58 to 68 Delancey Street
Ormiston QLD 4160

Water Supply and Sewerage
Service Options Assessment

FINAL Report V2 - 21 April, 2023

H2One Pty Ltd

Water, Sewer and Stormwater Engineering Specialists

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Joshua May	18064		21 April, 2023

Version	Date	Author	Reviewer
DRAFT - V1	21 October, 2022	D Colledge	J May
FINAL - V1	17 November, 2022	D Colledge	J May
FINAL - V2	21 April, 2023	D Colledge	J May

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1 INTRODUCTION

1.1 Background

An Integrated Health and Education Precinct is currently in the planning phase of the Ministerial Infrastructure Designation (MID) process, located at 58 to 68 Delancey Street, Ormiston QLD 4160, Lots 0/SP308738; 0 – 2/SP308739; 0/SP308740; 4/SP308740; 10 – 16/SP314782. The preliminary land-use type and density for this development is as follows (refer to Appendix 1 for the site layout plan).

- Hospital - 166 beds
- Aged Care - 134 beds
- Child Care - 175 students and staff
- Assisted Living units - 20 x 1 bedroom and 180 x 2 bedroom
- Consulting Offices - 4,614 m^2 Gross Floor Area (GFA)
- Retail - 6,213 m^2 GFA
- Research Institute - 4,407 m^2 GFA
- Community Hub - 2,000 m^2 GFA

The development site will be serviced by Redland City Council's (RCC) local water supply and sewer infrastructure, with a number of available connection options for both services. As part of the MID process, RCC (RCC) requested a service options analysis, to determine the available capacity of the downstream network and identify any infrastructure upgrades relevant to each service option.

On behalf of the Applicant (*The Hub Precinct Pty Ltd)*, H2One Pty Ltd was engaged to undertake this assessment in accordance with RCC's minimum Design Standards; "*South East Queensland Water Supply and Sewerage Design and Construction Code*" (SEQ Code) (2020). The results of the study are presented in this report.

1.2 Objectives

The objectives of the project were as follows.

1. For each sewer service option, assess the capacity of the downstream gravity mains, pumps, wet wells and emergency storage for the relevant sewer catchments (Sewage Pump Stations (SPS) 5 and 6).
2. Assess standard flow and fire flow capacity of the relevant water supply network (Alexandra Hills Low Level Zone (LLZ)).
3. Determine infrastructure upgrades necessary to achieve RCC's minimum Design Standards, where system performance failures have occurred due to the additional loadings of the new development.
4. Undertake a capital cost assessment of each sewer service option, to identify the most economical solution.
5. Prepare an engineering assessment report.

1.3 Sewer Service Strategy

The development site is located adjacent to the SPS 5 and SPS 6 sub-catchments, which are both situated within the larger catchment area of the Cleveland Sewage Treatment Plant (STP). The subject site will have an on-site private SPS that can discharge to a number of gravity main options east and south of the subject site. A number of discharge points were identified, with the following locations determined to be the preferred options.

- Option 1 - DN225 on corner of Wellington Street and Coburg Street West (SPS 6)
- Option 2 - DN225 on corner of Wellington Street and Shore Street West (SPS 5).
- Option 3 - DN150 on Delancey Street, which is the existing sewer connection for the development site (SPS 5).

From each of the connection options, the discharge from the private SPS would be transferred downstream to the relevant RCC SPS. SPS 5 transfers sewage south and discharges to the SPS 6 catchment. SPS 6 transfers flow west and discharges directly to the Cleveland STP.

Refer to Appendix 2 for an overview of the proposed service options and relevant sewer catchments.

1.4 Water Supply Service Strategy

The development site is located within the Alexandra Hills LLZ, which is supply by a series of water supply tanks located at the top of Alexandra Hill (RL 65 m). A network of DN600, DN375 and DN200 trunk mains transfer water north-east to the development site, with the proposed connection located on the existing DN375 along Delancey Street, adjacent to the eastern property boundary. For security of supply purposes, a second connection could also be located on the DN200 along Finucane Road. The pipe chainage from the Alexandra Hills water supply tanks to the proposed connection point/s is estimated at 4.2 km.

Refer to Appendix 3 for an overview of the proposed service connections and relevant water supply zone.

1.5 Demand Assessment

A water supply and sewage demand assessment was undertaken on the proposed development, to determine the approximate network loading attributed to the land-use type and density. This was calculated using RCC’s Equivalent Persons (EP) unit rates and average “per capita” demands for potable water and sewage; 230 L/EP/day and 210 L/EP/day, respectively. Refer to Table 1 below for a summary of the relevant demand estimate.

Table 1. Estimated Average Day (AD) water supply and sewage demands from the proposed development

Site Land-use and Density	Demand Rate	EP	AD Water Demand (kL/day)	AD Sewage Demand (kL/day)
166 x hospital beds	1.40 EP/bed	232.4	53.5	48.8
134 x aged care beds	0.95 EP/bed	127.3	29.3	26.7
175 x students/staff child care	0.14 EP/Stud. & Staff	24.5	5.6	5.1
20 x 1 bedroom unit assisted living	1.31 EP/Unit	26.2	6.0	5.5
180 x 2 bedroom unit assisted living	1.76 EP/Unit	316.8	72.9	66.5
4,614 m^2 GFA consulting offices	1.68 EP/100 m^2 GFA	77.5	17.8	16.3
6,213 m^2 GFA retail	1.68 EP/100 m^2 GFA	104.4	24.0	21.9
4,407 m^2 GFA research institute	1.68 EP/100 m^2 GFA	74.0	17.0	15.5
2,000 m^2 GFA community hub	4.47 EP/100 m^2 GFA	89.4	20.6	18.8
	TOTAL	**1072.5**	**246.7**	**225.2**

Note 1: Demand rates were sourced from CoGC's criteria within the *SEQ Water Supply and Sewerage Design and Construction Code* (2022). RCC advised the project team that this was acceptable.

Note 2: For the child care facility, 25 x staff were assumed for the planned 150 x student capacity.

For the post-development scenarios, RCC's Netserv demands allocated to the subject site, were removed from the hydraulic models and replaced with the demands presented in Table 1 above. The Netserv demands were sourced from RCC's 2022 IDM and are presented in Table 2 below.

Table 2. RCC's LGIP water and sewer demands (EP) removed from the hydraulic models @ post-development

Address	Sewer Node ID	Water Node ID	2021	2026	2031	2036	2051-Ult.
58-68 Delancey St, Ormiston	41618	J5445	107.3	136.3	177.6	224.6	272.2

2 METHODOLOGY

2.1 Design Standards

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

Table 3. SEQ Code provisions relevant to the analysis

	Provision	Specification
Sewerage	ET to EP conversion factor	2.7
	Average Dry Weather Flow (ADWF)	210 L/EP/day
	Peak Wet Weather Flow (PWWF)	5 x ADWF
	Single pump capacity	C1 x ADWF (L/s) where; C1 = 3.5 to 5.0 C1 = 15 x $(EP)^{-0.1587}$
	Pump station operational storage (m^3)	0.9 x Q / N where; Q = Single pump capacity (L/s) N = Number of pump starts per hour, where N = 12 for duty pump motor < 100 kW N = 8 for duty pump motor 100 – 200 kW N = 5 for duty pump motor > 200 kW
	Pump station emergency storage (m^3)	4 hours ADWF
	Total pump station 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 pressure main flow velocity	3.0 m/s
Water Supply	ET to EP conversion factor	2.7
	Average Day (AD) Demand	230 L/EP/day
	Maximum pipe velocity (m/s)	2.5 m/s
	Standard flow minimum network pressure and background demand	22m at the property boundary at PH demand
	Residential fire flow minimum network pressure and background demand	12m at 2/3 PH demand Positive pressure at PH demand Reservoir at Minimum Operating Level (15%)
	Commercial fire flow minimum network pressure and background demand	12m at PH demand
	Fire flows	Residential (> 3 storey) - 30 L/s Commercial/industrial - 30 L/s

2.2 Sewerage Network Assessment

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

1. RCC's latest LGIP MIKE+ sewer network model was adopted for the analysis (*Clev722P_(Netserv_Model))*", which includes the 2022 Netserv planning demands. For the post development scenarios, the site's estimated sewage loading was placed into the model at the relevant discharge manholes, i.e. *42254* for Option 1, *42374* for Option 2 and *41618* for Option 3. RCC's pre-existing LGIP demands were also removed from the hydraulic model, as per Section 1.5 of this report.
2. The pump capacity of SPS 5 and SPS 6 was assessed by running the model at pre- and post-development PWWF, and assessing if wet well levels operated within the stand-by pump start/stop settings.

   If the pump station could not maintain acceptable well levels and surcharging occurred, pump and rising main capacity upgrades were investigated until design standards were achieved.
3. The wet well operational storage of SPS 5 and SPS 6 was subsequently evaluated by comparing the required operational storage capacity, for the post-development scenarios, against wet well volumes between duty pump start/stop levels.

   If the wet well's operational storage volume was above the minimum requirement, compliance was achieved. If it was below the minimum requirement, upgrades were investigated until design standards were achieved.
4. The flow depth capacity of gravity mains was assessed from each of the development pump discharge locations, to SPS 5 and SPS 6. To avoid surcharging from unrelated issues downstream, pumps were deactivated from the model and gravity mains discharged directly to a wet well outlet.

   If flow depths could not be maintained within RCC specifications, pipe augmentations were investigated until design standards were achieved.
5. The emergency storage of the SPS 5 and SPS 6 catchments was assessed by determining the available storage volume between the relevant overflow levels and duty pump start levels, including upstream gravity mains and manholes.

   The available emergency storage was compared against the 4 hour ADWF requirement. If the available storage was above the minimum requirement, compliance was achieved. If it was below the minimum requirement, compliance was not achieved and storage augmentations were investigated.
6. After the determination of all sewer network upgrades, a capital cost comparison was undertaken for each service option, to determine the most economical solution. This was based on nominal unit cost rates, and should be considered a planning guide only.
7. Modelling results were verified and findings reported.

2.3 Water Supply Network Assessment

The methodology adopted for the water supply network analysis is as follows.

1. RCC's latest MIKE+ LGIP hydraulic model was adopted for the water supply analysis (*RCC WD LGIP Model_2021 FINAL v1*), which includes the 2022 Netserv planning demands. The site's estimated water demand and diurnal patterns were evenly placed into the model on node J5467.
2. For the relevant planning horizons, a 1 x Maximum Day (MD) demand standard flow hydraulic analysis was undertaken on the property connection point/s and local network, at both pre-

and post-development. Any deficiencies in the network were investigated and appropriate solutions determined.

Note: An assessment on the capacity of the water supply tanks (Alexandra Hills LLZ) was not undertaken, as the development's additional loading was considered negligible for the existing storage capacity.

3. Residential (15 L/s) and commercial (30 L/s) fire flow allocation was applied to the surrounding network. Hydrants directly servicing the subject site were allocated 30 L/s fire flow.
4. For the relevant planning horizons, a fire flow hydraulic analysis was undertaken on hydrants servicing the local network, at pre- and post-development. Any deficiencies in the network were investigated and appropriate solutions determined.
5. Based on the scenario of a second development connection to the DN200 along Finucane Road, an additional hydraulic analysis was undertaken on the external network with the site demand evenly split on the eastern and southern property connections, at the Ultimate planning horizon.

   An existing closed valve is located on the DN200 along Finucane Road, as a District Meter Area (DMA) boundary for the Alexandra Hills LLZ and HLZ, therefore a connection either side of the closed valve was considered. For the Alexandra Hills HLZ, impact to the local network was also assessed, east of McDonald Road.

   Any standard flow and fire flow deficiencies in the network were investigated and appropriate solutions determined.
6. Modelling results were verified and findings reported.

3 RESULTS

3.1 Sewerage Network Assessment

3.1.1 Pumps

A pump capacity assessment was undertaken on SPS 5 and SPS 6, as per the methodology described in Section 2.2 of this report. The analysis identified that SPS 5 was not adversely impacted by the development's additional loading and performed within RCC requirements across all planning horizons. For SPS 6 however, insufficient capacity was identified at the Ultimate planning horizon and would therefore require a pump capacity upgrade to service the proposed development.

Note the SPS 6 deficiency was identified to be a pre-existing capacity issue that was not triggered by the development site, as the pump performance was very similar at both the pre- and post-development scenarios. It is therefore recommended that RCC investigates the identified pump deficiency and resolves via standard Netserv processes, with design consideration to the additional loading of the development site (if required).

Due to the large size of the SPS 6 facility, the development's additional EP loading (800 EP) to pump/well sizing can be considered negligible, i.e. 800 EP or 2.0% of total catchment load.

Refer to Appendix 4 for detailed modelling results at pre- and post-development.

3.1.2 Wet Wells

An assessment on the operational storage capacity of the SPS 5 and SPS 6 wet wells was undertaken with the inclusion of the development's estimated loading. Table 4 below shows a summary of results and Appendix 5 provides detailed calculations.

Table 4. Operational storage capacity results (post-development)

SPS	Planning Horizon	Storage Available (kL)	Storage Required (kL)	Difference (kL)
5	2021	15.5	7.5	+8.0
	Ultimate	15.5	14.0	+1.5
6	2021	100.0	21.8	+78.2
	Ultimate	100.0	36.5	+63.5

The above table demonstrates that both pump stations have sufficient operational storage to incorporate the additional site loading, across all planning horizons. A wet well capacity upgrade is therefore not required.

3.1.3 Gravity Mains

As per the methodology described in Section 2.2 of this report, gravity pipe flow depths were assessed from the discharge point of each service option, to SPS 5 and SPS 6. The analysis identified that all service options presented sufficient pipe flow depth capacity, to incorporate the development loading across all planning horizons. No pipe capacity upgrades are therefore required to service the development site.

With respect to the connection point along Delancey Street, the hydraulic model presented that the downstream DN150 gravity mains can adequately service the additional PWWF loading (1,072.5 EP), due to the existing pipework installed at gradients higher than the minimum standard (1:180). The lowest pipe grade, up to the corner of Wellington Street and Shore Street West, is presented in the model at 1:58, which has an estimated full pipe flow capacity of 19.9 L/s, versus the upstream PWWF of 18.7 L/s, at post-development.

In addition, the gravity mains downstream from the corner of Wellington Street and Shore Street West, are serviced by 2 x DN150 gravity mains that both service upstream PWWF, i.e. a DN150 pipe grading east along Shore Street West and DN150 pipe grading south along Wellington Street, which discharges to a DN225 trunk main downstream. Presumably, RCC installed the DN150 gravity main across Shore Street West to improve capacity of the pipework to the east, which appears to be installed at grades lower than the minimum requirement (1:180).

Due to the above reasons, a connection to the DN150 gravity main along Delancey Street is theoretically viable, and should provide adequate capacity to service the proposed development site.

Refer to Appendix 6 for detailed modelling results and gravity main profiles, at pre- and post-development.

3.1.4 Emergency Storage

An emergency storage capacity assessment was undertaken on the SPS 5 and SPS 6 catchments, with the inclusion of the additional ADWF attributed to the proposed development (2.3 L/s). Table 5 below shows a summary of results and Appendix 7 shows detailed calculations.

Table 5. Emergency storage capacity results (post-development)

SPS	Planning Horizon	Storage Available (kL)	Storage Required (kL)	Difference (kL)
5	2021	612.6	199.5	+413.1
	Ultimate	612.6	326.8	+285.8
6	2021	399.3	252.2	+147.1
	Ultimate	444.5	345.3	+99.2

Note: No consideration was made to the reduction of available emergency storage from existing ADWF within the gravity network.

The results in Table 5 show that the SPS 5 and SPS 6 catchments have sufficient emergency storage to service the development's additional loading, across all planning horizons. No storage upgrades are therefore required to service the development site.

3.1.5 Capital Cost Estimate

A capital cost estimate was undertaken on the three service connection options, to identify the most cost-effective solution, with respect to achieving site connection to RCC's network and any downstream network upgrades.

The financial evaluation was based on nominal unit rates and should be considered a planning guide only. Refer to Table 6 below for a summary of outcomes.

Table 6. Capital cost estimate for the proposed sewer service options

Option	Asset Type	Length (m)	DN (mm)	Pipe Material	Unit Rate ($/m)	NPC ($)
Opt. 1	Sewer rising main	1060	150	uPVC	$520	$551,200
	Micro-tunnelling at road crossing/s	90	150	DICL	$5,500	$495,000
					SUB-TOTAL	**$1,046,200**
Opt. 2	Sewer rising main	490	100	uPVC	$520	$196,000
	Micro-tunnelling at road crossing/s	30	100	DICL	$5,500	$165,000
					SUB-TOTAL	**$361,000**
Opt. 3	Sewer rising main	40	100	uPVC	$520	$16,000
	Micro-tunnelling at road crossing/s	30	100	DICL	$5,500	$165,000
					SUB-TOTAL	**$181,000**

Note 1: Capital costs associated with the SPS 6 upgrade, identified at the Ultimate planning horizon, was excluded for Option 3, as this was identified to be an existing capacity shortfall that was <u>not</u> triggered by the subject site. Design considerations for the development's additional sewage loading would be negligible to the overall upgrade/costs.

Note 2: Capital costs associated with the on-site SPS was not considered, as all options would have similar infrastructure sizing and privately owned, i.e. RCC will not own and/or operate the SPS.

Note 3: Option 3 was assumed to have a connection on the eastern side of Delancey Road, even though an existing manhole is present within the development site. This was adopted to provide a conservative cost comparison and consider discharge levels/options for the private SPS.

The above capital cost comparison shows that Service Option 3 will likely provide a much more economical solution to that of Options 1 and 2, with a cost saving of $865,200 and $180,000 respectively. The main reason for this outcome is that Option 3 would utilise a discharge manhole in close proximity to the eastern property boundary, significantly reducing the total length of the new rising main.

3.2 Water Supply Network Assessment

3.2.1 Standard Flow

As per the methodology described in Section 2.3 of this report, a standard flow network analysis was undertaken on all planning horizons, with the development demand applied to the DN375 trunk main along Delancey Street. A summary of results is presented below in Table 7.

Table 7. Standard flow network modelling results (pre- and post-development)

Provision	2021		Ultimate	
	Pre-develop.	Post-develop.	Pre-develop.	Post-develop.
Connection point (*J5467*) min. pressure (m)	37.6	37.1	33.3	32.6
Network min. pressure (m)	28.0	26.5	23.0	22.5
Network min. pressure node ID	J5224			
Network no. failures	0	0	0	0
Max. pipe velocity (m/s)	1.1	1.2	1.9	2.0
Network max. velocity ID	9668			
Network no. failures	0	0	0	0

Note 1: Peak hour occurred at 9 am within the local network.

Note 2: Modelling with the supply reservoir at MOL was not considered, as the network at peak demand is largely supported by the pumps at the Capalaba Water Treatment Plant (WTP).

The above results demonstrate that the network performed within RCC's Design Standards across all planning horizons. No infrastructure upgrades are therefore required to service the development for standard flow.

3.2.2 Fire Flow

As per the methodology described in Section 2.3 of this report, a fire flow network analysis was undertaken on all planning horizons, with the development demand applied to the DN375 trunk main along Delancey Street. A summary of results is presented below in Table 8.

Table 8. Fire flow network modelling results (pre- and post-development)

Provision		2021		Ultimate	
		Pre-develop.	Post-develop.	Pre-develop.	Post-develop.
PH @ 30 L/s	Site hydrant 1 (*J5467*) min. pressure (m)	35.8	35.1	30.9	30.2
	Site hydrant 2 (*J5445*) min. pressure (m)	31.8	27.5	26.9	26.3
	Site hydrant 3 (*J5446*) min. pressure (m)	31.7	31.7	28.0	28.0
	Network hydrants min. pressure (m)	14.0	13.3	8.9	3.0
	Network hydrant min. pressure node ID	J5477			
	Network hydrants no. failures	0	0	1	1
2/3 PH @ 15 L/s	Network hydrants min. pressure (m)	16.5	16.2	13.0	12.6
	Network hydrant min. pressure node ID	J5224			
	Network hydrants no. failures	0	0	0	0

Note 1: Peak hour and 2/3 peak hour occurred at 9 am and 4:30 pm respectively.

Note 2: Modelling with the supply reservoir at MOL was not considered, as the network at peak demand is largely supported by the pumps at the Capalaba Water Treatment Plant (WTP).

The above table demonstrates that the water supply network performed within RCC's minimum fire flow design standards across all planning horizons, with exception to a single 30 L/s minimum pressure failure on node J5477. This node is located on Lucy Court and will directly service the development site from the north.

However, further investigation determined that this node would achieve a minimum pressure of 13.1 m, at post-development, if the 30 L/s fire flow was evenly distributed across 3 hydrants in close proximity. Queensland Fire and Emergency Service (QFES) generally require 3 x hydrants to achieve a 30 L/s fire flow, therefore node J5224 was deemed to comply with RCC's minimum design standards.

The above results demonstrate that the network performed within RCC's Design Standards across all planning horizons. No infrastructure upgrades are required to service the development for fire flow.

3.2.3 Additional Connection

As per the methodology described in Section 2.3 of this report, an additional hydraulic analysis was undertaken with a second connection on the DN200 along Finucane Road, at the Ultimate planning horizon. This included connection options either side of the Alexandra Hills HLZ/LLZ boundary valve. The key outcomes were as follows.

- All service options achieved minimum standard flow pressure standards, at both the connection points and within the local network. The minimum residual pressure was identified to be 30.2 m, at node J5445.
- All service options achieved minimum 15 L/s and 30 L/s fire flow pressure standards, at both the connection points and within the local network. The minimum residual pressure was identified to be 16.0 m, at node J17149.

The above results demonstrate that, if required, the site can be adequately serviced by a second connection on the DN200 trunk main along Finucane Road. A service connection either side of the Alexandra Hills HLZ/LLZ boundary valve would be acceptable, however consideration to maintaining the zone boundary would be required, with respect to the internal plumbing system of the development site.

4 CONCLUSION

An Integrated Health and Education Precinct is currently in the planning phase of the Ministerial Infrastructure Designation (MID) process, located at 58 to 68 Delancey Street, Ormiston QLD 4160, Lots 0/SP308738; 0 – 2/SP308739; 0/SP308740; 4/SP308740; 10 – 16/SP314782. The preliminary land-use type and density for this development is as follows (refer to Appendix 1 for the site layout plan).

- Hospital - 166 beds
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- Consulting Offices - 4,614 m^2 Gross Floor Area (GFA)
- Retail - 6,213 m^2 GFA
- Research Institute - 4,407 m^2 GFA
- Community Hub - 2,000 m^2 GFA

The development site will be serviced by Redland City Council's (RCC) local water supply and sewer infrastructure, with a number of available connection options for both service networks. These include the following.

- A water supply connection on the DN375 trunk main along Delancey Street, with the potential for a second "security of supply" connection on the DN200 trunk main along Finucane Road.
- An onsite private Sewage Pump Station (SPS) transferring wastewater via 3 x service options, details are as follows.
  - Option 1: DN225 on corner of Wellington Street and Coburg Street West (SPS 6 catchment)
  - Option 2: DN225 on corner of Wellington Street and Shore Street West (SPS 5 catchment).
  - Option 3: DN150 on Delancey Street, which is the existing sewer connection for the development site (SPS 5 catchment).

As part of the MID process, RCC (RCC) requested a service options analysis, to determine the available capacity of the downstream network and identify any infrastructure upgrades relevant to each service option. On behalf of the Applicant (*The Hub Precinct Pty Ltd*), H2One Pty Ltd was commissioned to undertake this assessment in accordance with RCC's minimum Design Standards; "South East Queensland Water Supply and Sewerage Design and Construction Code" (2020).

The hydraulic modelling analysis identified the following key outcomes.

1. The existing water supply network has adequate standard flow and fire flow capacity to service the proposed development (1,073 EP), across all planning horizons.
2. The SPS 5 catchment has adequate capacity to service the proposed development, across all planning horizons.
3. The SPS 6 catchment has adequate capacity to service the proposed development, across all planning horizons, with exception to a pump capacity deficiency identified at the Ultimate planning horizon. Further investigation identified that this shortfall was a pre-existing capacity

issue that was not triggered by the development site, as the deficiency occurred at both pre- and post-development scenarios.

4. A capital cost estimate identified that sewer service Option 3 will likely be the most economical solution, i.e. $181,000 for Option 3, versus $1,046,000 and $361,000 for Options 1 and 2 respectively. This was predominantly due to the discharge manhole for Option 3 being in close proximity to the development site.

In summary, it is recommended that RCC verifies the above findings against available SCADA records, 'As Constructed' plans etc., and approves the development water supply connection on the existing DN375 along Delancey Street, and sewer connection on the existing DN150 gravity main located adjacent to the eastern property boundary of the development site. It is particularly critical to verify sewer pipe invert levels from the proposed DN150 connection to SPS 5, to ensure adequate capacity is available for the private SPS discharge rate.

Detailed modelling results, calculations and system plan can be observed in Appendices 1 through 7.

5 REFERENCE LIST

RCC. (2020). *SEQ Water Supply and Sewerage Design and Construction Code*. Cleveland, QLD

RCC. (2013). *SEQ Water Supply and Sewerage Design and Construction Code*. Cleveland, QLD

6 APPENDICES

Appendix 1. Development layout plan

CLARIFICATIONS AND DISCLAIMERS

1. THE MAXIMUM BUILDING HEIGHT VARIES IN RELATION TO THE ADJACENT AT GRADE GROUND LEVEL DUE TO SITE TOPOGRAPHY
2. REFER TO BUILDING SECTIONS FOR BUILDING HEIGHT INFORMATION, WHICH ARE TO BE READ IN CONJUNCTION WITH SITE PLANS FOR AT GRADE GROUND LEVELS
3. ALL PLANS ARE PRELIMINARY AND SUBJECT TO FURTHER DEVELOPMENT OF THE FUNCTIONAL BRIEF AND FINAL DESIGN
4. TENANCY SPACES ARE PROVIDED AS "COLD SHELL" AREAS FOR FIT OUT BY TENANTS
5. PARKING NUMBERS ARE SUBJECT TO DEVELOPMENT OF THE FINAL DESIGN FINAL DESIGN

SCALE 1:500 AT ORIGINAL SIZE

DESTRAVIS GROUP

PRELIMINARY

REV	DESCRIPTION	DATE	INIT
1	Revision 2	28/02/2023	
2	Revision 3	10/03/2023	NB
3	Coordination and Comments	27/03/2023	NB
4	Client's comments incorporated	04/04/2023	NS

CLIENT
HUB68 PRECINCT PTY LTD

PROJECT NAME
CLEVELAND PRIVATE HOSPITAL

LOCATION
58-68 DELANCEY STREET, ORMISTON QLD 4160

STATUS
DRAFT MID - FOR COORDINATION AND COMMENT

DRAWING
STAGE ONE - WHOLE SITE PLAN

SCALE @ A1
As indicated

DATE
27/03/2023

DRAWN BY
JPS

JOB No
4_2301_03

DWG No
A120

REV
4

NORTH

Plot Date: 4/04/2023 4:27:17 PM File Path: D:\Destravis Dropbox\DES_Projects\Hub 68_Cleveland MID\A15_Working Drawings\230404_2-hub68_with linkt RAC.rvt

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0 5 10 15 m
SCALE 1:500 AT ORIGINAL SIZE

DESTRAVIS GROUP

PRELIMINARY

REV	DESCRIPTION	DATE	INIT
1	Revision 2	28/02/2023	
2	Revision 3	10/03/2023	NB
3	Coordination and Comments	27/03/2023	NB
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CLIENT
HUB68 PRECINCT PTY LTD

PROJECT NAME
CLEVELAND PRIVATE HOSPITAL

LOCATION
58-68 DELANCEY STREET, ORMISTON QLD 4160

STATUS
DRAFT MID - FOR COORDINATION AND COMMENT

DRAWING
STAGE TWO - WHOLE SITE PLAN

SCALE @ A1
1 : 500

DATE
27/03/2023

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JPS

JOB No
4_2301_03

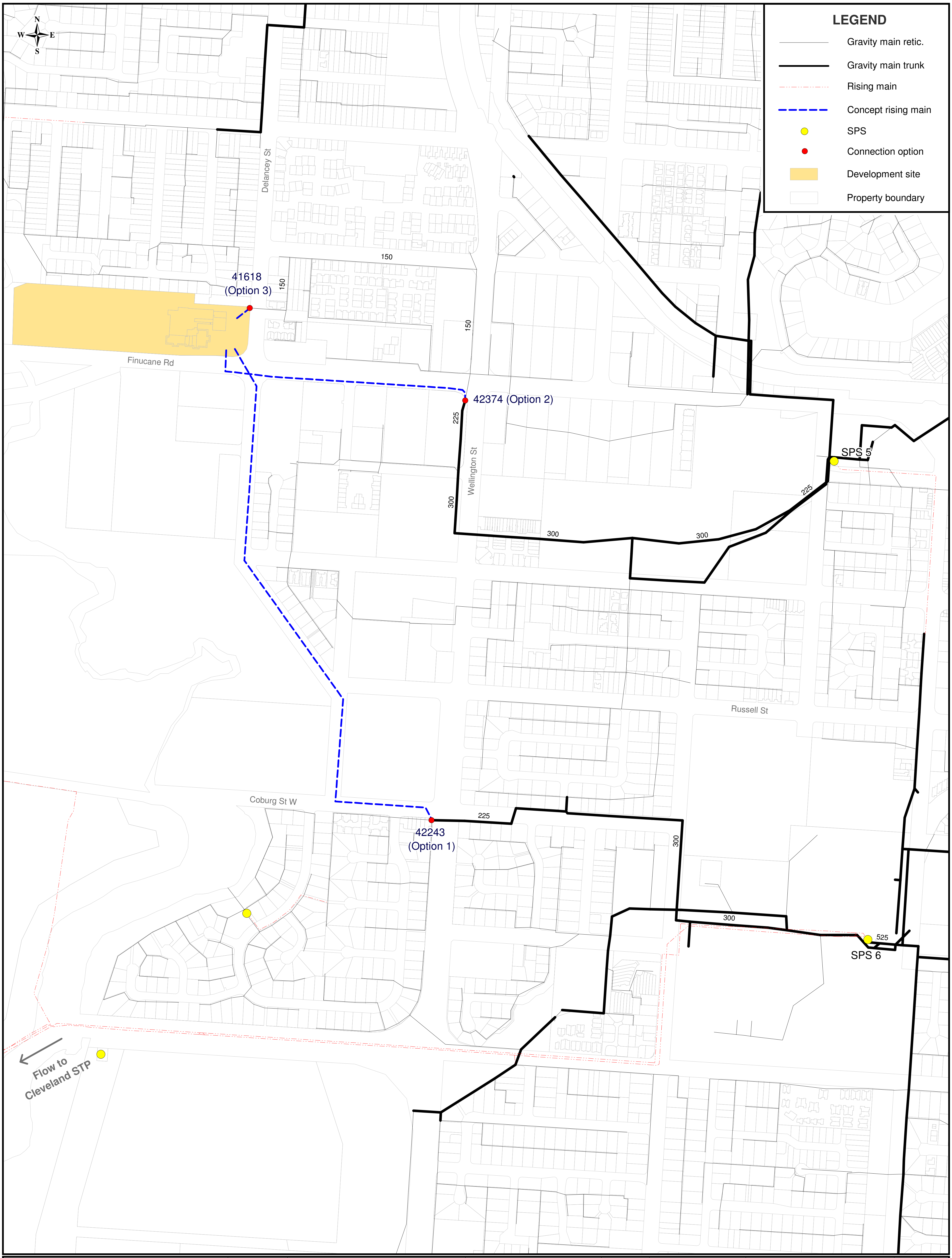
DWG No
A140

REV
4

NORTH

Plot Date: 4/04/2023 4:41:57 PM File Path: D:\Destravis Dropbox\DES_Projects\Hub 68_Cleveland MID\A15_Working Drawings\230404_2-hub68_with linkt RAC.rvt

Appendix 2. Proposed sewer service options



H2ONE

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DRAWN: D Colledge
CHECKED: J May
APPROVED: J May
CLIENT PM:
H2ONE PM: J May

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No.	REVISION	APPROVED
A	ORIGINAL ISSUE - 21 OCT, 2022	

DATUM:
HORIZ: MGA94 (ZONE 56)
HEIGHT: AHD

SCALE:
0 100 200
Metres

SURVEYED BY / DATE:
SURVEY CHECKED:

PROJECT NO: 2208505
FILE REF:
CAD FILE:

Redland CITY COUNCIL

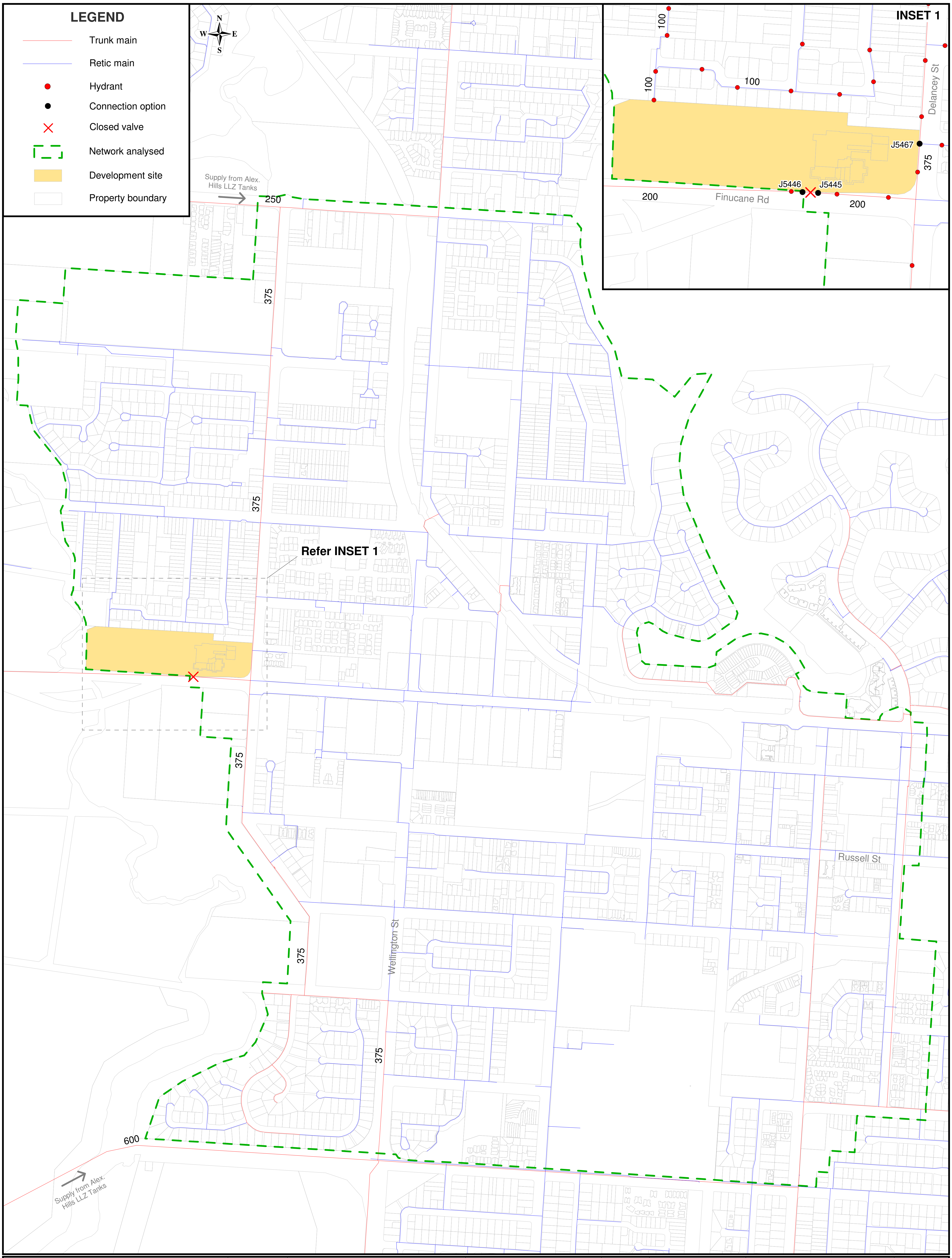
REDLAND CITY COUNCIL
PO BOX 21
CLEVELAND QLD 4163

58-68 Delancey St
Ormiston QLD 4160
Water Supply & Sewerage
Service Options Assessment

Appendix 2. Proposed sewer connection options

OCT, 2022
DATE SCANNED:
DRG No:
REV:

Appendix 3. Proposed water supply service options



H2ONE H2One Pty Ltd PO Box 290 IPSWICH QLD 4305 P: 07 5463 9538 E: info@H2One.com.au W: h2one.com.au	DESIGNED: D Colledge DRAWN: D Colledge CHECKED: J May APPROVED: J May CLIENT PM: H2ONE PM: J May	NOTE: DESIGN NOT TO BE AMENDED WITHOUT H2ONE PTY LTD ACCEPTANCE	DATUM: HORIZ: MGA94 (ZONE 56) HEIGHT: AHD SCALE: 0 125 250 Metres	PROJECT NO: 2208505 FILE REF: CAD FILE:	Redland CITY COUNCIL REDLAND CITY COUNCIL PO BOX 21 CLEVELAND QLD 4163	58-68 Delancey St Ormiston QLD 4160 Water Supply & Sewerage Service Options Assessment Appendix 3. Proposed water supply connection options
		A ORIGINAL ISSUE - 21 OCT 2022	SURVEYED BY / DATE:	SURVEY CHECKED:		OCT, 2022 DATE SCANNED: DRG No: REV:
		No. REVISION APPROVED				

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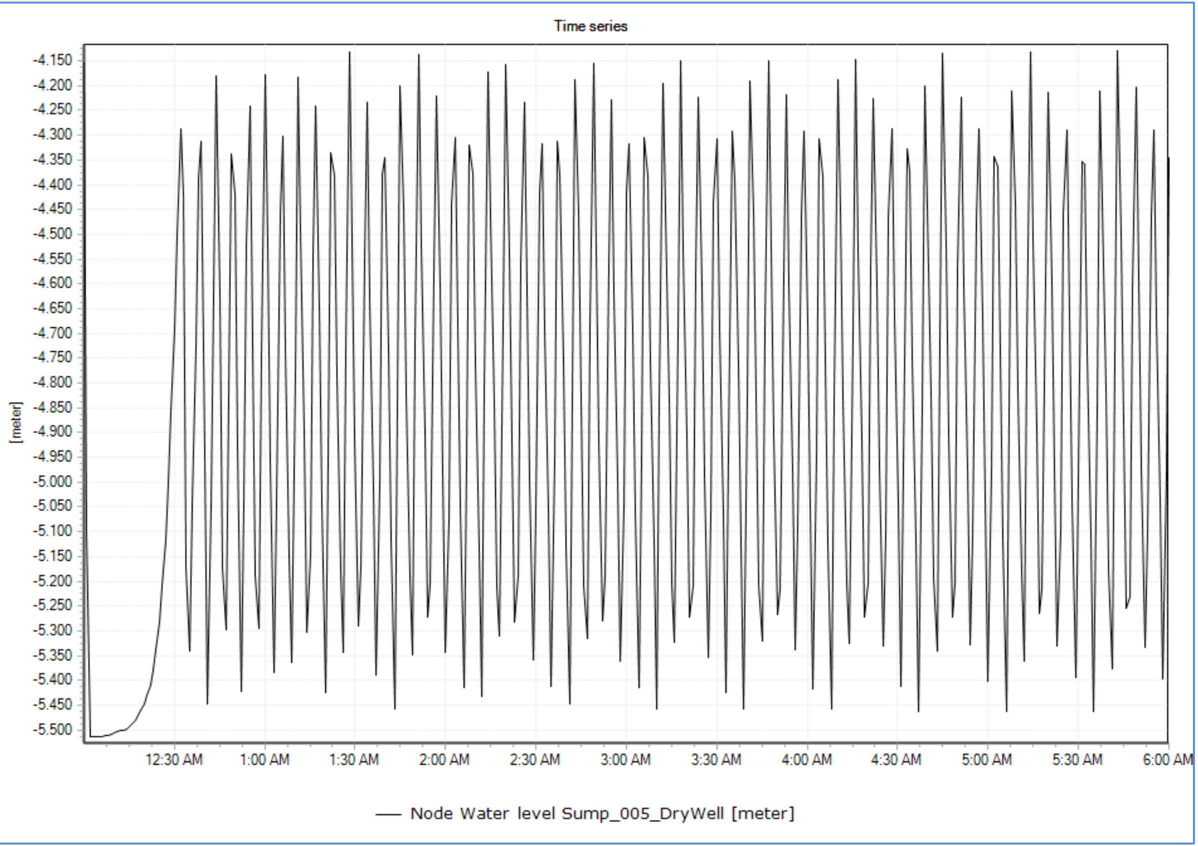
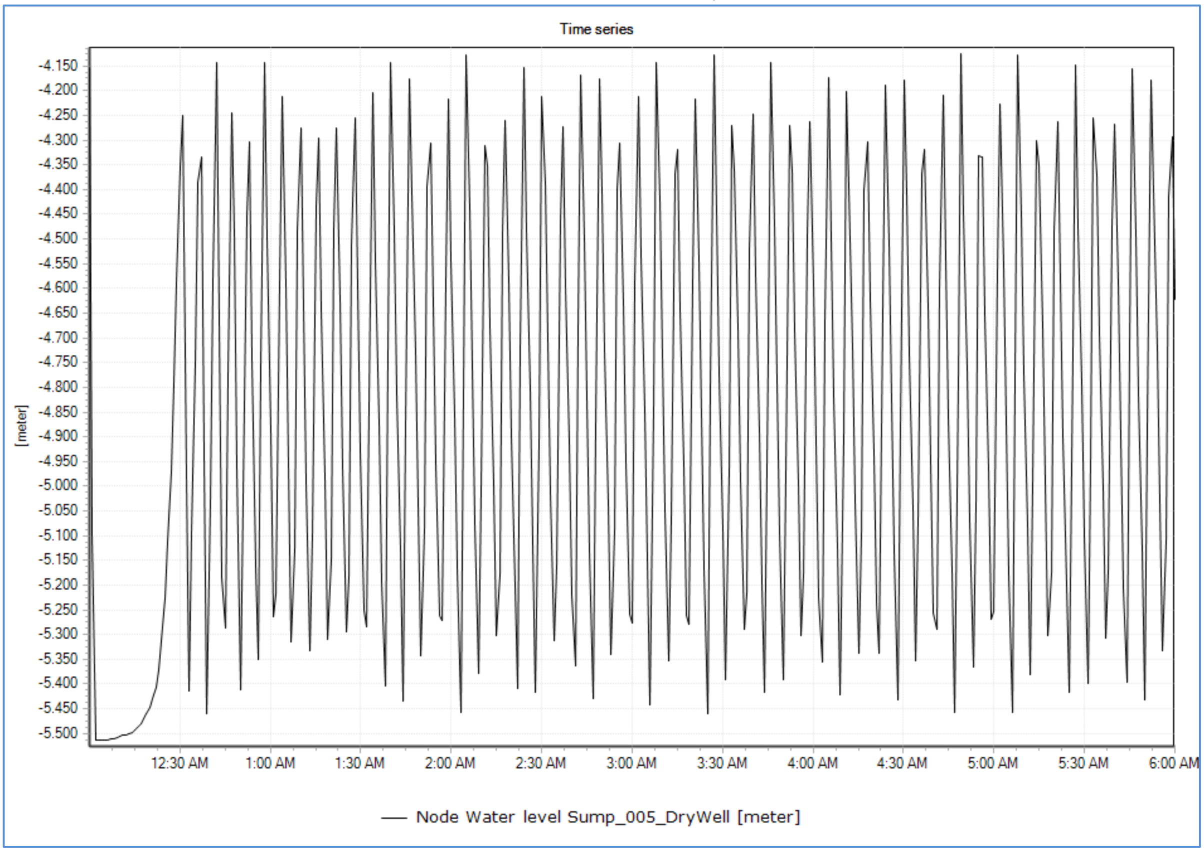
Appendix 4. Pump capacity assessment results

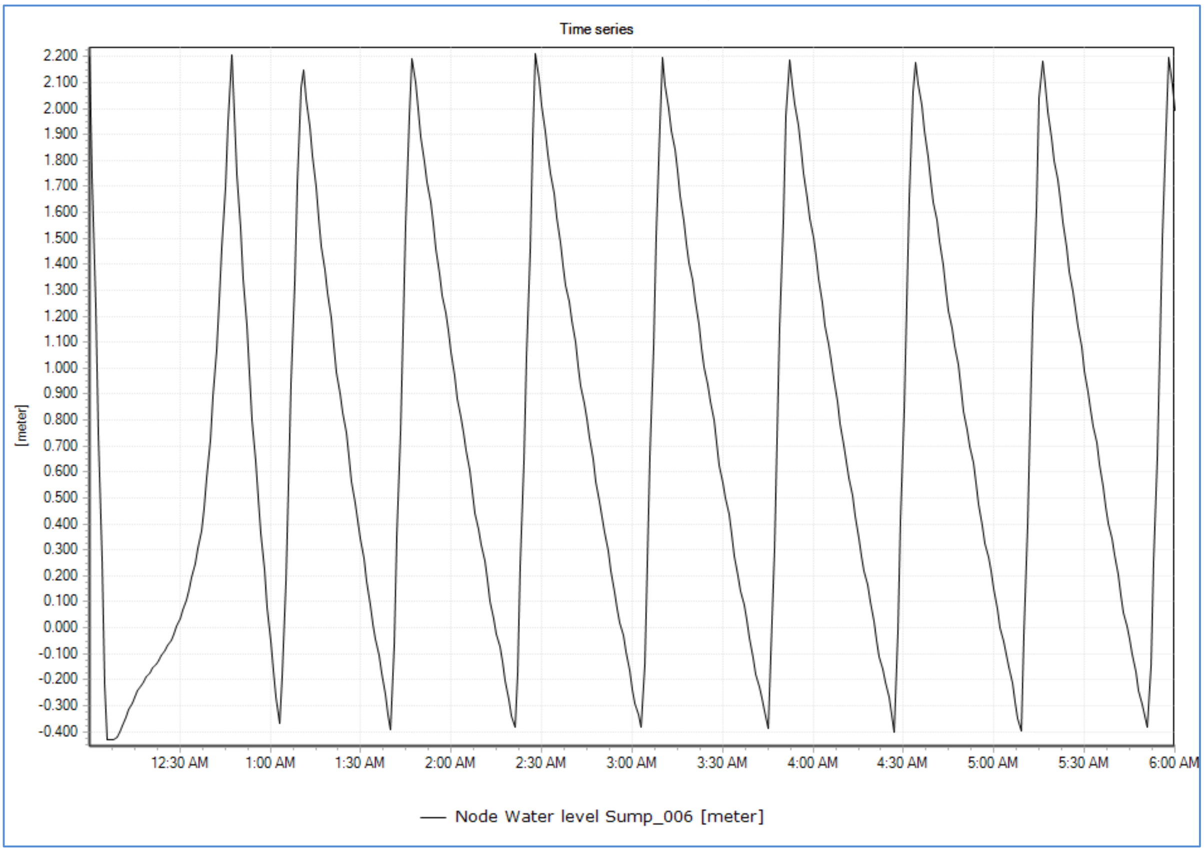
SPS 5 @ 2021, Pre-development



SPS 5 @ 2021, Post-development



SPS 6 @ 2021, Pre-development



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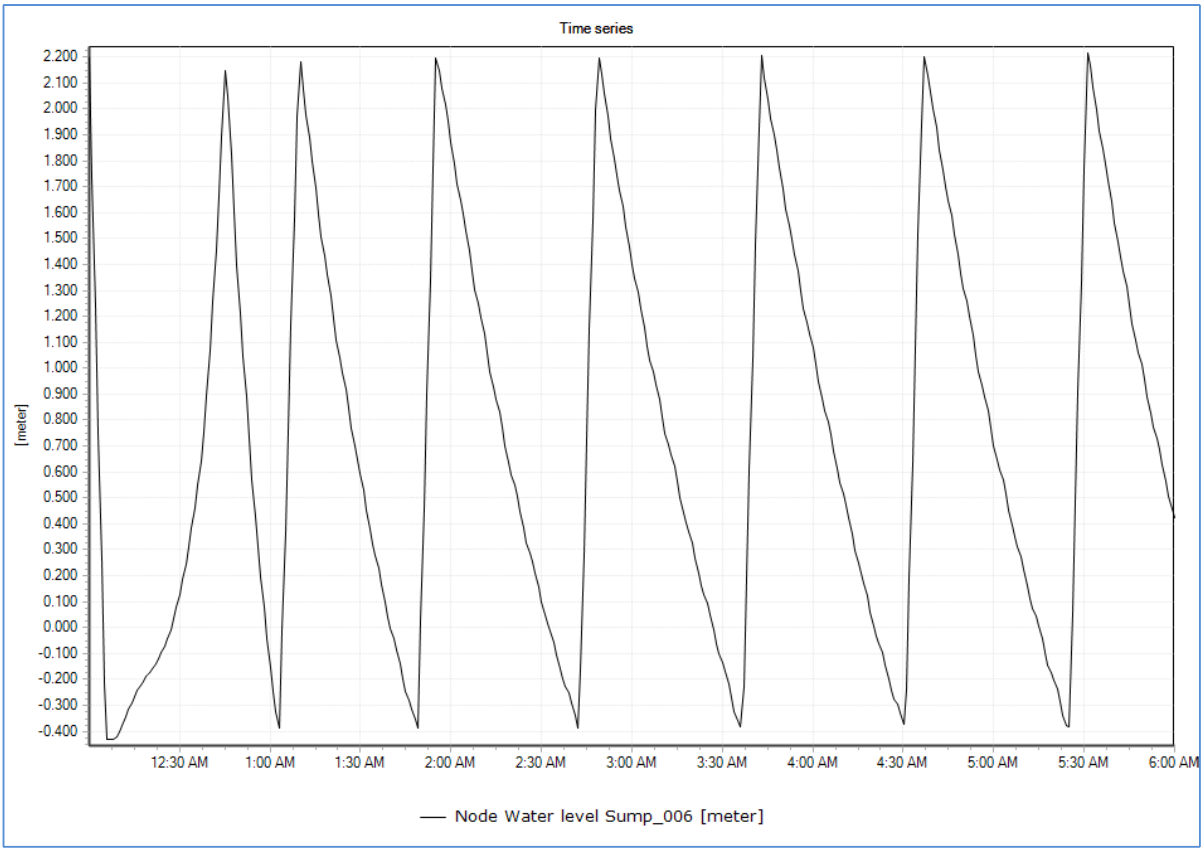
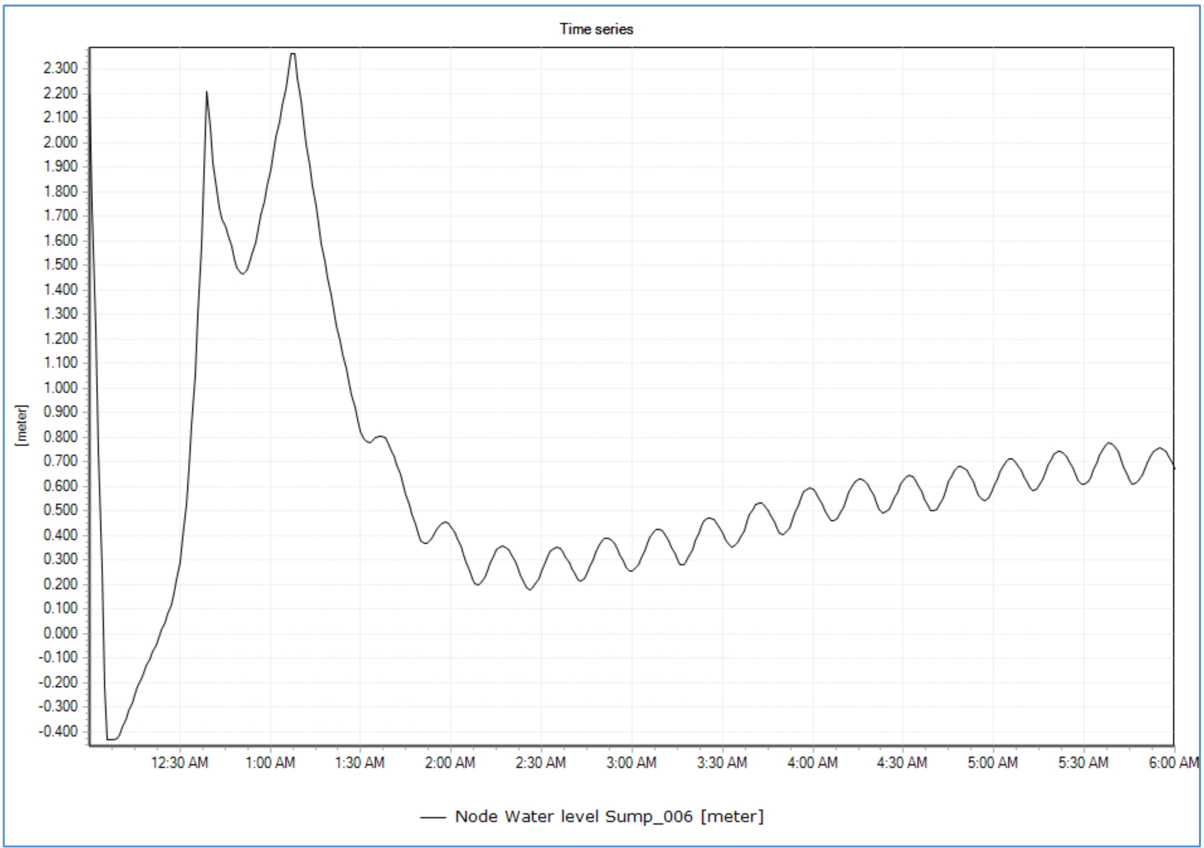
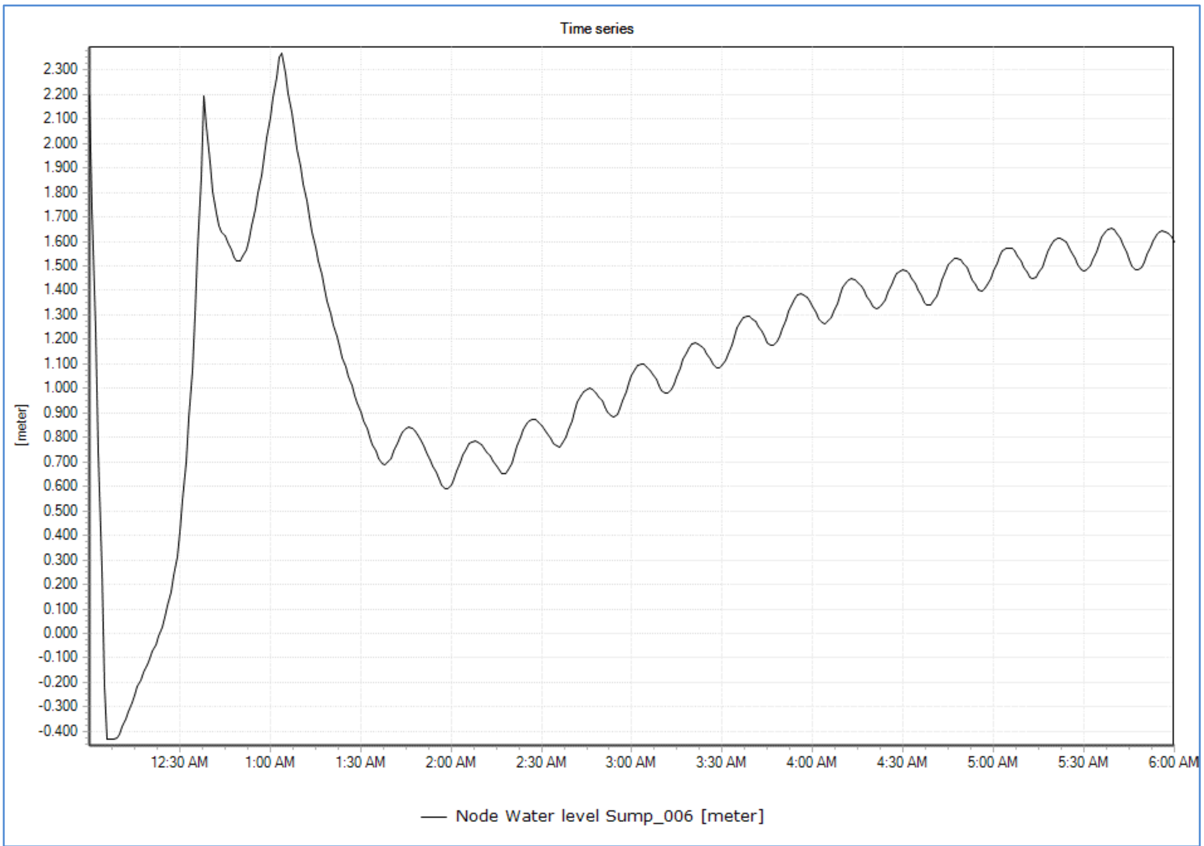


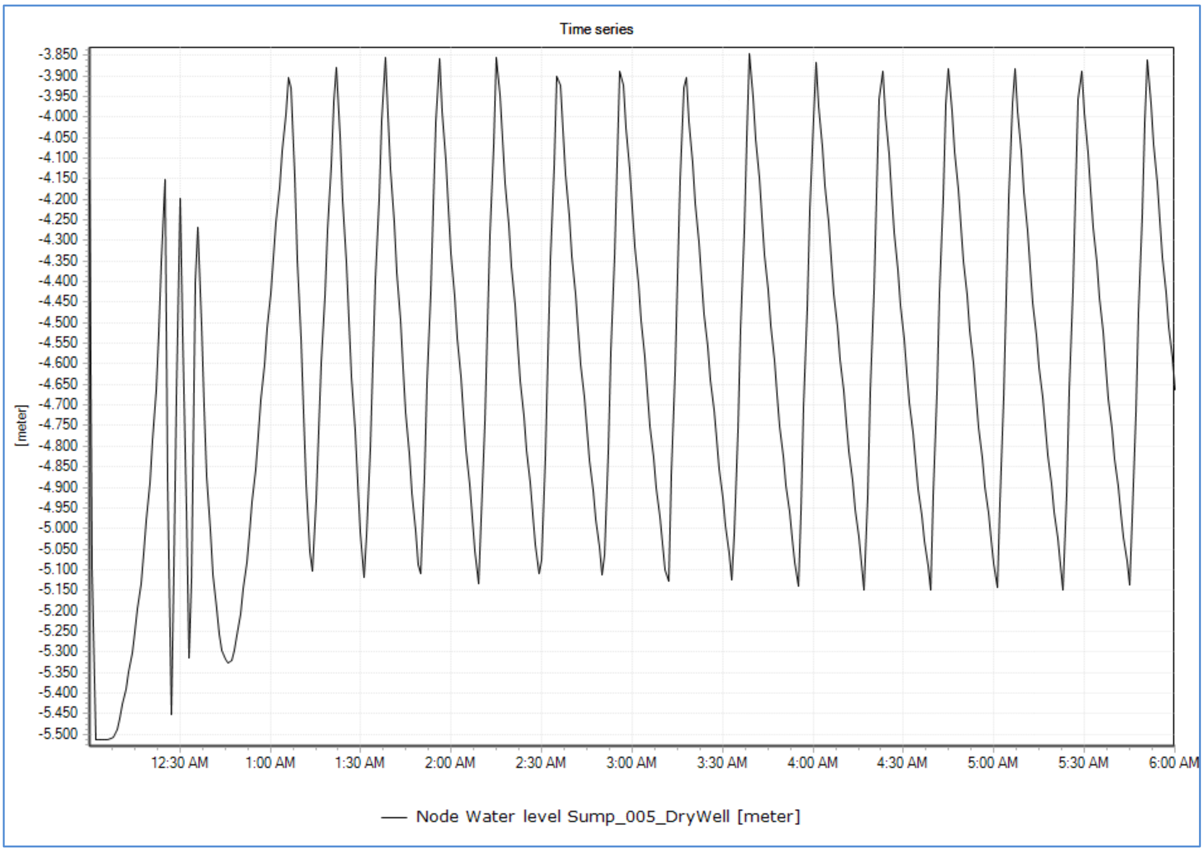
SPS 6 @ 2051, Pre-development



SPS 6 @ 2051, Post-development



SPS 5 @ Ultimate, Pre-development



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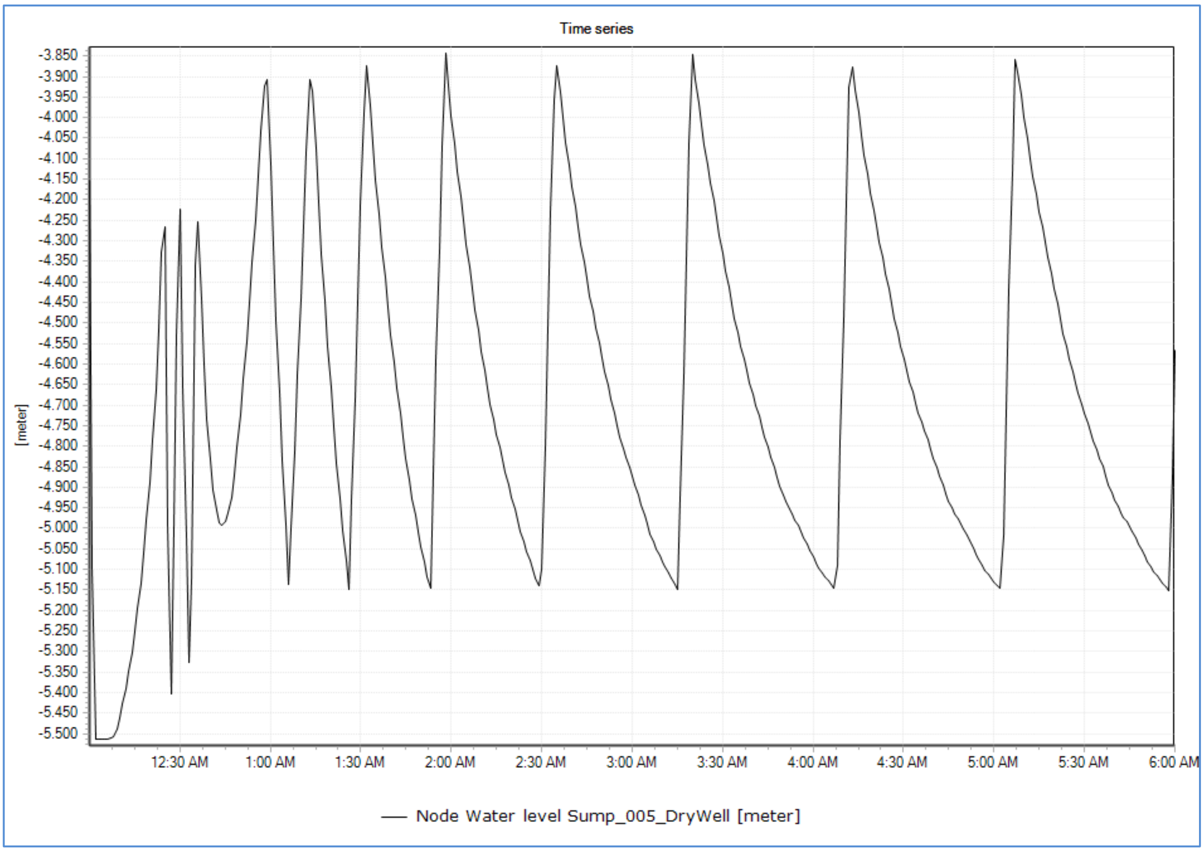
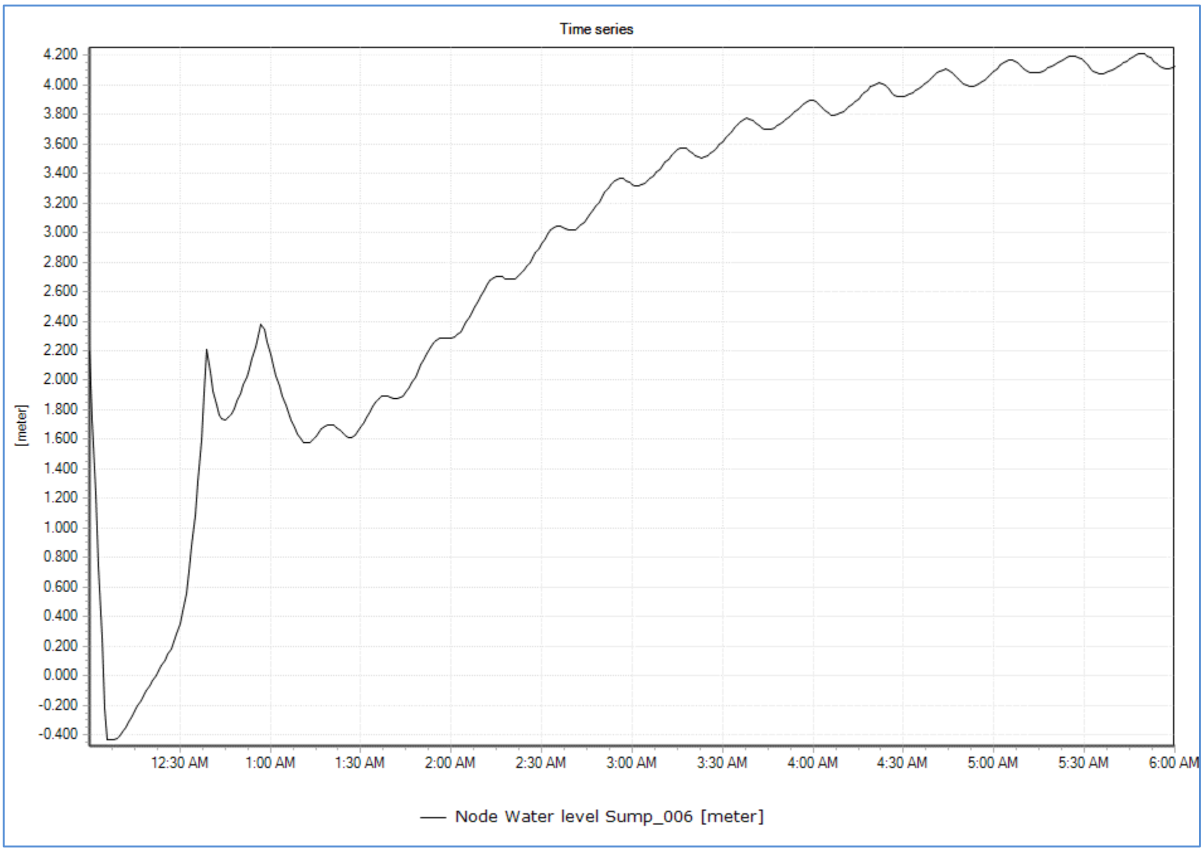
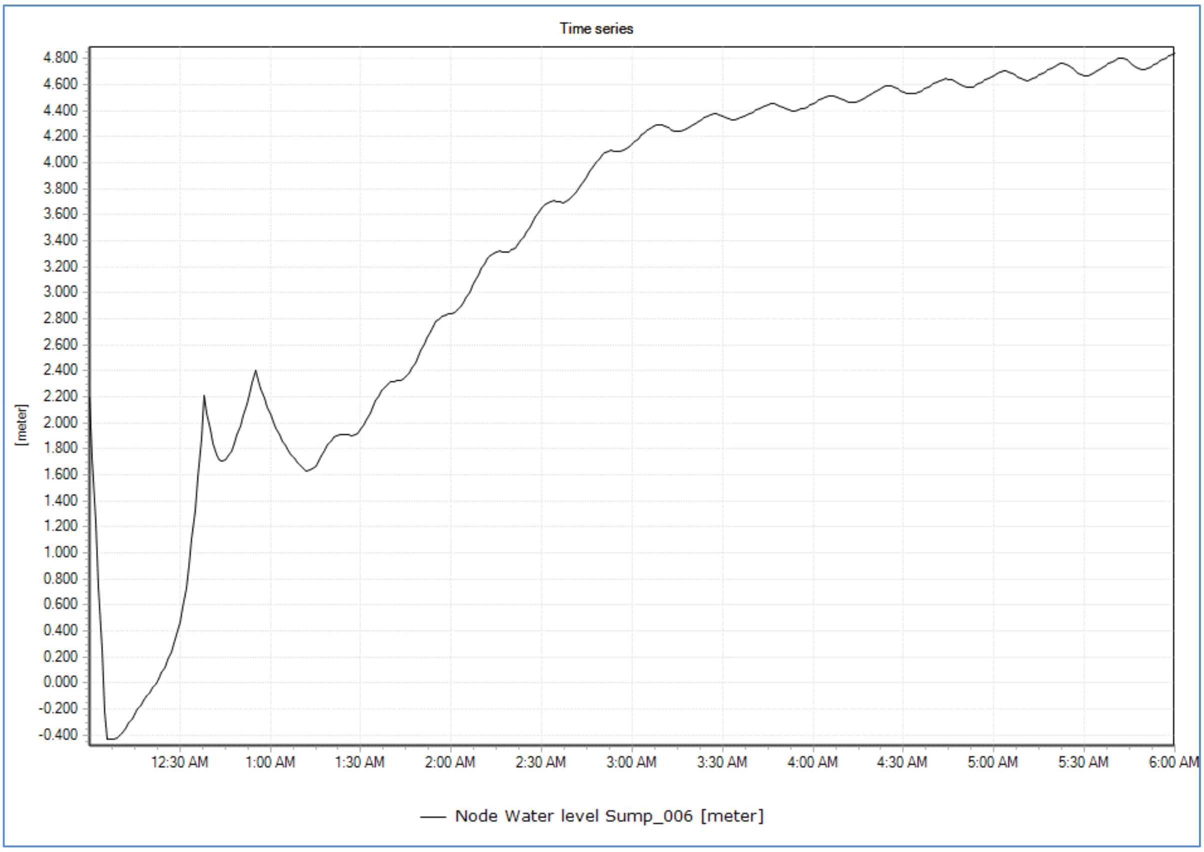


SPS 6 @ Ultimate, Pre-development



SPS 6 @ Ultimate, Post-development



Appendix 5. Operational storage capacity assessment results

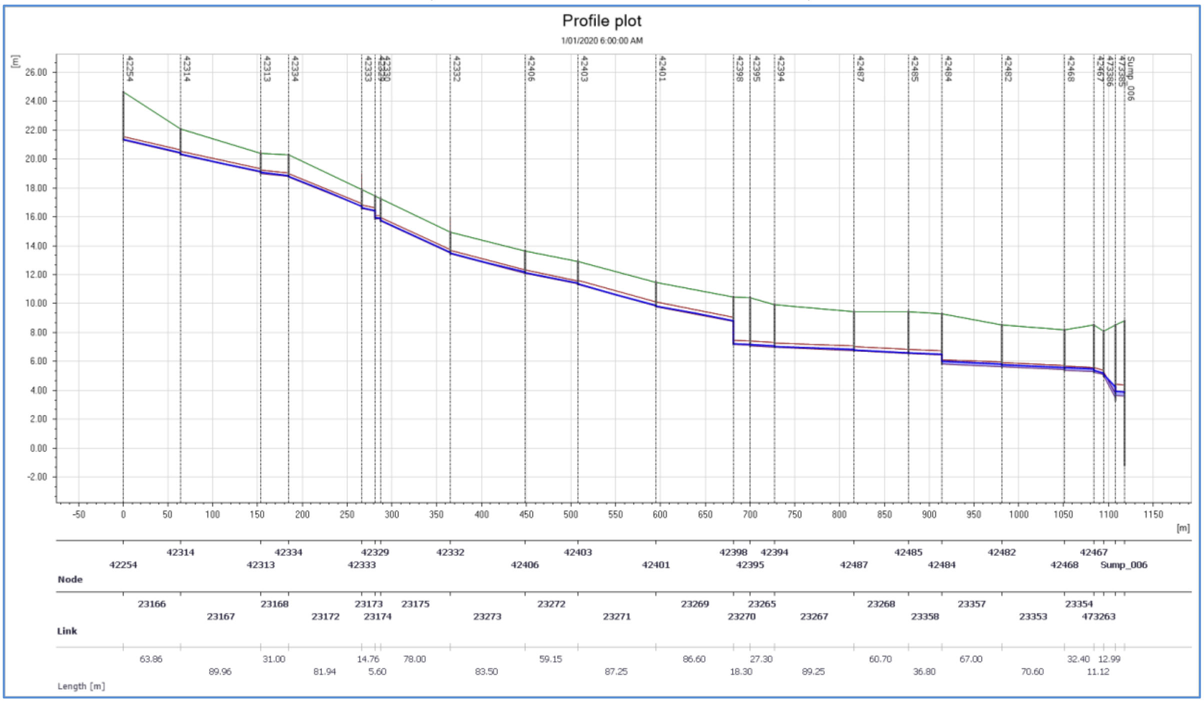
		2021		Ultimate	
		SPS 6	**SPS 5**	**SPS 6**	**SPS 5**
Single Pump Capacity Required	C1	3.50	3.50	3.50	3.50
	ADWF (L/s)	55.25	28.51	92.80	53.14
	Q (L/s)	193.39	99.79	324.80	185.99
Storage Capacity Required	Pump Setup	Duty-assist	Duty-assist	Duty-assist	Duty-assist
	Duty Head (m)	NA	NA	NA	NA
	Pump Efficiency (%)	NA	NA	NA	NA
	Duty Power (kW)	100 to 200	<100	100 to 200	<100
	No. pump starts (n)	8.00	12.00	8.00	12.00
	Volume (kL)	21.76	7.48	36.54	13.95
Storage Capacity Available	Duty Start (RL m)	2.20	-4.15	2.20	-4.15
	Duty Stop (RL m)	-0.40	-5.45	-0.40	-5.45
	Duty Height (m)	2.60	1.30	2.60	1.30
	WW Diam. (m)	7.00	3.90	7.00	3.90
	Volume (kL)	100.01	15.48	100.01	15.48
OUTCOME	**Difference (kL)**	**+78.25**	**+ 8.00**	**+63.47**	**+1.53**
	Pass / Fail	**Pass**	**Pass**	**Pass**	**Pass**

Note 1: Wet well and pump details were sourced from the RCC's hydraulic model.

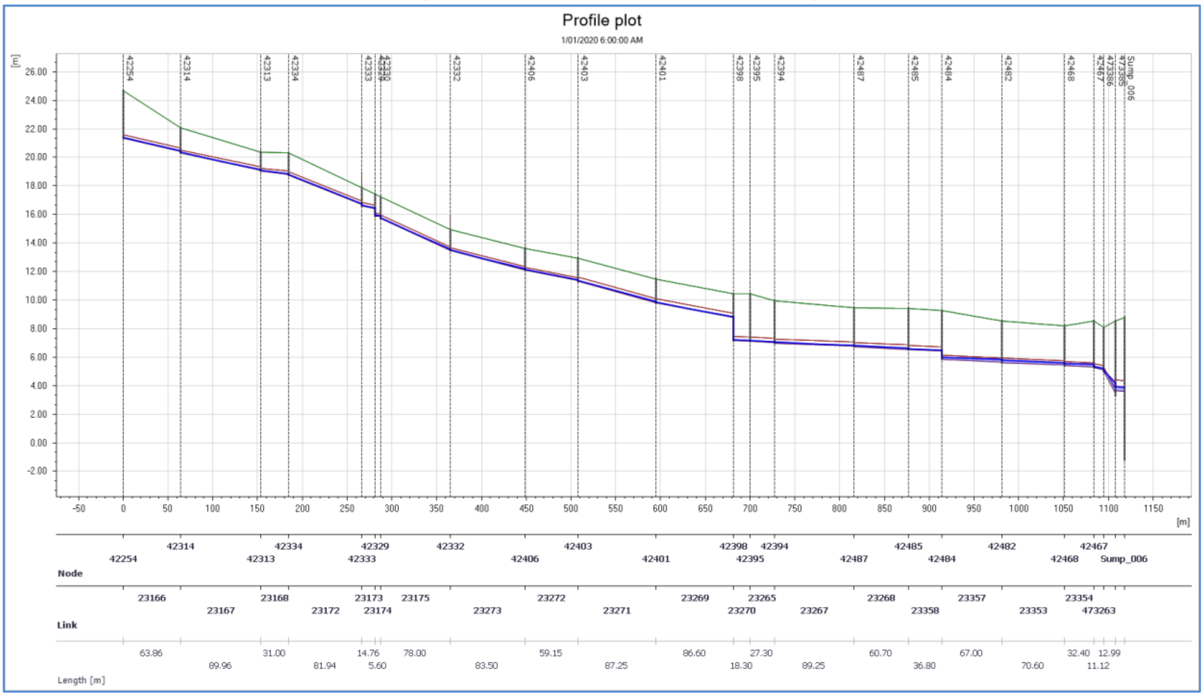
Note 2: The above table presents results at post-development.

Appendix 6. Gravity main capacity assessment results

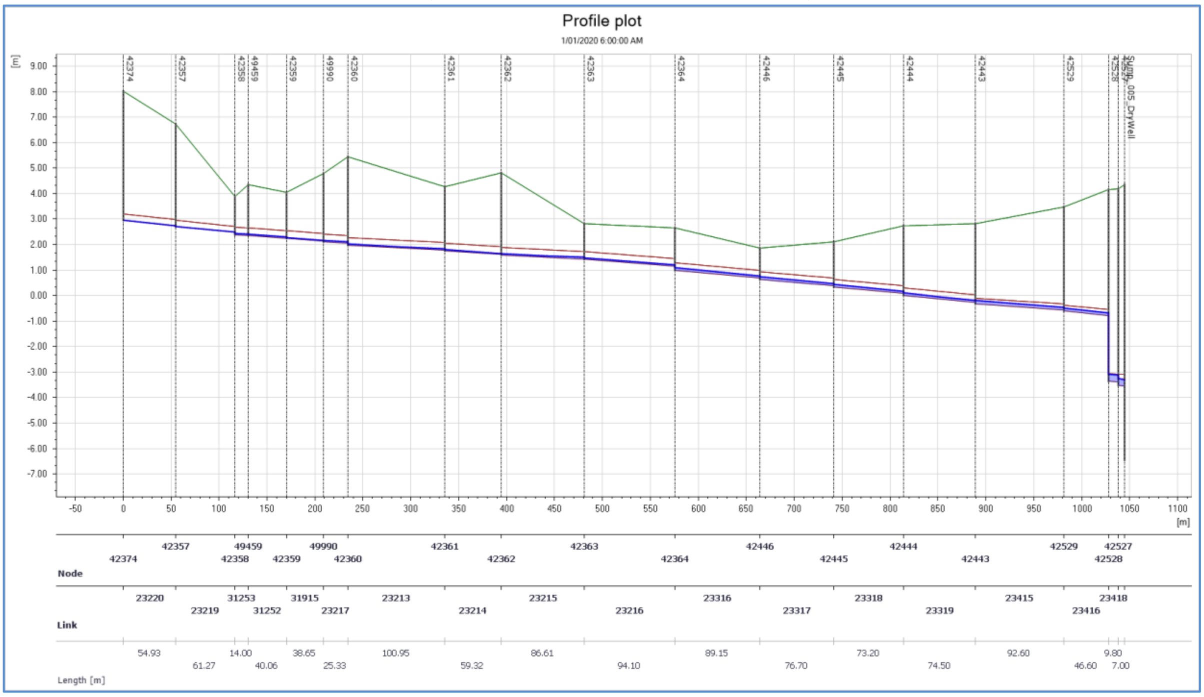
Service Option 1 (SPS 6) @ 2021, Pre-development



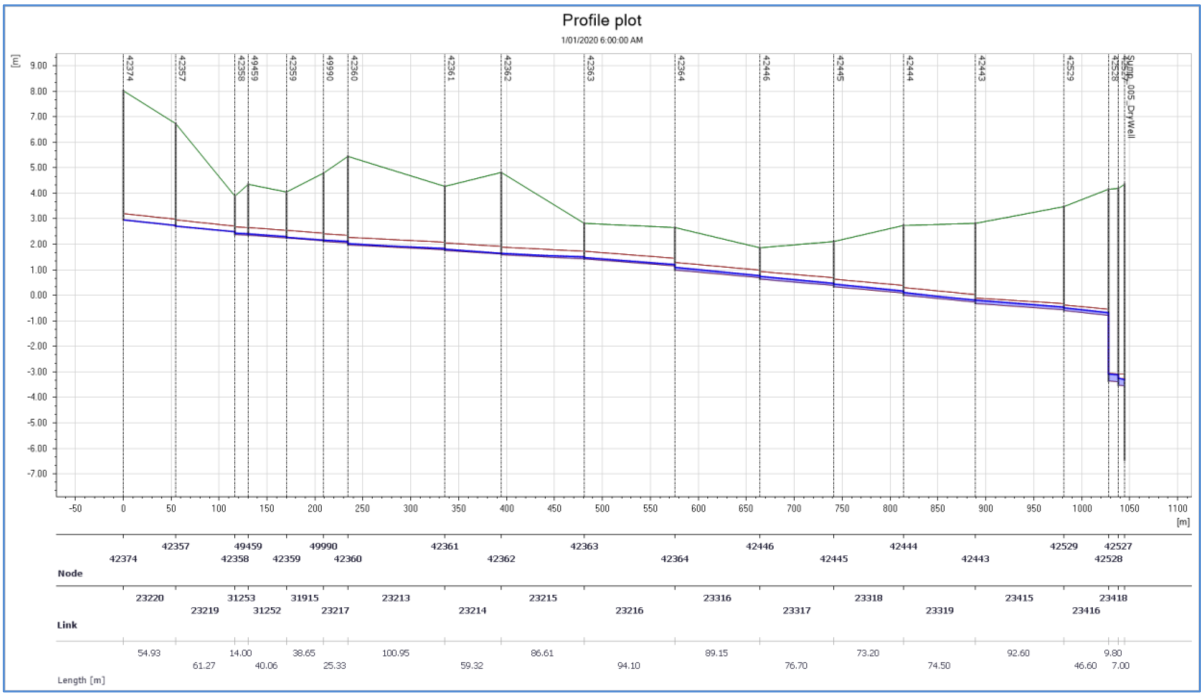
Service Option 1 (SPS 6) @ 2021, Post-development



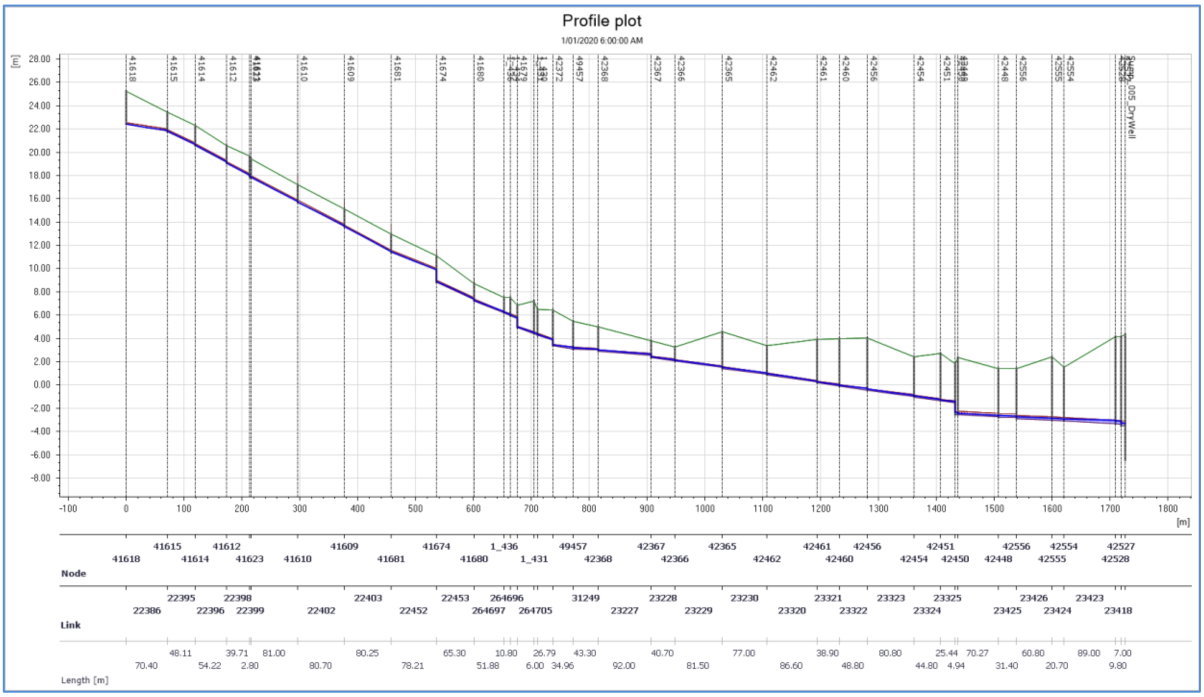
Service Option 2 (SPS 5) @ 2021, Pre-development

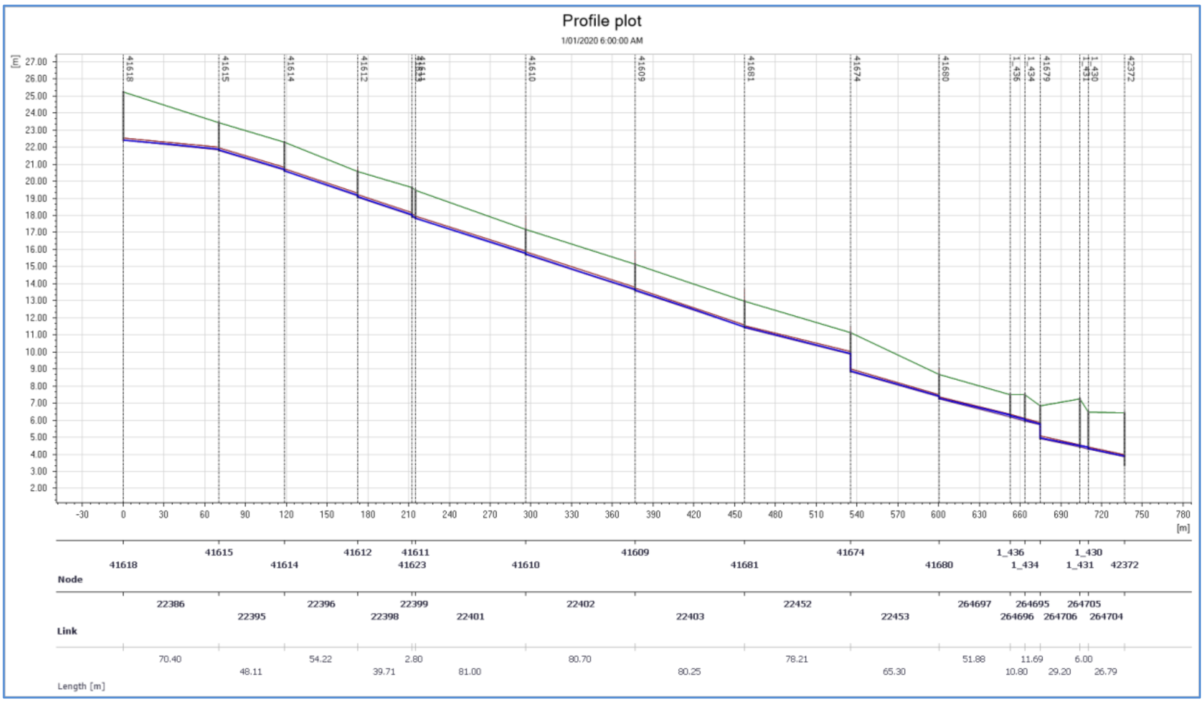


Service Option 2 (SPS 5) @ 2021, Post-development

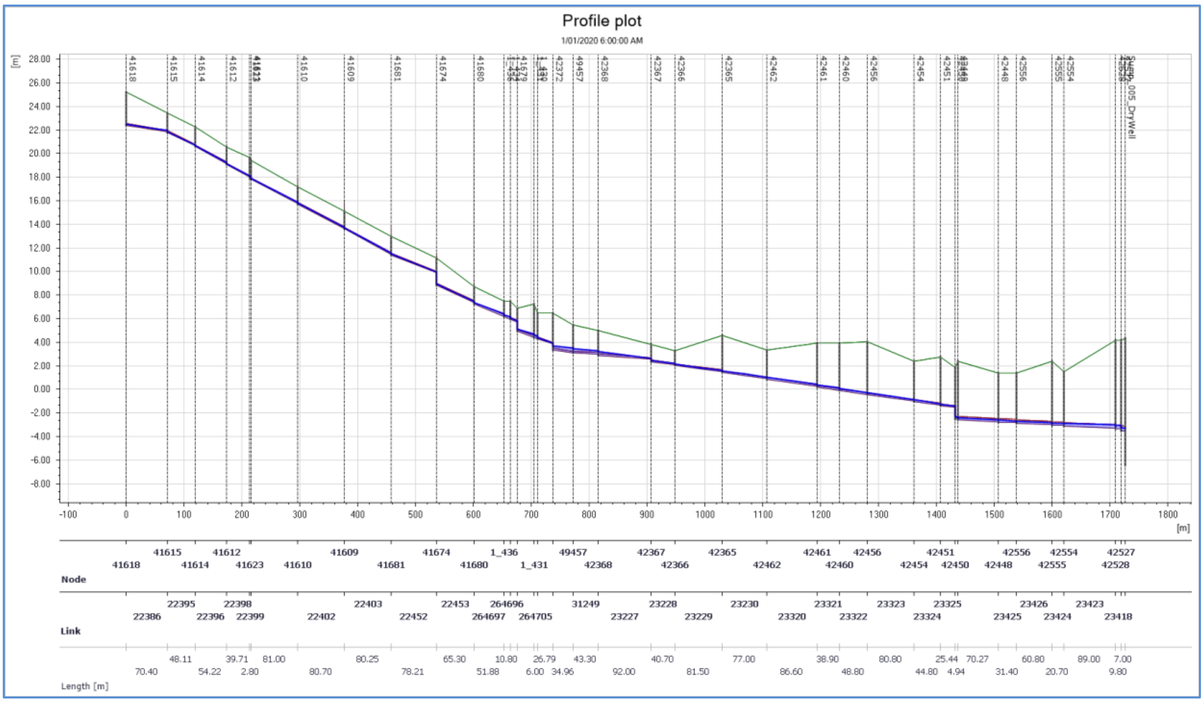


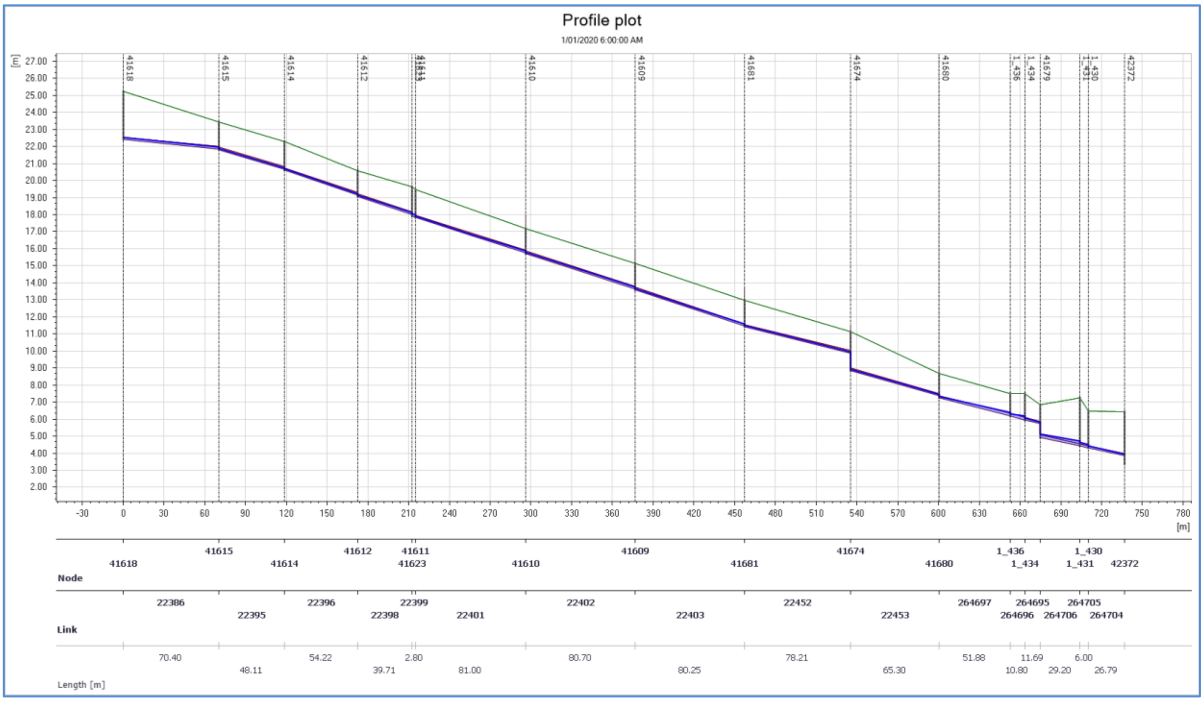
Service Option 3 (SPS 5) @ 2021, Pre-development



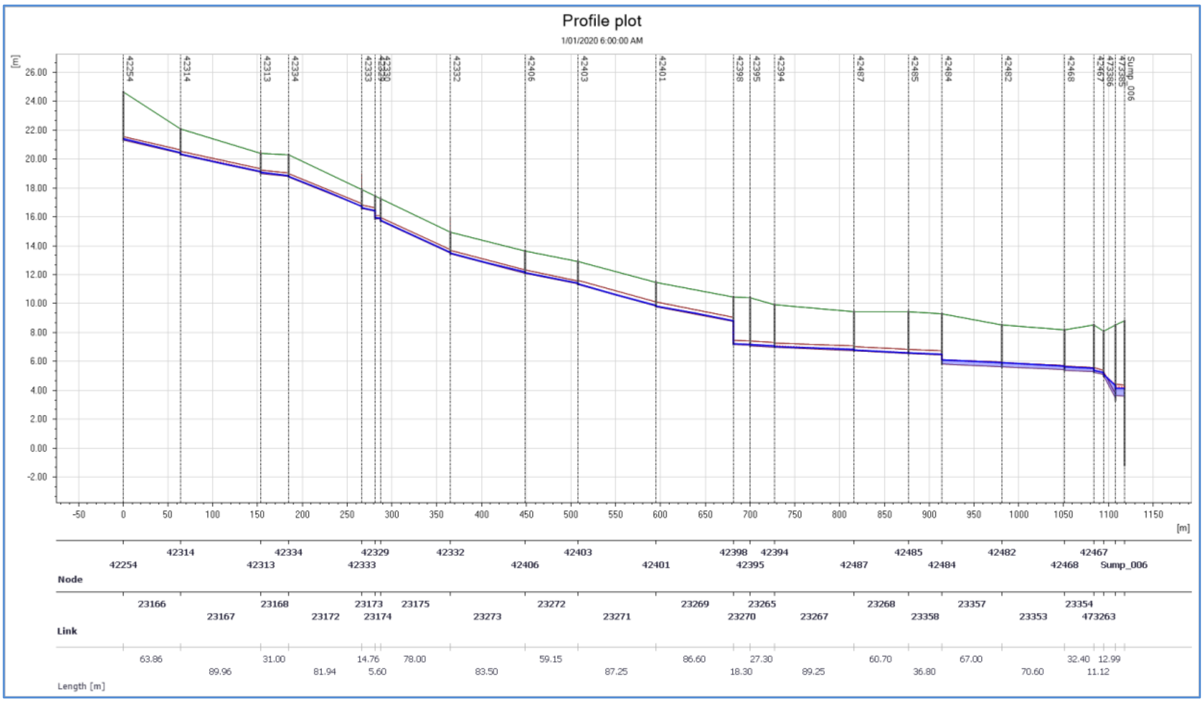


Service Option 3 (SPS 5) @ 2021, Post-development

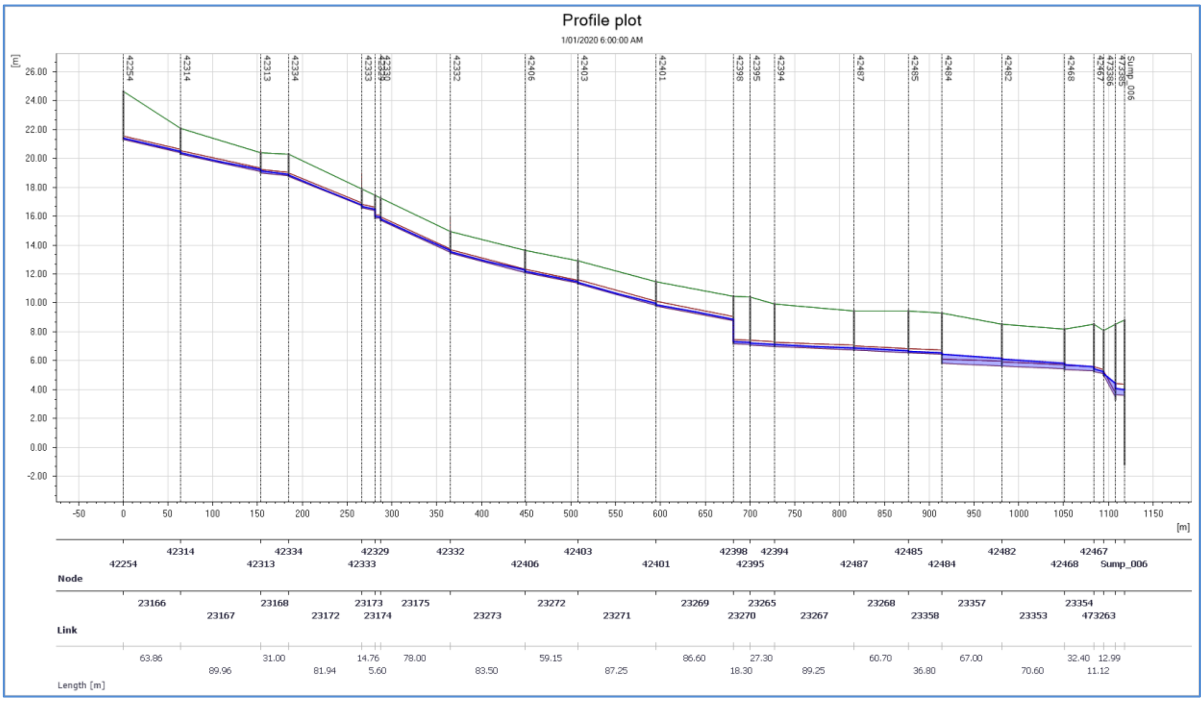




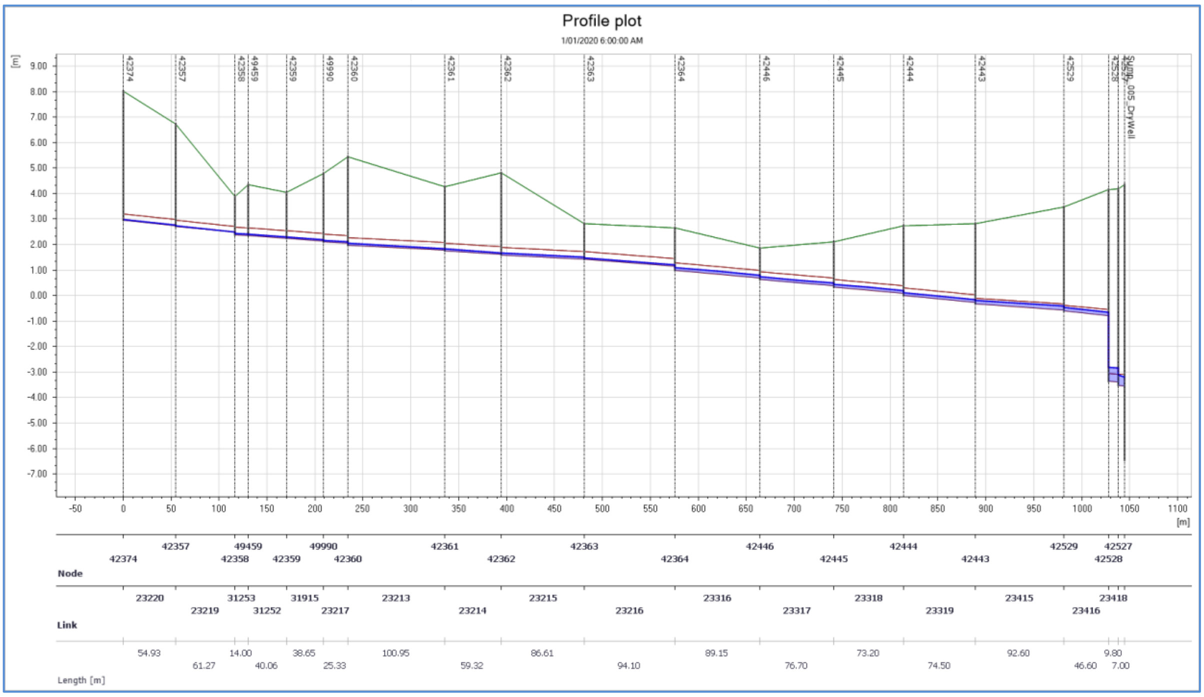
Service Option 1 (SPS 6) @ Ultimate, Pre-development



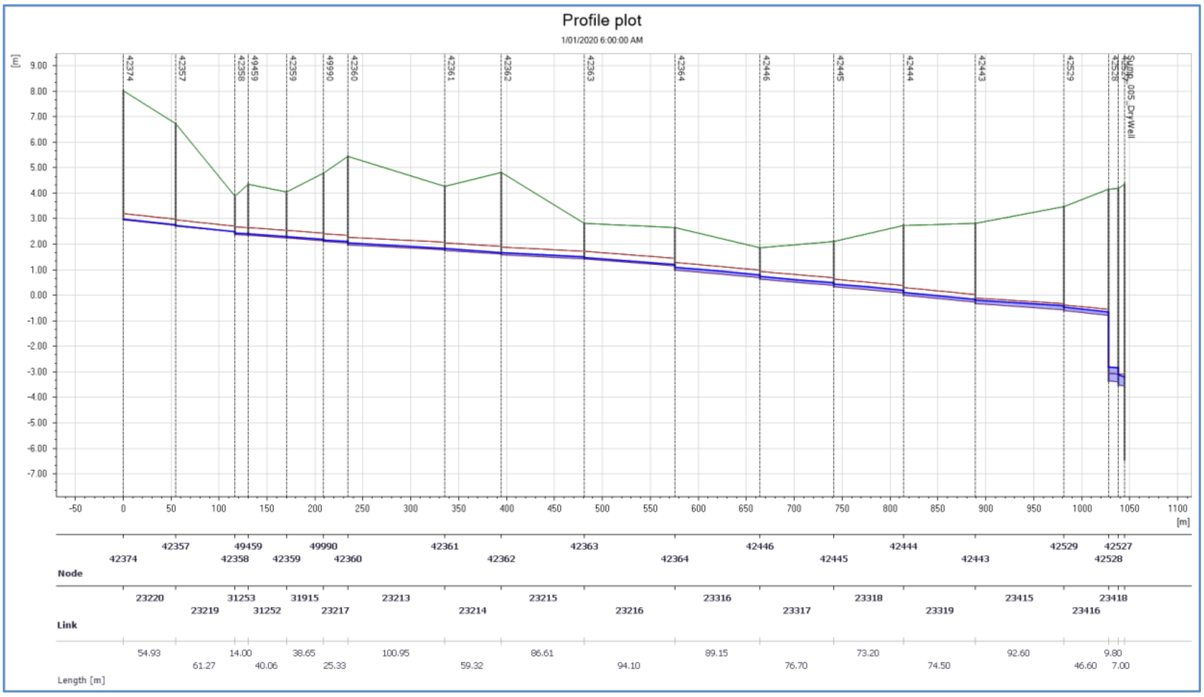
Service Option 1 (SPS 6) @ Ultimate, Post-development



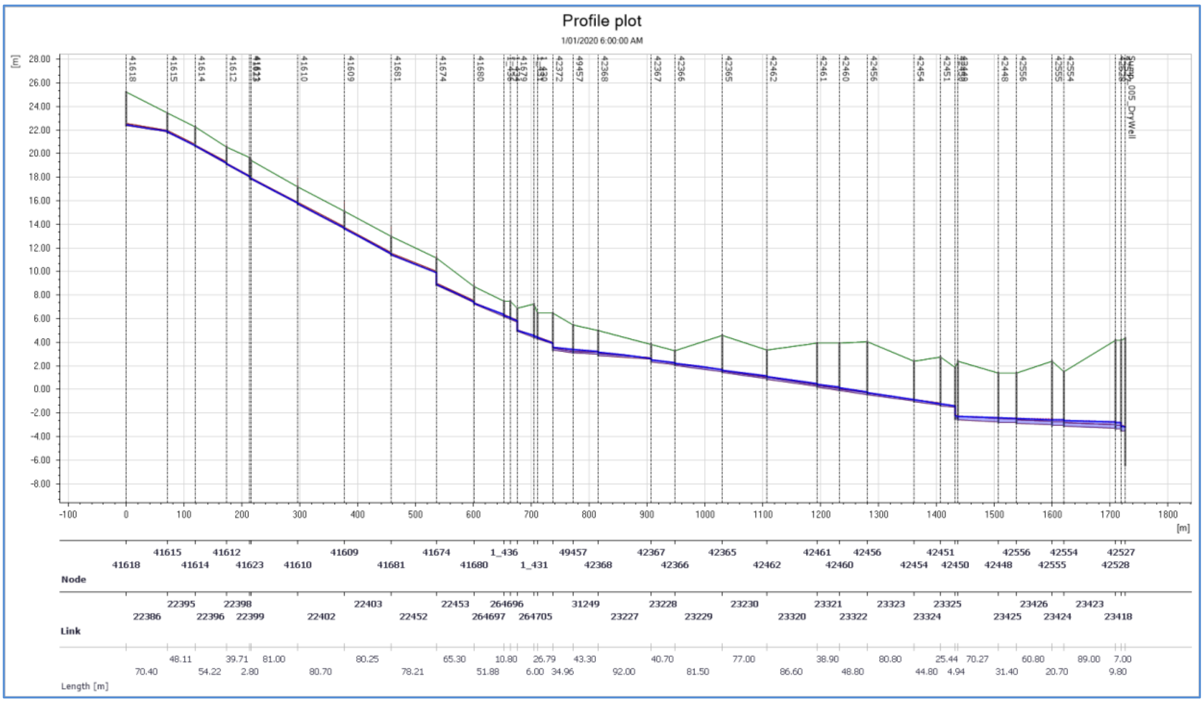
Service Option 2 (SPS 5) @ Ultimate, Pre-development

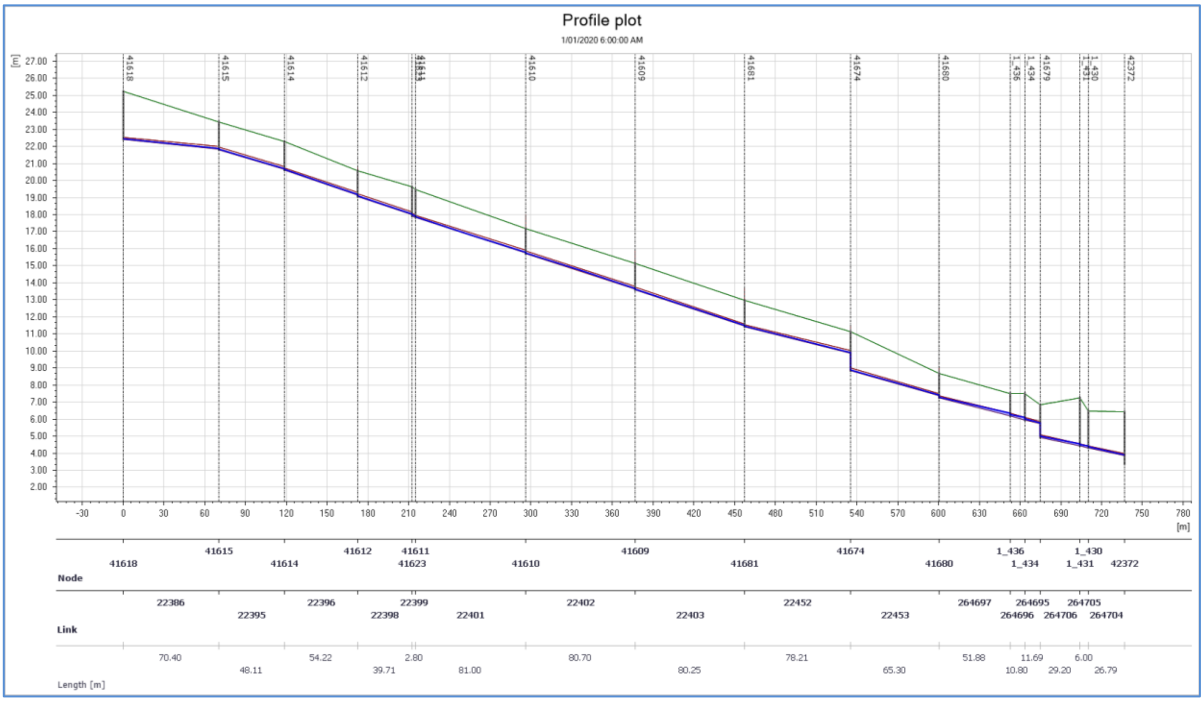


Service Option 2 (SPS 5) @ Ultimate, Post-development

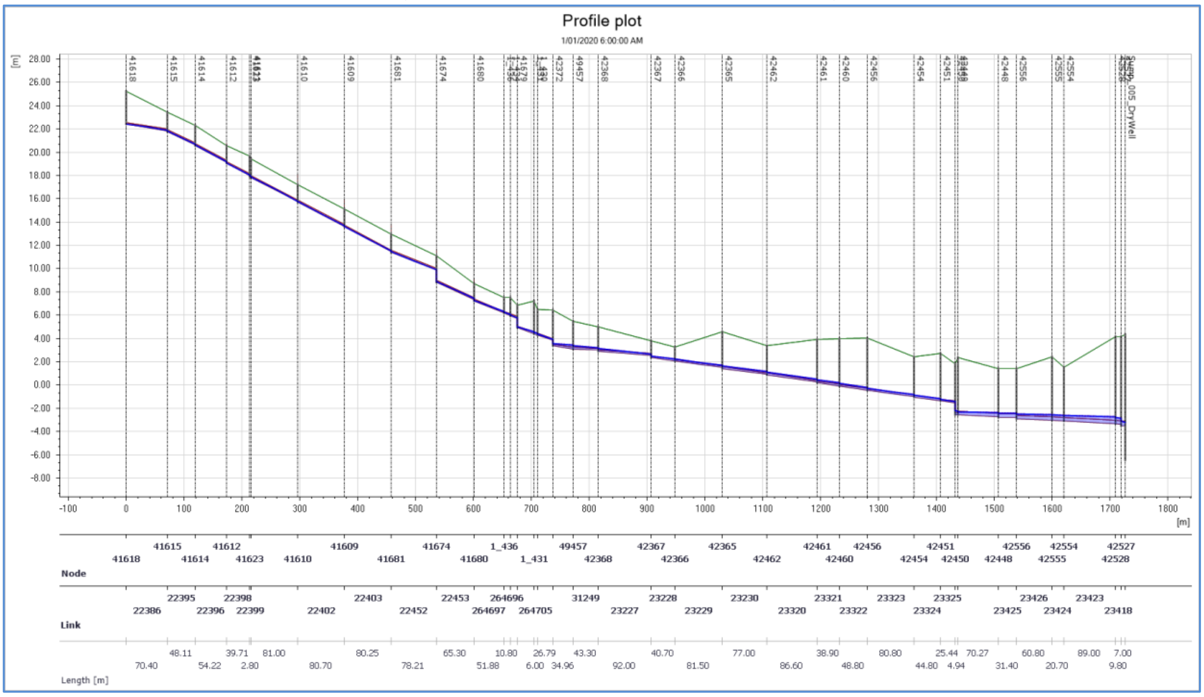


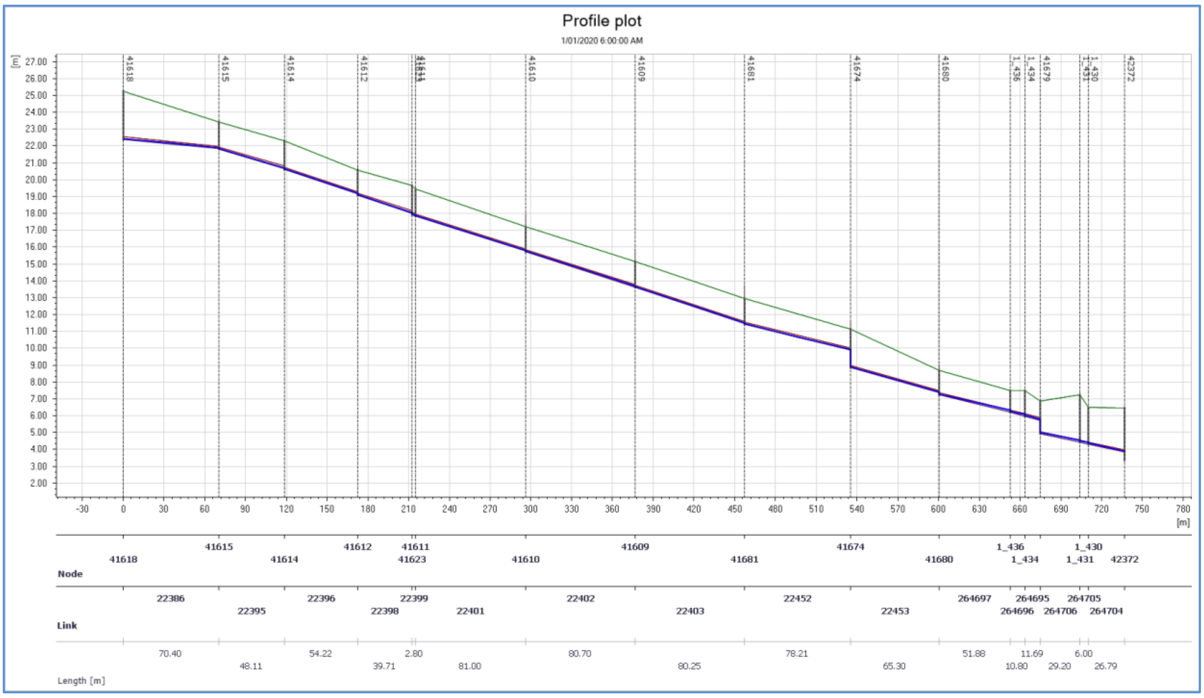
Service Option 3 (SPS 5) @ Ultimate, Pre-development





Service Option 3 (SPS 5) @ Ultimate, Post-development





Appendix 7. Emergency storage capacity assessment results

SPS 6

Wet Well Volume Below Overflow (RL 6.44 m)

Diameter: 7.0 m

Duty Start: RL 2.20 m

Overflow: RL 6.44 - 0.3 m = RL 6.14 m

ES Volume Available: 151.6 kL

Gravity Main Volume Below Overflow (RL 6.44 m)

Diameter (mm) and Length (m): DN150 @ 35 m, DN300 @ 680 m, DN375 @ 300 m, DN450 @ 570 m, DN525 @ 320 m, DN600 @ 20 m, DN750 @ 40 m.

ES Volume Available (2021): 221.2 kL (excl. DN450 future upgrades)

ES Volume Available (Ultimate): 266.4 kL (incl. DN450 future upgrades)

Manhole Volume Below Overflow (RL 6.44 m)

Diameter: 1.05 m

Total Length below Overflow: 30.7 m

ES Volume Available: 26.5 kL

TOTAL AVAILABLE ES (2021): 151.6 + 221.2 + 26.5 = 399.3 kL

TOTAL AVAILABLE ES (Ultimate): 151.6 + 266.4 + 26.5 = 444.5 kL

TOTAL REQUIRED ES (2021): 7,207 EP @ 210 L/EP/day / 6 = 252.2 kL

TOTAL REQUIRED ES (Ultimate): 9,865 EP @ 210 L/EP/day / 6 = 345.3 kL

Note: No consideration was made to the reduction of available ES from existing ADWF within the gravity network.

SPS 5

Wet Well Volume Below Overflow (RL 1.4 m)

Diameter: 3.90 m

Duty Start: RL -5.45 m

Overflow: RL 1.4 m - 0.3 m = RL 1.1 m

ES Volume Available: 78.8 kL

Gravity Main Volume Below Overflow (RL 1.4 m)

Diameter (mm) and Length (m): DN150 @ 1050 m, DN225 @ 1,220 m, DN300 @ 820 m, DN450 @ 1710 m

ES Volume Available: 418.1 kL

Manhole Volume Below Overflow (RL 1.4 m)

Diameter: 1.05 m

Total Length below Overflow: 133.6 m

ES Volume Available: 115.6 kL

TOTAL AVAILABLE ES: 78.8 + 418.1 + 115.6 = 612.6 kL

TOTAL REQUIRED ES (2021): 5,701 EP @ 210 L/EP/day / 6 = 199.5 kL

TOTAL REQUIRED ES (Ultimate): 9,336 EP @ 210 L/EP/day / 6 = 326.8 kL

Note: No consideration was made to the reduction of available ES from existing ADWF within the gravity network.