Trinity Engineering and Consulting
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6 April 2018

Chief Executive Officer
Douglas Shire Council
PO Box 723
MOSMMAN QLD 4873

Attention: Neil Beck

Dear Neil,

MOSSMAN COMMUNITY INFRASTRUCTURE UPGRADES
RESPONSE TO REQUEST FOR INFORMATION

On behalf of our client, Department of Aboriginal and Torres Strait Islander Partnerships, with reference to the Confirmation Notice & Information Request (OP2417/2017), we provide the following responses to your request *(in blue italics)* for your consideration.

Primary Items

Water supply and sewerage infrastructure plan supporting information: -

1. Please provide pressure and flow test results on Mossman Gorge Road to allow for calibration of the water network model.
   Please see attached water reticulation network analysis file note.

2. A water supply network analysis incorporating pressure and flow tests is to be provided.
   Please see attached water reticulation network analysis file note.

   Confirmation whether a booster pump station is required. The determination of the booster pump is to have regard to the results of the water supply network analysis.

   Please see attached water reticulation network analysis file note.

   In summary a booster pump station may be installed if Council requires that all FNQROC guidelines are to be met.

   The analysis shows that the existing community does not meet full compliance with current FNQROC requirements. The proposed upgrades provide marginal improvement however are still not enough to meet full compliance. In terms of the upgraded system the desktop assessment shows that not all hydrants meet the requirements of 15 L/s and 12 m residual head at the adjacent hydrant under the FNQROC pipe roughness requirements (C=100). However, the most critical hydrant achieves 12.9 L/s and 12 m residual head at the adjacent hydrant. 15 L/s can be drawn from the system at all hydrants except that at the BBN Carpark.

   A booster system is not recommended due to the requirement for ongoing maintenance (electrical and pump based). A booster will only be required to provide additional residual pressure to the system during a firefighting event and with the cumulative effects of all conservative assumptions applying concurrently. That is, a QFES fire tender is drawing flows higher than 12.9 L/s; and the community demand is 2/3 of PH flows; and the reservoir is not full; and the pipe roughness is at C=100 (not C=110 as calibrated from hydrant flow tests). In all other reasonable situations, the booster will remain dormant.

3. Supporting calculations for upgraded sewage pump station including flow estimates, wet well sizing and level calculations, pump station buoyancy calculations, system curves and pump curves are to be provided.

   Please see attached sewage pump station calculations file note

Drainage Study/Stormwater system design

6. Stormwater system calculations and a catchment plan are to be provided.

   Please see attached stormwater drainage catchment plan and calculations.

Secondary Items

7. Confirmation of the location of the change from Access Street to Access Place and update the cross sections accordingly. A minimum carriageway width of 6.5 m is required for Access Streets in accordance with FNQROC Development Manual. From a review of the plan, there appears to have been a chainage shift. The chainages on the typical section need to be amended to match the plans.

   The type cross section chainages have been amended and reference made to the transition setout on drawing 1120-018.

Roads, Access & Stormwater

8. Provide a footpath on Bama Bubu Street and the full length of Junkurrji Street.

   Design drawings have been amended to continue the footpath as per Council's request.

9. Provide easements where drains are located through lots. Clearly show the easements on the drawings.

   Easement have been shown on the engineering drawings with final locations provided on survey plans post construction.

10. Extend the drain north at Lot 23.

    An earth bund has been provided in Lot 23 to meet Council's intent. It is not practical to extend the drain north as there is a level difference between Lot 6 and 23 down to Lot 7.

11. Show access driveway for Lots 39 and 40 extended to the boundary of Lot 39. Show an easement over the access to Lot 39.

    Whilst it is not clear on the plans, Lot 39 extends from Lund Street through to the Public Use Land fronting Mossman River. Therefore, access to Lot 39 is from Lund Street and not via Lot 40's driveway. The plans have been amended to clearly show this for Lot 39.

12. Change the description of Lot 53 from a freehold lot to land dedicated to the State as a Public Use Land — Drainage Reserve.

    Plans have been amended to reflect this request from Council.

13. Note on the plan that Lot 42 is a private community land.

    Plans have been amended to reflect this request from Council.

14. Clearly show the location of the required easements on the drawings. Include line type in legend or label or the like.

    Plans have been amended to reflect this request from Council.

15. Provide service conduits to lot 40 adjacent to the driveway together with associated access pits if necessary, to extend from the front boundary to the end of the access driveway.

    Plans have been amended to reflect this request from Council.

16. Include a note regarding requirement to remove roots from HCB at Lot 12.

    Plans have been amended to reflect this request from Council.

Sewerage Pump Station

17. Provide suitable access arrangements to the proposed pump station and be in accordance with WSAA SPS - 1200.

    Access has been amended to meet the intent of SPS-1200.

18. Provide access hatches requirements.

It is intended to specify Austral TSP Series access hatches or an approved (by Council) equivalent.

19. Include details of demolition/removal of existing pump station.

The existing pump station is to remain operational until such time that the new pump station commissioning is completed. After which the redundant pump well will be excavated, and concrete removed to 1.5m deep and filled with a sand slurry. Similarly, the pump well pipe work etc, switchboard plinth and vent stack are removed from site and ground level reinstated to suit surrounding levels.

Kerbs

20. Improve line types employed for kerb/kerb and channel/kerb and tray as the drawings are difficult to distinguish in this regard.

Plans have been amended to assist with kerb type delineation.

We trust this advice and attached supporting information is sufficient to satisfy Council's request.

Please do not hesitate to contact me with any queries that you may have in relation to this matter.

Yours sincerely
TRINITY ENGINEERING AND CONSULTING

Scott Christensen
Project Manager

File: T:\1020 Mossman Gorge\Drawings\SKETCH 1020-004.dwg

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PRELIMINARY ONLY

0 7.5 15 22.5 30 37.5m
SCALE 1:750 (A1 SIZE)

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Client	DATSIP
Project	MOSSMAN GORGE INFRASTRUCTURE UPGRADES
Title	STORMWATER CATCHMENT PLAN

JOB No.	Scale (A1 size)	Date	Drawing No.	Revision
1020	1:750	29 MARCH 2018	SKETCH 1020-004	A

External References: 1020-X-SURVEY.dwg ; 1020-X-DESIGN.dwg ; TEC-TITLE-SKETCH-A1_a.dwg

1 DESIGN A.R.I. (years)	2 STRUCTURE NO.	3 DRAIN SECTION	4 SUB-CATCHMENTS CONTRIBUTING	5 SURFACE CONDITION (LAND USE)	6 SLOPE OF CATCHMENT (%)	7 tc SUB-CATCHMENT TIME OF CONCENTRATION (min)	8 I RAINFALL INTENSITY From intensity Chart (mm/h)	9 C COEFFICIENT OF RUNOFF	10 A SUB-CATCHMENT AREA (ha)	11 (CxA) EQUIVALENT AREA 9 x 10 (ha)	12 +(CxA) SUM OF CONTRIBUTING EQUIVALENT AREAS sum 11 (ha)	13 Q SUB-CATCHMENT DISCHARGE (8x12)/360 (cumec)	14 FLOW PAST PREVIOUS GULLIES sum 25 (cumec)	15 FLOW IN K&C (INCLUDING BYPASS) 13 + 14 (cumec)	16 ROAD GRADE AT INLET (%)	17 K - K WIDTH (m)	18 Wf FLOW WIDTH (m)	19 dg FLOW DEPTH AT INVERT (m)	20 Vg GUTTER FLOW VELOCITY (m/sec)	21 dg x Vg 20 x 19 (m2/s)	22 INLET NUMBER	23 INLET TYPE From Std. Drg.	24 Qg FLOW INTO INLET From Charts (cumec)	25 BYPASS FLOW 15 - 24 (cumec)
LOCATION				TIME			SUB-CATCHMENT RUNOFF							INLET DESIGN										
5 100	1/1	1/1 to 2/1	1/1			15.00 15.00	139 221	0.78 1.00	0.305 0.305	0.238 0.305	0.238 0.305	0.092 0.187	0.000	0.000	2.1	6.5m Wide Road	1.798Wd	0.084	1.20	0.10	1/1	1TC	0.087	0.005 1/4
5 100	2/1	2/1 to 3/1	1/1;2/1			10.00 10.00	162 259	0.78 1.00	0.284 0.284	0.222 0.284	0.222 0.284	0.100 0.204	0.000	0.000	2.1	6.5m Wide Road	1.872Wd	0.086	1.22	0.11	2/1	1TC	0.092	0.008 3/1
5 100	3/1	3/1 to 4/1	1/1;2/1;3/1			5.00 5.00	204 329	0.78 1.00	0.027 0.027	0.021 0.027	0.021 0.027	0.012 0.025	0.008	0.000	0.5	6.5m Wide Road	1.167Wd	0.065	0.50	0.03	3/1	1TC	0.020	0.000 4/1
5 100	4/1	4/1 to 5/1	1/1;2/1;3/1;4/1			8.00 8.00	175 281	0.78 1.00	0.065 0.065	0.051 0.065	0.051 0.065	0.025 0.051	0.000	0.000	0.0	6.5m Wide Road	0.664Wd	0.050	0.00	0.00	4/1	1TBS0.07	0.025	0.000
5 100	1/2	1/2 to 5/1	1/2			10.00 10.00	162 259	0.78 1.00	0.118 0.118	0.092 0.118	0.092 0.118	0.041 0.085	0.000	0.000	0.0	6.5m Wide Road					1/2	1TC	0.041	0.000
5 100	5/1	5/1 to 6/1	1/1;2/1;3/1;4/1;1/2													5.5m Wide Road					5/1	M		
5 100	6/1	6/1 to 7/1	1/1;2/1;3/1;4/1;1/2 ;6/1			5.00 5.00	204 329	0.78 1.00	0.093 0.093	0.073 0.093	0.073 0.093	0.041 0.085	0.000	0.000	0.0	6.5m Wide Road	0.915Wd	0.057	0.00	0.00	6/1	1TBS0.07	0.041	0.000
5 100	0/4	0/4 to 1/4	0/4			15.00 15.00	139 221	0.78 1.00	0.235 0.235	0.183 0.235	0.183 0.235	0.071 0.144	0.000	0.000	0.00		0.093Dp			0.00	0/4	#D0.15L2.7F.5	0.071	0.000 1/4
5 100	1/4	1/4 to 2/4	0/4;1/4			15.00 15.00	139 221	0.78 1.00	0.215 0.215	0.168 0.215	0.168 0.215	0.065 0.132	0.005	0.000	3.8	6.5m Wide Road	1.352Wd	0.071	1.42	0.10	1/4	1TC	0.069	0.001 2/4
5 100	1/5	1/5 to 2/4	1/5			15.00 15.00	139 221	0.78 1.00	0.333 0.333	0.260 0.333	0.260 0.333	0.100 0.204	0.000	0.000	2.0	6.5m Wide Road	1.913Wd	0.087	1.19	0.10	1/5	1TC	0.093	0.007 2/4
5 100	2/4	2/4 to 3/4	0/4;1/4;1/5;2/4			8.00 8.00	175 281	0.78 1.00	0.083 0.083	0.065 0.083	0.065 0.083	0.032 0.065	0.009	0.000	2.1	6.5m Wide Road	1.165Wd	0.065	1.02	0.07	2/4	1TC	0.040	0.000 1/6
5 100	3/4	3/4 to 4/4	0/4;1/4;1/5;2/4;3 /4			12.00 12.00	152 241	0.78 1.00	0.145 0.145	0.113 0.145	0.113 0.145	0.048 0.097	0.000	0.000	0.00		0.059Dp			0.00	3/4	#D0.1L3.6F0.5	0.048	0.000 4/4
5 100	1/6	1/6 to 2/6	1/6			10.00 10.00	162 259	0.78 1.00	0.154 0.154	0.120 0.154	0.120 0.154	0.054 0.111	0.000	0.000	0.0	6.5m Wide Road	1.090Wd	0.063	0.00	0.00	1/6	1TBS0.07	0.054	0.000 2/6
5 100	2/6	2/6 to 4/4	1/6;2/6			8.00 8.00	175 281	0.78 1.00	0.145 0.145	0.113 0.145	0.113 0.145	0.055 0.113	0.000	0.000	0.0	6.5m Wide Road	1.102Wd	0.063	0.00	0.00	2/6	1TBS0.07	0.055	0.000
5 100	4/4	4/4 to 5/4	0/4;1/4;1/5;2/4;3 /4;1/6;2/6;4/4			5.00 5.00	204 329	0.78 1.00	0.041 0.041	0.032 0.041	0.032 0.041	0.018 0.037	0.000	0.000	0.00		0.031Dp			0.00	4/4	#D0.1L3.6F0.5	0.018	0.000 5/4
5 100	1/8	1/8 to 2/8	1/8			15.00 15.00	139 221	0.78 1.00	0.189 0.189	0.147 0.189	0.147 0.189	0.057 0.116	0.001	0.000	0.0	6.5m Wide Road	1.143Wd	0.064	0.00	0.00	1/8	1TBS0.07	0.058	0.000 2/8

2 STRUCTURE NO.	26 tc CRITICAL TIME OF CONCENTRATION (min)	27 I RAINFALL INTENSITY From Intensity Chart (mm/h)	28 +(CxA) TOTAL CONTRIBUTING EQUIVALENT AREA sum of U/S 12 (ha)	29 Qt MAJOR TOTAL FLOW (cumec)	30 Qm MAJOR SURFACE FLOW CAPACITY (cumec)	31 Qs MAJOR SURFACE FLOW (cumec)	32 Qo FLOW IN PIPE (cumec)	33 L REACH LENGTH (m)	34 S PIPE GRADE (%)	35 PIPE / BOX DIMENSIONS (mm)	36 V FLOW VELOCITY FULL (PIPE GRADE VELOCITY) 32/Area of Sect (m/sec)	37 T TIME OF FLOW IN REACH 33/(36x60) (min)	38 - 39 STRUCTURE RATIOS FOR 'K' VALUE CALCULATIONS FROM Q.U.D.M. CHARTS VOLUME 2
	DRAIN DESIGN												HEADLOSSES
1/1	15.00 15.00	139 221	0.238 0.305	0.187		(Pipe flow= Grate flow)	0.087	7.398	4.68	375(2)	0.79(0.54 1y) (3.43)	0.12	Qg 0.087 Qo 0.087 Do 375 CHRT 32: Vo2/2gDo 0.08 H/Do 0.10 Kg side flow 7.94 end flow 6.05
2/1	15.12 15.12	138 220	0.460 0.589	0.360		(Pipe flow= Sum upstr atten flows)	0.165	15.687	2.03	375(2)	1.49(1.04 1y) (2.26)	0.18	Qg 0.078 Qo 0.165 Do 375 CHART 33 Angle 1 S/Do 2.5 Du/Do 1.00 Qg/Qo 0.48 K 1.47 S/Do 2.02 cor 0.18 Ku 1.65 Kw 1.65
3/1	15.30 15.30	138 219	0.481 0.616	0.375		(Pipe flow= Sum upstr atten flows)	0.178	18.284	1.03	375(2)	1.61(1.08 1y) (1.61)	0.19	Qg 0.013 Qo 0.178 Do 375 Flow 2/1 made eqv grate flow CHRT 32: Vo2/2gDo 0.35 H/Do 1.35 Kg side flow 3.11 end flow 2.81 K vals above for stepped pipes as grate flow grate flow decreased by 0.165 from 2/1 Angle 45 Chart 39 S/Do 2.5 chartdeg Du/Do 1.00 K0 1.80 K0.5 1.91 Qu/Qo 0.93 Cg 0.19 K 1.82
4/1	15.49 15.49	137 218	0.532 0.681	0.412		(Pipe flow= Sum upstr atten flows)	0.196	19.948	1.25	375(2)	1.78(1.18 1y) (1.78)	0.19	Qg 0.019 Qo 0.196 Do 375 Angle 57 Chart 45 S/Do 2.5 chartdeg Du/Do 1.00 K0 2.16 K0.5 1.81 Qu/Qo 0.90 Cg 0.25 K 2.08 S/Do 2.5 K0 2.16 K0.5 1.81 K 2.08 S/Do 2.0 K0 2.47 K0.5 2.34 K 2.44
1/2	10.00 10.00	162 259	0.092 0.118	0.085		(Pipe flow= Grate flow)	0.041	40.375	1.15	375(2)	0.37(0.24 1y) (1.70)	0.67	Qg 0.041 Qo 0.041 Do 375 CHRT 32: Vo2/2gDo 0.02 H/Do 0.00 Kg side flow 10.31 end flow 7.28 Part full downstream pipe
5/1	15.68 15.68	136 216	0.624 0.799	0.479		(Pipe flow= Sum upstr atten flows)	0.229	31.639	3.52	375(2)	2.08(1.38 1y) (2.98)	0.25	Qo 0.229 Do 375 Routine 2.15 Join Pipes: 4/1 and 1/2 Vel1 1.763 Vel2 0.315
6/1	15.93 15.93	136 215	0.697 0.892	0.533		(Pipe flow= Sum upstr atten flows)	0.257	33.467	0.81	450(2)	1.62(1.06 1y) (1.62)	0.34	Qg 0.028 Qo 0.257 Do 450 CHART 33 Angle 3 S/Do 2.5 Du/Do 0.83 Qg/Qo 0.11 K 0.04 S/Do 1.17 cor 0.17 Ku 0.21 Kw 0.21
0/4	15.00 15.00	139 221	0.183 0.235	0.144		(Pipe flow= Grate flow)	0.071	4.720	13.12	375(2)	0.64(0.41 1y) (5.74)	0.08	Qg 0.071 Qo 0.071 Do 375 CHRT 32: Vo2/2gDo 0.06 H/Do 0.00 Kg side flow 9.06 end flow 6.68
1/4	15.08 15.08	139 220	0.351 0.450	0.275		(Pipe flow= Sum upstr atten flows)	0.139	49.207	2.62	375(2)	1.26(0.79 1y) (2.57)	0.65	Qg 0.069 Qo 0.139 Do 375 Angle 81 Chart 47 S/Do 2.5 chartdeg Du/Do 1.00 K0 1.92 K0.5 2.12 Qu/Qo 0.51 Cg 0.99 K 2.12 S/Do 2.0 K0 2.44 K0.5 2.40 K 2.40 S/Do 1.5 K0 2.67 K0.5 2.58 K 2.58
1/5	15.00 15.00	139 221	0.260 0.333	0.204		(Pipe flow= Grate flow)	0.093	11.192	7.21	375(2)	0.84(0.59 1y) (4.26)	0.19	Qg 0.093 Qo 0.093 Do 375 CHRT 32: Vo2/2gDo 0.10 H/Do 0.40 Kg side flow 6.70 end flow 5.18
2/4	15.73 15.73	136 216	0.676 0.866	0.520		(Pipe flow= Sum upstr atten flows)	0.259	14.149	2.18	375(2)	2.34(1.50 1y) (2.34)	0.10	Qg 0.031 Qo 0.259 Do 375 Routine 2.15 Join Pipes: 1/4 and 1/5 Vel1 1.234 Vel2 0.823 Eq Dia 520 Angle 103 Flow 0.227 Angle 77 Chart 43 S/Do 2.5 chartdeg Du/Do 1.39 K0 1.45 K0.5 2.32 Qu/Qo 0.88 Cg 0.30 K 1.71
3/4	15.83 15.83	136 216	0.789 1.011	0.607		(Pipe flow= Sum upstr atten flows)	0.301	34.956	0.45	525(2)	1.35(0.85 1y) (1.35)	0.43	Qg 0.043 Qo 0.301 Do 525 Angle 90 Chart 47 S/Do 2.5 chartdeg Du/Do 0.71 K0 2.37 K0.5 2.33 Qu/Qo 0.86 Cg 0.35 K 2.35 S/Do 2.0 K0 2.55 K0.5 2.41 K 2.50 S/Do 1.5 K0 2.82 K0.5 2.78 K 2.80
1/6	10.00 10.00	162 259	0.120 0.154	0.111		(Pipe flow= Grate flow)	0.054	6.494	0.95	375(2)	0.49(0.31 1y) (1.55)	0.11	Qg 0.054 Qo 0.054 Do 375 CHRT 32: Vo2/2gDo 0.03 H/Do 0.00 Kg side flow 9.87 end flow 7.05 Part full downstream pipe
2/6	10.11 10.11	162 258	0.233 0.299	0.214		(Pipe flow= Sum upstr atten flows)	0.105	11.321	5.01	450(2)	0.66(0.42 1y) (4.01)	0.19	Qg 0.051 Qo 0.105 Do 450 CHART 37 Angle 43 Case3 S/Do 2.5 Du/Do 0.83 Qg/Qo 0.48 K 1.78 S/Do 1.13 cor 0.79 Ku 2.57 Kw 2.57
4/4	16.26 16.26	134 213	1.054 1.351	0.799		(Pipe flow= Sum upstr atten flows)	0.395	30.290	0.40	600(2)	1.35(0.86 1y) (1.39)	0.37	Qg 0.012 Qo 0.395 Do 600 Routine 2.1 CHART 48 Du/Do 0.88 Qu/Qo 0.75 K 0.55 d/Do 2.0 chrt Qg/Qo 0.03 Kg 0.03 d/Do 1.5 chrt Qg/Qo 0.03 Kg 0.02 d/Do 1.24 Interp value Kg 0.02 Ku=Kw= 0.58 Combined pipes in line case Join Pipes:
1/8	15.00 15.00	139 221	0.147 0.189	0.116		(Pipe flow= Grate flow)	0.058	6.373	1.91	375(2)	0.53(0.33 1y) (2.19)	0.11	Qg 0.058 Qo 0.058 Do 375 CHRT 32: Vo2/2gDo 0.04 H/Do 0.64 Kg side flow 7.30 end flow 5.32

2 STRUCTURE NO.	40 V2/2g VELOCITY HEAD 36x36/2g (m)	41 Ku U/S HEADLOSS COEFFICIENT From Q.U.D.M. Volume 2	42 hu U/S PIPE STRUCTURE HEADLOSS 40 x 41 (m)	43 Kl LATERAL HEADLOSS COEFFICIENT From Q.U.D.M. Volume 2	44 hl LATERAL PIPE STRUCTURE HEADLOSS (m)	45 Kw W.S.E COEFFICIENT From Q.U.D.M. Volume 2	46 hw CHANGE IN W.S.E (m)	47 Sf FRICTION SLOPE From Sect. 14.5.7 A.R.R. Vol. 1 1987 (%)	48 hf PIPE FRICTION HEADLOSS 47 x 33/100 (m)	49 DEPTH (m)	50 Vp VELOCITY (m/sec)	51 OBVERT LEVELS U/S RL D/S RL (m)	52 DRAIN SECTION H.G.L. U/S RL D/S RL (m)	53 U/S H.G.L (m)	54 LATERAL H.G.L. (m)	55 W.S.E. (m)	56 SURFACE OR K&C INVERT LEVEL (m)	57 FREEBOARD (m)	58 STRUCTURE No.
	HEADLOSSES									PART FULL		DESIGN LEVELS							
1/1	0.032	7.94	0.253			7.94	0.253	0.25	0.018			43.034 42.688	43.070 43.052	43.323		43.323	43.669	0.346	1/1
2/1	0.113	1.65	0.186			1.65	0.186	0.88	0.139			42.668 42.349	42.866 42.727	43.052		43.052	43.564	0.512	2/1
3/1	0.132	1.59	0.210	S/Do 3.0 K0 1.63 K0.5 1.73 K 1.64 S/Do 2.5 K0 1.80 K0.5 1.91 K 1.82 Interp val for S/Do 2.94 Kw 1.67 CHART 38 S/Do 3.0 K0 1.57 K0.5 1.59 K 1.57 S/Do 2.5 K0 1.70 K0.5 1.66 K 1.70 Interp val for S/Do 2.94 Ku 1.59 K vals step pipes as pipe flow Ku 1.59 Kw 1.67		1.67	0.220	1.03	0.189			42.011 41.822	42.517 42.328	42.727		42.737	42.904	0.167	3/1
4/1	0.161	2.07	0.334	Interp val for S/Do 2.43 Kw 2.12 CHART 44 S/Do 2.5 K0 2.16 K0.5 1.81 K 2.08 S/Do 2.0 K0 1.99 K0.5 2.11 K 2.02 Interp val for S/Do 2.43 Ku 2.07		2.12	0.342	1.25	0.250			41.802 41.552	41.994 41.744	42.328		42.336	42.972	0.636	4/1
1/2	0.007	1.00	0.080	Upstream HGL 41.847 below outlet pipe obv 42.015 Set Kp to 1		1.00	0.080	0.06	0.023	0.120 (0.095 1y)	1.37 (1.20 1y)	42.015 41.552	41.767 41.744	41.847		41.847	43.562	1.715	1/2
5/1	0.221	0.96	0.212	Eq Dia 435 Angle 211 Flow 0.229 CHART 50 Du/Do1.16 alpha 31 K'w 0.23 Vu 1.54 WSE 0.24 Ku 0.96 Kw 1.09		1.09	0.240	1.72	0.543	0.231 (0.179 1y)	3.22 (2.92 1y)	41.532 40.417	41.532 40.550	41.744		41.772	42.605	0.833	5/1
6/1	0.134	0.21	0.028			0.21	0.028	0.81	0.272			40.472 40.200	40.522 40.250	40.550		40.550	41.896	1.346	6/1
0/4	0.021	9.06	0.189			9.06	0.189	0.16	0.008	0.084 (0.068 1y)	3.78 (3.33 1y)	40.446 39.827	40.446 39.990	40.635		40.635	41.081	0.446	0/4
1/4	0.081	2.26	0.183	Interp val for S/Do 1.55 Kw 2.56 CHART 46 S/Do 2.0 K0 2.04 K0.5 1.92 K 1.92 S/Do 1.5 K0 2.09 K0.5 2.31 K 2.30 Interp val for S/Do 1.55 Ku 2.26		2.56	0.207	0.63	0.311	0.185 (0.144 1y)	2.56 (2.27 1y)	39.807 38.517	39.807 39.444	39.990		40.014	41.210	1.196	1/4
1/5	0.036	6.70	0.241			6.70	0.241	0.28	0.031			39.324 38.517	39.475 39.444	39.716		39.716	39.959	0.243	1/5
2/4	0.279	1.37	0.383	S/Do 4.0 K0 1.20 K0.5 1.52 K 1.30 S/Do 3.0 K0 1.49 K0.5 1.81 K 1.59 Interp val for S/Do 3.57 Kw 1.42 CHART 42 S/Do 4.0 K0 1.24 K0.5 1.49 K 1.31 S/Do 3.0 K0 1.31 K0.5 1.72 K 1.44 Interp val for S/Do 3.57 Ku 1.37		1.42	0.397	2.18	0.308			38.497 38.188	39.061 38.753	39.444		39.458	39.766	0.308	2/4
3/4	0.093	1.96	0.182	Interp val for S/Do 1.90 Kw 2.56 CHART 46 S/Do 2.0 K0 1.84 K0.5 2.03 K 1.91 S/Do 1.5 K0 2.10 K0.5 2.31 K 2.17 Interp val for S/Do 1.90 Ku 1.96		2.56	0.238	0.45	0.157			38.327 38.171	38.571 38.414	38.753		38.809	39.718	0.909	3/4
1/6	0.012	1.00	0.027	Upstream HGL 38.551 below outlet pipe obv 38.661 Set Kp to 1		1.00	0.027	0.10	0.006	0.145 (0.114 1y)	1.37 (1.21 1y)	38.661 38.599	38.524 38.518	38.551		38.551	39.296	0.745	1/6
2/6	0.022	1.00	0.089	Part full downstream pipe Upstream HGL 38.518 below outlet pipe obv 38.654 Set Kp to 1		1.00	0.089	0.14	0.015	0.123 (0.098 1y)	2.96 (2.60 1y)	38.654 38.087	38.429 38.414	38.518		38.518	39.296	0.778	2/6
4/4	0.093	0.46	0.043	3/4 and 2/6 Vel1 1.371 Vel2 0.545 Eq Dia 642 Angle 186 Flow 0.384 CHART 33 Angle 0 S/Do 2.5 Du/Do 1.07 Qg/Qo 0.03 K 0.31 S/Do 1.29 cor 0.04 Ku 0.35 Kw 0.35 Interpolated Ku= 0.46 Kw= 0.46		0.46	0.043	0.38	0.115			38.227 38.105	38.371 38.256	38.414		38.414	39.916	1.502	4/4
1/8	0.014	7.30	0.105			7.30	0.105	0.11	0.007			38.017 37.895	38.258 38.251	38.363		38.363	38.652	0.289	1/8

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Client: DATSIP

Project: MOSSMAN GORGE INFRASTRUCTURE UPGRADES

Title: STORMWATER CALCULATIONS TABLE 1 OF 2

JOB No.	Scale (A1 size)	Date	Drawing No.	Revision
1020		29 MARCH 2018	SKETCH 1020-005	A

File: T:\1020 Mossman Gorge\Drawings\ SKETCH 1020-005.dwg
Printed: 28 March 2018, 1:51 PM
External References: TEC-TITLE-SKETCH-A1_a.dwg

LOCATION				TIME			SUB-CATCHMENT RUNOFF						
1	2	3	4	5	6	7	8	9	10	11	12	13	14
						tc	I	C	A	(CxA)	+(CxA)	Q	
DESIGN A.R.I.	STRUCTURE NO.	DRAIN SECTION	SUB-CATCHMENTS CONTRIBUTING	SURFACE CONDITION (LAND USE)	SLOPE OF CATCHMENT	SUB-CATCHMENT TIME OF CONCENTRATION	RAINFALL INTENSITY	COEFFICIENT OF RUNOFF	SUB-CATCHMENT AREA	EQUIVALENT AREA	SUM OF CONTRIBUTING EQUIVALENT AREAS	SUB-CATCHMENT DISCHARGE	FLOW PAST PREVIOUS GULLIES
							From intensity Chart			9 x 10	sum 11	(8x12)/360	sum 25
years					%	min	mm/h		ha	ha	ha	cumec	cumec
5 100	2/8	2/8 to 3/8	1/8;2/8			5.00 5.00	204 329	0.78 1.00	0.034 0.034	0.027 0.034	0.027 0.034	0.015 0.031	0.000
5 100	3/8	3/8 to 6/4	1/8;2/8;3/8			5.00 5.00	204 329	0.78 1.00	0.093 0.093	0.073 0.093	0.073 0.093	0.041 0.085	0.000
5 100	1/7	1/7 to 5/4	1/7			15.00 15.00	139 221	0.78 1.00	0.273 0.273	0.213 0.273	0.213 0.273	0.082 0.168	0.000
5 100	5/4	5/4 to 6/4	0/4;1/4;1/5;2/4;3 /4;1/6;2/6;4/4;1/ 7;5/4			5.00 5.00	204 329	0.78 1.00	0.050 0.050	0.039 0.050	0.039 0.050	0.022 0.046	0.000
5 100	6/4	6/4 to 7/4	1/8;2/8;3/8;0/4;1/ 4;1/5;2/4;3/4;1/6; 2/6;4/4;1/7;5/4;6 /4			15.00 15.00	139 221	0.78 1.00	0.107 0.107	0.083 0.107	0.083 0.107	0.032 0.066	0.000

	INLET DESIGN											DRAIN DESIGN											
2	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
				Wf	dg	Vg				Qg		tc	I	+(CxA)	Qt	Qm	Qs	Qo	L	S		V	T
STRUCTURE NO.	FLOW IN K&C (INCLUDING BYPASS)	ROAD GRADE AT INLET	K - K WIDTH	FLOW WIDTH	FLOW DEPTH AT INVERT	GUTTER FLOW VELOCITY	dg x Vg	INLET NUMBER	INLET TYPE	FLOW INTO INLET	BYPASS FLOW	CRITICAL TIME OF CONCENTRATION	RAINFALL INTENSITY	TOTAL CONTRIBUTING EQUIVALENT AREA	MAJOR TOTAL FLOW	MAJOR SURFACE FLOW CAPACITY	MAJOR SURFACE FLOW	FLOW IN PIPE	REACH LENGTH	PIPE GRADE	PIPE / BOX DIMENSIONS	FLOW VELOCITY FULL (PIPE GRADE VELOCITY)	TIME OF FLOW IN REACH
	13 + 14						20 x 19		From Std. Drg.	From Charts	15 - 24		From Intensity Chart	sum of U/S 12								32/Area of Sect	33/ (36x60)
	cumec	%	m	m	m	m/sec	m2/s			cumec	cumec	min	mm/h	ha	cumec	cumec	cumec	cumec	m	%	mm	m/sec	min
2/8	0.000	0.00	0.5m Wide Road	0.487Wd	0.045	0.00	0.00	2/8	1TBS0.07	0.015	0.000	15.11 15.11	139 220	0.174 0.223	0.136	(Pipe flow= Sum upstr atten flows)		0.069	11.358	2.38	375(2)	0.62(0.39 1y) (2.45)	0.19
3/8	0.000	1.05	0.5m Wide Road	1.659Wd	0.074	0.75	0.06	3/8	1TC	0.041	0.000	15.30 15.30	138 219	0.247 0.316	0.192	(Pipe flow= Sum upstr atten flows)		0.096	8.925	0.40	375(2)	0.87(0.55 1y) (1.00)	0.15
1/7	0.000	0.59	0.5m Wide Road	2.320Wd	0.100	0.70	0.07	1/7	1TC	0.081	0.001 1/8	15.00 15.00	139 221	0.213 0.273	0.168	(Pipe flow= Grate flow)		0.081	22.600	2.38	375(2)	0.73(0.48 1y) (2.45)	0.38
5/4	0.000	0.00		0.035Dp			0.00	5/4	#D0.1L3.6F0.5	0.022	0.000 6/4	16.63 16.63	133 211	1.306 1.674	0.981	(Pipe flow= Sum upstr atten flows)		0.484	75.329	0.40	750(2)	1.06(0.67 1y) (1.61)	1.18
6/4	0.000	0.00		0.045Dp			0.00	6/4	#D0.1L3.6F0.5	0.032	0.000	17.81 17.81	130 205	1.636 2.097	1.194	(Pipe flow= Sum upstr atten flows)		0.594	7.274	0.40	750(2)	1.30(0.83 1y) (1.61)	0.09

	HEADLOSSES									PART FULL			DESIGN LEVELS							
2	38 - 39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58
		V2/2g	Ku	hu	Kl	hl	Kw	hw	Sf	hf		Vp								
STRUCTURE NO.	STRUCTURE RATIOS FOR 'K' VALUE CALCULATIONS	VELOCITY HEAD	U/S HEADLOSS COEFFICIENT	U/S PIPE STRUCTURE HEADLOSS	LATERAL HEADLOSS COEFFICIENT	LATERAL PIPE STRUCTURE HEADLOSS	W.S.E COEFFICIENT	CHANGE IN W.S.E	FRICTION SLOPE	PIPE FRICTION HEADLOSS	DEPTH	VELOCITY	OBVERT LEVELS	DRAIN SECTION H.G.L	U/S H.G.L	LATERAL H.G.L.	W.S.E.	SURFACE OR K&C INVERT LEVEL	FREEBOARD	STRUCTURE No.
	FROM Q.U.D.M. CHARTS VOLUME 2	36x36/2g	From Q.U.D.M. Volume 2	40 x 41	From Q.U.D.M. Volume 2		From Q.U.D.M. Volume 2		From Sect. 14.5.7 A.R.R. Vol. 1 1987	47 x 33/ 100			U/S RL D/S RL	U/S RL D/S RL						
		m		m		m		m	%	m	m	m/sec	m	m	m	m	m	m	m	
2/8	Qg 0.010 Qo 0.069 Do 375 Angle 86 Chart 47 S/Do 2.5 chartdeg Du/Do 1.00 K0 1.92 K0.5 2.12 Qu/Qo 0.85 Cg 0.37 K 2.00 S/Do 2.5 K0 1.92 K0.5 2.12 K 2.00 S/Do 2.0 K0 2.44 K0.5 2.40 K 2.42	0.020	1.98	0.039	Interp val for S/Do 2.03 Kw 2.40 CHART 46 S/Do 2.5 K0 1.82 K0.5 1.71 K 1.78 S/Do 2.0 K0 2.04 K0.5 1.92 K 2.00 Interp val for S/Do 2.03 Ku 1.98		2.40	0.047	0.15	0.017			37.875 37.605	38.212 38.195	38.251		38.259	38.630	0.371	2/8
3/8	Qg 0.028 Qo 0.096 Do 375 CHART 34 Angle 20 Case3 S/Do 2.5 Du/Do 1.00 Qg/Qo 0.29 K 1.16 S/Do 2.63 cor -0.02 Ku 1.14 Kw 1.14	0.039	1.14	0.044			1.14	0.044	0.30	0.027			37.585 37.549	38.151 38.124	38.195		38.195	38.777	0.582	3/8
1/7	Qg 0.081 Qo 0.081 Do 375 CHRT 32: Vo2/2gDo 0.07 H/Do 0.00 Kg side flow 8.59 end flow 6.44 Part full downstream pipe	0.027	1.00	0.232	Upstream HGL 38.773 below outlet pipe obv 38.775 Set Kp to 1		1.00	0.232	0.21	0.048	0.141 (0.113 1y)	2.14 (1.90 1y)	38.775 38.237	38.541 38.256	38.773		38.773	39.729	0.956	1/7
5/4	Qg 0.014 Qo 0.484 Do 750 Routine 2.1 CHART 48 Du/Do 0.80 Qu/Qo 0.81 K -0.02 d/Do 2.0 chrt Qg/Qo 0.03 Kg 0.02 d/Do 1.5 chrt Qg/Qo 0.03 Kg 0.02 d/Do 1.02 Interp value Kg 0.02 Ku=Kw= -0.01 Combined pipes in line case Join Pipes:	0.057	0.01	0.001	4/4 and 1/7 Vel1 1.388 Vel2 0.700 Eq Dia 684 Angle 187 Flow 0.470 CHART 33 Angle 0 S/Do 2.5 Du/Do 0.91 Qg/Qo 0.03 K 0.06 S/Do 1.03 cor 0.05 Ku 0.11 Kw 0.11 Interpolated Ku= 0.01 Kw= 0.01		0.01	0.001	0.17	0.131			38.237 37.936	38.255 38.124	38.256		38.256	38.654	0.398	5/4
6/4	Qg 0.030 Qo 0.594 Do 750 Routine 2.1 CHART 48 Du/Do 0.50 Qu/Qo 0.15 K 2.13 d/Do 2.0 chrt Qg/Qo 0.05 Kg 0.01 d/Do 1.5 chrt Qg/Qo 0.05 Kg 0.01 d/Do 1.07 Interp value Kg 0.01 Ku=Kw= 2.14 Combined pipes in line case Join Pipes:	0.086	1.80	0.155	3/8 and 5/4 Vel1 0.820 Vel2 1.071 Eq Dia 834 Angle 121 Flow 0.564 CHART 33 Angle 0 S/Do 2.5 Du/Do 1.11 Qg/Qo 0.05 K 0.37 S/Do 1.12 cor 0.08 Ku 0.45 Kw 0.45 Interpolated Ku= 1.80 Kw= 1.80		1.80	0.155	0.26	0.019			37.916 37.887	37.969 37.950	38.124		38.124	38.491	0.367	6/4

File: T:\1020 Mossman Gorge\Drawings\SKETCH 1020-006.dwg

Printed: 28 March 2018, 1:51 PM

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Client: DATSIP

Project: MOSSMAN GORGE INFRASTRUCTURE UPGRADES

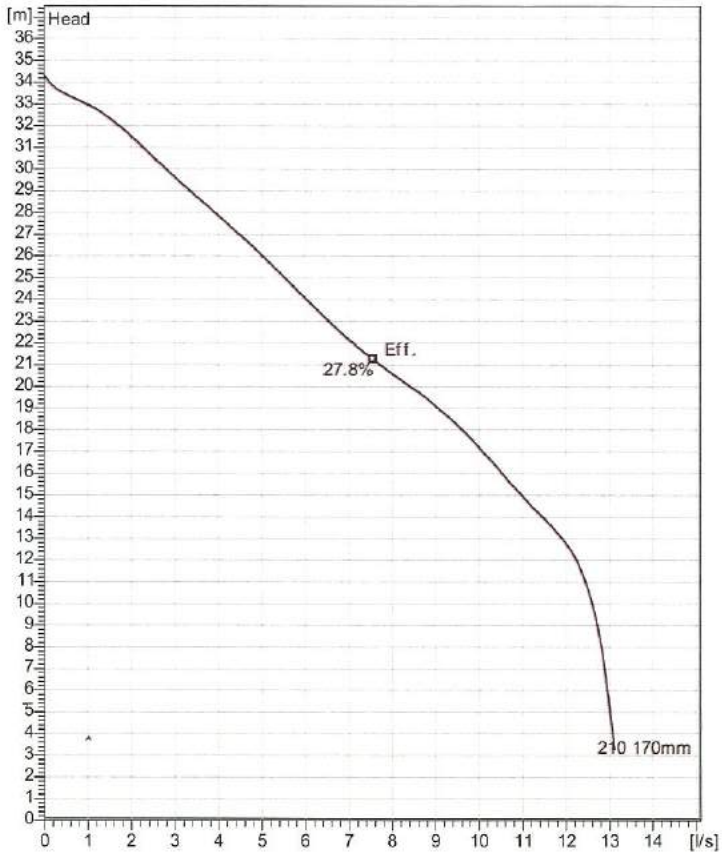
Title: STORMWATER CALCULATIONS TABLE 2 OF 2

JOB No.	Scale (A1 size)	Date	Drawing No.	Revision
1020		29 MARCH 2018	SKETCH 1020-006	A

External References: TEC-TITLE-SKETCH-A1_a.dwg

MP 3127 LT 3~ 210

Technical specification



Curve according to: ISO 9906

Note: Picture might not correspond to the current configuration.

General
Semi-open multi-channel impellers with integral grinder cutter in single volute casing for liquids containing solids and fibres.

Impeller

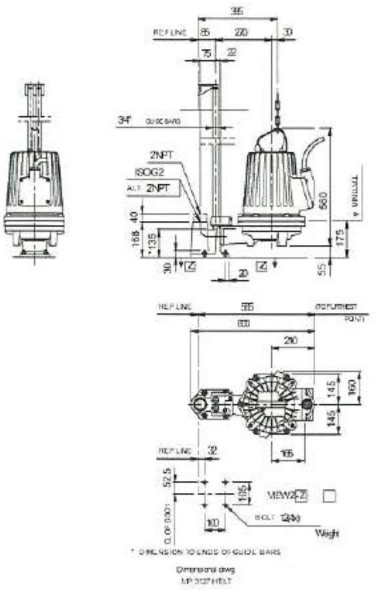
Impeller material	Grey cast iron
Outlet width	50 mm
Inlet diameter	85 mm
Impeller diameter	170 mm
Number of blades	6

Motor

Motor #	M3127.170 21-11-2AL-W 7,4KW
Stator variant	
Frequency	50 Hz
Rated voltage	415 V
Number of poles	2
Phases	3~
Rated power	7.4 kW
Rated current	13 A
Starting current	98 A
Rated speed	2895 rpm
Power factor	
1/1 Load	0.92
3/4 Load	0.90
1/2 Load	0.86
Efficiency	
1/1 Load	83.5 %
3/4 Load	84.5 %
1/2 Load	83.5 %

Configuration

Installation: P - Semi permanent, Wet



Project	Project ID	Created by	Created on	Last update
			2012-10-25	

MP 3127 LT 3~ 210

Performance curve

Pump

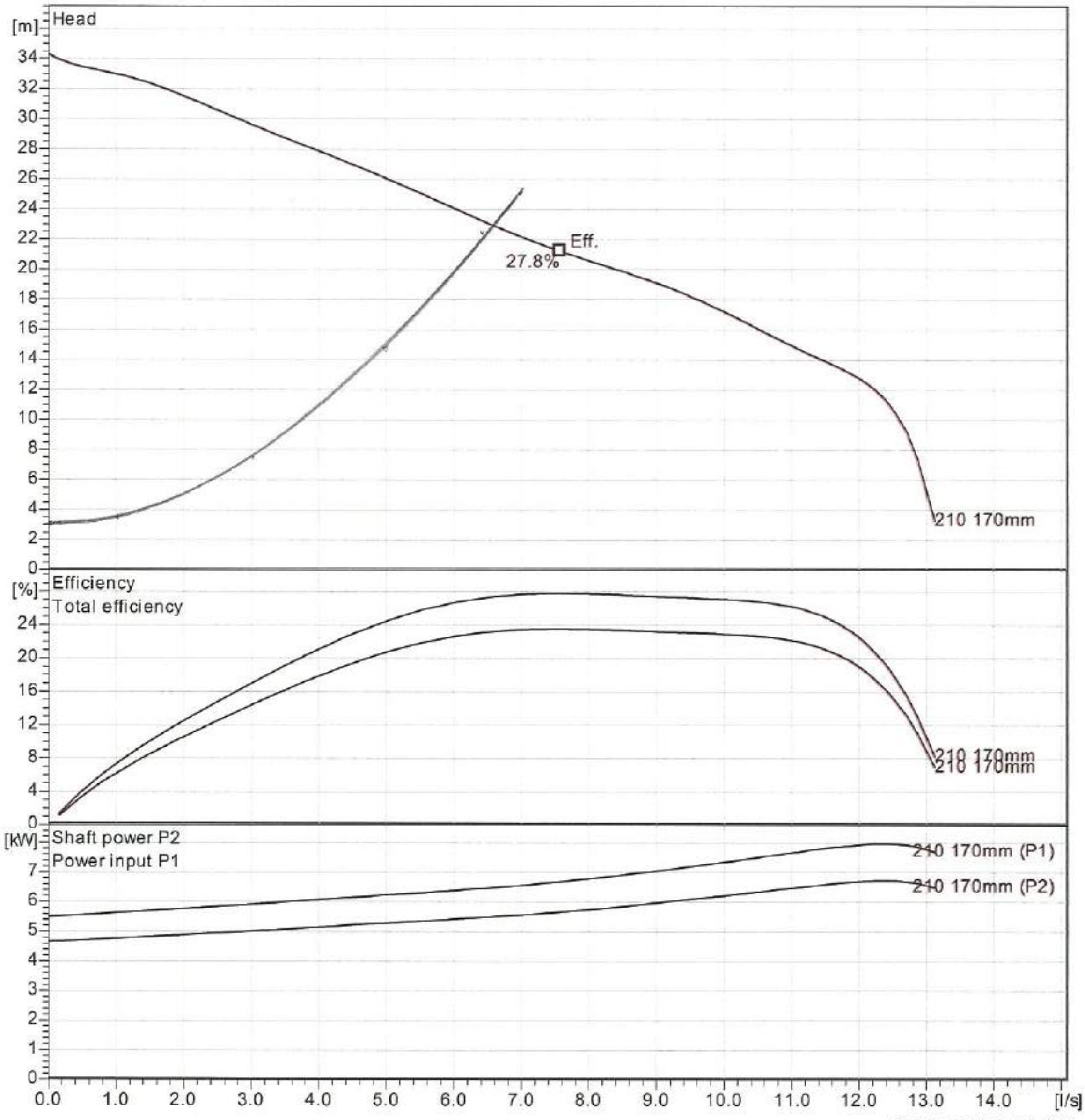
Outlet width	50 mm
Inlet diameter	85 mm
Impeller diameter	170 mm
Number of blades	6

Motor

Motor #	M3127.170 21-11-2AL-W 7,4KW
Stator variant	
Frequency	50 Hz
Rated voltage	415 V
Number of poles	2
Phases	3~
Rated power	7.4 kW
Rated current	13 A
Starting current	98 A
Rated speed	2895 rpm

Power factor	
1/1 Load	0.92
3/4 Load	0.90
1/2 Load	0.86

Efficiency	
1/1 Load	83.5 %
3/4 Load	84.5 %
1/2 Load	83.5 %

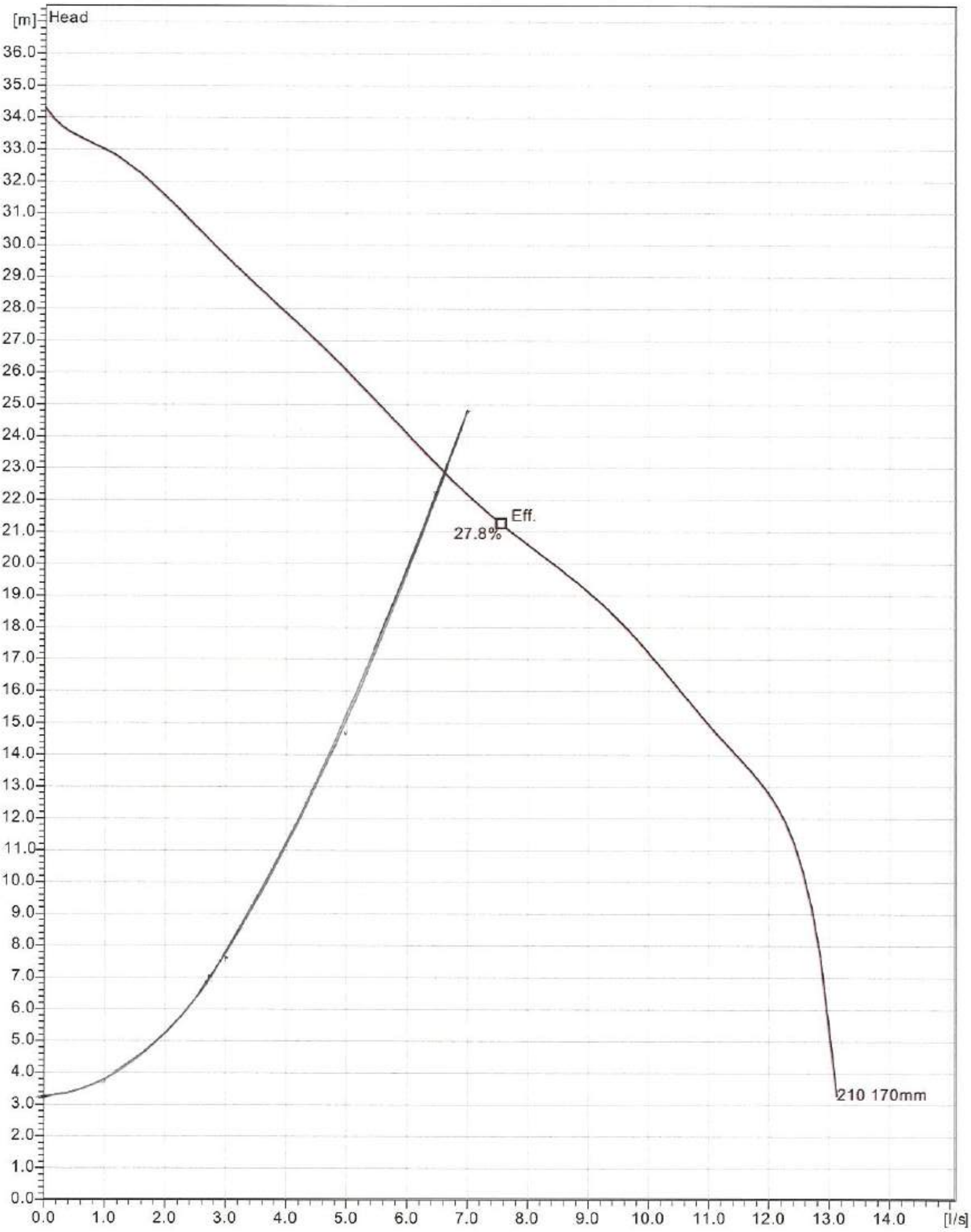


Curve according to: ISO 9906

Project	Project ID	Created by	Created on	Last update
			2012-10-25	

MP 3127 LT 3~ 210

Duty Analysis

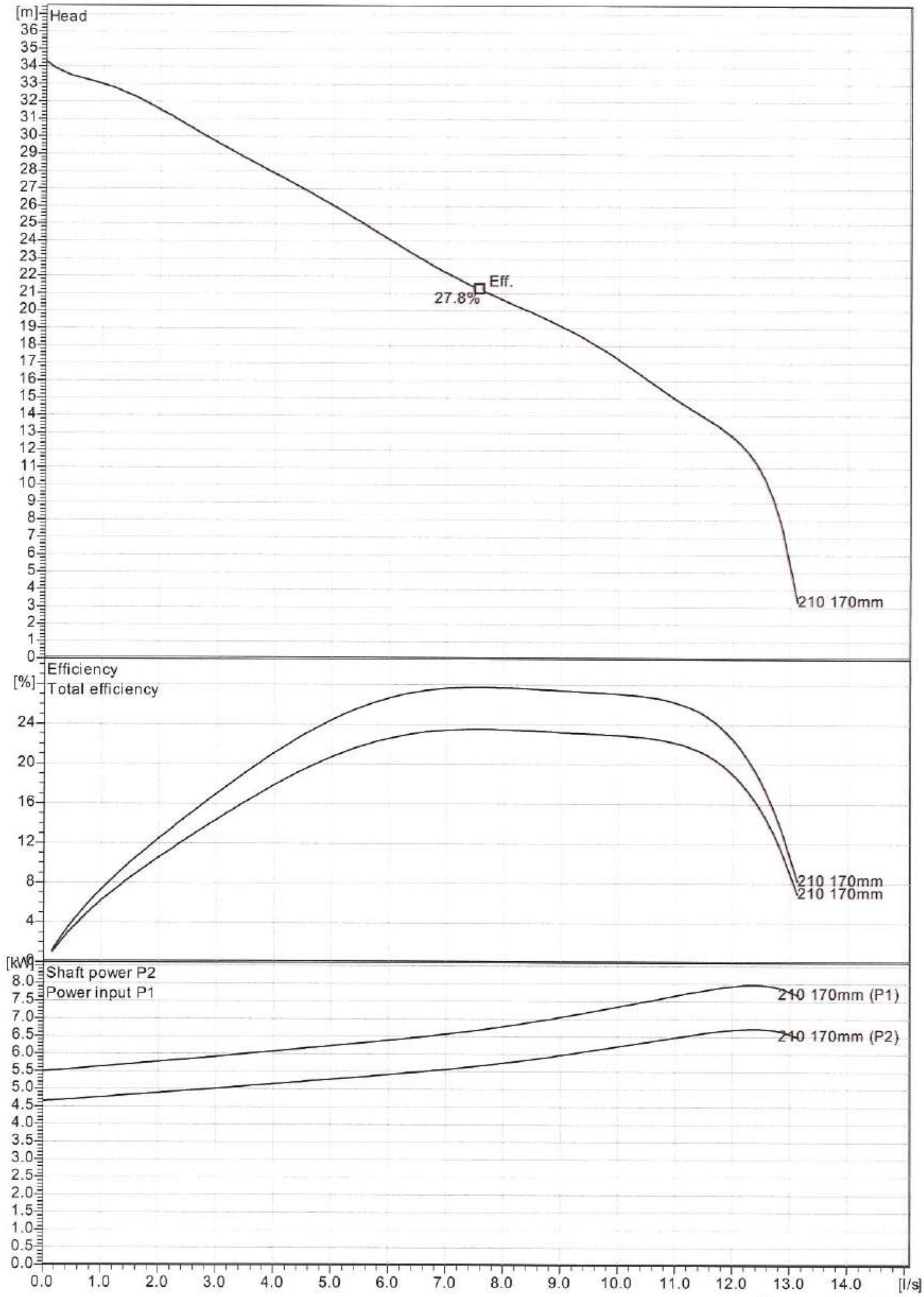


Curve according to: ISO 9906

Project	Project ID	Created by	Created on	Last update
			2012-10-25	

xylem
Let's Solve Water

MP 3127 LT 3~ 210
VFD Curve

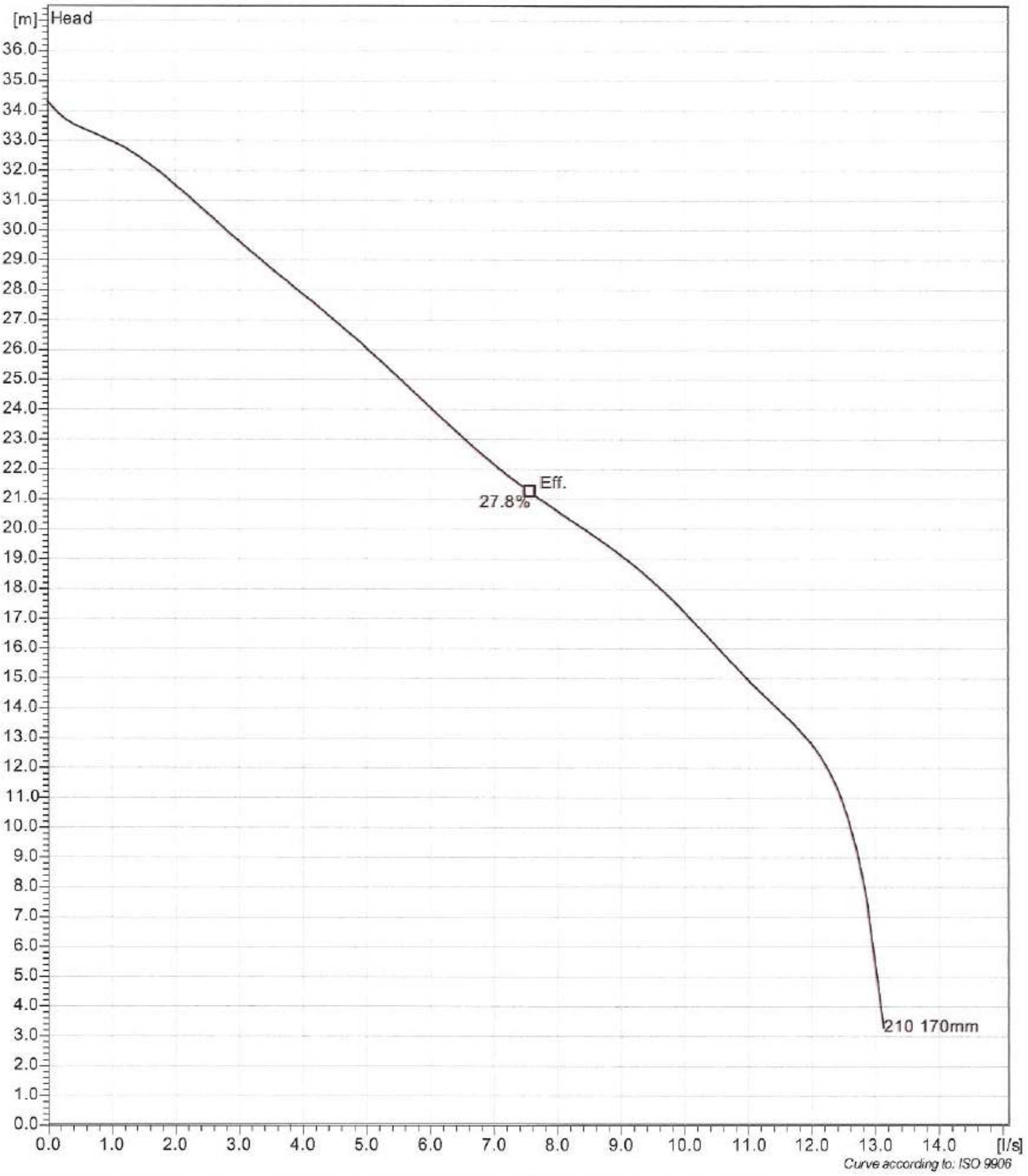


Curve according to: ISO 9906

Project	Project ID	Created by	Created on	Last update
			2012-10-25	

MP 3127 LT 3~ 210

VFD Analysis

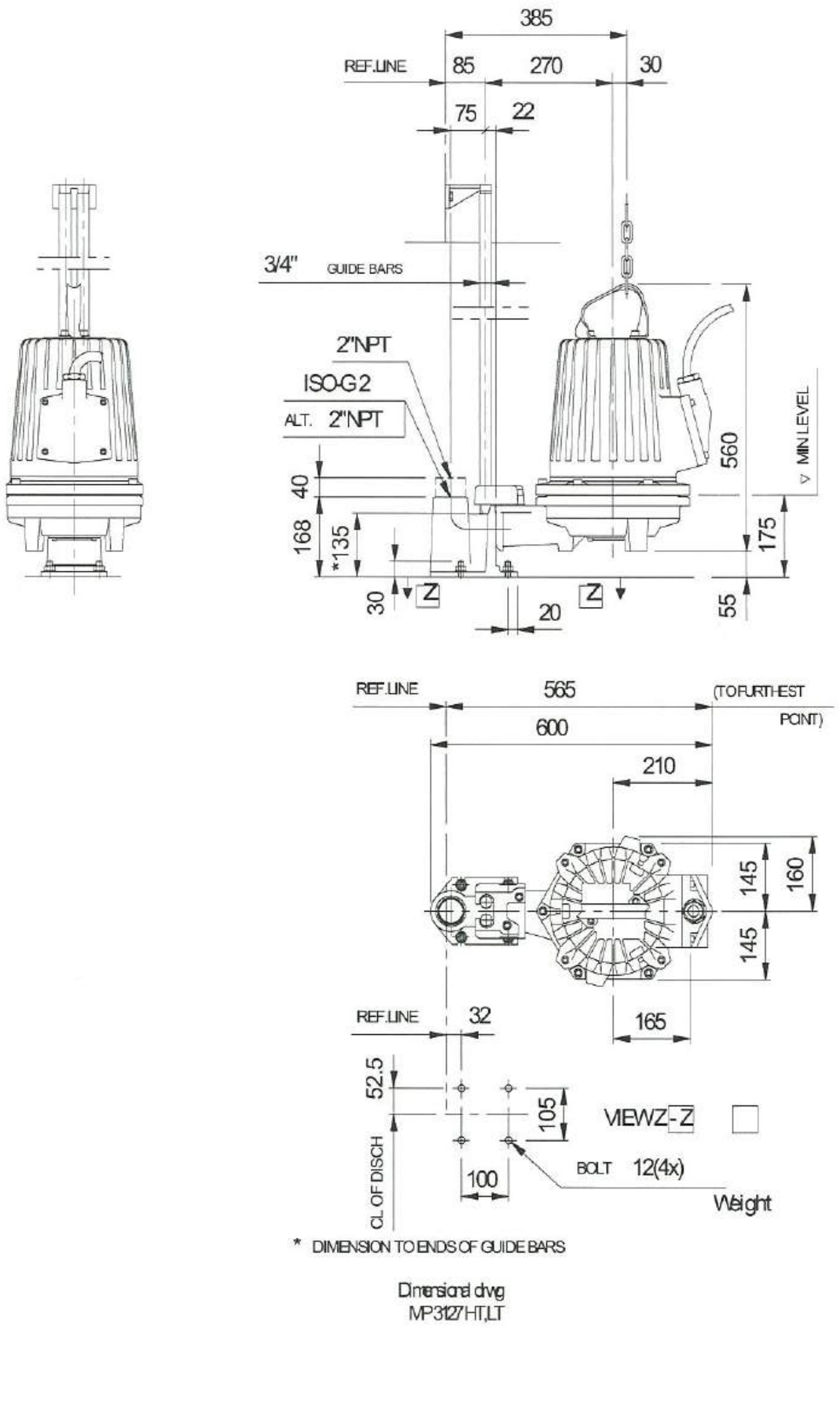


Curve according to: ISO 9906

Project	Project ID	Created by	Created on	Last update
			2012-10-25	

MP 3127 LT 3~ 210

Dimensional drawing



Project	Project ID	Created by	Created on	Last update
			2012-10-25	

1020 – Mossman Gorge Community Infrastructure Upgrades

28/02/2018

Water Reticulation

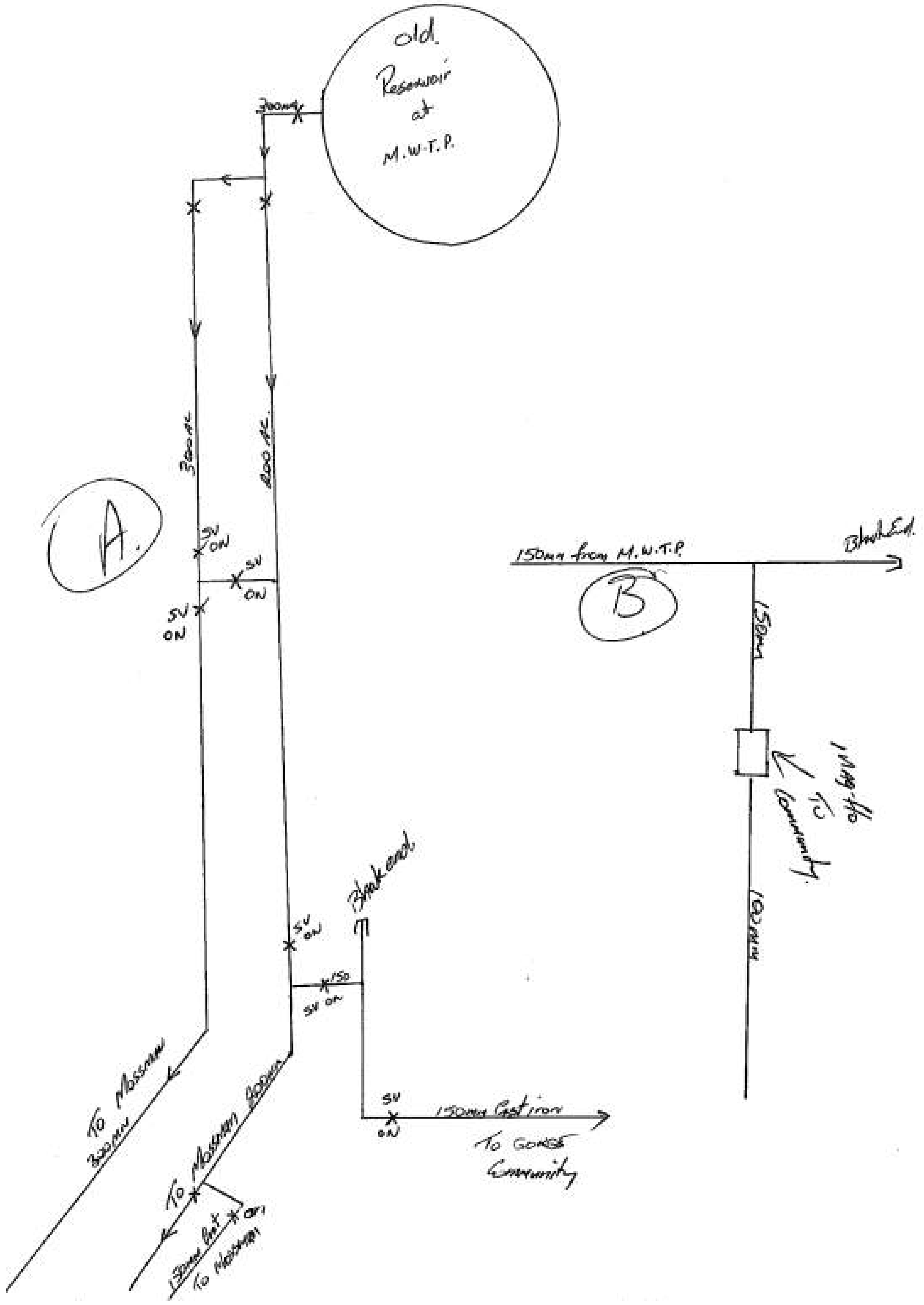
This information has been prepared by Trinity Engineering and Consulting on behalf of the Department of Aboriginal and Torres Strait Islander Partnerships (DATSIP), in relation to the proposed infrastructure upgrades to the Mossman George Community. In particular, the information has been prepared to address Items 1, 2, and 3 of the Information Request dated 20/12/2017, being **Water Supply supporting information.**

For ease of reference, these requests are reproduced below;

1. Please provide pressure and flow test results on Mossman Gorge Road to allow for calibration of the water network model.
2. A water supply network analysis incorporating pressure and flow tests is to be provided.
3. Confirmation whether a booster pump station is required. The determination of the booster pump is to have regard to the results of the water supply network analysis.

Overview:

The water reticulation system for Mossman Gorge has been modelled for performance using an EPANET model based on the assumptions outlined below. The existing water reticulation system servicing the Mossman Gorge Community involves pipelines with diameters ranging from 25 mm to 150 mm. The Mossman George Community water reticulation system draws from the Mossman reservoir located on George View Crescent via a 150 mm diameter main along Mossman George Road.



Schematic of the network from reservoir to community (provided by Council Officers).

For the purpose of the model, 90 m AHD was adopted as the connection pressure (being 2.2 m below the reservoir's advised top water level).

The model geometry information was obtained from the following information sources

- As-constructed survey
- Aerial photography
- Council reservoir information

Demand on the network was established based on the requirements of Section D6 of the FNQROC Development Manual. The demand criteria adopted to model the water reticulation system is outlined in Table 1. Appendix A provides the demand calculations for each node based on the number of connections allocated to each node. The node layouts for the EPANET models (existing and proposed) can be seen on 1020-SKETCH-1 and 1020-SKETCH-2 respectively. Figure 1 (below) is a reproduction of 1020-SKETCH-1 and it shows the node layout of the EPANET model representing the existing network.

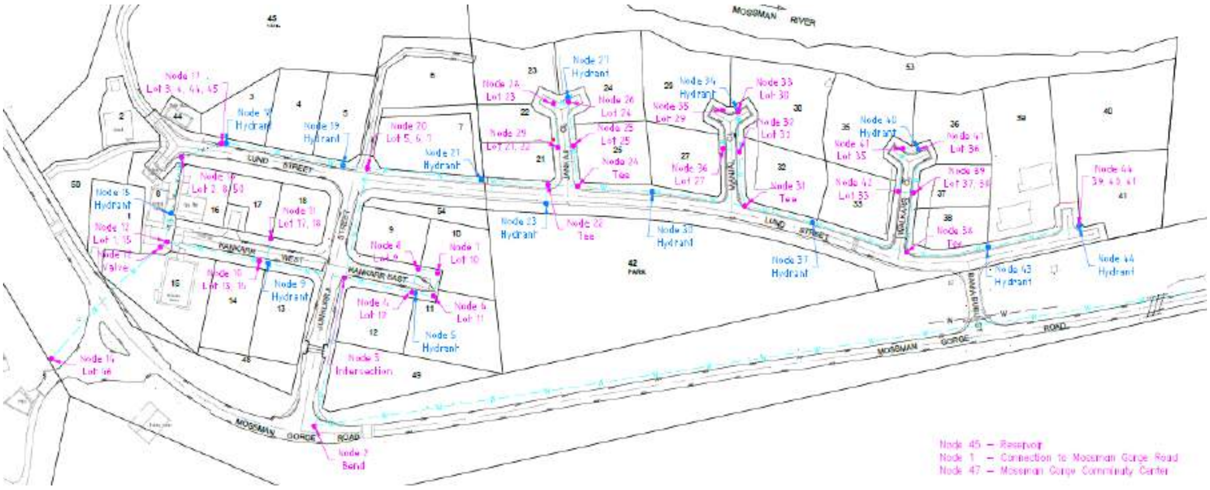


Figure 1: Reproduction of 1020-SKETCH-1 showing the node layout of the EPANET model representing the existing network.

Table 1: Model Demand Criteria

Criteria	Adopted Value
Number of Lots	32 Residential Lots 6 Non-Residential Lots 3 Parks
Equivalent Persons per Connection (EP)*	2.5 - 3.7 Persons/Connection (House) + 1 Person/Connection per 90m^2 of GFA
Equivalent Population (EP)	160 EP
Average Daily (AD) Consumption	500 litres/person/day
Average Day (AD) demand	80 kL/d
Mean Day Max Month (MDMM) demand	120 kL/d
Peak Day (PD) demand	180 kL/d
Peak Hour (PH) demand	4.25 L/s
Minimum Pressures (per FNQROC)	22 m head @ peak hourly consumption 12 m head @ adjacent hydrant for firefighting scenario

Criteria	Adopted Value
Maximum Pressure	60 m head
Residential Fire Flow Requirement	15 L/s for 2 hours
Maximum Pipe velocity during Peak Hour	2.5 m/s
Hazen-Williams C-value	Ø ≤ 150mm, C = 100

*As per Table 6.1 of Section D6 of the FNQROC Development Manual

The following two EPANET models were developed:

- The existing network
- The proposed upgraded network.

Proposed Changes to the Water Reticulation Network

The proposed changes are illustrated on engineering drawings 1020-028 and 029 (Appendix F). The major changes are summarised as follows;

- 150 mm diameter connection from Mossman Gorge Road to East Lund Street via Bama Bubu Street, (proposed for capacity under fire fighting);
- Decommissioning of pipeline between medical centre and Opp hub and construct local loop main, (proposed for land tenure reasons);
- Hydrant connection at BBN carpark; and
- Replace 25 mm diameter pipelines with 50 mm diameter pipelines, (proposed for operational reasons and minimum pipe sizes).

Results:

Peak Hour Flow

The Peak Hour (PH) flow analysis results for the Mossman George Community are detailed in Appendix C. The analysis confirmed that under peak hour demand conditions both the current and proposed network provide adequate pressures to the lots as per FNQROC guidelines (> 22m & < 60m).

Firefighting

Under firefighting demand (15 L/s), field testing showed that the network is adequate to provide FNQROC guideline residual pressures (above 12 m head) at adjacent hydrants for some but not all hydrants. However, the EPANET model showed that the existing network is not adequate to provide FNQROC guideline residual pressures for critical hydrants within the system.

Numerous firefighting scenario analyses were conducted on the proposed upgraded network. The results are summarised in Table 2.

Table 2: Firefighting scenarios on proposed upgraded system

Pipe Roughness C	Node	Location	Maximum flow at node to allow 12m head at adjacent hydrant		Pressure at node if drawing 15 L/s		Pressure at adjacent hydrant if drawing 15 L/s	
			Existing	Proposed	Existing	Proposed	Existing	Proposed
100 (FNQROC Design Roughness)	14	BBN Carpark	12.24 L/s	12.87 L/s	-6.44 m *	-5.77 m *	1.99 m *	2.16 m *
	18	East Lund Street	12.71 L/s	13.11 L/s	0.25 m *	2.14 m	1.56 m *	3.97 m
	44	West Lund Street	11.15 L/s	14.99 L/s	-10.70 m *	8.48 m	-8.02 m *	11.97 m

Pipe Roughness C	Node	Location	Maximum flow at node to allow 12m head at adjacent hydrant		Pressure at node if drawing 15 L/s		Pressure at adjacent hydrant if drawing 15 L/s	
			Existing	Proposed	Existing	Proposed	Existing	Proposed
110 (systems true roughness based on pressure and flow tests)	14	BBN Carpark	13.74 L/s	14.42 L/s	1.80 m	2.82 m	6.60 m	9.37 m
	18	East Lund Street	13.60 L/s	14.7 L/s	7.63 m	9.27 m	6.66 m	10.84 m
	44	West Lund Street	13.09 L/s	16.74 L/s	-0.59 m *	15.5 m	1.63 m *	17.78 m

Note: *Negative pressures in system
Peak hour flow factor of 0.667
BBN is Bamanga Bubu Ngadimunku inc.

As per FNQROC modelling requirements a pipe roughness value (C value) of 100 was used for pipes ≤150 mm diameter. This roughness for the upgraded network allows between 86% and 100% of the required firefighting flow to be achieved at the critical hydrants whilst maintaining the required 12 m residual pressure at the adjacent hydrant. The modelling shows that the hydrant at node 14 cannot provide 15 L/s of flow due to frictional resistance and limited differential elevation between the reservoir and node (46.5m). However, the modelling shows that all the other critical hydrants can provide the nominated flow with positive pressure in the system. Additional upgrades (connection of node 2 to node 14) achieves the 15 L/s flow, however residual pressure at the adjacent hydrant remains less than FNQROC requirements.

Response to the Information Request

1. Please provide pressure and flow test results on Mossman Gorge Road to allow for calibration of the water network model.

    TEC Response: *Hydrant pressure and flow tests were conducted by Gilboy Hydraulic Solutions in February 2018, refer Appendix B. Advice given, stated the achievable flows from the three tested hydrants were between 15 L/s and 17 L/s, residual pressures however, were not above 12 m head. This does not meet FNQROC Guidelines (Section D6). The measured static pressures enabled for back analysis of the reservoir water level location, the calculated water level height was above the Top Water Level (TWL) of the reservoir recorded in a council report.*

    Earlier testing conducted in August 2017 indicated similar static levels to that of the TWL of the Mossman Reservoir #2. The 2017 results under flow conditions vary from the 2018 results. In discussions with Council Officers it was determined that these (August 2017) tests were undertaken whilst the mains were undergoing maintenance and therefore resulted in low flows and residual pressures. The 2017 flow tests are therefore not considered representative of normal system operating conditions.

2. A water supply network analysis incorporating pressure and flow tests is to be provided.

    TEC Response: *The hydrant flow tests were used to identify the water level of the reservoir as well as provide a value for the roughness of the pipe network. For conservatism the water level of 90 m AHD was used and assumed to be the water level of the reservoir at 15% capacity. With further checks, the document detailing Council reservoirs stated Mosman Reservoir #2 has a TWL of 95m, and a Bottom Water Level of 89m. Therefore a 15% capacity at 89.9 m.*

    The hydrant flow tests allowed calibration of the existing pipe roughness and indicate the operating conditions to have a C value of 110. FNQROC states that the C value for pipes of diameter ≤150 mm should be modelled with a C value of 100. Discussion on the system performance based on modelled values and flow test values is included below.

3. Confirmation whether a booster pump station is required. The determination of the booster pump is to have regard to the results of the water supply network analysis.

   TEC Response: *A booster pump station may be installed if Council requires that all FNQROC guidelines to be met.*

   Note: The major influencing factors is the significant distance from the reservoir to the community supplied with a 150 mm water main providing significant frictional head loss under FF flows (40.15m). The second disadvantage for the community in terms of water supply is the elevation relative to the reservoir level, which limits the achievable static and residual head.

   To allow the BBN carpark hydrant to provide FNQROC required firefighting flows, the following upgrades would be required:

   - *Duplicate 925m of the 150 mm watermain (or replace with a 225 mm watermain) prior to the Mossman George Community; or*
   - *Duplicate 700 m of 150 mm main (or replace with 225 mm watermain) and connect the main along Mossman Gorge Road (node 2) to the carpark hydrant (node 14) with a 150 mm pipe; or*
   - *Construct a booster pump station to provide 10 m of additional head.*

   We do not consider replacement of the existing water main is warranted (or economical) on the basis that the infrastructure provides only marginal increase and only under firefighting at isolated nodes. In addition, this will result in further congestion of water pipeline infrastructure as currently there are a significant number of pipelines along Mosman George Road.

   Further, TEC does not consider duplication of the existing water main is warranted or economical as this would provide Council with an inefficient system under normal operation (domestic consumption) with significantly reduced velocities, requiring additional operation and maintenance considerations.

   Booster – a booster system is not recommended due to the requirement for ongoing maintenance (electrical and pump based). A booster will only be required to provide additional residual pressure to the system during a firefighting event and with the cumulative effects of all conservative assumptions applying concurrently. That is, a QFES fire tender is drawing flows higher than 12.9 L/s; <u>and</u> the community demand is 2/3 of PH flows; <u>and</u> the reservoir is not full; <u>and</u> the pipe roughness is at C=100 (not C=110 as calibrated from hydrant flow tests). In all other reasonable situations, the booster will remain dormant.

   Connection of node 2 to node 14 (no other changes) allows firefighting flows to be achieved with 4.5 m residual head at the adjacent hydrant at 2/3 peak hour flow. However, the model suggests that negative pressures at the hydrant occur during a FF event (with full PH flows). The modelling shows that after the proposed upgrades and connection of Node 2 to Node 14, firefighting flows can be achieved with 11.4 m residual head at the adjacent hydrant at 2/3 peak hour flow.

Design Compliance

- *Network analysis provided using EPANET*
- *Average Daily Consumption calculated using equivalent demands per Table 6.1 of FNQROC*
- *22 meters head minimum pressure provided at peak hourly consumption*
- *60 meters head maximum pressures not exceeded*
- *Properties located on the opposite side of the road to a water reticulation main are serviced by a 50 mm loop main.*
- *All road crossings are 100 mm diameter.*

Conclusions

The analysis shows that the existing community does not meet full compliance with current FNQROC requirements. The proposed upgrades provide marginal improvement however are still not enough to meet full compliance. In terms of the upgraded system the desktop assessment shows that not all hydrants meet the requirements of 15 L/s and 12 m residual head at the adjacent hydrant under the FNQROC pipe roughness requirements (C=100). However, the most critical hydrant achieves 12.9 L/s and 12 m residual head at the adjacent hydrant. 15 L/s can be drawn from the system at all hydrants except that at the BBN Carpark.

Hydrant flow tests undertaken by Gilboy Hydraulics suggest that the real-world performance of the existing network can provide firefighting flows; this suggests that the existing system resistance is less than FNQROC design requirements for network design modelling. Due to a long service history of the watermain, we believe that the roughness of C=110, back analysed from the hydrant flow tests, is representative of real world conditions.

The subsequent desktop analysis based on the proposed system pipe roughness value of C=110, shows that critical hydrants can draw greater than 14.4 L/s with 12 m of residual head at the adjacent hydrant. TEC considers that this meets the intent of the FNQROC. Council can be reassured that this assessment is supported by hydrant flows tests of the system. This is not a new system; the pipelines have been in place for a significant amount of time (and are unlikely to have further changes to pipe roughness post commissioning).

The scenarios modelled include multiple areas of conservatism, these include; the reservoir modelled at 15 % capacity, roughness of C = 100 and with firefighting demand along with 2/3 PH demand. Cumulative conservativism is built into the model, this provides an overall very conservative operating scenario, Council can be somewhat reassured that if one condition was relaxed the system will likely meet the other requirements.

If Council requires strict FNQROC compliance, significant additional infrastructure is required to achieve the slight increase in performance for full compliance.

Appendix A – Demand calculations on each node (existing network)

Demand calculations on each node (existing network)

Client	DATSIP				
Project	Mossman Gorge	Calcd. by	SB	Ckd. by	
Job No.	1020	Date	26/02/2018	Date	

Table 1. Demand Calculations for Each Node EXISTING

Node Number	Ground Level (m)	Lots Associated to Node	Description	Total EP	AD (L/s)	MDMM (L/s)	PD (L/s)	PH (L/s)	FF (L/s) 15L/s + 2/3PH
1	90.29	Reservoir	-	-	-	-	-	-	-
2	42	2x Parks	-	-	-	-	-	-	-
3	42.25	-	-	-	-	-	-	-	-
4	42	12	401m2 to 900m2	2.8	0.016	0.024	0.036	0.073	0.048
5	42	Hydrant	-		0.000	0.000	0.000	0.000	0.000
6	41.5	11	1101m2 to 1500m2	3.4	0.020	0.030	0.044	0.089	0.058
7	41.5	10	901m2 to 1100m2	3.1	0.018	0.027	0.040	0.081	0.053
8	41.75	9	401m2 to 900m2	2.8	0.016	0.024	0.036	0.073	0.048
9	43.25	Hydrant	-	-	-	-	-	-	-
10	43.25	13,14	2x 901m2 to 1100m2	6.2	0.036	0.054	0.081	0.161	0.107
11	43.5	17, 18	2x 401m2 to 900m2	5.6	0.032	0.049	0.073	0.146	0.096
12	45.5	15,1	401m2 to 900m2 Offices 1.0EP/90m2 (400m2)	7.2	0.042	0.063	0.094	0.189	0.125
13	45.25	-	-	-	-	-	-	-	-

14	43.5	46	Offices 1.0EP/90m2 (285+240m2)	5.8	0.034	0.051	0.076	0.152	0.100
15	45.2	Hydrant		-	-	-	-	-	-
16	44.5	8,50,2	Offices 1.0EP/90m2 (200m2) 2x Park	2.2	0.013	0.019	0.029	0.058	0.038
17	44.15	44,3,45,4	Toilets (0.0178ha) 2x 401m2 to 900m2 Offices 1.0EP/90m2 (700m2)	5.6	0.050	0.075	0.113	0.226	0.149
18	44.15	Hydrant	-	-	-	-	-	-	-
19	43	Hydrant	-	-	-	-	-	-	-
20	42.5	5,6,7	401m2 to 900m2 Triplex 2bed? 1101m2 to 1500m2	11.0	0.064	0.095	0.143	0.286	0.189
21	41	Hydrant	-	-	-	-	-	-	-

Table 1. Demand Calculations for Each Node EXISTING

Node Number	Ground Level (m)	Lots Associated to Node	Description	Total EP	AD (L/s)	MDMM (L/s)	PD (L/s)	PH (L/s)	FF (L/s) 15L/s + 2/3PH
22	40	-	-	-	-	-	-	-	-
23	40	42	Park	-	-	-	-	-	-
24	40.25	-	-	-	-	-	-	-	-
25	40	25	901m2 to 1100m2	3.1	0.018	0.027	0.040	0.081	0.053
26	41.25	24	1101m2 to 1500m2	3.4	0.020	0.030	0.044	0.089	0.058
27	40.5	Hydrant	-	-	-	-	-	-	-
28	40.75	23	901m2 to 1100m2	3.1	0.018	0.027	0.040	0.081	0.053
29	40.25	22,21	2x 401m2 to 900m2	5.6	0.032	0.049	0.073	0.146	0.096
30	39.5	Hydrant	-	-	-	-	-	-	-
31	39.66	-	-	-	-	-	-	-	-
32	39.85	32	901m2 to 1100m2	3.1	0.018	0.027	0.040	0.081	0.053
33	39.75	30	1101m2 to 1500m2	3.4	0.020	0.030	0.044	0.089	0.058
34	39.75	Hydrant		-	-	-	-	-	-
35	40.75	29	1101m2 to 1500m2	3.4	0.020	0.030	0.044	0.089	0.058
36	40	27	901m2 to 1100m2	3.1	0.018	0.027	0.040	0.081	0.053
37	39.38	Hydrant	-	-	-	-	-	-	-
38	38.25	-	-	-	-	-	-	-	-
39	38.25	38,37	2x 401m2 to 900m2	5.6	0.032	0.049	0.073	0.146	0.096
40	38.5	36	901m2 to 1100m2	3.1	0.018	0.027	0.040	0.081	0.053
41	39	35	1101m2 to 1500m2	3.4	0.020	0.030	0.044	0.089	0.058
42	39	33	401m2 to 900m2	2.8	0.016	0.024	0.036	0.073	0.048

43	38.4	Hydrant	-	-	-	-	-	-	-
44	38.25	41,40,39	2x >1500m2 1101m2 to 1500m2	10.8	0.063	0.094	0.141	0.281	15.186
47	36	Development on line prior to Community	Shop 1.0EP/90m2 (3000m2) 5x 1101m2 to 1500m2	50.3	0.291	0.437	0.655	1.311	0.865
			TOTAL	160.03	0.94	1.42	2.12	4.25	17.80
				EP	L/s	L/s	L/s	L/s	L/s

Client	DATSIP					
Project	Mossman Gorge		Calcd. by	SB	Ckd. by	
Job No.	1020		Date	26/02/2018	Date	

Table 1. Demand Calculations for Each Node POST UPGRADE

Node Number	Ground Level (m)	Lots Associated to Node	Description	Total EP	AD (L/s)	MDMM (L/s)	PD (L/s)	PH (L/s)	FF (L/s) 15L/s + 2/3PH
1	90.29	Reservoir	-	-	-	-	-	-	-
2	42	2x Parks	-	-	-	-	-	-	-
3	42.25	-	-	-	-	-	-	-	-
4	42	12	401m2 to 900m2	2.8	0.016	0.024	0.036	0.073	0.048
5	42	Hydrant	-		0.000	0.000	0.000	0.000	0.000
6	41.5	11	1101m2 to 1500m2	3.4	0.020	0.030	0.044	0.089	0.058
7	41.5	10	901m2 to 1100m2	3.1	0.018	0.027	0.040	0.081	0.053
8	41.75	9	401m2 to 900m2	2.8	0.016	0.024	0.036	0.073	0.048
9	43.25	Hydrant	-	-	-	-	-	-	-
10	43.25	13,14	2x 901m2 to 1100m2	6.2	0.036	0.054	0.081	0.161	0.107
11	43.5	17, 18	2x 401m2 to 900m2	5.6	0.032	0.049	0.073	0.146	0.096
12	45.5	15,1	401m2 to 900m2 Offices 1.0EP/90m2 (400m2)	7.2	0.042	0.063	0.094	0.189	0.125
13	45.25	-	-	-	-	-	-	-	-
14	43.5	46	Offices 1.0EP/90m2 (285+240m2)	5.8	0.034	0.051	0.076	0.152	0.100
15	45.2	Hydrant		-	-	-	-	-	-
16	44.5	-	-	-	-	-	-	-	-

17	44.15	44,3,45,4	Toilets (0.0178ha) 2x 401m2 to 900m2 Offices 1.0EP/90m2 (700m2)	5.6	0.050	0.075	0.113	0.226	0.149
18	44.15	Hydrant	-	-	-	-	-	-	-
19	43	Hydrant	-	-	-	-	-	-	-
20	42.5	5,6,7	401m2 to 900m2 Triplex 2bed? 1101m2 to 1500m2	11.0	0.064	0.095	0.143	0.286	0.189
21	41	Hydrant	-	-	-	-	-	-	-

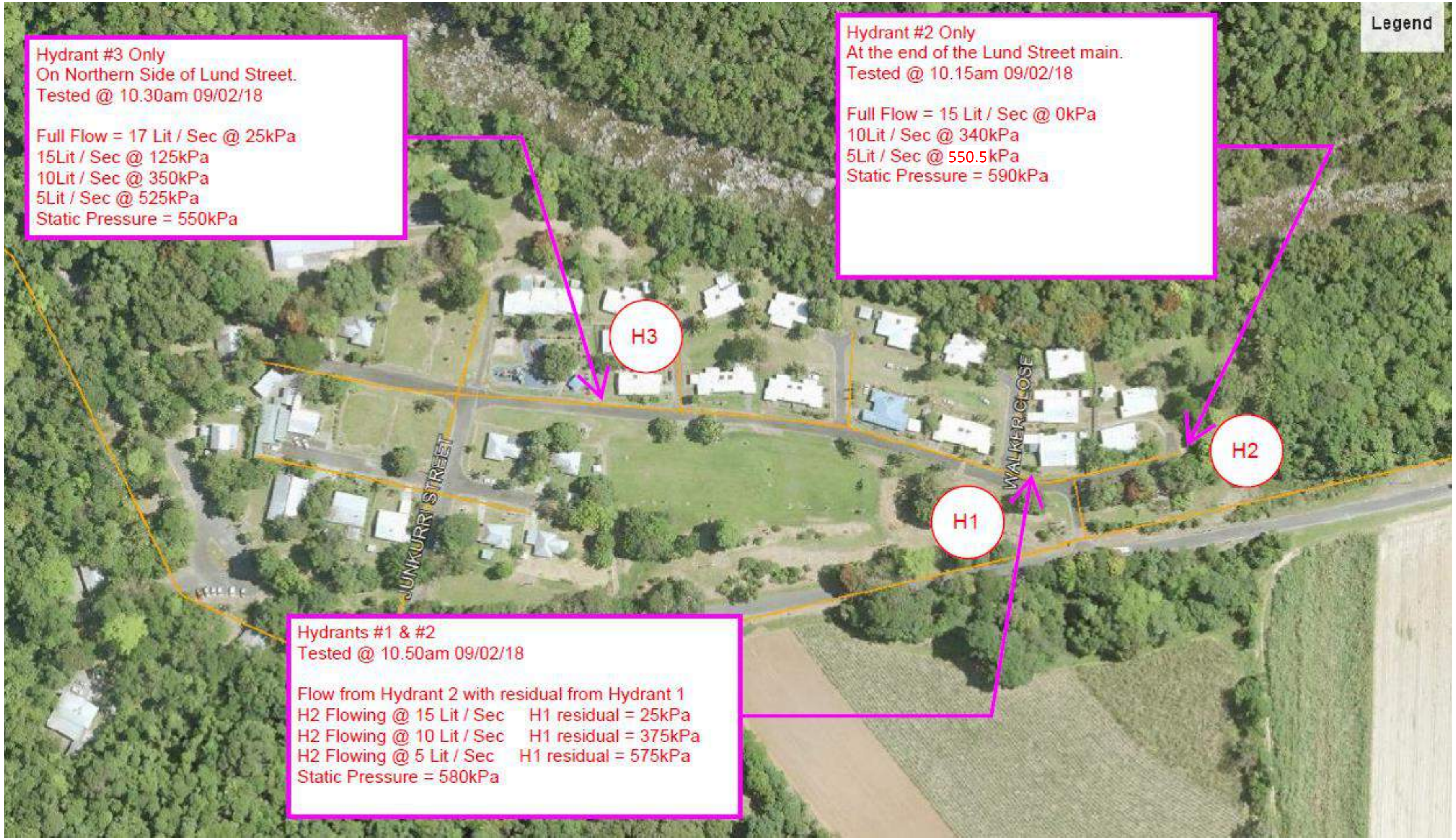
Table 1. Demand Calculations for Each Node POST UPGRADE

Node Number	Ground Level (m)	Lots Associated to Node	Description	Total EP	AD (L/s)	MDMM (L/s)	PD (L/s)	PH (L/s)	FF (L/s) 15L/s + 2/3PH
22	40	-	-	-	-	-	-	-	-
23	40	42	Park	-	-	-	-	-	-
24	40.25	-	-	-	-	-	-	-	-
25	40	25	901m2 to 1100m2	3.1	0.018	0.027	0.040	0.081	0.053
26	41.25	24	1101m2 to 1500m2	3.4	0.020	0.030	0.044	0.089	0.058
27	40.5	Hydrant	-	-	-	-	-	-	-
28	40.75	23	901m2 to 1100m2	3.1	0.018	0.027	0.040	0.081	0.053
29	40.25	22,21	2x 401m2 to 900m2	5.6	0.032	0.049	0.073	0.146	0.096
30	39.5	Hydrant	-	-	-	-	-	-	-
31	39.66	-	-	-	-	-	-	-	-
32	39.85	32	901m2 to 1100m2	3.1	0.018	0.027	0.040	0.081	0.053
33	39.75	30	1101m2 to 1500m2	3.4	0.020	0.030	0.044	0.089	0.058
34	39.75	Hydrant		-	-	-	-	-	-
35	40.75	29	1101m2 to 1500m2	3.4	0.020	0.030	0.044	0.089	0.058
36	40	27	901m2 to 1100m2	3.1	0.018	0.027	0.040	0.081	0.053
37	39.38	Hydrant	-	-	-	-	-	-	-
38	38.25	-	-	-	-	-	-	-	-
39	38.25	38,37	2x 401m2 to 900m2	5.6	0.032	0.049	0.073	0.146	0.096
40	38.5	36	901m2 to 1100m2	3.1	0.018	0.027	0.040	0.081	0.053
41	39	35	1101m2 to 1500m2	3.4	0.020	0.030	0.044	0.089	0.058
42	39	33	401m2 to 900m2	2.8	0.016	0.024	0.036	0.073	0.048

43	38.4	Hydrant	-	-	-	-	-	-	-
44	38.25	41,40,39	2x >1500m2 1101m2 to 1500m2	10.8	0.063	0.094	0.141	0.281	15.186
46	44.7	8,50,2	Offices 1.0EP/90m2 (200m2) 2x Park	2.2	0.013	0.019	0.029	0.058	0.038
47	36	Development on line prior to Community	Shop 1.0EP/90m2 (3000m2) 5x 1101m2 to 1500m2	50.3	0.291	0.437	0.655	1.311	0.865
48	37.2	-	-	-	-	-	-	-	-
			TOTAL	160.03	0.94	1.42	2.12	4.25	17.80
				EP	L/s	L/s	L/s	L/s	L/s

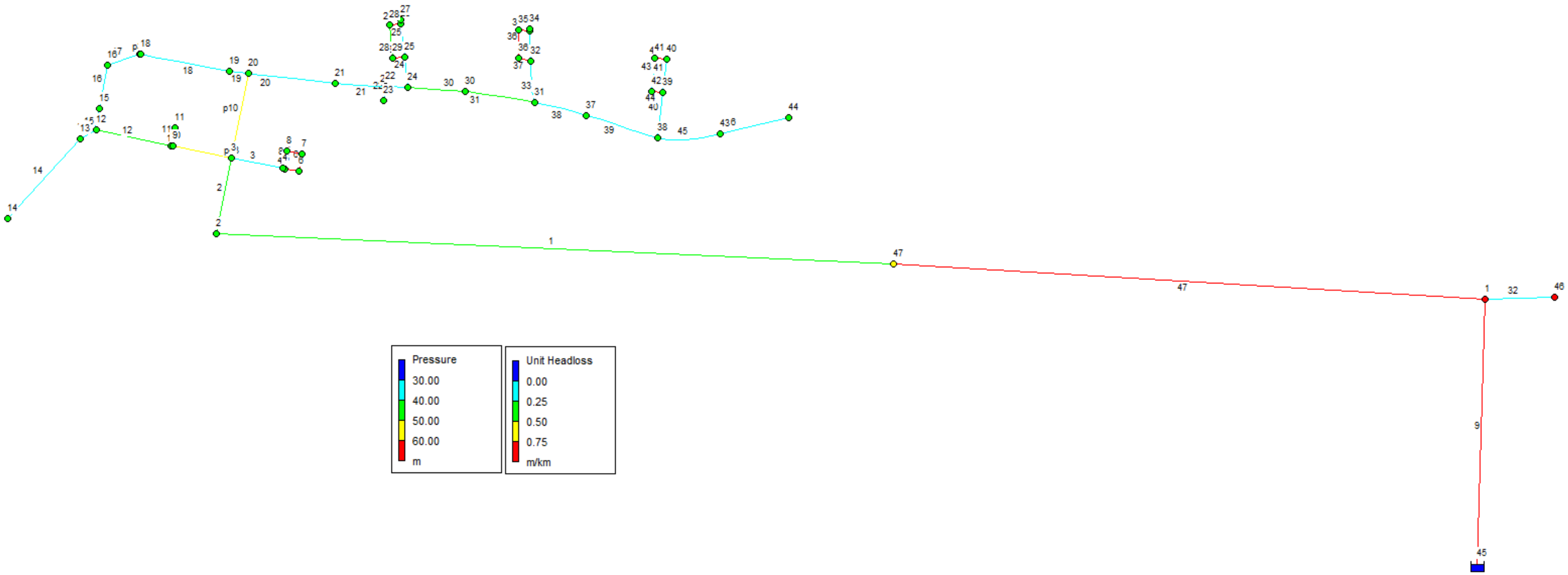
Appendix B: Hydrant flow tests as received from Gilboy Hydraulic Solutions

Hydrant flow tests as received from Gilboy Hydraulic Solutions



Appendix C – EPANET Model Peak Hour Results

Client	DATSIP				
Project	Mossman Gorge	Calcd. by	SB	Ckd. by	
Job No.	1020	Date	9/01/2018	Date	



EPANET MODEL: Peak Hour Flows (EXISTING NETWORK)

TEC

Client	DATSIP				
Project	Mossman Gorge	Calcd. by	SB	Ckd. by	
Job No.	1020	Date	9/01/2018	Date	

EPANET MODEL: Peak Hour Flows (EXISTING NETWORK)

Network Table- Nodes

Node ID	*Elevation*	*Bas Demand*	*Head*	*Pressure*
	m	*LPS*	*m*	*m*
Junc 3	42.25	0	87.4	45.15
Junc 12	45.5	0.19	87.36	41.86
Junc 14	43.5	0.15	87.36	43.86
Junc 22	40	0	87.35	47.35
Junc 23	40	0	87.35	47.35
Junc 31	39.66	0	87.32	47.66
Junc 33	39.75	0.09	87.32	47.57
Junc 24	40.25	0	87.35	47.1
Junc 25	40	0.08	87.35	47.35
Junc 10	43.25	0.16	87.38	44.13
Junc 11	43.5	0.15	87.37	43.87
Junc 6	41.5	0.09	87.32	45.82
Junc 5	42	0	87.39	45.39
Junc 20	42.5	0.29	87.36	44.86
Junc 7	41.5	0.08	87.31	45.81
Junc 26	41.25	0.09	87.35	46.1
Junc 27	40.5	0	87.35	46.85
Junc 38	38.25	0	87.31	49.06
Junc 39	38.25	0.15	87.31	49.06
Junc 43	38.4	0	87.31	48.91
Junc 44	38.25	0.15	87.31	49.06
Junc 40	38.5	0.08	87.31	48.81
Junc 41	39	0.09	87.29	48.29
Junc 42	39	0.07	87.29	48.29
Junc 37	39.38	0	87.32	47.94
Junc 35	40.75	0.09	87.13	46.38
Junc 36	40	0.08	86.91	46.91
Junc 32	39.85	0.08	86.88	47.03
Junc 34	39.75	0	87.32	47.57
Junc 30	39.5	0	87.34	47.84

Junc 29	40.25	0.15	87.3	47.05
Junc 28	40.75	0.08	87.31	46.56
Junc 21	41	0	87.35	46.35
Junc 19	43	0	87.36	44.36
Junc 17	44.15	0.23	87.36	43.21
Junc 18	44.15	0	87.36	43.21
Junc 16	44.5	0.06	87.36	42.86
Junc 15	45.2	0	87.36	42.16
Junc 9	43.25	0	87.38	44.13
Junc 4	42	0.07	87.39	45.39
Junc 8	41.75	0.07	87.32	45.57
Junc 13	45.25	0	87.36	42.11
Junc 2	42	0	87.41	45.41
Junc 1	19	0	89.46	70.46
Junc 46	0	0	89.46	89.46
Junc 47	36	1.31	87.8	51.8
Resvr 45	90	-4.12	90	0

Client	DATSIP				
Project	Mossman Gorge	Calcd. by	SB	Ckd. by	
Job No.	1020	Date	9/01/2018	Date	

EPANET MODEL: Peak Hour Flows (EXISTING NETWORK)

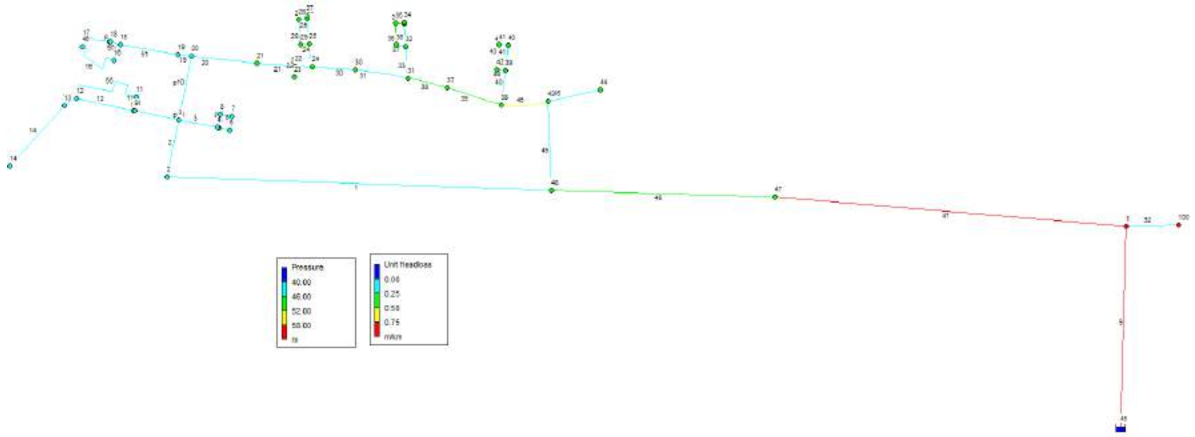
Network Table- Links

Link ID	*Length m*	*Diameter m*	*Roughness*	*Flow L/s*	*Velocity m/s*	*Unit Headloss m/km*	*Friction Factor*
Pipe 22	8.475	100	100	0	0	0	0
Pipe 33	43.17	100	100	0.34	0.04	0.06	0.062
Pipe 24	18.55	100	100	0.4	0.05	0.08	0.06
Pipe 11	10.83	100	100	0.15	0.02	0.01	0.068
Pipe 5	8.606	25	100	0.13	0.26	8.37	0.06
Pipe p10	51.01	100	100	1.33	0.17	0.74	0.051
Pipe 26	2	100	100	0	0	0	0
Pipe 40	27.02	100	100	0.39	0.05	0.08	0.061
Pipe 46	42.43	100	100	0.15	0.02	0.01	0.07
Pipe 42	7.088	25	100	0.08	0.16	3.53	0.064
Pipe 43	19.77	25	100	-0.01	0.02	0.05	0.083
Pipe 44	6.845	25	100	-0.08	0.17	3.56	0.064
Pipe 45	37.42	100	100	0.15	0.02	0.01	0.07

Pipe 39	44.65	100	100	0.54	0.07	0.14	0.058
Pipe 38	31.82	100	100	0.54	0.07	0.14	0.058
Pipe 36	17.08	25	100	0.16	0.33	12.81	0.058
Pipe 37	7.489	25	100	0.08	0.17	3.55	0.064
Pipe 34	0.9848	100	100	0	0	0	0
Pipe 35	6.763	25	100	0.25	0.51	28.83	0.054
Pipe 31	42.17	100	100	0.88	0.11	0.34	0.054
Pipe 30	34.05	100	100	0.88	0.11	0.34	0.054
Pipe 29	6.869	25	100	0.12	0.24	7.32	0.06
Pipe 25	20	100	100	0.2	0.02	0.02	0.068
Pipe 28	20	25	100	0.03	0.05	0.44	0.076
Pipe 27	6.869	25	100	0.11	0.22	5.97	0.061
Pipe 41	19.85	100	100	0.16	0.02	0.01	0.069
Pipe 23	13.54	150	100	1.28	0.07	0.09	0.054
Pipe 21	30.01	150	100	1.28	0.07	0.09	0.054
Pipe 20	52.16	150	100	1.28	0.07	0.09	0.054
Pipe 19	11	150	100	0.23	0.01	0	0.071
Pipe p36	0.6612	150	100	0.23	0.01	0	0
Pipe 18	54.01	150	100	0.23	0.01	0	0.069
Pipe 17	20.63	150	100	0.46	0.03	0.01	0.063
Pipe 16	25.98	150	100	0.52	0.03	0.02	0.061
Pipe 15	12.82	150	100	0.52	0.03	0.02	0.062
Pipe 12	45.92	100	100	0.86	0.11	0.33	0.054
Pipe 10	0.896	100	100	1.17	0.15	0.58	0.052
Pipe p43	35.56	100	100	1.17	0.15	0.58	0.052
Pipe 3	31.09	100	100	-0.32	0.04	0.05	0.063
Pipe 4	1.511	100	100	-0.13	0.02	0.01	0.045
Pipe 6	9.593	25	100	-0.04	0.08	0.95	0.071
Pipe 7	9.335	25	100	-0.04	0.08	1.02	0.071
Pipe 8	10.65	25	100	-0.11	0.23	6.72	0.061
Pipe 13	5.8	100	100	0.15	0.02	0.01	0.076
Pipe 14	69.7	100	100	0.15	0.02	0.01	0.069
Pipe 2	45.4	150	100	2.81	0.16	0.41	0.048
Pipe 1	930	150	100	2.81	0.16	0.41	0.048
Pipe 9	650	150	100	4.12	0.23	0.83	0.045
Pipe 32	1000	225	100	0	0	0	0
Pipe 47	2000	150	100	-4.12	0.23	0.83	0.045

Client	DATSIP				
Project	Mossman Gorge	Calcd. by	SB	Ckd. by	
Job No.	1020	Date	26/02/2018	Date	

EPANET MODEL: Run 19N – Peak Hour Flows @ C=100 with all new alterations



Peak Hour Flows with proposed changes

Client	DATSIP				
Project	Mossman Gorge	Calcd. by	SB	Ckd. by	
Job No.	1020	Date	26/02/2018	Date	

EPANET MODEL: Run 19N – Peak Hour Flows @ C=100 with all new alterations

Network Table- Nodes

Node ID	*Elevation*	*Base Demand*	*Demand*	*Head*	*Pressure*
	m	*LPS*	*LPS*	*m*	*m*
Junc 3	42.25	0	0	87.35	45.1
Junc 12	45.5	0.189	0.19	87.34	41.84
Junc 14	43.5	0.152	0.15	87.34	43.84
Junc 22	40	0	0	87.34	47.34
Junc 23	40	0	0	87.34	47.34
Junc 31	39.66	0	0	87.35	47.69
Junc 33	39.75	0.089	0.09	87.35	47.6
Junc 24	40.25	0	0	87.34	47.09
Junc 25	40	0.081	0.08	87.34	47.34
Junc 10	43.25	0.161	0.16	87.34	44.09
Junc 11	43.5	0.146	0.15	87.34	43.84
Junc 6	41.5	0.089	0.09	87.35	45.85
Junc 5	42	0	0	87.35	45.35
Junc 20	42.5	0.286	0.29	87.34	44.84
Junc 7	41.5	0.081	0.08	87.34	45.84
Junc 26	41.25	0.088	0.09	87.34	46.09
Junc 27	40.5	0	0	87.34	46.84
Junc 38	38.25	0	0	87.37	49.12
Junc 39	38.25	0.146	0.15	87.37	49.12
Junc 43	38.4	0	0	87.39	48.99
Junc 44	38.25	0.281	0.28	87.39	49.14
Junc 40	38.5	0.081	0.08	87.37	48.87
Junc 41	39	0.089	0.09	87.37	48.37
Junc 42	39	0.073	0.07	87.37	48.37
Junc 37	39.38	0	0	87.36	47.98
Junc 35	40.75	0.089	0.09	87.34	46.59
Junc 36	40	0.081	0.08	87.32	47.32
Junc 32	39.85	0.081	0.08	87.32	47.47
Junc 34	39.75	0	0	87.35	47.6
Junc 30	39.5	0	0	87.35	47.85

Junc 29	40.25	0.146	0.15	87.34	47.09
Junc 28	40.75	0.081	0.08	87.34	46.59
Junc 21	41	0	0	87.34	46.34
Junc 19	43	0	0	87.34	44.34
Junc 17	44.15	0.226	0.23	87.34	43.19
Junc 18	44.15	0	0	87.34	43.19
Junc 9	43.25	0	0	87.34	44.09
Junc 4	42	0.073	0.07	87.35	45.35
Junc 8	41.75	0.073	0.07	87.35	45.6
Junc 13	45.25	0	0	87.34	42.09
Junc 2	42	0	0	87.36	45.36
Junc 1	19	0	0	89.43	70.43
Junc 100	12	0	0	89.43	77.43
Junc 48	37.2	0	0	87.4	50.2
Junc 15	44.1	0	0	87.34	43.24
Junc 16	44.4	0	0	87.34	42.94
Junc 46	44.7	0.058	0.06	87.34	42.64
Junc 47	36	1.311	1.31	87.66	51.66
Resvr 45	90	#N/A	-4.25	90	0

Client	DATSIP				
Project	Mossman Gorge	Calcd. by	SB	Ckd. by	
Job No.	1020	Date	26/02/2018	Date	

EPANET MODEL: Run 19N – Peak Hour Flows @ C=100 with all new alterations

Network Table- Links

Link ID	*Length m*	*Diameter m*	*Roughness*	*Flow L/s*	*Velocity m/s*	*Unit Headloss m/km*	*Friction Factor*
Pipe 22	8.475	100	100	0	0	0	0
Pipe 33	43.17	100	100	0.34	0.04	0.06	0.062
Pipe 24	18.55	100	100	0.4	0.05	0.08	0.06
Pipe 11	10.83	100	100	0.18	0.02	0.02	0.068
Pipe 5	8.606	50	100	-0.13	0.07	0.29	0.065
Pipe p10	51.01	100	100	-0.52	0.07	0.13	0.058
Pipe 26	2	100	100	0	0	0	0

Pipe 40	27.02	100	100	0.39	0.05	0.08	0.061
Pipe 46	42.43	100	100	0.28	0.04	0.04	0.064
Pipe 42	7.088	50	100	0.08	0.04	0.11	0.071
Pipe 43	39	50	100	-0.01	0.01	0	0.095
Pipe 44	6.845	50	100	-0.09	0.04	0.13	0.069
Pipe 45	37.42	100	100	-1.17	0.15	0.58	0.052
Pipe 39	44.65	100	100	-0.78	0.1	0.28	0.055
Pipe 38	31.82	100	100	-0.78	0.1	0.28	0.055
Pipe 36	37	50	100	0.16	0.08	0.44	0.063
Pipe 37	7.489	50	100	0.08	0.04	0.12	0.07
Pipe 34	0.9848	100	100	0	0	0	0
Pipe 35	6.763	50	100	0.25	0.13	0.98	0.059
Pipe 31	42.17	100	100	-0.44	0.06	0.1	0.059
Pipe 30	34.05	100	100	-0.44	0.06	0.1	0.059
Pipe 29	6.869	50	100	-0.13	0.07	0.28	0.066
Pipe 25	20	100	100	0.19	0.02	0.02	0.067
Pipe 28	43.8	50	100	0.02	0.01	0.01	0.087
Pipe 27	6.869	50	100	0.1	0.05	0.18	0.068
Pipe 41	19.85	100	100	0.16	0.02	0.01	0.068
Pipe 23	13.54	150	100	-0.05	0	0	0
Pipe 21	30.01	150	100	-0.05	0	0	0.132
Pipe 20	52.16	150	100	-0.05	0	0	0.076
Pipe 19	11	150	100	-0.28	0.02	0.01	0.067

Pipe p36	0.6612	150	100	-0.28	0.02	0	0
Pipe 12	45.92	100	100	0.3	0.04	0.05	0.063
Pipe 10	0.896	100	100	0.65	0.08	0.2	0.057
Pipe p43	35.56	100	100	0.65	0.08	0.2	0.056
Pipe 3	31.09	100	100	-0.32	0.04	0.05	0.063
Pipe 4	1.511	100	100	-0.13	0.02	0.01	0.045
Pipe 6	9.593	50	100	-0.04	0.02	0.03	0.08
Pipe 7	9.335	50	100	-0.04	0.02	0.04	0.079
Pipe 8	10.65	50	100	-0.11	0.06	0.23	0.066
Pipe 13	5.8	100	100	0.15	0.02	0.01	0.067
Pipe 14	69.7	100	100	0.15	0.02	0.01	0.07
Pipe 2	45.4	150	100	1.49	0.08	0.13	0.052
Pipe 9	650	150	100	4.25	0.24	0.88	0.045
Pipe 32	1000	12	100	0	0	0	0
Pipe 1	330	150	100	-1.49	0.08	0.13	0.052
Pipe 48	600	150	100	-2.94	0.17	0.45	0.047
Pipe 49	30.7	150	100	-1.45	0.08	0.12	0.053
Pipe 55	71.02	50	100	0.04	0.02	0.03	0.078
Pipe 17	31.05	100	100	0.05	0.01	0	0.088
Pipe 16	59.18	50	100	-0.01	0	0	0.095
Pipe 15	10.92	100	100	-0.01	0	0	0
Pipe 50	8.32	150	100	-0.28	0.02	0.01	0.068
Pipe 51	45.69	150	100	-0.28	0.02	0.01	0.067
Pipe 47	2000	150	100	-4.25	0.24	0.88	0.045

Firefighting flows in water main from reservoir

Q = 17.84 L/s C=100

$$\frac{\Delta h}{100m} = \left(\frac{3.35 * 10^6 * Q}{D^{2.63} * C}\right)^{1.852}$$

If the pipe is Ø150 mm

$$\frac{\Delta h}{100m} = 1.255m/100m$$

If the pipe is Ø225 mm

$$\frac{\Delta h}{100m} = 0.174m/100m$$

If a Ø150 mm duplication

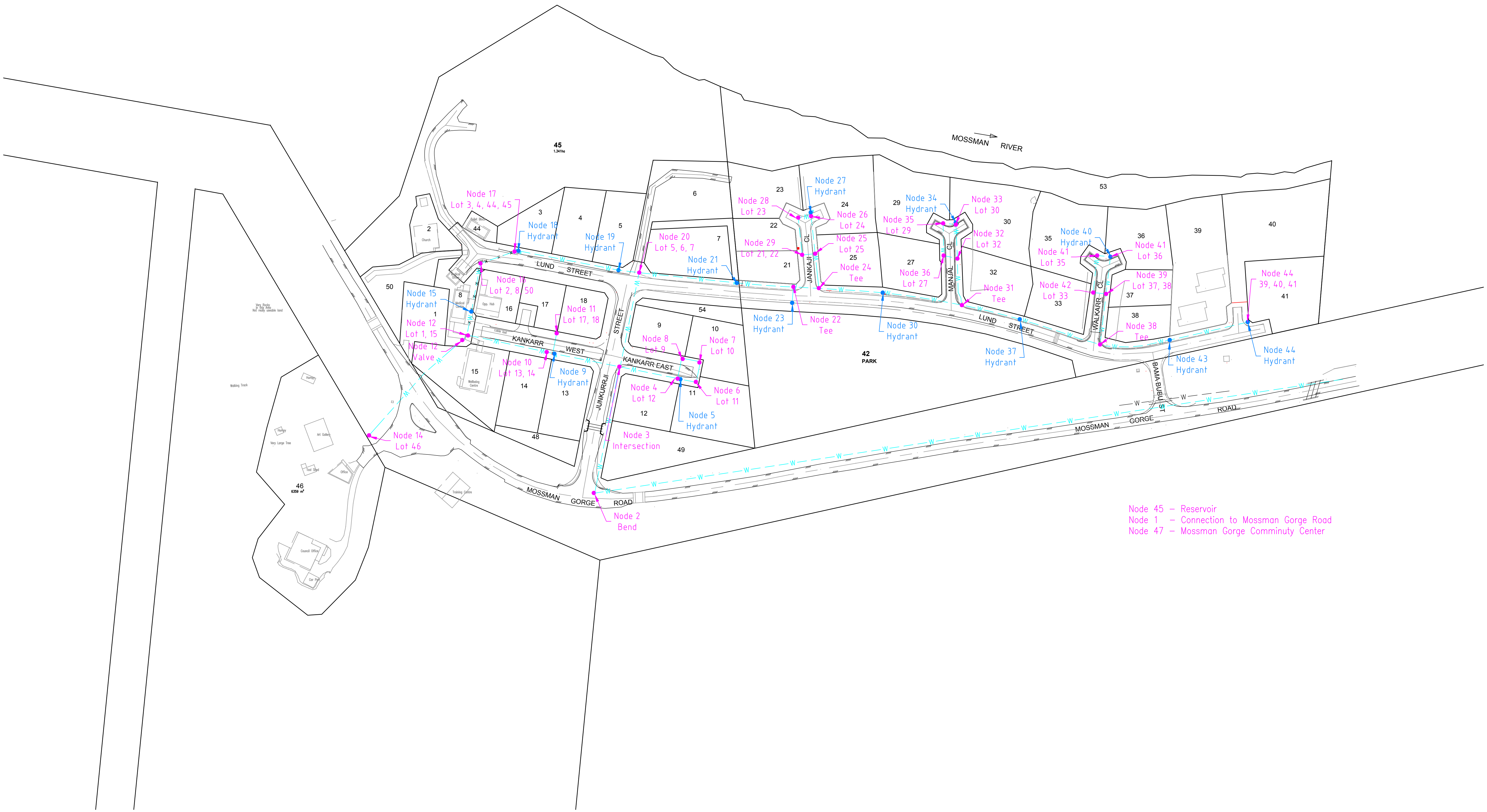
$$\frac{\Delta h}{100m} = \frac{0.348m}{100m}\ each$$

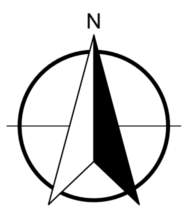
$$\frac{\Delta h}{100m} = \frac{0.696m}{100m}$$

Therefore, for every 100 m of pipeline replaced with a Ø225 mm pipe will provide 1.081m of extra head to the site. Or for every 100 m of duplicated Ø150 mm pipe will provide 0.529m of extra head to the site.

Appendix D

1020-Sketch 1 – Node Plan Layout of Existing Network





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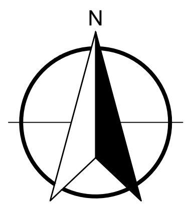
Client	DATSIP
Project	MOSSMAN GORGE INFRASTURCTURE UPGRADES
Title	EXISTING WATER RETICULATION NODE LAYOUT

JOB No.	Scale (A1 size)	Date	Drawing No.	Revision
1020	1:1000	12/03/2018	1020-SKETCH-1	A

Appendix E

1020-Sketch 2 – Node Plan Layout of Proposed Layout



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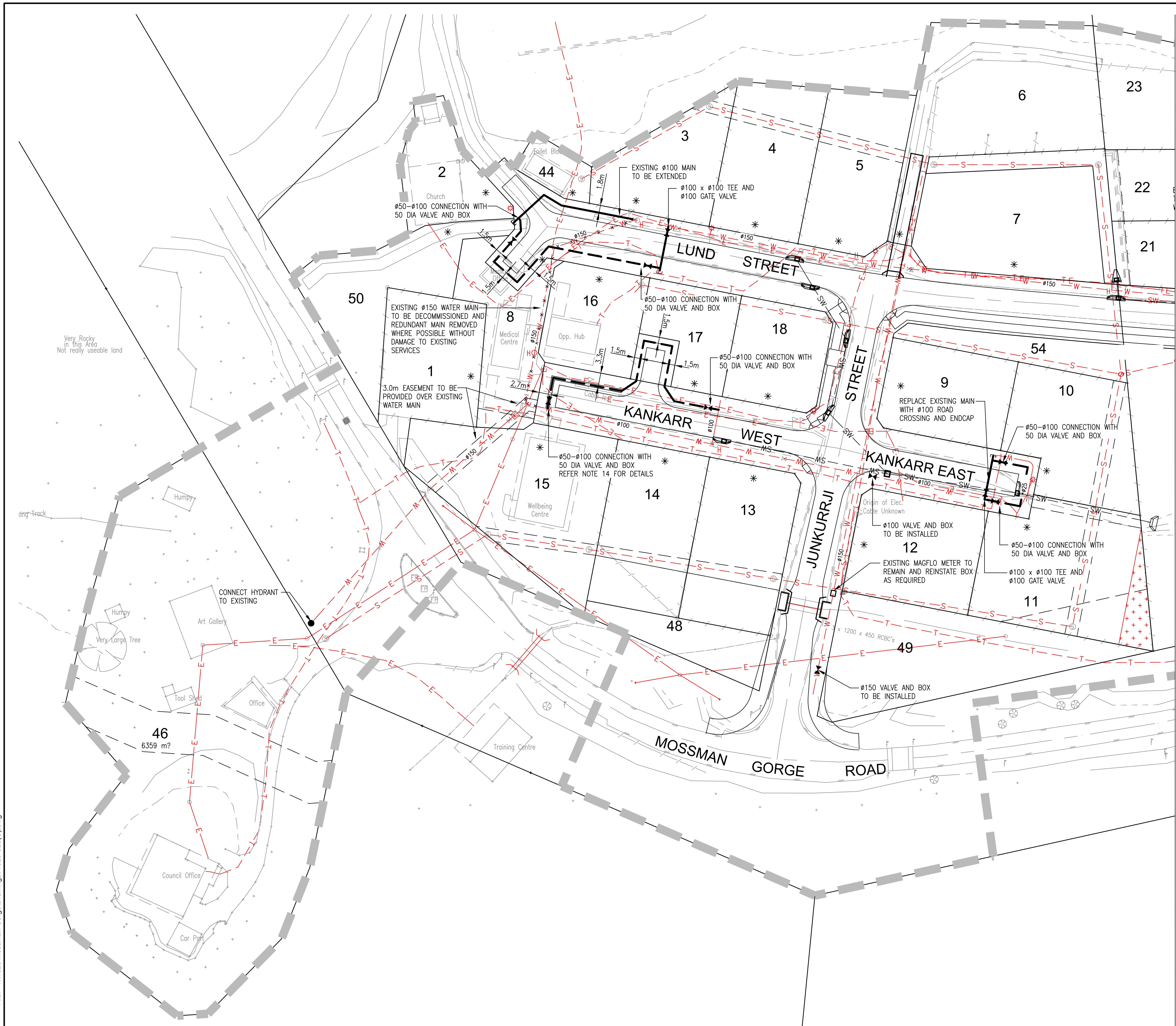
Client	DATSIP
Project	MOSSMAN GORGE INFRASTURCTURE UPGRADES
Title	PROPOSED WATER RETICULATION NODE LAYOUT SHEET 1 OF 2

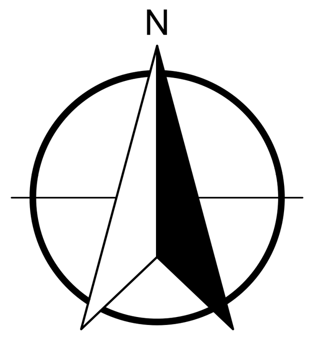
JOB No.	Scale (A1 size)	Date	Drawing No.	Revision
1020	1:1000	12/03/2018	1020-SKETCH-2	A

Appendix F

Engineering Drawings 1020-028 and 029



PLAN
SCALE 1:500



LEGEND

- ø100 WATER MAIN
- ø50 WATER MAIN (MDPE PIPE PN16)
- ø50 WATER MAIN (MDPE PIPE PN16) WITH ø100 ENEVELOPING CONDUIT
- HYDRANT, VALVE AND ENDCAP
- WATER METER ARRANGEMENT (REFER NOTE 8)
- STAGE BOUNDARY
- EXISTING WATER MAIN, DIAMETER, HYDRANT, STOP VALVE AND ENDCAP

NOTES

1. ALL WORKS AND MATERIALS TO BE IN ACCORDANCE WITH FNQROC DEVELOPMENT MANUAL GUIDELINES AND SPECIFICATIONS.
2. LOCATION OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE BY CONTRACTOR AND SUPERINTENDENT PRIOR TO CONSTRUCTION. THIS IS INCLUSIVE OF EXISTING SERVICES SHOWN ON PLAN.
3. NEW ALIGNMENT OF WATER MAINS SHALL BE AS PER FNQROC STD OFFSET OF 2.7m UNLESS SHOWN OTHERWISE.
4. REFER TO FNQROC STANDARD DRAWINGS:
   - S2000 : VALVE BOX INSTALLATION
   - S2005 : HYDRANT BOX INSTALLATION
   - S2010 : KERB AND ROAD MARKERS
   - S2015 : THRUST BLOCK DETAILS
   - S2016 : WATER RETICULATION BEDDING DETAILS
   - S2020 : MAIN CONNECTION DETAILS
5. HYDRANTS AND SLUICE VALVES TO BE NOMINALLY LOCATED OPPOSITE PROPERTY BOUNDARY TRUNCATIONS AND CORNERS UNLESS SHOWN OTHERWISE ON PLAN.
6. WHERE HYDRANTS AND STREET LIGHTING LOCATION COINCIDE, HYDRANT TO BE PLACED 1.0m (MIN.) AWAY FROM LIGHT.
7. VALVES ON LINES Ø100 OR GREATER TO BE ANCHORED AS PER FNQROC STD. DWG S2015.
8. THE CONTRACTOR IS TO LOCATE EACH PROPERTIES WATER CONNECTION POINT AT THE MAIN TAPPING BAND AND PROPERTY BOUNDARY. INSTALL FERRULE AND BONNET ARRANGEMENT AT TAPPING BAND (MAIN) AND INSTALL WATER METER INSIDE PROPERTY GENERALLY IN ACCORDANCE WITH DRAWING S2038. WATER METERS TO BE ELSTER V100(PSM–T) 20mm.
9. MINIMUM COVER IN ACCORDANCE WITH FNQROC TO BE ADHERED TO. WHERE OTHER EXISTING SERVICES CREATE CLASHES AT THE PREFERRED DEPTH ALTERNATE ALIGNMENT AND/OR DEPTH MAY BE PROPOSED AND AND CONSTRUCTED BY THE CONTRACTOR SUBJECT TO COUNCIL APPROVAL OF REVISED ALIGNMENT.
10. INSTALL BRASS KERB MARKERS IN THE KERB STAMPED WITH 'W' TO DENOTE THE LOCATION OF ALL EXISTING AND PROPOSED ROAD CROSSINGS.
11. UPON COMPLETION OF ROADWORKS NEW HYDRANT AND VALVE MARKERS ARE TO BE INSTALLED IN ACCORDANCE WITH FNQROC REQUIREMENTS.
12. EXISTING VALVE AND HYDRANT SURROUNDS MAY NEED TO BE MODIFICATION TO SUIT NEW VERGE LEVELS.
13. CONTRACTOR IS TO REINSTATE EXISTING DRIVEWAYS WHERE NECESSARY.
14. ø50 WATERMAIN INSTALLED UNDER HARD STAND AREAS (ADJACENT LOTS 8 & 16 KANKARR STREET) TO BE INSTALLED IN ø100 ENVELOPING PIPE.

WATERMAIN MINIMUM CLEARANCE TO SERVICES

	HORIZONTAL (mm)	VERTICAL (mm)
WATER MAINS <ø375	300	150
WATER MAINS >ø375	600	500
SEWER MAINS	1000	500
STORMWATER LINES	300	150
TELSTRA CONDUITS	300	150
ERGON ENERGY CONDUITS	500	300
GAS MAINS	300	150

Revisions

No.	Description	Reviewed	Approved	Date
C	OPERATIONAL WORKS ISSUE	–	–	07/12/17
B	MISCELLANEOUS AMENDMENTS	–	–	06/10/17
A	PRELIMINARY ISSUE	–	–	17/08/17

0 5 10 15 20 25m
SCALE 1:500 (A1 SIZE)

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Scale (A1 size): 1:500

Drawing is not to be used for construction unless approved.

Drawn	Designed
MS	MS

Client: **DATSIP**

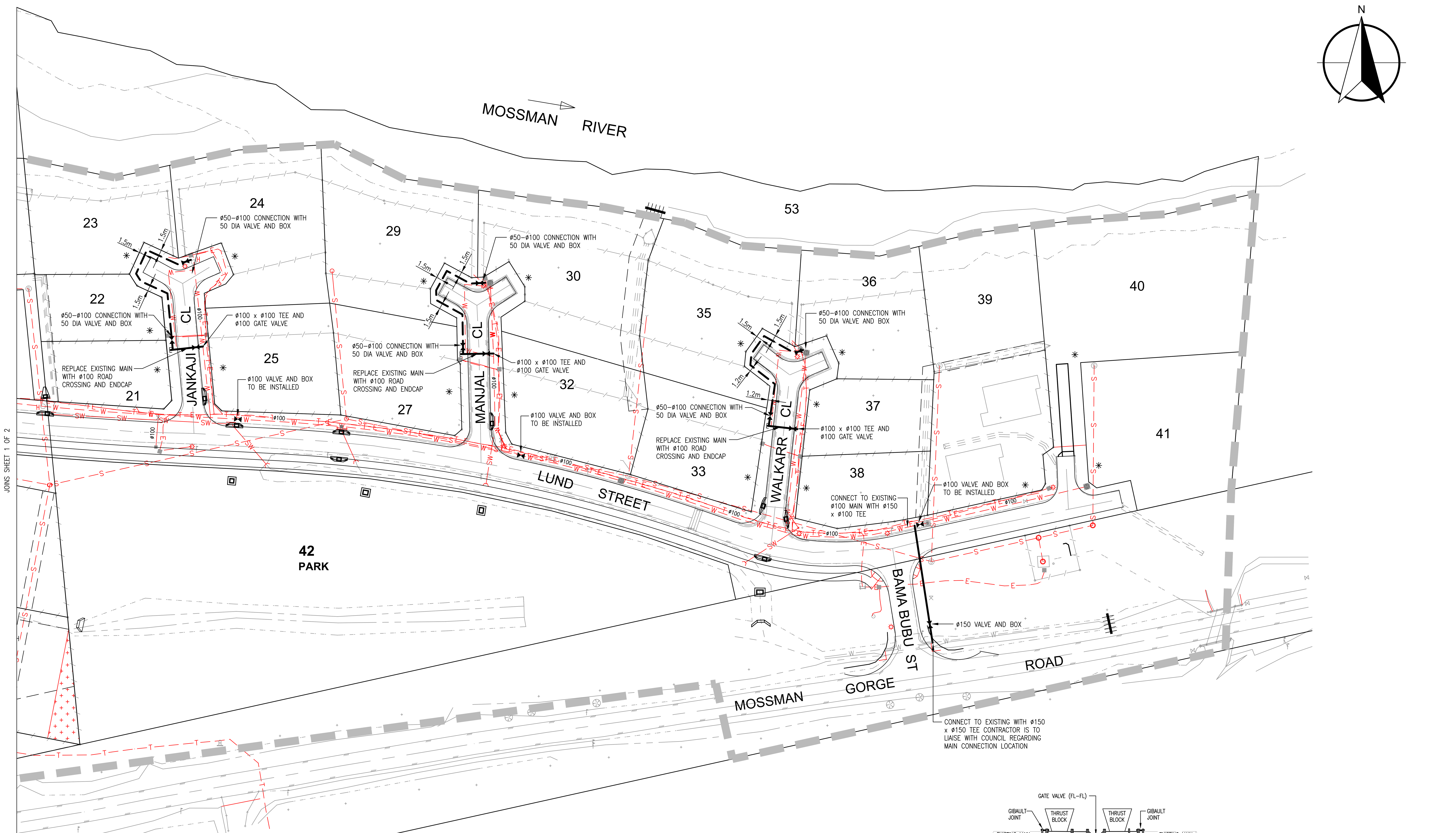
Project: **MOSSMAN GORGE INFRASTRUCTURE UPGRADES**

Title: **WATER RETICULATION LAYOUT SHEET 1 OF 2**

Drawing Check	Design Check	Approved	RPEQ	Date	Drawing No.	Revision
					1020-028	C

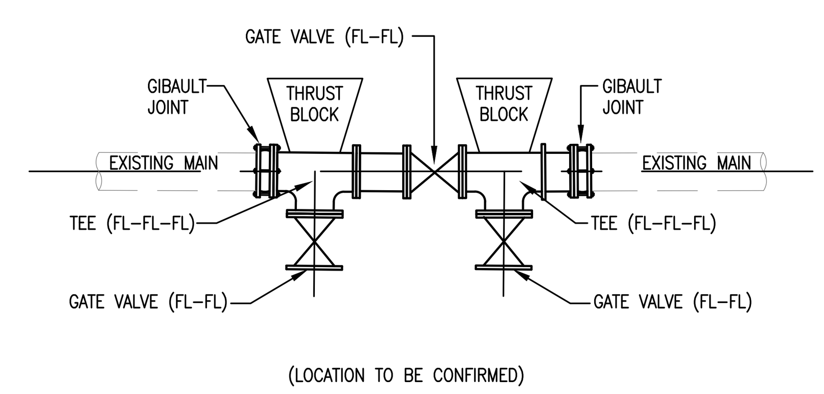
Printed: 06 December 2017, 11:56 AM   File: T:\1020 Mossman Gorge\Drawings\1020-028(C).dwg

External References: TEC-TITLE-A1_b.dwg ; 1020-X-SURVEY.dwg ; 1020-X-DESIGN.dwg



PLAN

SCALE 1:500



BOOSTER PUMP CONNECTION (IF ORDERED)

SCALE 1:25

NOTES

REFER TO DRG 1020–028 FOR LEGEND AND NOTES.

No.	Description	Reviewed	Approved	Date
B	OPERATIONAL WORKS ISSUE	–	–	07/12/17
A	PRELIMINARY ISSUE	–	–	17/08/17

Revisions

0 5 10 15 20 25m
SCALE 1:500 (A1 SIZE)

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Scale (A1 size): 1:500

Drawing is not to be used for construction unless approved.

Client: DATSIP

Project: MOSSMAN GORGE INFRASTRUCTURE UPGRADES

Title: WATER RETICULATION LAYOUT SHEET 2 OF 2

Drawn	Designed	Drawing Check	Design Check	Approved	RPEQ	Date	Drawing No.	Revision
MS	MS						1020-029	B

Printed: 06 December 2017, 11:58 AM File: T:\1020 Mossman Gorge\Drawings\1020-029(B).dwg

External References: TEC-TITLE-A1_b.dwg ; 1020-X-SURVEY.dwg ; 1020-X-DESIGN.dwg

Client: DATSIP
Project: Mossman Gorge Community
Job No.: 1020

Calc. By: SB
Date: 29/03/2018

TEC

Development Type	Demand Rate	Demand Units	Demand	Comments
Single Family Dwelling				
Lot > 1500m²	3.7 EP per Connection	2	8	40,39
Lot 1101m² to 1500m²	3.4 EP per Connection	7	24	11, 7, 24, 29, 30, 35, 41
Lot 901m² to 1100m²	3.1 EP per Connection	8	25	10, 13, 14, 23, 32, 36
Lot 401m² to 900m²	2.8 EP per Connection	11	31	1, 3, 4, 5, 9, 12, 17, 18, 21, 22, 37, 38
Multi Unit Accommodation				
Units with 3 bedrooms	2.2 EP per connection	12	27	39 (3 Units), 25, 27, 33 (duplex), 6 (triplex)
Commercial	1.0 EP per 90 sqm GFA	1825	21	area of exisiting buildings
Parks, Recreation & Communit	20.0 EP per hectare	1.3	26	(FROM WSA)
		TOTAL	**162**	**Equivalent Persons**

Client:	DATSIP		
Project:	Mossman Gorge Subdivision	Calc. By:	SB
Job No.:	1020	Date:	6/04/2018

TEC

PROPOSED PUMP STATION

Depth of Wet Well

DATA REQUIRED	Qty	Units	Notes/Source etc.
Connected Population	162	EP	
Design inflow/pump rate	3.387	L/s	PWWF
Pump Station Internal Diameter	2.1	m	
No. Pump Starts	2	No.	
Incoming Sewer Level	35.59	m	
Ground Level	38.47	m	

Min. Storage Volume = (0.9 x Pump rate)/No. Pump Starts =	1.52	m^3
Storage Depth = Volume/Cross Sectional Area =	0.440	m
Adopted Depth =	0.300	mm
Storage Volume =	1.039	m^3
Time to Fill @ 5ADWF = Volume/inflow =	5.1	min
Time to Fill @ADWF =	25.6	min
Time to Fill @5ADWF =	5.1	min
Adopted Pump Flow Rate	6.5	L/s
Pumping Time =	2.7	min
No. Starts/Hour =	2	No.

Levels

Alarm Level = IL-200mm =	35.390	m
Top Water Level (TWL)/Standby Start = AL - 200mm =	35.190	m
Duty Start = SL - 200mm =	34.990	m
Bottom Water Level (BWL)/Pump Stop = DS - Storage Depth =	34.690	m
Pump Station Invert Level = PS - 450mm =	34.240	m
Overall Depth =	4.230	m
Outlet Pipe IL =	37.67	m
Chamber IL =	37.470	m
Valve Pit Base RL =	37.320	m
Depth of Valve Box Below Ground =	1.150	m

Overflow and Emergency Storage

Pressure main (assumed 600mm below top of P.S.)	38.020	m AHD
Emergency storage depth in wet well above Pump Stop =	2.830	m
Emergency storage above Pump Stop =	9.802	m^3
Emergency storage in sewer gravity system - piped system =	4.79466225	m^3
Emergency storage in sewer gravity system - MH's =	6.38192047	m^3
overflow tank =	0.00	m^3
Total storage volume =	23.809	m^3
Emergency storage required = 4 hrs @ ADWF above Pump Stop =	7.290	m^3
Time to fill emergency storage @ ADWF = Volume/inflow =	9.763	hrs
Time to fill emergency storage @ 5 x ADWF = Volume/inflow =	1.953	hrs

Note: Additional storage is avalilable in the rising main

Buoyancy

F.O.S = 1.2

Uplift Force x FOS = Dead Load

Data:

Pump Station Wall Thickness =	230	mm	
Valve Box Wall/Base Thickness =	150	mm	
Wet Well Inside Diameter =	2.1	m	
Valve Box Internal Width W =	1	m	
Valve Box Internal Length =	1.5	m	
Unit Weight Water =	9.81	kN/m3	
Unit Weight Concrete =	24	kN/m3	
Buoyant Weight Concrete (Plug) =	12.228	kN/m3	(includes FOS)

Calculation:

Wet Well OD =	2.56	m	
Valve Box Base Area =	2.34	m2	
Volume of Concrete =	8.633115	m3	Excluding Plug
Displaced Water Volume =	24.96867	m3	Excluding Plug
Uplift Force x FOS =	293.9312	kN	
Dead Load =	207.1948	kN	
Required Plug Weight =	86.7364	kN	
Volume Plug + Plug Surround =	7.093261	m3	Includes plug surround walls
Minimum Thickness of Plug =	1.378085	m	
Rounded up to Nearest 0.1m =	1.4	m	

SYSTEM RESISTANCE CURVE

			COMMENTS
LEVELS	PS top water level	35.19	Pump Start Level
	PS bottom water level	34.69	Pump Stop Level
	PS outlet level	37.67	Pressure Main/Gravity Sewer
	PM high point	0	on rising main (if any, 0 otherwise)
	PM high point chainage	0	on rising main (if any, 0 otherwise)
	PM Diameter	80	millimetres (rising main) Assumes single pipe diameter
	PM Length	451	metres
	Connected EP	162	
	Req'd Pump Rate 1 (L/s)	6.50	

c1	6.69023
c1*ADWF	3.38693
5*ADWF	2.53125

	Q (L/s)	PIPEWORK FRICTION LOSSES HEAD (MAX) C= 100	HEAD (MIN) C= 150	FRICTION LOSSES TO HIGH POINT HEAD (MAX) C= 100	HEAD (MIN) C= 150	FITTING LOSSES V (m/s)	$k * V^2/2g$ K= 3.8	PUMP HEAD (MAX)	(MIN)
	0.000	0.00	0.00	0.00	0.00	0.00	0.00	2.98	2.48
	0.650	0.26	0.12	0.00	0.00	0.13	0.00	3.25	2.61
	1.000	0.58	0.27	0.00	0.00	0.20	0.01	3.57	2.76
	1.650	1.47	0.69	0.00	0.00	0.33	0.02	4.47	3.20
	2.300	2.72	1.28	0.00	0.00	0.46	0.04	5.74	3.81
	2.950	4.32	2.04	0.00	0.00	0.59	0.07	7.36	4.58
	3.600	6.24	2.95	0.00	0.00	0.72	0.10	9.32	5.53
	4.250	8.49	4.01	0.00	0.00	0.85	0.14	11.61	6.62
	4.900	11.05	5.21	0.00	0.00	0.97	0.18	14.21	7.88
	5.550	13.92	6.57	0.00	0.00	1.10	0.24	17.13	9.28
DUTY 1	**6.500**	**18.65**	**8.80**	**0.00**	**0.00**	**1.29**	**0.32**	**21.95**	**11.60**
	7.150	22.25	10.50	0.00	0.00	1.42	0.39	25.62	13.37
	7.800	26.14	12.33	0.00	0.00	1.55	0.47	29.58	15.28
	8.450	30.31	14.30	0.00	0.00	1.68	0.55	33.84	17.33
	9.100	34.77	16.41	0.00	0.00	1.81	0.63	38.39	19.52
	9.750	39.51	18.65	0.00	0.00	1.94	0.73	43.22	21.85