Sewerage Network Master Plan for the Weinam Creek PDA

Redland Bay, Qld

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EXECUTIVE SUMMARY

The Weinam Creek Priority Development Area (PDA) is located in Redland Bay, on the Moreton Bay foreshore, within the Redland City Council (RCC) Local Government Area (LGA). The Economic Development Queensland (EDQ) Weinam Creek PDA Development Scheme has proposed a mixed-use master plan, the majority of which will be high density residential apartment living, with buildings up to 7 storeys in height. The ultimate population density for the development scheme has been estimated at 3,000 Equivalent Population (EP) by Redland Investment Corporation (RIC).

EDQ's Weinam Creek PDA planning density (3,000 EP) far exceeds that of RCC's Local Government Infrastructure Plan (LGIP) ultimate planning demands (approximately 1,096 EP). A detailed sewerage planning study was therefore undertaken to determine the impact that the additional loading will have on the local existing network, and to identify infrastructure upgrades necessary to achieve RCC's minimum design standards.

The hydraulic analysis identified that there is sufficient capacity within the SPS 132 catchment south of the development, to incorporate the additional Weinam PDA loading, up to the 2041 planning horizon. For the SPS 90 catchment north of the development however, insufficient capacity was identified at both the existing (2017/18) and 2041 planning horizon. A summary of the deficiencies and proposed upgrades to resolve this are as follows.

- Insufficient gravity main flow depth capacity was identified along Outride Street and Banana Street across all planning horizons. A 390 m, DN150, DN200 and DN225 duplication main is therefore required to satisfy RCC's relevant Design Standards (d/D flow depth @ 75% for proposed pipework).
- Insufficient pump flow capacity was identified at SPS 90 across all planning horizons. This was identified to be a rising main capacity issue, as opposed to a pump capacity issues. Therefore, an 800 m, DN225 pipe upgrade is required to satisfy RCC's relevant Design Standard (3 m/s maximum flow velocity). To limit the impact on the downstream catchment, a renewal of the pump set and wet well will also be required.
- Insufficient emergency storage capacity was identified for the SPS 90 catchment, across all planning horizons. A 41 kL storage upgrade is therefore required to satisfy RCC's relevant Design Standard (4 hours ADWF storage).

A capital cost estimate for the proposed SPS 90 catchment infrastructure upgrade regime is as follows. See Appendix 8 for detailed calculations and assumptions.

Catchment	Proposed Infrastructure	$ / Unit Rate	Capital Cost ($)	Purpose
SPS 90	800 m x DN2225 pressure main	$440 / m	$352k	Comply SEQ Code flow velocity and increase pump capacity
	Duty/assist pump renewal/adjustment	$500 / kw + install $5k	$25k	Reduce flow to downstream catchment
	Well and internal pipework renewal	Nil	$500k	Extend asset life and reduce risk of failure
	41 kL offline ES tank	$4,389 / kL	$180k	Comply SEQ Code 4 hours ADWF retention
	154 m x DN150 GM 172 m x DN200 GM 66 m x DN225 GM	$594 / m $726 / m $796 / m	$269k	Comply SEQ Code flow depth
		TOTAL	**$1.326M**	

The approximate timing of construction for these items is as follows.

- Package 1, DN150/DN200/DN225 gravity main duplication required at approximately 500 EP growth upstream of Banana Street. It is estimated this package of works will be required between 2023 to 2025.
- Package 2, DN225 rising main upgrade, pump renewal, wet well renewal and offline emergency storage tank required at approximately 1,800 EP growth within the catchment, including population increase outside of the Weinam Creek PDA. It is estimated this packages of works will be required between 2025 to 2027.

It is therefore recommended the proposed augmentation works are undertaken prior to the identified EP trigger points above and detailed design works completed in the 2021/22 fiscal year.

1 INTRODUCTION

The Weinam Creek Priority Development Area (PDA) is located in Redland Bay, on the Moreton Bay foreshore, within the Redland City Council (RCC) Local Government Area (LGA). The total area of the PDA is estimated at 42 Hectares and is bounded by Weinam Street to the west, Moreton Bay to the east, Peel Street to the north, and Moores Road to the south.

The Economic Development Queensland (EDQ) Weinam Creek PDA Development Scheme has proposed a mixed-use master plan, the majority of which will be high density residential apartment living, with buildings up to 7 storeys in height. The ultimate population density for the development scheme has been estimated at 3,000 Equivalent Population (EP). Refer to Appendix 1 for an overview of the PDA.

EDQ's Weinam Creek PDA planning density (3,000 EP) far exceeds that of RCC's Local Government Infrastructure Plan (LGIP) ultimate planning demands (approximately 1,096 EP). Therefore, the PDA will likely have a significant impact on the capacity of the existing local sewerage network, triggering the need for a review on the infrastructure master plan for the relevant catchments.

1.1 Purpose

The purpose of this report is to quantify the impact of EDQ's Weinam Creek PDA planning demands on RCC's existing sewerage network, and associated trunk infrastructure master planning. This information will form part of the revised headworks charges for approved Development Applications (DA), within the Weinam Creek PDA.

The hydraulic modelling was completed up to the 2041 planning horizon, to align with the Redland City Plan (2018) strategic framework. The 2016 Netserv Plan (and associated Sewerage Master Plan) were completed to a 2036 planning horizon to ensure compliance with minimum 20-year planning criteria required under the South-East Queensland Water (Distribution and Retail Restructuring) Act 2009.

1.2 Background

The Weinam Creek PDA is serviced by two sewer catchments, i.e. SPS 132 servicing the PDA south of Weinam Creek, and SPS 90 servicing the PDA north of Weinam Creek. Both pump stations are a 'duty/assist' arrangement, with SPS132 possessing 1 x 27 kW and 1 x 30 kW pumps, and SPS 90 possessing 2 x 18 kW pumps.

SPS 132 and SPS 90 boost sewage west and discharge to the SPS 67 gravity pipe network, which is subsequently transferred to the Victoria Point Sewage Treatment Plan (STP). Within the PDA, the sewer reticulation gravity network consists of PVC and AC DN150 and DN225 gravity mains. Refer to Appendix 2 for an overview of the existing network.

RCC's current LGIP considers augmentations and demand projections up to 2036, which identified no upgrades required to achieve design standards from SPS 132 and SPS 90, to SPS 67.

1.3 Relevant Reports

- The '*Redland Water Sewer Network Master Plan*' (Aug 2016) report presents information on augmentations to support RCC's LGIP for sewerage.
- The '*SEQ Water Supply and Sewerage Design and Construction Code (SEQ WS&S D&C Code)*' (2020) report presents RCC latest design standards.

2 METHODOLOGY

2.1 Design Standards

The design standards of the "*South East Queensland Water Supply and Sewerage Design and Construction Code*" (2020) were utilised for the assessment. A summary of the most relevant requirements are as follows.

Table 2-1. SEQ WS&S D&C Code provisions relevant to the analysis

Provision	Specification
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
Minimum rising main flow velocity	0.75 m/s
Maximum rising main flow velocity	3.0 m/s

2.2 Hydraulic Modelling

The methodology adopted for the Weinam Creek PDA sewerage master plan study is as follows.

1. RCC's Mike Urban LGIP sewer hydraulic model (*VP72.3.8.4*) was adopted for the hydraulic analysis. For the post-development scenario, RCC's existing LGIP planning demands were removed from the model and EDQ's Weinam Creek PDA planning demands (3,000 EP total) were allocated to relevant model nodes, on a lot by lot basis. The analysis was undertaken at the existing (2017/18) and 2041 planning horizon scenarios.
2. The pump capacity of SPS 90 and SPS 132 was assessed by comparing the PWWF required to service the catchment, pre- and post-development, to available pump flow capacities presented in the hydraulic model and corporate records. In addition, dynamic model runs were undertaken to confirm findings via review of the wet well depth profiles.

   If the combined pump capacity was above the catchment's PWWF, relevant design standards were achieved. If it was below the PWWF, network upgrades were investigated until compliance was attained, up to SPS 67.

Note: A pump capacity assessment of SPS 67 was <u>not</u> undertaken as part of this study, as an independent assessment was previously completed as part of the South-west Victoria Point Local Area Plan (LAP).

3. The wet well operational storage of SPS 90 and SPS 132 was subsequently evaluated by comparing the required operational storage capacity, pre- and post-development, against the operational 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 of the gravity main network servicing the PDA was assessed at pre- and post-development PWWF. 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 capacity of the SPS 90 and SPS 132 catchments was assessed by determining the ADWF retention time, pre- and post-development. This was achieved by priming the hydraulic model with ADWF and simulating a pump shutdown at the duty pump start level. Using the wet well depth profiles, the time duration from pump shutdown to the overflow event was used to determine the sewage retention time.

   If the overflow event occurred at a duration beyond 4 hours, compliance was achieved. If it was below 4 hours, compliance was not achieved and storage upgrades were investigated.

6. Modelling results were reviewed and findings reported.

3 RESULTS

3.1 Pumps and Pressure Mains

A pump capacity assessment was undertaken on SPS 90 and SPS 132 as per the methodology described in Section 2.2 of this report. Refer to Table 3-1 below for a summary of results.

Table 3-1. Pump capacity modelling results for combined duty/assist flow rates (post-develop.)

SPS	Combined Pump Flow Capacity	2017 Flow Capacity Required (post-develop.)	2041 Flow Capacity Required (post-develop.)
SPS 90	44 L/s	48.5 L/s	53.2 L/s
SPS 132	50 L/s	23.5 L/s	25.0 L/s

The above results demonstrate that SPS 132 has sufficient pump capacity to incorporate the additional PDA loading for the relevant catchment. However, SPS 90 presented a flow deficiency of 11 L/s and will therefore require rectification works to achieve RCC's minimum design standards.

Further investigation identified that the SPS 90 deficiency was solely due to the downstream DN150 rising main (800 m length) being undersized, and not the power rating of the existing pumps. The DN150 pipework presented extensive headloss (in the order of 50 m) and flow velocities in excess of RCC's 3 m/s requirement. Hydraulic modelling indicated that a DN225 pipe upgrade should result in a combined pump flow velocity of 1.3 m/s and single pump flow velocity of 0.8-1.0 m/s, which is in compliance with RCC's minimum and maximum flow velocity requirements respectively. The pipe upgrade resulted in the friction headloss to significantly decrease to approximately 12 m along the length of the rising main, allowing the pumps to operate above the required PWWF of 53.2 L/s.

The proposed pipe upgrade did however result in the model to show the existing pumps operating at approximately 75-80 L/s combined flow, which resulted in the downstream gravity network to present capacity deficiencies. It is therefore recommended that the SPS 90 pump set is renewed and adjusted, in conjunction with the DN225 pipe upgrade, to achieve a combined pump flow rate that operates closer to the catchment's estimated PWWF (53 L/s). This flow rate resulted in the model to show sufficient capacity in the downstream gravity network, i.e. flow depths remained within pipe obvert. These works should also include renewal of the wet well (e.g. epoxy coating) and internal pipework.

Refer to Appendix 3 for dynamic pump modellings results.

3.2 Wet Wells

An assessment on the operational storage capacity of the SPS 132 and SPS 90 wet wells was undertaken, as per the methodology described in Section 2.2 of this report. Table 3-2 below shows a summary of results and Appendix 4 presents detailed calculations.

Table 3-2. Operational storage capacity assessment results (post-development)

SPS	2041 Op. Storage Capacity Available	2041 Op. Storage Capacity Required
SPS 90	1.7 kL	3.2 kL
SPS 132	4.3 kL	1.7 kL

The results in the above table demonstrate that there is sufficient operational storage capacity at SPS 132, to incorporate the PDA's ultimate sewage loading, however SPS 90 presented a 1.5 kL deficiency. Further modelling identified that adjustments to the SPS 90 duty pump start/stop levels could increase the available operational storage to 3.6 kL, avoiding the need for a well upgrade. This was based on a duty start level 50 mm below the invert of the discharging gravity line and a duty stop level 400 mm above the invert of the well floor. It is therefore recommended that the SPS 90 duty start and stop levels are adjusted to RL -3.2 m and RL -4.4 m to achieve RCC's minimum operational volume standard and avoid an upgrade to the well.

As previously discussed, it is recommended that the SPS 90 well (and internal pipework) is renewed, at the time of the proposed pump renewal/adjustment.

Refer to Appendix 4 for detailed modelling calculations.

3.3 Gravity Mains

As per the methodology described in Section 2.2 of this report, gravity pipe flow depths were assessed against RCC's minimum requirements, from site connection to each of the relevant pump stations. The analysis identified that SPS 132 gravity network should have sufficient capacity to incorporate the PDA's additional loading without the need for pipe upgrades. For SPS 90 however, there were significant deficiencies identified for pipework directly upstream of the pump station and along Outridge Street. The following upgrades were required to resolve within RCC's design standards.

- 154 m x DN150 duplication gravity main along Banana Street
- 172 m x DN200 duplication gravity main along Banana Street
- 66 m x DN225 duplication gravity main along Outridge Street

To determine the impact of the SPS 90 flow capacity increase identified in Section 3.1 of this report, downstream gravity mains were assessed up to SPS 67. This analysis identified no deficiencies with the combined flow increase to 53 L/s, avoiding the need for additional pipe upgrades.

Refer to Appendix 5 for detailed modelling results and gravity main profiles.

3.4 Emergency Storage

An emergency storage capacity assessment was undertaken on the SPS 132 and SPS 90 catchments, as per the methodology described in Section 2.2 of this report. Based on an overflow level of RL 1.47 m for SPS 132 and 1.01 m for SPS 90 (considering design standard of 300 mm below surface level), the analysis identified the following overflow time durations.

Table 3-3. Emergency storage ADWF retention time results

SPS	2041 ES Capacity Available (pre-develop.)	2041 ES Capacity Available (post-develop.)
SPS 90	6H 0M	2H 56M
SPS 132	11H 2M	9H 15M

The above table shows that SPS 132 has sufficient emergency storage capacity to incorporate the Weinam Creek PDA loading, however SPS 90 presented a 1 hour deficiency (approximately). Based on an ADWF of 10.6 L/s, SPS 90 will require an additional 41 kL storage to satisfy RCC's design requirement of 4 hours ADWF. The installation of a 41 kL offline storage tank is therefore recommended to incorporate the additional Weinam Creek PDA loading. The pump station is located

within the Neville Stafford Park and a desktop review indicates there's sufficient space for the offline tank, adjacent to the existing well.

Refer to Appendix 6 for modelling results pre- and post-development

3.5 Sewer Infrastructure Upgrades

As previously discussed, the following infrastructure upgrades are required to incorporate the additional loading from the Weinam Creek PDA, within the SPS 90 catchment. Note the hydraulic analysis identified that the SPS 132 catchment does not require any infrastructure upgrades.

- Renew the wet well, including epoxy coating of the walls, replacement of internal pipework and adjustment/renewal of existing pumps to 53 L/s combined flow (in conjunction with rising main upgrade – refer below).
- Upgrade rising main from DN150 to DN225 (800m)
- Duplication gravity main along Banana Street and Outridge Street DN150, DN200 and DN225 (392 m)
- Install 41 kL offline emergency storage tank adjacent to existing SPS 90 well.

Refer to Appendix 7 for a layout plan of the proposed upgrades and the table below for associated capital cost estimates. Appendix 8 has detailed costing and assumptions.

Table 3-4. Summary of the capital cost estimate for sewer upgrades

Catchment	Proposed Infrastructure	$ / Unit Rate	Capital Cost ($)	Purpose
SPS 90	800 m x DN2225 pressure main	$440 / m	$352k	Comply SEQ Code flow velocity and increase pump capacity
	Duty/assist pump renewal/adjustment	$500 / kw + install $5k	$25k	Reduce flow to downstream catchment
	Well and internal pipework renewal	Nil	$500k	Extend asset life and reduce risk of failure
	41 kL offline ES tank	$4,389 / kL	$180k	Comply SEQ Code 4 hours ADWF retention
	154 m x DN150 GM 172 m x DN200 GM 66 m x DN225 GM	$594 / m $726 / m $796 / m	$269k	Comply SEQ Code flow depth
		TOTAL	**$1.326M**	

Note: Refer Appendix 8 for assumptions and calculation details.

3.6 Timing of Construction

The timing of construction is recommended as two separate works packages (details below). This is to achieve required network capacities and/or provide a more economical outcome from related works being undertaken simultaneously. Estimated trigger points for each of these packages are as follows.

- Package 1, DN150/DN200/DN225 duplication gravity main required at approximately 500 EP growth upstream of Banana Street. It is estimated this package of works will be required between 2023 to 2025.
- Package 2, DN225 rising main upgrade, pump renewal, wet well renewal and offline emergency storage tank. This would be required at approximately 1,800 EP growth within the catchment, including population growth outside of the Weinam Creek PDA. It is estimated this packages of works will be required between 2025 to 2027.

It is recommended the above work packages are installed with close monitoring of development and population growth within the SPS 90 catchment and Weinam Creek PDA.

4 CONCLUSION

The Weinam Creek Priority Development Area (PDA) is located in Redland Bay, on the Moreton Bay foreshore, within the Redland City Council (RCC) Local Government Area (LGA). The Economic Development Queensland (EDQ) Weinam Creek PDA Development Scheme has proposed a mixed-use master plan, majority of which will be high density residential apartment living, with buildings up to 7 storeys in height. The ultimate population density for the development scheme has been estimated at 3,000 Equivalent Population (EP) by Redland Investment Corporation (RIC).

EDQ's Weinam Creek PDA planning density (3,000 EP) far exceeds that of RCC's Local Government Infrastructure Plan (LGIP) ultimate planning demands (approximately 1,096 EP). A detailed sewerage planning study was therefore undertaken to determine the impact that the additional loading will have on the existing network, and to identify infrastructure upgrades necessary to achieve RCC's minimum design standards.

The hydraulic analysis identified that there is sufficient capacity within the SPS 132 catchment, to incorporate the additional Weinam Creek PDA loading, up to the 2041 planning horizon. For the SPS 90 catchment however, insufficient capacity was identified at both the existing (2017/18) and 2041 planning horizon. A summary of the deficiencies and proposed upgrades to resolve are as follows.

- Insufficient gravity main flow depth capacity was identified along Outride Street and Banana Street across all planning horizons. A 390 m, DN150, DN200 and DN225 duplication main is therefore required to satisfy RCC's relevant Design Standards (d/D flow depth @ 75% for proposed pipework).
- Insufficient pump flow capacity was identified at SPS 90 across all planning horizons. This was identified to be a rising main capacity issue, as opposed to a pump capacity issues. Therefore, an 800 m, DN225 pipe upgrade is required to satisfy RCC's relevant Design Standard (3 m/s maximum flow velocity). To limit the impact on the downstream catchment, a renewal of the existing pumps and wet well will also be required.
- Insufficient emergency storage capacity was identified for the SPS 90 catchment, across all planning horizons. A 41 kL storage upgrade is therefore required to satisfy RCC's relevant Design Standard (4 hours ADWF storage).

A capital cost estimate for the installation of the proposed sewer infrastructure upgrades is as follows.

Catchment	Proposed Infrastructure	$ / Unit Rate	Capital Cost ($)	Purpose
SPS 90	800 m x DN2225 pressure main	$440 / m	$352k	Comply SEQ Code flow velocity and increase pump capacity
	Duty/assist pump renewal/adjustment	$500 / kw + install $5k	$25k	Reduce flow to downstream catchment
	Well and internal pipework renewal	Nil	$500k	Extend asset life and reduce risk of failure
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		TOTAL	**$1.326M**	

The approximate timing of construction for these items is as follows.

- Package 1, DN150/DN200/DN225 duplication gravity main required at approximately 500 EP growth upstream of Banana Street. It is estimated this package of works will be required between 2023 to 2025.
- Package 2, DN225 rising main upgrade, pump renewal, wet well renewal and offline emergency storage tank required at approximately 1,800 EP growth within the catchment, including population increase outside of the Weinam Creek PDA. It is estimated this packages of works will be required between 2025 to 2027.

It is recommended the proposed augmentation works is undertaken prior to the identified EP trigger points above, in addition to completing the following tasks.

- Validation of the modelling outcomes presented in this report against, field surveys, historical records, SCADA data etc. during the detailed design phase of works.
- Undertake discussions with RCC's IC Unit regarding the implementation of the proposed upgrades including apportionment of headworks charges to this area.

5 APPENDICES

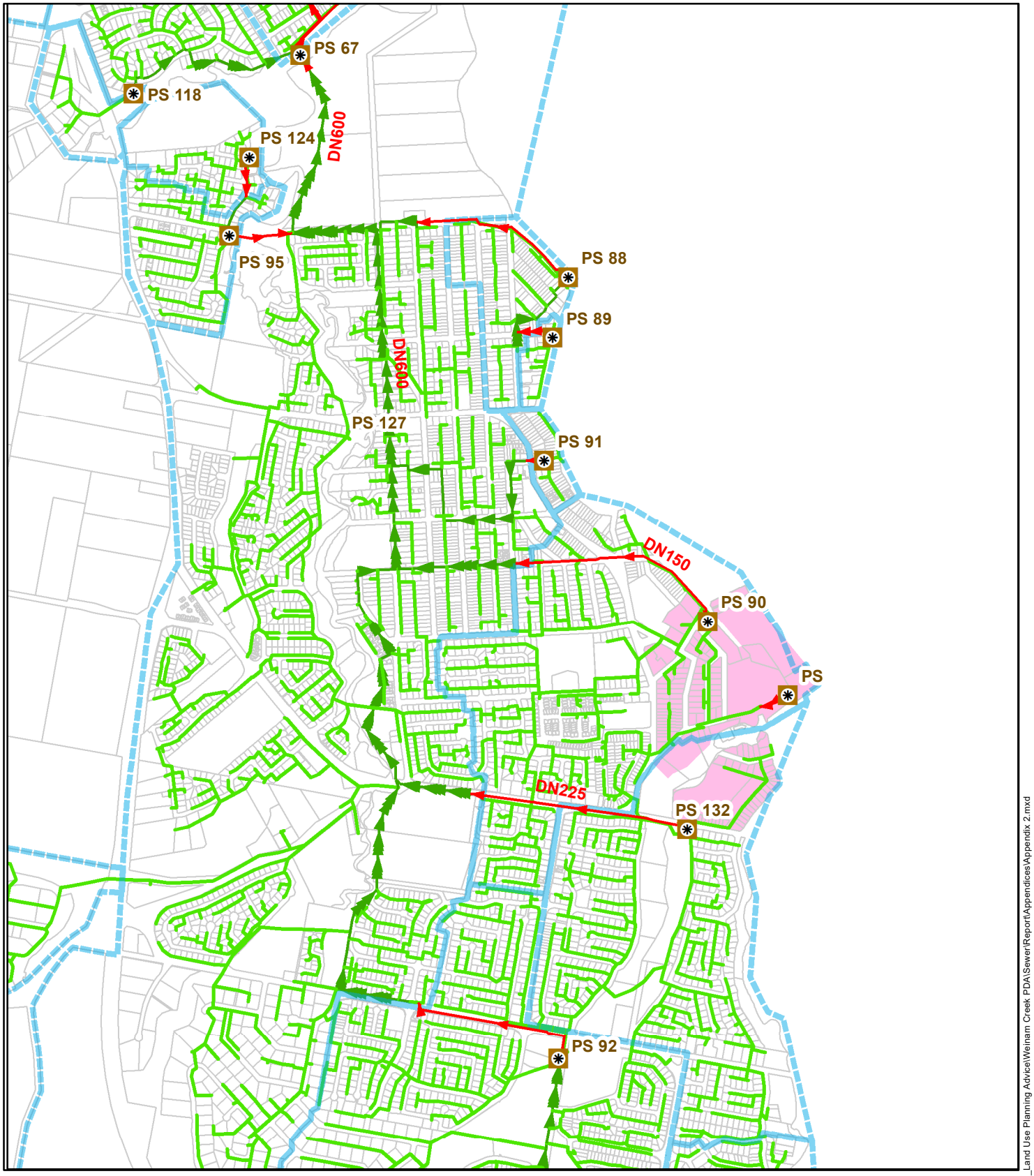
Appendix 1. Weinam Creek PDA Master Plan

weinam creek

master plan

Ref. No. 133693 Date : March 2019 Scale 1 : 1500@A1

Appendix 2. Sewerage catchments servicing the Weinam Creek PDA



Legend

- Current Land
- Weinam Creek PDA
- WW Catchment

WW Pumpstations

- Operating

WW Pressure Pipes

- Operating
- Out of Service
- Decommissioned

WW Non-pressure Pipes

- Trunk Gravity
- Reticulation
- Effluent Outflow
- Effluent Reuse

Issue	Date	By	Chkd	Appd
D1	17/02/2020	JM	MI	MI

Redland CITY COUNCIL
Redland Water
PO Box 21
Cleveland QLD 4163

Job Title	**Weinam Creek PDA**
Drawing Title	**Sewer catchments servicing PDA**
Scale at A3	**1:406,300**
Drawing Status	**Draft V1**
Coordinate System	**GDA 1994 MGA Zone 56**
Date of Print	**17/02/2020**
Drawing No	**001**

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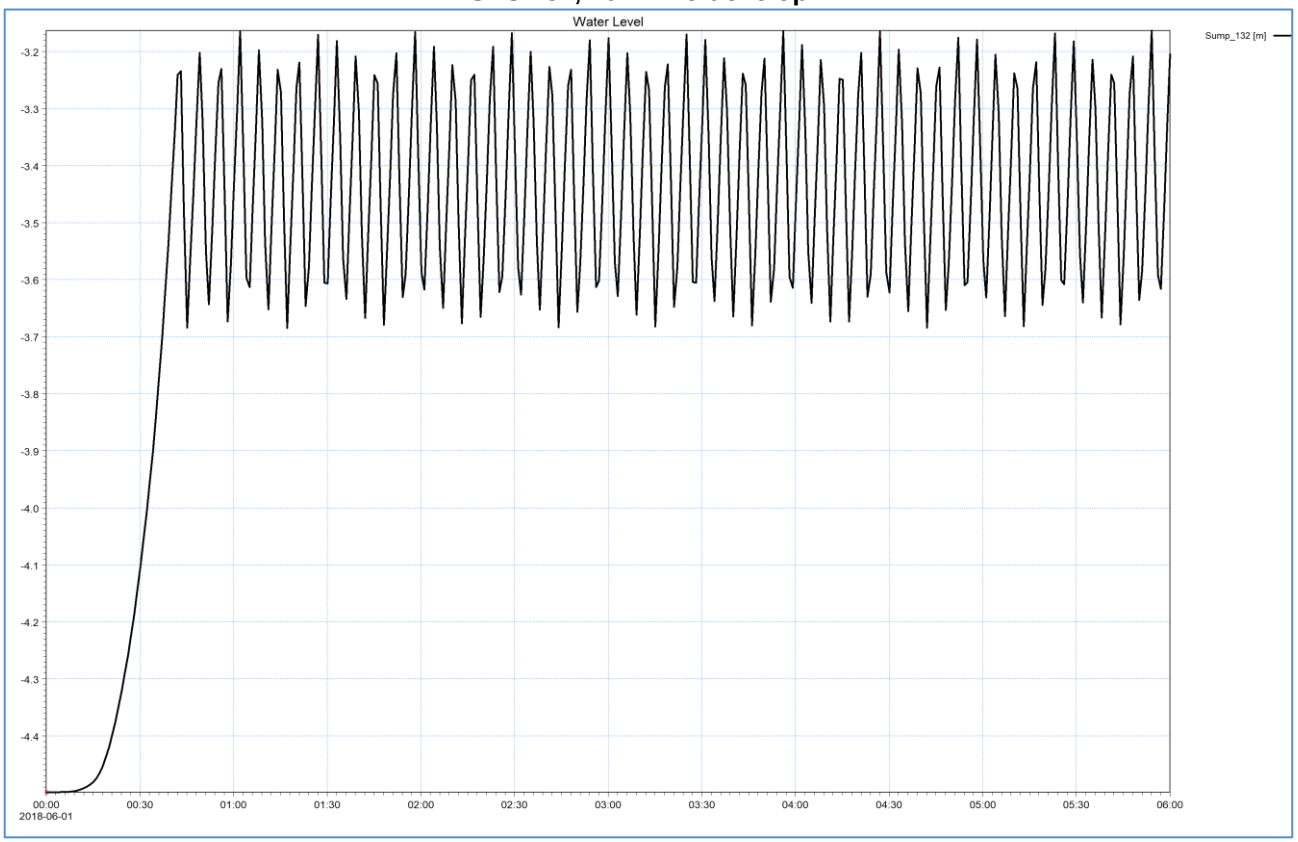
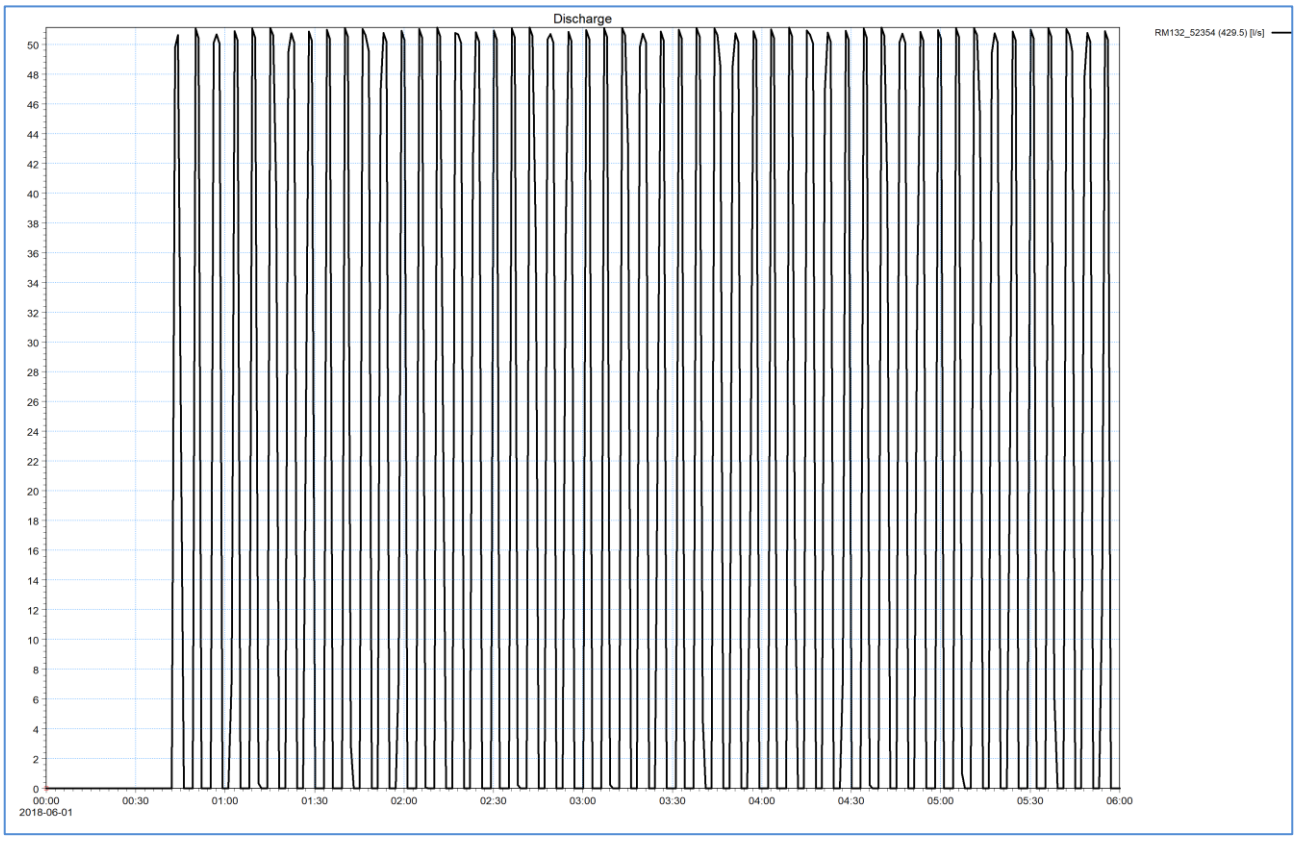
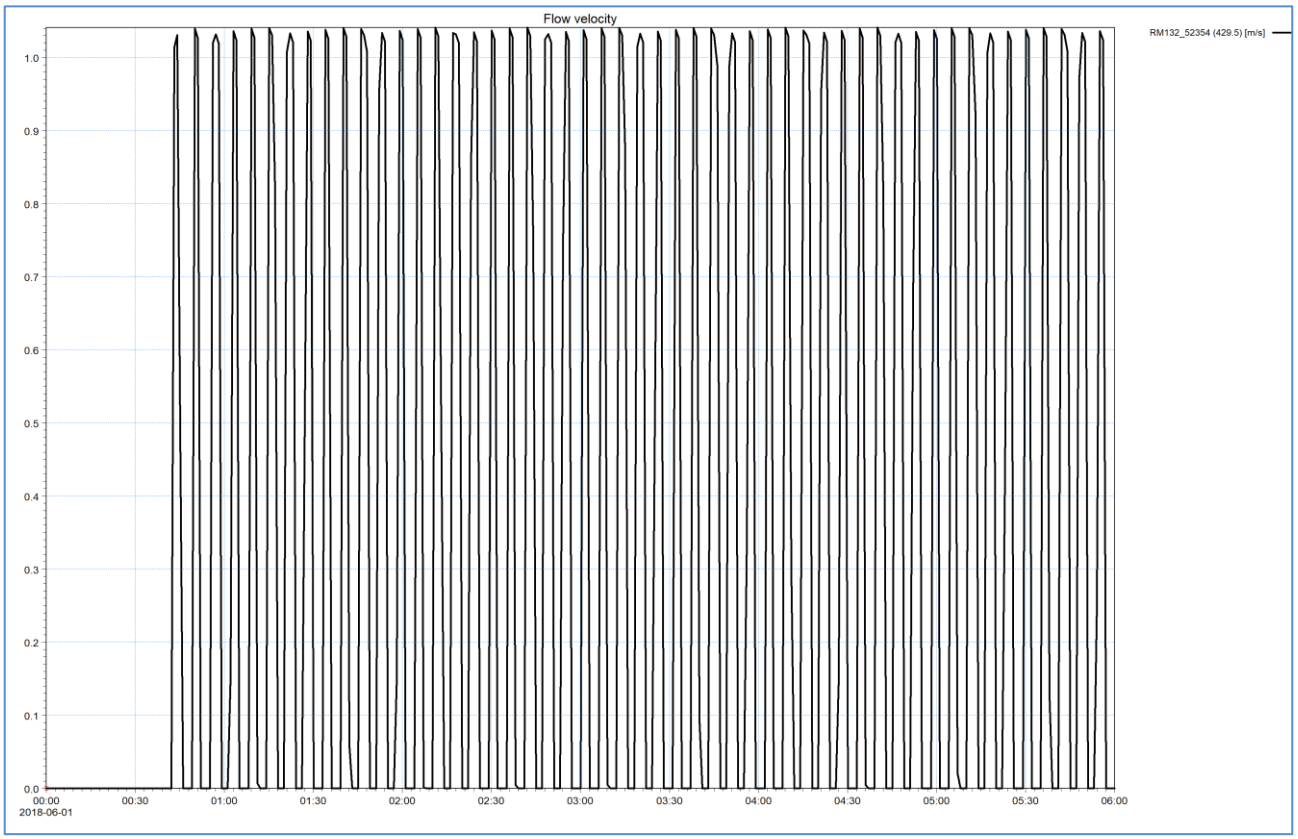
Appendix 3. Pump station modelling results for Weinam PDA

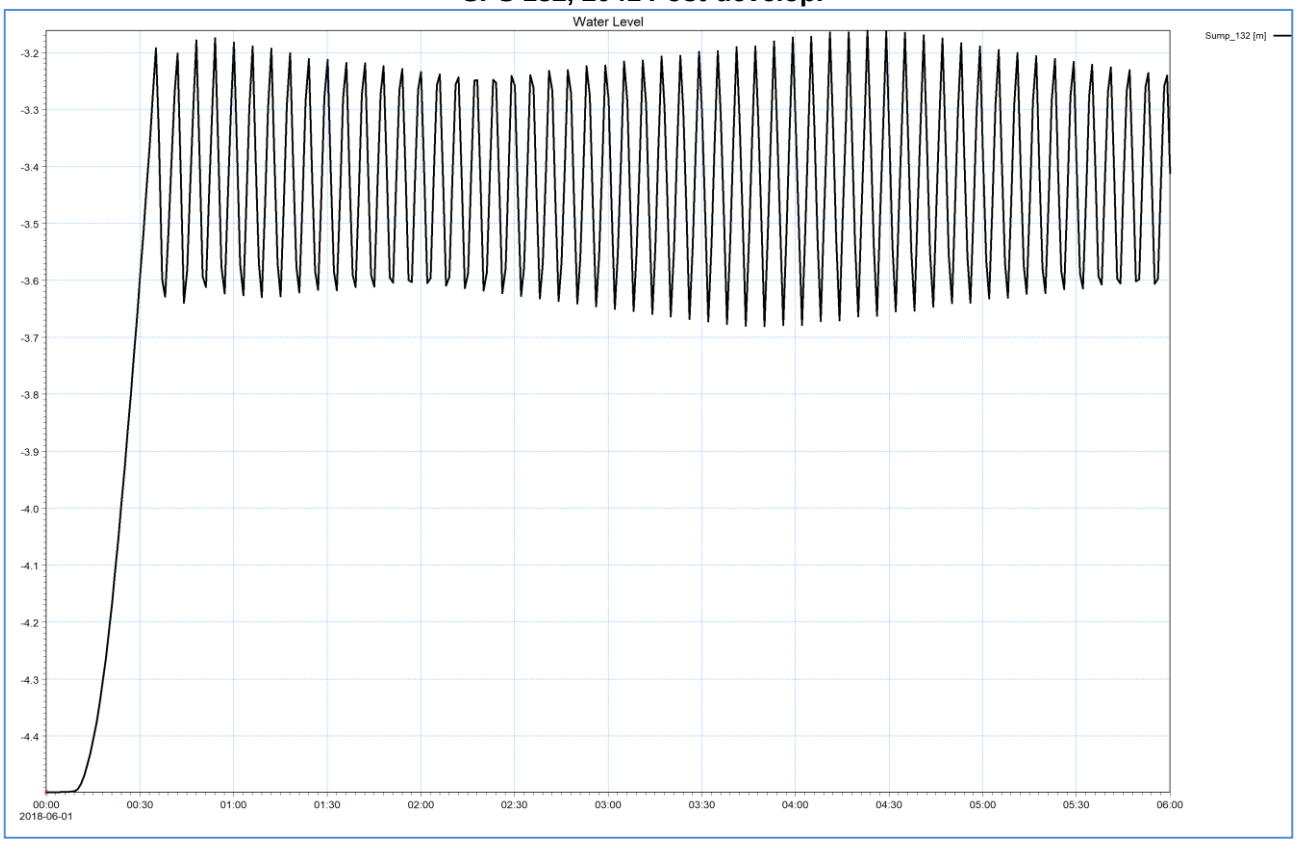
SPS 132, 2041 Pre-develop.

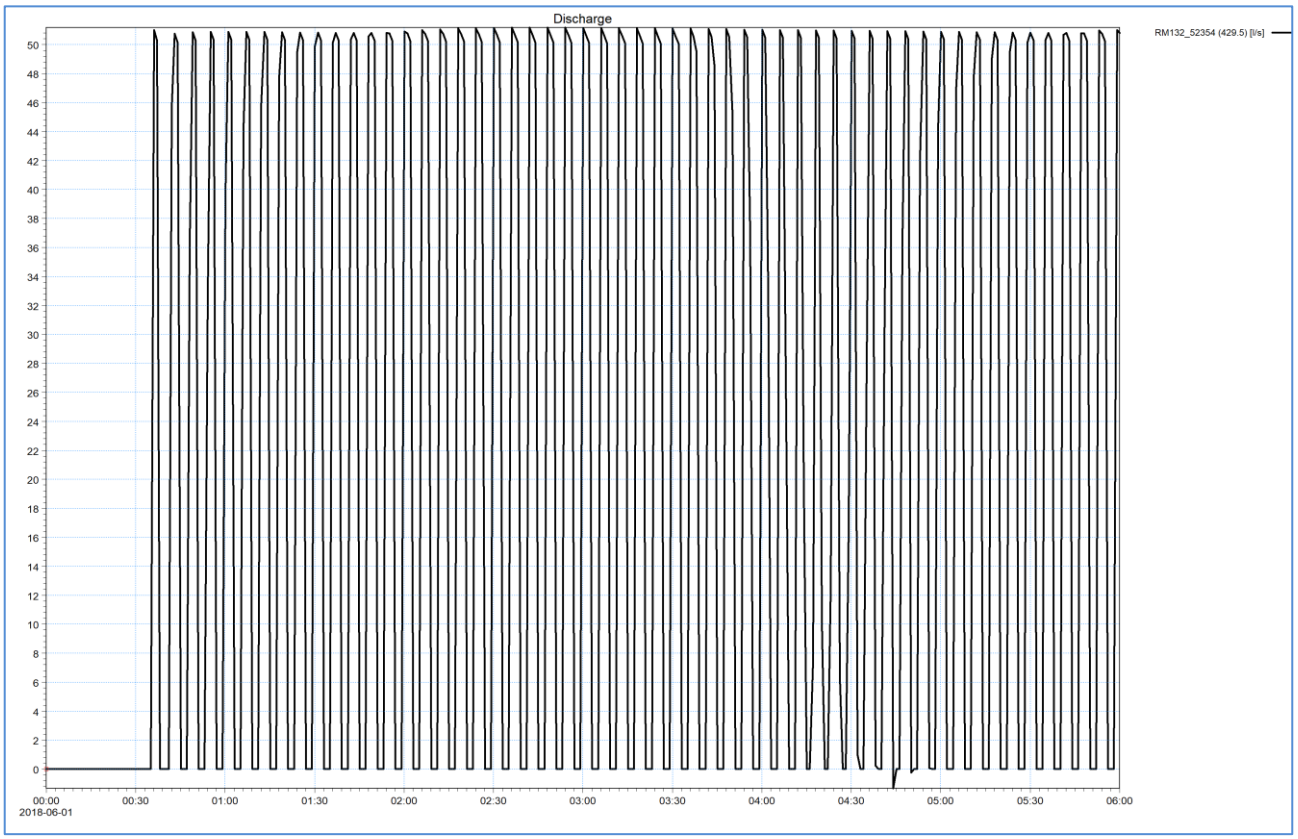






SPS 132, 2041 Post-develop.

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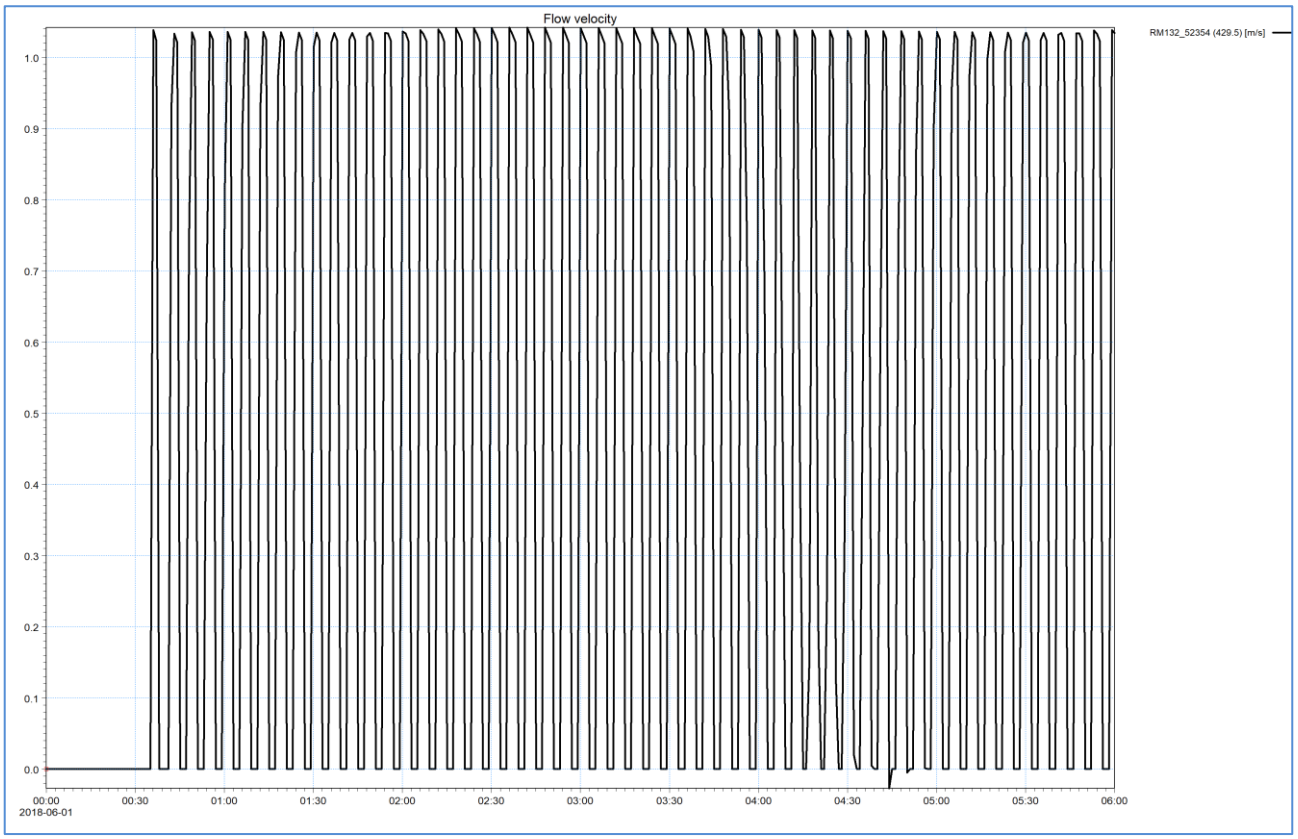
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0.6
0.5
0.4
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0.2
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0.0
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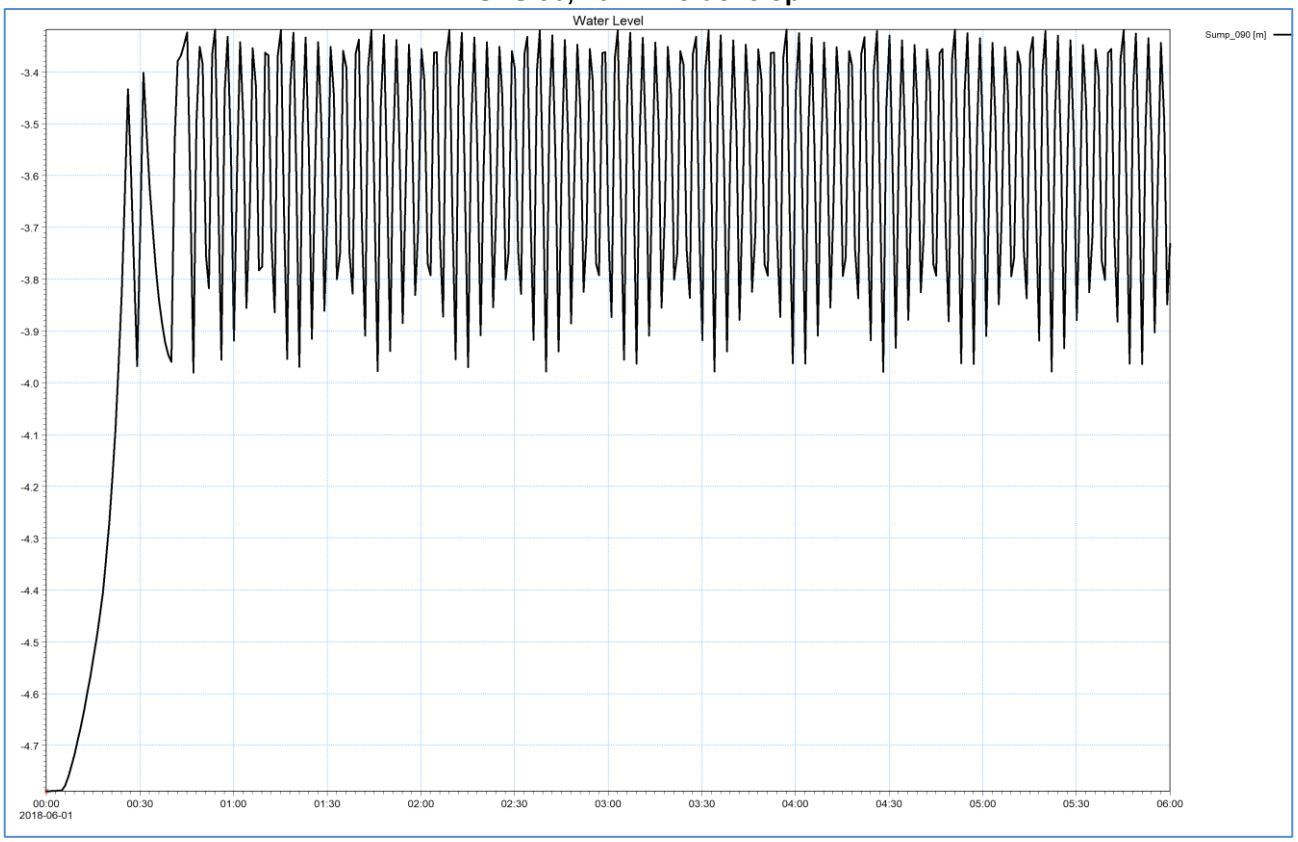
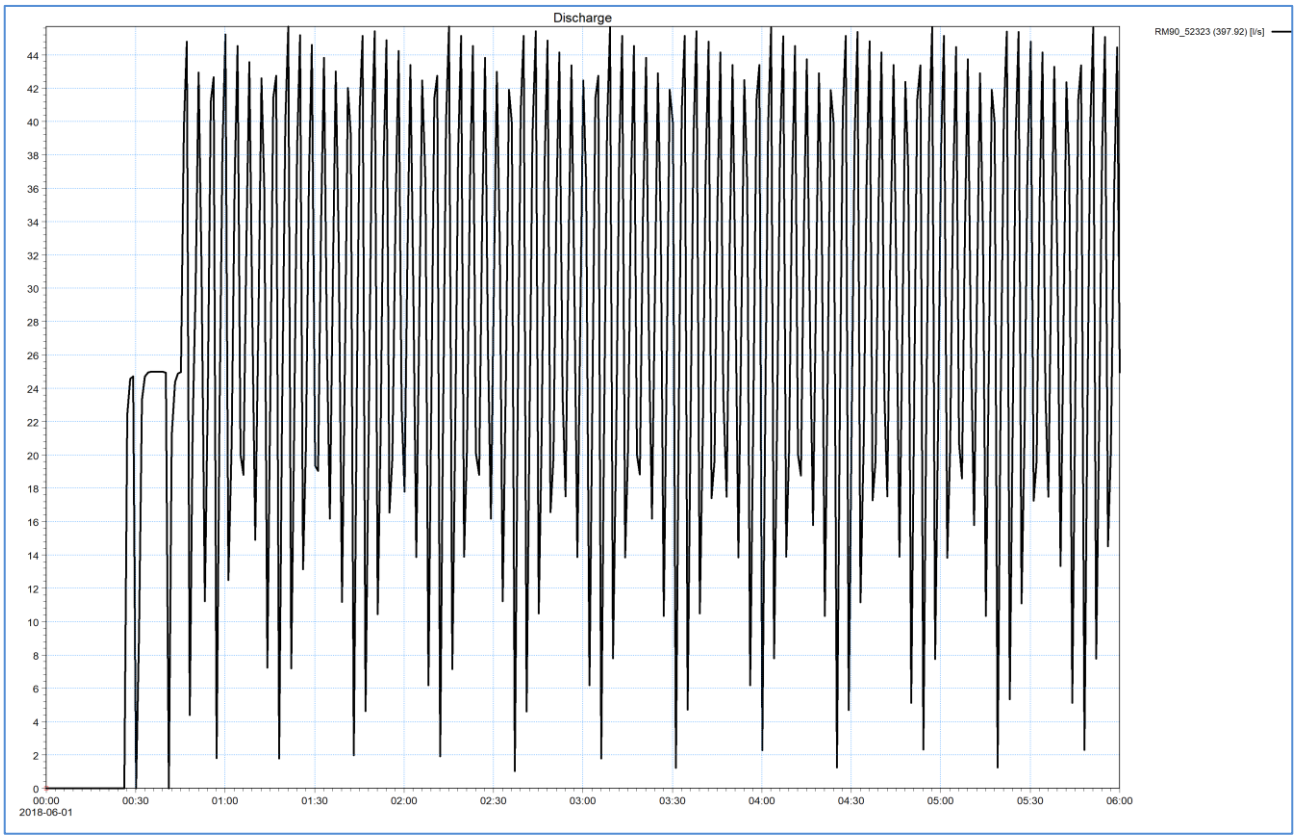
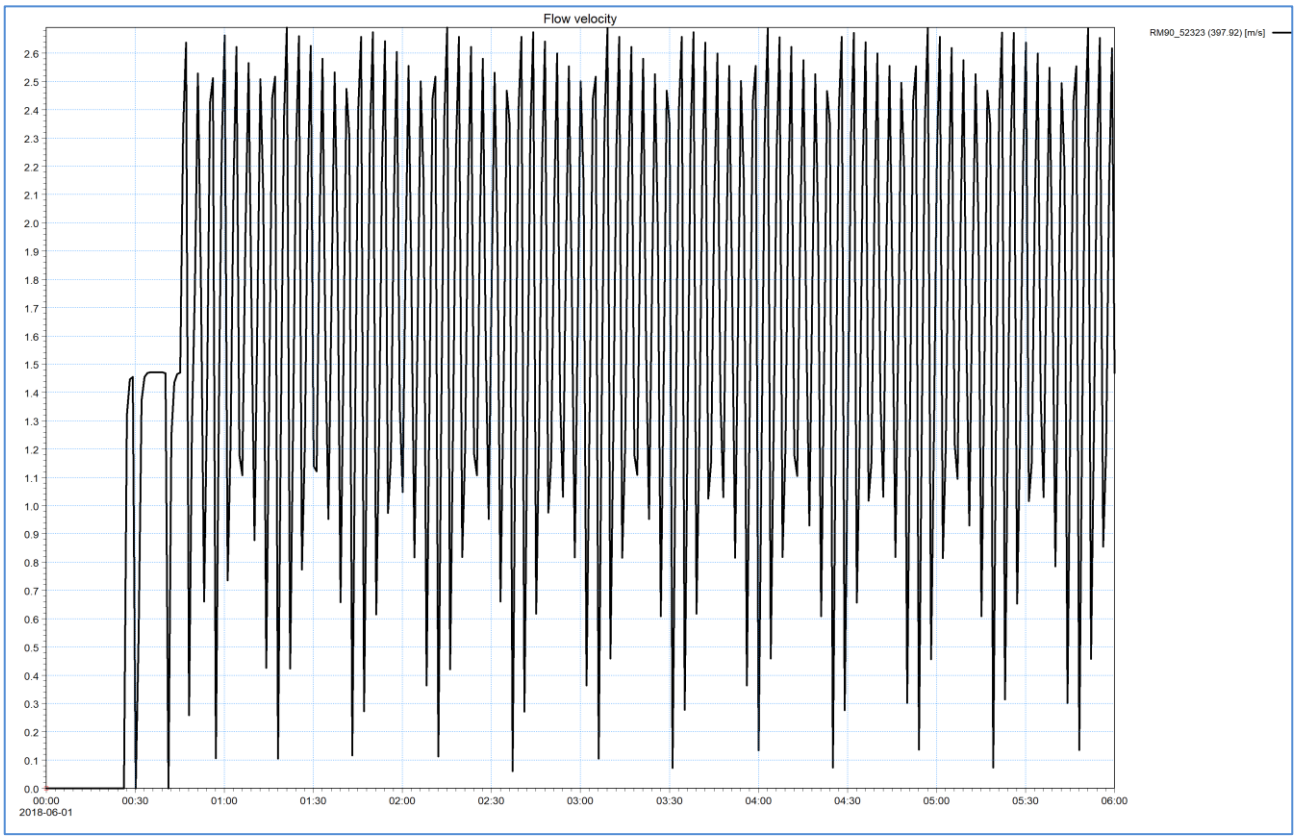
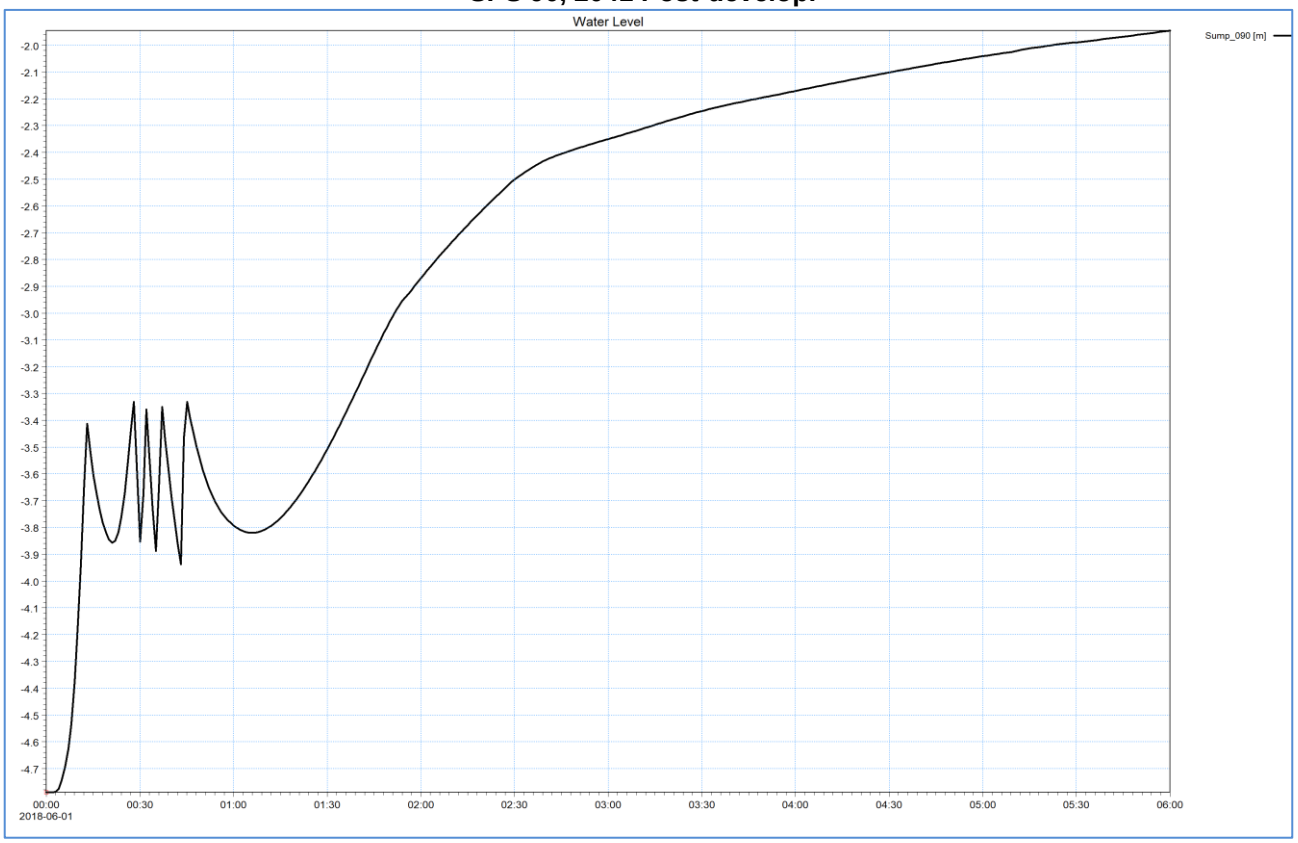
SPS 90, 2041 Pre-develop.

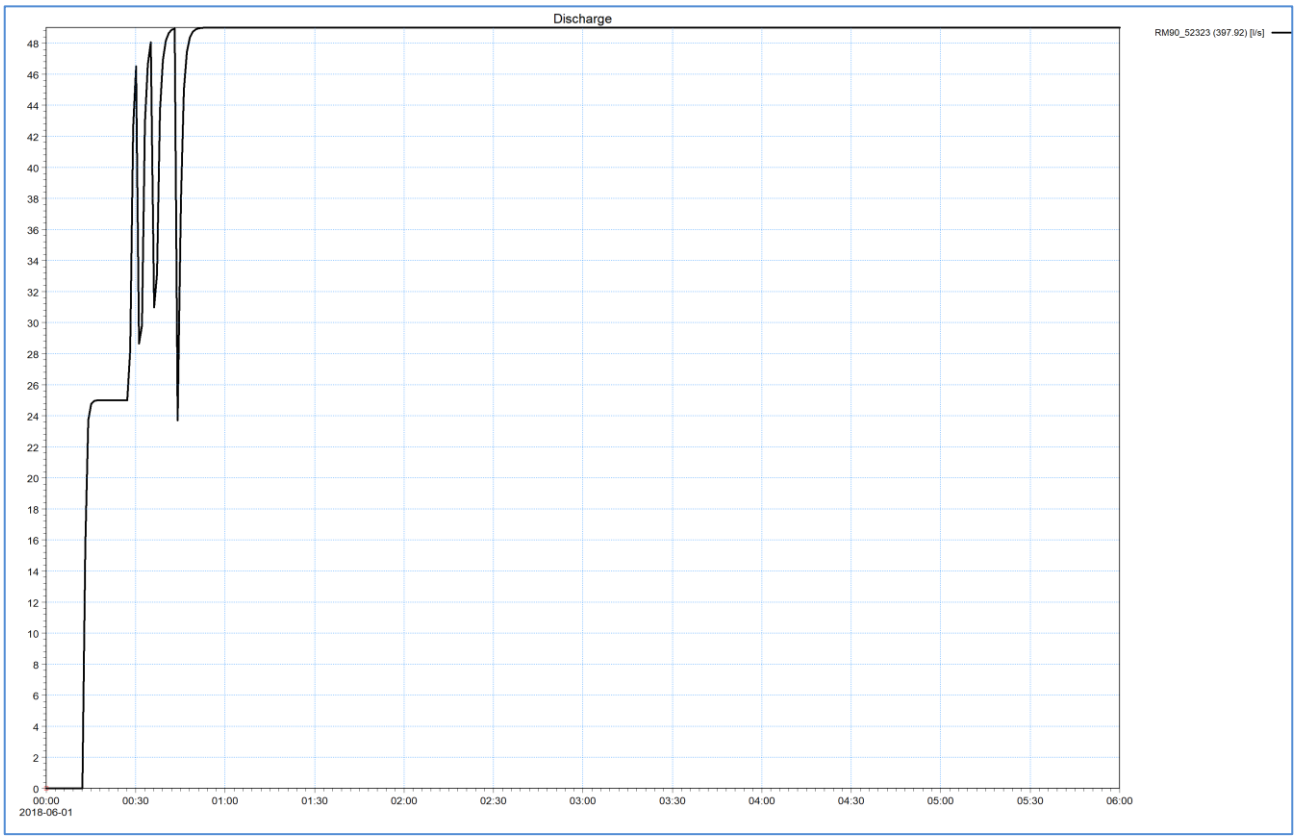






SPS 90, 2041 Post-develop.

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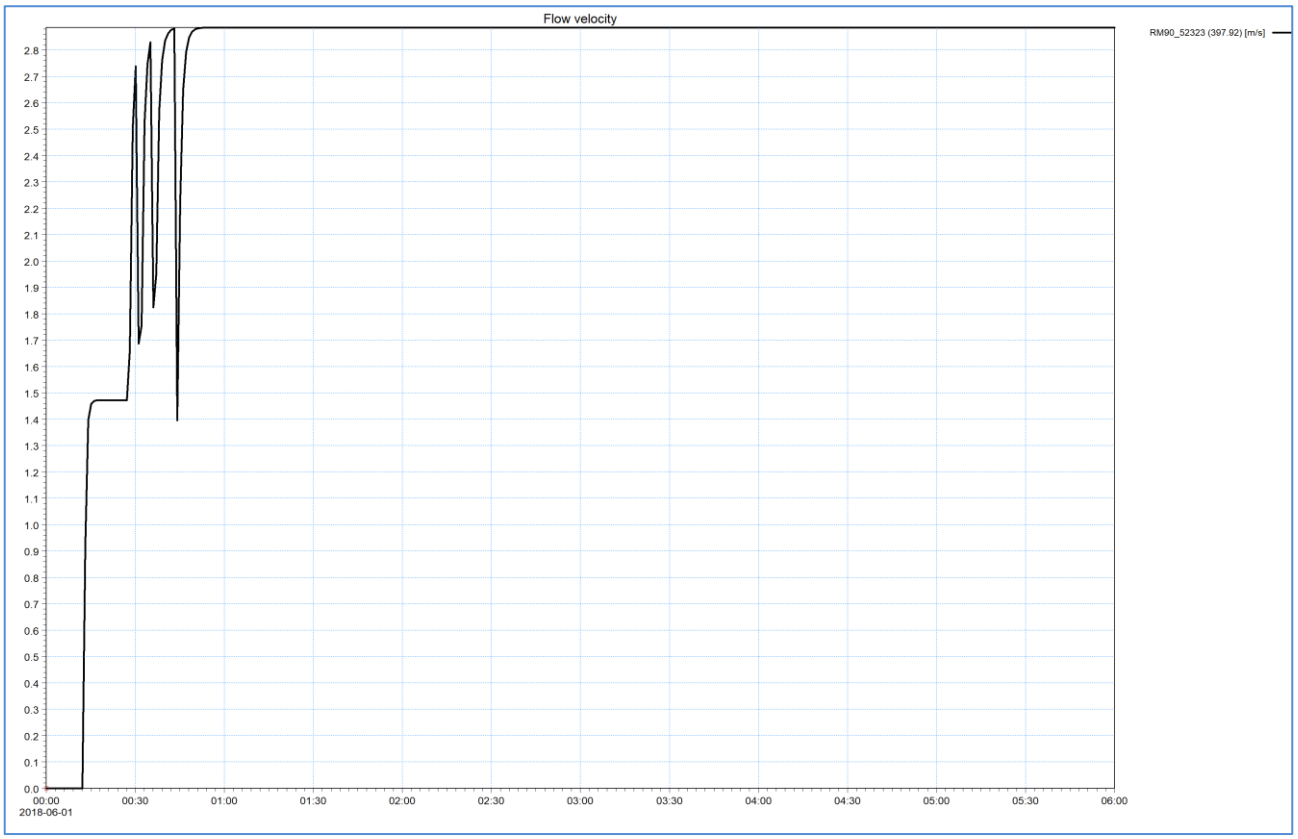
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RM90_52323 (397.92) [m/s]
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2.7
2.6
2.5
2.4
2.3
2.2
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2.0
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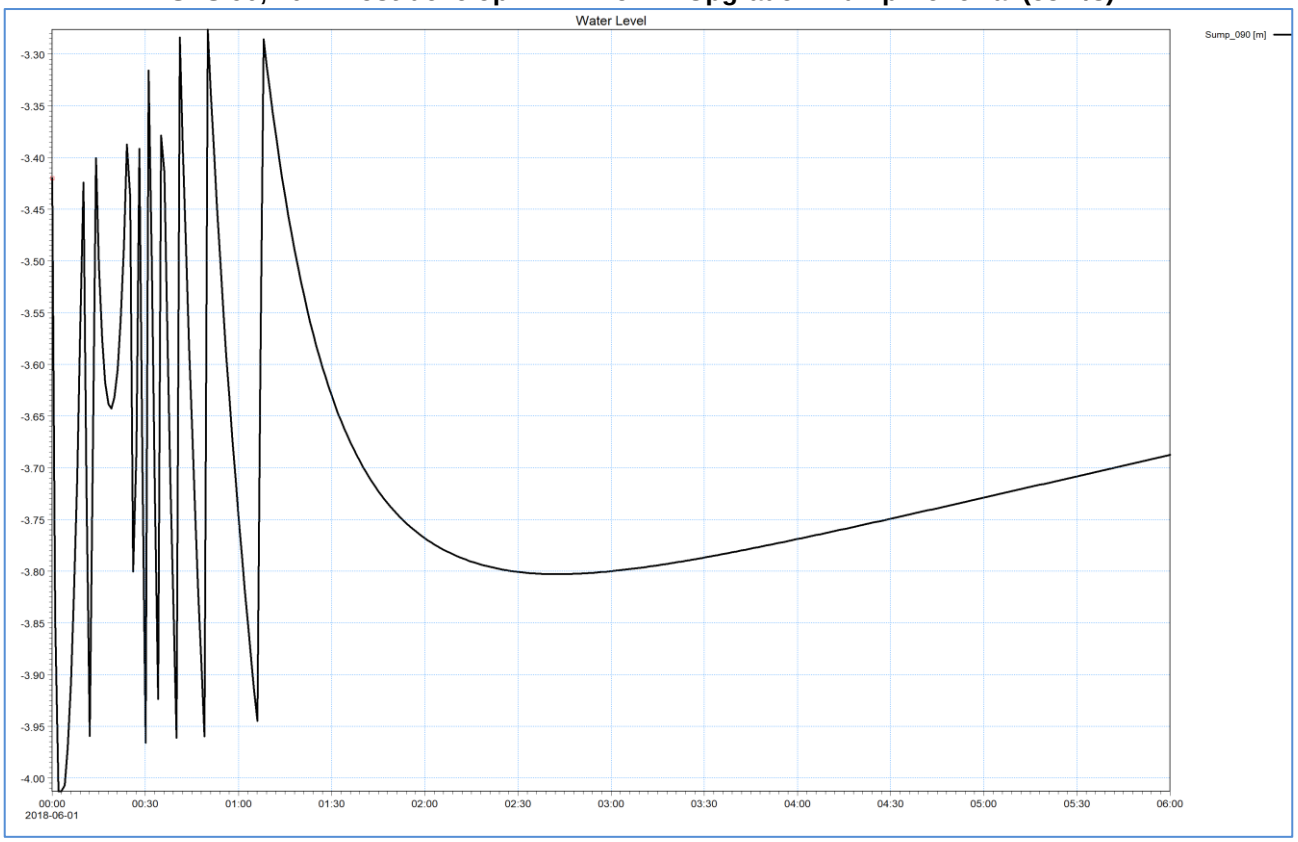
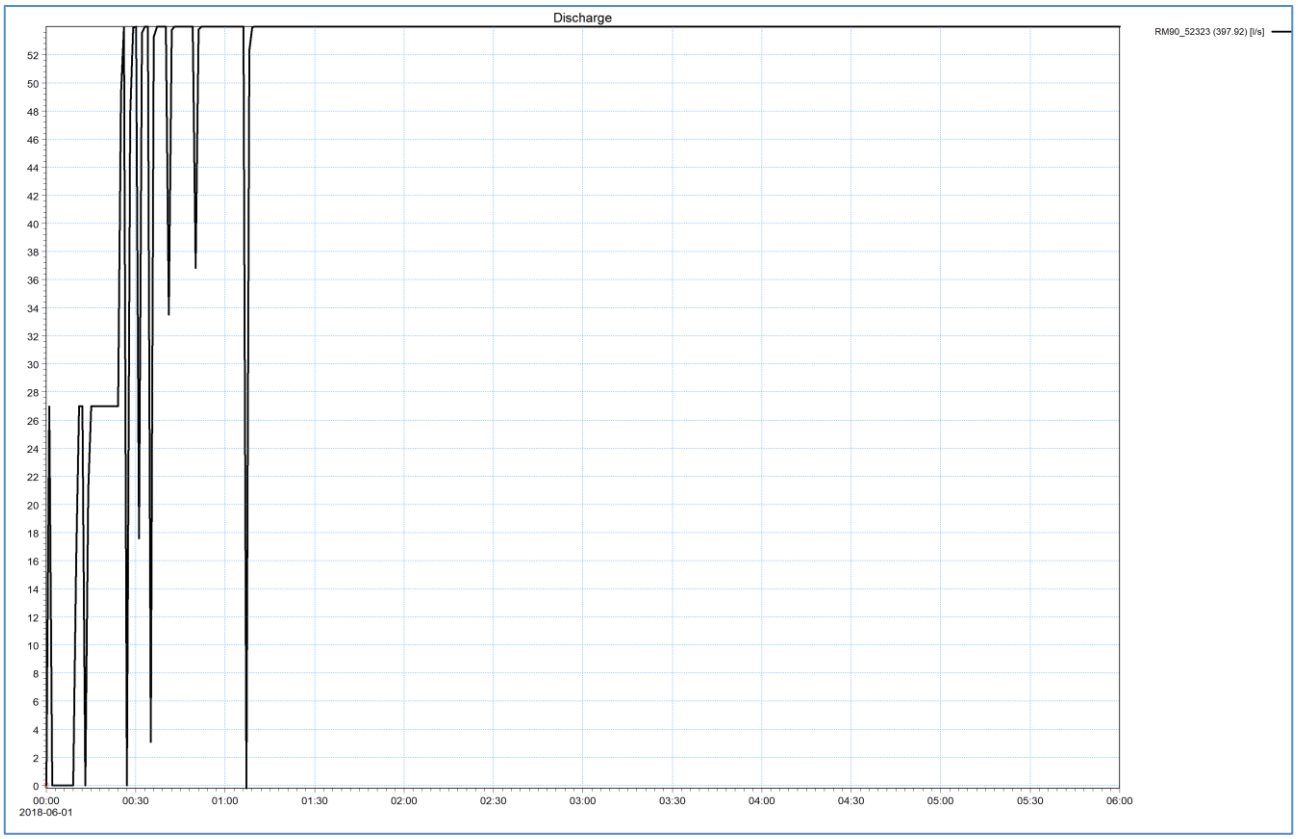
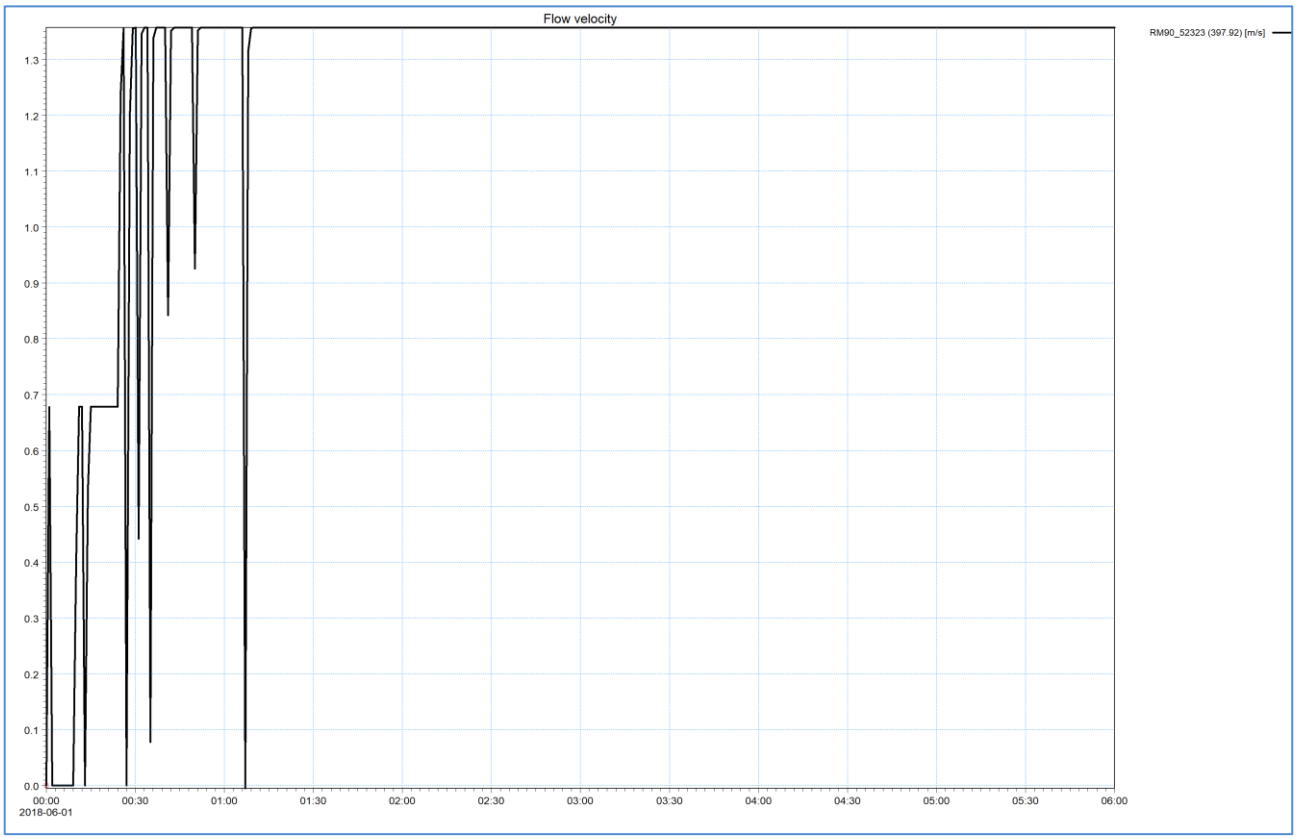
SPS 90, 2041 Post-develop. + DN225 RM Upgrade + Pump Renewal (53 L/s)






Flow velocity
RM90_52323 (397.92) [m/s]
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1.1
1.0
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0.8
0.7
0.6
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Appendix 4. Wet well modelling results for Weinam Creek PDA

		2041 Post-develop.	
		SPS 90	SPS 132
Single Pump Capacity Required	Catchment EP	4,377.0	2,055.0
	Pump Arrangement	Duty/Assist	Duty/Assist
	C1	4.0	4.5
	ADWF (L/s)	10.6	5.0
	Q (L/s)	42.2	22.3
Operational Storage Capacity Required	Duty Flow (L/s)	42.2	22.3
	Duty Head (m)	-	-
	Pump Efficiency (%)	-	-
	Duty Power (kW)	<100	<100
	No. pump starts (n)	12.0	12.0
	OSCR (kL)	3.2	1.7
Operational Storage Capacity Available	Duty Start (m)	-3.2	-3.2
	Duty Stop (m)	-4.4	-3.7
	Duty Height (m)	1.16	0.5
	WW Diam. (m)	2.0	3.3
	OSCA (kL)	3.6	4.3
OUTCOME	**Difference (kL)**	**+0.5**	**+2.6**
	Pass / Fail	**PASS**	**PASS**

Note: Above calculations include the proposed duty start/stop level changes for SPS 90, i.e. duty start at 50 mm below invert of gravity main and duty stop at 400 mm above WW IL.

Appendix 5. Gravity main modelling results for Weinam Creek PDA

SPS 132 - 2041 PWWF Pre-develop.						
Name	**Diam. (mm)**	**Link Water Level**	**Link Discharge (L/s)**	**Link Velocity (m/s)**	**Link Depth (m)**	**d/D (%)**
56683	214	-2.676	1.629	0.347	0.034	15.7%
56684	214	-2.616	1.629	0.413	0.034	15.7%
56685	214	-2.356	1.629	0.413	0.034	15.7%
56686	214	-2.099	1.586	0.332	0.041	19.2%
56687	214	-1.862	1.169	0.403	0.028	13.3%
56688	214	-1.503	1.072	0.379	0.027	12.7%
56689	150	-1.171	0.563	0.448	0.019	12.4%
56690	150	-0.144	0.387	0.401	0.016	10.3%
56691	150	-1.207	0.308	0.223	0.023	15.5%
56692	150	-0.887	0.194	0.271	0.013	8.4%
56693	150	-0.584	0.050	0.209	0.006	4.0%
56694	150	-0.095	0.044	0.241	0.005	3.4%
56695	150	-0.602	0.087	0.260	0.008	5.0%
56696	150	0.058	0.087	0.224	0.008	5.5%
Inlet_132_1_56682	233	-3.205	1.580	0.037	1.295	555.9%

SPS 132 - 2041 PWWF Post-develop.						
Name	**Diam. (mm)**	**Link Water Level**	**Link Discharge (L/s)**	**Link Velocity (m/s)**	**Link Depth (m)**	**d/D (%)**
56683	214	-2.648	5.534	0.510	0.062	28.9%
56684	214	-2.576	5.534	0.517	0.074	34.4%
56685	214	-2.322	5.534	0.548	0.068	32.0%
56686	214	-2.054	4.796	0.392	0.086	40.4%
56687	214	-1.826	2.938	0.398	0.064	30.0%
56688	214	-1.487	2.599	0.484	0.043	20.1%
56689	150	-1.170	0.678	0.474	0.020	13.5%
56690	150	-0.145	0.339	0.385	0.015	9.7%
56691	150	-1.183	1.243	0.330	0.047	31.4%
56692	150	-0.874	0.904	0.430	0.026	17.7%
56693	150	-0.573	0.452	0.407	0.017	11.4%
56694	150	-0.087	0.339	0.445	0.013	8.8%
56695	150	-0.592	0.226	0.248	0.018	12.0%
56696	150	0.063	0.226	0.299	0.013	8.7%
Inlet_132_1_56682	233	-2.809	5.534	0.601	0.061	26.0%

SPS 90 - 2041 PWWF Pre-develop.						
Name	**Diam. (mm)**	**Link Water Level**	**Link Discharge (L/s)**	**Link Velocity (m/s)**	**Link Depth (m)**	**d/D (%)**
232863	150	4.078	0.488	0.164	0.048	31.9%
29531	214	-0.291	15.709	0.701	0.129	60.5%
29570	150	5.716	1.363	0.651	0.026	17.6%
29571	150	4.187	1.469	1.381	0.017	11.0%
29572	150	4.078	0.041	0.019	0.048	31.9%
29573	150	3.749	1.999	0.549	0.039	26.0%
29574	150	0.779	2.015	0.973	0.029	19.4%
29575	150	0.563	2.064	0.513	0.043	28.4%

29576	150	0.253	2.116	0.757	0.033	22.2%
29577	150	0.563	0.032	0.088	0.013	8.4%
29578	150	-0.625	2.118	0.593	0.045	30.1%
29579	150	-1.085	2.427	0.543	0.045	29.9%
29580	150	-0.625	0.299	0.328	0.015	10.1%
29581	150	7.091	1.238	0.809	0.021	14.2%
29582	150	7.930	0.207	0.383	0.010	7.0%
29583	150	8.137	0.083	0.277	0.007	4.6%
29584	150	6.379	0.156	0.367	0.009	5.9%
29585	150	5.471	0.284	0.486	0.011	7.3%
29586	150	4.826	0.416	0.404	0.016	10.8%
29587	150	4.920	0.219	0.410	0.010	6.9%
29588	150	5.268	0.157	0.421	0.008	5.4%
29589	150	4.009	0.647	0.503	0.019	12.6%
29590	150	2.094	0.659	0.759	0.014	9.6%
29591	150	1.801	0.659	0.443	0.021	13.9%
29592	219	-0.542	16.010	0.727	0.148	67.7%
29593	214	-0.810	20.942	0.670	0.180	84.0%
29594	150	0.850	0.138	0.254	0.010	7.0%
29595	150	1.015	0.041	0.204	0.005	3.6%
29596	150	1.155	0.043	0.211	0.005	3.6%
29597	150	-1.685	2.881	0.530	0.055	36.8%
29598	150	1.127	0.101	0.311	0.007	4.9%
29599	150	1.537	0.064	0.229	0.007	4.5%
29600	150	-1.855	3.726	0.524	0.055	37.0%
29601	150	-2.081	4.000	0.572	0.059	39.1%
29602	150	0.106	0.051	0.205	0.006	4.1%
29603	150	1.036	0.051	0.199	0.006	4.2%
29604	219	-1.261	21.650	0.805	0.149	68.0%
29605	150	0.064	0.032	0.257	0.004	2.6%
29606	219	-1.628	21.682	0.911	0.122	55.6%
29611	214	-1.968	23.140	0.834	0.152	71.1%
29612	214	-2.203	23.264	1.007	0.127	59.3%
29614	150	-2.185	4.000	0.563	0.065	43.0%
29615	150	-2.523	4.598	0.489	0.087	58.3%
29616	150	0.860	0.634	0.458	0.020	13.2%
29617	150	1.454	0.027	0.208	0.004	2.6%
29618	150	-2.761	5.480	0.514	0.099	66.1%
29619	150	-2.870	5.677	0.463	0.110	73.1%
Inlet_090_29613	214	-3.712	29.823	0.749	1.078	503.5%

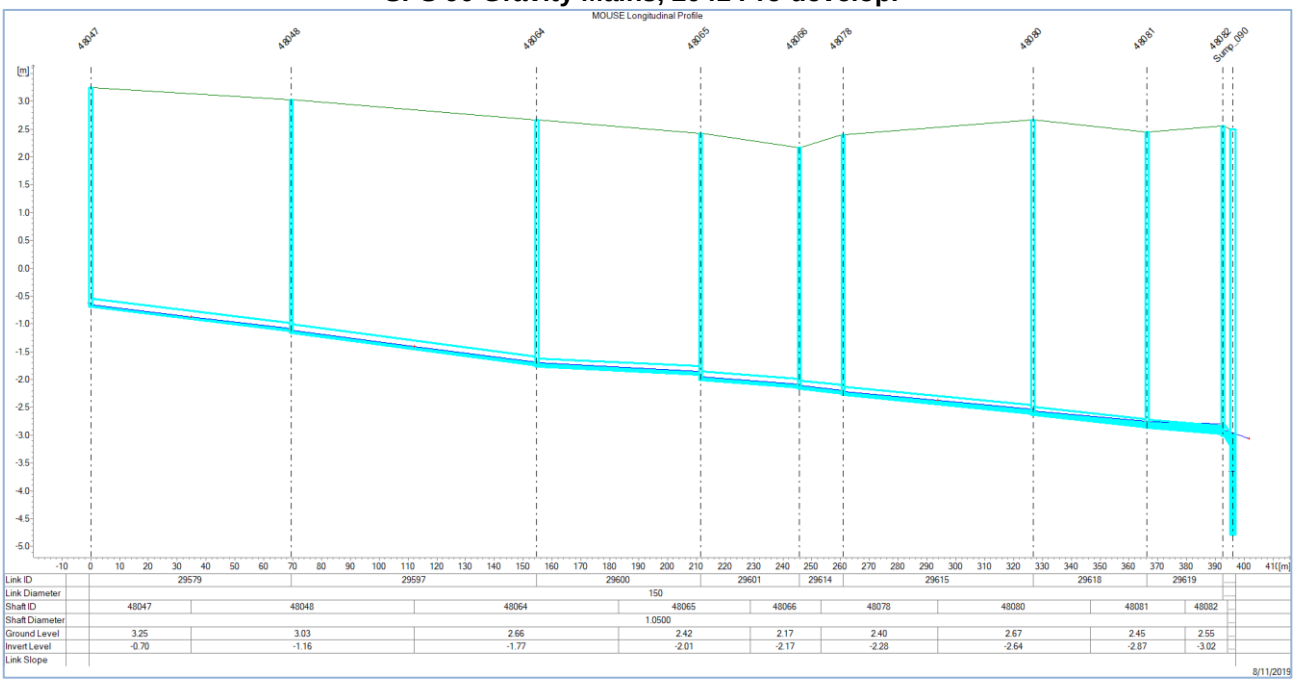
SPS 90 - 2041 PWWF Post-develop. + DN150/200/225 Duplication Main						
Name	**Diam. (mm)**	**Link Water Level**	**Link Discharge (L/s)**	**Link Velocity (m/s)**	**Link Depth (m)**	**d/D (%)**
232863	150	4.2	2.7	0.2	0.131	87.3%
29531	214	-0.3	15.7	0.7	0.138	64.7%
29570	150	5.7	3.2	0.8	0.041	27.0%
29571	150	4.2	4.0	1.9	0.027	17.9%
29572	150	4.2	1.0	0.1	0.131	87.3%
29573	150	3.8	7.6	0.8	0.079	52.9%
29574	150	0.8	7.8	0.9	0.097	64.9%

29575	150	0.6	8.4	0.6	0.118	78.6%
29576	150	0.3	8.9	0.8	0.112	74.5%
29577	150	0.6	0.2	0.0	0.088	58.6%
29578	150	-0.6	9.7	0.9	0.105	70.1%
29579	150	-1.0	7.0	0.6	0.106	70.9%
29580	150	-0.6	3.7	0.5	0.075	50.1%
29581	150	7.1	1.5	0.9	0.023	15.6%
29582	150	7.9	0.9	0.6	0.022	14.4%
29583	150	8.2	0.4	0.3	0.023	15.4%
29584	150	6.4	0.8	0.6	0.019	12.5%
29585	150	5.5	1.3	0.8	0.023	15.3%
29586	150	4.8	1.3	0.6	0.028	18.9%
29587	150	4.9	0.8	0.6	0.019	12.5%
29588	150	5.3	0.6	0.6	0.015	10.0%
29589	150	4.0	2.3	0.7	0.035	23.3%
29590	150	2.1	2.5	0.8	0.040	26.5%
29591	150	1.8	2.5	0.7	0.040	26.6%
29592	219	-0.4	17.9	0.5	0.271	123.7%
29593	214	-0.7	22.8	0.6	0.303	141.7%
29594	150	0.9	2.2	0.6	0.040	26.8%
29595	150	1.1	0.4	0.1	0.050	33.5%
29596	150	1.2	0.9	0.5	0.023	15.1%
29597	150	-1.6	8.6	0.7	0.107	71.5%
29598	150	1.1	1.3	0.7	0.025	16.8%
29599	150	1.5	0.4	0.4	0.017	11.1%
29600	150	-1.8	8.1	0.7	0.082	54.7%
29601	150	-2.0	8.3	0.6	0.109	72.7%
29602	150	0.1	2.3	0.6	0.039	25.7%
29603	150	1.1	2.3	0.6	0.039	26.2%
29604	219	-1.1	26.6	0.7	0.327	149.5%
29605	150	0.1	2.0	0.9	0.027	18.3%
29606	219	-1.5	28.6	0.8	0.285	130.0%
29611	214	-1.9	31.5	0.9	0.204	95.4%
29612	214	-2.2	31.6	1.1	0.148	69.1%
29614	150	-2.1	8.8	0.7	0.110	73.4%
29615	150	-2.5	9.1	0.6	0.133	88.6%
29616	150	0.9	1.2	0.6	0.028	18.3%
29617	150	1.5	0.0	0.0	0.005	3.3%
29618	150	-2.6	8.7	0.5	0.229	153.0%
29619	150	-2.7	5.7	0.3	0.306	204.2%
Inlet_090_29613	214	-3.0	54.0	1.6	0.173	81.0%
Link_12	150	-1.0	6.7	0.6	0.106	70.9%
Link_13	150	-1.6	8.4	0.7	0.107	71.5%
Link_15	200	-1.8	11.3	0.7	0.090	44.9%
Link_16	200	-2.0	11.4	0.7	0.109	54.5%
Link_17	200	-2.1	11.3	0.7	0.110	55.1%
Link_18	200	-2.5	11.7	0.6	0.133	66.5%
Link_19	225	-2.6	13.7	0.4	0.229	102.0%
Link_20	225	-2.7	16.7	0.4	0.306	136.1%

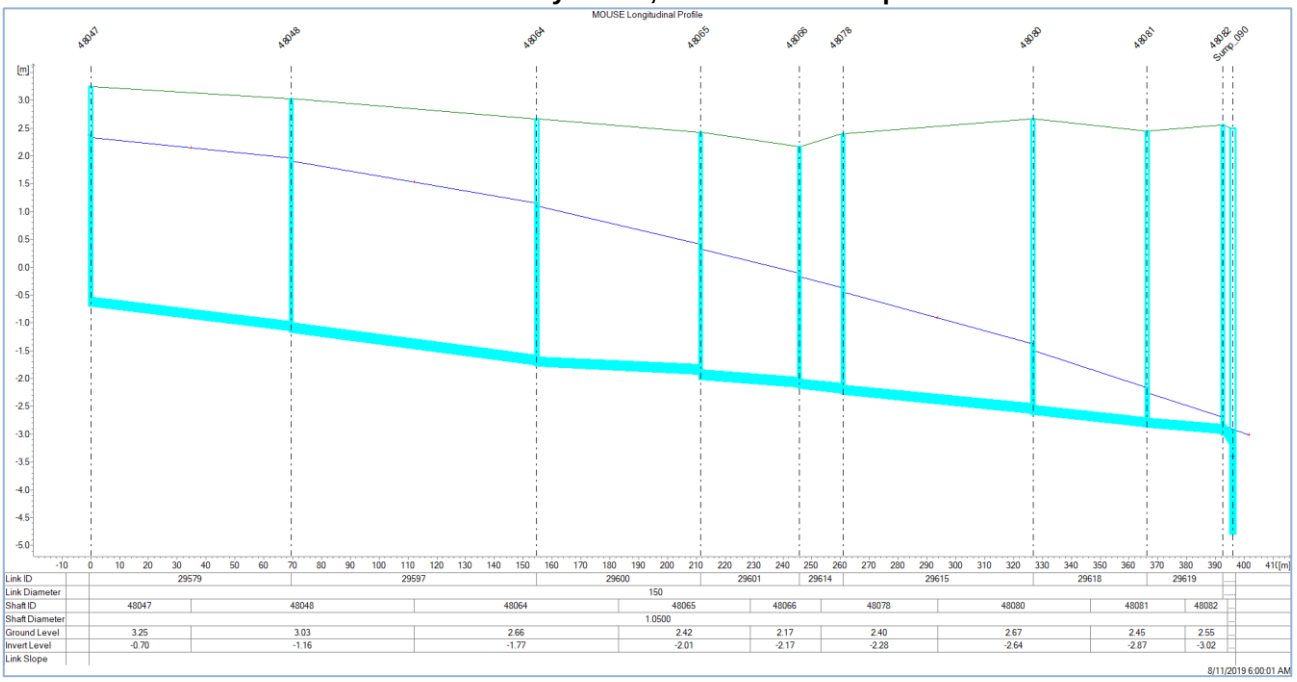
Note: Link_19 and Link_20 show results that do not comply with SEQ Code 75% d/D flow depth, however this is due to erroneous results from Mike Urban, as the well HGL was above the invert level of this pipework, which could not be

altered. Manual calculations showed that the DN150/DN225 duplication main should be sufficient to achieve 75% d/D. Further modelling will be required at the detailed design stage to confirm pipe sizing.

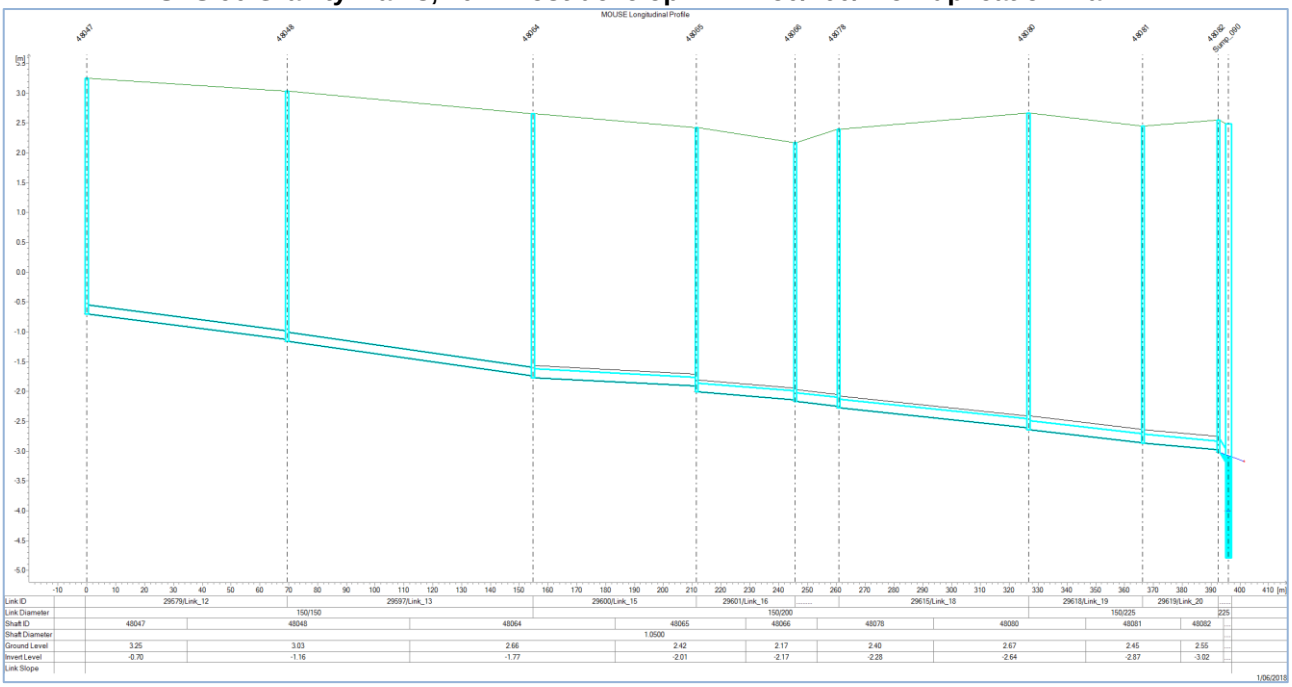
SPS 90 Gravity Mains, 2041 Pre-develop.



SPS 90 Gravity Mains, 2041 Post-develop.

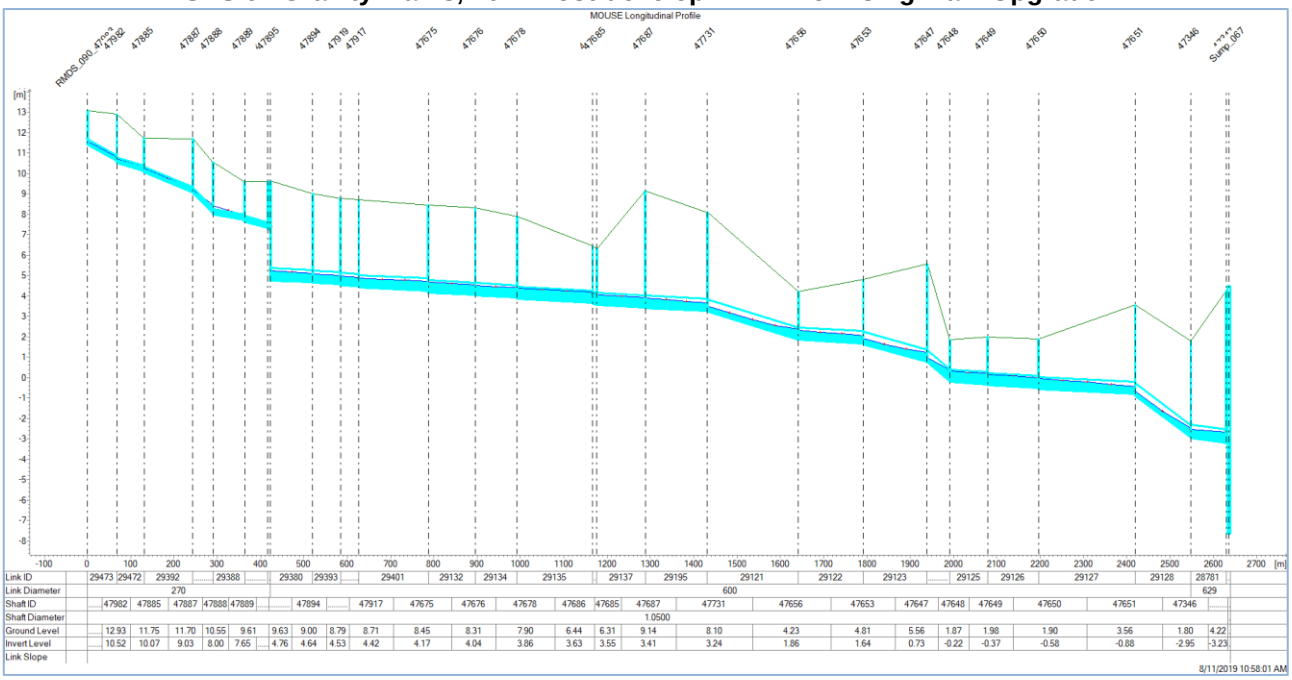


SPS 90 Gravity Mains, 2041 Post-develop. + DN150/200/225 Duplication Main



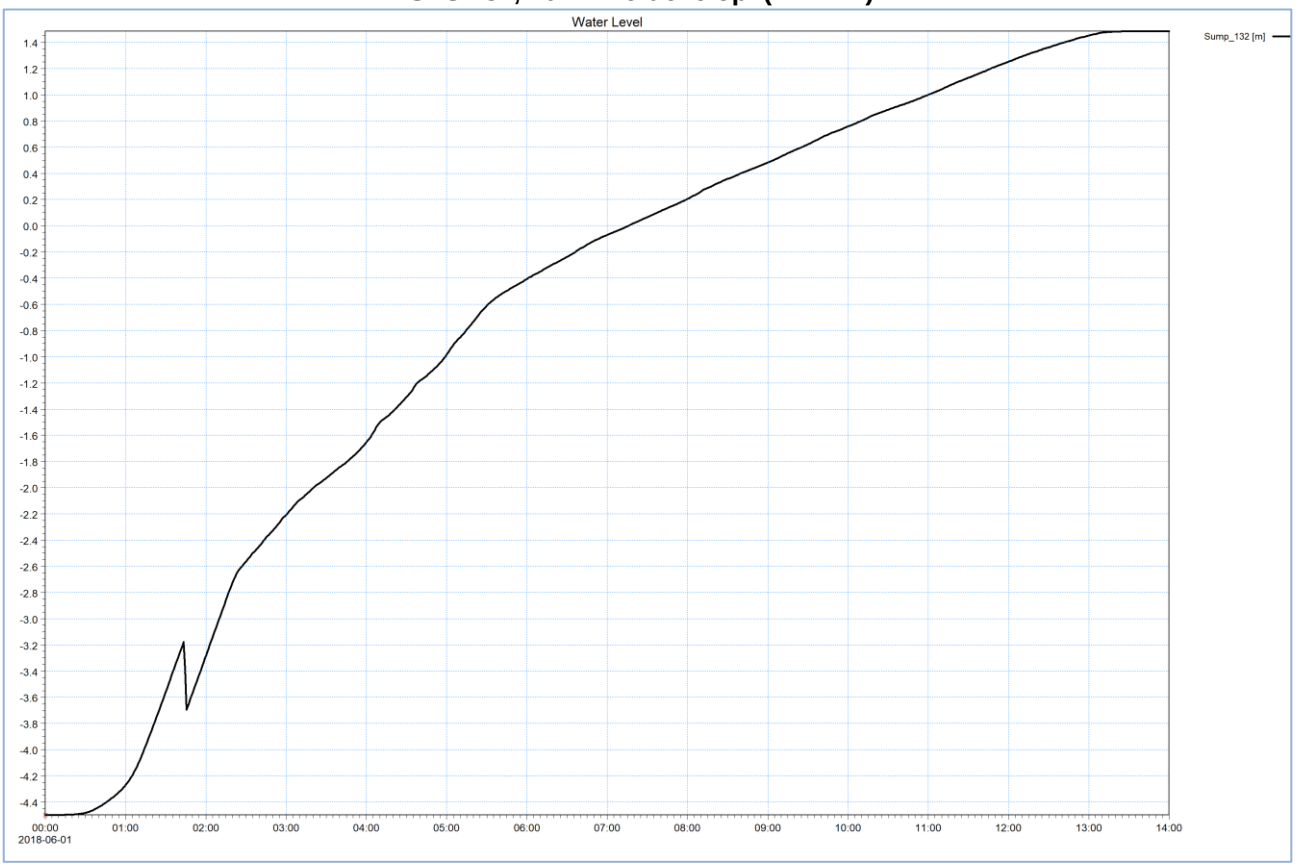
SPS 67 - 2041 PWWF Post-develop. + SPS 90 DN225 Rising Main Upgrade						
Name	**Diam. (mm)**	**Link Water Level**	**Link Discharge (L/s)**	**Link Velocity (m/s)**	**Link Depth (m)**	**d/D (%)**
28781	629	-2.679	235.647	0.968	0.501	79.6%
29121	600	2.394	209.356	0.945	0.534	89.0%
29122	600	2.066	209.288	1.048	0.386	64.4%
29123	600	1.227	209.288	1.086	0.447	74.4%
29124	600	0.373	239.074	1.210	0.543	90.4%
29125	600	0.205	238.220	0.889	0.535	89.2%
29126	600	-0.007	237.089	0.924	0.503	83.9%
29127	600	-0.428	235.972	1.156	0.382	63.7%
29128	600	-2.475	235.745	1.389	0.455	75.8%
29132	600	4.553	204.350	0.820	0.493	82.1%
29134	600	4.412	204.791	0.830	0.492	82.0%
29135	600	4.196	204.655	0.761	0.546	91.0%
29136	600	4.117	208.168	0.791	0.557	92.8%
29137	600	3.919	208.745	0.856	0.479	79.8%
29195	600	3.673	209.430	1.001	0.403	67.2%
29380	600	5.116	190.257	0.850	0.436	72.7%
29381	270	7.391	58.204	1.431	0.181	66.9%
29384	270	7.622	56.306	0.983	0.282	104.5%
29388	270	7.996	56.216	0.981	0.256	94.8%
29391	270	8.477	56.216	0.981	0.427	158.3%
29392	270	9.338	55.265	1.063	0.268	99.1%
29393	600	5.005	190.259	0.860	0.435	72.6%
29399	600	4.919	190.888	0.851	0.449	74.8%
29401	600	4.706	191.168	0.856	0.436	72.7%
29472	270	10.368	54.578	1.049	0.248	91.7%
Inlet_067_28784	629	-2.937	242.658	1.513	0.313	49.7%

SPS 67 Gravity Mains, 2041 Post-develop. + DN225 Rising Main Upgrade

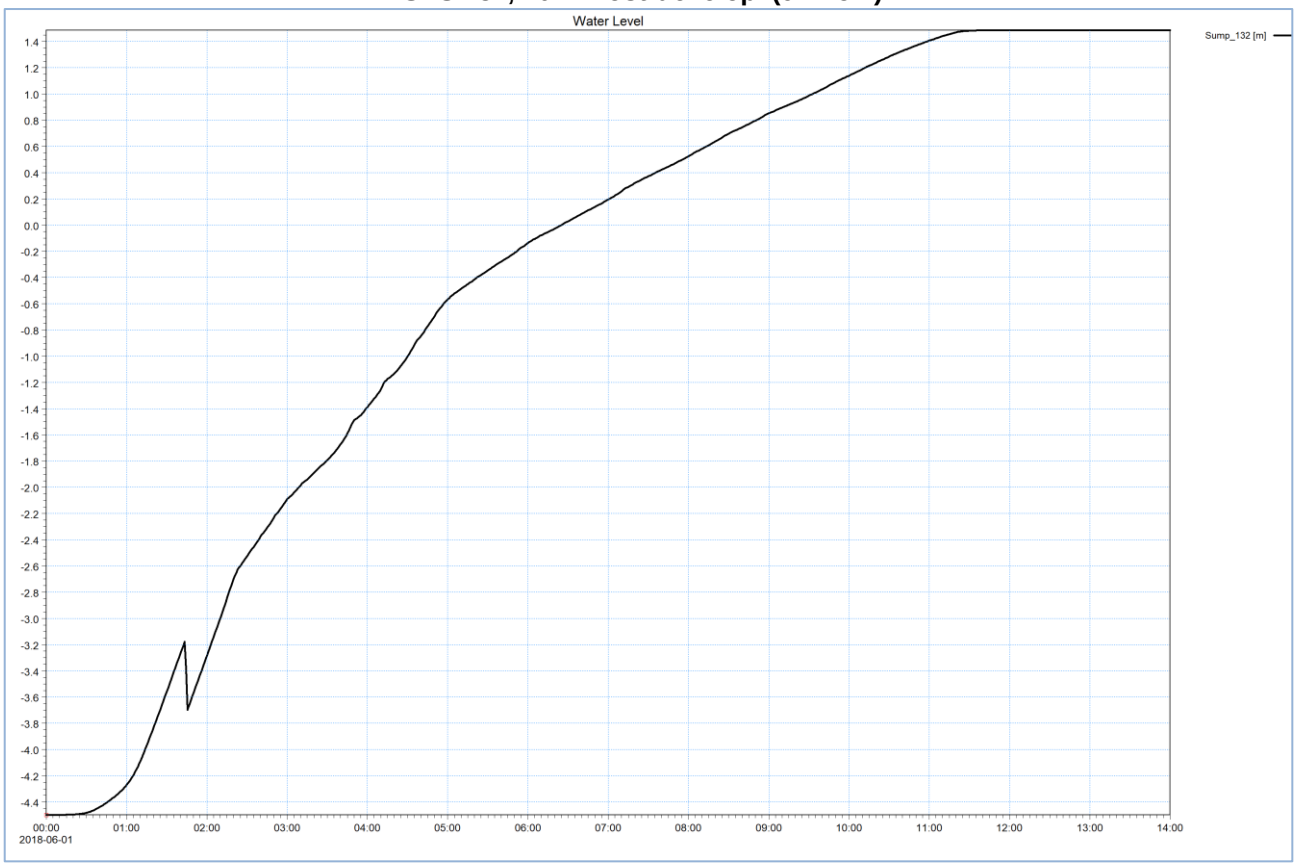


Appendix 6. Emergency storage modelling results for Weinam Creek PDA

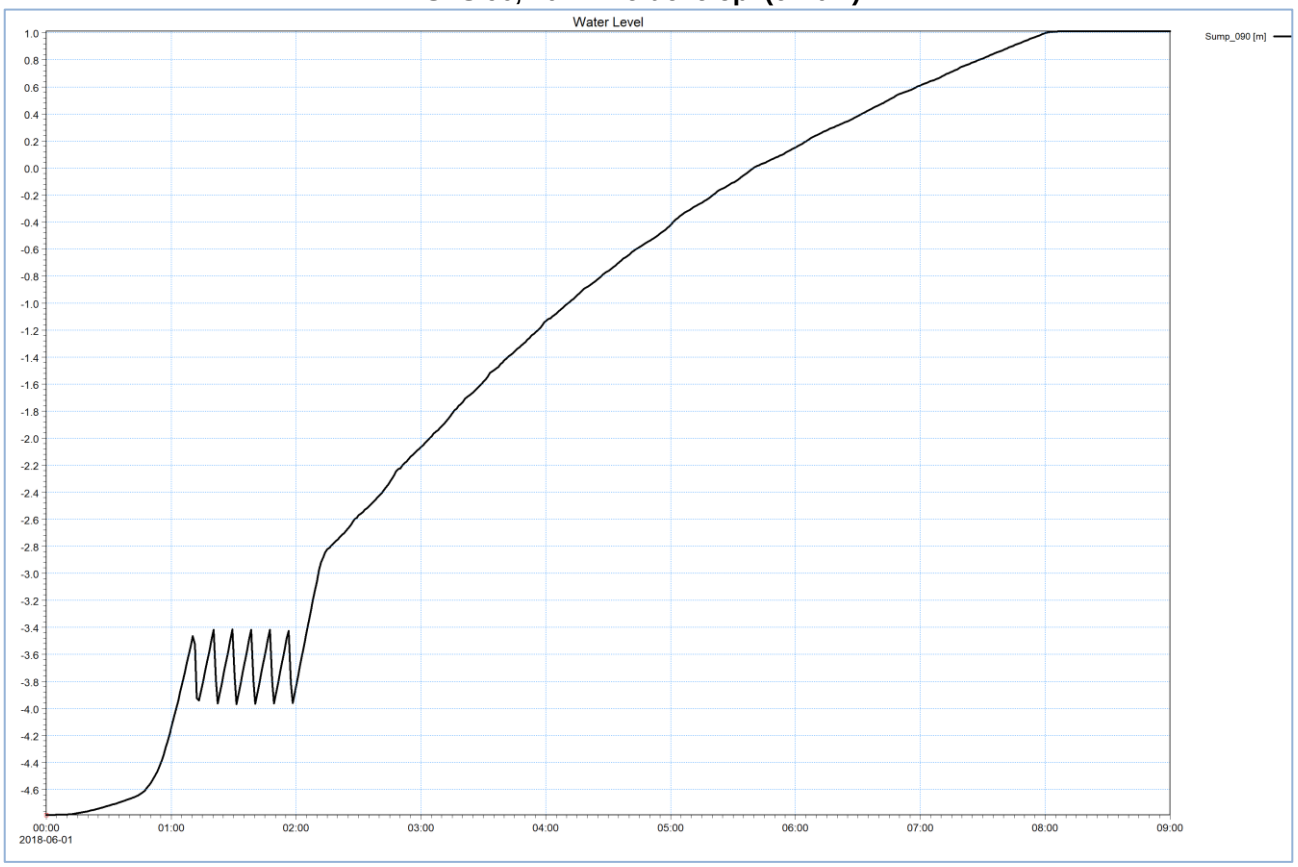
SPS 132, 2041 Pre-develop. (11H 2M)



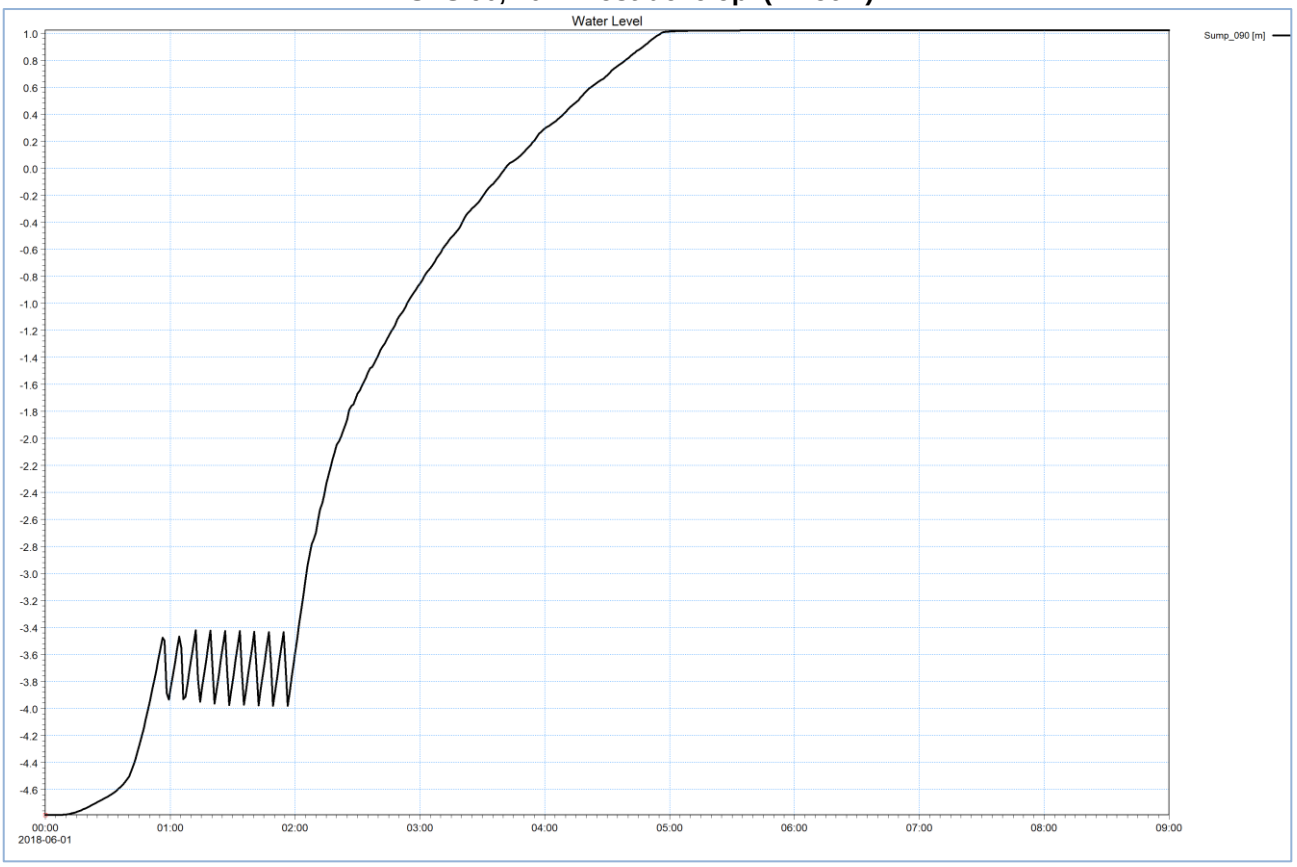
SPS 132, 2041 Post-develop. (9H 15M)



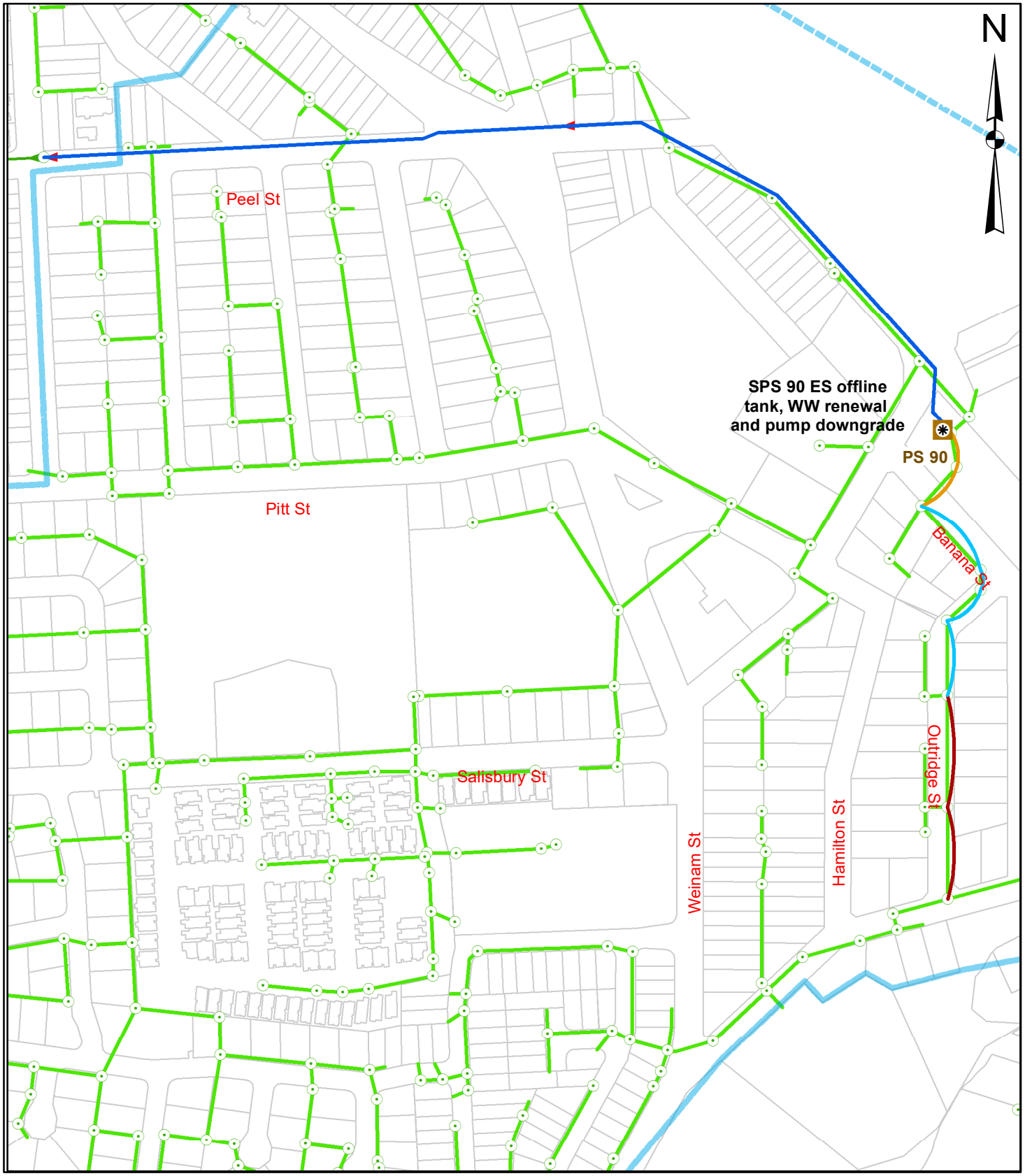
SPS 90, 2041 Pre-develop. (6H 0M)



SPS 90, 2041 Post-develop. (2H 56M)



Appendix 7. Proposed sewer infrastructure upgrades for the Weinam Creek PDA



Legend

- Current Land
- Weinam Creek PDA
- WW Catchment

GM Duplication

- 150
- 200
- 225

RM Upgrade

- 225

WW Pressure Pipes

- Operating
- Out of Service
- Decommissioned

WW Non-pressure Pipes

- Trunk Gravity
- Reticulation
- Effluent Outflow
- Effluent Reuse

Issue	Date	By	Chkd	Appd
D1	3/04/2020	JM	MI	MI

Redland CITY COUNCIL
Redland Water
PO Box 21
Cleveland QLD 4163

Job Title	**Weinam Creek PDA**
Drawing Title	**Sewer catchments servicing PDA**
Scale at A3	**1:406,300**
Drawing Status	**Draft V1**
Coordinate System	**GDA 1994 MGA Zone 56**
Date of Print	**3/04/2020**
Drawing No	**001**

G:\RedlandWater&Waste\Data\TechSup\Planning\Water\02_Planning\002_Land Use Planning Advice\Weinam Creek PDA\Sewer\Report\Appendices\Appendix 3.mxd

Appendix 8. Detailed capital cost estimate calculations and assumptions

Catchment	Aug No.	Description	Size	Length (m)	Unit Base Rate	Adjustment Factor	Base Sub-total	Indexed Sub-total
SPS 90	1	Rising main upgrade	DN225	800	$ 326	1.20	$312,960	$352,239
	2	Duty/assist renewal	18 kW	NA	$500 / kW + $7k install	NA	$25,000	$25,000
	3	Well and internal pipework renewal	NA	NA	NA	NA	$500,000	$500,000
	4	Emergency storage tank	41 kL	NA	$ 3,676	NA	$150,716	$179,963
	5	Gravity mains	DN150	154	$ 385	1.37	$81,227	$ 91,422
	6		DN200	172	$ 471	1.37	$110,986	$124,916
	7		DN225	66	$ 516	1.37	$46,657	$52,513
							TOTAL	**$1,326,053**

Note 1: Assumed soft rock urban for all pipework

Note 2: Aug No. 2 was estimated based on RCC costs from recent works

Note 3: Aug No. 3 was a high level estimation based on RCC historical works

Note 4: Emergency storage tank cost estimation sourced from Cardno's CoGC 2014 wet well unit rates, indexed at 3% per annum for 6 years

Note 5: Gravity main cost estimation sourced from Cardno's RCC 2017 unit rates, indexed at 3% per annum for 4 years

Note 6: Rates include 20% overheads. No contingency adjustments have been applied.