Infrastructure Report

Pound Road Industrial Subdivision

Pound Road/Barters Road • Islington

NTP Development Holdings Limited

Proposed Industrial Subdivision

20739

June 2025

DAVIE LOVELL-SMITH

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1. General

1.1 Introduction

This infrastructure report addresses the servicing of the proposed industrial development located between Pound and Barters Road, Islington. The site is located on the southwest fringes of Christchurch, near Templeton. The proposed site is comprised of 173 and 111 Pound Road, 570 and 578 Waterloo Road, 2, 38, 64, 86 and 94 Barters Road and 4, 22, 30, 40 and 48 Hasketts Road. The corresponding legal descriptions are Lot 3 and 2 DP 33334, Lot 1 DP 33334, Lot 2 DP 20738, Lot 1 DP 20738, Lot 10 DP23834, Lot 2 DP 38418, Lot 1 DP 38418, Lot 7 DP 23834, Lot 6 DP 23834, Lot 2 DP 24156, Lot 1 DP 24156, Lots 2 and 1 DP 23834. The total area of the subdivision is approximately 60 ha. It is proposed to subdivide the land into approximately 73 Industrial lots, utility reserves and associated roads.

This report has been prepared to support and application under the Fast Track Approvals Act and addresses all aspects of servicing of the proposed subdivision including stormwater disposal and reticulation, sewer reticulation, water supply, earthworks, roading, pavements, power and telecommunications. Each section of the report provides an overview of the proposed infrastructure and justification of the Engineering decision as to why the methodology for servicing has been adopted. In addition, the suitability of the soils over the site to accommodate the industrial development is addressed.

Consultation will be undertaken with Orion and Enable to ensure the coordinated provision of power and telecommunications.

The design and construction of the proposed subdivision infrastructure will generally comply with the requirements of Christchurch City Council's Infrastructure Design Standard and Construction Standard Specifications. Supplementary local and national standards have also been used to inform the concept infrastructure design.

Initial high-level consultation has been undertaken with both the Christchurch City Council and Environment Canterbury. The purpose of the consultation was to advise of the proposed subdivision and outline the intended methodology for servicing the development. It is expected that both Councils will have input into the final conditions of the resource consent and as such, the intended servicing of the development generally aligns with expected Council practices.

1.2 1.2 Executive Summary

The site comprises relatively flat land previously used for agricultural and residential purposes and is bordered by Pound, Barters, Waterloo, and Hasketts Roads. It sits adjacent to a mix of industrial, rural, and recreational land uses.

Geotechnical investigations confirm the land is generally equivalent to Technical Category 1 (TC1) with a low risk of settlement under standard industrial loading. Approximately 175,000 cubic metres of earthworks cut and fill will be required to achieve appropriate levels for drainage and serviceability. Known contamination, including arsenic and asbestos-containing materials, will be remediated in accordance with a site-specific remediation action plan.

The development will be accessed via a new roundabout on Pound Road and new intersections on Barters Road. The internal road network has been designed for industrial use, incorporating wide carriageways, dual

footpaths, and compliant secondary flow paths for stormwater. The road layout aligns with Christchurch City Council's District Plan requirements.

Water supply to the site presents a known constraint. Modelling has shown that the existing network lacks sufficient capacity and redundancy to serve the development under current or future demand scenarios. Three servicing strategies were considered. The preferred option includes the installation of a water storage tank and associated pump system on-site. This system is designed to buffer peak water demands, provide fire protection in accordance with FW4 classification, and reduce pressure on the existing network.

Wastewater will be managed via a Local Pressure Sewer (LPS) system. Each lot will be fitted with its own pump and tank system, with tailored storage based on 24 hours ASF allowing buffered discharge to the public system. This is consistent with Christchurch City Council's approach in similar industrial developments within the area. Further consultation will be required with Council to ensure sufficient mitigation is being provided.

Stormwater management will involve onsite soakage of roof runoff for individual lots, and the construction of two communal infiltration basins (Lots 200 and 201) to treat and dispose of runoff from public roads and private lot paved areas. The basins are designed to comply with both Christchurch City Council's global discharge consent. These facilities incorporate treatment of the first flush of the first 25mm of runoff, detention and soakage for all events up to an including the 2% AEP critical event.

Power and telecommunications services will be installed underground, with service design to be completed by Orion and Enable or their nominated providers. Kiosks will be installed as required, and overhead lines along the new intersection on Pound Road are expected to be relocated underground. There are no known constraints regarding network capacity in the area.

Overall, the site is considered suitable for an industrial subdivision and 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.

2. Site Description

The site is located in Islington, Christchurch bounded by Pound Road to the east, Waterloo Road and Council stormwater basins to the south, Baters Road to the southwest, Hasketts Road to the northwest and Templeton Golf Course to the north. The site currently comprises of several agricultural/horticultural blocks, lifestyle blocks and a Kainga Ora housing complex. The site is dominated by relatively flat grass and crop paddocks, several large shelterbelts, various houses and ancillary farm type infrastructure. A section of the Paparua Water Race follows Barters Road along the western boundary of the site.

The site is proposed to be subdivided to generally align with the General Industrial Zoning as per the Christchurch District Plan. The zoning is considered a suitable match to both the site itself and its surrounding environment. Waterloo business park is located on the eastern side of Pound Road and is zoned Industrial General. Aside from the golf course, all other surrounding land is zoned Rual Urban Fringe and generally comprising 4ha+ lifestyle and farming blocks. Ruapuna Speedway is located near the northwestern corner of the site, several quarries are also located in proximity on the western side of the site. All these factors lend the suitability of the site to adopt the standards and provisions of the Industrial General Zone.

The topography of the site is relatively flat with a gently sloping ground level. The highest part of the site is in the northern corner at height of approximately RL 42 (Lot 1 DP 23834). The site falls to the south at a grade

of approximately 1 in 260. The corresponding low point in the southern corner of the site is at a height of approximately RL 37 (Lot 1 DP 33334). There are two anomalies to the general landform, being historic drainage/riverbed channels which are very common in this area of the Canterbury Plains. One of these channels starts near the Barters/Madisons/Hasketts Road intersection and extends northeast across the site before continuing through into the golf course land to the north of the site. This channel ranges from approximately 0.6 – 1.8m deep, however is very wide at approximately 40m resulting in bank slopes of 1 in 10 at the steepest point. The second channel begins at the eastern boundary of Lot 2 DP 33334 near the centre of the overall site and grades southeast towards the existing Council and NZTA stormwater basins located at the Pound Road/Waterloo Road intersection. The channel is approximately 1m deep at its extreme and 30m wide, with a corresponding bank grade of approximately 1 in 12 at the steepest point. These two channels are not connected to any known source of water and would only be expected to hold or convey water in low AEP storm events. As such, it is proposed to fill these channels as part of the subdivision works with no adverse effects on surrounding properties. If anything, the new subdivision drainage systems and overland flow paths will assist in ensuring any overland flow is directed away from neighbouring properties.

The Paparua Water race which extends along the eastern side of Barters Road for the majority of the development boundary is proposed to be retained in its open form. Contact was made with Selwyn District Council who operate and maintain the water race, and it was confirmed they have no short-term intention of closing or piping this section of the water race as they have done further downstream. It is also recognised that this section of the water race has low ecological value (refer to the aquatic ecology assessment of Instream Consulting Ltd). Culvert crossings are proposed for the road entry from Barters Road, these are further discussed in Section 5 and 6 of this report. A 5m planted setback within future lots 44 - 56 that border the water race is proposed to enhance the water race and offset any loss of value due to the culvert crossings. A small section of the water race enters the site near the eastern corner. This section was also investigated by Instream Consulting Ltd. It was concluded that this small section can be considered an artificial waterway with low ecological value. It is therefore proposed to fill this section of water race.

3. Site Conditions

3.1 Soils

There is approximately 0.3m – 0.5m of topsoil on the site. The underlying soils of the site are predominantly grey river alluvium. These deposits generally comprise fine to coarse grained sand and silts and gravels. The characteristics of the deposits can vary widely over small distances, both horizontally and vertically. A summary of the soil layers contained in the Geotechnical Investigation Report is as follows; 0.3m-0.5m of topsoil, overlying silt and sand deposits underlain by dense gravels to significant depth. The depth to the gravel layer varied across the site, predominantly encountered between the depths of 1 – 3m. The depth to gravel is shallowest in the east increasing as you travel west and south across the site. The site is expected to behave as TC1 equivalent, however noting that due to the industrial use this is simply a reference to further land performance. There is a section of the site where access was limited at the time of the geotechnical assessment, and therefore further investigation is required prior to subdivision earthworks. The subsurface conditions and area requiring further investigation are further discussed in the Geotechnical Assessment.

Groundwater was not found during the geotechnical investigations on the site. The Geotechnical Report summarises the groundwater level ranging from 13 – 17m below ground level, with the long term avergage mostly between 15 – 16m below ground level. This information is based on historic bore logs and nearby Environment Canterbury monitoring well. These levels are consistent with levels encountered on other development sites within the near vicinity. The groundwater level combined with the composition of underlying soils on the site, confirm suitability of the proposed stormwater disposal methodology, that being soakage to ground.

Various Preliminary and Detailed site investigations into contamination have been undertaken over the subject site (refer to Momentum Environmental DSI). The primary source of contaminants is arsenic, present across various burn pits, many of which exceed the commercial/industrial SGVs. Other sources include an ACM fence at 64 Barters Road, an ACM fragment found in a bund on the 94 Barters Road property and TPH at 173 Pound Road. All contamination that exceeds the commercial/industrial SGVs or that is significantly elevated above background levels and may result in contamination being spread or topsoil being unable to be disposed of to clean fill will be removed from site and disposed of at an appropriate contaminated waste facility in accordance with the Remediation Action Plan that has been formed. 40 Hasketts Road and 111 Pound Road are recommended to have a site inspection and any subsequent DSI testing undertaken prior to any works on those sites.

Overall, it is proposed to remediate the site in accordance with the recommendations of the DSI and the RAP provided. Remediation will be undertaken prior to bulk earthworks occurring within the vicinity of the known contamination. Further investigation into the 94 Barters Road bund, 40 Hasketts Road overall site and 111 Pound Road site will occur prior to any bulk earthworks within these areas.

3.2 Flooding

The site is not located within either the High Hazard Flood Management Area or the Flood Management Area as identified in the Christchurch District Plan. Any historic flooding on the site is anticipated to have been restricted to natural low areas that would have corresponded to old river and water course channels. Figure 1 below, is an extract from the Selwyn District Council flood model that happens to cover part of the subject

site. It can be seen in this figure that any flood ponding is limited to localised low points, this is expected to be the case across the site.

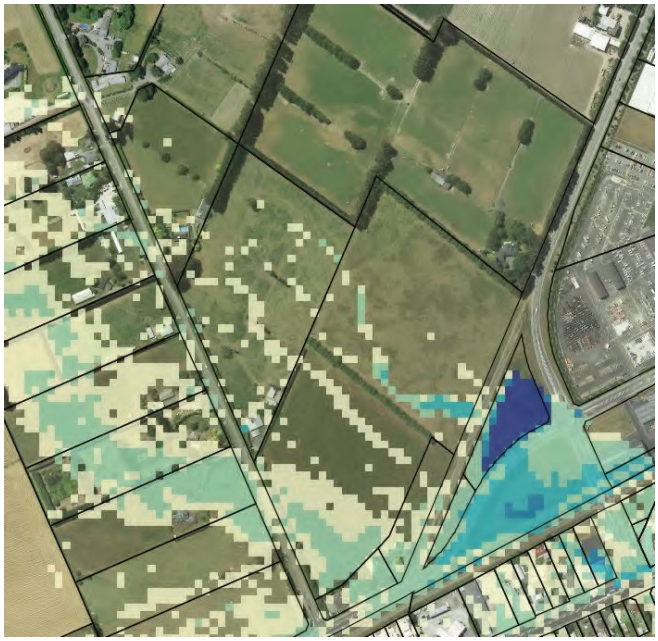


Figure 1: SDC flood model, that covers the southern portion of the subject site.

There are no known watercourses or water sources within the site that are anticipated to cause flooding. As previously mentioned, the low areas of the site will be filled during the bulk earthworks across the site. Overland flow paths will be formed within the development to ensure that secondary flow is transported to the stormwater detention and infiltration facilities. This is further discussed in the stormwater section of this report.

The Paparua water race is known to carry incidental stormwater flows in high rainfall events. As such, all sites bordering the water race will be sufficiently elevated to ensure flows do not overtop into the site in high rainfall events. Culvert crossings will be sized sufficiently to ensure there is a level of redundancy to allow for additional flow in high rainfall events.

4. Geotechnical Assessment

The complete geotechnical investigation by KGA Geotechnical is attached to the Fast Track Approval application. This consisted of a desktop study as well as numerous site tests.

The following observations and recommendations can be made from this report:

- The site is likely to behave as TC1 equivalent.
- Groundwater wasn't encountered but is expected to be present at a depth of 13m below ground level in the worst case.
- Static settlement risk is low under 'normal' industrial/commercial building loads.
- Earthworks across the site to be undertaken in accordance with NZS 4431:2022

- Additional Geotechnical testing to be undertaken as per Drawing 1.5 in the report.
- Subgrade across any historic paleochannel infill to be check by an experienced geotechnical engineer.
- Lot specific geotechnical investigations to be undertaken at the building consent stage to accurately assess ground conditions below each future proposed building/development.

5. Earthworks

Earthworks will be carried out on the site to ensure that all future lots will drain towards the new roads at a grade of at least 1/300. All lots will be elevated above the road and utility lot frontages to ensure sufficient secondary flow conveyance without inundation on the lot in low AEP events. The natural fall of the site from north to south will be generally maintained to ensure secondary flow is conveyed to the stormwater facilities located on Lots 200 & 201. This will involve grading the roads towards these facilities to carry any excess runoff from the lots and flows generated from within the road reserve.

The total estimated on-site cut to fill volume is approximately 175,000m³. The significant areas of cut are in the roadways and the proposed stormwater basins where the depth to the subgrade may be up to 3.5m below existing ground level. Excavation of stormwater infrastructure such as soakpits will be lower than this again, to ensure the basin of infiltration is into free draining gravels. The main areas of fill will be the two low areas of the site, being the historic channels, previously mentioned in Section 2 of this report. It is expected that a balance of cut, and fill can be maintained across the site. Temporary stockpiling of material during construction of stages and in between construction of stages may be required to ensure material is available for proposed filling in future stages.

Due to the site being surrounded by existing roads and the golf course, level transitions from the completed earthworks site to surrounding properties is expected to be relatively level. Battering will be implemented as required to account for any level difference. Lots will batter down to any respective existing road frontage. The boundary with the golf course has a varying level difference. A fill height of approximately 0.5m above existing ground level is expected to be able to be battered into the golf course, this will be confirmed during detailed design. Failing battering a low retaining wall can be constructed on the base of the boundary fence to accommodate the height difference. The level differences are shown on the earthworks concept plan. Lots along Barters Road will drain towards the internal road to ensure stormwater is directed away from the water race. A 5m setback is proposed from the top of the water race bank into the private lots fronting the water race, this setback will be used to batter down from the elevated lot to the water race. It is proposed to plant this setback, please refer to the proposed landscaping plans for more detail. Levels surrounding Lot 5 DP 23834 which does not form part of the development are generally flush, except for the filling of the historic channel, the height difference at these two locations will be accounted for by either retaining or battering into the neighbours with their approval.

All topsoil on site will be stripped, stockpiled and replaced on the land immediately following bulk earthworks. Where possible topsoil will be stripped from one area of the site and placed directly on completed earthworks areas to limit the time of exposed land. All disturbed topsoil will be re-sown with CCC specification grass seed mixes. Removal of material from site is not anticipated to be required, however it is expected that there will be minor amounts of unsuitable material (containing excess organics or residential/farm debris) that will need disposal off-site.

Sediment runoff within the site will be controlled as per CCC requirements. The basis of the sediment control will be the Environment Canterbury Guidelines and the discharge during construction will be undertaken either under Council's overall discharge consent or in accordance with Environment Canterbury rules. All dust created on the site will be controlled by water cart or other such Council approved methods. An Erosion, Sediment and Dust Control Plan will be compiled and submitted to both local and regional council for approval. This Erosion and Sediment Control Plan is also included as part of the Fast Track Application.

All bulk earth fill will be compacted in accordance with NZS 4431:2022. All fill testing will be carried out by a suitably qualified person or laboratory. The Earthworks Concept Plan is attached in Appendix A.

6. Roading

The site is bounded by the existing Pound, Barters and Hasketts Road. Road connections will be formed to each of these roads. A round-a-bout connection will be formed to Pound Road, this is anticipated to be the primary access point to the development for most traffic. Two giveway intersections will connect the development to Barters Road. A future connection is anticipated to connect through to Hasketts Road pending development plans for lot owners within Lot 73.

The existing roads will largely remain as is. No direct access is proposed from lots to either Barters or Pound Road. Barters Road due to the water race, and Pound Road due to the volume of traffic and current formed carriageway. Road widening will occur at both Barters Road intersections to facilitate the installation of a right turn bay and widening of the formed shoulder to better assist left turn in and left turn out of the development roads. Initial discussions with CCC have indicated that they would be willing to facilitate the reduction of the Barters Road speed limit to 60 km/hr to better suit the increased road use anticipated to result from the development. As such the concept design of the two intersections to Barters Road have been on the basis of a 60km/hr speed limit. The existing carriageway formation of Pound Road will need alterations to facilitate the installation of the proposed round-a-bout connection to Road 1. Localised widening and re-alignment will be required on the approaches to the round-a-bound to facilitate the splitter islands and offset nature of the round-a-bout due to the existing road reserve boundary constraints on the eastern side.

The culvert to be installed for the Road 3 crossing of the Paparua Water Race will be a 450mm dia. RCRRJ Class 4 pipe. The nearest downstream culvert that crosses Barters Road is a 375mm, however, to ensure fish passage isn't hindered by the installation of the new culvert, it has been upsized to 450mm dia. to allow for 20% of the pipe to be submerged below the bed of the water race whilst maintaining sufficient hydraulic capacity.

The internal roading network consists of four roads. Road 1 will form the intersection with Pound Road and extend northwest to for a t-intersection with Road 2. Road 2 will extend from the southern corner of the site northwest parallel to Barters Road before extending northeast into the norther corner of the site before heading west through the balance lot out to Hasketts Road. Roads 3 and 4 will extend northeast from their intersection with Barters Road, intersect with Road 2 before forming terminal t-intersections with Road 1 in the northern portion of the site. All internal intersections will be t-intersections with the exception of the Road 2/3 intersection which will be a round-a-bout. All internal intersections will have a minimum kerb radius of 15m and boundaries are splayed to assist with sightlines.

The legal widths of these roads is 22m with formed widths of 12.5m. This is designed to enable on-street parking and still facilitate two-way movement of large heavy vehicles. Footpaths will be provided on both sides of all internal roads. A shared path will be provided through Lot 200 to form a connection with the existing Waterloo Road share path. This will ensure full pedestrian and cycle connectivity through to the Waterloo Road bus stop and various surrounding cycle and pedestrian paths. The legal and formed widths of the roads and dual footpaths have been selected to comply with both the Industrial Collector Road and Industrial Local Road classifications in accordance with Appendix 8.10.3 of the Christchurch District Plan.

Scala penetrometer testing has been carried out at various locations onsite as part of the Geotechnical Report provided by KGA Geotechnical. The results showed that once topsoil is stripped a worst-case subgrade CBR of approximately 3.5 was consistently achieved. It is expected that for the majority of the site and with

compaction of road subgrades a CBR of 5.5 would be more appropriate. Based on a CBR of 3.5 a worst-case preliminary pavement depth of 550mm is expected, however using a CBR of 5.5 this would reduce to 450mm. These assumptions will be verified by further testing during detailed design with full pavement design calculations in accordance with Austroads Part 2. Final pavement composition may vary once roads have been excavated to subgrade level and inspected by the Engineer during construction.

All site accesses except for lot 44 will be designed and constructed at the time of building consent for each individual lot. An access will be formed to Lot 44 as part of the subdivision works, this access has a legal width of 10m and a formed width of 8m.

Roads and the Lot 44 access will be constructed with an asphalt surface. 55mm of AC14 is provisionally intended for all internal roads. A Polymer Modified Binder suitable for resisting higher turning movements will be utilised in the asphalt at the round-a-bouts and intersections where higher turning movements are expected.

The roads will provide the secondary flow path for flows up to a 1 in 200-year storm event. The flows will be conveyed to lots 200 & 201 where the proposed stormwater facilities are located. Flows beyond the capacity of the stormwater facilities will overtop to the secondary flow paths of Waterloo and Pound Road for Lots 200 and 201 respectively.

Streetlights will be designed in accordance with Christchurch City Council specification, with detailed design plans submitted to CCC for approval. Streetlights will then be installed by the nominated electrical contractor.

Please refer to Appendix B for typical roading cross sections and overall roading layout.

For detailed reporting on the proposed road layout, external intersection designs and overall traffic flow modelling, please refer to the Novo Group Integrated Transport Assessment also included in the Fast Track Application.

7. Water Supply

Water supply for the proposed development is a known constraint. The Islington suburban water supply is largely dependent on a series of booster pumps located on Foremans Road, near the intersection with Main South Road. These booster pumps are heavily relied on to ensure sufficient operating and firefighting pressure for the neighbouring Waterloo Business Park and surrounding residential and commercial properties. Water supply modelling has been undertaken by Opus on behalf of the Christchurch City Council to confirm the effect of the proposed development on the water supply network. The results of this modelling are included as Appendix C.

The modelling considered three scenarios;

1. Current base model
2. Base model + Proposed Development
3. Base model + Proposed Development + Proposed Plan Changes 16 & 17.

For scenario 2 both the base level of service (LoS), FW3 and FW2 requirements were all assessed. It is noted that since the modelling was undertaken plan change 16 is no longer occurring and Council has been formally notified of this. Plan change 16 was expected to provide approximately 100 commercial/industrial lots with a peak day demand of 47l/s. Plan Change 17 is lodged with Council and is understood to be progressing through the process of rezoning.

A summary of the modelling conclusions are as follows;

- Scenario 1: Current base model is acceptable, except for properties on Dawsons Road where pressures drop below 20m. It is noted no figure is provided for the area experiencing residual pressures less than 20m in this scenario.

- Scenario 2: Pressure LoS is met for the development, headloss >10m/km along Foremans and Main South Road therefore failing headloss LoS. Residual pressure issues in the upstream networks are increased and higher elevation areas north of Templeton drop below 20. The increased area that is affected by the residual pressure issue due to the proposed development is not shown or commented on in the modelling report. The issue is compounded under fire service requirements. Opus modelled a scenario of 50l/s fire demand, corresponding to FW3 in accordance with SNZ PAS 4509:2003, which shows significant residual pressure issues for the Templeton township < 10m. The modelling concludes that 25l/s is available to allow a residual pressure of 12.7m corresponding to a FW2 classification in accordance with SNZ PAS 4509:2003.

- Scenario 3: Scenario 2 effects compounded, with excessive pipe headlosses >20m/km and residual pressure within the proposed Pound Road development dropping below 10m. Therefore, significant upgrades are required.

- In addition to the above three scenarios being modelled, it is identified that the 200mm main in Waterloo and Pound Road is the only point of connection and this is fed only from the Templeton Booster Pump. As such, there is very limited redundancy in the network.

From the modelling and further engineering investigation, three proposed options for water supply servicing of the development were considered;

1. Upgrading the existing network. This would involve the upsizing of approximately 1.2km of 200mm watermain from the connection point at the Pound Road/Waterloo Road intersection back to the booster pump station. It is noted this watermain extends through the trafficable lanes of Foremans, Pound and Waterloo Road, 3 private industrial properties and the railway corridor. A 350-400m section of the existing 150mm main in Foremans Road would also require upsizing. In addition, the booster pump station would also need to be upgraded to service the upgraded pipe size, ensure sufficient residual pressure is maintained and ensure firefighting demand equivalent to FW3 is able to be met within the proposed development.

OR

2. Installation of a new bore on the development site to boost supply and pressure to service the development and assist the surrounding network.

OR

3. Installation of a water supply tank and pumps within the development to provide both buffering during base demand and fire fighting supply.

Option 1 is a significant cost to the development and would involve extensive disruption to surrounding businesses and road users. It is also heavily reliant on financial and Engineering support from the Council in facilitating the upgrade of the Council booster pump station. This option would still not address the lack of redundancy in the network as the development is still solely reliant on the booster pump station and the single feed from the booster pumps.

Option 2 is again a significant cost to the development, however, has implications beyond design and cost. The most significant issue is obtaining Regional Council consents for the installation of a new bore, take of groundwater for community supply and transfer of those allocations and required consents to Council. This option also required Council to provide treatment and monitoring infrastructure suitable for a new Community Drinking Supply bore. The time, Council/Developer complexity and cost to both associated with this option make it the least preferred.

Option 3 is the most favourable for the development. This option provides buffering of peak base demand to the proposed development, ensuring the existing network is not suffering excess headloss during their periods. This option also provides the necessary fire supply volume, flow and pressure for the development without compromising the existing network. The tank and pumps will assist in boosting the residual pressure in the surrounding existing network as well as providing an additional level of redundancy in the overall Islington area.

It is therefore proposed to install a new 200mm watermain connecting to the existing 200mm watermain at the intersection of Waterloo and Pound Road and extending this new main into the development to Lot 202. Lot 202 will contain the proposed tank and pump infrastructure. From the tank a network of mains will be extended through the road network of the development. Water mains will be sized to ensure the unit head loss in any pipe section does not exceed 0.01m/m with sizing confirmed during modelling of the network at

the time of detailed design. All submains will be 63mm (OD) and each rear lot will be served with a 32mm (OD) lateral and dummy connection at the road frontage. The layout of the proposed tanks and watermains are shown in the Engineering Concept plans included as Appendix B. Pipe sizing calculations are included as Appendix D.

The provisional sizing of the tank is based on achieving FW4 fire hazard category and providing sufficient buffering in the network. FW4 requires 100l/s firefighting flow for a duration of 90 minutes, this corresponds to a volume of 540m^3, refer to SNZ PAS 4509:2008 Table 2. The peak demand for the development is approximately 39l/s, based on 84 lots, allowing for 10 additional through further subdivision. It can be conservatively assumed that continuous demand is approximately 60% of peak demand and that industrial/commercial activities are likely to draw for approximately 10 hours of the day. This gives a take of 23.4l/s over a 10-hour period, giving a total volume of 842,400l used per day. Given the tank can be continuously filled over a 24-hour period, this would place a continuous flow rate demand of 9.75l/s on the network, corresponding to a peak demand of 16.25l/s less than half of that without the tank. Using 9.25l/s over a 24-hour period the additional storage required in the tank for buffering is 491.4m^3 giving a required tank volume of 1031.4m^3, applying a factor of safety of 10% the proposed tank volume is 1150m^3.

The tank will be serviced by a pump set designed in accordance with the CCC IDS and supplementary CCC pumping station and reservoir design guides. The pump set will consist of an operational pump that will maintain pressure in the system and provide the base level of pressure for everyday demand and a jockey pump that will boost pressure in the event of a fire. The developer would be willing to upsize the pump set, tank and mains through an Infrastructure Provision Agreement to increase redundancy in the surrounding existing network if requested by Council.

We would expect a condition of consent requiring the final sizing of the tank to be confirmed during detailed design based on an updated model from Opus incorporating the proposed servicing strategy and maximum available supply flow rate from the existing Council infrastructure to site without cause adverse effects of the network considering plan change 16 has been withdrawn.

It is noted that all three options were presented to Council during preliminary consultation. Council have not confirmed a preference. Council have provided a set of water supply conditions of consent and are included as Appendix H; these conditions of consent are considered suitable for the proposed Option 3.

The design and construction of all water infrastructure will be completed to Council and national standards as applicable.

8. Sewer

The sewer capacity in the existing Council network has similar constraints to that of the water supply. The existing gravity network is currently sufficient and can cater for the proposed development in both dry and wet weather flows. However, with future growth and proposed plan changes 16 and 17 added to the model there are obvious capacity constraints. As previously mentioned, plan change 16 no longer needs to be considered, however for the purposes of the modelling it shows the impact of future development in the wider area on the existing network.

Six scenarios were modelled by Opus on behalf of CCC, the six scenarios and the results of the model are summarised in Table 1 below. The full modelling report is included as Appendix E.

Table 1: Council modelling scenarios and results summary.

Scenario	Dry Weather Flow	Wet Weather Flow
Service Option a – Gravity (MF = 28 L/s)		
Base model	No capacity issues predicted.	No capacity issues predicted.
Growth model	Minor capacity issues predicted – surcharged pipes but no freeboard issues.	Some capacity issues predicted – surcharged pipes and two manholes with a freeboard of < 500 mm.
Growth model + plan changes 16and 17	Capacity issues predicted, including one manhole overflow which increases in spill volume by 551 m^3 due to the development.	Capacity issues predicted, including two manhole overflows which increase in spill volume by a total of 1602 m^3 due to the development.
Service Option b – Local Pressure Sewer (MF = 10 L/s)		
Base model	Results are identical to service option 1 dry weather flow results.	No capacity issues predicted.
Growth model		Some capacity issues predicted – surcharged pipes but > 500 mm freeboard.
Growth model + plan changes 16 and 17		Capacity issues predicted, including two manhole overflows which increase in spill volume by a total of 1276 m^3 due to the development.

As shown in the table above, once future growth is considered surcharging of the pipes occurs and if future plan change areas are considered the spill volume is increased by the proposed development. The volume of additional spill seems excessive as at 10l/s this nearly 50% more volume than the 24-hour maximum flow from the development. Regardless, two main servicing options were considered.

1. A gravity network with either a downstream pump station upgrade or storage tank within the development site to buffer flows.
2. A Local Pressure Sewer (LPS) network with each lot to provide storage within their pump and tank unit corresponding to their expected wastewater discharge established at the time of building consent.

Option 2 is the preferred servicing strategy. This will allow the development to progress without requiring alteration to the existing council network or vesting of a large storage facility to Council that would incur on-going maintenance cost. Providing LPS connections to each site, with the site then providing the required storage based upon the end use is the most effective outcome. It is well known that there can be a large variance in sewer discharge volumes depending on end use of an industrial allotment, this way excessive storage or upgrades are not required based on a worst-case scenario that may never eventuate. Each lot is proposed to provide 24-hrs average dry weather flow storage and therefore the level of storage provided is suited to match the proposed demand on the system from that lot. The LPS option also allows Council to maintain a level of control over the discharge from each lot via the IOTA OneBox Control Panel if desired. This adds a further layer of buffering into the system with discharges able to be controlled by Council to allow off-peak discharge and holding of discharge in emergency situations. It is recognised that Council have imposed a sewer discharge limit of 0.09l/s/ha, controlled by way of consent notice on new titles, on development sites in the surrounding area. It is expected that a similar limit will also be applied to this site. This corresponds to a flow rate of 5.4l/s from the site with the tanks on each lot providing the buffer.

The LPS system will be designed and sized by IOTA in accordance with CCC requirements. Mains greater than 90mm in diameter will be installed within the carriageway, all pipes smaller than 90mm will be installed in the common services trench located in the berms of the road reserve. The development works will include the installation of a lateral pipe, isolation valve and boundary box to each Lot located at the road boundary. The pump tanks will be installed at the time of building consent and connect to the boundary box installed by the developer. The power to the pump stations will be provided by the future owner. Please refer to Appendix B for the proposed LPS layout and associated details.

The proposed outlet point in the modelling was the existing sewer manholes (WwAccessID 45973) located in the Pound Road/Waterloo. For the simplicity of connection and to avoid the closure of the intersection to facilitate these works it is proposed for the connection to be made to WwAccessID 45971. This manhole has an existing pressure sewer pipe discharging to this manhole and as such is plastic. This would also suit the discharge from the LPS network proposed. Odour control and corrosion protection is expected to be required at the location of the LPS discharge into the gravity network. There is no existing odour control at this manhole and therefore would be a suitable opportunity to install an Armatec Active Greendome that can treat both the LPS discharge and the existing pressure sewer discharge. The Greendome will be sized by Armatec to treat the proposed discharge flow rate and anticipated H_2S loading. Lining of manholes downstream of the outlet for corrosion protection will be undertaken in accordance with Council requirements.

Council have again provided suggested conditions of consent for the proposed LPS network. These are included as Appendix I. There are no concerns with the proposed conditions provided.

9. Stormwater

The stormwater management strategy for the development site will utilise both public and private stormwater discharge consents to treat, convey and dispose of stormwater. It is proposed to have individual lots soaking all stormwater up to and including the 2% AEP event for roof areas directly to ground within the lot, this will be under a Regional Council discharge consent obtained by the developer. Stormwater from public roads and reserves, and individual lot hardstand areas will be managed under the Christchurch City Council Global Discharge Consent CRC252424.

Both primary (pipe) and secondary (road and utility reserve) network to convey and dispose of stormwater form roads, reserves and individual lot hardstands. The site contour is generally falling from northwest to southeast and as such utility lots 200 and 201 have been positioned to provide treatment and detention for the development's stormwater near/at the low points of their respective catchments. Please refer to Appendix B for the proposed stormwater network and basin layouts. It is noted that Lot 201 has been positioned to take flows from the northern portion of the site if Lot 73 is unable to be further developed. Lot 73 has been positioned to correspond to a land holding that has been difficult obtain ownership of by the developer. If lot 73 is not able to be developed alongside the remainder of the proposed site, Lot 201 will need to take flows from this northern catchment. If Lot 73 is developed both primary and secondary flow can follow Road 4 and reach the Lot 200 stormwater facility. In this case lot 201 will be varied to an industrial allotment.

Stormwater emanating from the road and reserves will be directed to the kerb and channel where it will flow to sumps. Stormwater will then enter the piped network via the sumps and be conveyed to the treatment and soakage facilities located in Lots 200 and 201. The piped network will follow the alignment of the internal road network, positioned near the centre of the carriageway. Individual 225mm connections will be provided to each lot to collect hardstand run-off, either directly from the main pipe in the road or via bubble up sumps in the road kerb and channel where practical. The piped network will be sized to convey all flows up to and including the critical duration 20% AEP event, in accordance with the CCC IDS.

Secondary flow paths will be utilised for flows exceeding the capacity of the piped network and graded as such to convey flow to lots 200 and 201. Secondary flow paths will be designed to ensure no flow enters the private lot in the critical duration 2% AEP event. Flood modelling will be undertaken as part of detailed design for the 1 in 50-year and 1 in 200-year storm events. Sites will be sufficiently elevated to ensure compliance with District Plan requirements for flooding of private property and minimum finished floor levels.

The site is located within the Christchurch Groundwater Protection Zone, it is therefore important to ensure any stormwater is being sufficiently treated given the method of disposal in soakage to ground. The first flush, being the first 25mm of run-off in accordance with the CCC WWDG will be treated via infiltration basin. The infiltration basin will be sized to cater for the first 25mm of run-off from all roads and reserves, with lots providing their own treatment for run-off from hardstand areas entering the public network. The basin will be constructed so as that the base of the infiltration treatment media is exposed to natural gravels, this will ensure that once treated stormwater can soak away efficiently. The infiltration media is expected to consist of a makeup similar to the following: 50% screened soil, 25% 2A sand, 25% bark mulch. The media will be required to provide an infiltration rate of between 75mm/hr and 300mm/hr in accordance with the CCC Global Stormwater Discharge Consent and the CCC WWDG. The media composition will be confirmed during

detailed design with test pads constructed on site and tested using a double ring infiltrometer to verify the infiltration rate prior basin construction. The basin(s) will be designed to allow the storage of a 10% AEP 18-hour duration event in accordance with Council requirements. Any stormwater over and above these volumes up to and including the 2% AEP event will overtop to a series of rapid soakage chambers constructed into the natural gravels below the infiltration basin. Calculations for the basin sizing are included as Appendix G.

As mentioned above, lots are expected to provide their own pre-treatment for hardstand areas prior to discharge to the public network. A consent notice will be registered on the title for all lots to enforce this requirement.

Consultation has been previously undertaken with CCC regarding the proposed stormwater strategy for the development site. A series of standard Council Subdivision Consent Conditions and the proposed Consent Notices mentioned above, have been provided by Council Officer Mr Brian Norton, it is proposed to adopt these suggested conditions except for conditions 17 & 20. These are included as Appendix J to this report. Condition 17 is deemed un-necessary as there are examples of infiltration infrastructure adjacent to the proposed site, showing soakage to ground is viable with reasonable soakage rates. As such infiltration testing at the time of infrastructure construction would be considered sufficient. Condition 20 is deemed excessive, as testing will be undertaken to ensure compliance with Council requirements prior to the section 224(c) issuing and then again prior to the end of the developer's maintenance period. Bonding would only be considered necessary if the infrastructure was non-complying with the Council requirements at the time of section 224(c).

10. Power and Telecommunications

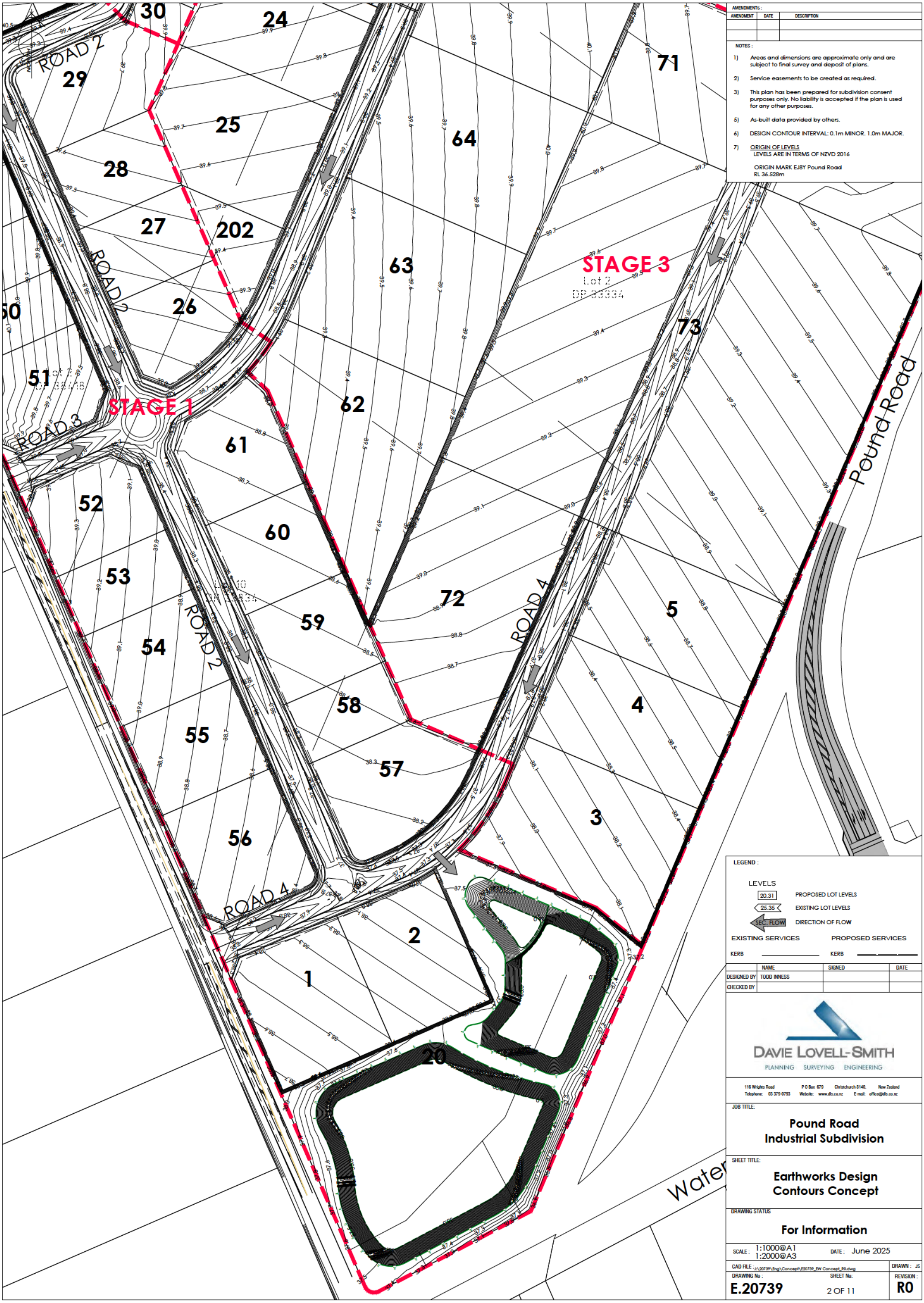
Power and Telecommunication connection will be provided to all sites to utility company and industry standards. The design of these services will be undertaken by nominated sub-consultants/network installers. Power will be designed in accordance with Orion and Transpower requirements and approved by Orion prior to installation. Telecommunications will be designed by either Chorus or Enable and installed by them or their nominated installer.

All cables will be placed underground, and all kiosks will be constructed on separate individual lots. The kiosk sites will be forwarded to Council for approval following the power design.

Undergrounding of overhead lines is expected to be required along Pound Road where Road 1 forms the new intersection. Further undergrounding along Pound Road may be undertaken for amenity at the request of the network owner, however this would be at their cost and discretion. Baters Road overhead powerlines are located on the western side of the road, and therefore no undergrounding in anticipated. There are several overhead road crossings that look to service the current residential properties being removed as part of the proposed development. These overhead crossings would be removed and underground feeds trenched across Barters Road to service the development.

There are no known telecommunication or power capacity constraints in this area that would affect the proposed development.

Appendix A – Earthworks Concept



AMENDMENTS :

AMENDMENT	DATE	DESCRIPTION

NOTES :

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2) Service easements to be created as required.
3) This plan has been prepared for subdivision consent purposes only. No liability is accepted if the plan is used for any other purposes.
5) As-built data provided by others.
6) DESIGN CONTOUR INTERVAL: 0.1m MINOR. 1.0m MAJOR.
7) ORIGIN OF LEVELS
LEVELS ARE IN TERMS OF NZVD 2016
ORIGIN MARK EJ8Y Pound Road
RL 36.528m

LEGEND :

LEVELS
20.31 PROPOSED LOT LEVELS
25.35 EXISTING LOT LEVELS
SEC. FLOW DIRECTION OF FLOW

EXISTING SERVICES — KERB

PROPOSED SERVICES — KERB

	NAME	SIGNED	DATE
DESIGNED BY	TODD INNESS		
CHECKED BY			

DAVIE LOVELL-SMITH
PLANNING SURVEYING ENGINEERING

116 Wrights Road P O Box 679 Christchurch 8140. New Zealand
Telephone: 03 379 0793 Website: www.dls.co.nz E-mail: office@dls.co.nz

JOB TITLE:

Pound Road Industrial Subdivision

SHEET TITLE:

Earthworks Design Contours Concept

DRAWING STATUS

For Information

SCALE : 1:1000@A1 1:2000@A3

DATE : June 2025

CAD FILE : J:\20739\Eng\Concept\E20739_EW Concept_R0.dwg

DRAWN : JS

DRAWING No : **E.20739**

SHEET No: 2 OF 11

REVISION : **R0**

NORTH

Lot 2
DP 403260

Lot 1
DP 23834

Lot 2
DP 23834

74

Haskells Road

Lot 1
DP 24156

STAGE 4

14

ROAD 2

Lot 2
DP 24156

15

13

Lot 5
DP 23834

16

12

STAGE 2

Lot 6
DP 23834

17

18

19

20

37

ROAD 2

38

36

35

39

22

40

34

44

41

33

32

23

Lot 7
DP 23834

42

31

43

30

24

ROAD 2

45

29

46

25

47

28

AMENDMENTS :

AMENDMENT	DATE	DESCRIPTION

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7) ORIGIN OF LEVELS
LEVELS ARE IN TERMS OF NZVD 2016

ORIGIN MARK EJ8Y Pound Road
RL 36.528m

LEGEND :

LEVELS

20.31 PROPOSED LOT LEVELS

25.35 EXISTING LOT LEVELS

SEC. FLOW DIRECTION OF FLOW

EXISTING SERVICES — PROPOSED SERVICES

KERB — KERB

	NAME	SIGNED	DATE
DESIGNED BY	TODD INNESS		
CHECKED BY			

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JOB TITLE:

Pound Road Industrial Subdivision

SHEET TITLE:

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For Information

SCALE : 1:1000@A1 1:2000@A3

DATE : June 2025

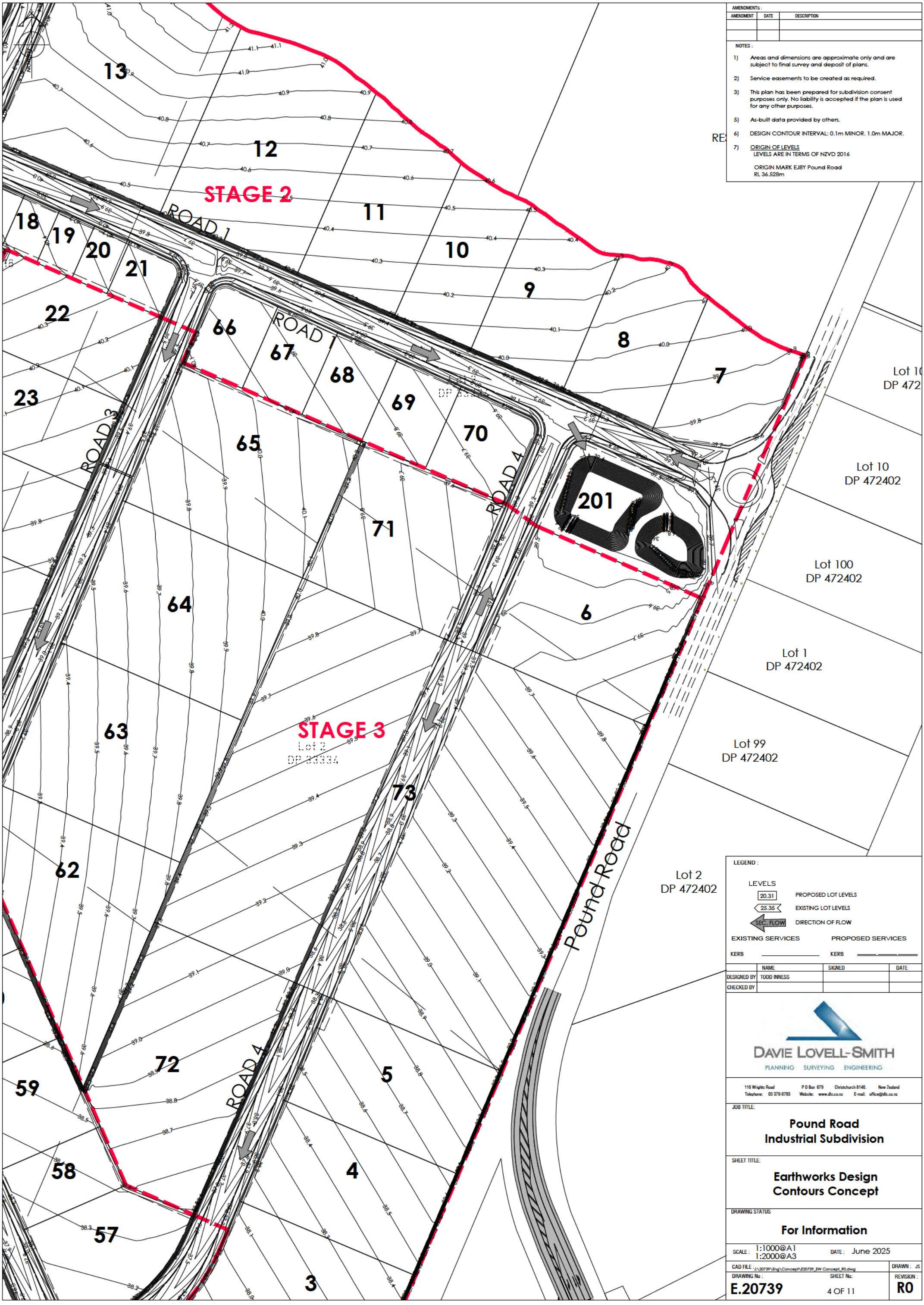
CAD FILE : J:\20739\Eng\Concept\E20739_EW Concept_R0.dwg

DRAWN : JS

DRAWING No : **E.20739**

SHEET No: 3 OF 11

REVISION : **R0**



AMENDMENTS :		
AMENDMENT	DATE	DESCRIPTION

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7) ORIGIN OF LEVELS
LEVELS ARE IN TERMS OF NZVD 2016

ORIGIN MARK EJ8Y Pound Road
RL 36.528m

LEGEND :

LEVELS
20.31 PROPOSED LOT LEVELS
25.35 EXISTING LOT LEVELS
SEC. FLOW DIRECTION OF FLOW

EXISTING SERVICES — KERB
PROPOSED SERVICES — KERB

	NAME	SIGNED	DATE
DESIGNED BY	TODD INNESS		
CHECKED BY			

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Telephone: 03 379 0793 Website: www.dls.co.nz E-mail: office@dls.co.nz

JOB TITLE:
Pound Road Industrial Subdivision

SHEET TITLE:
Earthworks Design Contours Concept

DRAWING STATUS
For Information

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DATE : June 2025
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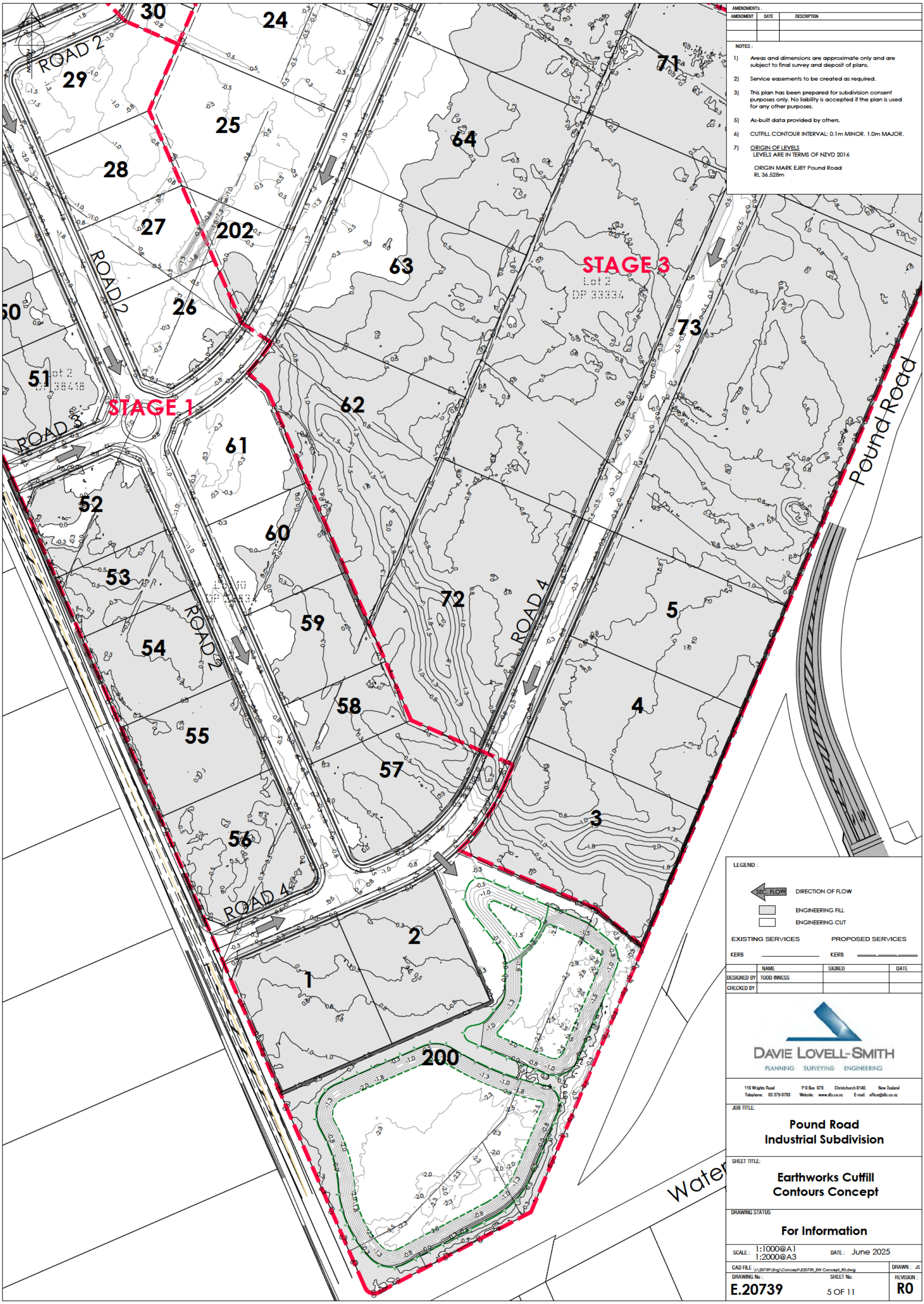
DRAWING No : **E.20739**
SHEET No: 4 OF 11
REVISION : **R0**



AMENDMENTS :

AMENDMENT	DATE	DESCRIPTION

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6) CUTFILL CONTOUR INTERVAL: 0.1m MINOR. 1.0m MAJOR.

7) ORIGIN OF LEVELS
LEVELS ARE IN TERMS OF NZVD 2016

ORIGIN MARK EJ8Y Pound Road
RL 36.528m

LEGEND :

SEC. FLOW DIRECTION OF FLOW

ENGINEERING FILL

ENGINEERING CUT

EXISTING SERVICES	PROPOSED SERVICES
KERB	KERB

	NAME	SIGNED	DATE
DESIGNED BY	TODD INNESS		
CHECKED BY			

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JOB TITLE:

Pound Road Industrial Subdivision

SHEET TITLE:

Earthworks Cutfill Contours Concept

DRAWING STATUS

For Information

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DATE : June 2025

CAD FILE : J:\20739\Eng\Concept\E20739_EW Concept_R0.dwg

DRAWN : JS

DRAWING No : **E.20739**

SHEET No: 5 OF 11

REVISION : **R0**

NORTH

Lot 2
DP 403260

Lot 1
DP 23834

Lot 2
DP 23834

74

Haskells Road

STAGE 4

Lot 1
DP 24156

14

ROAD 2

Lot 2
DP 24156

15

13

Lot 5
DP 23834

16

12

STAGE 2

17

18

19

20

37

38

ROAD 1

39

36

35

22

40

34

44

41

33

23

Lot 7
DP 23834

32

42

43

31

30

24

ROAD 3

45

ROAD 2

29

46

25

47

28

AMENDMENTS :

AMENDMENT	DATE	DESCRIPTION

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7) ORIGIN OF LEVELS
LEVELS ARE IN TERMS OF NZVD 2016

ORIGIN MARK EJ8Y Pound Road
RL 36.528m

LEGEND :

SEC. FLOW DIRECTION OF FLOW

ENGINEERING FILL

ENGINEERING CUT

EXISTING SERVICES	PROPOSED SERVICES
KERB	KERB

	NAME	SIGNED	DATE
DESIGNED BY	TODD INNESS		
CHECKED BY			

DAVIE LOVELL-SMITH
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Telephone: 03 379-0793 Website: www.dls.co.nz E-mail: office@dls.co.nz

JOB TITLE:

Pound Road Industrial Subdivision

SHEET TITLE:

Earthworks Cutfill Contours Concept

DRAWING STATUS

For Information

SCALE : 1:1000@A1 1:2000@A3

DATE : June 2025

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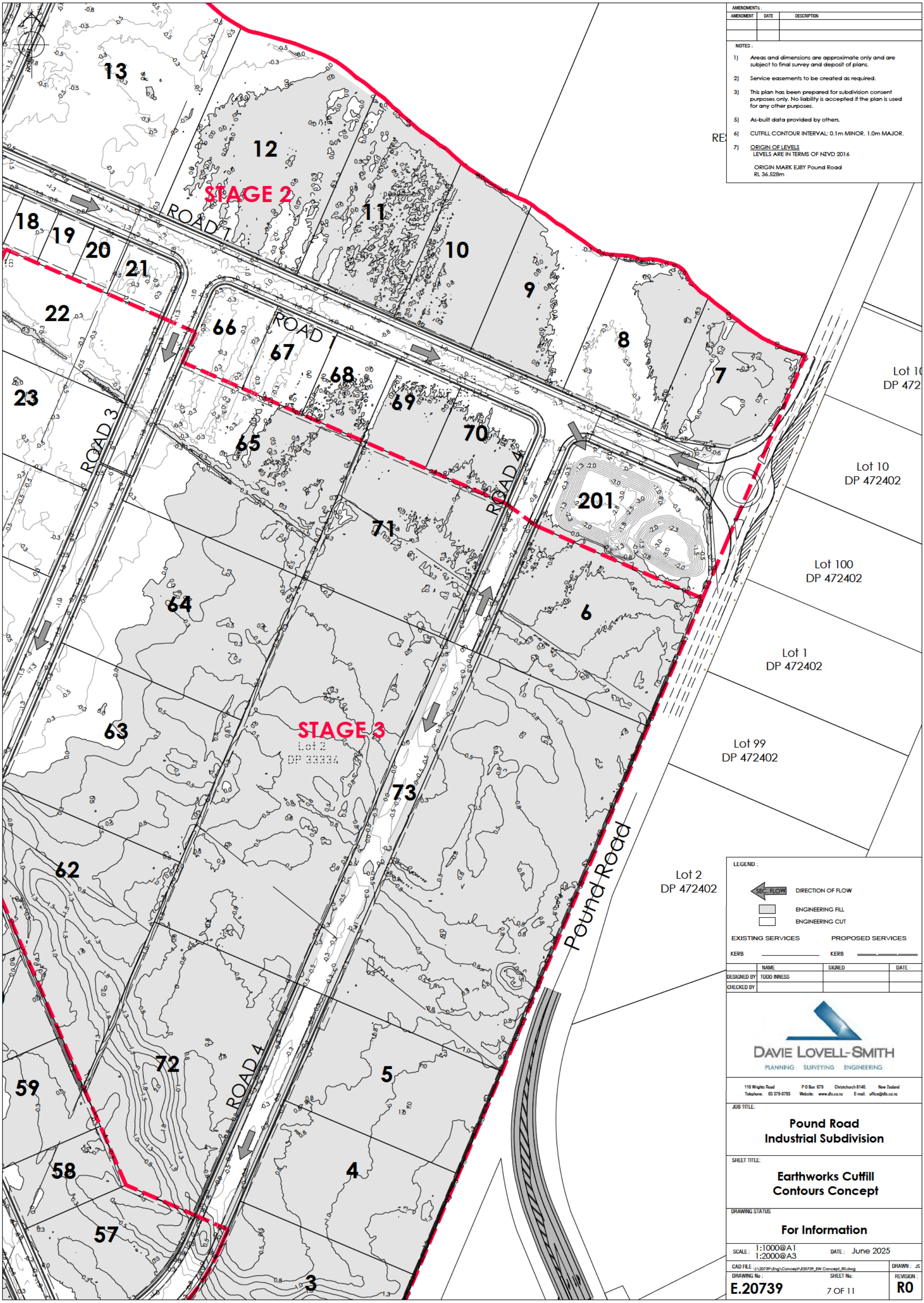
DRAWING No : E.20739

SHEET No: 6 OF 11

REVISION : R0



AMENDMENTS :

AMENDMENT	DATE	DESCRIPTION

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7) ORIGIN OF LEVELS
LEVELS ARE IN TERMS OF NZVD 2016

ORIGIN MARK EJ8Y Pound Road
RL 36.528m

LEGEND :

SEC. FLOW DIRECTION OF FLOW

ENGINEERING FILL

ENGINEERING CUT

EXISTING SERVICES	PROPOSED SERVICES
KERB	KERB

	NAME	SIGNED	DATE
DESIGNED BY	TODD INNESS		
CHECKED BY			

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PLANNING SURVEYING ENGINEERING

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Telephone: 03 379-0793 Website: www.dls.co.nz E-mail: office@dls.co.nz

JOB TITLE:

Pound Road Industrial Subdivision

SHEET TITLE:

Earthworks Cutfill Contours Concept

DRAWING STATUS

For Information

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DATE : June 2025

CAD FILE : J:\20739\Eng\Concept\E20739_EW Concept_R0.dwg

DRAWN : JS

DRAWING No : E.20739

SHEET No: 7 OF 11

REVISION : R0

Appendix B – Engineering Concept

SHEET LAYOUT ENG CONCEPT 02, EW DESIGN
CONCEPT 02 & EW CUTFILL CONCEPT 02

SHEET LAYOUT ENG CONCEPT 03, EW DESIGN
CONCEPT 03 & EW CUTFILL CONCEPT 03

SHEET LAYOUT ENG CONCEPT 01, EW DESIGN
CONCEPT 01 & EW CUTFILL CONCEPT 01

AMENDMENTS :		
AMENDMENT	DATE	DESCRIPTION

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5) CONTOUR INTERVAL: 0.5m MINOR. 2.0m MAJOR.
6) ORIGIN OF LEVELS
LEVELS ARE IN TERMS OF NZVD 2016

ORIGIN MARK EJ8Y Pound Road
RL 36.528m

LEGEND :

EXISTING SERVICES PROPOSED SERVICES

KERB KERB

	NAME	SIGNED	DATE
DESIGNED BY	TODD INNESS		
CHECKED BY			

DAVIE LOVELL-SMITH
PLANNING SURVEYING ENGINEERING

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Telephone: 03 379 0793 Website: www.dls.co.nz E-mail: office@dls.co.nz

JOB TITLE:

**Pound Road
Industrial Subdivision**

SHEET TITLE:

Engineering Concept Overall

DRAWING STATUS

For Information

SCALE : 1:2000@A1
1:4000@A3

DATE : June 2025

CAD FILE : J:\20739\Eng\Concept\E20739_Eng Concept_R0.dwg

DRAWN : JS

DRAWING No : **E.20739**

SHEET No: 1 OF 11

REVISION : **R0**

AMENDMENTS :		
AMENDMENT	DATE	DESCRIPTION

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5) ORIGIN OF LEVELS
LEVELS ARE IN TERMS OF NZVD 2016
ORIGIN MARK EJ8Y Pound Road
RL 36.528m

LEGEND :

EXISTING SERVICES	PROPOSED SERVICES
SANITARY SEWER STD. MH	SANITARY SEWER STD. MH
SANITARY SEWER VENTED MH	SANITARY SEWER VENTED MH
STORMWATER MH	STORMWATER MH
WATER FH VALVE	WATER FH VALVE
KERB	KERB

	NAME	SIGNED	DATE
DESIGNED BY	TODD INNESS		
CHECKED BY			

DAVIE LOVELL-SMITH
PLANNING SURVEYING ENGINEERING

116 Wrights Road P O Box 679 Christchurch 8140. New Zealand
Telephone: 03 379-0793 Website: www.dls.co.nz E-mail: office@dls.co.nz

JOB TITLE:

Pound Road Industrial Subdivision

SHEET TITLE:

Infrastructure Concept

DRAWING STATUS

For Information

SCALE : 1:1000@A1 1:2000@A3
DATE : June 2025
CAD FILE : J:\20739\Eng\Concept\E20739_Eng Concept_R0.dwg
DRAWN : JS
DRAWING No : E.20739
SHEET No: 8 OF 11
REVISION : R0

AMENDMENTS :

AMENDMENT	DATE	DESCRIPTION

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5) ORIGIN OF LEVELS
LEVELS ARE IN TERMS OF NZVD 2016

ORIGIN MARK EJ8Y Pound Road
RL 36.528m

NORTH

Lot 2
DP 403260

Lot 1
DP 23834

Lot 2
DP 23834

Haskells Road

74

STAGE 4

Lot 1
DP 24156

14

ROAD 2

Lot 2
DP 24156

2 x 45° BEND WITH THRUST BLOCK

R15.00

15

SW.20
ST.MH1050

13

Ø200mm uPVC PN12 WATERMAIN

Lot 5
DP 23834

16

SW.19
ST.MH1050

SW.26
ST.MH1200

12

Ø200mm uPVC PN12 WATERMAIN

STAGE 2

SW.18
ST.MH1200

17

18

Lot 6
DP 23834

37

38

36

19

20

DN63 (OD) PE100 PN16 O/S 1.5m FROM BDY

39

35

Ø200mm uPVC PN12 WATERMAIN

22

40

SW.17
ST.MH1200

34

44

41

33

DN63 (OD) PE100 PN16 O/S 1.5m FROM BDY

32

23

Lot 7
DP 23834

45° BEND WITH THRUST BLOCK

42

31

43

SW.15
ST.MH1500

30

DN63 (OD) PE100 PN16 O/S 1.5m FROM BDY

24

ROAD 3

45

SW.16
ST.MH1200

2 x 45° BEND WITH THRUST BLOCK

29

46

SW.14
ST.MH1050

SW.13
ST.MH1200

47

25

DN63 (OD) PE100 PN16 O/S 1.5m FROM BDY

28

DN90 (OD) PE100

LEGEND :

EXISTING SERVICES	PROPOSED SERVICES
SANITARY SEWER STD. MH	SANITARY SEWER STD. MH
SANITARY SEWER VENTED MH	SANITARY SEWER VENTED MH
STORMWATER MH	STORMWATER MH
WATER FH VALVE	WATER FH VALVE
KERB	KERB

	NAME	SIGNED	DATE
DESIGNED BY	TODD INNESS		
CHECKED BY			

DAVIE LOVELL-SMITH
PLANNING SURVEYING ENGINEERING

116 Wrights Road P O Box 679 Christchurch 8140. New Zealand
Telephone: 03 379-0793 Website: www.dls.co.nz E-mail: office@dls.co.nz

JOB TITLE:

Pound Road Industrial Subdivision

SHEET TITLE:

Infrastructure Concept

DRAWING STATUS

For Information

SCALE : 1:1000@A1 1:2000@A3

DATE : June 2025

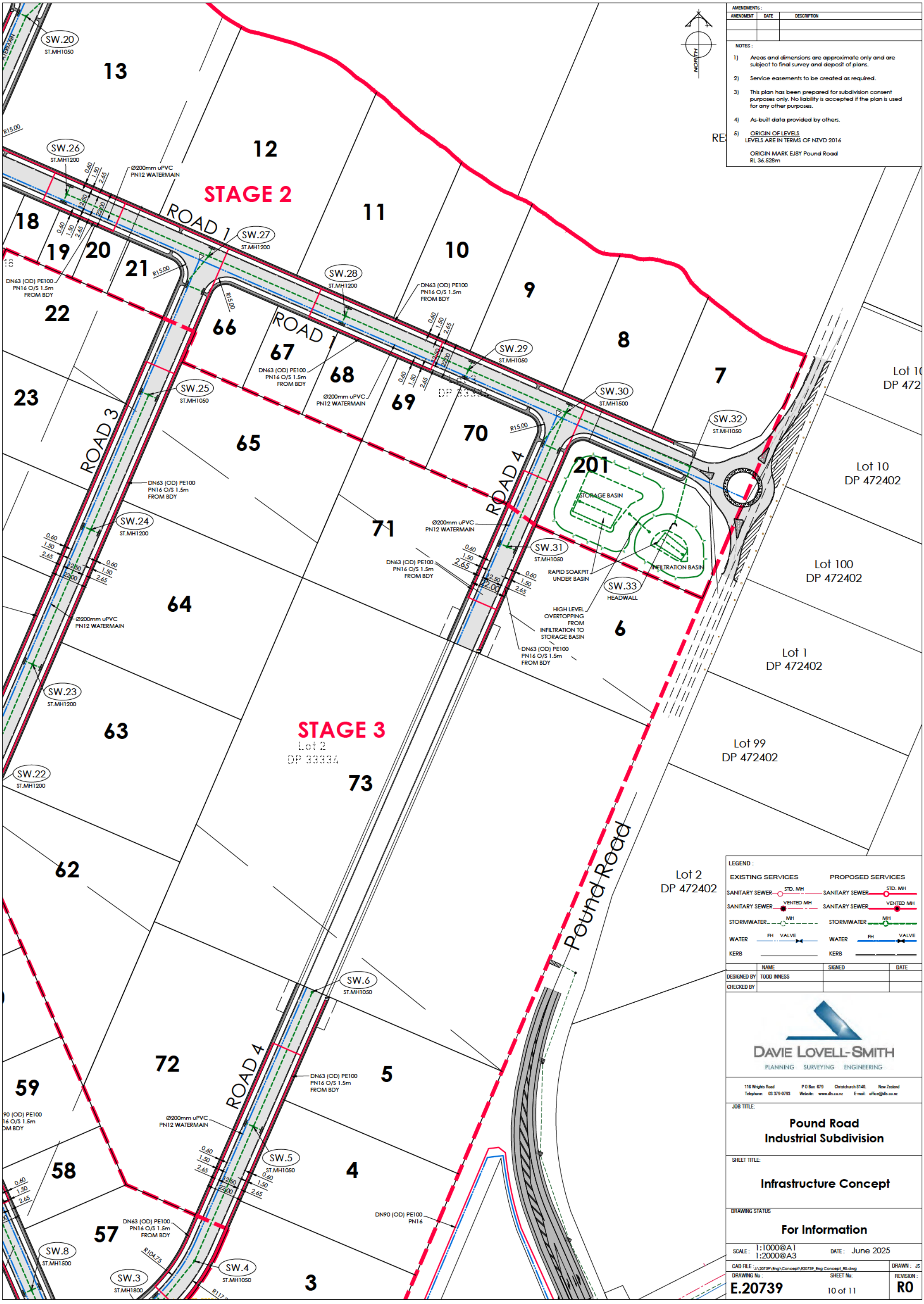
CAD FILE : J:\20739\Eng\Concept\E20739_Eng Concept_R0.dwg

DRAWN : JS

DRAWING No : E.20739

SHEET No: 9 of 11

REVISION : R0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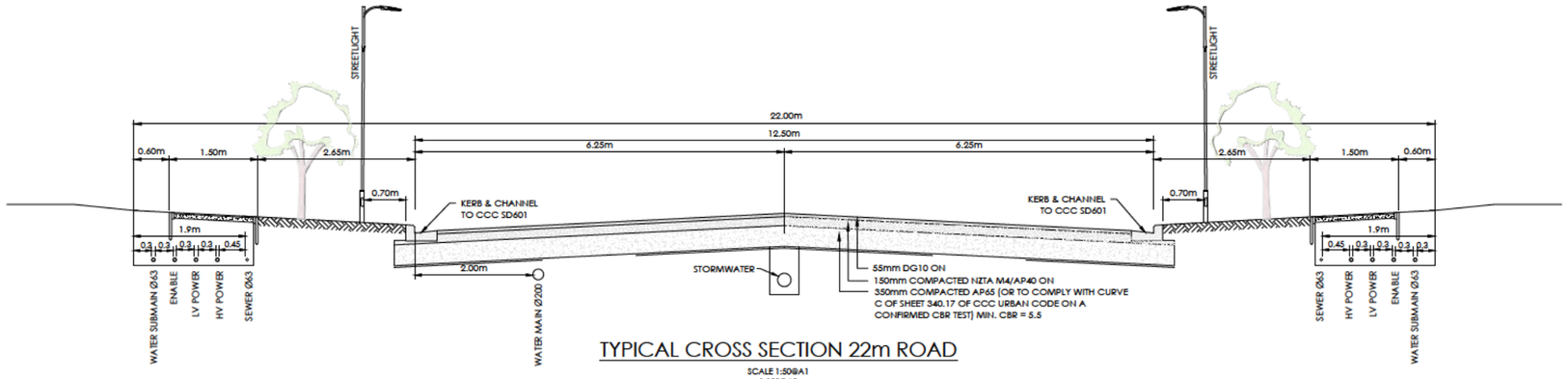
ST.MH1050
13
12
11
10
9
8
7
R15.00
SW.26
ST.MH1200
Ø200mm uPVC
PN12 WATERMAIN
STAGE 2
ROAD 1
SW.27
ST.MH1200
18
19
20
21
22
SW.28
ST.MH1200
DN63 (OD) PE100
PN16 O/S 1.5m
FROM BDY
SW.29
ST.MH1050
66
67
68
69
70
SW.25
ST.MH1050
SW.30
ST.MH1500
SW.32
ST.MH1050
23
ROAD 3
65
ROAD 4
201
STORAGE BASIN
INFILTRATION BASIN
RAPID SOAKPIT
UNDER BASIN
SW.31
ST.MH1050
SW.33
HEADWALL
HIGH LEVEL
OVERTOPPING
FROM
INFILTRATION TO
STORAGE BASIN
71
64
6
SW.24
ST.MH1200
SW.23
ST.MH1200
63
STAGE 3
Lot 2
DP 33334
73
SW.22
ST.MH1200
62
72
5
59
58
4
57
3
SW.6
ST.MH1050
SW.5
ST.MH1050
SW.8
ST.MH1500
SW.3
ST.MH1800
SW.4
ST.MH1050
R104.75
Lot 10
DP 472402
Lot 100
DP 472402
Lot 1
DP 472402
Lot 99
DP 472402
Lot 2
DP 472402
Pound Road
NORTH
AMENDMENTS :
AMENDMENT
DATE
DESCRIPTION
NOTES :
1) Areas and dimensions are approximate only and are subject to final survey and deposit of plans.
2) Service easements to be created as required.
3) This plan has been prepared for subdivision consent purposes only. No liability is accepted if the plan is used for any other purposes.
4) As-built data provided by others.
5) ORIGIN OF LEVELS
LEVELS ARE IN TERMS OF NZVD 2016
ORIGIN MARK EJ8Y Pound Road
RL 36.528m
LEGEND :
EXISTING SERVICES
PROPOSED SERVICES
SANITARY SEWER STD. MH
SANITARY SEWER VENTED MH
STORMWATER MH
WATER FH VALVE
KERB
NAME
SIGNED
DATE
DESIGNED BY
TODD INNESS
CHECKED BY
DAVIE LOVELL-SMITH
PLANNING SURVEYING ENGINEERING
116 Wrights Road P O Box 679 Christchurch 8140. New Zealand
Telephone: 03 379-0793 Website: www.dls.co.nz E-mail: office@dls.co.nz
JOB TITLE:
Pound Road
Industrial Subdivision
SHEET TITLE:
Infrastructure Concept
DRAWING STATUS
For Information
SCALE : 1:1000@A1
1:2000@A3
DATE : June 2025
CAD FILE : J:\20739\Eng\Concept\E20739_Eng Concept_R0.dwg
DRAWN : JS
DRAWING No :
E.20739
SHEET No:
10 of 11
REVISION :
R0



TYPICAL CROSS SECTION 22m ROAD

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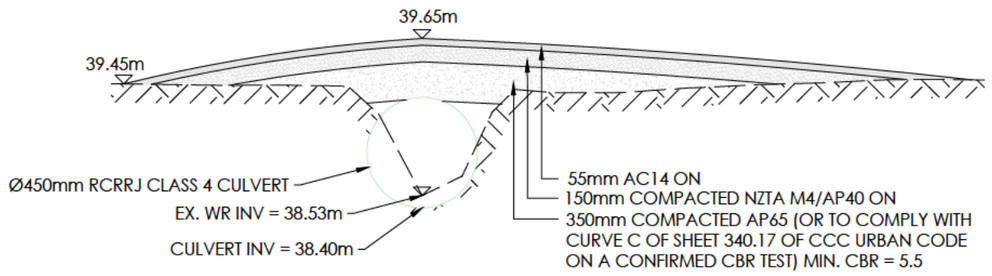
1:100@A3



TYPICAL CROSS SECTION A-A

SCALE 1:50@A1
1:100@A3

AMENDMENTS :

AMENDMENT	DATE	DESCRIPTION

NOTES :

1) Areas and dimensions are approximate only and are subject to final survey and deposit of plans.
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4) As-built data provided by others.

DAVIE LOVELL-SMITH
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JOB TITLE:
Pound Road Industrial Subdivision

SHEET TITLE:
Roading Cross Sections

DRAWING STATUS
For Information

SCALE : As Shown DATE : June 2025

CAD FILE : J:\20739\Eng\Concept\E20739_Eng Concept_R0.dwg DRAWN : JS

DRAWING No : **E.20739** SHEET No: 11 of 11 REVISION : **R0**

Appendix C – CCC Water Supply Modelling

Christchurch City Council

POUND ROAD INDUSTRIAL PARK - DEVELOPMENT

WATER SUPPLY MODELLING ASSESSMENT

3-CHDM1.06

CONFIDENTIAL

POUND ROAD INDUSTRIAL DEVELOPMENT
WATER SUPPLY ASSESSMENT

Christchurch City Council

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Christchurch, 8011
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REV	DATE	DETAILS
1.0	28/02/2024	Report for client review
1.1	30/04/2024	Clients review comments

	NAME	DATE	SIGNATURE
Prepared by:	Abhi Ramola	29/02/2024	Abhi Ramola
Reviewed by:	Dan Johnson	05/03/2024	D. Johnson
Approved by:	Sue Harrison	05/03/2024	S. Harrison

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

WSP has carried out a water supply development assessment for the proposed Pound Road Industrial development. The purpose of this assessment was to investigate if the development meets the Level of Services (Los) criteria, will meet fire flow requirements, and assess the impact of other proposed plan changes within the localised area.

The following scenarios have been conducted in this assessment.

MODEL	SCENARIO	DESCRIPTION
Base Model	LoS assessment	The network was tested for minimum pressure and maximum headloss criteria.
Base Model + Proposed Development on Pound Road	LoS assessment	The network was tested for minimum pressure and maximum headloss criteria.
	FW3 fire flow assessment	Two hydrants were tested for available fire flow against FW3 fire flow criteria
	Maximum available fire flow	Two hydrants were tested for the maximum available fire flow
Base Model + Proposed development on Pound Road + Plan Changes 16 and 17 (Templeton & Marshs)	LoS assessment	The network was tested for minimum pressure and maximum headloss criteria.

The results of the modelling assessment are summarised in the table below.

MODEL	SCENARIO	SUMMARY
Base Model	LoS assessment Pass	Minimum pressure and maximum headloss and velocity criteria are generally met. Properties on Dawsons Road has pressures below 20 m.
Base Model + Proposed Development on Pound Road	LoS assessment Fail	Pressure LoS is met at the Pound Road industrial development, with minimum pressure exceeding 25 m. The LoS is not met for the localised network as the model predicts high headlosses >10m/km along Foremans Road and Main South Road to Templeton booster PS. Therefore, the development fails to meet the LoS performance criteria due to the impact on the surrounding area.

	FW3 fire flow assessment Fail	Hydrants cannot maintain a minimum residual pressure of 10 m at the required fire flow. The maximum unit headloss of the Templeton booster pump outlet pipe and DN 150 section on Waterloo Road exceeds 20 m/km.
	Maximum available fire flow	The maximum available fire flow to the site is 25 L/s, or FW2 based on the current network.
Base Model + Proposed development on Pound Road + Plan Changes 16 and 17	LoS assessment Fail	LoS/performance criteria are not met. The current network cannot supply the combined plan changes (16, 17, and 19) without infrastructure upgrades to increase network capacity to achieve LoS/performance criteria.

In summary, the existing water supply network cannot service the Pound Road Industrial Estate without network upgrades to address high headlosses in the network and to meet fire flow requirements.

Growth within the wider water supply zone has not been considered as part of this assessment. A master plan is recommended for the Christchurch West Zone to develop options to service the proposed development area and consider future growth expansion. Infrastructure upgrades are required to reduce headlosses and increase capacity in the Templeton area to meet proposed growth/development and to improve the resilience of the water supply zone.

1 PROJECT BACKGROUND

1.1 INTRODUCTION

Christchurch City Council (Council) engaged WSP to carry out a demand and fire flow assessment of a proposed industrial development located to the North of Pound Road. A Plan Change application has been made to the Council for properties currently zoned as Rural Urban Fringe.

The proposed development contains 84 industrial sites with a peak demand of 39 L/s within a total area of approximately 61.4 ha. An overview of the proposed development and water supply network is shown in Figure 1-1.

The proposed development will be serviced from two connections off the existing uPVC DN200 PN12 pipe on Waterloo Road at the intersections of Pound Road and Barters Road. The proposed development is located within the West Pressure Zone and the Templeton booster zone and is supplied from the Templeton booster pump station.

Figure 1-2 shows the extent of plan changes near the Pound Road industrial development.

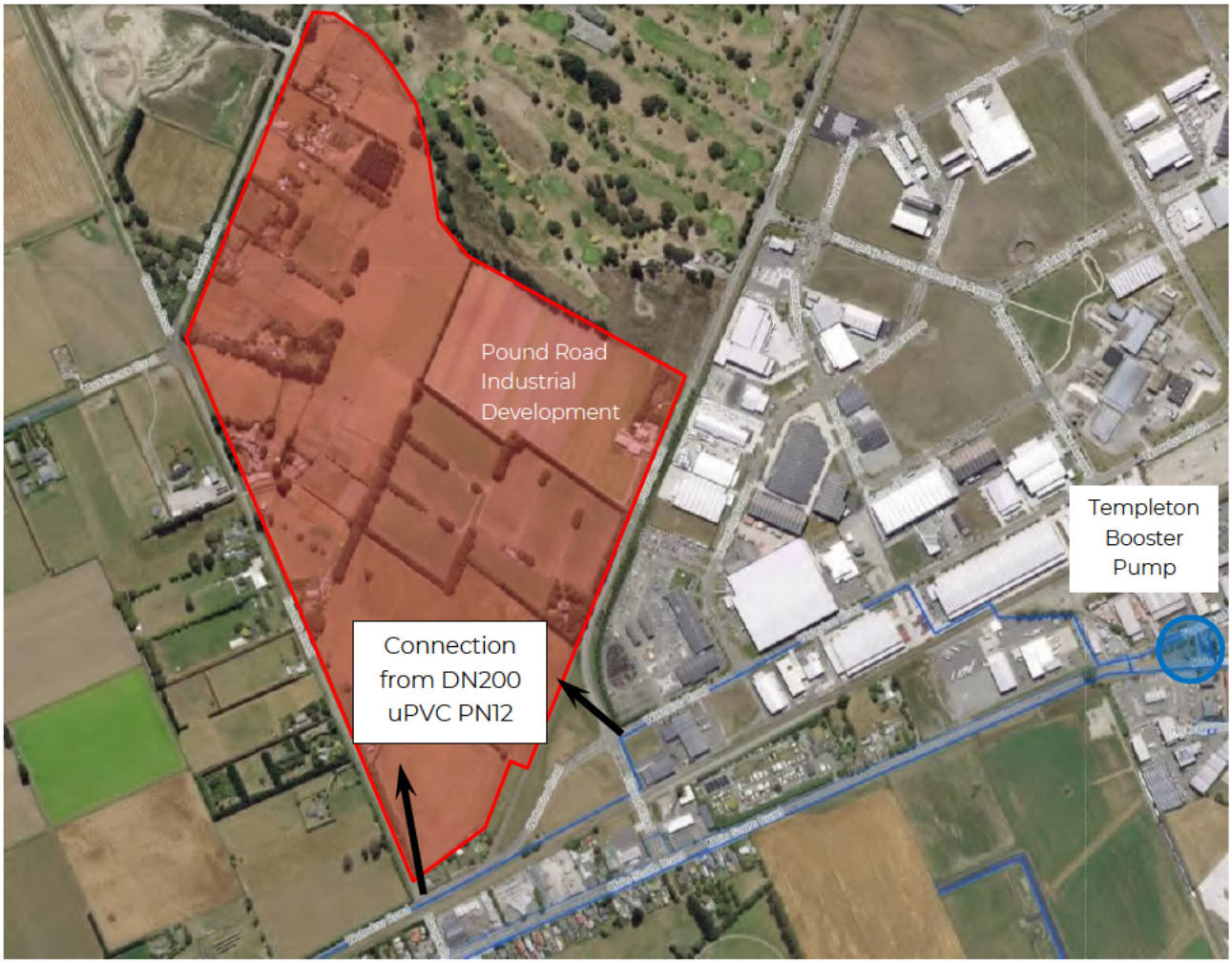

Figure 1-1: Location of the Pound Road industrial development and existing network

Figure 1-2: Plan Change Industrial developments within the Pound Road Area

1.2 OBJECTIVES

The objective of this study is to assess the Level of Services (LoS) and available fire flow to the proposed industrial network, and to include a scenario to determine the impact on LoS, with Plan Change 16 (Tempelton) and Plan Change 17 (Marshs Road) included.

An FW3 (50 L/s) fire flow assessment is to be carried out to determine the available fire flow to hydrants within the development, as per the New Zealand Fire Service Code of Practice (CoP).

The locations of the hydrants within the proposed industrial developments are currently not available. Therefore, for this assessment, we have allocated hydrants to the proposed network. This is to measure the available fire flow to the proposed Pound Road industrial development.

2 INFORMATION / DATA PROVIDED TO THE CONSULTANT

This section summarises the information received from the Council and the assumptions applied for this assessment.

2.1 PROPOSED INDUSTRIAL SITE DEMANDS

A summary of information related to the proposed industrial development site received from the Council is shown in Table 2-1.

Council also wishes to understand the network performance of other localised plan changes as presented in Table 2-2.

Table 2-1: Summary of proposed industrial demand

DEVELOPMENT	DEMAND CATEGORY	AREA (HA) / SITES	PEAK DEMAND (L/s)	WATER SUPPLY SOURCE
Pound Rd Development (Plan Change 19)	Commercial-10 Hours	61.4 / 84	39	Denton Station Well via Templeton booster pump station

Table 2-2: Plan Change Industrial developments within the localised area

DEVELOPMENT	DEMAND CATEGORY	AREA (HA) / SITES	PEAK DAY DEMAND (L/S)	WATER SUPPLY SOURCE
Templeton Industrial (Plan Change 16)	Commercial-10 Hours	68 / 100	47.0	Denton Station Well via Templeton booster pump station
Marshs Road Industrial (Plan Change 17)	Commercial-10 Hours	22.6 / 30	23.4	Denton Well Source

2.2 PERFORMANCE CRITERIA

The following performance criteria were used for the hydraulic assessment:

- **Level of Service (LoS) – Minimum pressure:** 200 kPa (20m) pressure at customer connection
- **Pipe Performance** – Maximum pipe headloss of 10 m/km under normal conditions and maximum pipe headloss of 5 m/km for trunk mains; and maximum velocity ≤ 1.5 m/s for normal conditions, < 3.0 m/s for emergency conditions.
- **Fire flow Assessment New Zealand Fire Service Code of Practice**; SNZ PAS 4509:2008 and subsequent amendments, to the satisfaction of the New Zealand Fire Service. Table 2-3 lists

the minimum fire flow requirements for the development sites.

Table 2-3: Fire Flow Requirements as per Fire Fighting Water Supply Code of Practice

CODE	DESCRIPTION	MAX. NUMBER OF HYDRANTS TO PROVIDE FLOW	REQUIREMENTS	
			Required Fire Flow (L/s)	Residual Pressure at Required Fire Flow (m)
FW3	Industrial	3	50	10
FW4	Industrial	4	100	10

2.3 ASSUMPTIONS, UNCERTAINTIES, AND LIMITATIONS

The following assumptions have been applied for this modelling assessment:

2.3.1 GENERAL

- WSP has used the InfoWorks WS Pro current peak day demand (PDD) model for this assessment:
  - Model Name: CCC Peak Day Demand Model:
    - Network: Peak Day Model – Pound Road - Network
    - Control: Peak Day Model – Pound Road - Control
    - Demand Diagram: Peak Day Demand 02/02/2020
  - Run Files: Pound Road Plan Change - Run Group

2.3.2 SCENARIO SPECIFIC

- WSP has used elevation data from LINZ to allocate ground levels to the proposed developments.
- Demand assumptions for Plan Change 16 (Templeton) and Plan Change 17 (Marshs Road) are based on the information provided by the Council as used for previous assessments and shown in Table 2-3.
- The CSD and NTP industrial sites and associated pipework are included in the base model.

3 MODELLING ASSESSMENT

3.1 BASE MODEL RESULTS

3.1.1 MINIMUM PRESSURE AND MAXIMUM UNIT HEADLOSS

This section presents the base model outcomes of the network before adding the proposed industrial demand.

Figure 3-1 shows the minimum pressure and maximum unit headloss results in the base model of the Pound Road industrial development.

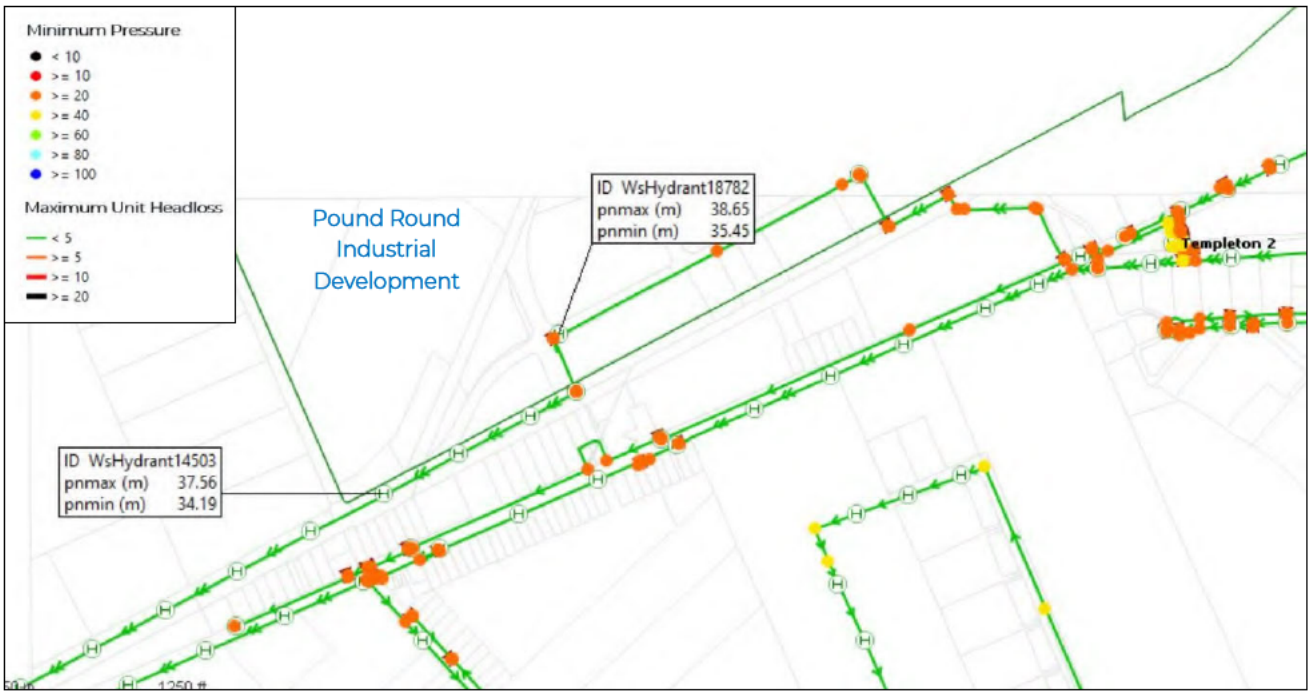

Figure 3-1: LoS results of the base model.

As shown in Figure 3-1, the minimum pressure in the existing water supply network at the proposed connection points on Waterloo Road is between 34-39 m. The localised pipe network meets the headloss criteria, as the maximum unit headloss of the pipes is less than 1.5 m/km.

As previously mentioned, the localised water supply network is supplied by Denton Station well via the Templeton booster pump station. The flow through the Templeton booster station in the base scenario is shown in Figure 3-2.

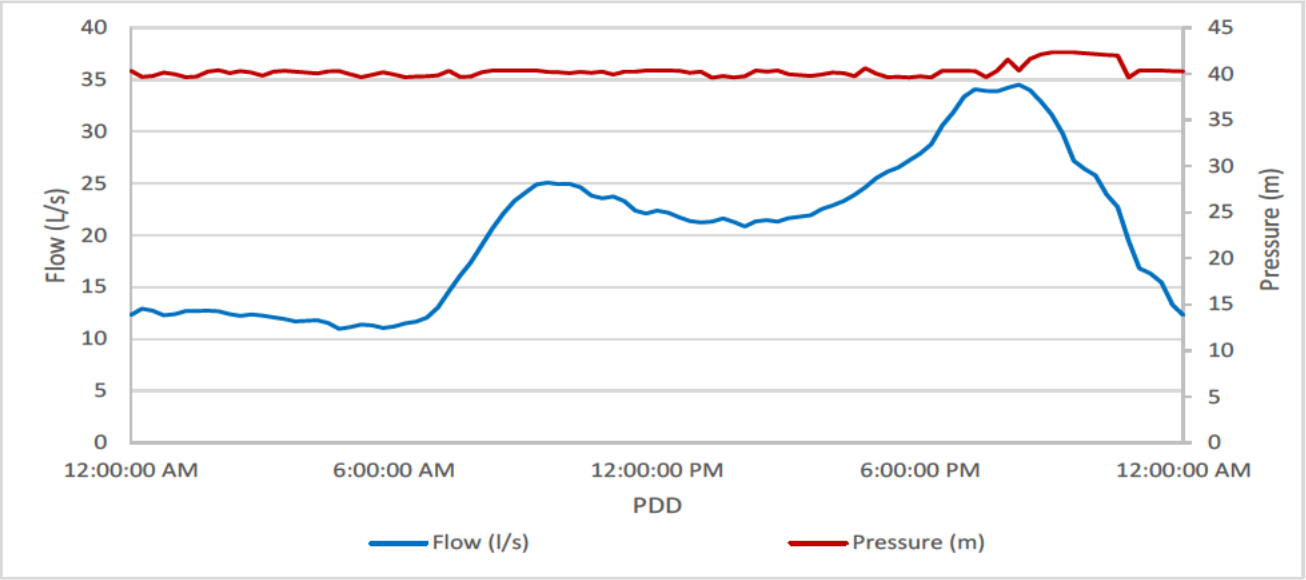

Figure 3-2 : Flow through the Templeton booster pump in the base model

3.2 POUND ROAD INDUSTRIAL DEVELOPMENT

3.2.1 MINIMUM PRESSURE AND MAXIMUM UNIT HEADLOSS

This section discusses the modelling results after adding the demands of the proposed Pound Road industrial development to the base model.

The proposed industrial peak demand of 39 L/s for the 84 industrial blocks was added to the base model. Figure 3-3 shows the minimum pressure and maximum unit headloss results for this scenario.

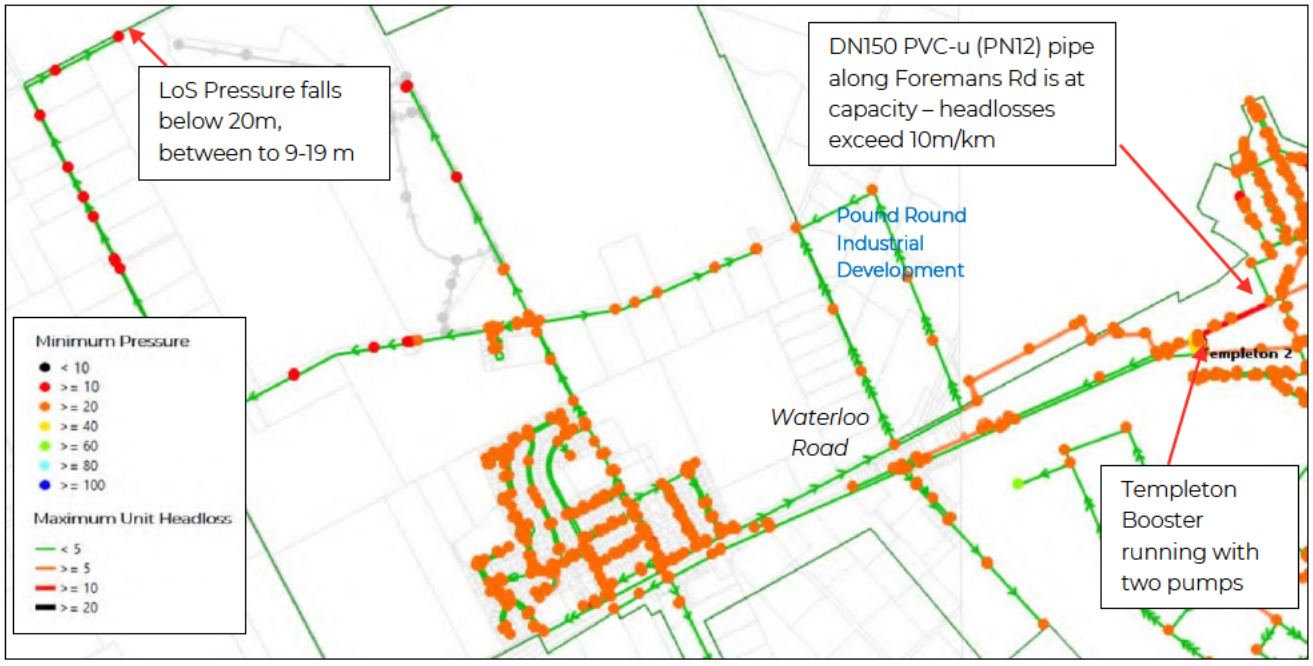

Figure 3-3 : LoS after adding the proposed Pound Road industrial development demand

As shown in Figure 3-3 the minimum pressure within the proposed Pounds Road industrial site at an elevation of 50 m is 25 m, therefore, the minimum pressure criteria are met. In addition, the high elevation areas within Templeton (>56 m) experience pressure below 20m with the addition of the industrial demand and fail to meet the LoS pressure requirements.

Two pumps are operating at the Templeton booster PS to meet the Pound Road industrial development demand. The maximum unit headloss of the Templeton booster pump outlet pipe and the existing DN 150 pipe section (20m) on Waterloo Road exceed 20 m/km. The Templeton booster flow and discharge pressure are presented in Figure 3-4. The maximum flow through the Templeton pump station is approximately 64 L/s.

Pipe headlosses of approximately 10 m/km are experienced on sections of pipe on Foremans Road and Main South Road to Templeton booster PS. In addition, the pipe headloss exceeds 5 m/km on Waterloo Road to the Pound Road industrial development.

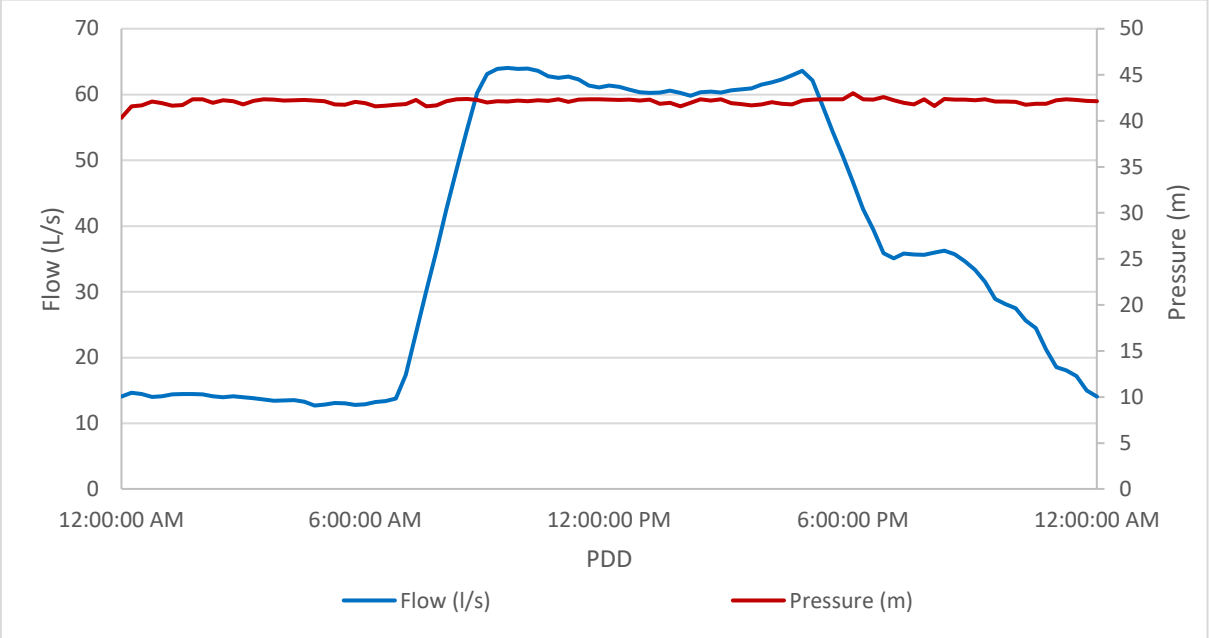

Figure 3-4 : Flow through the Templeton booster pump with Pound Road Industrial Development

3.2.2 AVAILABLE FIRE FLOW

Fire flow tests were run to investigate the available fire flow to the proposed Pound Road industrial development.

An FW3 (50 L/s) fire flow assessment was modelled following the CoP to determine the available fire flow for the development site. Hydrants were applied to the model within the Pound Road ring main for the fire flow assessment. No hydrant location information was provided for the development of the existing network.

An exceptional flow of 25 L/s was allocated to two hydrants for 30 minutes at the 60% peak day demand, to supply a total flow of 50 L/s. The fire flow results are summarised in Table 3-1.

Table 3-1: Summary of fire flow results

HYDRANT	FIRE FLOW ACHIEVED (L/S)	RESIDUAL PRESSURE AT REQUIRED FIRE FLOW (M)	GROUND ELEVATION (M)
1	25	0	50
2	25	0	50

As shown in Table 3-1, the two selected hydrants are not able to meet a residual pressure greater than 10 m when providing 50 L/s, therefore they do not provide the FW3 fire flow criteria.

Figure 3-5 shows the minimum pressure of the localised water supply network supplied by the Templeton booster PS is less than 10 m. All three pumps at Templeton booster PS are available and in operation for the fire flow simulation. However, as the DN 200 supply mains on Waterloo Rd and Main South Rd to Templeton booster PS experience headlosses of 30 m/km, and 10 m/km under normal demand conditions, there is not sufficient pipe capacity to meet the fire flow demand on both the up and downstream of the Templeton booster PS. The DN 150 pipe section on Waterloo Road does not meet the performance criteria under emergency conditions, as the velocity exceeds 3 m/s and the headloss is 60 m/km.

In summary, the available fire flow to the proposed Pound Road industrial development site does not meet the FW3 criteria. Significant upgrades to the upstream supply pipes and the Templeton booster PS are required to achieve FW3 fire flows at the Pound Road industrial development site. The Templeton flow and pressure are shown in Figure 3-6 for the fire flow simulation.

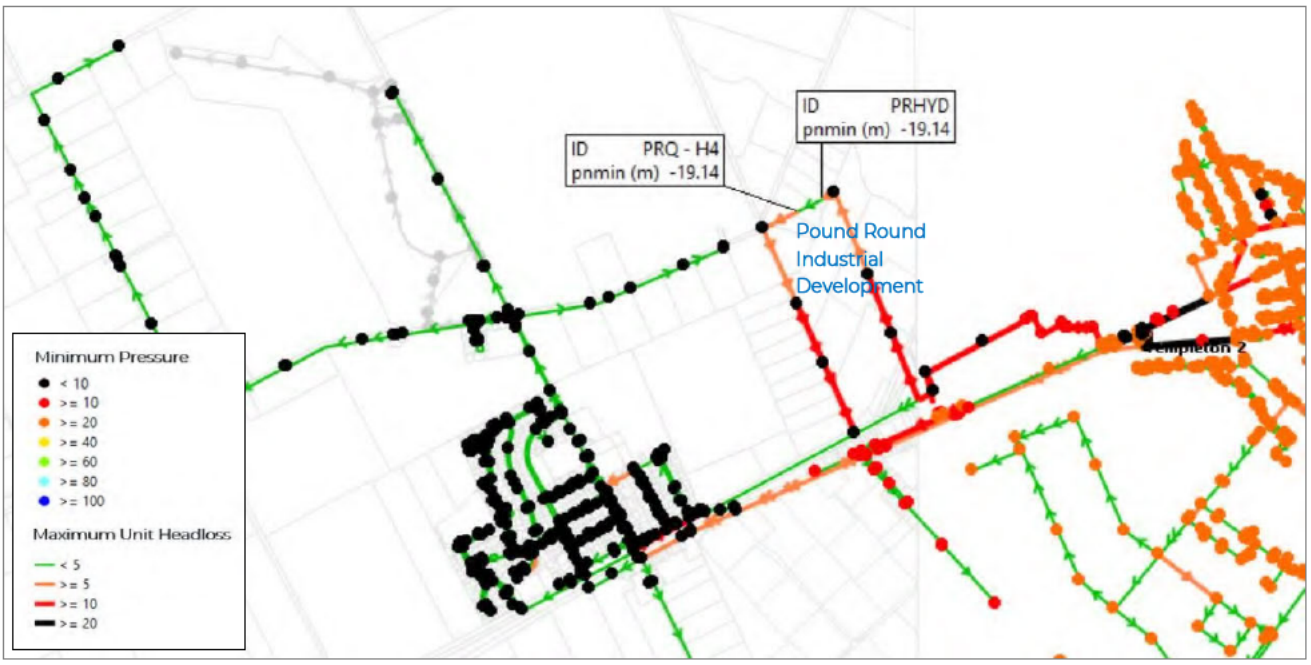

Figure 3-5 : LoS results in the available fire flow scenario for FW3 criteria

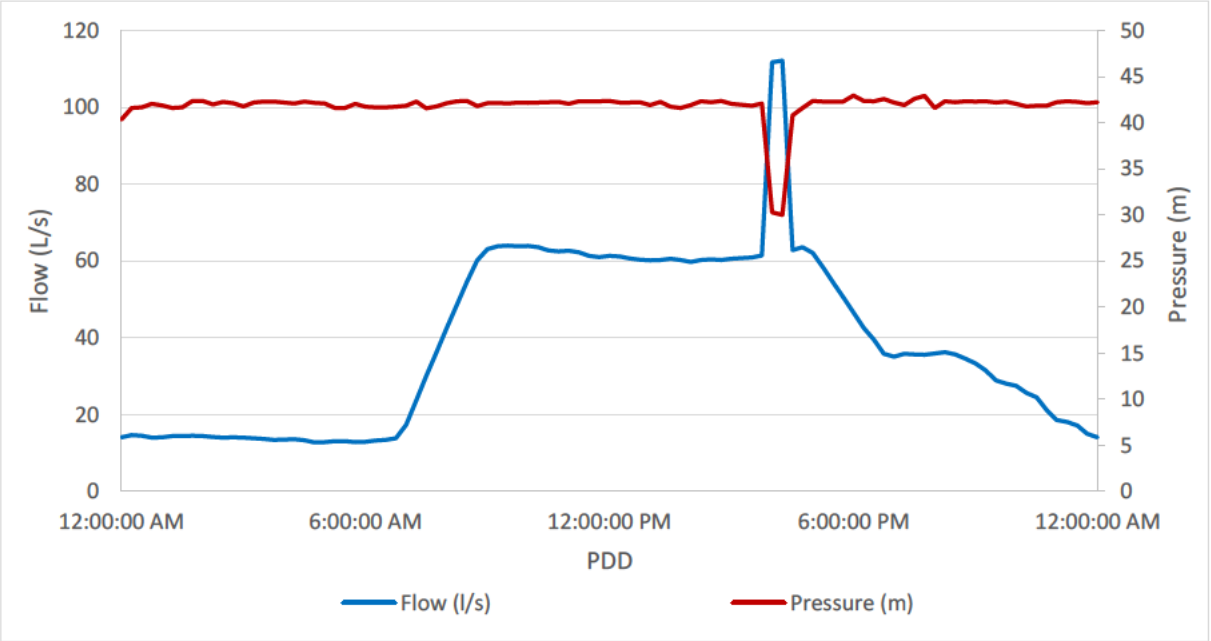

Figure 3-6 : Flow through the Templeton booster pump during the FW3 fire flow simulation

To identify the maximum available fire flow from the existing network to the development, further model simulations were carried out. Table 3-2 summarises the results.

Table 3-2: Summary of fire flow results

REQUIRED FIRE FLOW (L/S)	HYDRANT	MINIMUM FIRE FLOW (L/S)	RESIDUAL PRESSURE AT MINIMUM FIRE FLOW (M)
25	1	12.5	12.7
	2	12.5	12.8

As per the results listed above, the maximum available fire flow achievable at the proposed site is approximately 25 L/s. This means that FW2 is the maximum fire flow criteria achievable for the proposed site with the current water supply infrastructure.

3.2.3 LOS WITH LOCALISED PLAN CHANGES (16,17)

Demand scenario to include Plan Change 1 (Templeton) and Plan Change 17 (Marshs Road) with the Pound Road industrial development (Plan Change 19).

As shown in Figure 3-7 the trunk and localised network experiences excessive headlosses resulting in low pressures below 10 m. The current network does not have sufficient capacity to meet the proposed plan changes without upgrades to infrastructure, namely the Templeton booster PS (see Figure 3-8) and pipework to and from the booster PS. For this scenario, additional pumps have been turned on at the Denton and Sockburn pump stations.

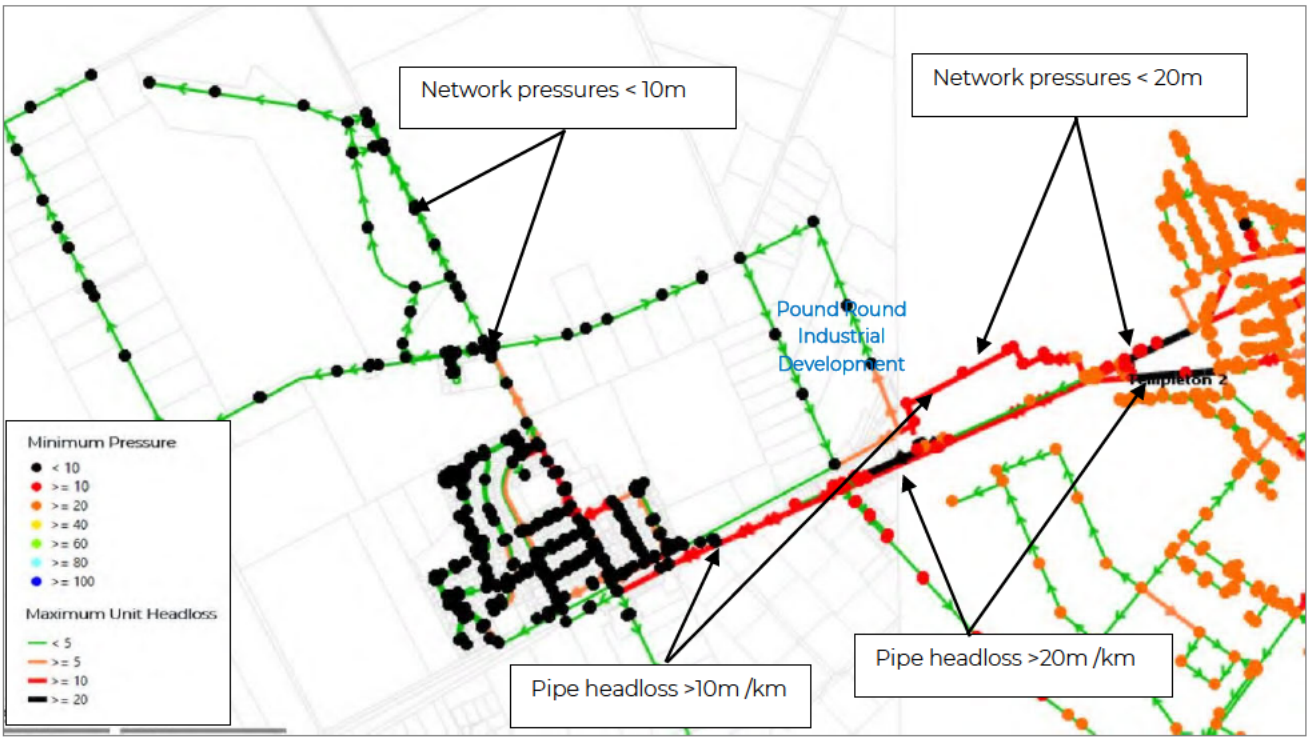

Figure 3-7: Templeton Booster Flow/Pressure with Plan Changes (16, 17 and 19)

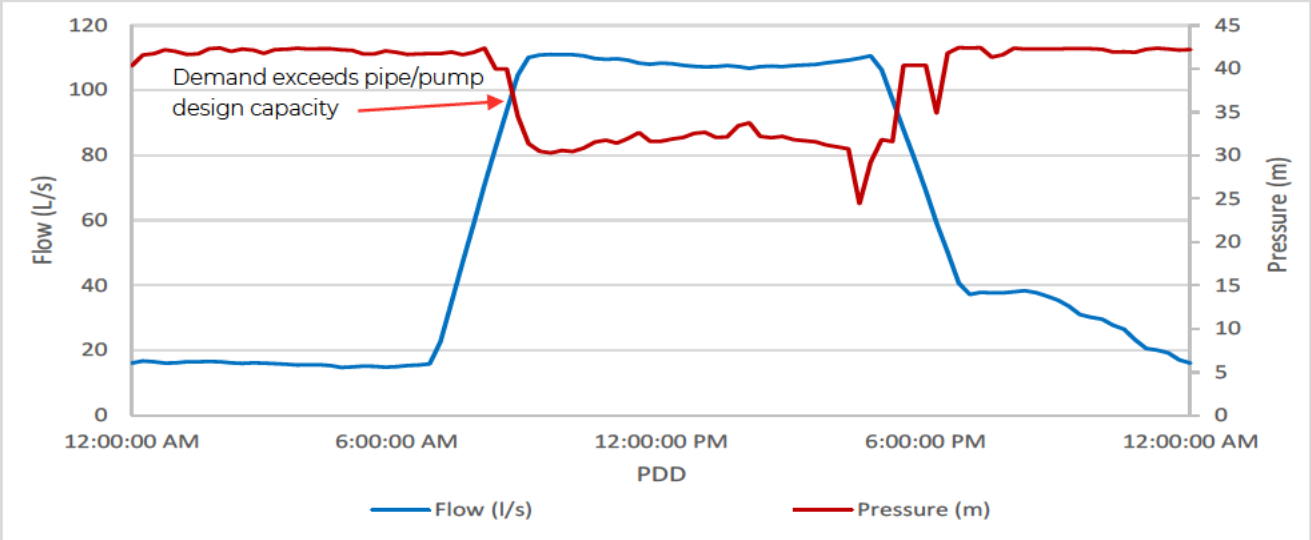

Figure 3-8: Templeton Booster Flow / Pressure with Plan Changes (16, 17 and 19)

A summary of the modelling assessment is presented below:

- The existing Templeton boosted zone meets the LoS requirements, except for the Dawsons Road area where the minimum pressures are between 10-20 m. This is due to the elevation difference, as it changes from approximately 50-52 m to over 60 m.
- The minimum pressure requirements were met when the Pound Road industrial site demands (39 L/s) were added to the model. The minimum pressures of the existing Templeton zone are above 20 m and therefore meet the LoS performance criteria.
- FW3 fire flow criteria are not achieved, as the Templeton booster pump outlet was not able to supply the required fire flow due to high headlosses in the upstream and downstream pipes. The existing DN 150 pipe section on Waterloo Road experiences higher headlosses when the size reduces from DN 200. As a result, the hydrants are not able to maintain a

residual pressure of 10 m at the required fire flow.

- The maximum available fire flow for the proposed site is 25L/s, which means FW2 fire flow criteria can be achieved.
- The current network cannot supply the combined plan changes (16, 17, and 19) without infrastructure upgrades to increase network capacity to achieve LoS/performance criteria. Network pressures are below 10m across the Templeton area, as the Templeton booster pump and localised pipework are undersized to meet the demand.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

Council engaged WSP on behalf of the plan change applicant to carry out a modelling assessment for the proposed industrial development on Pound Road. The key findings from this modelling assessment are summarised below.

- The base scenario (current peak day demand) was carried out for the existing Templeton boosted zone. The existing localised area maintained a minimum pressure between 20-30 m. However, the minimum pressures of the properties along Dawsons Road are between 10-20 m due to higher elevation in the area (over 60 m). The localised pipe network meets the headloss criteria.
- The proposed development demand (peak demand of 39 L/s) was added to the base model in to investigate the LoS results. The minimum pressure criteria were met, with the pressure exceeding 25 m, however the localised network experiences headlosses that exceeds 10m/km. The development fails to meet the LoS performance criteria due to the impact on the surrounding area and will require upgrades to and from the Templeton booster PS to service the Pound Road Industrial Estate.
- Fire flow model runs were carried out to determine the available fire flow to the proposed industrial development site on Pound Road.
- FW3 criteria is not achievable as the selected hydrants were not able to provide a residual pressure of 10 m at the required fire flow. The localised network also fails to maintain a minimum pressure of 10 m during the fire simulation.
- The existing DN 200 DI booster pump outlet pipe section has a maximum unit headloss higher than 20 m/km. The maximum flow that the pipe section could deliver is 74 L/s.
- The pipe section on Waterloo Road also experiences a unit headloss greater than 20 m/km, when the pipe size changes from DN 200 (PVC) to DN 150 (AC) near the Bicknor St intersection.
- The maximum available fire flow to the site, with the existing water supply network is approximately 25 L/s. This means the FW2 residential fire flow criteria is achievable.
- Pipe upgrades in the network, plus increased capacity at Templeton booster PS are required to service the proposed industrial development to meet fire flow requirements.
- The current network cannot service all the proposed plan changes within the Templeton area without infrastructure upgrades.

4.2 RECOMMENDATIONS

Further modelling is recommended to develop options to provide sufficient capacity to support future growth and meet fire flow requirements for the proposed industrial area.

In addition, it was noticed that the Templeton booster pump is the only supply option for the Templeton industrial area. Consideration should be given to improving the security of supply/resilience, with alternative supply options to the Templeton area that includes localised storage options. Future supply options should also include growth and development scenarios for the localised area.

5 LIMITATIONS

This report ('Report') has been prepared by WSP New Zealand Limited ('WSP') exclusively for Christchurch City Council ('Client') in relation to Pound Road Industrial Development – Modelling Assessment ('Purpose') and in accordance with the Short Form Agreement – WS Model Query Request – Plan Change Pound Road Industrial Extension with the Client dated 19/12/2023 ('Agreement'). The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any use or reliance on this Report, in whole or in part, for any purpose other than the Purpose or for any use or reliance on this Report by any third party.

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

Appendix D – Water Supply Calculations

Pipe Hydraulics Using Colebrook-White equation in simplified usage mode
(water at 15 degrees celcius (kinematic viscosity 1.141x10-6 m²/s))

PROJECT : Pound Road - Water Supply Headloss **JOB NO:** 21222
DATE: 16/05/2025

Pipe diameter	**200**	mm	D =	*0.2 m*
Gradient - 1 in	**120**	HGL	S =	*0.008333333*
Pipe Roughness - ks	**0.15**	mm	ks =	*0.00015 m*

Results for Full Bore Conditions:

Velocities	**1.284**	m/s	
Discharge	**40.34**	litres/sec	Allowed for 80 lots @
Discharge	**0.0403**	m³/sec	0.5l/s/lot

Part-Full Conditions:

Proportion depth =	**1.00**	(between 0 and 1)
Actual depth =	**200**	mm
Velocity	**1.284**	m/s
Discharge	**40.34**	litres/sec
Discharge	**0.0403**	m³/sec

Appendix E – CCC Sewer Modelling

Memorandum

To	Michele McDonald
Copy	Sue Harrison (WSP)
From	Kelsey van der Schyff
Office	Christchurch
Date	11 January 2024
File/Ref	3-CHDM1.05 / 00002
Subject	Wastewater Model Query Request - Plan Change 19: Pound Road Industrial
Ref	\\corp.pbwan.net\ANZ\ProjectsNZ\3c\3-CHDM1.05 WW Network Modelling for Asset Planning\Home\Queries\00002 - Plan change 19 - Round Road Industrial

1 Introduction

Christchurch City Council (Council) engaged WSP to model the effect of a proposed commercial development near Pound Road on the wastewater network. Council provided the following information for this investigation:

- The development is to be modelled as Industrial Park or Sewer Limited Area, with an average sewer flow of 0.09 L/s/ha.
- Two service options are to be modelled. These are:
    - Gravity system, discharging to the manhole WwAccess45973. A maximum flow (MF) of 28 L/s is to be applied.
    - Local pressure sewer, with a maximum flow of 10 L/s to be applied.

These service options are to be modelled with and without growth. An additional growth scenario will be made for each service option which also includes plan changes 16 (Templeton) and 17 (Marshs Road), which have been modelled previously.

2 Modelling

2.1 Assumptions, Uncertainties, and Limitations

General

- This assessment was performed using InfoWorks ICM v9.0.7, using the existing 2020 wastewater model[1]. Only the existing model (Version 636) was used. It was assumed that this model is suitable for this assessment. More details on this model can be found in the

[1] WSP model reference: *dcapa500app57:40000/CCC 2019 InfoNet*

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Christchurch City Wastewater Model: Model Update and Calibration Report (WSP, 2020).

- This model is predominately a trunk main model. Hence, pipes smaller than DN 225 are generally not included in the model unless this would cause connectivity issues. Additionally, subcatchments in this model can be quite large and are not split up by each manhole. If required during development inquiries, pipes smaller than DN 225 can be added to the model and large subcatchments can be split up to better reflect the flow distributions in the area.
- Pump stations are modelled using a "screw pump". The modelled pump operates continuously with the discharge rate matching the incoming flow up to the maximum possible pump rate, as opposed to start-stop operation. This method reduces model run times but may lead to under predictions of peak flows downstream.
- For wet weather flow (WWF), there are two design events available for this model. The first is the compliance design event, which was provided by Council in September 2020 and is assumed suitable for compliance assessments. The second is the planning design event, which is the same as the compliance event but shifted by three days and 13 hours such that the peak rainfall aligns with peak growth trade flows. The planning design event was used for this assessment. For more details on the planning design storm, refer to *Design Storm Modification – May 2021 Update Memorandum* (WSP, 25 May 2021).
- The impact of this development during WWF was assessed using the planning design event. However, a variety of storm events would be necessary to fully understand the impact of WWF on the network. Variables to consider include the annual exceedance probability (AEP), intensity, duration, and timing of the event with respect to flow patterns in the network.
- The wastewater network model has both a Base Model and a Growth Model. The base model represents the current network and flow inputs. The Growth Model has committed network and growth changes included in addition to the Base Model.

  More information on the creation of the Growth Model can be found in *Christchurch City Wastewater Model-Updated Growth Model Report* (WSP, 17 June 2020, Council ref CPMS#51866). In summary, the Growth Model differs from the Base Model through the inclusion of the following:

  - City wide population uplift using Stats NZ 2013 Meshblocks with Council calculated 2041 populations.
  - Identified population growth areas from 2016 with either lot density or number of lots.
  - Large industrial / commercial areas:
    - Christchurch Airport
    - Dakota Park, Memorial Avenue Investments Ltd (MAIL) and North West Review Area 3 (NWRA3)
    - Ravensdown
    - East Frame (mixed use)
    - Riccarton Park (mixed use)
  - Additional industrial / commercial areas modelling using *IDS Part 6* (CCC, December 2018)

Scenario Specific

- The nearest flow monitor is Annex, a long-term flow monitor installed in manhole WwAccess6455. A good level of calibration was achieved against data between February 2018 and June 2019 (WSP, 2020), although the model in this area can over-predict slow response for large summer rainfall events.
- Council have requested that plan changes 16 (Templeton) and 17 (Marshs Road) are modelled with the Pound Road development in additional scenarios. See the relevant memorandums ***Templeton Plan Change*** (WSP, 5 October 2023) and ***Marshs Road Industry*** (WSP, 20 September 2023) for more detail.
- Private infrastructure for the development has not been modelled.
- Council provided the following information for the development flows:
    - The development area is shown in Figure 2-1, in between Barters Road, Waterloo Road, and Pound Road. The approximate size of the development is 61.3 hectares. The plan change is from Rural Urban Fringe to Industrial Park or Sewer Limited Area. Hence, an average sewer flow of 5.5 L/s is to be applied.
    - For service option 1 (gravity discharge to WwAccess45973), the maximum flow to be applied is 28 L/s.
    - For service option 2 (local pressure sewer), the maximum flow to be applied is 10 L/s, since inflow and infiltration is not included due to the attenuation already included in the system.
- The maximum flow for service option 1 was applied by calculating the required runoff area. For simplicity, this maximum flow was modelled as impervious runoff only, and the pervious runoff area was set to 0.
- Council have requested that the growth flows for Waterloo Business Park and the Department of Corrections are confirmed for the growth scenarios of this assessment. Hence, the growth applied for these areas is summarised in Table 2-1.

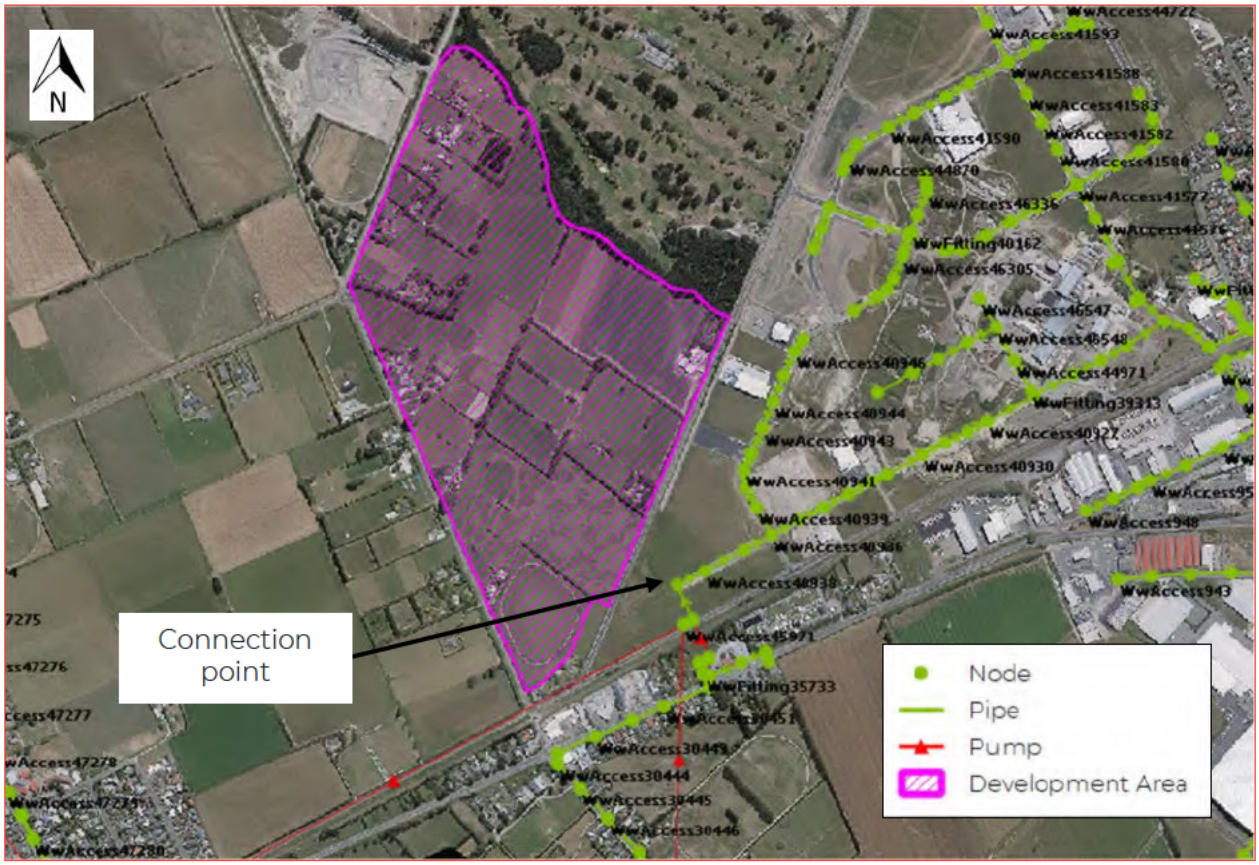


Figure 2-1: Development Location Plan.

Table 2-1: Growth flows for the Department of Corrections and Waterloo Business Park.

Department of Corrections			
Subcatchment ID	Base Scenario ASF (L/s)	Growth Scenario ASF (L/s)	Growth Scenario PWWF (L/s)
Christchurch Mens Prison	4.3	15.3	31.9
Christchurch Womens Prison	0.6	5.6	11.6
Waterloo Business Park			
Subcatchment ID	Base Scenario ASF (L/s)	Growth Scenario ASF (L/s)	Growth Scenario PWWF (L/s)
Islington Park	1.00	4.2	16.3
Islington Park A	1.1	4.7	18.5
Islington Park CB6	1.0	1.0	1.2
Islington Park CB6_1	1.3	1.3	1.6

2.2 Methodology

The following methodology was undertaken:

1 Two scenarios were made based on the Base model – one for each service option.

2 For service option 1 (gravity), the development subcatchment was added as shown in Figure 2-1, connecting to the manhole WwAccess45973. The average sewer flow was applied as trade flow with an average dry weather flow of 5.5 L/s and a peak dry weather flow of 10 L/s. For the maximum flow during wet weather, the impervious runoff area was calculated using the rational method to achieve the desired peak wet weather flow for the planning design storm. This impervious area was then adjusted according to model results to achieve a closer match to the specified maximum flow. For simplicity, the pervious runoff area was set to 0.

3 For service option 2 (local pressure sewer), the development subcatchment was set to drain to the same manhole WwAccess45973. It is assumed there is no inflow and infiltration for this option, hence the impervious and pervious runoff areas were set to 0. The maximum flow of 10 L/s thus was applied as the peak dry weather flow of the trade profile.

4 Four more scenarios were created for the service options. These were:

   (a) Growth model with service option 1.

   (b) Growth model with service option 2.

   (c) Growth model with service option 1 and plan changes 16 and 17.

   (d) Growth model with service option 2 and plan changes 16 and 17.

5 Simulations were run for each of the six scenarios in dry weather flow (DWF) and wet weather flow (WWF), using the planning design storm for the latter.

3 Results

3.1 Service Option One: Gravity

3.1.1 Dry Weather Flow

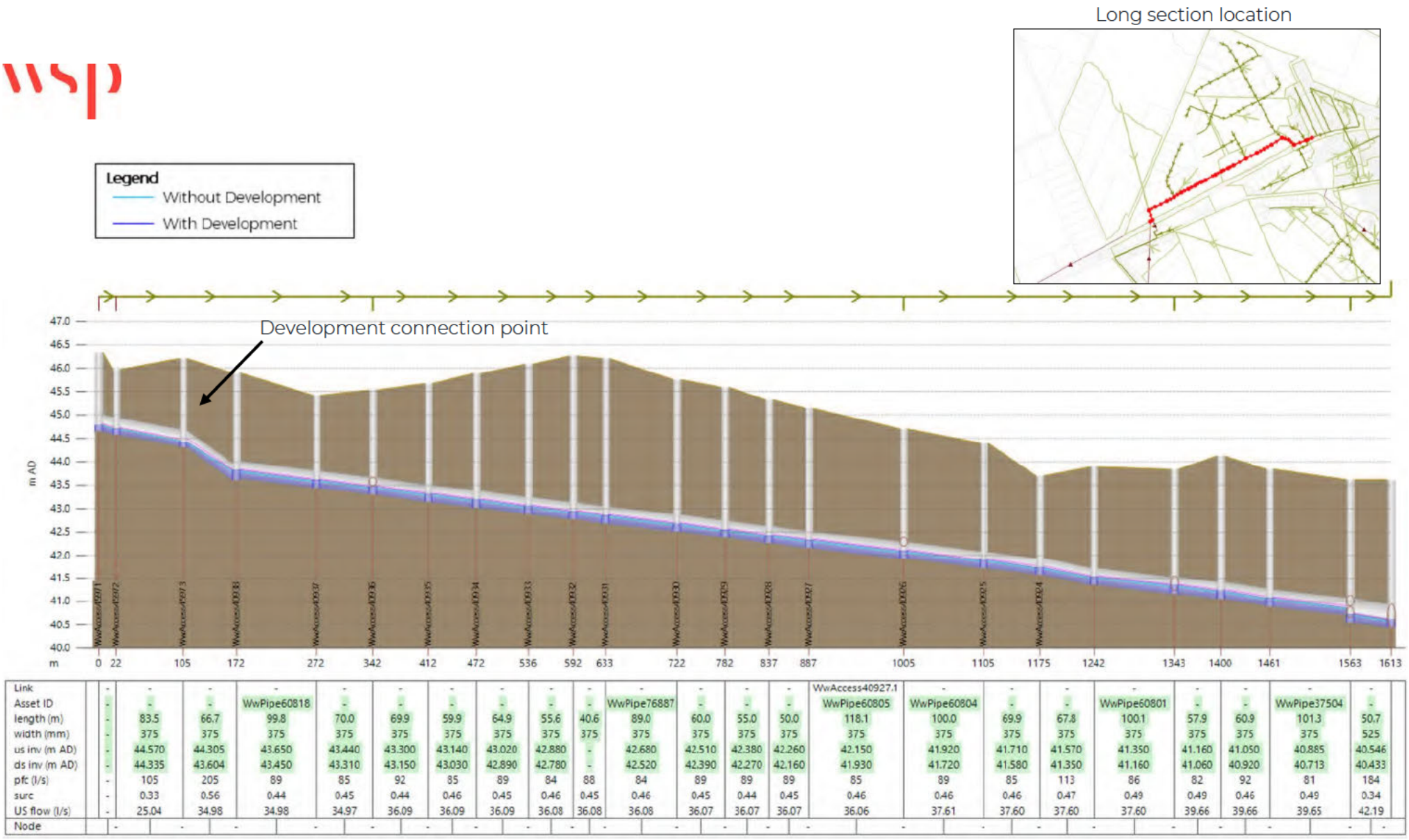
There are no capacity issues predicted for the Base scenario during dry weather flow for service option 1 – see Figure 3-1.

Some minor capacity issues are predicted for the Growth scenario, as shown in Figure 3-2. The long section shows surcharged pipes, however, there is still considerable freeboard available.

Figure 3-3 shows that the development is predicted to cause capacity issues with the inclusion of plan changes 16 and 17 in the Growth scenario – including a manhole overflow. The effect of the development on the overflow volume is shown in Table 3-1.

Table 3-1: Comparison of overflow volume with and without the development (service option 1) in dry weather flow, for the Growth scenario with plan changes 16 and 17.

Manhole ID	Spill Volume without Development (m^3)	Spill Volume with Development Volume (m^3)	Increase in Spill Volume (m^3)	Percentage Increase (%)
WwAccess45972	368	919	551	150



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length (m)	-	83.5	66.7	99.8	70.0	69.9	59.9	64.9	55.6	40.6	89.0	60.0	55.0	50.0	118.1	100.0	69.9	67.8	100.1	57.9	60.9	101.3	50.7	
width (mm)	-	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	525	
us inv (m AD)	-	44.570	44.305	43.650	43.440	43.300	43.140	43.020	42.880	-	42.680	42.510	42.380	42.260	42.150	41.920	41.710	41.570	41.350	41.160	41.050	40.885	40.546	
ds inv (m AD)	-	44.335	43.604	43.450	43.310	43.150	43.030	42.890	42.780	-	42.520	42.390	42.270	42.160	41.930	41.720	41.580	41.350	41.160	41.060	40.920	40.713	40.433	
pfc (l/s)	-	105	205	89	85	92	85	89	84	88	84	89	89	89	85	89	85	113	86	82	92	81	184	
surc	-	0.33	0.56	0.44	0.45	0.44	0.46	0.45	0.46	0.45	0.46	0.45	0.44	0.45	0.46	0.46	0.46	0.47	0.49	0.49	0.46	0.49	0.34	
US flow (l/s)	-	25.04	34.98	34.98	34.97	36.09	36.09	36.09	36.08	36.08	36.08	36.07	36.07	36.07	36.06	37.61	37.60	37.60	37.60	39.66	39.66	39.65	42.19	
Node	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Figure 3-1: DWF – Base model – service option 1.

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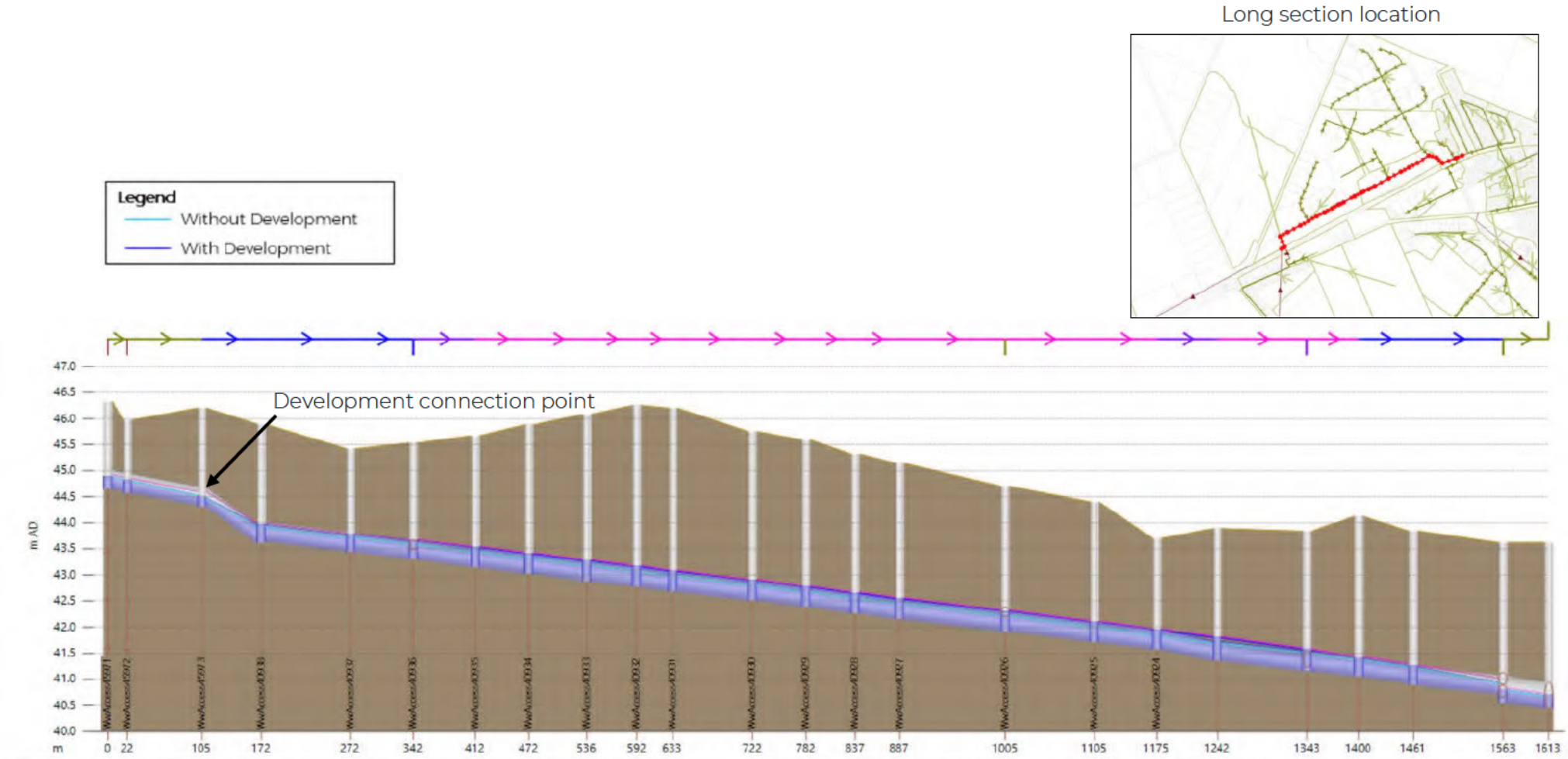

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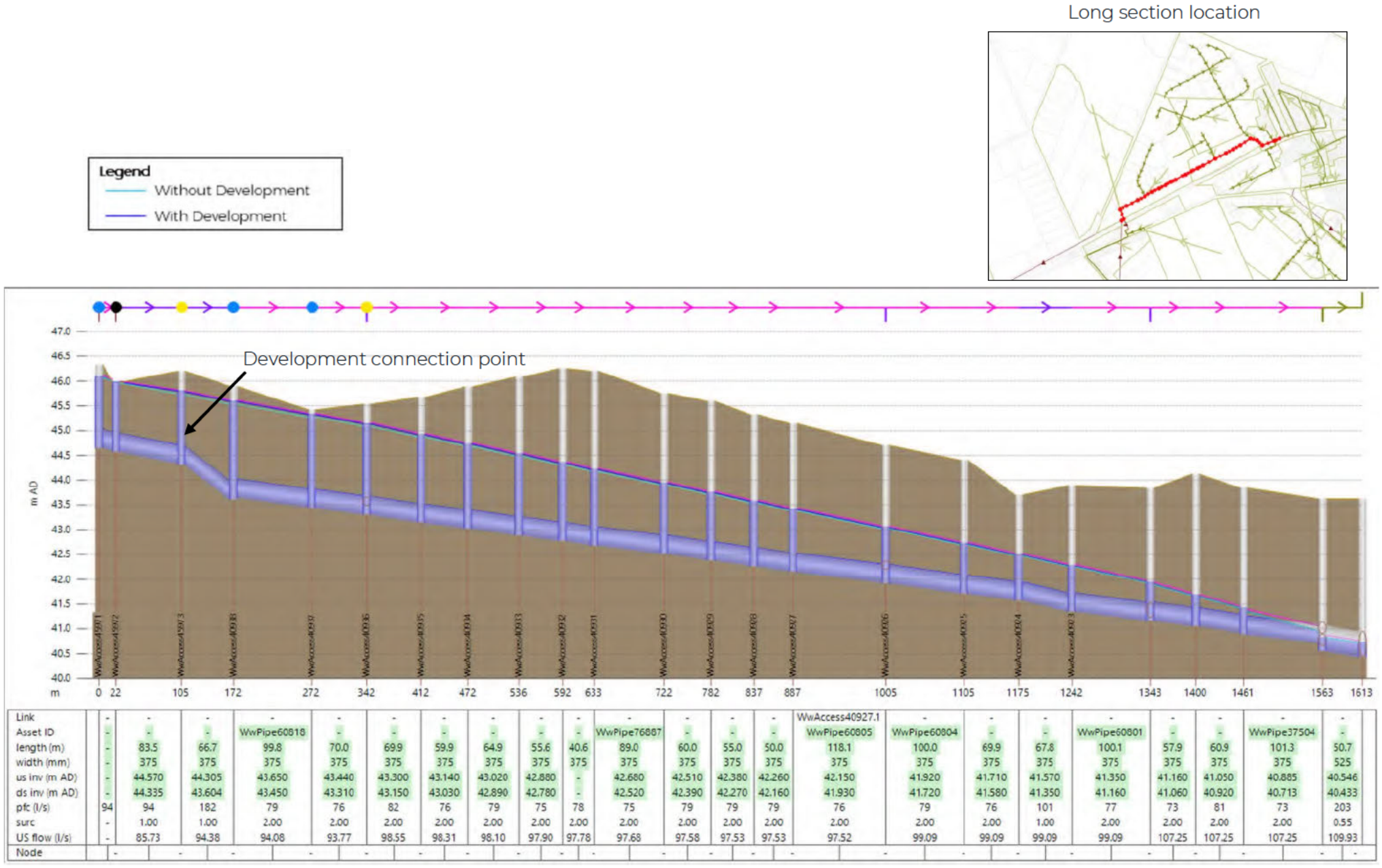
length (m)	-	83.5	66.7	99.8	70.0	69.9	59.9	64.9	55.6	40.6	89.0	60.0	55.0	50.0	118.1	100.0	69.9	67.8	100.1	57.9	60.9	101.3	50.7			
width (mm)	-	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	525			
us inv (m AD)	-	44.570	44.305	43.650	43.440	43.300	43.140	43.020	42.880	-	42.680	42.510	42.380	42.260	42.150	41.920	41.710	41.570	41.350	41.160	41.050	40.885	40.546			
ds inv (m AD)	-	44.335	43.604	43.450	43.310	43.150	43.030	42.890	42.780	-	42.520	42.390	42.270	42.160	41.930	41.720	41.580	41.350	41.160	41.060	40.920	40.713	40.433			
pfc (l/s)	94	94	182	79	76	82	76	79	75	78	75	79	79	79	76	79	76	101	77	73	81	73	203			
surc	-	0.63	0.96	0.86	0.91	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	2.00	2.00	0.93	0.93	0.49			
US flow (l/s)	-	68.31	78.25	78.22	78.08	85.08	84.95	85.28	84.90	84.67	84.60	84.43	84.93	85.54	84.10	85.22	83.68	82.97	82.75	89.54	89.51	89.51	92.20			
Node		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Figure 3-2: DWF – Growth model – service option 1.



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length (m)	-	83.5	66.7	99.8	70.0	69.9	59.9	64.9	55.6	40.6	89.0	60.0	55.0	50.0	118.1	100.0	69.9	67.8	100.1	57.9	60.9	101.3	50.7
width (mm)	-	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	525
us inv (m AD)	-	44.570	44.305	43.650	43.440	43.300	43.140	43.020	42.880	-	42.680	42.510	42.380	42.260	42.150	41.920	41.710	41.570	41.350	41.160	41.050	40.885	40.546
ds inv (m AD)	-	44.335	43.604	43.450	43.310	43.150	43.030	42.890	42.780	-	42.520	42.390	42.270	42.160	41.930	41.720	41.580	41.350	41.160	41.060	40.920	40.713	40.433
pfc (l/s)	94	94	182	79	76	82	76	79	75	78	75	79	79	79	76	79	76	101	77	73	81	73	203
surc	-	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	2.00	2.00	2.00	2.00	0.55
US flow (l/s)	-	85.73	94.38	94.08	93.77	98.55	98.31	98.10	97.90	97.78	97.68	97.58	97.53	97.53	97.52	99.09	99.09	99.09	99.09	107.25	107.25	107.25	109.93
Node	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Figure 3-3: DWF – Growth model – service option 1 and plan changes 16 and 17.

3.1.2 Wet Weather Flow

There are no predicted capacity issues caused by service option 1 for the Base scenario during wet weather flow, as shown in Figure 3-4.

In the Growth scenario, however, service option 1 is predicted to cause some capacity issues during wet weather flow. As seen in Figure 3-5, much of the long section is surcharged, and two of the manholes have a freeboard of less than 500 mm.

The inclusion of plan changes 16 and 17 to the Growth scenario results in capacity issues and two manhole overflows – see Figure 3-6. The effect of the development on the overflow volumes is shown in Table 3-2.

Table 3-2: Comparison of overflow volumes with and without the development (service option 1) in wet weather flow, for the Growth scenario with plan changes 16 and 17.

Manhole ID	Spill Volume without Development (m^3)	Spill Volume with Development Volume (m^3)	Increase in Spill Volume (m^3)	Percentage Increase (%)
WwAccess45972	1253	2830	1578	126
WwAccess40937	<1	25	25	123700

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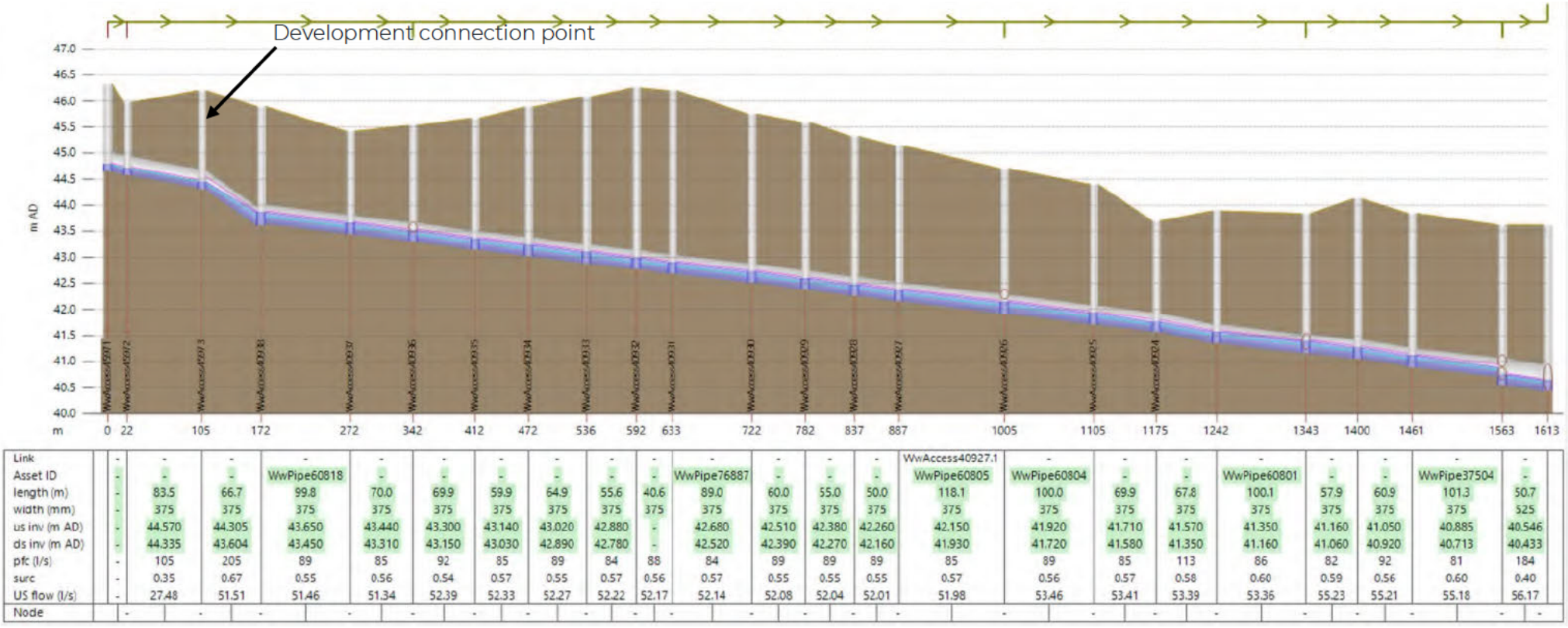
Long section location



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length (m)	-	83.5	66.7	99.8	70.0	69.9	59.9	64.9	55.6	40.6	89.0	60.0	55.0	50.0	118.1	100.0	69.9	67.8	100.1	57.9	60.9	101.3	50.7
width (mm)	-	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	525
us inv (m AD)	-	44.570	44.305	43.650	43.440	43.300	43.140	43.020	42.880	-	42.680	42.510	42.380	42.260	42.150	41.920	41.710	41.570	41.350	41.160	41.050	40.885	40.546
ds inv (m AD)	-	44.335	43.604	43.450	43.310	43.150	43.030	42.890	42.780	-	42.520	42.390	42.270	42.160	41.930	41.720	41.580	41.350	41.160	41.060	40.920	40.713	40.433
pfc (l/s)	-	105	205	89	85	92	85	89	84	88	84	89	89	89	85	89	85	113	86	82	92	81	184
surc	-	0.35	0.67	0.55	0.56	0.54	0.57	0.55	0.57	0.56	0.57	0.55	0.55	0.55	0.57	0.56	0.57	0.58	0.60	0.59	0.56	0.60	0.40
US flow (l/s)	-	27.48	51.51	51.46	51.34	52.39	52.33	52.27	52.22	52.17	52.14	52.08	52.04	52.01	51.98	53.46	53.41	53.39	53.36	55.23	55.21	55.18	56.17
Node	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Figure 3-4: WWF – Base model – service option 1.

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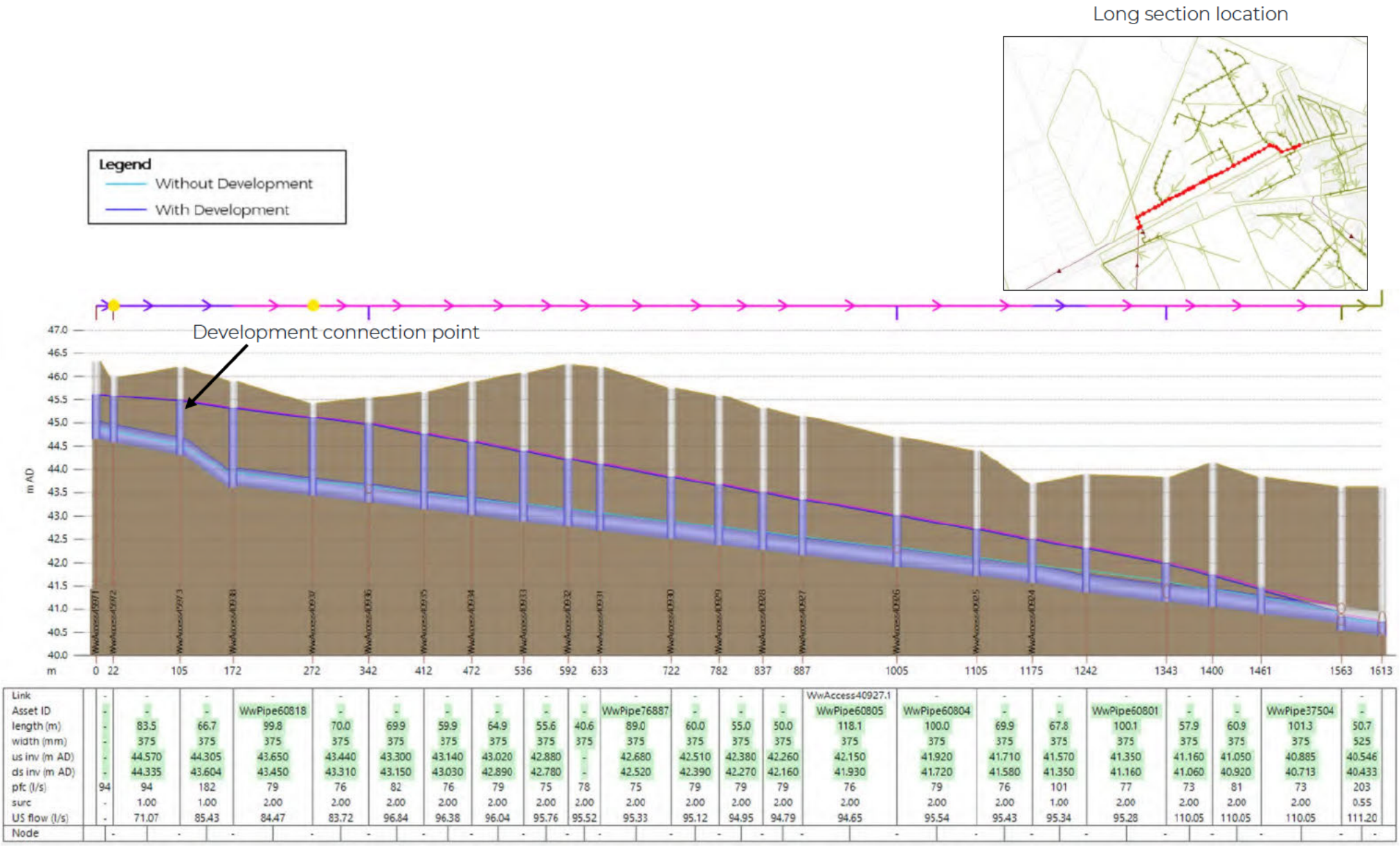

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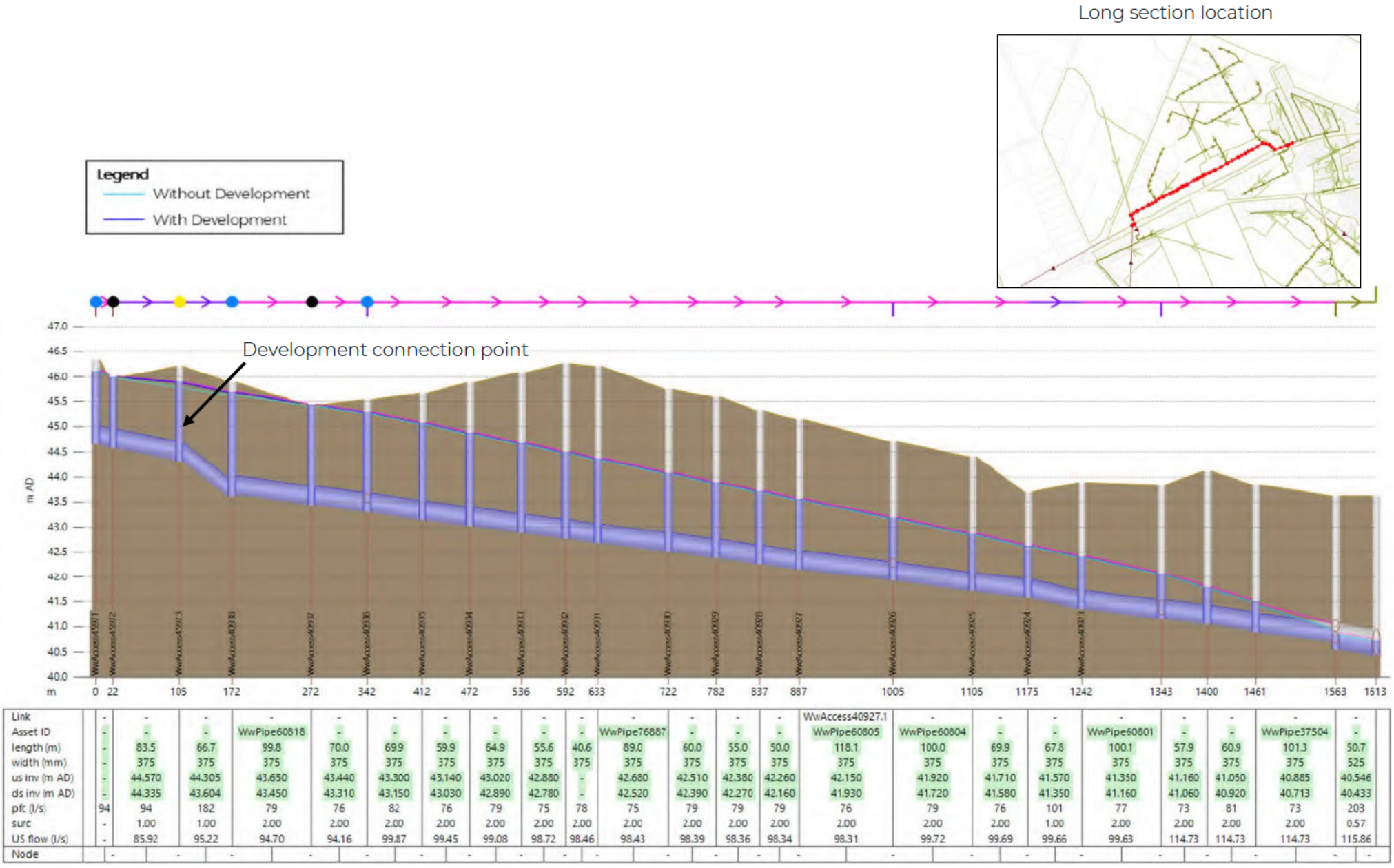
length (m)	-	83.5	66.7	99.8	70.0	69.9	59.9	64.9	55.6	40.6	89.0	60.0	55.0	50.0	118.1	100.0	69.9	67.8	100.1	57.9	60.9	101.3	50.7
width (mm)	-	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	525
us inv (m AD)	-	44.570	44.305	43.650	43.440	43.300	43.140	43.020	42.880	-	42.680	42.510	42.380	42.260	42.150	41.920	41.710	41.570	41.350	41.160	41.050	40.885	40.546
ds inv (m AD)	-	44.335	43.604	43.450	43.310	43.150	43.030	42.890	42.780	-	42.520	42.390	42.270	42.160	41.930	41.720	41.580	41.350	41.160	41.060	40.920	40.713	40.433
pfc (l/s)	94	94	182	79	76	82	76	79	75	78	75	79	79	79	76	79	76	101	77	73	81	73	203
surc	-	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	2.00	2.00	2.00	2.00	0.55
US flow (l/s)	-	71.07	85.43	84.47	83.72	96.84	96.38	96.04	95.76	95.52	95.33	95.12	94.95	94.79	94.65	95.54	95.43	95.34	95.28	110.05	110.05	110.05	111.20
Node	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Figure 3-5: WWF – Growth model – service option 1.



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length (m)	-	83.5	66.7	99.8	70.0	69.9	59.9	64.9	55.6	40.6	89.0	60.0	55.0	50.0	118.1	100.0	69.9	67.8	100.1	57.9	60.9	101.3	50.7	
width (mm)	-	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	525	
us inv (m AD)	-	44.570	44.305	43.650	43.440	43.300	43.140	43.020	42.880	-	42.680	42.510	42.380	42.260	42.150	41.920	41.710	41.570	41.350	41.160	41.050	40.885	40.546	
ds inv (m AD)	-	44.335	43.604	43.450	43.310	43.150	43.030	42.890	42.780	-	42.520	42.390	42.270	42.160	41.930	41.720	41.580	41.350	41.160	41.060	40.920	40.713	40.433	
pfc (l/s)	94	94	182	79	76	82	76	79	75	78	75	79	79	79	76	79	76	101	77	73	81	73	203	
surc	-	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	2.00	2.00	2.00	2.00	0.57	
US flow (l/s)	-	85.92	95.22	94.70	94.16	99.87	99.45	99.08	98.72	98.46	98.43	98.39	98.36	98.34	98.31	99.72	99.69	99.66	99.63	114.73	114.73	114.73	115.86	
Node	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Figure 3-6: WWF – Growth model – service option 1 and plan changes 16 and 17.

3.2 Service Option Two: Local Pressure Sewer

3.2.1 Dry Weather Flow

The dry weather flow results for service option 2 are the same as for service option 1. Hence, refer to the dry weather flow results for service option 1.

3.2.2 Wet Weather Flow

There are no capacity issues predicted for service option 2 in the Base scenario for wet weather flow – see Figure 3-7.

Service option 2 is predicted to cause some capacity issues in the Growth scenario during wet weather flow. Figure 3-8 shows surcharging pipes, but there is still more than 500 mm of freeboard for all of the manholes.

Figure 3-9 shows that service option 2 is predicted to cause capacity issues in the Growth scenario with the addition of plan changes 16 and 17. This includes two predicted manhole overflows, which are summarised in Table 3-3.

Table 3-3: Comparison of overflow volumes with and without the development (service option 2) in wet weather flow, for the Growth scenario with plan changes 16 and 17.

Manhole ID	Spill Volume without Development (m^3)	Spill Volume with Development Volume (m^3)	Increase in Spill Volume (m^3)	Percentage Increase (%)
WwAccess45972	1253	2523	1270	101
WwAccess40937	<1	6	6	31500

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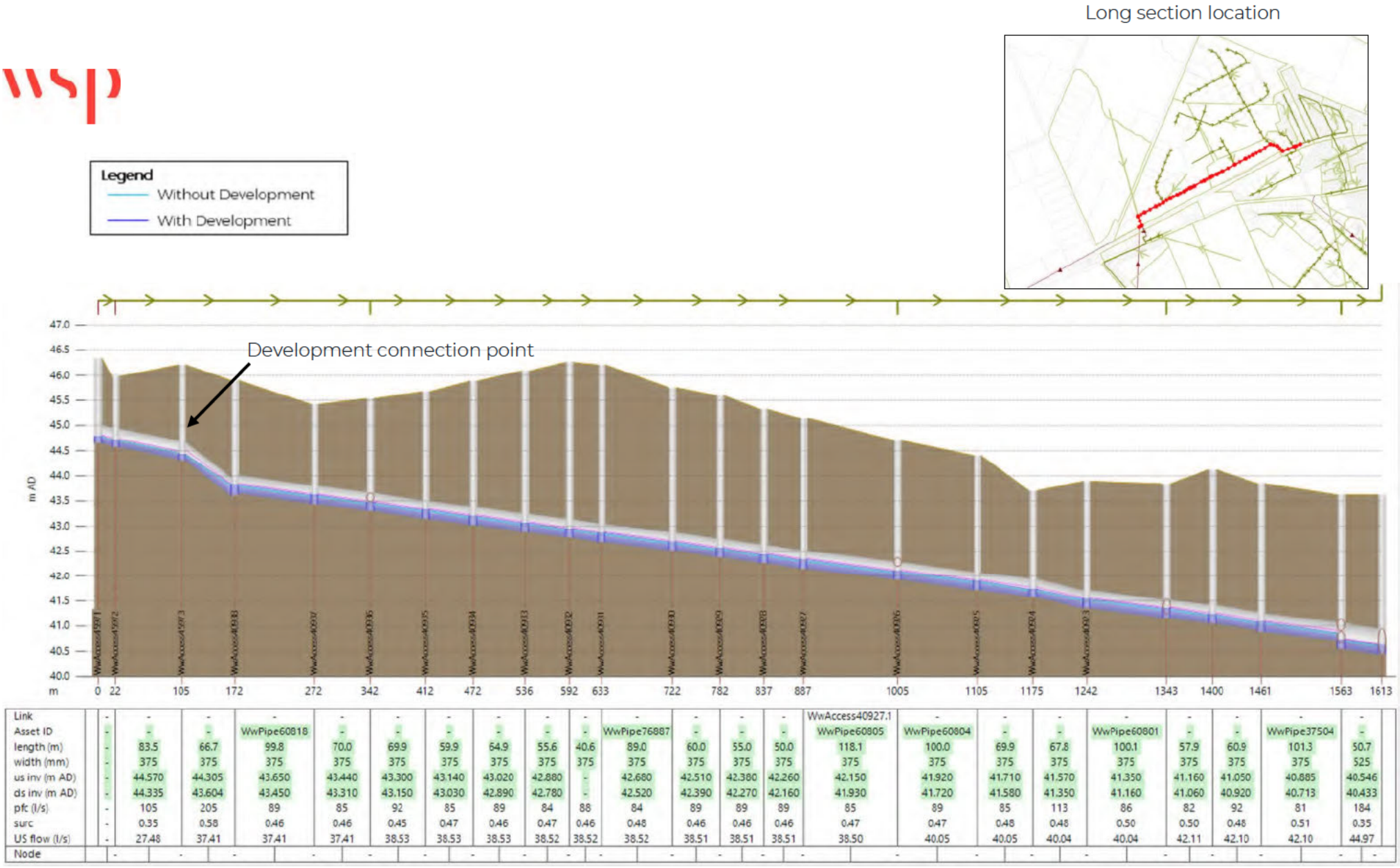

Link	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	WwAccess40927.1	-	-	-	-	-	-	-	-	-
Asset ID	-	-	-	WwPipe60818	-	-	-	-	-	-	-	WwPipe76887	-	-	-	-	WwPipe60805	WwPipe60804	-	-	WwPipe60801	-	-	-	WwPipe37504	-
length (m)	-	83.5	66.7	99.8	70.0	69.9	59.9	64.9	55.6	40.6	89.0	60.0	55.0	50.0	118.1	100.0	69.9	67.8	100.1	57.9	60.9	101.3	50.7			
width (mm)	-	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	525			
us inv (m AD)	-	44.570	44.305	43.650	43.440	43.300	43.140	43.020	42.880	-	42.680	42.510	42.380	42.260	42.150	41.920	41.710	41.570	41.350	41.160	41.050	40.885	40.546			
ds inv (m AD)	-	44.335	43.604	43.450	43.310	43.150	43.030	42.890	42.780	-	42.520	42.390	42.270	42.160	41.930	41.720	41.580	41.350	41.160	41.060	40.920	40.713	40.433			
pfc (l/s)	-	105	205	89	85	92	85	89	84	88	84	89	89	89	85	89	85	113	86	82	92	81	184			
surc	-	0.35	0.58	0.46	0.46	0.45	0.47	0.46	0.47	0.46	0.48	0.46	0.46	0.46	0.47	0.47	0.48	0.48	0.50	0.50	0.48	0.51	0.35			
US flow (l/s)	-	27.48	37.41	37.41	37.41	38.53	38.53	38.53	38.52	38.52	38.52	38.51	38.51	38.51	38.50	40.05	40.05	40.04	40.04	42.11	42.10	42.10	44.97			
Node		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Figure 3-7: WWF – Base model – service option 2.

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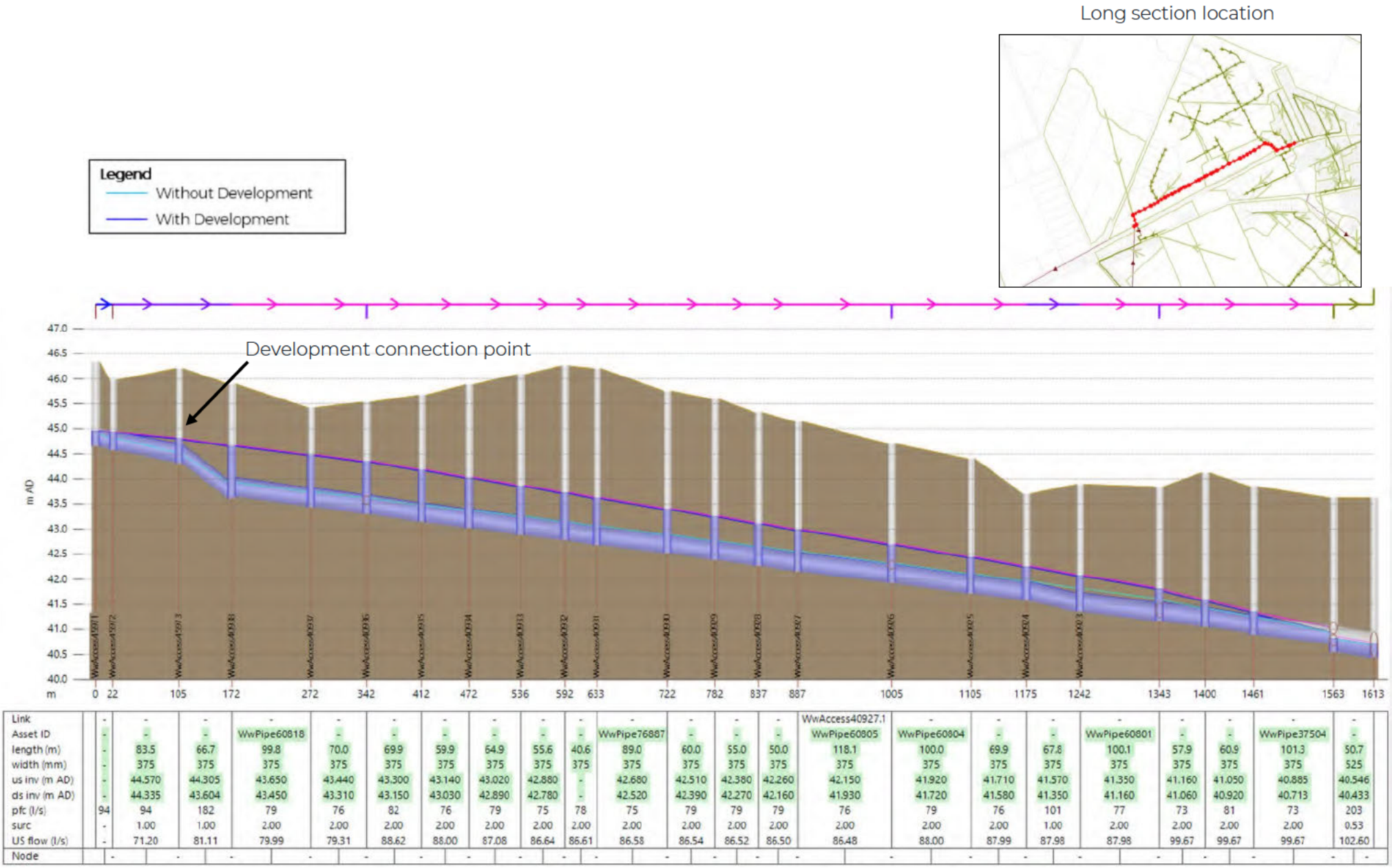
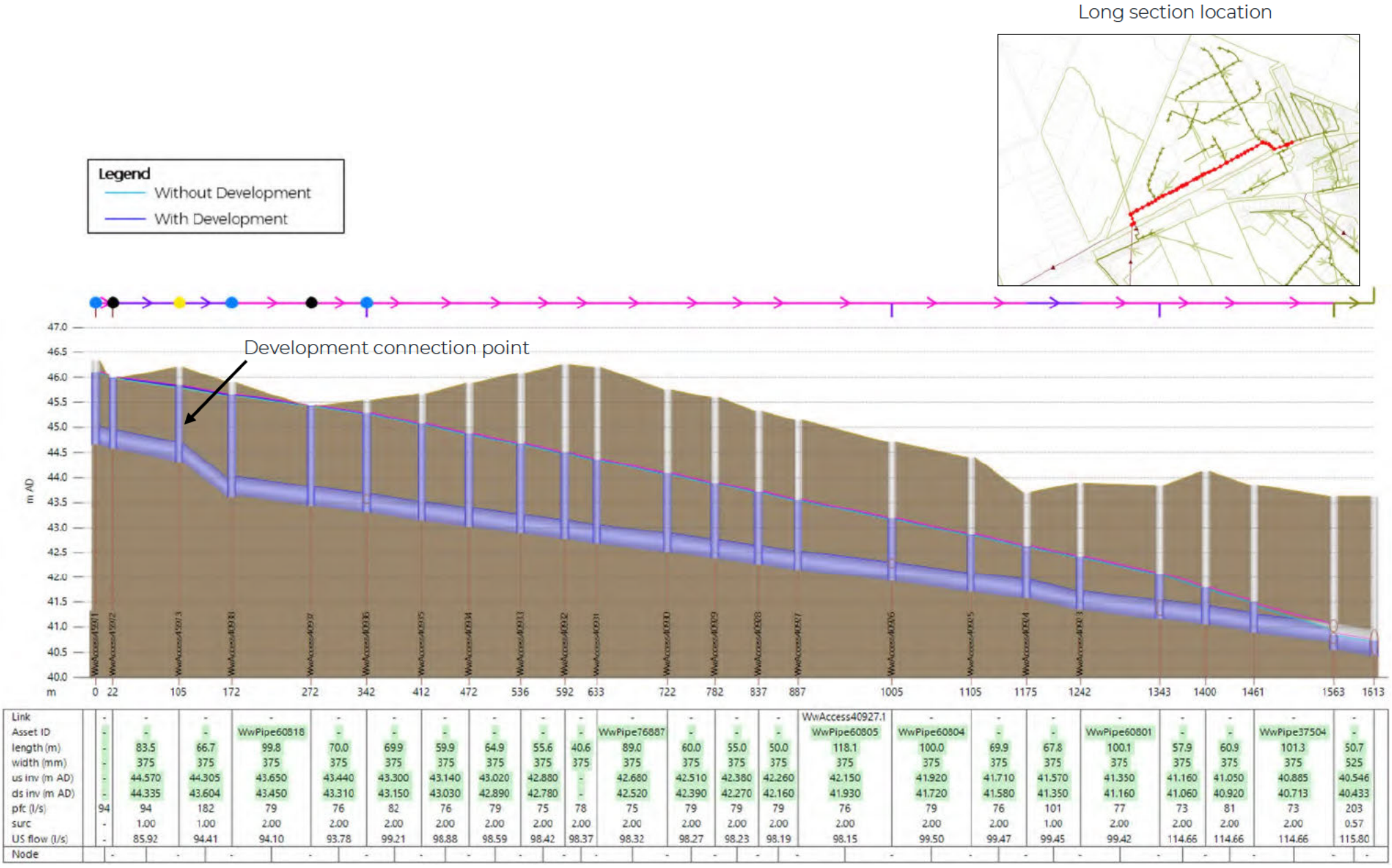


Link	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	WwAccess40927.1	-	-	-	-	-	-	-	-	-
Asset ID	-	-	-	WwPipe60818	-	-	-	-	-	-	-	WwPipe76887	-	-	-	WwPipe60805	WwPipe60804	-	-	WwPipe60801	-	-	WwPipe37504	-	
length (m)	-	83.5	66.7	99.8	70.0	69.9	59.9	64.9	55.6	40.6	89.0	60.0	55.0	50.0	118.1	100.0	69.9	67.8	100.1	57.9	60.9	101.3	50.7	
width (mm)	-	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	525	
us inv (m AD)	-	44.570	44.305	43.650	43.440	43.300	43.140	43.020	42.880	-	42.680	42.510	42.380	42.260	42.150	41.920	41.710	41.570	41.350	41.160	41.050	40.885	40.546	
ds inv (m AD)	-	44.335	43.604	43.450	43.310	43.150	43.030	42.890	42.780	-	42.520	42.390	42.270	42.160	41.930	41.720	41.580	41.350	41.160	41.060	40.920	40.713	40.433	
pfc (l/s)	94	94	182	79	76	82	76	79	75	78	75	79	79	79	76	79	76	101	77	73	81	73	203	
surc	-	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	2.00	2.00	2.00	2.00	0.53	
US flow (l/s)	-	71.20	81.11	79.99	79.31	88.62	88.00	87.08	86.64	86.61	86.58	86.54	86.52	86.50	86.48	88.00	87.99	87.98	87.98	99.67	99.67	99.67	102.60	
Node	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Figure 3-8: WWF – Growth model – service option 2.



Link	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	WwAccess40927.1	-	-	-	-	-	-	-	-	-
Asset ID	-	-	-	WwPipe60818	-	-	-	-	-	-	-	WwPipe76887	-	-	-	WwPipe60805	WwPipe60804	-	-	WwPipe60801	-	-	WwPipe37504	-	-
length (m)	-	83.5	66.7	99.8	70.0	69.9	59.9	64.9	55.6	40.6	89.0	60.0	55.0	50.0	118.1	100.0	69.9	67.8	100.1	57.9	60.9	101.3	50.7	
width (mm)	-	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	525	
us inv (m AD)	-	44.570	44.305	43.650	43.440	43.300	43.140	43.020	42.880	-	42.680	42.510	42.380	42.260	42.150	41.920	41.710	41.570	41.350	41.160	41.050	40.885	40.546	
ds inv (m AD)	-	44.335	43.604	43.450	43.310	43.150	43.030	42.890	42.780	-	42.520	42.390	42.270	42.160	41.930	41.720	41.580	41.350	41.160	41.060	40.920	40.713	40.433	
pfc (l/s)	94	94	182	79	76	82	76	79	75	78	75	79	79	79	76	79	76	101	77	73	81	73	203	
surc	-	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	2.00	2.00	2.00	2.00	0.57	
US flow (l/s)	-	85.92	94.41	94.10	93.78	99.21	98.88	98.59	98.42	98.37	98.32	98.27	98.23	98.19	98.15	99.50	99.47	99.45	99.42	114.66	114.66	114.66	115.80	
Node	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Figure 3-9: WWF – Growth model – service option 2 and plan changes 16 and 17.

4 Conclusions and Recommendations

The results of this assessment are summarised in Table 4-1 below. In general, there are no capacity issues predicted in any Base scenario. There are some predicted capacity issues caused by the development in the Growth scenarios, with ranging severity. When plan changes 16 and 17 are also included in the Growth scenarios, manhole overflows are predicted during both dry weather and wet weather flow, and both service options significantly increase the volume of the overflows predicted compared to the results without the development.

Table 4-1: Summary of results.

Scenario	Dry Weather Flow	Wet Weather Flow
Service Option 1 – Gravity (MF = 28 L/s)		
Base model	No capacity issues predicted.	No capacity issues predicted.
Growth model	Minor capacity issues predicted – surcharged pipes but no freeboard issues.	Some capacity issues predicted – surcharged pipes and two manholes with a freeboard of < 500 mm.
Growth model + plan changes 16 and 17	Capacity issues predicted, including one manhole overflow which increases in spill volume by 551 m^3 due to the development.	Capacity issues predicted, including two manhole overflows which increase in spill volume by a total of 1602 m^3 due to the development.
Service Option 2 – Local Pressure Sewer (MF = 10 L/s)		
Base model	Results are identical to service option 1 dry weather flow results.	No capacity issues predicted.
Growth model		Some capacity issues predicted – surcharged pipes but > 500 mm freeboard.
Growth model + plan changes 16 and 17		Capacity issues predicted, including two manhole overflows which increase in spill volume by a total of 1276 m^3 due to the development.

See the previous reports for plan changes 16 and 17 for more recommendations on the capacity issues caused by these previously modelled developments.

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Appendix F – IOTA Sewer Modelling

Appendix G – Stormwater Basin Calculations

NTP Development Holdings - Pound Road

Job # 20739

SW Infiltration Basin Calculation (lot 200) - All flow to southern basin

Date:	5-May-2025
Calculated by:	Todd Inness
Checked by:	Andy Hall

Industrial Site SW Infiltration First Flush and Additional Storage Basin - CCC WWDG

CATCHMENT A + B

Catchment Area	604001	sq.m	
Total Lot	494673	sq.m	
Lot Hardstand	296804	sq.m	60% Lot Area to Basins, 40% to Ground onsite
Road	70590	sq.m	
Utility Reserve	2216	sq.m	
Stormwater Reserves	36522	sq.m	

All roof runoff is to be discharged to ground. An assumption of 40% site coverage by buildings has been applied. 60% of the Lots is assumed to be hardstand carpark and Landscape. The coefficient of runoff is 0.81 from WWDG for the First Flush and 0.77 for the 10% AEP

VOLUME OF FIRST FLUSH (CCC WWDG CHAPTER 6)

Vff = 10 X Cff x A x dff EQN 6-23

cff =	0.81		Business Land - WWDG Chapter 6
A =	36.961	ha	
dff =	25	mm	CCC first flush treatment requirement
Vff =	7484.6	m3	Volume First Flush

USING CHIRSTCHURCH CITY COUNCILS SOAKAGE BASIN SIZING WWDG SECTION 6.5.5

FIRST FLUSH BASIN SIZING

FIRST FLUSH BASIN WATER SURFACE AREA (Aff)

Aff = Vff/Yff + 8*(Vff*Yff)^(1/2) WWDG EQN (6-7)

Aff 4721.0886 m2 2m depth 5157m2 provided

SIZING OF REDUNDANT CCC STORAGE BASIN

STORAGE BASIN TO MEET THE 10% AEP CRITICAL EVENT (18hr)
STORM AVERAGE RUNOFF FLOW RATE, Qavg

Qavg =	2.78CiA/1000		WWDG EQN (6-8)
C =	0.77		Table 21-5 WWDG for Business Zone 10% AEP
I =	5.04	mm	10% AEP 18 hour storm event as dictated by Brian Norton
A =	40.613	ha	
Qavg =	0.4381603	m3/s	

BASIN SIZE TO BE DETERMINED FROM HALF OF THE 10% AEP FLOOD MINUS THE FIRST FLUSH INFILTRATION, MINUS THE FIRST FLUSH VOLUME

DETERMINE BASIN FLOOR INFILTRATION FLOW RATE

Qff =	Aif * f		WWDG EQN (6-9)
Aif =	3445	m2	base area from DWG
f =	50	mm/hr	From soakage basin design criteria Page 6-22 WWDG
f =	1.389E-05	m/s	
Qff =	0.0478472	m3/s	

UNDER DRAIN FLOW RATE **Qud** IS IGNORED AS IT IS ASSUMED ALL INFILTRATED FLOW SOAKS DIRECTLY TO THE UNDERLYING FREE FLOWING GRAVELS.

STORM TOTAL VOLUME

Vs =	Qavg * D		WWDG EQN (6-11)
D =	64800	s	18 hour duration as dictated by Brian Norton
Vs =	28392.789	m3	

BASIN LIVE STORAGE CALCULATION (SECOND BASIN)

Vls =	Vs - Vff - Qff * D		WWDG EQN (6-15)
Vls =	17807.691	m3	

CALCULATION SUMMARY

VOLUME OF FIRST FLUSH REQUIRED	=	7484.6	m3
AREA OF FIRST FLUSH @ 2m MAX DEPTH	=	4286	m2

LOT ROOF RUNOFF WILL BE DEALT WITH ON SITE IN IT'S OWN RAPID SOAKAGE CHAMBER
THE REMAINING REQUIRED VOLUME OF THE 50 YEAR CRITICAL STORM EVENT FROM ROADS AND LOT HARDSTAND

WILL BE DISCHARGED TO GROUND VIA A RAPID SOAKAGE CHAMBER BELOW THE BASINS

THE CHRISTHCURCH CITY COUNCIL OFFICER BRIAN NORTON HAS ALSO REQUESTED A REDUNDANCY BASIN. THE REDUNDANCY BASIN HAS BEEN SIZED TO HOLD THE 10 YEAR 18 HOUR EVENT MINUS THE FIRST FLUSH VOLUME AND THE FIRST FLUSH BASIN INFILTRATION AND THE STORAGE WITHIN A SECOND REDUNDANT RAPID SOAKAGE TRENCH BELOW THE STORAGE BASIN

VOLUME OF THE REDUNDANT RETENTIONS BASIN = 17807.691 m3

NTP Development Holdings - Pound Road

Job # 20739

SW Infiltration Basin Calculation (lot 201) - Northern catchment to lot 201 if Lot 73 doesn't develop

Date:	5-May-2025
Calculated by:	Todd Inness
Checked by:	Andy Hall

Industrial Site SW Infiltration First Flush and Additional Storage Basin - CCC WWDG
CATCHMENT B

Catchment Area	105710 sq.m	
Total Lot	89645 sq.m	
Lot Hardstand	53787 sq.m	60% Lot Area to Basins, 40% to Ground onsite
Road	9917 sq.m	
Utility Reserve	0 sq.m	
Stormwater Reserves	6148 sq.m	

All roof runoff is to be discharged to ground. An assumption of 40% site coverage by buildings has been applied. 60% of the Lots is assumed to be hardstand carpark and Landscape. The coefficient of runoff is 0.81 from WWDG for the First Flush and 0.77 for the 10% AEP

VOLUME OF FIRST FLUSH (CCC WWDG CHAPTER 6)

Vff = 10 X Cff x A x dff EQN 6-23

cff =	0.81		Business Land - WWDG Chapter 6
A =	6.370	ha	
dff =	25	mm	CCC first flush treatment requirement
Vff =	1290.0	m3	Volume First Flush

USING CHIRSTCHURCH CITY COUNCILS SOAKAGE BASIN SIZING WWDG SECTION 6.5.5

FIRST FLUSH BASIN SIZING
FIRST FLUSH BASIN WATER SURFACE AREA (Aff)

Aff = Vff/Yff + 8*(Vff*Yff)^(1/2) WWDG EQN (6-7)

Aff	1051.3535	m2	2m depth

SIZING OF REDUNDANT CCC STORAGE BASIN

STORAGE BASIN TO MEET THE 10% AEP CRITICAL EVENT (18hr)
STORM AVERAGE RUNOFF FLOW RATE, Qavg

Qavg =	2.78CiA/1000		WWDG EQN (6-8)
C =	0.77		Table 21-5 WWDG for Business Zone 10% AEP
I =	5.04	mm	10% AEP 18 hour storm event as dictated by Brian Norton
A =	6.985	ha	
Qavg =	0.0753607	m3/s	

BASIN SIZE TO BE DETERMINED FROM HALF OF THE 10% AEP FLOOD MINUS THE FIRST FLUSH INFILTRATION, MINUS THE FIRST FLUSH VOLUME

DETERMINE BASIN FLOOR INFILTRATION FLOW RATE

Qff =	Aif * f		WWDG EQN (6-9)
Aif =	3445	m2	base area from DWG
f =	50	mm/hr	From soakage basin design criteria Page 6-22 WWDG
f =	1.389E-05	m/s	
Qff =	0.0478472	m3/s	

UNDER DRAIN FLOW RATE **Qud** IS IGNORED AS IT IS ASSUMED ALL INFILTRATED FLOW SOAKS DIRECTLY TO THE UNDERLYING FREE FLOWING GRAVELS.

STORM TOTAL VOLUME

Vs =	Qavg * D		WWDG EQN (6-11)
D =	64800	s	18 hour duration as dictated by Brian Norton
Vs =	4883.3731	m3	

BASIN LIVE STORAGE CALCULATION (SECOND BASIN)

Vls =	Vs - Vff - Qff * D		WWDG EQN (6-15)
Vls =	492.867	m3	

CALCULATION SUMMARY

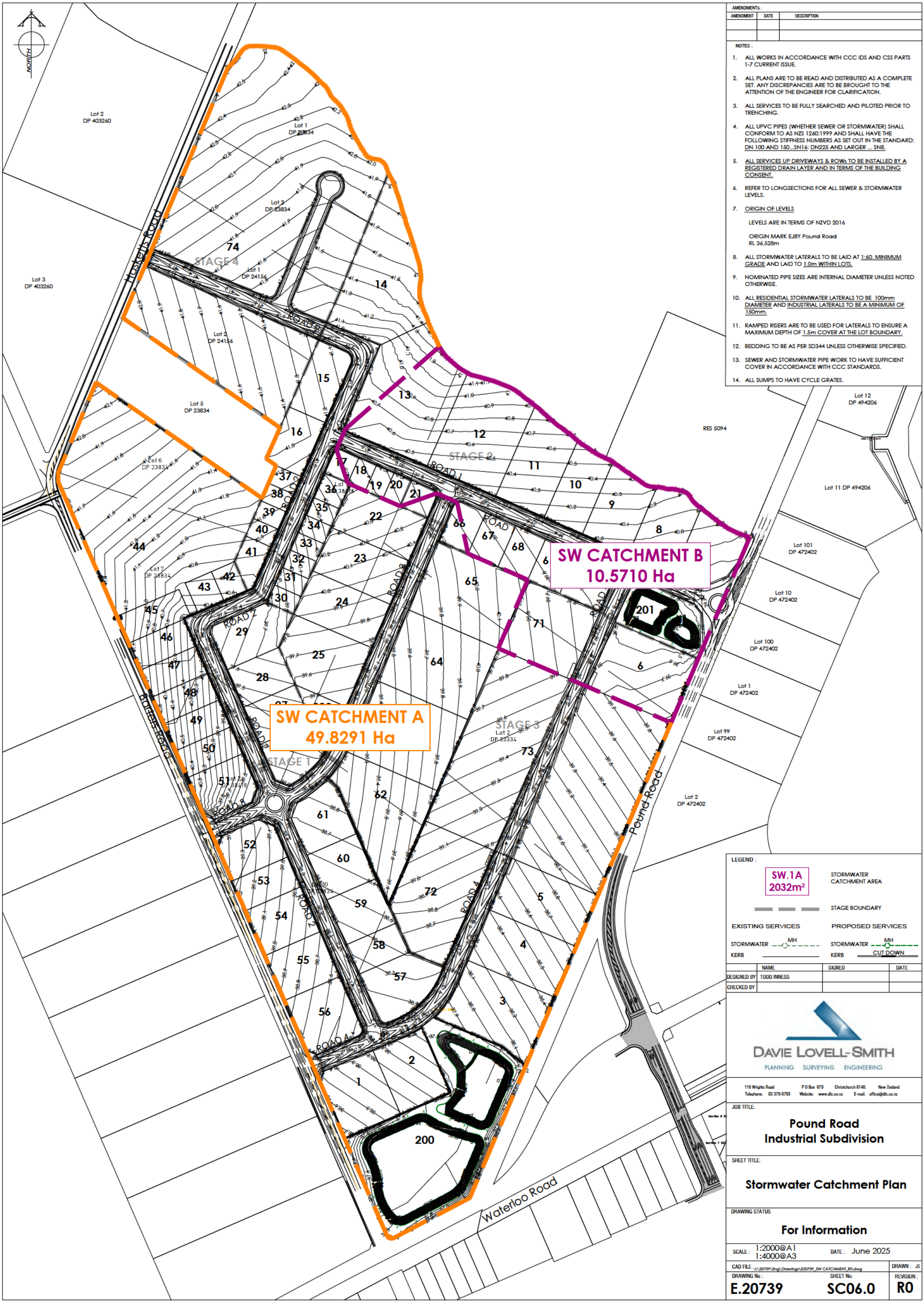
VOLUME OF FIRST FLUSH REQUIRED	=	1290.0	m3
AREA OF FIRST FLUSH @ 2m MAX DEPTH	=	1051	m2

LOT ROOF RUNOFF WILL BE DEALT WITH ON SITE IN IT'S OWN RAPID SOAKAGE CHAMBER
THE REMAINING REQUIRED VOLUME OF THE 50 YEAR CRITICAL STORM EVENT FROM ROADS AND LOT HARDSTAND WILL BE DISCHARGED TO GROUND VIA A RAPID SOAKAGE CHAMBER BELOW THE BASINS

THE CHRISTHCURCH CITY COUNCIL OFFICER BRIAN NORTON HAS ALSO REQUESTED A REDUNDANCY BASIN. THE

REDUNDANCY BASIN HAS BEEN SIZED TO HOLD THE 10 YEAR 18 HOUR EVENT MINUS THE FIRST FLUSH VOLUME AND THE FIRST FLUSH BASIN INFILTRATION AND THE STORAGE WITHIN A SECOND REDUNDANT RAPID SOAKAGE TRENCH BELOW THE STORAGE BASIN

VOLUME OF THE REDUNDANT RETENTIONS BASIN	=	492.867 m3



AMENDMENTS :

AMENDMENT	DATE	DESCRIPTION

NOTES :

1. ALL WORKS IN ACCORDANCE WITH CCC IDS AND CSS PARTS 1-7 CURRENT ISSUE.
2. ALL PLANS ARE TO BE READ AND DISTRIBUTED AS A COMPLETE SET. ANY DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF THE ENGINEER FOR CLARIFICATION.
3. ALL SERVICES TO BE FULLY SEARCHED AND PILOTED PRIOR TO TRENCHING.
4. ALL UPVC PIPES (WHETHER SEWER OR STORMWATER) SHALL CONFORM TO AS NZS 1260:1999 AND SHALL HAVE THE FOLLOWING STIFFNESS NUMBERS AS SET OUT IN THE STANDARD: DN 100 AND 150...SN16; DN225 AND LARGER ... SN8.
5. ALL SERVICES UP DRIVEWAYS & ROWs TO BE INSTALLED BY A REGISTERED DRAIN LAYER AND IN TERMS OF THE BUILDING CONSENT.
6. REFER TO LONGSECTIONS FOR ALL SEWER & STORMWATER LEVELS.
7. ORIGIN OF LEVELS

   LEVELS ARE IN TERMS OF NZVD 2016

   ORIGIN MARK EJ8Y Pound Road
   RL 36.528m
8. ALL STORMWATER LATERALS TO BE LAID AT 1:60. MINIMUM GRADE AND LAID TO 1.0m WITHIN LOTS.
9. NOMINATED PIPE SIZES ARE INTERNAL DIAMETER UNLESS NOTED OTHERWISE.
10. ALL RESIDENTIAL STORMWATER LATERALS TO BE 100mm DIAMETER AND INDUSTRIAL LATERALS TO BE A MINIMUM OF 150mm.
11. RAMPED RISERS ARE TO BE USED FOR LATERALS TO ENSURE A MAXIMUM DEPTH OF 1.5m COVER AT THE LOT BOUNDARY.
12. BEDDING TO BE AS PER SD344 UNLESS OTHERWISE SPECIFIED.
13. SEWER AND STORMWATER PIPE WORK TO HAVE SUFFICIENT COVER IN ACCORDANCE WITH CCC STANDARDS.
14. ALL SUMPS TO HAVE CYCLE GRATES.

LEGEND :

SW.1A
2032m²
STORMWATER CATCHMENT AREA

STAGE BOUNDARY

EXISTING SERVICES		PROPOSED SERVICES	
STORMWATER	MH	STORMWATER	MH
KERB		KERB	CUT DOWN

	NAME	SIGNED	DATE
DESIGNED BY	TODD INNESS		
CHECKED BY			

DAVIE LOVELL-SMITH
PLANNING SURVEYING ENGINEERING

116 Wrights Road P O Box 679 Christchurch 8140. New Zealand
Telephone: 03 379-0793 Website: www.dls.co.nz E-mail: office@dls.co.nz

JOB TITLE:

Pound Road Industrial Subdivision

SHEET TITLE:

Stormwater Catchment Plan

DRAWING STATUS

For Information

SCALE : 1:2000@A1 1:4000@A3

DATE : June 2025

CAD FILE : J:\20739\Eng\Drawings\E20739_SW CATCHMENT_R0.dwg

DRAWN : JS

DRAWING No : **E.20739**

SHEET No: **SC06.0**

REVISION : **R0**

Appendix H – CCC Suggested Water Consent Conditions

Sample water supply, gravity sewer, and local pressure sewer conditions of consent

v 2025-05-27

Water Supply

1. The point of water supply for this subdivision shall be the DNxx xx water main in xx Road as well as a new water supply system to be installed by the Developer in accordance with an Infrastructure Provision Agreement to be entered into with Council (**New Water Supply System**).

2. The New Water Supply System shall be designed in accordance with the provisions of the Infrastructure Provision Agreement.

3. The New Water Supply System must be installed on land vested in Council (Utility Lot). The size and configuration of the Utility Lot for the reservoir and appurtenant facilities must be accepted by Council who will consider matters such as accessibility, feasibility to conduct maintenance activities and ensuring service objectives are achievable.

   The final size and location of the Utility Lot must be amended to meet requirements of Council's Water Supply and Wastewater Asset Planning Team, if required. Council's Water Supply and Wastewater Asset Planning Team will confirm the land requirements under the New Water Supply System Infrastructure Provision Agreement. This will include either:

   a. Confirmation that no changes are required to the Utility Lot if the design work identifies that no changes are necessary to accommodate the New Water Supply System; or
   b. Confirmation that the Utility Lot will need to be increased in size, and detail of additional land necessary to accommodate New Water Supply System assets

   If additional land is required, the Consent Holder must increase the Utility Lot by reducing the area of adjacent lot(s). Any land re-allocated to the Utility Lot must be outside the adjacent existing power line easement. Changes to the layout of the Lots must be approved by Council's Water Supply and Wastewater Asset Planning Team and be incorporated into the Survey Plan prior to seeking s223 approval.

4. Any part of the New Water Supply System that is constructed pursuant to this Consent but located on a balance lot, shall follow the alignment of the road network for the subsequent development Stage and be protected by an easement in gross in favour of Christchurch City Council, until vested as road or utility lot (as applicable) as part of the subsequent development Stage.

5. The water main and submains on Lots xx (Roads to Vest) shall be designed by a suitably qualified person in accordance with the Infrastructure Design Standard and in general accordance with the NZ Fire Service Fire Fighting Water Supplies Code of Practice NZS 4509:2008, subject to Council engineering acceptance. Engineering drawings supported by hydraulic model outputs shall be sent to the Subdivisions Planning Engineer for Engineering Acceptance by the Water Supply & Wastewater Asset Planning Team prior to the commencement of any physical work.

6. The construction of Council vested water mains and submains shall be carried out by a Council approved water supply installer at the expense of the applicant. The construction of the New Water Supply System shall be in accordance with the Infrastructure Provision Agreement. Practical Completion of the relevant parts of the New Water Supply System must achieved in accordance with the Infrastructure Provision Agreement prior to the issue of a section 224 certificate.

7. All water mains and submains for the subdivision shall be installed in road to be vested in Council.

8. DNxx xx water mains shall be extended along the full length of roads to vest as per the requirements of the Infrastructure Design Standard.

9. All lots shall be served with a water supply to their boundary. Submains shall be installed to 1m past each lot boundary.

10. Any rear lot or lot within a Right of Way shall be serviced by its own DNxx lateral within a shared access. Each water supply lateral connection shall be installed with a dummy connection spacer rod in accordance with CSS Part 4, SD 403. An easement for the right to convey water shall be created over the lateral in favour of the lot serviced by the lateral. Laterals shall be installed by a Licensed Certified Plumber and shall not cross the boundary of the net site area of other sites.

    Advice Note: This work will require a Building Consent or a Building Act Exemption.

Appendix I – CCC Suggested Sewer Consent Conditions

Wastewater – Pressure Sewer

1. The site shall be serviced by a Local Pressure Sewer System designed in accordance with Council's Infrastructure Design Standards and Construction Standard Specifications. Engineering drawings supported by hydraulic calculations shall be sent to the Subdivisions Engineer for Engineering Acceptance by the Three Waters and Waste Planning Team prior to the commencement of any physical work

2. The Approved Sanitary Sewer Outfall for this site shall be the DNxx xx gravity sewer main in xx Road.

3. The consent holder shall put in place measures to enable the initial operation of the local pressure sewer system within and from the site during the build phase, including (but not limited to) ensuring self-cleansing flow and limiting sewage retention time within the system when the design number of pressure sewer tanks are not yet in operation. These measures shall be reported to the Council Engineer prior to seeking section 224(c) certification.

4. Provision must be made for odour treatment and corrosion protection at a location to be confirmed by CCC, downgradient of the discharge point in xx in accordance with Council's Infrastructure Design Standards, Construction Standard Specification, the CCC Odour and Corrosion Management Design Guide, CCC Design Guideline DG61 Protective Coatings for Concrete Wastewater Structures, and other specifications or operational requirements provided by Council as part of the engineering acceptance process. Engineering drawings supported by design calculations and specifications for the odour treatment facility and corrosion protection works must be sent to the Subdivision Engineer for acceptance prior to the commencement of any physical work. Smoke testing is required during the commissioning of the odour treatment unit.

5. Each lot shall have a Boundary Kit located within the legal road or Right of Way outside the boundary of the lot. The pressure lateral from the Boundary Kit is to extend at least 600mm into the net site of each lot.

6. Properties in a Right of Way shall be serviced by a single private pressure main. An isolation valve shall be installed on the private pressure main at the boundary of the Right of Way and the public road. Private easements shall be created over Pressure Sewer Systems in private Rights of Way.

7. Installation of the common pressure sewer main and boundary kits in roads to vest shall be carried out by a Council Authorised Drainlayer (Pressure Sewer Reticulation).

8. Each lot shall be serviced by a private Local Pressure Sewer Unit.

9. The following conditions shall be recorded pursuant to Section 221 of the RMA in a consent notice registered on the titles of each **commercial Lot:**

    a. Each residential lot must be served by a local pressure sewer unit comprising a pump and storage chamber which can accommodate at least 24 hours average dry weather flow to be supplied by EcoFlow or similar.

    b. The property owner shall retain ownership of the local pressure sewer unit complete with pump, chamber and control equipment. The property owner will be responsible for the operation and maintenance of the complete system.

    Advice Note: This is an on-going condition and a consent notice will be issued under section 221 of the Act at the time of section 224(c) certificate.

Appendix J – CCC Suggested Stormwater Consent Conditions

CCC Stormwater & Waterways Planning Unit

Report to ……Rachel Wilson (Senior Planner)

Date ……..28 May 2025

Project Address ……173 Pound Road

Applicant…….Ngai Tahu Property Developments Ltd

Consultant……Novo Group

Scheme No. ……PRE1355578

Trim Record File Number…… 25/1055999

Stormwater & Waterways Planning Author ……Brian Norton

Stormwater & Waterways Planning Team Leader …..Kevin McDonnell

SUGGESTED SUBDIVISION CONSENT CONDITIONS:

Stormwater

1. The stormwater management and mitigation system to be constructed under this application shall rely on stormwater treatment and disposal to ground via infiltration. In addition to the below conditions, the stormwater management system to be constructed under this application shall meet the requirements of the Waterways, Wetlands and Drainage Guide (2003, including updates), the Infrastructure Design Standard (IDS 2022) and the Construction Standard Specifications (CSS 2022).

2. The consent holder shall demonstrate that authorisation for the discharge of construction and operational phase stormwater has been obtained from Christchurch City Council or Canterbury Regional Council.

3. The consent holder shall submit an Engineering Design Report for acceptance by the *3 Waters Asset Planning - Stormwater & Waterways* and *Resource Consents* Units. The Engineering Design Report shall demonstrate how the design will meet all of the applicable standards and shall contain all of the plans, specifications and calculations for the design and construction of all stormwater infrastructure systems.

4. Stormwater generated from all roading and hardstand areas on all allotments shall be collected via channels, sumps, pipes or swales and discharged to a first flush treatment system. Unless otherwise approved by the Council Planning Engineer, the first flush treatment system shall be either:

    a. Soil adsorption basins, or;
    b. Stormwater360 Filterra proprietary treatment devices.

5. Treated stormwater and stormwater in excess of the first flush treatment system capacity shall discharge into a rapid soakage disposal system. The rapid soakage system shall:
    a. Consist of infiltration soak pits or trenches designed in general accordance with WWDG Part 6.5, and;
    b. Provide sufficient storage and soakage to dispose of stormwater generated from the critical two percent annual exceedance probability storm event, and;
    c. Either: 1) Provide sufficient above-ground storage to contain the stormwater runoff generated from a 10 percent annual exceedance probability storm of 18 hours duration, OR; 2) be fitted with redundant "capped off" rapid soakage chambers or trenches providing at least double the design soakage capacity.

6. If the stormwater infiltration systems are within 2,000 metres up-gradient or 500 metres down or cross-gradient of any domestic or community drinking water supply wells, a site specific assessment undertaken by a suitably qualified person shall be provided demonstrating less than minor adverse effects on those domestic or community drinking water supply wells. This assessment shall form part of the Engineering Design Report and will be submitted to Canterbury Regional Council for certification under Councils Comprehensive Stormwater Network Discharge Consent.

7. The following consent notice, pursuant to Section 221 of the Resource Management Act 1991, shall be memorialised on the Certificates of Title for all industrial allotments to ensure that ongoing conditions are complied with:

    Pre-treatment of Hardstand Stormwater Runoff
    Stormwater generated from hardstanding areas within the site (concrete, asphalt, compact gravel, etc.) shall be pre-treated using an approved Gross Pollutant Trap (GPT), vegetated swale or other proprietary pre-treatment device prior to discharge into the CCC network. Unless otherwise approved by the Council Stormwater Planning Engineer, any proprietary stormwater pre-treatment device used shall hold "pre-treatment" designation certification (or better) on the State of Washington Department of Ecology (U.S.A.) – Technology Assessment Protocol - Ecology (TAPE) approved technologies list.

    Hazardous Activities and Industries
    Sites engaging in any of the activities listed in Environment Canterbury's Land and Water Regional Plan Schedule 3 Hazardous Industries and Activities (or successor schedule) shall submit a Stormwater Quality Management Plan for acceptance by the Christchurch City Council Stormwater Planning Engineer. Any site activities considered by the Council to pose a high risk of contamination of ground or surface water may be excluded from the Christchurch City Council's Comprehensive Stormwater Network Discharge Consent and may be required to obtain separate resource consent for the discharge of operational phase stormwater from Canterbury Regional Council.

8. Stormwater in excess of the stormwater management and disposal system capacity shall be diverted to the CCC stormwater network in Pound Road or Waterloo Road.

9. Stormwater generated from roofs of all buildings shall be collected via a sealed stormwater system separated from all other stormwater and discharged into an onsite rapid soakage disposal system. The following consent notice, pursuant to Section 221 of the Resource Management Act 1991, shall be memorialised on the Certificates of Title for all industrial allotments to ensure that ongoing conditions are complied with:

    Roof Stormwater Disposal
    Stormwater runoff from roofs of all buildings within this allotment shall be captured and disposed of via rapid soakage infiltration systems that are fully sealed and separated from other stormwater runoff. The rapid soakage infiltration systems shall be designed to dispose of the critical 2 percent annual exceedance probability storm event.

    Roof and Flashing Materials
    Roofs and flashings of all buildings within the site shall be low-zinc and low-copper generating materials (those generating less than 20 parts per million dissolved zinc and less than 3 parts per million dissolved copper, i.e.; painted steel, non-zinc treated aluminium, BUR, Modified Bitumen, Single Ply/Thermoset Membrane, Thermoplastic Polyolefin). If zinc-generating or copper-generating materials are used, treatment of stormwater runoff from the full roof area shall be provided using an

approved treatment device designed to remove at least 80% of dissolved zinc and/or copper in stormwater.

10. Earthworks shall not cause adverse flooding effects on other land. The consent holder shall provide a report summarizing any effects of disruption of overland flow or displacement of ponded floodwaters caused by filling within the site, and identify all measures proposed to avoid, remedy or mitigate those effects. This report shall form part of the Engineering Design Report.

11. Prior to vesting of reserves the consent holder shall confirm, by Detailed Site Investigation and/or Validation Report (if required) that soil contaminants within all Local Purpose (Utility) Reserves containing stormwater basins or soakage systems are below ANZECC SQG-High Sediment Quality guidelines.

12. Stormwater laterals shall be laid to at least 600mm inside the boundary of all building allotments at the subdivision stage. The laterals shall be laid at sufficient depth to ensure protection and adequate fall is available to serve the furthermost part of the lot.

13. The stormwater management system shall be designed to ensure complete capture and conveyance of all stormwater runoff from the site for all rainfall events up to and including the critical two percent annual exceedance probability storm. This will require internal reticulation and conveyance to meet Council's inundation standards as specified in the WWDG. A combination of primary and secondary conveyance systems may be used to ensure this level of service is achieved.

14. The primary stormwater reticulation network shall be designed to convey (at minimum) the critical twenty percent annual exceedance probability storm event. No flooding of private property shall occur during the critical ten percent annual exceedance probability storm event.

15. A stormwater design and flood modelling report shall be provided for the subdivision which addresses the critical 10%, 2% and 0.5% annual exceedance probability rainfall events in the post-development scenario. This report shall form a part of the Engineering Design Report and shall include (but may not be limited to) the following information in PDF and GIS *.shp file format:
    a. A plan showing design ground levels (100mm contours or appropriate) and proposed secondary flow paths.
    b. A plan showing the predicted extent of flooding (for flood depths in excess of 100mm) for the critical 2 percent and 0.5 percent annual exceedance probability rainfall events.
    c. A plan showing predicted floodwater levels for the critical 2 percent and 0.5 percent annual exceedance probability rainfall events marked at every 10m interval along all overland flow paths.
    d. All elevations shall be in NZVD2016.

16. The designer of the stormwater management system shall provide a report which identifies all overland flow paths proposed for storm events that exceed the capacity of the reticulated stormwater network. All overland stormwater flow paths are to be identified and protected by an easement in favour of Christchurch City Council, if required.

17. Prior to the commencement of engineering works, the consent holder shall demonstrate, by means of appropriate site testing (by a suitably qualified professional) that the 'design' soakage rates for the infiltration systems are able to be achieved within the stormwater disposal sites. Measured soakage rates, determined by test, shall be reduced by a factor of three (or more) in the final design of the soakage system.

18. At the time of excavation of the actual infiltration site(s) during the construction phase of the development, the consent holder shall confirm that the initial assumptions of infiltration rates, derived from the preliminary testing, are appropriate. Subject to this investigation, the Council may review these conditions pursuant to Section 128 of the Act to require the consent holder to alter the engineering design.

19. Upon practical completion of any soil adsorption basins (if implemented) and prior to issuance of the s224c certificate, hydraulic conductivity testing of all installations shall be undertaken and supervised by a suitably qualified consultant with the results submitted to the Senior Stormwater Planning Engineer, 3 Waters Asset Planning - Stormwater & Waterways Unit and Subdivisions Engineer,

Resource Consents Unit, for acceptance. Median infiltration test results of the engineered treatment media layer shall be within the range of 75mm-300mm per hour, with no single test result less than 50mm per hour. Should that range not be achieved, the consent holder shall undertake all necessary works to achieve the required infiltration rate, at no cost to Council.

20. To ensure compliance with the above conditions, the value of restoration of all first flush soil adsorption basins (if implemented) shall be determined and agreed by the Senior Stormwater Planning Engineer, 3 Waters Asset Planning - Stormwater & Waterways Unit. The consent holder shall bond that sum with the Council prior to the issuance of the Section 224(c) Certificate.

21. The consent holder shall provide easement in gross over any public stormwater infrastructure located outside of Local Purpose (Utility) Reserves or legal road.

22. All boundaries between industrial allotments and Local Purpose (Utility) Reserves shall be fenced. The design and placement of fencing shall form part of the Engineering or Landscape acceptance.

23. Safe and adequate access to all stormwater management and mitigation facilities for operation and maintenance, including sediment removal, shall be provided and designed in accordance with WWDG Sections 6.8 & 6.9.

24. A Maintenance and Operations manual for all stormwater water management systems shall be provided and shall form part of the Resource Consents and 3 Waters Asset Planning - Stormwater & Waterways Unit acceptance. This manual is to include a description of the activity, the design assumptions, maintenance schedule and monitoring requirements.

25. The consent holder shall provide as-built plans of the stormwater management systems and confirm that they have been constructed in accordance with the approved plans and comply with the IDS, particular Part 3: Quality Assurance and Part 12: As-Builts.

26. No more than 90 days prior to the expiry of the engineering defects period, hydraulic conductivity testing of soil adsorption basins (if implemented) shall be undertaken and supervised by a suitably qualified consultant with the results submitted to the Senior Stormwater Planning Engineer, 3 Waters Asset Planning - Stormwater & Waterways Unit and Subdivisions Engineer, Resource Consents Unit, for acceptance. Median infiltration test results shall be within the range of 50mm-300mm per hour, with no single test result less than 30mm per hour. Should that range not be achieved, the consent holder shall undertake all necessary works to achieve the required infiltration rate, at no cost to Council.

Brian Norton
(SENIOR STORMWATER PLANNING ENGINEER)

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Pound Road Industrial Development – Paparua Water Race Culvert

Site Description

The Paparua Water race extends along the eastern side of Barters Road for the majority of the development boundary. Whist the water race will remain as is for most of the current length a short section of approximately 20m will require the installation of a culvert to facilitate the Road 3 connection to Barters Road.

The base of the water race ranges between approximately 600 – 750mm wide with banks at a grade of approximately 1h in 1v, with a height from top of bank to invert of approximately 800mm. The water race has a base flow depth of approximately 300mm. The water race has been classed as having low ecological value, however care will still be required during the design and construction of the culvert to ensure any aquatic and ecological values are considered and protected.

The water race alignment is being retained as is. The culvert crossing has been sized as 450mm dia. RCRRJ Class 4. The culvert immediate downstream of the new proposed culvert is sized as a 375mm dia. The culvert has been upsized to ensure the base of the culvert can be submerged a minimum of 20% of its dia. below the invert of the water race without compromising hydraulic capacity. This will allow the deposition of the natural water race base material within the culvert over time, creating a more natural culvert base. The culvert will have a rock headwall installed at the upstream and downstream ends of the culvert. Rock will be locally sourced and placed to prevent erosion whilst maintaining a natural channel shape and headwall.

Construction Methodology

The construction of the new channel will require over pumping of the existing drain section while works are occurring. The indicative construction methodology is described below:

- Fish management plan to be formed
- Installation of fish barriers at upstream and downstream ends of the proposed site.
- Defishing of the live waterway
- Once defishing has been completed, existing channel at western and eastern ends of the site to be dammed (either driven steel sheet or fabric stabilised earth bund). These bunds will remain in place the length of time the over pumping is occurring.
- Over pumping to commence.
- Mucking out of the existing alignment to ensure the culvert has a sufficient bearing material.
- Installation of the culvert and backfilling
- Construction of the culvert headwalls and stabilisation of any exposed areas with hydroseed and wool matting.
- Complete excavation and shaping of new alignment, and finish backfilling of existing alignment.

- Cease over pumping
- Remove dams and stabilise.
- Plant banks of the new alignment and seed any disturbed areas as soon as possible following civil works, subject to planting season and Council approvals.

De-fishing will be undertaken by the appointed freshwater ecologist, with over-pumping only to commence once de-fishing has been completed. The over pumping will simply convey upstream flows downstream of the construction for a length of approximately 20-25m.

The construction methodology will be confirmed with the contractor on-site once full construction conditions are assessed. This methodology is seen to provide the least amount of erosion and sediment control risk and allow the completion of the works in a time efficient manner and any deviation from this methodology would be discussed with any stakeholders prior to works commencing. Estimated construction period is 10 working days, it is expected that over pumping will be occurring for the majority of the construction period. Works will be programmed to occur when the water race is at a steady flow rate and weather forecast is favourable to minimise the potential of sediment discharge.

It is noted there are periods where the Selwyn District Council (SDC) will shut flow to the water race to carry out routine maintenance. SDC will be contacted near the time of proposed construction to ascertain if any upcoming shutdowns are planned. If so, works may be timed to coincide with the shut down to reduce any risk and assist in simplifying the construction methodology.

The Erosion and Sediment Control Plan formed for the site shows the location of the culvert and proposed sediment controls during the works. The Engineering Concept Plans for the development have a cross section showing the proposed embedment and pipe sizing.

Todd Inness
Civil Engineer