BARKER RYAN STEWART

Sewer Servicing Assessment

Request for Planning Proposal
1055 Bruxner Highway, Goonellabah

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Prepared for: Nimble Estates Pty Ltd

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1 Introduction

1.1 Background and Scope

This Sewer Servicing Assessment has been prepared by H2One (with support from Barker Ryan Stewart) to accompany a Request for Planning Proposal (Planning Proposal) to amend the Lismore Local Environmental Plan 2012 (LLEP) to enable mixed use development of land referred to as 1055 Bruxner Highway, Goonellabah (the site) comprising residential, employment and public open space lands.

To support the planning process, Lismore City Council (LCC) requested a sewerage network capacity assessment, to determine if the additional loading of the development area will impact system performance and trigger the need for infrastructure upgrades. On behalf of the Applicant, H2One Pty Ltd was engaged to address the capacity assessment, in accordance with LCC's Design Standards. The results of the analysis are presented in this report.

1.2 Background

The site at 1055 Bruxner Highway has an area of approximately 76ha and is located adjoining existing urban development on the eastern fringe of Goonellabah. The site comprises two allotments being Lot 42 DP868366 and Lot 1 DP957677 and benefits from frontages to the Bruxner Highway to the north and Oliver Avenue to the west. The site is zoned RU1 Primary Production and has been used for many years for grazing purposes and is largely cleared of vegetation except for remnant trees dispersed across the site. The property is bisected by Tucki Tucki creek with several minor watercourses feeding into it. The site is free from extensive flooding other than waters confined within Tucki Tucki Creek.

1.3 Proposal

The Planning Proposal seeks to amend the LLEP as follows:

- Rezone the site from RU1 Primary Production to the following mix of land use zones:
    - R1 General Residential.
    - B4 Mixed Use.
    - RE1 Public Recreation.
    - IN1 General Industrial.
- Amend the Lot Size Map (Sheet LSZ_005 and Sheet LSZ_006) to remove the current minimum lot size requirement of 40ha and 20ha and impose the following minimum lot sizes:
    - R1 zoned land: a minimum lot size of 300m2
    - B4 zoned land to the north of Tucki Tucki creek: a minimum lot size of 300m2
    - B4 zoned land to the south of Tucki Tucki creek: a minimum lot size of 1,500m2
    - IN1 zoned land: a minimum lot size of 1,500m2
- Amend the LLEP 2012 Height of Building Map (Sheet HOB_005 and Sheet HOB_006) to impose the following maximum height of building control (excluding the RE1 and IN1 zoned land):
    - B4 zoned land to the north of Tucki Tucki creek: maximum building height of 13.5m
    - R1 zoned land: maximum building height of 8.5m

Changes to the planning controls facilitate the potential development of the site to accommodate a diversity of new housing, employment, and public open space opportunities in an environmentally and socially sustainable environment.

An Indicative Layout Plan (**ILP**), informed by detailed technical investigations into the characteristics of the site and adjoining land along with available servicing and community infrastructure, confirms the capacity to accommodate urban development comprising the following:

- Approximately 346 residential and mixed use zoned allotments capable of accommodating a variety of housing forms and densities with an estimated population of over 855 residents.
- Approximately 105 allotments zoned industrial and mixed use capable of supporting a variety of employment generating and service activities with an associated potential 2,614 direct jobs.
- Provision of over 14ha of the site to open space comprising land zoned and utilised for public recreation along with riparian corridors and landscape buffers.

1.4 Objectives

The main objectives of the project were as follows.

1. Identify sewer service strategy options for the development site.
2. Assess capacity of downstream gravity mains, pumps and pressure mains, up to the East Lismore Sewage Treatment Plant (STP).
3. Determine sewer infrastructure upgrades necessary to achieve LCC's minimum Design Standards, where system performance failures have occurred due to the additional loading of the new development; and
4. Report on findings.

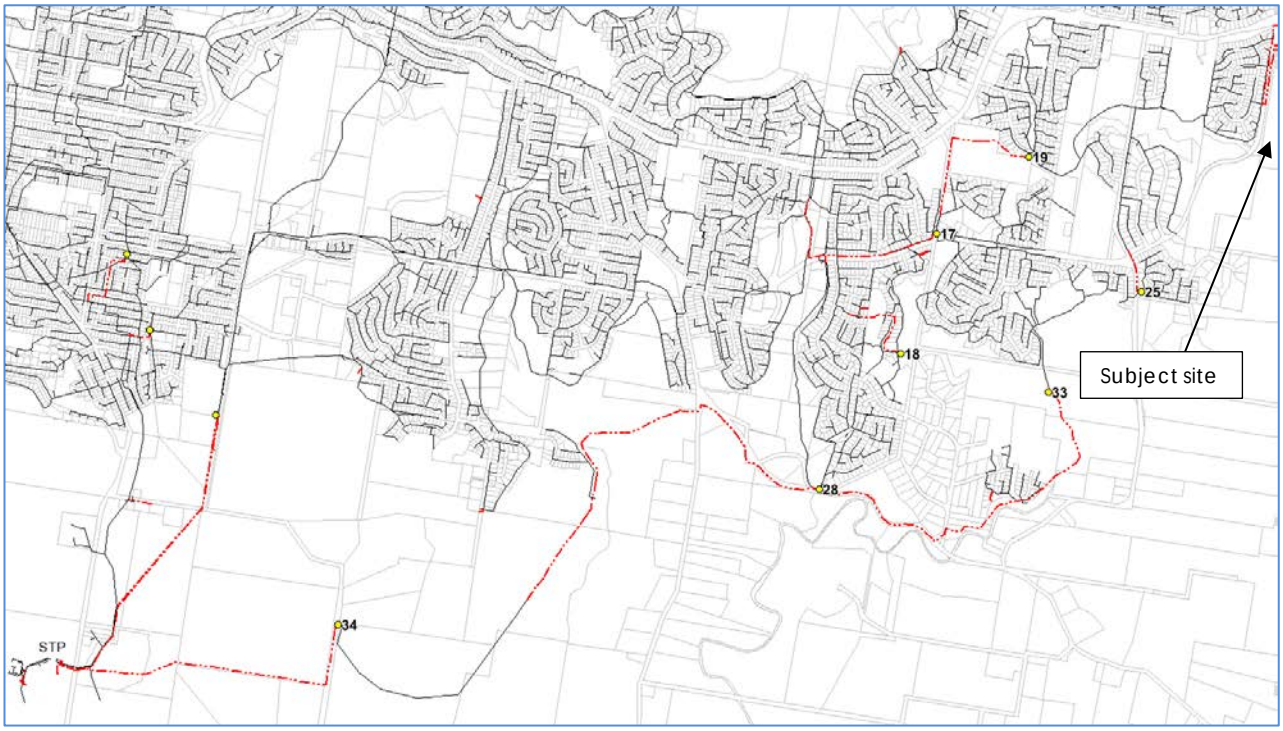
1.5 Sewerage Catchment System

Two potential service strategy options were identified for the development site, as per the following.

- Option 1 - A pump or gravity connection to the existing DN225 gravity main along Oliver Avenue, adjacent to the western property boundary of the subject site, located within the Sewer Pump Station (SPS) 19 catchment. SPS 19 operates with duty/standby pumps that transfer wastewater downstream to the East Lismore STP, via the SPS 17, SPS 28 and SPS 34 catchments.
- Option 2 - A pump or gravity connection to the existing DN150 gravity main adjacent to Taylor Road, approximately 600 m south-west of the development site, located within the SPS 33 catchment. SPS 33 operates with duty/standby pumps that transfer wastewater downstream to the East Lismore STP, via a shared pressure system with the Chiltcotts Grass SPS, and the SPS 28 and SPS 34 catchments downstream.

The relevant sewer catchments were assessed based on both the existing and ultimate systems, as per LCC's latest hydraulic model, and Willow and Sparrow's study on the southern trunk network completed in 2020. Refer to Figure 1 below for an overview of the relevant sewer network.

Figure 1 – Local sewer network



1.6 Demand Assessment

A demand assessment of the development area was undertaken to quantify the approximate sewage discharge attributed to the proposed land-use type and density. This was calculated using the "*South East Queensland Water Supply and Sewerage Design and Construction Code*" (2020), and LCC's average "per capita" demands for sewage (240 L/EP/day @ 3.2 EP/ET). Table 1 shows a summary of the development's demand estimation.

NOTE: a total of 364 lots has been used in this assessment so it is additionally conservative.

Table 1 - Estimated sewage demand for the proposed development

Site Land Use and Density	Demand Rate	EP	ADWF (L/s)	PWWF (L/s)
364 x res. lots	3.2 EP/Lot	1,165.0	3.24	26.31
26.0 Ha of employment	36.0 EP/Net Develop. Ha	750.0	2.08	16.94
0.50 Ha of local centre	32.2 EP/Net Develop. Ha	13.0	0.04	0.29
	TOTAL	**1,928.0**	**5.36**	**43.54**

Note 1: PWWF based on 8.13 x ADWF.

Note 2: An assumed 80% net developable area was assumed for the employment and local centre areas.

Note 3: As per the SEQ Code, Urban Utilities' demand rates were adopted for the employment area and local centre, based on the "Mixed Industry and Business" and "Neighbourhood Centre" demand categories.

2 Methodology

2.1 Desired Standards of Service

The design standards adopted for the hydraulic assessment were based on the "*NSW Development Design Specification D12 Sewerage System*" (2009) and "*South East Queensland Water Supply and Sewerage Design and Construction Code*" (2020), with exception to the maximum depth of gravity pipe flow at 1.0 m freeboard. This requirement is merely a standard industry practice adopted by many water authorities in Australia, and is not a specific design standard from either the SEQ Code or Water Service Association of Australia (WSAA) Sewerage Code.

A summary of the relevant design provisions utilised for the project is as follows.

Table 2 - Sewer design provisions relevant to the analysis

Provision	Specification
Average day weather flow (ADWF)	240 L/EP/day
Peak wet weather flow (PWWF)	8.13 x ADWF
Duty pump capacity (L/s)	PWWF
Maximum depth of gravity flow (proposed system)	75% pipe diameter
Maximum depth of gravity flow (existing system)	1.0 m below manhole level
Maximum rising main flow velocity	3.0 m/s

2.2 Network Modelling

The methodology adopted for the sewer network hydraulic analysis is as follows.

1. LCC's latest InfoSWMM hydraulic sewer model (*East Lismore Sewer Model v7*) was utilised for the assessment. The development's estimated sewage loading was placed onto nodes "*19AG16" and "STM_S1_MH2"*, which represented the proposed connection points for service Options 1 and 2, respectively.
2. The hydraulic analysis consisted of running the model at Peak Wet Weather Flow (PWWF), for both the existing and ultimate catchment scenarios, and assessing if sufficient pump/pipe capacity was available to service the development site, from the connection point through to the STP. Details of the adopted planning scenarios are as follows.
    a. Existing system: The modelling analysis was undertaken at pre- and post-development, including the temporary connection from the Pineapple Road subdivision with 109 approved lots.
    b. Ultimate system: The modelling analysis was undertaken excluding the Pineapple Road development connection, but with greenfield sites fully developed within all sewer catchment areas, and inclusion of identified pump/pipe upgrades from the previous Pineapple Road study. The ultimate scenario provided the baseline outcomes, to determine the impact of the development site on LCC's infrastructure master plan.

3. For the assessment of pump capacity at each pump station, the duty flow was simply compared to the PWWF loading from the upstream catchment. If the duty pump could not maintain catchment flows, pump capacity upgrades were adopted at the same flow rate as upstream PWWF. This was represented in the model as an 'ideal' duty pump, i.e. upstream catchment PWWF is simply transferred to the downstream catchment, at the delivery head required to achieve the flow rate.
4. The gravity main capacity was assessed using a minimum design flow depth of 1 metre below surface level. If flow depths could not be maintained within 1m below surface level, pipe augmentations were investigated until this design standard was achieved (including 80% d/D flow depth for new infrastructure). For the gravity main assessment, all pump stations were amended in the model to 'ideal' pumps, so unrelated pump capacity issues didn't cause erroneous results.
5. Sewer rising main capacity was assessed on the basis of a maximum flow velocity of 3 m/s. If flow velocity ≥ 3 m/s, pipe augmentations were investigated until the design standard was achieved. Identified pump capacity upgrades were considered in the rising main assessment, with all pump upgrades again simulated as an 'ideal' pump.
6. Once all scenarios were modelled and infrastructure upgrades identified, a subsequent sensitivity analysis was undertaken with catchment demands modified at +/- 20%. This analysis was undertaken to determine the impact of lower/higher planning demands on identified infrastructure upgrades.
7. Modelling results were verified and findings reported

3 Results

3.1 Ultimate Demand Scenario

As per the methodology in Section 2.2 of this report, a hydraulic analysis was undertaken on the ultimate development scenario, at pre- and post-development. A summary of the modelling results follows.

3.1.1 Pump capacity

Table 3 outlines the duty pump capacity upgrades required to service the development site.

Table 3 - Pump capacity results (post-development)

Service Option	SPS	Duty Pump Capacity Available (L/s)	Pre-Development Duty Pump Capacity Required (L/s)	Post-Development Duty Pump Capacity Required (L/s)
Option 1 (SPS 19)	SPS19	60.0	84.8	128.3
	SPS 17	80.0	120.0	163.5
	SPS 28	150.0	268.5	312.0
	SPS 34	250.0	353.5	397.0
Option 2 (SPS 33)	SPS 33	48.0	28.9	72.4
	SPS 28	150	268.5	312.0
	SPS 34	250	353.5	397.0

Note: The development site accounted for 43.5 L/s (PWWF) of the identified pump upgrades. The remaining component is from development of greenfield sites external to the subject site.

The previous Pineapple Road study (2020), completed by Willow and Sparrow Pty Ltd, identified that all pump stations in Table 3 required pump capacity upgrades to service greenfield development external to the subject site, with exception to SPS 33.

Therefore, the proposed development only triggered the SPS 33 upgrade, and all remaining capacity improvements are merely an increase in size of already proposed pump upgrades.

3.1.2 Gravity Mains

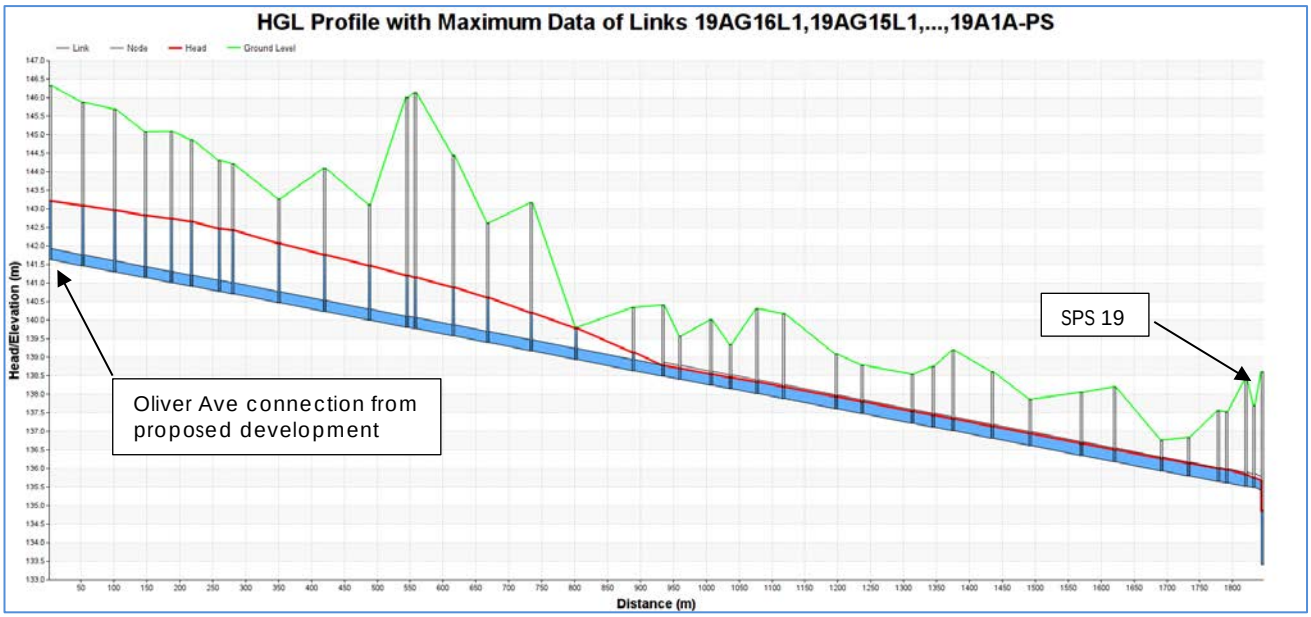
Table 4 outlines the trunk gravity main upgrades were required to service the development site.

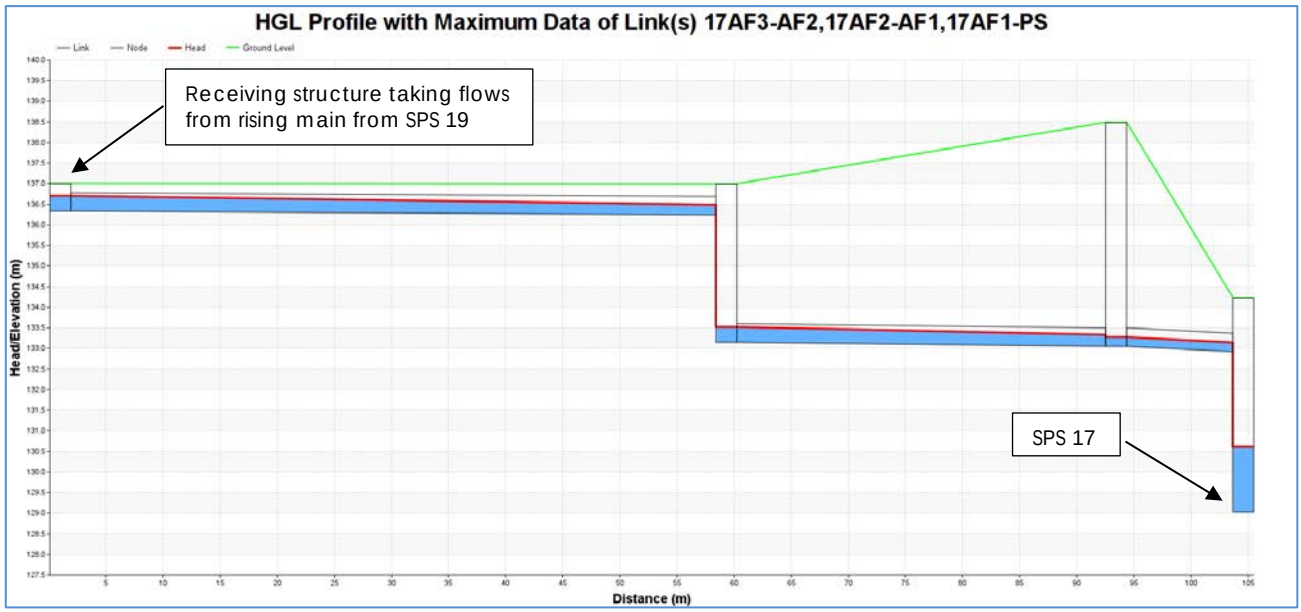
Table 4 - Ultimate gravity main upgrades

Service Option	Catchment	Existing Pipe Size (mm)	Pre-development Recommended Pipe Size (mm)	Post-development Recommended Pipe Size (mm)	Length (m)
Option 1 (SPS 19)	SPS 19	DN225	DN300	DN375	940
		DN225	DN375	DN450	910
	SPS 28	DN375	DN450	DN450	155
				DN525	440
				DN450	485
	SPS 34	DN450	DN525	DN525	840
		DN450	DN450 (no change)	DN600	220
Option 2 (SPS 33)	SPS 33	DN150	DN150 (no change)	DN225	270
				DN300	515
	SPS 34	DN450	DN525	DN525	840
		DN450	DN450 (no change)	DN600	220

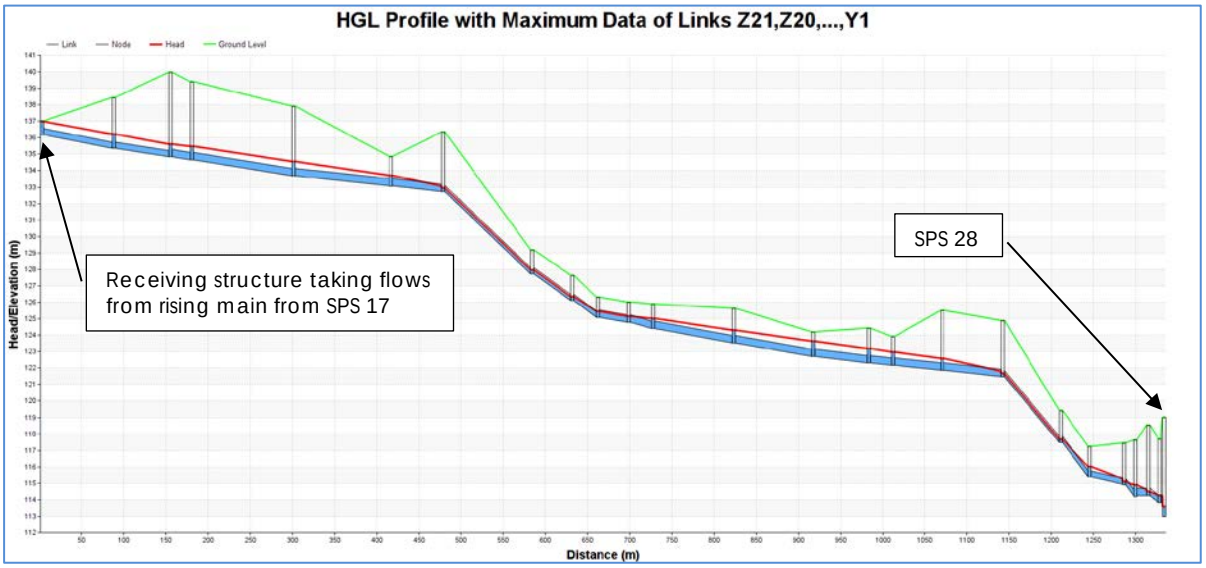
Similar to the pump assessment, majority of the pipe upgrades were previously identified from the Pineapple Road study, with the additional sewage loading from the development site merely upsizing the pipework. The only exceptions being all pipe upgrades upstream of SPS 33, and the DN600 pipe upgrade upstream of SPS 34. Refer to Figures below for modelling results and pipe upgrades.

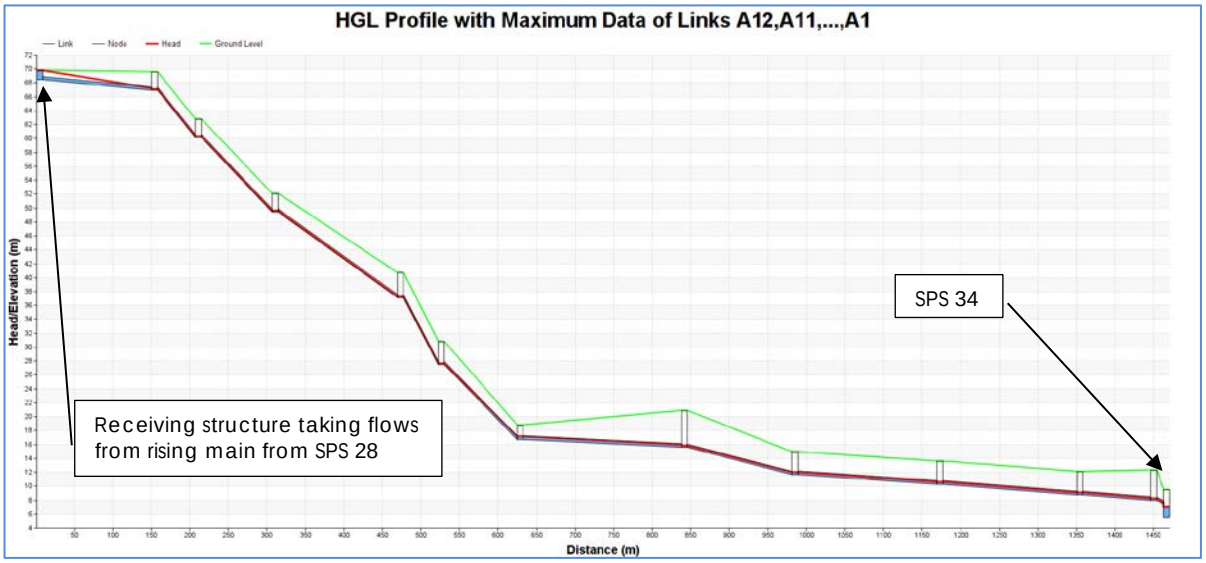
Option 1 – Post development – no pipe upgrades



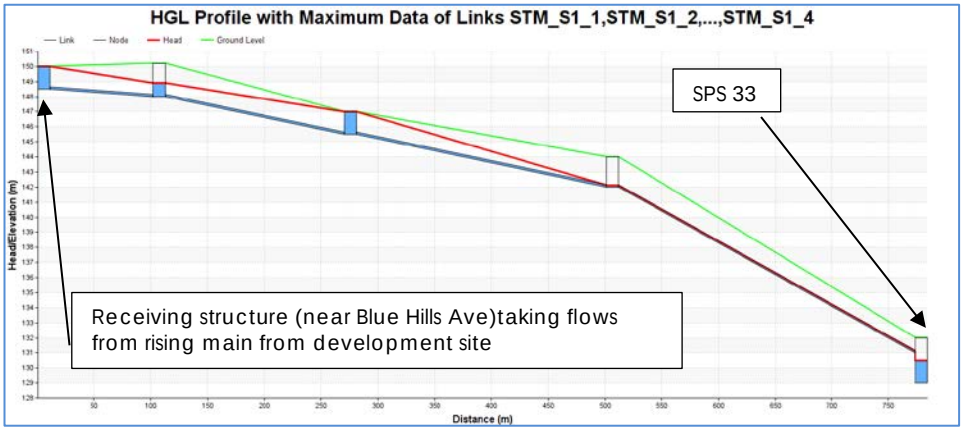


Option 1 - Post development – no pipe upgrades (continued)



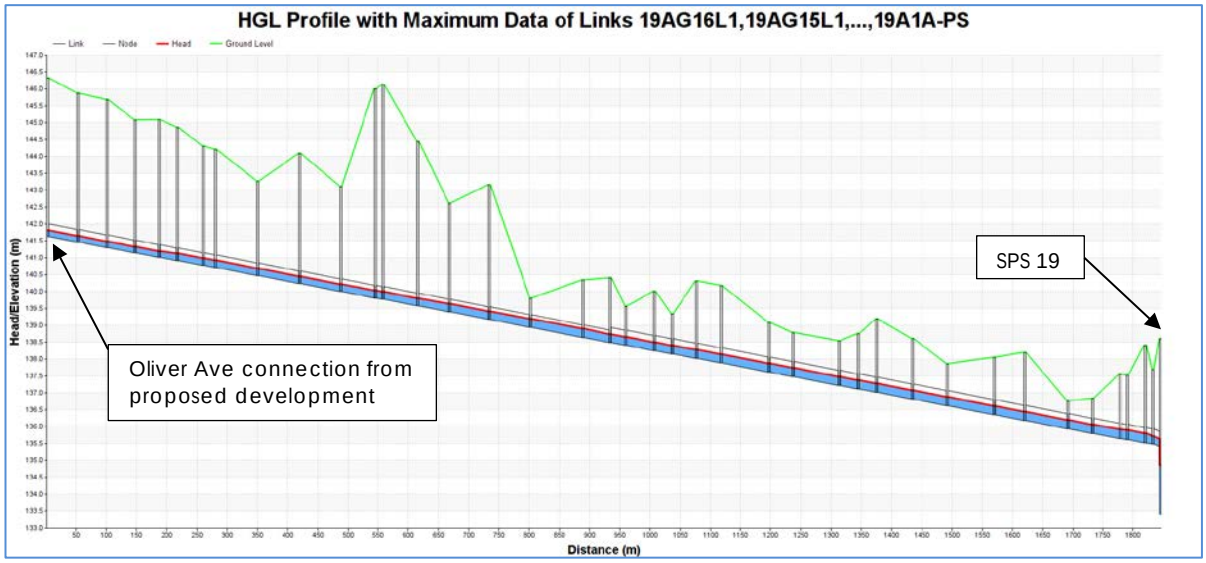


Option 2 – Post development – no pipe upgrades

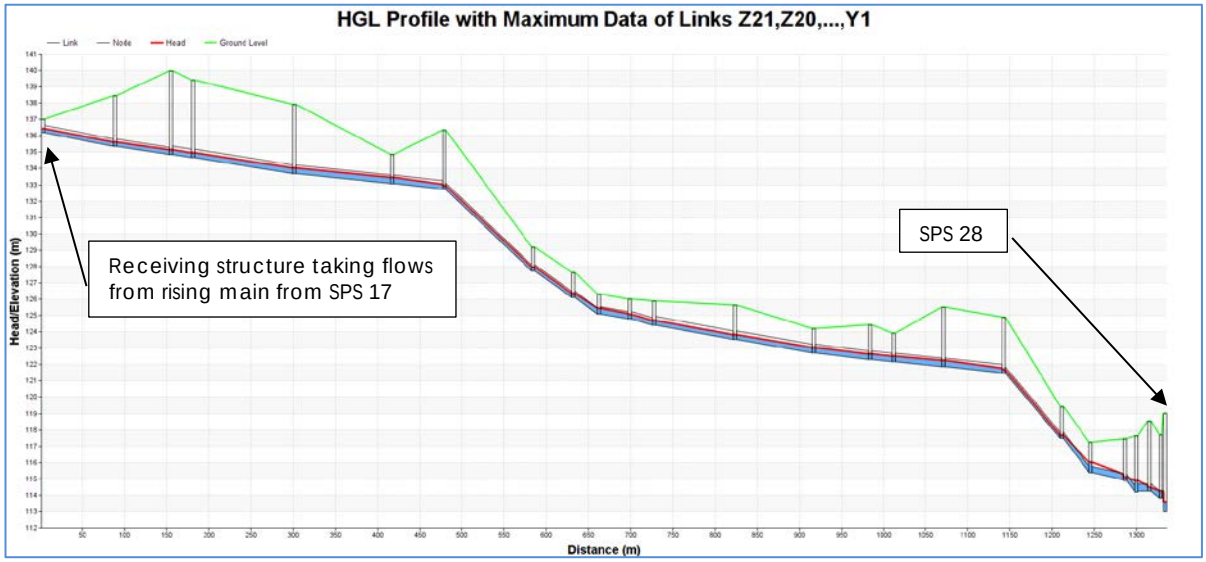


Note that the current sewer network model of the gravity system flowing to SPS33 is likely to be a poor representation of actual infrastructure.

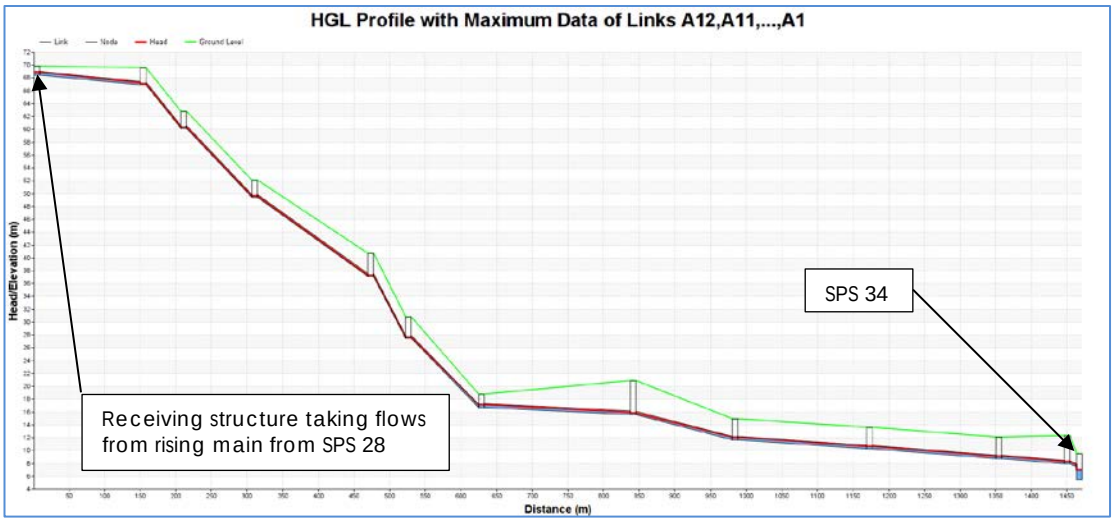
Option 1 – Post development – with pipe upgrades



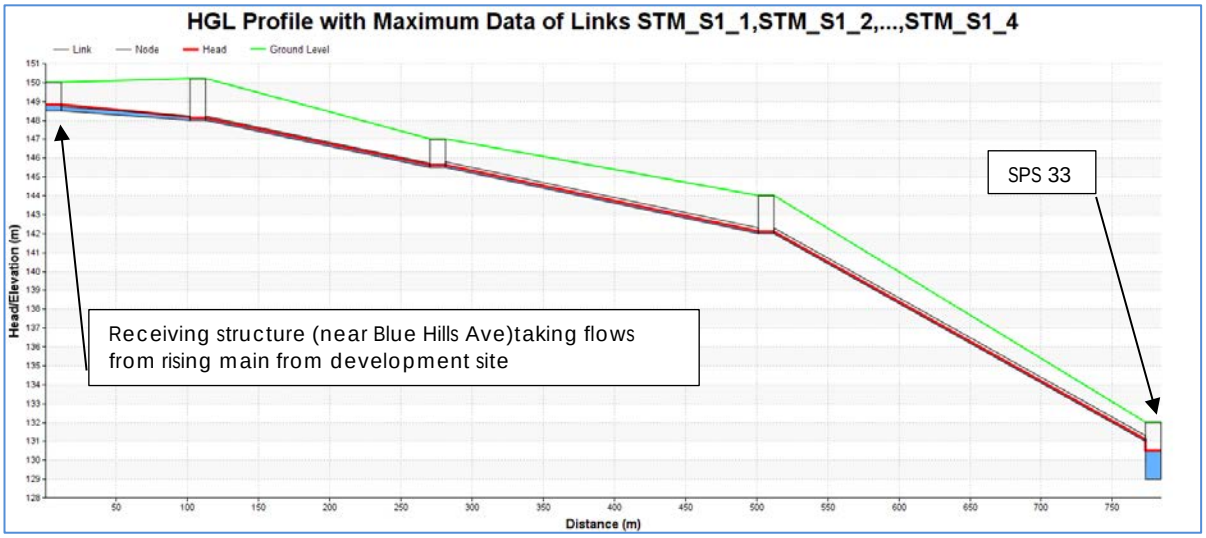
Gravity line from receiving structure taking flows from rising main from SPS 19 and connecting to SPS 17 is passing with existing pipework – no upgrade required post development (refer HGL above).



Option 1 – Post development – with pipe upgrades (continued)



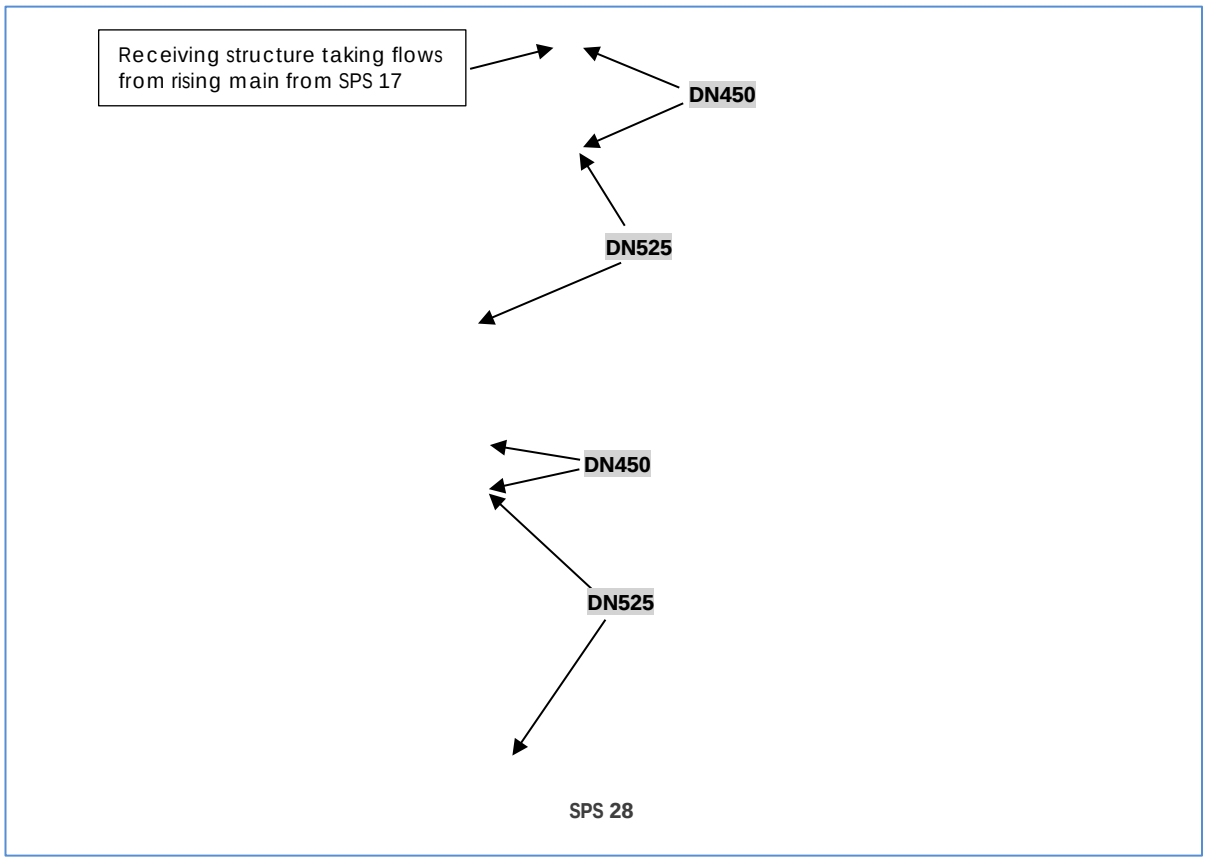
Option 2 – Post development – with pipe upgrades (continued)

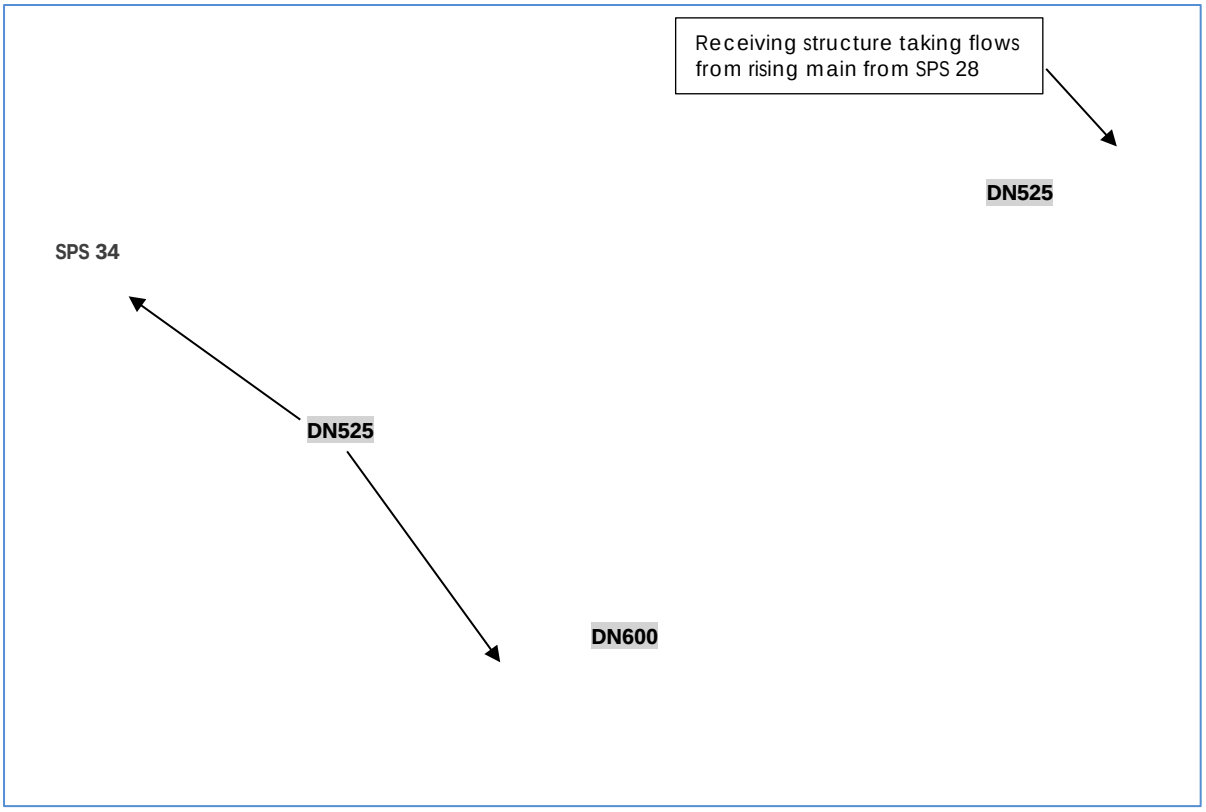


Option 1 – Post development – with pipe upgrades

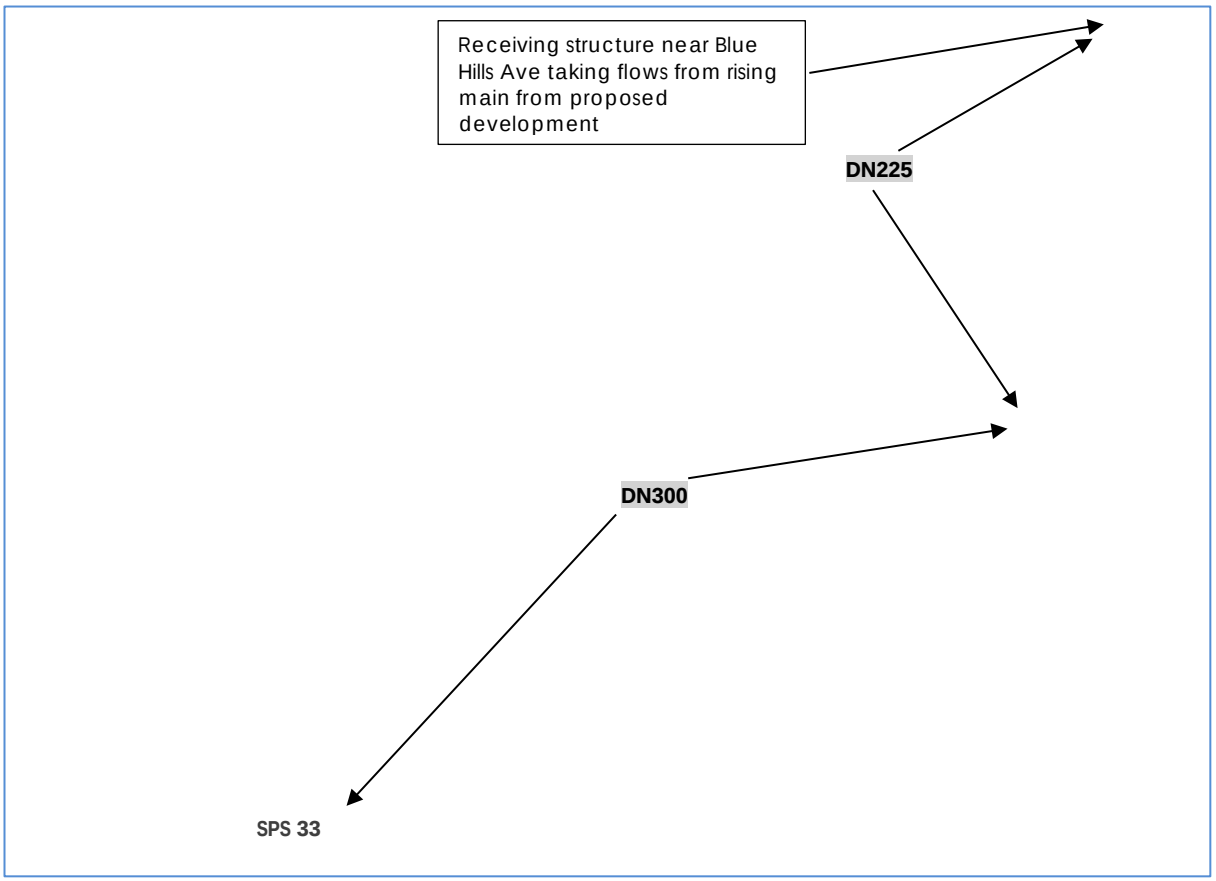
Option 1 – Post development – with pipe upgrades (continued)

Gravity line from receiving structure taking flows from rising main from SPS 19 and connecting to SPS 17 is passing with existing pipework – no upgrade required post development (no upgrade plan necessary).





Option 2 - Post development – with pipe upgrades



3.1.3 Pressure Mains

All pressure mains operated below the maximum allowable flow velocity of 3 m/s, with exception to a inor flow velocity of 3.2 m/s, downstream of SPS 28. Upsizing the pipework only reduced headloss by approx. 8-10 m therefore it may not be economical to upgrade the pipeline when pump selection at SPS 28 could still perform acceptably with a potential minor increase in operational costs. It is recommended that further review of pressure main performance is undertaken in liaison with the relevant pump manufacturer, during the detailed planning phase.

3.2 Existing Demand Scenario

For Service Option 1, all upgrades identified at the Ultimate scenario, were required to service the development site with existing network demands. This means that all upgrades will be required prior to development connection.

For Service Option 2, the only upgrades required were the gravity mains upstream of SPS 33. This means that development connection can occur with no pump upgrades required. However, SPS 33 would be operating at capacity (48 L/s) therefore any subsequent development within the catchment would trigger a pump upgrade.

3.3 Sensitivity Analysis

A sensitivity analysis was undertaken with all Ultimate background demands increased/decreased by 20%. A summary of outcomes is as follows.

3.3.1 20% Demand Increase

For both service options, a 20% increase in background demands resulted in the following changes to the baseline augmentation schedule.

- An increase of all pump stations to meet the additional PWWF.
- Upgrade a short length of DN300/DN375 rising main (50 m) downstream of SPS 28. It may also increase the need for a full rising main upgrade up to the discharge point, depending on pump selection and manufacturer's advice.
- Increase all gravity main upgrades, upstream of SPS 34, by a single pipe size.

Note this scenario can be considered conservative as the adopted PWWF factor is above SEQ Code requirements, i.e. 8.13 x ADWF as opposed to 5 x ADWF.

3.3.2 20% Demand Decrease

For Service Option 1, a 20% decrease in background demands resulted in the following changes to the baseline augmentation schedule.

- A decrease of all pump station to meet the reduced PWWF.
- Decrease all gravity mains upgrades, upstream of SPS 28, by a single pipe size.

For Service Option 2, a 20% decrease in background demands resulted in the following changes to the baseline augmentation schedule.

- A decrease of all pump station to meet the reduced PWWF.
- Decrease all gravity mains upgrades, upstream of SPS 28, by a single pipe size.
- Decrease DN300 gravity main upgrades, upstream of SPS 33, to DN225.

4 Conclusion

The proposed development can be readily serviced for reticulated sewer following upgrades of the existing sewer network.

The hydraulic analysis determined that the following infrastructure upgrades were required to service each connection option, at ultimate development.

Service Option 1 (SPS 19 catchment)

- Upgrade SPS's 19, 17, 28 and 34
- Upgrade the following gravity mains.
    - 940 m of DN375
    - 1,550 m of DN450
    - 1,280 m of DN525
    - 220 m of DN600

Service Option 2 (SPS 33 catchment)

- Upgrade SPS 33, SPS 28 and SPS 34
- Upgrade the following gravity mains
    - 270 m of DN225
    - 515 m of DN300
    - 840 m of DN525
    - 220 m of DN600

With exception to all pump/pipe upgrades recommended for the SPS 33 catchment, and DN600 gravity main upgrade upstream of SPS 34, the above augmentation schedule is essentially identical to that previously identified by the Pineapple Road assessment, however all upgrades need to be increased in size to service the subject site. Service Option 1 will need to be implemented prior to development connection, while Service Option 2 will only necessitate the gravity main upgrades, as SPS 33 theoretically has sufficient capacity to service both the subject site and existing demands. Subsequent development within the SPS 33 catchment however, will trigger downstream upgrades.

It is recommended that the identified infrastructure upgrades should be considered as a planning guide only, and LCC should verify outcomes via SCADA records, field surveys etc. In particular, confirm PWWF for relevant catchments and detailed Invert Level (IL) surveys on all trunk gravity mains along the relevant flow path.

5 References

WSAA. (2020) *SEQ Water Supply and Sewerage Design and Construction Code*. Urban Utilities.

Northern Rivers Local Government (2009) *Development Design Specification D12 Sewerage System.*

Willow and Sparrow Pty Ltd. (2020) *Sewer Capacity Assessment Pineapple Rd, Lismore*. Alstonville NSW.