Branch Manager