AECOM

City of Prince George

Sanitary Sewer Services Master Plan

Final Report

Prepared by:
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Project Number:

60305337

Date:

September 2017

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September 7, 2017

City of Prince George
Engineering Department
1100 Patricia Boulevard
Prince George, BC
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Attention: Ian Sinclair
Engineering Assistant, Engineering Services

Regarding: City of Prince George Sanitary Sewer Services Master Plan
Final Report

We are pleased to present to you our final issue of the City of Prince George Sanitary Sewer Services Master Plan. This report summarizes the following:

- Our approach to model development;
- Model calibration results and parameters used;
- Future growth projection and flow estimate;
- Hydraulic assessment and results for Existing and OCP time horizons; and
- Recommendations on capital upgrades

Please do not hesitate to contact me if you have any further questions or comments regarding the report, and thank you for the opportunity to work with you on this project.

Sincerely,
AECOM Canada Ltd.

Project Engineer
Taylor Briggs, P.Eng.

Distribution List

# of Hard Copies	PDF Required	Name
2	Yes	Ian Sinclair, City of Prince George

Revision Log

Version #	Version By	Date	Issue / Revision Description
1	Taylor Briggs	April 7, 2015	Draft Final Report
2	Taylor Briggs	May 26, 2017	Second Draft Final Report
3	Taylor Briggs	September 7, 2017	Final Report

AECOM Signatures

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Taylor Briggs, P.Eng.
Project Engineer

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Executive Summary

The City of Prince George is anticipating growth over the next 20 years. To assist with planning for this growth, the City is updating their Sanitary Master Plan that will be used for development of a Capital Expenditure Program and outlining Operations & Maintenance budgets. The City has a population of approximately 76,000 residents based on 2010 BC Stats and is projected to grow to between 78,900 and 90,200 by 2025. The existing sewer system includes 32 lift stations, over 430 km of sanitary sewers, and approximately 18 km of forcemains. Sewage is treated and discharged at five locations. The Landsdowne Waste Water Treatment Centre (WWTC) is the largest treatment location, treating over 80% of the City's total sewage. The Lansdowne WWTC discharges to the Fraser River.

The previous master plan was completed in 2001 and included use of a hydraulic model (Hydra and later converted to InfoSewer in 2006). The City retained AECOM to develop a new hydrodynamic (flow hydrology + hydraulics) model for the City's sanitary sewer system. The new model includes the City's entire sanitary sewer system, with the exclusion of service laterals and private systems.

The key objectives of this Master Plan are to:

- Develop a new hydraulic model of the City's entire sanitary sewer system;
- Calibrate and validate the model under existing land-use for dry & wet weather conditions (using recent flow monitoring data and pump station SCADA data);
- Assess the performance of the sewer system (local sewers, trunks, pump stations and forcemains) under existing and future land-use conditions; identify hydraulic constraints; and recommend system improvements; and
- Perform a risk and criticality assessment for the recommended system improvements and use this to prioritize capital projects

A computer model of the City's sanitary sewer system was developed and used as a tool to evaluate hydraulic capacity and constraints in the pipe network under both existing and future conditions and identify where capital improvements are recommended. Development of a new City wide sanitary sewers model ("an all pipe model") has been completed for two scenarios: Existing Conditions and OCP Development.

Following this assessment, capital improvements were recommended to satisfy the following goals and objectives:

- Improve the level of service to existing users while supporting future development;
- Reduce surcharging and flooding from manholes;
- Address known service issues; and
- Reduce the chance of environmental impacts.

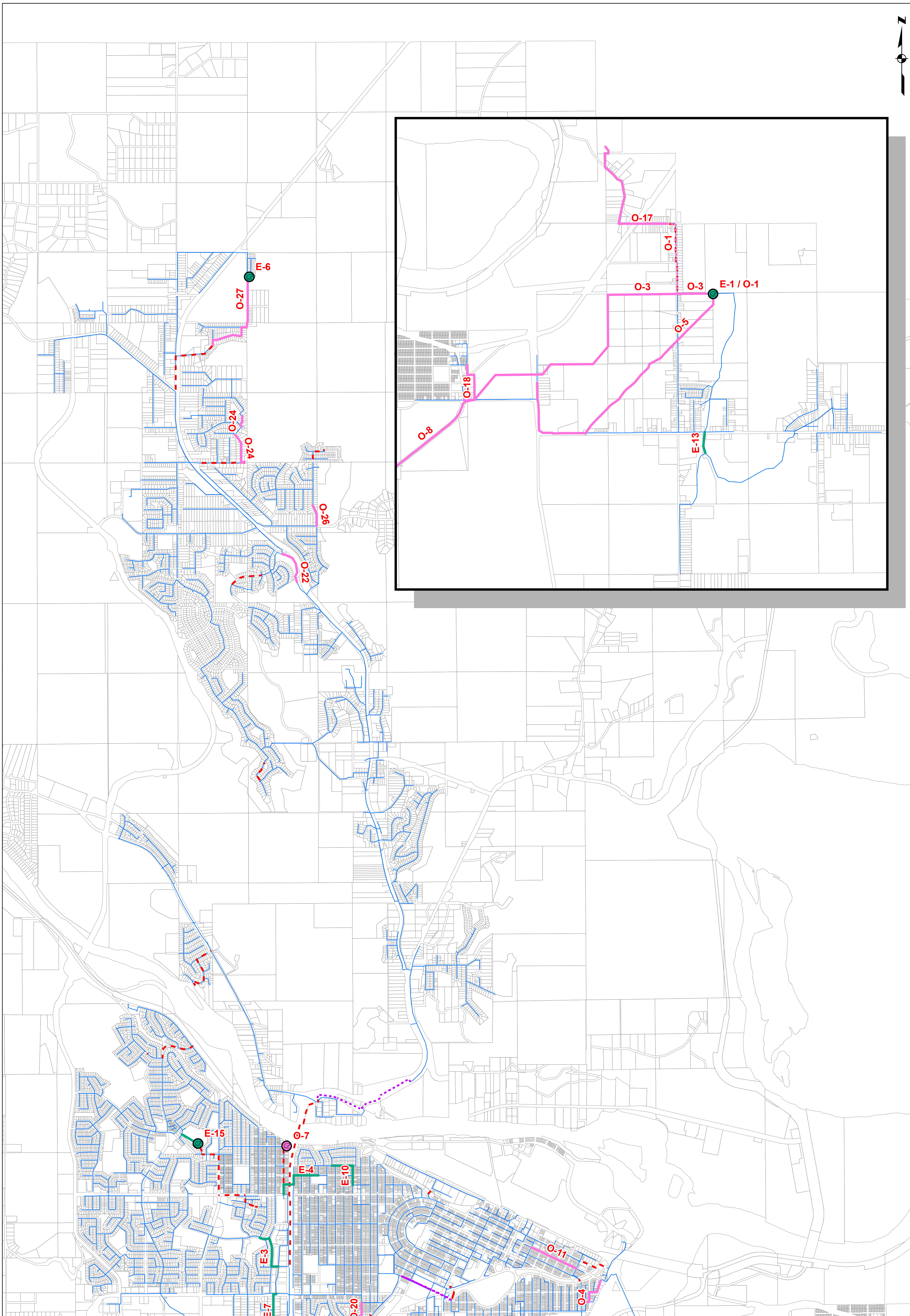
With the aid of the updated hydraulic model the City will be in a stronger position to plan capital works and respond to queries from developers. Going forward, the following is a list of recommendations for the City with respect to I&I, sewer system capacity and sewer model maintenance:

- Over 43 km of sanitary sewer improvements (mostly pipe upsizing) are recommended to improve pipe capacities and reduce surcharging and flooding. Individual projects have been prioritized based on the risk associated with each;
- The City should begin I&I Management Plans and flow monitoring for Blackburn and the area south of Highway 16 and Cowart Rd. Results from these programs should be used to further calibrate the model in localized catchment areas, and refine GWI and RTK parameters. For the I&I estimates, the RTK parameters and more specifically the “R” parameter has a significant impact on RDII volumes/flows therefore further calibration in un-metered areas would be beneficial. If I&I can be reduced in the existing system or future development, capital improvements could potentially be reduced;
- The City should visit all the manholes where flooding and surcharging is predicted by the model, to observe if evidence of surcharging exists and determine whether the priorities within the capital plan need to be adjusted accordingly;
- The City should develop a Siphon Maintenance Program to ensure all siphons are cleaned to maintain sufficient capacity for peak flows;
- The City should allocate additional resources to its Source Control Program to reduce maintenance issues; and
- Pump Station PW125 does not have sufficient capacity for the modelled PWWF in the existing scenario. Rather than upgrade or replace the pump station, the City should decommission the station and convey the flow by a gravity trunk sewer through the future Ospika South neighbourhood;

All together a total of $65.5M of sanitary system capital improvements, including new and replacements sewers, siphons, pump stations and forcemains are recommended for the City. Approximately 30% ($18.3M) is attributed to existing system improvements while the remaining 70% ($47.2M) is attributed to future OCP improvements as indicated in ***Table ES-1***. The locations of the proposed upgrades are shown in ***Figure ES-1*** and ***Figure ES-2***; and details for each project are provided in ***Table ES-2*** and ***Table ES-3***.

Table ES-1 – Sanitary System Improvement Costs

Scenario	Total Length of New or Upgraded Pipe (km)	Total Pump Station Upgrades	Total Number of Projects	Total Capital Cost
Existing	11.6	4	19	$18.3M
OCP	31.9	4	29	$47.2M
Total	43.5	8	48	$65.5M



Sanitary Master Plan

CITY OF PRINCE GEORGE

Project No. 60305337

Date May 2017

Legend

Existing Upgrades

- Short Term Required Upgrades

OCP Upgrades

- Long Term Required Upgrades
- Required New Forcemains - OCP
- Existing PS Upgrade
- OCP PS Upgrade
- Existing Forcemains
- Existing Siphons
- Existing Gravity Sewers

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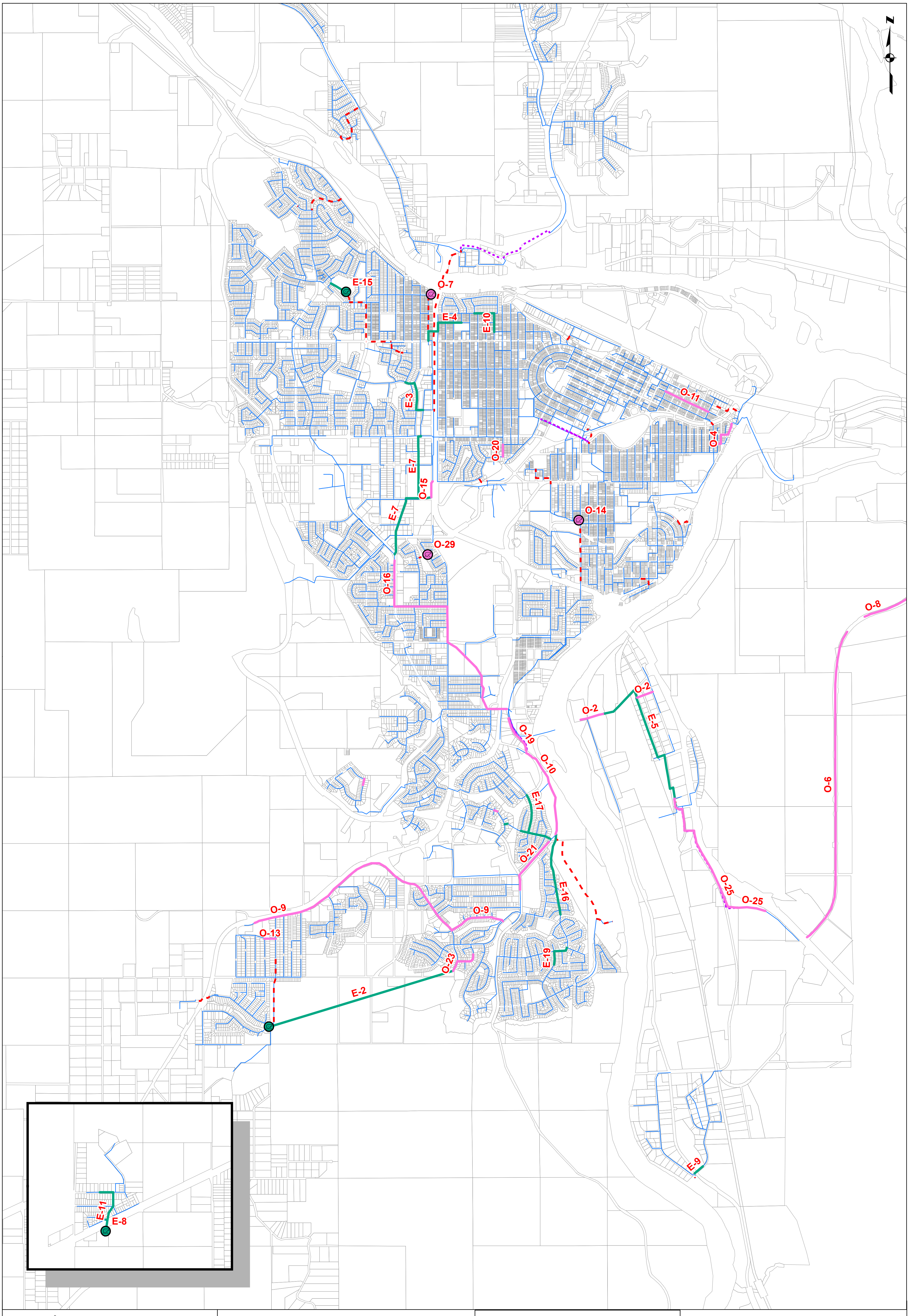
0 500 1,000 Meters

Recommended Upgrades (North and East PG)

FIGURE ES-1



CITY OF PRINCE GEORGE	Sanitary Master Plan	
Project No. 60305337	Date May 2017	

Legend

Existing Upgrades
- Short Term Required Upgrades

OCP Upgrades
- Long Term Required Upgrades
- Required New Forcemains - OCP

- Existing PS Upgrade
- OCP PS Upgrade
- Existing Forcemains
- Existing Siphons
- Existing Gravity Sewers

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0 500 1,000 Meters

Recommended Upgrades (South PG)

FIGURE ES-2

Table ES-2 - Short Term Upgrades

Project ID	Project Description	Probability of Failure: Capacity Deficiency	Probability of Failure: Asset Age	Probability of Failure: Known Service Issue	Consequence of Failure: Failure Severity (Size & Material)	Consequence of Failure: Restricts Development	Consequence of Failure: ICI Impact	Consequence of Failure: Environmental Impact	Consequence of Failure: > 5000 PE Impact	Risk Score	Length	Model ID	Existing Dia. (mm)	Proposed Diameter (mm)	Capital Cost
E-1	Replace PW115 with 100 L/s firm capacity pump station, expandable to 375 L/s firm capacity	✔✔		✔	✔	✔✔		✔	✔	141	-	PW115	-	-	$ 2,000,000
E-2	Decomission existing pump station PW125, construct new 2297 m, 300 mm dia. gravity sewer from PW125 to Southridge Dr.	✔✔			✔	✔✔	✔	✔	✔	124	2,297	CDT-119	-	300	$ 2,595,610
E-3	Replace 331 m of existing 300 mm sewer with 375 mm on Ahbau between Rainbow and Chilako Replace 65 m of existing 200 mm sewer with 375 mm on Chilako between Ahbau and Commercial Replace 112 m of existing 250 mm with 375 mm on Rainbow between Kerry and Ahbau	✔✔	✔	✔	✔	✔✔	✔		✔	84	526	6047 7331 9547 9548 7211 6046 6049	300 300 300 300 200 250 250	375 375 375 375 375 375 375	$ 669,224
E-4	Replace 283 m of 200 mm with 300 mm on 3rd Ave., between Harper and Central Replace 217 m of existing 200 mm sewer with 300 mm at Central and 5th Replace 112 m of existing 200 mm sewer on Kelly, north of 5th	✔✔	✔	✔		✔	✔			70	612	7560 7562 7564 7563 388 7527	200 200 200 200 200 200	250 250 250 250 300 300	$ 660,743
E-5	Replace 2,018 m of existing 200 mm and 250 mm sewer with 525 mm, 600mm, and 675 mm sewer downstream of PW123 Replace 52 m of existing 200 mm dia. upstream of PW123 with 250 mm dia.	✔✔				✔✔	✔			61	2,070	10262 10266 10267 10268 10269 10271 10272 10273 10274 10275 10276 10277 10579 3233 3242 3262 3271 3272 3273 3232	200 200 200 200 200 200 200 200 200 200 200 200 200 200 250 250 250 250 250 200	600 525 525 525 525 525 525 525 525 525 525 525 600 600 750 675 750 750 675 250	$ 3,472,903
E-6	Replace pump station PW126 with new 60 L/s firm capacity station	✔✔			✔	✔✔				59	-	PW126	-	-	$ 600,000
E-7	Replace 405 m of existing sewers on 15th Ave. and Lyon with new 450 mm sewer	✔				✔✔	✔		✔	58	1,746	10469 10470 9392	375 375 375	450 450 450	$ 3,194,286
	Replace 586 m of existing 375 mm sewer on Lyon between 15th and 22nd with 525 mm and 600 mm	✔✔			✔	✔✔	✔		✔			9393 9394 9390 9379 9375 9372	375 375 375 375 375 375	450 450 450 450 450 450	
	Replace 532 m of existing sewers on 22nd and Nicholson with new 750 mm sewer	✔✔				✔	✔		✔			914 9366 9367 6764 9370 9374 6713	600 600 600 525 600 600 600	750 750 750 750 750 750 750	
	Replace 476 m of existing 600 mm sewer with 900 mm on Nicholson between 22nd and Ospika	✔✔			✔	✔✔	✔		✔			9359 9358 9353 9350 9349 9347	600 600 600 600 600 600	900 900 900 900 900 900	
E-8	Replace pump station PW119 to with new 30 L/s firm capacity station	✔✔			✔	✔✔				58	-	PW119	-	-	$ 300,000
E-9	Replace 126 m of existing 200 mm sewer with 300 mm sewer on Penn Rd. east of Willow Cale	✔✔				✔✔	✔			54	126	10557 10555	200 200	300 300	$ 142,711
E-10	Replace 196 m of existing 250 mm sewer on 2nd between Freeman and Douglas with 300 mm Replace 223 m of existing 250 mm with 300 mm on Douglas between 2nd and 4th	✔		✔		✔				54	196 223	7596 7599 9471 10475	250 250 250 250	300 300 300 300	$ 473,792
E-11	Replace 158 m of existing 150 mm with 200 mm on Corral, west of Western Replace 20 m of existing 150 mm sewer at Cinch Loop and Highway 16 with 200 mm Replace 472 m of existing 150 mm and 200 mm sewer upstream of PW119 with 250 mm and 300 mm	✔✔		✔		✔✔				53	650	17 5552 5538 19 13 10430 10431 5536	150 150 150 200 150 200 200 150	200 200 200 250 250 300 300 300	$ 691,327
E-12	Replace 249 m of existing 250 mm sewer south of Giscome and east of Blackburn with 300 and 375 mm	✔				✔✔	✔			53	249	5976 5046 6590	250 250 250	300 300 375	$ 286,129
E-13	Replace 237 m of existing 250 mm sewer on 2nd between Freeman and Douglas with 300 mm Replace 223 m of existing 250 mm with 300 mm on Douglas between 2nd and 5th	✔	✔	✔		✔				41	460	7594 7596 7599 9471 10475	250 250 250 250 250	300 300 300 300 300	$ 520,166
E-14	Replace 214 m of existing 300 mm sewer upstream of PW106 with 375 mm	✔		✔	✔	✔				41	214	7065 7707 8623 8624 10291	300 300 300 300 300	375 375 375 375 375	$ -
E-15	Add third pump to PW106 to increase firm capacity to 80 L/s	✔✔			✔					41	-	PW106	-	-	$ 100,000
E-16	Replace 981 m of existing 250 mm and 300 mm sewer on Gladstone and east of Simon Fraser with 375 mm	✔			✔	✔✔			✔	39	981	3554 3089 3552 8769 8770 6134 6135 6137 6144 6150 6154 6159 6163 3103	300 300 300 300 300 300 250 250 250 250 250 250 250 250	375 375 375 375 375 375 375 375 375 375 375 375 375 375	$ 1,248,272
E-17	Replace 558 m of existing 200 mm sewer with 250 mm on Simon Fraser between Cowart and Rideau Replace 275 m of existing 200 mm and 250 mm sewer on Rideau between Trent and Brock with 300 mm	✔				✔✔				38	833	6179 6173 5942 5930 5907 5897 5892 5891 5888 6170	200 200 200 200 200 200 200 250 250 250	250 250 250 250 250 250 250 300 300 300	$ 897,165
E-18	Replace 36 m of existing 200 mm sewer with 250 mm on McGrath at Moriarty	✔								37	36	5900	200	250	$ 37,800
E-19	Replace 179 m of 250 mm dia. gravity sewer on Gladstone and east of Simon Fraser with 300 mm dia. Replace 158 m of 250 mm dia. gravity sewer on Loyola, south of Gladstone with 300 mm dia.	✔				✔✔			✔	36	336	2633 2637 5618 5608 5520	250 250 250 250 250	300 300 300 300 300	$ 380,018

Table ES-3 - Long Term Upgrades

Project ID	Project Description	Probability of Failure			Consequence of Failure					Risk Score	Length	Model ID	Existing Dia. (mm)	Proposed Diameter (mm)	Capital Cost	Upstream Equivalent Population Growth Trigger
		Capacity Deficiency	Asset Age	Known Service Issue	Failure Severity (Size & Material)	Restricts Development	ICI Impact	Environmental Impact	> 5000 PE Impact							
O-1	Upgrade PW115 to 300 L/s firm capacity and twin existing 1,333 m 300 mm dia. forcemain with a 450 mm forcemain	✔✔					✔	✔		412	-	PW115	-	-	$ 1,956,240	8640
											1,333	47	300	525		
O-2	Replace 203 m of existing 200 mm sewer between Great and Eastern with 525 mm to service ALI flows	✔✔				✔	✔	✔		156	203	10258	200	525	$ 793,294	2934
												10259	200	525		
	Replace 274 m of existing 250 mm, 300 mm, 350 mm upstream of the BCR lagoon with 525 mm and 900 mm sewer.										274	3270	250	525		
												3269	250	525		
												10763	300	525		
												10762	350	900		
O-3	Replace 427 m of existing 250 mm sewer on Mackus Rd. with 450 mm	✔✔				✔	✔			131	427	8798	250	450	$ 5,526,739	1959
												7185	250	450		
												7188	250	450		
												7207	250	450		
												10278	250	450		
	Construct new 525 mm gravity trunk sewer from Boeing Rd. and Sabre Rd. to Blackburn and Mackus Rd.										3,177	CDT-135	-	525		
O-4	Replace 421 m of existing sewer on Taylor, 15th, Ash, and 16th with 250 mm and 300 mm	✔✔		✔		✔✔		✔		91	421	8886	200	250	$ 464,858	516
												8885	200	250		
												8876	200	300		
												8875	200	300		
												10488	200	300		
												8879	200	300		
												8884	200	300		
O-5	Replace 550 m of existing 250 mm sewer on Old Cariboo, north of Giscome	✔✔				✔	✔			84	550	6766	200	250	$ 4,879,084	807
												6754	200	250		
												6738	250	450		
												6714	250	450		
												10546	250	450		
												10547	250	450		
	Replace 544 mm of existing 250 mm sewer on Giscome Rd.										544	6595	250	450		
												6575	250	450		
												6576	250	450		
												6567	250	450		
												6570	250	450		
												6571	250	450		
												6572	250	450		
	Replace 2,215 m of existing 300 mm dia. sewer between Giscome Rd. and PW115										2,215	6618	300	450		
												6643	300	450		
												6710	300	525		
												6676	300	525		
												6731	300	525		
												6753	300	525		
												6757	300	525		
												6767	300	525		
												6827	300	525		
												6881	300	525		
												6897	300	525		
												6915	300	525		
												6904	300	525		
												6659	300	525		
												6083	300	525		
												6852	300	525		
												6854	300	525		
												6002	300	525		
												6008	300	525		
												6966	300	525		
												6974	300	525		
												7103	300	525		
												7129	300	525		
												10280	300	525		
												10279	300	525		
O-6	Replace 3800m of existing 200mm, 250mm, and 300mm with 250mm, 375mm, and 450mm pipe on Boundary Rd.	✔✔			✔	✔	✔			82	3,799	11062	200	250	$ 4,846,159	4561
												11063	200	250		
												11064	200	250		
												11065	200	250		
												11066	200	250		
												11067	200	375		
												11068	200	375		
												11069	200	375		
												11070	200	375		
												11071	200	375		
												11072	200	375		
												11054	250	375		
												11055	250	375		
												11056	250	375		
												11057	250	375		
												11058	250	375		
												11059	250	375		
												11060	250	375		
												11061	250	375		
												11053	300	450		
												11052	300	450		
												11051	300	450		
												11050	300	450		
												11049	300	450		
												11048	300	450		
												11047	300	450		
												11046	300	450		
												11045	300	450		
O-7	Upgrade pump station PW112 to 20 L/s firm capacity	✔✔						✔		75	-	PW112	-	-	$ 100,000	806
O-8	Replace 2134m of existing 200mm, 250mm, and 300mm on Boundary Rd. with 250mm, 300mm, 450mm, and 525mm pipe.	✔✔				✔	✔			73	2,134	11073	200	250	$ 2,580,675	7678
												11074	200	300		
												11075	200	300		
												11076	200	300		
												11077	200	300		
												11078	250	300		
												11079	250	300		
												11080	250	300		
												11081	250	300		
												11082	250	300		
												11083	250	300		
												11084	250	300		
												11085	250	300		
												11086	300	450		
												11087	300	525		
												11088	300	525		
												11089	300	525		
												11092	300	525		
O-9	Replace 1,790m of existing 200 mm, 250 mm, and 300 mm sewer on Highway 16 with 300 mm and 375 mm	✔✔		✔	✔	✔	✔		✔	67	1,790	3061	200	300	$ 5,014,806	1283
												5778	200	375		
												5780	200	375		
												3064	200	375		
												5794	250	375		
												2939	250	375		
												3362	250	375		
												2783	300	375		
												2784	300	375		
												6092	300	375		
												2786	250	375		
												2787	250	375		
												6101	250	375		
												6124	250	375		
												6133	250	375		
												6138	250	375		
												6143	250	375		
												6146	250	375		
												6147	250	375		
												6145	250	375		
	Replace 1,123 m of existing 250 mm and 300 mm sewer on Marleau and Southridge with 375 mm and 525 mm										1,123	6136	250	375		
												6140	250	375		
												6132	300	525		
												6126	300	525		
												6123	300	525		
												2827	300	525		
												2821	300	525		
												3367	300	525		
												2816	300	525		
												9205	300	525		
												9201	300	525		
												2808	300	525		
												9212	300	525		
												9213	300	525		
	Replace 677 m of existing 250 mm and 300 mm sewer on St. Anne with 525 mm sewer										677	5883	300	525		
												2752	300	525		
												5782	300	525		
												5784	300	525		
												2753	300	525		
												2754	300	525		
												5788	300	525		
												2747	250	525		
												2755	250	525		
												2832	300	525		

Project ID	Project Description	Probability of Failure			Consequence of Failure					Risk Score	Length	Model ID	Existing Dia. (mm)	Proposed Diameter (mm)	Capital Cost	Upstream Equivalent Population Growth Trigger
		Capacity Deficiency	Asset Age	Known Service Issue	Failure Severity (Size & Material)	Restricts Development	ICI Impact	Environmental Impact	> 5000 PE Impact							
O-10	Replace 1,105 m of existing 600 and 675 mm sewer upstream of College Siphon with 675 mm, 750 mm, and 900 mm	✔✔				✔		✔	✔	65	1,105	3351 5903 5937 6175 9127 9105 9104 6221 6247 9097 9096 9095 9094	610 610 610 610 610 610 686 686 686 686 686 686 686	675 675 675 750 750 750 900 900 900 900 900 900 900	$ 2,338,961	19275
O-11	Replace 568 m of existing 200 mm sewer with 250 mm on 3rd between Ontario and London	✔		✔		✔✔	✔			62	568	7329 7309 7282 7253 7238 7178	200 200 200 200 200 200	250 250 250 250 250 250	$ 596,865.15	50
O-12	Replace 74 m of existing 525 mm sewer on Maurice, south of Chancellor with 675 mm sewer	✔✔				✔				62	74	11016	525	675	$ 138,932	20127
O-13	Replace 131 m of existing 200 mm sewer with 250 mm on Deer Rd.	✔✔		✔		✔	✔			59	131	5650 2963	200 200	250 300	$ 144,020	1368
O-14	Upgrade PW101 to 250 L/s firm capacity	✔✔					✔			55	-	PW101	-	-	$ 200,000	15840
O-15	Replace 198 m of existing 600 mm sewer with 750 mm on Central between 20th and 22nd	✔			✔	✔	✔		✔	52	198	9376 9377	600 600	750 750	$ 397,015	2702
O-16	Replace 2615 m of existing 750 mm sewer with 900 mm on Ospika, Pinewood, Westwood, and Wiebe	✔				✔✔	✔		✔	52	2,615	9343 9344 9345 9346 9351 9300 9352 9301 6446 6447 6449 6450 6451 9622 9285 9286 6383 5958 6366 6367 6358 6347 5486 5482 6341	750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750	900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900	$ 6,569,417	30482
	Replace 217 m of existing 750 mm sewer on Vance with 1050 mm										217	6328 6330 6331 6332	750 750 750 750	1050 1050 1050 1050		
	Replace 20 m of existing 750 mm with 1350 mm on Vance										20	6333	750	1050		
O-17	Replace 1,579 m of existing 400 mm and 450 mm sewer downstream of PW115 with 525 mm and 600 mm	✔				✔	✔		✔	52	1,579	7200 7201 7202 7203 7205 7204 7378 7545 7570 7576 7607 7617 7655 7674 7685 7705 7706 7066 7723 7724 5501 5607	400 400 450 450 450 450 400 400 400 400 400 400 450 450 450 450 450 450 450 450 450 450	525 525 525 525 525 525 525 525 525 525 525 525 525 525 600 600 600 600 600 600 600 600	$ 2,513,729	14536
O-18	Replace 602 m of existing 200 mm sewer at Boundary and Boeing with 300 mm and 375 mm sewer	✔✔				✔	✔			51	602	6895 6844 6829 6830 5518 6750 6729 6728	200 200 200 200 200 200 200 200	300 300 300 300 300 300 300 375	$ 685,987	1969
O-19	Construct new 350 mm siphon parallel to existing College Heights siphon	✔✔								49	465	-	-	350	$ 530,100	44928
O-20	Replace 145 m of existing 200 mm sewer on Carney with 250 mm	✔		✔		✔				48	145	6950	200	250	$ 152,561	308
O-21	Replace 709 m of existing 600 and 675 mm sewers along Domano and east of Trent with 675, and 750 mm	✔✔				✔			✔	45	709	6121 6127 9135 6139 6148 6152 6157 6162	600 600 600 600 600 600 600 610	675 675 675 750 750 750 750 750	$ 1,400,470	29523
O-22	Replace 421 m of existing sewer on Hart Highway between Austin and Telford with new 600 mm sewer	✔				✔			✔	42	421	8219 8217 8206 8193 8178 7090	525 525 525 525 525 525	600 600 600 600 600 600	$ 712,060	114
O-23	Replace 133 m of 300 mm sewer with 450 mm on Southridge, south of St. Mary	✔				✔				40	130	5837	300	450	$ 538,803	15184
	Replace 252 m of existing 200 mm and 350 mm sewer on St. Mary with 450 mm										252	2863 2867 2840	350 350 200	450 450 450		
O-24	Replace 521 m of existing 200 mm and 250 mm sewer on Pearl Dr. and Sapphire Cres. With new 250 mm and 300 mm sewer	✔				✔✔				35	521	9838 9839 8388 8370 8369 9831 9830 9648 9649	200 200 200 250 250 250 250 200 200	250 250 250 300 300 300 300 300 300	$ 578,365	238
O-25	Construct new 250 mm siphon parllel to existing Boundary Rd. siphon	✔				✔	✔			33	1,689	6588	-	250	$ 1,857,149	12482
	Replace 330 m of existing 375 mm sewer upstream of the Boundary siphon with 600 mm										330	CDT-77 CDT-75 CDT-73	375 375 375	600 600 600		
O-26	Replace 246 m of existing 250 mm sewer on Dawnson between Barr and Austin with new 300 mm sewer	✔				✔				33	246	8307 9791 9792	250 250 250	300 300 300	$ 278,017	1201
O-27	Replace 1,147 m of existing 200 mm and 250 mm sewers on Estavilla, Glendale, and Wapiti with 250 mm and 300 mm	✔				✔✔				31	1,147	8497 8498 8500 8501 8503 8504 8502 8506 8507 8515 8523 8533 8534 10413 8537 8546 8547	200 200 200 200 200 200 250 250 250 250 250 250 250 250 250 250 200	250 250 250 250 250 250 250 250 250 300 300 300 300 300 300 300 300	$ 1,251,990	1658
O-28	Replace 42 m of existing 200 mm sewer on Moriarty with 250 mm	✔				✔				30	42	5933	200	250	$ 43,919	181
O-29	Upgrade PW109 to 15 L/s firm capacity	✔					✔			23		PW109	-	-	$ 100,000	1440

1 Introduction

1.1 Overview

The City of Prince George is anticipating growth over the next 20 years. To assist with planning for this growth, the City is updating their Sanitary Master Plan that will be used for development of a Capital Expenditure Program and outlining O&M budgets. The previous master plan was completed in 2001 and included use of a hydraulic model (Hydra and later converted to InfoSewer in 2006). The City retained AECOM to develop a new hydrodynamic (flow hydrology + hydraulics) model for the City's sanitary sewer system. The new model includes the City's entire sanitary sewer system, with the exclusion of service laterals and private systems.

The City has a population of approximately 76,000 residents based on 2010 BC Stats and is projected to grow to between 78,900 and 90,200 by 2025. The existing sewer system includes 32 lift stations, over 430 km of sanitary sewers, and approximately 18 km of forcemains. Sewage is treated and discharged at five locations. The Landsdowne Waste Water Treatment Centre (WWTC) is the largest treatment location, treating over 80% of the City's total sewage. The Lansdowne WWTC discharges to the Fraser River. The other four treatment facilities are lagoons, treating sewage from smaller, remote catchments. ***Figure 1.1*** illustrates the City's existing sanitary sewer system.

1.2 Key Objectives

Generally, the objectives of this project are to:

1. Review the City's existing model and GIS Data;
2. Develop a new hydraulic model of the City's entire sanitary sewer system;
3. Prepare a flow monitoring plan and collect sanitary flow data from selected locations;
4. Calibrate and validate the model under existing land-use for dry & wet weather conditions (using recent flow monitoring data and pump station SCADA data);
5. Develop various "modelling scenarios" to reflect the City's existing land-use and OCP planning projections;
6. Assess the performance of the sewer system (local sewers, trunks, pump stations and forcemains) under existing and future land-use conditions; identify hydraulic constraints; and recommend system improvements; and
7. Perform a risk and criticality assessment for the recommended system improvements and use this to prioritize capital projects

1.3 Past Technical Memorandum

Previous to this report, a memo 'Technical Memorandum – Model Development and Calibration', dated November 14, 2014, was prepared. Key information from this Technical Memorandum has been extracted, updated, summarized, and incorporated into this report. A full copy of the Memorandum and its associated tables, figures and appendices is included in ***Appendix F***.

1.4 Key Terms and Abbreviations

A list of key terms and abbreviations along with their definitions is presented in ***Table 1.1***.

Table 1.1 – Key Terms and Abbreviations

Term	Definition
Average Dry Weather Flow (ADWF)	The lowest 24-hour average sanitary flow value during a 7-day period of dry weather. The sanitary flow is composed of base sanitary flow plus groundwater infiltration (ADWF = BSF + GWI).
Base Sanitary Flow (BSF)	All wastewater flow from residential, commercial, industrial and institutional sources that the sanitary sewer system is intended to carry. (BSF = ADWF – GWI)
Diurnal Pattern	Pattern describing the variance in sewage flows over a day
Groundwater Infiltration (GWI)	Groundwater infiltration that enters the sanitary sewer system during dry weather periods; through breaks, cracks, misaligned joints, tree root punctures and manhole joints and covers. In general, GWI = 70 - 85% of minimum night-time flow.
Hydraulic Grade Line (HGL)	The maximum level of water in the pipe system, calculated as the height that liquid will rise in a piezometer using the Bernoulli's Equation
Inflow	Stormwater that enters the sewer through direct connections (i.e. CB leads or roof drains connected to the sanitary sewer)
Inflow and Infiltration (I&I)	The total inflow and infiltration that enters the sanitary sewer system from all sources, equal to GWI + RDII
Peak Dry Weather Flow (PDWF)	Peak instantaneous sanitary flow value during dry weather conditions (peak of the diurnally varying BSF plus normal GWI).
Peak Wet Weather Flow (PWWF)	Maximum instantaneous sanitary flow value. It represents all flow contributions carried by the sanitary sewer system (equals PDWF + RDII).
Rain Dependent Inflow and Infiltration (RDII)	All stormwater inflow (see above) into the sanitary sewer system plus increase in GWI that occurs directly due to the influence of rainfall
RTK	A synthetic unit hydrograph technique used by InfoSWMM and SSOAP to quantity and simulate RDII. The R parameter is the fraction of rainfall volume entering the sewer system as RDII, T is the time to peak, and K is the recession time/ratio
Sanitary Sewer Overflow (SSO)	Non-frequent occurrence when sewage backs-up, surcharges and overflows from the municipal sewer system.
Sanitary Sewer Overflow Analysis and Planning (SSOAP)	A software program / toolbox developed by the US EPA. The software is used to quantify RDII using a hydraulic approach and RTK method.

1.5 References

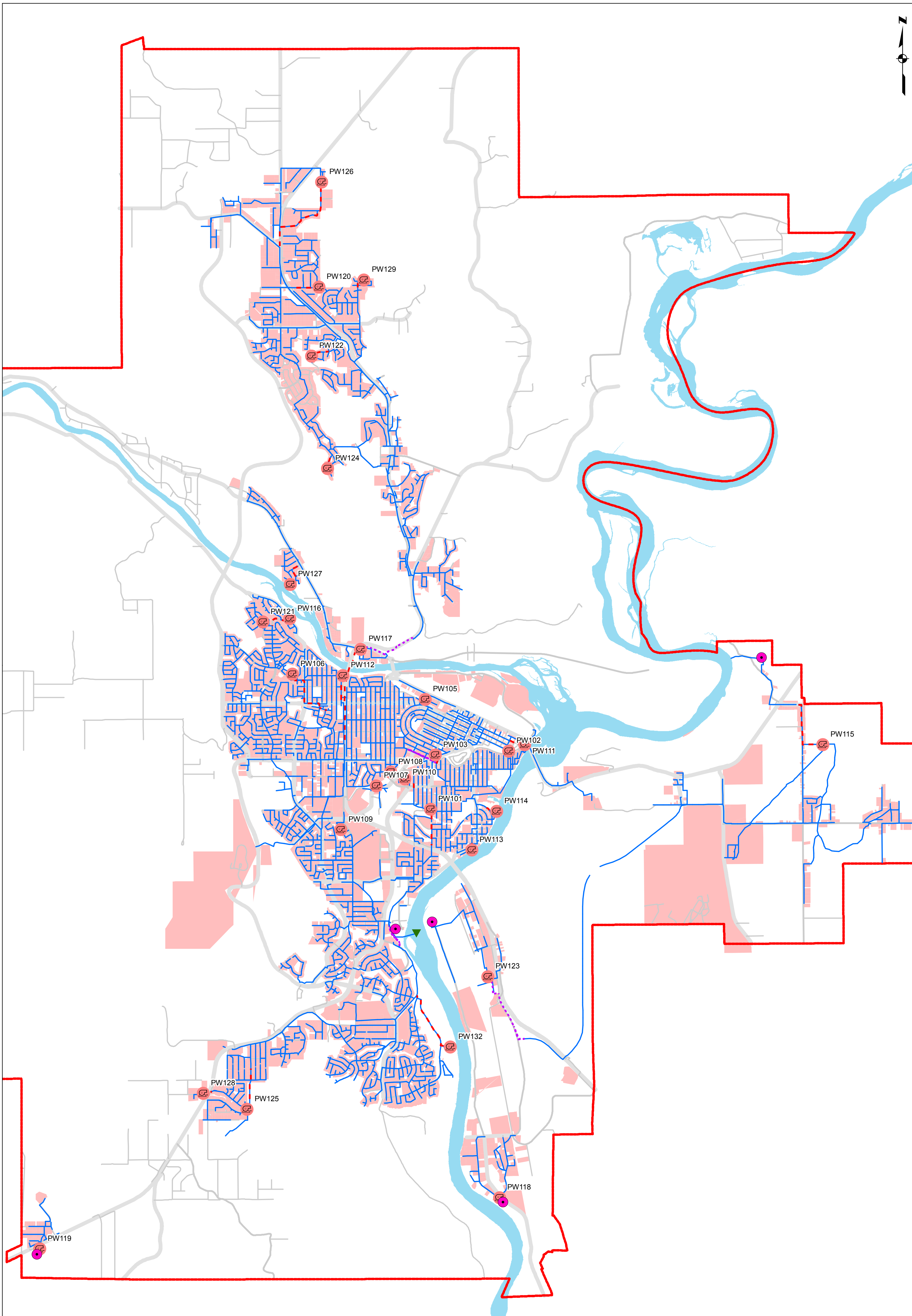
The following reports and documents were referenced during the completion of this report:

Neighbourhood Plans:

- *Airport Light Industrial Plan*. L&M Engineering Ltd.. September 2008
- *Crescents Neighbourhood Plan*. City of Prince George. November 2003
- *Fraser River Bench Lands Neighbourhood Plan*. L&M Engineering Ltd.
- *Glenview Crescents Neighbourhood Plan*. L&M Engineering Ltd.. April 2011
- *Golf Course – Pine Centre Neighbourhood Plan*. Site 360. October 2010
- *Ospika South Neighbourhood Plan*. Eric Vance & Associates. November 2006.
- *Wessner Heights Development Neighbourhood Plan and Conceptual Servicing Report*. L&M Engineering, June 2004.
- *University Heights Neighbourhood Plan.* L&M Engineering Ltd., October 2007.

Reports:

- *East Prince George and Airport Light Industrial Lands Sewer Servicing Alternative Review*. Opus Dayton Knight. April 2011
- *Prince George – 2001 Sanitary Sewer Study*. McElhanney. June 2002
- *Prince George Golf and Curling Club Lands Preliminary Servicing Assessment*. McElhanney Consulting Services Ltd. May 2010



CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No. 60305337

Date August 2017

Legend

- Treatment Facilities
- Lift Station
- Outfall
- Existing Forcemains
- Existing Siphons
- Existing Gravity Sewers
- Municipal Boundary
- Serviced Parcel
- River

AECOM

0 1,000 2,000 Meters

Existing Modelled Sanitary Sewer System

FIGURE 1.1

2 Model Development & Calibration

2.1 Software Selection

InfoSWMM Suite (version 12.0) modeling software was selected for development of the new sanitary sewer model. InfoSWMM is a GIS based SWMM software that utilizes the US EPA's SWMM 5.0 engine. The software is fully integrated with ArcGIS.

The City currently has an InfoSewer software license. AECOM recommended upgrading to InfoSWMM, which is a more advanced software application. Some of the key benefits of InfoSWMM compared to InfoSewer include:

- The ability to model backwater conditions;
- The ability to model pump stations with multiple pumps;
- Has the capability to do stormwater modelling in addition to sanitary sewer modelling;
- Uses dynamic wave routing for flow calculations; and,
- Uses the 'RTK' approach for inflow and infiltration modelling.

Additionally, InfoSWMM was recommended over similar SWMM based modelling applications for its compatibility with InfoSewer, which the City's existing model was built in InfoSewer and its direct integration with ArcMap.

The City will be able to utilize InfoSWMM for other studies such as Real Time Control studies for operations of pump stations. Additionally, if permanent flow monitoring stations are installed by the City, additional calibration and validation can be completed.

2.2 Previous Model & GIS Integration

The City has an existing sanitary model built in InfoSewer. This model was used as the main source of data, for both infrastructure and hydraulic information, in building the new model in InfoSWMM. The steps taken to convert the model from InfoSewer to InfoSWMM are outlined below.

- Exported all modeling elements from InfoSewer (manhole, pipe, pump, wetwell) into a shapefile, including all relevant hydraulic information.
- Imported all modeling elements, including all relevant hydraulic information into InfoSWMM.
- Calculated the upstream/downstream pipe offset based on the upstream/downstream invert level information available in InfoSewer.

- Transferred the pump on/off and design point information. For the calibrated pump stations, pump curve information was incorporated in the InfoSWMM model.
- Changed the manhole ID and pipe ID to reflect the latest IDs used by the City. The old IDs are kept in a separate column in the model.
- Incorporated four siphons in the system:
  - Downstream of PW117 (499 Tomlin Rd)
  - Hospital Siphon, east of University Hospital of Northern British Columbia
  - College Heights Siphon, off Cowart Road
  - Boundary Siphon, at Boundary Road and Cariboo Highway
- Incorporated additional infrastructure from the City's GIS network data, but missing from the InfoSewer model including:
  - Gravity sewer upstream of the Boundary Rd. siphon
  - Gravity sewers on Boundary Rd.
  - Gravity sewers on Links Dr. and McTavish Rd.
  - Gravity sewer between the Prince George Golf & Curling Club and the Pine Centre Mall
  - Gravity sewer on Great St., north of Railway Rd.
  - Gravity sewers on St. Lawrence Ave., Grayshell Rd., and Eastview St.
  - Gravity sewers on Westmount Dr., Chartwell Ave., and Westgate Ave.
  - Gravity sewers on Greenforest Crescent
  - Fraser River Benchlands gravity sewer, lift station (PW132), and forcemain
  - Gravity sewer west of Domano Blvd. and Trent Dr.
  - Gravity sewer south of Tyner Blvd. and Baker Rd.
  - Gravity sewer north-east of Tyner Blvd. and Ospika Blvd.
- Identified and resolved data gaps and errors to fix connectivity, slope, elevation, and other hydraulic errors in the model.

There were some newly constructed sewers where data was not available from the existing model, GIS, or as-builts. In these areas the sewers were not added to the model, but the flows were assigned to the nearest downstream sewers. The model should be updated as data for new sewers becomes available. Some of these areas include:

- Highland Dr. and Wallace Crescent.
- Between John Hart Hwy. and Northwood Pulp Rd.
- South of Churchill Rd.
- North end of RecPlace Dr.
- Bearspaw Crescent
- New sewers in the University Heights area
- New sewers in the Ospika South area

2.3 Existing Residential Population and ICI Flow Allocation

Sewage flows were generated on a parcel by parcel basis such that each parcel/lot is its own sanitary catchment and was achieved using the following key information provided by the City in GIS shapefiles and excel spreadsheet format:

- Parcel fabric with a unique identifier (PID) for each parcel;
- Tract census polygon and associated population numbers;
- Landuse (zoning) information GIS data; and
- Geocoded 2012 water meter records for institutional, commercial and industrial (ICI) parcels.

Additionally a separate stormwater utility study done by AECOM was used to assist with determining the people per unit density for the Multi Family (MF) dwelling type. The steps taken in calculating and allocating residential population and ICI flow meter data are outlined below.

1. The parcels with fronting sewer pipes were selected as serviced parcels.
2. The serviced parcels were overlaid with the Zoning polygons to identify the type of users, i.e., residential (single family vs. multifamily), industrial, institutional or commercial (ICI).
3. The geocoded 2012 water meter records for ICI users were associated to the ICI parcels.
4. The residential serviced parcels were overlaid with the Tract census polygon hence for each census tract polygon the total residential population and the total number of single and multifamily parcels were identified.
5. Total number of units for each multifamily parcel was obtained from a separate stormwater utility study done by AECOM.
6. Assumption of 2 people per unit for the multifamily parcels was used to estimate total residential people at the multifamily dwellings/parcels.
7. To calculate the population density of the single family dwellings, the total population of multifamily dwellings was subtracted from the total population for each census tract. Each single family parcel within the same census tract was given the same level of population density. Average calculated population density for single family parcels was 2.8 people per parcel.

This approach allowed all information to be stored in GIS (parcel by parcel) including: area, land-use, residential population, and ICI water usage.

Table 2.1 shows the summary of residential population and estimated ICI sewage flow for each monitored pump station catchment area, the temporary metered areas and the remaining non-metered areas in the City. It should be noted that sanitary sewage associated with ICI users was assumed to be 80% of their water usage.

Once both residential and ICI flows were generated, the catchment (or parcel) was then automatically allocated to the nearest fronting sewer manhole and ultimately assigned to the upstream manhole of the sewer using tools within InfoSWMM. It should be noted that:

1. Residential population on the 2 circled areas shown in ***Figure 1.1*** was not allocated to the sanitary system since it was confirmed by the City that these areas are not serviced by the City's sanitary system.
2. An average flow of 5.8 L/s was added to a parcel upstream of PW117 (at 499 Tomlin Rd) to account for flow coming in from the Pacific Brewery.
3. An average flow of 2.2 L/s was added to account for flow pumped from the Prince George Airport.
4. The industrial areas north of Boundary Rd are not currently serviced by the City's sanitary system.

Table 2.1 - Residential Population and Estimated ICI Sewage Flow

Flow Monitoring Site	Area (Ha)	ICI Flow	Serviced Population		
		80%Water (L/s)	Single Family	Multi Family	Total
FM1	332.3	2.2	6,111	6	6,116
FM2	82.9	3.1	1,892	954	2,846
FM3	620.6	12.6	15,507	1,103	16,610
FM4	457.1	3.7	12,339	150	12,489
FM5	76.3	0.1	1,089	0	1,089
PW101	419.9	15.1	12,030	2,508	14,538
PW102	150.4	9.0	665	676	1,341
PW103	35.4	5.4	595	432	1,027
PW106	130.2	0.6	4,106	888	4,994
PW115	40.7	3.1	474	0	474
PW117	76.8	6.7	1,102	0	1,102
PW118	118.8	1.5	0	0	0
PW120	66.1	0.1	1,019	0	1,019
PW126	65.8	0.2	847	0	847
Unmetered Areas	298.8	6.1	4,810	60	4,870
Total	2,972.1	69.2	62,586	6,777	69,363

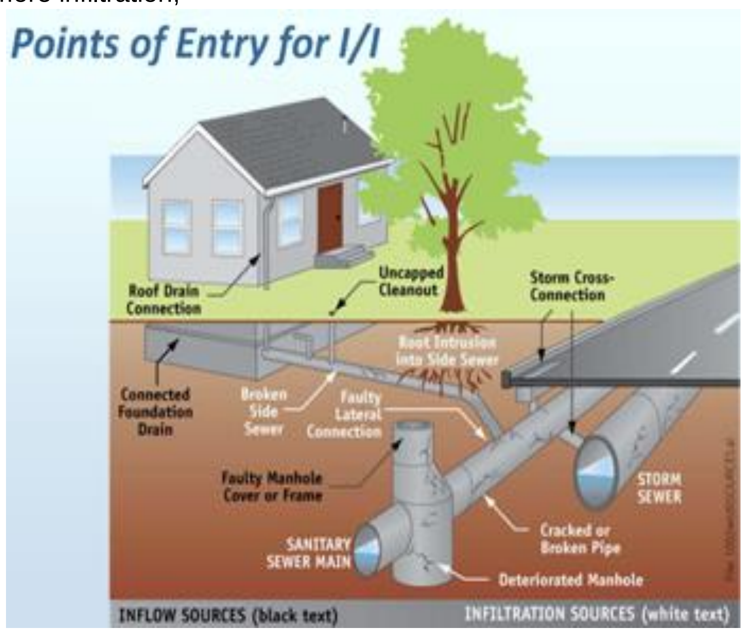
2.4 Residential Flow Generation

The residential flow was estimated using pump station and temporary flow monitoring data from dry weather periods. Through the calibration process (discussed further in ***Section 2.6.2***) we were able to determine the sewage flow rate (L/capita/day) for each of the 14 metered sites. For the rest of the system, where there was no flow monitoring data available, the neighbouring residential flow rate was applied to estimate the area's residential sewage flow.

2.5 Groundwater Infiltration

Groundwater infiltration (GWI) is the flow that enters the sewer system through holes in the sewers and manholes, misaligned joints and service laterals, outside of rainfall events. Determining the rate of GWI can be complicated and highly variable across the City because GWI varies with:

- pipe condition (e.g. cracks, holes and joint dislocations etc);
- joint type (e.g. gasketted joints to minimize infiltration);
- amount of pipe in the catchment (diameter and length), because the more pipe and surface area in contact with groundwater will result in more infiltration;
- depth of groundwater table relative to the sewer pipe;
- number of service connections, as more connections result in a higher rate of infiltration; and
- subsurface soil type and location of pipe relative to till/clay layers. If a pipe is at deeper depths and installed above an impermeable layer, the groundwater table is most likely above the pipe and can cause infiltration whereas a pipe installed at shallower depths in sandy soils will tend to have a groundwater table below the pipe since the material is free draining.



GWI rates were determined based on flow meter results and are presented in ***Table 2.2*** for the metered areas along with rates that were applied for the non-metered catchment areas.

2.6 Model Calibration

2.6.1 Data for Model Calibration

Model calibration plays an important role in developing a representative hydraulic model. The ability of the model to mimic the actual flow, velocity, head, and volume of the system depends highly on the accuracy of model calibration. Two types of data are required when performing model calibration: flow monitoring data and rainfall data.

Table 2.2 - Calculated Residential (Dry-weather) and GWI Rates (December 2013)

Flow Monitoring Site	Cumulative Area (Ha)	Cumulative Ave DWF (L/s)	Cumulative GWI (L/s)	Cumulative ICI Flow (L/s)	Cumulative Res Flow (L/s)	Cumulative Res Pop	Res Rate (Lpcd)	GWI Rate (L/ha/d)	Notes
FM1	464.2	21.9	7.6	2.4	11.9	7,983	128.6	1,415	
FM2	213.12	43.1	13.6	3.7	25.8	7,840	284.7	5,514	
FM3	1636.84	92.9	32	25.3	35.6	33,535	91.6	1,689	
FM4	457.1	41.2	10.4	3.7	27.1	12,489	187.5	1,966	
FM5	76.3	2.9	1.2	0.1	1.6	1,090	129.9	1,359	
PW101	605.67			29.5		16,906			Not Calibrated, observed inflow is unreasonable
PW102	150.4	17.3	6.5	9.0	1.8	1,341	113.7	3,734	
PW103	35.37			5.4		1,027			Not Calibrated, observed inflow is unreasonable
PW106	130.22	31.6	9.6	0.6	21.4	4,994	370.1	6,370	
PW115	117	5.2	1.8	3.1	0.3	1,563	14.2	1,329	Low Residential Rate
PW117	76.8	11.3	3.2	6.7	1.4	1,102	110.1	3,600	
PW118	118.8	1.9	0.5	1.4	N/A	0	N/A	364	
PW120	66.1	3.3	1.5	0.1	1.7	1,019	145.8	1,961	
PW126	65.8	3.3	1.5	0.2	1.6	848	166.2	1,970	

Flow Monitoring Data is required to provide sufficient flow data for the calibration and validation of the hydraulic model. For this study, the flow monitoring data used was obtained from 9 pump stations and 5 gravity monitoring points located throughout the City within the time period of November 2013 to May 2014. For the monitored pump stations, the inflow into the wetwell was calculated based on wetwell level fluctuation, pump on/off levels and wetwell dimension from record drawings.

Rainfall Data for the same period of time as the flow monitor data is required for calibration and validation of sanitary hydraulic models. The availability of flow data along with rain records serves as an essential tool to evaluate the condition of the system and its overall capacity. There were three rain gauge stations used during the calibration process: PW650 (Foothills Blvd), PW817 (Stauble Rd) and PW629 (Sintich Rd).

Figure 2.1 shows the locations of the 15 flow monitoring sites and the 3 rain gauges used during calibration and validation process.

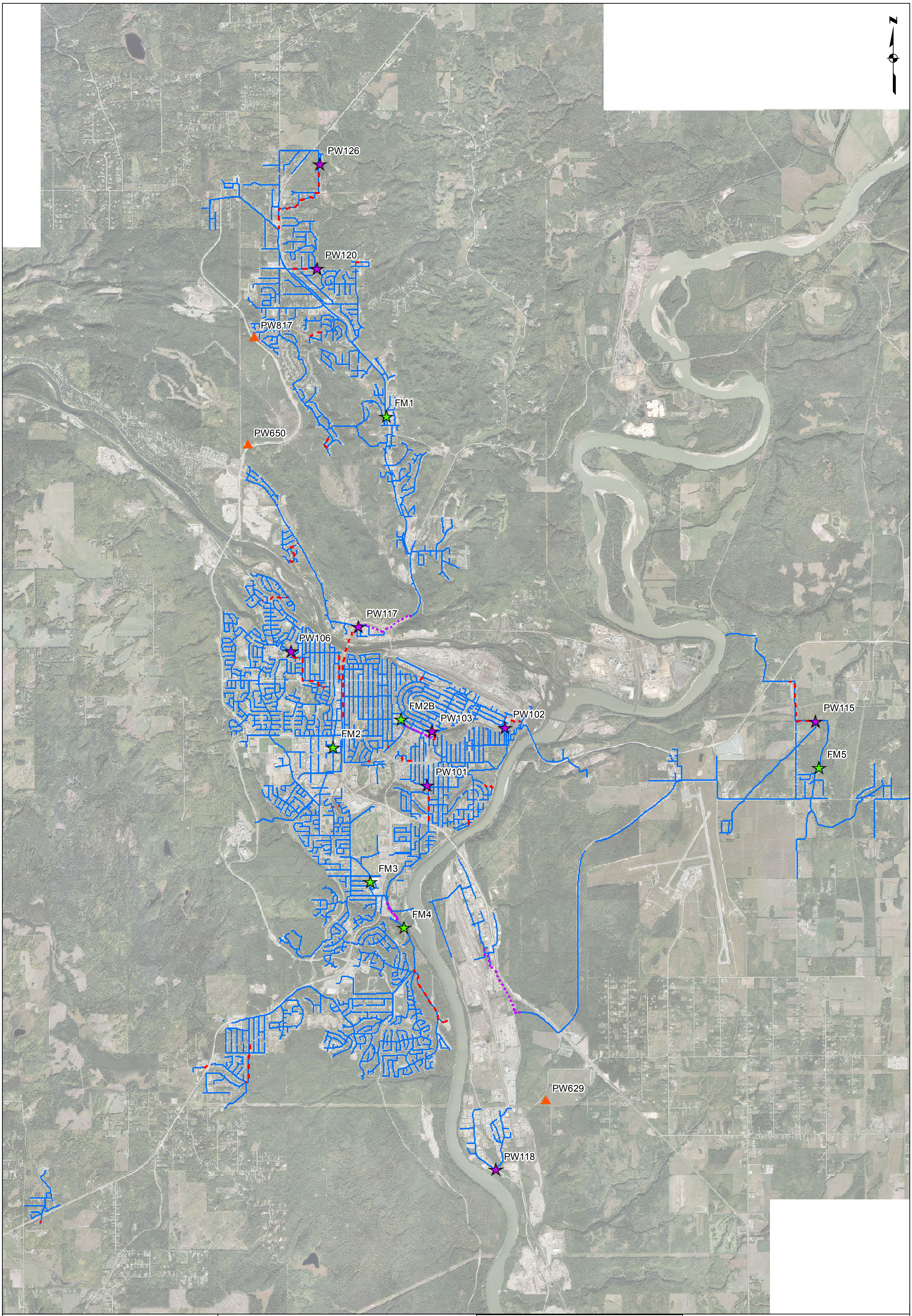
It should be noted that the inflow for PW101 (Victoria St/Milburn Ave) and PW103 (Victoria St/15th Ave) could not be calculated because the City confirmed that the pumps at these locations were always ON and there is very little fluctuation on the wetwell level recorded.

2.6.2 Average Dry Weather Flow and Diurnal Pattern Development

Dry weather flow is the typical day-to-day sanitary flow from residential, industrial, commercial, and institutional areas. Review of 2013 dry weather flow data was the first step in the model calibration process and involves detailed assessment of the flow data to develop diurnal patterns. The dry weather flows at each pump station and monitored area had to be repeatable and consistent to create a baseline for wet weather flow analysis and calibration. The diurnal pattern for each land-use type would be generic across the system (i.e. unique diurnal pattern would not be developed for each flow monitoring catchment area). This condition is applicable to the City as the typical usage pattern for each land-use type is expected to be more or less the same across the system.

A unique industrial pattern needed to be developed for PW118 as the generic pattern did not accurately reflect actual flows. Additionally, upon review of the monitoring data it became apparent that PW117 (499 Tomlin Rd) and PW118 (Penn Rd/Milwaukee Way) had a different diurnal pattern between weekday and weekend, due to high ICI users within these catchment areas. Separate weekday and weekend patterns were developed and incorporated in the InfoSWWM model. By reviewing the flow monitoring data, a factor of 0.25 and 0.3 was applied to the weekday pattern for PW117 and PW118 respectively to generate reduced flow conditions during weekends for these two sites.

Figure 2.2 shows the different diurnal patterns applied in the model.



CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No.	Date
60305337	May 2017

Legend

- Rain Gauge
- Temporary Flow Monitor
- Monitored Pump Station
- Existing Forcemains
- Existing Siphons
- Existing Gravity Sewers

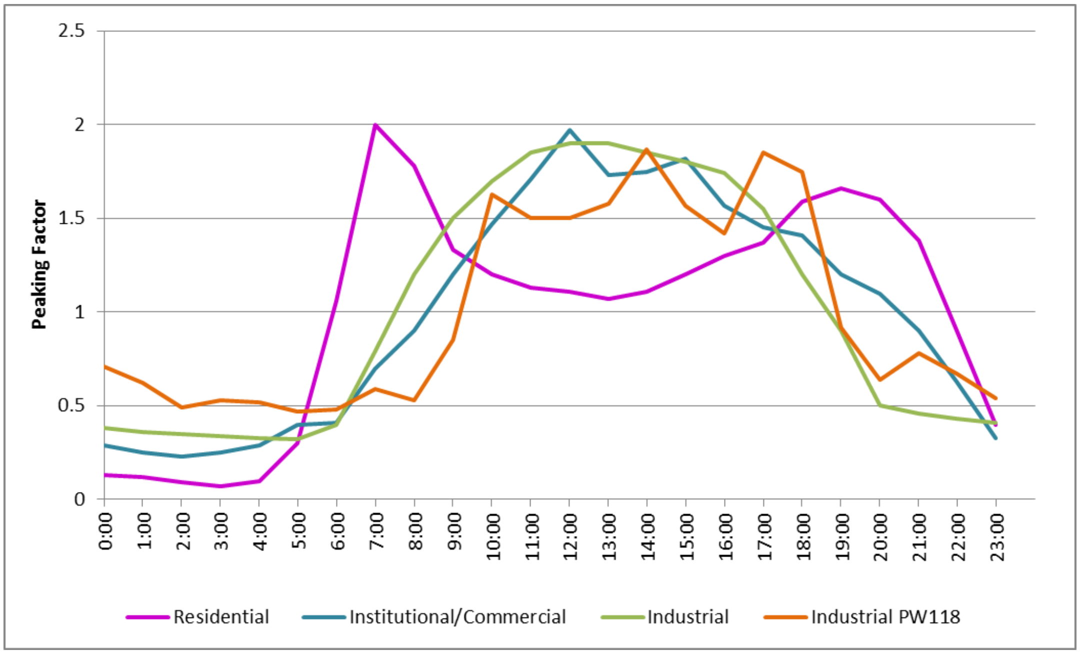
AECOM

0 1,000 2,000 Meters

Flow Monitoring and Rain Gauge Locations

FIGURE 2.1

Figure 2.2 - Diurnal Patterns

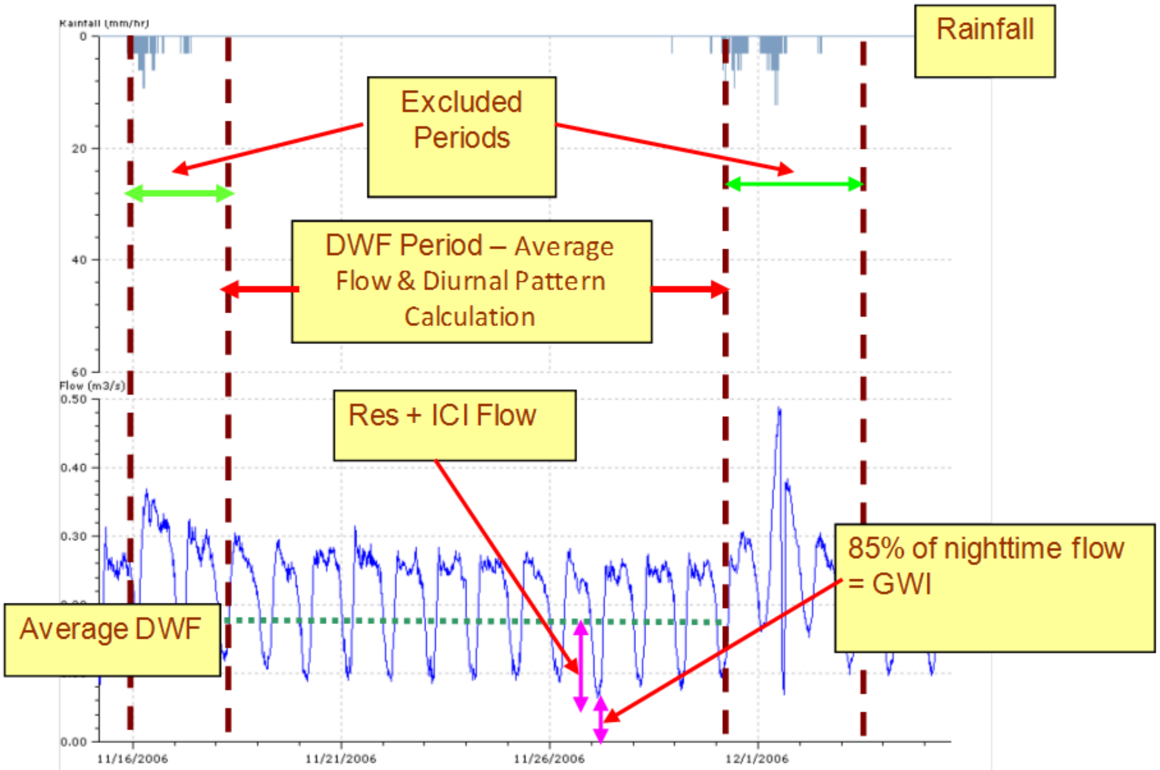


In order to accurately capture the average dry weather flow conditions, dry weather data was isolated from the overall flow monitoring data. In this exercise, it was assumed that the majority of wet weather influences, such as inflow and most infiltration, persists for up to 12 hours after a rainfall event. Flow monitoring records were compared with the rainfall records to determine when rain events occurred. Subsequently, rain events, as well as the following 12 hours, as a minimum, were excluded from the dry weather calibration (see ***Figure 2.3*** for visual reference). The remaining data provided the foundation for the average dry weather flow generation for each flow monitoring catchment area.

At first, the GWI component was estimated to be 85% of the minimum night-time flow. This number was further adjusted during the calibration process to match the overall observed flow data. Once the GWI component was determined it was removed from the average flow monitoring data leaving only the residential and ICI components (refer to ***Figure 2.3*** for visual reference). The ICI flow was determined as 80% of the ICI water meter data (based on typical values and Prince George's monitoring results) which left only the residential flow and estimated per capita sewage flow generation rate (L/capita/day).

As a component of the model calibration the observed dry weather flow was compared with the model-generated dry weather flow. During this process adjustments were made to the GWI and/or residential rates to determine the best fit between the model result and the observed flow. The ICI flows established based on water meter data were kept as is. ***Table 2.2*** shows the calculated residential and GWI rates based on the observed flow data available.

Figure 2.3 - Average Dry Weather Flow Estimate

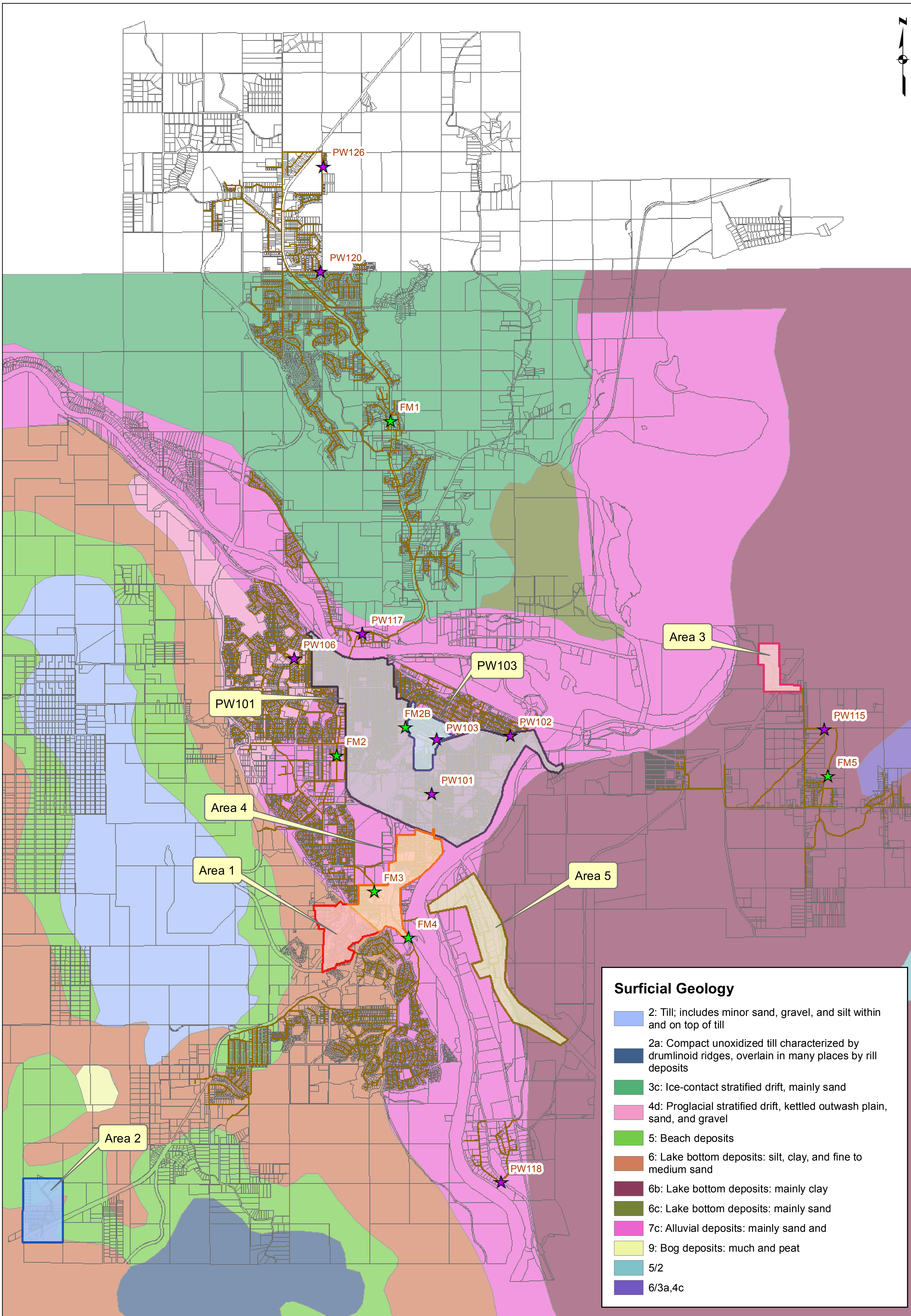


As shown in ***Table 2.2***, PW101 (Victoria St/Milburn Ave) and PW103 (Victoria St/15th Ave) were not calibrated. The pump station inflow at these locations could not be calculated based on the available information as explained in ***Section 2.6.1***.

Additionally, PW115 (Mackus Rd/Blackburn Rd) had unreasonably low residential rates. This issue may be attributed to several factors:

1. Inaccurate population numbers, it may be that not all residential population is served by the City's sewer system.
2. Not all ICI users are connected to the City's sewer system thus the ICI water billing may not reflect the actual ICI sewer flow conditions.
3. Incorrect inflow data for this pump station

Other than the three noted locations, the other calibrated sites showed reasonable residential sewage rates with a weighted average rate of 172.8 L/cap/d and average GWI rate of 2,605 L/Ha/d. For the non-calibrated areas within the City (including PW101 and PW103), each area was compared to the calibrated areas for similarities in residential use pattern, soil, terrain, and pipe conditions and the residential and GWI rates of the most similar calibrated area was applied. A comparison of the calibrated areas is shown in ***Appendix G***. The five non-calibrated areas within the City as shown in ***Figure 2.4*** were given residential and GWI rates as outlined in ***Table 2.3***.



CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No. 60305337

Date May 2017

Legend

Non-Calibrated Areas

- Area 1
- Area 2
- Area 3
- Area 4
- Area 5
- PW101
- PW103

Temporary Monitor Location

Monitored Pump Station

Existing Sanitary Network

AECOM

0 1,000 2,000 Meters

Non Calibrated Areas

FIGURE 2.4

Table 2.3 - Non Calibrated Areas

General Location	ID	Residential Population	ICI Flow (L/s)	Area (Ha)	Calibrated Meter Used	Res Rate (L/cap/d)	GWI (L/Ha/d)
PW101		16,906	15.1	420	PW102	113.7	3,734
PW103		1,027	5.4	35	PW102	113.7	3,734
West of FM3&FM4	Area1	2,101	0.0	66	FM4	187.5	1,966
Southwest of FM4	Area2	387	0.2	362	FM4	187.5	1,966
North of PW115	Area3	119	0.0	9.8	FM5	129.9	1,359
Between FM3&FM4	Area 4	2,007	4.0	90	FM3	91.6	1,689
East of FM4	Area 5	0	2.4	78	FM4	187.5	1,966

2.6.3 Dry Weather Day Calibration Results

The complete hydrograph comparison between the model result and the observed flow monitoring data for Dry Weather Flow calibration is shown in ***Appendix A*** while ***Table 2.4*** shows the summary of average dry weather flow at each pump station and monitoring site for both measured and model predicted flow as well as the error calculation for the calibration process.

Table 2.4 shows that in general the DWF calibration is within the acceptable range of ±10% of difference between the model result and the observed value in terms of average flow, total volume and peak flow. In some calibrated areas namely FM2, FM4, FM5, PW118 and PW126, the model underestimated the peak values by more than 10%. This was due to the high instantaneous peaks apparent in the observed data which was likely due to flow disturbances during data collection process. Therefore throughout the calibration process the model was calibrated to match the more general or average peak flow instead of the instantaneous peaks which are not necessarily depicting the real peak flow in the system.

In conclusion, the DWF calibration for the sites is considered to be sufficient for the purpose of this study.

Once this initial calibration was complete, the City elected to continue the flow monitoring until May 2014. The additional flow monitoring data was reviewed and it was confirmed that GWI is highest during the spring freshet. Since the City of Prince George experiences significant snow melt in the spring, it was found that GWI was higher in April than in December. ***Table 2.5*** summarizes the differences in GWI between December and April.

Table 2.4 - DWF Calibration Results

Monitoring ID	General Location	Observed (Dec 2013)			Model			% Difference			Notes
		Ave Flow (L/s)	Peak Flow (L/s)	Volume (m3)	Ave Flow (L/s)	Peak Flow (L/s)	Volume (m3)	Ave Flow (L/s)	Peak Flow (L/s)	Volume (m3)	
FM1	4952 John Hart Hwy	21.9	39.6	13,266	20.9	37.4	12,689	-4.4%	-5.5%	-4.3%	
FM2	1702 Lyon St	43.1	74.2	26,054	46.9	61.7	28,410	8.9%	-16.8%	9.0%	Unreasonable DWF spike in observed data
FM3	3641 Wiebe Rd	92.9	150.3	56,240	97.8	144.7	59,262	5.3%	-3.7%	5.4%	
FM4	Service Rd off Yellowhead Hwy	41.2	81.8	24,933	43.8	66.4	26,536	6.3%	-18.9%	6.4%	Unreasonable DWF spike in observed data
FM5	Behind 5850 Kovachich Rd	2.9	6.1	1,778	2.9	4.1	1,764	-0.9%	-32.3%	-0.8%	Unreasonable DWF spike in observed data
PW101	Victoria St/Milburn Ave	0.1	8.6	56	80.5	256.3	48,737				Not calibrated due to unreasonable observed data
PW102	Lower Patricia Blvd/4th St	17.3	29.6	10,514	18.6	27.8	11,276	7.7%	-6.2%	7.2%	
PW103	Victoria St/15th Ave	0.2	3.1	123	10.8	17.7	6,555				Not calibrated due to unreasonable observed data
PW106	1st Ave/McIntyre	31.6	48.6	19,256	31.0	49.7	18,762	-2.1%	2.3%	-2.6%	
PW115	Mackus Rd/Blackburn Rd	5.2	9.8	3,136	6.1	9.4	3,723	19.2%	-4.4%	18.7%	
PW117	499 Tomlin Rd	11.3	21.6	6,880	11.2	19.6	6,767	-1.2%	-9.2%	-1.6%	
PW118	Penn Rd/Milwaukee Way	1.5	5.0	885	1.6	2.9	945	7.2%	-42.5%	6.7%	Unreasonable DWF spike in observed data
PW120	Weisbrod Rd/Pearl Dr	3.3	5.3	2,004	3.6	5.2	2,176	9.1%	-2.4%	8.6%	
PW126	Wapiti Rd/Fisher Rd	3.3	5.8	1,990	3.4	4.7	2,065	4.2%	-19.3%	3.7%	Unreasonable DWF spike in observed data

Table 2.5 - Seasonal GWI Comparison

FM Site	December GWI Rate (L/ha/d)	April GWI Rate (L/ha/d)
FM1	1,415	2,350
FM2	5,514	-
FM2B	-	3,734
FM3	1,689	1,974
FM4	1,966	8,270
FM5	1,359	3,093
PW118	364	956

Due to significant differences in seasonal sanitary flow due to GWI, the model was calibrated using a December rainfall event as well as an April rainfall event; to develop two scenarios. This will be described further in ***Section 2.6.4***.

2.6.4 Wet Weather Flow Calibration

2.6.4.1 Flow Monitoring and Rainfall Data Assessment

Wet weather flow can generally be described using two components: the Rainfall Derived Inflow (Fast Response) component and the Rainfall Derived Infiltration (Slow Response) component. The methodology for wet weather calibration included an analysis of rainfall data across the City, a comparison of rainfall events with available pump station and temporary meter flow data, and selection of appropriate calibration sites and events. Correlation between flow and rain data highlighted the evidence of inflow and infiltration (I&I) in the sewer collection system. There are several factors that influence the flow response in a sanitary sewer system to a storm event: rainfall intensity, rainfall volume, rainfall duration, antecedent moisture conditions in the soil, size of contributing catchments, location of manhole lids, the presence of snow and whether catch basins are clear.

As mentioned in the above section, there were three (3) rain gauges and 15 flow monitoring sites across the City that were used during the calibration process. The locations of these stations are presented in ***Figure 2.1***.

Three rain gauges were used during the calibration process and each flow monitoring site was assigned a rain gauge location as listed in ***Table 2.6.*** In order to select the appropriate calibration events, the available flow monitoring data was compared to the corresponding rainfall data. The two largest events showing good correlation with flow meter data were selected as calibration events. The dates of the selected events were December 26, 2013 and April 17, 2014. It was noted during the calibration process that in some areas the baseline GWI and RDII (rainfall dependent inflow and infiltration) varied significantly between the two calibration events. The December event generally had greater RDII rates, while the April event had generally higher GWI. The City offered that the higher RDII during the

December event may have been due to frozen or snow covered catch basins causing a significant portion of runoff to enter the sanitary system through sanitary manhole lids. The higher baseline GWI is likely because the April event directly follows the spring snow melt. Due to the uniqueness of the two events, it was determined that there were not any similar rainfall events captured during the flow monitoring period that could be used for model validation. In discussion with City staff it was decided that calibration would be done for both events. Calibration for the second event was performed using data from the temporary flow monitoring locations and 1 pump station, due to data availability. The calibration events chosen for each monitoring site are summarized in ***Table 2.6***.

Table 2.6 - WWF Calibration Events

Monitoring ID	General Monitoring Location	Rain Gauge Location	General Rain Gauge Location	Events	
				25-Dec-13	17-Apr-14
FM1	4952 John Hart Hwy	PW817	Stauble Rd	✓	✓
FM2	1702 Lyon St	PW650	Foothills Blvd	✓	✓
FM3	3641 Wiebe Rd	PW650	Foothills Blvd	✓	✓
FM4	Service Rd off Yellowhead Hwy	PW629	Sintich Rd	✓	✓
FM5	Behind 5850 Kovachich Rd	PW650	Foothills Blvd	✓	✓
PW101	Victoria St/Milburn Ave	PW650	Foothills Blvd	✓	
PW102	Lower Patricia Blvd/4th St	PW650	Foothills Blvd	✓	
PW103	Victoria St/15th Ave	PW650	Foothills Blvd	✓	
PW106	1st Ave/McIntyre	PW650	Foothills Blvd	✓	
PW115	Mackus Rd/Blackburn Rd	PW650	Foothills Blvd	✓	
PW117	499 Tomlin Rd	PW650	Foothills Blvd	✓	
PW118	Penn Rd/Milwaukee Way	PW629	Sintich Rd	✓	✓
PW120	Weisbrod Rd/Pearl Dr	PW817	Stauble Rd	✓	
PW126	Wapiti Rd/Fisher Rd	PW817	Stauble Rd	✓	

It should be noted that for the December 25th, 2013 event, in addition to rainfall there was also some snowfall and snowmelt as recorded at the City's Sewage Treatment Plant summarized in ***Table 2.7***. No snowfall or snowmelt occurred during the April 17th, 2014 event as the spring snowmelt finished on April 6th, however GWI would have been significantly increased by the recent snowmelt. It should also be noted that the December 25th event was also exacerbated by frozen catch basins.

Table 2.7 - December 25 Snow and Snowmelt during Calibration Period

Date	Snow (cm)	Snow on Ground (cm)
December 24, 2013	0	34
December 25, 2013	2	36
December 26, 2013	0	30
December 27, 2013	0	22
December 28, 2013	0	22
December 29, 2013	15	37
December 30, 2013	0	35
December 31, 2013	0	32

2.6.4.2 Wet Weather Parameters

Wet weather flow can generally be described using two components: the Rainfall Derived Inflow (Fast Response) component and the Rainfall Derived Infiltration (Slow Response) component. It is not uncommon to see the flow peaks measured during rain events being higher than that can be attributed to participating impervious areas associated with the connected catchments. In addition, the increased wet weather flows could persist long after the rain events and the associated surface runoffs are over. This condition shows that Rainfall Derived Infiltration depends not only on the actual precipitation but also on the soil moisture condition preceding the precipitation event. It also explains why a similar intensity and duration storm preceding a dry period would produce much lower peak flow rate and infiltration volume than the same event following a wet period. Therefore, when performing a numerical simulation of flows in sanitary sewers, the slow response can have great importance, especially when analyzing volumes.

Wet weather calibration was completed in InfoSWMM for a minimum of 5-days including at least 2 days before and after the major storm event. This time frame was chosen to make sure that the antecedent moisture condition was captured before the event and the slow infiltration response was also captured after the event.

Using InfoSWMM, the rainfall-derived infiltration/inflow (RDII) into a sewer system was modelled and calibrated using the RTK and unit hydrograph approach. The RTK technique is defined by three parameters:

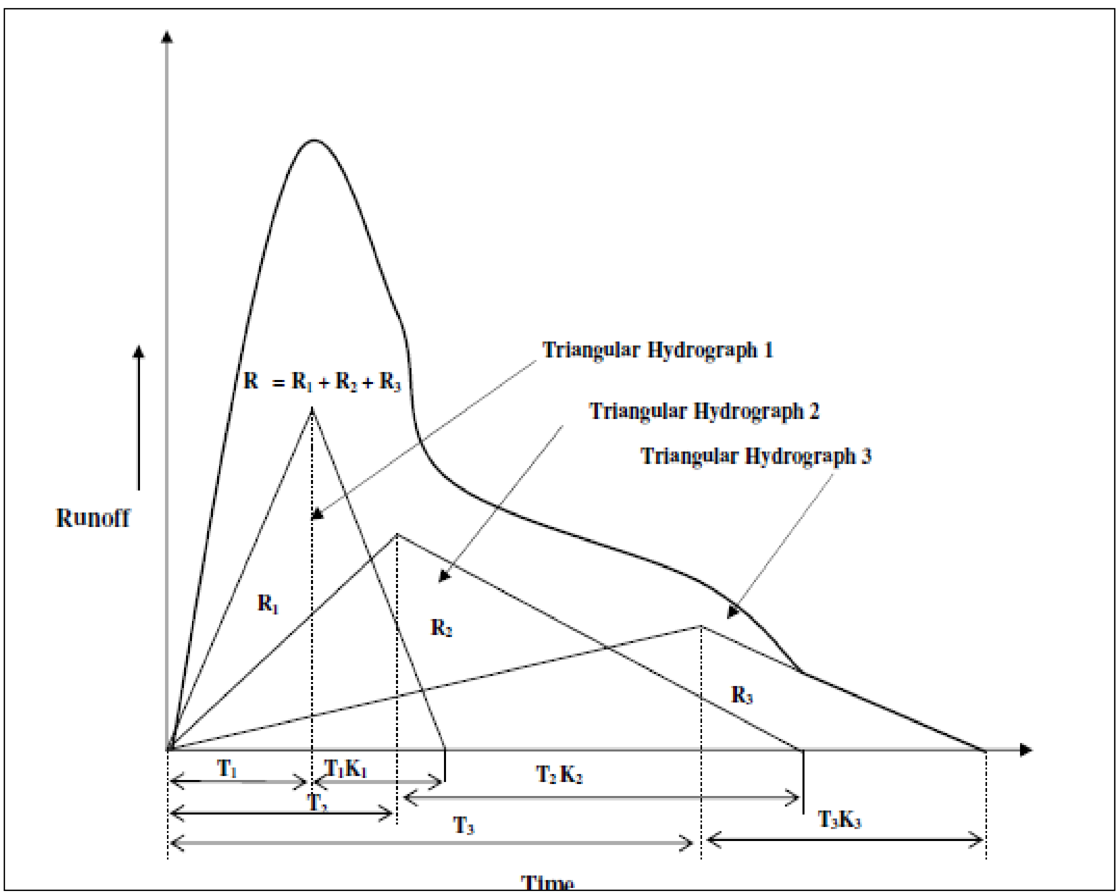
- R: the fraction of rainfall volume that enters the sewer system
- T: the time from the onset of rainfall to the peak of the unit hydrograph in hours
- K: the ratio of time to peak vs recession of the unit hydrograph

The RTK approach has three unit hydrographs as shown in ***Figure 2.5***.

- R1 is for a short-term, fast response similar to inflow from direct connections;
- R2 is an intermediate response indicative of faster responding groundwater infiltration that is triggered by rainfall; and
- R3 is a long-term response that represents rainfall induced GWI that occurs due to soils being saturated by the distributed rainfall.

In the InfoSWMM model, separate RTK values were defined and calibrated for each flow monitoring site. It is important to note that the RTK values are representative of the particular rainfall event used for calibration, with "R" being the main parameter that impacts the quantity (peak flow and volume) of RDII in the system. For example, a 10-year storm will have a higher "R" value than a 2-year storm, with the "R" value increasing vs. return period in a logarithmic manner and eventually reaching a plateau. It should be noted that all events selected for the calibration process had a return period of less than a 5-year storm event. Therefore refinements to the calibrated wet weather flow parameters (in particular "Total R") are recommended for simulating events such as a 1 in 25-year or greater return period.

Figure 2.5 – RTK Parameter Description



The RTK parameters derived from the calibration process using InfoSWMM are summarized in ***Table 2.8***. For the non-calibrated areas, the neighbouring area's calibrated RTK parameters were applied based on the assumptions that these areas would have similar governing WWF parameters including soil, terrain and pipe conditions. The non-calibrated areas within the City were subdivided into the same three sub-areas as shown in ***Figure 2.4*** and their RTK parameters are summarized in ***Table 2.8***. Total R values across the City for calibrated and non-calibrated areas are shown graphically in ***Figure 2.6*** and ***Figure 2.7*** .

Wet weather calibration results presented as a hydrograph comparison between the model results and the observed flow monitoring data are shown in ***Appendix B*** for the December event and ***Appendix C*** for the April event. In addition, a summary of the wet weather calibration events per site including the duration and amount of total rainfall along with the peak flow and volumetric comparison is provided in ***Table 2.9***

Table 2.9 shows that in general the WWF calibration is within the acceptable range of ±10% between the model result and the observed value in terms of average flow, total volume and peak flow.

As with the DWF calibration, PW101 (Victoria St/Milburn Ave) and PW103 (Victoria St/15th Ave) were not calibrated under WWF conditions because the pump station inflow at these locations could not be calculated based on the available information as explained in ***Section 2.6.1***. Similar to the DWF calibration process, PW115 (Mackus Rd/Blackburn Rd) also showed inconsistency in the observed flow result. Therefore the data from this site was not used in the calibration.

In conclusion, the WWF calibration is considered to be sufficient for the purpose of this study.

2.7 Flow Monitoring Summary and Recommendations

Flow monitoring was completed over a period of four months from the end of November 2016 to the end of April 2017. Data was collected from 9 pump stations and 5 temporary flow monitoring stations. Rainfall data from three City rain gauges were used to measure rainfall across the City. Temporary flow monitoring stations were installed and monitored by SFE Global. SFE's Flow Monitoring Report is included in ***Appendix H***. Inflows to pump stations were calculated using wet well level fluctuations, pump on/off data, and wet well dimensions from as-builts. Stations PW101 and PW103 could not be used because the pumps are always running, there is very little fluctuation on the wet well level recorded and a reliable method of estimating the flow could not be developed.

As mentioned above, three rain gauges were used to measure rainfall across the City. The rain gauges used are sufficient for the size of the study area; however, in general, a greater the number of rain gauges will allow for more accurate calibration of the model. Rain volumes are directly correlated with elevation and the total rainfall increases with higher elevation. For future analysis it is recommended that the City install a rain gauge close to the center of the City at an elevation of approximately 580-600m.

The two largest events showing good correlation with flow meter data were selected as calibration events. The two selected events were on December 26, 2016 and April 17, 2014. Calibration for the April event was only performed for the temporary flow monitoring locations and 1 pump station. It was noted during the calibration process that in some areas the baseline GWI and RDII varied significantly between events, with the December event showing much higher RDII and the April event showing generally higher GWI. It is possible that the higher RDII in December is related to frozen catch basins and the higher GWI is likely due to the snow-melt during the spring. There were no other significant rainfall events that showed good correlation with the flow monitoring data and as such neither calibration could be validated.

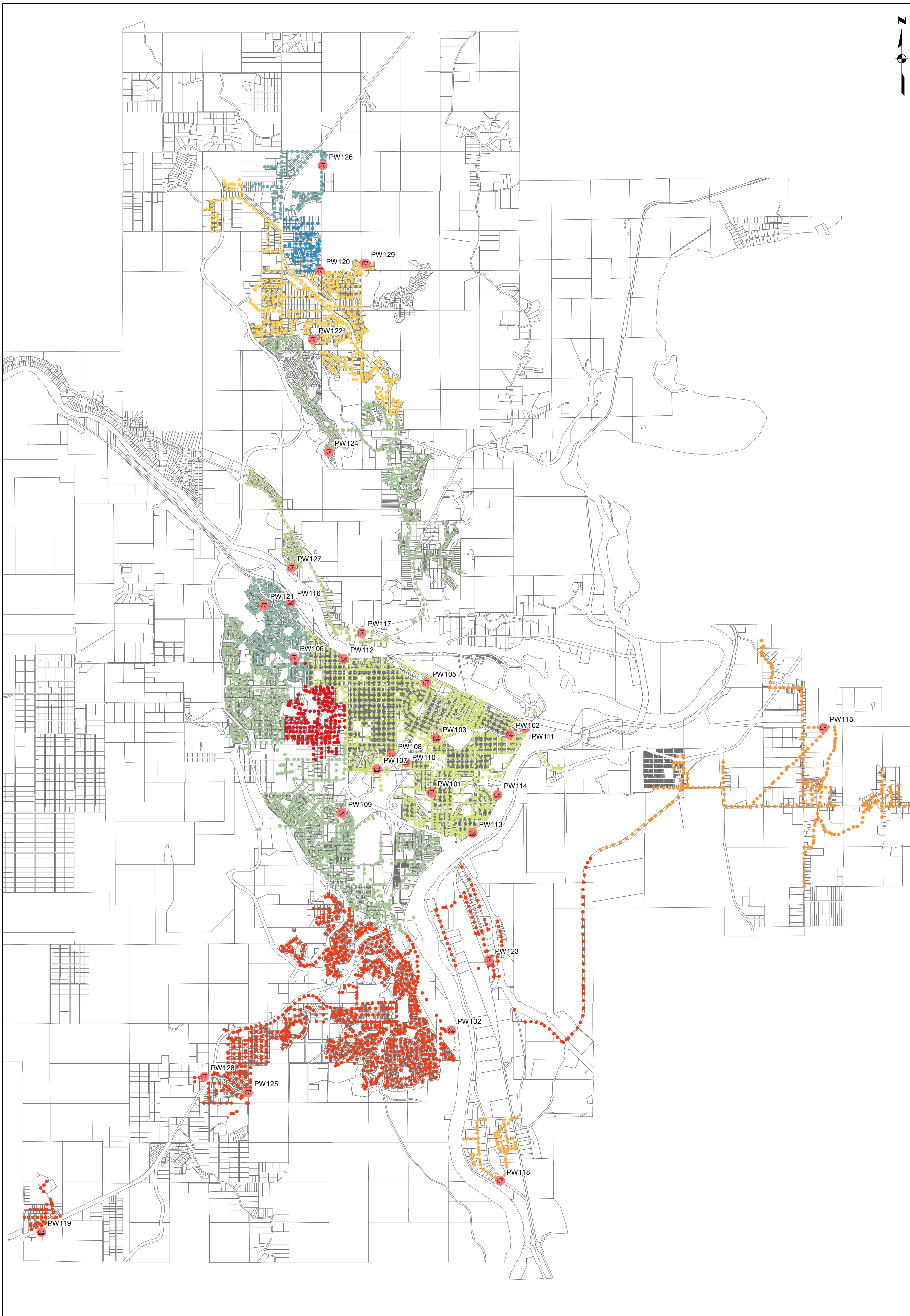
Model validation is a check that the calibration is reflective of more rainfall events than just that used for the calibration. It is recommended that the City perform further flow monitoring so that the model can be validated. Since the City believes that the worst case for the sanitary collection system is during the spring freshet, it is recommended that flow monitoring be performed during that period to validate the April calibration. Further, the high RDII experienced during the December event is likely to be unpredictable if it is attributable to frozen catch basins, and the calibration may be difficult to validate. Future flow monitoring could target some of the non-calibrated areas so that they could be calibrated and validated in the future. Additionally, the April calibration could be further refined by performing calibration for some of the 9 pump stations used for the December calibration.

One of the key recommendations resulting from this report is that the City should implement an I&I Management Plan and flow monitoring program for the Blackburn, College Heights, and BCR areas. These areas show very high GWI and RDII. The total 'R' values in the wet weather calibration indicate that a large portion of the rainfall is entering the sanitary sewer system. This is an indication that there could be stormwater leaders entering the sanitary sewer, manholes in ditches, or significant infiltration through cracks or joints. Modelling results show that in order to adequately convey wet weather flows, significant upgrades will be required both at present and in the future. Uncontrolled I&I can lead to excessive flows resulting in surcharging of the sewers and flooding from manholes. As I&I becomes a significant component of the sanitary flow, as it appears to be in these two areas, it is often more cost-effective to reduce I&I rather than upgrade the conveyance system for the increased flow.

Flow monitoring of these areas can be used to confirm the model calibration and, in conjunction with other methods of investigation such as CCTV inspections, help locate the sources of the I&I. If I&I can be reduced, it is likely that some of the recommended capital projects would not be required or reduced cost through smaller sized pipe upgrades. Installation of permanent flow monitoring facilities, especially for I&I problem areas and catchments where reliable pump station data is not available, may be valuable to the City in order to obtain year-round flow data in key areas. Permanent flow monitoring facilities offering reliable sewer flow data can also be used to measure the success of repair and rehabilitation programs.

Table 2.8 - Calibrated RTK Parameters

Monitoring ID	General Location	Rain Gauge	Proxy Calibrated Meter	Event Date	R1	T1	K1	R2	T2	K2	R3	T3	K3	Total R
FM1	4952 John Hart Hwy	Stauble Rd	-	25-Dec-13	0.002	2	1	0.018	5	6	0.030	17	7	0.050
			-	17-Apr-14	0.002	1	1	0.010	3	1	0.010	5	1	0.022
FM2	1702 Lyon St.	Foothills Blvd	-	25-Dec-13	0.025	0.3	5	0.280	0.5	10	0.005	1	25	0.310
		Foothills Blvd	FM3	17-Apr-14	0.001	0.5	2	0.001	6	1	0.001	15	3	0.003
FM2B	1215 Lethbridge St.	Foothills Blvd	-	17-Apr-14	0.001	1	1	0.005	3	1	0.010	10	5	0.016
FM3	3641 Wiebe Rd	Foothills Blvd	-	25-Dec-13	0.012	0.5	2	0.001	6	1	0.001	15	3	0.014
			-	17-Apr-14	0.001	0.5	2	0.001	6	1	0.001	15	3	0.003
FM4	Service Rd off Yellowhead Hwy	Sintich Rd	-	25-Dec-13	0.025	1	2	0.040	3	4	0.180	5	15	0.245
			-	17-Apr-14	0.005	1	2	0.020	2	4	0.090	5	10	0.115
FM5	Behind 5850 Kovachich Rd	Foothills Blvd	-	25-Dec-13	0.010	1	5	0.040	3	20	0.040	5	80	0.090
			-	17-Apr-14	0.001	1	2	0.092	7	3	0.060	10	40	0.153
PW102	Lower Patricia Blvd/4th St	Foothills Blvd	-	25-Dec-13	0.001	1	1	0.005	3	1	0.010	10	5	0.016
			FM2B	17-Apr-14	0.001	1	1	0.005	3	1	0.010	10	5	0.016
PW106	1st Ave/McIntyre	Foothills Blvd	-	25-Dec-13	0.000	1	1	0.003	2	1	0.008	3	16	0.011
			FM3	17-Apr-14	0.001	0.5	2	0.001	6	1	0.001	15	3	0.003
PW117	499 Tomlin Rd	Foothills Blvd	-	25-Dec-13	0.015	0.5	1	0.000	5	5	0.000	7	5	0.015
			FM1	17-Apr-14	0.002	1	1	0.010	3	1	0.010	5	1	0.022
PW118	Penn Rd/Milwaukee Way	Sintich Rd	-	25-Dec-13	0.035	1	2	0.008	3	20	0.017	5	45	0.060
			-	17-Apr-14	0.009	1	1	0.000	2	1	0.000	5	1	0.009
PW120	Weisbrod Rd/Pearl Dr	Stauble Rd	-	25-Dec-13	0.000	1	1	0.001	3	10	0.000	17	7	0.001
			FM1	17-Apr-14	0.002	1	1	0.010	3	1	0.010	5	1	0.022
PW126	Wapiti Rd/Fisher Rd	Stauble Rd	-	25-Dec-13	0.002	1	1	0.003	7	4	0.004	17	7	0.009
			FM1	17-Apr-14	0.002	1	1	0.010	3	1	0.010	5	1	0.022
PW101	Victoria St/Milburn Ave	Foothills Blvd	PW102	25-Dec-13	0.001	1	1	0.005	3	1	0.01	10	5	0.016
			FM2B	17-Apr-14	0.001	1	1	0.005	3	1	0.010	10	5	0.016
PW103	Victoria St/15th Ave	Foothills Blvd	PW102	25-Dec-13	0.001	1	1	0.005	3	1	0.01	10	5	0.016
			FM2B	17-Apr-14	0.001	1	1	0.005	3	1	0.010	10	5	0.016
PW115	Mackus Rd/Blackburn Rd	Foothills Blvd	FM5	25-Dec-13	0.01	1	5	0.04	3	20	0.04	5	80	0.09
			FM5	17-Apr-14	0.001	1	2	0.092	7	3	0.060	10	40	0.153
Area1	West of FM3 & FM4	Sintich Rd	FM4	25-Dec-13	0.025	1	2	0.04	3	4	0.18	5	15	0.245
			FM4	17-Apr-14	0.005	1	2	0.020	2	4	0.090	5	10	0.115
Area2	Southwest of FM4	Sintich Rd	FM4	25-Dec-13	0.025	1	2	0.04	3	4	0.18	5	15	0.245
			FM4	17-Apr-14	0.005	1	2	0.020	2	4	0.090	5	10	0.115
Area3	North of PW115	Foothills Blvd	FM5	25-Dec-13	0.01	1	5	0.04	3	20	0.04	5	80	0.09
			FM5	17-Apr-14	0.001	1	2	0.092	7	3	0.060	10	40	0.153
Area 4	Between FM3 & FM4	Sintich Rd	FM3	25-Dec-13	0.012	0.5	2	0.001	6	1	0.001	15	3	0.014
			FM3	17-Apr-14	0.001	0.5	2	0.001	6	1	0.001	15	3	0.003
Area 5	BCR (East of FM4)	Sintich Rd	FM4	25-Dec-13	0.025	1	2	0.04	3	4	0.18	5	15	0.245
			FM4	17-Apr-14	0.005	1	2	0.020	2	4	0.090	5	10	0.115



CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No. 60305337

Date May 2017

Legend

Total 'R' Values

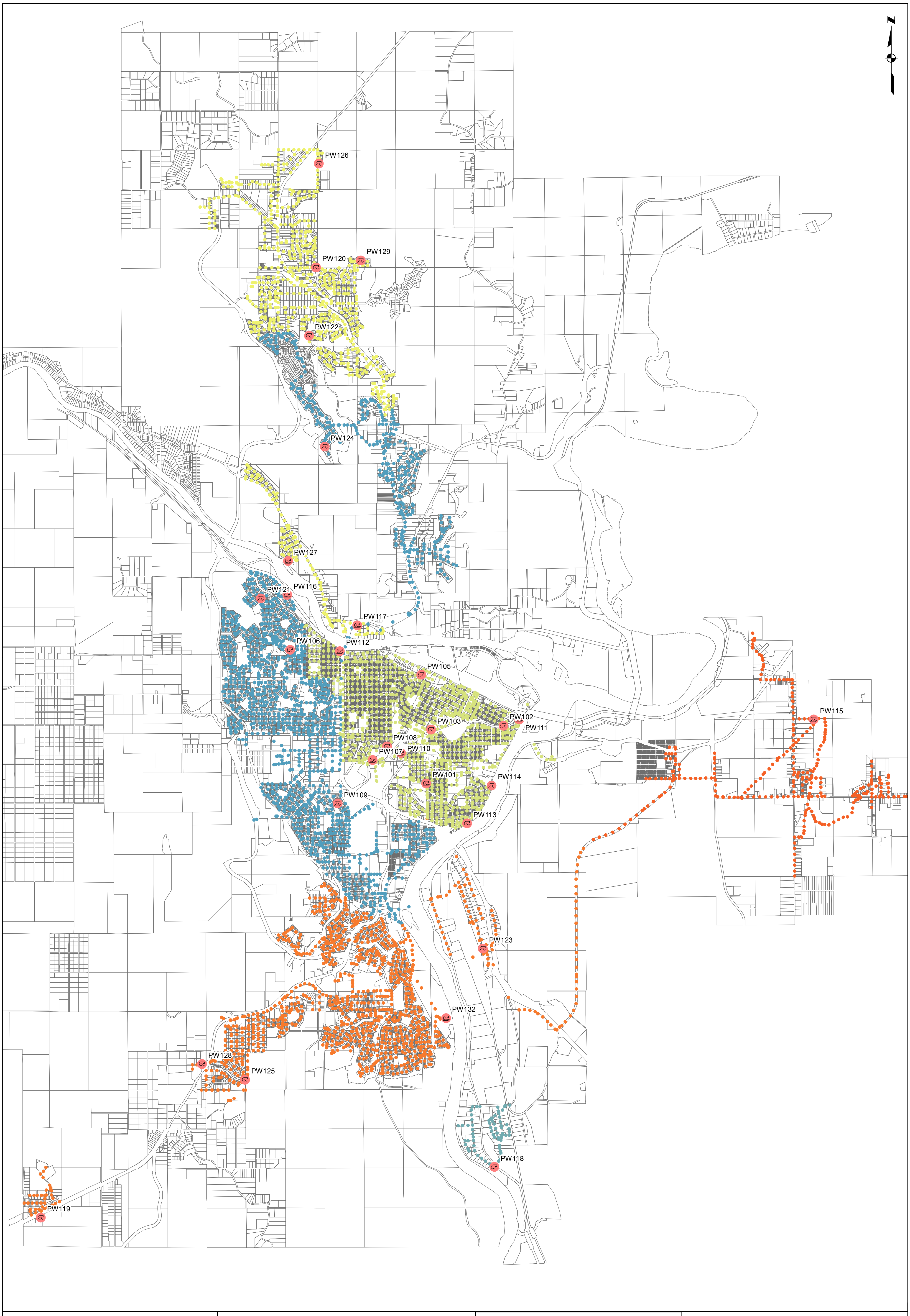
- 0.001
- 0.003
- 0.009
- 0.011
- 0.014
- 0.015
- 0.016
- 0.022
- 0.035
- 0.05
- 0.06
- 0.09
- 0.115
- 0.153
- 0.245
- 0.31
- Lift Station

AECOM

0 1,000 2,000 Meters

December Total R Values

FIGURE 2.6



CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No. 60305337

Date May 2017

Legend

Total 'R' Values

0.001
0.003
0.009
0.011
0.014
0.015
0.016
0.022
0.035
0.05
0.06
0.09
0.115
0.153
0.245
0.31

Lift Station

AECOM

0 1,000 2,000 Meters

April
Total R Values

FIGURE 2.7

Table 2.9 - WWF Calibration Results

Monitoring ID	General Location	Rain Gauge	Event Date	Event Duration	Total Rain Vol (mm)	Observed			Model			% Difference			Notes
						Ave Flow (L/s)	Peak Flow (L/s)	Volume (m3)	Ave Flow (L/s)	Peak Flow (L/s)	Volume (m3)	Ave Flow (L/s)	Peak Flow (L/s)	Volume (m3)	
FM1	4952 John Hart Hwy	PW817	25-Dec-13	21	25	32	62	13,653	28	62	12,283	-10%	1%	-10%	
			17-Apr-14	30	14	29	62	12,406	29	65	13,256	2%	6%	7%	
FM2	1702 Lyon St	PW650	25-Dec-13	48	22	54	152	23,410	59	128	25,421	8%	-16%	9%	
FM2B	1215 Lethbridge St.	PW650	17-Apr-14	8	10	21	33	8,900	20	34	8,780	-1%	1%	-1%	
FM3	3641 Wiebe Rd	PW650	25-Dec-13	48	22	104	261	44,862	115	246	49,993	11%	-5%	11%	
			17-Apr-14	28	10	110	167	47,552	107	189	48,091	-3%	13%	1%	
FM4	Service Rd off Yellowhead Hwy	PW629	25-Dec-13	35	7	63	130	27,422	69	117	29,929	9%	-10%	9%	One instantaneous peak in observed data most likely due to noise and not Wet weather related
			17-Apr-14	28	7	91	141	39,199	92	143	39,656	1%	1%	1%	
FM5	Behind 5850 Kovachich Rd	PW650	25-Dec-13	48	22	5	12	2,258	8	19	3,440	2%	-2%	5%	
			17-Apr-14	28	7	8	20	3,361	8	19	3,440	5%	-2%	2%	
PW102	Lower Patricia Blvd/4th St	PW650	25-Dec-13	48	22	17	32	7,564	19	30	8,402	12%	-7%	11%	
PW106	1st Ave/McIntyre	PW650	25-Dec-13	48	22	31	55	13,347	31	52	13,603	3%	-6%	2%	
PW117	499 Tomlin Rd	PW650	25-Dec-13	48	22	7	17	3,071	7	15	3,182	4%	-9%	4%	Flow is adjusted in the spreadsheet (not in model) to reduce the Brewery production during christmas week
PW118	Penn Rd/Milwaukee Way	PW629	25-Dec-13	35	7	3	14	1,160	3	14	1,244	8%	1%	7%	
			17-Apr-14	28	7	2	5	1,032	3	5	1,118	8%	-7%	8%	
PW120	Weisbrod Rd/Pearl Dr	PW817	25-Dec-13	21	25	3	6	1,433	4	5	1,563	10%	-12%	9%	One instantenous peak in observed data most likely due to noise and not Wet weather related
PW126	Wapiti Rd/Fisher Rd	PW817	25-Dec-13	21	25	3	6	1,479	4	6	1,588	8%	1%	7%	

3 Future Flow Generation

3.1 Future Flows Overview

The following sections outline the development of future sanitary sewer flows based on the OCP development scenario. The future land use shapefile from the City's open data catalogue was used to determine projected development types and sizes. ***Figure 3.1*** shows the future land use utilized in the development of the OCP scenario. The largest new planned development areas are the Airport Light Industrial Lands (ALI), Ospika South, and University Heights neighbourhoods. There is also significant growth planned for the other neighbourhood plan areas including Fraser River Bench Lands, Glenview Crescents, Wessner Heights, and Golf Course – Pine Centre; as well as general infill in existing developed areas. Future average dry weather flow (ADWF) was calculated using a unit rate of *300 L/Capita/Day*. This rate was applied to all residential and ICI equivalent populations (PE).

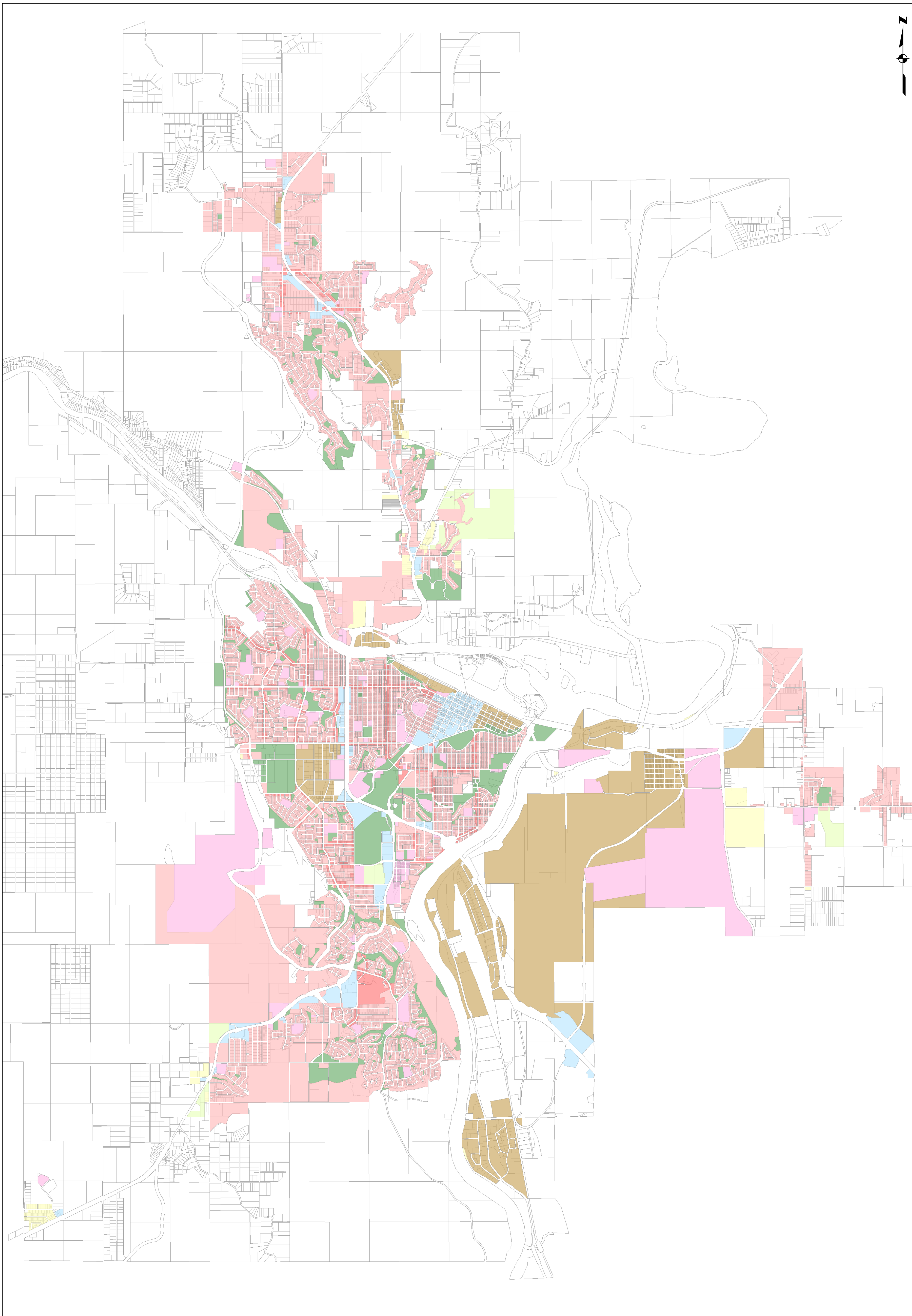
3.2 Residential Flows

Simultaneous with this report, the City is updating their Water Service Network Plan with the help of another consultant. The consultant, with the help of the City Planning Department, developed a forecast of the future serviced residential populations. Two growth scenarios were developed: OCP and Phase 1.

In order to maintain consistency in projected residential populations, the City provided a shapefile of the water model nodes that contained the projected residential populations. For this report, the OCP growth scenario was used to estimate future populations. In the sanitary model, the populations from these nodes were geospatially assigned to the nearest sanitary sewer and then the upstream manhole. Nodes that were greater than 20 m from a sanitary sewer were checked to ensure that the populations were assigned to the correct manhole.

3.3 ICI DWF

Future ICI parcels were mapped using the City's Future Land Use shapefile from the Prince George Open Data Catalogue. Parcels were geospatially assigned to the nearest sewer's upstream manhole. Existing equivalent populations were calculated using water meter data and compared to MMCD design guidelines and the Draft City of Prince George Design Guidelines. It was found that the existing flows were significantly less than the design guidelines, and that neither set of design guidelines were suitable for applying City-wide. Instead, a new set of equivalent populations was developed. ***Table 3.1*** summarizes the ICI equivalent populations by land use type.



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Legend

Future Land Use

- Residential
- Corridor
- Commercial
- Institutional
- Commercial Recreation
- Industrial
- Parks & Open Space
- Rural

0 1,000 2,000 Meters

Future Land Use

FIGURE 3.1

Table 3.1 - ICI Equivalent Populations

Land Use	Existing (PE/ha)	CoPG Design Guidelines (PE/ha)	MMCD Design Guidelines (PE/ha)	2014 Sanitary Sewer Model (PE/ha)
Industrial	15	114	200	30
Commercial	50	76	120	60
Institutional	23	63	200	60

3.4 GWI and RDII

The ground water infiltration (GWI) and RDII rates are based on the calibrated model. For future developments, Inflow & Infiltration (I&I) was estimated using the calibrated rates of adjacent parcels or areas. For details please refer to ***Section 2***.

3.5 Neighbourhood Plan Flows

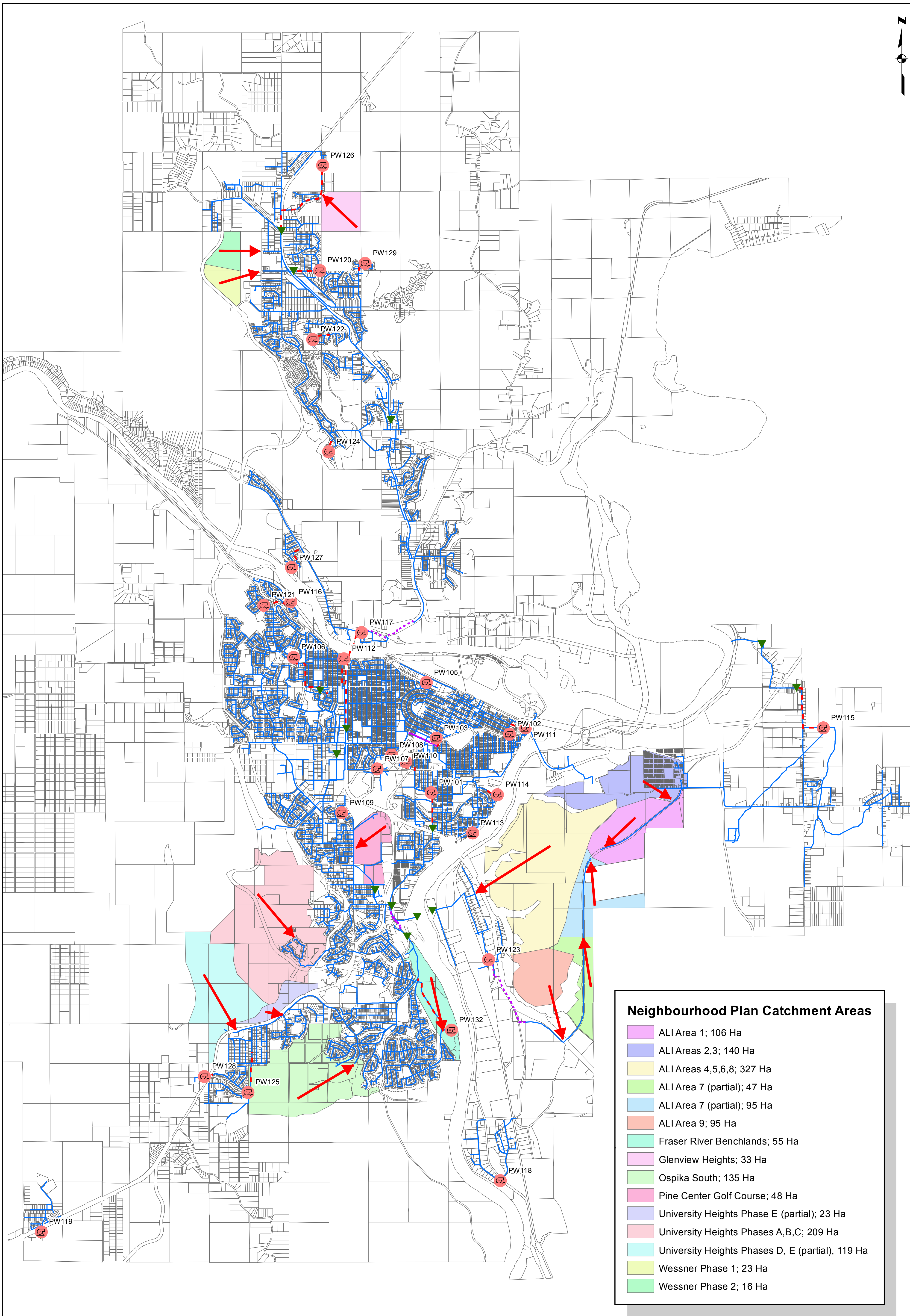
City neighbourhood plans were reviewed and included with the Future Land Use GIS data to develop the OCP scenario. The neighbourhood plans utilized in this report are listed below.

- Fraser River Benchlands
- Ospika South
- Golf Course Pine Centre
- Airport Light Industrial Lands
- University Heights
- Wessner
- Glenview Crescents

Figure 3.2 shows where the loads from these neighbourhood plans were assigned in the model. It should be noted that in the case of large developments where the sanitary network has not yet been built, a significant load is applied to a single manhole where it is assumed that the future sanitary network will tie-in to the existing system. This causes the peaking of the flow to be greater than if the loads were applied at a number of manholes at varying distances from the tie-in point. As new sewers are built, they should be incorporated in to the model to reduce this effect.

3.6 Diurnal Patterns

The diurnal patterns for future flows follow the same patterns as the calibrated model. For details please refer to ***Section*** 2.



CITY OF PRINCE GEORGE

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Legend

- Lift Station
- Outfall
- Existing Forcemains
- Existing Siphons
- Existing Gravity Sewers

AECOM

0 1,000 2,000 Meters

Neighbourhood Plan Development Areas

FIGURE 3.2

4 Scenario Development

Land-use, zoning, Neighbourhood Plans, and OCP information was collected from the City GIS via the Prince George Open Data Catalogue. The following is a summary of key information obtained from the City:

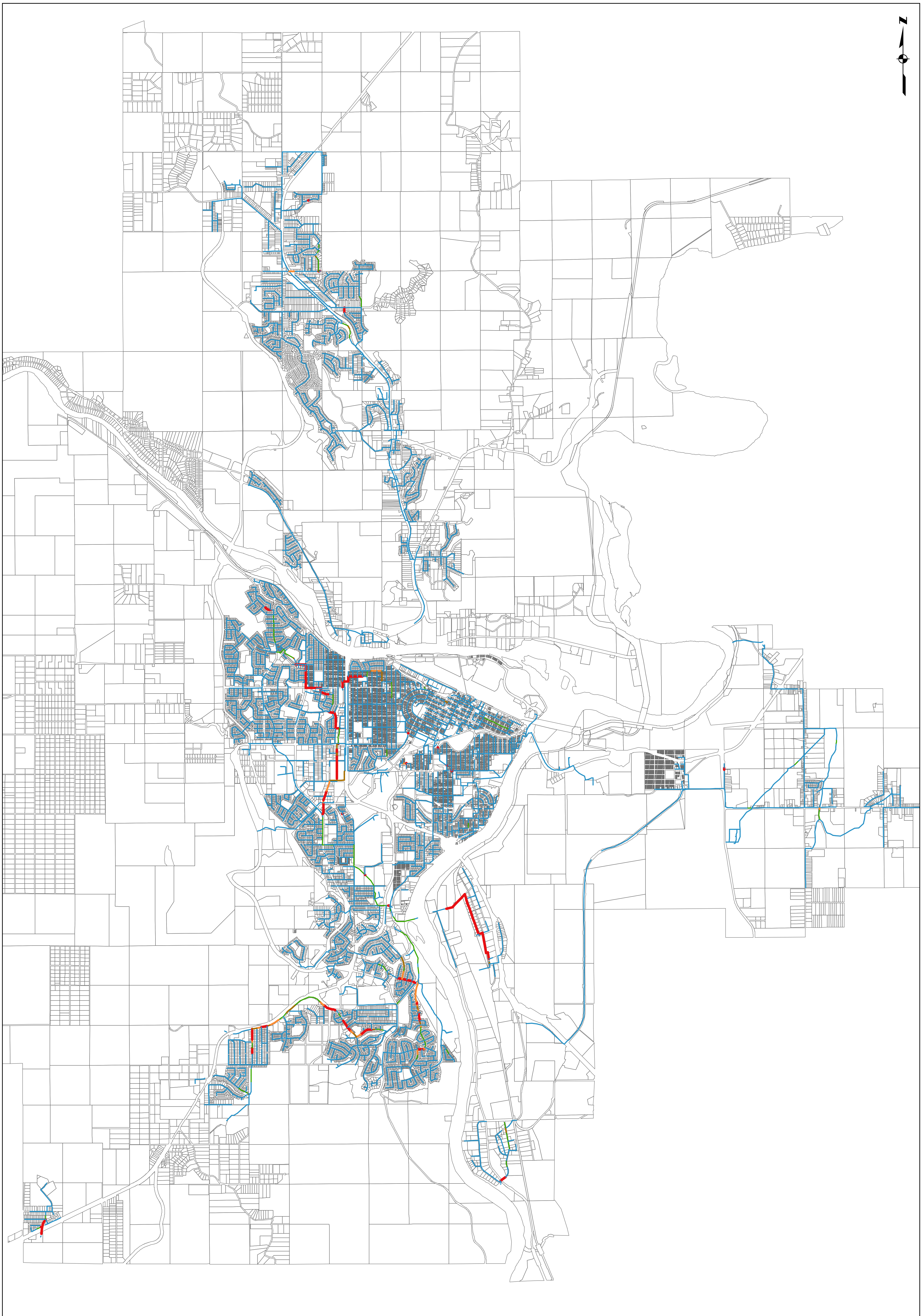
- Existing zoning and existing land-use shape files;
- Future Land Use shape file of planned future land use zoning; and
- Neighbourhood Plans for Fraser River Benchlands, Ospika South, Crescents, Gold Course - Pine Centre, Airport Light Industrial (ALI), Glenview Crescents, University Heights, and Wessner; as well as the corresponding shapefile where official neighbourhood plans exist for future development areas.

Two land-use scenarios were developed in the InfoSWMM model. Each scenario includes different flow generation data sets. The scenarios are:

- **"Existing"** – Represents current land-use and flow conditions based on calibration results. This scenario only includes lots currently serviced by the City. Populations are based on the latest census data, sewage flows are based on population, water meter records and observed GWI rates. The infrastructure is existing infrastructure as per the City's GIS; and
- '**"OCP"** – Represents the future development scenario. This scenario is based on the future residential populations from the *City of Prince George Water Service Network Plan Update* (2014), City future land-use data, and the ICI equivalent populations from ***Section 3.3***.

Additionally, dry weather and wet weather scenarios were developed for each land-use scenario. Dry weather scenarios have no RDII; however, GWI is still utilized. Wet weather scenarios include RDII from the 5-year 24-hour design storm. It was determined that the April rainfall event and calibration best match the real conditions observed by the City. For this reason, the April WWF calibration was used for capacity analysis.

The results of the Existing April 5-Year 24-Hour gravity sewer modelling results are shown graphically in ***Figure 4.1***. The results of the OCP April 5-Year 24-Hour gravity sewer modelling results are shown graphically in ***Figure 4.2***.



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Gravity Sewer Percent Full

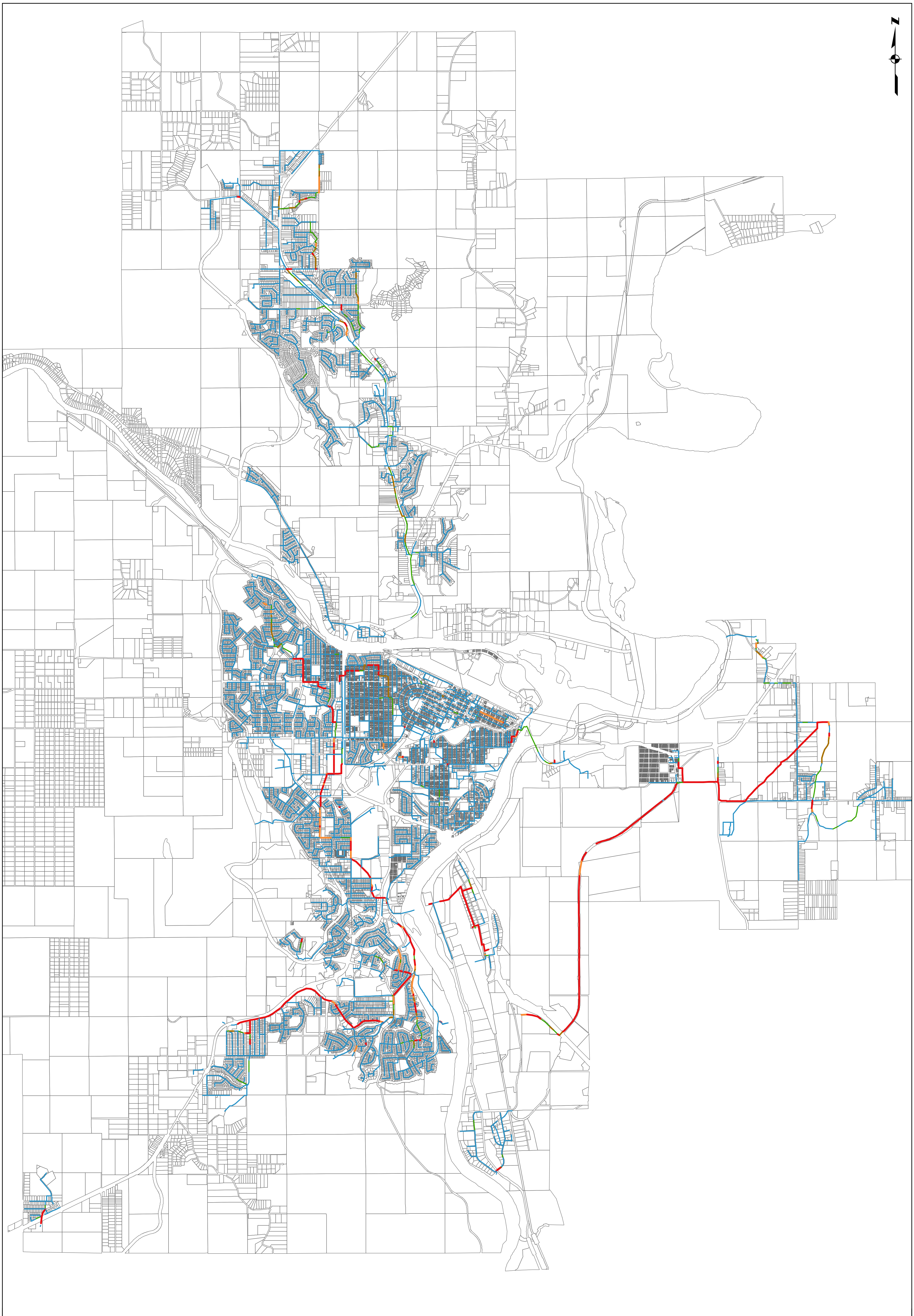
- > 100%
- 83.5 - 100%
- 70 - 83.5%
- 50 - 70%
- < 50 %

AECOM

0 1,000 2,000 Meters

Existing April 5-Year 24-Hour Gravity Sewer Results

FIGURE 4.1



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AECOM

OCP
April 5-Year 24-Hour
Gravity Sewer Results

FIGURE 4.2

5 Sewer System Assessment

5.1 Hydraulic Capacity Criteria

Sections 2, 3, and 4 of this report described the approach to developing the sewer model, and the subsequent scenarios that were developed to assist the City with planning for capital works required to service increased development. The model scenarios were simulated to identify hydraulic constraints such as undersized sewers and pump stations. The capacity assessment was completed for both the Existing and OCP scenarios. Both scenarios were simulated under a 5-year 24-hour design storm condition. In general, the following criteria were used to assess the sanitary sewer system:

- Local sewers (PWWF<40 L/s) running more than 70% full (Qpeak/Qfull > 0.7) were recommended for upgrade.
- Trunk sewers (PWWF>=40 L/s) running more than 83.5% full (Qpeak/Qfull > 0.835) were recommended for upgrade. This is equivalent to approximately 70% of the full pipe depth.
- Pump stations should have capacity to convey the PWWF using only the duty pump. Stand-by pumps were deactivated for the assessment.

5.2 Gravity Sewer Assessment

The results of each scenario are summarized in ***Figure 5.1*** and ***Figure 5.2***. Full size hardcopies of ***Figure 5.1*** and ***Figure 5.2*** showing model results of the various scenarios are provided in ***Appendix D***. Sewers with a Qpeak/Qfull greater than the threshold criteria have been flagged, and are shown in bold red. Manholes are colour-coded based on the maximum surcharge level experienced in the simulation. Surcharging is defined when the HGL is above the pipe crown, but below the ground surface, whereas flooding is defined when the HGL exceeds the ground elevation. ***Table 5.1*** and ***Table 5.2*** provide a summary of the total length of sewers in each category of capacity (PWWF vs full) for the two modelling scenarios.

As an important reminder, calibration of the model results was based on a tolerance of +/- 15% and some of the highlighted sewers may fluctuate on the design criteria threshold. The sewers highlighted as exceeding the design criteria and/or surcharging may not necessarily be undersized and in need of immediate upsizing because they are based on theoretical population horizons. These highlighted sewers should be examined in more detail on a case by case basis in order to confirm if and when capital upgrades and upsizing are warranted. The detailed examination should consider diversion options to alleviate peak flows, alternate routing / twinning options, risk of property damage upstream and potentially flow/level monitoring to confirm model results in these localized areas.

Table 5.1 - Local Sewer Capacity Summary (Q < 40 L/s)

Peak Flow to Capacity Ratio	Length of Sanitary Sewers (km)	
	Existing	OCP
0 - 0.5	387	355
0.5 - 0.7	5.5	9.5
0.7 - 1.0	1.3	5.0
> 1.0	2.9	2.8

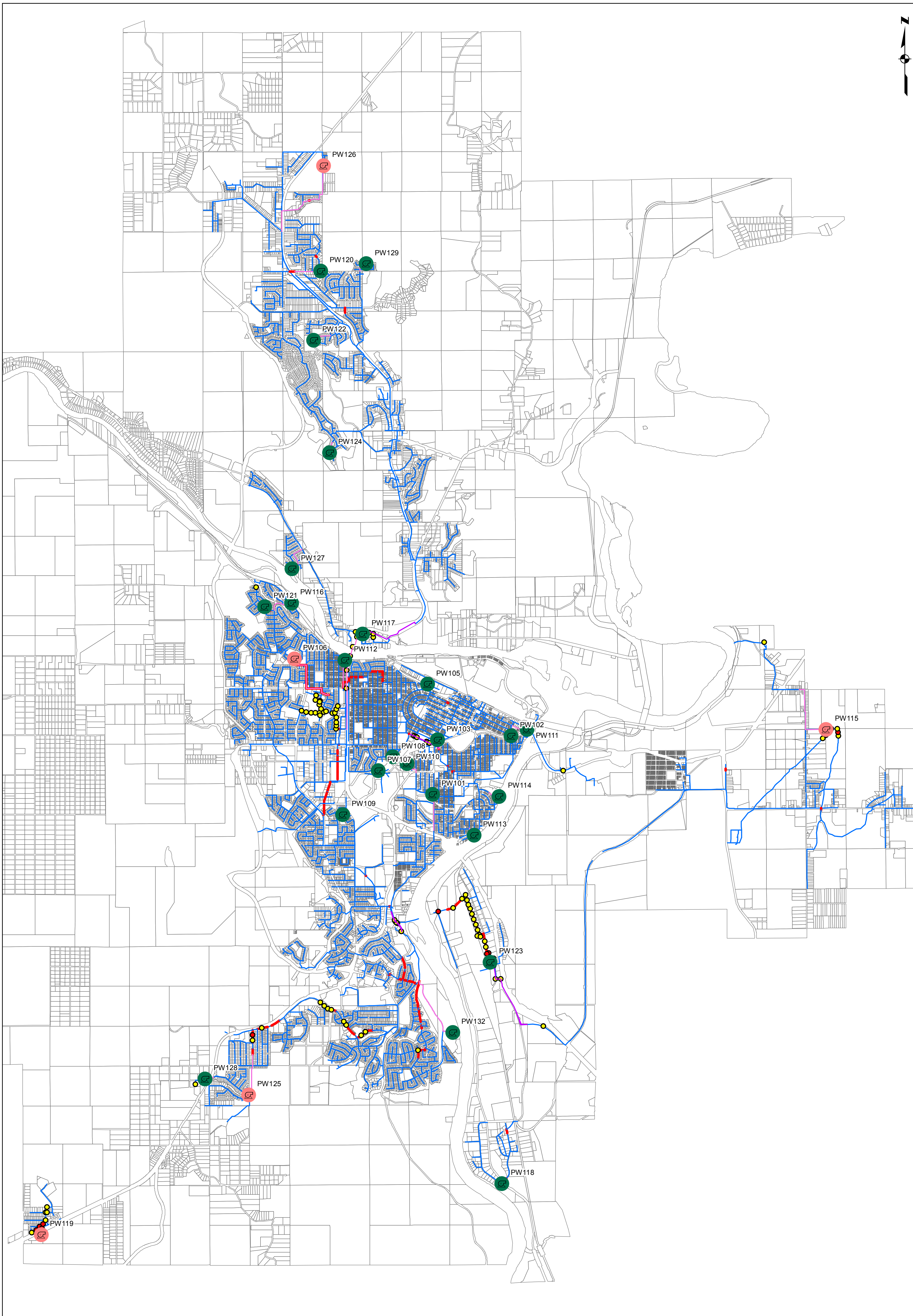
Table 5.2 - Trunk Sewer Capacity Summary (Q > 40 L/s)

Peak Flow to Capacity Ratio	Length of Sanitary Sewers (km)	
	Existing	OCP
0 - 0.5	23	23.3
0.5 - 0.835	8.1	11
0.835 - 1.0	1.6	4.5
> 1.0	5.2	23

Under the current scenario, 11.1 km of gravity sewers are identified as undersized. 82 manholes are flagged as surcharging and 10 manholes are flagged as flooding during the design storm. The flooding and surcharging manholes are generally limited to 6 areas:

- Trunk sewer downstream of PW125
- Loyola Dr.
- Trunk sewer downstream of PW123
- Sewers upstream of Commercial Crescent and Armstrong Ave.
- Upstream of PW115
- Western Acres - upstream of PW119

In the OCP scenario, 35.1 km of gravity sewers are identified as undersized. The number of surcharged and flooded manholes increases to 279 and 45, respectfully. The areas experiencing capacity issues are mostly the same with the addition of the area upstream of PW126 and upstream of PW123. The capacity issues are exacerbated in all 6 areas identified for the existing scenario. Additionally, the recently constructed gravity sewers on Boundary Rd. servicing the future Airport Light Industrial Lands developments is flagged as under capacity in the OCP scenario. It is recommended that flow monitoring and further calibration and validation of this catchment and the BCR area in general to confirm flows before these sewers are replaced.



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Legend

Lift Stations
- Over Capacity
- Sufficient Capacity
- Forcemains
- Siphons

Existing Manholes
- Flood
- Surcharge

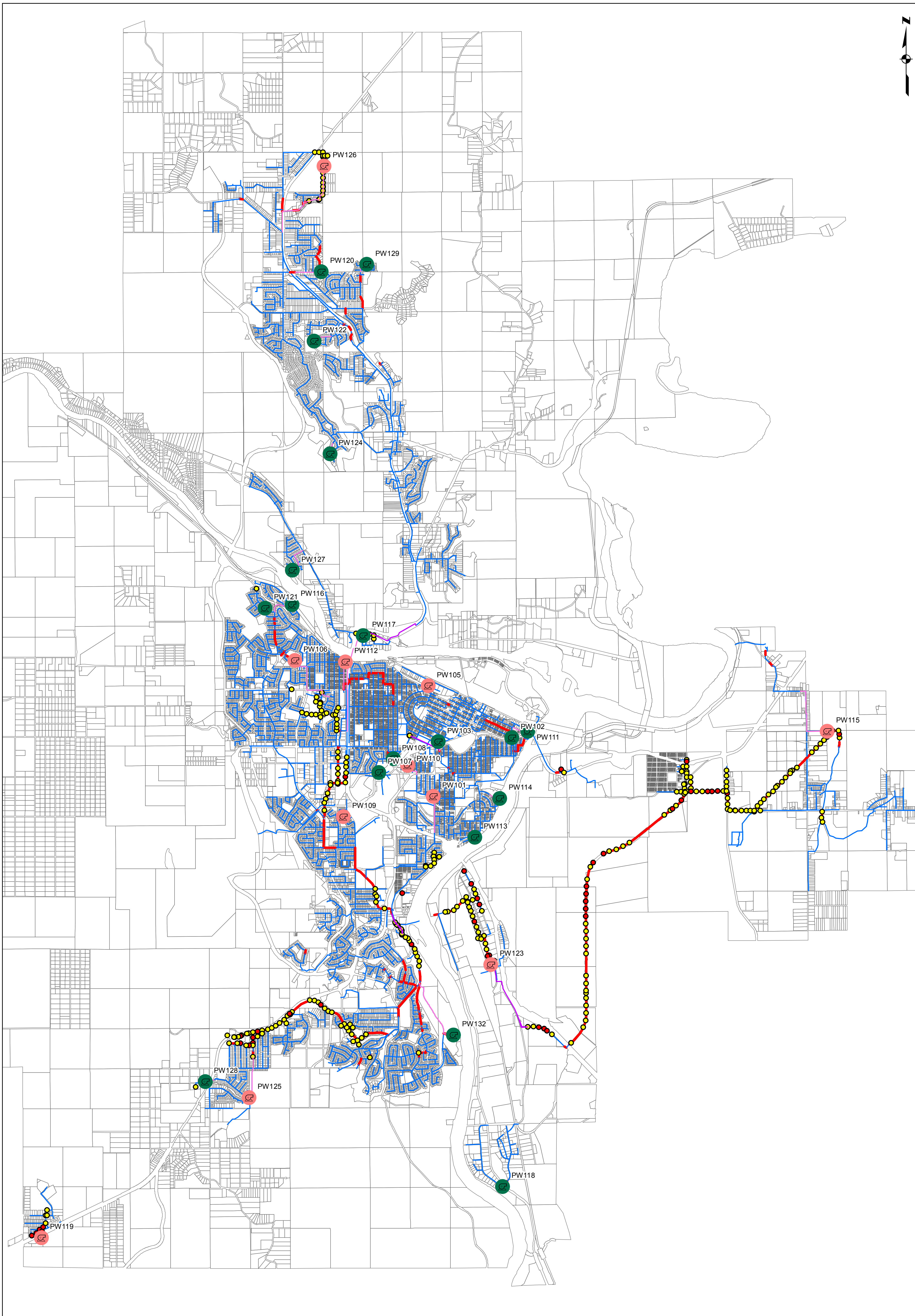
Existing Sewers
- OK
- Insufficient

AECOM

0 1,000 2,000 Meters

Existing Deficiencies

FIGURE 5.1



CITY OF PRINCE GEORGE

Sanitary Master Plan

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Legend

Lift Stations
- Over Capacity
- Sufficient Capacity
- Forcemains
- Siphons

Existing Manholes
- Flood
- Surcharge

Existing Sewers
- OK
- Insufficient

AECOM

0 1,000 2,000 Meters

OCP Deficiencies

FIGURE 5.2

5.3 Inverted Siphon Sewer Assessment

The City operates several inverted siphons to convey sanitary flows across creeks, rivers, and irregular terrain. Several of these siphons operate with parallel pipes conveying sewage flows. All siphon capacities were calculated using a single equivalent pipe diameter which can carry the same total flow as the parallel pipes. It was assumed that the majority of the length of the siphons will operate as pressure pipes at maximum capacity and therefore the capacity was assessed using the Hazen-Williams Equation. The theoretical capacity was compared to the peak existing and OCP flows to identify any gaps in conveyance capacity. The results of the assessment are summarized in ***Table 5.3***.

Of the four siphon crossing areas assessed, all have sufficient capacity under existing conditions. Under the OCP scenario, the Boundary Road siphon and College heights siphon both have insufficient capacity. Due to significant development of the Airport Light Industrial Lands (ALI), the Boundary Road Siphon will require twinning of the existing 200 mm siphon with an additional 250 mm siphon. The College Heights siphon will require the addition of another 300 mm parallel siphon.

Table 5.3 - Siphon Capacity Summary

Siphon	Inlet Elevation (m)	Outlet Elevation (m)	Length (m)	Pipe 1 Dia. (mm)	Pipe 2 Dia. (mm)	Pipe 3 Dia. (mm)	Pipe 4 Dia. (mm)	Equivalent Diameter (mm)	Hazen Williams 'C'	Capacity (L/s)	Existing PWWF (L/s)	OCP PWWF (L/s)
Hospital	581	578	645	300	300	250*	250*	389	110	135	68	86
Boundary	657	590	1730	200				200	110	76	5	189
PW117	601	577	1285	600				600	110	918	413	392
College Heights	581	572	431	250	350	250		438	110	435	279	552
	Flow exceeds siphon capacity											

*Siphon is inactive

5.4 Pump Station and Forcemain Assessment

In conjunction with the gravity sewer evaluation, the capacity of the existing sanitary pump stations and forcemains was reviewed. ***Figure 5.3*** shows pump station catchments and subcatchments. Existing pump station capacities were estimated using one of three sources, depending on the available information, in the following order of preference:

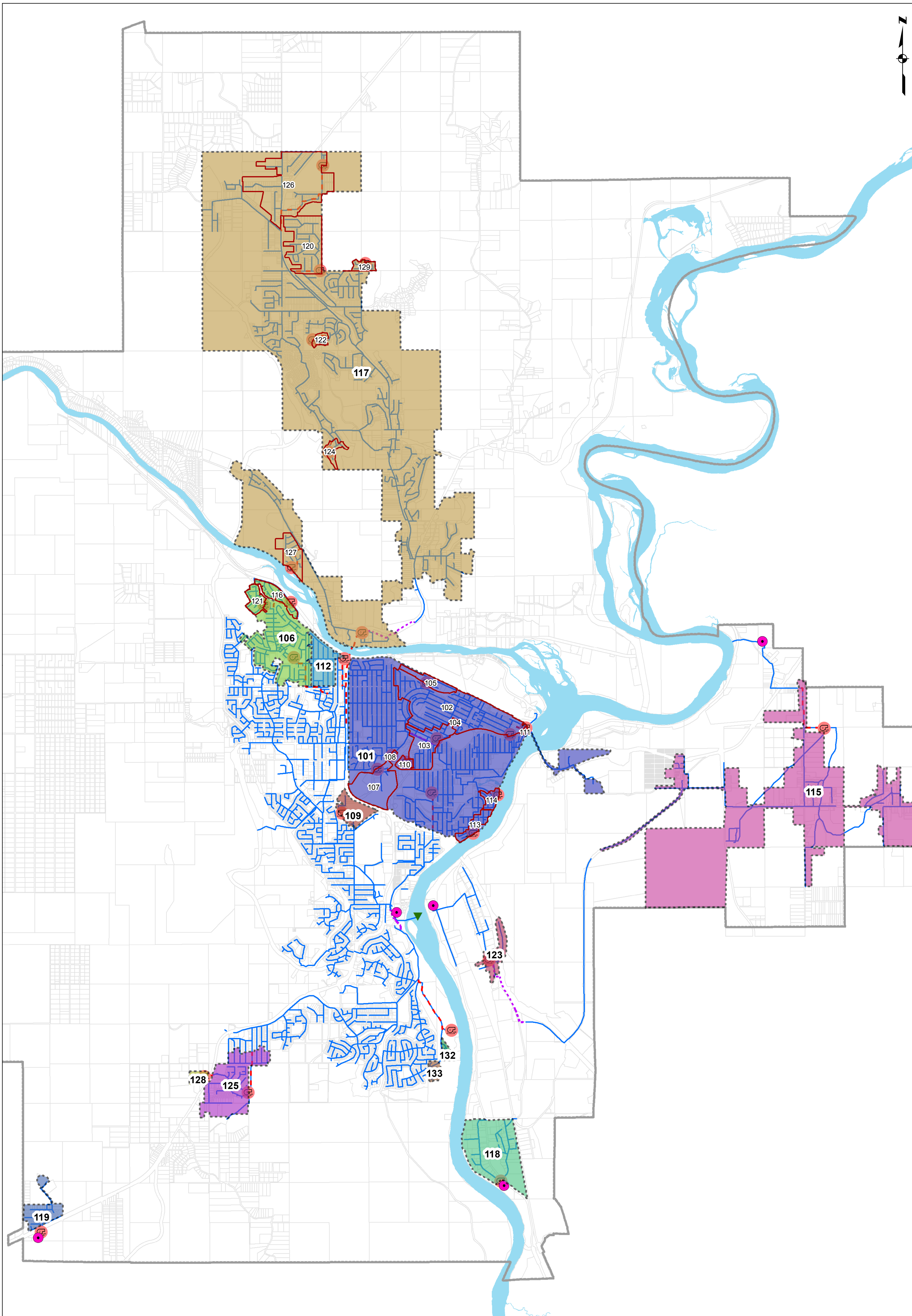
1. Drawdown tests performed in December 2013
2. Drawdown tests performed in August 2001
3. SCADA data

Modelled pump station inflows were compared to the existing capacities. ***Table 5.4*** summarizes the existing station capacity versus the predicted PWWF flows for each scenario. Note the station capacity is calculated based on firm capacity, which is the capacity when the highest power pump is "held" out of service (i.e back-up only).

As noted in ***Table 5.4***, 5 of 28 pump stations are undersized for the Existing Scenario and an additional 3 are undersized for the "OCP Scenario" peak flows. In conjunction with pump station upgrades, some of the discharge forcemains may require upsizing. It is important to re-iterate that the peak inflows predicted at the pump stations may vary depending on the model calibration, and therefore any pump stations within a 10% +/- tolerance of the predicted peak inflows should be monitored regularly for longer run times and increased pump cycles as these are signs of potential under-sizing. Stations that fall into this category include those highlighted in orange in ***Table 5.4***. Pump stations that are undersized by more than 10% are highlighted in red.

Pump Station PW115 is the most critical in the list, with existing PWWF greatly exceeding current capacity during the 5-year 24-hour event. Drawdown tests completed by the City measured the firm capacity at 20 L/s, which is greatly exceeded by peak flows in the Existing Scenario. Additionally, under the OCP Scenario the peak flows increase dramatically due to the development of the ALI. The Blackburn area experiences a very high level of RDII. It is recommended that an I&I study be performed for this area to determine the sources and possible solutions to reduce I&I. If I&I cannot be reduced, the pump station and forcemain will require upgrades. Modelled results show a peak inflow of 70 L/s and 374 L/s for the Existing and OCP scenarios, respectively. Under the OCP scenario the forcemain will be required to be twinned with a 450 mm pipe.

Pump station PW126 is shown to be under capacity under the Existing Scenario. The drawdown test measured a firm pump station capacity in the range of 15-20 L/s which is exceeded by the modelled PWWF of 22 L/s. It was noted by City operations staff that the capacity was expected to be closer to 30 L/s. It is recommended that the City perform an additional drawdown test to confirm the capacity of this station before replacement. If the pump station does have sufficient capacity for the existing conditions, then the upgrade will likely be triggered by the development of the Glenview Crescent neighbourhood.



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Legend

- Lift Station
- Treatment Facilities
- Outfall
- Existing Gravity Sewers
- Existing Siphons
- Existing Forcemains
- Subcatchment Areas
- Parcels
- Municipal Boundary

AECOM

0 1,000 2,000 Meters

Pump Station Catchment and Subcatchment Areas

FIGURE 5.3

Table 5.4 – Pump Station Capacity and Inflow

Pump Station	Pump Equipment	Drive Type	Approximate Capacity (L/s)	PWWF (L/s)		Forcemain Velocity at Greater of Existing Capacity and PWWF (m/s)	
				Existing Scenario	OCP	Existing Scenario	OCP
PW101	2 X 230 HP & Standby	V	217	162	230	0.77	0.82
PW102	2 x 30 HP	V	55	36	47	1.27	1.27
PW103	2 x 30 HP	V	35	17	21	1.25	1.25
PW104	1 x 2.2 HP	C	8				
PW105	2 x 7.3 HP	C	13	5.8	5.5	0.74	0.74
PW106	2 x 20 HP	V	40	46	45	1.07	1.07
PW107	2 x 10 HP	C	9	3.0	7.3	0.51	0.51
PW108	1 x 1.5 HP	C	3	0.4	0.8	0.38	0.38
PW109	2 x 7.5 HP	C	9	4.0	9.4	0.51	0.53
PW110	2 x 7.5 HP	C	11	1.6	4.1	0.35	0.35
PW111	1 x 7.5 HP	C	10	2.9	1.6	1.27	1.27
PW112	2 x 5 HP	C	9	6.2	14	0.51	0.77
PW113	2 x 5 HP	C	7	2.4	2.6	0.40	0.40
PW114	2 x 1.5 HP	C	5	1.2	2.5	0.64	0.64
PW115	2 x 40 HP	C	20	70	374	0.99	5.30
PW116	2 x 15 HP	C	13	5.6	6.8	0.74	0.74
PW117	1 x 200 HP 1 x 230 HP & Standby	V	160	35.1	77.2	1.01	1.01
PW118	2 x 20 HP	C	77	42	70	0.61	0.61
PW119	2 x 2.2 HP	C	9	13	24	0.40	0.77
PW120	2 x 46 HP	C	40	22	26	1.27	1.27
PW121	2 x 3.8 HP	C	20	5.4	5.8	1.13	1.13
PW122	2 x 9.4 HP	C	9	1.4	3.1	1.15	1.15
PW123	2 x 2.2 HP	C	22	16	16	2.80	2.80
PW124	2 x 3.8 HP	C	14	0.5	1.6	1.78	1.78
PW125	2 x 40 HP	C	23	49	50	1.55	1.58
PW126	2 x 46 HP	V	15	22	49	0.69	1.56
PW127	2 x 25 HP	C	13	6.9	7.4	0.41	0.41
PW128	2 x 2.2 HP	C	8	6.3	4.6	1.02	1.02
PW129	2 x 2.2 HP	C	15	2.2	7.6	0.85	0.85
PW132	No Data Available			4	39	0.13	1.22
(orange)	Flow within +10% of capacity						
(red)	Upgrade Required						

5.5 Wastewater Treatment Facilities

An assessment of the City's wastewater treatment facilities is outside the scope of this project; however, the modelled 24-hour inflows to the treatment facilities has been included in ***Table 5.5*** below.

Table 5.5 - Wastewater Treatment Facility Inflows

Treatment Facility	Existing 5-Year 24-Hour Flow (MLD)	OCP 5-Year 24-Hour Flow (MLD)
Lansdowne WWTC	48	100
BCR Lagoon	2.9	31
Blackburn Lagoon	4.8	18
Western Acres Lagoon	1.0	1.1
Danson Lagoon	1.3	6

5.6 Risk and Criticality

As part of a previous project for the City of Prince George, AECOM developed a Sanitary Main Risk Framework. This framework has been modified for use in this project to assess the risk associated with each recommended upgrade project. ***Table 5.6*** summarizes how the risk score was developed for each asset. Each recommended project was then assigned the average risk score weighted by length. The risk score was then used to prioritize recommended capital improvements.

Table 5.6 - Risk Score Summary

<table>
<tr><th colspan="2">Criteria</th><th>Score</th><th>Description</th></tr>
<tr><td rowspan="3">Probability of Failure</td><td>Capacity</td><td>25*</td><td>Modelled Flow / Existing Capacity</td></tr>
<tr><td>Known Service Issues</td><td>12.5</td><td>Service issue identified during workshop</td></tr>
<tr><td>Pipe Age</td><td>12.5</td><td>Refer to Table 5.7 and Figure 5.4</td></tr>
<tr><td rowspan="4">Consequence of Failure</td><td>Pipe Size & Material</td><td>10</td><td>Refer to Table 5.8, Table 5.9, and Figure 5.5</td></tr>
<tr><td>Restricts Development</td><td>10</td><td>OCP PWWF > Existing PWWF = score of 5
OCP PWWF > Existing PWWF and
Existing PWWF > (Design capacity – 5 L/s) = score of 10</td></tr>
<tr><td>Impacts ICI</td><td>10</td><td>ICI parcels impacted</td></tr>
<tr><td>Environmental Impact</td><td>20</td><td>Asset failure harms environmentally sensitive area or watercourse</td></tr>
<tr><td colspan="2">Total Risk Score</td><td>100*</td><td></td></tr>
</table>

* Score may be greater than listed value if modelled flow exceeds 100% of the existing capacity

Table 5.7 - Risk Score from Age

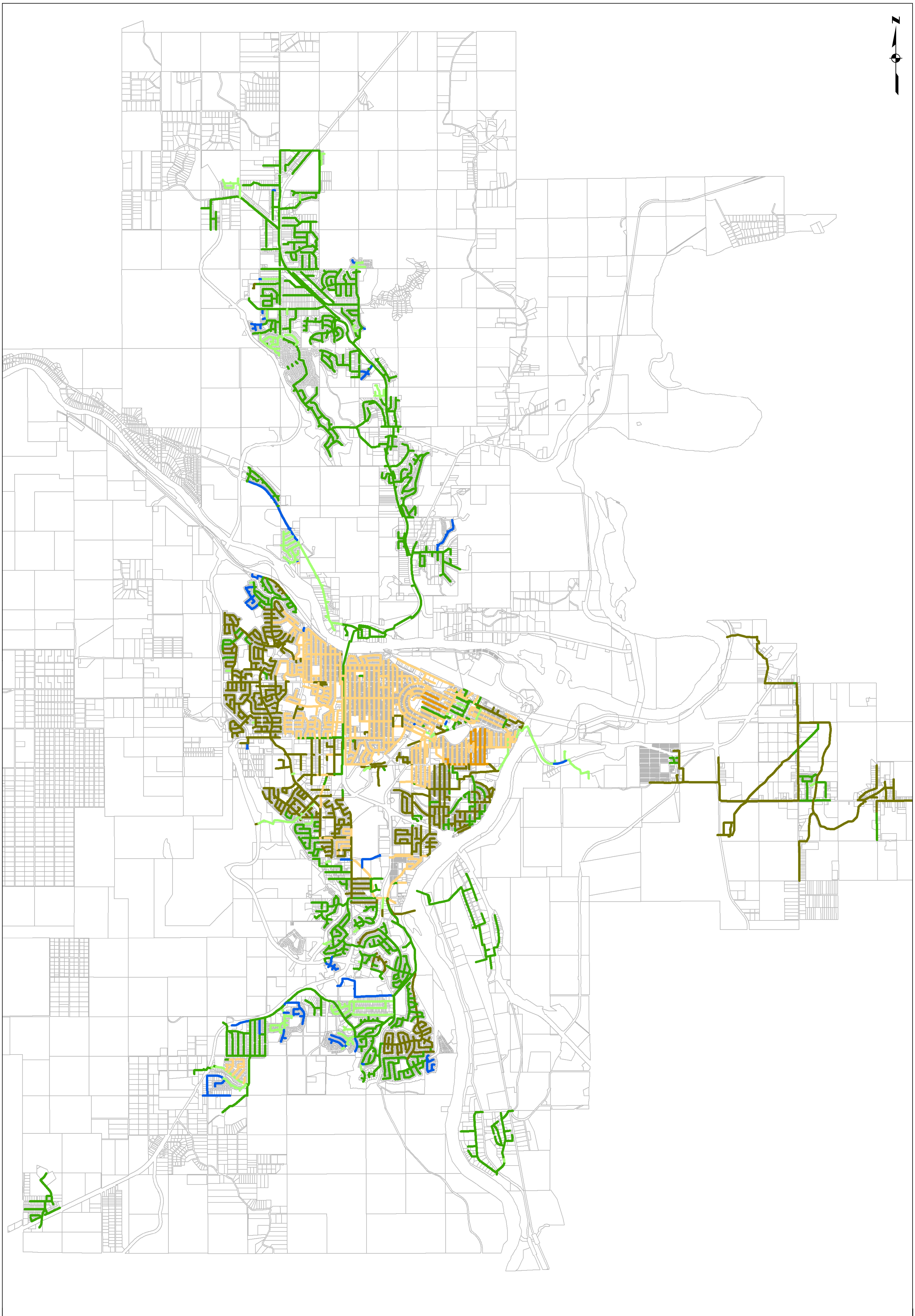
Asset Age	Score %
Unknown	60
100<=A	100
90<=A<100	95
80<=A<90	85
70<=A<80	75
60<=A<70	65
50<=A<60	60
40<=A<50	35
30<=A<40	25
20<=A<30	15
10<=A<20	5
0<A<10	1

Table 5.8 - Risk Score from Pipe Size

Diameter (mm)	Score %
Unknown	80
0<D<300	25
300<=D<500	80
500<=D	100

Table 5.9 - Risk Score from Material

Material	Score %
Unknown	80
PCCP	100
Corrugated Steel	100
HDPE	80
PVC	70
DI	40
AC	40
CI	30
Steel	30
Clay	20
Concrete	20



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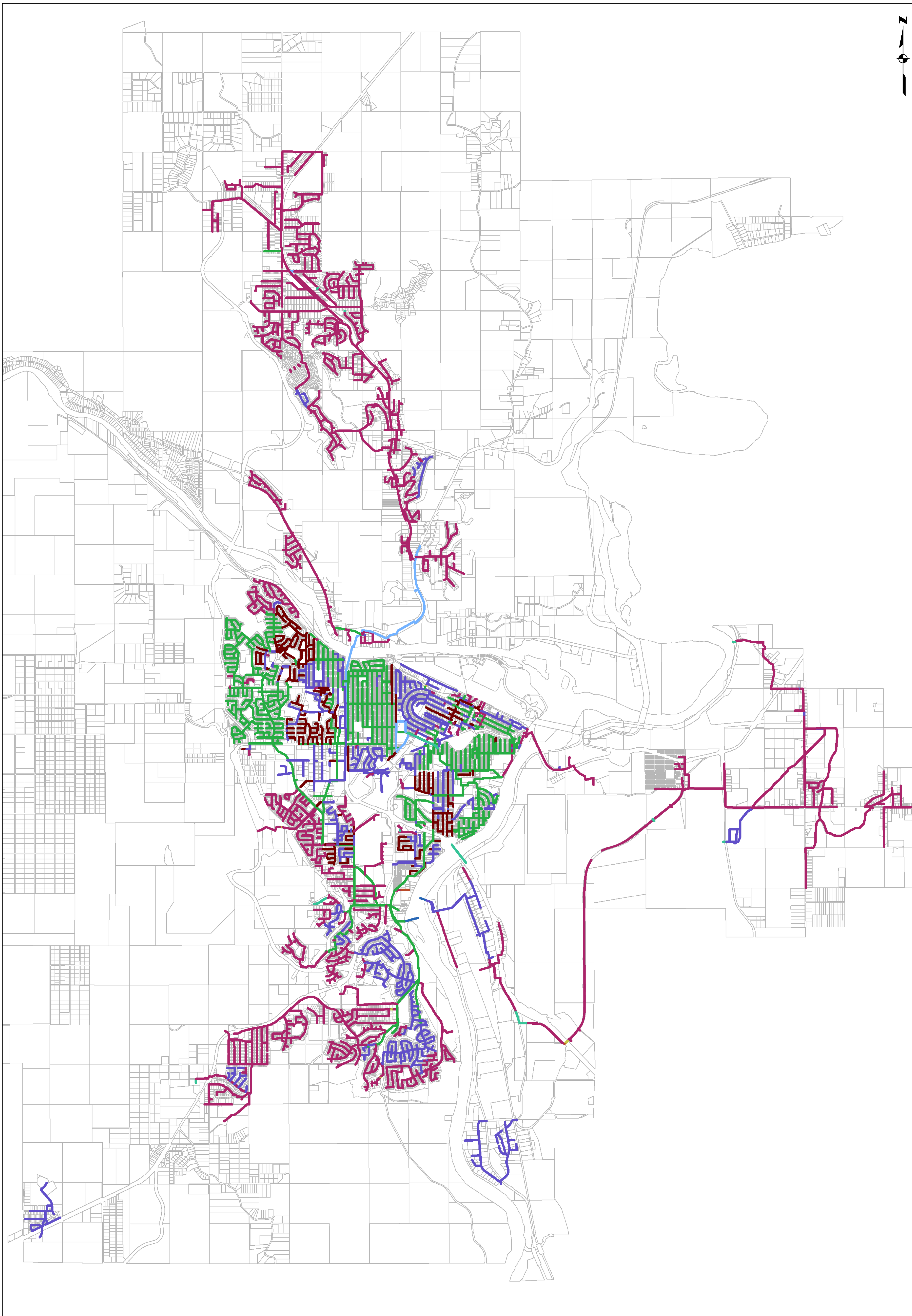
AECOM

Pipe Age

FIGURE 5.4



CITY OF PRINCE GEORGE

Sanitary Master Plan

Legend

Pipe Materials

- AC
- CON
- CSP
- DI
- PE
- PVC
- ST
- UNK
- VIT

AECOM

0 1,000 2,000 Meters

Pipe Materials

FIGURE 5.5

Project No.	Date
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5.7 Recommended Upgrades

An analysis of the existing sewer capacities vs. existing and future peak flows was completed. In general, the OCP scenario results in the highest peak flows in most pipes. For the purposes of this sewer assessment, the maximum 5-yr 24hr peak flows between the Existing and OCP scenario were used to assess sewer capacity and determine the recommended pipe diameters.

Figure 5.6 shows the location of the proposed short and long term capital improvements for the north and east portions of the city. ***Figure 5.7*** shows the location of the proposed short and long term capital improvements for the southern portion of the city. At a few locations the pipes downstream of the proposed upgrade are smaller in size than the proposed diameter but have sufficient capacity to convey the design flows because of steep slopes. The City can consider upgrading these sections during the detailed design stage to avoid downsizing diameters as flow travels downstream, even if the pipe has sufficient capacity. Additionally, there are a few locations where short sections of pipe with low slopes were shown to be under capacity in the model; however, the hydraulic profiles were reviewed and found that an upgrade was not required.

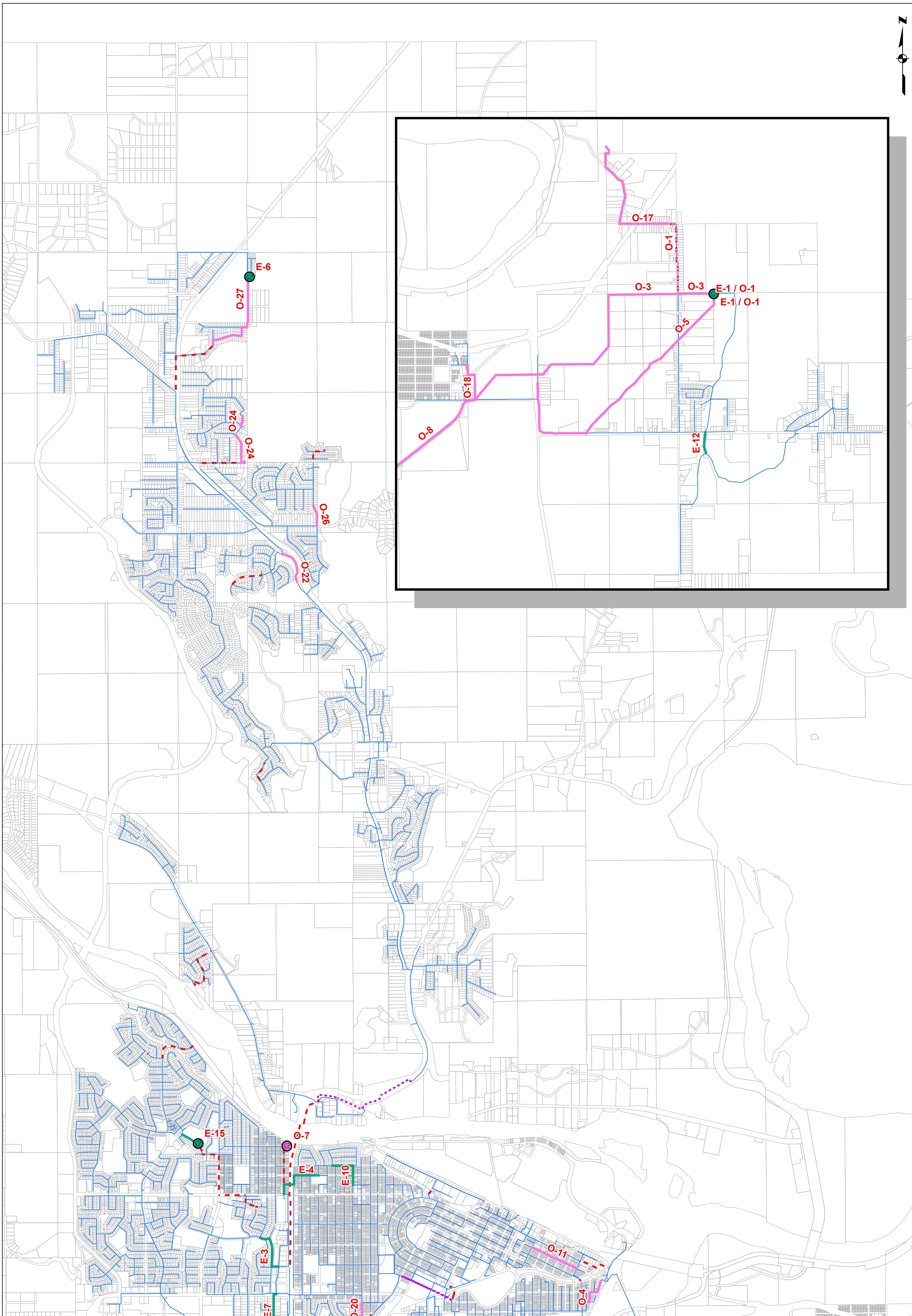
Appendix E provides a tabular summary of the recommended pipe upgrades. Projects for each scenario are listed in ascending order of priority. All recommended upgrades were given a 'Risk Score' to provide a numerical estimate of risk that could be used to rank the priority of upgrades. The methodology used to evaluate risk is described in ***Section 5.6***. Additionally, ***Appendix E*** includes an estimate of the equivalent population growth required for the recommended upgrade to be triggered, based on a flow rate of 300 L/cap/d. No peaking factor or additional I&I was included in this estimate. Pipes that require future upgrades but are located on the same street requiring current upgrades were grouped in the same project; this was done in order to achieve possible cost savings in mobilization and to avoid disturbing the same street several times. The recommended upgrades were reviewed to determine whether any intermediate upgrades could be beneficial. Since the OCP Scenario is based on development only approximately 20 years in to the future and typical design horizon for new pipes is approximately 50 years of useful service, it was determined that it would not be cost effective to complete any intermediate upgrades. ***Table 5.10*** shows the units rates used to estimate the capital cost of new sewers, siphons, and forcemains. The unit rates include pavement cutting, excavation, backfill, asphalt restoration, engineering, and contingency. ***Table 5.11*** summarizes the recommended upgrades for each modelling scenario.

Table 5.10 - Pipe Unit Rates

Diameter (mm)	Unit Rate ($/m)	
	Gravity Sewer and Siphon	Forcemain
200	$ 960	$ 830
250	$ 1,050	$ 920
300	$ 1,130	$ 1,010
375	$ 1,273	$ 1,140
450	$ 1,410	$ 1,280
525	$ 1,550	$ 1,430
600	$ 1,690	$ 1,560
675	$ 1,870	$ 1,700
750	$ 2,010	-
900	$ 2,280	-
1,050	$ 2,570	-
1,200	$ 2,390	-
1,350	$ 2,500	-

Table 5.11 - Summary of Recommended Upgrades

Scenario	Total Length of New or Upgraded Pipe (km)	Total Pump Station Upgrades	Total Number of Projects	Total Capital Cost
Existing	12	4	19	$18.3M
OCP	32	4	29	$47.2M



CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No. 60305337

Date May 2017

Legend

Existing Upgrades

- Short Term Required Upgrades
- Existing PS Upgrade
- OCP PS Upgrade

OCP Upgrades

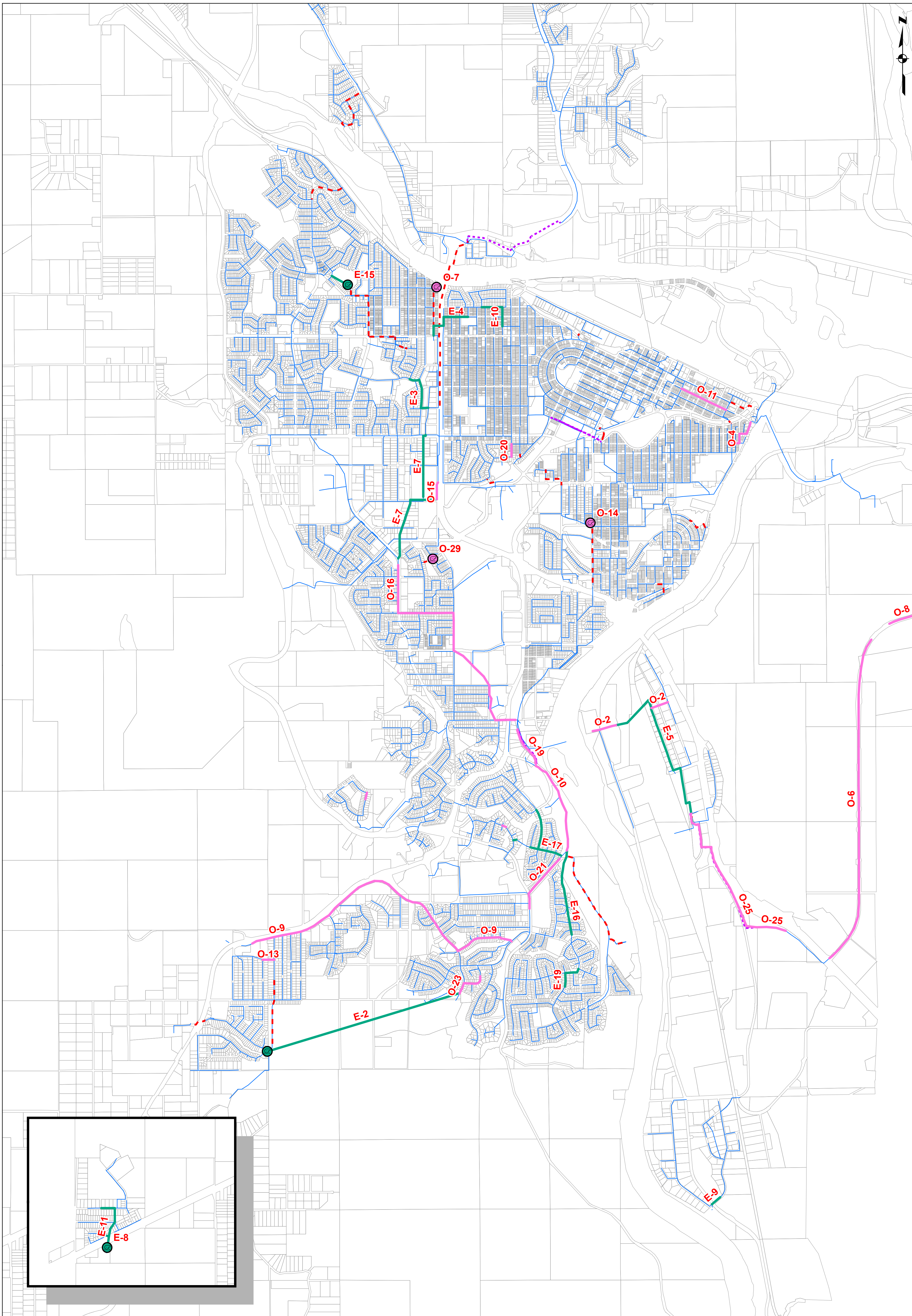
- Long Term Required Upgrades
- Required New Forcemains - OCP
- Existing Forcemains
- Existing Siphons
- Existing Gravity Sewers

AECOM

0 500 1,000 Meters

Recommended Upgrades (North and East PG)

FIGURE 5.6



CITY OF PRINCE GEORGE

Sanitary Master Plan

Legend

Existing Upgrades
- Short Term Required Upgrades
- Existing PS Upgrade
- OCP PS Upgrade

OCP Upgrades
- Long Term Required Upgrades
- Required New Forcemains - OCP
- Existing Forcemains
- Existing Siphons
- Existing Gravity Sewers

AECOM

0 490 980 Meters

Recommended Upgrades (South PG)

Project No.	Date
60305337	May 2017

FIGURE 5.7

6 Summary and Recommendations

6.1 Summary

Development of a new City wide sanitary sewer model ("an all pipe model") has been completed for two scenarios: Existing Conditions and OCP Development. The following is a summary of the key conclusions:

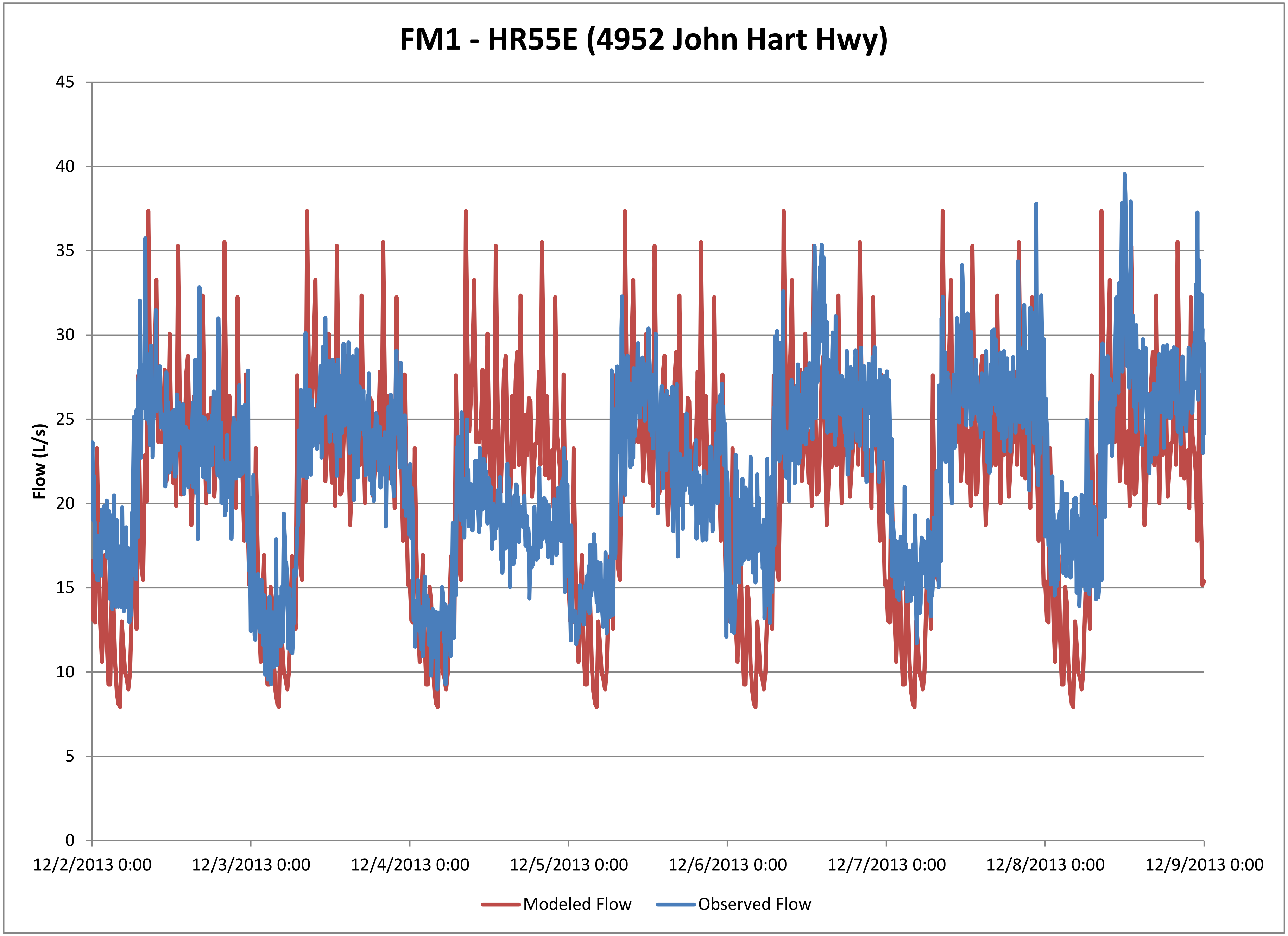
- The sanitary sewer model was developed using Innovyze's InfoSWMM software package version 12;
- The sanitary sewer model was built using the City's existing InfoSewer model, the City's GIS information for pipe network and the latest census data for populations. Recently constructed sewers were added to the model. The model includes all of the City's infrastructure up to the WWTP and lagoons;
- Residential flows were based on census data, existing parcel and land use data, and number of units for each multifamily parcel was obtained from a separate stormwater utility study done by AECOM. Single family units had an average of 2.8 ppu and an average of 2.0 ppu was assumed for multi-family units.
- For ICI properties, the base sanitary flows was input based on 80% of average water consumption during the winter (based on 2009-2013 water meter records);
- The model was calibrated at 11 locations for dry and wet weather flow conditions for the December 25, 2013 storm
- During attempts at validating the model it was determined that ground water conditions varied significantly between available storm events. A second calibration at 6 locations was performed for the April 17, 2014 event during the spring freshet, when the ground was saturated from the snowmelt. During the workshop it was determined that the April event more accurately reflected the worst-case condition the City experiences during the Spring freshet; therefore, the April calibration was used for analysis.
- Future population projections were taken from the City's water model nodes and ICI population equivalents were calculated using City Future Land Use GIS data;
- Analysis of the hydraulic capacity of the existing sanitary sewers and pump stations was completed for each planning level scenario, with upgrades sized for the maximum flow condition. These projects were prioritized by the risk score of each project.

6.2 Recommendations

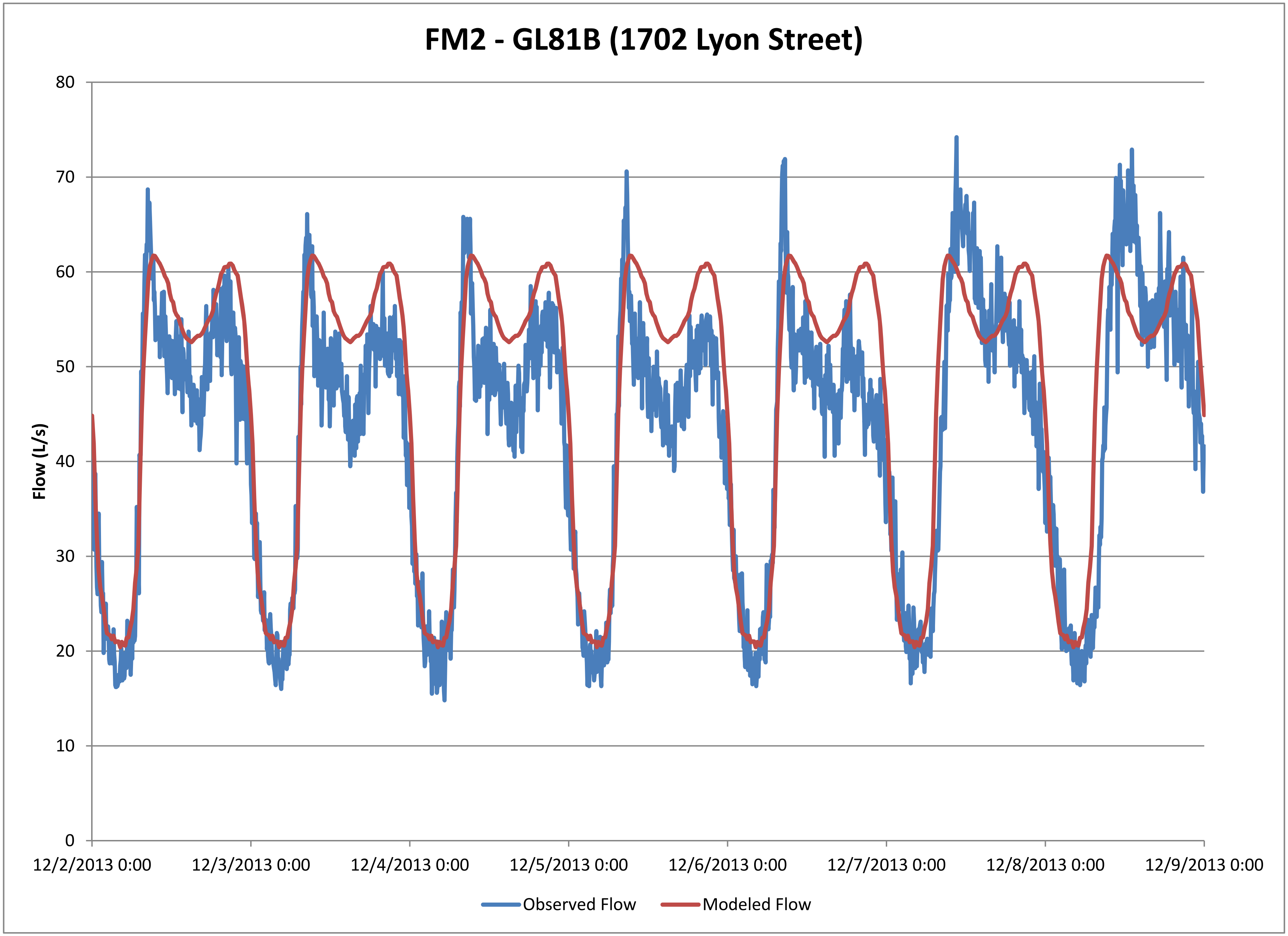
With the aid of the updated hydraulic model the City will be in a stronger position to plan capital works and respond to queries from developers. Going forward, the following is a list of recommendations for the City with respect to the sewer model, I&I, sewer system capacity and sewer model maintenance.

- The City should begin I&I Management Plans and flow monitoring for Blackburn, the area south of Highway 16 and Cowart Rd, and BCR / ALI. Results from these programs should be used to further calibrate the model in localized catchment areas, and refine GWI and RTK parameters. For the I&I estimates, the RTK parameters and more specifically the "R" parameter has a significant impact on RDII volumes/flows therefore further calibration in un-metered areas would be beneficial. If I&I can be reduced in the existing system or future development, capital improvements could potentially be reduced. It is also recommended that the City install an additional rain gauge close to the City center at an elevation of approximately 580-600m.
- The City should visit all the manholes where flooding and surcharging is predicted by model, to observe if evidence of surcharging exists, determine whether the proposed upgrades need to be revisited, and whether additional preventative action needs to occur such as the "bolting down" of manhole lids.
- The City should develop a Siphon Maintenance Program to ensure all siphons are cleaned to maintain sufficient capacity for peak flows.
- The City should allocate additional resources to its Source Control Program to reduce maintenance issues
- Pump Station PW125 does not have sufficient capacity for the modelled PWWF in the existing scenario. Rather than upgrade or replace the pump station, the City should decommission the station and convey the flow by a gravity trunk sewer through the future Ospika South neighbourhood.
- Pump Station PW115 does not have sufficient capacity under the existing scenario due to high I&I. The results of an I&I Management Plan for the area should have a significant impact on sizing of the pump station upgrades.
- It is recommended that the City perform an additional drawdown test to pump station PW126 to confirm the capacity of this station before replacement. The previous drawdown test measured a firm pump station capacity in the range of 15-20 L/s, but City operations staff expects the capacity to be closer to 30 L/s.
- The City should use the tabulated list of recommended upgrades in ***Appendix E*** to plan capital improvements and budgets.

Appendix A
Dry Weather Flow Calibration Plots

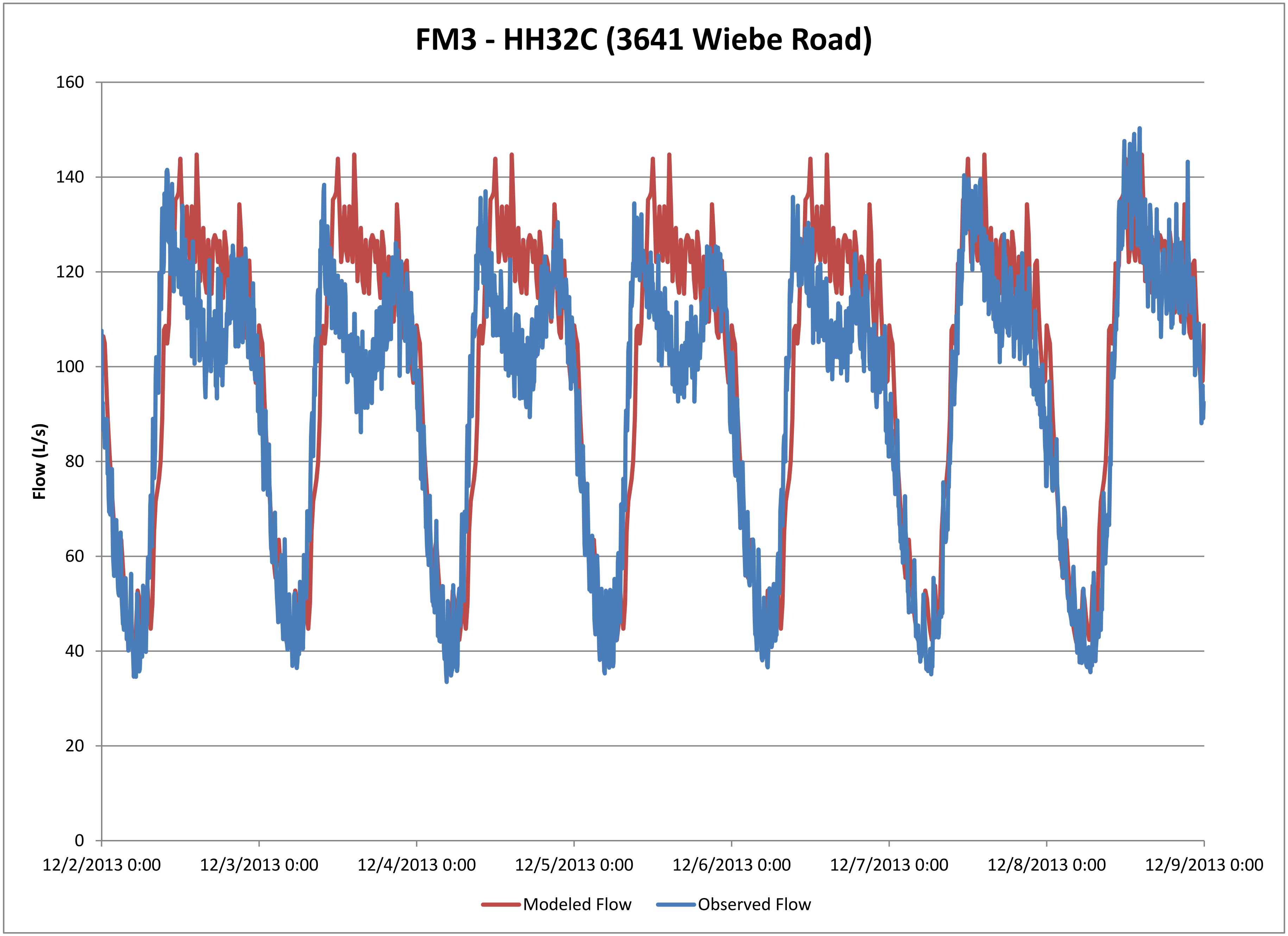

FM1 - HR55E (4952 John Hart Hwy)
45
40
35
30
25
20
15
10
5
0
Flow (L/s)
12/2/2013 0:00
12/3/2013 0:00
12/4/2013 0:00
12/5/2013 0:00
12/6/2013 0:00
12/7/2013 0:00
12/8/2013 0:00
12/9/2013 0:00
Modeled Flow
Observed Flow

4/9/2014

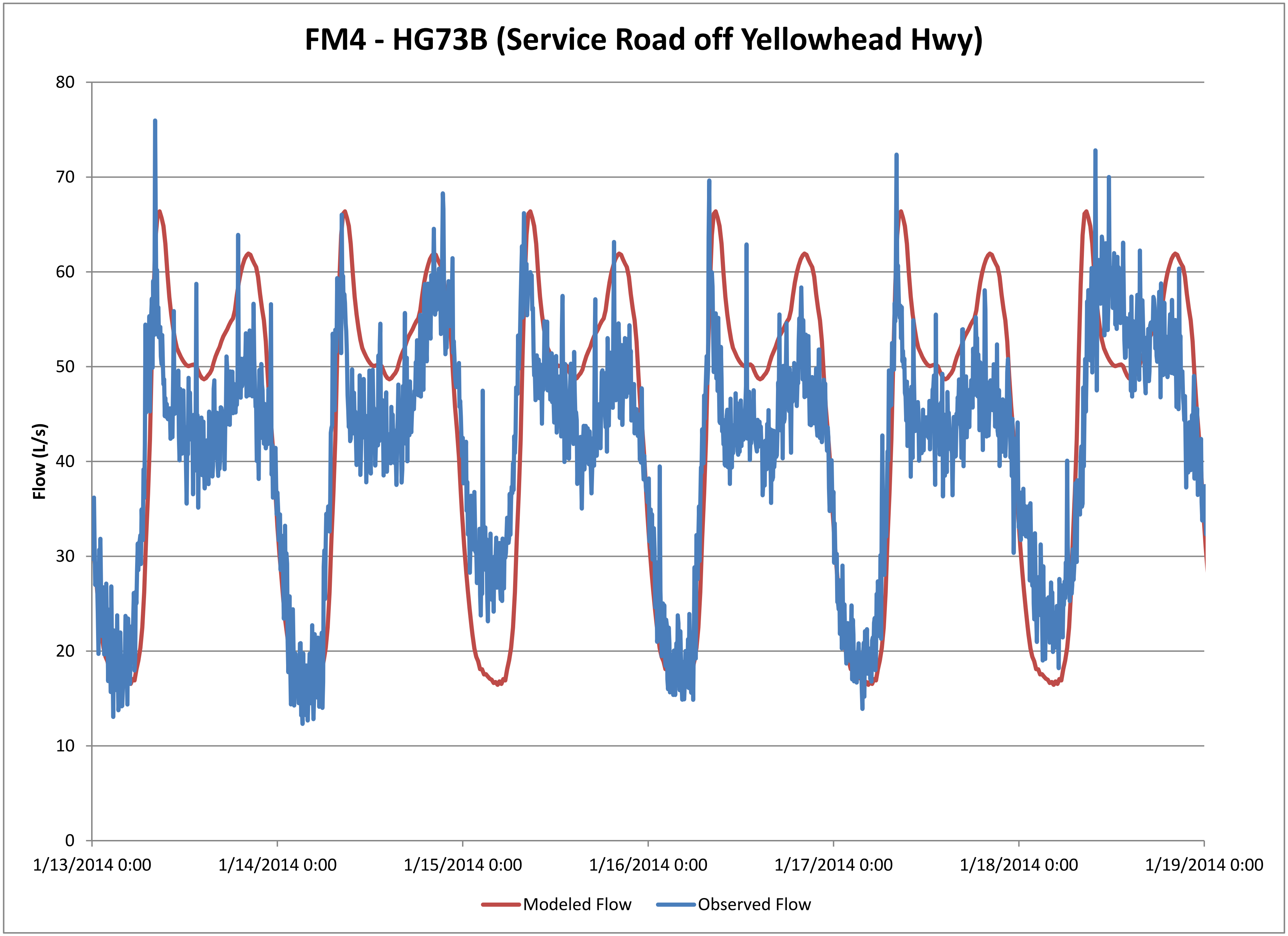


FM2 - GL81B (1702 Lyon Street)
Flow (L/s)
80
70
60
50
40
30
20
10
0
12/2/2013 0:00
12/3/2013 0:00
12/4/2013 0:00
12/5/2013 0:00
12/6/2013 0:00
12/7/2013 0:00
12/8/2013 0:00
12/9/2013 0:00
Observed Flow
Modeled Flow

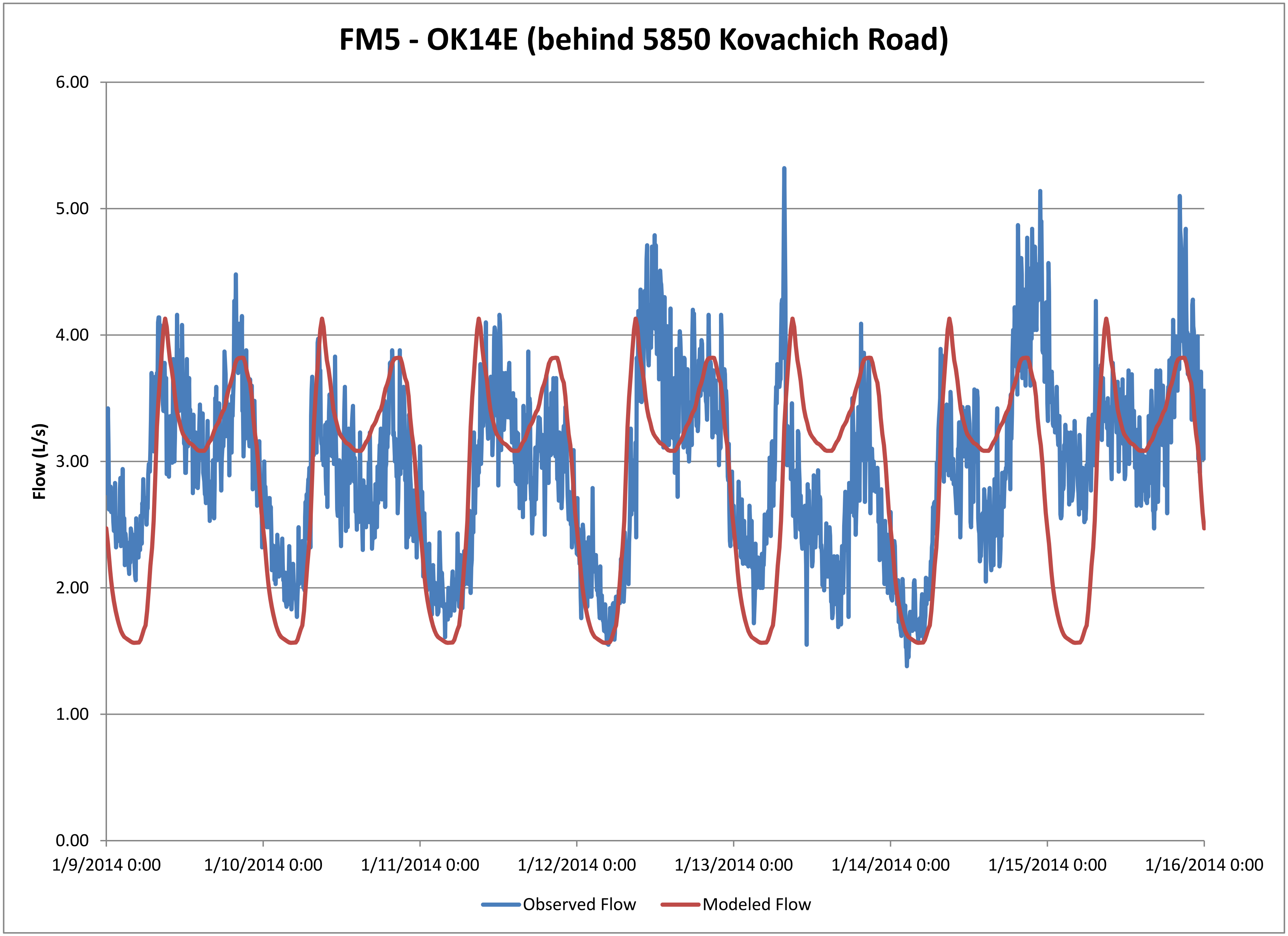
4/9/2014


FM3 - HH32C (3641 Wiebe Road)
160
140
120
100
80
60
40
20
0
Flow (L/s)
12/2/2013 0:00
12/3/2013 0:00
12/4/2013 0:00
12/5/2013 0:00
12/6/2013 0:00
12/7/2013 0:00
12/8/2013 0:00
12/9/2013 0:00
Modeled Flow
Observed Flow

4/9/2014

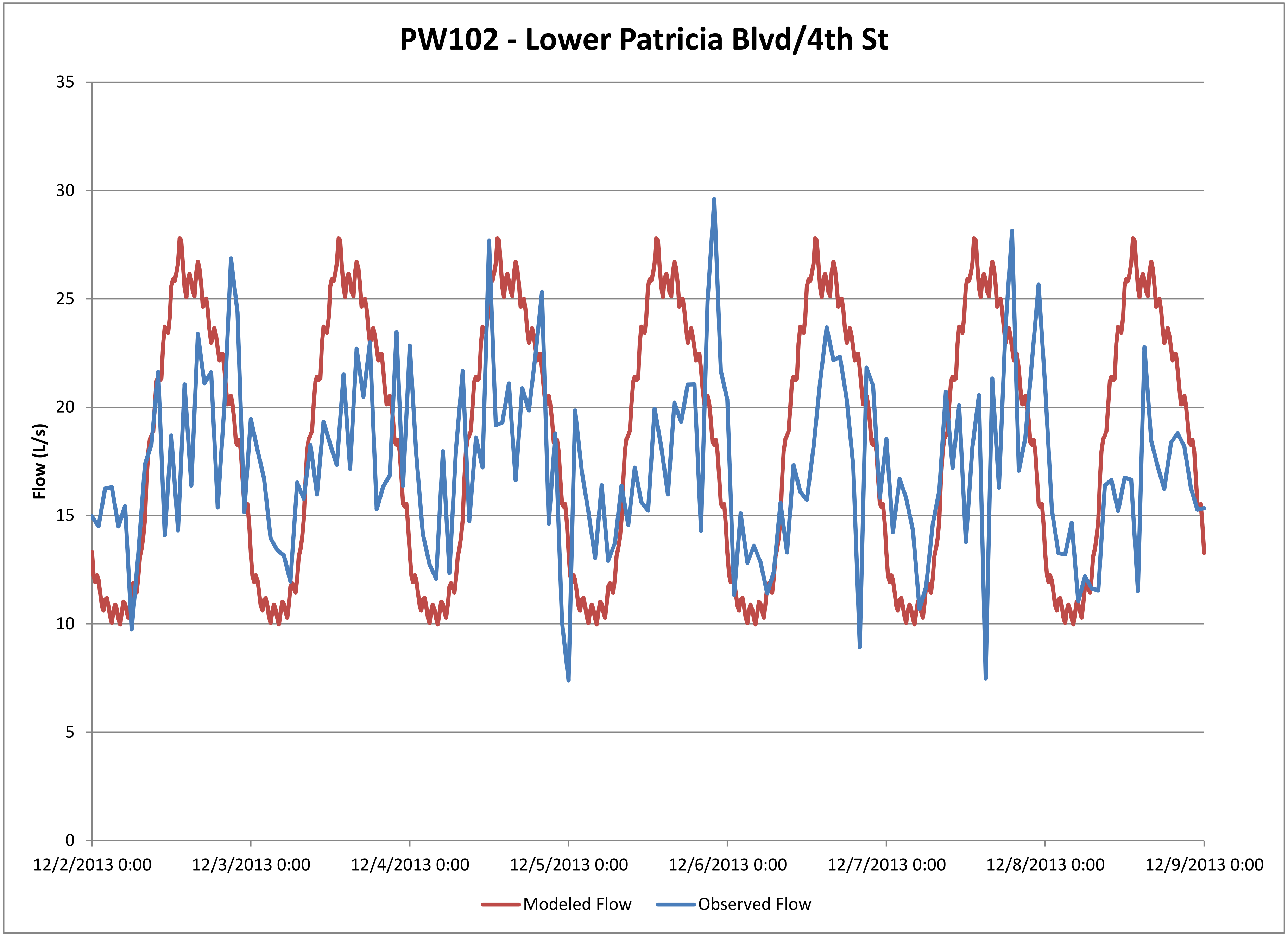

FM4 - HG73B (Service Road off Yellowhead Hwy)
Flow (L/s)
0
10
20
30
40
50
60
70
80
1/13/2014 0:00
1/14/2014 0:00
1/15/2014 0:00
1/16/2014 0:00
1/17/2014 0:00
1/18/2014 0:00
1/19/2014 0:00
Modeled Flow
Observed Flow

4/9/2014

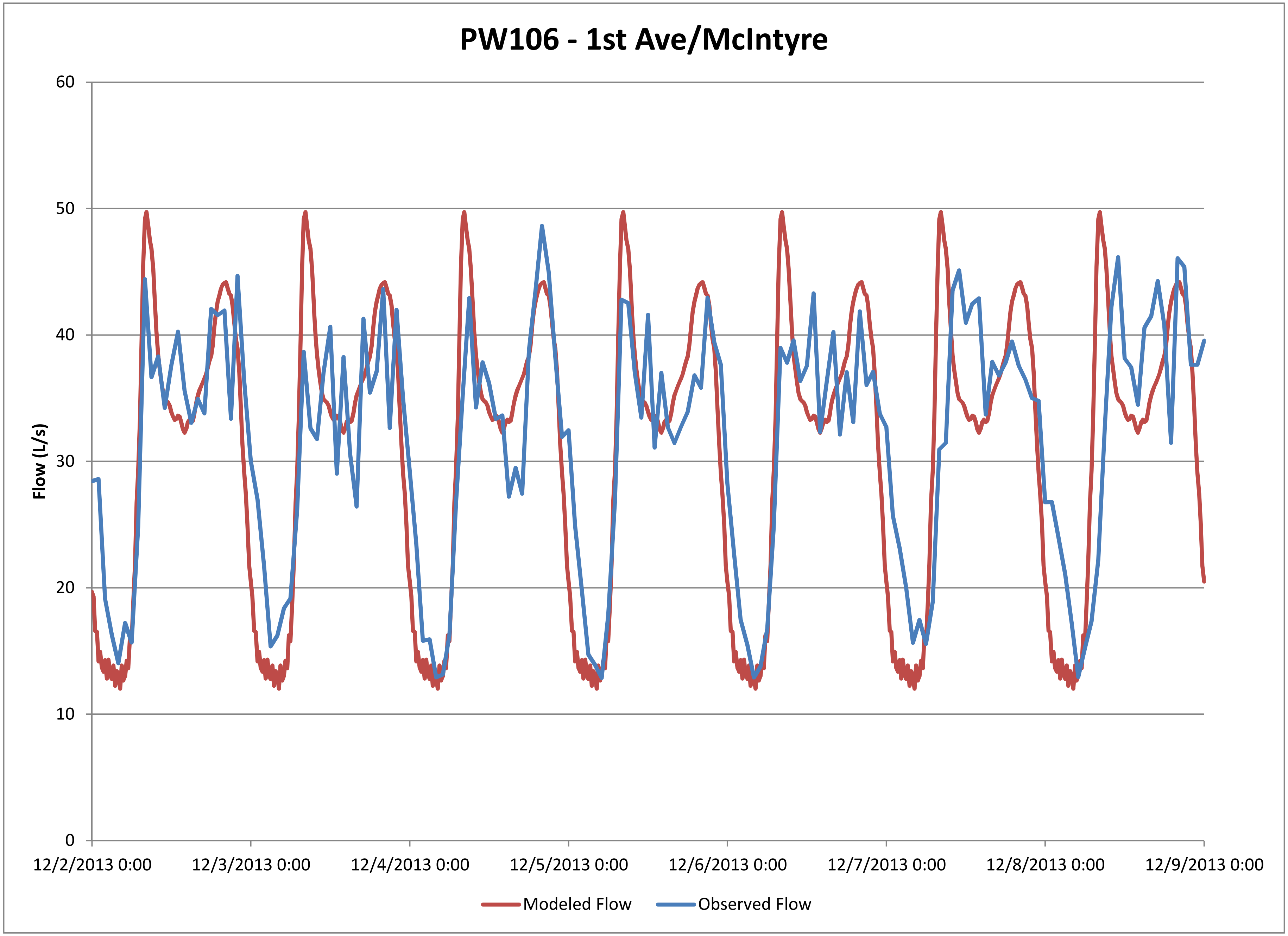


FM5 - OK14E (behind 5850 Kovachich Road)
Flow (L/s)
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1/9/2014 0:00
1/10/2014 0:00
1/11/2014 0:00
1/12/2014 0:00
1/13/2014 0:00
1/14/2014 0:00
1/15/2014 0:00
1/16/2014 0:00
Observed Flow
Modeled Flow

4/9/2014

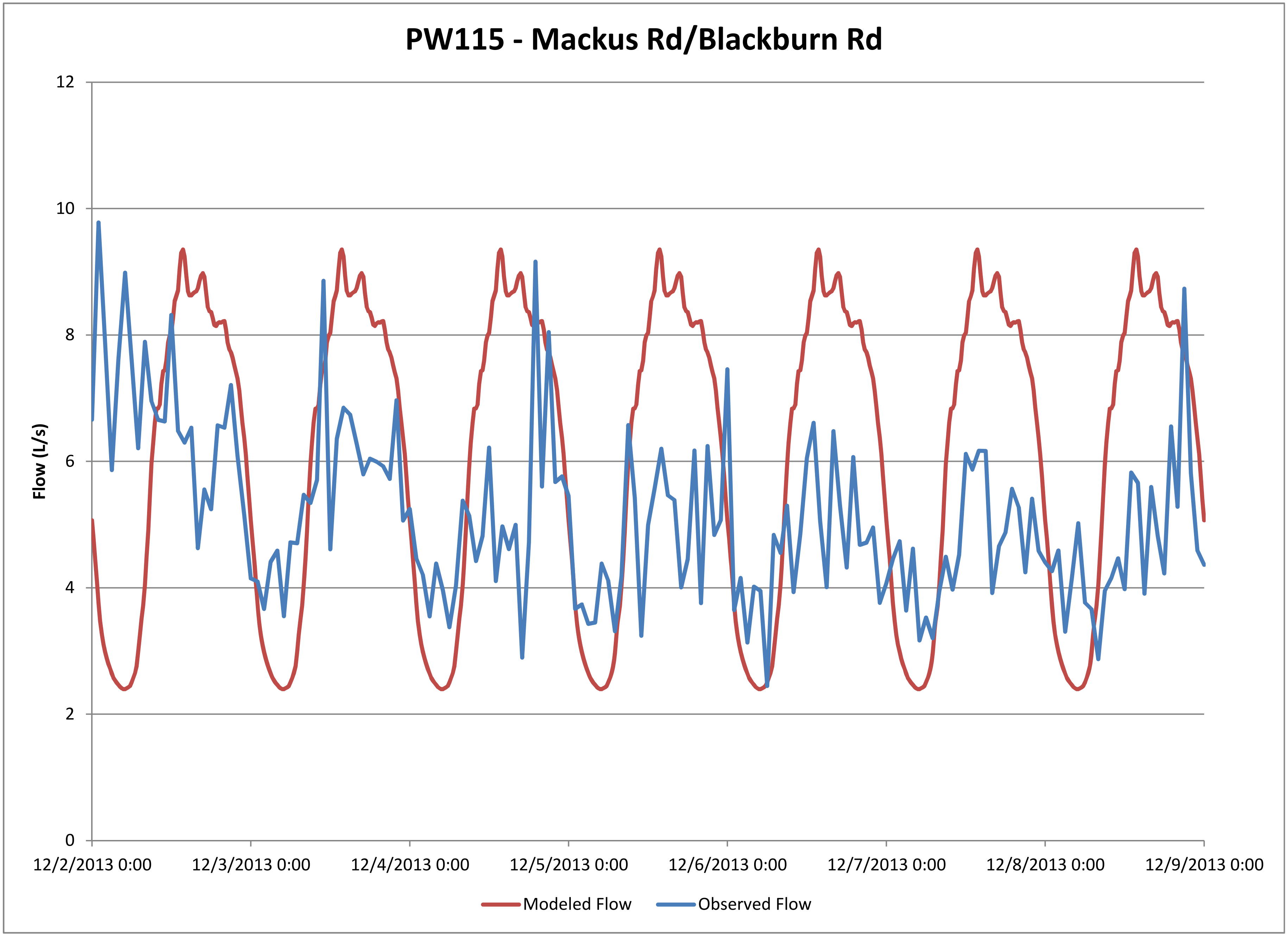

PW102 - Lower Patricia Blvd/4th St
Flow (L/s)
35
30
25
20
15
10
5
0
12/2/2013 0:00
12/3/2013 0:00
12/4/2013 0:00
12/5/2013 0:00
12/6/2013 0:00
12/7/2013 0:00
12/8/2013 0:00
12/9/2013 0:00
Modeled Flow
Observed Flow

4/9/2014

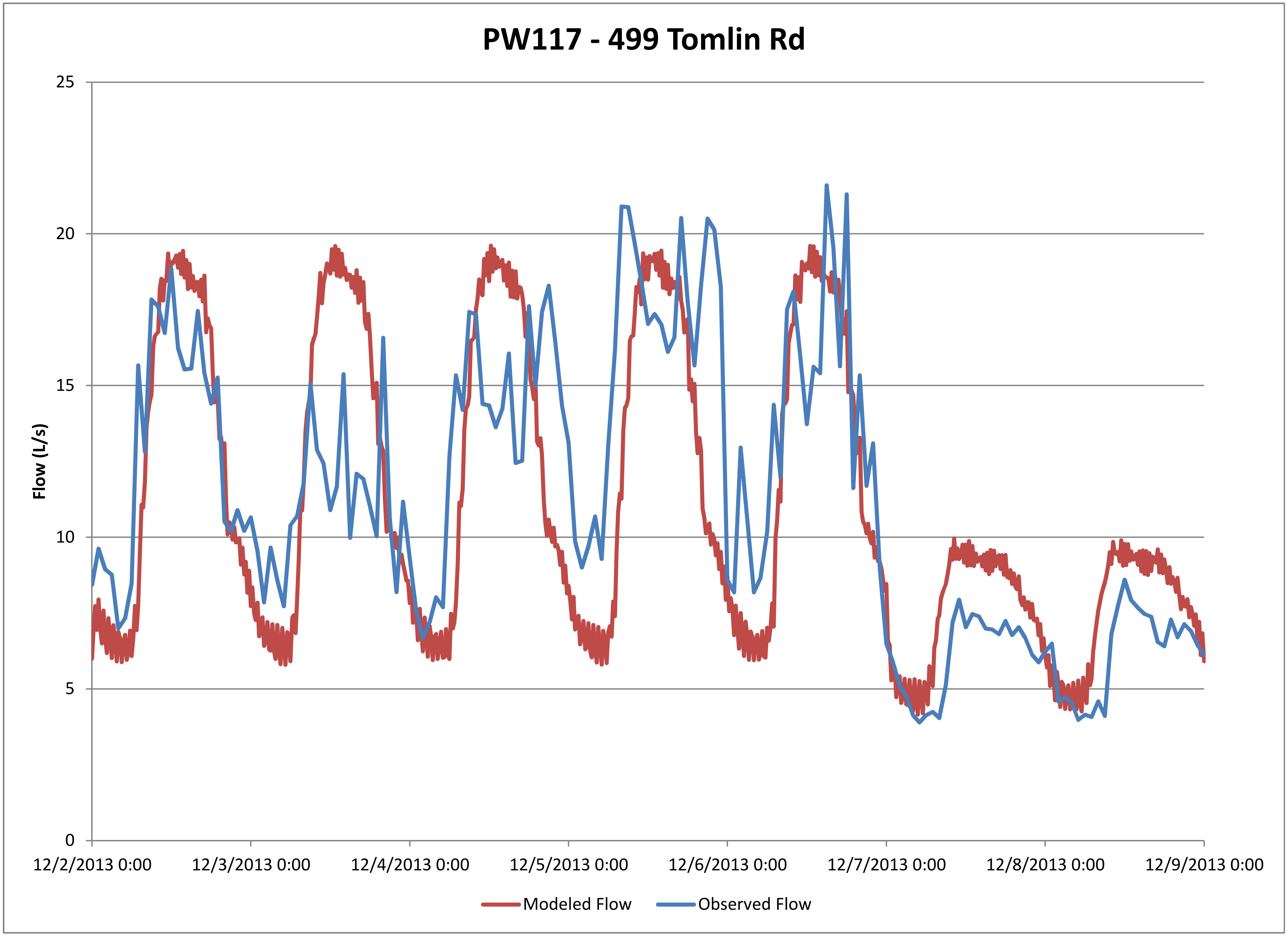


PW106 - 1st Ave/McIntyre
Flow (L/s)
60
50
40
30
20
10
0
12/2/2013 0:00
12/3/2013 0:00
12/4/2013 0:00
12/5/2013 0:00
12/6/2013 0:00
12/7/2013 0:00
12/8/2013 0:00
12/9/2013 0:00
Modeled Flow
Observed Flow

4/9/2014

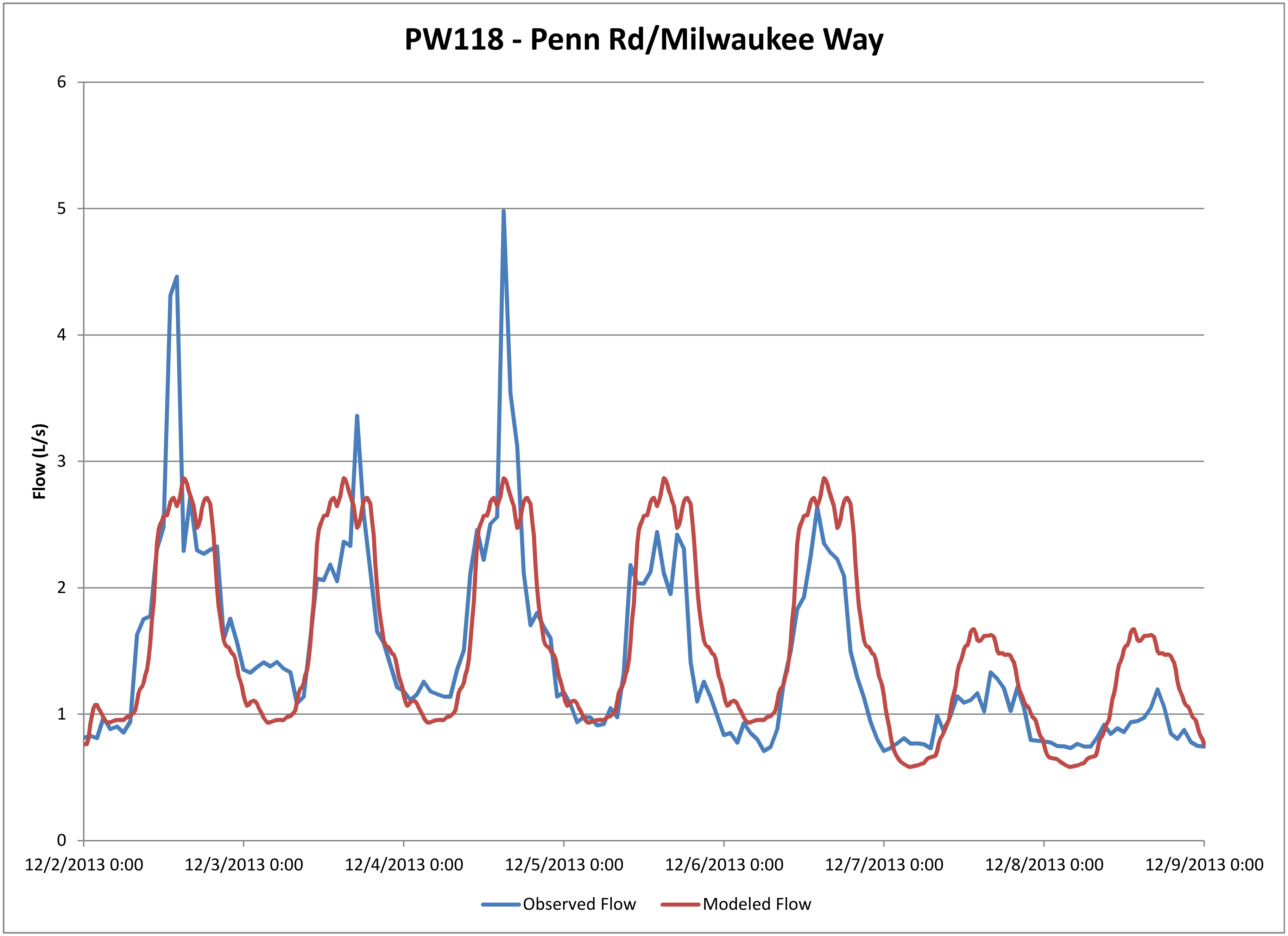

PW115 - Mackus Rd/Blackburn Rd
Flow (L/s)
0
2
4
6
8
10
12
12/2/2013 0:00
12/3/2013 0:00
12/4/2013 0:00
12/5/2013 0:00
12/6/2013 0:00
12/7/2013 0:00
12/8/2013 0:00
12/9/2013 0:00
Modeled Flow
Observed Flow

4/9/2014

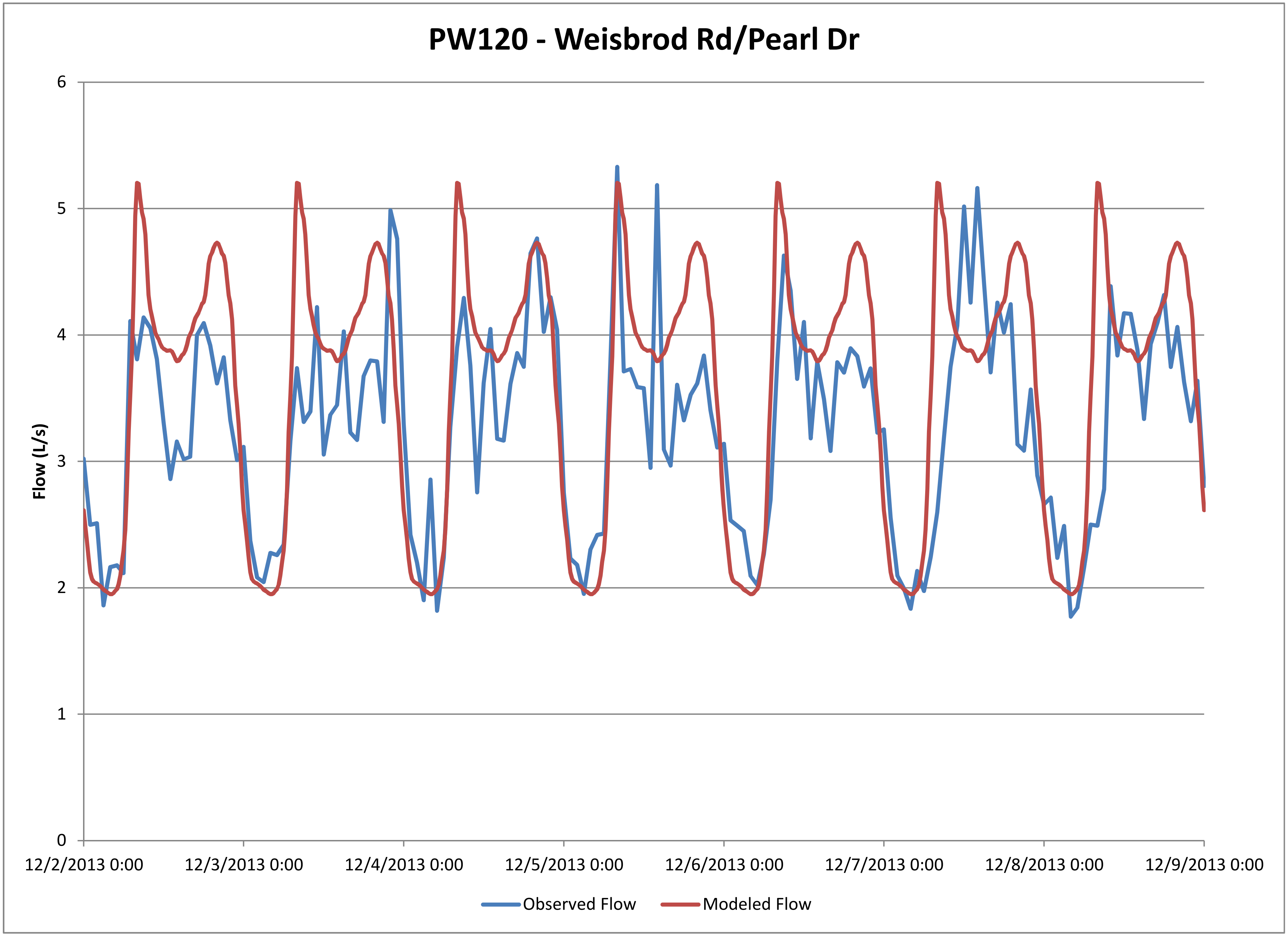


PW117 - 499 Tomlin Rd
Flow (L/s)
25
20
15
10
5
0
12/2/2013 0:00
12/3/2013 0:00
12/4/2013 0:00
12/5/2013 0:00
12/6/2013 0:00
12/7/2013 0:00
12/8/2013 0:00
12/9/2013 0:00
Modeled Flow
Observed Flow

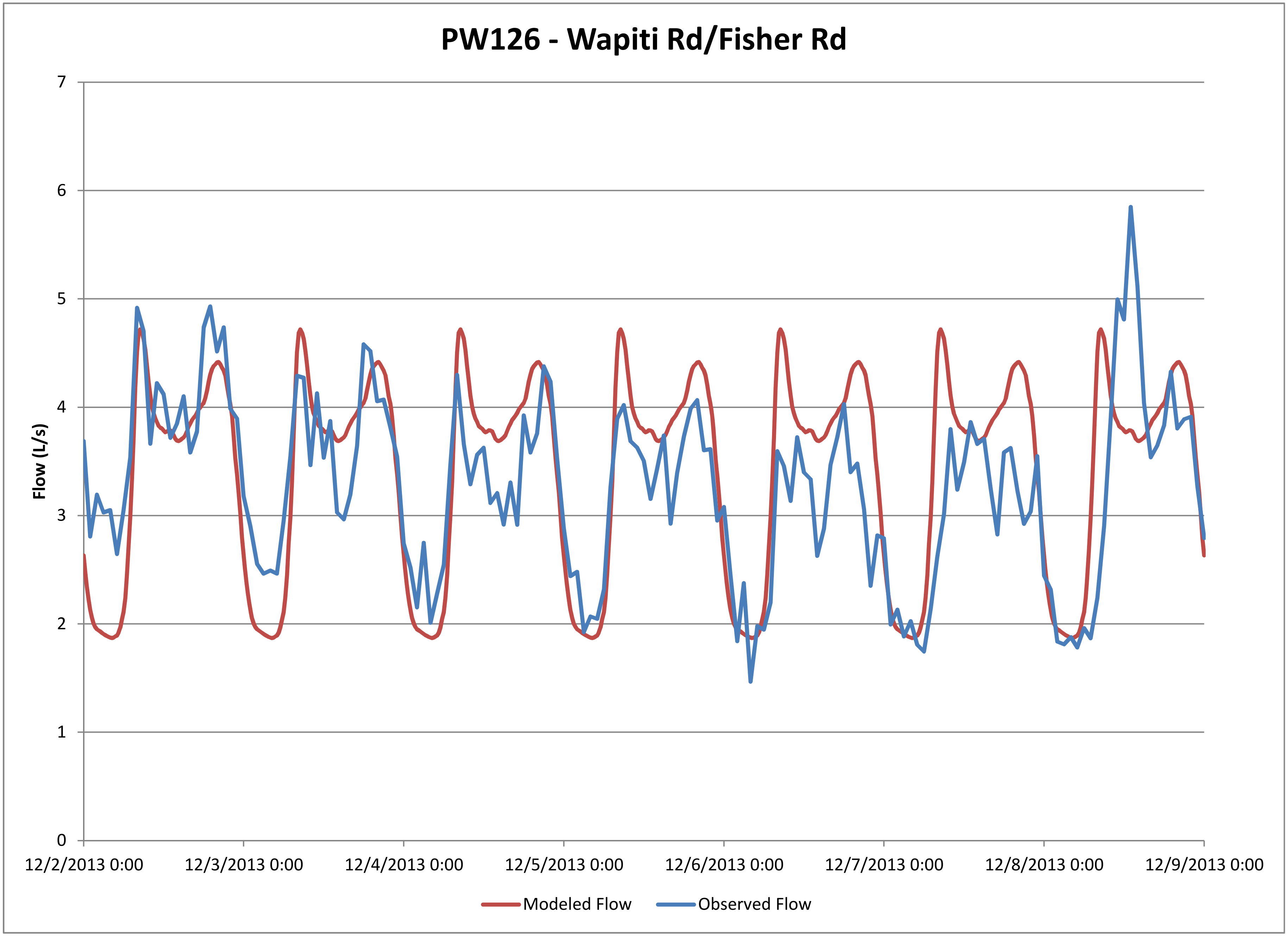
4/9/2014


PW118 - Penn Rd/Milwaukee Way
Flow (L/s)
6
5
4
3
2
1
0
12/2/2013 0:00
12/3/2013 0:00
12/4/2013 0:00
12/5/2013 0:00
12/6/2013 0:00
12/7/2013 0:00
12/8/2013 0:00
12/9/2013 0:00
Observed Flow
Modeled Flow

4/9/2014


PW120 - Weisbrod Rd/Pearl Dr
Flow (L/s)
0
1
2
3
4
5
6
12/2/2013 0:00
12/3/2013 0:00
12/4/2013 0:00
12/5/2013 0:00
12/6/2013 0:00
12/7/2013 0:00
12/8/2013 0:00
12/9/2013 0:00
Observed Flow
Modeled Flow

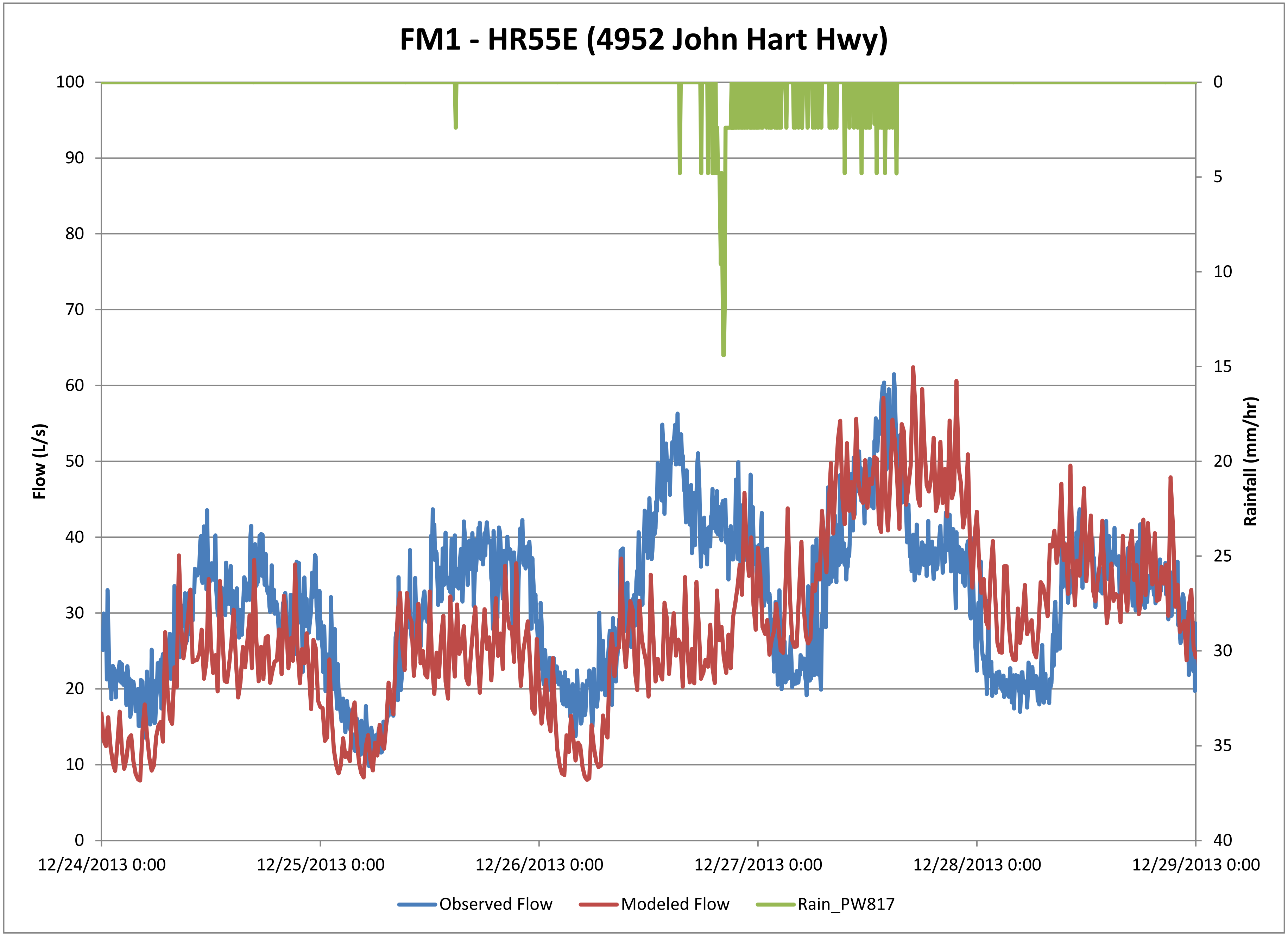
4/9/2014



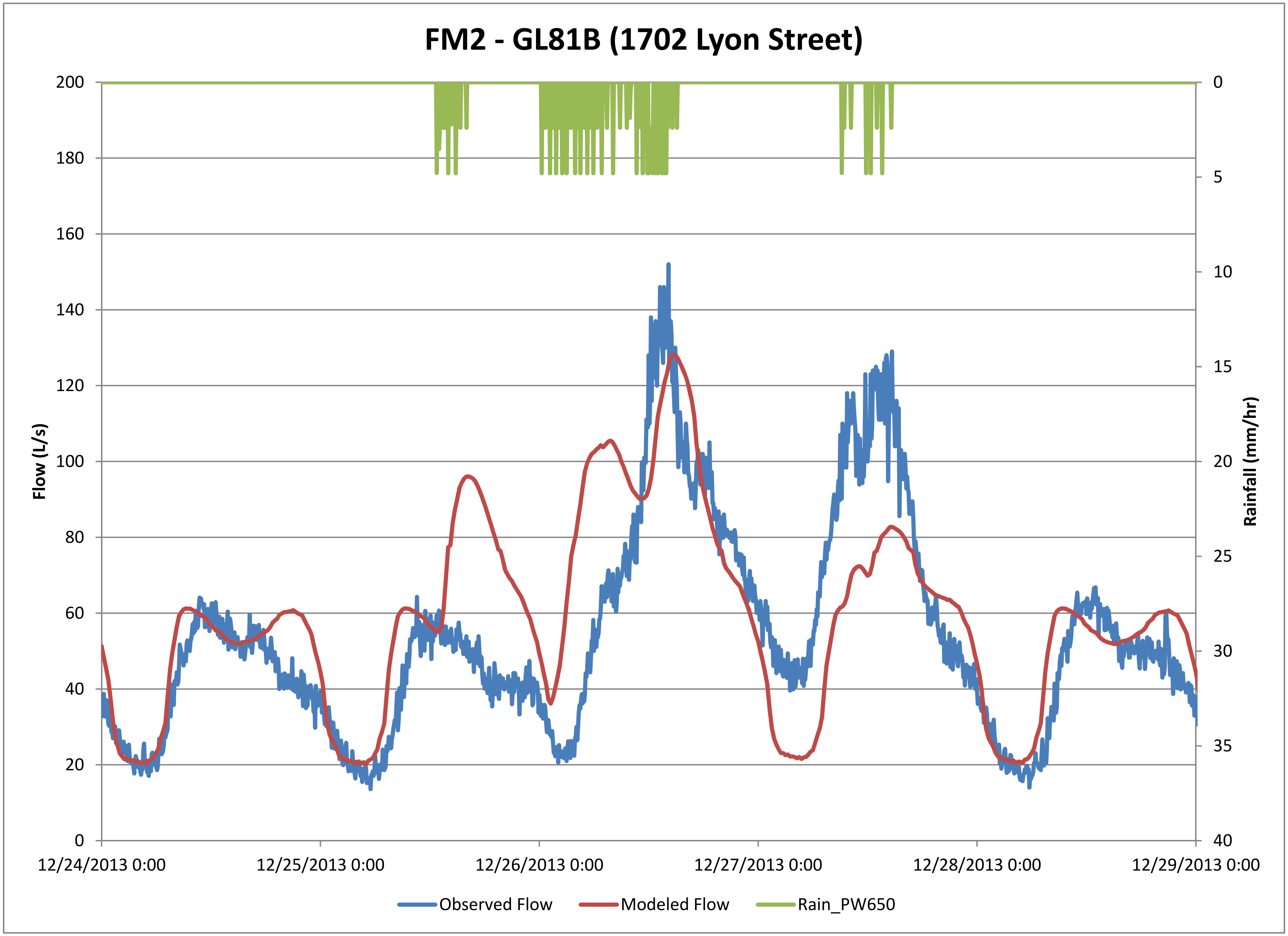
PW126 - Wapiti Rd/Fisher Rd
Flow (L/s)
0
1
2
3
4
5
6
7
12/2/2013 0:00
12/3/2013 0:00
12/4/2013 0:00
12/5/2013 0:00
12/6/2013 0:00
12/7/2013 0:00
12/8/2013 0:00
12/9/2013 0:00
Modeled Flow
Observed Flow

4/9/2014

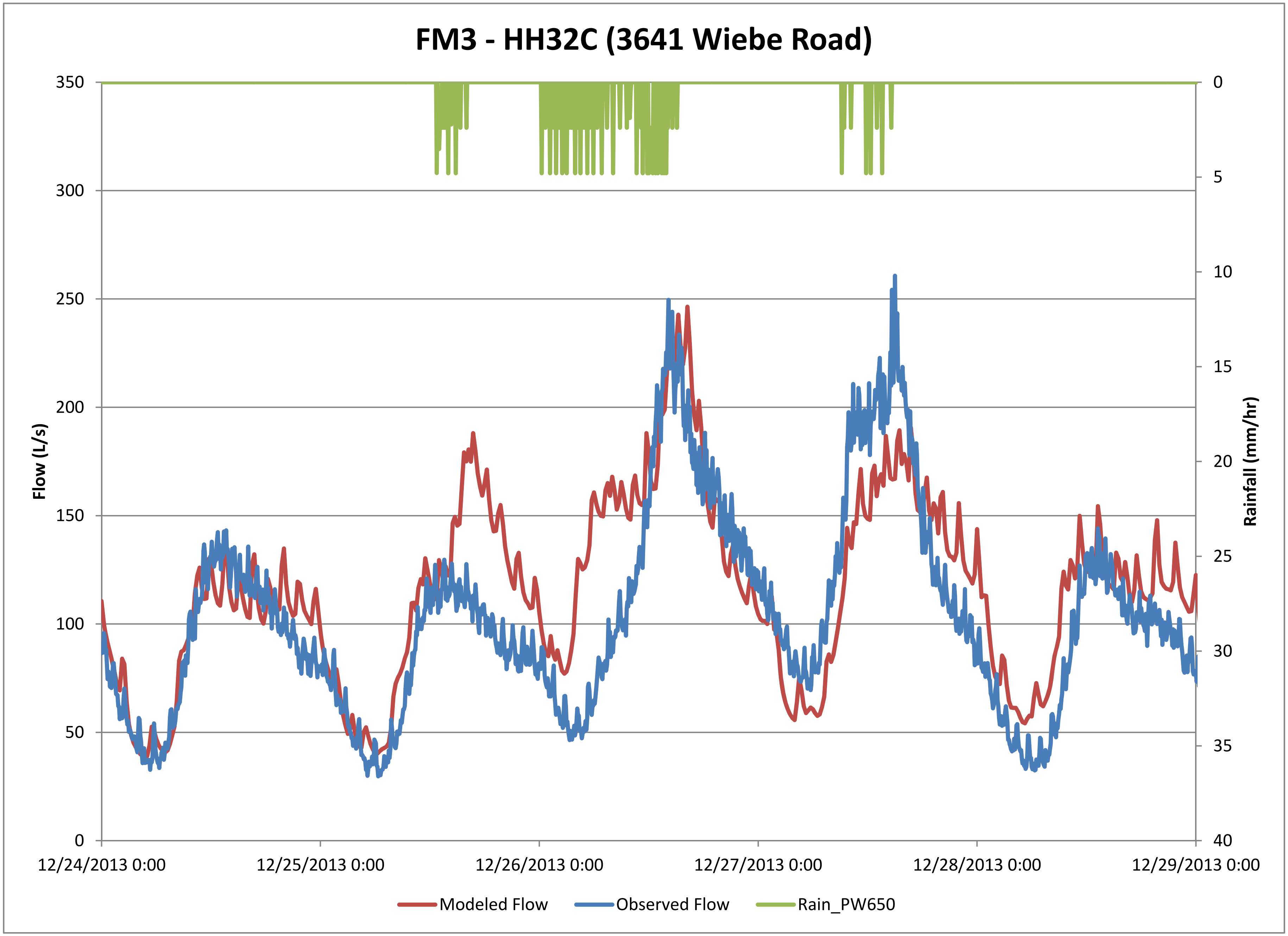
Appendix B
December Wet Weather Flow Calibration Plots


FM1 - HR55E (4952 John Hart Hwy)
Flow (L/s)
Rainfall (mm/hr)
100
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
40
12/24/2013 0:00
12/25/2013 0:00
12/26/2013 0:00
12/27/2013 0:00
12/28/2013 0:00
12/29/2013 0:00
Observed Flow
Modeled Flow
Rain_PW817

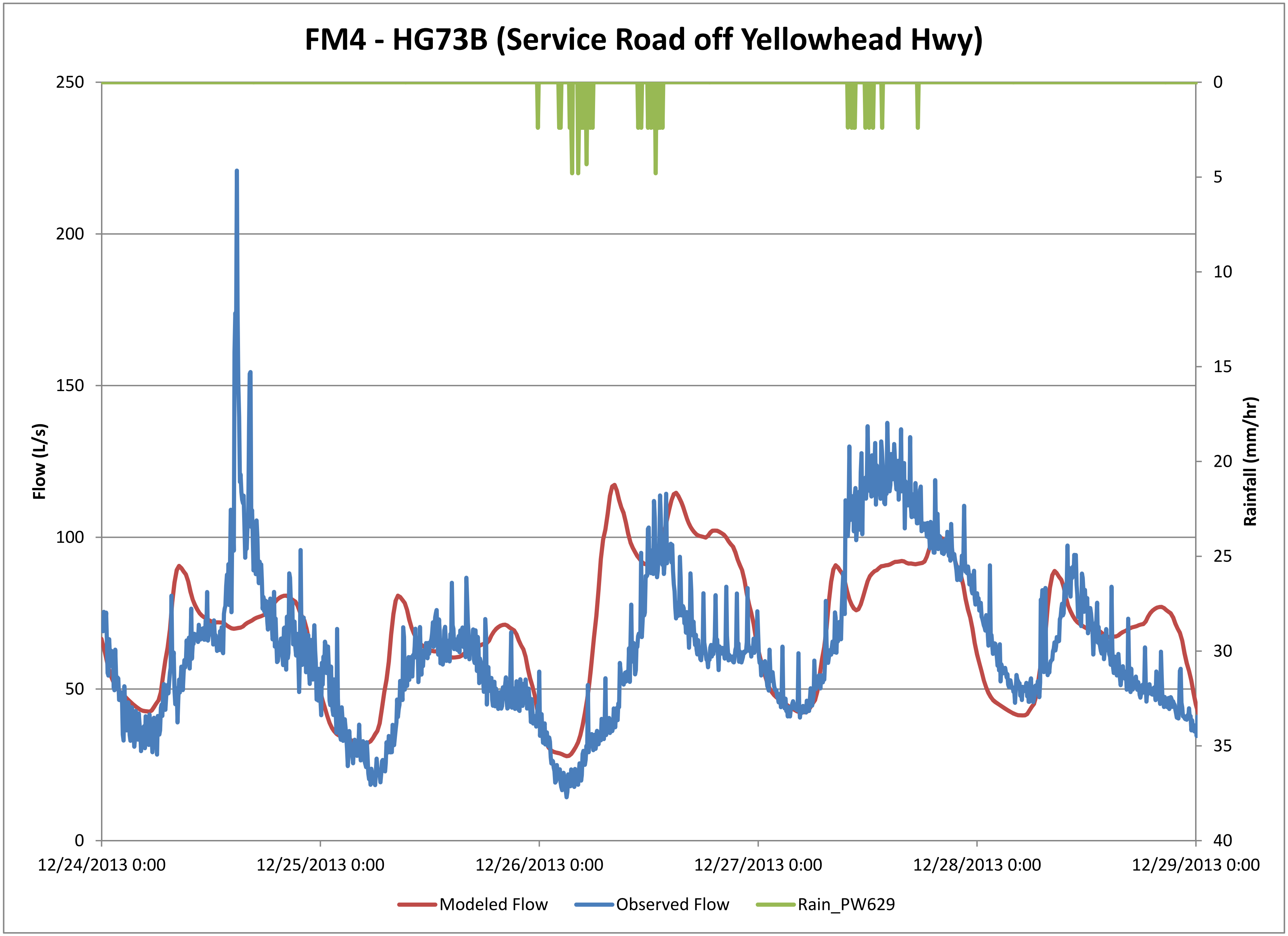
4/10/2014


FM2 - GL81B (1702 Lyon Street)
Flow (L/s)
Rainfall (mm/hr)
0
20
40
60
80
100
120
140
160
180
200
5
10
15
25
30
35
12/24/2013 0:00
12/25/2013 0:00
12/26/2013 0:00
12/27/2013 0:00
12/28/2013 0:00
12/29/2013 0:00
Observed Flow
Modeled Flow
Rain_PW650

4/10/2014

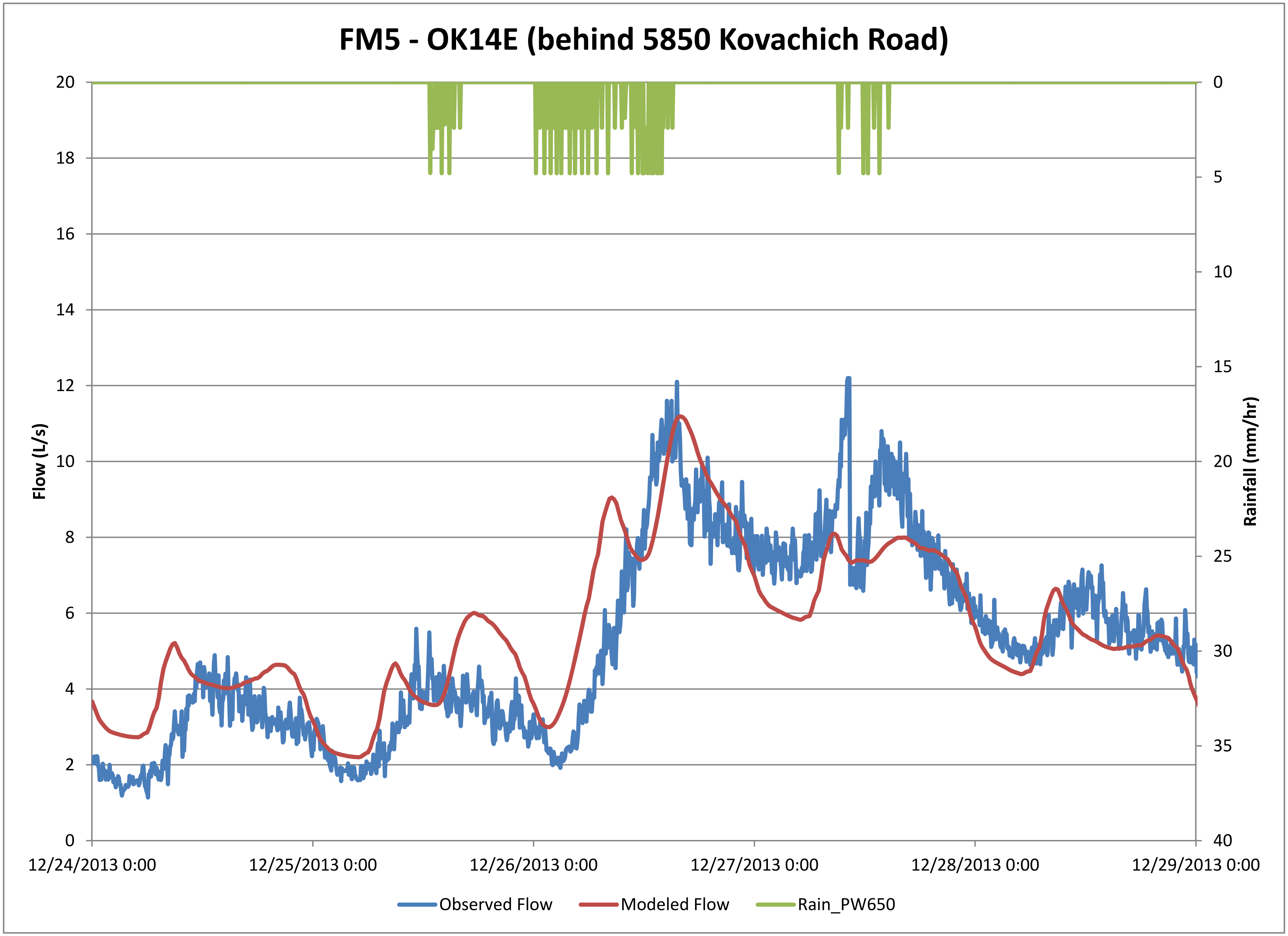

FM3 - HH32C (3641 Wiebe Road)
Flow (L/s)
Rainfall (mm/hr)
0
50
100
150
200
250
300
350
0
5
10
15
20
25
30
35
40
12/24/2013 0:00
12/25/2013 0:00
12/26/2013 0:00
12/27/2013 0:00
12/28/2013 0:00
12/29/2013 0:00
Modeled Flow
Observed Flow
Rain_PW650

4/10/2014



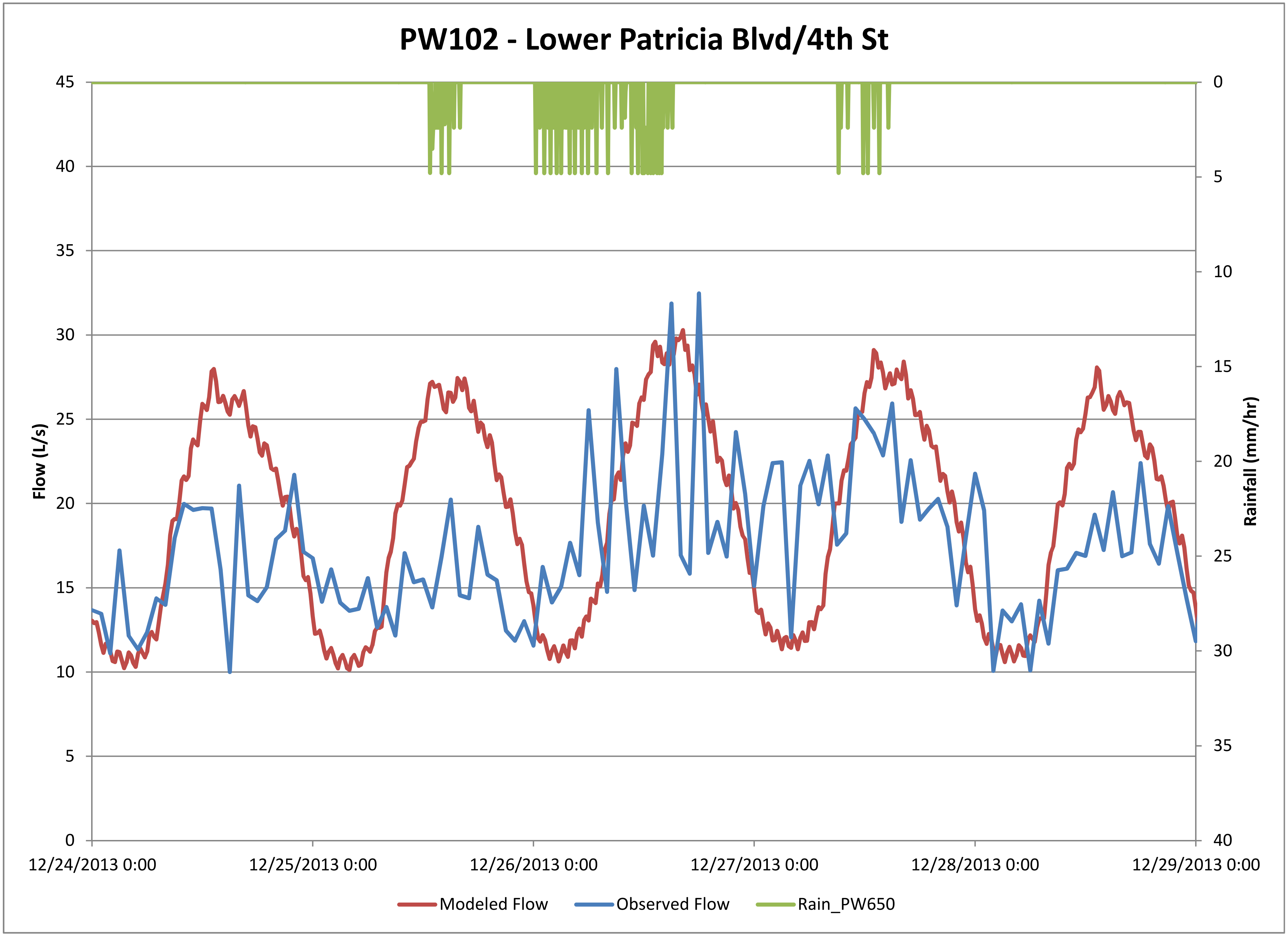
FM4 - HG73B (Service Road off Yellowhead Hwy)
Flow (L/s)
Rainfall (mm/hr)
250
200
150
100
50
0
0
5
10
15
20
25
30
35
40
12/24/2013 0:00
12/25/2013 0:00
12/26/2013 0:00
12/27/2013 0:00
12/28/2013 0:00
12/29/2013 0:00
Modeled Flow
Observed Flow
Rain_PW629

4/10/2014



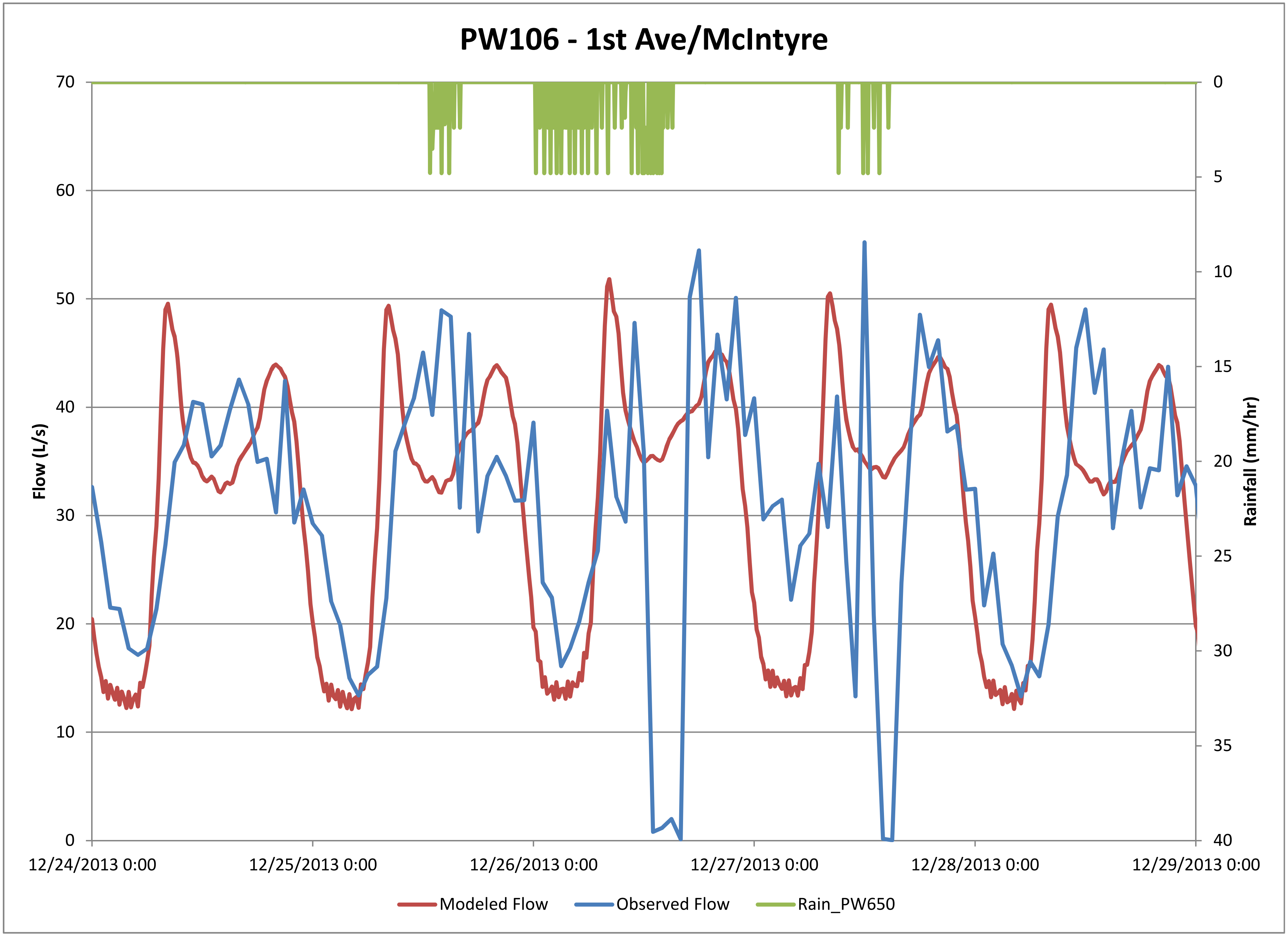
FM5 - OK14E (behind 5850 Kovachich Road)
Flow (L/s)
Rainfall (mm/hr)
0
2
4
6
8
10
12
14
16
18
20
0
5
10
15
20
25
30
35
40
12/24/2013 0:00
12/25/2013 0:00
12/26/2013 0:00
12/27/2013 0:00
12/28/2013 0:00
12/29/2013 0:00
Observed Flow
Modeled Flow
Rain_PW650

4/10/2014

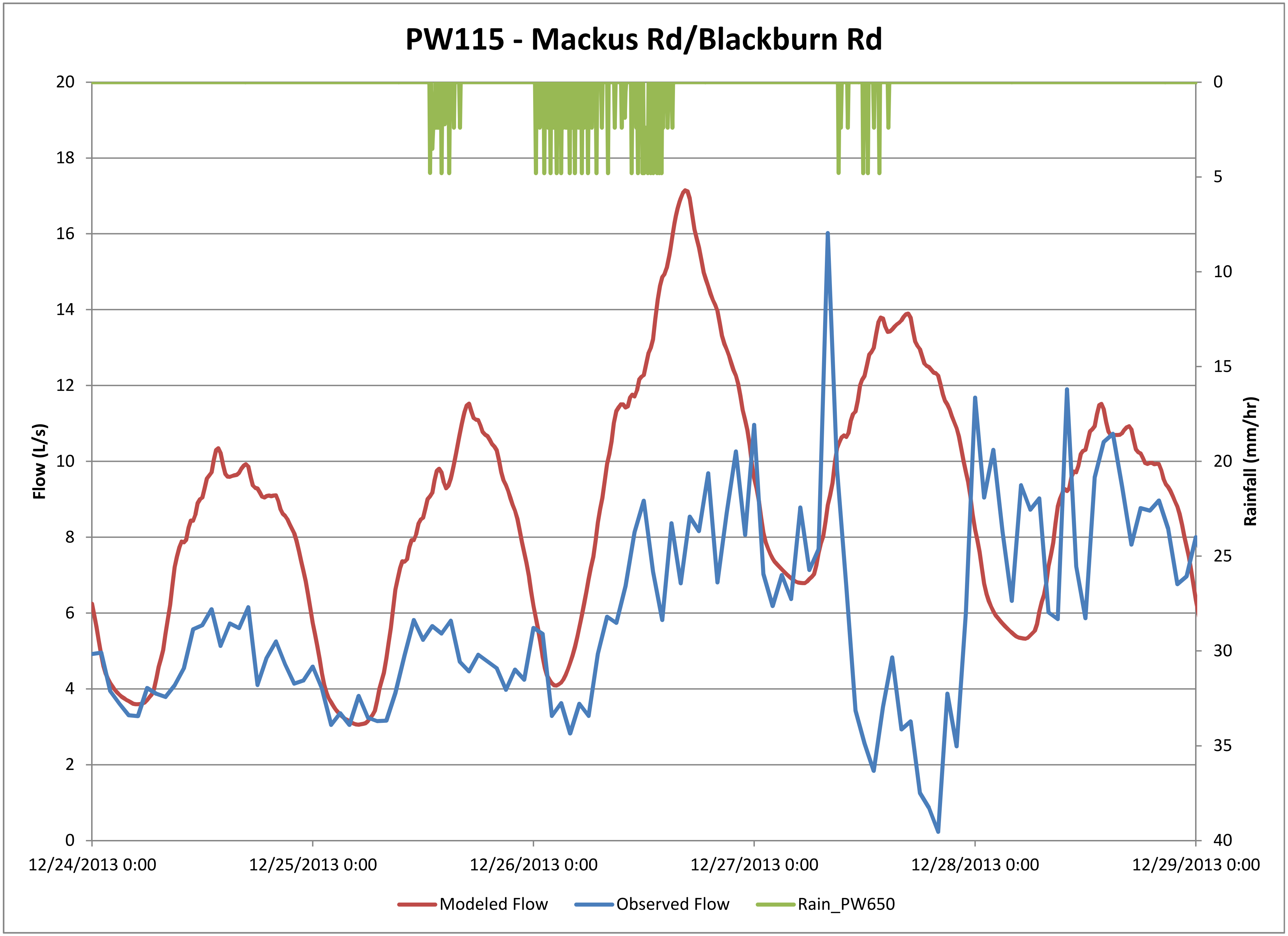


PW102 - Lower Patricia Blvd/4th St
Flow (L/s)
Rainfall (mm/hr)
45
40
35
30
25
20
15
10
5
0
10
15
20
25
30
35
40
12/24/2013 0:00
12/25/2013 0:00
12/26/2013 0:00
12/27/2013 0:00
12/28/2013 0:00
12/29/2013 0:00
Modeled Flow
Observed Flow
Rain_PW650

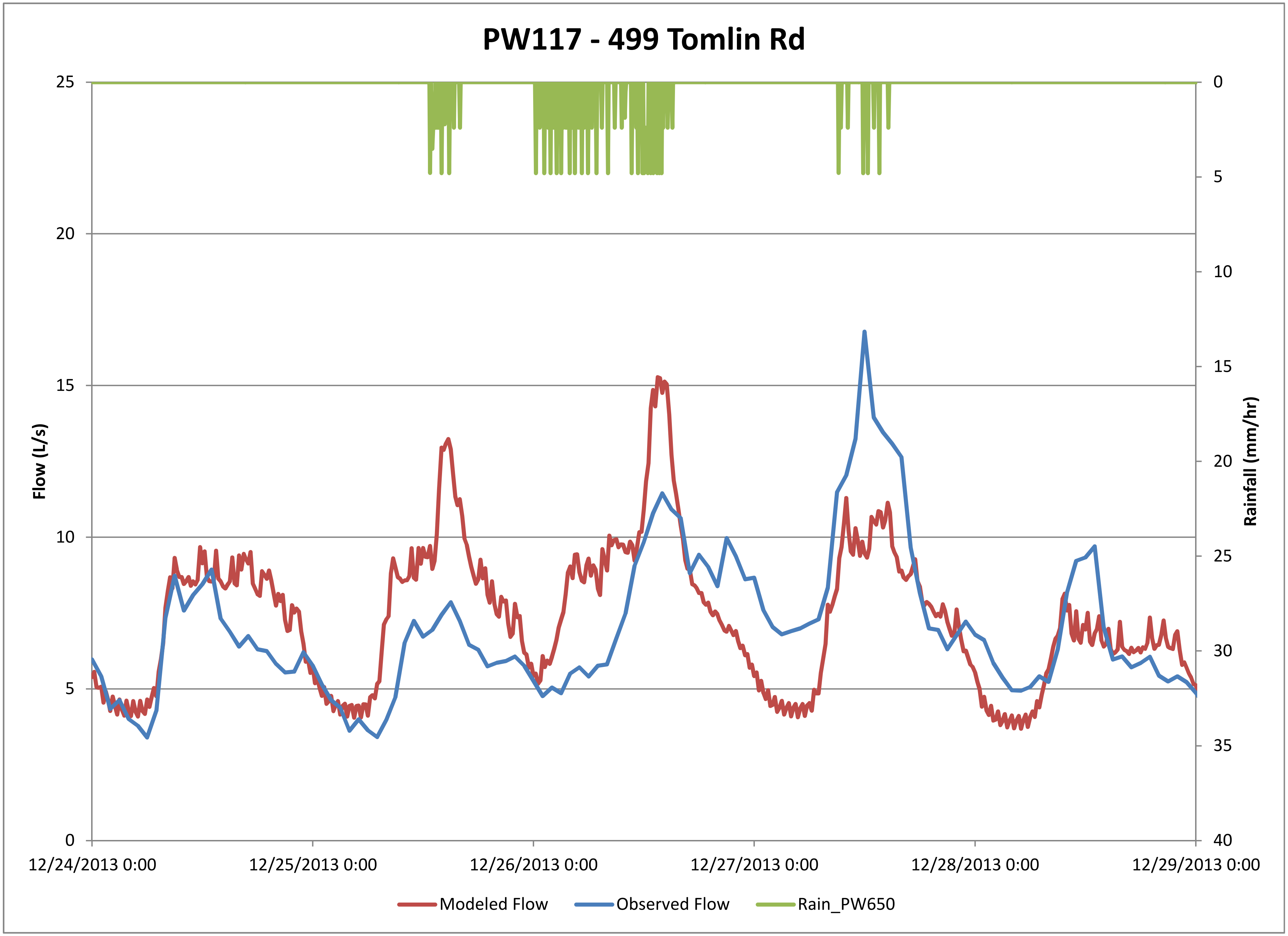
4/10/2014


PW106 - 1st Ave/McIntyre
Flow (L/s)
Rainfall (mm/hr)
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
40
12/24/2013 0:00
12/25/2013 0:00
12/26/2013 0:00
12/27/2013 0:00
12/28/2013 0:00
12/29/2013 0:00
Modeled Flow
Observed Flow
Rain_PW650

4/10/2014

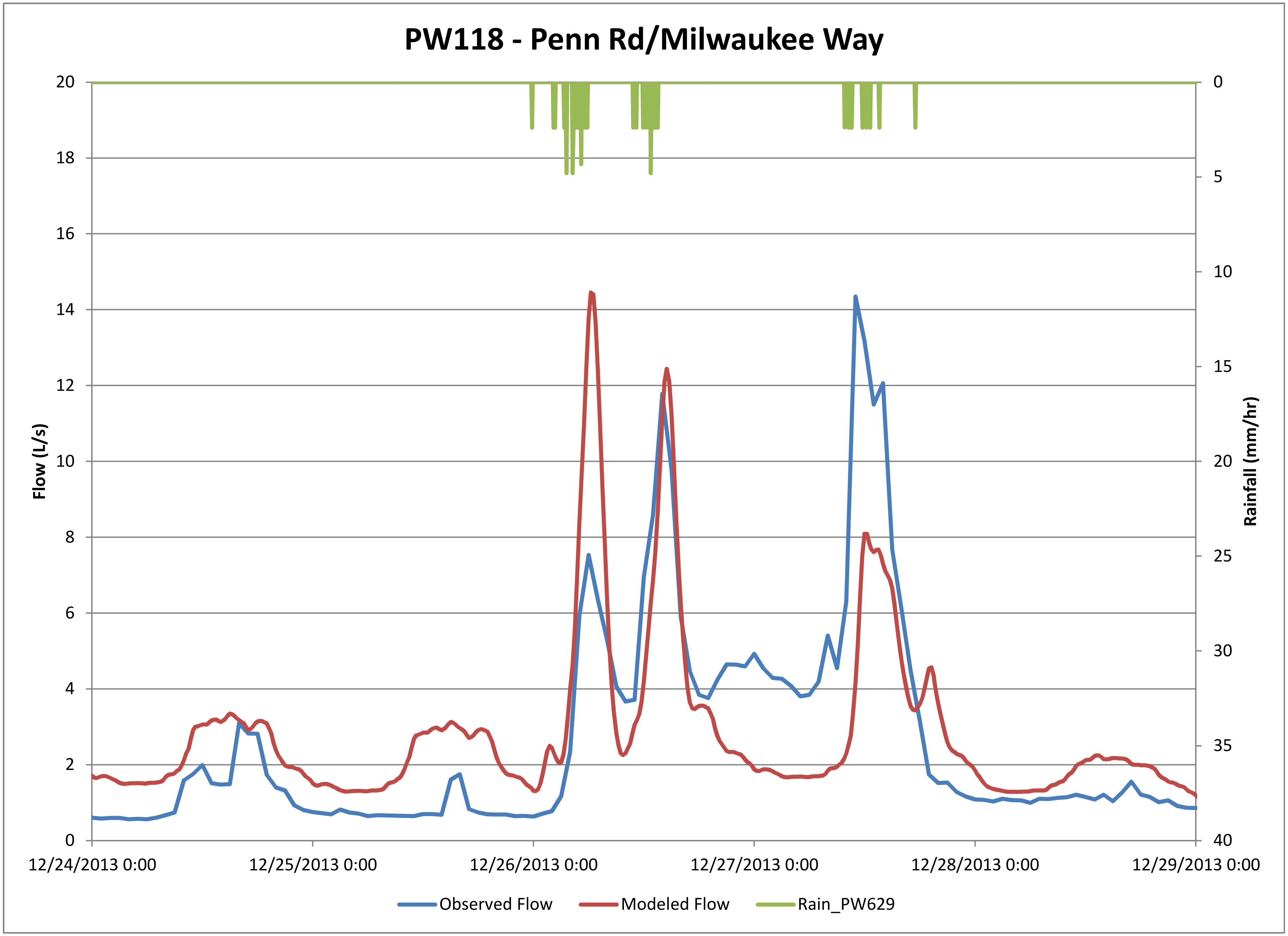

PW115 - Mackus Rd/Blackburn Rd
Flow (L/s)
Rainfall (mm/hr)
0
2
4
6
8
10
12
14
16
18
20
0
5
10
15
20
25
30
35
40
12/24/2013 0:00
12/25/2013 0:00
12/26/2013 0:00
12/27/2013 0:00
12/28/2013 0:00
12/29/2013 0:00
Modeled Flow
Observed Flow
Rain_PW650

4/10/2014

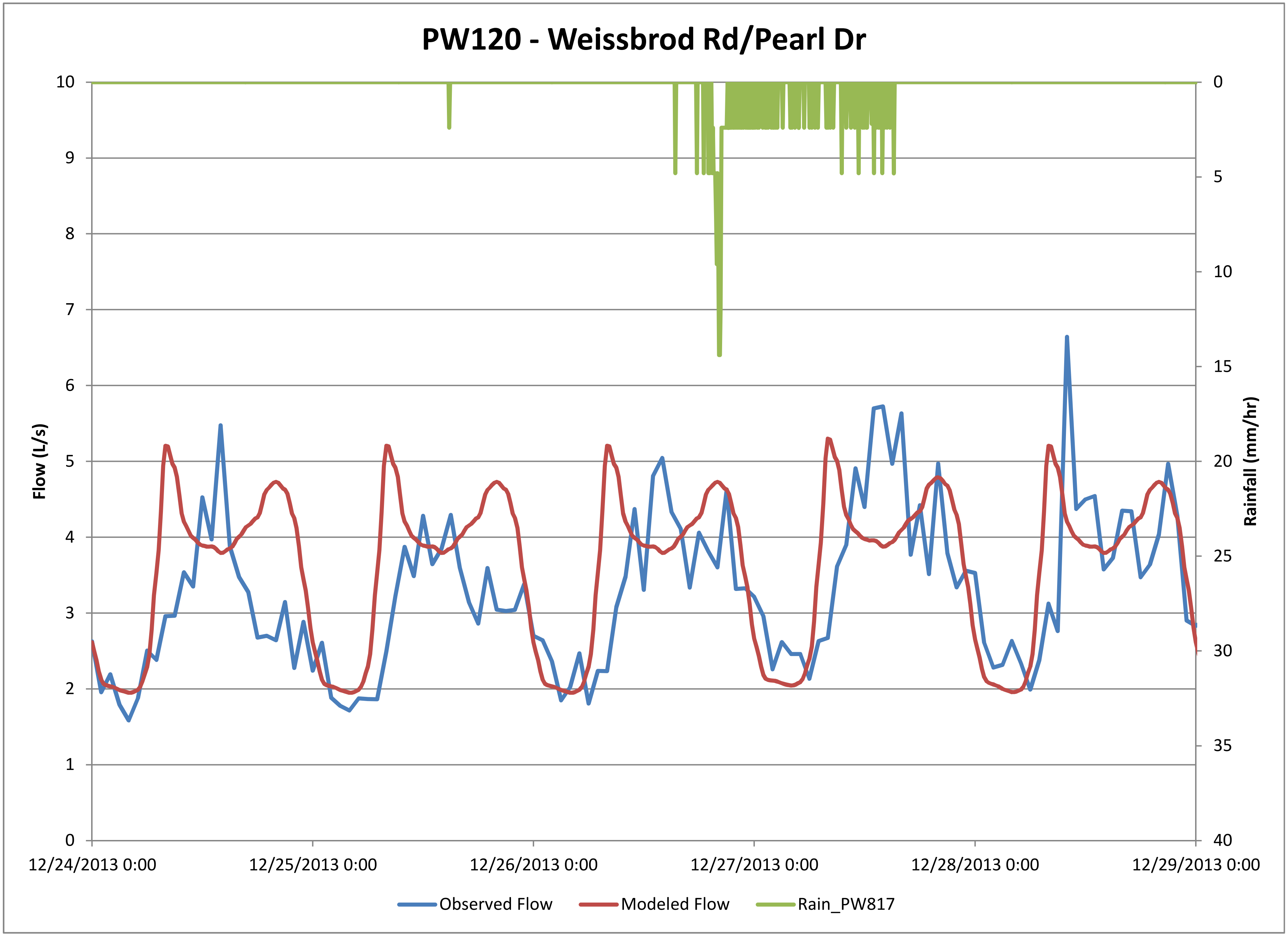


PW117 - 499 Tomlin Rd
Flow (L/s)
Rainfall (mm/hr)
25
20
15
10
5
0
0
5
10
15
20
25
30
35
40
12/24/2013 0:00
12/25/2013 0:00
12/26/2013 0:00
12/27/2013 0:00
12/28/2013 0:00
12/29/2013 0:00
Modeled Flow
Observed Flow
Rain_PW650

4/10/2014

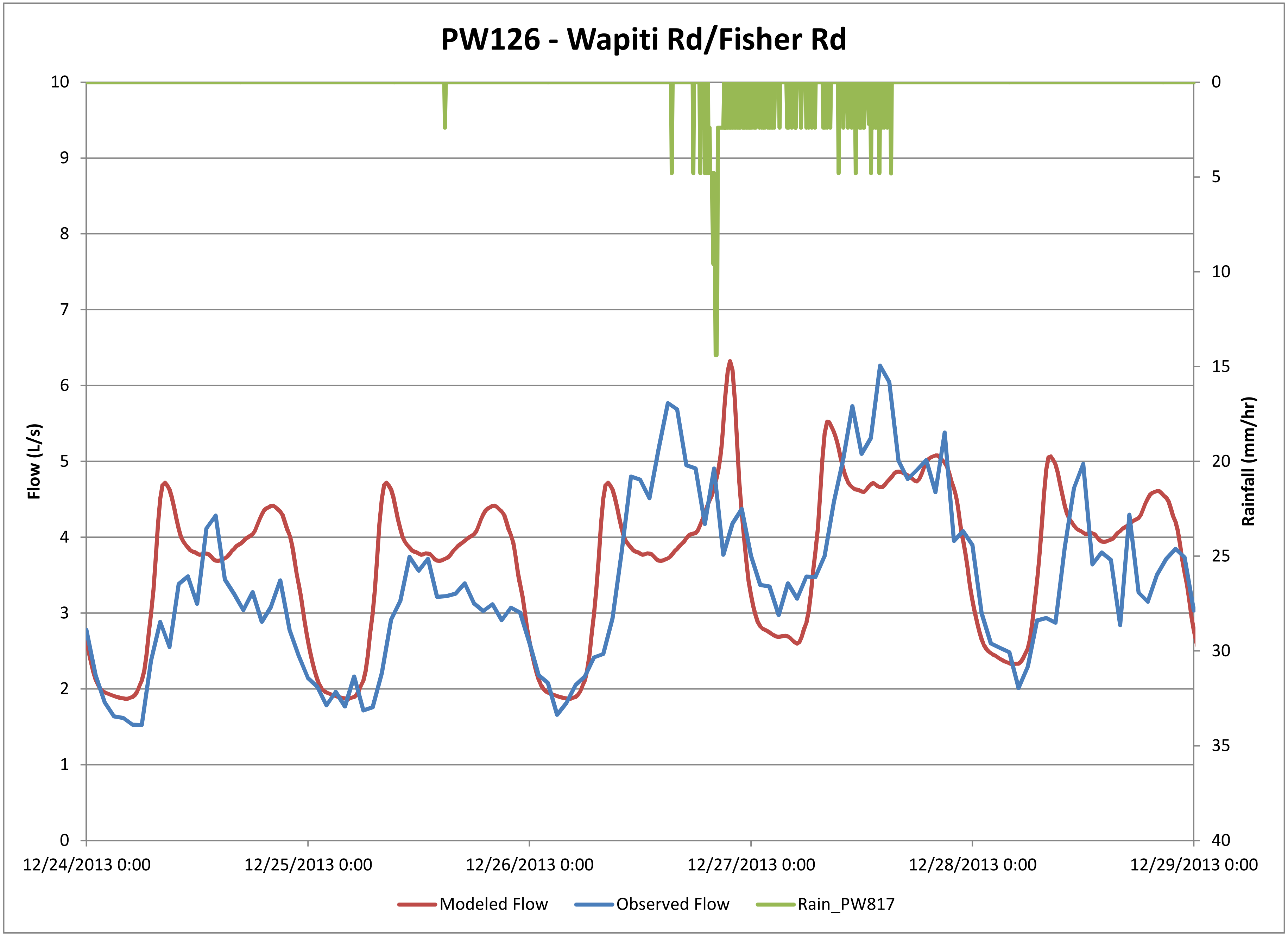

PW118 - Penn Rd/Milwaukee Way
Flow (L/s)
Rainfall (mm/hr)
20
18
16
14
12
10
8
6
4
2
0
0
5
10
15
20
25
30
35
40
12/24/2013 0:00
12/25/2013 0:00
12/26/2013 0:00
12/27/2013 0:00
12/28/2013 0:00
12/29/2013 0:00
Observed Flow
Modeled Flow
Rain_PW629

4/10/2014



PW120 - Weissbrod Rd/Pearl Dr
Flow (L/s)
Rainfall (mm/hr)
0
1
2
3
4
5
6
7
8
9
10
0
5
10
15
20
25
30
35
40
12/24/2013 0:00
12/25/2013 0:00
12/26/2013 0:00
12/27/2013 0:00
12/28/2013 0:00
12/29/2013 0:00
Observed Flow
Modeled Flow
Rain_PW817

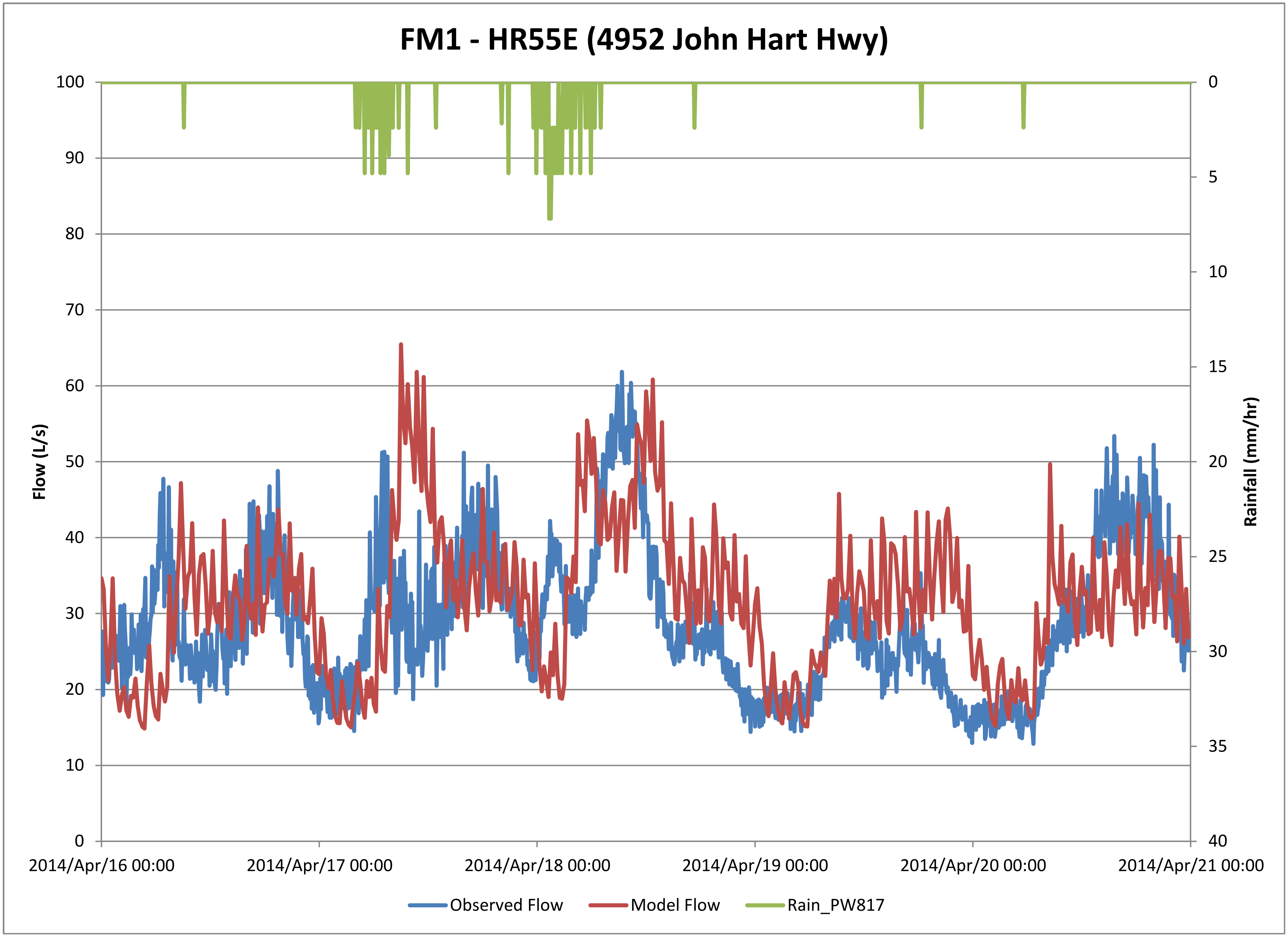
4/10/2014

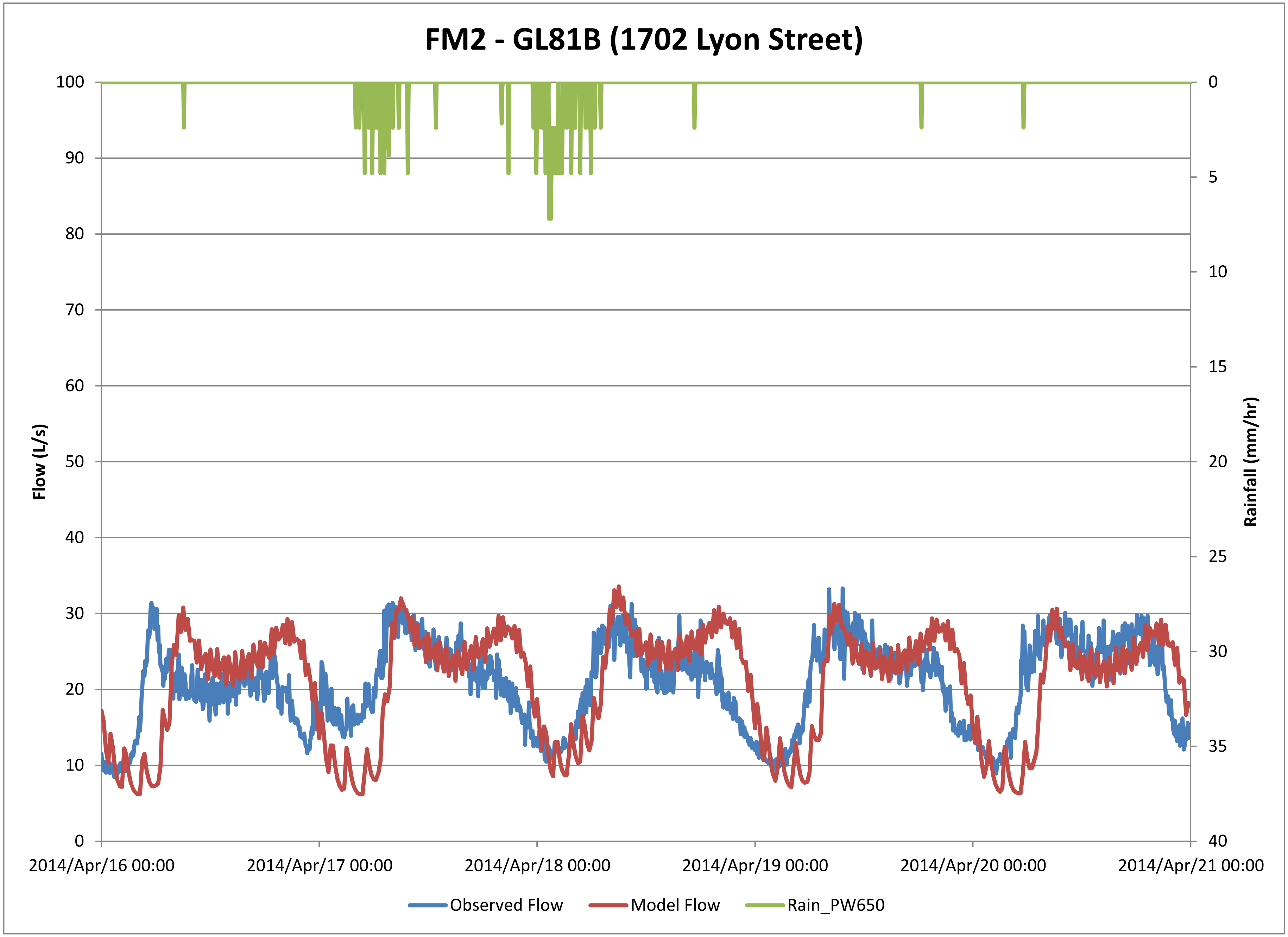


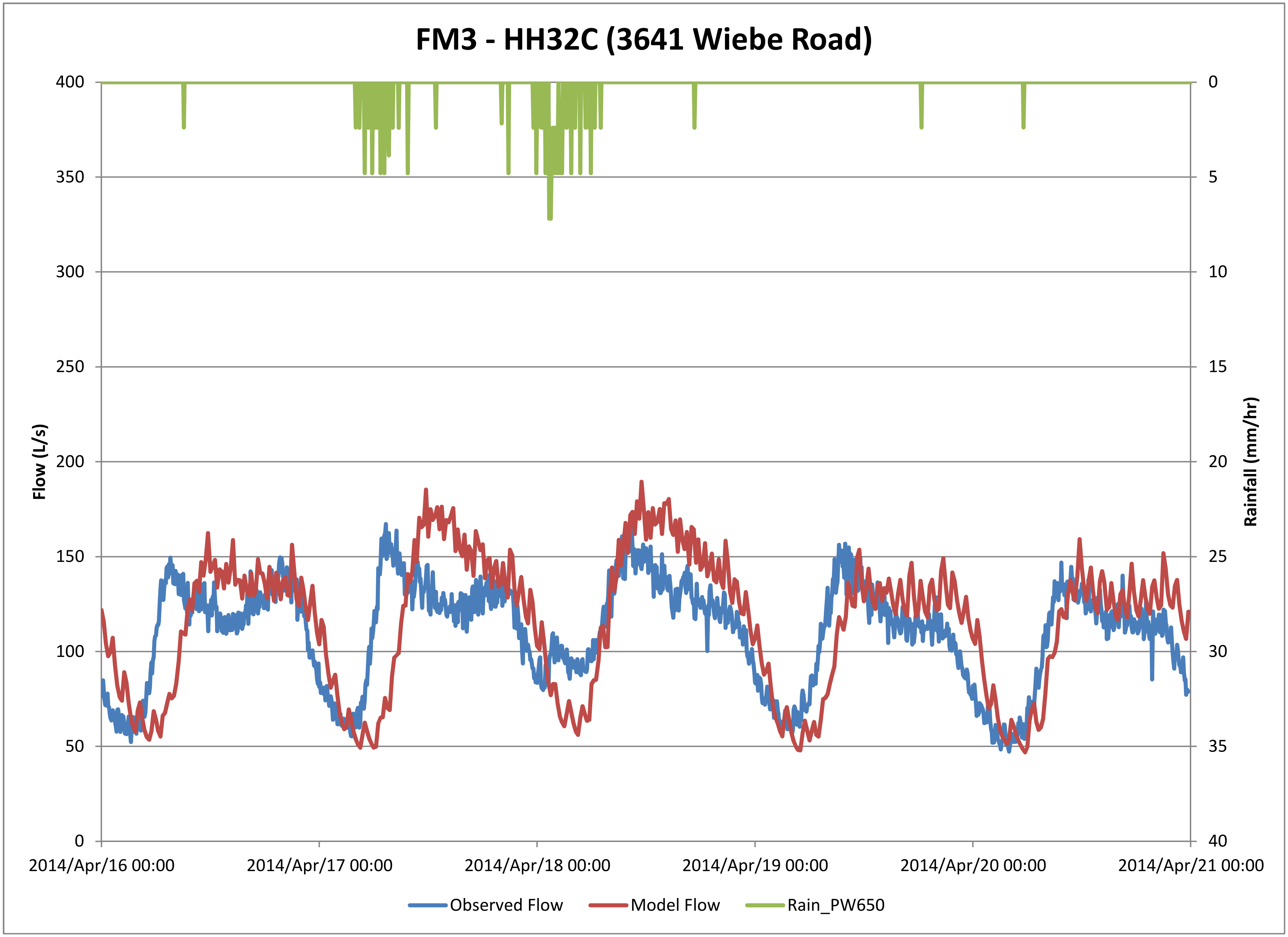
PW126 - Wapiti Rd/Fisher Rd
Flow (L/s)
Rainfall (mm/hr)
10
9
8
7
6
5
4
3
2
1
0
0
5
10
15
20
25
30
35
40
12/24/2013 0:00
12/25/2013 0:00
12/26/2013 0:00
12/27/2013 0:00
12/28/2013 0:00
12/29/2013 0:00
Modeled Flow
Observed Flow
Rain_PW817

4/10/2014

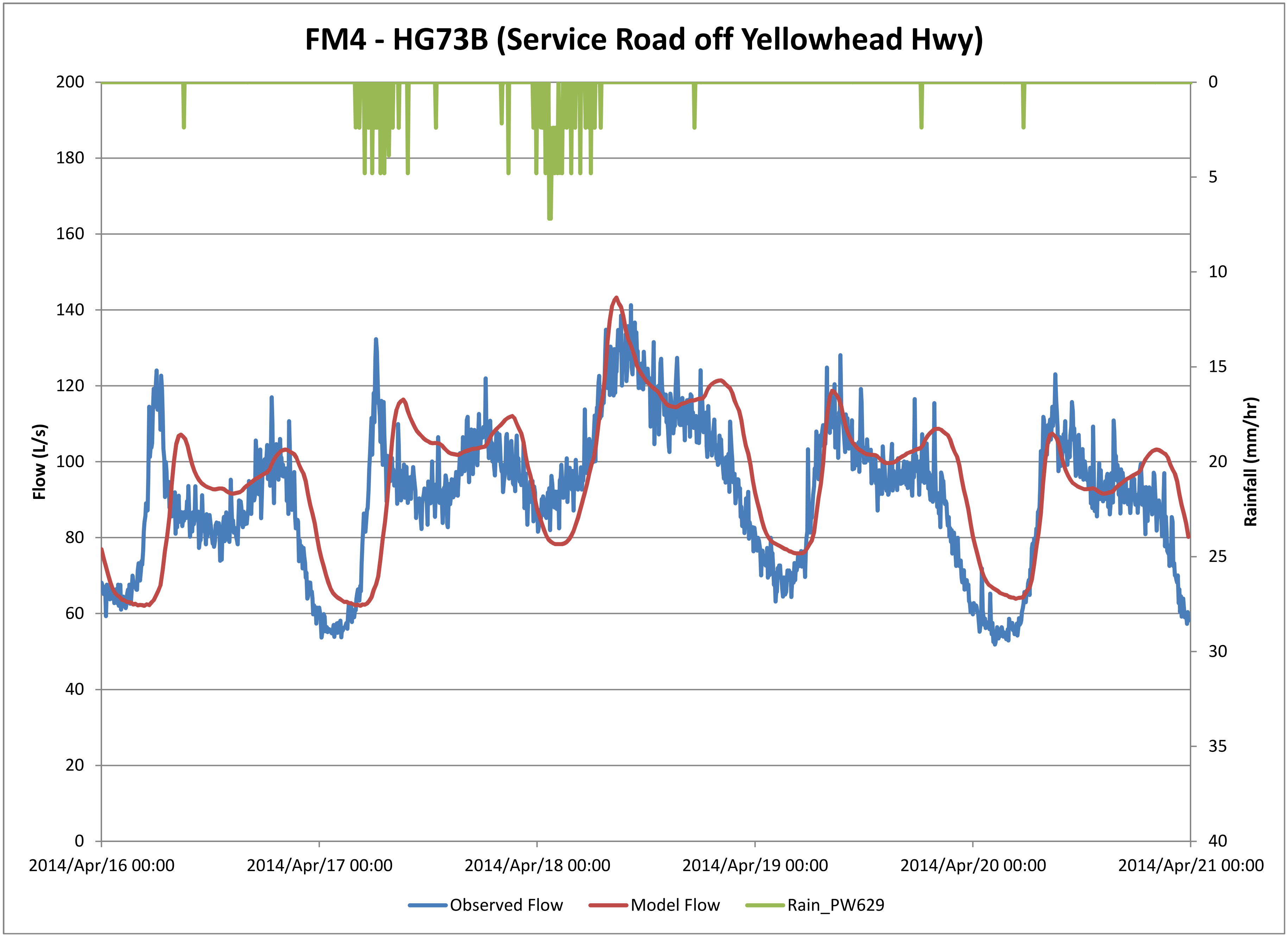
Appendix C
April Wet Weather Flow Calibration Plots


FM1 - HR55E (4952 John Hart Hwy)
Flow (L/s)
Rainfall (mm/hr)
100
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
40
2014/Apr/16 00:00
2014/Apr/17 00:00
2014/Apr/18 00:00
2014/Apr/19 00:00
2014/Apr/20 00:00
2014/Apr/21 00:00
Observed Flow
Model Flow
Rain_PW817

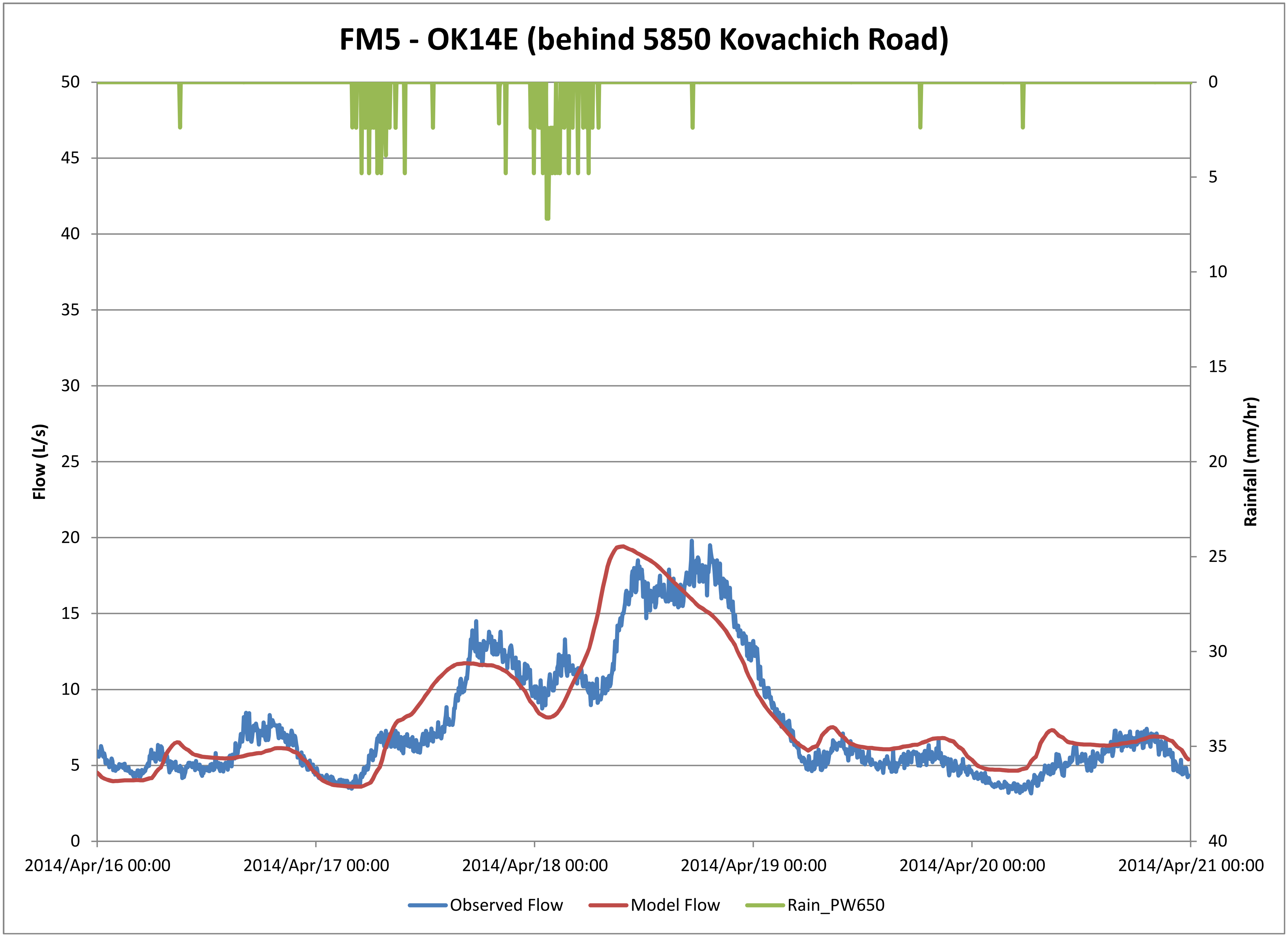

FM2 - GL81B (1702 Lyon Street)
Flow (L/s)
Rainfall (mm/hr)
0
10
20
30
40
50
60
70
80
90
100
5
15
25
35
2014/Apr/16 00:00
2014/Apr/17 00:00
2014/Apr/18 00:00
2014/Apr/19 00:00
2014/Apr/20 00:00
2014/Apr/21 00:00
Observed Flow
Model Flow
Rain_PW650

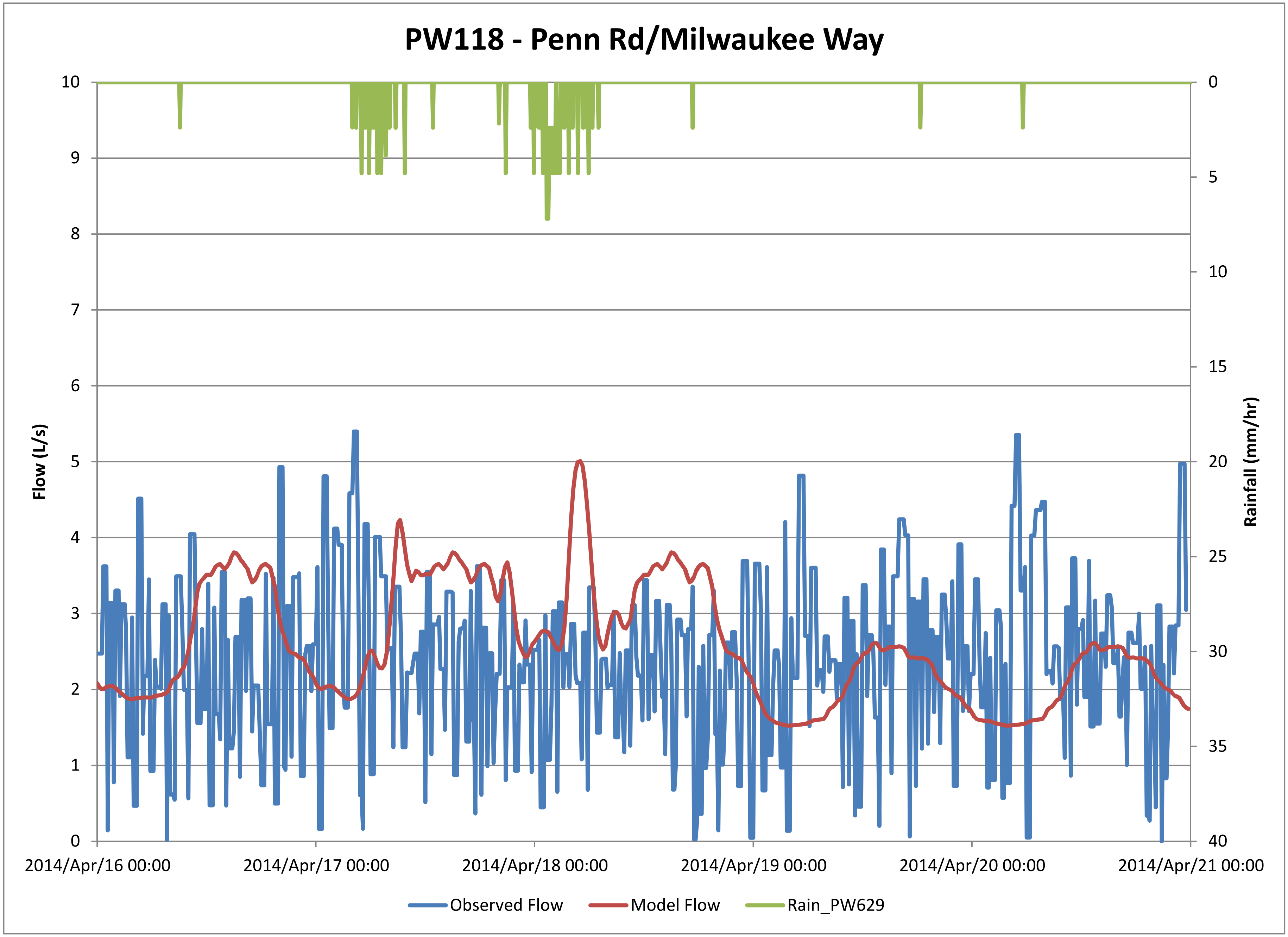


FM3 - HH32C (3641 Wiebe Road)
Flow (L/s)
Rainfall (mm/hr)
400
350
300
250
200
150
100
50
0
0
5
10
15
20
25
30
35
40
2014/Apr/16 00:00
2014/Apr/17 00:00
2014/Apr/18 00:00
2014/Apr/19 00:00
2014/Apr/20 00:00
2014/Apr/21 00:00
Observed Flow
Model Flow
Rain_PW650



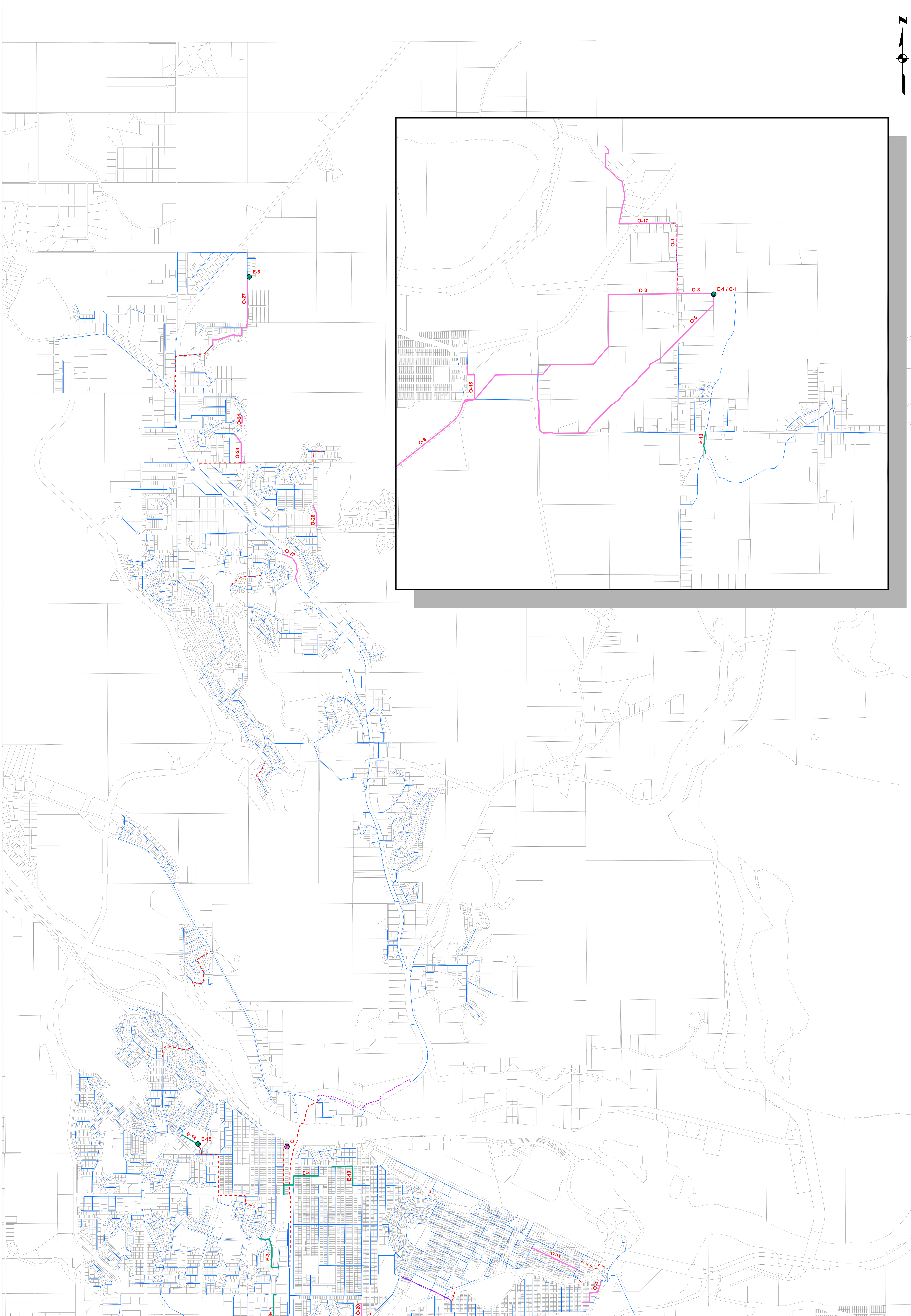
FM4 - HG73B (Service Road off Yellowhead Hwy)
Flow (L/s)
Rainfall (mm/hr)
200
180
160
140
120
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
2014/Apr/16 00:00
2014/Apr/17 00:00
2014/Apr/18 00:00
2014/Apr/19 00:00
2014/Apr/20 00:00
2014/Apr/21 00:00
Observed Flow
Model Flow
Rain_PW629


FM5 - OK14E (behind 5850 Kovachich Road)
Flow (L/s)
Rainfall (mm/hr)
0
5
10
15
20
25
30
35
40
45
50
0
5
10
15
20
25
30
35
40
2014/Apr/16 00:00
2014/Apr/17 00:00
2014/Apr/18 00:00
2014/Apr/19 00:00
2014/Apr/20 00:00
2014/Apr/21 00:00
Observed Flow
Model Flow
Rain_PW650


PW118 - Penn Rd/Milwaukee Way
Flow (L/s)
Rainfall (mm/hr)
0
1
2
3
4
5
6
7
8
9
10
0
5
10
15
20
25
30
35
40
2014/Apr/16 00:00
2014/Apr/17 00:00
2014/Apr/18 00:00
2014/Apr/19 00:00
2014/Apr/20 00:00
2014/Apr/21 00:00
Observed Flow
Model Flow
Rain_PW629

Appendix D
Full Size Maps of Model Results and Proposed Upgrades

See eDoc 439865



CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No.	Date
60305337	May 2017

Legend

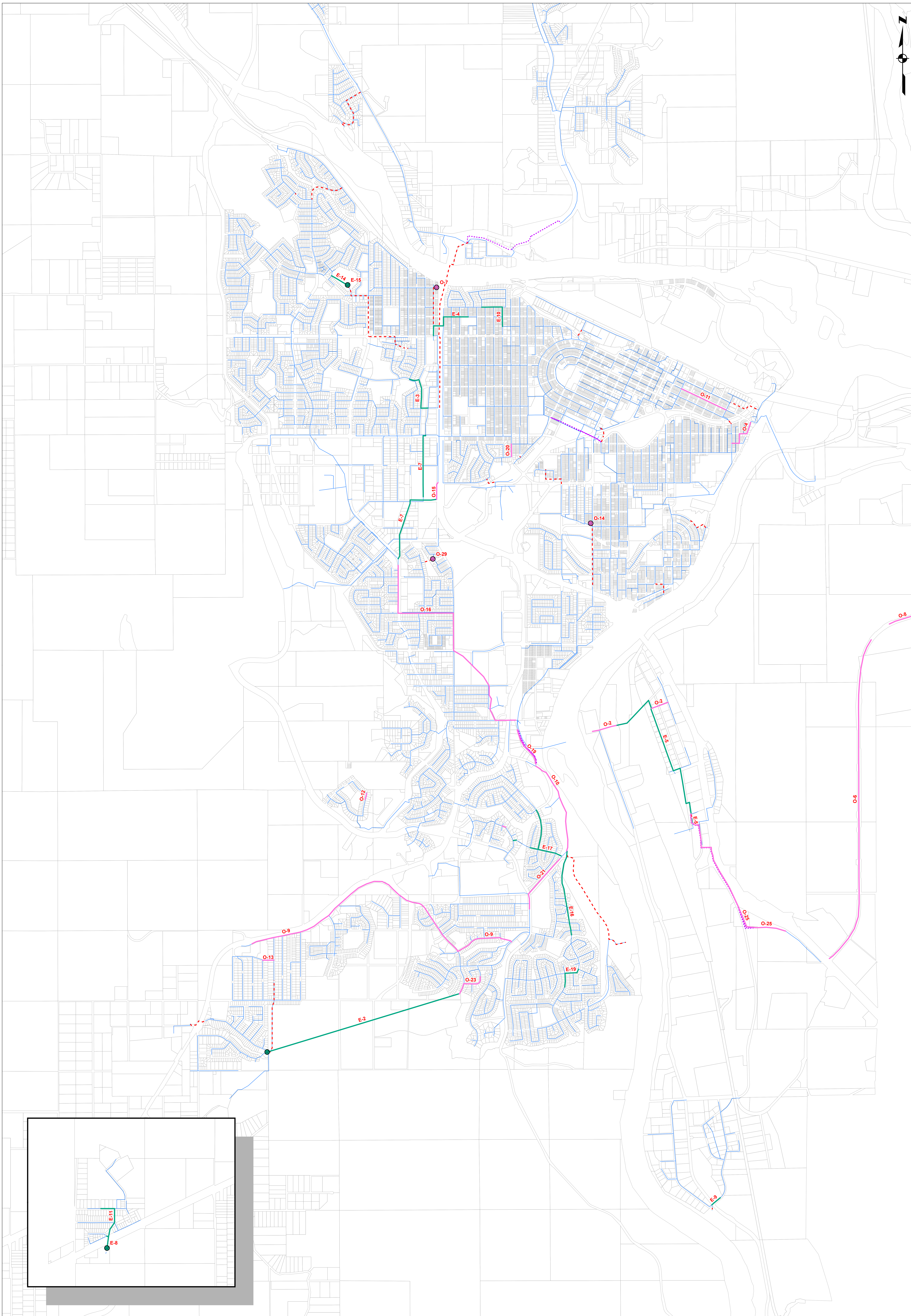
Existing Upgrades
- Short Term Required Upgrades

OCP Upgrades
- Long Term Required Upgrades
- Required New Forcemains - OCP
- Existing PS Upgrade
- OCP PS Upgrade
- Existing Forcemains
- Existing Siphons
- Existing Gravity Sewers

0 500 1,000 Meters

Recommended Upgrades (North and East PG)

APPENDIX D-1



CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No. 60305337

Date August 2017

Legend

Existing Upgrades

- Short Term Required Upgrades
- Existing PS Upgrade
- OCP PS Upgrade

OCP Upgrades

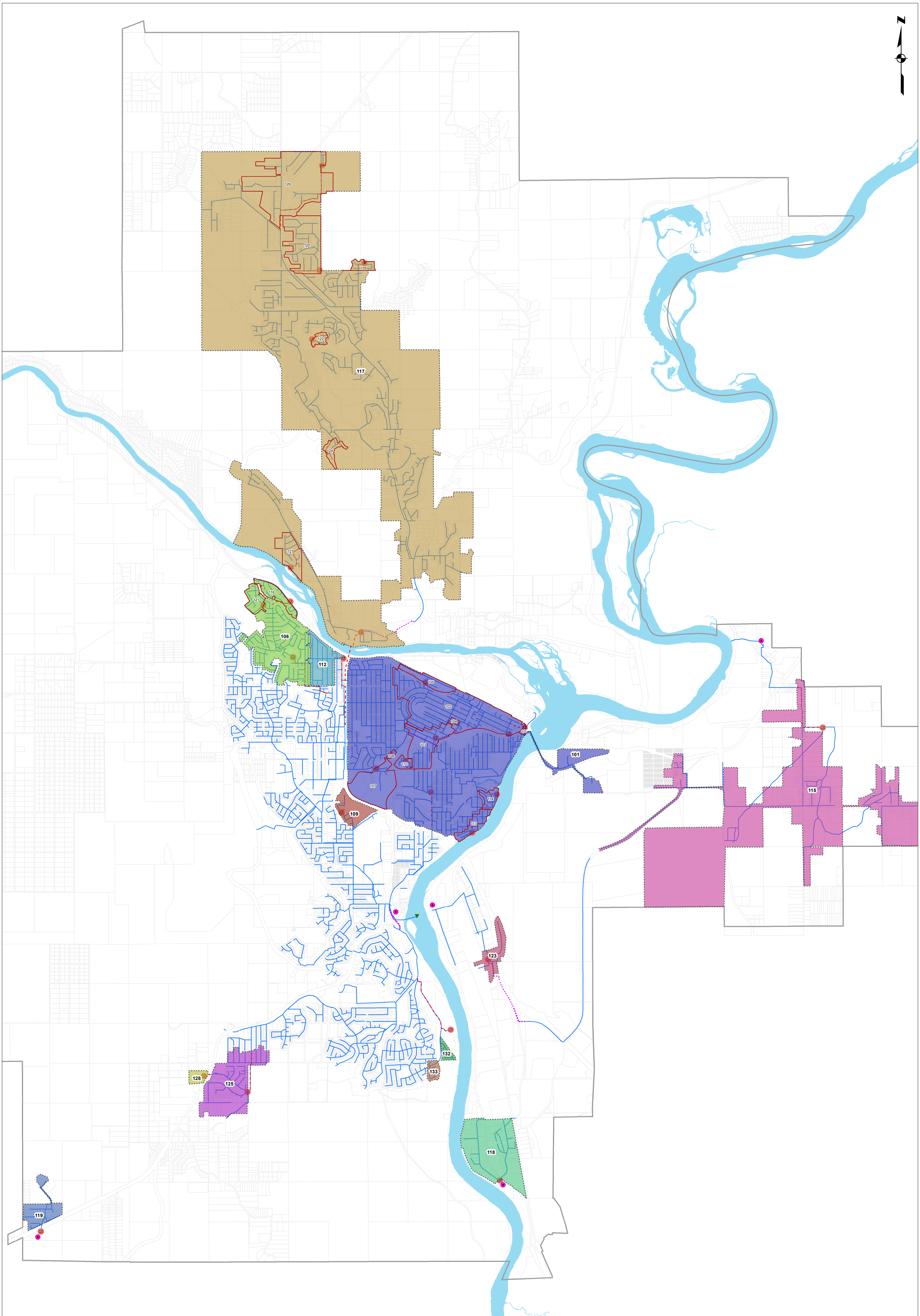
- Long Term Required Upgrades
- Required New Forcemains - OCP
- Existing Forcemains
- Existing Siphons
- Existing Gravity Sewers

AECOM

0 500 1,000 Meters

Recommended Upgrades (South PG)

APPENDIX D-2



CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No. 60305337

Date August 2017

Legend

- Lift Station
- Treatment Facilities
- Outfall
- Existing Gravity Sewers
- Existing Siphons
- Existing Forcemains
- Subcatchment Areas
- Parcels
- Municipal Boundary

AECOM

0 1,000 2,000 Meters

Pump Station Catchment and Subcatchment Areas

APPENDIX D-3

Appendix E
Tabular Summary of Proposed Capital Plan Upgrades

Short Term Upgrades

Project ID	Project Description	Probability of Failure: Capacity Deficiency	Probability of Failure: Asset Age	Probability of Failure: Known Service Issue	Consequence of Failure: Failure Severity (Size & Material)	Consequence of Failure: Restricts Development	Consequence of Failure: ICI Impact	Consequence of Failure: Environmental Impact	Consequence of Failure: > 5000 PE Impact	Risk Score	Length	Model ID	Existing Dia. (mm)	Proposed Diameter (mm)	Capital Cost
E-1	Replace PW115 with 100 L/s firm capacity pump station, expandable to 375 L/s firm capacity	✔✔		✔	✔	✔✔		✔	✔	141	-	PW115	-	-	$ 2,000,000
E-2	Decomission existing pump station PW125, construct new 2297 m, 300 mm dia. gravity sewer from PW125 to Southridge Dr.	✔✔			✔	✔✔	✔	✔	✔	124	2,297	CDT-119	-	300	$ 2,595,610
E-3	Replace 331 m of existing 300 mm sewer with 375 mm on Ahbau between Rainbow and Chilako	✔✔	✔	✔	✔	✔✔	✔		✔	84	526	6047	300	375	$ 669,224
												7331	300	375	
												9547	300	375	
												9548	300	375	
	Replace 65 m of existing 200 mm sewer with 375 mm on Chilako between Ahbau and Commercial											7211	200	375	
	Replace 112 m of existing 250 mm with 375 mm on Rainbow between Kerry and Ahbau											6046	250	375	
												6049	250	375	
E-4	Replace 283 m of 200 mm with 300 mm on 3rd Ave., between Harper and Central	✔✔	✔	✔		✔	✔			70	612	7560	200	250	$ 660,743
												7562	200	250	
												7564	200	250	
	Replace 217 m of existing 200 mm sewer with 300 mm at Central and 5th											7563	200	250	
												388	200	300	
	Replace 112 m of existing 200 mm sewer on Kelly, north of 5th											7527	200	300	
E-5	Replace 2,018 m of existing 200 mm and 250 mm sewer with 525 mm, 600mm, and 675 mm sewer downstream of PW123	✔✔				✔✔	✔			61	2,070	10262	200	600	$ 3,472,903
												10266	200	525	
												10267	200	525	
												10268	200	525	
												10269	200	525	
												10271	200	525	
												10272	200	525	
												10273	200	525	
												10274	200	525	
												10275	200	525	
												10276	200	525	
												10277	200	525	
												10579	200	600	
												3233	200	600	
												3242	250	750	
												3262	250	675	
												3271	250	750	
												3272	250	750	
												3273	250	675	
	Replace 52 m of existing 200 mm dia. upstream of PW123 with 250 mm dia.											3232	200	250	
E-6	Replace pump station PW126 with new 60 L/s firm capacity station	✔✔			✔	✔✔				59	-	PW126	-	-	$ 600,000
E-7	Replace 405 m of existing sewers on 15th Ave. and Lyon with new 450 mm sewer	✔				✔✔	✔		✔	58	1,746	10469	375	450	$ 3,194,286
												10470	375	450	
												9392	375	450	
	Replace 586 m of existing 375 mm sewer on Lyon between 15th and 22nd with 525 mm and 600 mm	✔✔			✔	✔✔	✔		✔			9393	375	450	
												9394	375	450	
												9390	375	450	
												9379	375	450	
												9375	375	450	
												9372	375	450	
	Replace 532 m of existing sewers on 22nd and Nicholson with new 750 mm sewer	✔✔				✔	✔		✔			914	600	750	
												9366	600	750	
												9367	600	750	
												6764	525	750	
												9370	600	750	
												9374	600	750	
												6713	600	750	
	Replace 476 m of existing 600 mm sewer with 900 mm on Nicholson between 22nd and Ospika	✔✔			✔	✔✔	✔		✔			9359	600	900	
												9358	600	900	
												9353	600	900	
												9350	600	900	
												9349	600	900	
												9347	600	900	
E-8	Replace pump station PW119 to with new 30 L/s firm capacity station	✔✔			✔	✔✔				58	-	PW119	-	-	$ 300,000
E-9	Replace 126 m of existing 200 mm sewer with 300 mm sewer on Penn Rd. east of Willow Cale	✔✔				✔✔	✔			54	126	10557	200	300	$ 142,711
												10555	200	300	
E-10	Replace 196 m of existing 250 mm sewer on 2nd between Freeman and Douglas with 300 mm	✔		✔		✔				54	196	7596	250	300	$ 473,792
												7599	250	300	
	Replace 223 m of existing 250 mm with 300 mm on Douglas between 2nd and 4th										223	9471	250	300	
												10475	250	300	
E-11	Replace 158 m of existing 150 mm with 200 mm on Corral, west of Western	✔✔		✔		✔✔				53	650	17	150	200	$ 691,327
												5552	150	200	
	Replace 20 m of existing 150 mm sewer at Cinch Loop and Highway 16 with 200 mm											5538	150	200	
	Replace 472 m of existing 150 mm and 200 mm sewer upstream of PW119 with 250 mm and 300 mm											19	200	250	
												13	150	250	
												10430	200	300	
												10431	200	300	
												5536	150	300	
E-12	Replace 249 m of existing 250 mm sewer south of Giscome and east of Blackburn with 300 and 375 mm	✔				✔✔	✔			53	249	5976	250	300	$ 286,129
												5046	250	300	
												6590	250	375	
E-13	Replace 237 m of existing 250 mm sewer on 2nd between Freeman and Douglas with 300 mm	✔	✔	✔		✔				41	460	7594	250	300	$ 520,166
												7596	250	300	
												7599	250	300	
	Replace 223 m of existing 250 mm with 300 mm on Douglas between 2nd and 5th											9471	250	300	
												10475	250	300	
E-14	Replace 214 m of existing 300 mm sewer upstream of PW106 with 375 mm	✔		✔	✔	✔				41	214	7065	300	375	$ -
												7707	300	375	
												8623	300	375	
												8624	300	375	
												10291	300	375	
E-15	Add third pump to PW106 to increase firm capacity to 80 L/s	✔✔			✔					41	-	PW106	-	-	$ 100,000
E-16	Replace 981 m of existing 250 mm and 300 mm sewer on Gladstone and east of Simon Fraser with 375 mm	✔			✔	✔✔			✔	39	981	3554	300	375	$ 1,248,272
												3089	300	375	
												3552	300	375	
												8769	300	375	
												8770	300	375	
												6134	300	375	
												6135	250	375	
												6137	250	375	
												6144	250	375	
												6150	250	375	
												6154	250	375	
												6159	250	375	
												6163	250	375	
												3103	250	375	
E-17	Replace 558 m of existing 200 mm sewer with 250 mm on Simon Fraser between Cowart and Rideau	✔				✔✔				38	833	6179	200	250	$ 897,165
												6173	200	250	
												5942	200	250	
												5930	200	250	
												5907	200	250	
												5897	200	250	
												5892	200	250	
	Replace 275 m of existing 200 mm and 250 mm sewer on Rideau between Trent and Brock with 300 mm											5891	250	300	
												5888	250	300	
												6170	250	300	
E-18	Replace 36 m of existing 200 mm sewer with 250 mm on McGrath at Moriarty	✔								37	36	5900	200	250	$ 37,800
E-19	Replace 179 m of 250 mm dia. gravity sewer on Gladstone and east of Simon Fraser with 300 mm dia.	✔				✔✔			✔	36	336	2633	250	300	$ 380,018
												2637	250	300	
												5618	250	300	
	Replace 158 m of 250 mm dia. gravity sewer on Loyola, south of Gladstone with 300 mm dia.											5608	250	300	
												5520	250	300	

Long Term Upgrades

Project ID	Project Description	Probability of Failure			Consequence of Failure					Risk Score	Length	Model ID	Existing Dia. (mm)	Proposed Diameter (mm)	Capital Cost	Upstream Equivalent Population Growth Trigger
		Capacity Deficiency	Asset Age	Known Service Issue	Failure Severity (Size & Material)	Restricts Development	ICI Impact	Environmental Impact	> 5000 PE Impact							
O-1	Upgrade PW115 to 300 L/s firm capacity and twin existing 1,333 m 300 mm dia. forcemain with a 450 mm forcemain	✔✔					✔	✔		412	-	PW115	-	-	$ 1,956,240	8640
											1,333	47	300	525		
O-2	Replace 203 m of existing 200 mm sewer between Great and Eastern with 525 mm to service ALI flows	✔✔				✔	✔	✔		156	203	10258	200	525	$ 793,294	2934
												10259	200	525		
	Replace 274 m of existing 250 mm, 300 mm, 350 mm upstream of the BCR lagoon with 525 mm and 900 mm sewer.										274	3270	250	525		
												3269	250	525		
												10763	300	525		
												10762	350	900		
O-3	Replace 427 m of existing 250 mm sewer on Mackus Rd. with 450 mm	✔✔				✔	✔			131	427	8798	250	450	$ 5,526,739	1959
												7185	250	450		
												7188	250	450		
												7207	250	450		
												10278	250	450		
	Construct new 525 mm gravity trunk sewer from Boeing Rd. and Sabre Rd. to Blackburn and Mackus Rd.										3,177	CDT-135	-	525		
O-4	Replace 421 m of existing sewer on Taylor, 15th, Ash, and 16th with 250 mm and 300 mm	✔✔		✔		✔✔		✔		91	421	8886	200	250	$ 464,858	516
												8885	200	250		
												8876	200	300		
												8875	200	300		
												10488	200	300		
												8879	200	300		
												8884	200	300		
O-5	Replace 550 m of existing 250 mm sewer on Old Cariboo, north of Giscome	✔✔				✔	✔			84	550	6766	200	250	$ 4,879,084	807
												6754	200	250		
												6738	250	450		
												6714	250	450		
												10546	250	450		
												10547	250	450		
	Replace 544 mm of existing 250 mm sewer on Giscome Rd.										544	6595	250	450		
												6575	250	450		
												6576	250	450		
												6567	250	450		
												6570	250	450		
												6571	250	450		
												6572	250	450		
	Replace 2,215 m of existing 300 mm dia. sewer between Giscome Rd. and PW115										2,215	6618	300	450		
												6643	300	450		
												6710	300	525		
												6676	300	525		
												6731	300	525		
												6753	300	525		
												6757	300	525		
												6767	300	525		
												6827	300	525		
												6881	300	525		
												6897	300	525		
												6915	300	525		
												6904	300	525		
												6659	300	525		
												6083	300	525		
												6852	300	525		
												6854	300	525		
												6002	300	525		
												6008	300	525		
												6966	300	525		
												6974	300	525		
												7103	300	525		
												7129	300	525		
												10280	300	525		
												10279	300	525		
O-6	Replace 3800m of existing 200mm, 250mm, and 300mm with 250mm, 375mm, and 450mm pipe on Boundary Rd.	✔✔			✔	✔	✔			82	3,799	11062	200	250	$ 4,846,159	4561
												11063	200	250		
												11064	200	250		
												11065	200	250		
												11066	200	250		
												11067	200	375		
												11068	200	375		
												11069	200	375		
												11070	200	375		
												11071	200	375		
												11072	200	375		
												11054	250	375		
												11055	250	375		
												11056	250	375		
												11057	250	375		
												11058	250	375		
												11059	250	375		
												11060	250	375		
												11061	250	375		
												11053	300	450		
												11052	300	450		
												11051	300	450		
												11050	300	450		
												11049	300	450		
												11048	300	450		
												11047	300	450		
												11046	300	450		
												11045	300	450		
O-7	Upgrade pump station PW112 to 20 L/s firm capacity	✔✔						✔		75	-	PW112	-	-	$ 100,000	806
O-8	Replace 2134m of existing 200mm, 250mm, and 300mm on Boundary Rd. with 250mm, 300mm, 450mm, and 525mm pipe.	✔✔				✔	✔			73	2,134	11073	200	250	$ 2,580,675	7678
												11074	200	300		
												11075	200	300		
												11076	200	300		
												11077	200	300		
												11078	250	300		
												11079	250	300		
												11080	250	300		
												11081	250	300		
												11082	250	300		
												11083	250	300		
												11084	250	300		
												11085	250	300		
												11086	300	450		
												11087	300	525		
												11088	300	525		
												11089	300	525		
												11092	300	525		
O-9	Replace 1,790m of existing 200 mm, 250 mm, and 300 mm sewer on Highway 16 with 300 mm and 375 mm	✔✔		✔	✔	✔	✔		✔	67	1,790	3061	200	300	$ 5,014,806	1283
												5778	200	375		
												5780	200	375		
												3064	200	375		
												5794	250	375		
												2939	250	375		
												3362	250	375		
												2783	300	375		
												2784	300	375		
												6092	300	375		
												2786	250	375		
												2787	250	375		
												6101	250	375		
												6124	250	375		
												6133	250	375		
												6138	250	375		
												6143	250	375		
												6146	250	375		
												6147	250	375		
												6145	250	375		
	Replace 1,123 m of existing 250 mm and 300 mm sewer on Marleau and Southridge with 375 mm and 525 mm										1,123	6136	250	375		
												6140	250	375		
												6132	300	525		
												6126	300	525		
												6123	300	525		
												2827	300	525		
												2821	300	525		
												3367	300	525		
												2816	300	525		
												9205	300	525		
												9201	300	525		
												2808	300	525		
												9212	300	525		
												9213	300	525		
	Replace 677 m of existing 250 mm and 300 mm sewer on St. Anne with 525 mm sewer										677	5883	300	525		
												2752	300	525		
												5782	300	525		
												5784	300	525		
												2753	300	525		
												2754	300	525		
												5788	300	525		
												2747	250	525		
												2755	250	525		
												2832	300	525		

Project ID	Project Description	Probability of Failure: Capacity Deficiency	Probability of Failure: Asset Age	Probability of Failure: Known Service Issue	Consequence of Failure: Failure Severity (Size & Material)	Consequence of Failure: Restricts Development	Consequence of Failure: ICI Impact	Consequence of Failure: Environmental Impact	Consequence of Failure: > 5000 PE Impact	Risk Score	Length	Model ID	Existing Dia. (mm)	Proposed Diameter (mm)	Capital Cost	Upstream Equivalent Population Growth Trigger
O-10	Replace 1,105 m of existing 600 and 675 mm sewer upstream of College Siphon with 675 mm, 750 mm, and 900 mm	✔✔				✔		✔	✔	65	1,105	3351 5903 5937 6175 9127 9105 9104 6221 6247 9097 9096 9095 9094	610 610 610 610 610 610 686 686 686 686 686 686 686	675 675 675 750 750 750 900 900 900 900 900 900 900	$ 2,338,961	19275
O-11	Replace 568 m of existing 200 mm sewer with 250 mm on 3rd between Ontario and London	✔		✔		✔✔	✔			62	568	7329 7309 7282 7253 7238 7178	200 200 200 200 200 200	250 250 250 250 250 250	$ 596,865.15	50
O-12	Replace 74 m of existing 525 mm sewer on Maurice, south of Chancellor with 675 mm sewer	✔✔				✔				62	74	11016	525	675	$ 138,932	20127
O-13	Replace 131 m of existing 200 mm sewer with 250 mm on Deer Rd.	✔✔		✔		✔	✔			59	131	5650 2963	200 200	250 300	$ 144,020	1368
O-14	Upgrade PW101 to 250 L/s firm capacity	✔✔					✔			55	-	PW101	-	-	$ 200,000	15840
O-15	Replace 198 m of existing 600 mm sewer with 750 mm on Central between 20th and 22nd	✔			✔	✔	✔		✔	52	198	9376 9377	600 600	750 750	$ 397,015	2702
O-16	Replace 2615 m of existing 750 mm sewer with 900 mm on Ospika, Pinewood, Westwood, and Wiebe	✔				✔✔	✔		✔	52	2,615	9343 9344 9345 9346 9351 9300 9352 9301 6446 6447 6449 6450 6451 9622 9285 9286 6383 5958 6366 6367 6358 6347 5486 5482 6341	750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750 750	900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900 900	$ 6,569,417	30482
	Replace 217 m of existing 750 mm sewer on Vance with 1050 mm										217	6328 6330 6331 6332	750 750 750 750	1050 1050 1050 1050		
	Replace 20 m of existing 750 mm with 1350 mm on Vance										20	6333	750	1050		
O-17	Replace 1,579 m of existing 400 mm and 450 mm sewer downstream of PW115 with 525 mm and 600 mm	✔				✔	✔		✔	52	1,579	7200 7201 7202 7203 7205 7204 7378 7545 7570 7576 7607 7617 7655 7674 7685 7705 7706 7066 7723 7724 5501 5607	400 400 450 450 450 450 400 400 400 400 400 400 450 450 450 450 450 450 450 450 450 450	525 525 525 525 525 525 525 525 525 525 525 525 525 525 600 600 600 600 600 600 600 600	$ 2,513,729	14536
O-18	Replace 602 m of existing 200 mm sewer at Boundary and Boeing with 300 mm and 375 mm sewer	✔✔				✔	✔			51	602	6895 6844 6829 6830 5518 6750 6729 6728	200 200 200 200 200 200 200 200	300 300 300 300 300 300 300 375	$ 685,987	1969
O-19	Construct new 350 mm siphon parallel to existing College Heights siphon	✔✔								49	465	-	-	350	$ 530,100	44928
O-20	Replace 145 m of existing 200 mm sewer on Carney with 250 mm	✔		✔		✔				48	145	6950	200	250	$ 152,561	308
O-21	Replace 709 m of existing 600 and 675 mm sewers along Domano and east of Trent with 675, and 750 mm	✔✔				✔			✔	45	709	6121 6127 9135 6139 6148 6152 6157 6162	600 600 600 600 600 600 600 610	675 675 675 750 750 750 750 750	$ 1,400,470	29523
O-22	Replace 421 m of existing sewer on Hart Highway between Austin and Telford with new 600 mm sewer	✔				✔			✔	42	421	8219 8217 8206 8193 8178 7090	525 525 525 525 525 525	600 600 600 600 600 600	$ 712,060	114
O-23	Replace 133 m of 300 mm sewer with 450 mm on Southridge, south of St. Mary	✔				✔				40	130	5837	300	450	$ 538,803	15184
	Replace 252 m of existing 200 mm and 350 mm sewer on St. Mary with 450 mm										252	2863 2867 2840	350 350 200	450 450 450		
O-24	Replace 521 m of existing 200 mm and 250 mm sewer on Pearl Dr. and Sapphire Cres. With new 250 mm and 300 mm sewer	✔				✔✔				35	521	9838 9839 8388 8370 8369 9831 9830 9648 9649	200 200 200 250 250 250 250 200 200	250 250 250 300 300 300 300 300 300	$ 578,365	238
O-25	Construct new 250 mm siphon parllel to existing Boundary Rd. siphon	✔				✔	✔			33	1,689	6588	-	250	$ 1,857,149	12482
	Replace 330 m of existing 375 mm sewer upstream of the Boundary siphon with 600 mm										330	CDT-77 CDT-75 CDT-73	375 375 375	600 600 600		
O-26	Replace 246 m of existing 250 mm sewer on Dawnson between Barr and Austin with new 300 mm sewer	✔				✔				33	246	8307 9791 9792	250 250 250	300 300 300	$ 278,017	1201
O-27	Replace 1,147 m of existing 200 mm and 250 mm sewers on Estavilla, Glendale, and Wapiti with 250 mm and 300 mm	✔				✔✔				31	1,147	8497 8498 8500 8501 8503 8504 8502 8506 8507 8515 8523 8533 8534 10413 8537 8546 8547	200 200 200 200 200 200 250 250 250 250 250 250 250 250 250 250 200	250 250 250 250 250 250 250 250 250 300 300 300 300 300 300 300 300	$ 1,251,990	1658
O-28	Replace 42 m of existing 200 mm sewer on Moriarty with 250 mm	✔				✔				30	42	5933	200	250	$ 43,919	181
O-29	Upgrade PW109 to 15 L/s firm capacity	✔					✔			23		PW109	-	-	$ 100,000	1440

Appendix F
Model Development and Calibration Memorandum

See eDoc 439866

City of Prince George

Sanitary Master Plan

Technical Memo – Model Development and Calibration

Prepared by:

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Project Number:

60305337

Date:

November 14, 2014

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Appendices

1. Introduction

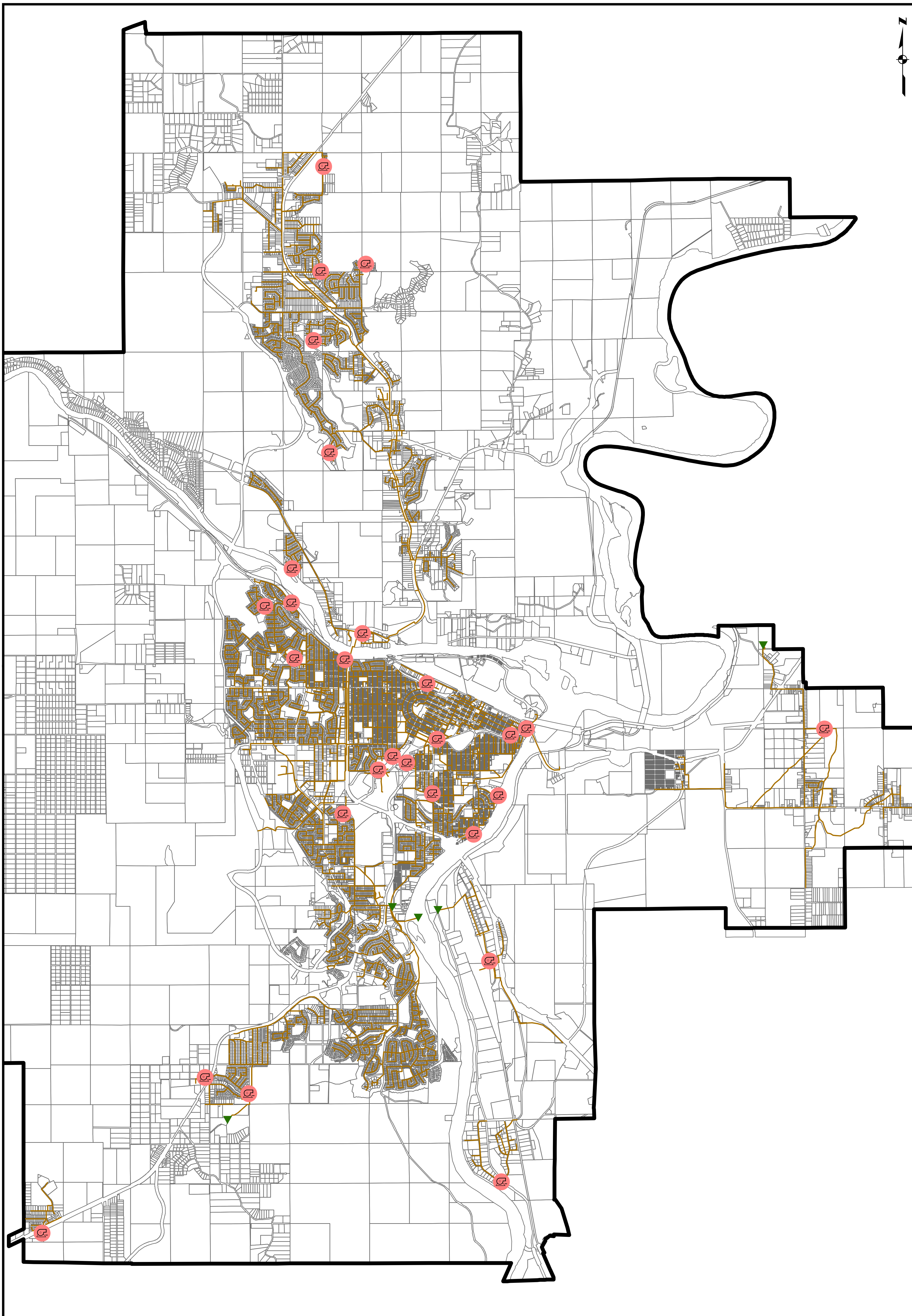
The City of Prince George is anticipating growth over the next 20 years. To assist with planning for this growth, the City is updating their Sanitary Master Plan that will be used for development of a capital Expenditure program and outlining O&M budgets. The previous master plan was completed in 2001 and included use of a hydraulic model (Hydra and later converted to InfoSewer in 2006). The City retained AECOM to develop a new hydrodynamic (flow hydrology + hydraulics) model for the City's sanitary sewer system.

The City has a population of approximately 76,000 residents based on 2010 BC Stats and is projected to grow to between 78,900 and 90,200 by 2025. The existing sewer system includes 32 lift stations, over 430 km of sanitary sewers, and approximately 18 km of forcemains.

Sewage is treated and discharged from five locations. The Landsdowne Waste Water Treatment Centre (WWTC) is the largest treatment location, treating over 80% of the City's total sewage. The Lansdowne WWTC discharges to the Fraser River. The other four treatment facilities are lagoons, treating sewage from smaller, remote catchments. ***Figure 1.1*** illustrates the City's existing sanitary sewer system.

Generally, the objectives of this project are to:

1. Review the City's existing model and GIS Data;
2. Develop a new hydraulic model of the City's entire sanitary sewer system;
3. Prepare a flow monitoring plan and collect sanitary flow data from selected locations;
4. Calibrate and validate the model under existing land-use for dry & wet weather conditions (using recent flow monitoring data and pump station SCADA data);
5. Develop various "modelling scenarios" to reflect the City's existing land-use and OCP planning projections; and
6. Assess the performance of the sewer system (local sewers, trunks, pump stations and forcemains) under existing and future land-use conditions; identify hydraulic constraints; and recommend system improvements;



CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No. 60305337

Date September 2014

Legend

- Lift Station
- Outfall
- Existing Sanitary Sewers
- Municipal Boundary
- Parcels

AECOM

0 1,250 2,500 Meters

Existing Sanitary Sewer System

FIGURE 1.1

2. Model Development

The City has an existing sanitary model built in InfoSewer. This model was used as the main source of data, for both infrastructure and hydraulic information, in building the new model in InfoSWMM. In converting the model from InfoSewer to InfoSWMM, below are the steps taken.

- Export all modeling elements from InfoSewer (manhole, pipe, pump, wetwell) into a shapefile, including all relevant hydraulic information.
- Import all modeling elements, including all relevant hydraulic information into InfoSWMM.
- Calculated the upstream/downstream pipe offset based on the upstream/downstream invert level information available in InfoSewer.
- Transferred the pump on/off and design point information. For the calibrated pump stations, pump curve information was incorporated in the InfoSWMM model.
- Changed the manhole ID and pipe ID to reflect the latest IDs used by the City. The old IDs are kept in a separate column in the model.
- Incorporated four siphons in the system:
    - Downstream of PW117 (499 Tomlin Rd)
    - Hospital Siphon, east of University Hospital of Northern British Columbia
    - College Heights Siphon, off Cowart Road
    - Boundary Siphon, at Boundary Road and Cariboo Highway
- Identified and resolved data gaps and errors to fix connectivity, slope, elevation, and other hydraulic errors in the model.

3. Residential Population and ICI Flow Allocation

Sewage flows were generated on a parcel by parcel basis such that each parcel/lot is its own sanitary catchment and was achieved using the following key information provided by the City in GIS shapefiles and excel spreadsheet format:

- Parcel fabric with a unique identifier (PID) for each parcel;
- Tract census polygon and associated population numbers;
- Landuse (zoning) information shp; and
- Geocoded 2012 water meter records for institutional, commercial and industrial (ICI) parcels.

Additionally a separate stormwater utility study done by AECOM was used to assist with determining the people per unit density for the Multi Family (MF) dwelling type.

The steps taken in calculating and allocating residential population and ICI flow meter data were as follows:

1. The parcels with fronting sewer pipes were selected as serviced parcels.
2. The serviced parcels were overlaid with the Zoning polygons to identify the type of users, i.e., residential (single family vs. multifamily), industrial, institutional or commercial (ICI).
3. The geocoded 2012 water meter records for ICI users were associated to the ICI parcels.

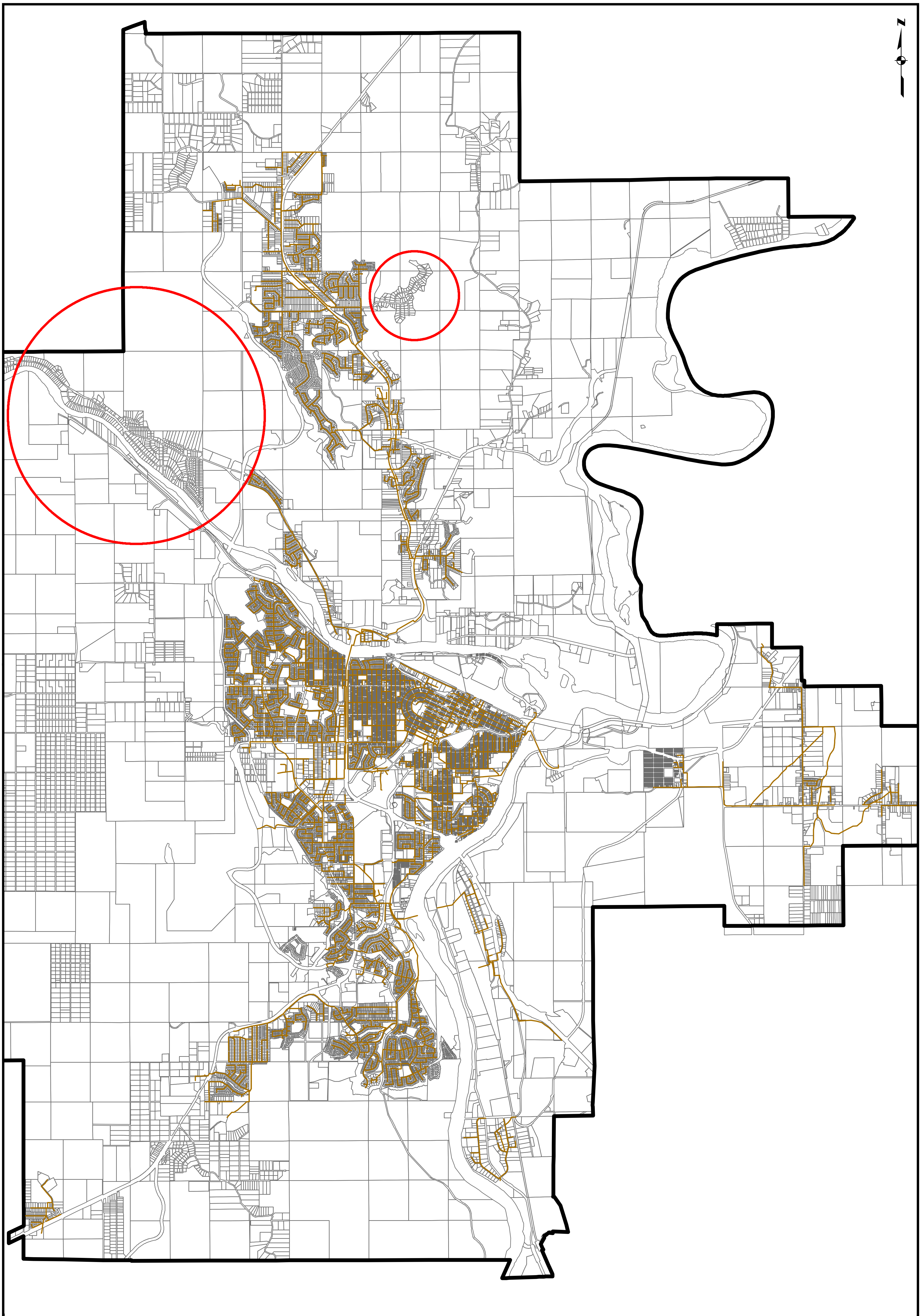
4. The residential serviced parcels were overlaid with the Tract census polygon hence for each census tract polygon the total residential population and the total number of single and multifamily parcels were identified.
5. Total number of units for each multifamily parcel was obtained from a separate stormwater utility study done by AECOM.
6. Assumption of 2 people per unit for the multifamily parcels was used to estimate total residential people at the multifamily dwellings/parcels.
7. To calculate the population density at the single family dwellings, the total population of multifamily dwellings was subtracted from the total population for each census tract. Each single family parcel within the same census tract has the same level of population density. Average calculated population density for single family parcels was 2.8 people per parcel.

This approach allowed all information to be stored in GIS (parcel by parcel) including: area, land-use, residential population, and ICI water usage. ***Table 3.1*** shows the summary of residential population and estimated ICI sewage flow for each monitored pump station catchment area, the temporary metered areas and the remaining non-metered areas in the City. It should be noted that sanitary sewage associated with ICI users was assumed to be 80% of their water usage.

Once both residential and ICI flows were generated, the catchment (or parcel) was then automatically allocated to the nearest fronting sewer manhole and ultimately assigned to the upstream manhole of the sewer using tools within InfoSWMM.

It should be noted that:

1. Residential population on the 2 circled areas shown in ***Figure 3.1*** below was not allocated to the sanitary system since it was confirmed by the City that these areas are not serviced by the City's sanitary system.
2. An average flow of 5.8 L/s was added to a parcel upstream of PW117 (at 499 Tomlin Rd) to account for flow coming in from the Pacific Brewery.
3. An average flow of 2.2 L/s was added to account for flow pumped from the Prince George Airport.
4. The industrial areas north of Boundary Rd are not currently serviced by the City's sanitary system.



Legend
Existing Sanitary Sewers
Municipal Boundary
Parcels
Non Serviced Area

CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No. 60305337

Date September 2014

AECOM

0 1,200 2,400 Meters

Non Serviced Areas

FIGURE 3.1

Table 3.1 - Residential Population and Estimated ICI Sewage Flow

FM Site	Area (Ha)	ICI Flow	Serviced Population		
		80%Water (L/s)	Single Family	Multi Family	Total
FM1	332.3	2.2	6,111	6	6,116
FM2	82.9	3.1	1,892	954	2,846
FM3	620.6	12.6	15,507	1,103	16,610
FM4	457.1	3.7	12,339	150	12,489
FM5	76.3	0.1	1,089	0	1,089
PW101	419.9	15.1	12,030	2,508	14,538
PW102	150.4	9.0	665	676	1,341
PW103	35.4	5.4	595	432	1,027
PW106	130.2	0.6	4,106	888	4,994
PW115	40.7	3.1	474	0	474
PW117	76.8	6.7	1,102	0	1,102
PW118	118.8	1.5	0	0	0
PW120	66.1	0.1	1,019	0	1,019
PW126	65.8	0.2	847	0	847
Unmetered Areas	298.8	6.1	4,810	60	4,870
Total	***2,972.1***	***69.2***	***62,586***	***6,777***	***69,363***

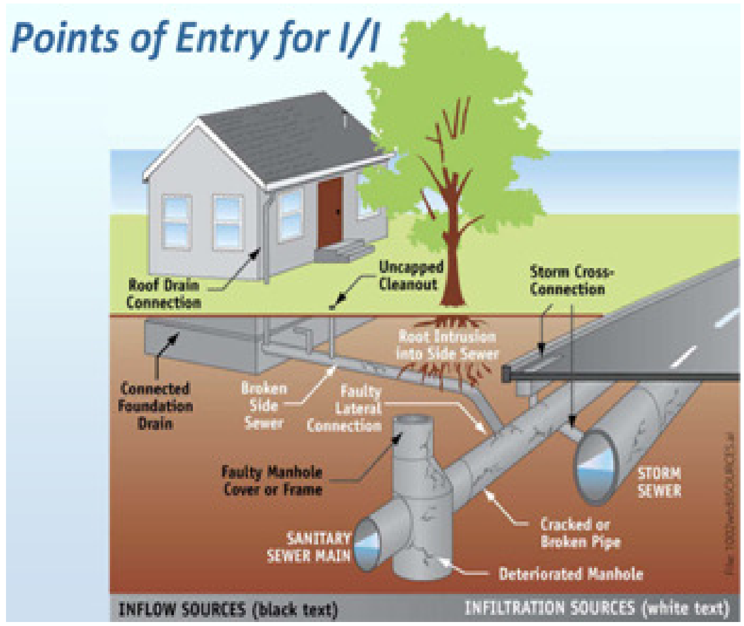
4. Residential Flow Generation

The residential flow was estimated using pump station and temporary flow monitoring data from dry weather periods. Through the calibration process (discussed further in ***Section 6.2***) we were able to determine the sewage flow rate (L/capita/day) for each of the 14 metered sites. For the rest of the system, where there was no flow monitoring data available, the neighbouring residential flow rate was applied to estimate the area's residential sewage flow.

5. Groundwater Infiltration

Groundwater infiltration (GWI) is the flow that enters the sewer system through holes in the sewers and manholes, misaligned joints and service laterals, outside of rainfall events. Determining the rate of GWI can be complicated and highly variable across the City because GWI varies with:

- pipe condition (e.g. cracks, holes and joint dislocations etc);
- joint type (e.g. gasketted joints to minimize infiltration);
- amount of pipe in the catchment (diameter and length), because the more pipe and surface area in contact with groundwater will result in more infiltration;



- depth of groundwater table relative to the sewer pipe;
- number of service connections, with the more connections resulting in a higher rate of infiltration; and
- subsurface soil type and location of pipe relative to till/clay layers. If a pipe is at deeper depths and installed above an impermeable layer, the groundwater table is most likely elevated and can cause infiltration whereas a pipe installed at shallower depths in sandy soils will tend to have a lower groundwater table since the material is free draining.

GWI rates were determined based on flow meter results and are presented in ***Table 6.1*** for the metered areas along with rates that were applied for the non-metered catchment areas.

6. Model Calibration

6.1 Data for Model Calibration

Model calibration plays an important role in developing a representative hydraulic model. The ability of the model to mimic the actual flow, velocity, head, and volume of the system depends highly on the accuracy of model calibration. Two types of data are required when performing model calibration:

- ***Flow Monitoring Data*** is required to provide sufficient flow data for the calibration and validation of the hydraulic model. For this study, the flow monitoring data used was obtained from 9 pump stations and 5 gravity monitoring points located throughout the City within the time period of November 2013 to May 2014. For the monitored pump stations, the required inflow into the wetwell was calculated based on the following information:
  - Wetwell level fluctuation
  - Pump on/off
  - Wetwell dimension from As-Builts

It should be noted that the inflow for PW101 (Victoria St/Milburn Ave) and PW103 (Victoria St/15th Ave) could not be calculated because the City confirmed that the pumps at these locations were always ON and there is very little fluctuation on the wetwell level recorded.

- ***Rainfall Data*** for the same period of time as the flow monitor data is required for calibration and validation of sanitary hydraulic models. The availability of flow data along with rain records serves as an essential tool to evaluate the condition of the system and its overall capacity. There were three rain gauge stations used during the calibration process: PW650 (Foothills Blvd), PW817 (Stauble Rd) and PW629 (Sintich Rd).

Figure 6.2 shows the locations of the 14 flow monitoring sites and the 3 rain gauges used during calibration and validation process.

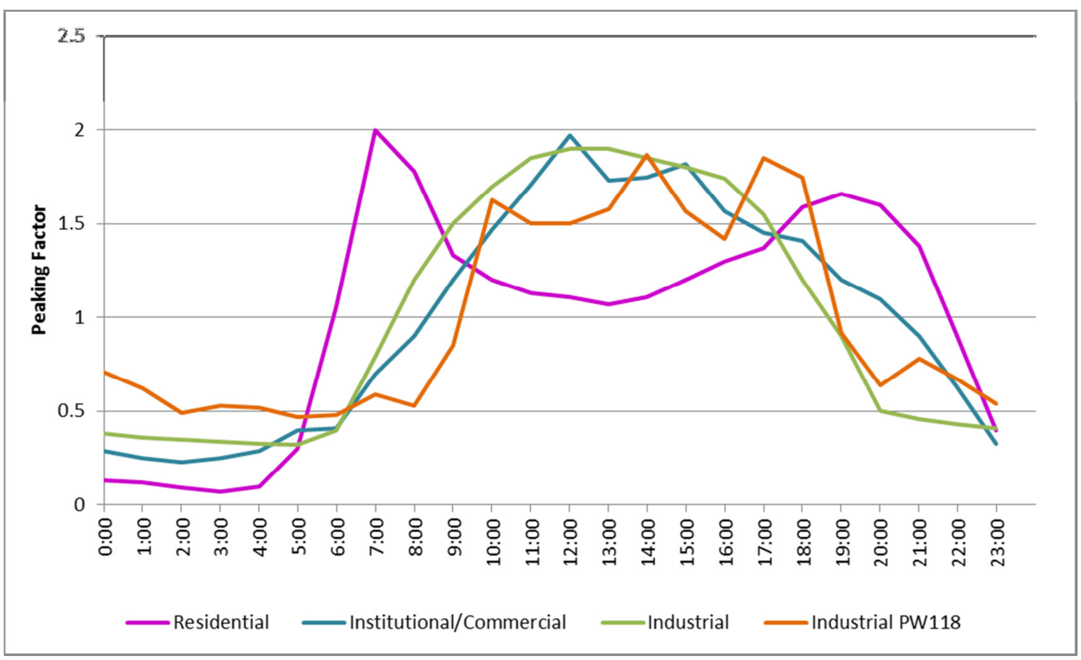
6.2 Average Dry Weather Flow and Diurnal Pattern Development

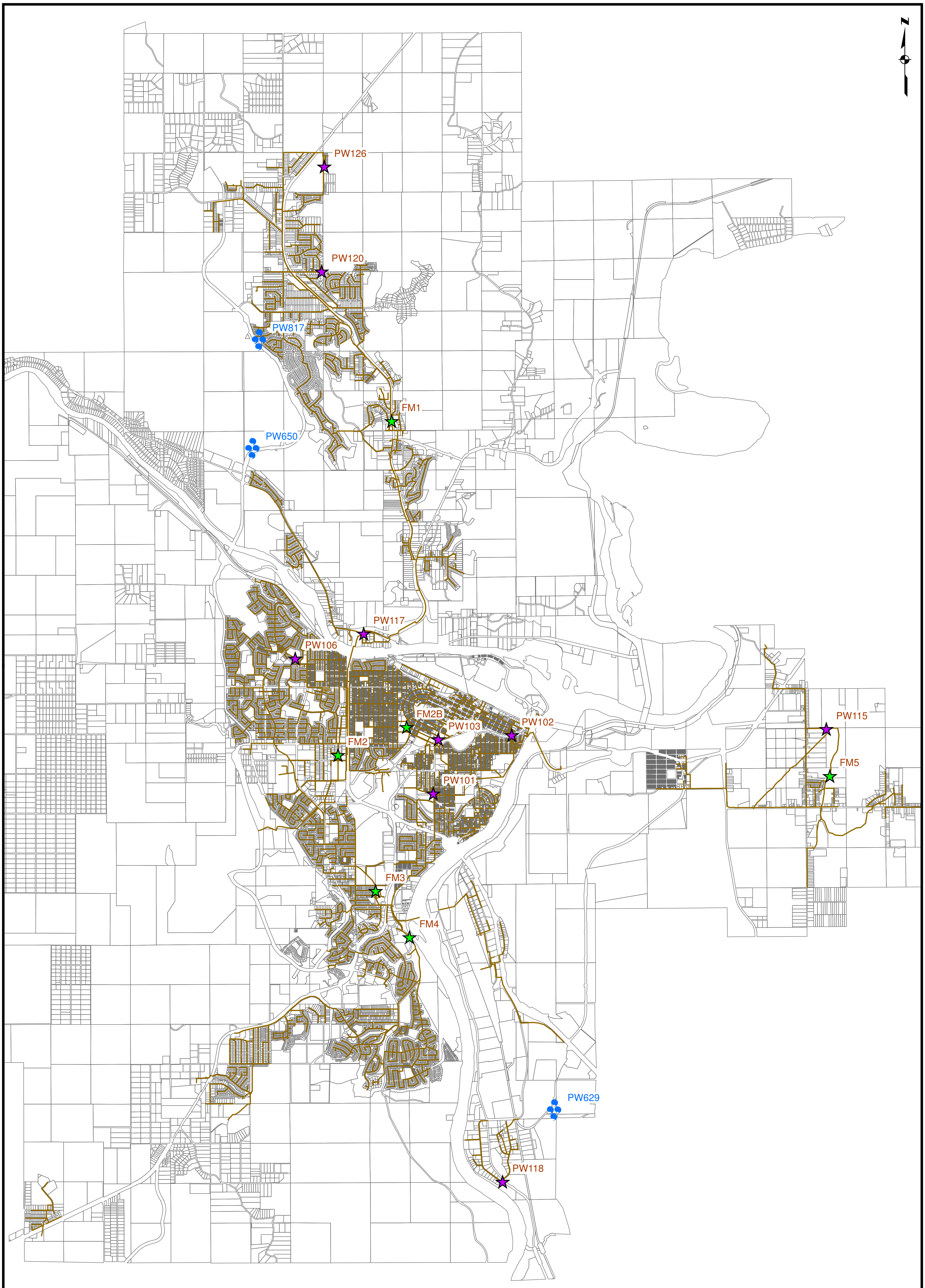
Dry weather flow is the typical day-to-day sanitary flow from residential, industrial, commercial, and institutional areas. Review of 2013 dry weather flow data was the first step in the model calibration process and involves detailed assessment of the flow data to develop diurnal patterns. The dry weather flows at each pump station and monitored area had to be repeatable and consistent to create a baseline for wet weather flow analysis and calibration. The diurnal pattern for each land-use type would be generic across the system (i.e. unique diurnal pattern would not be developed for each flow monitoring catchment area). This condition is applicable to the City as the typical usage pattern for each land-use type is expected to be more or less the same across the system.

A unique industrial pattern needed to be developed for PW118 as the generic pattern did not accurately reflect actual flows. Additionally, upon review of the monitoring data it became apparent that PW117 (499 Tomlin Rd) and PW118 (Penn Rd/Milwaukee Way) had a different diurnal pattern between weekday and weekend, due to high ICI users within these catchment areas. Separate weekday and weekend patterns were developed and incorporated in the InfoSWWM model. By reviewing the flow monitoring data, a factor of 0.25 and 0.3 was applied to the weekday pattern for PW117 and PW118 respectively to generate reduced flow conditions during weekend for these two sites.

Figure 6.1 shows the different diurnal patterns applied in the model.

Figure 6.1 - Diurnal Patterns





CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No. 60305337

Date September 2014

Legend

- Raingauge
- Monitored Pump Station
- Temporary Monitor Location
- Existing Sanitary Network
- Parcels

AECOM

0 1,250 2,500 Meters

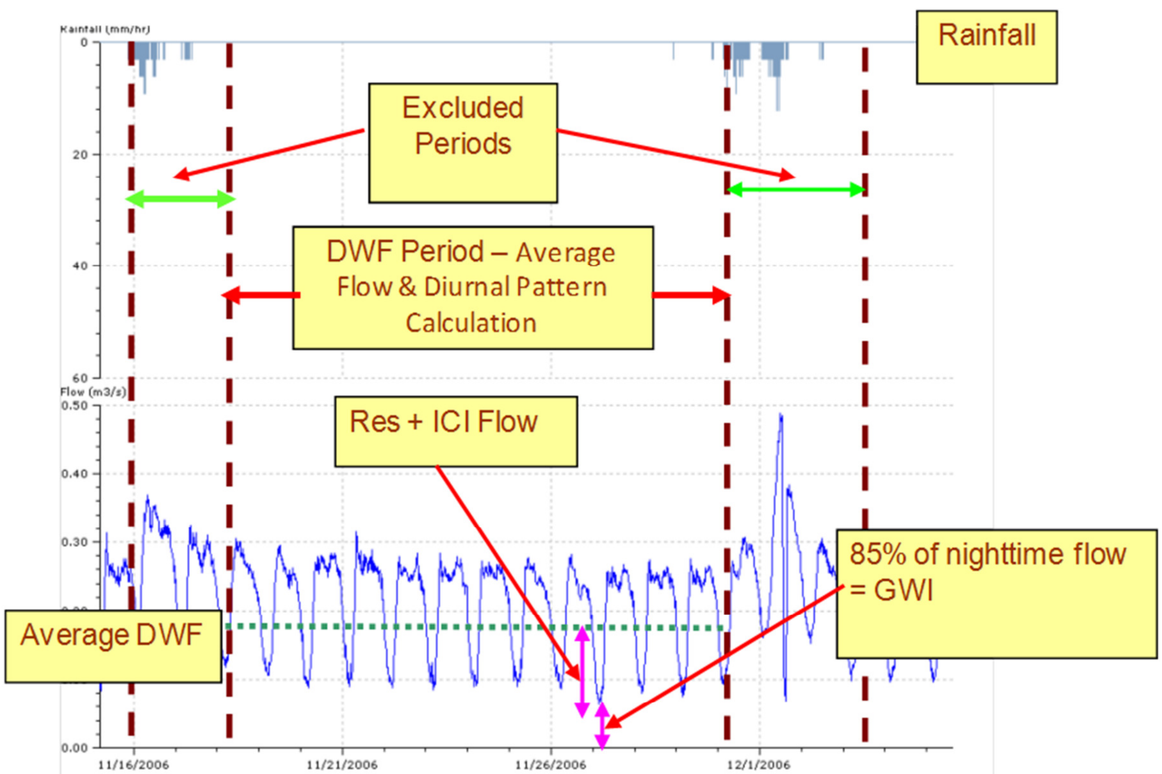
Flow Monitoring and Rain Gauge Locations

FIGURE 6.2

In order to accurately capture the average dry weather flow conditions, dry weather data was isolated from the overall flow monitoring data. In this exercise, it was assumed that the majority of wet weather influences, such as inflow and most infiltration, persists for up to 12 hours after a rainfall event. Flow monitoring records were compared with the rainfall records to determine when rain events occurred; subsequently, these instances as well as the next 12 hours minimum following the rain event were excluded from the dry weather calibration (see ***Figure 6.3*** for visual reference). The remaining data provided the foundation for the average dry weather flow generation for each flow monitoring catchment area.

At first, the GWI component was estimated to be 85% of the minimum night-time flow. This number was further adjusted during the calibration process to match the overall observed flow data. Once the GWI component was determined it was removed from the average flow monitoring data leaving only the residential and ICI components (refer to ***Figure 6.3*** for visual reference). The ICI flow was determined as 80% of the ICI water meter data (based on typical values and Prince George monitoring results) which left only the residential flow and estimated per capita sewage flow generation rate (L/capita/day).

Figure 6.3 - Average Dry Weather Flow Estimate



As a component of the model calibration the observed dry weather flow was compared with the model-generated dry weather flow. During this process adjustments were made to the GWI and/or residential rates to determine the best fit between the model result and the observed flow. The ICI flows established based on water meter data were kept as is. ***Table 6.1*** shows the calculated residential and GWI rates based on the observed flow data available.

Table 6.1 - Calculated Residential (Dry-weather) and GWI Rates (December 2013)

FM Site	Cumulative Area (Ha)	Cumulative Ave DWF (L/s)	Cumulative GWI (L/s)	Cumulative ICI Flow (L/s)	Cumulative Res Flow (L/s)	Cumulative Res Pop	Res Rate (Lpcd)	GWI Rate (L/ha/d)	Notes
FM1	464.2	21.9	7.6	2.4	11.9	7,983	128.6	1414.6	
FM2	213.12	43.1	13.6	3.7	25.8	7,840	284.7	5513.5	
FM3	1636.84	92.9	32	25.3	35.6	33,535	91.6	1689.1	
FM4	457.1	41.2	10.4	3.7	27.1	12,489	187.5	1965.8	
FM5	76.3	2.9	1.2	0.1	1.6	1,090	129.9	1358.8	
PW101	605.67			29.5		16,906			Not Calibrated, observed inflow is unreasonable
PW102	150.4	17.3	6.5	9.0	1.8	1,341	113.7	3734.0	
PW103	35.37			5.4		1,027			Not Calibrated, observed inflow is unreasonable
PW106	130.22	31.6	9.6	0.6	21.4	4,994	370.1	6369.5	
PW115	117	5.2	1.8	3.1	0.3	1,563	14.2	1329.2	Low Residential Rate
PW117	76.8	11.3	3.2	6.7	1.4	1,102	110.1	3600.0	
PW118	118.8	1.9	0.5	1.4	N/A	0	N/A	363.6	
PW120	66.1	3.3	1.5	0.1	1.7	1,019	145.8	1960.7	
PW126	65.8	3.3	1.5	0.2	1.6	848	166.2	1969.6	

As shown in ***Table 6.1***, PW101 (Victoria St/Milburn Ave) and PW103 (Victoria St/15th Ave) were not calibrated. The pump station inflow at these locations could not be calculated based on the available information as explained in ***Section 6.1***.

Additionally, PW115 (Mackus Rd/Blackburn Rd) had unreasonably low residential rates. This issue may be attributed to several factors:

1. Inaccurate population numbers, it may be that not all residential population is served by the City's sewer system.
2. Not all ICI users are connected to the City's sewer system thus the ICI water billing may not reflect the actual ICI sewer flow conditions.
3. Incorrect inflow data for this pump station

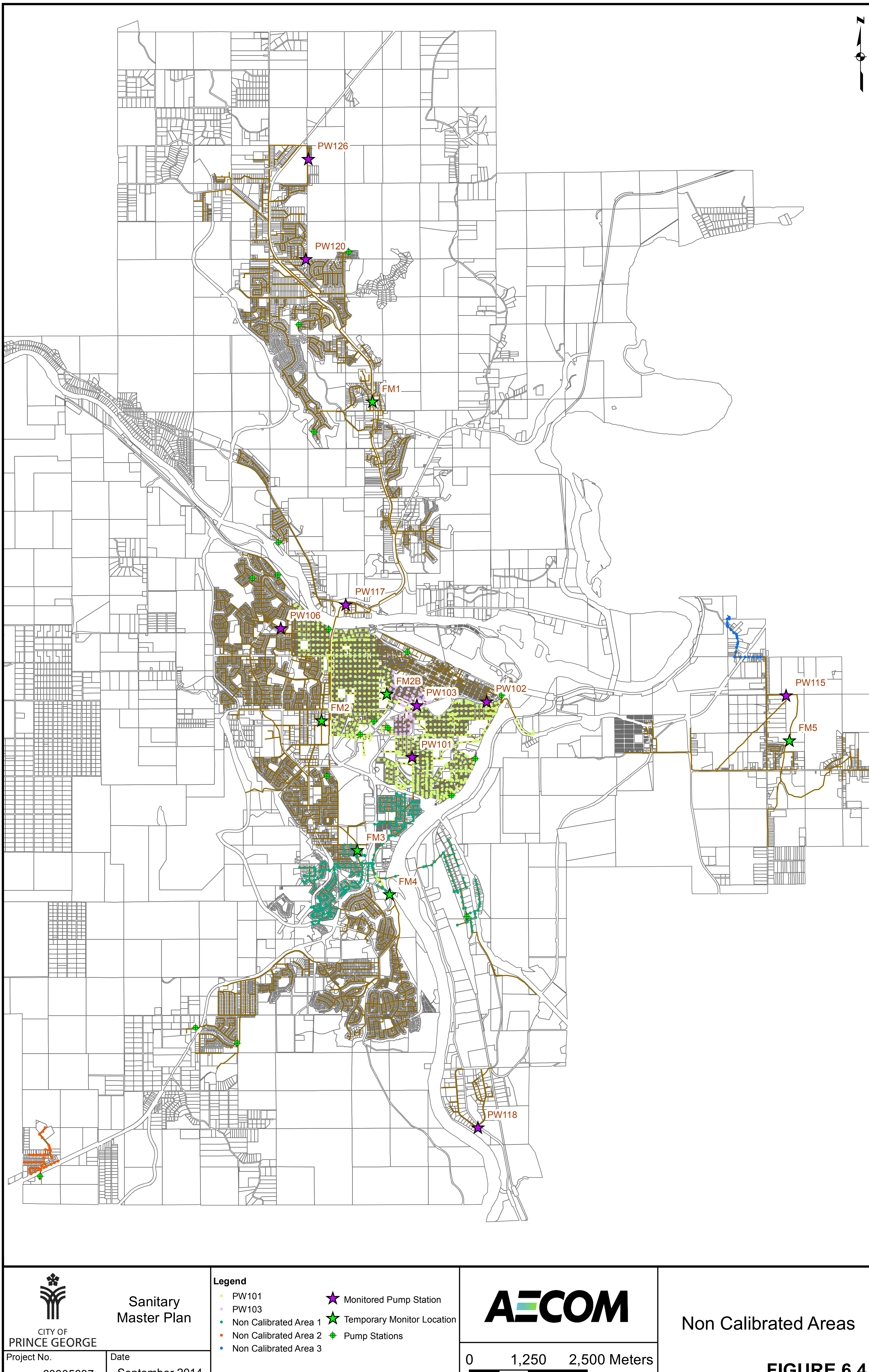
Other than the three noted locations, the other calibrated sites showed reasonable residential sewage rates with a weighted average rate of 172.8 L/cap/d and average GWI rate of 2,605 L/Ha/d. For the non-calibrated areas within the City (including PW101 and PW103), nearby Residential and GWI rates were applied. It was assumed that neighbouring areas have similar residential usage pattern, soil, terrain and pipe conditions. The five non-calibrated areas within the City as shown in ***Figure 6.4*** were given residential and GWI rates as outlined in ***Table 6.2***.

Table 6.2 - Non Calibrated Areas

General Location	ID	Residential Population	ICI Flow (L/s)	Area (Ha)	Calibrated Meter Used	Res Rate (L/cap/d)	GWI (L/Ha/d)
PW101		16,906	15.1	419.9	PW102	113.7	3,734
PW103		1,027	5.4	35.37	PW102	113.7	3,734
Between FM3/FM4	Area1	4,263	5.1	234.4	FM4	187.5	1,966
Southwest of FM4	Area2	387	0.2	362	FM4	187.5	1,966
North of PW115	Area3	119	0.0	9.8	FM5	129.9	1,359

6.3 Dry Weather Day Calibration Results

The complete hydrographs comparison between the model result and the observed flow monitoring data for Dry Weather Flow calibration is shown in ***Appendix A*** while ***Table 6.3*** shows the summary of average dry weather flow at each pump station and monitoring site for both measured and model predicted flow as well as the error calculation for the calibration process.



CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No. 60305337

Date September 2014

AECOM

Non Calibrated Areas

FIGURE 6.4

Table 6.3 - DWF Calibration Results

Monitoring ID	General Location	Observed (Dec 2013)			Model			% Difference			Notes
		Ave Flow (L/s)	Peak Flow (L/s)	Volume (m3)	Ave Flow (L/s)	Peak Flow (L/s)	Volume (m3)	Ave Flow (L/s)	Peak Flow (L/s)	Volume (m3)	
FM1	4952 John Hart Hwy	21.9	39.6	13,266	20.9	37.4	12,689	-4.4%	-5.5%	-4.3%	
FM2	1702 Lyon St	43.1	74.2	26,054	46.9	61.7	28,410	8.9%	-16.8%	9.0%	Unreasonable DWF spike in observed data
FM3	3641 Wiebe Rd	92.9	150.3	56,240	97.8	144.7	59,262	5.3%	-3.7%	5.4%	
FM4	Service Rd off Yellowhead Hwy	41.2	81.8	24,933	43.8	66.4	26,536	6.3%	-18.9%	6.4%	Unreasonable DWF spike in observed data
FM5	Behind 5850 Kovachich Rd	2.9	6.1	1,778	2.9	4.1	1,764	-0.9%	-32.3%	-0.8%	Unreasonable DWF spike in observed data
PW101	Victoria St/Milburn Ave	0.1	8.6	56	80.5	256.3	48,737				Not calibrated due to unreasonable observed data
PW102	Lower Patricia Blvd/4th St	17.3	29.6	10,514	18.6	27.8	11,276	7.7%	-6.2%	7.2%	
PW103	Victoria St/15th Ave	0.2	3.1	123	10.8	17.7	6,555				Not calibrated due to unreasonable observed data
PW106	1st Ave/McIntyre	31.6	48.6	19,256	31.0	49.7	18,762	-2.1%	2.3%	-2.6%	
PW115	Mackus Rd/Blackburn Rd	5.2	9.8	3,136	6.1	9.4	3,723	19.2%	-4.4%	18.7%	
PW117	499 Tomlin Rd	11.3	21.6	6,880	11.2	19.6	6,767	-1.2%	-9.2%	-1.6%	
PW118	Penn Rd/Milwaukee Way	1.5	5.0	885	1.6	2.9	945	7.2%	-42.5%	6.7%	Unreasonable DWF spike in observed data
PW120	Weisbrod Rd/Pearl Dr	3.3	5.3	2,004	3.6	5.2	2,176	9.1%	-2.4%	8.6%	
PW126	Wapiti Rd/Fisher Rd	3.3	5.8	1,990	3.4	4.7	2,065	4.2%	-19.3%	3.7%	Unreasonable DWF spike in observed data

The table above shows that in general the DWF calibration is within the acceptable range of ±10% of difference between the model result and the observed value in terms of average flow, total volume and peak flow. In some calibrated areas namely FM2, FM4, FM5, PW118 and PW126, the model underestimated the peak values by more than 10%. This was due to the high instantaneous peaks apparent in the observed data which was likely due to flow disturbances during data collection process. Therefore throughout the calibration process the model was calibrated to match the more general or average peak flow instead of the instantaneous peaks which are not necessarily depicting the real peak flow in the system.

In conclusion, the DWF calibration for the sites is considered to be sufficient for the purpose of this study.

Once this initial calibration was complete, the City elected to continue the flow monitoring until May 2014. The additional flow monitoring data was reviewed and it was confirmed that GWI is highest during the wettest months of the year. Since the City of Prince George experiences significant snow melt in the spring, it was found that GWI was higher in April than in December. ***Table 6.4*** summarizes the differences in GWI between December and April.

Table 6.4 - Seasonal GWI Comparison

FM Site	December GWI Rate (L/ha/d)	April GWI Rate (L/ha/d)
FM1	1,415	2,350
FM2	5,514	-
FM2B	-	3,734
FM3	1,689	1,689
FM4	1,966	8,270
FM5	1,359	3,093
PW118	364	956

Because of the significant differences in seasonal sanitary flow due to GWI, the model was calibrated using a December rainfall event as well as an April rainfall event; to develop two scenarios. This will be described further in ***Section 6.4***.

6.4 Wet Weather Flow Calibration

6.4.1 Flow Monitoring and Rainfall Data Assessment

Wet weather flow can generally be described using two components: the Rainfall Derived Inflow (Fast Response) component and the Rainfall Derived Infiltration (Slow Response) component. The methodology for wet weather calibration included an analysis of rainfall data across the City, a comparison of rainfall events with available pump station and temporary meter flow data, and selection of appropriate calibration sites and events. Correlation between flow and rain data highlighted the evidence of inflow and infiltration (I&I) in the sewer collection system. There are several factors that influence the flow response in a sanitary sewer system to a storm event: rainfall intensity, rainfall volume, rainfall duration, antecedent moisture conditions in the soil and size of contributing catchments.

As mentioned in the above section, there were three (3) rain gauges and 14 flow monitoring sites across the City that were used during the calibration process. The locations of these stations are presented in ***Figure 6.2***.

Three rain gauges were used during the calibration process and each flow monitoring site was assigned a rain gauge location as listed in ***Table 6.5.*** In order to select the appropriate calibration events, the available flow monitoring data was compared to the corresponding rainfall data. The two largest events showing good correlation with flow meter data were selected as calibration events. The dates of the selected events were December 26, 2013 and April 17, 2014. It was noted during the calibration process that in some areas the baseline GWI and RDII (rainfall dependent inflow and infiltration) varied significantly between the two calibration events. The December event generally had greater RDII rates, while the April event had generally higher GWI. The City offered that the higher RDII during the December event may have been due to frozen or snow covered catch basins causing a significant portion of runoff to enter the sanitary system through sanitary manhole lids. The higher baseline GWI is likely because the April event directly follows the spring snow melt. Due to the uniqueness of the two events, it was determined that there were not any similar rainfall events captured during the flow monitoring period that could be used for model validation. In discussion with City staff it was decided that calibration would be done for both events and that a "worst case scenario" will be used for analysis. Calibration for the second event was only performed for the temporary flow monitoring locations and 1 pump station. The calibration events chosen for each monitoring site are summarized in ***Table 6.5***.

Table 6.5 - WWF Calibration and Validation Events

Monitoring ID	General Monitoring Location	Rain Gauge Location	General Rain Gauge Location	Events	
				25-Dec-13	17-Apr-14
FM1	4952 John Hart Hwy	PW817	Stauble Rd	√	√
FM2	1702 Lyon St	PW650	Foothills Blvd	√	√
FM3	3641 Wiebe Rd	PW650	Foothills Blvd	√	√
FM4	Service Rd off Yellowhead Hwy	PW629	Sintich Rd	√	√
FM5	Behind 5850 Kovachich Rd	PW650	Foothills Blvd	√	√
PW101	Victoria St/Milburn Ave	PW650	Foothills Blvd	√	
PW102	Lower Patricia Blvd/4th St	PW650	Foothills Blvd	√	
PW103	Victoria St/15th Ave	PW650	Foothills Blvd	√	
PW106	1st Ave/McIntyre	PW650	Foothills Blvd	√	
PW115	Mackus Rd/Blackburn Rd	PW650	Foothills Blvd	√	
PW117	499 Tomlin Rd	PW650	Foothills Blvd	√	
PW118	Penn Rd/Milwaukee Way	PW629	Sintich Rd	√	√
PW120	Weisbrod Rd/Pearl Dr	PW817	Stauble Rd	√	
PW126	Wapiti Rd/Fisher Rd	PW817	Stauble Rd	√	

It should be noted that for the December 25th, 2013 event, in addition to rainfall there was also some snowfall and snowmelt as recorded at the City's Sewage Treatment Plant summarized in ***Table 6.6***. No snowfall or snowmelt occurred during the April 17th, 2014 event as the spring snowmelt finished on April 6th, however GWI would have been significantly increased by the recent snowmelt. It should also be noted that the December 25th event was also exacerbated by frozen catch basins.

Table 6.6 - December 25 Snow and Snowmelt during Calibration Period

Date	Snow (cm)	Snow on Ground (cm)
12/24/2013	0	34
12/25/2013	2	36
12/26/2013	0	30
12/27/2013	0	22
12/28/2013	0	22
12/29/2013	15	37
12/30/2013	0	35
12/31/2013	0	32

6.4.2 Wet Weather Parameters

Wet weather flow can generally be described using two components: the Rainfall Derived Inflow (Fast Response) component and the Rainfall Derived Infiltration (Slow Response) component. It is not uncommon to see the flow peaks measured during rain events being higher than that can be attributed to participating impervious areas associated with the connected catchments. In addition, the increased wet weather flows could persist long after the rain events and the associated surface runoffs are over. This condition shows that Rainfall Derived Infiltration depends not only on the actual precipitation but also on the soil moisture condition preceding the precipitation event. It also explains why a similar intensity and duration storm preceding a dry period would produce much lower peak flow rate and infiltration volume than the same event following a wet period. Therefore, when performing a numerical simulation of flows in sanitary sewers, the slow response can have great importance, especially when analyzing volumes.

Wet weather calibration was completed in InfoSWMM for a minimum of 5-day period including at least 2 days before and after the major storm event. This time frame was chosen to make sure that the antecedent moisture condition was captured before the event and the slow infiltration response was also captured after the event.

Using InfoSWMM, the rainfall-derived infiltration/inflow (RDII) into a sewer system was modelled and calibrated using the RTK and unit hydrograph approach. The RTK technique (illustrated in ***Figure 6.5***) is defined by three parameters:

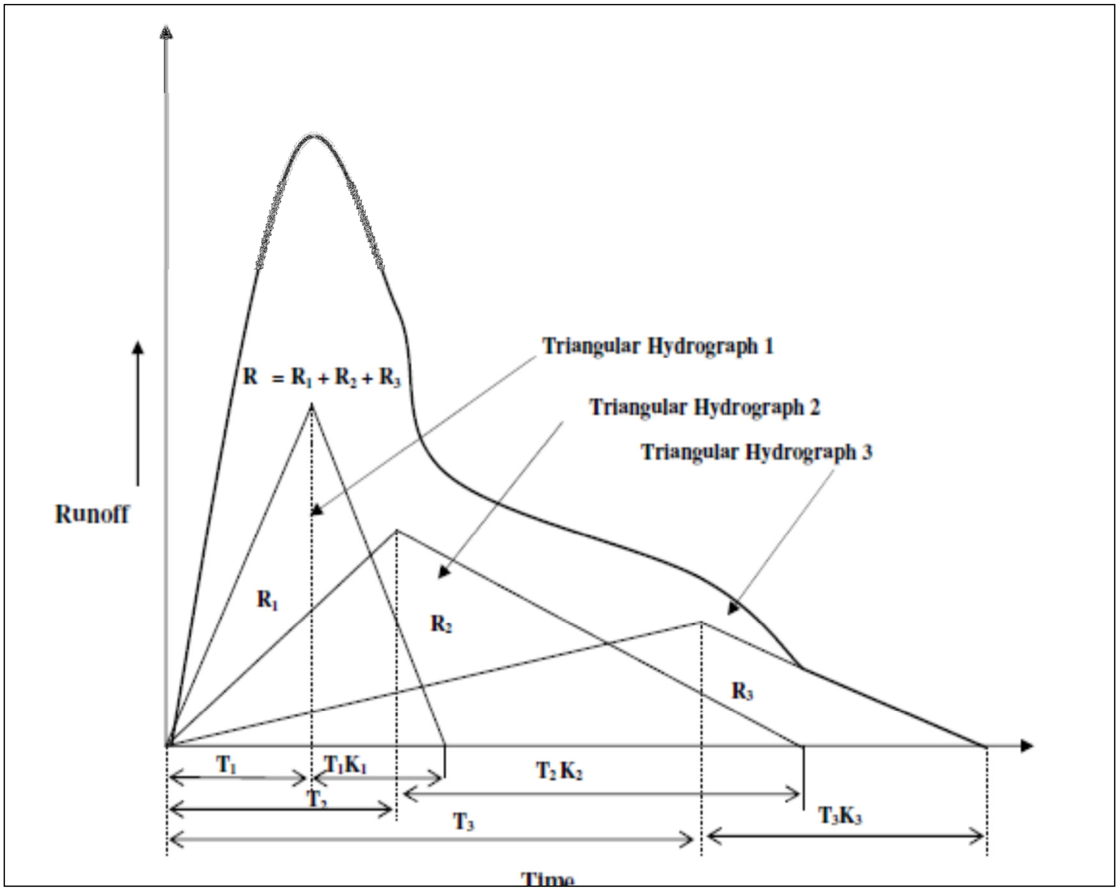
- R: the fraction of rainfall volume that enters the sewer system
- T: the time from the onset of rainfall to the peak of the unit hydrograph in hours
- K: the ratio of time to recession of the unit hydrograph to the time to peak

The RTK approach has three such unit hydrographs as shown in ***Figure 6.5***.
:

- R1 is for a short-term, fast response similar to inflow from direct connections;
- R2 is an intermediate response indicative of faster responding groundwater infiltration that is triggered by rainfall; and
- R3 is a long-term response that represents rainfall induced GWI that occurs due to soils being saturated by the distributed rainfall.

In the InfoSWMM model, separate RTK values were defined and calibrated for each flow monitoring site. It is important to note that the RTK values are representative of the particular rainfall event used for calibration, with “R” being the main parameter that impacts the quantity (peak flow and volume) of RDII in the system. For example, a 10-year storm will have a higher “R” value than a 2-year storm, with the “R” value increasing vs. return period in a logarithmic manner and eventually reaching a plateau. It should be noted that all events selected for the calibration process had a return period of less than a 5-year storm event. Therefore refinements to the calibrated wet weather flow parameter (in particular “Total R”) value are recommended for simulating events such as a 1 in 25-year or greater return period.

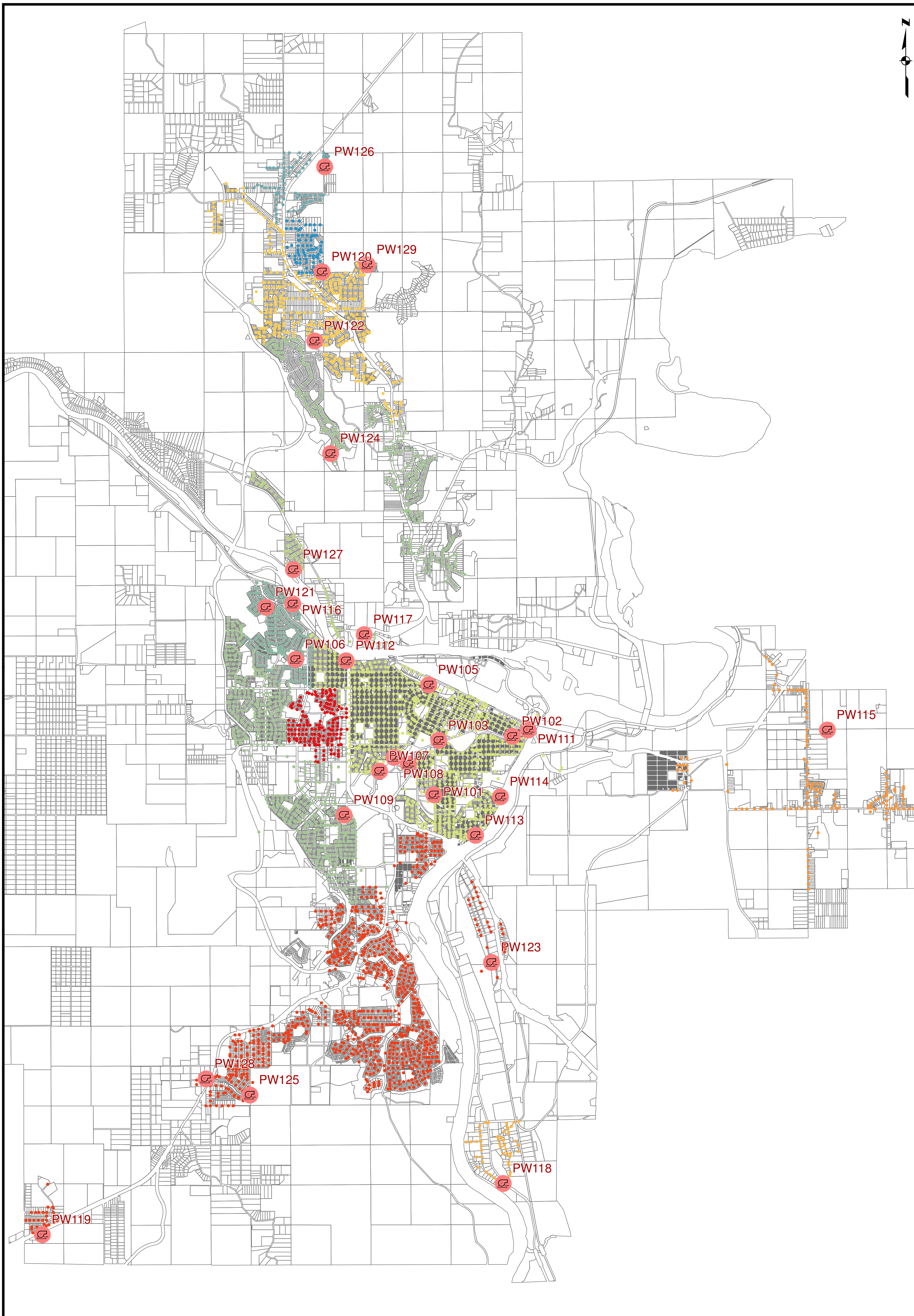
Figure 6.5 - RTK Parameter Description



The RTK parameters derived from the calibration process using InfoSWMM are summarized in ***Table 6.7***. For the non-calibrated areas the neighbouring's calibrated RTK parameters were applied based on the assumptions that these areas would have similar governing WWF parameters including soil, terrain and pipe conditions. The non-calibrated areas within the City were subdivided into the same three sub-areas as shown in ***Figure 6.4*** and their RTK parameters are summarized in ***Table 6.7.*** Total R values across the District for calibrated and non-calibrated areas are shown graphically in ***Figure 6.6*** and ***Figure 6.7*** .

Table 6.7 - Calibrated RTK Parameters

Monitoring ID	General Location	Rain Gauge	Proxy Calibrated Meter	Event Date	R1	T1	K1	R2	T2	K2	R3	T3	K3	Total R
FM1	4952 John Hart Hwy	Stauble Rd	-	25-Dec-13	0.002	2	1	0.018	5	6	0.030	17	7	0.050
			-	17-Apr-14	0.002	1	1	0.010	3	1	0.010	5	1	0.022
FM2	1702 Lyon St.	Foothills Blvd	-	25-Dec-13	0.025	0.3	5	0.280	0.5	10	0.005	1	25	0.310
FM2B	1215 Lethbridge St.	Foothills Blvd	-	17-Apr-14	0.001	1	1	0.005	3	1	0.010	10	5	0.016
FM3	3641 Wiebe Rd	Foothills Blvd	-	25-Dec-13	0.012	0.5	2	0.001	6	1	0.001	15	3	0.014
			-	17-Apr-14	0.001	0.5	2	0.001	6	1	0.001	15	3	0.003
FM4	Service Rd off Yellowhead Hwy	Sintich Rd	-	25-Dec-13	0.025	1	2	0.040	3	4	0.180	5	15	0.245
			-	17-Apr-14	0.005	1	2	0.020	2	4	0.090	5	10	0.115
FM5	Behind 5850 Kovachich Rd	Foothills Blvd	-	25-Dec-13	0.010	1	5	0.040	3	20	0.040	5	80	0.090
			-	17-Apr-14	0.001	1	2	0.092	7	3	0.060	10	40	0.153
PW102	Lower Patricia Blvd/4th St	Foothills Blvd	-	25-Dec-13	0.001	1	1	0.005	3	1	0.010	10	5	0.016
			FM2B	17-Apr-14	0.001	1	1	0.005	3	1	0.010	10	5	0.016
PW106	1st Ave/McIntyre	Foothills Blvd	-	25-Dec-13	0.000	1	1	0.003	2	1	0.008	3	16	0.011
				17-Apr-14	0.001	0.5	2	0.001	6	1	0.001	15	3	0.003
PW117	499 Tomlin Rd	Foothills Blvd	-	25-Dec-13	0.015	0.5	1	0.000	5	5	0.000	7	5	0.015
			FM1	17-Apr-14	0.002	1	1	0.010	3	1	0.010	5	1	0.022
PW118	Penn Rd/Milwaukee Way	Sintich Rd	-	25-Dec-13	0.035	1	2	0.008	3	20	0.017	5	45	0.060
			-	17-Apr-14	0.009	1	1	0.000	2	1	0.000	5	1	0.009
PW120	Weisbrod Rd/Pearl Dr	Stauble Rd	-	25-Dec-13	0.000	1	1	0.001	3	10	0.000	17	7	0.001
			FM1	17-Apr-14	0.002	1	1	0.010	3	1	0.010	5	1	0.022
PW126	Wapiti Rd/Fisher Rd	Stauble Rd	-	25-Dec-13	0.002	1	1	0.003	7	4	0.004	17	7	0.009
			FM1	17-Apr-14	0.002	1	1	0.010	3	1	0.010	5	1	0.022
PW101	Victoria St/Milburn Ave	Foothills Blvd	PW102	25-Dec-13	0.001	1	1	0.005	3	1	0.01	10	5	0.016
			FM2B	17-Apr-14	0.001	1	1	0.005	3	1	0.010	10	5	0.016
PW103	Victoria St/15th Ave	Foothills Blvd	PW102	25-Dec-13	0.001	1	1	0.005	3	1	0.01	10	5	0.016
			FM2B	17-Apr-14	0.001	1	1	0.005	3	1	0.010	10	5	0.016
PW115	Mackus Rd/Blackburn Rd	Foothills Blvd	FM5	25-Dec-13	0.01	1	5	0.04	3	20	0.04	5	80	0.09
			FM5	17-Apr-14	0.001	1	2	0.092	7	3	0.060	10	40	0.153
Area1	Between FM3/FM4	Sintich Rd	FM4	25-Dec-13	0.025	1	2	0.04	3	4	0.18	5	15	0.245
			FM4	17-Apr-14	0.005	1	2	0.020	2	4	0.090	5	10	0.115
Area2	Southwest of FM4	Sintich Rd	FM4	25-Dec-13	0.025	1	2	0.04	3	4	0.18	5	15	0.245
			FM4	17-Apr-14	0.005	1	2	0.020	2	4	0.090	5	10	0.115
Area3	North of PW115	Foothills Blvd	FM5	25-Dec-13	0.01	1	5	0.04	3	20	0.04	5	80	0.09
			FM5	17-Apr-14	0.001	1	2	0.092	7	3	0.060	10	40	0.153



CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No. 60305337

Date September 2014

Legend

Lift Station

Total 'R' Values

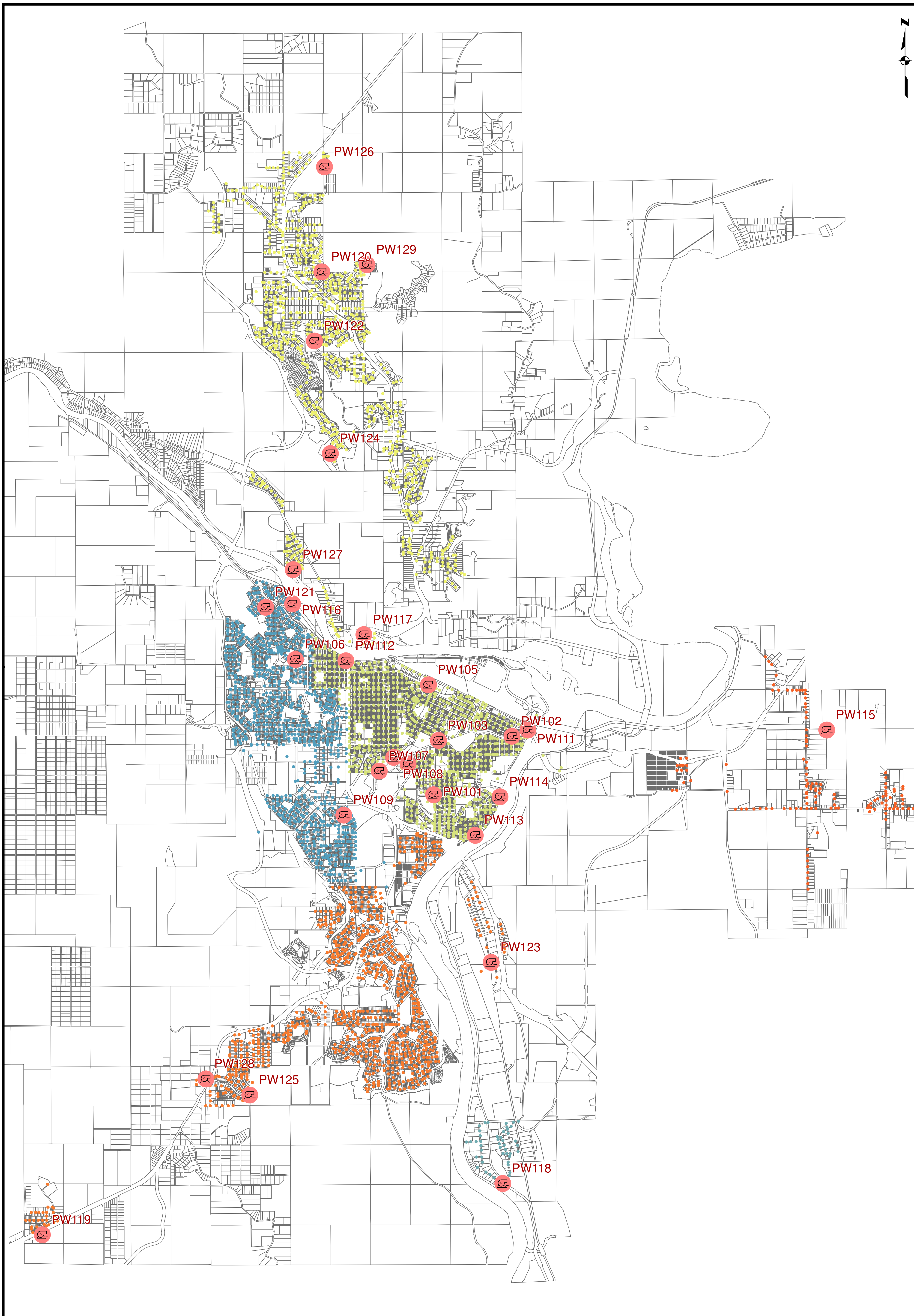
0.001	0.015	0.09
0.003	0.016	0.115
0.009	0.022	0.153
0.011	0.035	0.245
0.014	0.05	0.31
	0.06	

AECOM

0 1,250 2,500 Meters

December Total R Values

FIGURE 6.6



CITY OF PRINCE GEORGE

Sanitary Master Plan

Project No. 60305337

Date September 2014

Legend

Lift Station

Total 'R' Values

0.001
0.003
0.009
0.011
0.014
0.015
0.016
0.022
0.035
0.05
0.06
0.09
0.115
0.153
0.245
0.31

AECOM

0 1,250 2,500 Meters

April
Total R Values

FIGURE 6.7

Wet weather calibration results presented as a hydrograph comparison between the model results and the observed flow monitoring data are shown in ***Appendix B*** for the December event and ***Appendix C*** for the April event. In addition, a summary of the wet weather calibration events per site including the duration and amount of total rainfall event along with the peak flow and volumetric comparison is provided in ***Table 6.8***

Table 6.8 shows that in general the WWF calibration is within the acceptable range of ±10% of difference between the model result and the observed value in terms of average flow, total volume and peak flow.

As with the DWF calibration, PW101 (Victoria St/Milburn Ave) and PW103 (Victoria St/15th Ave) were not calibrated under WWF conditions because the pump station inflow at these locations could not be calculated based on the available information as explained in ***Section 6.1***. Similar to the DWF calibration process, PW115 (Mackus Rd/Blackburn Rd) also showed inconsistency in the observed flow result. Therefore the data from this site was not used in the calibration.

In conclusion, the WWF calibration is considered to be sufficient for the purpose of this study.

Table 6.8 - WWF Calibration Results

Monitoring ID	General Location	Rain Gauge	Event Date	Event Duration	Total Rain Vol (mm)	Observed			Model			% Difference			Notes
						Ave Flow (L/s)	Peak Flow (L/s)	Volume (m3)	Ave Flow (L/s)	Peak Flow (L/s)	Volume (m3)	Ave Flow (L/s)	Peak Flow (L/s)	Volume (m3)	
FM1	4952 John Hart Hwy	PW817	25-Dec-13	21	25	32	62	13,653	28	62	12,283	-10%	1%	-10%	
			17-Apr-14	30	14	29	62	12,406	29	65	13,256	2%	6%	7%	
FM2	1702 Lyon St	PW650	25-Dec-13	48	22	54	152	23,410	59	128	25,421	8%	-16%	9%	
FM2B	1215 Lethbridge St.	PW650	17-Apr-14	8	10	21	33	8,900	20	34	8,780	-1%	1%	-1%	
FM3	3641 Wiebe Rd	PW650	25-Dec-13	48	22	104	261	44,862	115	246	49,993	11%	-5%	11%	
			17-Apr-14	28	10	110	167	47,552	107	189	48,091	-3%	13%	1%	
FM4	Service Rd off Yellowhead Hwy	PW629	25-Dec-13	35	7	63	130	27,422	69	117	29,929	9%	-10%	9%	One instantenous peak in observed data most likely due to noise and not Wet weather related
			17-Apr-14	28	7	91	141	39,199	92	143	39,656	1%	1%	1%	
FM5	Behind 5850 Kovachich Rd	PW650	25-Dec-13	48	22	5	12	2,258	8	19	3,440	2%	-2%	5%	
			17-Apr-14	28	7	8	20	3,361	8	19	3,440	5%	-2%	2%	
PW102	Lower Patricia Blvd/4th St	PW650	25-Dec-13	48	22	17	32	7,564	19	30	8,402	12%	-7%	11%	
PW106	1st Ave/McIntyre	PW650	25-Dec-13	48	22	31	55	13,347	31	52	13,603	3%	-6%	2%	
PW117	499 Tomlin Rd	PW650	25-Dec-13	48	22	7	17	3,071	7	15	3,182	4%	-9%	4%	Flow is adjusted in the spreadsheet (not in model) to reduce the Brewery production during christmas week
PW118	Penn Rd/Milwaukee Way	PW629	25-Dec-13	35	7	3	14	1,160	3	14	1,244	8%	1%	7%	
			17-Apr-14	28	7	2	5	1,032	3	5	1,118	8%	-7%	8%	
PW120	Weisbrod Rd/Pearl Dr	PW817	25-Dec-13	21	25	3	6	1,433	4	5	1,563	10%	-12%	9%	One instantenous peak in observed data most likely due to noise and not Wet weather related
PW126	Wapiti Rd/Fisher Rd	PW817	25-Dec-13	21	25	3	6	1,479	4	6	1,588	8%	1%	7%	

Appendix G
Calibrated Areas Comparison

Comparison of Calibration Areas

Flow Monitoring Area	Dominant Surficial Geology	Dominant Pipe Materials	Average Install Date	Dec Total R	April Total R	Dec Proxy	April Proxy
FM1	Glaciofluvial Deposits, mainly sand	PVC	1982	0.05	0.022	-	-
FM2	Alluvial Sand & Gravel	VIT/AC/CON	1966	0.31	-	-	FM3
FM2B	Alluvial Sand & Gravel	CONC/AC	1962	-	0.016	-	-
FM3	Ice-contact stratified drift mainly sand; Alluvial S&G; Kettled Outwash S&G	PVC/CON	1969	0.014	0.003	-	-
FM4	Clay Lake Deposits; Alluvial Sand & Gravel	PVC/AC	1982	0.245	0.115	-	-
FM5	Clay Lake Deposits	PVC	1976	0.09	0.153	-	-
PW101	Alluvial Sand & Gravel	CON/AC	1965	-	-	PW102	FM2B
PW102	Alluvial Sand & Gravel	AC/CON	1967	0.016	-	-	FM2B
PW103	Alluvial Sand & Gravel	AC/CON	1963	-	-	PW102	FM2B
PW106	Kettled Outwash Plain, sand and gravel	VIT/PVC/CON	1973	0.011	-	-	FM3
PW115	Clay Lake Deposits	PVC	1974	-	-	FM5	FM5
PW117	Unknown - Glaciofluvial, mainly sand assumed	PVC	1989	0.015	-	-	FM1
PW118	Alluvial Sand & Gravel	PVC	1974	0.06	0.009	-	-
PW120	Unknown - Glaciofluvial, mainly sand assumed	PVC	1980	0.001	-	-	FM1
PW126	Unknown - Glaciofluvial, mainly sand assumed	PVC	1987	0.009	-	-	FM1
Area 1-1	Clay Lake Deposits	PVC/AC	1980	-	-	FM4	FM4
Area 1-2	Alluvial Sand & Gravel	PVC/CON/AC/VIT	1972	-	-	FM3	FM3
Area 1-3	Alluvial Sand & Gravel; Clay Lake Deposits	AC/PVC	1980	-	-	FM4	FM4
Area 2	Clay Lake Deposits	AC	1981	-	-	FM4	FM4
Area 3	Clay Lake Deposits	PVC	1976	-	-	FM5	FM5

Appendix H
Temporary Flow Monitoring Report

See eDoc 439868

Final Report for

The City of Prince George
c/o AECOM

Attn: Mr. Sumandeep Shergill, P.Eng.
Project Engineer

Prince George, BC
Sanitary Sewer Flow Monitoring 2013/2014
5 Flow Sites

Prepared and submitted by:

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July 22, 2014

AECOM
Fourth Floor, 3292 Production Way
Burnaby, BC, Canada V5A 4R4
T 604.444.6400 F 604.294.8597

(Via Email)

FINAL REPORT: PRINCE GEORGE, BC
Inflow and Infiltration Monitoring, Winter 2013 / 2014
November 2013 to May 2014
(10 Flow Sites)

Suman,

Please find enclosed SFE's Final Report for the above mentioned project. If you have any questions, comments or concerns, please do not hesitate to contact us at your earliest convenience.

Thank you for having SFE conduct this work on your behalf. We are appreciative of the opportunity to work with you and your team on this project.

Sincerely,
SFE Global

Glenn Cumyn, AScT
President
Cell: 604 880 5797
gcumyn@sfeonline.com
www.sfeonline.com

TABLE OF CONTENTS

1. Introduction

This report provides details of the sanitary sewer flow data collected by SFE within The City of Prince George, BC for the period. SFE Global was retained by The City of Prince George, under the direction of Ms. Hayley Sedola of Prince George. and Mr. Sumandeep Shergill, P.Eng. of AECOM, Burnaby, BC. Mr. Glenn Cumyn represented SFE Global as Project Manager during this project. The monitoring stations were as follows:

Site Description	Address	Weir Size or AV	Term
Site 1 – MH #HR55E	4952 John Hart Hwy	525mm Area Velocity	November 21 2013 to May 31 2014
Site 2 – MH #GL81B	1702 Lyon Street	525mm Area Velocity	November 21 2013 to February 12 2014
Site 2B – MH #	1215 Lethbridge Street	450mm Area Velocity	February 13 to May 31 2014
Site 3 – MH #HH32C	3641 Wiebe Road	750mm Area Velocity	November 21 2013 to May 31 2014
Site 4 – MH #HG73B	Yellowhead Hwy (service road)	675mm Area Velocity	November 20 2013 to May 31 2014
Site 5 – MH #OK14E	Behind 5850 Kovachich Road	400mm Area Velocity	November 22 2013 to May 31 2014

2. Commentary: Flow Monitoring Stations

All flow monitoring locations were pre-selected by The City of Prince George/AECOM and assessed by SFE. Prior to collecting data at these sites, SFE performed detailed site assessments of each potential site to determine the acceptability of flow monitoring and equipment to be utilized. Factors such as pipe size, channel condition, site location, site access, and flow hydraulics were all considered and documented while performing site assessments. Assessments were submitted to The City of Prince George/AECOM and approved for equipment installation. All equipment was operational by November 21 2013, and the monitoring term was until May 31 2014.

At site 2 MH #GL81B it was determined that there was an extensive amount of sand and gravel in the pipeline and creating a potential for adverse data collection results. Therefore the City decided to have SFE move the meter to a new location at 1215 Lethbridge Street on February 13th 2014.

SFE installed the flow monitoring stations in accordance with the approved site assessment documentation. The meters were calibrated and set to log data at 5 minute intervals. To ensure proper operation of the stations, a regular maintenance schedule was adhered to for the duration of the project.

SFE conducted routine maintenance / verification visits to each monitoring site on an on-going routine basis. During each site maintenance inspection conducted by SFE, corresponding meter and field readings were obtained and recorded on the field maintenance sheet. These readings provide an indication of the accuracy and operation of the meter. See Appendix #2 of this report for the field report sheets detailing site inspection information, calibrations, and depth verifications.

Site #414E – Site 1

Monitor Type / Location	Detectronic Area Velocity Meter (wireless data transfer to GoData) 4952 John Hart Highway, Prince George, BC
City MH #	HR55E
Data Duration	November 21 2013 to May 31 2014
% Data Collected	100%; good data quality with significant response to I/I

Site #414E – Site 2

Monitor Type / Location	Detectronic Area Velocity Meter (wireless data transfer to GoData) 1702 Lyon Street, Prince George, BC
City MH #	GL81B
Data Duration	November 21 2013 to February 12 2014; the meter was removed due to an excessive buildup of gravel and sand in the pipeline
% Data Collected	100%; good to fair data quality with excessive sand covering the AV sensor

Site #414E – Site 2B

Monitor Type / Location	Detectronic Area Velocity Meter (wireless data transfer to GoData) 1215 Lethbridge Street, Prince George, BC
City MH #	unknown
Data Duration	February 13 to May 31 2014
% Data Collected	100%; good data quality

Site #414E – Site 3

Monitor Type / Location	Detectronic Area Velocity Meter (wireless data transfer to GoData) 3641 Wiebe Road, Prince George, BC
City MH #	HH32C
Data Duration	November 21 2013 to May 31 2014
% Data Collected	100%; good data quality

Site #414E – Site 4

Monitor Type / Location	Detectronic Area Velocity Meter (wireless data transfer to GoData) Yellowhead Highway (service road), Prince George, BC
City MH #	HG73B
Data Duration	November 20 2013 to May 31 2014
% Data Collected	100%; good data quality

Site #414E – Site 5

Monitor Type / Location	Detectronic Area Velocity Meter (wireless data transfer to GoData) Behind 5850 Kavachich Road, Prince George
City MH #	OK14E
Data Duration	November 22 2013 to May 31 2014
% Data Collected	100%; fair data quality with effects from the downstream pump station and consequently surcharging

3. Site Maintenance

SFE conducted thorough site maintenance and field data verifications throughout the monitoring period. All field maintenance sheets and data graphs/summaries are included as Appendix #2 of this report.

4. QA/QC and Safety Statement

SFE confirms that all flow monitoring stations were installed and maintained according to SFE's QA/QC methodology and protocol, and standard industry practice.

SFE has a comprehensive Company Safety Manual and can be reviewed upon request. Confined space entry procedures and general site/traffic safety was adhered to during site installation and site maintenance. SFE utilizes an approved rescue system, a 2800 CFM air induction device and four-gas air quality monitors. All of our staff members are thoroughly trained and certified in confined space entry procedures. Certificates are available upon request.

A thorough traffic control plan was established and used by SFE Global crews where required.

5. Data

CSV data files for the project have previously been submitted to AECOM and The City of Prince George via email. Rain data collection was not the responsibility of SFE and rain data was not imported into the data files by SFE.

Summary sheets for daily Average Flow, Minimum Flow, Maximum Flow, Total Flow and Statistical Flow are included as appendix 2. All calculations are based on data collected during the monitoring period.

June 22 2013
Report End – SFE Global

Appendix 1

Site Installation Books

Velocity Profiles

Site Assessment S□eet

CLIENT FLO□ MONITORING #□	**□1□E**	**SFE PRO□ECT #□**	**□1□E**
NAME□	**City of Prince George□BC**	**SFE SITE #□**	**1 □MH#HR□□E**

Pro□ect Specific Information

Client Name:	City of Prince George
End □ser Name:	City of Prince George□AECOM
Project Name:	Sanitary Sewer Flow Monitoring
Client Contact:	□ayley Sedola, EIT
Field Contact:	□ayley Sedola and Sumandeep S□ergill
SFE PM Contact:	Glenn Cumyn
Site Maintenance:	bi□wee□ly

Site Equipment

Install □Removal Date:	11□21□1□	05□□1□1□
Meter Ma□e □ Model:	Detectronics A□	
Meter I.D. □□1 and □2	6□0□	207□017□6
□ireless I.D □ □Cell □:	na	na
Level □□elocity Type:	Pressure Probe	A□ Sensor
Sensor Mounting:	Compression	
Primary Device:	Area □elocity	
Logging Rate □Call out:	5 minute	2□□r

Site Location Information

Client Man□ole □:	□R55E
Address □Location□	□□52 □o□n □art □wy □across□
City, Province:	Prince George, BC
GPS □Nort□ □□ est □	5□.□6□07 122.767□□
Landmar□s:	□wy □7
Traffic Control Re□'s:	full □ig□way
Additional Information:	need to mar□site

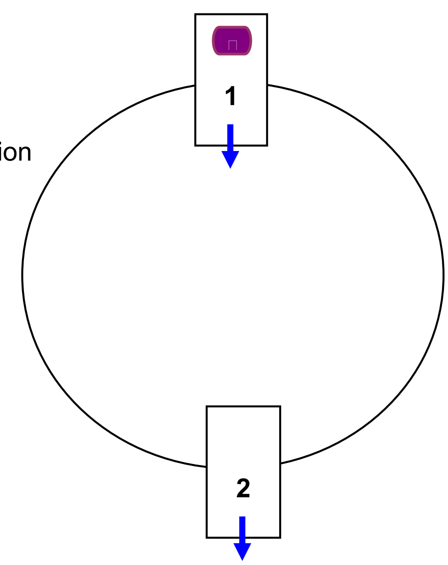
Site Profile

Man□ole Dept□ □cm□	250	Rungs□	yes
Overall Site Condition:	good		
Pipe Si□e □mm□	□1 525	□2	525
	□□	□□	
Location of Sensor □w□ic□pipe□□	□		1
Overall Pipe Condition:	good		
Additional Information:	good condition□install b□u downstream		

Map of Area

site location

Man□ole Layout



Additional Notes

□ need to install a post to mar□t□e site□place it far □
□ enoug□bac□so it doesn□t get □it by plow □
□ □

Site Pictures

CLIENT FLO□ MONITORING #□ □1□E | **SFE PRO□ECT #□** □1□E
NAME□ City of Prince George□BC | **SFE SITE #□** 1 □MH#HR□□E

Notes

1
2
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5
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Area Velocity Install S□eet

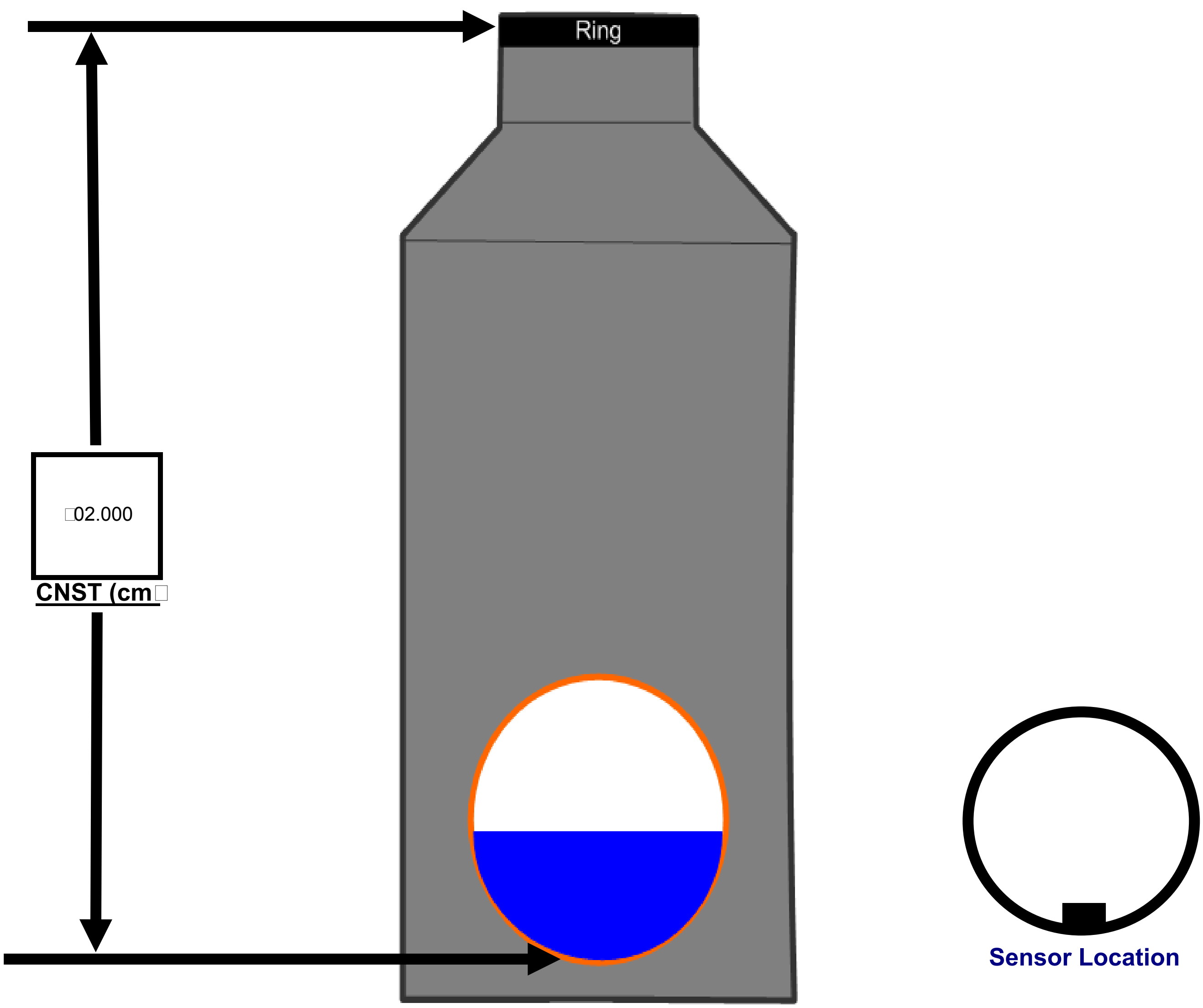
CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ 1 □MH#HR□□E
Tec□nician 1: □eff □e□oe
Tec□nician 2: Tim Croc□ett

Meter Dept□ vs□□Field Dept□ Calibration □Verification

Reading Number	Date (m□d□yyyy□	Time (□□□mm□	Field Meas (cm□	Meter Dept□ (cm□	Comments (□ero Meter Level before Installation□
Initial	Nov 21 201□	12:10	□.000	7.□00	PMAC ID 6□0□
1		□PST□	□.000	7.□00	525mm diameter
2			□.000	7.□00	constant for Isco is □0□.5cm
□			□.000	7.600	
Average			□.0	7.□	

** Three Continuous Measurements Within 2 Centimeters*
** Average Meter vs (WL1 and WL2) Within 5%*



Velocity Profile S□eet

CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ 1 □MH#HR□□E
Tec□nician 1: □eff □e□oe
Tec□nician 2: Tim Croc□ett

Pipe Diameter (mm□□	525	**PV Meter**	ISCO 2150
□ eat□er	Overcast □□C	**AV Meter□**	Mars□ McBirney

2□D Met□od					
Dept□ from Invert (cm□	**Left Corner**	**Left**	**Center**	**Rig□t**	**Rig□t Corner**
top					
mid					
bottom					
Average all readings		□DI□□0□			

0□9 Vmax Met□od

If dept□ is less t□an □", use Ma□ measured velocity □0.□
□se above 2□D met□od as preferred met□od w□en possible

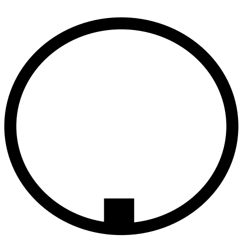
Max	1.25	**Max □0□9**	1.12	

Velocity Profile Summary

Profile Average m□s	Meter Reading m□s	Meter Coeff□	Dept□ of Flow (cm□	Date (m□d□yyyy□	Time (□□□mm□
1.12	0.□6	na	□	11□21□201□	11:5□

Meter Location and Orientation

Sensor Location



Section View

Comments□

Velocity Profile S□eet

CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ 1 □MH#HR□□E
Tec□nician 1: □eff □e□oe
Tec□nician 2: Tim Croc□ett

Pipe Diameter (mm□□	525	**PV Meter**	ISCO 2150
□ eat□er	Cloudy □15	**AV Meter□**	Mars□ McBirney

2□D Met□od

Dept□ from Invert (cm□	Left Corner	Left	Center	Rig□t	Rig□t Corner
top					
mid					
bottom					
Average all readings	□DI□0□				

0□9 Vmax Met□od

If dept□ is less t□an □", use Ma□ measured velocity □0.□
□se above 2□D met□od as preferred met□od w□en possible

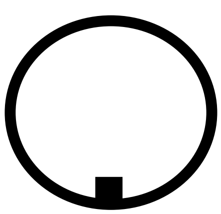
Max	1.11	**Max □0□9**	1.00	

Velocity Profile Summary

Profile Average m□s	Meter Reading m□s	Meter Coeff□	Dept□ of Flow (cm□	Date (m□d□yyyy□	Time (□□□mm□
1.00	0.□2	na	□	□une □201□	□:56

Meter Location and Orientation

Sensor Location



Section View

Comments□

Final C□ec□off S□eet

CLIENT FLO□ MONITORING #□	**□1□E**	**SFE PRO□ECT #□**	**□1□E**
NAME□	**City of Prince George□BC**	**SFE SITE #□**	**1□MH#HR□□E**
Date □Time□	**November 21 201□ 12□00**	Tec□nician 1:	□eff □e□oe
		Tec□nician 2:	Tim Croc□ett

Flow Meter Information

Meter Ma□e □ Model:	Detectronics A□		Logging Rate□Call out:	5 minute	2□□r
Meter I.D. □:	6□0□	207□017□6	Flow □nits:	lps	
□ ireless I.D. □Cell □:	na	na	□elocity □nits:	m□s	
Level □□elocity Type:	Pressure Probe	A□ Sensor	Dept□ □nits:	mm	
Primary Device:	Area □elocity		Surc□arge Meter □Y□N□:	Y	
Battery Old □New		12.□□			

Site P□ysical Information

Silt Level:	0	□ eat□er:	Overcast □□C
Slope:	N□A	□ eir Si□e:	na
□niform Flow □Y□N□	Yes	Dept□ Only□DO□	
Debris in Flow □Y□N□:	Yes □sanitary□	or Loo□up Table□LT□	A□ meter
Pipe Material:	Concrete	Comments	

C□ec□ Off List

	Yes	No
Time Set:	□	
Dept□ Calibrated:	□	
□elocity Profile:	□	
Download Data:	□	
Meter Running:	□	
Pipe Si□e □erified:	□	
P□otograp□ Ta□en:	□	
Site Cleaned:		□
Site Secured:	□	

Site Assessment S□eet

CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ 2 □MH#GL□1B

Pro□ect Specific Information

Client Name:	City of Prince George
End □ser Name:	City of Prince George□AECOM
Project Name:	Sanitary Sewer Flow Monitoring
Client Contact:	□ayley Sedola, EIT
Field Contact:	□ayley Sedola and Sumandeep S□ergill
SFE PM Contact:	Glenn Cumyn
Site Maintenance:	bi□wee□ly

Site Equipment

Install □Removal Date:	11□20□1□	05□□1□1□
Meter Ma□e □ Model:	Detectronics A□	
Meter I.D. □□1 and □2	6□0□	207□010□1
□ireless I.D □ □Cell □:	na	na
Level □□elocity Type:	Pressure Probe	A□ Sensor
Sensor Mounting:	Compression	
Primary Device:	Area □elocity	
Logging Rate □Call out:	5 minute	2□□r

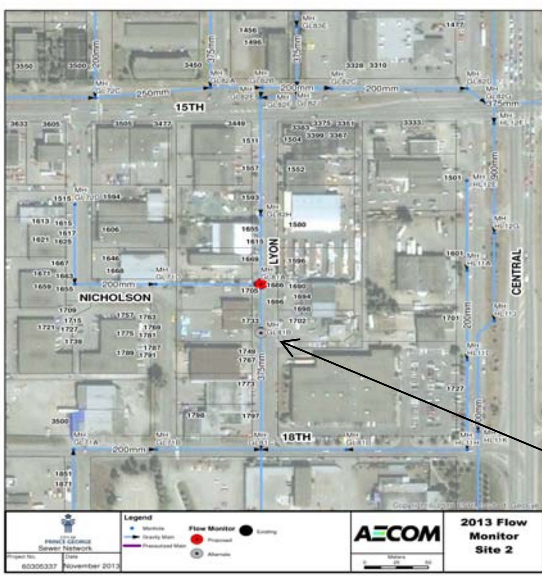
Site Location Information

Client Man□ole □:	GL□1A	
Address □Location□:	17□□ Lyon Street	
City, Province:	Prince George, BC	
GPS □Nort□ □□ est □:	5□.□0□□□	122.7□□7□
Landmar□s:	n□a	
Traffic Control Re□'s:	local	
Additional Information:		

Site Profile

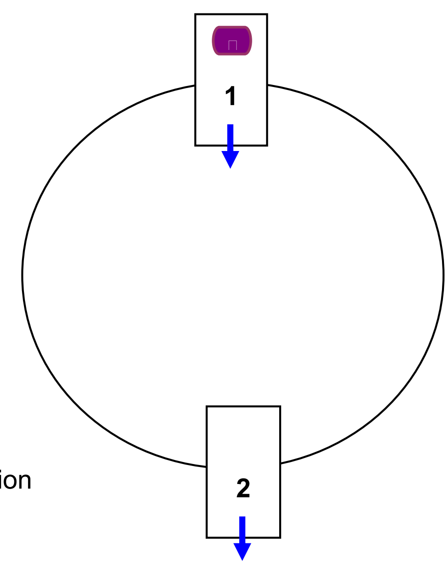
Man□ole Dept□ □cm□:	□50	Rungs□	yes
Overall Site Condition:	good		
Pipe Si□e □mm□:	□1 525	□2 525	
	□□	□□	
Location of Sensor □w□ic□ pipe□□:	□	1	
Overall Pipe Condition:	good		
Additional Information:	deep man□ole		

Map of Area



site location

Man□ole Layout



Additional Notes

□ □
□ □
□ □

Site Pictures

CLIENT FLO□ MONITORING #□ □1□E

NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E

SFE SITE #□ 2□MH#GL□1B

Notes

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Area Velocity Install S□eet

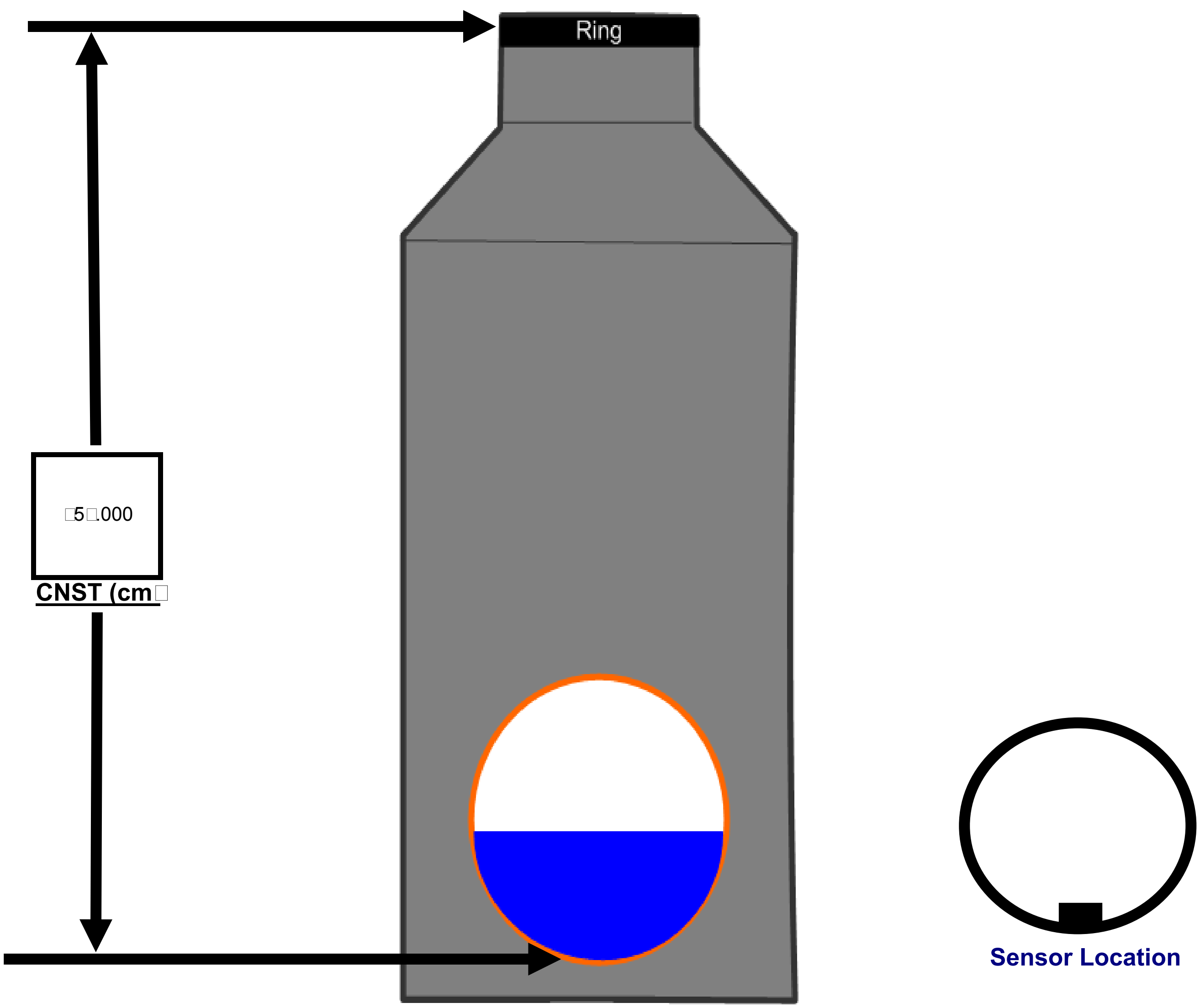
CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ 2□MH#GL□1B
Tec□nician 1: □eff □e□oe
Tec□nician 2: Tim Croc□ett

Meter Dept□ vs□Field Dept□ Calibration □Verification

Reading Number	Date (m□d□yyyy□	Time (□□mm□	Field Meas (cm□	Meter Dept□ (cm□	Comments (□ero Meter Level before Installation□
Initial	11□20□1□	12:□5	21.500	21.□00	PMAC ID 6□0□
1		□PST□	21.500	21.□00	525mm dia
2			21.500	21.600	constant is □51cm for Isco
□			21.500	21.700	
Average			21.5	21.6	

** Three Continuous Measurements Within 2 Centimeters*
** Average Meter vs (WL1 and WL2) Within 5%*



Velocity Profile S□eet

CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ 2□MH#GL□1B
Tec□nician 1: □eff □e□oe
Tec□nician 2: Tim Croc□ett

Pipe Diameter (mm□□	525	**PV Meter**	ISCO 2150
□eat□er	Snowing □1□C	**AV Meter□**	Mars□McBirney

2□D Met□od					
Dept□ from Invert (cm□	**Left Corner**	**Left**	**Center**	**Rig□t**	**Rig□t Corner**
top	0.27	0.□□	0.51	0.□6	0.□□
mid		0.55	0.□1	0.51	
bottom		0.□7	0.□5	0.□5	
Average all readings		0.□□			

0□9 Vmax Met□od

If dept□ is less t□an □", use Ma□ measured velocity □0.□
□se above 2□D met□od as preferred met□od w□en possible

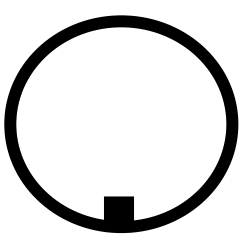
Max	N□A	**Max □0□9**	N□A	

Velocity Profile Summary

Profile Average m□s	Meter Reading m□s	Meter Coeff□	Dept□ of Flow (cm□	Date (m□d□yyyy□	Time (□□□mm□
0.□□	0.□5	na	21	Nov 20 201□	12:20

Meter Location and Orientation

Sensor Location



Section View

Comments□

Final C□ec□□off S□eet

CLIENT FLO□ MONITORING #□	**□1□E**	**SFE PRO□ECT #□**	**□1□E**
NAME□	**City of Prince George□BC**	**SFE SITE #□**	**2 □MH#GL□1B**
Date □Time□	**November 20 201□ 12□20**	Tec□nician 1:	□eff □e□oe
		Tec□nician 2:	Tim Croc□ett

Flow Meter Information

Meter Ma□e □ Model:	Detectronics A□		Logging Rate□Call out:	5 minute	2□□r
Meter I.D. □:	6□0□	207□010□1	Flow □nits:	lps	
□ ireless I.D. □Cell □:	na	na	□elocity □nits:	m□s	
Level □□elocity Type:	Pressure Probe	A□ Sensor	Dept□ □nits:	mm	
Primary Device:	Area □elocity		Surc□arge Meter □Y□N□	Y	
Battery Old □New		12.□□			

Site P□ysical Information

Silt Level:	0	□ eat□er:	Snowing □1□C
Slope:	N□A	□ eir Si□e:	na
□niform Flow □Y□N□	Yes	Dept□ Only□DO□	
Debris in Flow □Y□N□	Yes □sanitary□	or Loo□up Table□LT□	A□ meter
Pipe Material:	Concrete	Comments	

C□ec□ Off List

	Yes	No
Time Set:	□	
Dept□ Calibrated:	□	
□elocity Profile:	□	
Download Data:	□	
Meter Running:	□	
Pipe Si□e □erified:	□	
P□otograp□ Ta□en:	□	
Site Cleaned:		□
Site Secured:	□	

Site Assessment S□eet

CLIENT FLO□ MONITORING #□	□1□E	SFE PRO□ECT #□	□1□E
NAME□	City of Prince George□BC	SFE SITE #□	2 NE□

Pro□ect Specific Information

Client Name:	City of Prince George
End □ser Name:	City of Prince George□AECOM
Project Name:	Sanitary Sewer Flow Monitoring
Client Contact:	□ayley Sedola, EIT
Field Contact:	□ayley Sedola and Sumandeep S□ergill
SFE PM Contact:	Glenn Cumyn
Site Maintenance:	bi□wee□ly

Site Equipment

Install □Removal Date:	02□1□□1□	05□□1□1□
Meter Ma□e □ Model:	Detectronics A□	
Meter I.D. □□1 and □2	6572	207□010□1
□ireless I.D □ □Cell □:	na	na
Level □□elocity Type:	Pressure Probe	A□ Sensor
Sensor Mounting:	Compression	
Primary Device:	Area □elocity	
Logging Rate □Call out:	5 minute	2□□r

Site Location Information

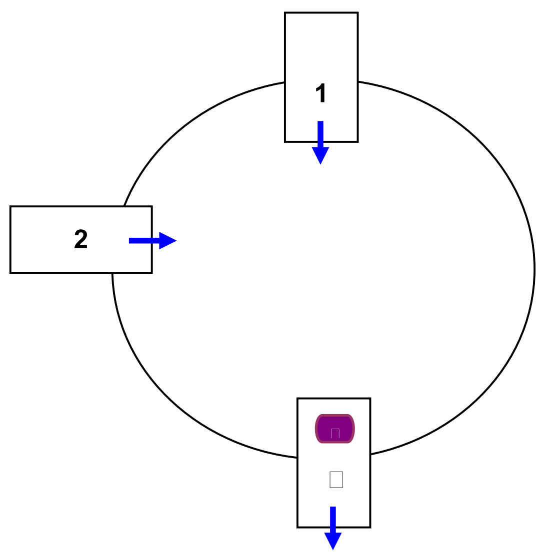
Client Man□ole □:		
Address □Location□:	1215 Let□bridge Street	
City, Province:	Prince George, BC	
GPS □Nort□ □□ est □	5□.□1□□□5	122.76□702
Landmar□s:	n□a	
Traffic Control Re□'s:	local	
Additional Information:		

Site Profile

Man□ole Dept□ □cm□:	570	Rungs□	yes
Overall Site Condition:	good		
Pipe Si□e □mm□:	□1 □50	□2	150
	□□ □50	□□	
Location of Sensor □w□ic□ pipe□□:	□		1
Overall Pipe Condition:	good		
Additional Information:	deep man□ole		

Map of Area

Man□ole Layout



Additional Notes

□ □
□ □
□ □

Site Pictures

CLIENT FLO□ MONITORING #□	□1□E	SFE PRO□ECT #□	□1□E
NAME□	City of Prince George□BC	SFE SITE #□	2 NE□

Notes

1	□
2	5
□	6

Area Velocity Install S□eet

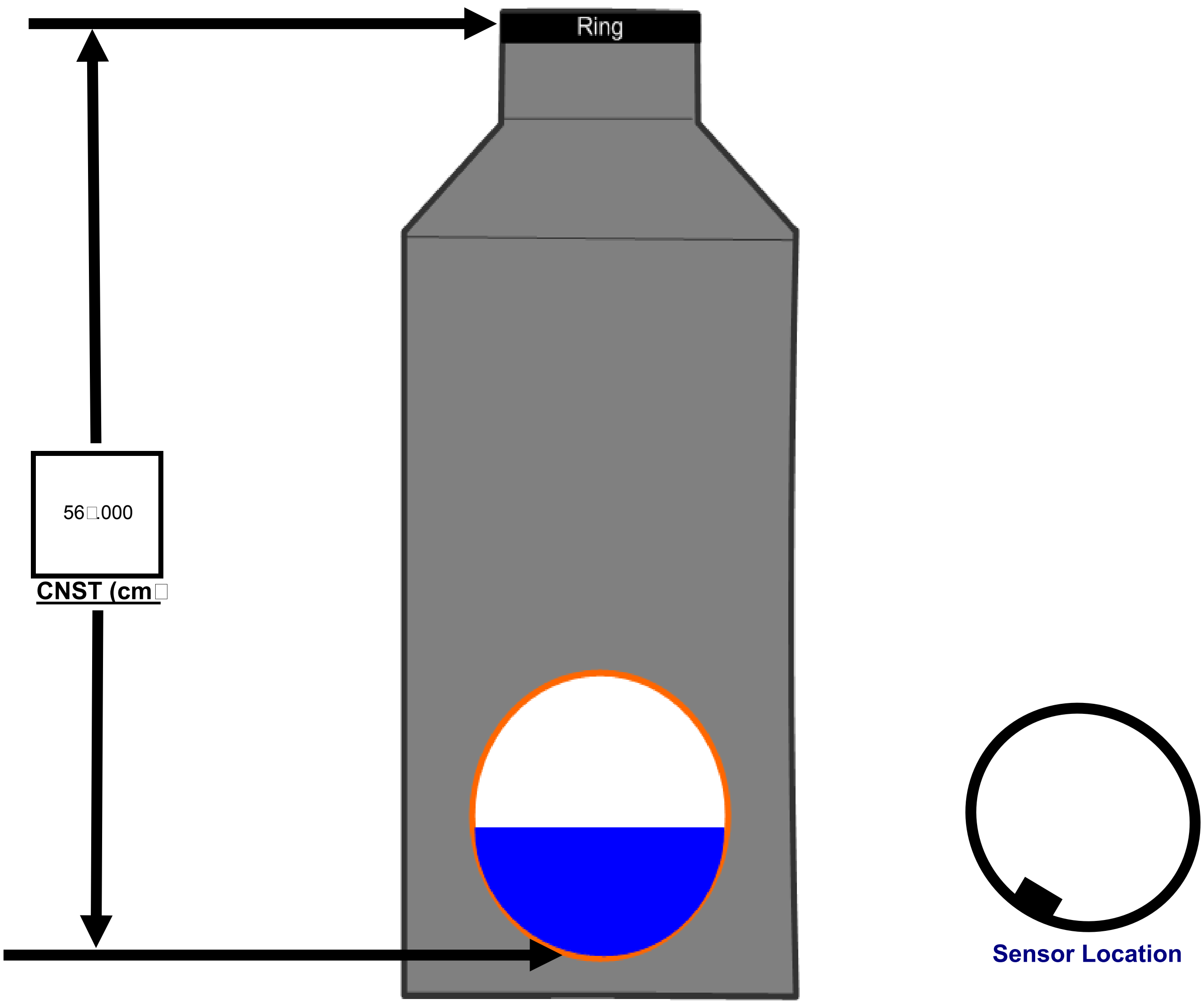
CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ 2 NE□
Tec□nician 1: □eff □e□oe
Tec□nician 2: Tim Croc□ett

Meter Dept□ vs□Field Dept□ Calibration □Verification

Reading Number	Date (m□d□yyyy□	Time (□□□mm□	Field Meas (cm□	Meter Dept□ (cm□	Comments (□ero Meter Level before Installation□
Initial	2□1□201□	1□:□5	16.500	16.700	PMAC ID 6572
1		□PST□	16.500	16.600	□50mm dia
2			16.500	16.500	constant is 56□cm for Isco
□			16.500	16.600	
Average			16.5	16.6	

** Three Continuous Measurements Within 2 Centimeters*
** Average Meter vs (WL1 and WL2) Within 5%*



Velocity Profile S□eet

CLIENT FLO□ MONITORING #□ □1□E

NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E

SFE SITE #□ 2 NE□

Tec□nician 1: □eff □e□oe

Tec□nician 2: Tim Croc□ett

Pipe Diameter (mm□□	□50	**PV Meter**	ISCO 2150
□ eat□er	Snowing □10C	**AV Meter□**	Mars□ McBirney

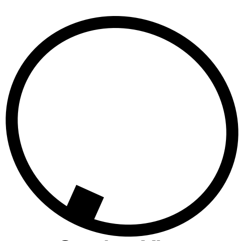
2□D Met□od					
Dept□ from Invert (cm□	**Left Corner**	**Left**	**Center**	**Rig□t**	**Rig□t Corner**
top	0.2□	0.51	0.5	0.5	0.□□
mid		0.□5	0.□□	0.□	
bottom		0.22	0.25	0.2	
Average all readings		0.□6			
0□9 Vmax Met□od					
If dept□ is less t□an □", use Ma□ measured velocity □0.□ □se above 2□D met□od as preferred met□od w□en possible					
Max	N□A	**Max □0□9**	N□A		

Velocity Profile Summary

Profile Average m□s	**Meter Reading m□s**	**Meter Coeff□**	**Dept□ of Flow (cm□**	**Date (m□d□yyyy□**	**Time (□□□mm□**
0.□6	0.□7	na	17	Feb 1□ 1□	1□:□5

Meter Location and Orientation

Sensor Location



Section View

Comments□

Velocity Profile S□eet

CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ 2B
Tec□nician 1: □eff □e□oe
Tec□nician 2: Tim Croc□ett

Pipe Diameter (mm□□	□50	**PV Meter**	ISCO 2150
□ eat□er	Cloudy □15C	**AV Meter□**	Mars□ McBirney

2□D Met□od					
Dept□ from Invert (cm□	**Left Corner**	**Left**	**Center**	**Rig□t**	**Rig□t Corner**
top	0.□5	0.□5	0.56	0.□5	0.□2
mid		0.□1	0.□5	0.□5	
bottom		0.2□	0.□□	0.□	
Average all readings		0.□0			

0□9 Vmax Met□od

If dept□ is less t□an □", use Ma□ measured velocity □0.□
□se above 2□D met□od as preferred met□od w□en possible

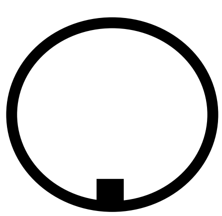
Max	N□A	**Max □0□9**	N□A	

Velocity Profile Summary

Profile Average m□s	**Meter Reading m□s**	**Meter Coeff□**	**Dept□ of Flow (cm□**	**Date (m□d□yyyy□**	**Time (□□□mm□**
0.□0	0.□6	na	15	□une □201□	□:25

Meter Location and Orientation

Sensor Location



Section View

Comments□

SFE GLOBAL

Final C□ec□□off S□eet

CLIENT FLO□ MONITORING #□	**□1□E**	**SFE PRO□ECT #□**	**□1□E**
NAME□	**City of Prince George□BC**	**SFE SITE #□**	**2 NE□**
Date □Time□	**February 1□201□ 0□00**	Tec□nician 1:	□eff □e□oe
		Tec□nician 2:	Tim Croc□ett

Flow Meter Information

Meter Ma□e □ Model:	Detectronics A□		Logging Rate□Call out:	5 minute | 2□□r
Meter I.D. □:	6572	207□010□1	Flow □nits:	lps
□ ireless I.D. □Cell □:	na	na	□elocity □nits:	m□s
Level □□elocity Type:	Pressure Probe	A□ Sensor	Dept□ □nits:	mm
Primary Device:	Area □elocity		Surc□arge Meter □Y□N□:	Y
Battery Old □New		12.□□		

Site P□ysical Information

Silt Level:	0	□ eat□er:	Snowing □10C
Slope:	N□A	□ eir Si□e:	na
□niform Flow □Y□N□	Yes	Dept□ Only□DO□	
Debris in Flow □Y□N□:	Yes □sanitary□	or Loo□up Table□LT□	A□ meter
Pipe Material:	Concrete	Comments	

C□ec□ Off List

	Yes	No
Time Set:	□	
Dept□ Calibrated:	□	
□elocity Profile:	□	
Download Data:	□	
Meter Running:	□	
Pipe Si□e □erified:	□	
P□otograp□ Ta□en:	□	
Site Cleaned:		□
Site Secured:	□	

Site Assessment S□eet

CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ □ □MH#HH□2C

Pro□ect Specific Information

Client Name:	City of Prince George
End □ser Name:	City of Prince George□AECOM
Project Name:	Sanitary Sewer Flow Monitoring
Client Contact:	□ayley Sedola, EIT
Field Contact:	□ayley Sedola and Sumandeep S□ergill
SFE PM Contact:	Glenn Cumyn
Site Maintenance:	bi□wee□ly

Site Equipment

Install □Removal Date:	11□21□1□	05□□1□1□
Meter Ma□e □ Model:	Detectronics A□	
Meter I.D. □□1 and □2	657□	207□01065
□ireless I.D □ □Cell □:	na	na
Level □□elocity Type:	Pressure Probe	A□ Sensor
Sensor Mounting:	Compression	
Primary Device:	Area □elocity	
Logging Rate □Call out:	5 minute	2□□r

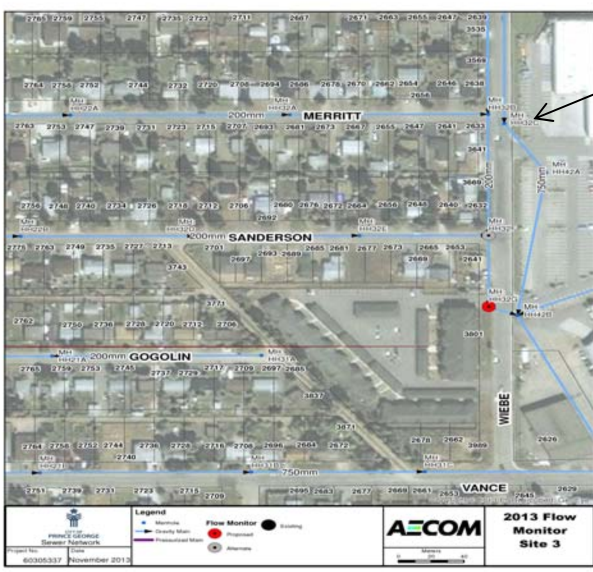
Site Location Information

Client Man□ole □:	□□□2G
Address □Location□:	□iebe Road and Merritt Street
City, Province:	Prince George, BC
GPS □Nort□ □□est □:	5□.□□□55 122.77□□7
Landmar□s:	Costco e□it
Traffic Control Re□'s:	full
Additional Information:	

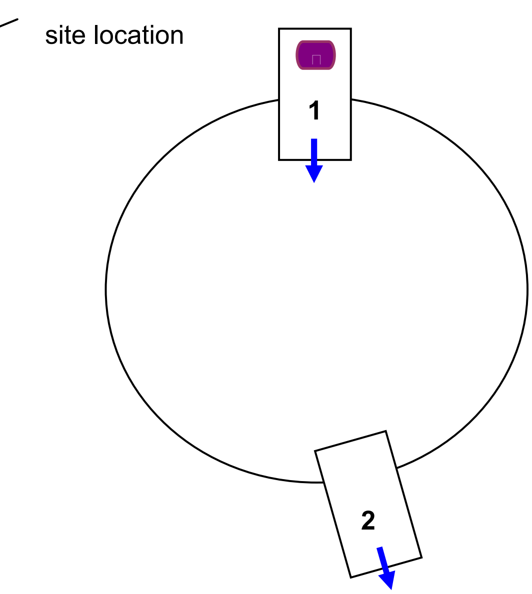
Site Profile

Man□ole Dept□ □cm□:	516	Rungs□	yes
Overall Site Condition:	good		
Pipe Si□e □mm□	□1 750	□2 750	
	□□	□□	
Location of Sensor □w□ic□pipe□□:	□ 1		
Overall Pipe Condition:	good		
Additional Information:	slig□t bend		

Map of Area



Man□ole Layout



Additional Notes

□ site was c□anged by t□e City to M□ □□□□2C
□
□
□
□
□

Site Pictures

CLIENT FLO□ MONITORING #□ □1□E

NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E

SFE SITE #□ □ □MH#HH□2C

Notes

1

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□

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Area Velocity Install S□eet

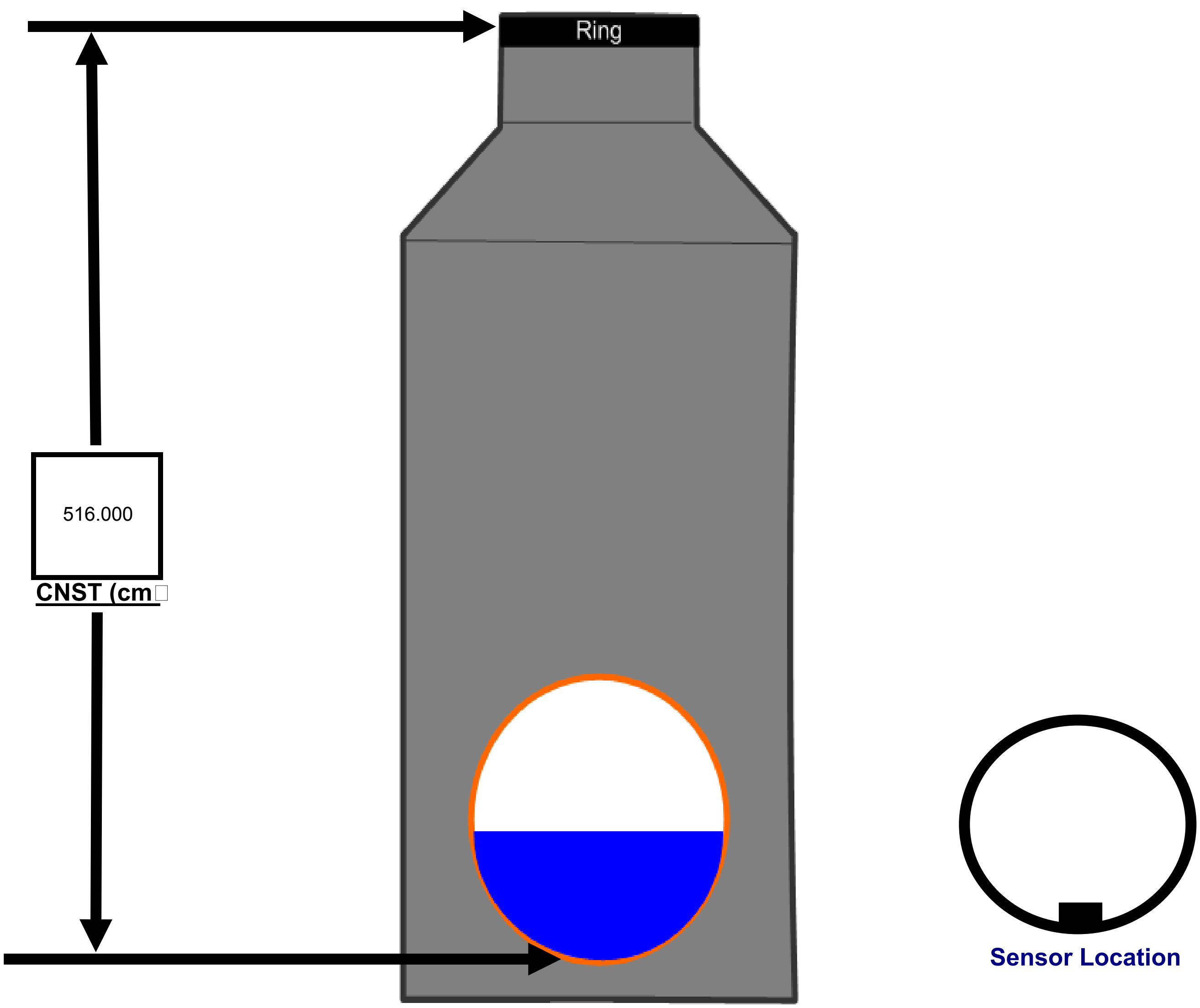
CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ □□MH#HH□2C
Tec□nician 1: □eff □e□oe
Tec□nician 2: Tim Croc□ett

Meter Dept□ vs□□Field Dept□ Calibration □Verification

Reading Number	Date (m□d□yyyy□	Time (□□□mm□	Field Meas (cm□	Meter Dept□ (cm□	Comments (□ero Meter Level before Installation□
Initial	21□11□201□	□:21	□□.000	□□.□00	PMAC ID 657□
1		□PST□	□□.500	□□.□00	750mm dia pipe
2			□□.000	□□.600	constant for Isco is 521
□			□□.500	□□.200	
Average			□□.7	□□.7	

** Three Continuous Measurements Within 2 Centimeters*
** Average Meter vs (WL1 and WL2) Within 5%*



Velocity Profile S□eet

CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ □ □MH#HH□2C
Tec□nician 1: □eff □e□oe
Tec□nician 2: Tim Croc□ett

Pipe Diameter (mm□□	750	PV Meter	ISCO 2150
□eat□er	Overcast □□C	AV Meter□	Mars□McBirney

2□D Met□od					
Dept□ from Invert (cm□	Left Corner	Left	Center	Rig□t	Rig□t Corner
top	0.□	0.□2	0.□□	0.□7	0.□2
mid		0.□	0.□□	0.□□	
bottom		0.7	0.7□	0.7□	
Average all readings		0.□7			

0□9 Vmax Met□od

If dept□ is less t□an □", use Ma□ measured velocity □0.□
□se above 2□D met□od as preferred met□od w□en possible

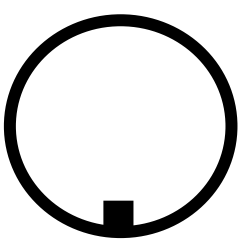
Max	N□A	Max □0□9	N□A

Velocity Profile Summary

Profile Average m□s	Meter Reading m□s	Meter Coeff□	Dept□ of Flow (cm□	Date (m□d□yyyy□	Time (□□□mm□
0.□7	0.□1	na	□2	11□21□1□	□:□6

Meter Location and Orientation

Sensor Location



Section View

Comments□

Velocity Profile S□eet

CLIENT FLO□ MONITORING #□ □1□E

NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E

SFE SITE #□ □ □MH#HH□2C

Tec□nician 1: □eff □e□oe

Tec□nician 2: Tim Croc□ett

Pipe Diameter (mm□□	750	**PV Meter**	ISCO 2150
□ eat□er	Cloudy □15C	**AV Meter□**	Mars□ McBirney

2□D Met□od					
Dept□ from Invert (cm□	**Left Corner**	**Left**	**Center**	**Rig□t**	**Rig□t Corner**
top	0.7	0.7□	0.□	0.77	0.72
mid		0.77	0.□2	0.75	
bottom		0.66	0.7	0.72	
Average all readings		0.75			

0□9 Vmax Met□od

If dept□ is less t□an □", use Ma□ measured velocity □0.□
□se above 2□D met□od as preferred met□od w□en possible

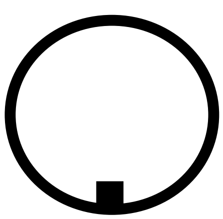
Max	N□A	**Max □0□9**	N□A	

Velocity Profile Summary

Profile Average m□s	**Meter Reading m□s**	**Meter Coeff□**	**Dept□ of Flow (cm□**	**Date (m□d□yyyy□**	**Time (□□□mm□**
0.75	0.76	na	□□	□une □201□	10:10

Meter Location and Orientation

Sensor Location



Section View

Comments□

Final C□ec□□off S□eet

CLIENT FLO□ MONITORING #□	**□1□E**	**SFE PRO□ECT #□**	**□1□E**
NAME□	**City of Prince George□BC**	**SFE SITE #□**	**□□MH#HH□2C**
Date □Time□	**November 21 201□ 9□□0**	Tec□nician 1:	□eff □e□oe
		Tec□nician 2:	Tim Croc□ett

Flow Meter Information

Meter Ma□e □ Model:	Detectronics A□		Logging Rate□Call out:	5 minute	2□□r
Meter I.D. □:	657□	207□01065	Flow □nits:	lps	
□ireless I.D. □Cell □:	na	na	□elocity □nits:	m□s	
Level □□elocity Type:	Pressure Probe	A□ Sensor	Dept□ □nits:	mm	
Primary Device:	Area □elocity		Surc□arge Meter □Y□N□:	Y	
Battery Old □New		12.□□			

Site P□ysical Information

Silt Level:	0	□eat□er:	Overcast □□C
Slope:	N□A	□eir Si□e:	na
□niform Flow □Y□N□	Yes	Dept□ Only□DO□	
Debris in Flow □Y□N□:	Yes □sanitary□	or Loo□up Table□LT□	A□ meter
Pipe Material:	Concrete	Comments	

C□ec□ Off List

	Yes	No
Time Set:	□	
Dept□ Calibrated:	□	
□elocity Profile:	□	
Download Data:	□	
Meter Running:	□	
Pipe Si□e □erified:	□	
P□otograp□ Ta□en:	□	
Site Cleaned:		□
Site Secured:	□	

Site Assessment S□eet

CLIENT FLO□ MONITORING #□	**□1□E**	**SFE PRO□ECT #□**	**□1□E**
NAME□	**City of Prince George□BC**	**SFE SITE #□**	**□□MH#HG7□B**

Pro□ect Specific Information

Client Name:	City of Prince George
End □ser Name:	City of Prince George□AECOM
Project Name:	Sanitary Sewer Flow Monitoring
Client Contact:	□ayley Sedola, EIT
Field Contact:	□ayley Sedola and Sumandeep S□ergill
SFE PM Contact:	Glenn Cumyn
Site Maintenance:	bi□wee□ly

Site Equipment

Install □Removal Date:	11□20□1□	05□□1□1□
Meter Ma□e □ Model:	Detectronics A□	
Meter I.D. □□1 and □2	657□	207□010□0
□ireless I.D □□Cell □:	na	na
Level □□elocity Type:	Pressure Probe	A□ Sensor
Sensor Mounting:	Compression	
Primary Device:	Area □elocity	
Logging Rate □Call out:	5 minute	2□□r

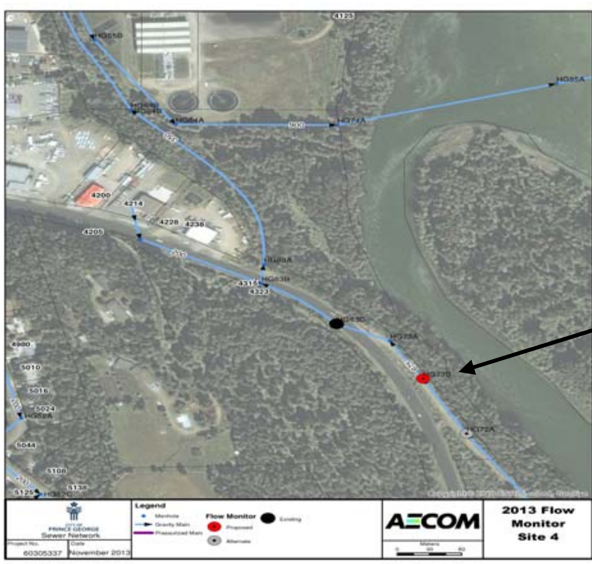
Site Location Information

Client Man□ole □:	□G7□B
Address □Location□:	Yellow□ead □ig□way □no address□
City, Province:	Prince George, BC
GPS □Nort□ □□est □:	5□.□7□61 122.76151
Landmar□s:	□ig□way
Traffic Control Re□'s:	none□need gate □ey
Additional Information:	gated access road

Site Profile

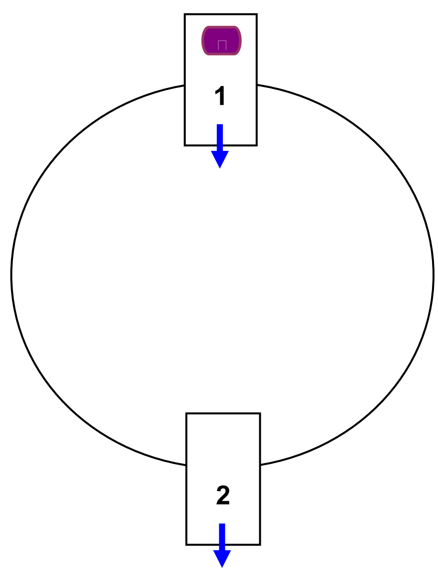
Man□ole Dept□ □cm□:	□50	Rungs□	yes
Overall Site Condition:	good		
Pipe Si□e	□1 675	□2	675
□mm□:	□□	□□	
Location of Sensor □w□ic□pipe□□:	□	□	1
Overall Pipe Condition:	good		
Additional Information:	install b□u downstream		

Map of Area



site location

Man□ole Layout



Additional Notes

□ City to supply SFE wit□a □ey to t□e gate for access □
□ located on service road to lift station □
□ □

Site Pictures

CLIENT FLO□ MONITORING #□ □1□E

NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E

SFE SITE #□ □ □MH#HG7□B

Notes

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Area Velocity Install S□eet

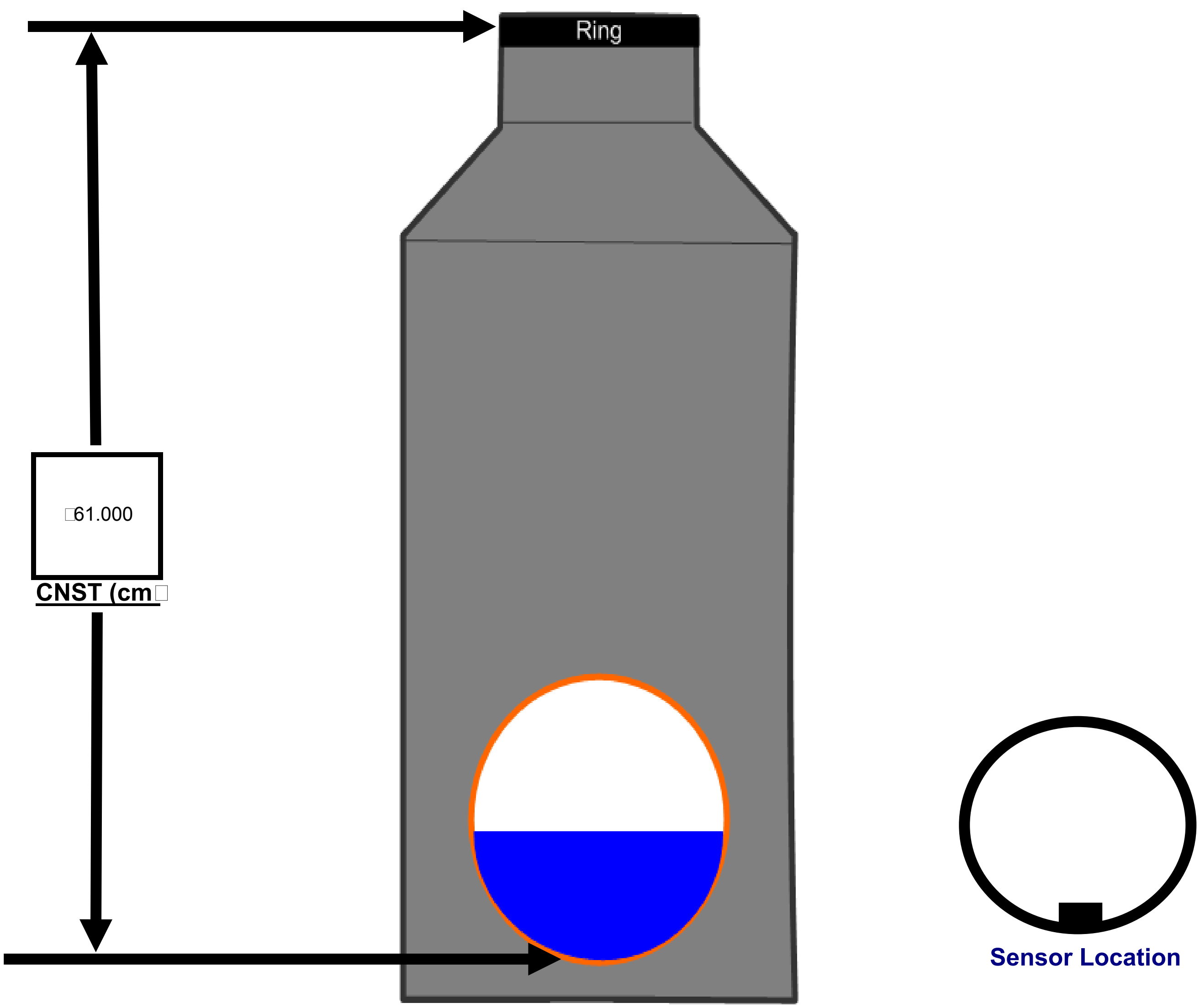
CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ □□MH#HG7□B
Tec□nician 1: □eff □e□oe
Tec□nician 2: Tim Croc□ett

Meter Dept□ vs□□Field Dept□ Calibration □Verification

Reading Number	Date (m□d□yyyy□	Time (□□□mm□	Field Meas (cm□	Meter Dept□ (cm□	Comments (□ero Meter Level before Installation□
Initial	11□20□201□	10:20	16.000	16.000	PMAC ID 657□
1		□PST□	16.000	15.□00	675mm dia
2			15.500	15.□00	constant for Isco is □6□cm
□			15.500	15.700	
Average			15.7	15.□	

** Three Continuous Measurements Within 2 Centimeters*
** Average Meter vs (WL1 and WL2) Within 5%*



Velocity Profile S□eet

CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ □ □MH#HG7□B
Tec□nician 1: □eff □e□oe
Tec□nician 2: Tim Croc□ett

Pipe Diameter (mm□□	675mm	**PV Meter**	ISCO 2150
□ eat□er	Snowing □1□C	**AV Meter□**	Mars□ McBirney

2□D Met□od					
Dept□ from Invert (cm□	**Left Corner**	**Left**	**Center**	**Rig□t**	**Rig□t Corner**
top	0.52	0.6□	0.77	0.7□	0.55
mid		0.6□	0.71	0.7	
bottom		0.5□	0.6□	0.6	
Average all readings		0.6□			

0□9 Vmax Met□od

If dept□ is less t□an □", use Ma□ measured velocity □0.□
□se above 2□D met□od as preferred met□od w□en possible

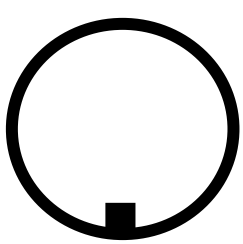
Max	N□A	**Max □0□9**	N□A	

Velocity Profile Summary

Profile Average m□s	**Meter Reading m□s**	**Meter Coeff□**	**Dept□ of Flow (cm□**	**Date (m□d□yyyy□**	**Time (□□□mm□**
0.6□	0.6	na	17	11□20□201□	□:50

Meter Location and Orientation

Sensor Location



Section View

Comments□

Velocity Profile S□eet

CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ □ □MH#HG7□B
Tec□nician 1: □eff □e□oe
Tec□nician 2: Tim Croc□ett

Pipe Diameter (mm□□	675mm	PV Meter	ISCO 2150
□ eat□er	Cloudy □15C	AV Meter□	Mars□ McBirney

2□D Met□od					
Dept□ from Invert (cm□	Left Corner	Left	Center	Rig□t	Rig□t Corner
top	1.2□	1.2□	1.22	1.2□	1.2□
mid		1,12	1.2□	1.2□	
bottom		0.□□	0.□6	0.□1	
Average all readings		1.12			

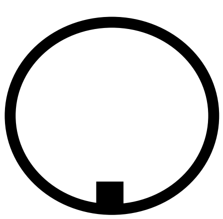
0□9 Vmax Met□od			
If dept□ is less t□an □", use Ma□ measured velocity □0.□ □se above 2□D met□od as preferred met□od w□en possible			
Max	N□A	Max □0□9	N□A

Velocity Profile Summary

Profile Average m□s	Meter Reading m□s	Meter Coeff□	Dept□ of Flow (cm□	Date (m□d□yyyy□	Time (□□□mm□
1.12	1.15	na	15	□une □201□	□:50

Meter Location and Orientation

Sensor Location



Section View

Comments□

Final C□ec□□off S□eet

CLIENT FLO□ MONITORING #□	**□1□E**	**SFE PRO□ECT #□**	**□1□E**
NAME□	**City of Prince George□BC**	**SFE SITE #□**	**□ □MH#HG7□B**
Date □Time□	**November 20 201□ 10□□0**	Tec□nician 1:	□eff □e□oe
		Tec□nician 2:	Tim Croc□ett

Flow Meter Information

Meter Ma□e □ Model:	Detectronics A□		Logging Rate□Call out:	5 minute	2□□r
Meter I.D. □:	657□	207□010□0	Flow □nits:	lps	
□ireless I.D. □Cell □:	na	na	□elocity □nits:	m□s	
Level □□elocity Type:	Pressure Probe	A□ Sensor	Dept□ □nits:	mm	
Primary Device:	Area □elocity		Surc□arge Meter □Y□N□:	Y	
Battery Old □New		12.□□			

Site P□ysical Information

Silt Level:	0	□eat□er:	Snowing □1□C
Slope:	N□A	□eir Si□e:	na
□niform Flow □Y□N□	Yes	Dept□ Only□DO□	
Debris in Flow □Y□N□:	Yes □sanitary□	or Loo□up Table□LT□	A□ meter
Pipe Material:	Concrete	Comments	

C□ec□ Off List

	Yes	No
Time Set:	□	
Dept□ Calibrated:	□	
□elocity Profile:	□	
Download Data:	□	
Meter Running:	□	
Pipe Si□e □erified:	□	
P□otograp□ Ta□en:	□	
Site Cleaned:		□
Site Secured:	□	

Site Assessment S□eet

CLIENT FLO□ MONITORING #□	**□1□E**	**SFE PRO□ECT #□**	**□1□E**
NAME□	**City of Prince George□BC**	**SFE SITE #□**	**□□MH#O□1□E**

Pro□ect Specific Information

Client Name:	City of Prince George
End □ser Name:	City of Prince George□AECOM
Project Name:	Sanitary Sewer Flow Monitoring
Client Contact:	□ayley Sedola, EIT
Field Contact:	□ayley Sedola and Sumandeep S□ergill
SFE PM Contact:	Glenn Cumyn
Site Maintenance:	bi□wee□ly

Site Equipment

Install □Removal Date:	11□22□1□	05□□1□1□
Meter Ma□e □ Model:	Detectronics A□	
Meter I.D. □□1 and □2	207□010□6	207□015□□
□ireless I.D □ □Cell □:	60□□□6□□7□	na
Level □□elocity Type:	Pressure Probe	A□ Sensor
Sensor Mounting:	Compression	
Primary Device:	Area □elocity	
Logging Rate □Call out:	5 minute	2□□r

Site Location Information

Client Man□ole □:	O□1□E
Address □Location□:	be□ind □ouse at 5□50 □ovac□ic□ Rd
City, Province:	Prince George, BC
GPS □Nort□ □□ est □:	5□.□0□51 122.6□□55
Landmar□s:	access trail
Traffic Control Re□'s:	none
Additional Information:	access trail

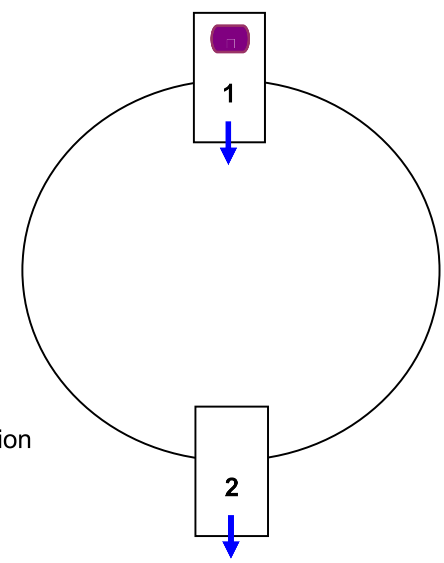
Site Profile

Man□ole Dept□ □cm□:	505	Rungs□	yes
Overall Site Condition:	good		
Pipe Si□e	□1	□00	□2 □00
□mm□:	□□		□□
Location of Sensor □w□ic□ pipe□□:	□		1
Overall Pipe Condition:	good		
Additional Information:	install b□u downstream		

Map of Area

site location

Man□ole Layout



Additional Notes

□ very slow velocity□e□cessive ragging
□ main meter was installed Nov 22□b□u on Nov 21
□

□
□
□

Site Pictures

CLIENT FLO□ MONITORING #□ □1□E

NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E

SFE SITE #□ □ □MH#O□1□E

Notes

1 □
2 5
□ 6

Area Velocity Install S□eet

CLIENT FLO□ MONITORING #□ □1□E

NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E

SFE SITE #□ □□MH#O□1□E

Tec□nician 1: □eff □e□oe

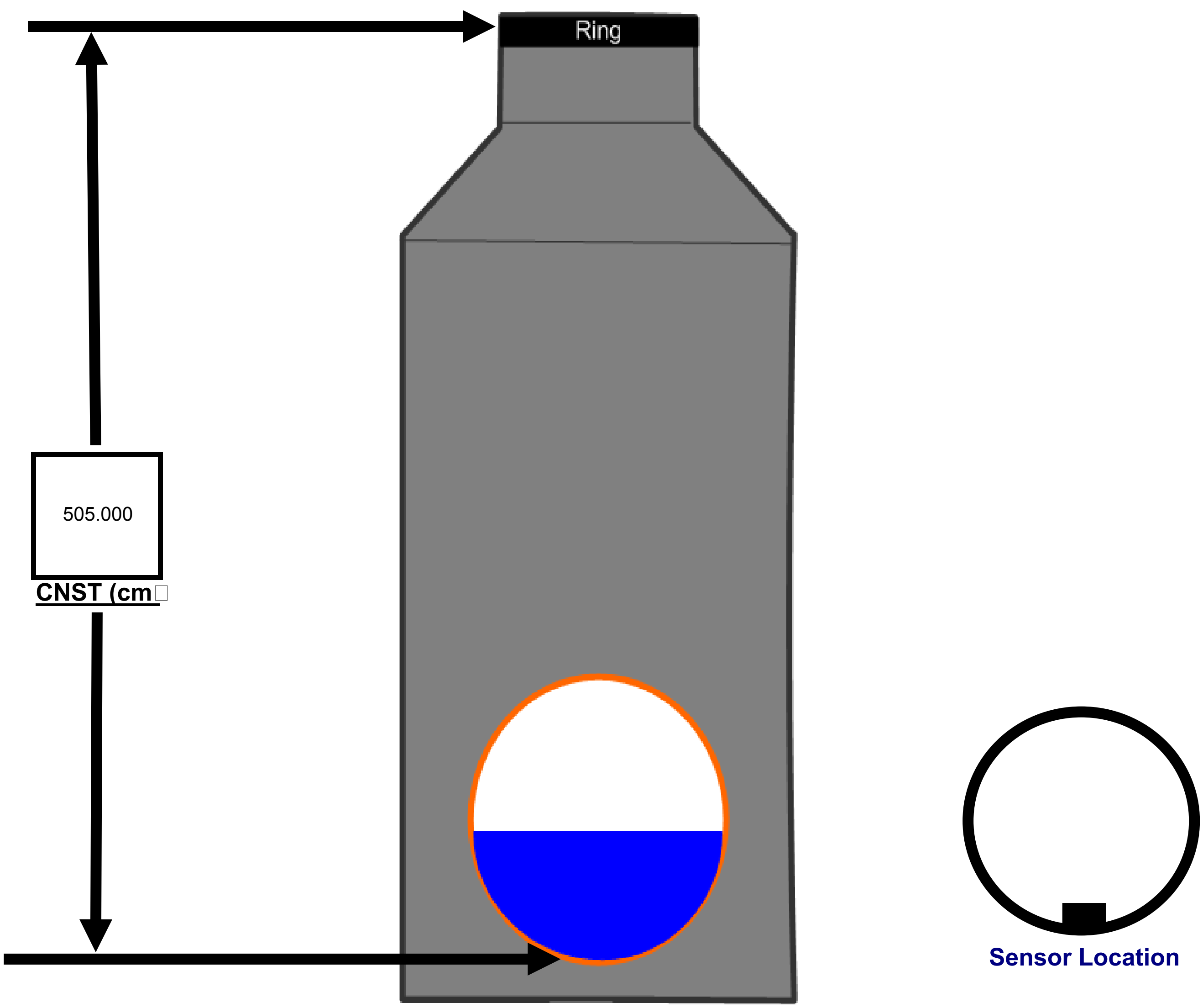
Tec□nician 2: Tim Croc□ett

Meter Dept□ vs□□Field Dept□ Calibration □Verification

Reading Number	Date (m□d□yyyy□	Time (□□□mm□	Field Meas (cm□	Meter Dept□ (cm□	Comments (□ero Meter Level before Installation□
Initial	Nov 22 201□	11:□0	6.000	5.□00	Isco meter is main meter
1		□PST□	6.000	5.□00	□00mm dia
2			6.000	5.□00	
□			6.000	5.□00	
Average			6.0	5.□	

** Three Continuous Measurements Within 2 Centimeters*

** Average Meter vs (WL1 and WL2) Within 5%*



Velocity Profile S□eet

CLIENT FLO□ MONITORING #□ □1□E
NAME□ City of Prince George□BC

SFE PRO□ECT #□ □1□E
SFE SITE #□ □ □MH#O□1□E
Tec□nician 1: □eff □e□oe
Tec□nician 2: Tim Croc□ett

Pipe Diameter (mm□□	□00mm	**PV Meter**	ISCO 2150
□eat□er	Overcast □10C	**AV Meter□**	Mars□McBirney

2□D Met□od					
Dept□ from	**Left**	**Left**	**Center**	**Rig□t**	**Rig□t**
Invert (cm□	**Corner**				**Corner**
top					
mid					
bottom					
Average all readings		□DI□□0□			

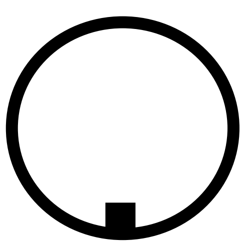
0□9 Vmax Met□od					
If dept□ is less t□an □", use Ma□ measured velocity □0.□ □se above 2□D met□od as preferred met□od w□en possible					
Max	0.□1	**Max □0□9**	0.27□		

Velocity Profile Summary

Profile Average m□s	**Meter Reading m□s**	**Meter Coeff□**	**Dept□ of Flow (cm□**	**Date (m□d□yyyy□**	**Time (□□□mm□**
0.2□	0.22	na	6	22□11□201□	11:□0

Meter Location and Orientation

Sensor Location



Section View

Comments□

Velocity Profile S□eet

CLIENT FLO□ MONITORING #□	□1□E
NAME□	City of Prince George□BC
SFE PRO□ECT #□	□1□E
SFE SITE #□	□ □MH#O□1□E
Tec□nician 1:	□eff □e□oe
Tec□nician 2:	Tim Croc□ett

Pipe Diameter (mm□□	□00mm	PV Meter	ISCO 2150
□ eat□er	Cloudy □15C	AV Meter□	Mars□ McBirney

2□D Met□od

Dept□ from Invert (cm□	Left Corner	Left	Center	Rig□t	Rig□t Corner
top					
mid					
bottom					
Average all readings	□DI□0□				

0□9 Vmax Met□od

If dept□ is less t□an □", use Ma□measured velocity □0.□

□se above 2□D met□od as preferred met□od w□en possible

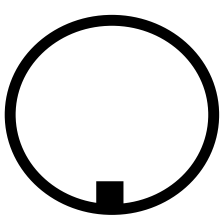
Max	0.□□	Max □0□9	0.□0	

Velocity Profile Summary

Profile Average m□s	Meter Reading m□s	Meter Coeff□	Dept□ of Flow (cm□	Date (m□d□yyyy□	Time (□□□mm□
0.□0	0.25	na	7.5	□une □201□	□:10

Meter Location and Orientation

Sensor Location



Section View

Comments□

Final C□ec□□off S□eet

CLIENT FLO□ MONITORING #□	**□1□E**	**SFE PRO□ECT #□**	**□1□E**
NAME□	**City of Prince George□BC**	**SFE SITE #□**	**□□MH#O□1□E**
Date □Time□	**November 22 201□ 11□□0**	Tec□nician 1:	□eff □e□oe
		Tec□nician 2:	Tim Croc□ett

Flow Meter Information

Meter Ma□e □ Model:	Detectronics A□		Logging Rate□Call out:	5 minute | 2□□r
Meter I.D. □:	207□010□6	207□015□□	Flow □nits:	lps
□ireless I.D. □Cell □:	60□□□6□□7□	na	□elocity □nits:	m□s
Level □□elocity Type:	Pressure Probe	A□ Sensor	Dept□ □nits:	mm
Primary Device:	Area □elocity		Surc□arge Meter □Y□N□	Y
Battery Old □New		12.□□		

Site P□ysical Information

Silt Level:	0	□eat□er:	Overcast □10C
Slope:	N□A	□eir Si□e:	na
□niform Flow □Y□N□	Yes	Dept□ Only□DO□	
Debris in Flow □Y□N□	Yes □sanitary□	or Loo□up Table□LT□	A□ meter
Pipe Material:	Concrete	Comments	

C□ec□ Off List

	Yes	No
Time Set:	□	
Dept□ Calibrated:	□	
□elocity Profile:	□	
Download Data:	□	
Meter Running:	□	
Pipe Si□e □erified:	□	
P□otograp□ Ta□en:	□	
Site Cleaned:		□
Site Secured:	□	

Appendix 2

Per Site:

Maintenance Sheets
Monthly Graphs
Monthly Data Summary Sheets

FIELD MAINTENANCE RECORD

NAME□ City of Prince George, BC
SFE SITE #□ □1□E □1 M□ □□R55E
ADDRESS□ □□52 □o□n □art □wy
GPS□ 5□.□6□07 122.767□□
SENSOR TYPE□ A□
PRIMARY DEVICE□ 525mm A□

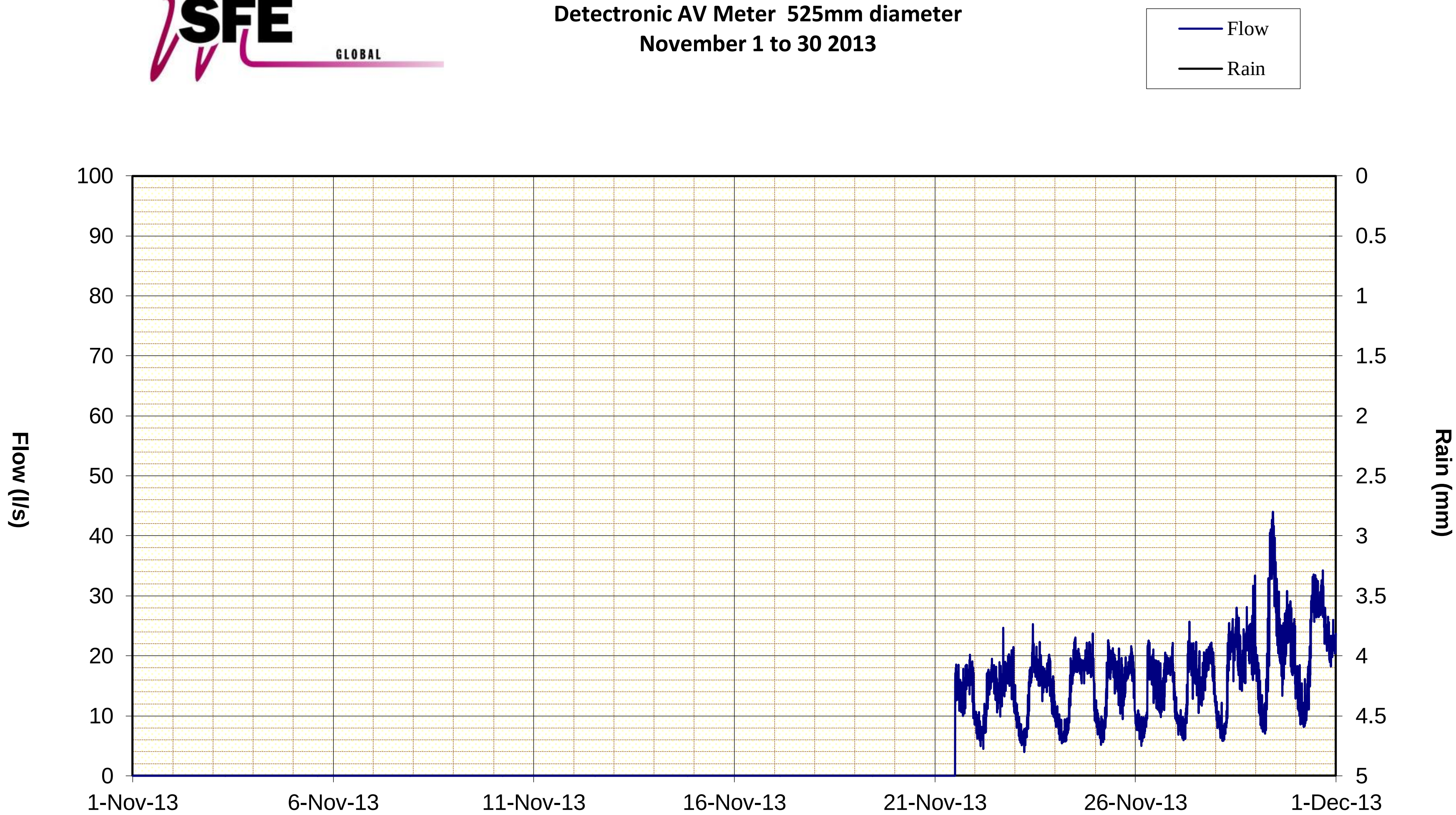
CONSTANTS			
D1 □cm□	D1□lip to □bar		
TOM □cm□ □02.000	Raw □ eir L □□bar to water		
METER □ 6□0□		DATE:	11□21□1□
METER □ 207□017□6		DATE:	11□21□1□
METER □		DATE:	

LEGEND	
DL □DO□ NLOAD	**PC** □PROGRAM COMPLETE
CB □C□G BATTERY	**PM** □PROG. METER
V □□ERIFY	**VIS** □□IS□AL
LA □LE□EL AD□□ST	**VP** □□ELOCITY PROFILE
DO □DEPT□ ONLY	**CD** □C□G DESICCANT

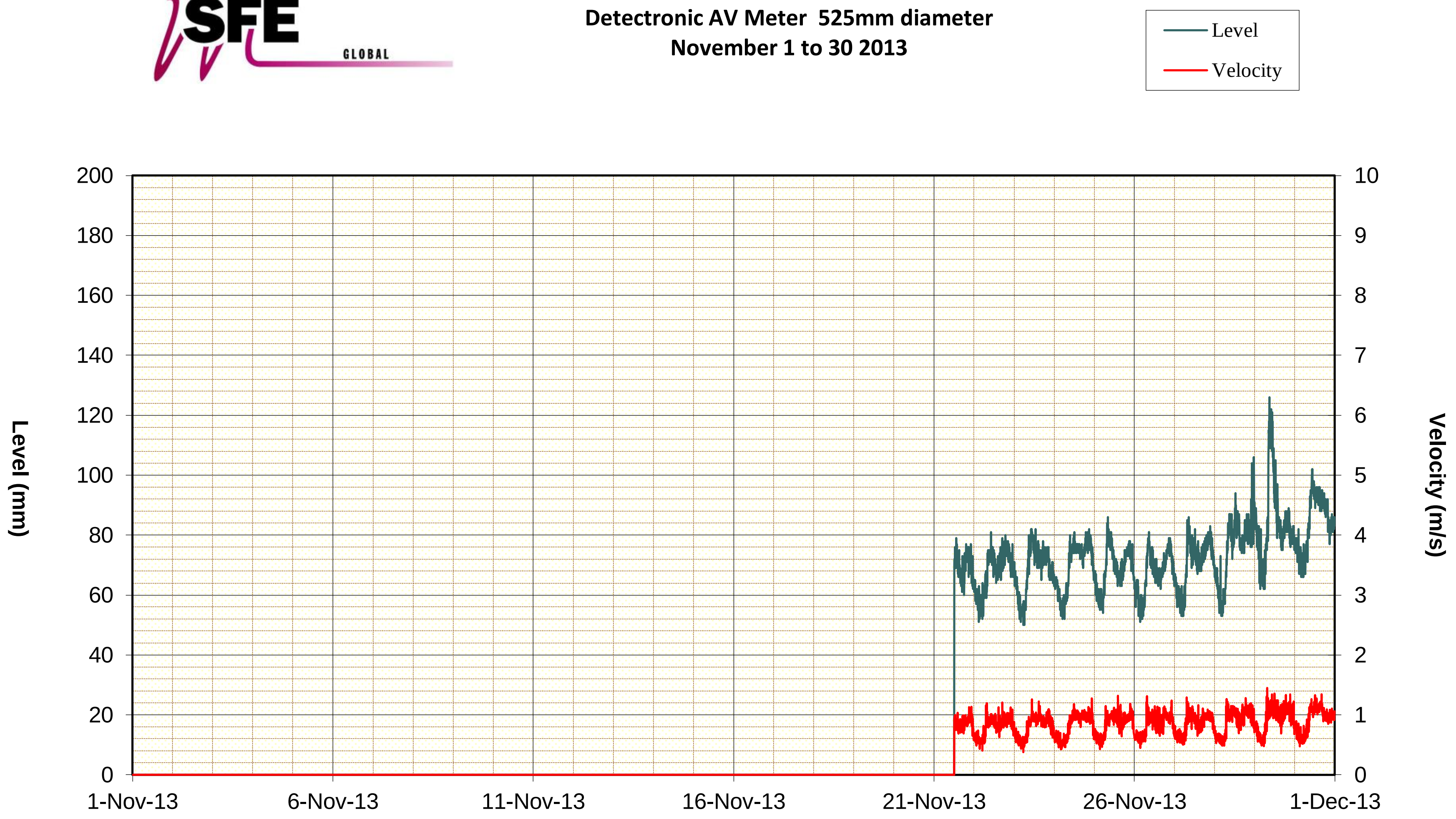
DATE M□D□YY	TIME □□:MM	METER TIME □□:MM	METER DEPT□ cm	FIELD DEPT□ cm	METER □EL M□S	FIELD □EL□□IS M□S	FLO□ LPS	BATT □	SILT cm	MTC BY □INIT.□	COMMENTS
11□21□1□	12:21	12:20	7.2	7.5	0.□6	1.12	□	12.2	0	□□	installed meter 6□0□ and b□u
11□22□1□	10:1□	10:20	□.1	□.5	0.□2	□	□	12.2	0	□□	downloaded□pus□ed data□all O□
12□10□1□	1□:□7	1□:□6	10.□	10.5	1.1	□	□	12.2	0	□□	DL O□
01□0□□1□	12:5□	1□:00	12.2	12	1	□	□	12.2	0	□□	DL sensor cleared
01□22□1□	11:50	11:51	□.6	□	0.□5	□	□	11.6	0	□□	DL sensor cleared
02□1□□1□	12:10	12:10	10.2	10.5	1.21	□	□	10.□	0	□□	DL sensor clear
0□01□1□	1□:□0	1□:□0	6.□	□	1	□	1□.7	12.□	0	GC	remote data download
0□12□1□	10:17	□:15	□.5	□.5	1.0□	□	2□.□	12.□	0	□□	DL sensor clear
0□0□□1□	12:57	11:57	□.5	□.5	1.1	□	□	12.2	0	□□	DL sensor clear
0□26□1□	11:26	10:26	□.□	□	1.□1	□	□	12	0	□□	DL sensor clear
05□1□□1□	11:1□	10:1□	10	□.5	1.07	□	□	11.□	0	□□	DL sensor cleared of minor debris
06□0□□1□	□:55	7:56	□	□	0.□2	1	□	11.□	0	□□	Removed meter

DATE□	NOTES□

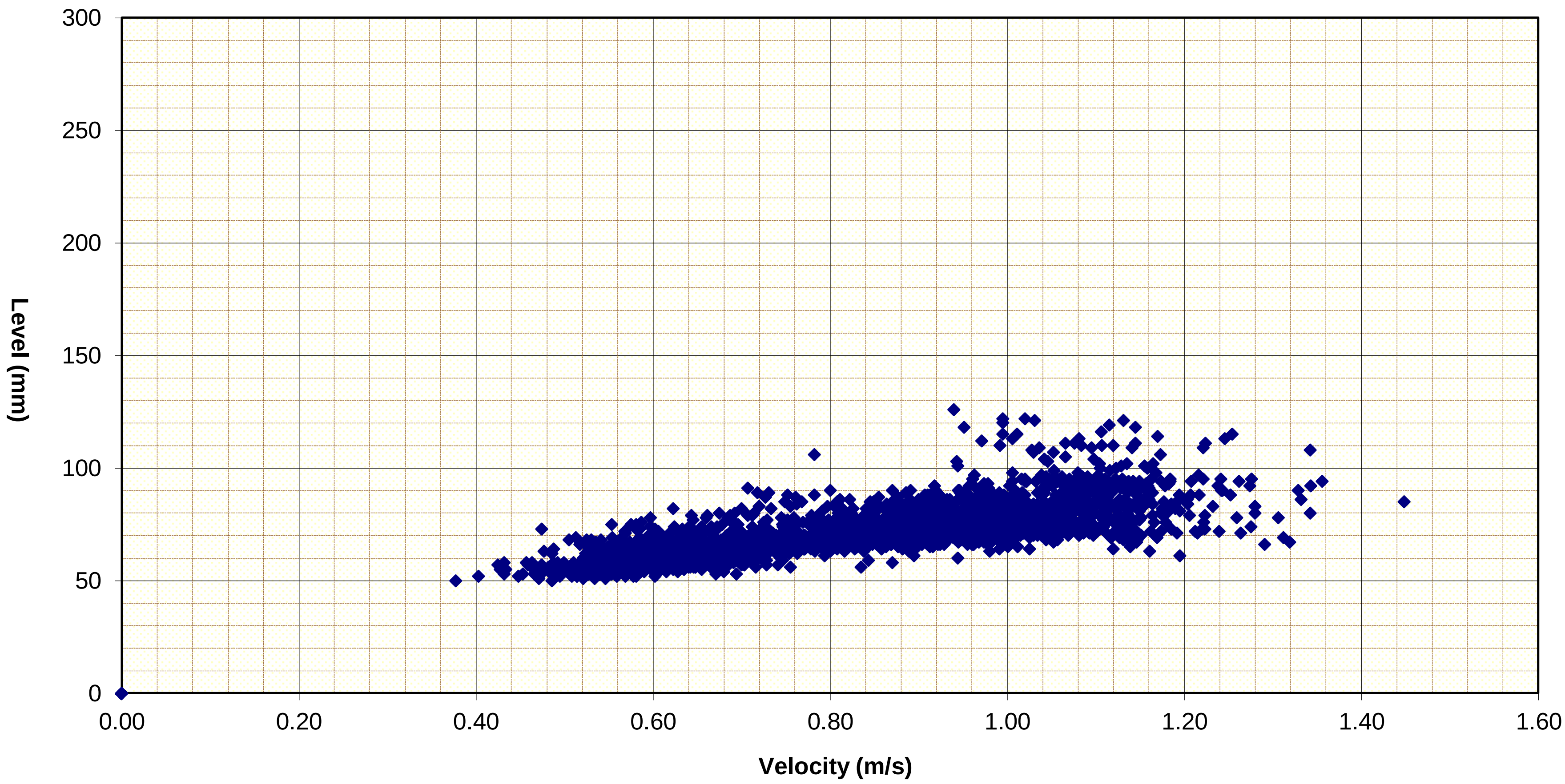
City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
November 1 to 30 2013



City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
November 1 to 30 2013



City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
November 1 to 30 2013

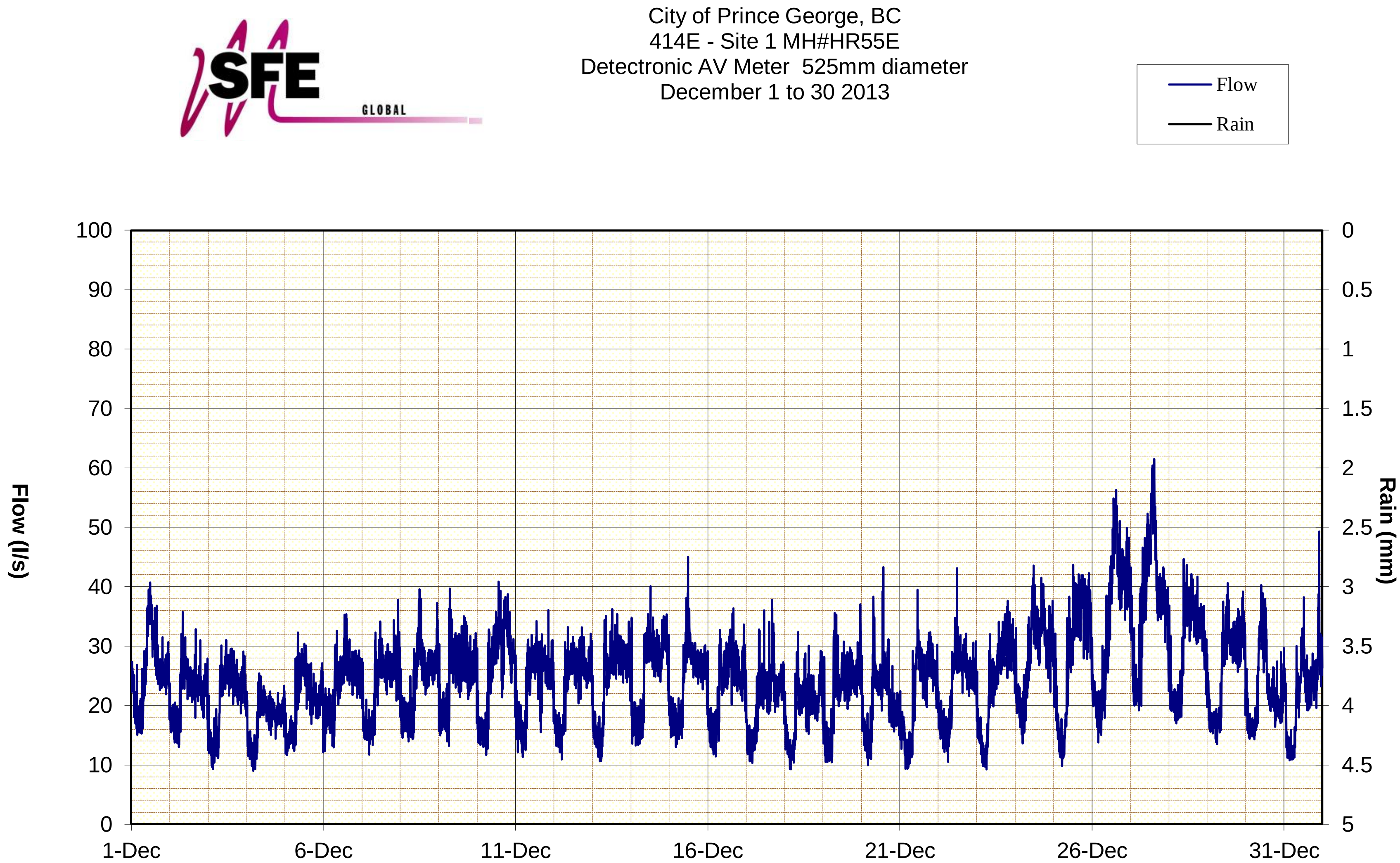


City of Prince George, BC
Site #414E - Site 1 MH #HR55E
Detectronic AV - 525mm Dia
4952 John Hart Highway
November 1 to 30 2013

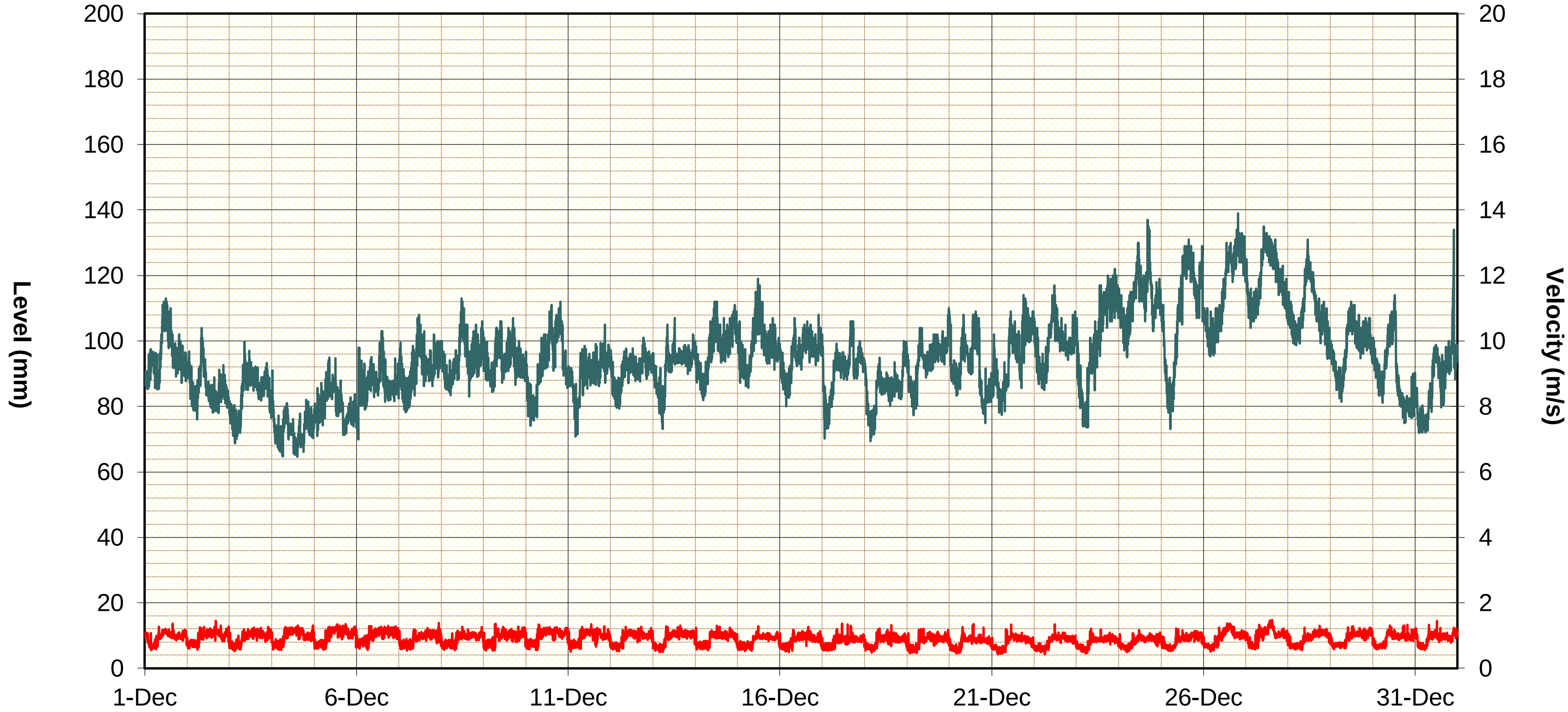
Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Nov-13	0.00	0.00	0.00	0.00	0.0
02-Nov-13	0.00	0.00	0.00	0.00	0.0
03-Nov-13	0.00	0.00	0.00	0.00	0.0
04-Nov-13	0.00	0.00	0.00	0.00	0.0
05-Nov-13	0.00	0.00	0.00	0.00	0.0
06-Nov-13	0.00	0.00	0.00	0.00	0.0
07-Nov-13	0.00	0.00	0.00	0.00	0.0
08-Nov-13	0.00	0.00	0.00	0.00	0.0
09-Nov-13	0.00	0.00	0.00	0.00	0.0
10-Nov-13	0.00	0.00	0.00	0.00	0.0
11-Nov-13	0.00	0.00	0.00	0.00	0.0
12-Nov-13	0.00	0.00	0.00	0.00	0.0
13-Nov-13	0.00	0.00	0.00	0.00	0.0
14-Nov-13	0.00	0.00	0.00	0.00	0.0
15-Nov-13	0.00	0.00	0.00	0.00	0.0
16-Nov-13	0.00	0.00	0.00	0.00	0.0
17-Nov-13	0.00	0.00	0.00	0.00	0.0
18-Nov-13	0.00	0.00	0.00	0.00	0.0
19-Nov-13	0.00	0.00	0.00	0.00	0.0
20-Nov-13	0.00	0.00	0.00	0.00	0.0
21-Nov-13	7.25	0.00	20.18	626.46	0.0
22-Nov-13	13.54	4.48	24.67	1170.10	0.0
23-Nov-13	13.77	3.95	25.28	1189.71	0.0
24-Nov-13	14.40	5.40	23.72	1244.10	0.0
25-Nov-13	14.50	5.15	22.60	1252.61	0.0
26-Nov-13	14.04	4.98	22.55	1212.63	0.0
27-Nov-13	15.10	5.93	25.69	1304.88	0.0
28-Nov-13	17.82	5.82	33.38	1539.58	0.0
29-Nov-13	22.04	7.02	44.01	1903.91	0.0
30-Nov-13	21.21	8.14	34.24	1832.24	0.0

Statistics

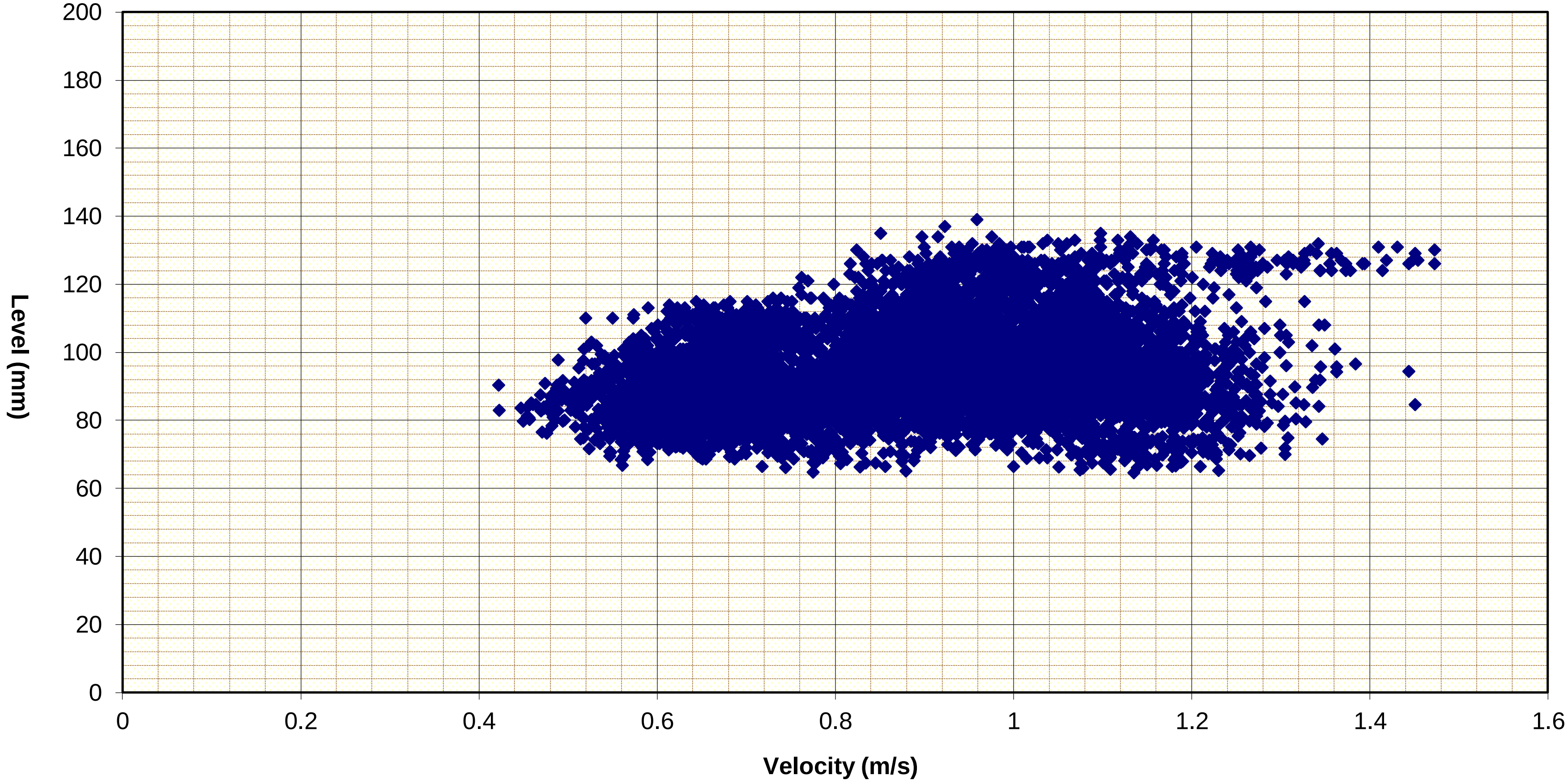
Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
13276.220	3.954	44.008	0.0


City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
December 1 to 30 2013
Flow
Rain
Flow (l/s)
Rain (mm)
100
90
80
70
60
50
40
30
20
10
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
1-Dec
6-Dec
11-Dec
16-Dec
21-Dec
26-Dec
31-Dec

City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
December 1 to 30 2013



City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
December 1 to 30 2013



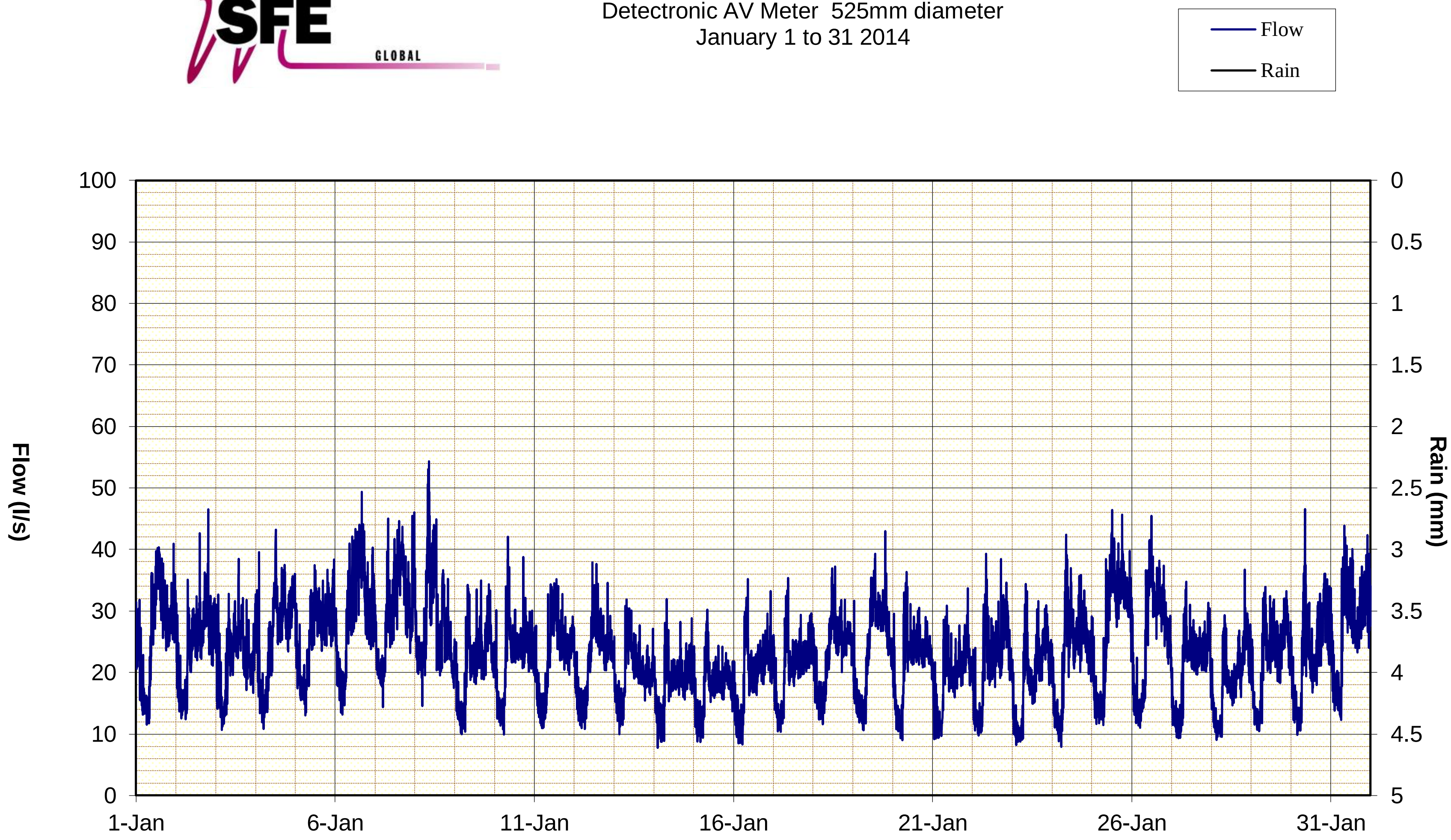
City of Prince George, BC
Site #414E - Site 1 MH #HR55E
Detectronic AV - 525mm Dia
4952 John Hart Highway
December 1 to 31 2013

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Dec-13	25.66	15.02	40.69	2217.36	0.0
02-Dec-13	22.10	12.96	35.74	1909.13	0.0
03-Dec-13	21.35	9.29	31.01	1844.99	0.0
04-Dec-13	17.69	8.97	25.40	1528.48	0.0
05-Dec-13	21.07	11.65	32.28	1820.30	0.0
06-Dec-13	23.75	12.33	35.35	2051.64	0.0
07-Dec-13	23.35	11.70	37.79	2017.19	0.0
08-Dec-13	24.16	13.92	39.55	2087.08	0.0
09-Dec-13	25.08	13.17	39.68	2167.31	0.0
10-Dec-13	26.17	11.62	40.84	2261.39	0.0
11-Dec-13	23.68	11.28	36.06	2045.89	0.0
12-Dec-13	23.68	10.89	33.19	2046.16	0.0
13-Dec-13	24.06	10.58	36.22	2078.74	0.0
14-Dec-13	25.36	13.24	40.07	2191.04	0.0
15-Dec-13	24.34	12.98	45.03	2102.89	0.0
16-Dec-13	23.62	11.38	36.36	2040.87	0.0
17-Dec-13	21.14	10.30	37.80	1826.66	0.0
18-Dec-13	19.36	9.24	32.34	1672.37	0.0
19-Dec-13	22.59	10.41	37.02	1952.08	0.0
20-Dec-13	20.94	9.93	43.29	1809.38	0.0
21-Dec-13	21.85	9.29	39.47	1887.75	0.0
22-Dec-13	23.22	10.49	43.09	2006.35	0.0
23-Dec-13	23.65	9.21	37.62	2043.38	0.0
24-Dec-13	28.62	13.59	43.55	2472.52	0.0
25-Dec-13	28.17	9.80	43.67	2434.23	0.0
26-Dec-13	34.01	13.75	56.29	2938.31	0.0
27-Dec-13	37.54	19.15	61.50	3243.37	0.0
28-Dec-13	29.60	16.97	44.67	2557.35	0.0
29-Dec-13	26.42	13.48	40.59	2282.60	0.0
30-Dec-13	22.54	14.28	40.25	1947.18	0.0
31-Dec-13	22.26	10.75	49.28	1923.52	0.0

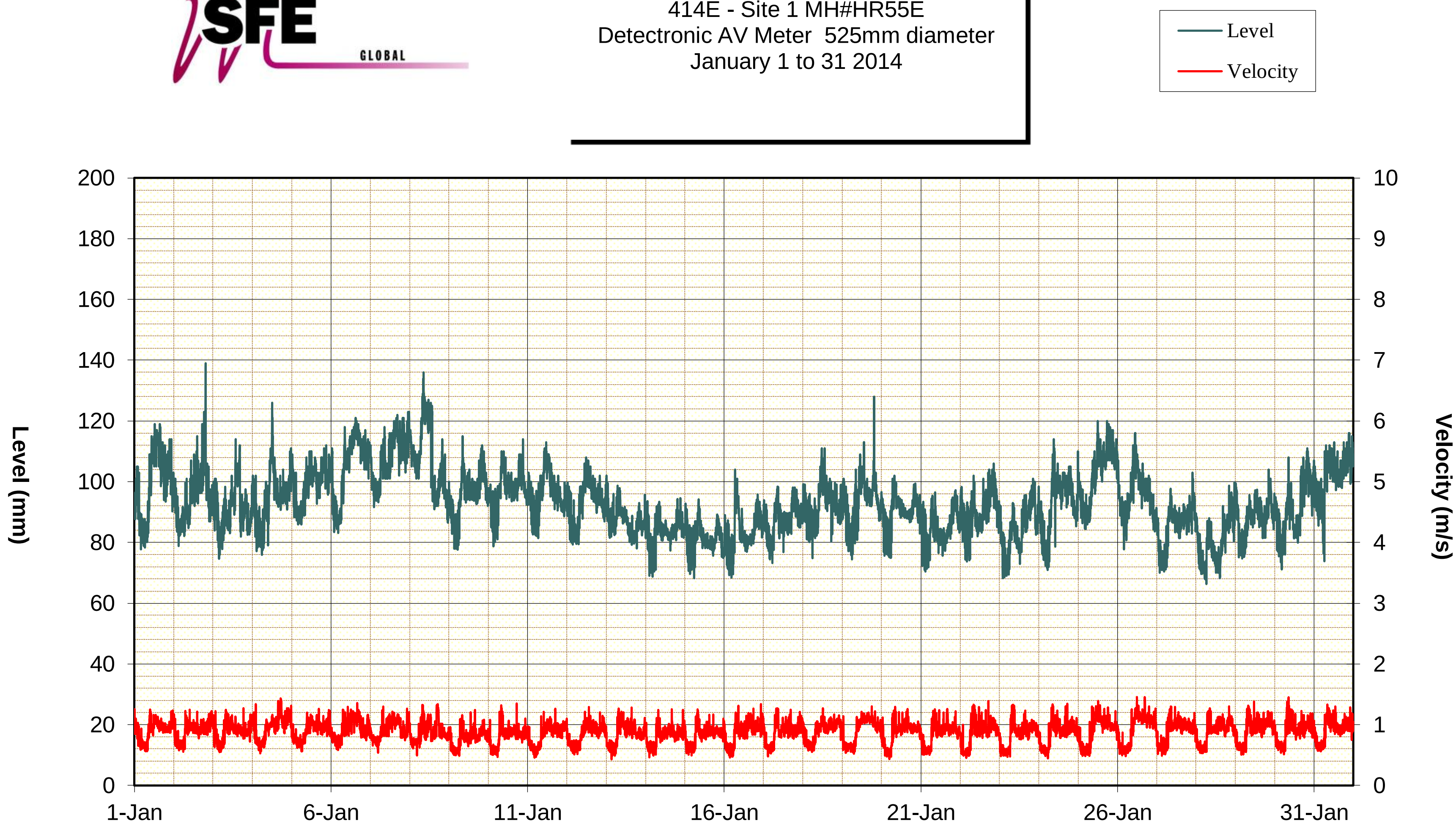
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
65407.520	8.972	61.503	0.0

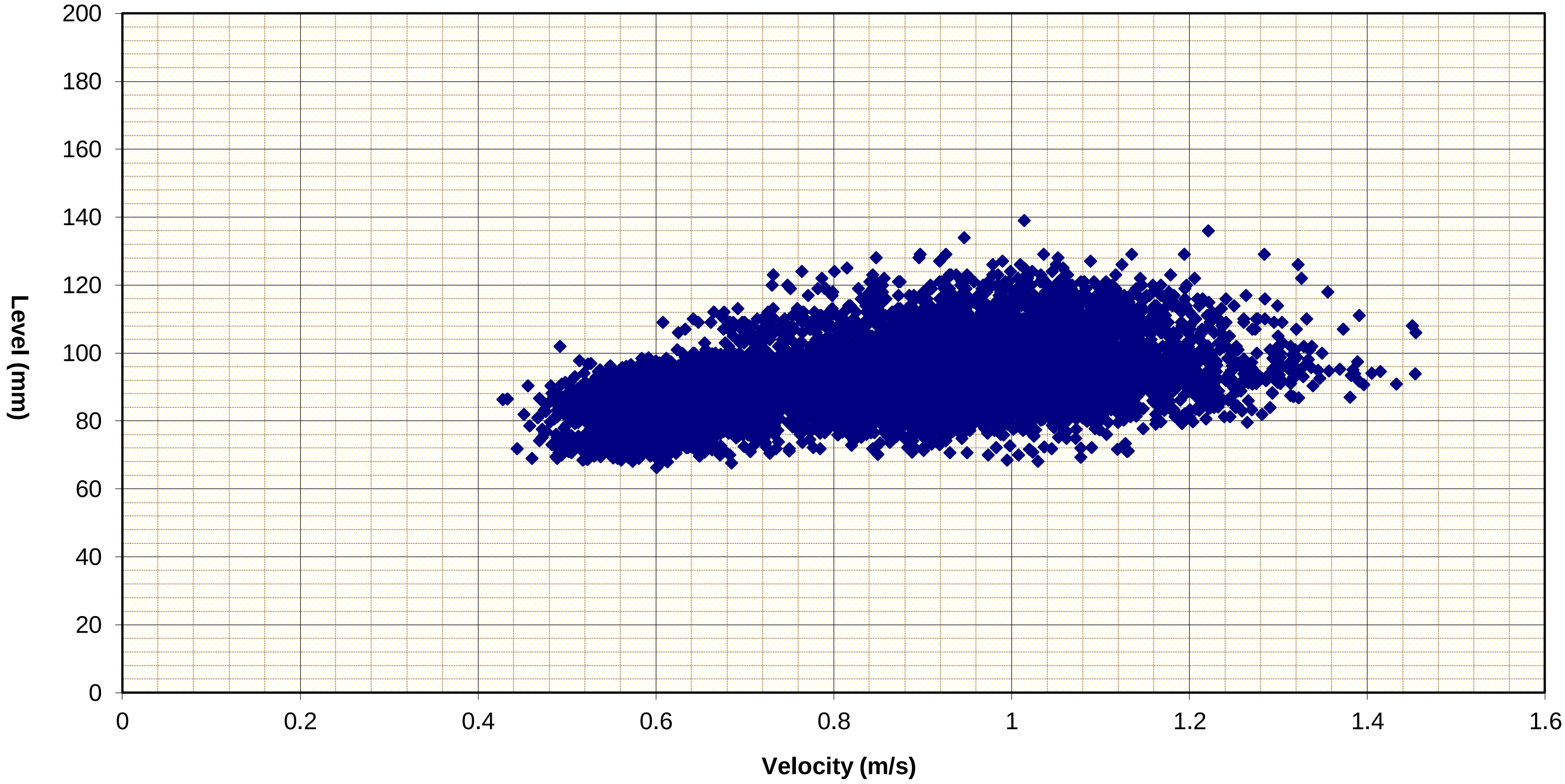
City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
January 1 to 31 2014



City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
January 1 to 31 2014



City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
January 1 to 31 2014



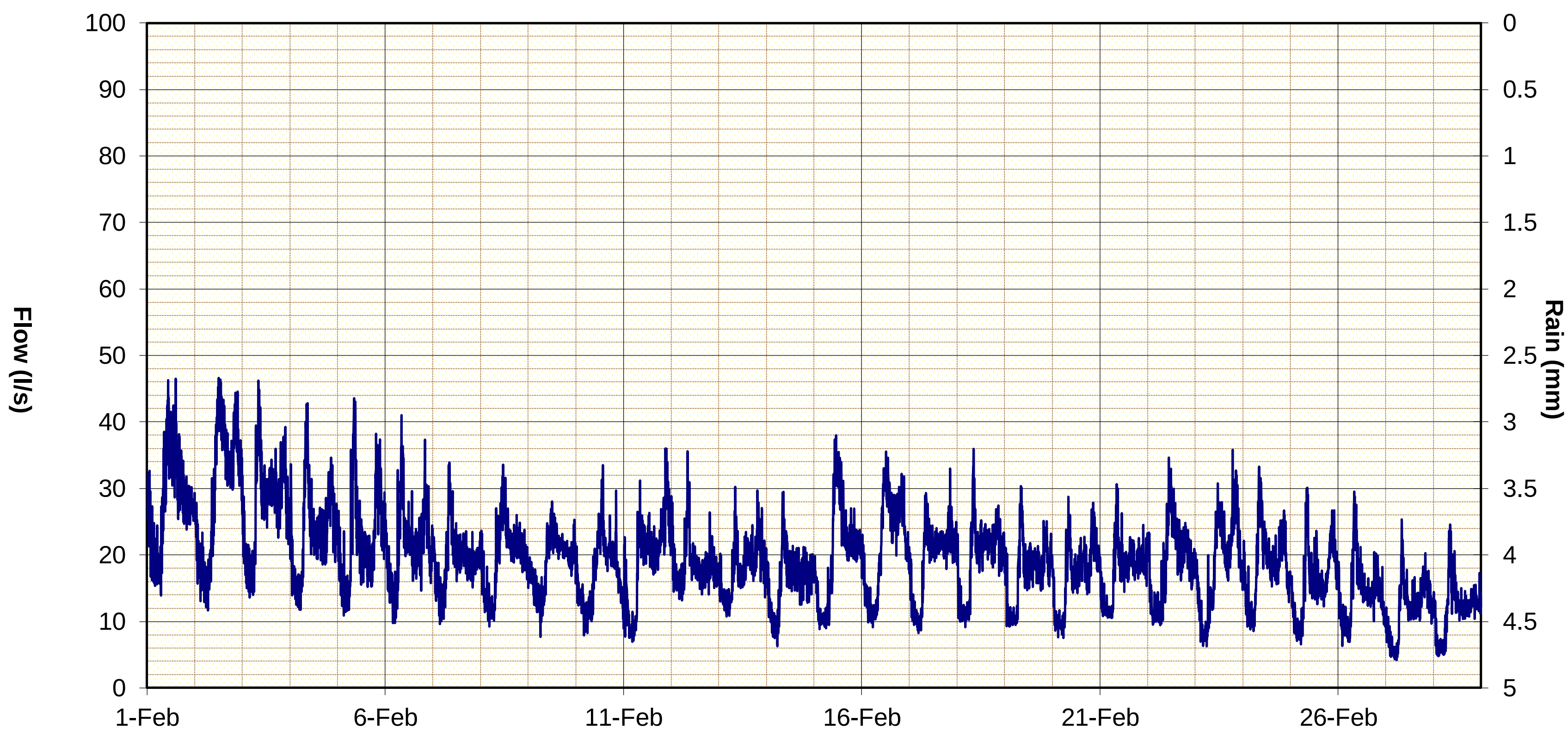
City of Prince George, BC
Site #414E - Site 1 MH #HR55E
Detectronic AV - 525mm Dia
4952 John Hart Highway
January 1 to 31 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Jan-14	26.68	11.51	40.93	2305.56	0.0
02-Jan-14	24.90	12.38	46.52	2151.71	0.0
03-Jan-14	22.45	10.65	38.47	1939.90	0.0
04-Jan-14	26.14	10.82	43.21	2258.61	0.0
05-Jan-14	25.99	13.02	38.37	2245.61	0.0
06-Jan-14	29.66	13.15	49.36	2562.54	0.0
07-Jan-14	30.29	14.36	46.03	2617.40	0.0
08-Jan-14	28.35	14.55	54.33	2449.12	0.0
09-Jan-14	21.61	9.96	34.96	1867.13	0.0
10-Jan-14	22.82	9.91	42.06	1972.02	0.0
11-Jan-14	23.06	10.95	35.17	1992.37	0.0
12-Jan-14	22.28	10.81	37.90	1924.88	0.0
13-Jan-14	20.04	9.95	31.87	1731.04	0.0
14-Jan-14	18.31	7.75	31.94	1581.86	0.0
15-Jan-14	17.81	8.69	30.22	1539.10	0.0
16-Jan-14	19.62	8.29	35.19	1695.29	0.0
17-Jan-14	20.90	10.35	35.36	1806.07	0.0
18-Jan-14	23.21	11.58	37.22	2005.49	0.0
19-Jan-14	23.98	10.60	42.97	2071.67	0.0
20-Jan-14	21.62	8.99	36.34	1867.69	0.0
21-Jan-14	19.45	9.15	33.69	1680.70	0.0
22-Jan-14	21.68	9.74	39.30	1873.03	0.0
23-Jan-14	19.19	8.20	34.39	1658.45	0.0
24-Jan-14	22.76	7.91	42.40	1966.30	0.0
25-Jan-14	27.48	11.45	46.42	2373.92	0.0
26-Jan-14	25.66	11.01	45.46	2217.32	0.0
27-Jan-14	21.10	9.31	34.76	1823.21	0.0
28-Jan-14	18.93	9.04	36.72	1635.98	0.0
29-Jan-14	22.16	10.45	33.92	1914.36	0.0
30-Jan-14	22.95	9.85	46.56	1983.31	0.0
31-Jan-14	27.74	12.28	43.88	2396.57	0.0

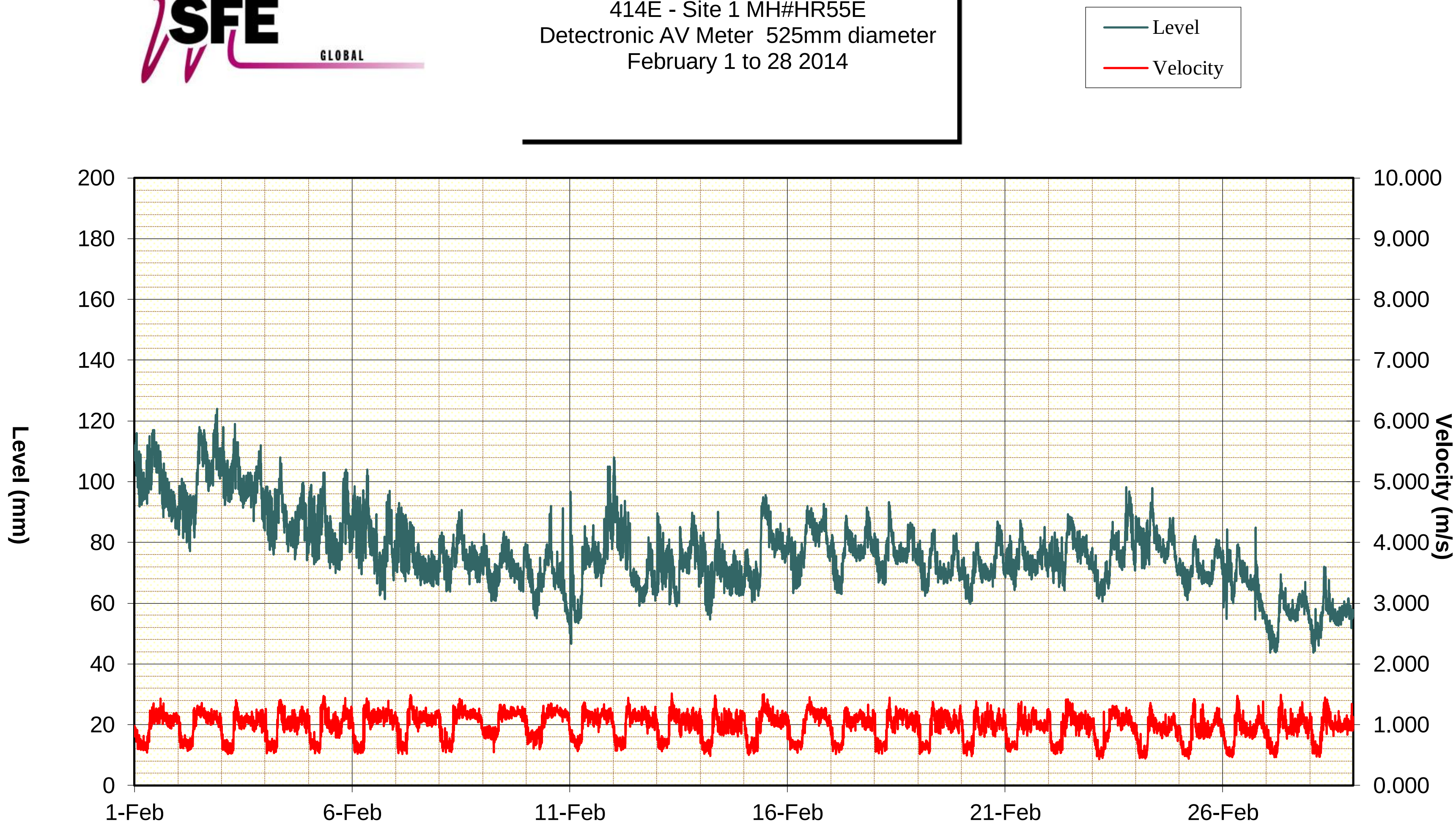
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
62108.209	7.746	54.327	0.0

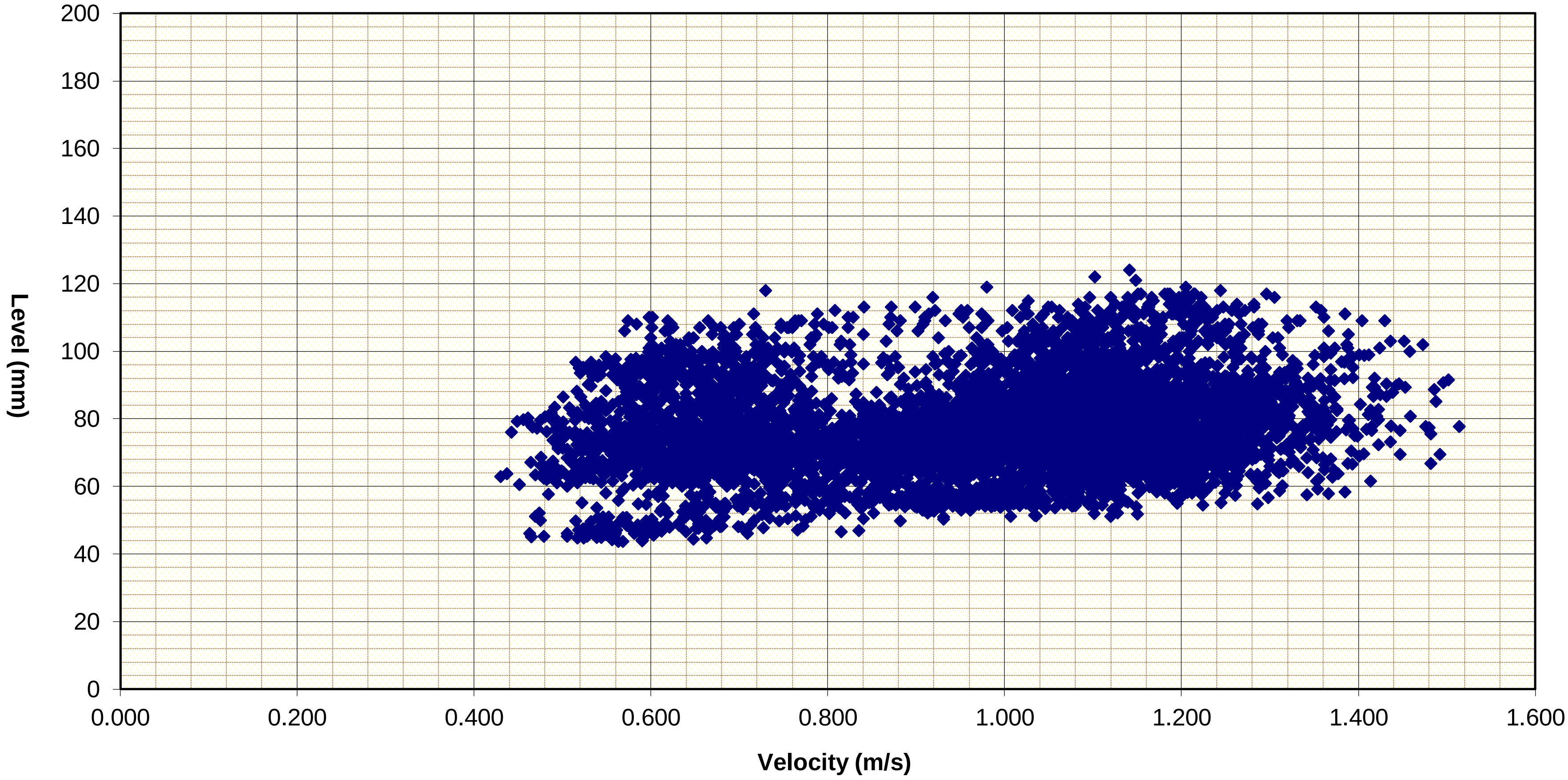
City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
February 1 to 28 2014



City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
February 1 to 28 2014



City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
February 1 to 28 2014



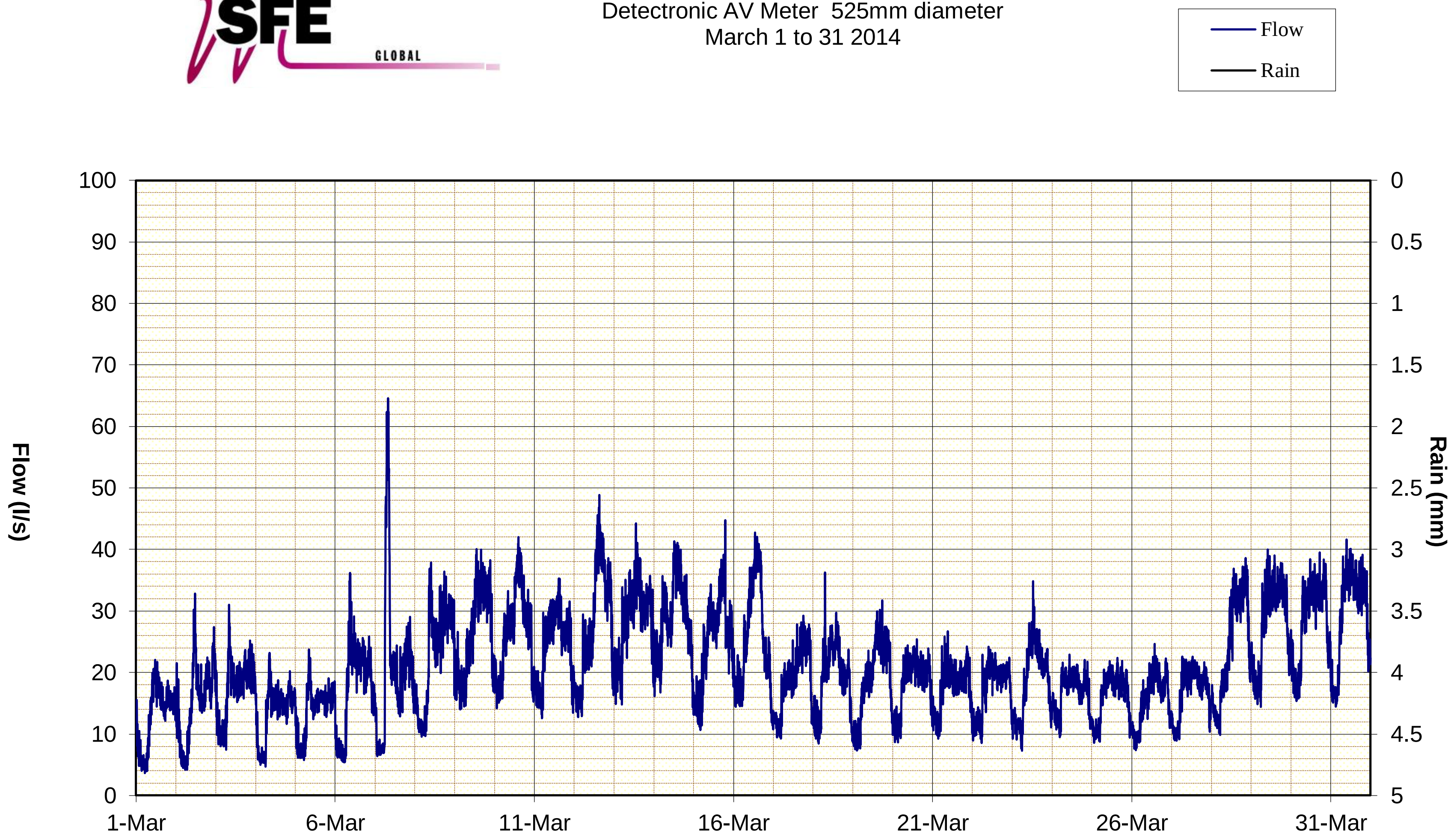
City of Prince George, BC
Site #414E - Site 1 MH #HR55E
Detectronic AV - 525mm Dia
4952 John Hart Highway
February 1 to 28 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Feb-14	28.44	13.89	46.49	2457.47	0.0
02-Feb-14	29.54	11.65	46.61	2552.60	0.0
03-Feb-14	27.58	13.59	46.22	2382.58	0.0
04-Feb-14	23.56	11.75	42.81	2035.48	0.0
05-Feb-14	22.70	10.88	43.55	1961.14	0.0
06-Feb-14	21.57	9.75	41.01	1863.52	0.0
07-Feb-14	19.41	9.60	33.90	1676.75	0.0
08-Feb-14	19.77	9.23	33.57	1707.73	0.0
09-Feb-14	19.00	7.67	28.04	1641.17	0.0
10-Feb-14	17.53	7.90	33.50	1514.60	0.0
11-Feb-14	19.51	6.94	36.00	1685.77	0.0
12-Feb-14	18.67	13.17	35.58	1613.12	0.0
13-Feb-14	18.20	10.74	30.23	1572.74	0.0
14-Feb-14	16.13	6.26	29.48	1393.82	0.0
15-Feb-14	20.27	8.83	37.99	1751.08	0.0
16-Feb-14	21.31	9.12	35.54	1840.75	0.0
17-Feb-14	19.44	8.25	32.98	1679.60	0.0
18-Feb-14	19.69	9.13	35.94	1700.86	0.0
19-Feb-14	17.71	9.24	30.35	1530.25	0.0
20-Feb-14	17.14	7.51	28.75	1480.49	0.0
21-Feb-14	17.51	10.52	30.63	1513.14	0.0
22-Feb-14	18.90	9.43	34.63	1633.08	0.0
23-Feb-14	18.71	6.26	35.81	1616.48	0.0
24-Feb-14	18.52	8.55	33.27	1600.41	0.0
25-Feb-14	15.99	6.55	30.09	1381.33	0.0
26-Feb-14	14.38	6.31	29.53	1242.79	0.0
27-Feb-14	11.81	4.19	25.34	1020.42	0.0
28-Feb-14	11.95	4.77	24.57	1032.78	0.0

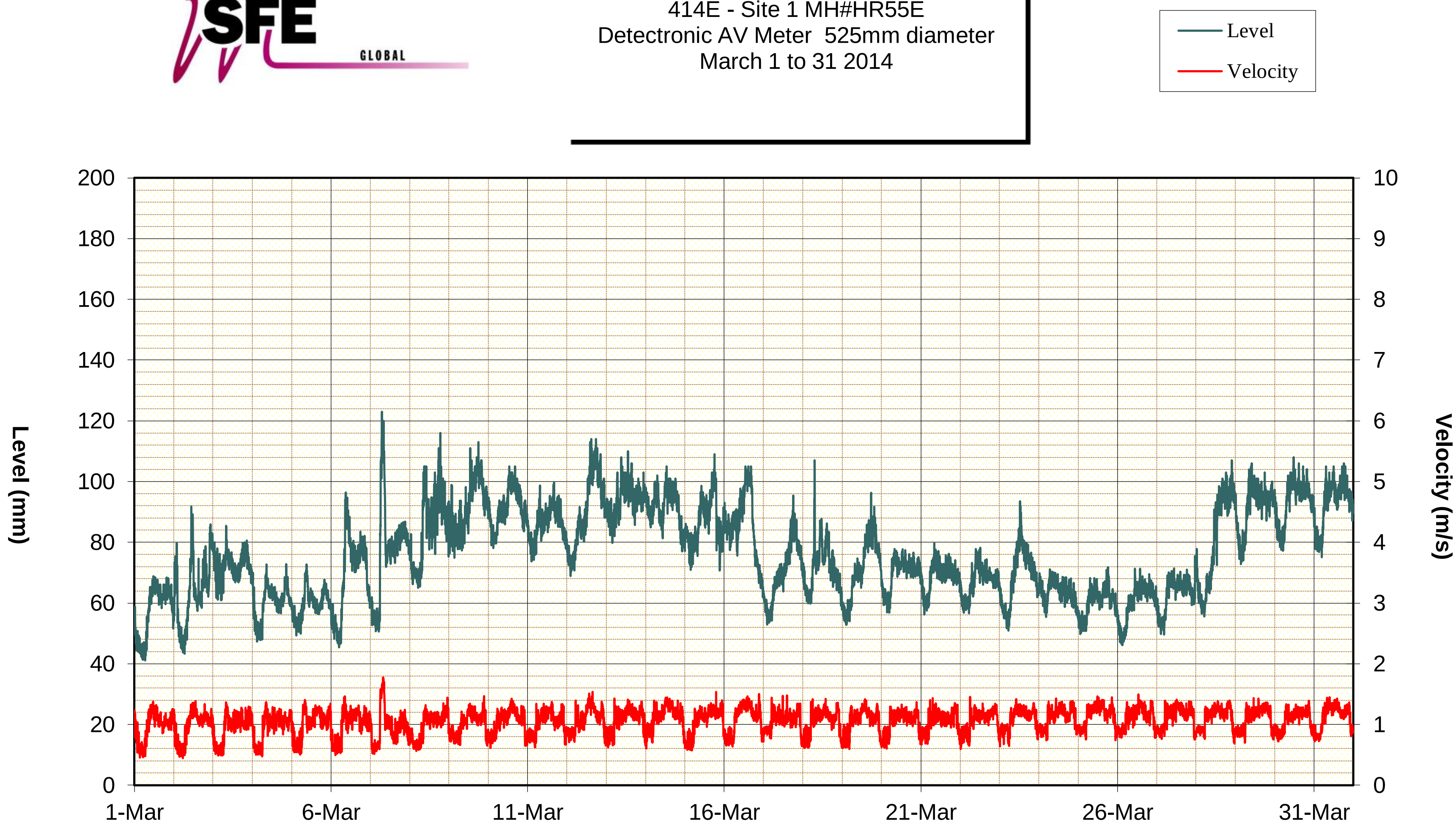
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
47081.912	4.190	46.611	0.0

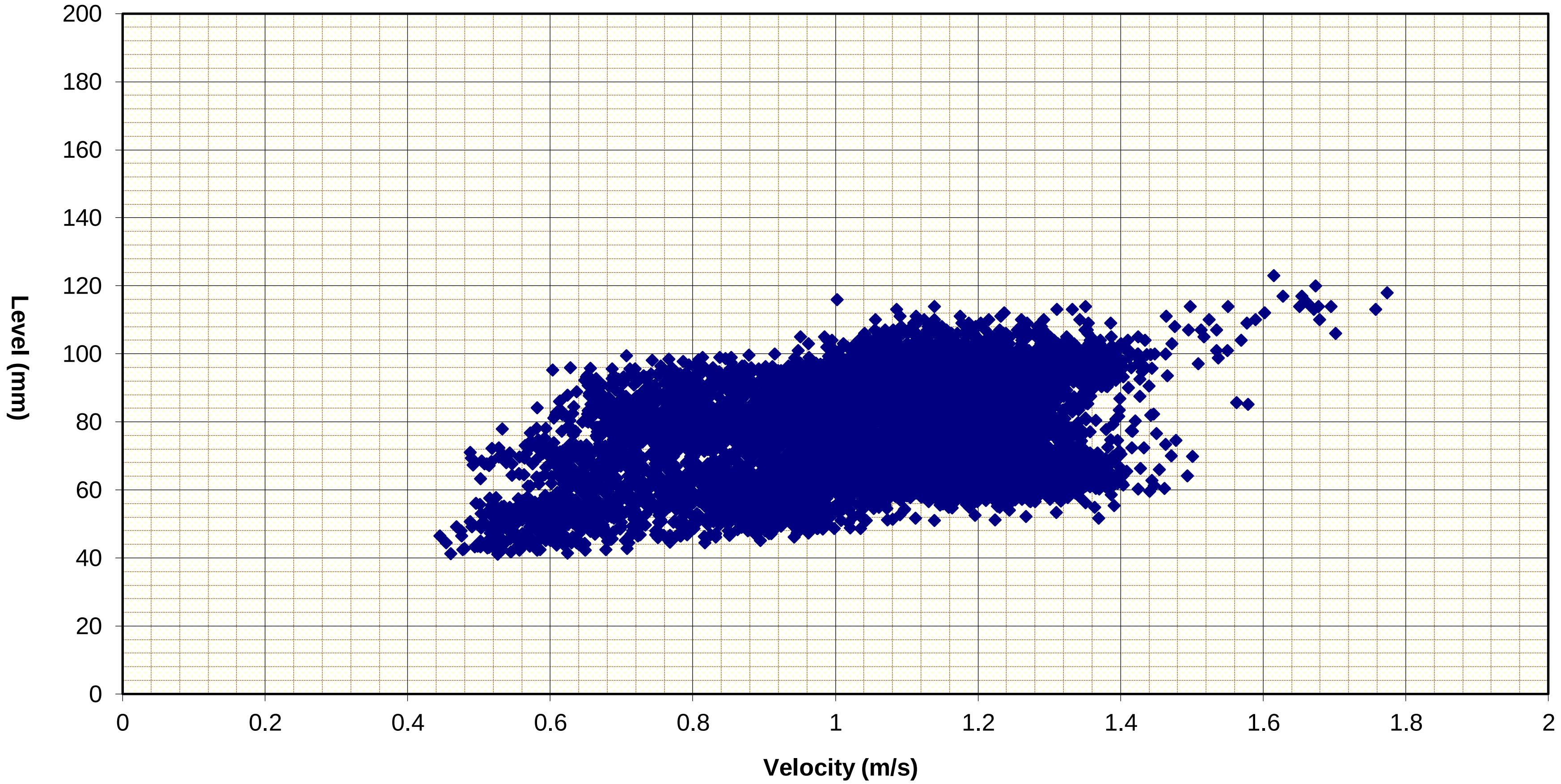
City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
March 1 to 31 2014



City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
March 1 to 31 2014



City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
March 1 to 31 2014



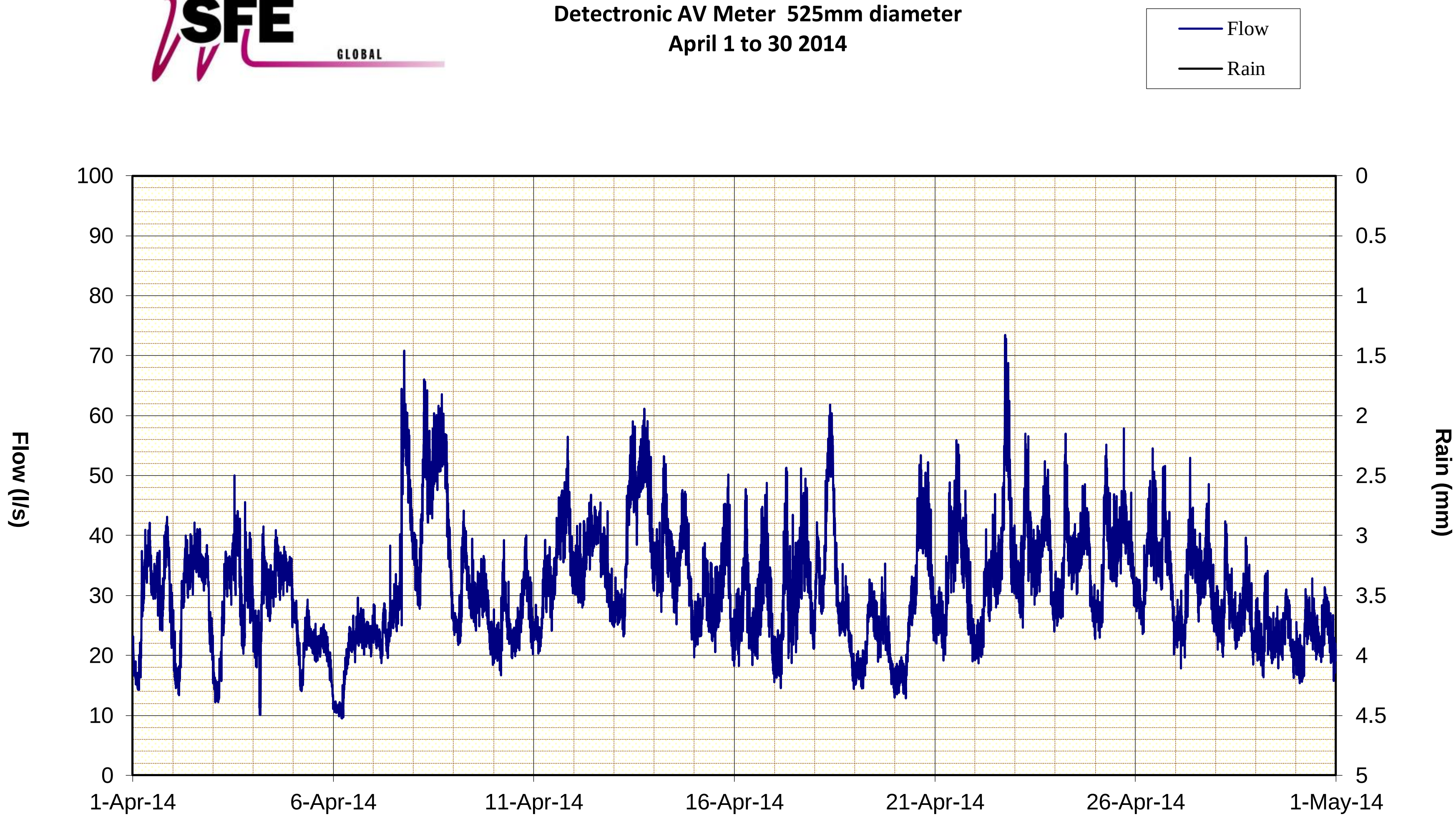
City of Prince George, BC
Site #414E - Site 1 MH #HR55E
Detectronic AV - 525mm Dia
4952 John Hart Highway
March 1 to 31 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Mar-14	12.92	3.64	22.05	1116.51	0.0
02-Mar-14	15.17	4.18	32.83	1310.28	0.0
03-Mar-14	17.26	7.44	31.00	1491.15	0.0
04-Mar-14	13.48	4.69	23.18	1164.24	0.0
05-Mar-14	13.86	5.76	23.73	1197.14	0.0
06-Mar-14	17.51	5.41	36.18	1512.50	0.0
07-Mar-14	20.76	6.40	64.58	1793.66	0.0
08-Mar-14	23.12	9.56	37.88	1997.92	0.0
09-Mar-14	26.29	13.99	40.06	2271.88	0.0
10-Mar-14	26.80	14.18	42.01	2315.26	0.0
11-Mar-14	24.49	12.56	35.28	2116.28	0.0
12-Mar-14	27.69	12.74	48.85	2392.18	0.0
13-Mar-14	28.90	14.79	44.24	2496.69	0.0
14-Mar-14	28.91	14.13	41.33	2498.02	0.0
15-Mar-14	24.93	10.65	44.75	2154.10	0.0
16-Mar-14	25.66	10.76	42.75	2216.66	0.0
17-Mar-14	18.84	9.25	29.23	1627.73	0.0
18-Mar-14	19.09	8.44	36.26	1649.29	0.0
19-Mar-14	19.08	7.31	31.72	1648.77	0.0
20-Mar-14	18.08	8.63	25.40	1561.94	0.0
21-Mar-14	17.71	9.24	26.70	1530.05	0.0
22-Mar-14	17.42	8.54	24.19	1505.20	0.0
23-Mar-14	18.71	7.28	34.84	1616.77	0.0
24-Mar-14	16.80	9.48	22.90	1451.60	0.0
25-Mar-14	16.03	8.56	22.37	1385.02	0.0
26-Mar-14	15.66	7.37	24.64	1353.09	0.0
27-Mar-14	16.90	8.91	22.58	1459.77	0.0
28-Mar-14	24.39	9.85	38.60	2106.96	0.0
29-Mar-14	28.19	14.40	39.99	2435.23	0.0
30-Mar-14	28.33	15.36	39.51	2448.10	0.0
31-Mar-14	29.56	14.44	41.62	2554.13	0.0

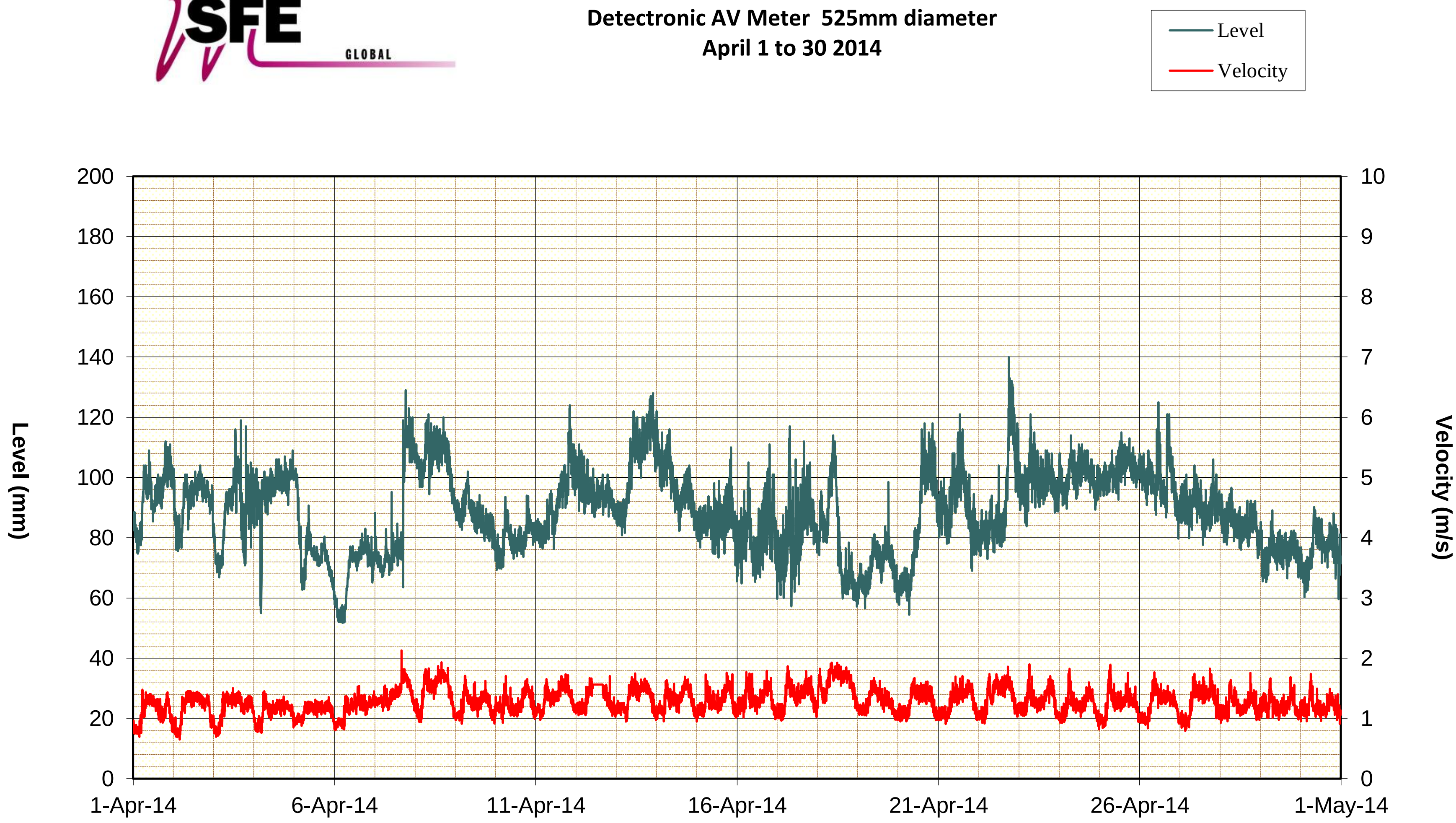
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
56378.132	3.641	64.579	0.0

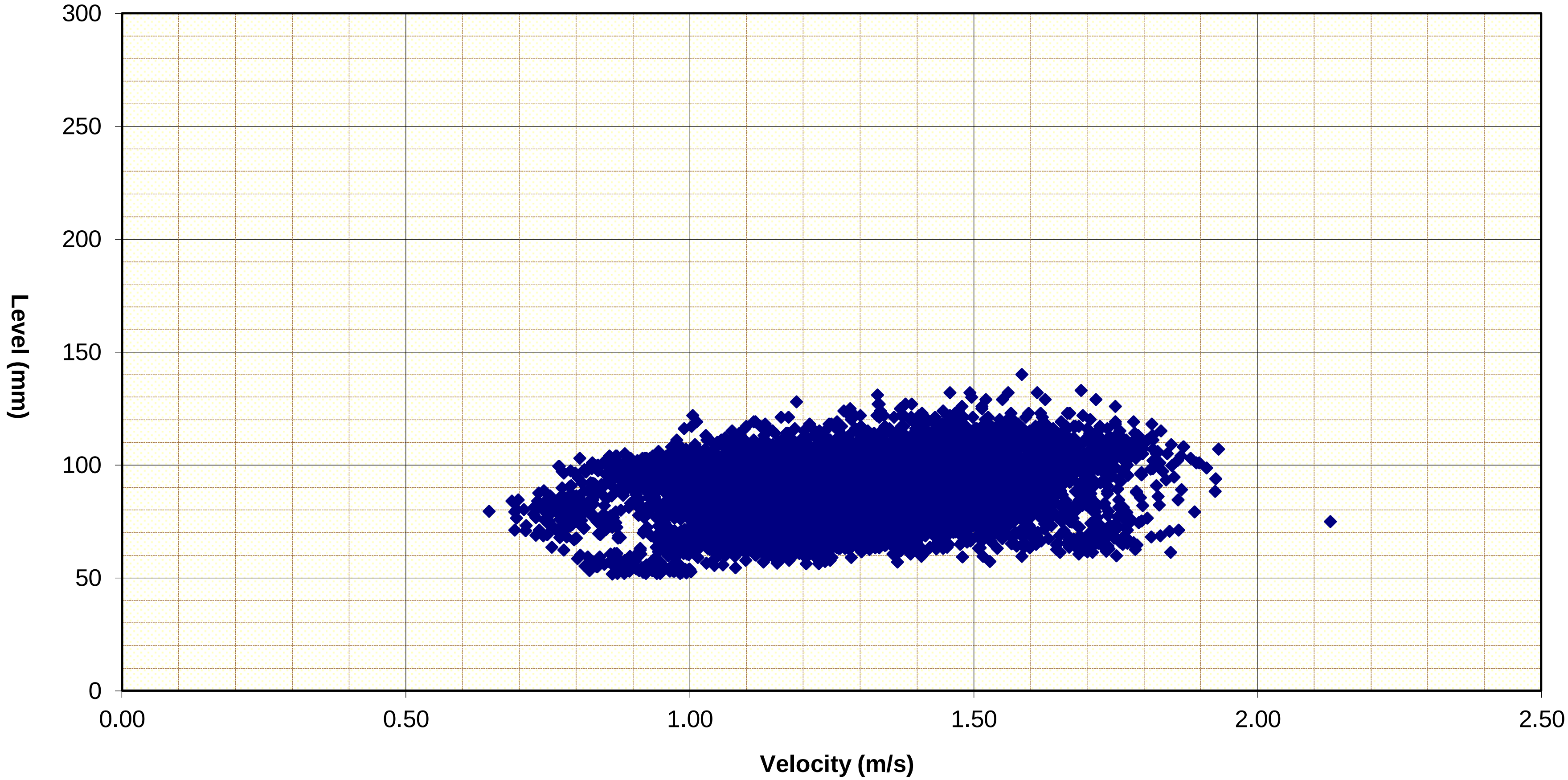
City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
April 1 to 30 2014



City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
April 1 to 30 2014



City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
April 1 to 30 2014



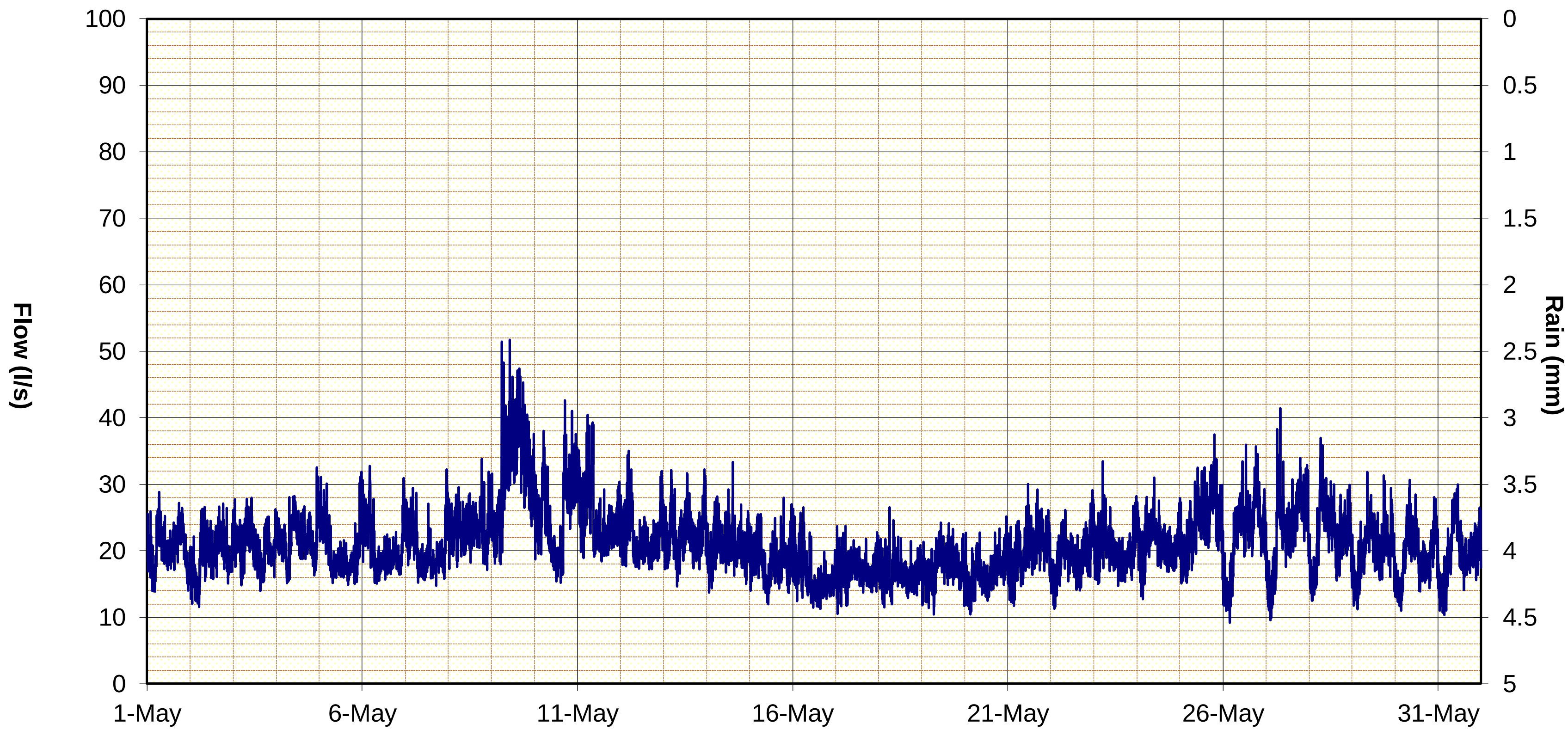
City of Prince George, BC
Site #414E - Site 1 MH #HR55E
Detectronic AV - 525mm Dia
4952 John Hart Highway
April 1 to 30 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Apr-14	29.78	14.23	43.12	2573.06	0.0
02-Apr-14	30.36	13.36	42.16	2622.88	0.0
03-Apr-14	28.89	12.17	50.03	2495.98	0.0
04-Apr-14	30.75	10.07	41.51	2656.76	0.0
05-Apr-14	21.71	13.08	29.37	1875.84	0.0
06-Apr-14	19.57	9.48	29.65	1690.78	0.0
07-Apr-14	33.09	18.71	70.83	2859.08	0.0
08-Apr-14	46.26	25.76	66.04	3996.46	0.0
09-Apr-14	29.03	18.41	44.15	2507.93	0.0
10-Apr-14	25.90	16.67	40.03	2237.48	0.0
11-Apr-14	34.51	20.30	56.48	2981.84	0.0
12-Apr-14	36.02	24.98	46.81	3112.29	0.0
13-Apr-14	41.86	23.15	61.15	3616.31	0.0
14-Apr-14	36.30	22.53	53.23	3136.44	0.0
15-Apr-14	29.77	18.25	50.17	2572.49	0.0
16-Apr-14	28.73	15.53	48.78	2482.31	0.0
17-Apr-14	29.97	14.53	51.31	2589.74	0.0
18-Apr-14	33.68	14.40	61.83	2909.75	0.0
19-Apr-14	22.25	12.96	35.32	1922.66	0.0
20-Apr-14	29.11	12.83	53.40	2515.20	0.0
21-Apr-14	33.09	18.99	55.91	2858.88	0.0
22-Apr-14	35.69	18.66	73.45	3083.43	0.0
23-Apr-14	36.89	23.97	56.99	3187.34	0.0
24-Apr-14	35.66	22.73	56.99	3081.06	0.0
25-Apr-14	37.09	22.95	57.88	3204.88	0.0
26-Apr-14	35.31	20.16	54.54	3050.70	0.0
27-Apr-14	31.87	17.82	52.96	2753.94	0.0
28-Apr-14	27.46	18.46	42.37	2372.93	0.0
29-Apr-14	23.27	16.22	34.11	2010.29	0.0
30-Apr-14	23.12	15.35	32.85	1997.76	0.0

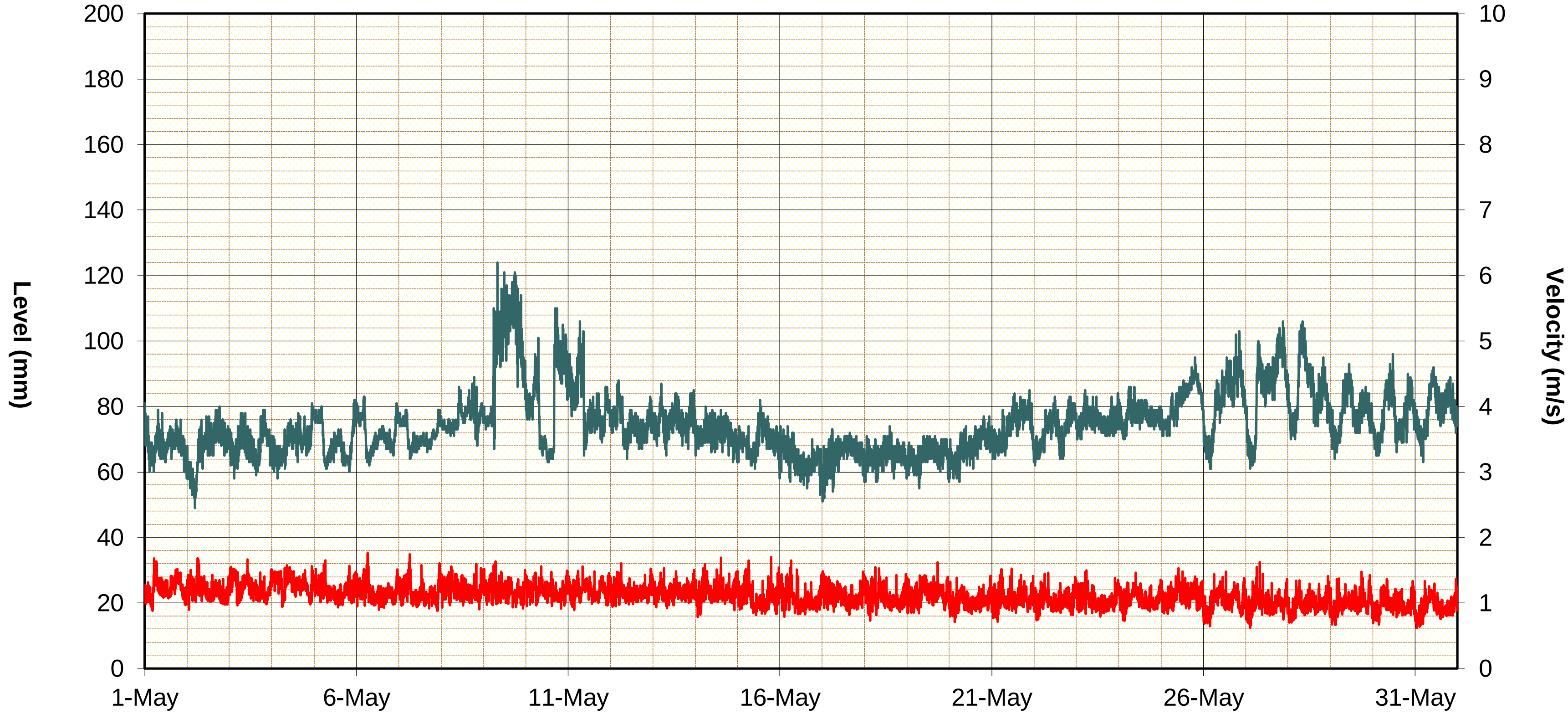
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
80956.454	9.480	73.453	0.0

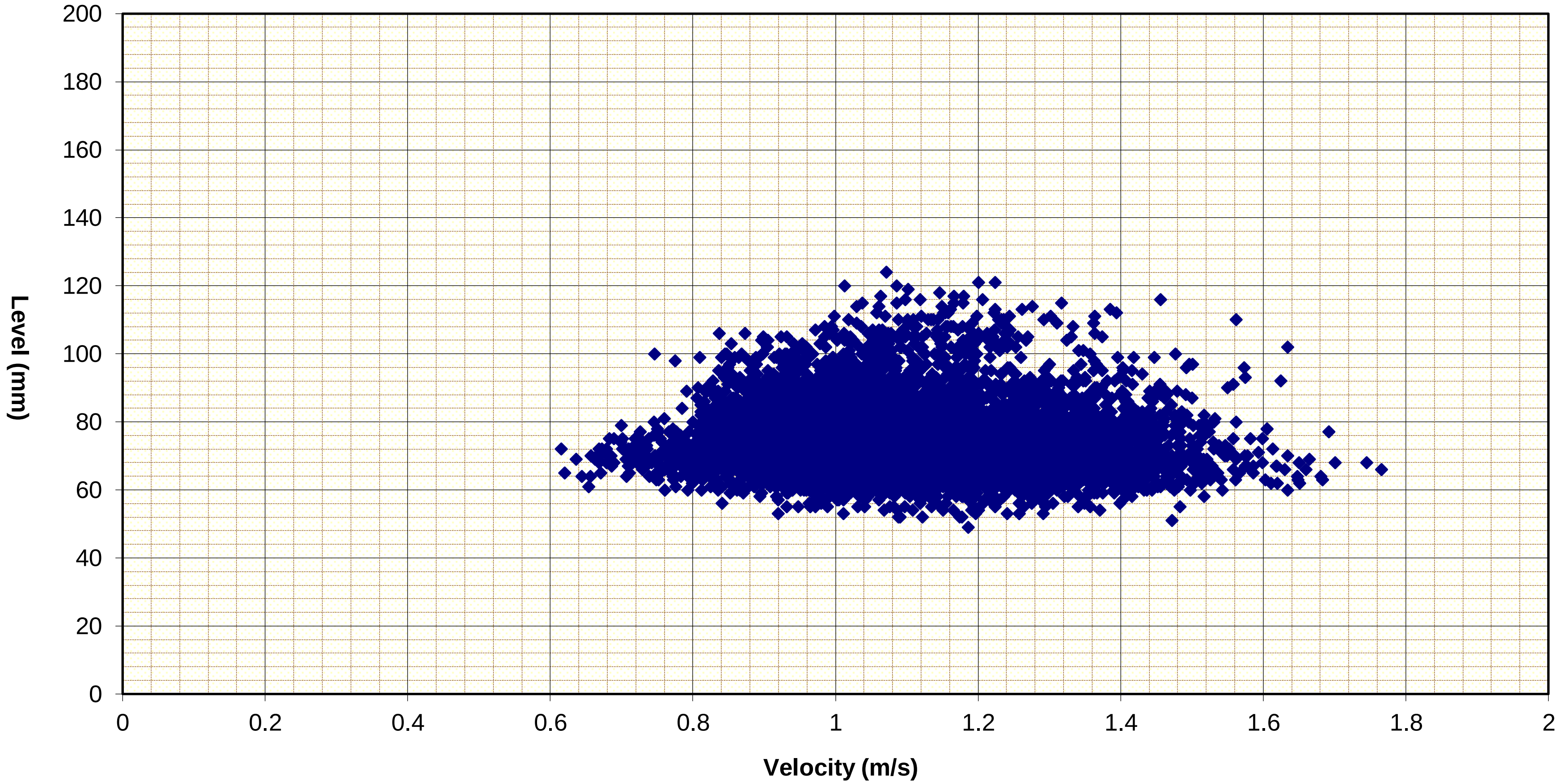
City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
May 1 to 31 2014



City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
May 1 to 31 2014



City of Prince George, BC
414E - Site 1 MH#HR55E
Detectronic AV Meter 525mm diameter
May 1 to 31 2014



City of Prince George, BC
Site #414E - Site 1 MH #HR55E
Detectronic AV - 525mm Dia
4952 John Hart Highway
May 1 to 31 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-May-14	20.46	13.86	28.84	1767.90	0.0
02-May-14	19.32	11.55	27.10	1669.10	0.0
03-May-14	20.65	13.96	27.98	1783.78	0.0
04-May-14	21.85	15.12	32.54	1888.09	0.0
05-May-14	20.21	14.86	31.87	1746.10	0.0
06-May-14	20.41	15.06	32.75	1763.85	0.0
07-May-14	20.25	14.75	32.23	1749.31	0.0
08-May-14	23.40	17.11	33.82	2022.11	0.0
09-May-14	32.43	17.97	51.73	2801.95	0.0
10-May-14	25.48	15.19	42.63	2201.14	0.0
11-May-14	25.19	18.40	40.44	2176.38	0.0
12-May-14	22.01	17.21	35.03	1901.73	0.0
13-May-14	22.57	14.63	32.24	1949.91	0.0
14-May-14	20.86	13.72	33.35	1802.41	0.0
15-May-14	18.64	11.96	27.98	1610.42	0.0
16-May-14	15.99	11.24	26.53	1381.22	0.0
17-May-14	17.13	10.51	23.73	1479.65	0.0
18-May-14	16.71	11.48	26.53	1443.52	0.0
19-May-14	17.55	10.42	24.23	1516.53	0.0
20-May-14	16.67	10.43	25.15	1440.14	0.0
21-May-14	19.76	11.71	30.04	1706.96	0.0
22-May-14	19.00	11.28	29.12	1641.97	0.0
23-May-14	20.14	14.72	33.45	1740.26	0.0
24-May-14	21.16	12.72	31.01	1827.88	0.0
25-May-14	24.01	15.08	37.49	2074.46	0.0
26-May-14	22.33	9.18	35.95	1929.58	0.0
27-May-14	22.95	9.55	41.43	1983.09	0.0
28-May-14	22.40	12.49	36.97	1935.05	0.0
29-May-14	20.08	11.19	31.86	1734.83	0.0
30-May-14	19.33	10.99	30.66	1670.01	0.0
31-May-14	19.30	10.33	29.98	1667.88	0.0

Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
56007.207	9.180	51.730	0.0

FIELD MAINTENANCE RECORD

NAME□	City of Prince George, BC
SFE SITE #□	□1□E □2 M□ □GL□1B
ADDRESS□	1702 Lyon Street
GPS□	5□.□0□□□ 122.7□□7□
SENSOR TYPE□	A□
PRIMARY DEVICE□	525mm A□

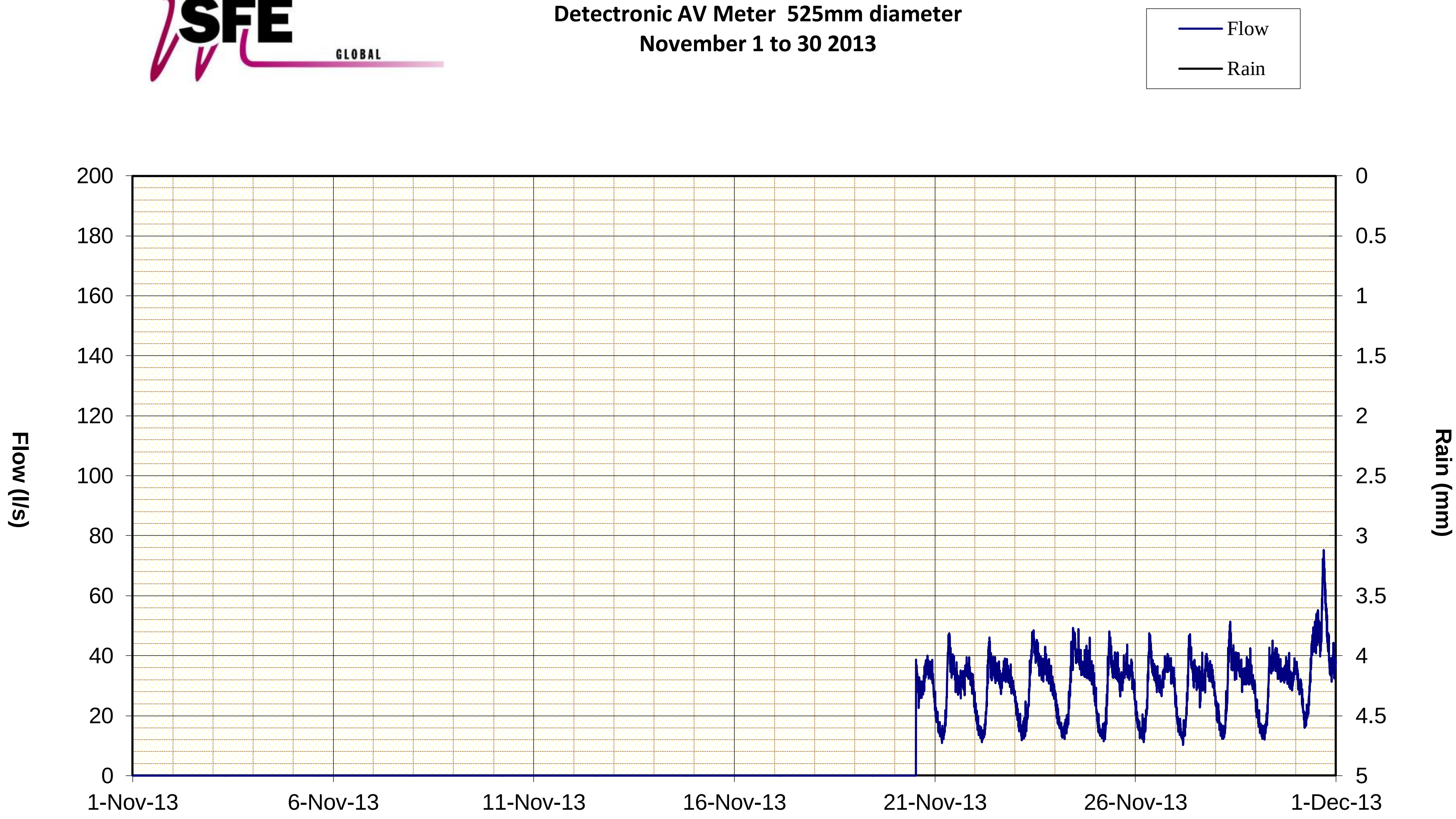
CONSTANTS			
D1 □cm□:		D1□lip to □bar	
TOM □cm□:	□5□.000	Raw □ eir L □□bar to water	
METER □	6□0□	DATE:	11□20□1□
METER □	207□010□1	DATE:	11□20□1□
METER □		DATE:	

LEGEND	
DL □DO□ NLOAD	**PC** □PROGRAM COMPLETE
CB □C□G BATTERY	**PM** □PROG. METER
V □□ERIFY	**VIS** □□IS□AL
LA □LE□EL AD□□ST	**VP** □□ELOCITY PROFILE
DO □DEPT□ ONLY	**CD** □C□G DESICCANT

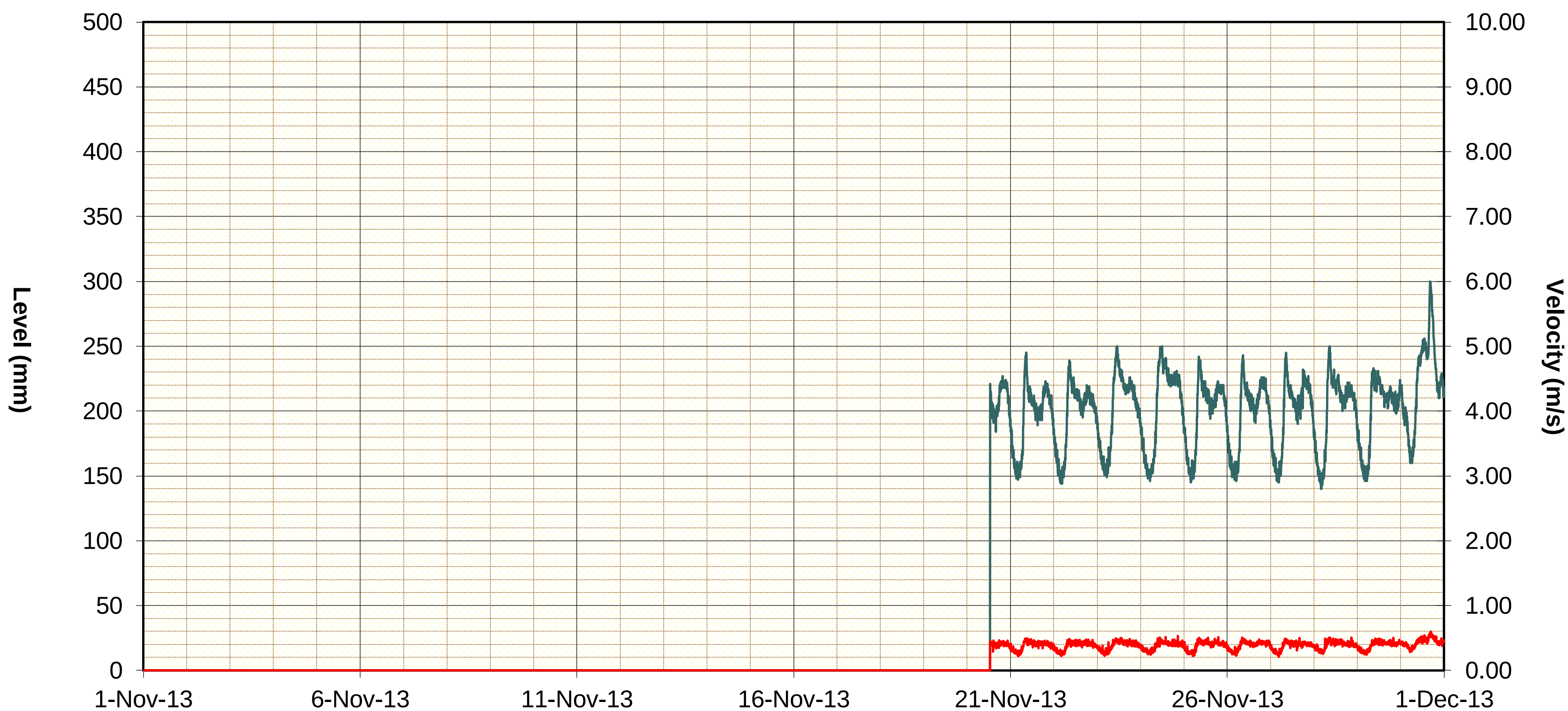
DATE M□D□YY	TIME □□:MM	METER TIME □□:MM	METER DEPT□ cm	FIELD DEPT□ cm	METER □EL M□S	FIELD □EL□□IS M□S	FLO□ LPS	BATT □	SILT cm	MTC BY □INIT.□	COMMENTS
11□21□1□	12:52	12:52	22.1	22	0.□5	0.□□	□	12.□	0	□□	installed meter 6□0□and b□u□asbuilt says □75mm but is 525mm dia
11□22□1□	□:5□	□:5□	22.6	22	0.□2	□	□	12.□	0	□□	downloaded□pus□ed data□all O□
12□10□1□	1□:07	1□:06	21.1	20.6	0.57	□	□	12.1	0	□□	DL O□
01□0□1□	1□:25	1□:25	21.7	21.5	0.55	□	□	11.□	0	□□	DL O□
01□21□1□	17:10	17:10	1□.□	20	□	□	□	12.□	0	□□	installed 6572
01□22□1□	□:05	□:05	22.7	22.5	0.6□	□	57	12.□	0	□□	DL sensor cleared
02□12□1□	11:5□	11:5□	□	□	□	□	□	□	□	□□	removed for flus□ing
02□1□1□	1□:5□	1□:5□	16.□	16.5	0.□7	□	22.1	12.□	0	□□	installed at new site 1215 Let□bridge Str □□50mm dia□
0□01□1□	1□:□5	1□:□5	17.1	25.5	0.□2	□	26		0	GC	remote data download
0□12□1□	1□:15	1□:15	21.6	21	0.5□	□	□□2	12.6	0	□□	DL sensor clear
0□0□1□	12:25	11:25	16.6	17	0.□5	□	26	11.□	0	□□	DL sensor clear
0□26□1□	11:□□	10:□□	17.□	17.5	0.□□	□	□0.2	12	0	□□	DL sensor clear
05□1□1□	11:□1	10:□0	16.2	16.5	0.□1	□	2□2	11.□	0	□□	DL sensor cleared of minor debris
06□0□1□	□:2□	□:25	15.□	15	0.□6	0.□	1□1	11.5	0	□□	Removed meter

DATE□	NOTES□

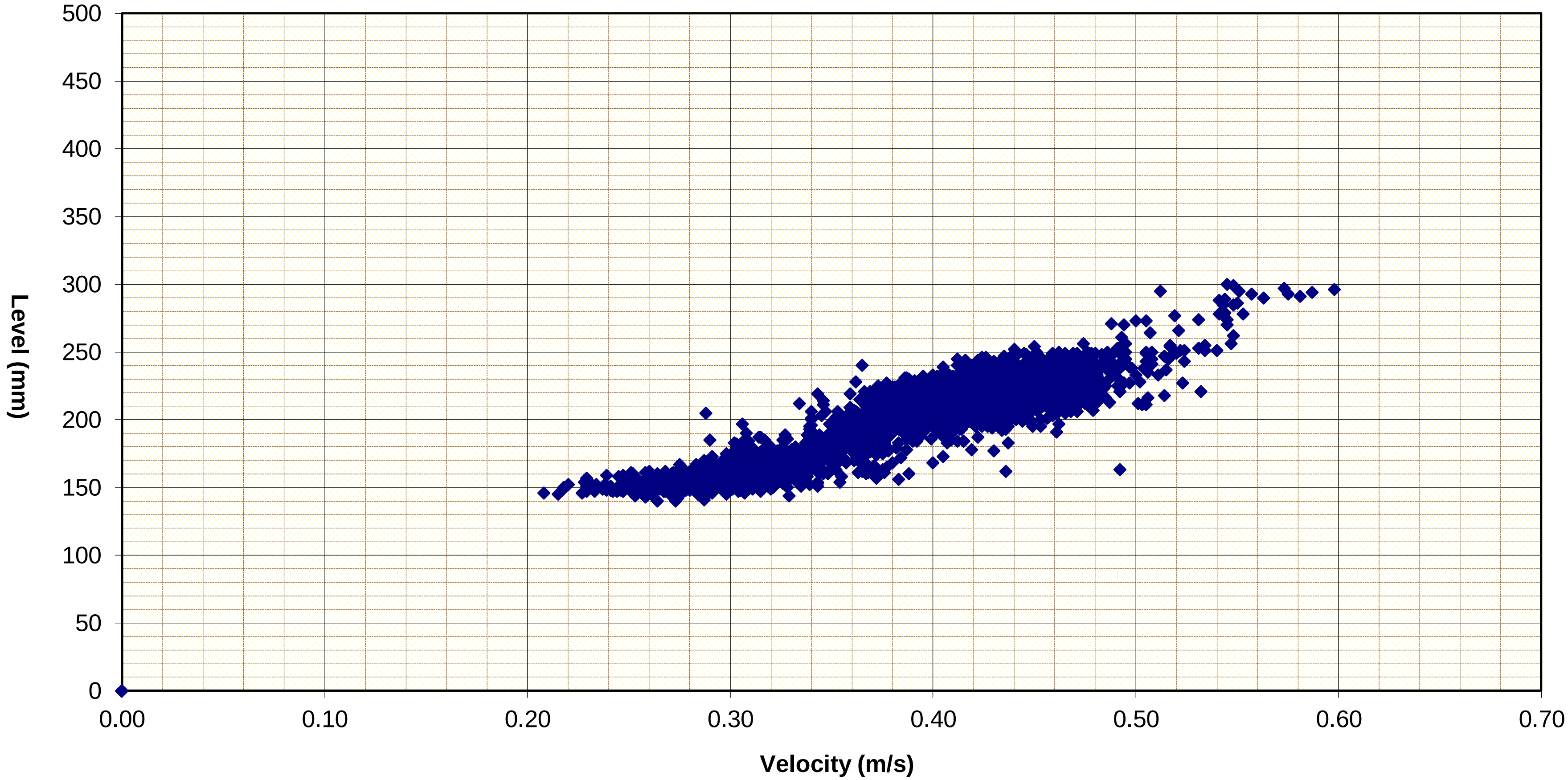
City of Prince George, BC
414E - Site 2 MH#GL81B
Detectronic AV Meter 525mm diameter
November 1 to 30 2013



City of Prince George, BC
414E - Site 2 MH#GL81B
Detectronic AV Meter 525mm diameter
November 1 to 30 2013



City of Prince George, BC
414E - Site 2 MH#GL81B
Detectronic AV Meter 525mm diameter
November 1 to 30 2013



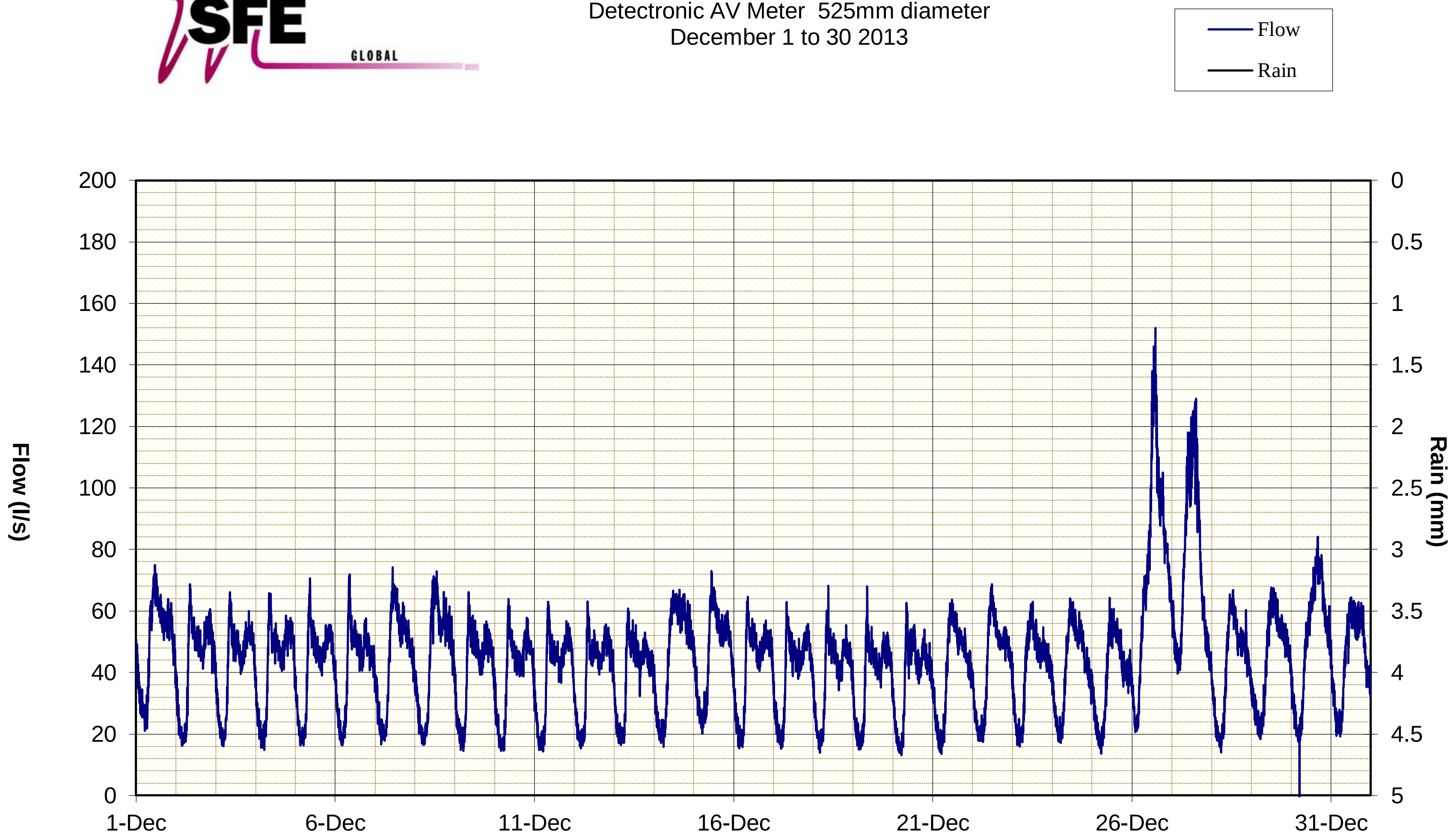
City of Prince George, BC
Site #414E - Site 2 MH #GL81B
Detectronic AV - 525mm Dia
1702 Lyon Street
November 1 to 30 2013

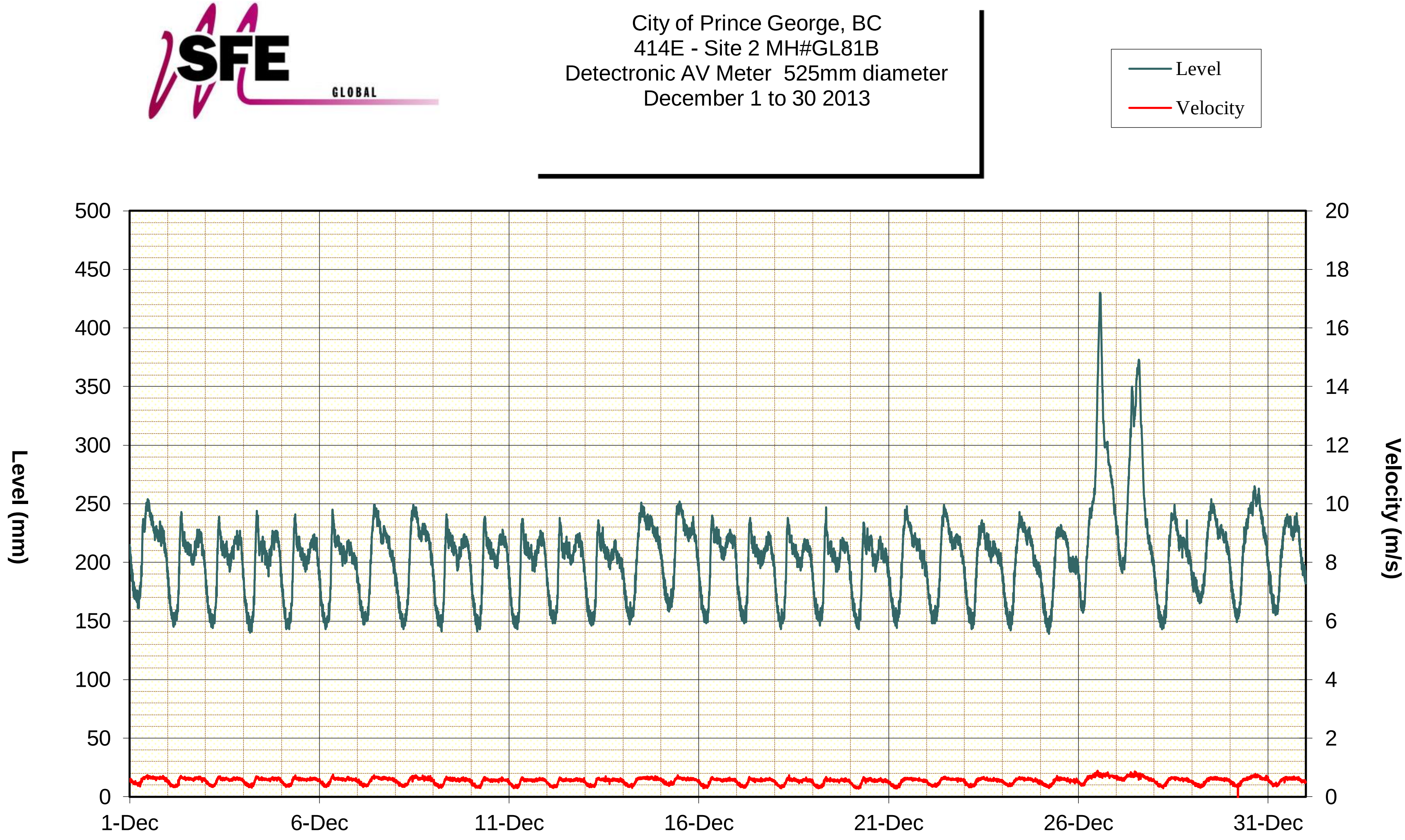
Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Nov-13	0.00	0.00	0.00	0.00	0.0
02-Nov-13	0.00	0.00	0.00	0.00	0.0
03-Nov-13	0.00	0.00	0.00	0.00	0.0
04-Nov-13	0.00	0.00	0.00	0.00	0.0
05-Nov-13	0.00	0.00	0.00	0.00	0.0
06-Nov-13	0.00	0.00	0.00	0.00	0.0
07-Nov-13	0.00	0.00	0.00	0.00	0.0
08-Nov-13	0.00	0.00	0.00	0.00	0.0
09-Nov-13	0.00	0.00	0.00	0.00	0.0
10-Nov-13	0.00	0.00	0.00	0.00	0.0
11-Nov-13	0.00	0.00	0.00	0.00	0.0
12-Nov-13	0.00	0.00	0.00	0.00	0.0
13-Nov-13	0.00	0.00	0.00	0.00	0.0
14-Nov-13	0.00	0.00	0.00	0.00	0.0
15-Nov-13	0.00	0.00	0.00	0.00	0.0
16-Nov-13	0.00	0.00	0.00	0.00	0.0
17-Nov-13	0.00	0.00	0.00	0.00	0.0
18-Nov-13	0.00	0.00	0.00	0.00	0.0
19-Nov-13	0.00	0.00	0.00	0.00	0.0
20-Nov-13	15.13	0.00	40.02	1307.31	0.0
21-Nov-13	28.84	10.87	47.45	2492.05	0.0
22-Nov-13	28.78	11.13	46.08	2486.75	0.0
23-Nov-13	30.19	11.80	48.45	2608.43	0.0
24-Nov-13	30.38	12.19	49.26	2625.03	0.0
25-Nov-13	29.52	11.44	48.08	2550.57	0.0
26-Nov-13	29.35	11.16	47.48	2536.02	0.0
27-Nov-13	29.09	10.22	47.18	2513.53	0.0
28-Nov-13	30.54	12.23	51.35	2638.61	0.0
29-Nov-13	29.82	12.01	45.04	2576.48	0.0
30-Nov-13	39.32	15.94	75.22	3397.16	0.0

Statistics

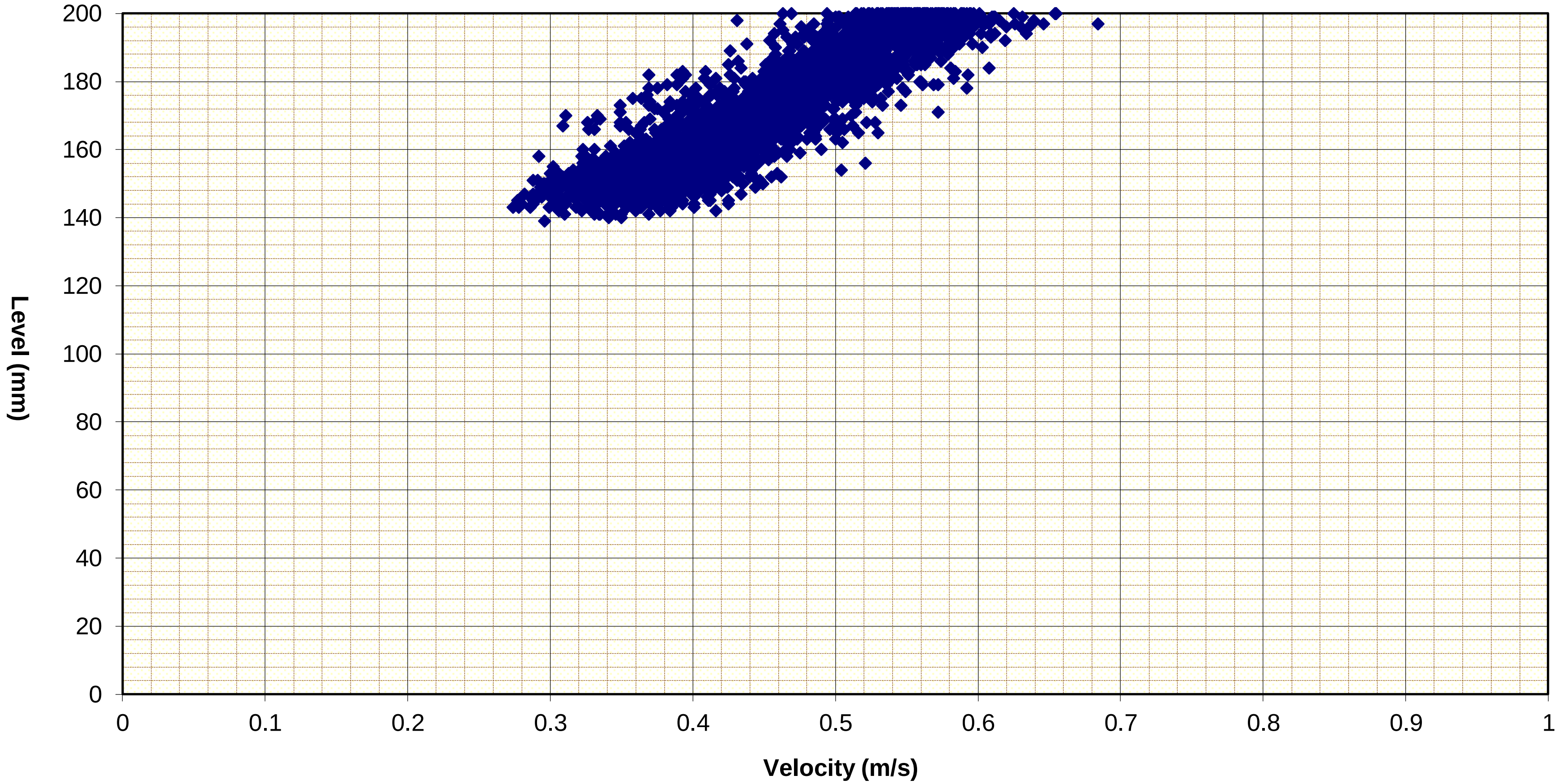
Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
27731.945	10.223	75.215	0.0

City of Prince George, BC
414E - Site 2 MH#GL81B
Detectronic AV Meter 525mm diameter
December 1 to 30 2013




City of Prince George, BC
414E - Site 2 MH#GL81B
Detectronic AV Meter 525mm diameter
December 1 to 30 2013
Level
Velocity
Level (mm)
Velocity (m/s)
500
450
400
350
300
250
200
150
100
50
0
20
18
16
14
12
10
8
6
4
2
0
1-Dec
6-Dec
11-Dec
16-Dec
21-Dec
26-Dec
31-Dec

City of Prince George, BC
414E - Site 2 MH#GL81B
Detectronic AV Meter 525mm diameter
December 1 to 30 2013



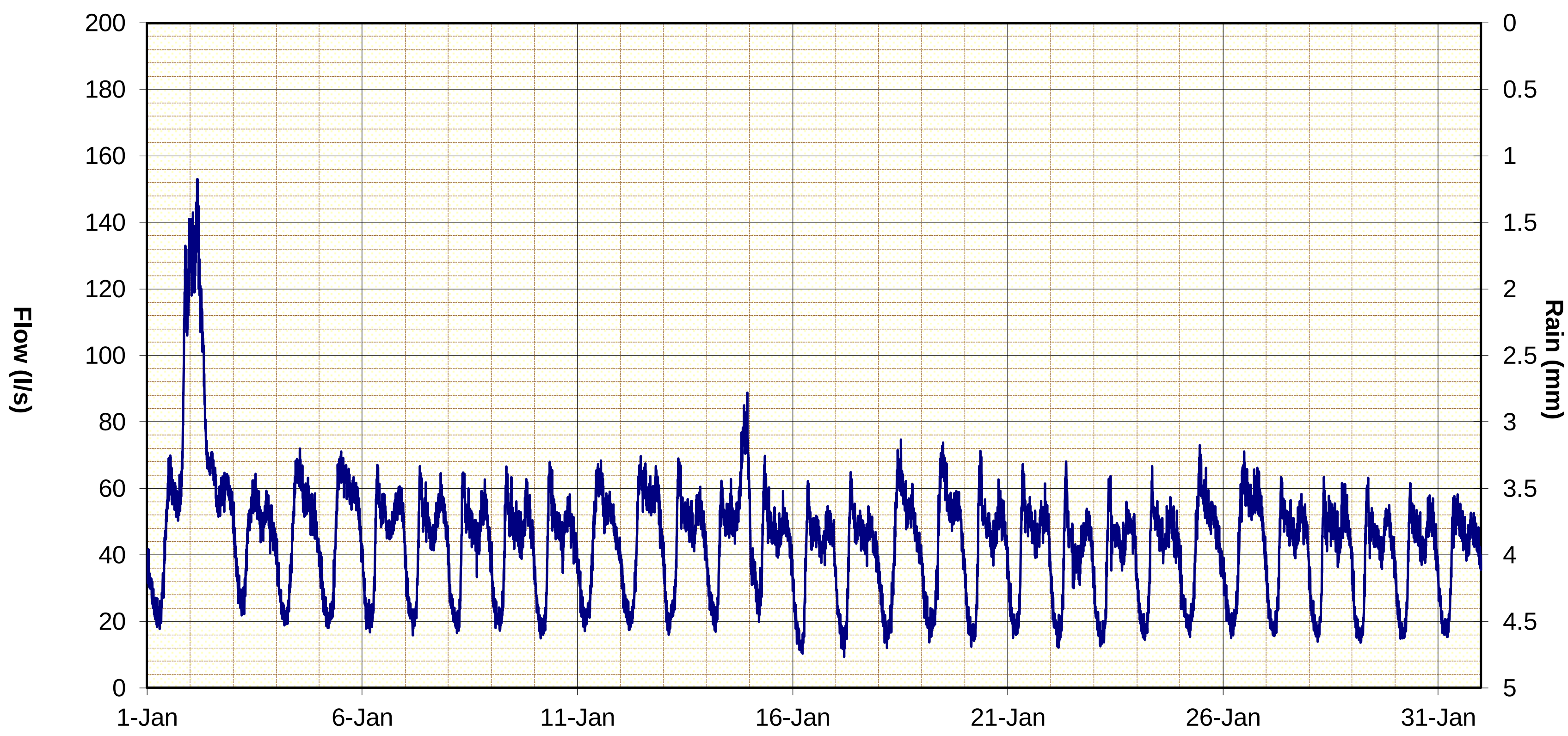
City of Prince George, BC
Site #414E - Site 2 MH #GL81B
Detectronic AV - 525mm Dia
1702 Lyon Street
December 1 to 31 2013

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Dec-13	49.72	21.00	74.90	4295.46	0.0
02-Dec-13	43.08	16.20	68.70	3721.86	0.0
03-Dec-13	42.25	16.00	66.10	3650.55	0.0
04-Dec-13	42.30	14.80	65.80	3654.60	0.0
05-Dec-13	41.88	16.30	70.60	3618.33	0.0
06-Dec-13	42.32	16.30	71.90	3656.07	0.0
07-Dec-13	44.71	16.60	74.20	3863.16	0.0
08-Dec-13	44.88	16.40	72.90	3877.23	0.0
09-Dec-13	40.91	14.50	66.10	3534.66	0.0
10-Dec-13	39.83	14.50	63.90	3441.03	0.0
11-Dec-13	39.65	14.30	63.00	3425.91	0.0
12-Dec-13	39.77	15.30	63.10	3436.23	0.0
13-Dec-13	39.38	16.40	60.80	3402.84	0.0
14-Dec-13	46.02	15.80	66.90	3976.32	0.0
15-Dec-13	46.31	20.10	73.00	4001.25	0.0
16-Dec-13	41.65	15.30	64.60	3598.95	0.0
17-Dec-13	40.18	15.20	62.90	3471.33	0.0
18-Dec-13	39.22	13.90	68.20	3388.89	0.0
19-Dec-13	38.44	14.90	68.00	3321.36	0.0
20-Dec-13	38.42	13.10	62.60	3319.80	0.0
21-Dec-13	40.70	13.50	63.70	3516.39	0.0
22-Dec-13	42.29	17.40	68.70	3654.09	0.0
23-Dec-13	40.90	15.90	63.00	3533.70	0.0
24-Dec-13	41.71	17.10	64.10	3603.69	0.0
25-Dec-13	38.81	13.60	64.30	3353.37	0.0
26-Dec-13	74.88	20.60	152.00	6469.77	0.0
27-Dec-13	73.69	39.60	129.00	6366.51	0.0
28-Dec-13	41.73	14.00	66.80	3605.07	0.0
29-Dec-13	44.60	18.30	67.60	3853.05	0.0
30-Dec-13	49.93	-68.20	84.10	4313.85	0.0
31-Dec-13	44.13	19.20	64.40	3813.06	0.0

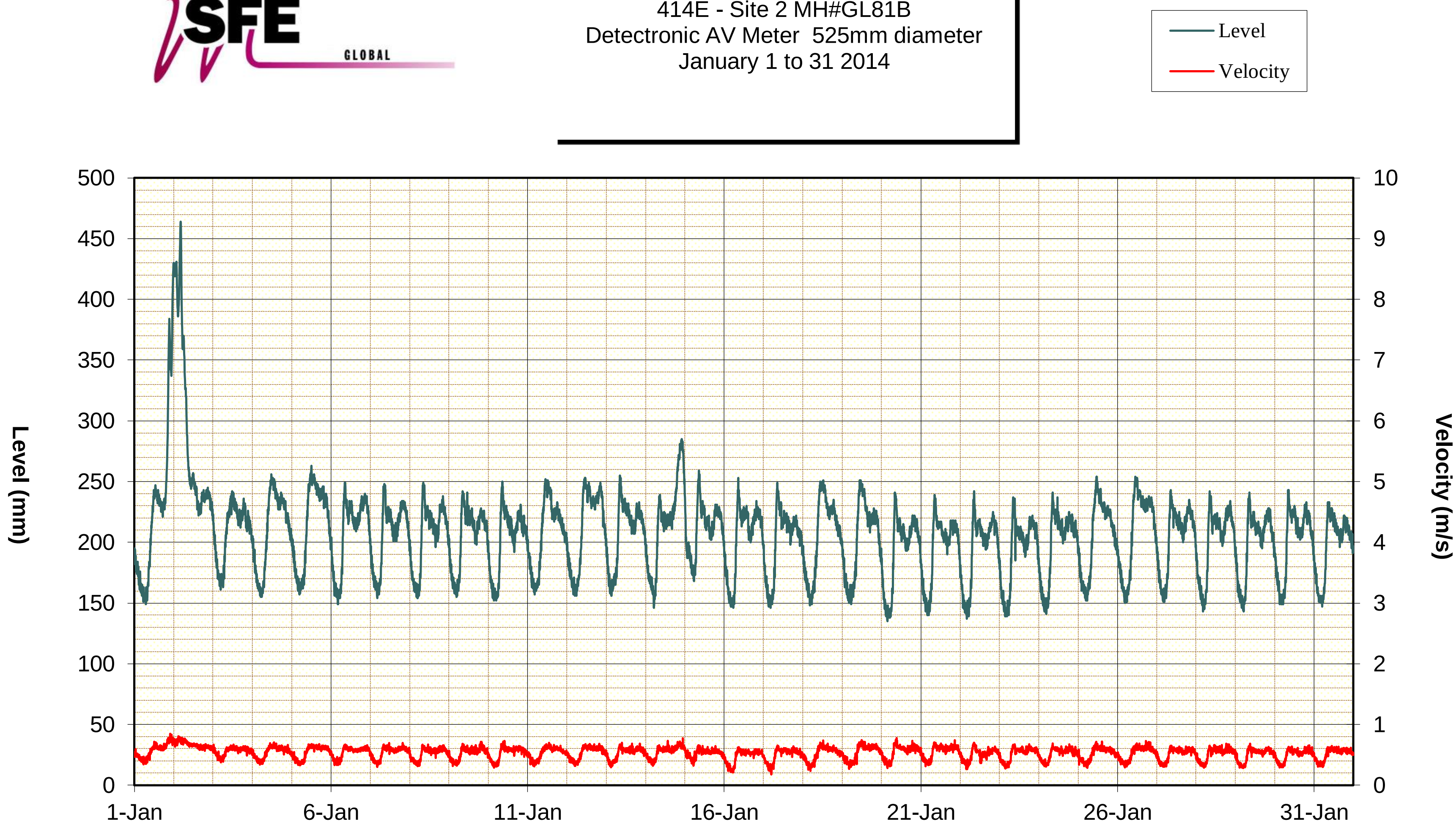
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
118738.380	-68.200	152.000	0.0

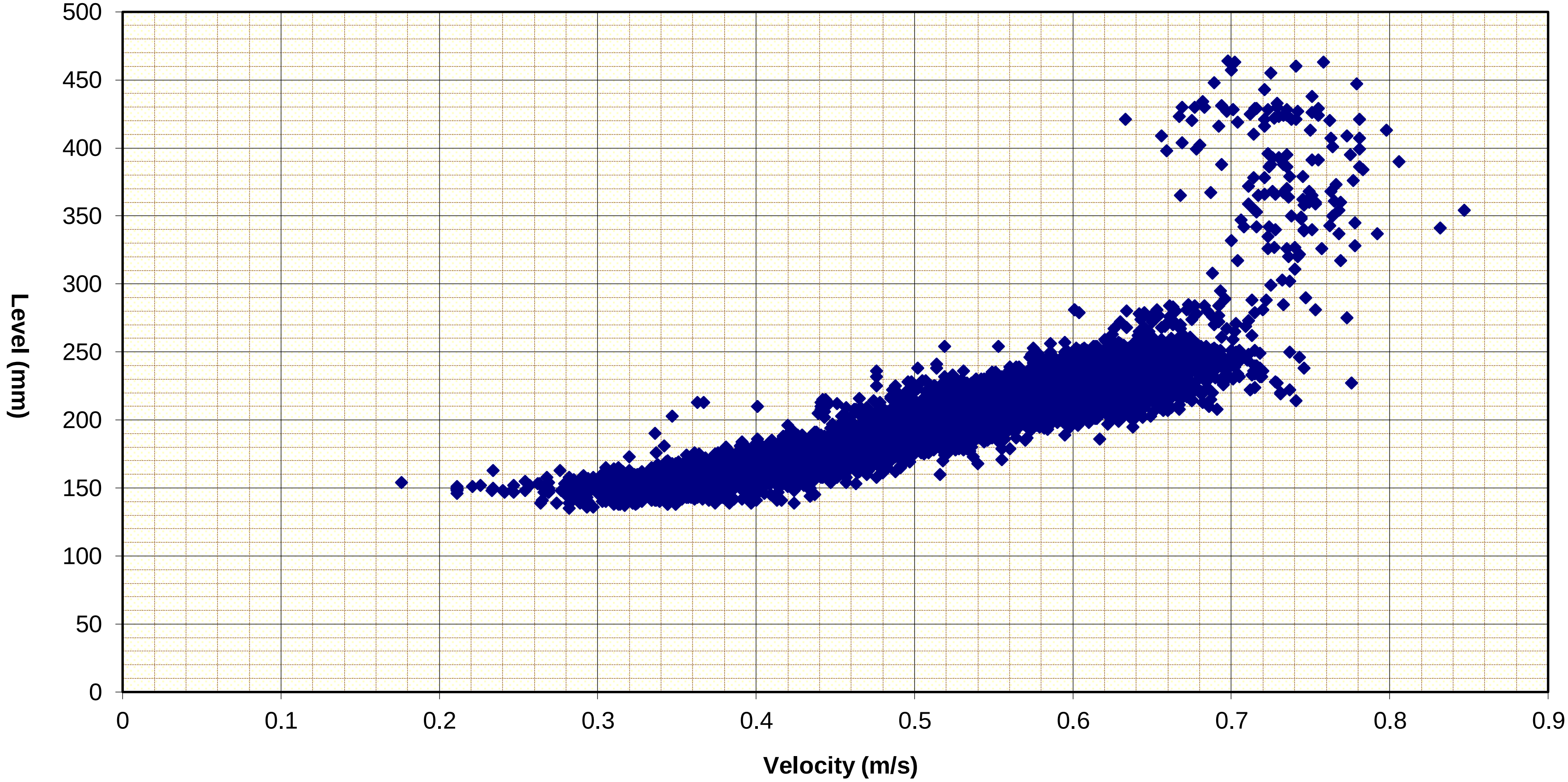
City of Prince George, BC
414E - Site 2 MH#GL81B
Detectronic AV Meter 525mm diameter
January 1 to 31 2014



City of Prince George, BC
414E - Site 2 MH#GL81B
Detectronic AV Meter 525mm diameter
January 1 to 31 2014



City of Prince George, BC
414E - Site 2 MH#GL81B
Detectronic AV Meter 525mm diameter
January 1 to 31 2014



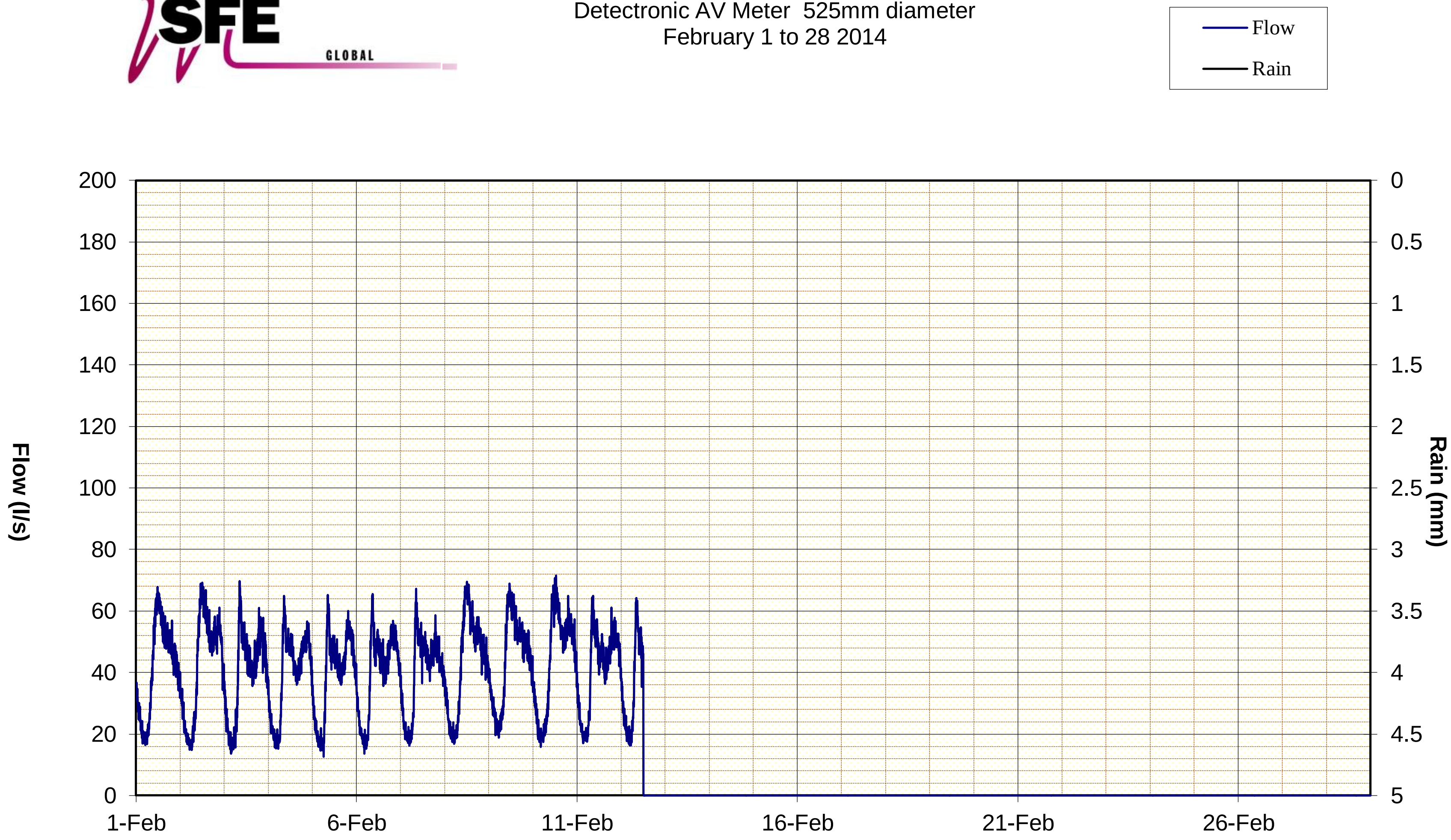
City of Prince George, BC
Site #414E - Site 2 MH #GL81B
Detectronic AV - 525mm Dia
1702 Lyon Street
January 1 to 31 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Jan-14	55.10	17.70	141.00	4760.28	0.0
02-Jan-14	83.61	48.30	153.00	7223.55	0.0
03-Jan-14	45.59	21.80	64.40	3938.76	0.0
04-Jan-14	45.39	18.80	72.00	3921.93	0.0
05-Jan-14	46.83	18.00	71.10	4046.16	0.0
06-Jan-14	44.63	16.70	67.10	3855.93	0.0
07-Jan-14	43.66	15.80	66.70	3772.56	0.0
08-Jan-14	42.64	16.50	64.80	3684.15	0.0
09-Jan-14	42.13	17.20	66.60	3640.02	0.0
10-Jan-14	41.74	14.90	68.00	3606.15	0.0
11-Jan-14	43.73	17.10	68.40	3778.23	0.0
12-Jan-14	45.43	17.40	69.70	3925.35	0.0
13-Jan-14	43.64	16.00	69.00	3770.16	0.0
14-Jan-14	48.48	16.90	88.80	4188.99	0.0
15-Jan-14	43.77	19.90	69.80	3781.62	0.0
16-Jan-14	38.37	10.30	62.20	3314.82	0.0
17-Jan-14	39.50	9.32	64.90	3412.84	0.0
18-Jan-14	42.44	12.00	74.70	3667.14	0.0
19-Jan-14	43.52	13.70	73.80	3760.02	0.0
20-Jan-14	41.09	12.40	71.30	3550.17	0.0
21-Jan-14	41.92	15.00	67.30	3621.75	0.0
22-Jan-14	37.89	12.10	68.10	3273.72	0.0
23-Jan-14	38.61	12.50	63.70	3336.27	0.0
24-Jan-14	39.82	14.50	66.70	3440.10	0.0
25-Jan-14	42.05	15.30	73.00	3633.15	0.0
26-Jan-14	44.14	15.00	71.10	3813.96	0.0
27-Jan-14	41.11	15.60	63.40	3551.52	0.0
28-Jan-14	40.47	13.90	63.40	3496.26	0.0
29-Jan-14	39.09	13.60	63.20	3377.13	0.0
30-Jan-14	39.51	14.80	61.60	3413.46	0.0
31-Jan-14	39.25	15.30	58.20	3391.14	0.0

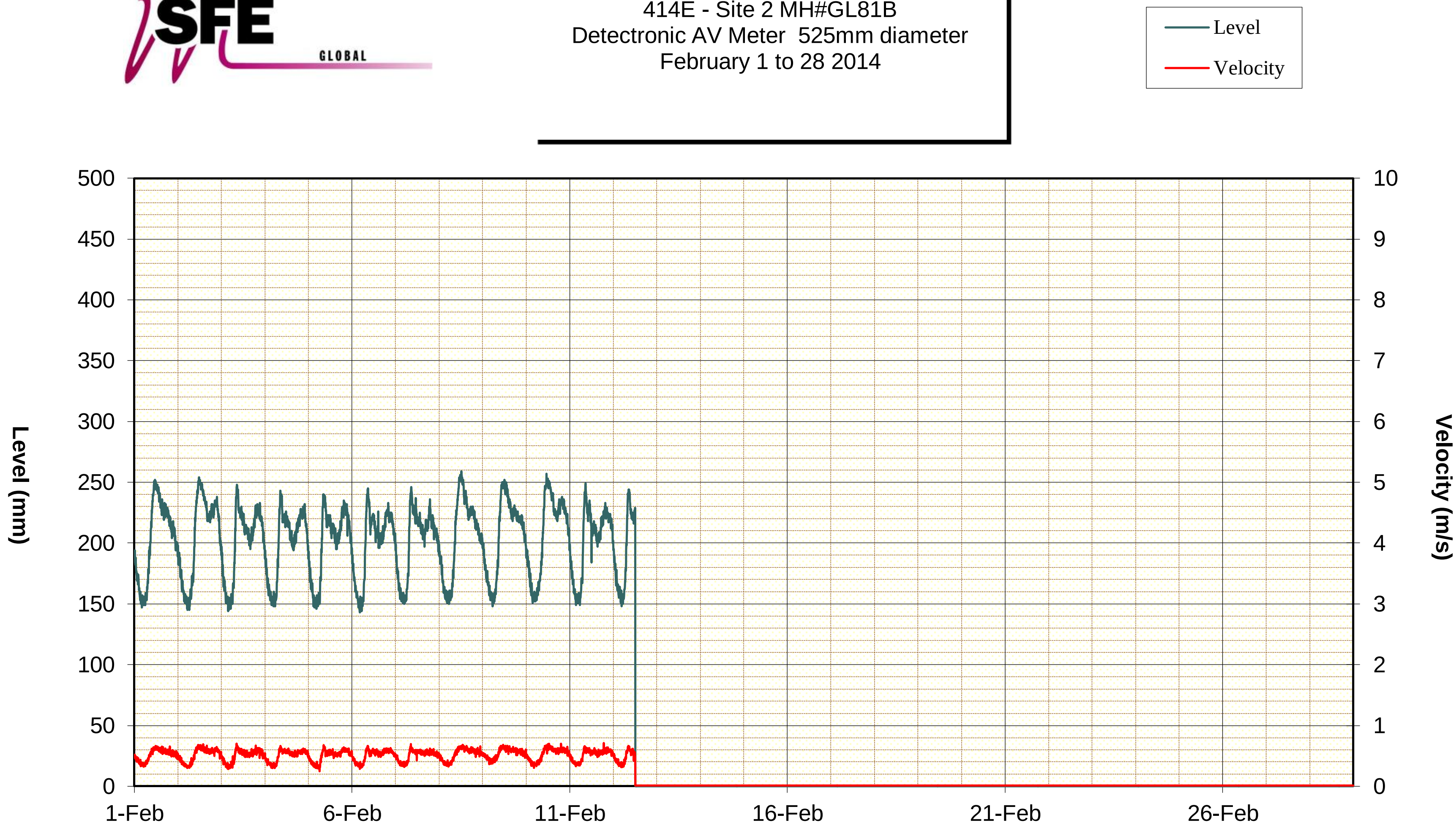
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
117947.286	9.320	153.000	0.0

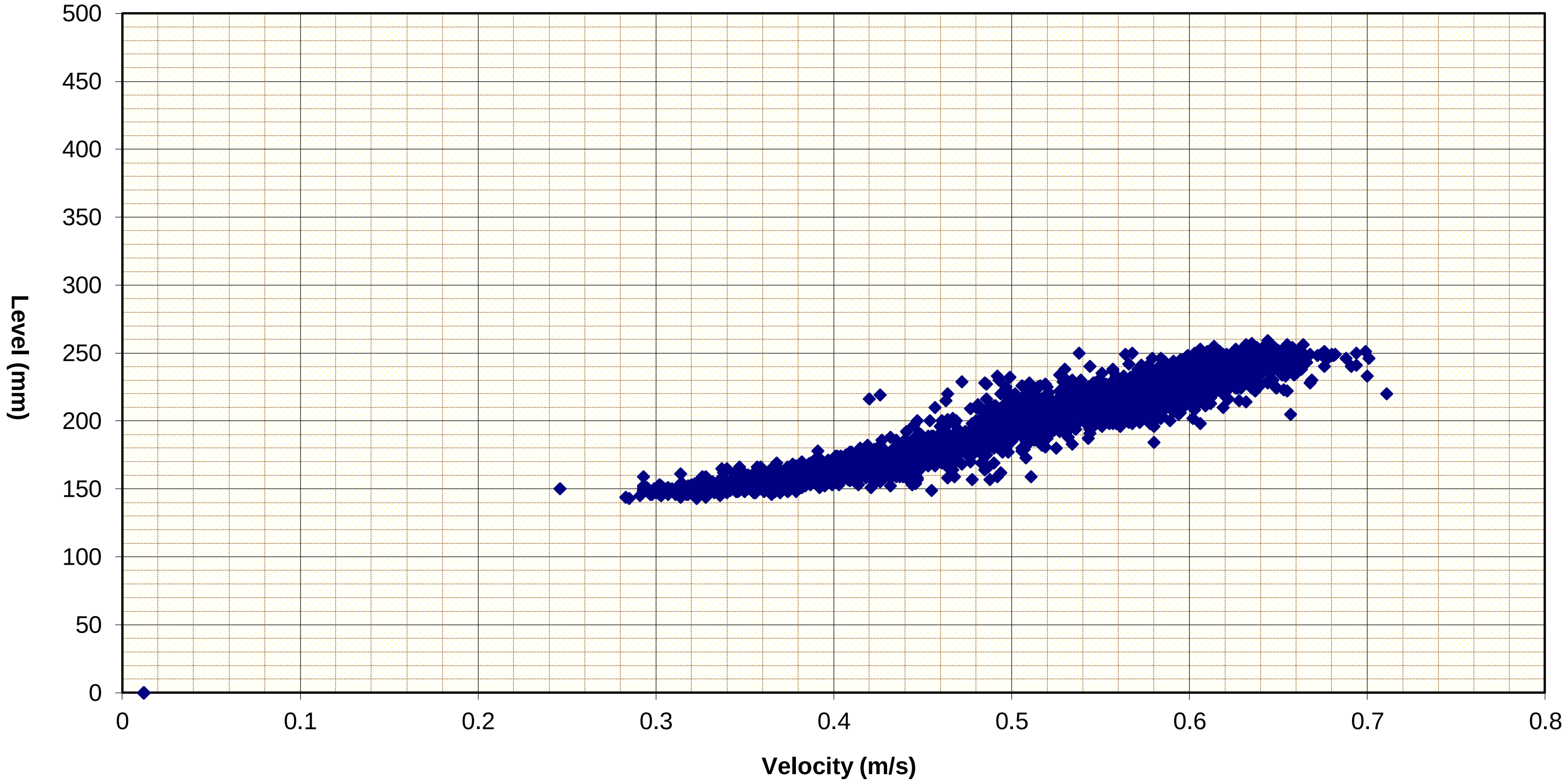
City of Prince George, BC
414E - Site 2 MH#GL81B
Detectronic AV Meter 525mm diameter
February 1 to 28 2014



City of Prince George, BC
414E - Site 2 MH#GL81B
Detectronic AV Meter 525mm diameter
February 1 to 28 2014



City of Prince George, BC
414E - Site 2 MH#GL81B
Detectronic AV Meter 525mm diameter
February 1 to 28 2014



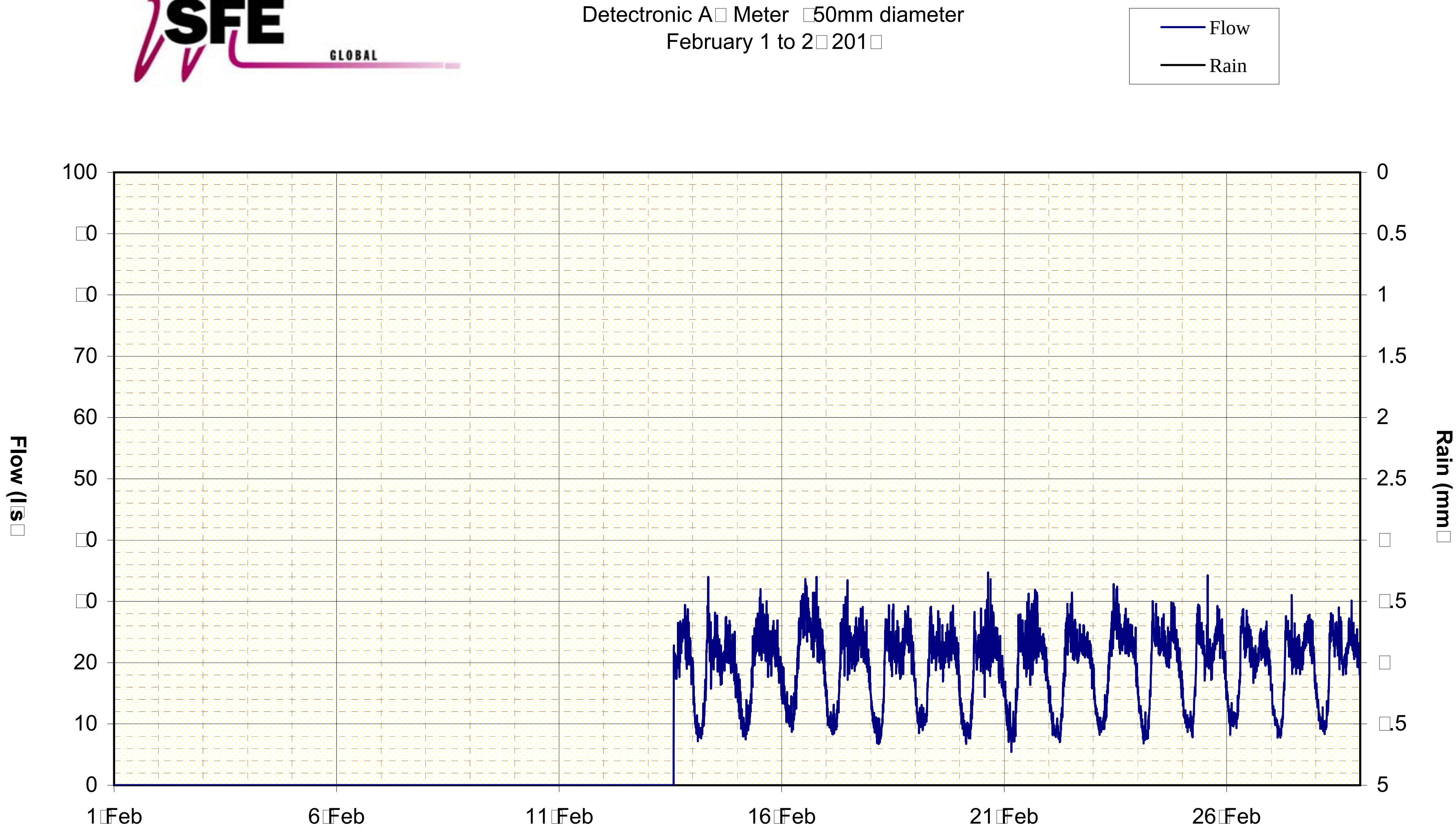
City of Prince George, BC
Site #414E - Site 2 MH #GL81B
Detectronic AV - 525mm Dia
1702 Lyon Street
February 1 to 28 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Feb-14	41.55	16.40	67.80	3590.10	0.0
02-Feb-14	42.27	14.80	69.20	3652.14	0.0
03-Feb-14	39.77	13.60	69.70	3436.32	0.0
04-Feb-14	39.44	15.20	64.90	3407.91	0.0
05-Feb-14	39.39	12.60	65.20	3403.65	0.0
06-Feb-14	39.73	13.60	65.50	3432.66	0.0
07-Feb-14	40.05	16.20	67.20	3460.26	0.0
08-Feb-14	43.04	16.80	69.50	3718.59	0.0
09-Feb-14	44.05	18.80	68.90	3806.16	0.0
10-Feb-14	43.83	15.80	71.50	3786.48	0.0
11-Feb-14	41.15	17.00	64.90	3555.03	0.0
12-Feb-14	17.73	0.00	64.20	1532.10	0.0
13-Feb-14	0.00	0.00	0.00	0.00	0.0
14-Feb-14	0.00	0.00	0.00	0.00	0.0
15-Feb-14	0.00	0.00	0.00	0.00	0.0
16-Feb-14	0.00	0.00	0.00	0.00	0.0
17-Feb-14	0.00	0.00	0.00	0.00	0.0
18-Feb-14	0.00	0.00	0.00	0.00	0.0
19-Feb-14	0.00	0.00	0.00	0.00	0.0
20-Feb-14	0.00	0.00	0.00	0.00	0.0
21-Feb-14	0.00	0.00	0.00	0.00	0.0
22-Feb-14	0.00	0.00	0.00	0.00	0.0
23-Feb-14	0.00	0.00	0.00	0.00	0.0
24-Feb-14	0.00	0.00	0.00	0.00	0.0
25-Feb-14	0.00	0.00	0.00	0.00	0.0
26-Feb-14	0.00	0.00	0.00	0.00	0.0
27-Feb-14	0.00	0.00	0.00	0.00	0.0
28-Feb-14	0.00	0.00	0.00	0.00	0.0

Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
40781.400	0.000	71.500	0.0

City of Prince George, BC
□1□E □Site 2 NE□ 1215 Let□bridge Str
Detectronic A□ Meter □50mm diameter
February 1 to 2□201□

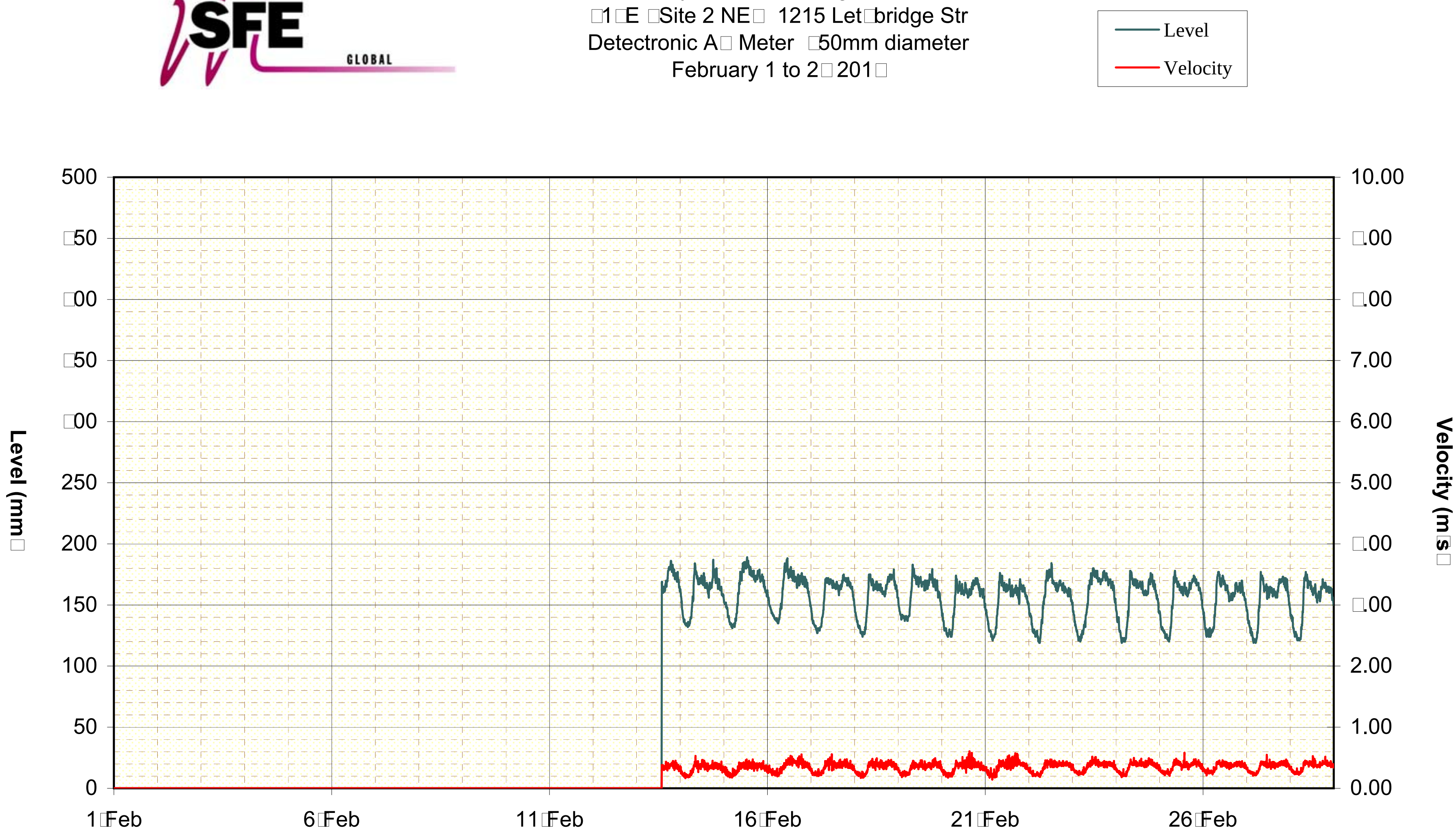


City of Prince George, BC

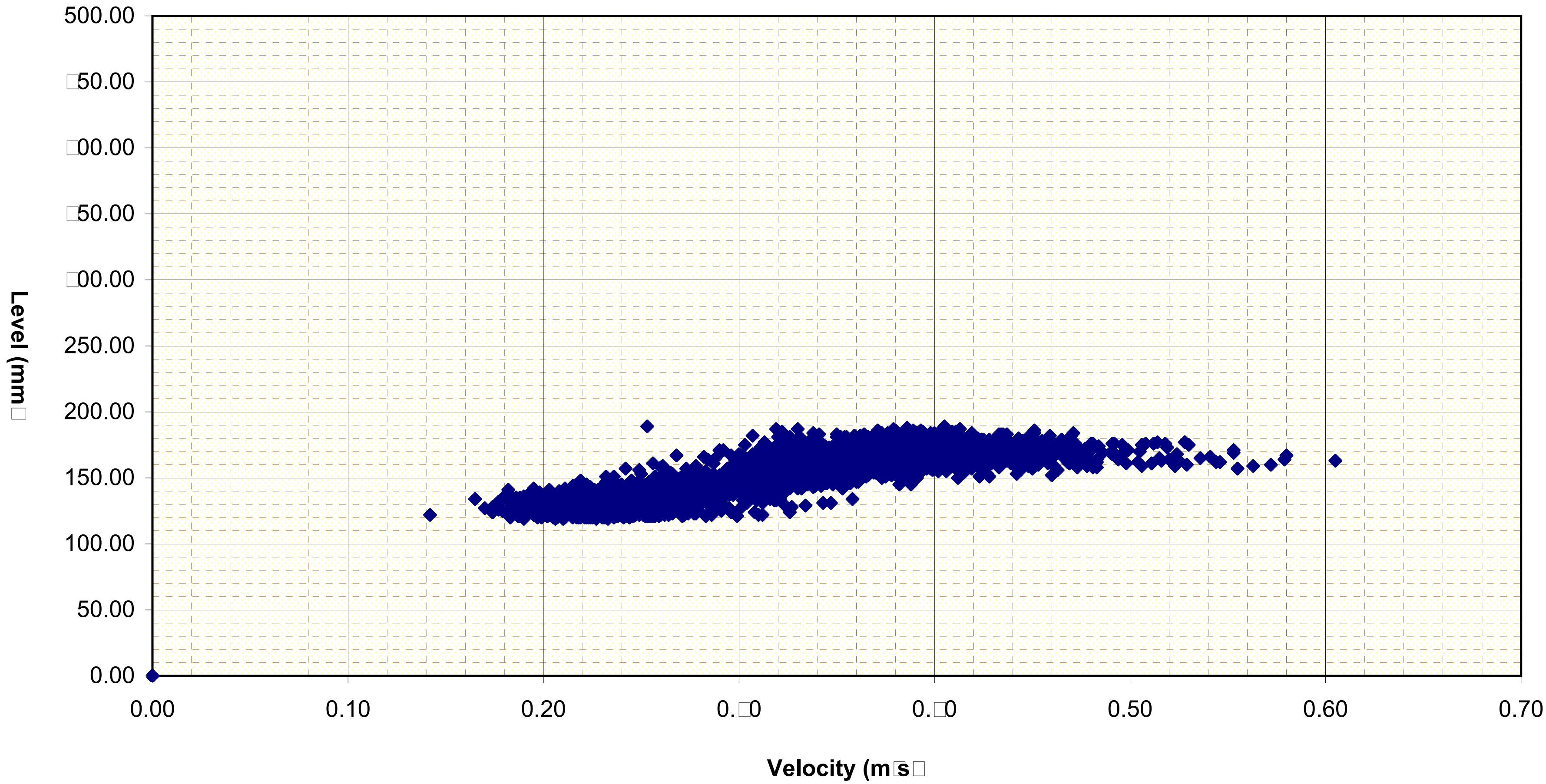
□1□E □Site 2 NE□ 1215 Lethbridge Str

Detectronic A□ Meter □50mm diameter

February 1 to 2□ 201□



City of Prince George, BC
□1□E □Site 2 NE□ 1215 Let□bridge Str
Detectronic A□ Meter □50mm diameter
February 1 to 2□201□



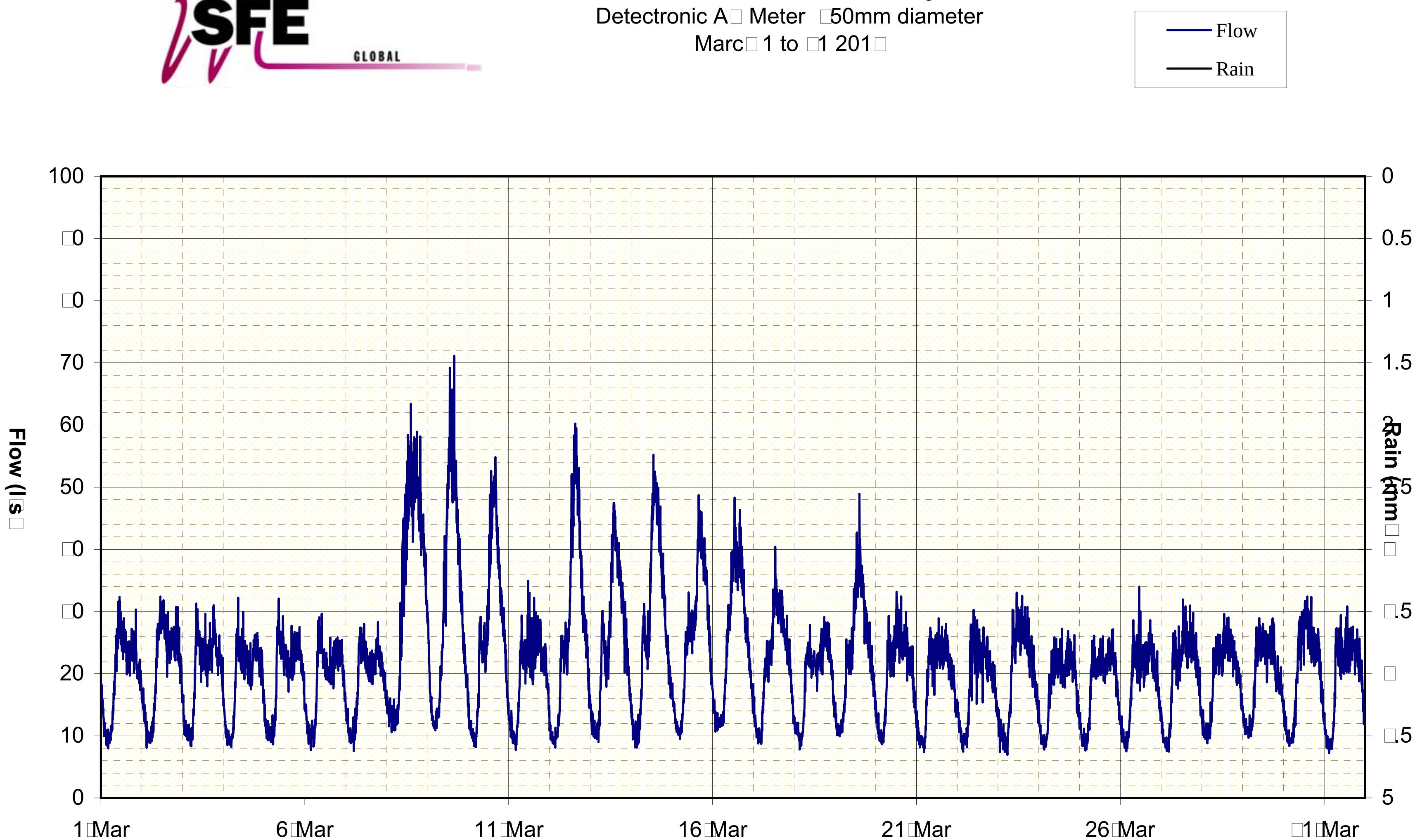
City of Prince George, BC
Site □□1□E □Site 2 NE□
Detectronic A□ □□50mm Dia
1215 Let□bridge Street
February 1 to 2□ 201□

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l□s□	(l□s□	(l□s□	(m□d□	(mm□
1□Feb□1□	0.00	0.00	0.00	0.00	0.0
2□Feb□1□	0.00	0.00	0.00	0.00	0.0
□□Feb□1□	0.00	0.00	0.00	0.00	0.0
□□Feb□1□	0.00	0.00	0.00	0.00	0.0
5□Feb□1□	0.00	0.00	0.00	0.00	0.0
6□Feb□1□	0.00	0.00	0.00	0.00	0.0
7□Feb□1□	0.00	0.00	0.00	0.00	0.0
□□Feb□1□	0.00	0.00	0.00	0.00	0.0
□□Feb□1□	0.00	0.00	0.00	0.00	0.0
10□Feb□1□	0.00	0.00	0.00	0.00	0.0
11□Feb□1□	0.00	0.00	0.00	0.00	0.0
12□Feb□1□	0.00	0.00	0.00	0.00	0.0
1□□Feb□1□	□.□5	0.00	2□.□0	□16.□6	0.0
1□□Feb□1□	1□.55	7.1□	□□.□0	1602.□5	0.0
15□Feb□1□	1□.27	7.5□	□2.00	166□.70	0.0
16□Feb□1□	20.76	□.77	□□.□0	17□□.65	0.0
17□Feb□1□	1□.25	□.2□	□□.□0	166□.□5	0.0
1□□Feb□1□	1□.□6	6.7□	2□.50	162□.□□	0.0
1□□Feb□1□	1□.□6	□.5□	2□.□0	1672.□7	0.0
20□Feb□1□	1□.62	6.□0	□□.70	160□.10	0.0
21□Feb□1□	1□.17	5.□5	□1.□0	1655.□□	0.0
22□Feb□1□	1□.7□	7.0□	□1.□0	162□.20	0.0
2□□Feb□1□	20.0□	□.20	□2.□0	17□0.62	0.0
2□□Feb□1□	1□.□□	6.□□	□0.00	1670.□□	0.0
25□Feb□1□	1□.□□	7.□1	□□.20	1670.□1	0.0
26□Feb□1□	1□.□1	□.2□	2□.70	166□.1□	0.0
27□Feb□1□	1□.21	7.7□	□0.□0	165□.□5	0.0
2□□Feb□1□	1□.□□	□.□6	□0.10	167□.2□	0.0

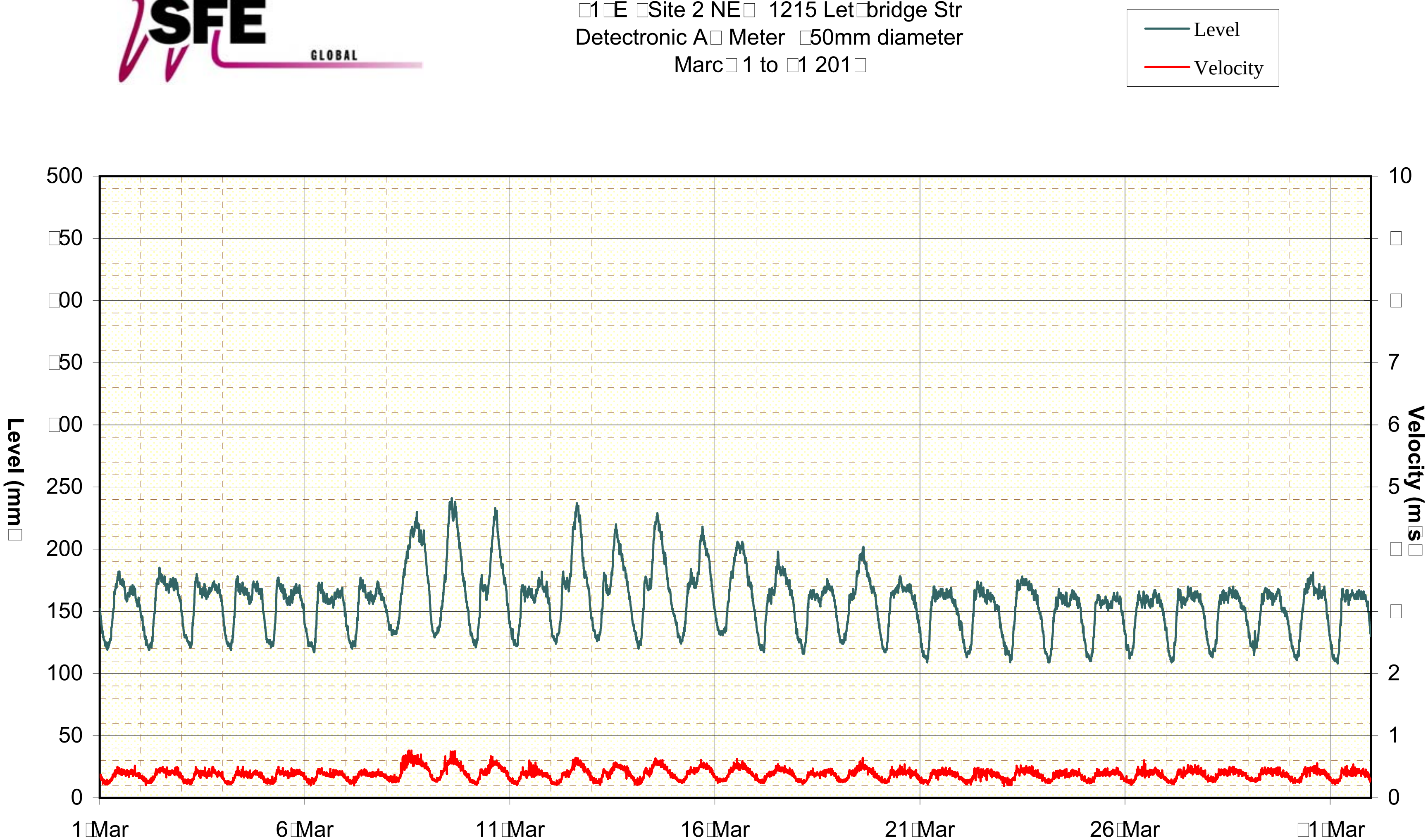
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m□□	(l□s□	(l□s□	(mm□
25□10.6□5	0.000	□□.700	0.0

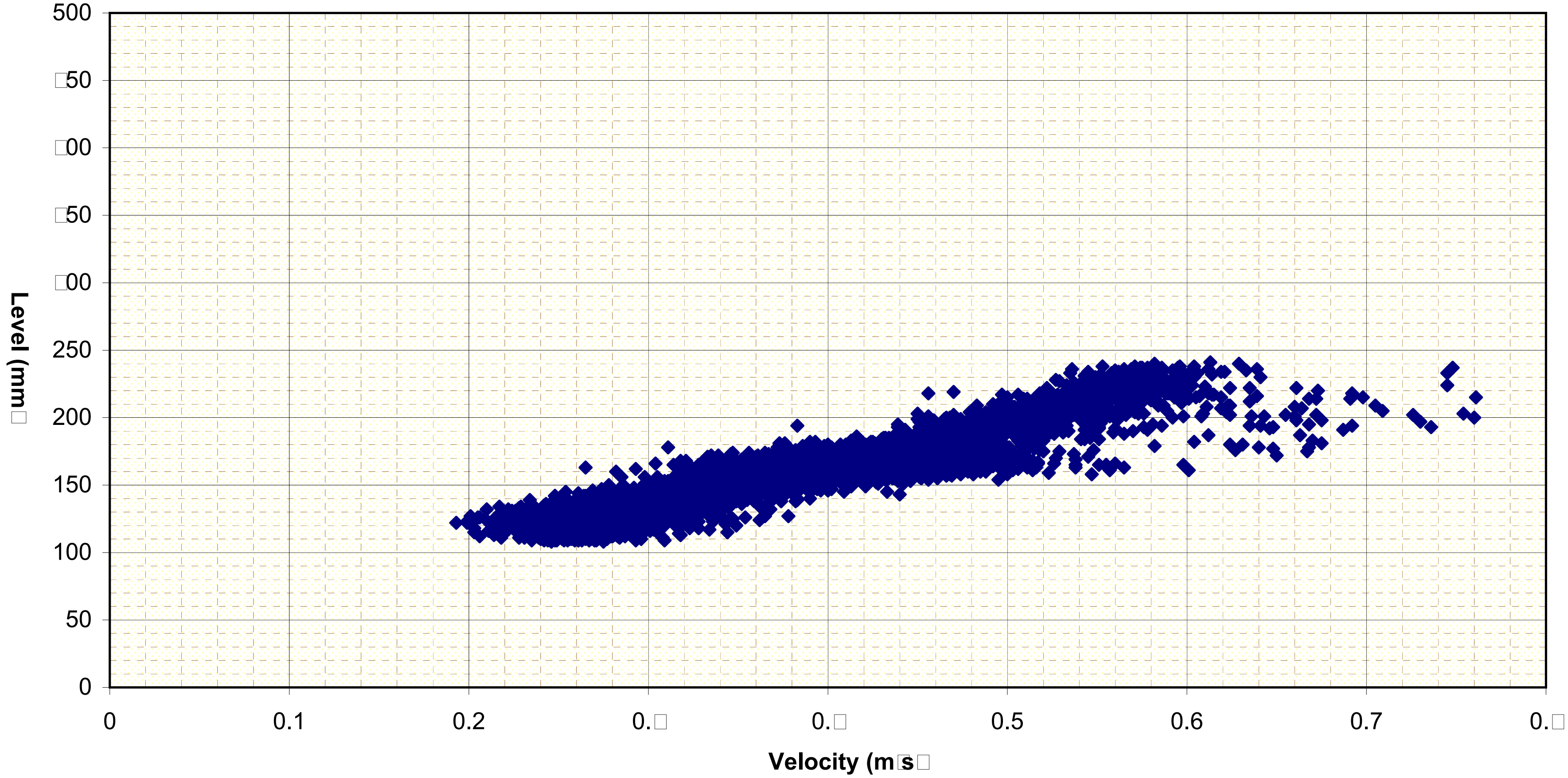
City of Prince George, BC
□1 □E □Site 2 NE□ 1215 Let□bridge Str
Detectronic A□ Meter □50mm diameter
Marc□ 1 to □1 201□



City of Prince George, BC
□1□E □Site 2 NE□ 1215 Let□bridge Str
Detectronic A□ Meter □50mm diameter
Marc□ 1 to □1 201□



City of Prince George, BC
□1□E □Site 2 NE□ 1215 Let□bridge Str
Detectronic A□ Meter □50mm diameter
Marc□ 1 to □1 201□



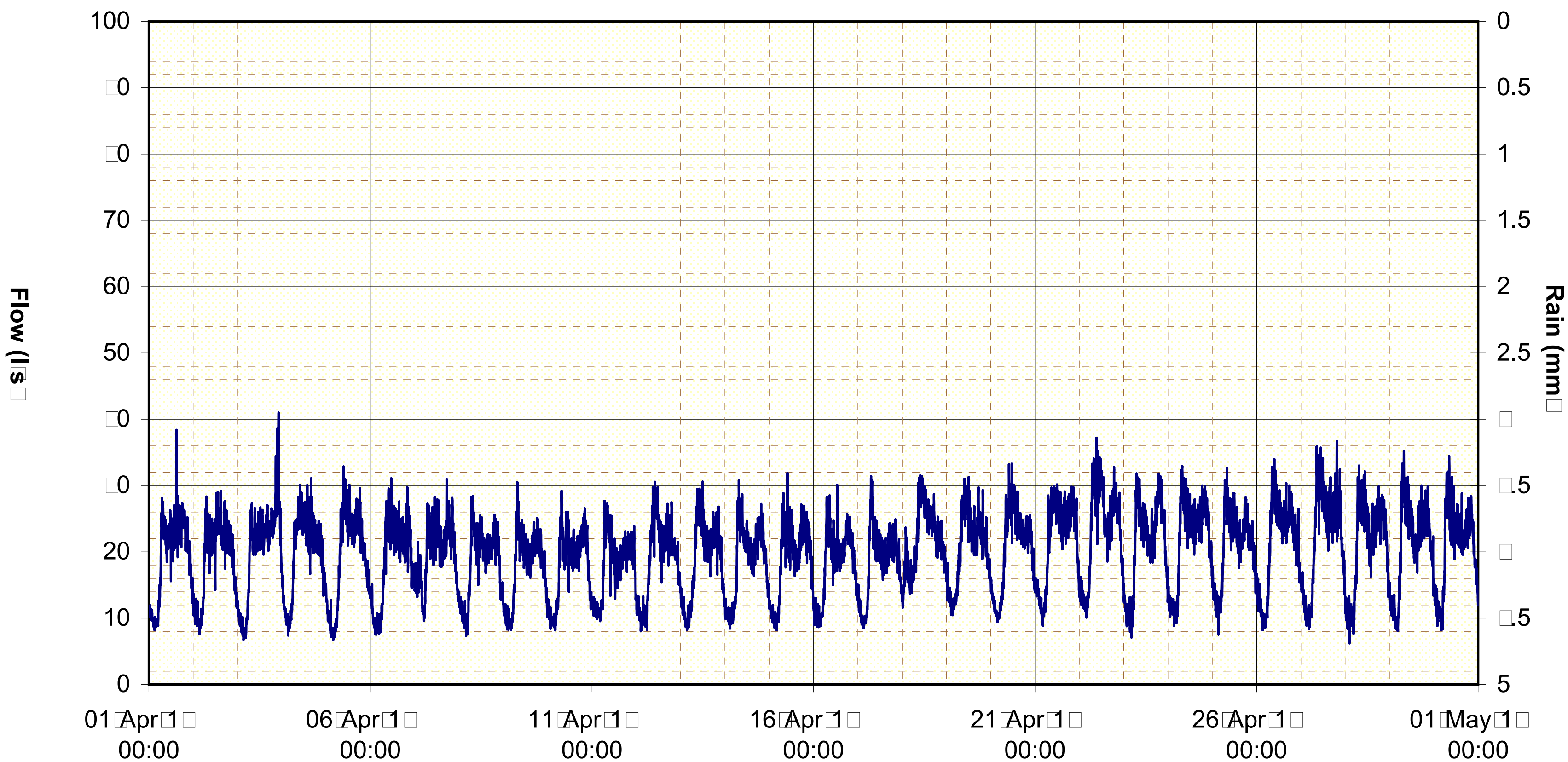
City of Prince George, BC
Site □□1□E □Site 2 NE□
Detectronic A□ □□50mm Dia
1215 Let□bridge Street
Marc□ 1 to □1 201□

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l□s□	(l□s□	(l□s□	(m□d□	(mm□
1□Mar□1□	1□.□□	7.□7	□2.□0	171□.66	0.0
2□Mar□1□	20.□□	□.0□	□2.□0	1□0□.61	0.0
□□Mar□1□	1□.□□	□.□2	□1.20	171□.0□	0.0
□□Mar□1□	1□.05	□.2□	□2.20	16□6.10	0.0
5□Mar□1□	1□.□2	□.61	□2.00	1677.7□	0.0
6□Mar□1□	1□.□6	7.72	2□.60	162□.□7	0.0
7□Mar□1□	1□.□0	7.5□	2□.□0	162□.21	0.0
□□Mar□1□	□□.57	10.60	6□.□0	2□00.22	0.0
□□Mar□1□	□0.□□	10.□0	71.10	2672.67	0.0
10□Mar□1□	26.□7	□.22	5□.70	22□7.0□	0.0
11□Mar□1□	1□.□□	7.7□	□□.70	1717.7□	0.0
12□Mar□1□	27.27	□.17	60.20	2□56.16	0.0
1□□Mar□1□	25.12	□.□□	□7.□0	2170.0□	0.0
1□□Mar□1□	27.□1	□.0□	55.20	2□6□.2□	0.0
15□Mar□1□	25.51	□.51	□□.70	220□.2□	0.0
16□Mar□1□	25.17	10.70	□□.□0	217□.□□	0.0
17□Mar□1□	21.61	□.7□	□0.□0	1□67.□5	0.0
1□□Mar□1□	1□.□6	7.□□	2□.10	16□1.2□	0.0
1□□Mar□1□	2□.□6	□.□2	□□.□0	2026.66	0.0
20□Mar□1□	1□.□0	□.66	□□.10	171□.0□	0.0
21□Mar□1□	1□.□7	7.□□	2□.□0	16□0.□□	0.0
22□Mar□1□	1□.□7	7.□6	□0.20	15□5.□0	0.0
2□□Mar□1□	1□.□7	6.□6	□□.00	1717.0□	0.0
2□□Mar□1□	1□.22	7.□5	27.20	157□.□□	0.0
25□Mar□1□	1□.11	7.66	27.10	1565.12	0.0
26□Mar□1□	1□.62	7.5□	□□.□0	160□.□0	0.0
27□Mar□1□	1□.65	7.□□	□1.□0	16□□.01	0.0
2□□Mar□1□	1□.6□	□.7□	2□.60	16□6.□□	0.0
2□□Mar□1□	1□.□5	□.67	2□.□0	16□0.□5	0.0
□0□Mar□1□	20.10	□.□1	□2.□0	17□6.□□	0.0
□1□Mar□1□	1□.1□	7.27	□0.□0	1657.□2	0.0

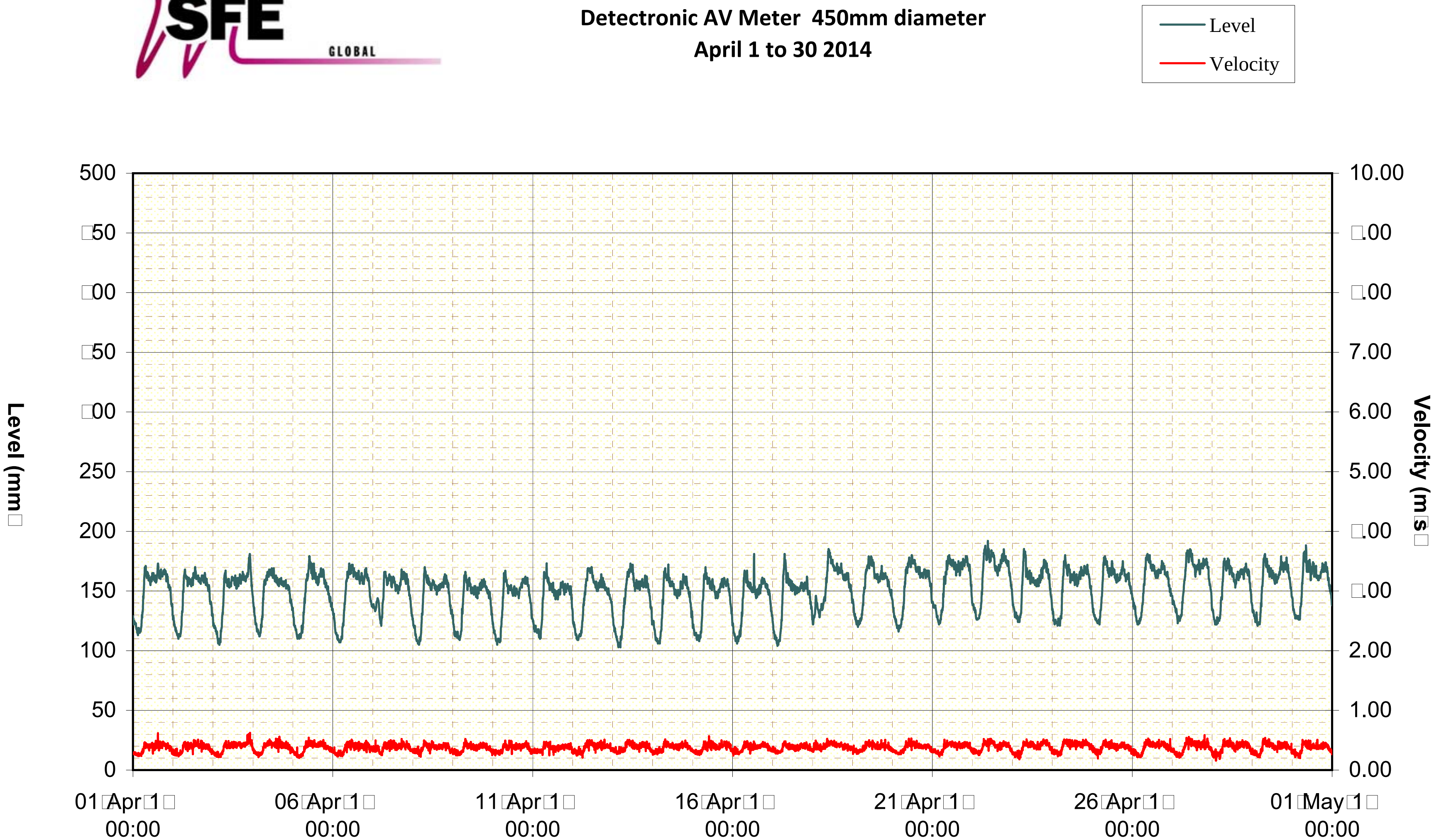
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m□□	(l□s□	(l□s□	(mm□
5□12□.5□5	6.□60	71.100	0.0

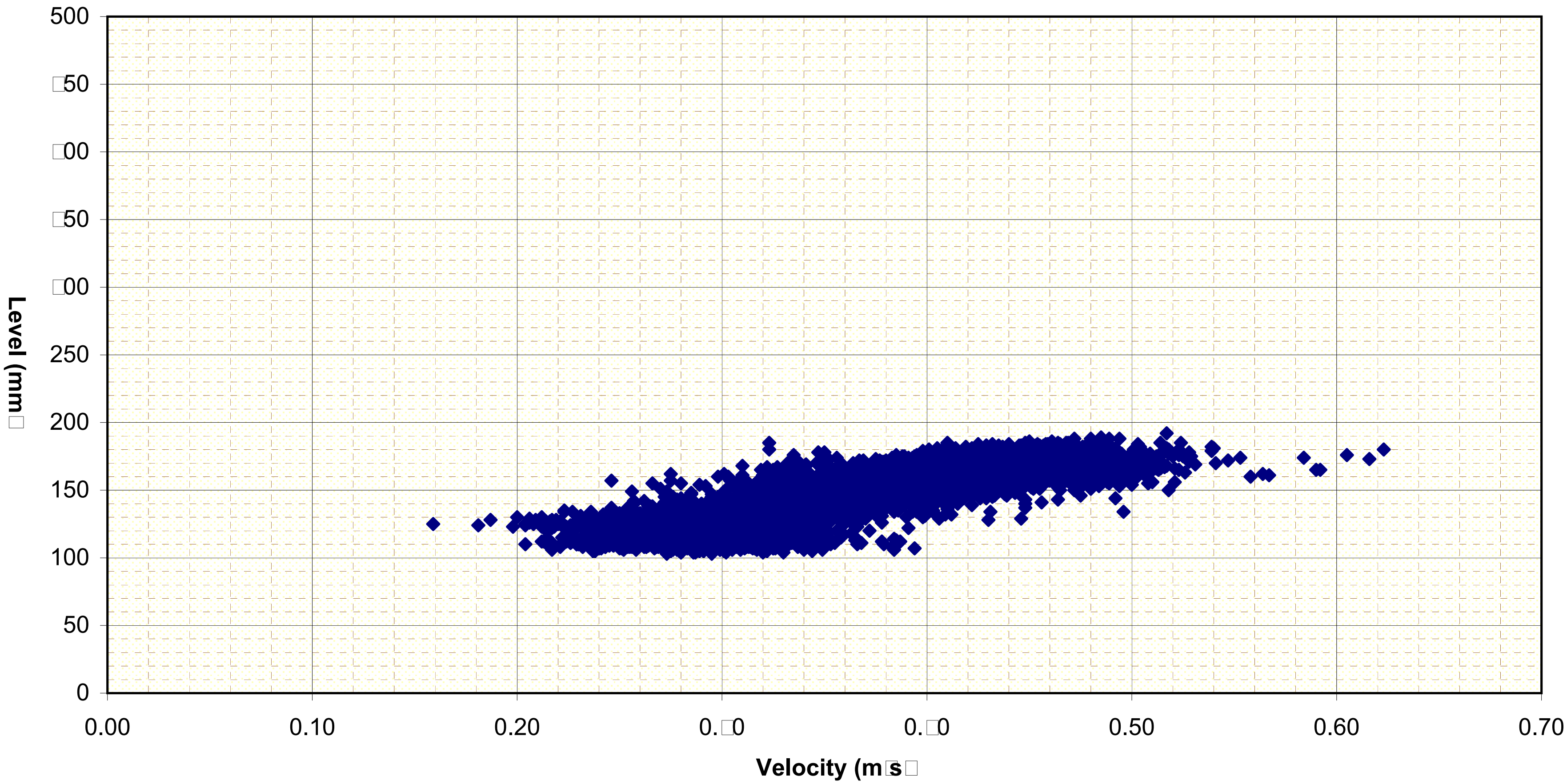
City of Prince George, BC
414E - Site 2 NEW 1215 Lethbridge Str
Detectronic AV Meter 450mm diameter
April 1 to 30 2014



City of Prince George, BC
414E - Site 2 NEW 1215 Lethbridge Str
Detectronic AV Meter 450mm diameter
April 1 to 30 2014



City of Prince George, BC
414E - Site 2 NEW 1215 Lethbridge Str
Detectronic AV Meter 450mm diameter
April 1 to 30 2014



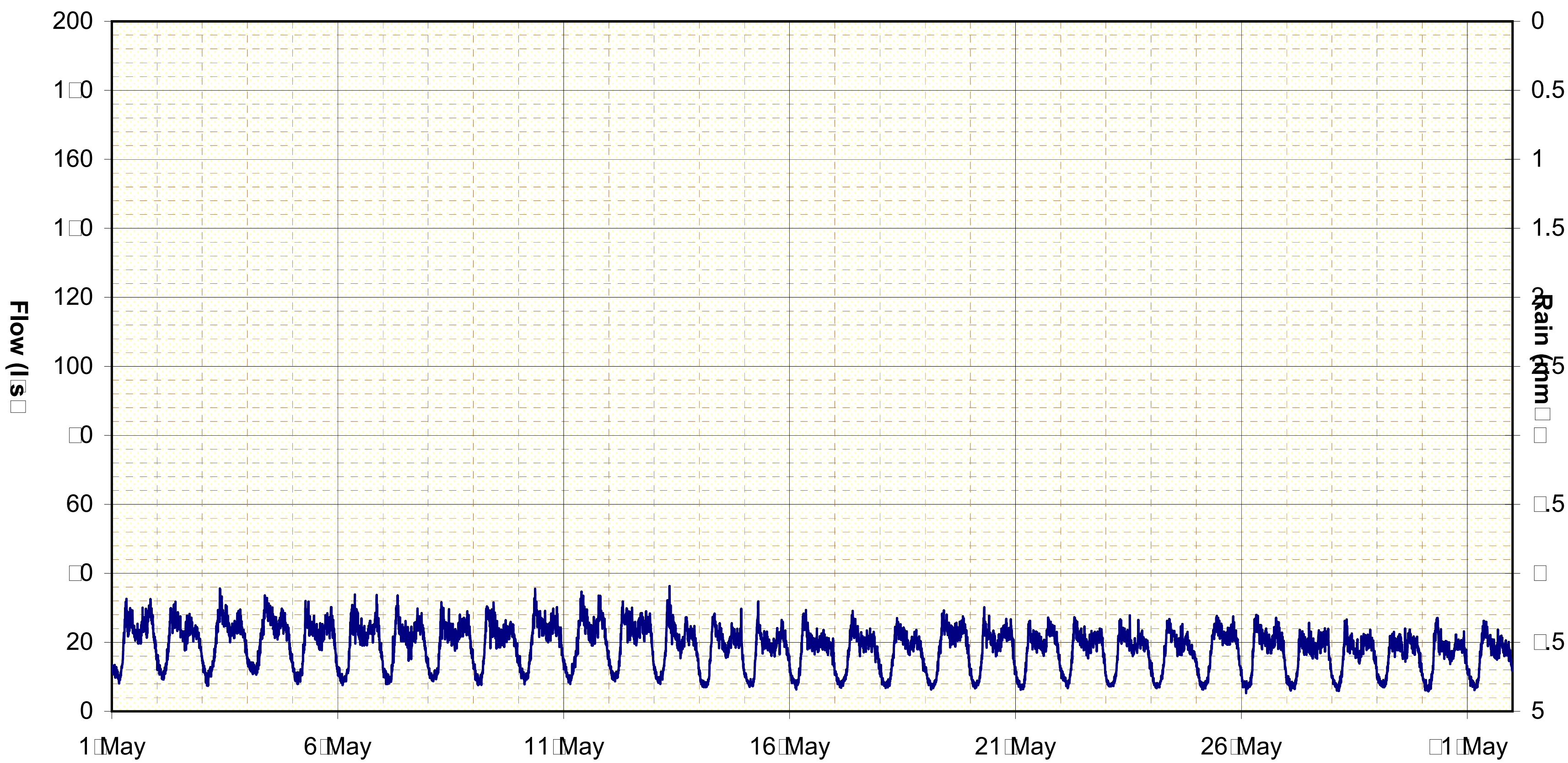
City of Prince George, BC
Site □□1□E □Site 2 NE□
Detectronic A□ □□50mm Dia
1215 Let□bridge Street
April 1 to □0 201□

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l□s□	(l□s□	(l□s□	(m□d□	(mm□
1□Apr□1□	1□.□2	□.21	□□.□0	167□.10	0.0
2□Apr□1□	1□.1□	7.5□	2□.20	165□.17	0.0
□□Apr□1□	20.22	6.76	□0.□0	17□7.0□	0.0
□□Apr□1□	1□.62	7.□0	□1.10	16□5.1□	0.0
5□Apr□1□	1□.□□	6.7□	□2.□0	16□0.67	0.0
6□Apr□1□	1□.□7	7.56	□1.10	16□0.□1	0.0
7□Apr□1□	1□.□□	□.57	□0.□0	1722.56	0.0
□□Apr□1□	1□.21	7.□0	2□.□0	157□.□0	0.0
□□Apr□1□	17.62	□.2□	□0.50	1521.□□	0.0
10□Apr□1□	17.□5	□.17	2□.20	15□2.□□	0.0
11□Apr□1□	17.□□	□.57	27.60	155□.□1	0.0
12□Apr□1□	1□.75	□.06	□0.□0	161□.□□	0.0
1□□Apr□1□	1□.□□	□.2□	□0.50	1627.□1	0.0
1□□Apr□1□	1□.75	□.□□	□0.□0	161□.7□	0.0
15□Apr□1□	1□.5□	□.2□	□1.□0	1605.□2	0.0
16□Apr□1□	1□.□0	□.65	□0.00	15□1.1□	0.0
17□Apr□1□	1□.□□	□.□□	□1.□0	15□7.□5	0.0
1□□Apr□1□	21.□□	11.60	□1.□0	1□□7.□6	0.0
1□□Apr□1□	20.51	10.50	□1.□0	1771.□□	0.0
20□Apr□1□	20.□6	□.□2	□□.□0	1767.□1	0.0
21□Apr□1□	21.77	□.□1	□0.10	1□□0.72	0.0
22□Apr□1□	2□.□0	10.10	□7.20	2012.7□	0.0
2□□Apr□1□	21.10	7.11	□1.□0	1□2□.0□	0.0
2□□Apr□1□	21.□5	□.□□	□2.□0	1□□□.1□	0.0
25□Apr□1□	20.□0	7.61	□2.60	1□05.□1	0.0
26□Apr□1□	21.00	□.22	□□.00	1□1□.0□	0.0
27□Apr□1□	22.2□	□.□1	□6.70	1□21.□2	0.0
2□□Apr□1□	21.05	6.25	□□.00	1□1□.□7	0.0
2□□Apr□1□	21.07	□.1□	□5.20	1□20.07	0.0
□0□Apr□1□	20.72	□.21	□□.□0	17□0.2□	0.0

Statistics

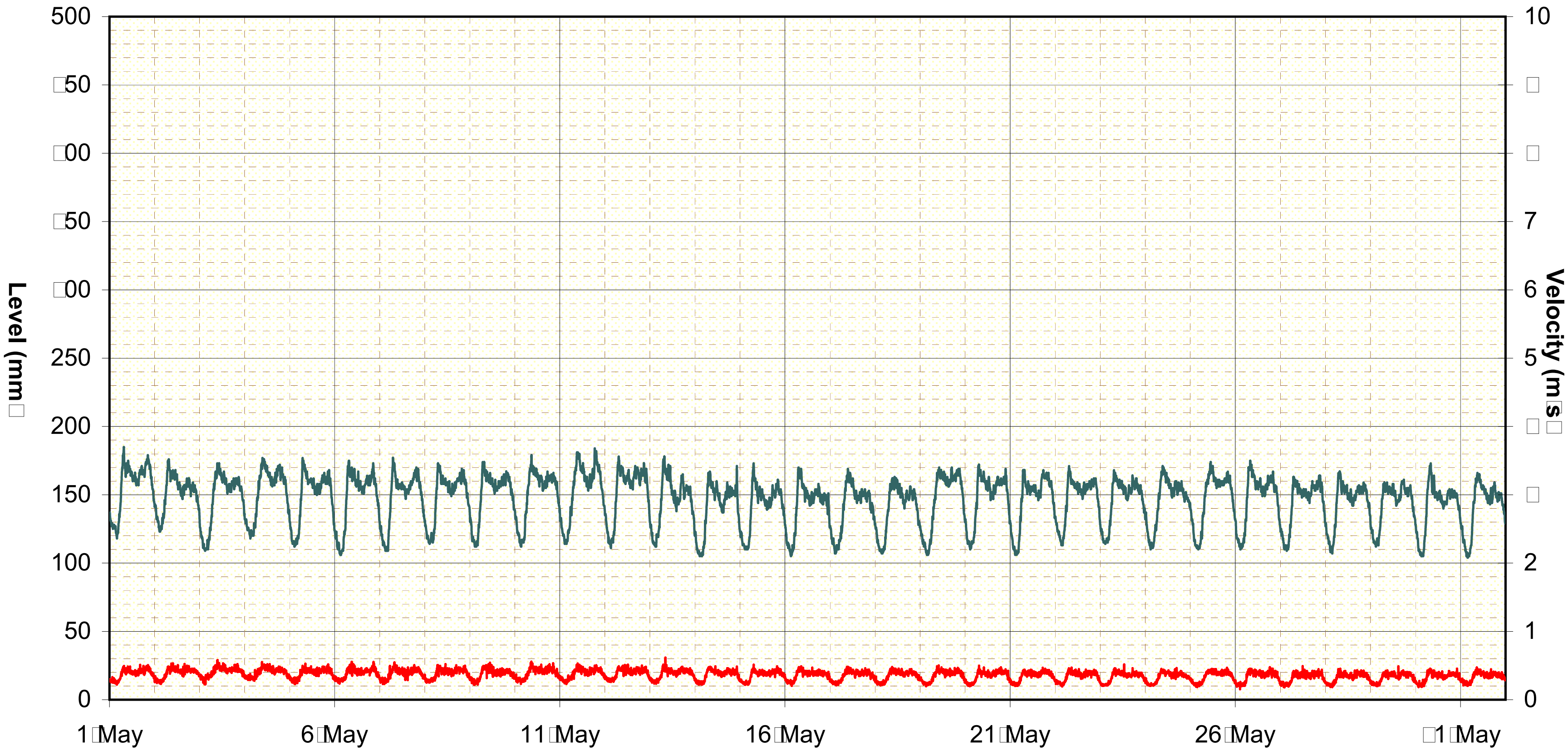
Total Flow	Min Flow	Max Flow	Total Rain
(m□□	(l□s□	(l□s□	(mm□
5160□.017	6.250	□0.□00	0.0

City of Prince George, BC
□1□E □Site 2 NE□ 1215 Let□bridge Str
Detectronic A□ Meter □50mm diameter
May 1 to □1 201□

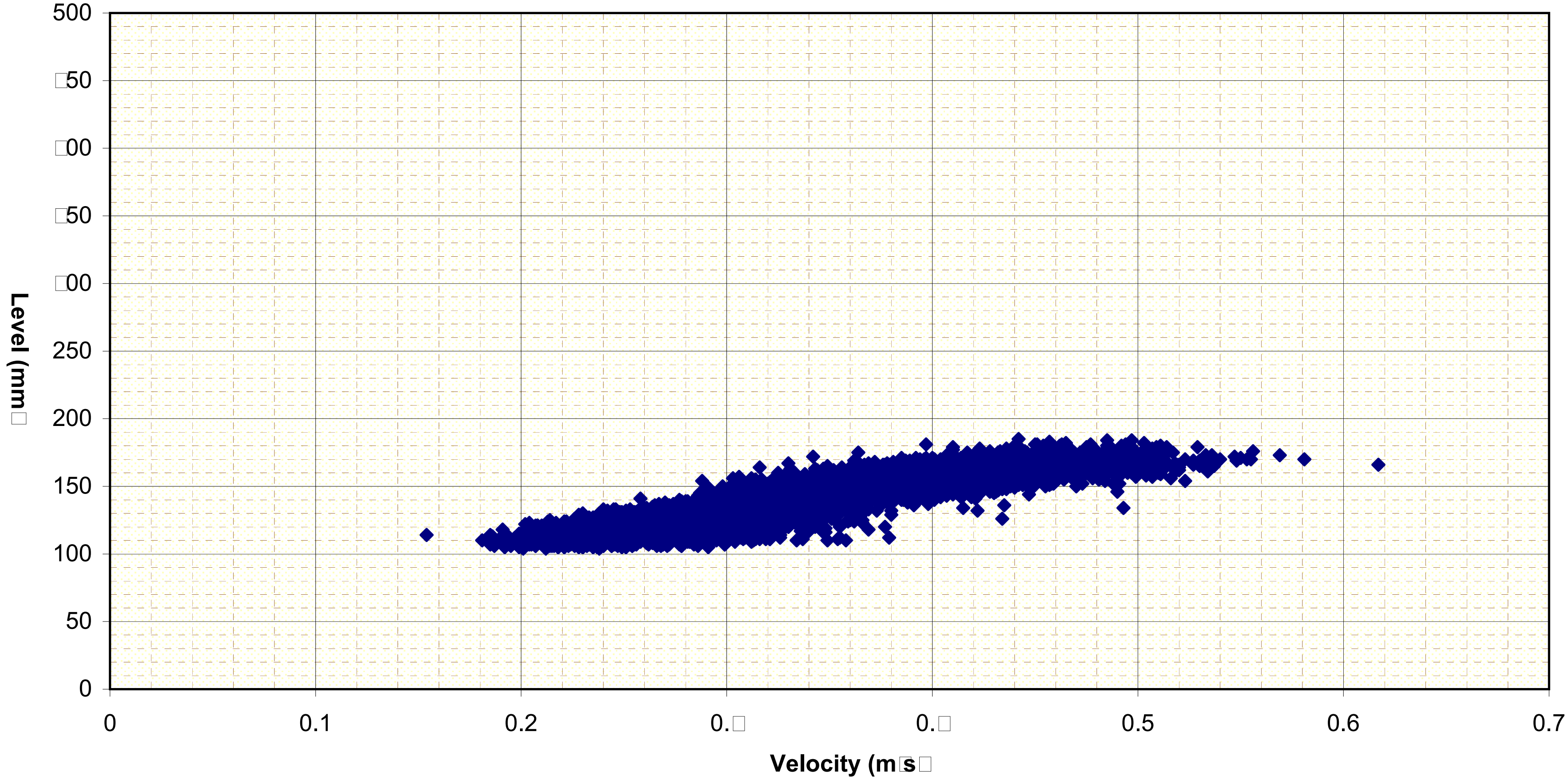


City of Prince George, BC
□1□E □Site 2 NE□ 1215 Let□bridge Str
Detectronic A□ Meter □50mm diameter
May 1 to □1 201□

Level
Velocity



City of Prince George, BC
□1□E □Site 2 NE□ 1215 Let□bridge Str
Detectronic A□ Meter □50mm diameter
May 1 to □1 201□



City of Prince George, BC
Site □□1□E □Site 2 NE□
Detectronic A□ □□50mm Dia
1215 Let□bridge Street
May 1 to □1 201□

Date	Avg Flow (l□s□	Min Flow (l□s□	Max Flow (l□s□	Total Flow (m□d□	Total Rain (mm□
1□May□1□	21.16	□.11	□2.60	1□27.□□	0.0
2□May□1□	20.72	□.2□	□1.70	17□0.15	0.0
□□May□1□	20.□2	7.□1	□5.□0	1□07.□5	0.0
□□May□1□	21.□5	10.60	□□.60	1□5□.16	0.0
5□May□1□	20.07	7.□6	□1.□0	17□□.05	0.0
6□May□1□	1□.□5	7.5□	□□.□0	172□.10	0.0
7□May□1□	1□.77	7.□□	□□.60	1707.□5	0.0
□□May□1□	20.07	□.7□	□1.60	17□□.□6	0.0
□□May□1□	1□.□2	7.6□	□1.□0	1712.77	0.0
10□May□1□	20.7□	7.□0	□5.□0	17□5.0□	0.0
11□May□1□	21.00	□.00	□□.60	1□1□.□□	0.0
12□May□1□	21.0□	□.71	□1.□0	1□21.□2	0.0
1□□May□1□	1□.20	7.□5	□6.□0	165□.2□	0.0
1□□May□1□	17.□1	6.□7	2□.70	15□□.06	0.0
15□May□1□	17.61	7.0□	□1.□0	1521.6□	0.0
16□May□1□	17.57	6.□5	2□.□0	151□.00	0.0
17□May□1□	16.□□	6.□6	2□.00	1□66.□□	0.0
1□□May□1□	16.□7	6.7□	27.00	1□57.5□	0.0
1□□May□1□	1□.27	6.□□	2□.20	157□.□5	0.0
20□May□1□	1□.0□	6.65	□0.10	156□.20	0.0
21□May□1□	17.6□	6.22	27.10	152□.6□	0.0
22□May□1□	17.67	6.6□	27.□0	1526.□0	0.0
2□□May□1□	17.07	7.22	27.□0	1□7□.70	0.0
2□□May□1□	16.□1	6.6□	26.70	1□52.□□	0.0
25□May□1□	17.50	6.□6	27.70	1512.□2	0.0
26□May□1□	17.61	5.□2	27.□0	1521.20	0.0
27□May□1□	16.□7	6.01	25.60	1□1□.21	0.0
2□□May□1□	16.20	5.□□	26.60	1□00.0□	0.0
2□□May□1□	16.□2	6.□5	2□.00	1□0□.□□	0.0
□0□May□1□	16.1□	5.□2	27.10	1□□□.□□	0.0
□1□May□1□	16.27	6.1□	26.20	1□05.□7	0.0

Statistics

Total Flow (m□□	Min Flow (l□s□	Max Flow (l□s□	Total Rain (mm□
□□662.570	5.□20	□6.□00	0.0

FIELD MAINTENANCE RECORD

NAME□	City of Prince George, BC
SFE SITE #□	□1□E □□M□ □□□□2C
ADDRESS□	□6□1 □iebe Road
GPS□	5□.□□□55 122.77□□7
SENSOR TYPE□	A□
PRIMARY DEVICE□	750mm A□

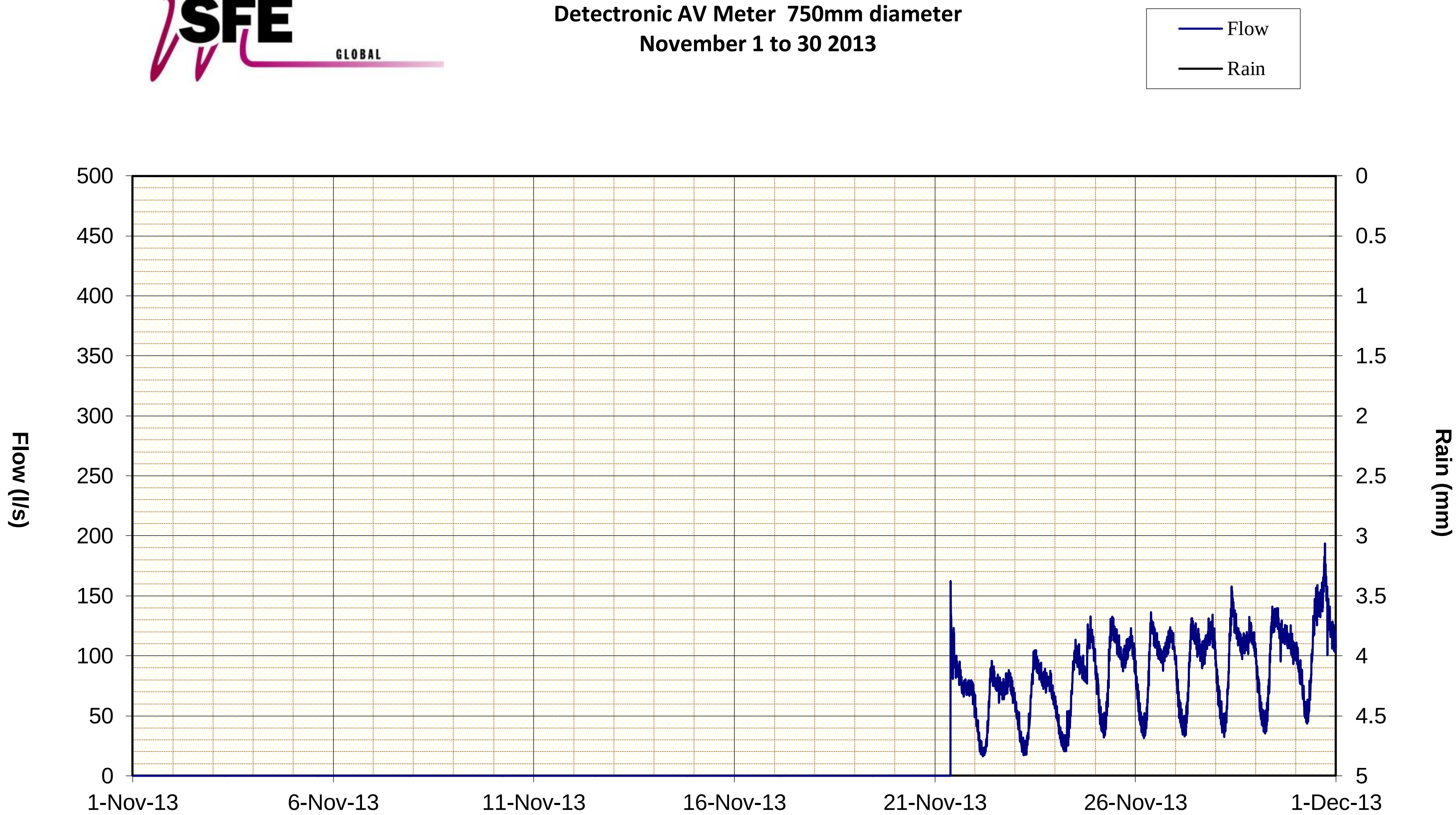
CONSTANTS			
D1 □cm□:		D1 □lip to □□bar	
TOM □cm□:	516.000	Raw □ eir L □□bar to water	
METER □	657□	DATE:	11□21□1□
METER □	207□01065	DATE:	11□21□1□
METER □		DATE:	

LEGEND	
DL □DO□ NLOAD	**PC** □PROGRAM COMPLETE
CB □C□G BATTERY	**PM** □PROG. METER
V □□ERIFY	**VIS** □□IS□AL
LA □LE□EL AD□□ST	**VP** □□ELOCITY PROFILE
DO □DEPT□ ONLY	**CD** □C□G DESICCANT

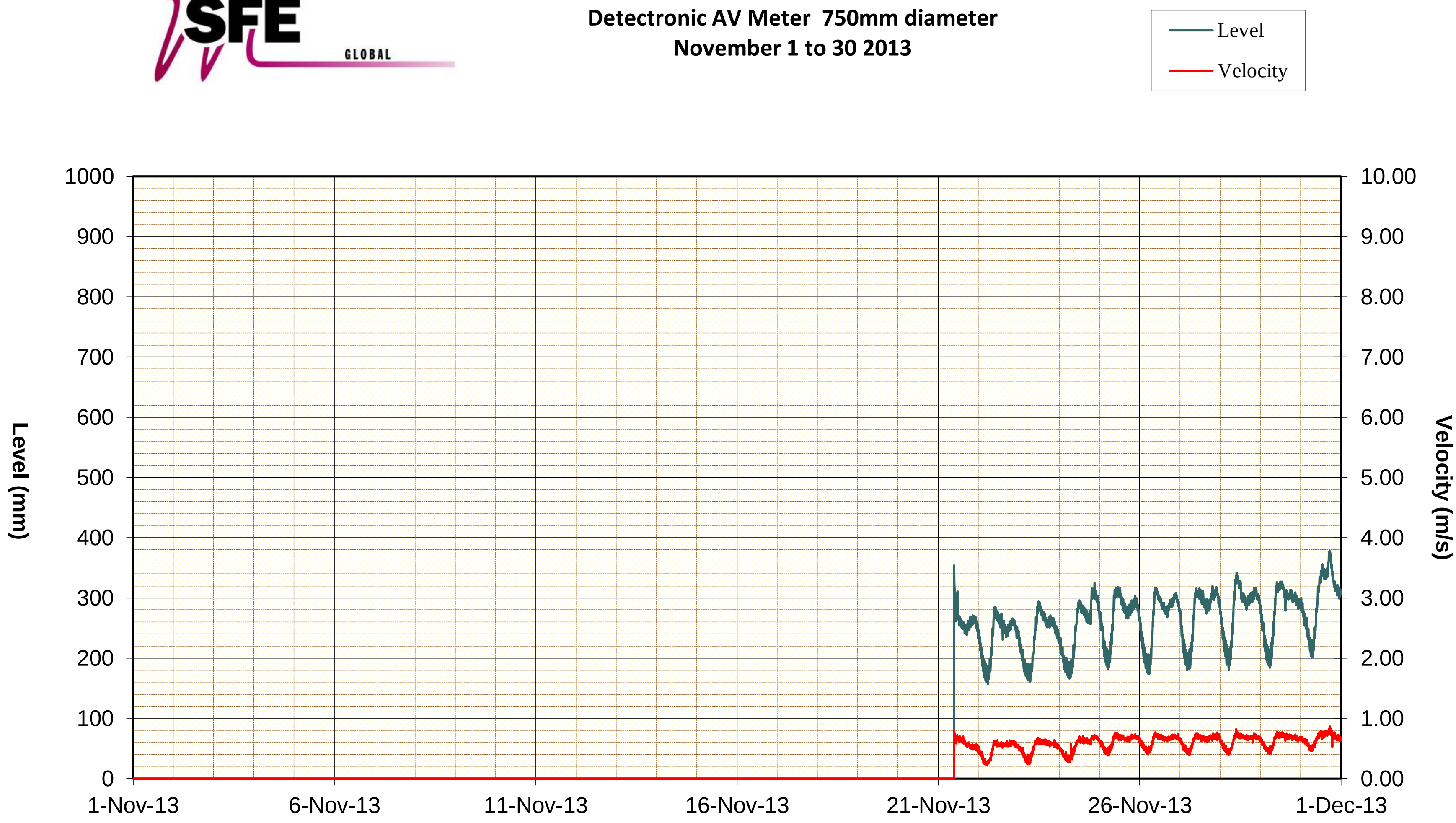
DATE	TIME	METER TIME	METER DEPT□	FIELD DEPT□	METER □EL	FIELD □EL□□IS	FLO□	BATT	SILT	MTC BY	COMMENTS
M□D□YY	□□:MM	□□:MM	cm	cm	M□S	M□S	LPS	□	cm	□INIT.□	
11□21□1□	□:□6	□:□5	□□.5	□□	0.76	0.□7	□	12.2	0	□□	installed meter 657□ and b□u
11□22□1□	12:□5	12:□5	26	26.5	0.57	□	□	12.2	0	□□	downloaded□pus□ed data□all O□
12□10□1□	1□:00	12:57	□0.5	□1	0.6□	□	□	12.1	0	□□	DL O□
01□0□1□	10:55	10:55	□0	2□.5	0.7	□	□	12.1	0	□□	DL O□
01□22□1□	10:57	10:5□	□0.□	□0.5	0.6□	□	□	11.□	0	□□	DL sensor cleared
02□12□1□	1□:50	1□:50	□0.□	□0.5	0.66	□	□	11.6	0	□□	DL sensor clear
0□01□1□	1□:□□	1□:□□	□1.□□		0.65	□	11□	11.5	0	GC	remote data download
0□12□1□	1□:□5	12:□5	□□	□□	0.7□	□	175	11.5	0	□□	DL sensor clear
0□0□1□	11:56	10:56	□5.□	□5	0.7□	□	1□□	12.1	0	□□	DL sensor clear
0□26□1□	12:□□	11:□□	□□.1	□□	0.66	□	□	11.□	0	□□	DL sensor cleared of minor debris
05□1□1□	12:05	11:0□	□□.□	□□.5	0.6□	□	□	11.□	0	□□	DL sensor cleared of minor debris
06□0□1□	10:10	□:0□	□□.□	□□	0.7□	0.75	25□	11.5	0	□□	Removed meter

DATE□	**NOTES□**

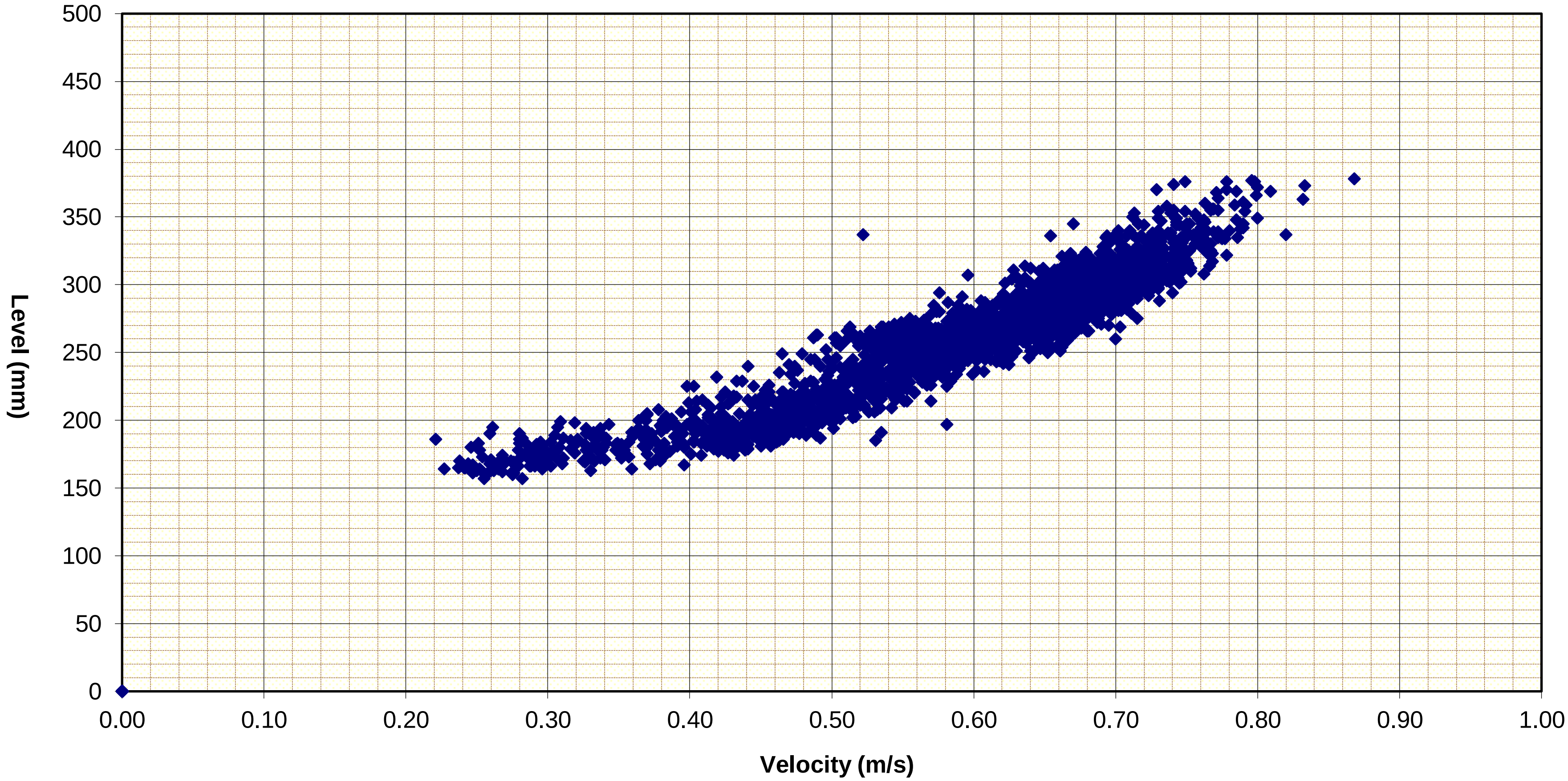
City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
November 1 to 30 2013



City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
November 1 to 30 2013



City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
November 1 to 30 2013



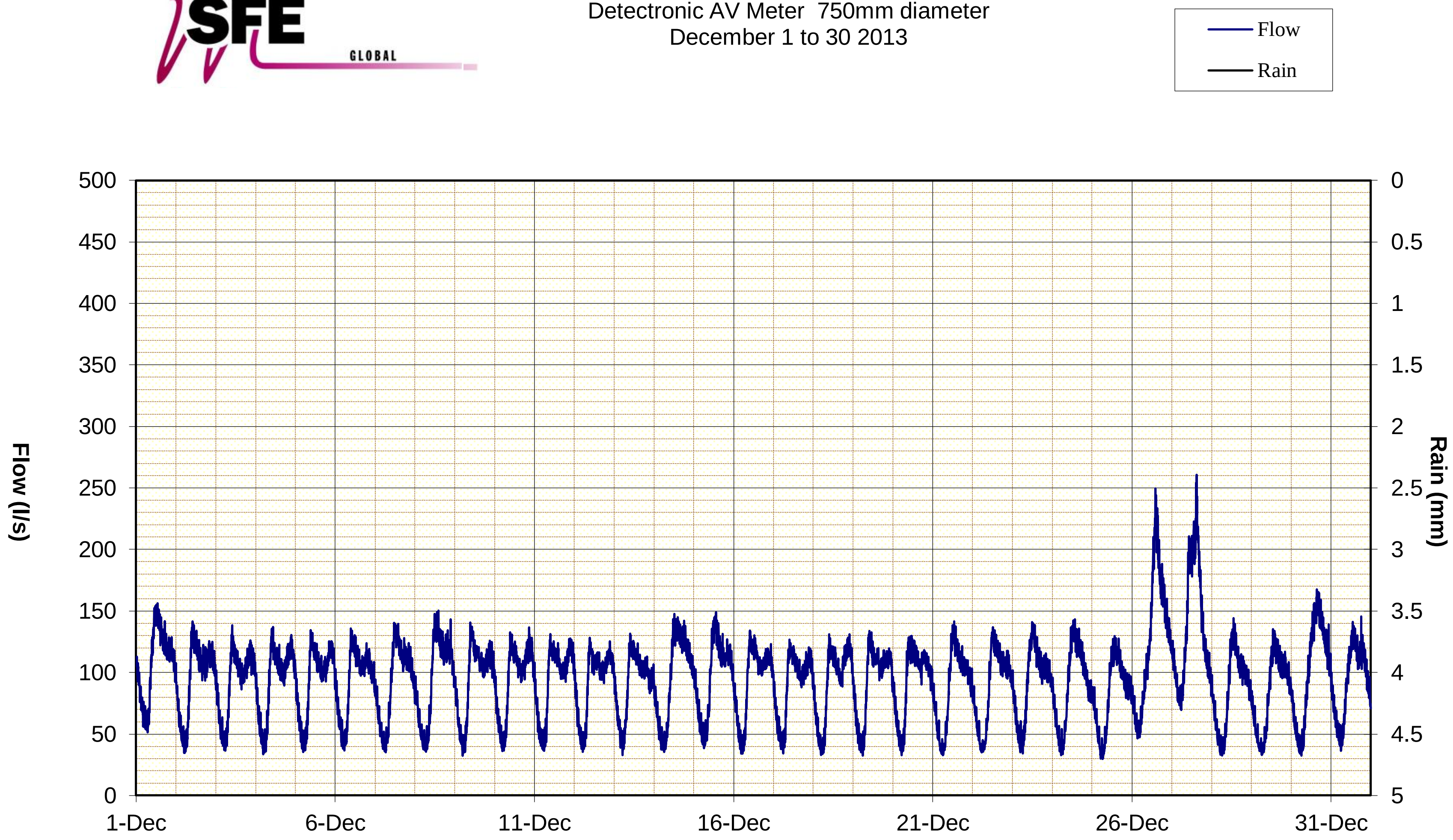
City of Prince George, BC
Site #414E - Site 3 MH #HH32C
Detectronic AV - 750mm Dia
3641 Wiebe Road
November 1 to 30 2013

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Nov-13	0.00	0.00	0.00	0.00	0.0
02-Nov-13	0.00	0.00	0.00	0.00	0.0
03-Nov-13	0.00	0.00	0.00	0.00	0.0
04-Nov-13	0.00	0.00	0.00	0.00	0.0
05-Nov-13	0.00	0.00	0.00	0.00	0.0
06-Nov-13	0.00	0.00	0.00	0.00	0.0
07-Nov-13	0.00	0.00	0.00	0.00	0.0
08-Nov-13	0.00	0.00	0.00	0.00	0.0
09-Nov-13	0.00	0.00	0.00	0.00	0.0
10-Nov-13	0.00	0.00	0.00	0.00	0.0
11-Nov-13	0.00	0.00	0.00	0.00	0.0
12-Nov-13	0.00	0.00	0.00	0.00	0.0
13-Nov-13	0.00	0.00	0.00	0.00	0.0
14-Nov-13	0.00	0.00	0.00	0.00	0.0
15-Nov-13	0.00	0.00	0.00	0.00	0.0
16-Nov-13	0.00	0.00	0.00	0.00	0.0
17-Nov-13	0.00	0.00	0.00	0.00	0.0
18-Nov-13	0.00	0.00	0.00	0.00	0.0
19-Nov-13	0.00	0.00	0.00	0.00	0.0
20-Nov-13	0.00	0.00	0.00	0.00	0.0
21-Nov-13	49.80	0.00	162.28	4303.04	0.0
22-Nov-13	60.47	16.22	95.82	5224.41	0.0
23-Nov-13	63.23	17.08	104.72	5463.36	0.0
24-Nov-13	73.50	20.40	132.86	6350.27	0.0
25-Nov-13	90.68	31.88	132.64	7834.61	0.0
26-Nov-13	91.05	31.42	136.37	7866.97	0.0
27-Nov-13	93.65	32.80	134.32	8091.41	0.0
28-Nov-13	98.36	32.29	157.80	8498.49	0.0
29-Nov-13	97.55	35.24	141.03	8428.32	0.0
30-Nov-13	111.47	43.43	193.69	9631.04	0.0

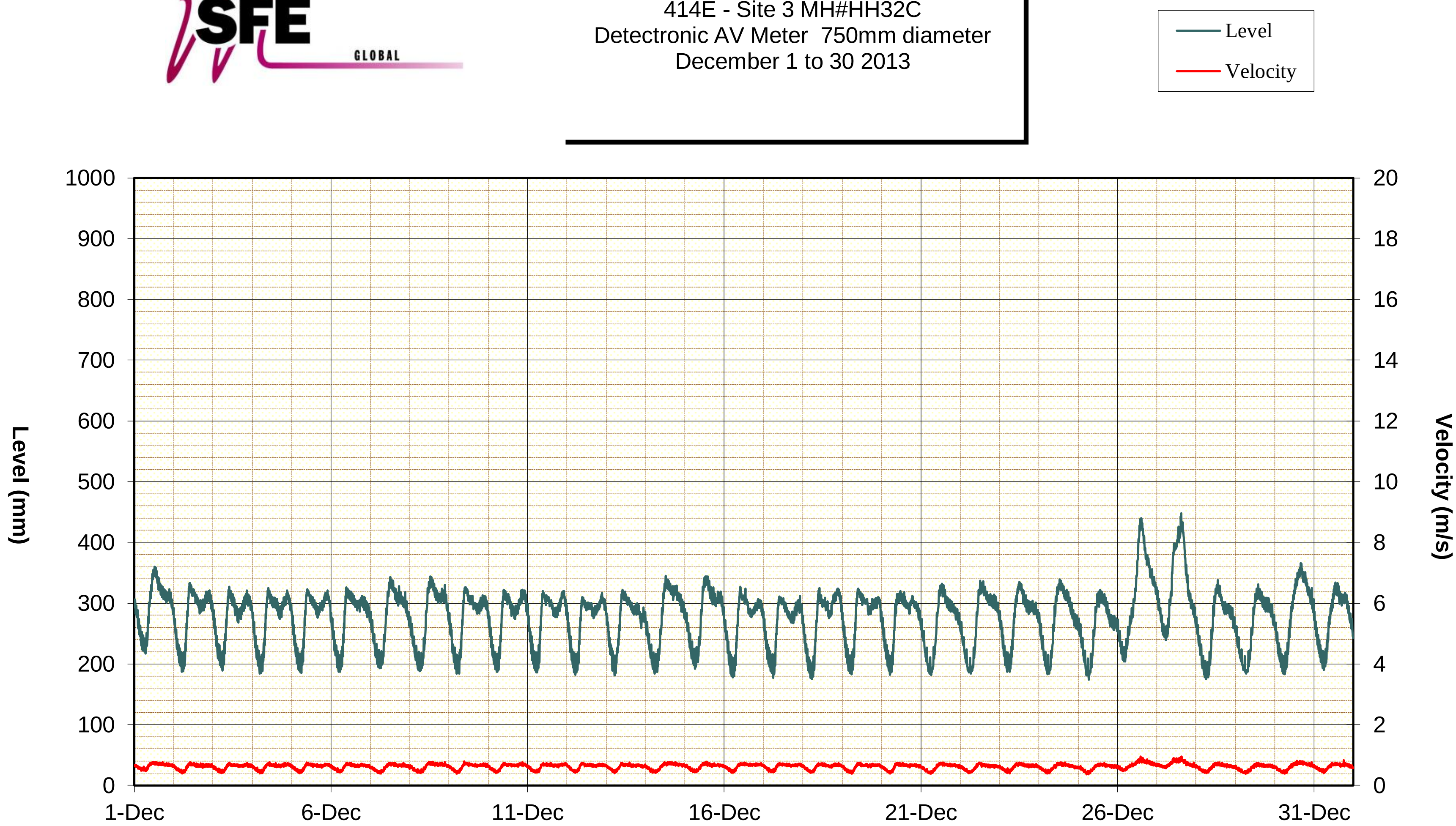
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
71691.924	16.218	193.688	0.0

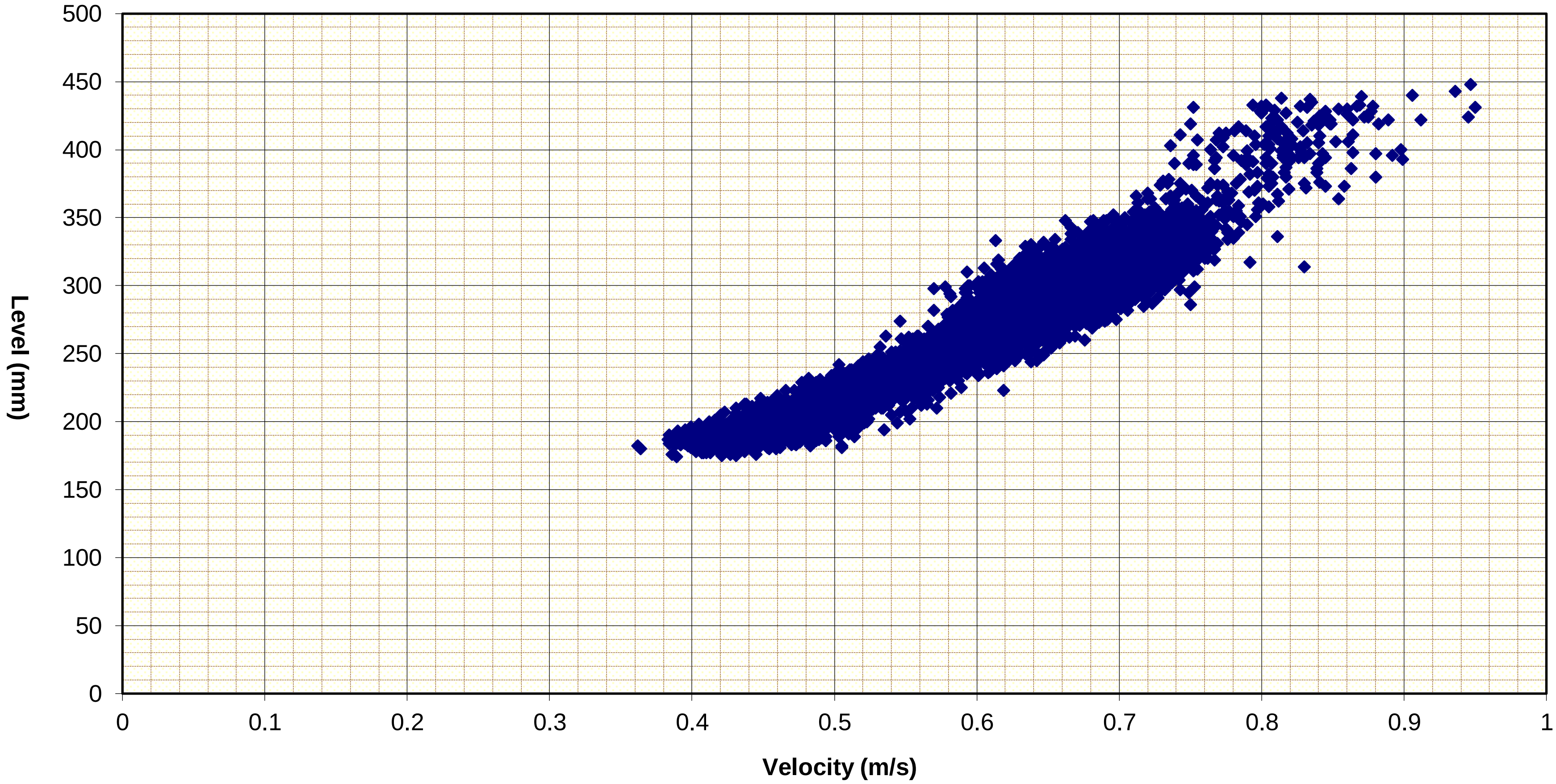
City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
December 1 to 30 2013



City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
December 1 to 30 2013



CCity of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
December 1 to 30 2013



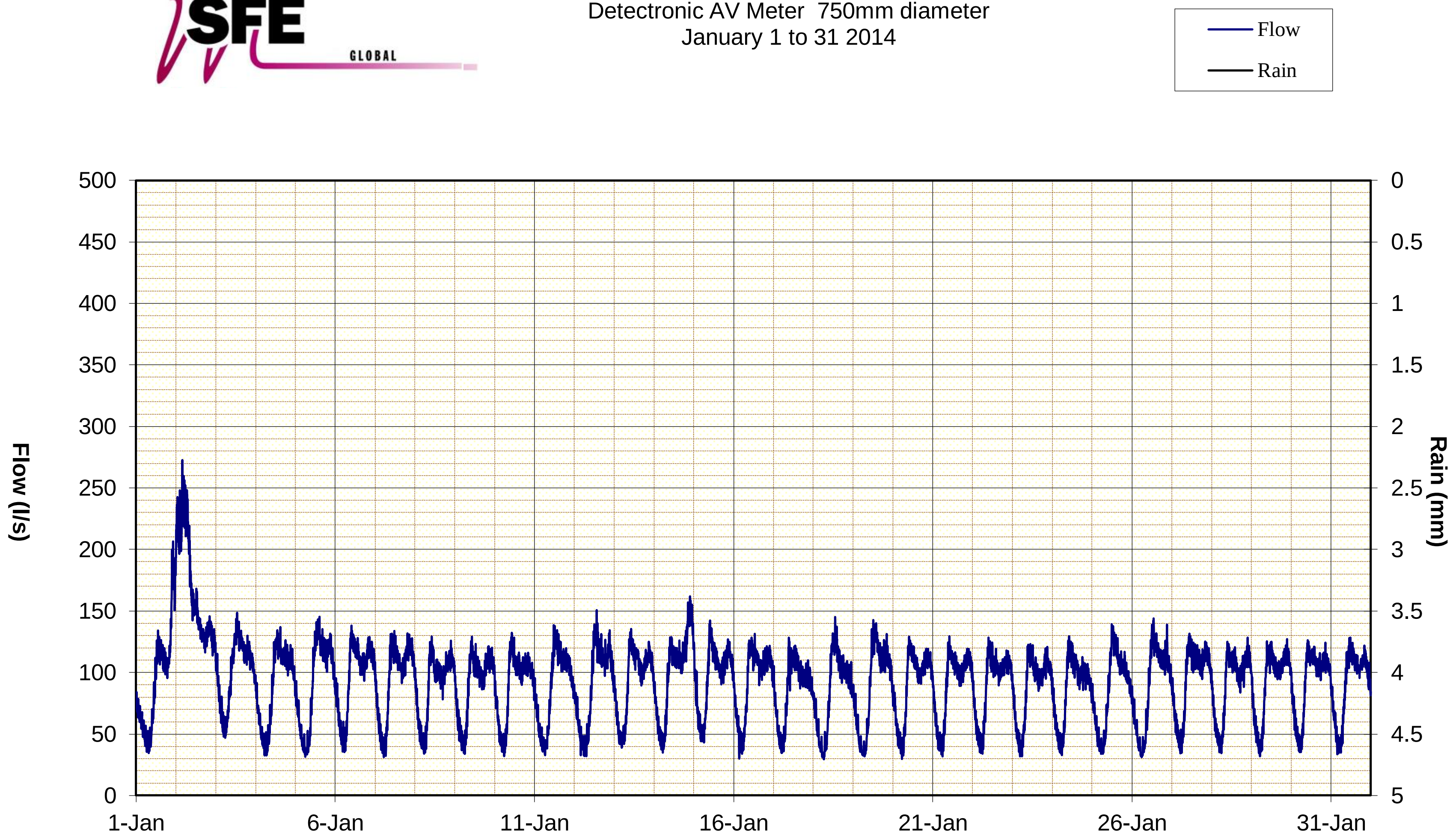
City of Prince George, BC
Site #414E - Site 3 MH #HH32C
Detectronic AV - 750mm Dia
3641 Wiebe Road
December 1 to 31 2013

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Dec-13	107.84	51.31	156.26	9317.59	0.0
02-Dec-13	94.16	34.58	141.53	8135.03	0.0
03-Dec-13	91.88	36.42	138.37	7938.72	0.0
04-Dec-13	92.89	33.48	137.00	8025.48	0.0
05-Dec-13	93.41	35.29	134.45	8071.03	0.0
06-Dec-13	92.55	36.57	135.79	7996.21	0.0
07-Dec-13	91.21	35.08	140.37	7880.89	0.0
08-Dec-13	94.50	35.55	150.30	8164.69	0.0
09-Dec-13	93.55	32.30	140.63	8082.35	0.0
10-Dec-13	93.63	36.08	136.64	8089.37	0.0
11-Dec-13	93.59	36.29	131.22	8086.04	0.0
12-Dec-13	92.12	35.44	128.26	7958.92	0.0
13-Dec-13	90.84	32.79	131.59	7848.83	0.0
14-Dec-13	95.49	35.37	147.62	8250.54	0.0
15-Dec-13	95.77	38.40	148.94	8274.15	0.0
16-Dec-13	93.23	34.00	134.12	8055.21	0.0
17-Dec-13	89.54	34.16	126.73	7736.45	0.0
18-Dec-13	91.06	32.88	131.07	7867.50	0.0
19-Dec-13	92.30	32.38	133.78	7975.12	0.0
20-Dec-13	91.86	32.72	129.79	7936.52	0.0
21-Dec-13	87.34	32.71	141.54	7545.88	0.0
22-Dec-13	87.88	35.02	136.83	7592.69	0.0
23-Dec-13	91.01	34.16	140.97	7863.31	0.0
24-Dec-13	88.96	32.72	143.22	7685.83	0.0
25-Dec-13	81.31	29.68	129.63	7024.80	0.0
26-Dec-13	127.27	46.45	249.60	10996.19	0.0
27-Dec-13	136.73	69.50	260.71	11813.72	0.0
28-Dec-13	84.70	32.48	144.16	7317.80	0.0
29-Dec-13	82.61	32.96	135.24	7137.90	0.0
30-Dec-13	99.71	32.38	167.56	8615.30	0.0
31-Dec-13	91.24	36.34	145.54	7883.09	0.0

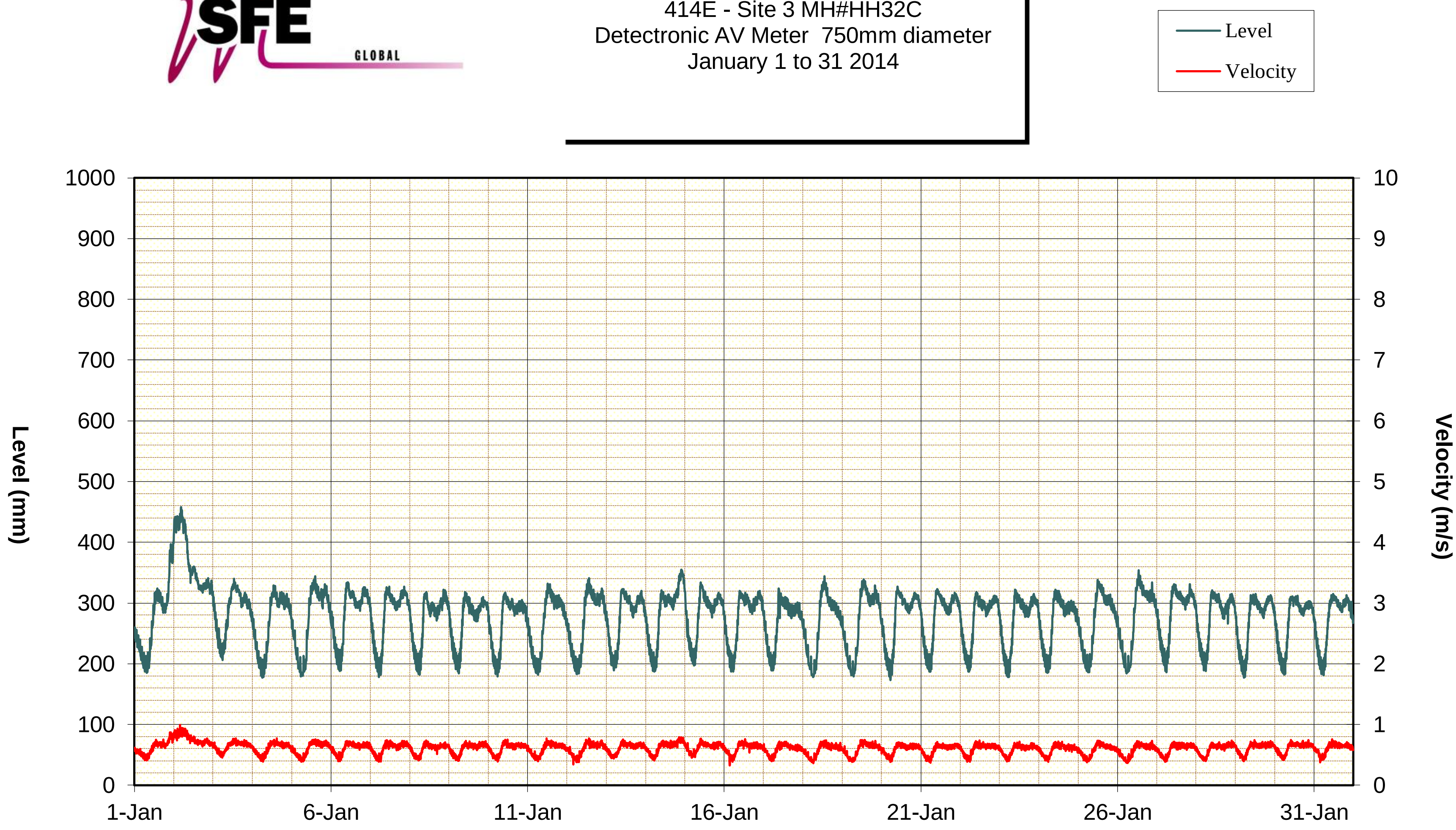
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
253167.140	29.677	260.705	0.0

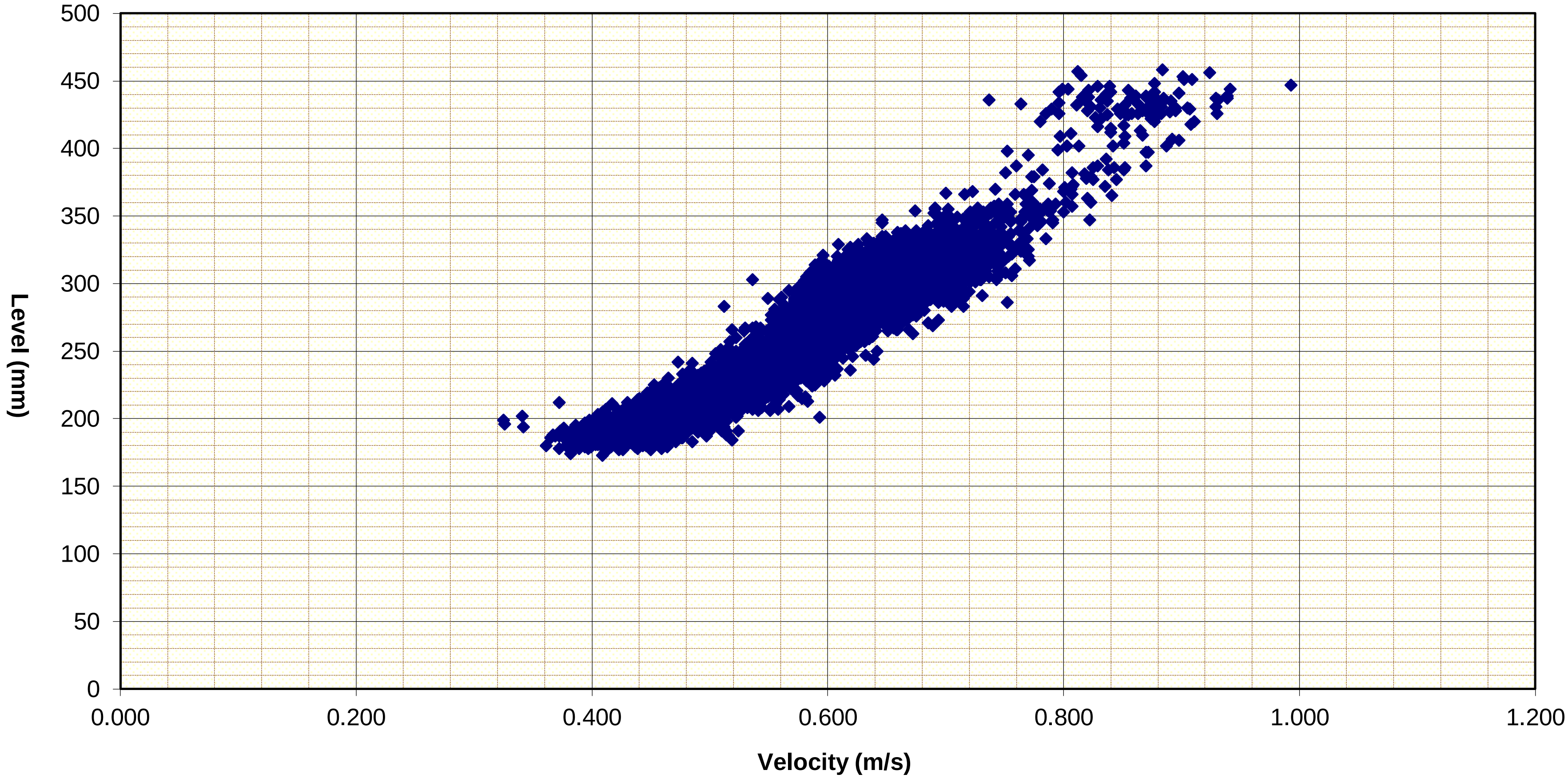
City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
January 1 to 31 2014



City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
January 1 to 31 2014



CCity of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
January 1 to 31 2014



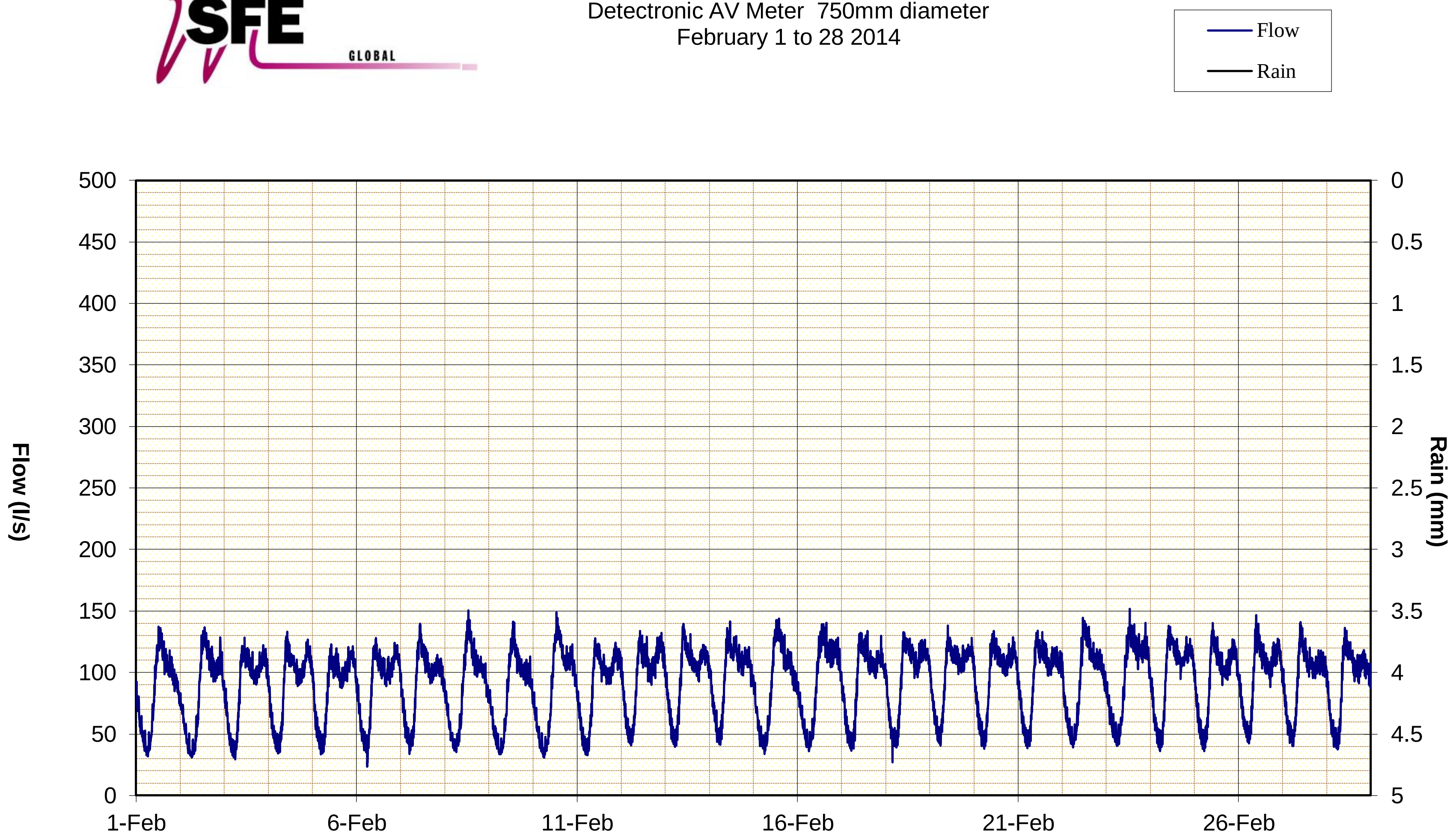
City of Prince George, BC
Site #414E - Site 3 MH #HH32C
Detectronic AV - 750mm Dia
3641 Wiebe Road
January 1 to 31 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Jan-14	93.85	34.49	206.52	8108.68	0.0
02-Jan-14	169.41	109.24	272.64	14637.08	0.0
03-Jan-14	100.99	46.89	148.54	8725.78	0.0
04-Jan-14	87.99	32.53	136.90	7602.26	0.0
05-Jan-14	90.87	31.47	145.29	7850.77	0.0
06-Jan-14	96.09	35.28	138.12	8301.97	0.0
07-Jan-14	93.88	31.22	133.75	8111.18	0.0
08-Jan-14	89.35	33.97	129.23	7720.12	0.0
09-Jan-14	89.20	33.81	129.08	7706.96	0.0
10-Jan-14	89.12	31.97	132.27	7699.78	0.0
11-Jan-14	86.46	32.71	138.44	7469.99	0.0
12-Jan-14	88.72	31.96	150.68	7665.61	0.0
13-Jan-14	93.22	38.83	135.38	8054.19	0.0
14-Jan-14	99.49	34.85	161.87	8595.58	0.0
15-Jan-14	96.87	43.08	142.27	8369.18	0.0
16-Jan-14	92.24	29.97	131.40	7969.71	0.0
17-Jan-14	85.72	34.59	128.30	7405.90	0.0
18-Jan-14	83.73	29.43	145.09	7234.37	0.0
19-Jan-14	87.27	31.80	142.62	7539.77	0.0
20-Jan-14	89.17	29.69	129.12	7704.17	0.0
21-Jan-14	89.19	31.75	129.42	7706.45	0.0
22-Jan-14	89.72	33.97	128.38	7752.02	0.0
23-Jan-14	87.32	31.80	123.09	7544.51	0.0
24-Jan-14	86.02	32.79	129.43	7431.86	0.0
25-Jan-14	84.96	33.83	139.23	7340.12	0.0
26-Jan-14	87.34	31.17	143.94	7546.24	0.0
27-Jan-14	93.11	34.29	131.57	8044.40	0.0
28-Jan-14	89.85	34.42	128.34	7762.90	0.0
29-Jan-14	90.71	31.87	127.11	7837.31	0.0
30-Jan-14	90.57	35.26	126.23	7824.91	0.0
31-Jan-14	89.95	33.49	128.37	7771.92	0.0

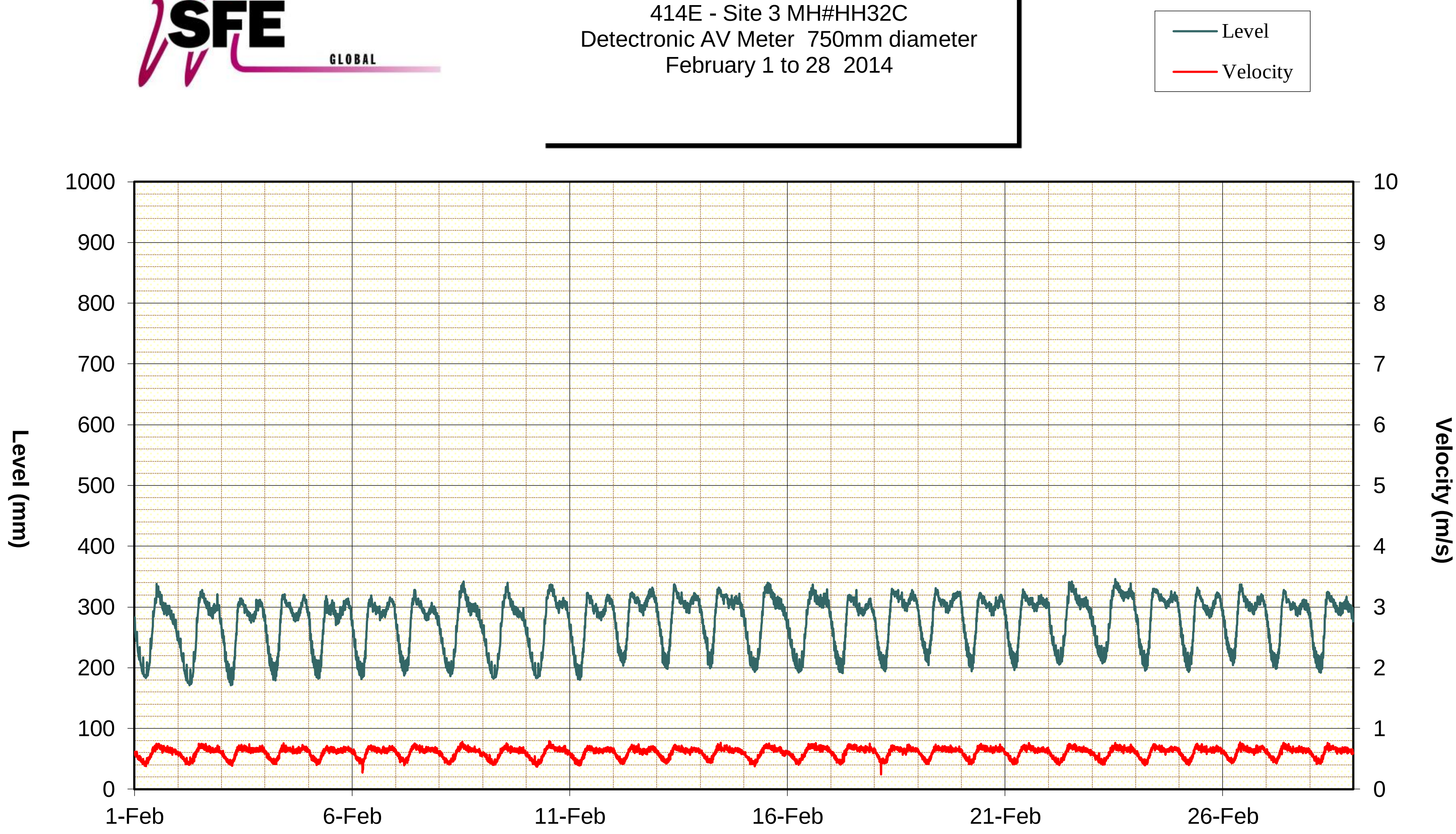
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
249035.700	29.433	272.638	0.0

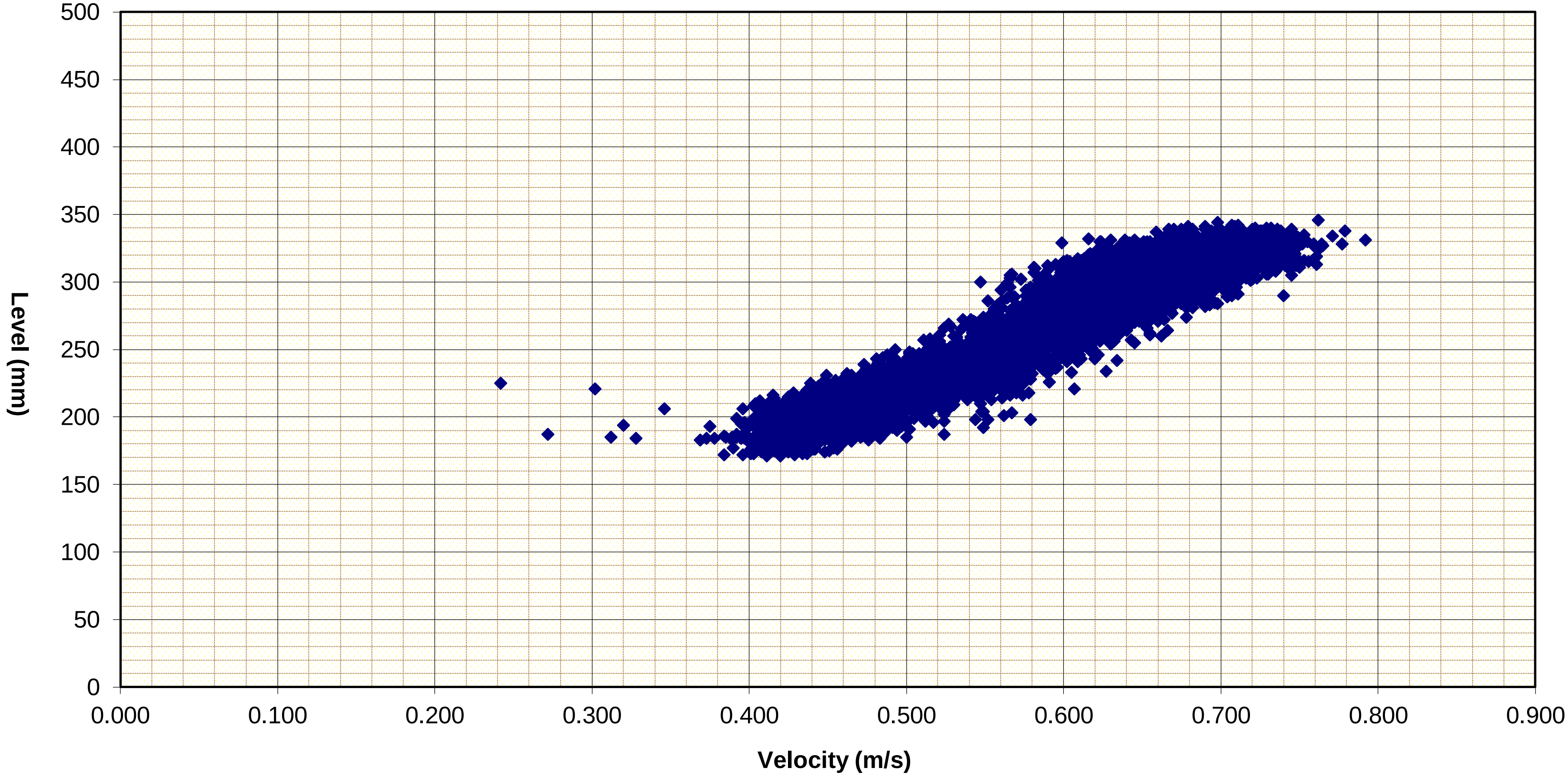
City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
February 1 to 28 2014



City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
February 1 to 28 2014



CCity of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
February 1 to 28 2014



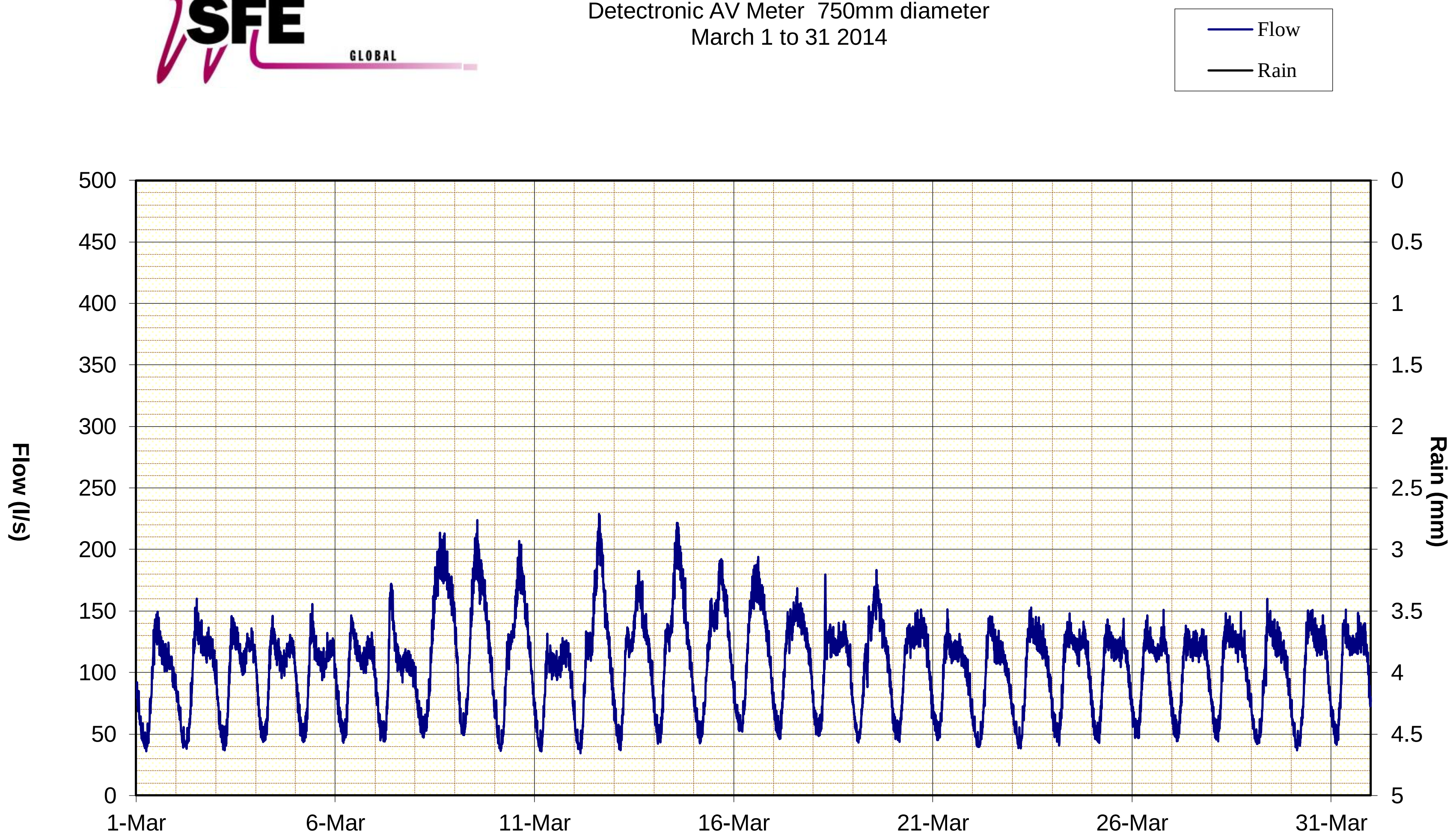
City of Prince George, BC
Site #414E - Site 3 MH #HH32C
Detectronic AV - 750mm Dia
3641 Wiebe Road
February 1 to 28 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Feb-14	84.26	31.79	137.26	7279.69	0.0
02-Feb-14	84.41	30.91	136.71	7292.68	0.0
03-Feb-14	87.65	29.36	128.35	7573.08	0.0
04-Feb-14	89.64	34.18	133.12	7744.68	0.0
05-Feb-14	87.69	33.39	122.91	7576.37	0.0
06-Feb-14	89.79	23.40	128.03	7757.82	0.0
07-Feb-14	90.51	33.73	139.67	7819.88	0.0
08-Feb-14	87.13	35.27	150.49	7527.79	0.0
09-Feb-14	84.01	33.47	141.35	7258.09	0.0
10-Feb-14	87.26	30.80	148.87	7539.12	0.0
11-Feb-14	89.07	32.69	127.84	7695.55	0.0
12-Feb-14	95.79	40.73	133.78	8276.39	0.0
13-Feb-14	96.06	39.54	139.52	8299.36	0.0
14-Feb-14	97.08	41.24	141.52	8387.96	0.0
15-Feb-14	90.51	33.74	143.79	7820.16	0.0
16-Feb-14	92.00	35.98	140.41	7948.41	0.0
17-Feb-14	93.57	36.34	133.76	8084.81	0.0
18-Feb-14	95.87	26.98	132.77	8283.15	0.0
19-Feb-14	97.65	40.44	138.16	8436.94	0.0
20-Feb-14	94.97	37.97	133.75	8205.30	0.0
21-Feb-14	94.86	38.41	133.96	8196.14	0.0
22-Feb-14	92.93	39.04	144.48	8028.93	0.0
23-Feb-14	95.74	40.27	151.76	8271.55	0.0
24-Feb-14	97.23	36.05	138.00	8400.41	0.0
25-Feb-14	94.30	36.05	140.23	8147.57	0.0
26-Feb-14	97.13	42.30	146.65	8391.95	0.0
27-Feb-14	94.54	40.19	140.97	8168.47	0.0
28-Feb-14	91.85	37.42	136.26	7935.56	0.0

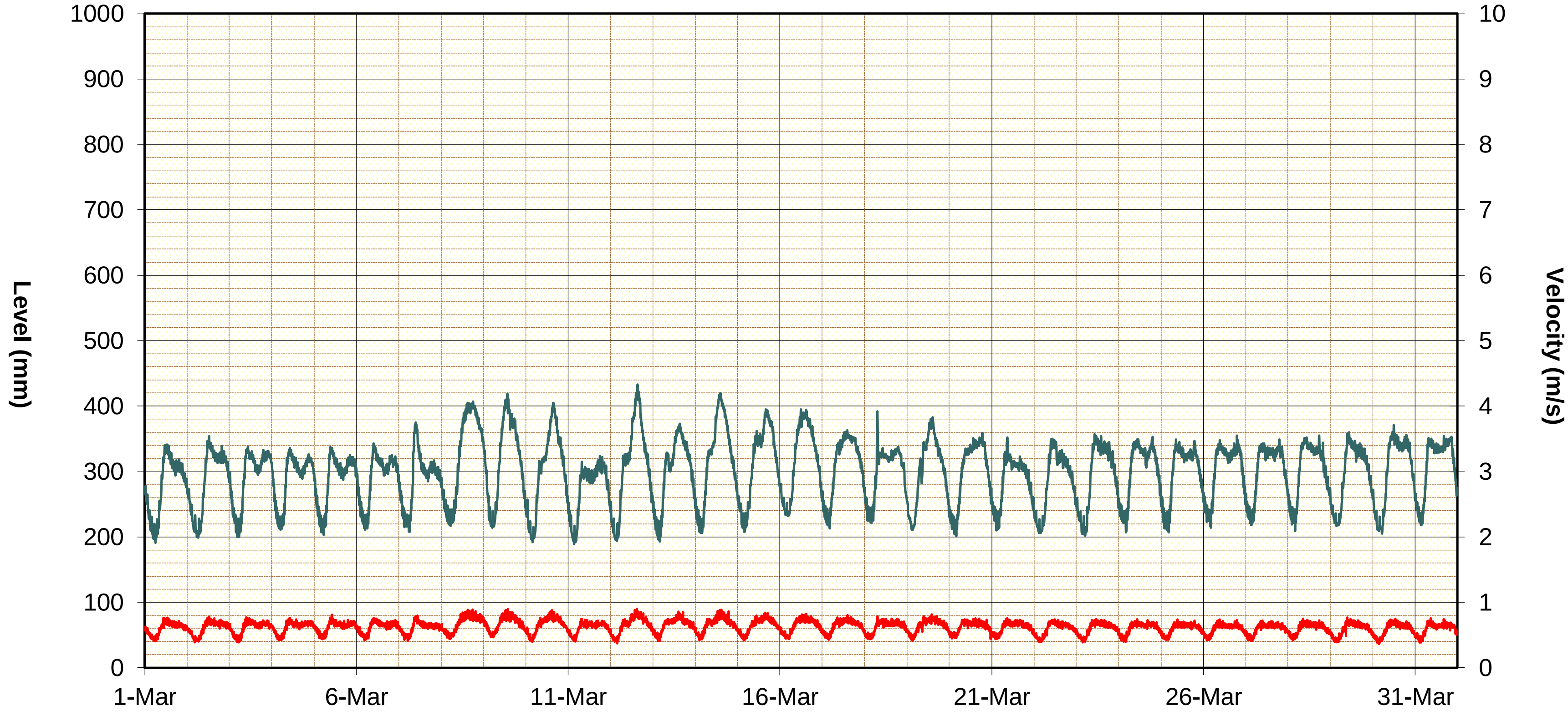
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
222347.804	23.404	151.764	0.0

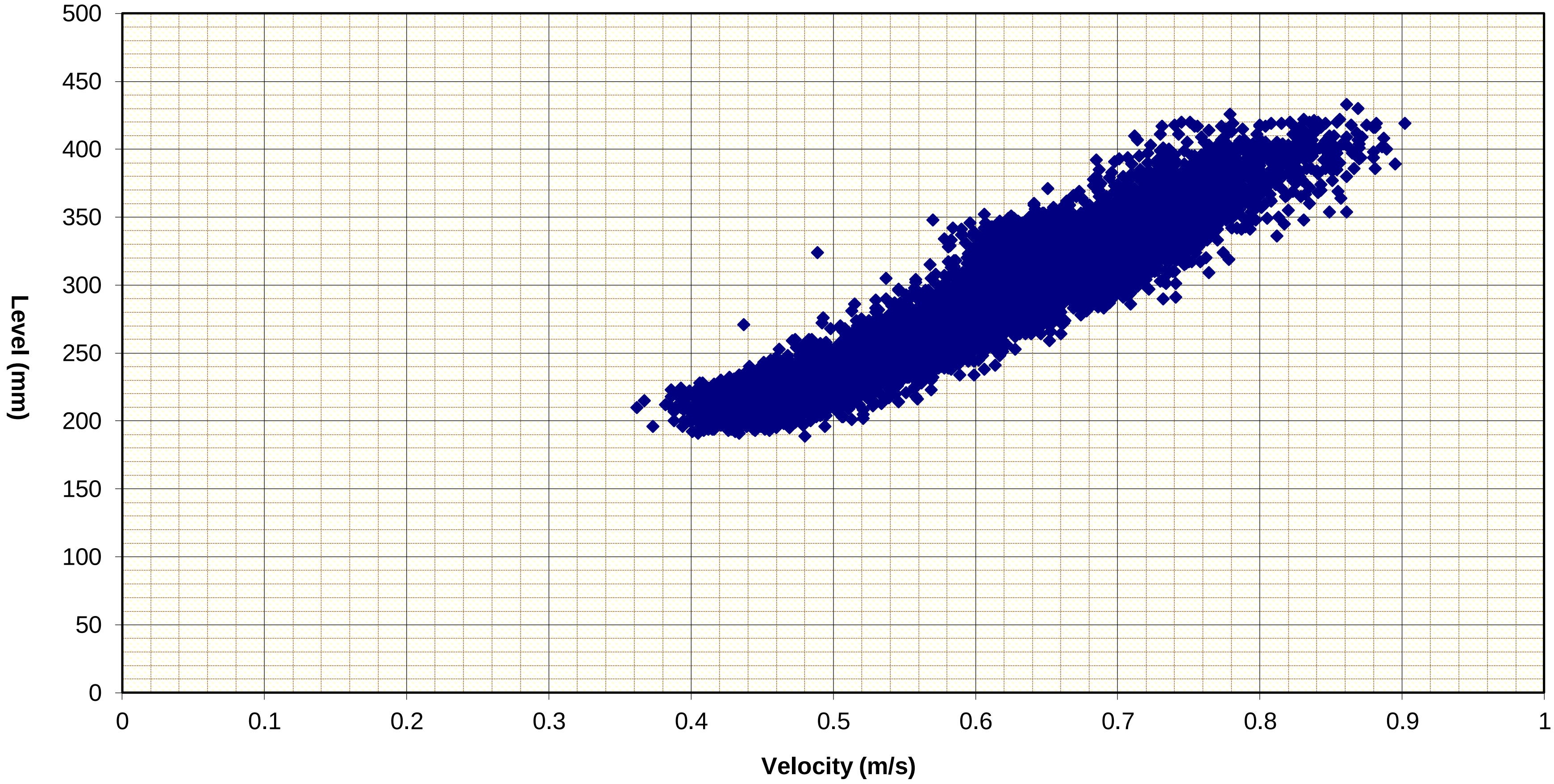
City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
March 1 to 31 2014



City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
March 1 to 31 2014



CCity of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
March 1 to 31 2014



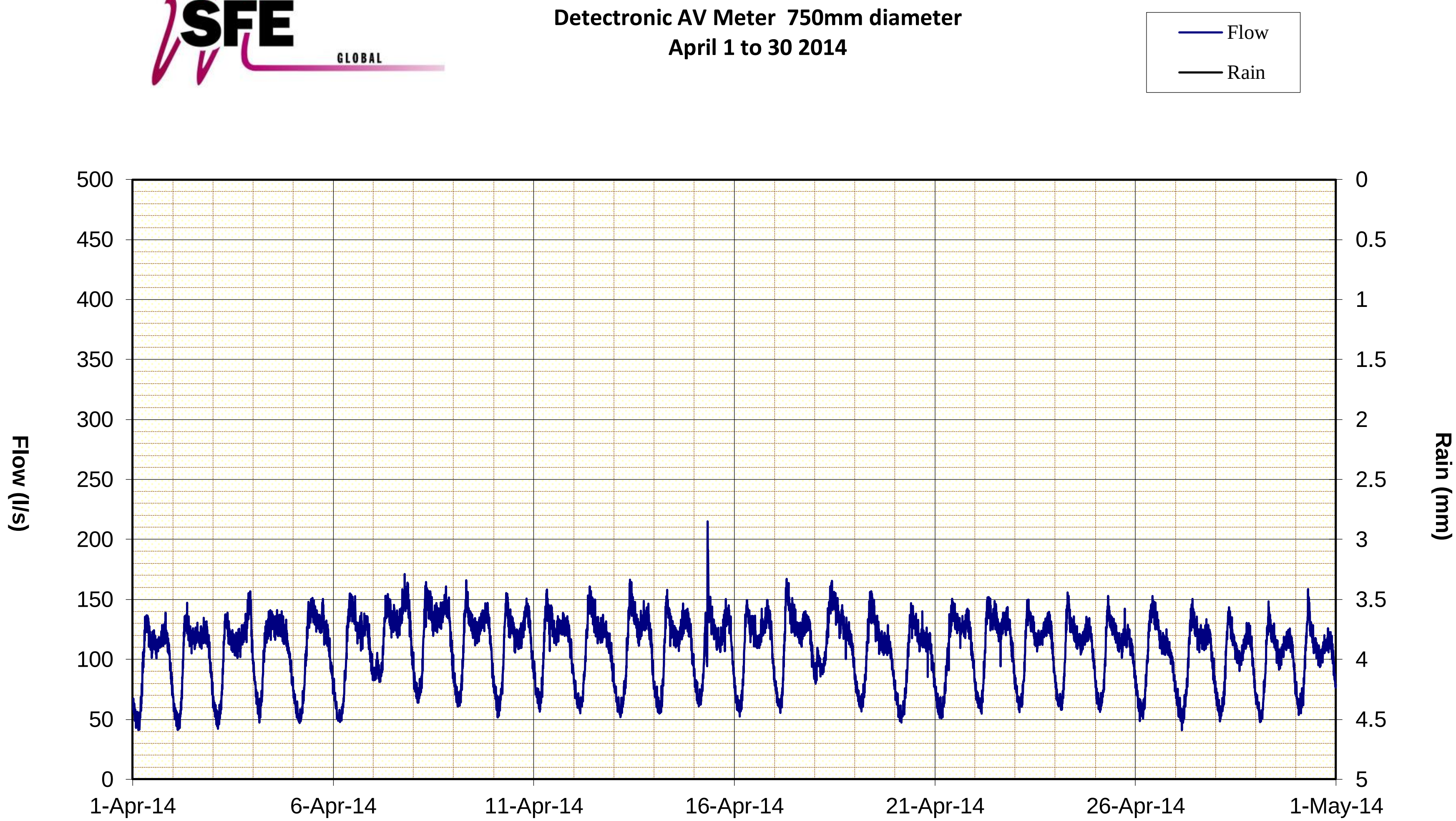
City of Prince George, BC
Site #414E - Site 3 MH #HH32C
Detectronic AV - 750mm Dia
3641 Wiebe Road
March 1 to 31 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Mar-14	92.74	35.90	149.50	8012.97	0.0
02-Mar-14	96.60	37.93	160.02	8346.34	0.0
03-Mar-14	100.37	36.70	145.88	8672.27	0.0
04-Mar-14	99.81	43.51	146.07	8623.81	0.0
05-Mar-14	99.74	43.37	155.66	8617.44	0.0
06-Mar-14	100.71	42.81	146.42	8701.01	0.0
07-Mar-14	99.55	43.86	172.15	8601.01	0.0
08-Mar-14	130.18	47.05	213.64	11247.74	0.0
09-Mar-14	126.30	49.08	223.87	10912.75	0.0
10-Mar-14	115.28	36.22	206.92	9960.47	0.0
11-Mar-14	91.86	35.81	131.54	7936.90	0.0
12-Mar-14	120.14	34.29	228.94	10380.23	0.0
13-Mar-14	111.85	36.79	182.57	9664.17	0.0
14-Mar-14	126.22	42.05	221.64	10905.72	0.0
15-Mar-14	117.68	42.36	192.13	10167.50	0.0
16-Mar-14	119.75	51.85	193.99	10346.08	0.0
17-Mar-14	113.54	45.90	168.56	9809.71	0.0
18-Mar-14	106.18	48.33	179.67	9173.79	0.0
19-Mar-14	109.97	42.97	183.31	9501.09	0.0
20-Mar-14	105.89	43.53	151.26	9148.67	0.0
21-Mar-14	97.57	45.05	151.33	8430.07	0.0
22-Mar-14	94.60	39.43	145.76	8173.70	0.0
23-Mar-14	98.49	38.27	152.84	8509.19	0.0
24-Mar-14	103.17	40.57	148.14	8914.14	0.0
25-Mar-14	100.96	42.68	143.74	8723.36	0.0
26-Mar-14	102.31	46.62	150.93	8839.97	0.0
27-Mar-14	101.88	44.06	138.13	8802.09	0.0
28-Mar-14	103.44	43.96	149.07	8936.90	0.0
29-Mar-14	98.36	41.87	159.86	8498.42	0.0
30-Mar-14	100.74	36.66	150.86	8703.96	0.0
31-Mar-14	106.30	41.18	151.13	9184.04	0.0

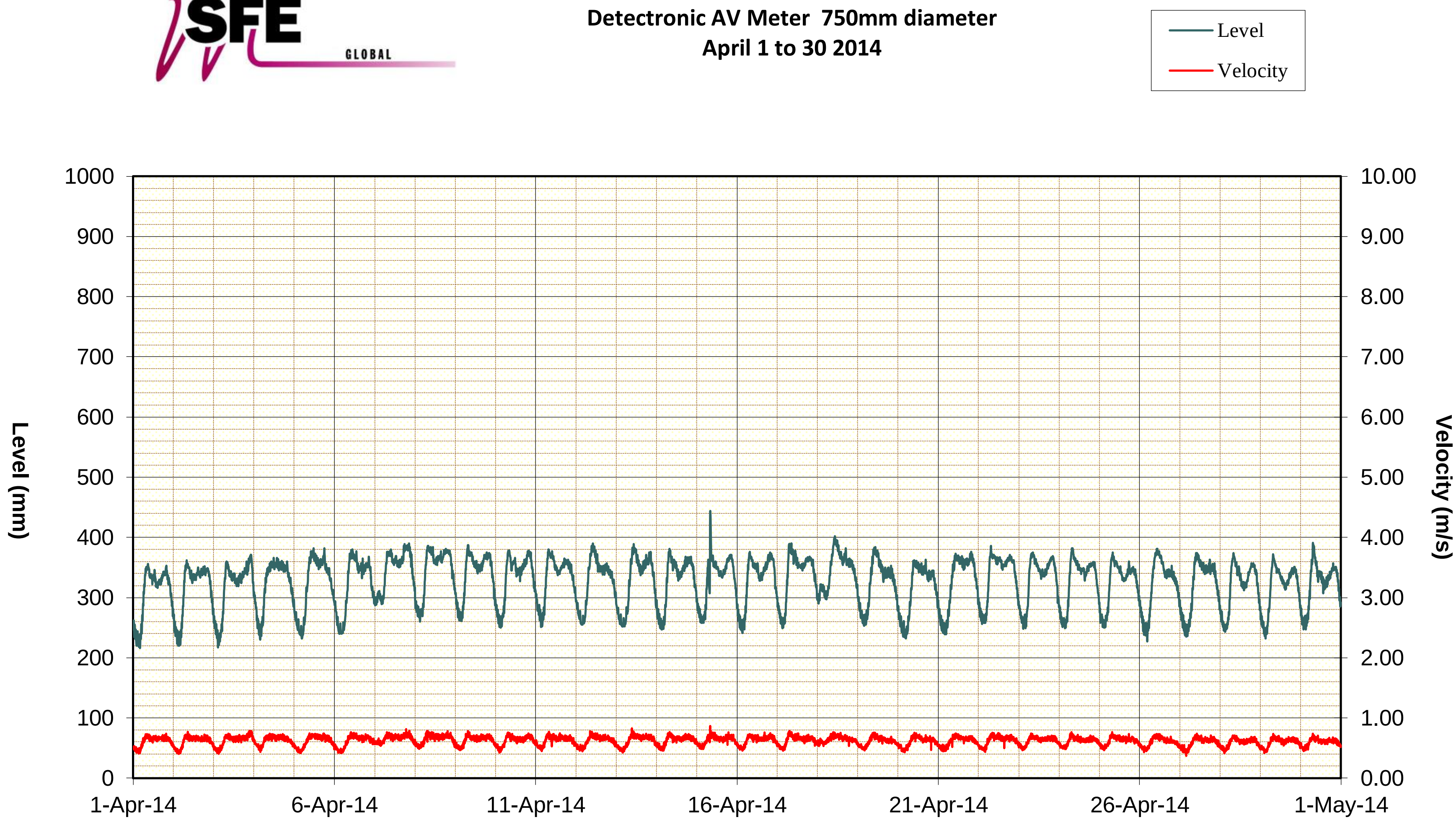
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
284445.502	34.290	228.943	0.0

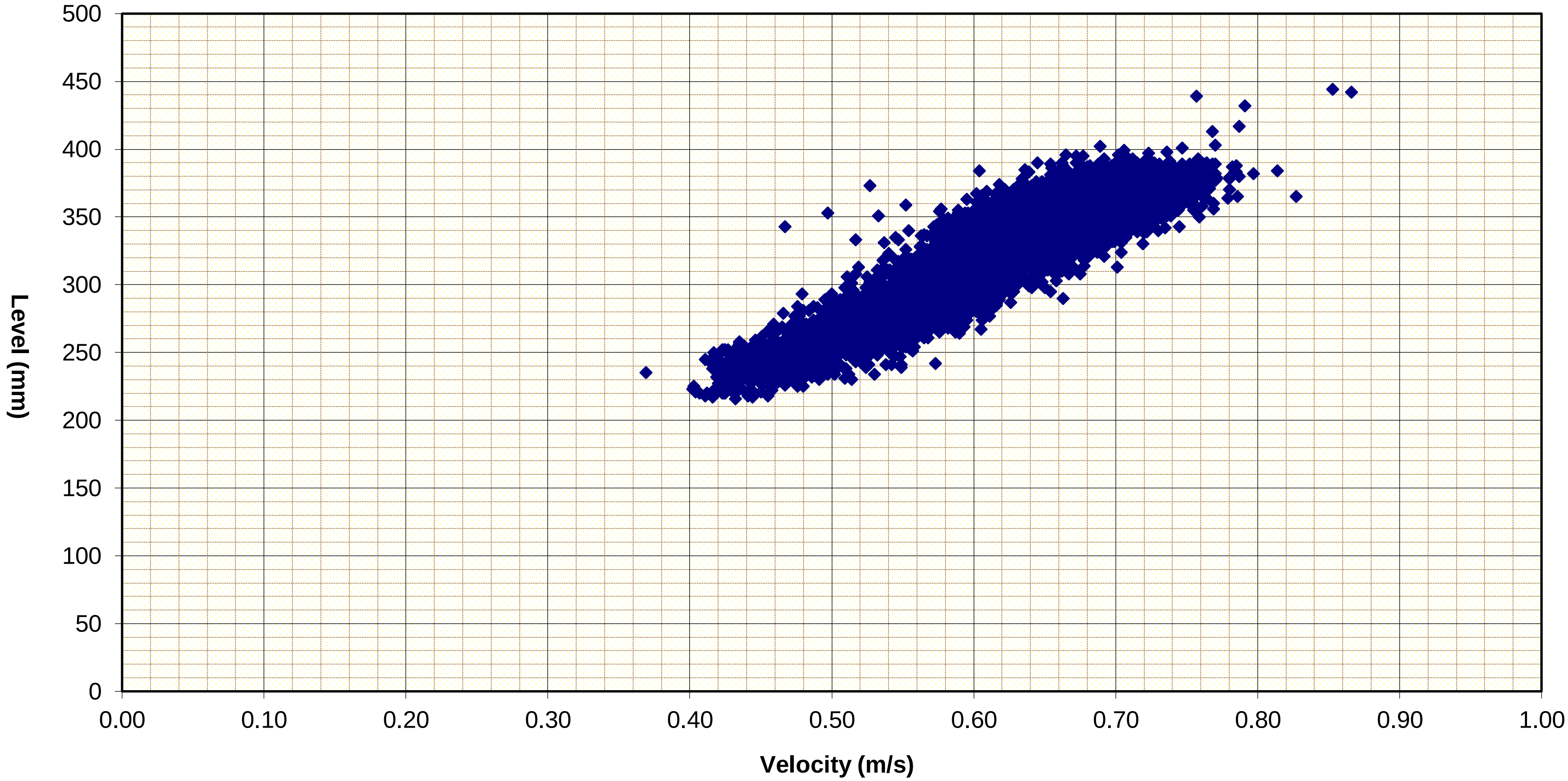
City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
April 1 to 30 2014



City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
April 1 to 30 2014



City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
April 1 to 30 2014



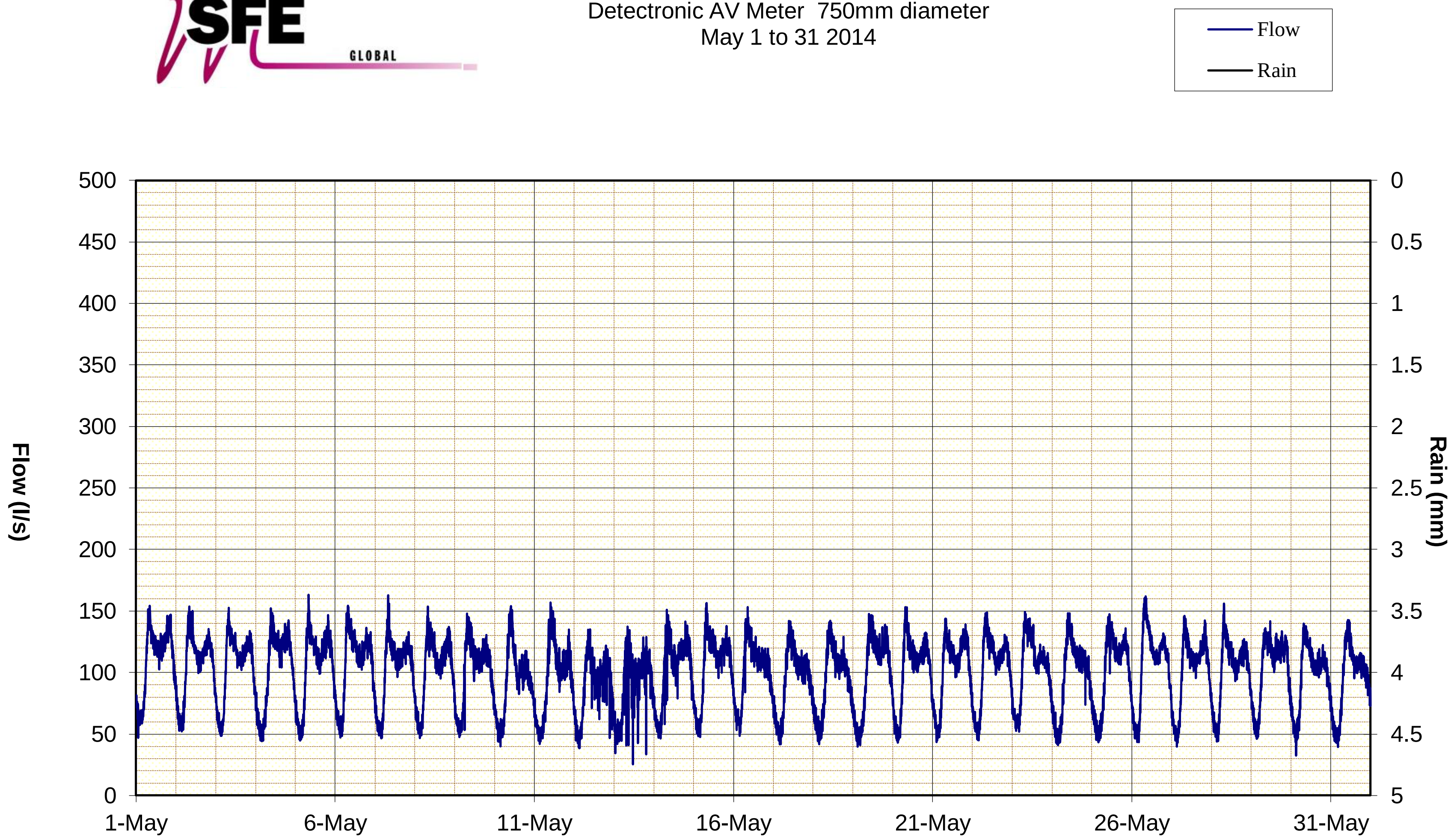
City of Prince George, BC
Site #414E - Site 3 MH #HH32C
Detectronic AV - 750mm Dia
3641 Wiebe Road
April 1 to 30 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Apr-14	99.21	41.09	138.96	8571.59	0.0
02-Apr-14	101.76	41.16	147.19	8791.71	0.0
03-Apr-14	106.32	42.08	156.65	9185.78	0.0
04-Apr-14	107.56	47.26	141.10	9292.91	0.0
05-Apr-14	105.06	46.90	151.23	9077.44	0.0
06-Apr-14	105.37	47.71	154.94	9104.35	0.0
07-Apr-14	124.58	81.13	171.11	10764.04	0.0
08-Apr-14	122.61	63.87	164.49	10593.31	0.0
09-Apr-14	115.16	60.60	165.95	9950.14	0.0
10-Apr-14	111.83	51.62	155.28	9661.92	0.0
11-Apr-14	112.47	56.34	158.25	9717.61	0.0
12-Apr-14	108.97	54.97	160.83	9414.78	0.0
13-Apr-14	109.30	51.78	166.47	9443.36	0.0
14-Apr-14	110.84	54.90	157.95	9576.95	0.0
15-Apr-14	112.73	60.74	215.04	9739.54	0.0
16-Apr-14	111.21	52.30	149.58	9608.26	0.0
17-Apr-14	114.77	55.32	167.11	9916.23	0.0
18-Apr-14	119.91	79.66	165.48	10360.11	0.0
19-Apr-14	105.07	56.52	156.78	9078.00	0.0
20-Apr-14	100.00	47.26	146.86	8639.63	0.0
21-Apr-14	106.47	50.91	150.51	9199.03	0.0
22-Apr-14	113.04	54.71	151.93	9766.71	0.0
23-Apr-14	110.22	55.92	149.79	9523.23	0.0
24-Apr-14	108.66	57.90	155.79	9387.87	0.0
25-Apr-14	106.86	56.11	152.92	9232.63	0.0
26-Apr-14	102.15	48.48	152.82	8826.14	0.0
27-Apr-14	100.13	40.89	150.40	8650.82	0.0
28-Apr-14	99.82	48.20	143.48	8624.61	0.0
29-Apr-14	100.12	47.59	148.30	8650.41	0.0
30-Apr-14	102.33	53.60	158.59	8841.12	0.0

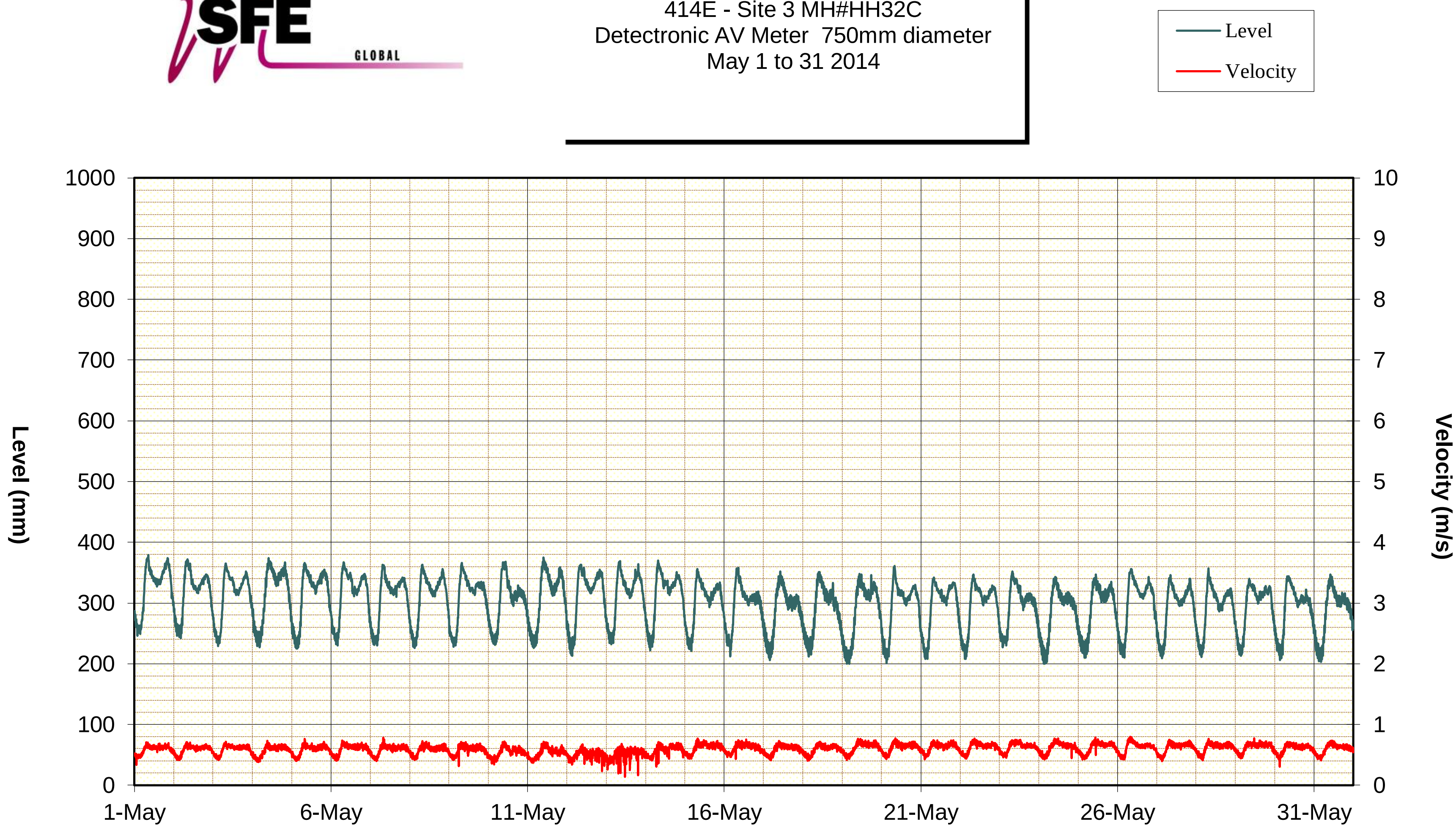
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
281190.255	40.891	215.043	0.0

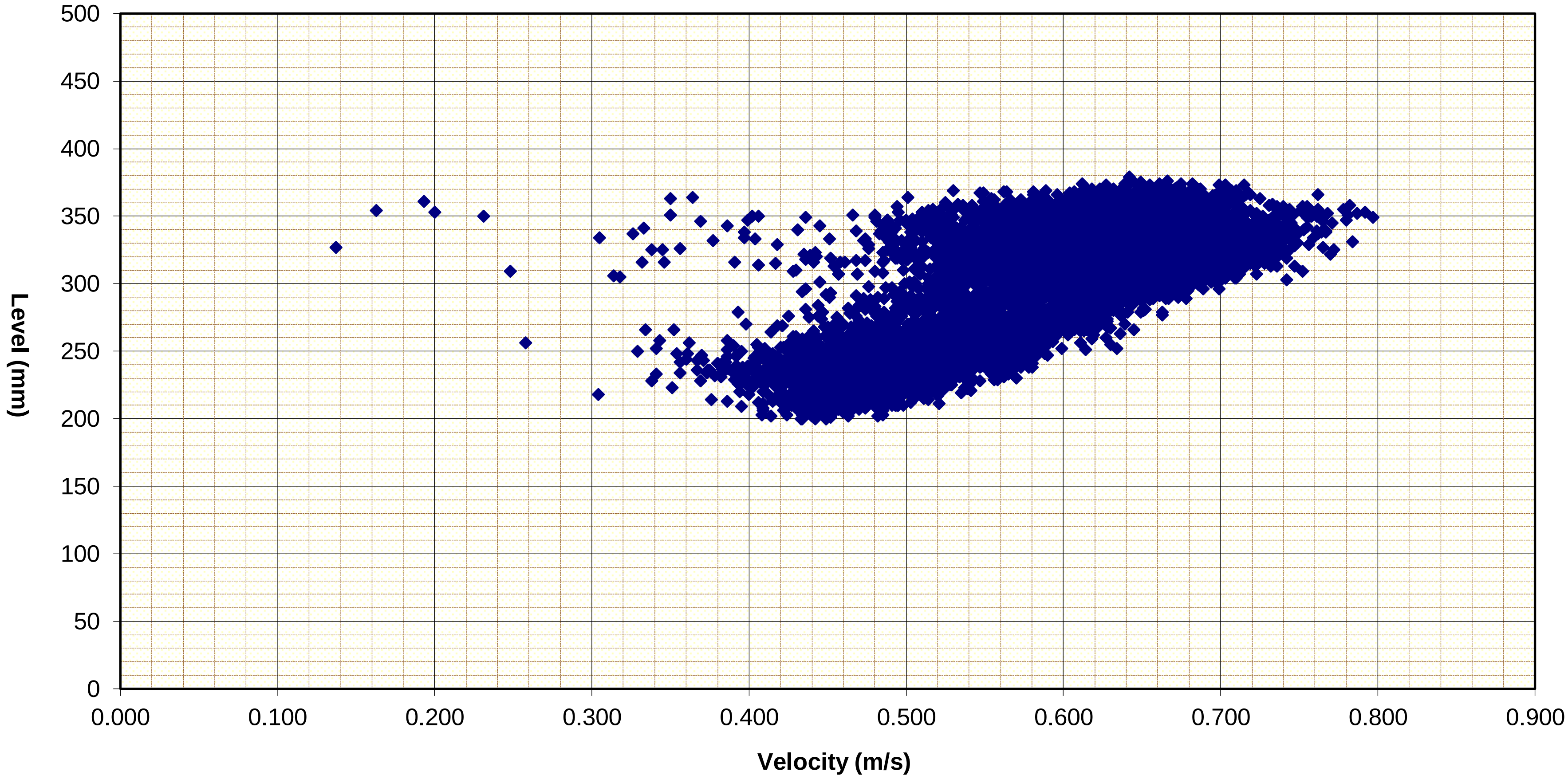
City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
May 1 to 31 2014



City of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
May 1 to 31 2014



CCity of Prince George, BC
414E - Site 3 MH#HH32C
Detectronic AV Meter 750mm diameter
May 1 to 31 2014



City of Prince George, BC
Site #414E - Site 3 MH #HH32C
Detectronic AV - 750mm Dia
3641 Wiebe Road
May 1 to 31 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-May-14	111.05	46.86	154.23	9594.41	0.0
02-May-14	106.59	52.07	153.64	9209.12	0.0
03-May-14	104.99	48.43	152.58	9070.75	0.0
04-May-14	102.73	44.16	152.16	8875.77	0.0
05-May-14	105.24	44.64	163.18	9092.84	0.0
06-May-14	106.63	47.10	154.29	9212.44	0.0
07-May-14	102.74	46.45	162.77	8877.01	0.0
08-May-14	103.32	46.66	153.62	8927.12	0.0
09-May-14	100.69	47.46	147.88	8699.20	0.0
10-May-14	92.34	39.90	153.97	7978.32	0.0
11-May-14	94.11	41.90	156.87	8131.35	0.0
12-May-14	88.54	38.38	135.05	7649.67	0.0
13-May-14	90.82	25.34	137.32	7846.77	0.0
14-May-14	102.13	46.32	150.98	8823.82	0.0
15-May-14	105.38	47.51	156.41	9105.13	0.0
16-May-14	101.18	48.45	153.13	8741.71	0.0
17-May-14	93.98	41.60	141.92	8120.22	0.0
18-May-14	93.44	41.66	142.07	8073.08	0.0
19-May-14	99.07	39.71	147.60	8559.61	0.0
20-May-14	102.49	42.96	153.12	8855.43	0.0
21-May-14	102.58	43.42	143.71	8862.80	0.0
22-May-14	103.49	44.84	148.75	8941.77	0.0
23-May-14	103.61	51.83	149.24	8951.86	0.0
24-May-14	96.60	40.95	148.18	8345.90	0.0
25-May-14	99.99	43.24	147.37	8639.52	0.0
26-May-14	105.99	43.32	161.89	9157.15	0.0
27-May-14	101.47	39.73	145.99	8767.06	0.0
28-May-14	101.13	43.83	155.96	8737.41	0.0
29-May-14	102.61	46.07	141.67	8865.55	0.0
30-May-14	97.68	32.43	139.75	8439.57	0.0
31-May-14	94.09	39.40	142.66	8129.77	0.0

Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
269282.100	25.340	163.180	0.0

FIELD MAINTENANCE RECORD

NAME□	City of Prince George, BC
SFE SITE #□	□1□E □□M□ □□G7□B
ADDRESS□	Yellow□ead □wy □service road□
GPS□	5□.□7□61 122.76151
SENSOR TYPE□	A□
PRIMARY DEVICE□	675mm A□

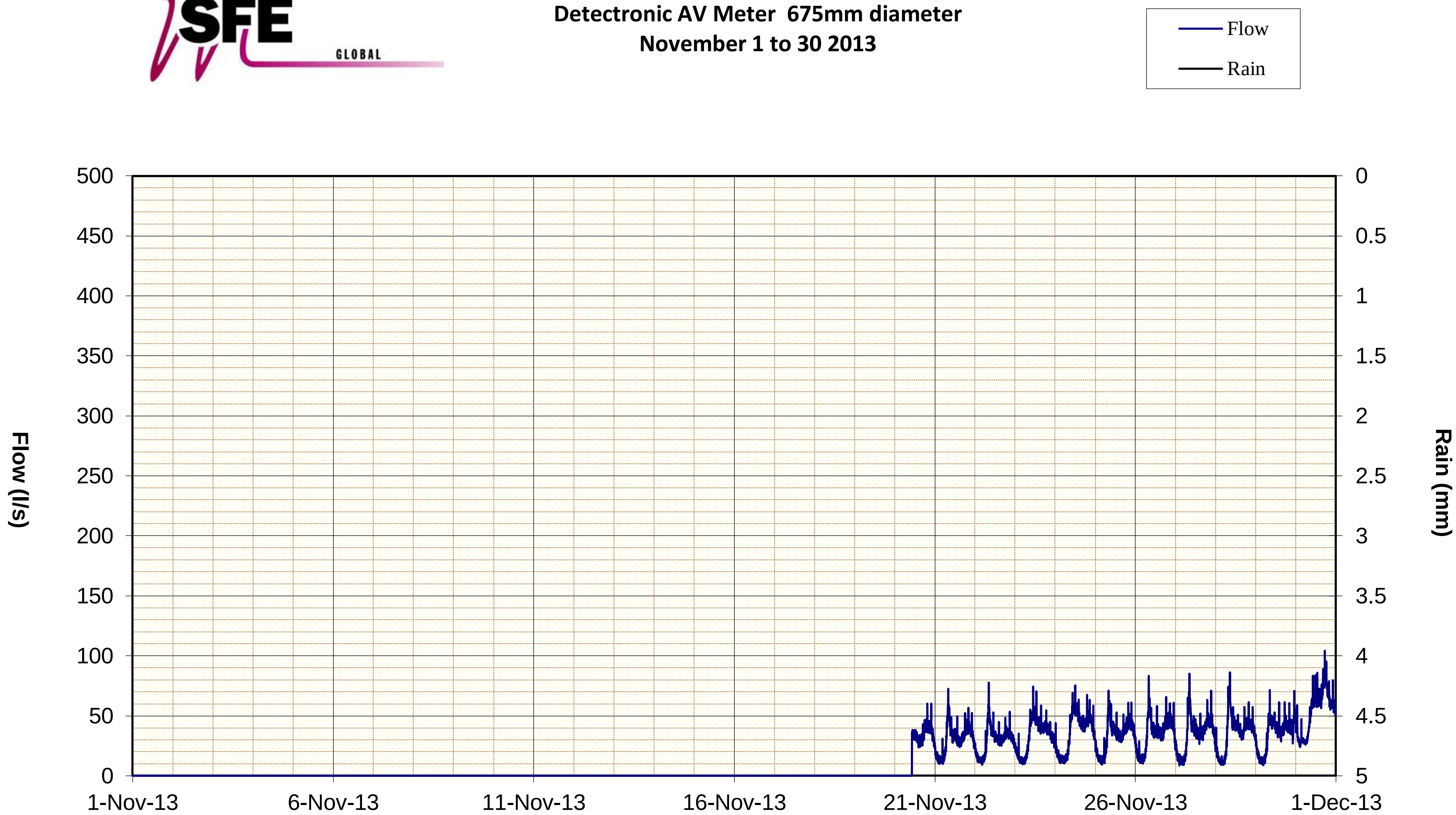
CONSTANTS				
D1 □cm□:		D1□lip to □bar		
TOM □cm□:	□61.000	Raw □ eir L □□bar to water		
METER □	657□		DATE:	11□20□1□
METER □	207□010□0		DATE:	11□20□1□
METER □			DATE:	

LEGEND	
DL □DO□ NLOAD	**PC** □PROGRAM COMPLETE
CB □C□G BATTERY	**PM** □PROG. METER
V □□ERIFY	**VIS** □□IS□AL
LA □LE□EL AD□□ST	**VP** □□ELOCITY PROFILE
DO □DEPT□ ONLY	**CD** □C□G DESICCANT

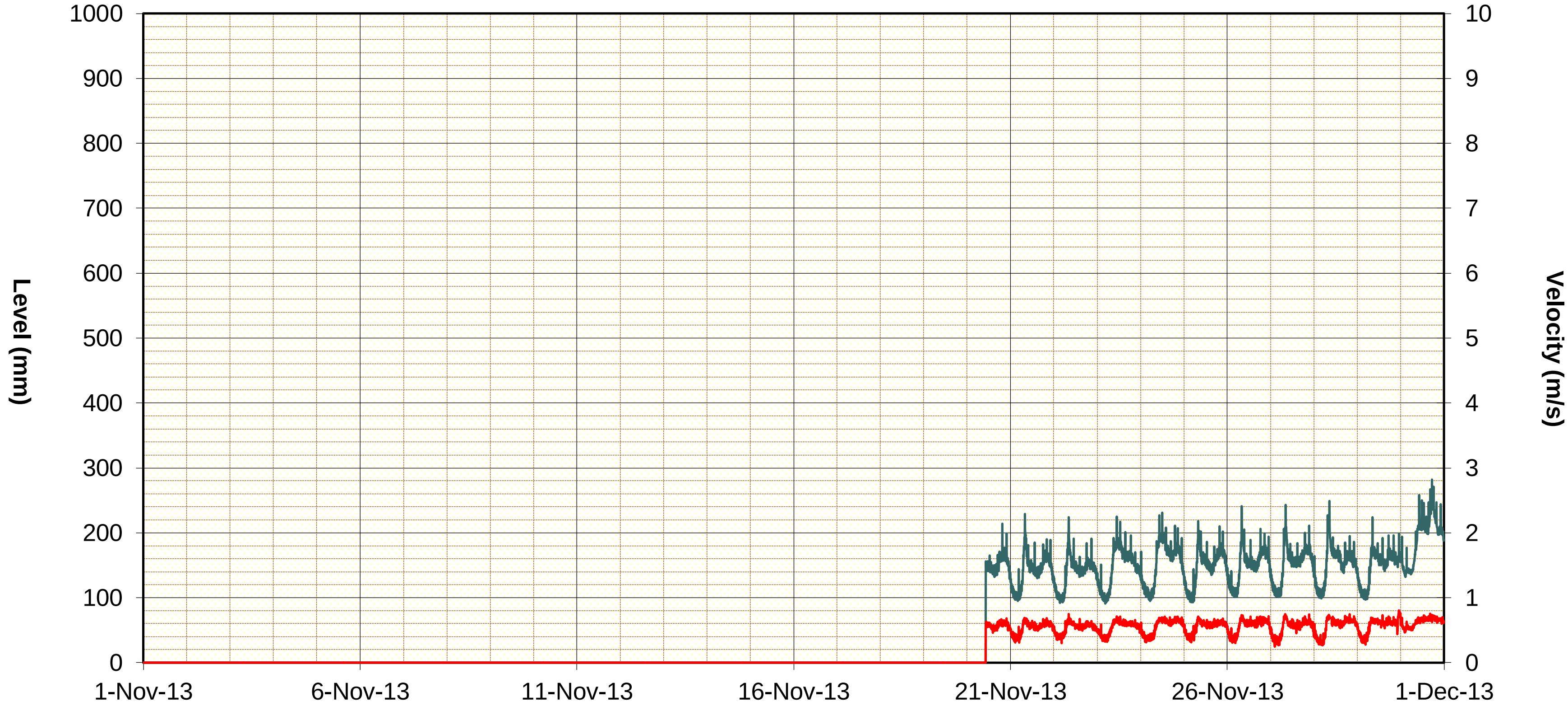
DATE	TIME	METER TIME	METER DEPT□	FIELD DEPT□	METER □EL	FIELD □EL□□IS	FLO□	BATT	SILT	MTC BY	COMMENTS
M□D□YY	□□:MM	□□:MM	cm	cm	M□S	M□S	LPS	□	cm	□INIT.□	
11□20□1□	10:2□	10:□0	15.6	15.5	0.5□	0.6□	□	12.□	0	□□	installed meter 657□ and b□u
11□22□1□	12:22	12:22	15.1	15.5	0.57	□	□	12.2	0	□□	downloaded□pus□ed data□all O□
12□10□1□	1□:1□	1□:1□	17.2	17	0.56	□	□	12.1	0	□□	DL O□
01□0□1□	11:50	11:52	1□.5	1□	0.51	□	□	12.1	0	□□	DL O□
01□22□1□	11:17	11:1□	1□.6	20	0.□□	□	□	11.□	0	□□	DL O□
02□12□1□	1□:20	1□:20	1□	12.5	0.67	□	□	11.6	0	□□	DL O□
0□01□1□	1□:□□	1□:□□	17.□	□	0.□5	□	6□	11.6	0	GC	remote data download
0□12□1□	1□:15	12:15	2□.1	2□	1.02	□	111	11.5	0	□□	DL sensor clear
0□0□1□	11:0□	10:0□	1□.7	1□	1.05	□	□5	12.□	0	□□	DL sensor clear
0□26□1□	12:11	11:10	1□	1□.6	1.1□	□	□	12.1	0	□□	DL sensor clear
05□1□1□	12:20	11:20	1□.5	1□.5	1.12	□	□	12.1	0	□□	DL sensor clear
06□0□1□	□:50	□:50	15.□	15.5	1.15	1.12	50	12	0	□□	Removed meter

DATE□	NOTES□

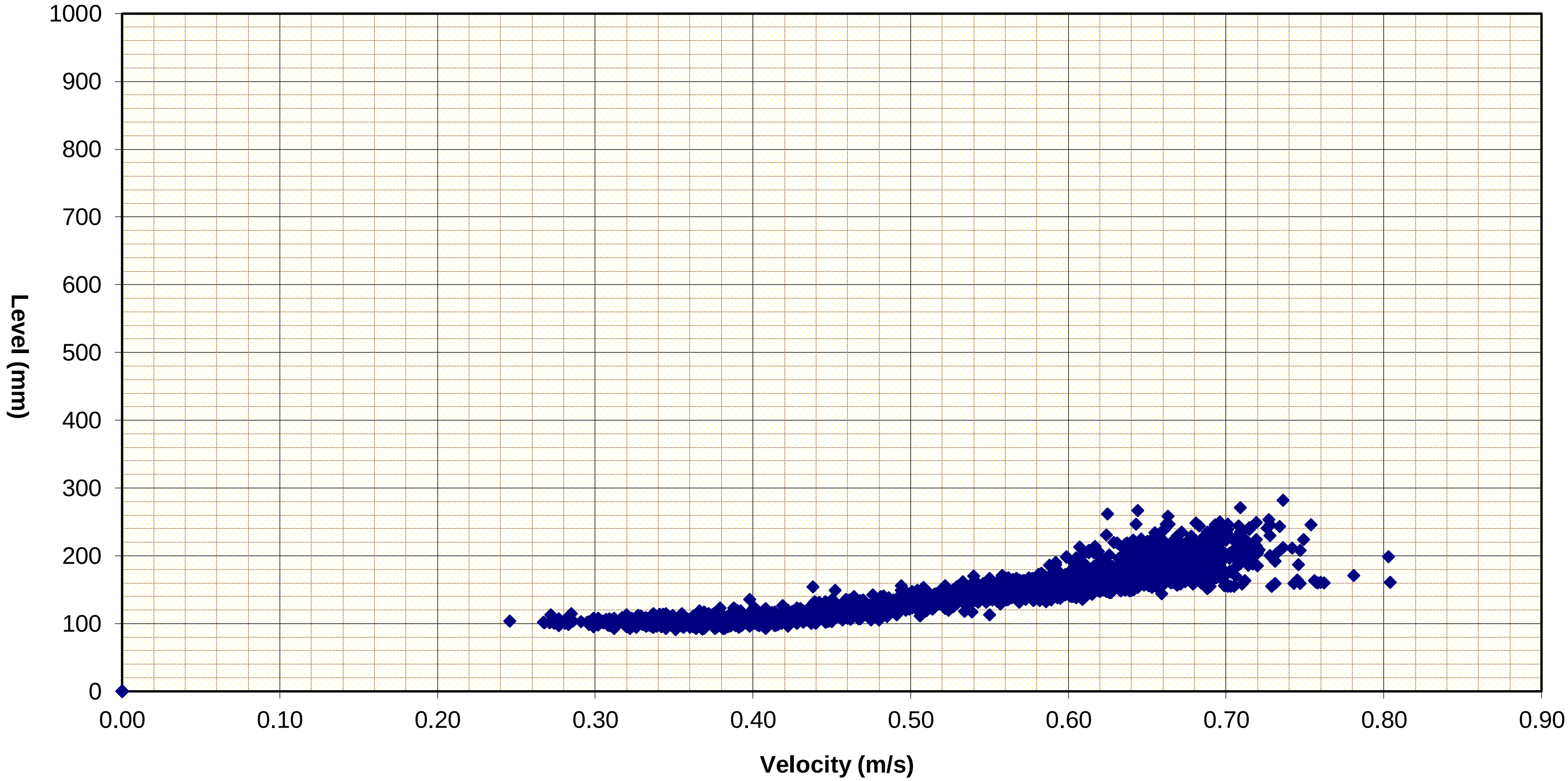
City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
November 1 to 30 2013



City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
November 1 to 30 2013



City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
November 1 to 30 2013



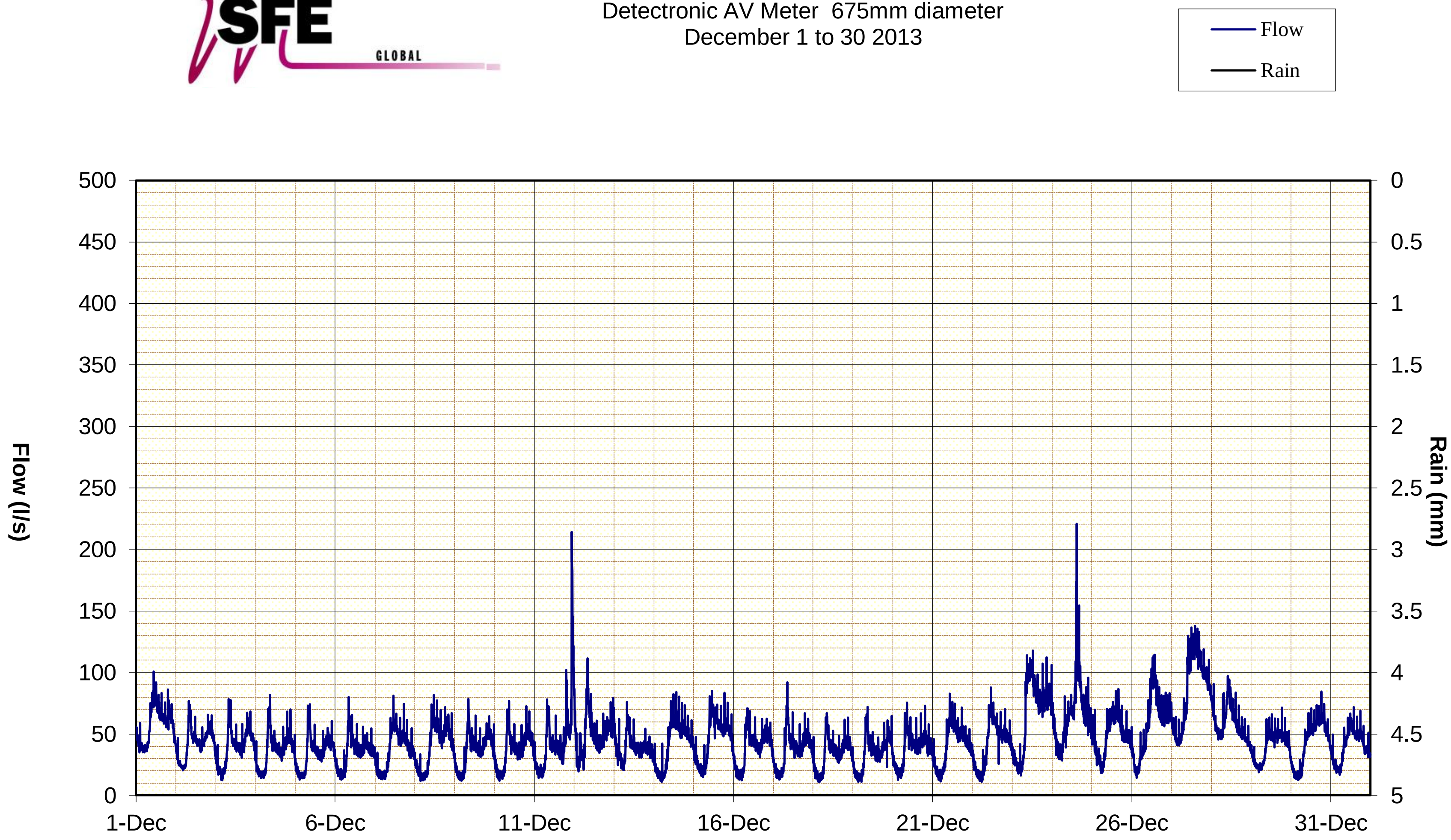
City of Prince George, BC
Site #414E - Site 4 MH #HG73B
Detectronic AV - 675mm Dia
Service Road off of Yellowhead Highway
November 1 to 30 2013

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Nov-13	0.00	0.00	0.00	0.00	0.0
02-Nov-13	0.00	0.00	0.00	0.00	0.0
03-Nov-13	0.00	0.00	0.00	0.00	0.0
04-Nov-13	0.00	0.00	0.00	0.00	0.0
05-Nov-13	0.00	0.00	0.00	0.00	0.0
06-Nov-13	0.00	0.00	0.00	0.00	0.0
07-Nov-13	0.00	0.00	0.00	0.00	0.0
08-Nov-13	0.00	0.00	0.00	0.00	0.0
09-Nov-13	0.00	0.00	0.00	0.00	0.0
10-Nov-13	0.00	0.00	0.00	0.00	0.0
11-Nov-13	0.00	0.00	0.00	0.00	0.0
12-Nov-13	0.00	0.00	0.00	0.00	0.0
13-Nov-13	0.00	0.00	0.00	0.00	0.0
14-Nov-13	0.00	0.00	0.00	0.00	0.0
15-Nov-13	0.00	0.00	0.00	0.00	0.0
16-Nov-13	0.00	0.00	0.00	0.00	0.0
17-Nov-13	0.00	0.00	0.00	0.00	0.0
18-Nov-13	0.00	0.00	0.00	0.00	0.0
19-Nov-13	0.00	0.00	0.00	0.00	0.0
20-Nov-13	20.03	0.00	60.13	1730.28	0.0
21-Nov-13	30.46	9.77	72.52	2632.08	0.0
22-Nov-13	29.64	9.18	77.73	2561.13	0.0
23-Nov-13	32.81	9.58	74.35	2835.16	0.0
24-Nov-13	36.55	10.31	75.34	3157.90	0.0
25-Nov-13	33.94	9.28	70.99	2932.71	0.0
26-Nov-13	35.34	10.13	83.26	3053.34	0.0
27-Nov-13	34.59	8.61	85.13	2988.82	0.0
28-Nov-13	35.90	9.06	86.19	3101.42	0.0
29-Nov-13	34.90	8.76	71.51	3015.40	0.0
30-Nov-13	53.57	23.95	104.24	4628.70	0.0

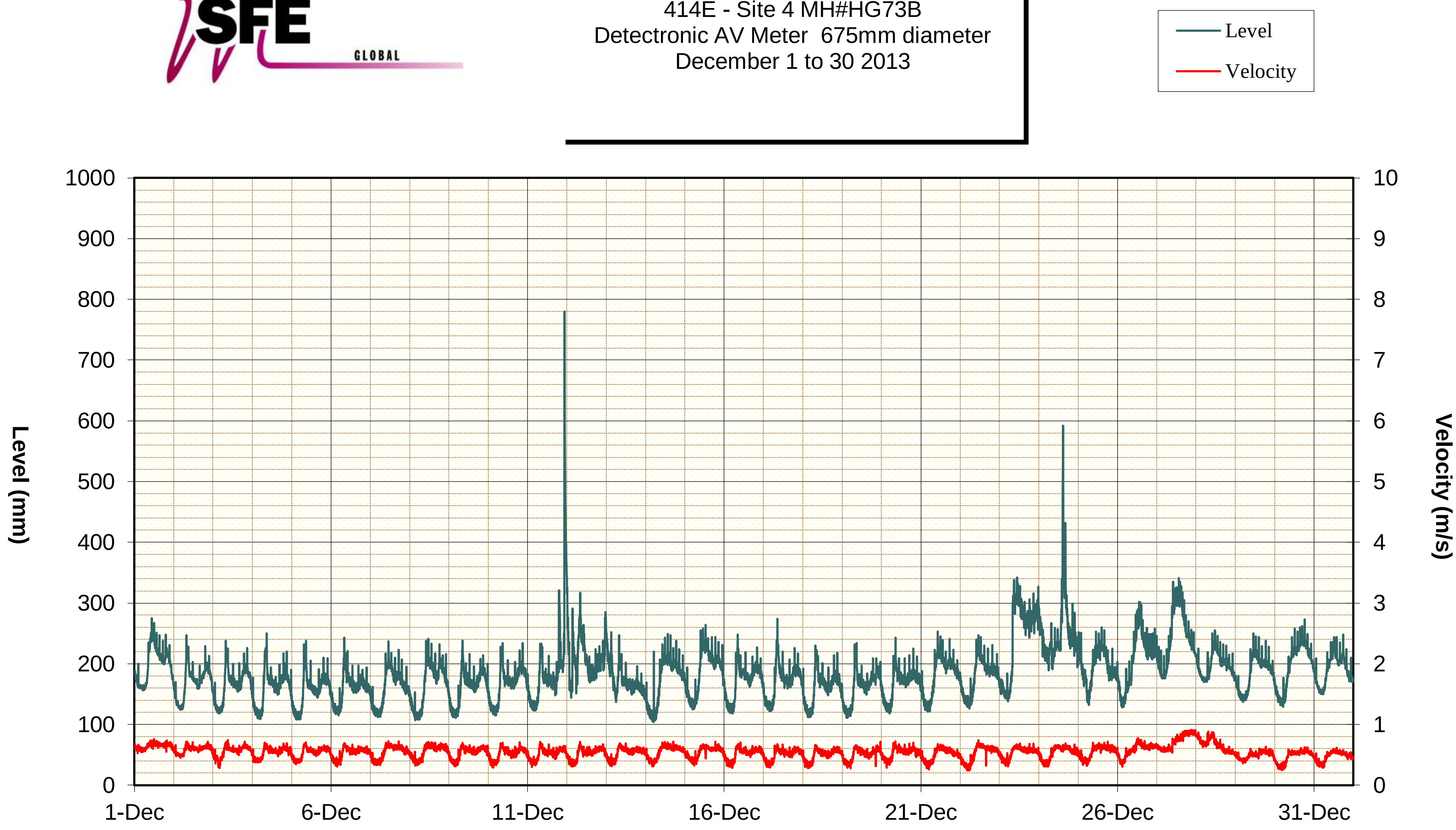
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
32636.927	8.608	104.240	0.0

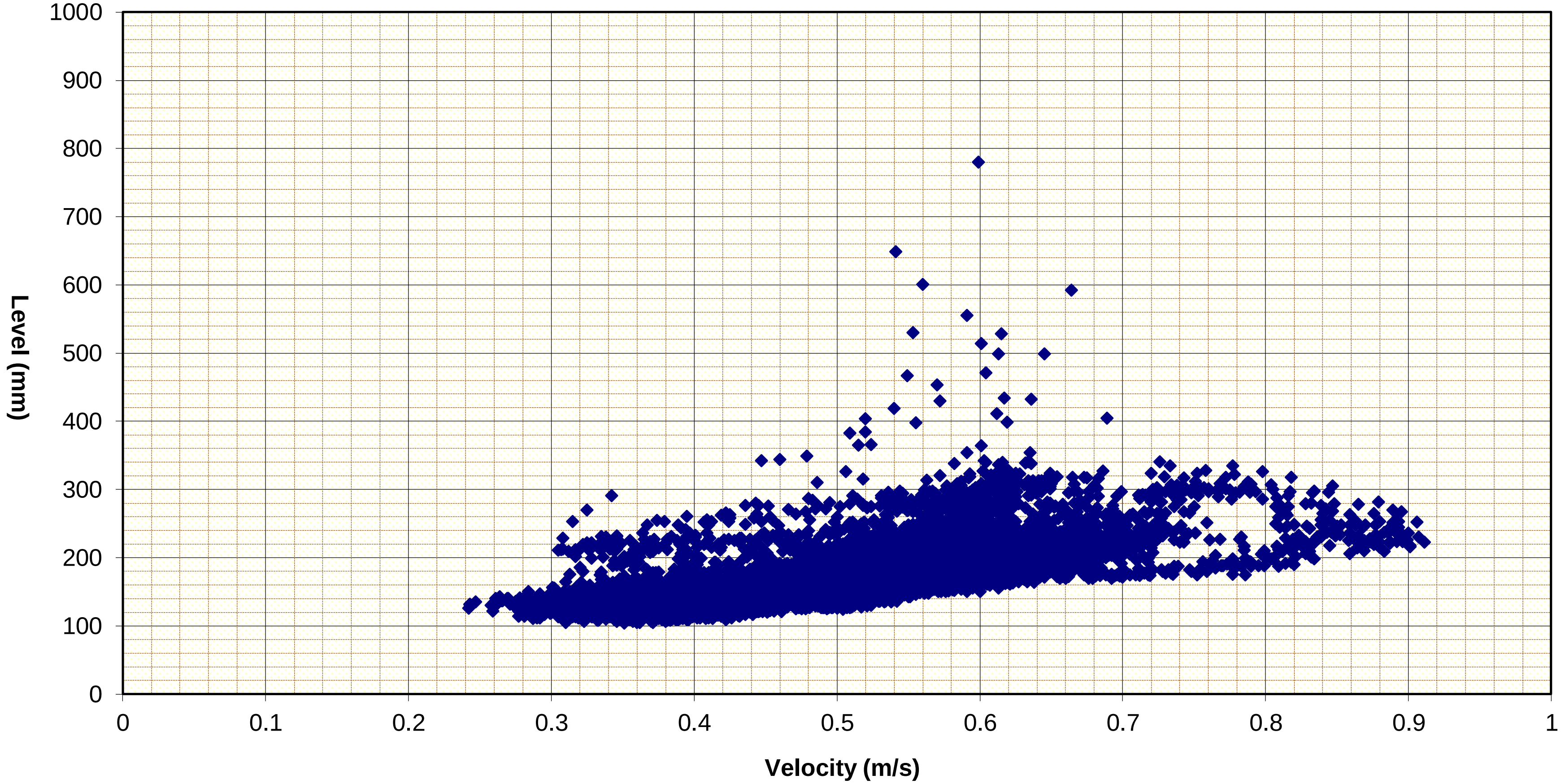
City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
December 1 to 30 2013



City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
December 1 to 30 2013



City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
December 1 to 30 2013



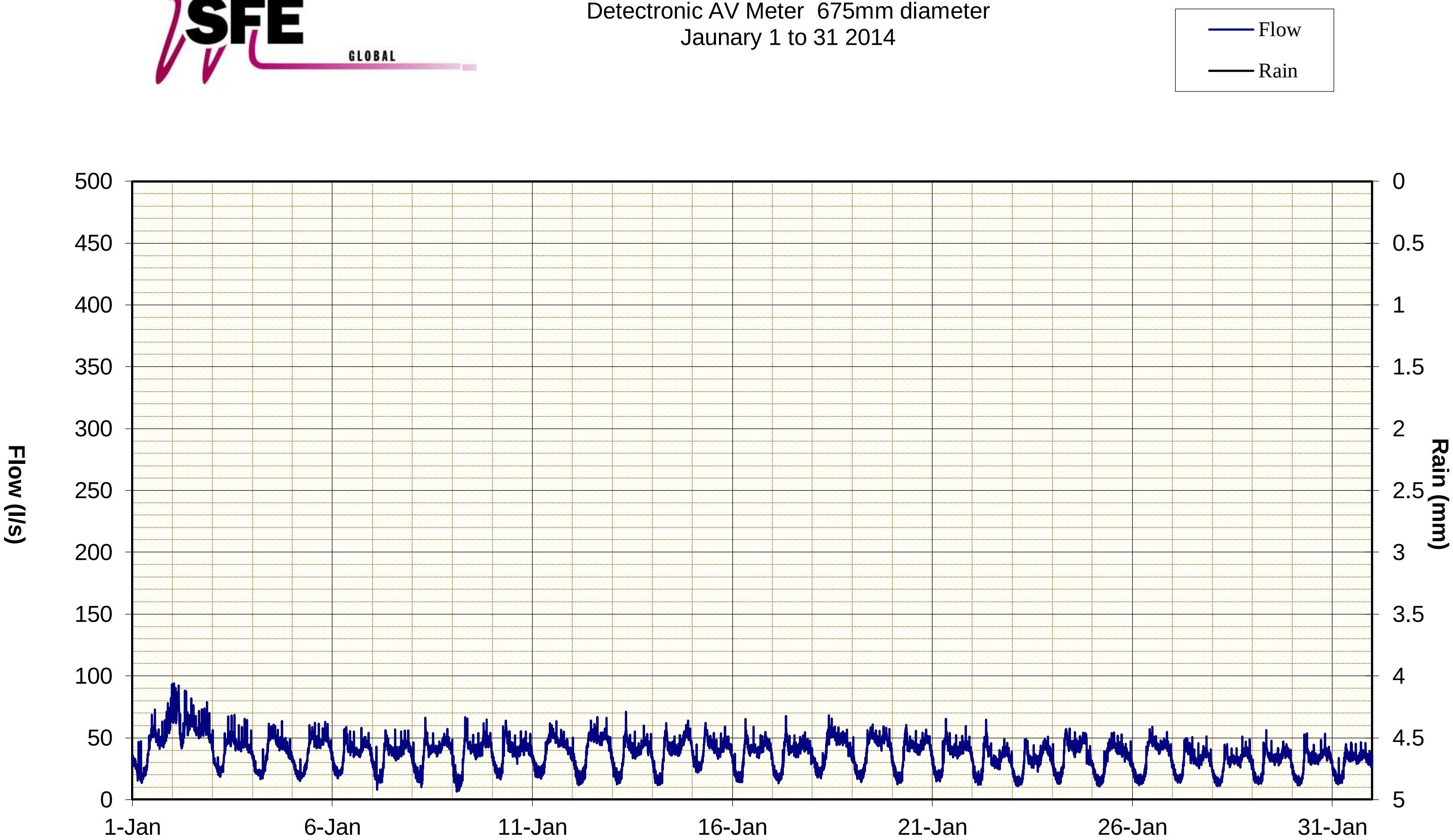
City of Prince George, BC
Site #414E - Site 4 MH #HG73B
Detectronic AV - 675mm Dia
Service Road off of Yellowhead Highway
December 1 to 31 2013

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Dec-13	58.13	35.04	100.82	5022.07	0.0
02-Dec-13	42.53	20.49	76.96	3674.57	0.0
03-Dec-13	39.78	12.43	78.47	3437.41	0.0
04-Dec-13	37.32	14.16	81.84	3224.22	0.0
05-Dec-13	35.20	12.88	74.19	3041.65	0.0
06-Dec-13	35.82	12.85	80.03	3095.12	0.0
07-Dec-13	37.29	13.22	81.16	3221.51	0.0
08-Dec-13	39.90	11.78	81.66	3447.50	0.0
09-Dec-13	37.06	12.04	78.59	3202.41	0.0
10-Dec-13	37.49	11.95	77.01	3238.77	0.0
11-Dec-13	46.03	14.27	214.35	3976.63	0.0
12-Dec-13	50.79	19.52	111.44	4388.67	0.0
13-Dec-13	38.98	20.76	76.01	3367.81	0.0
14-Dec-13	42.00	11.00	84.15	3629.16	0.0
15-Dec-13	45.66	14.95	84.89	3945.31	0.0
16-Dec-13	38.80	12.32	70.82	3352.53	0.0
17-Dec-13	37.66	12.95	92.01	3253.73	0.0
18-Dec-13	34.32	11.23	67.04	2965.47	0.0
19-Dec-13	34.83	11.04	72.05	3008.99	0.0
20-Dec-13	38.12	12.69	75.50	3293.43	0.0
21-Dec-13	40.78	11.41	82.80	3522.98	0.0
22-Dec-13	41.93	11.17	87.87	3622.97	0.0
23-Dec-13	67.06	16.19	117.88	5794.11	0.0
24-Dec-13	66.66	28.38	220.87	5759.43	0.0
25-Dec-13	48.96	18.33	86.66	4230.35	0.0
26-Dec-13	56.41	14.30	114.36	4874.11	0.0
27-Dec-13	85.97	40.60	137.71	7428.08	0.0
28-Dec-13	59.25	36.01	97.27	5118.95	0.0
29-Dec-13	40.02	18.78	71.48	3457.56	0.0
30-Dec-13	43.06	12.59	84.51	3720.02	0.0
31-Dec-13	40.11	16.82	71.84	3465.64	0.0

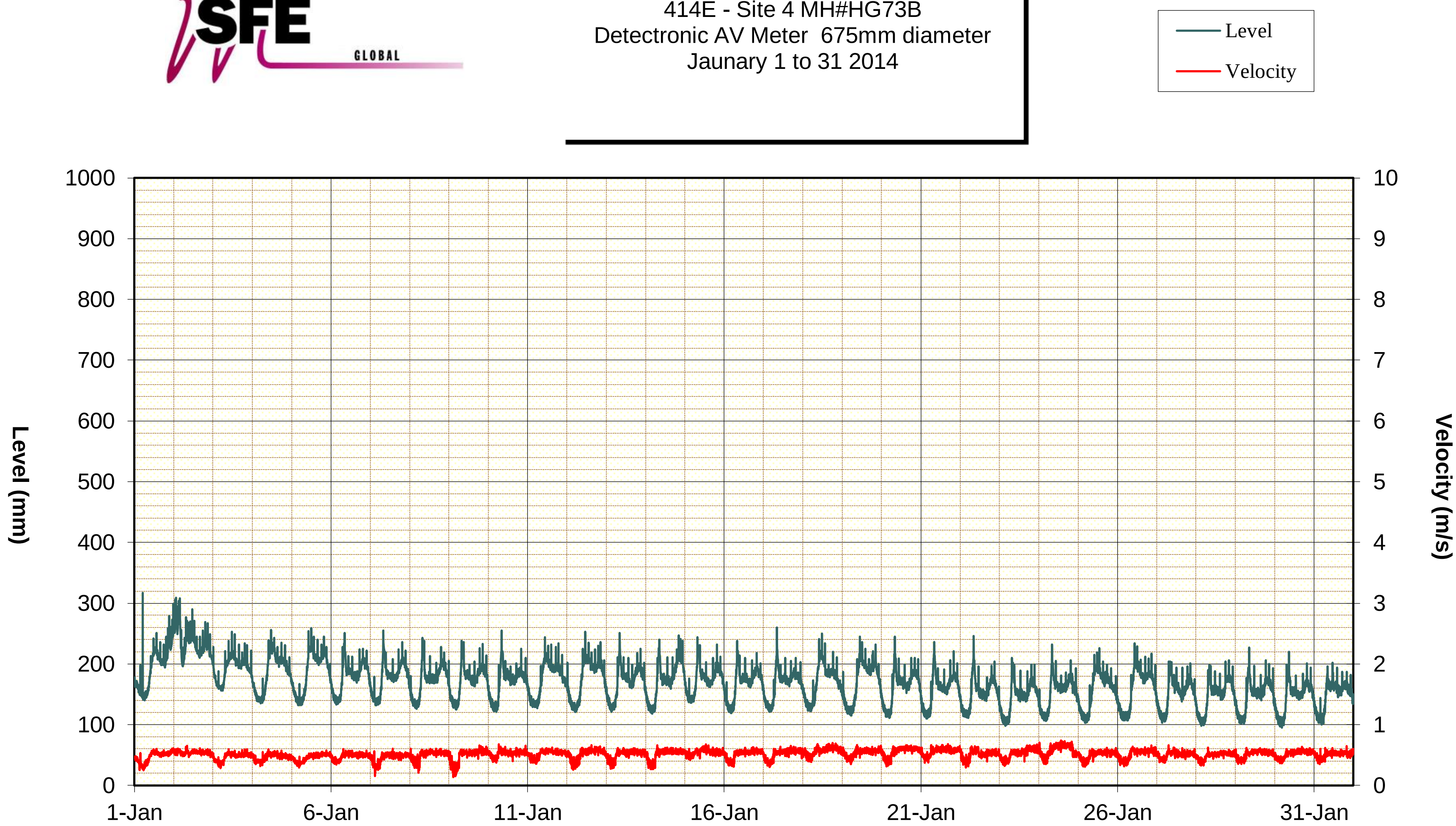
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
120781.154	10.999	220.874	0.0

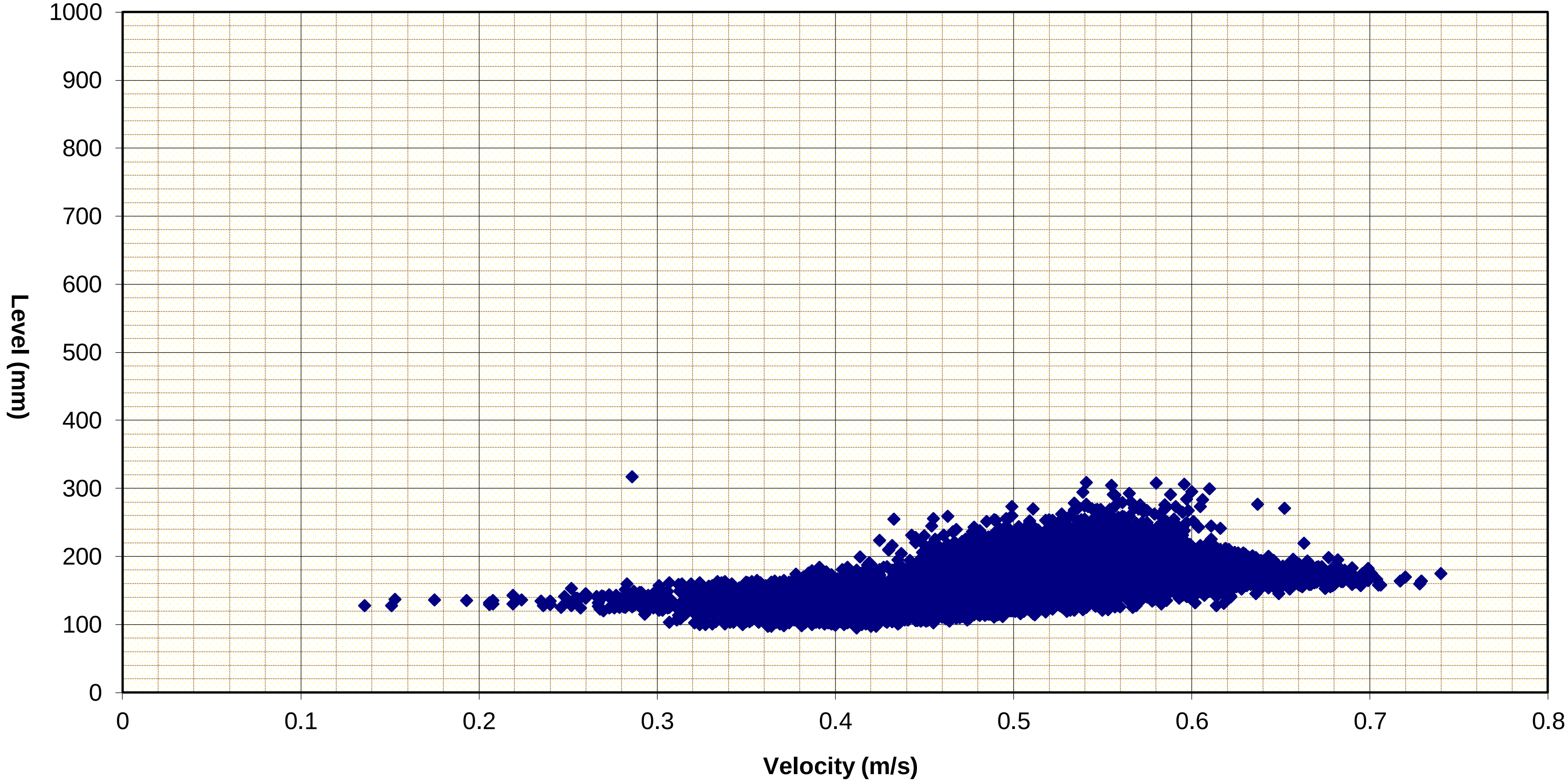
City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
Jaunary 1 to 31 2014



City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
Jaunary 1 to 31 2014



City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
January 1 to 31 2014



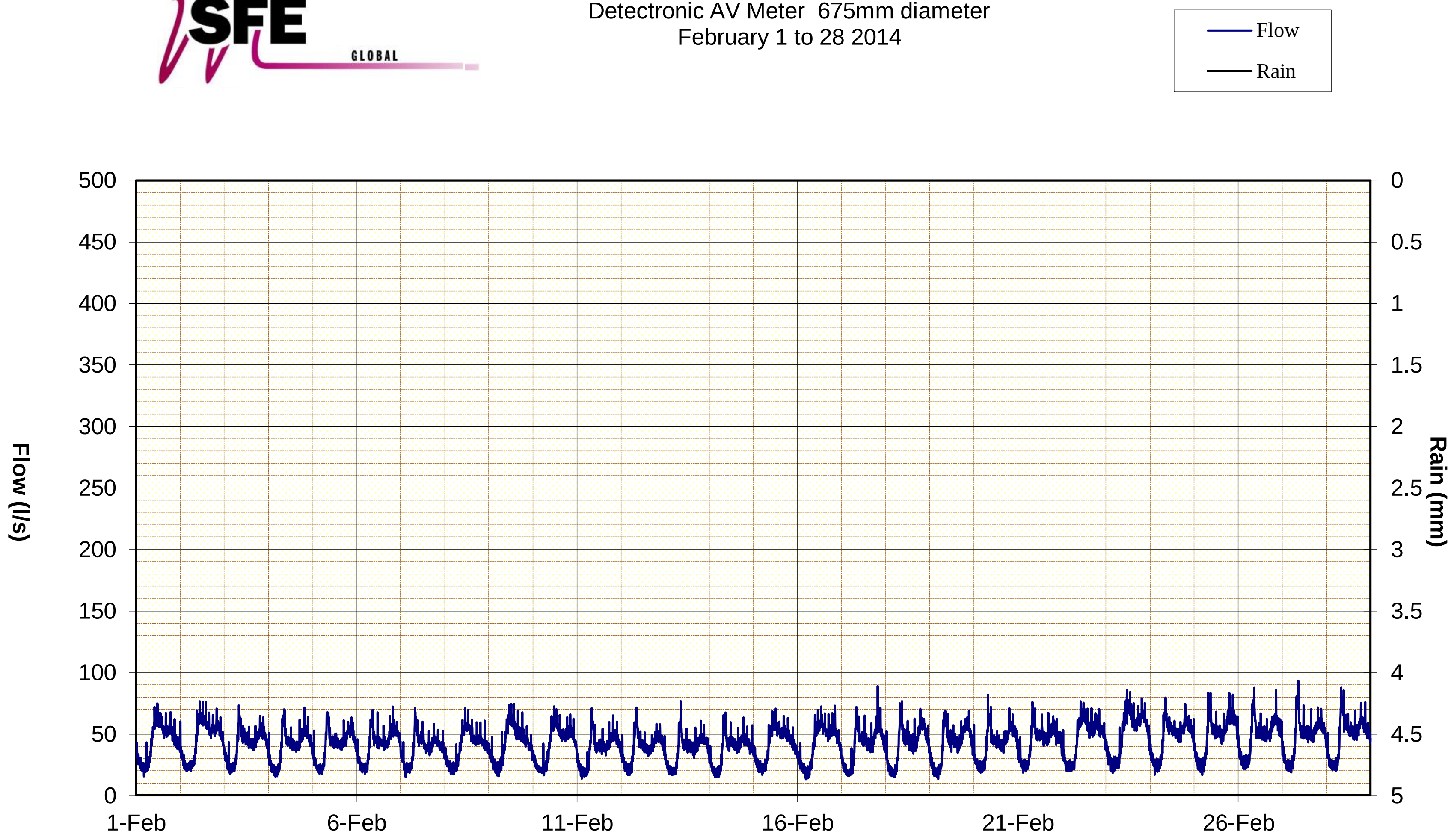
City of Prince George, BC
Site #414E - Site 4 MH #HG73B
Detectronic AV - 675mm Dia
Service Road off of Yellowhead Highway
January 1 to 31 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Jan-14	41.96	13.45	93.33	3625.32	0.0
02-Jan-14	60.46	40.72	93.98	5223.67	0.0
03-Jan-14	40.42	18.36	68.57	3492.49	0.0
04-Jan-14	38.58	16.49	63.50	3333.40	0.0
05-Jan-14	38.28	14.95	62.86	3307.80	0.0
06-Jan-14	37.50	17.06	58.77	3239.86	0.0
07-Jan-14	35.64	7.96	56.69	3079.31	0.0
08-Jan-14	37.79	10.04	66.18	3264.90	0.0
09-Jan-14	37.21	6.42	66.63	3214.54	0.0
10-Jan-14	38.41	16.29	63.80	3318.69	0.0
11-Jan-14	39.34	16.99	63.37	3399.19	0.0
12-Jan-14	40.08	11.59	66.71	3462.51	0.0
13-Jan-14	37.24	12.31	71.01	3217.77	0.0
14-Jan-14	38.59	11.62	63.88	3333.83	0.0
15-Jan-14	40.46	21.80	61.98	3496.11	0.0
16-Jan-14	36.80	14.01	65.17	3179.93	0.0
17-Jan-14	36.91	13.11	67.60	3189.19	0.0
18-Jan-14	41.20	17.16	68.12	3559.91	0.0
19-Jan-14	39.83	14.12	60.75	3441.50	0.0
20-Jan-14	38.05	12.31	60.40	3287.78	0.0
21-Jan-14	36.71	14.65	65.32	3171.84	0.0
22-Jan-14	31.73	11.86	64.62	2741.16	0.0
23-Jan-14	31.01	10.71	50.85	2678.93	0.0
24-Jan-14	37.11	12.59	57.49	3205.89	0.0
25-Jan-14	32.84	10.59	54.31	2837.63	0.0
26-Jan-14	34.99	11.57	58.88	3023.48	0.0
27-Jan-14	31.29	13.60	51.12	2703.43	0.0
28-Jan-14	29.57	10.81	50.99	2555.27	0.0
29-Jan-14	30.94	12.32	56.23	2673.49	0.0
30-Jan-14	30.68	11.45	53.56	2650.33	0.0
31-Jan-14	30.34	12.25	46.39	2620.98	0.0

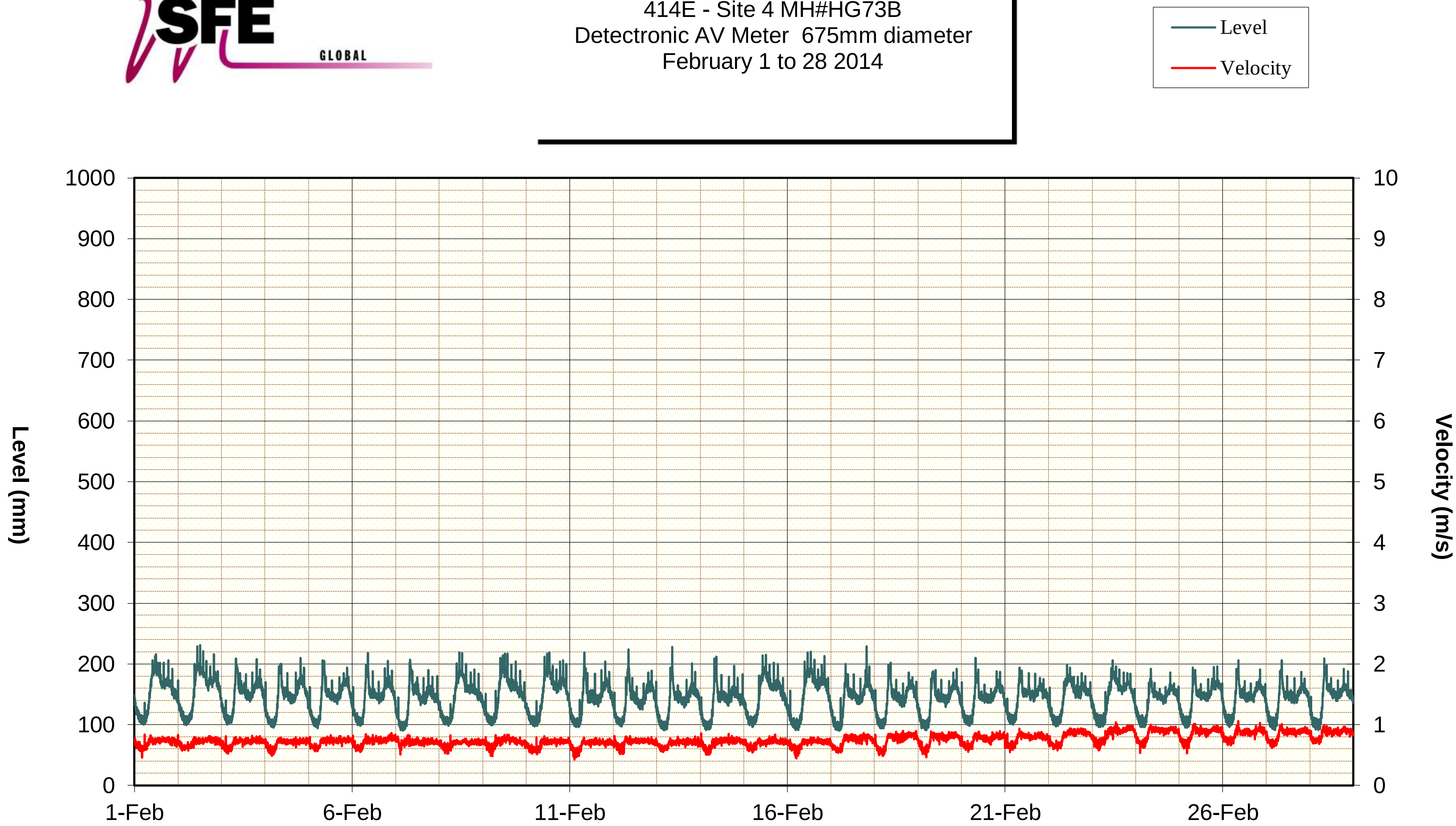
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
99530.142	6.420	93.984	0.0

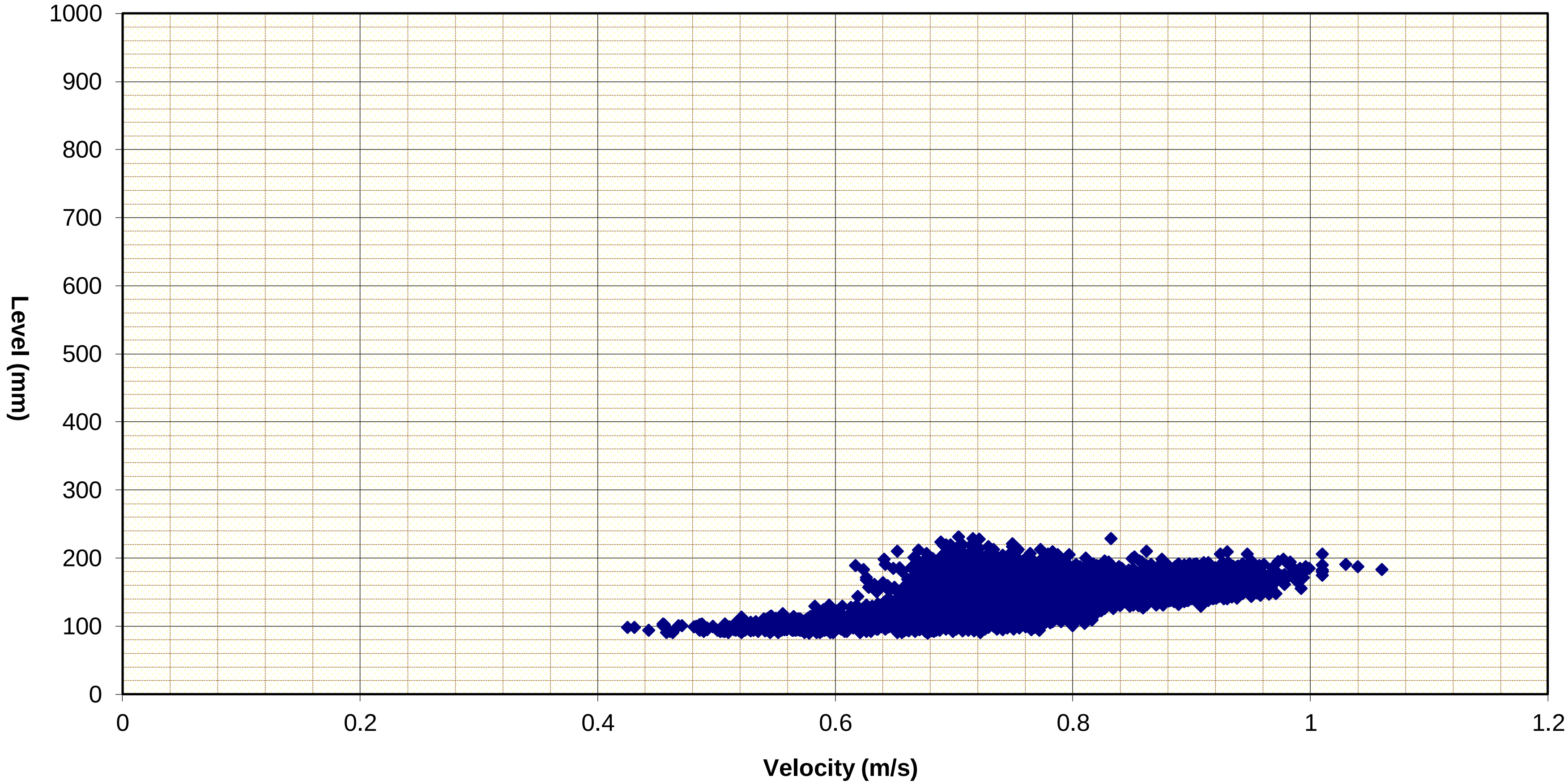
City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
February 1 to 28 2014



City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
February 1 to 28 2014



City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
February 1 to 28 2014



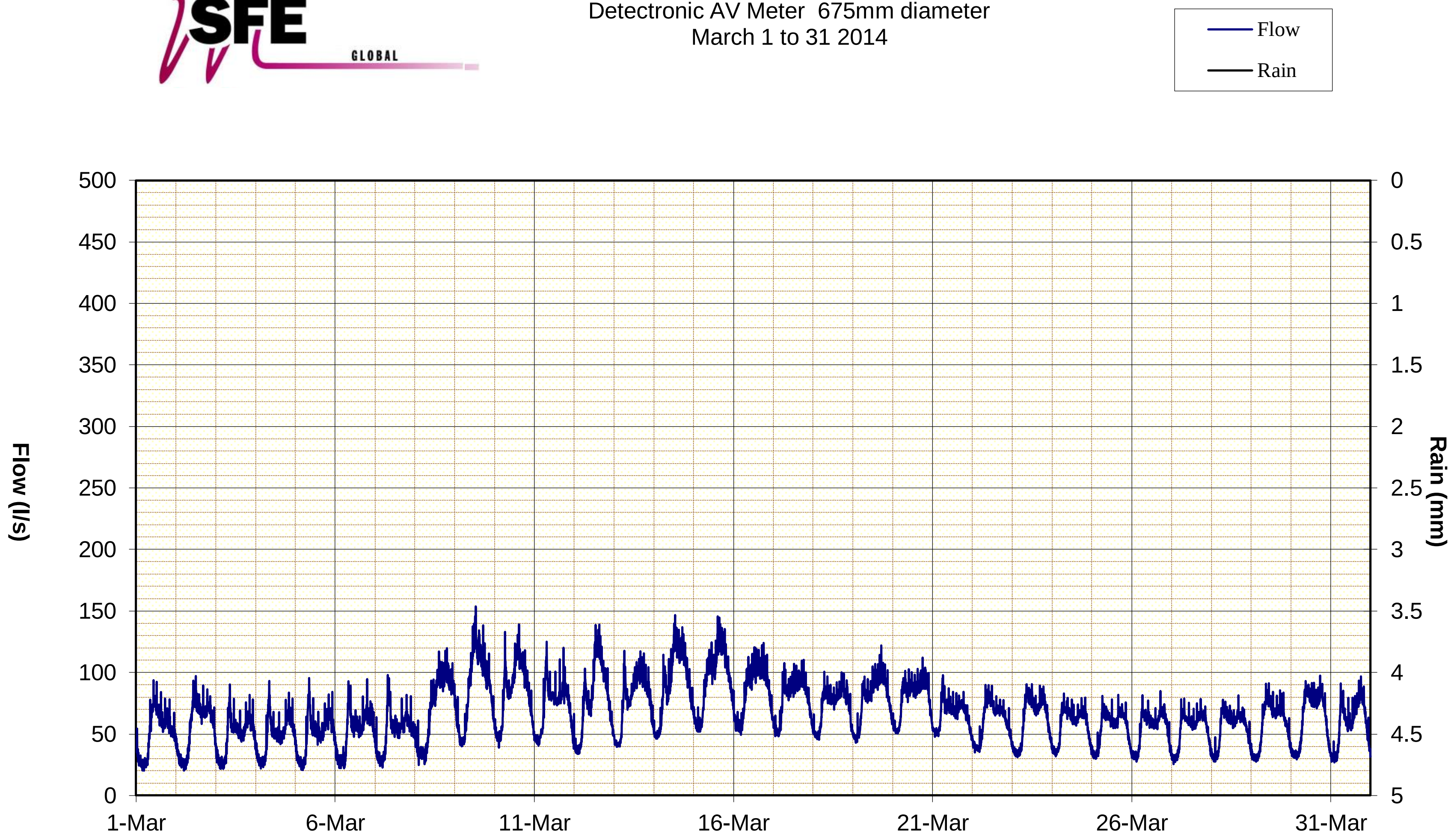
City of Prince George, BC
Site #414E - Site 4 MH #HG73B
Detectronic AV - 675mm Dia
Service Road off of Yellowhead Highway
February 1 to 28 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Feb-14	44.07	15.51	74.85	3807.23	0.0
02-Feb-14	45.38	19.64	76.59	3921.14	0.0
03-Feb-14	41.71	17.59	73.20	3603.76	0.0
04-Feb-14	40.16	15.34	71.50	3469.78	0.0
05-Feb-14	40.85	17.44	67.70	3529.30	0.0
06-Feb-14	42.04	17.63	72.28	3632.12	0.0
07-Feb-14	38.95	15.08	71.21	3365.60	0.0
08-Feb-14	40.40	17.16	71.13	3490.42	0.0
09-Feb-14	42.72	15.67	74.51	3691.21	0.0
10-Feb-14	41.63	16.41	72.43	3596.90	0.0
11-Feb-14	37.86	13.64	70.98	3270.94	0.0
12-Feb-14	38.85	16.50	71.51	3357.04	0.0
13-Feb-14	37.32	16.55	76.66	3224.14	0.0
14-Feb-14	37.78	14.73	67.44	3264.54	0.0
15-Feb-14	41.54	16.86	70.62	3589.04	0.0
16-Feb-14	41.85	13.20	73.01	3615.96	0.0
17-Feb-14	40.97	15.67	89.00	3539.54	0.0
18-Feb-14	42.26	15.10	76.66	3651.03	0.0
19-Feb-14	41.89	13.35	68.65	3619.47	0.0
20-Feb-14	42.50	18.55	81.85	3672.36	0.0
21-Feb-14	44.36	18.61	76.12	3832.75	0.0
22-Feb-14	46.97	19.53	76.58	4058.07	0.0
23-Feb-14	49.98	18.22	85.43	4318.53	0.0
24-Feb-14	47.35	16.86	79.53	4091.09	0.0
25-Feb-14	49.68	16.67	83.62	4292.32	0.0
26-Feb-14	48.07	21.59	87.56	4153.20	0.0
27-Feb-14	47.22	18.79	93.39	4080.16	0.0
28-Feb-14	48.57	20.26	87.73	4196.60	0.0

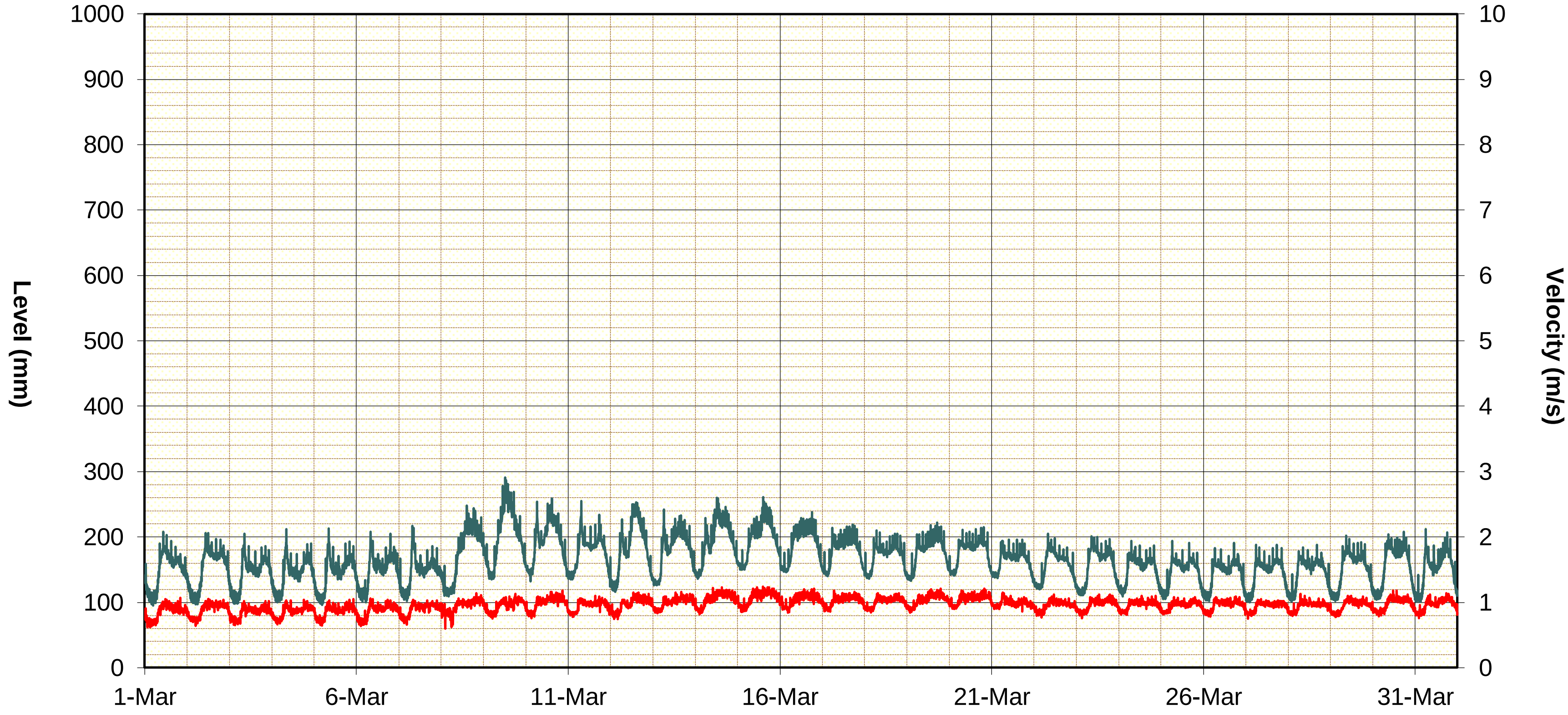
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
103934.233	13.201	93.386	0.0

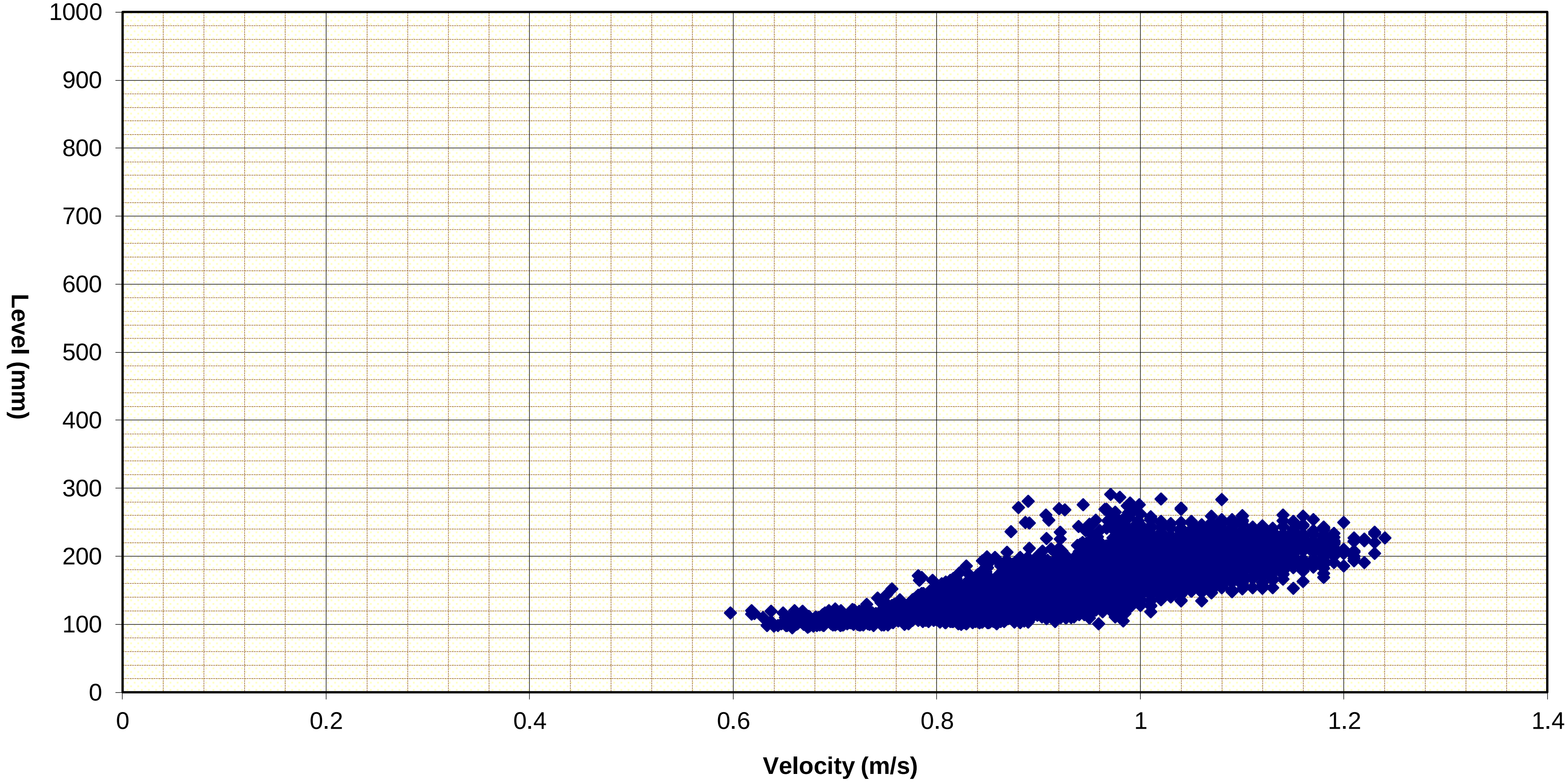
City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
March 1 to 31 2014



City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
March 1 to 31 2014



City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
March 1 to 31 2014



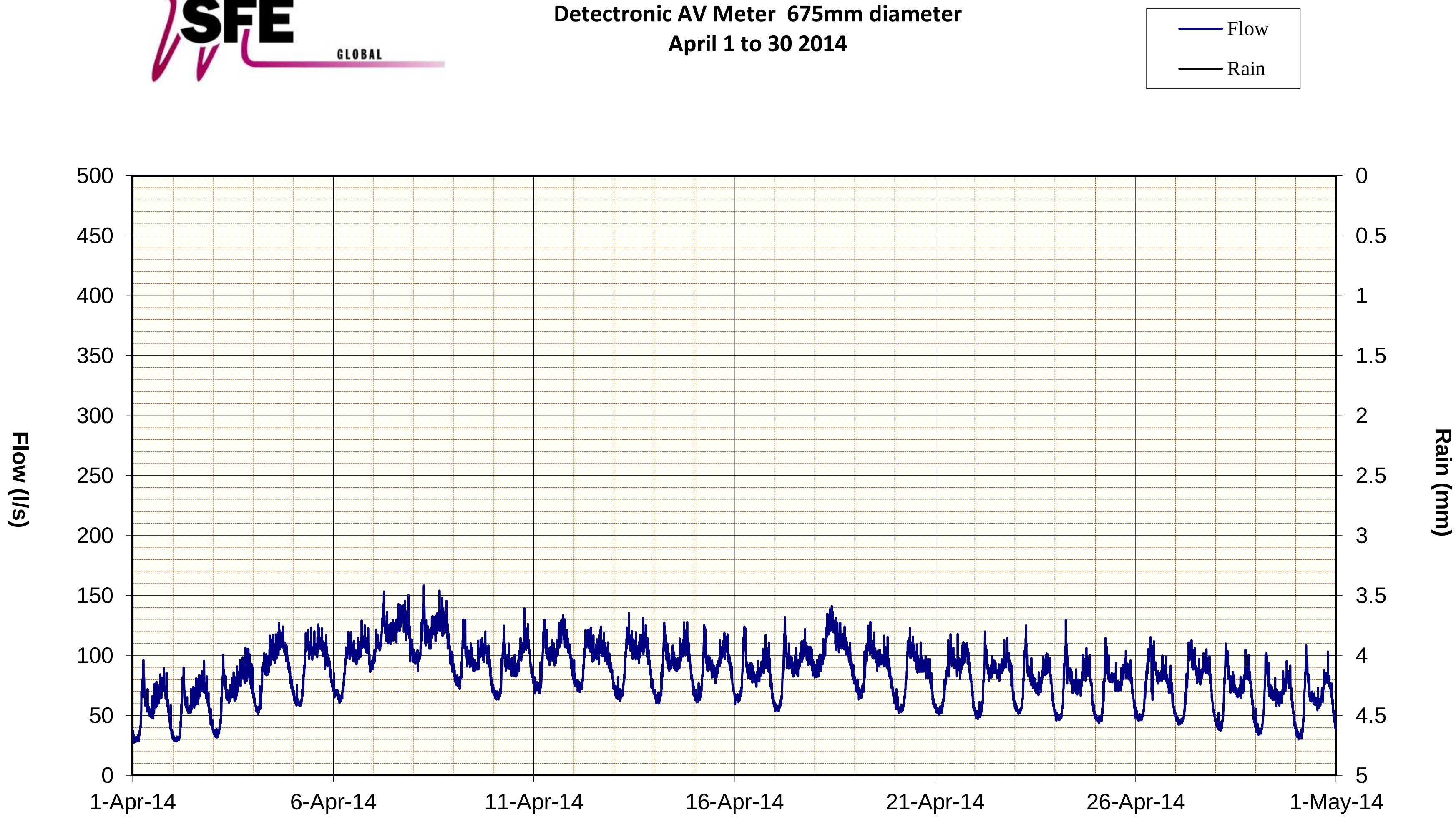
City of Prince George, BC
Site #414E - Site 4 MH #HG73B
Detectronic AV - 675mm Dia
Service Road off of Yellowhead Highway
March 1 to 31 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Mar-14	51.51	20.19	93.71	4450.35	0.0
02-Mar-14	55.70	20.24	97.08	4812.30	0.0
03-Mar-14	49.10	21.61	90.28	4242.17	0.0
04-Mar-14	49.41	21.88	93.13	4268.64	0.0
05-Mar-14	50.17	20.67	95.48	4334.76	0.0
06-Mar-14	52.93	22.12	94.60	4573.58	0.0
07-Mar-14	52.91	22.71	97.96	4571.02	0.0
08-Mar-14	71.81	24.77	119.74	6204.79	0.0
09-Mar-14	87.58	39.96	153.68	7566.56	0.0
10-Mar-14	84.24	38.88	139.06	7277.97	0.0
11-Mar-14	72.76	38.02	125.03	6286.11	0.0
12-Mar-14	78.98	33.80	138.89	6823.85	0.0
13-Mar-14	77.82	39.54	117.64	6723.89	0.0
14-Mar-14	91.86	46.19	146.65	7936.28	0.0
15-Mar-14	93.97	51.83	145.61	8119.36	0.0
16-Mar-14	85.95	49.33	124.02	7426.25	0.0
17-Mar-14	78.50	48.14	110.28	6782.51	0.0
18-Mar-14	73.17	45.30	100.65	6321.84	0.0
19-Mar-14	78.64	42.85	121.99	6794.14	0.0
20-Mar-14	80.01	50.37	112.08	6912.81	0.0
21-Mar-14	66.60	45.34	97.82	5753.95	0.0
22-Mar-14	60.97	34.98	89.91	5267.39	0.0
23-Mar-14	62.07	31.18	90.52	5363.13	0.0
24-Mar-14	57.96	31.80	82.94	5008.01	0.0
25-Mar-14	55.48	29.80	81.82	4793.39	0.0
26-Mar-14	54.83	27.50	84.90	4737.39	0.0
27-Mar-14	54.15	25.48	78.77	4678.14	0.0
28-Mar-14	55.03	27.52	81.42	4754.24	0.0
29-Mar-14	58.20	27.46	91.25	5028.61	0.0
30-Mar-14	62.45	29.32	97.45	5395.96	0.0
31-Mar-14	59.05	26.86	96.81	5102.26	0.0

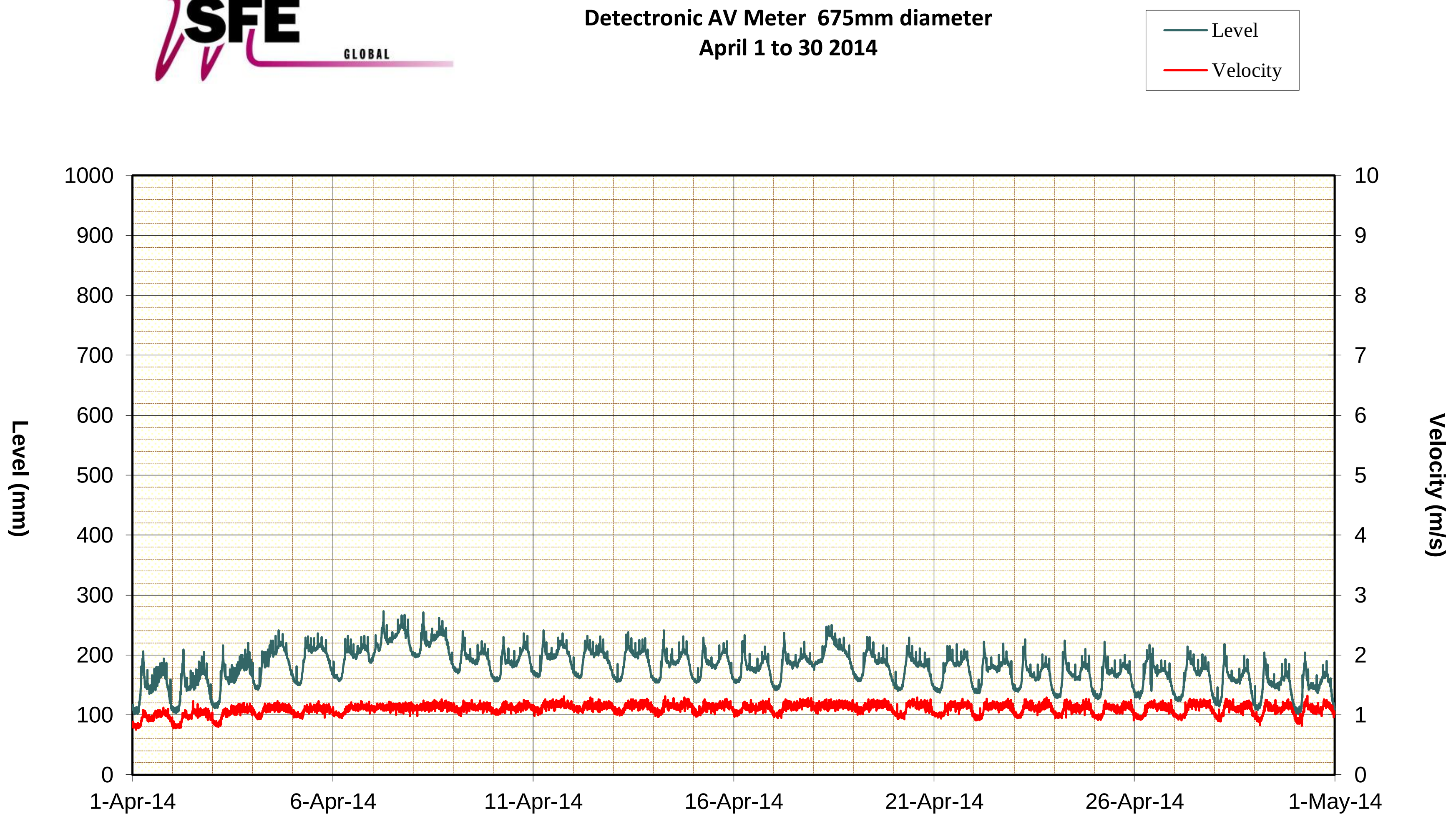
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
178311.661	20.191	153.680	0.0

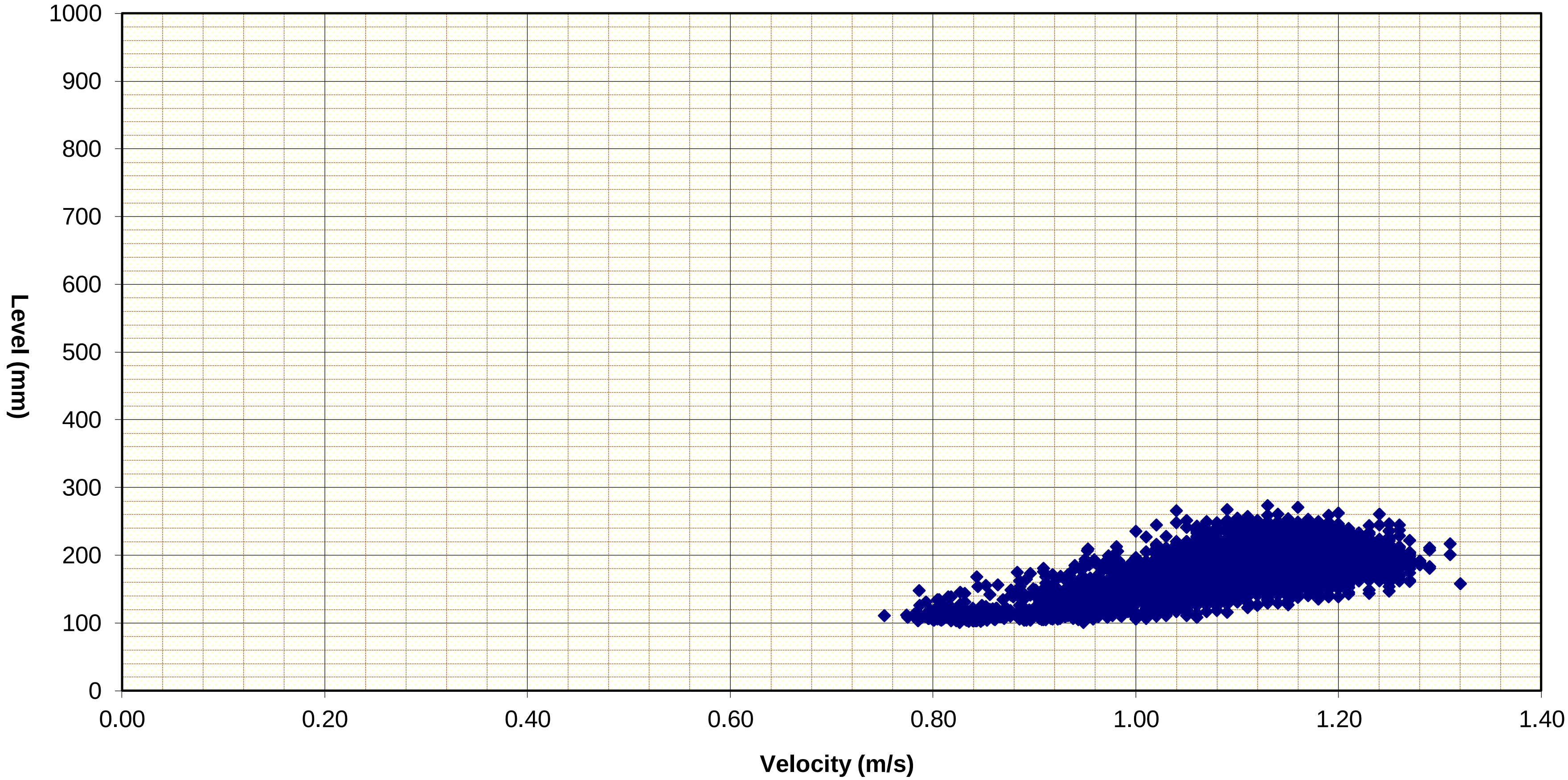
City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
April 1 to 30 2014



City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
April 1 to 30 2014



City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
April 1 to 30 2014



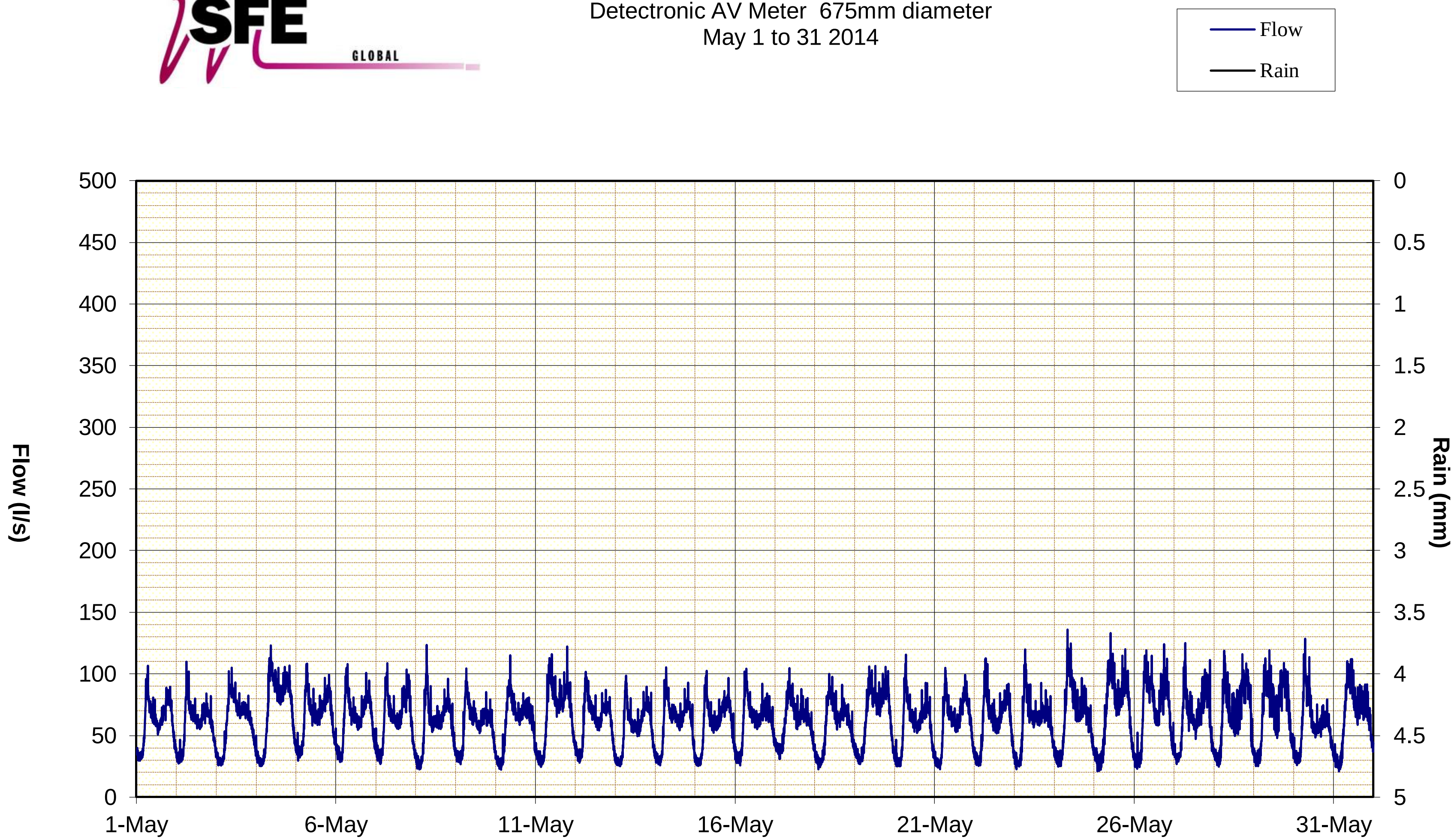
City of Prince George, BC
Site #414E - Site 4 MH #HG73B
Detectronic AV - 675mm Dia
Service Road off of Yellowhead Highway
April 1 to 30 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Apr-14	54.92	27.09	96.16	4745.34	0.0
02-Apr-14	57.26	28.23	95.51	4947.48	0.0
03-Apr-14	68.88	31.47	106.59	5951.65	0.0
04-Apr-14	89.74	50.88	127.30	7753.96	0.0
05-Apr-14	91.73	57.91	125.95	7925.69	0.0
06-Apr-14	93.06	60.29	129.13	8040.15	0.0
07-Apr-14	120.16	93.85	153.29	10381.64	0.0
08-Apr-14	116.83	85.80	158.39	10094.21	0.0
09-Apr-14	94.47	67.43	130.00	8162.48	0.0
10-Apr-14	92.20	63.17	139.32	7965.86	0.0
11-Apr-14	100.31	68.20	133.75	8667.04	0.0
12-Apr-14	96.74	69.39	124.04	8357.99	0.0
13-Apr-14	94.37	61.79	135.30	8153.51	0.0
14-Apr-14	91.42	59.86	127.90	7898.97	0.0
15-Apr-14	89.75	60.79	125.31	7754.70	0.0
16-Apr-14	84.21	57.34	124.04	7275.43	0.0
17-Apr-14	89.98	53.69	132.28	7774.62	0.0
18-Apr-14	107.25	76.42	141.25	9266.29	0.0
19-Apr-14	90.16	60.40	128.05	7789.50	0.0
20-Apr-14	82.49	51.84	123.01	7127.39	0.0
21-Apr-14	82.36	50.11	117.98	7115.93	0.0
22-Apr-14	81.41	46.96	119.98	7033.66	0.0
23-Apr-14	77.12	50.87	125.01	6663.30	0.0
24-Apr-14	74.64	45.61	129.73	6449.19	0.0
25-Apr-14	74.61	43.10	114.81	6446.42	0.0
26-Apr-14	74.55	45.28	115.25	6441.49	0.0
27-Apr-14	75.31	42.00	112.63	6506.44	0.0
28-Apr-14	69.02	37.27	109.98	5963.36	0.0
29-Apr-14	63.83	33.89	102.08	5515.28	0.0
30-Apr-14	62.46	29.85	108.55	5396.85	0.0

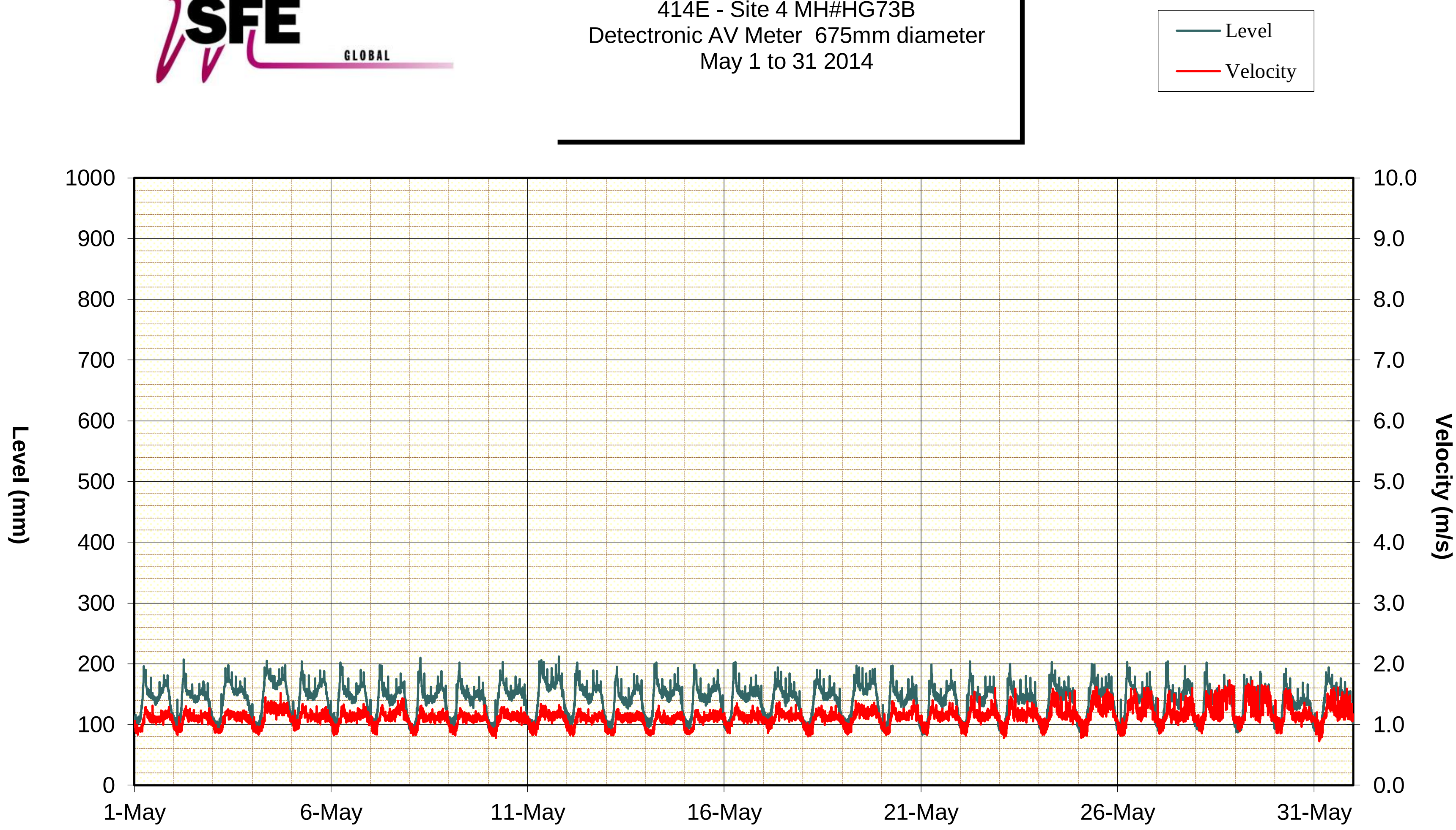
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
219565.801	27.087	158.387	0.0

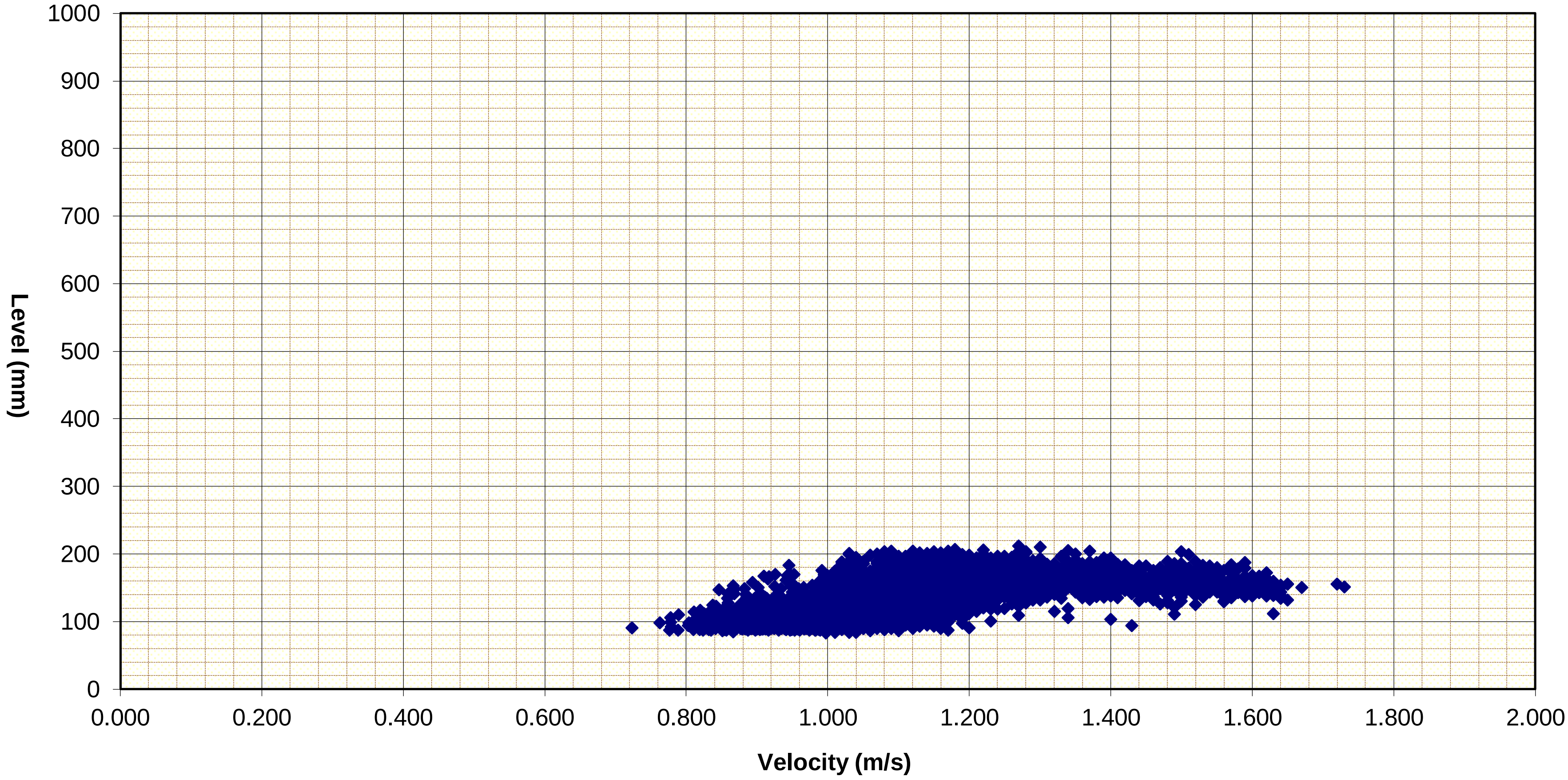
City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
May 1 to 31 2014



City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
May 1 to 31 2014



City of Prince George, BC
414E - Site 4 MH#HG73B
Detectronic AV Meter 675mm diameter
May 1 to 31 2014



City of Prince George, BC
Site #414E - Site 4 MH #HG73B
Detectronic AV - 675mm Dia
Service Road off of Yellowhead Highway
May 1 to 31 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-May-14	61.15	29.56	106.59	5283.25	0.0
02-May-14	59.31	27.25	109.84	5124.65	0.0
03-May-14	60.83	25.61	105.02	5255.31	0.0
04-May-14	71.45	25.12	123.07	6173.34	0.0
05-May-14	65.83	29.52	108.29	5687.42	0.0
06-May-14	63.71	28.44	107.95	5504.69	0.0
07-May-14	63.17	26.85	108.63	5458.22	0.0
08-May-14	59.66	22.48	123.44	5154.32	0.0
09-May-14	59.04	26.66	104.38	5101.19	0.0
10-May-14	60.73	22.24	115.06	5246.84	0.0
11-May-14	67.19	24.51	122.18	5805.62	0.0
12-May-14	61.80	27.89	101.68	5339.37	0.0
13-May-14	57.33	25.04	98.53	4953.70	0.0
14-May-14	60.77	25.75	105.28	5250.34	0.0
15-May-14	60.18	25.31	102.46	5199.71	0.0
16-May-14	62.07	25.68	104.19	5362.93	0.0
17-May-14	61.32	30.94	104.63	5297.63	0.0
18-May-14	57.99	22.54	99.98	5010.56	0.0
19-May-14	65.58	26.74	106.41	5666.27	0.0
20-May-14	59.23	24.98	115.58	5117.68	0.0
21-May-14	60.72	22.60	104.88	5245.81	0.0
22-May-14	62.00	25.31	112.61	5356.40	0.0
23-May-14	60.69	22.59	119.81	5243.22	0.0
24-May-14	65.07	24.71	135.90	5621.69	0.0
25-May-14	68.15	20.95	133.08	5887.75	0.0
26-May-14	69.61	22.98	124.04	6014.40	0.0
27-May-14	63.52	26.79	124.97	5487.82	0.0
28-May-14	67.72	24.67	118.74	5850.87	0.0
29-May-14	69.45	25.10	119.16	6000.56	0.0
30-May-14	58.94	25.93	128.49	5092.32	0.0
31-May-14	64.53	20.84	112.04	5575.45	0.0

Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
168369.305	20.840	135.900	0.0

FIELD MAINTENANCE RECORD

NAME□	City of Prince George, BC
SFE SITE #□	□1□E □5 M□ □O□1□E
ADDRESS□	be□ind 5□50 □ovac□ic□ Rd.
GPS□	5□.□0□51 122.6□□55
SENSOR TYPE□	A□
PRIMARY DEVICE□	□00mm A□

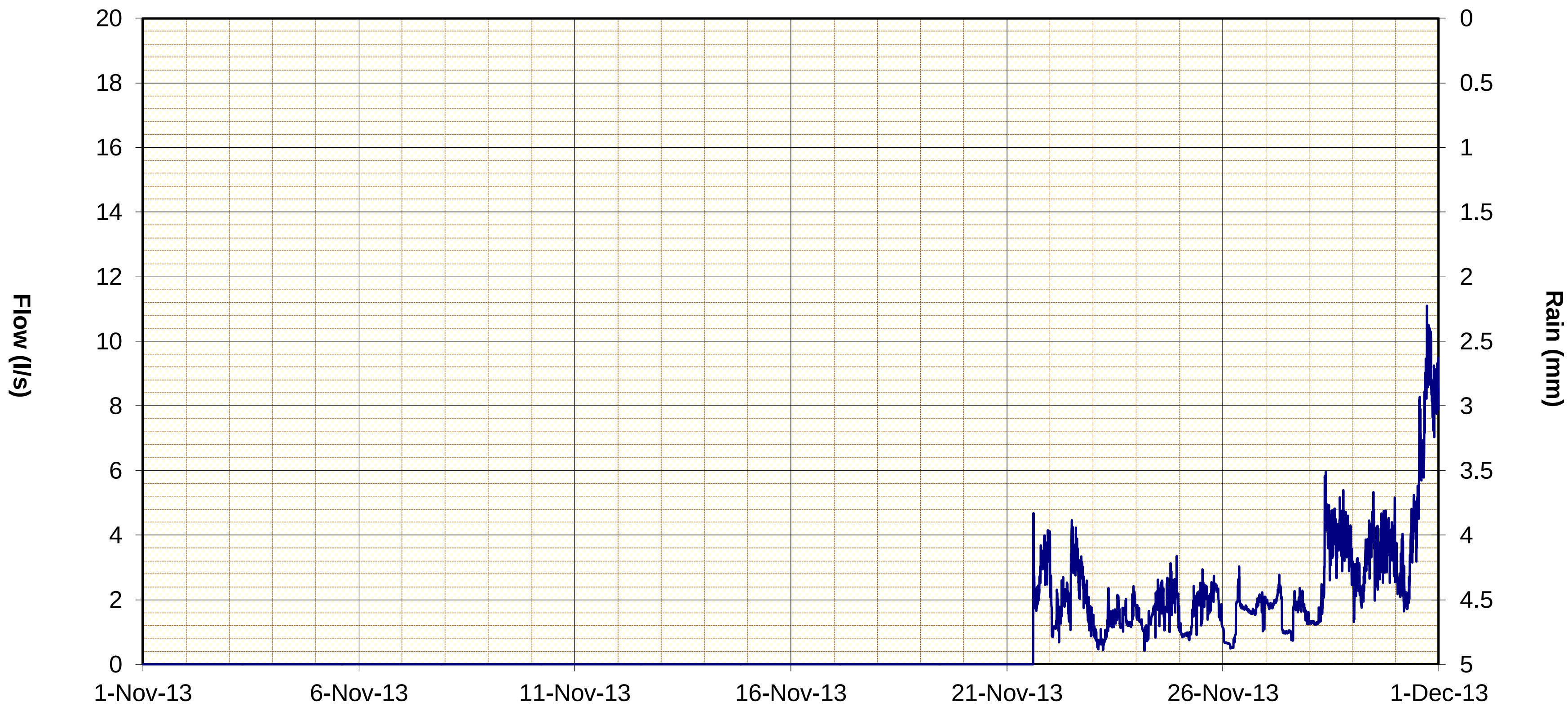
CONSTANTS			
D1 □cm□:		D1 □lip to □bar	
TOM □cm□: 505.000		Raw □ eir L □□bar to water	
METER □	207□010□6	DATE:	11□22□1□
METER □	207□015□□	DATE:	11□21□1□
METER □		DATE:	

LEGEND	
DL □DO□ NLOAD	**PC** □PROGRAM COMPLETE
CB □C□G BATTERY	**PM** □PROG. METER
V □□ERIFY	**VIS** □□IS□AL
LA □LE□EL AD□□ST	**VP** □□ELOCITY PROFILE
DO □DEPT□ ONLY	**CD** □C□G DESICCANT

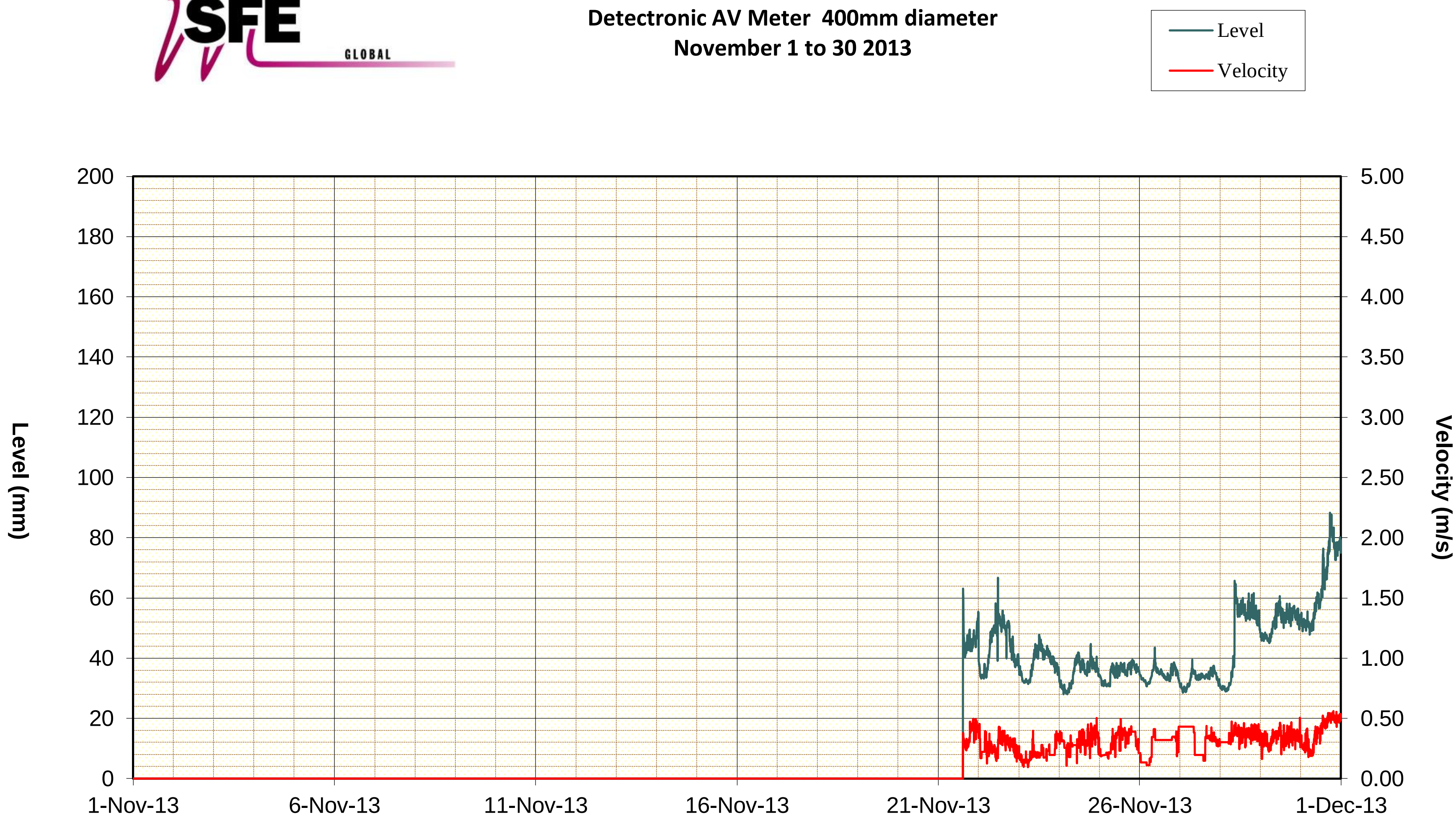
DATE	TIME	METER TIME	METER DEPT□	FIELD DEPT□	METER □EL	FIELD □EL□□IS	FLO□	BATT	SILT	MTC BY	COMMENTS
M□D□YY	□□:MM	□□:MM	cm	cm	M□S	M□S	LPS	□	cm	□INIT.□	
11□22□1□	11:□0	11:□0	5.□	5.5	0.22	0.25	□	12.1	0	□□	installed Isco meter□DL'd bac□up□debris on t□e b□u sensor
12□10□1□	11:22	11:21	5.□	5.5	0.2	□	□	11.2□1□.5	0	□□	DL O□
01□0□□1□	10:06	10:05	7.1	7	0.□	□	□	12.7	0	□□	DL O□
01□22□1□	1□:0□	1□:02	6.1	6	0.2□	□	□	12.□	0	□□	DL O□
02□12□1□	11:00	11:00	10.1	10	0.1□	□	□	12.2	0	□□	DL O□
0□□01□1□	1□:□0	1□:□0	□□.6	□	0.1□	□	□.1	12.2	0	GC	remote data download
0□□12□1□	12:10	11:0□	5.□	6	0.2□	□	□.□	12.1	0	□□	DL sensor clear□antenna and meter □as been disturbed
□	□	□	□	□	□	□	□	□	□	□	antenna and meter damaged□reported to t□e City
0□□0□□1□	1□:57	12:56	5.□	6	0.□	□	□.7	12.6	0	□□	DL sensor clear □reset meter □lost data 1st to □t□□
0□□26□1□	10:1□	□:15	6.□	7.5	0.□□	□	□.□	11.7□1□.2	0	□□	DL sensor clear
05□1□□1□	10:26	□:2□	□.1	□.5	0.1□	□	□.□	1□.1	0	□□	DL sensor clear
06□0□□1□	□:0□	7:05	7.□	7.5	0.25	0.□	□	1□.1	0	□□	minor sensor debris

DATE□	**NOTES□**

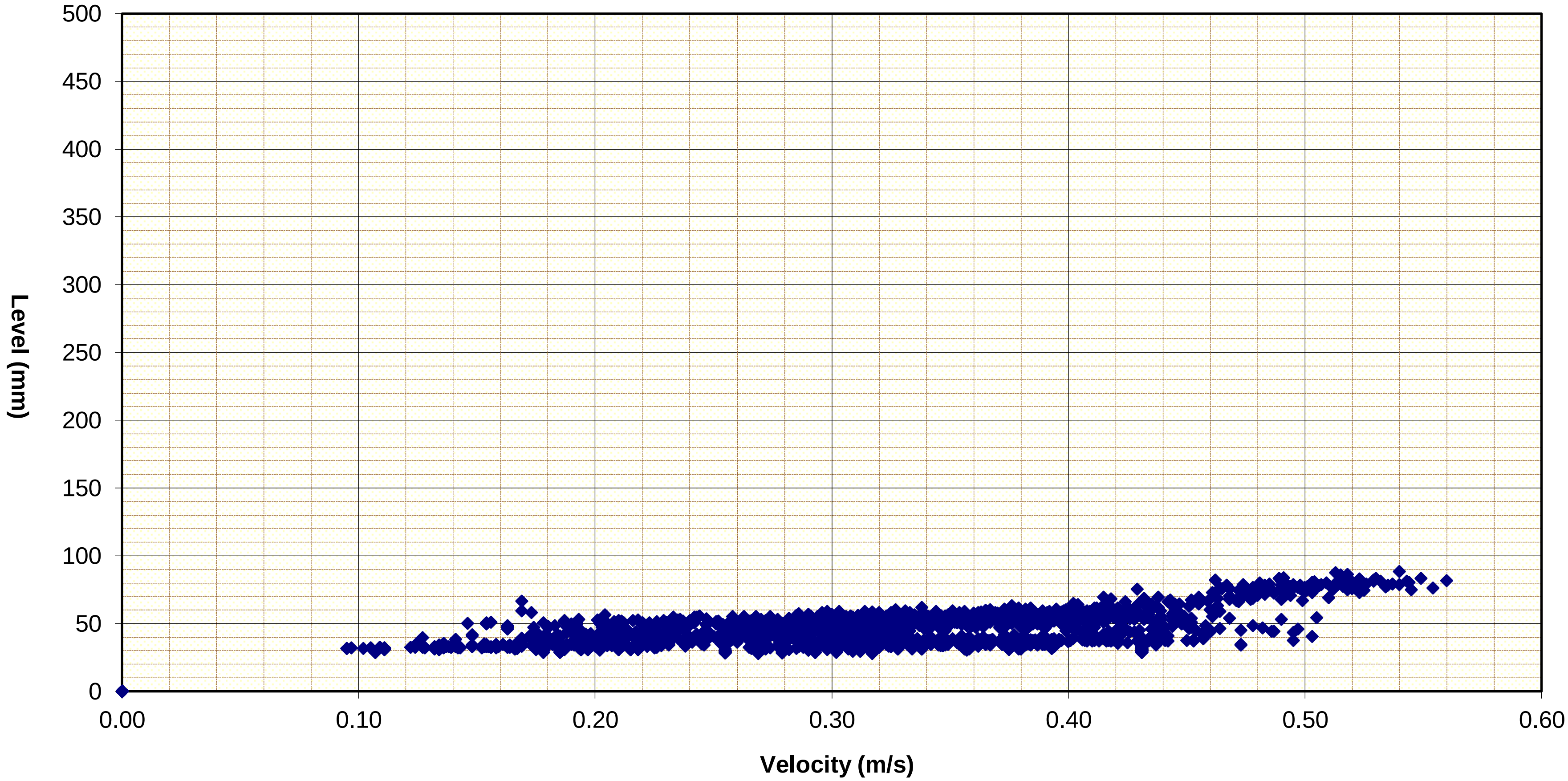
City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
November 1 to 30 2013



City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
November 1 to 30 2013



City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
November 1 to 30 2013



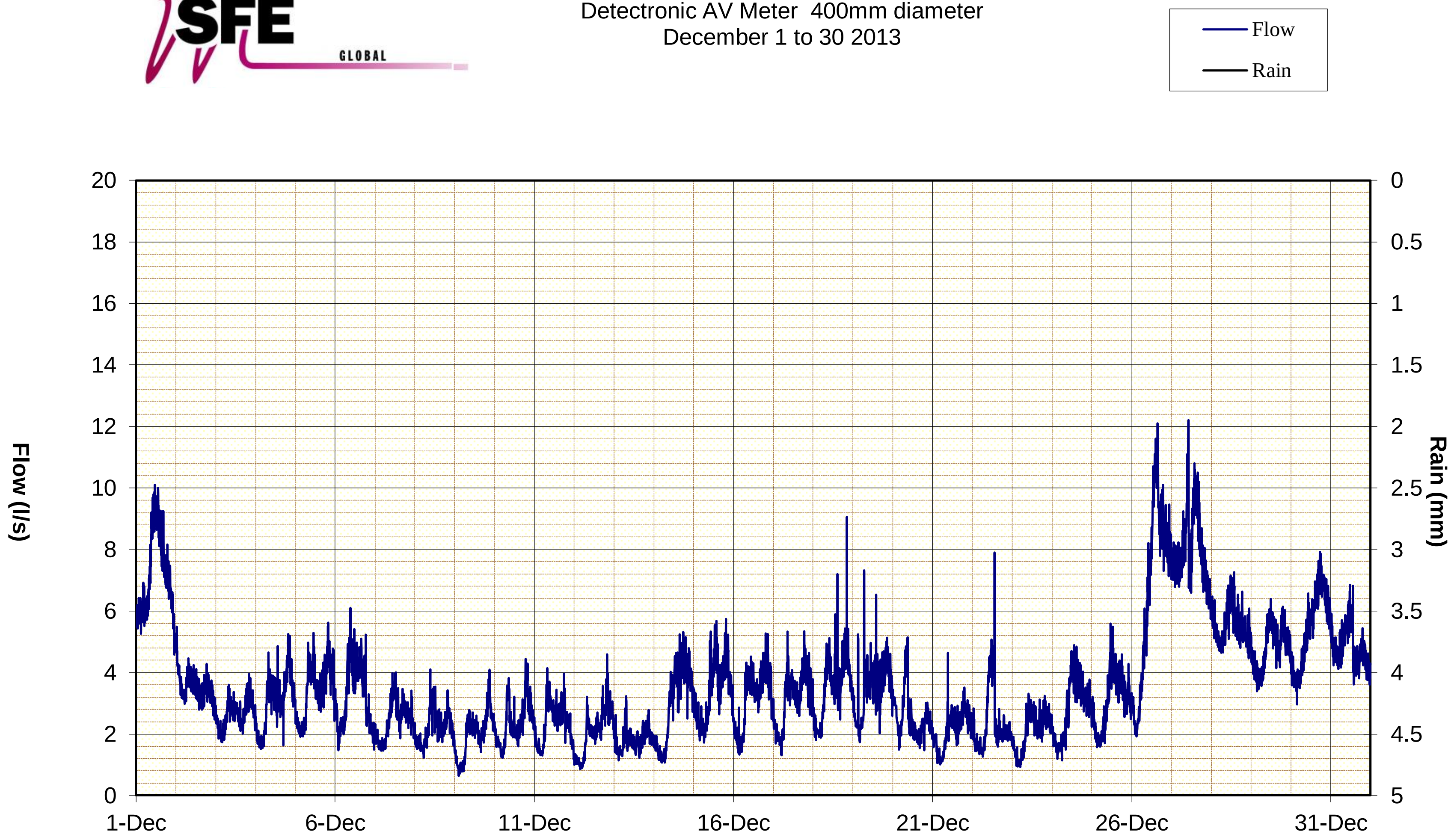
City of Prince George, BC
Site #414E - Site 5 MH #OK14E
Detectronic AV - 400mm Dia
behind 5850 Kovachich Road
November 1 to 30 2013

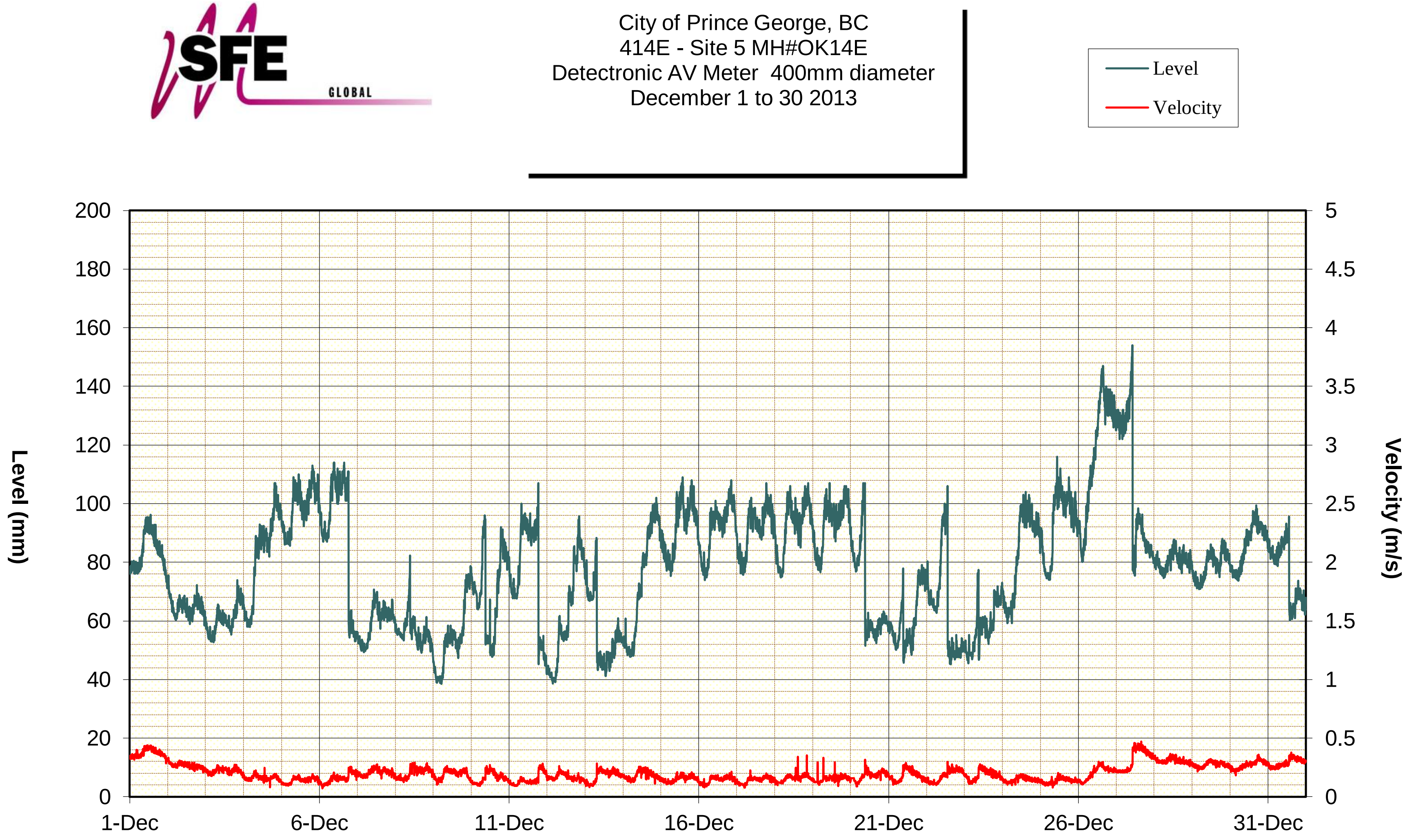
Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Nov-13	0.00	0.00	0.00	0.00	0.0
02-Nov-13	0.00	0.00	0.00	0.00	0.0
03-Nov-13	0.00	0.00	0.00	0.00	0.0
04-Nov-13	0.00	0.00	0.00	0.00	0.0
05-Nov-13	0.00	0.00	0.00	0.00	0.0
06-Nov-13	0.00	0.00	0.00	0.00	0.0
07-Nov-13	0.00	0.00	0.00	0.00	0.0
08-Nov-13	0.00	0.00	0.00	0.00	0.0
09-Nov-13	0.00	0.00	0.00	0.00	0.0
10-Nov-13	0.00	0.00	0.00	0.00	0.0
11-Nov-13	0.00	0.00	0.00	0.00	0.0
12-Nov-13	0.00	0.00	0.00	0.00	0.0
13-Nov-13	0.00	0.00	0.00	0.00	0.0
14-Nov-13	0.00	0.00	0.00	0.00	0.0
15-Nov-13	0.00	0.00	0.00	0.00	0.0
16-Nov-13	0.00	0.00	0.00	0.00	0.0
17-Nov-13	0.00	0.00	0.00	0.00	0.0
18-Nov-13	0.00	0.00	0.00	0.00	0.0
19-Nov-13	0.00	0.00	0.00	0.00	0.0
20-Nov-13	0.00	0.00	0.00	0.00	0.0
21-Nov-13	1.15	0.00	4.68	99.19	0.0
22-Nov-13	2.14	0.68	4.46	185.21	0.0
23-Nov-13	1.27	0.44	2.42	109.41	0.0
24-Nov-13	1.70	0.43	3.35	146.52	0.0
25-Nov-13	1.67	0.75	2.94	144.08	0.0
26-Nov-13	1.46	0.49	3.03	126.27	0.0
27-Nov-13	1.64	0.73	2.77	141.58	0.0
28-Nov-13	3.15	1.22	5.96	272.41	0.0
29-Nov-13	3.29	1.31	5.33	284.34	0.0
30-Nov-13	5.48	1.64	11.10	473.68	0.0

Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
1982.694	0.000	11.100	0.0

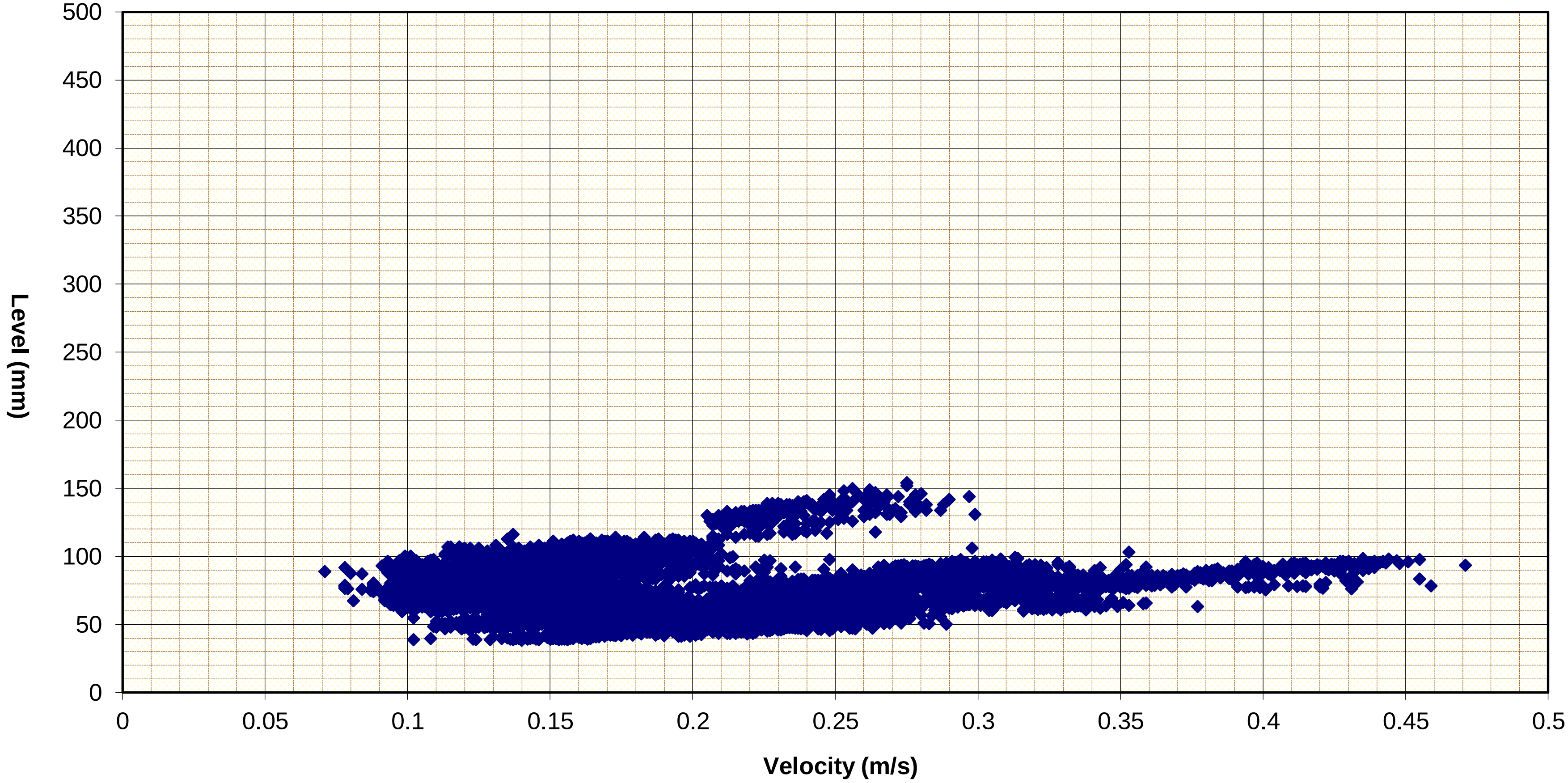
City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
December 1 to 30 2013





City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
December 1 to 30 2013
Level
Velocity
Level (mm)
Velocity (m/s)
200
180
160
140
120
100
80
60
40
20
0
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1-Dec
6-Dec
11-Dec
16-Dec
21-Dec
26-Dec
31-Dec

City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
December 1 to 30 2013



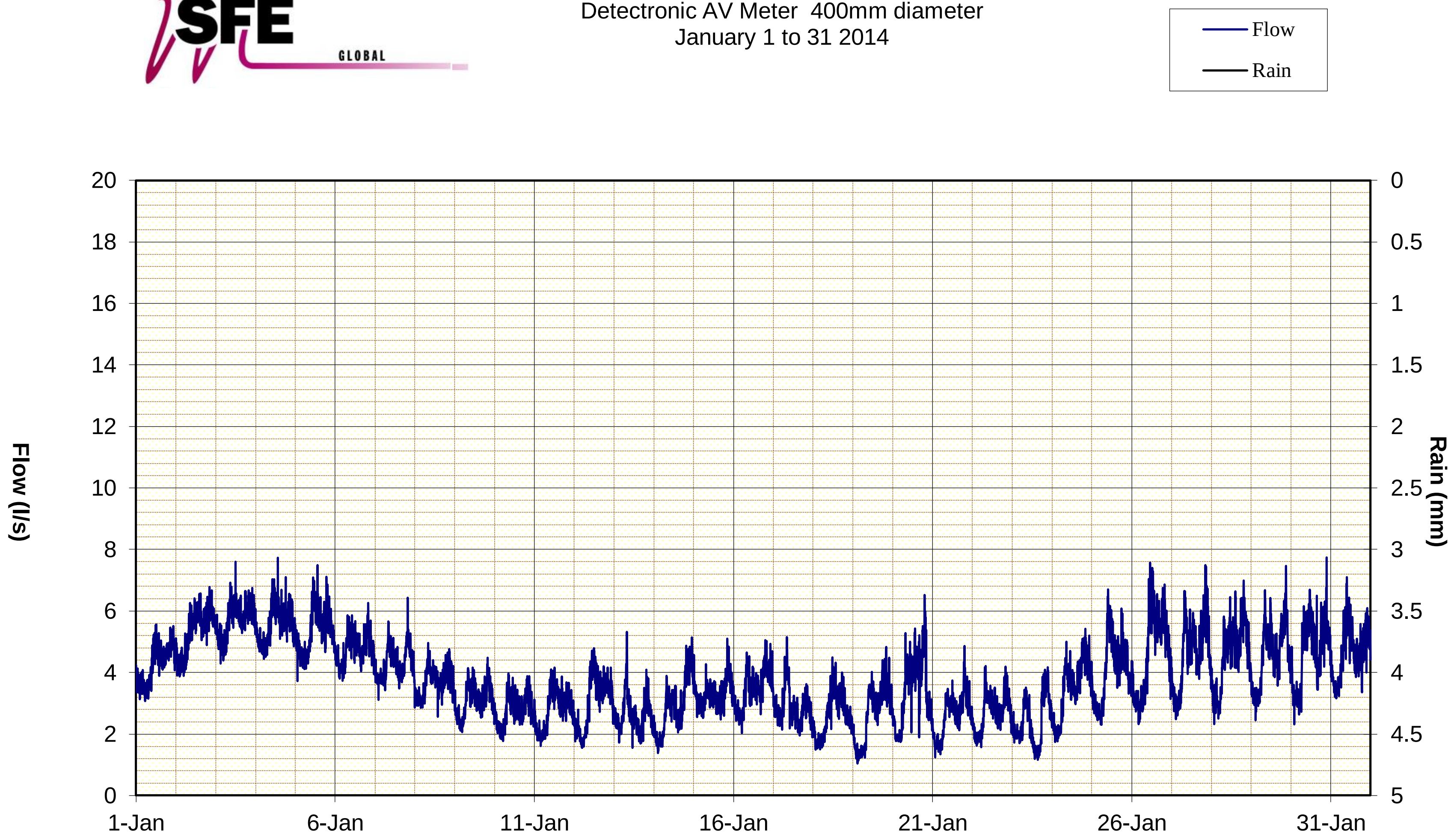
City of Prince George, BC
Site #414E - Site 5 MH #OK14E
Detectronic AV - 400mm Dia
behind 5850 Kovachich Road
December 1 to 31 2013

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Dec-13	7.14	4.58	10.10	617.13	0.0
02-Dec-13	3.53	2.47	5.49	305.37	0.0
03-Dec-13	2.66	1.73	3.95	229.90	0.0
04-Dec-13	3.04	1.51	5.25	263.03	0.0
05-Dec-13	3.42	1.91	5.62	295.92	0.0
06-Dec-13	3.27	1.47	6.10	282.32	0.0
07-Dec-13	2.46	1.46	4.00	212.15	0.0
08-Dec-13	2.20	1.23	4.10	189.84	0.0
09-Dec-13	1.98	0.64	4.09	171.47	0.0
10-Dec-13	2.36	1.23	4.44	203.99	0.0
11-Dec-13	2.36	1.18	4.14	204.30	0.0
12-Dec-13	2.08	0.85	4.59	180.12	0.0
13-Dec-13	1.83	1.14	3.23	158.12	0.0
14-Dec-13	2.99	1.07	5.32	258.41	0.0
15-Dec-13	3.38	1.72	5.74	292.31	0.0
16-Dec-13	3.17	1.33	5.27	274.28	0.0
17-Dec-13	3.15	1.31	5.34	271.90	0.0
18-Dec-13	3.53	1.80	9.06	304.93	0.0
19-Dec-13	3.48	1.73	7.32	300.54	0.0
20-Dec-13	2.54	1.47	5.14	219.23	0.0
21-Dec-13	2.15	1.01	4.64	185.68	0.0
22-Dec-13	2.33	1.26	7.90	201.35	0.0
23-Dec-13	2.11	0.93	3.31	181.97	0.0
24-Dec-13	2.85	1.14	4.89	246.49	0.0
25-Dec-13	3.05	1.57	5.59	263.93	0.0
26-Dec-13	6.63	1.92	12.10	573.05	0.0
27-Dec-13	8.02	5.74	12.20	693.27	0.0
28-Dec-13	5.55	4.46	7.26	479.82	0.0
29-Dec-13	4.82	3.39	6.39	416.12	0.0
30-Dec-13	5.45	2.96	7.92	470.79	0.0
31-Dec-13	4.82	3.60	6.85	416.47	0.0

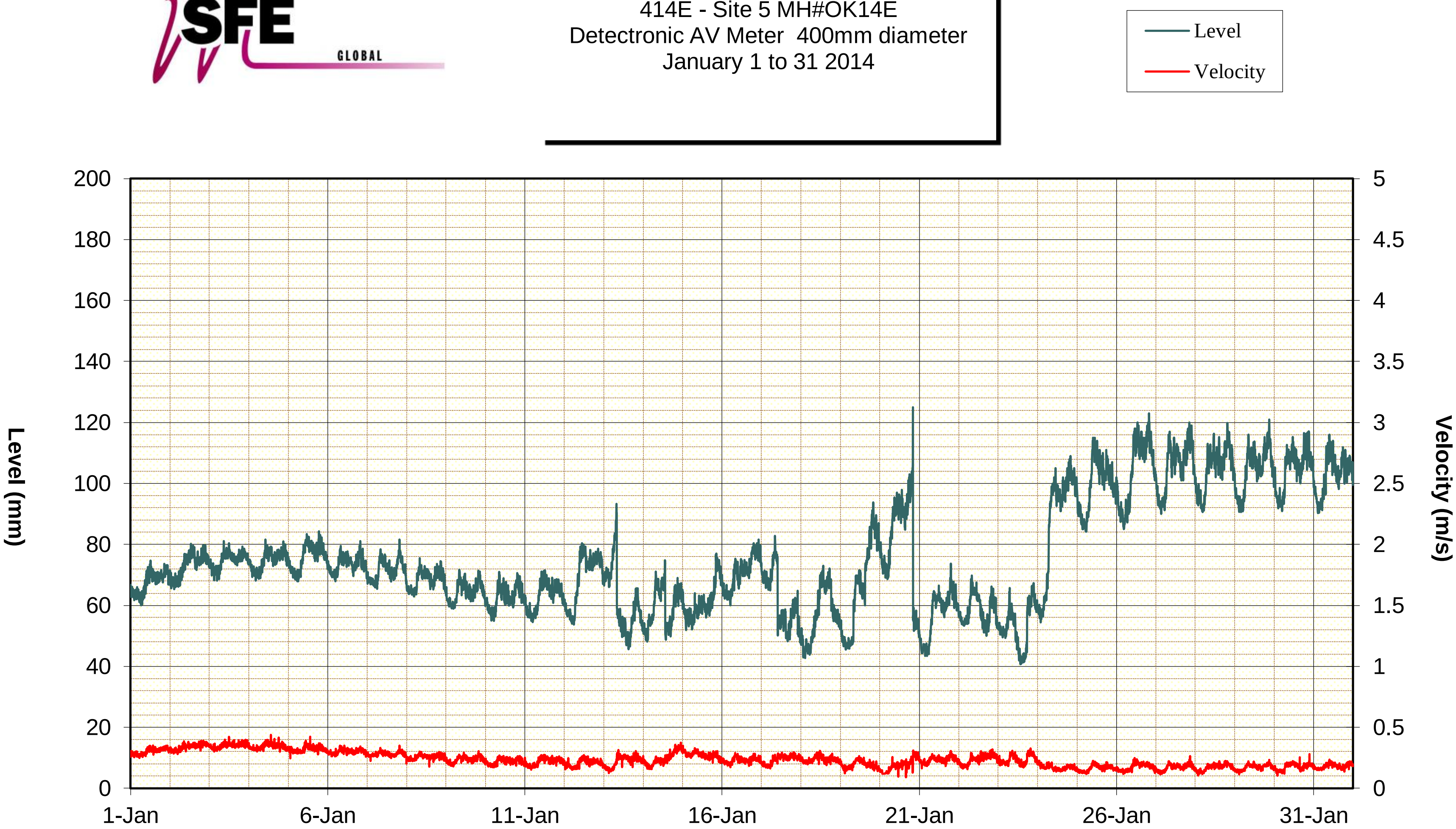
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
9364.188	0.638	12.200	0.0

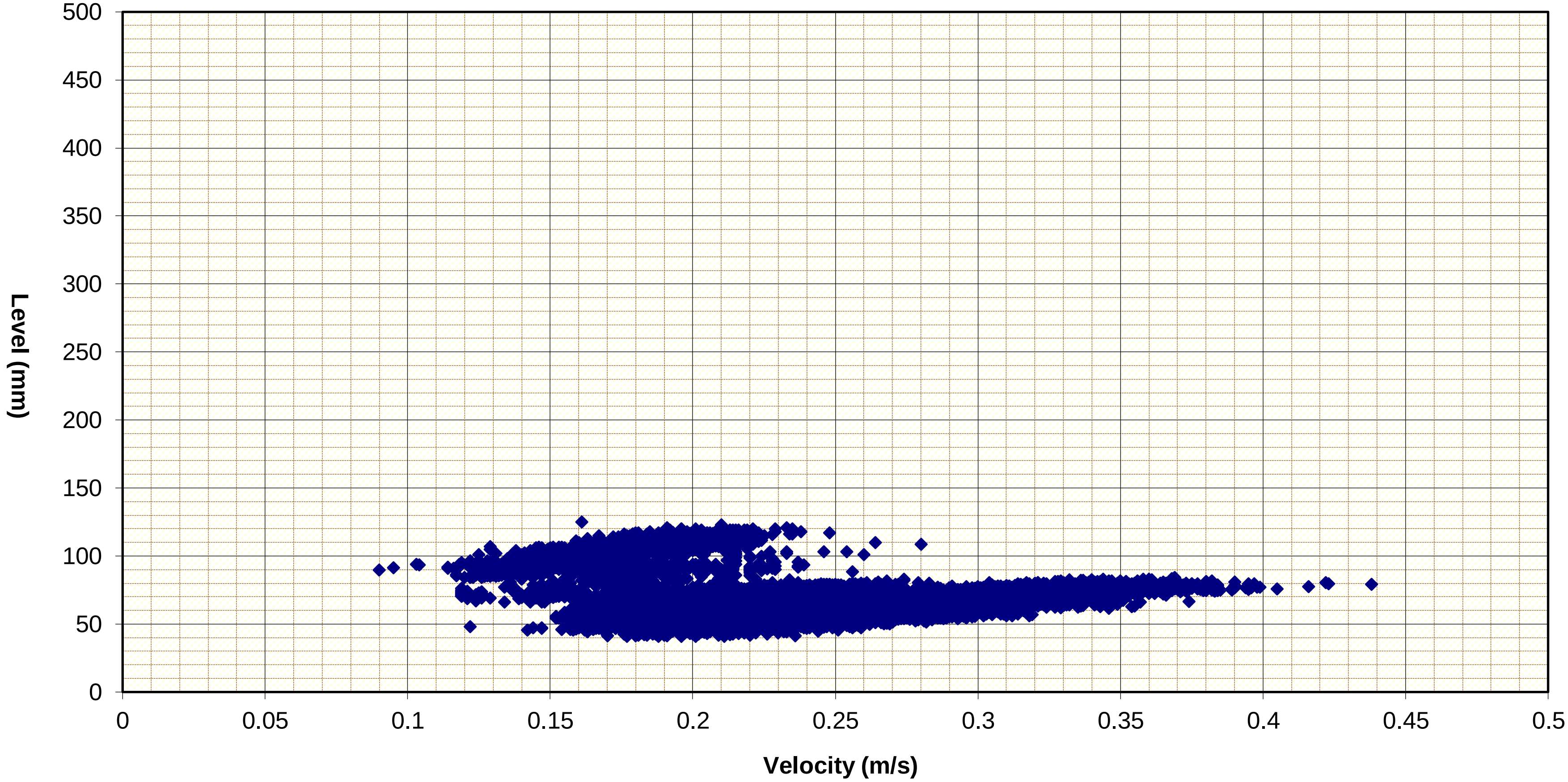
City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
January 1 to 31 2014



City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
January 1 to 31 2014



City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
January 1 to 31 2014



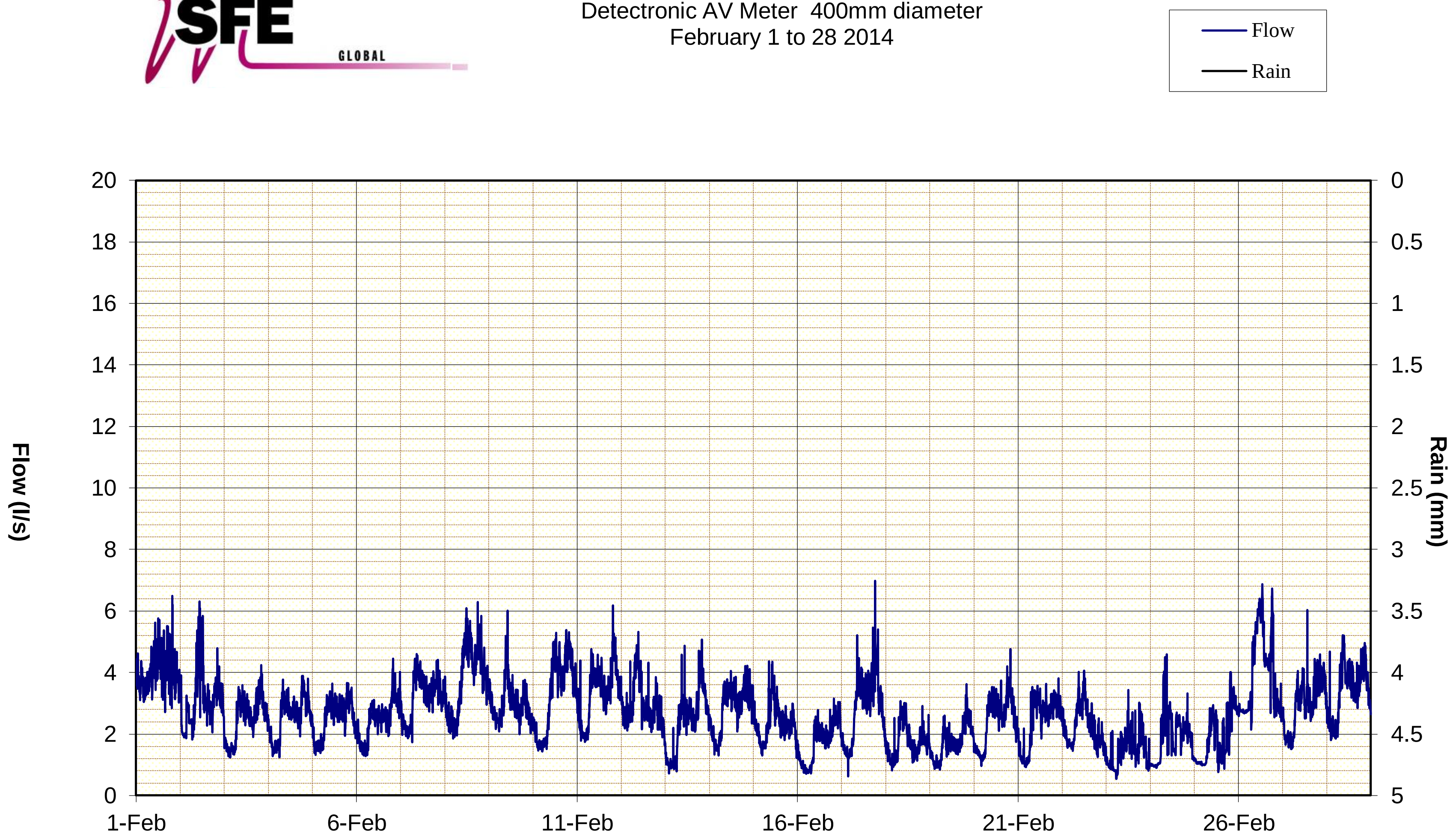
City of Prince George, BC
Site #414E - Site 5 MH #OK14E
Detectronic AV - 400mm Dia
behind 5850 Kovachich Road
January 1 to 31 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Jan-14	4.27	3.07	5.56	368.58	0.0
02-Jan-14	5.39	3.87	6.78	465.88	0.0
03-Jan-14	5.70	4.29	7.60	492.17	0.0
04-Jan-14	5.58	4.44	7.73	482.31	0.0
05-Jan-14	5.33	3.72	7.49	460.61	0.0
06-Jan-14	4.77	3.73	6.26	412.14	0.0
07-Jan-14	4.30	2.86	6.43	371.20	0.0
08-Jan-14	3.68	2.56	4.96	318.04	0.0
09-Jan-14	3.09	2.06	4.48	267.33	0.0
10-Jan-14	2.76	1.77	3.97	238.83	0.0
11-Jan-14	2.80	1.61	4.16	241.92	0.0
12-Jan-14	3.04	1.55	4.79	263.00	0.0
13-Jan-14	2.64	1.55	5.32	228.51	0.0
14-Jan-14	2.90	1.38	5.14	250.79	0.0
15-Jan-14	3.32	2.47	5.10	286.83	0.0
16-Jan-14	3.50	2.03	5.05	302.63	0.0
17-Jan-14	2.86	1.89	5.15	246.75	0.0
18-Jan-14	2.63	1.49	4.49	227.62	0.0
19-Jan-14	2.68	1.04	4.83	231.60	0.0
20-Jan-14	3.42	1.74	6.52	295.88	0.0
21-Jan-14	2.61	1.24	4.86	225.86	0.0
22-Jan-14	2.71	1.57	4.21	234.01	0.0
23-Jan-14	2.41	1.16	4.17	208.61	0.0
24-Jan-14	3.50	1.74	5.42	302.38	0.0
25-Jan-14	4.06	2.30	6.70	350.93	0.0
26-Jan-14	4.62	2.32	7.57	399.56	0.0
27-Jan-14	4.60	2.48	7.49	397.22	0.0
28-Jan-14	4.59	2.32	6.99	396.37	0.0
29-Jan-14	4.60	2.45	7.47	397.68	0.0
30-Jan-14	4.66	2.31	7.74	402.62	0.0
31-Jan-14	4.67	3.16	7.10	403.49	0.0

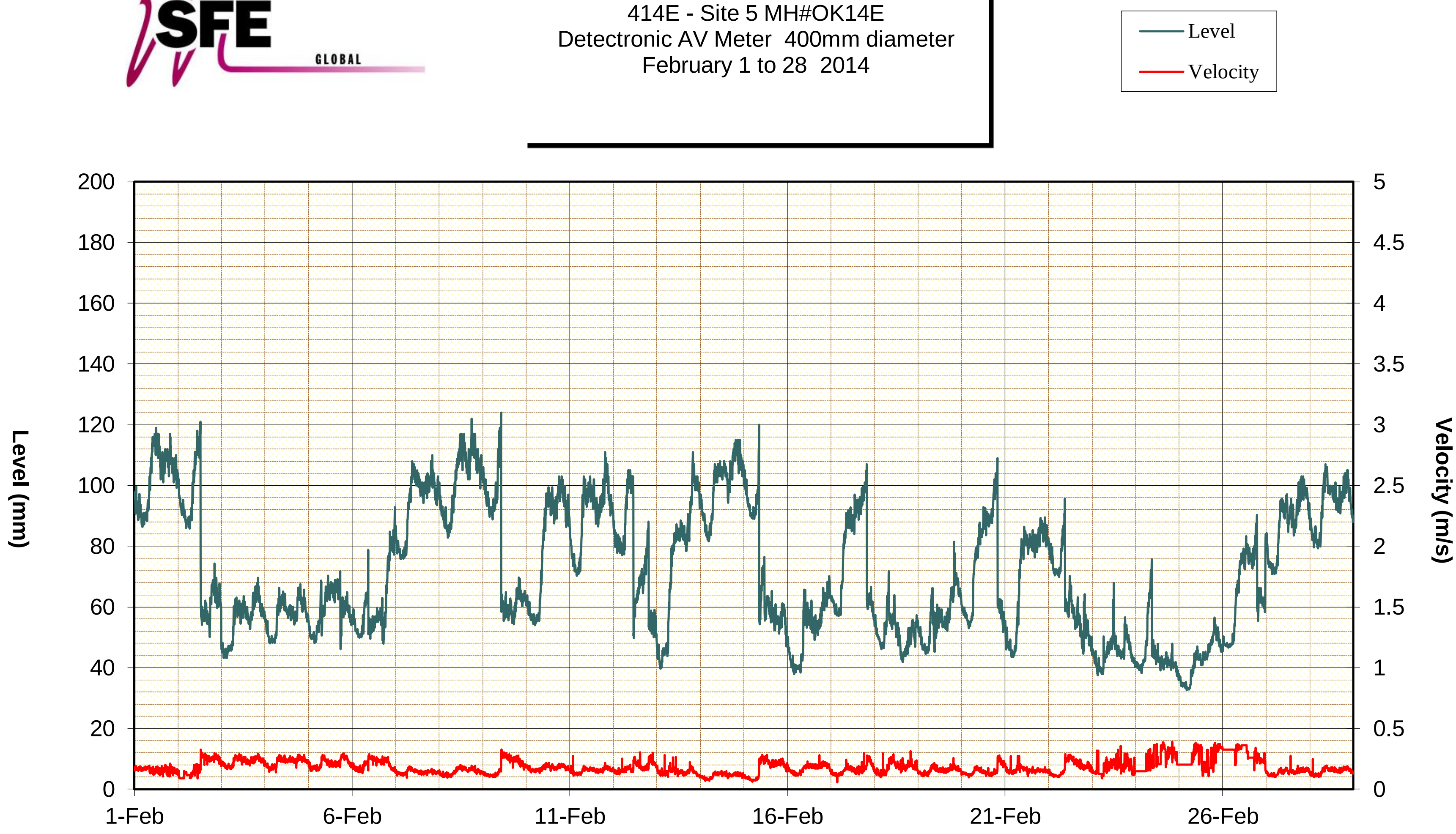
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
10171.348	1.040	7.740	0.0

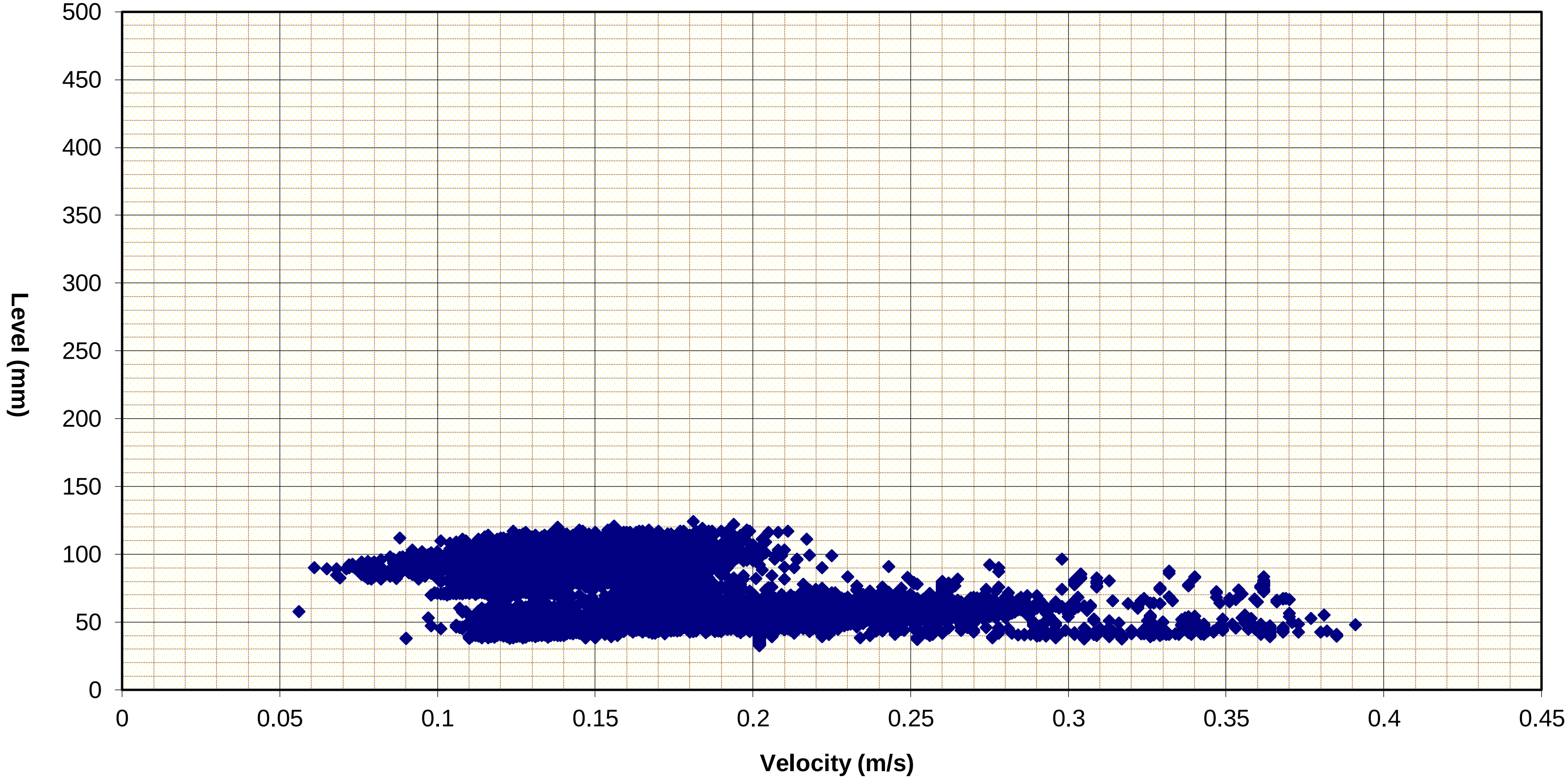
City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
February 1 to 28 2014



City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
February 1 to 28 2014



City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
February 1 to 28 2014



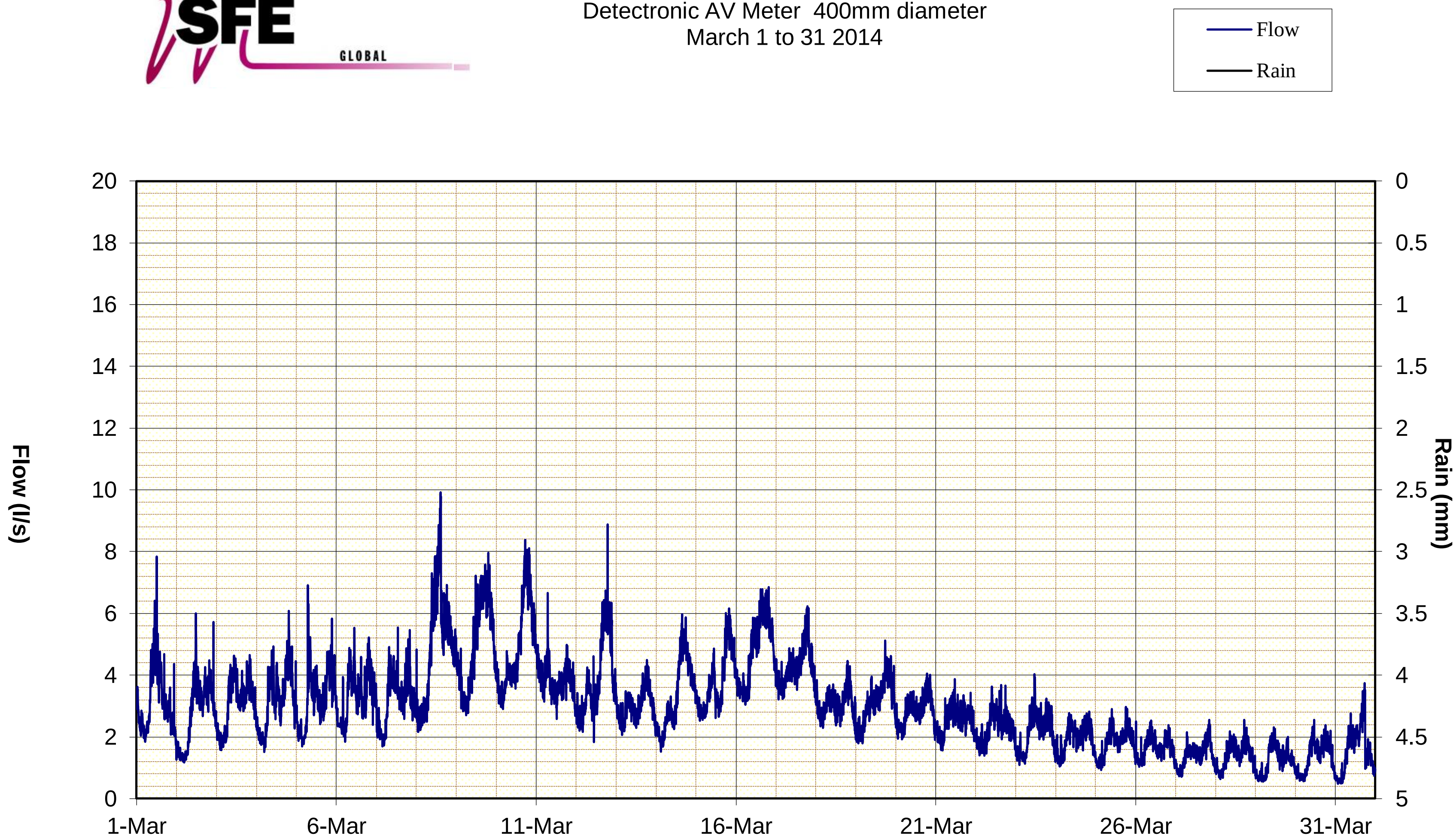
City of Prince George, BC
Site #414E - Site 5 MH #OK14E
Detectronic AV - 400mm Dia
behind 5850 Kovachich Road
February 1 to 28 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Feb-14	4.02	2.71	6.49	347.48	0.0
02-Feb-14	3.12	1.82	6.31	269.76	0.0
03-Feb-14	2.49	1.24	4.24	215.02	0.0
04-Feb-14	2.55	1.24	3.89	220.37	0.0
05-Feb-14	2.51	1.32	3.66	216.59	0.0
06-Feb-14	2.47	1.28	4.45	213.35	0.0
07-Feb-14	3.24	1.73	4.60	279.75	0.0
08-Feb-14	3.79	1.85	6.29	327.70	0.0
09-Feb-14	2.98	1.99	6.01	257.36	0.0
10-Feb-14	3.28	1.43	5.38	283.29	0.0
11-Feb-14	3.37	1.74	6.18	290.77	0.0
12-Feb-14	2.92	1.63	5.32	252.44	0.0
13-Feb-14	2.41	0.72	5.07	207.91	0.0
14-Feb-14	2.84	1.30	4.22	245.10	0.0
15-Feb-14	2.36	1.22	4.36	203.62	0.0
16-Feb-14	1.70	0.71	3.15	146.97	0.0
17-Feb-14	2.84	0.62	6.98	245.06	0.0
18-Feb-14	1.72	0.81	3.07	148.32	0.0
19-Feb-14	1.73	0.84	3.62	149.80	0.0
20-Feb-14	2.43	0.96	4.76	210.16	0.0
21-Feb-14	2.42	0.92	3.81	209.20	0.0
22-Feb-14	2.22	1.12	4.06	192.14	0.0
23-Feb-14	1.49	0.54	3.43	129.03	0.0
24-Feb-14	1.89	0.90	4.59	163.36	0.0
25-Feb-14	1.90	0.76	4.01	164.42	0.0
26-Feb-14	3.96	2.14	6.87	341.99	0.0
27-Feb-14	2.98	1.51	6.03	257.20	0.0
28-Feb-14	3.41	1.80	5.21	294.93	0.0

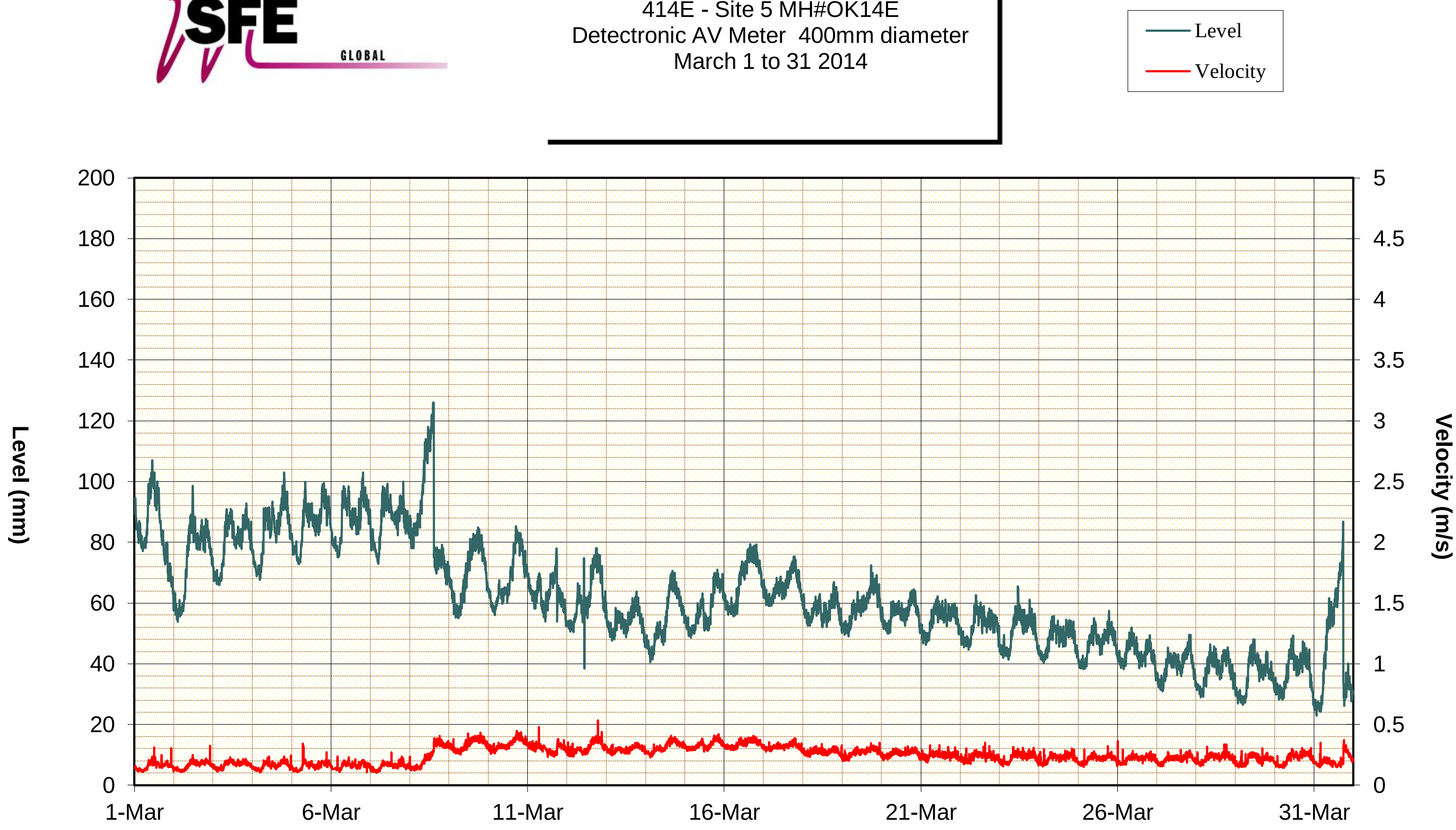
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
6483.093	0.543	6.980	0.0

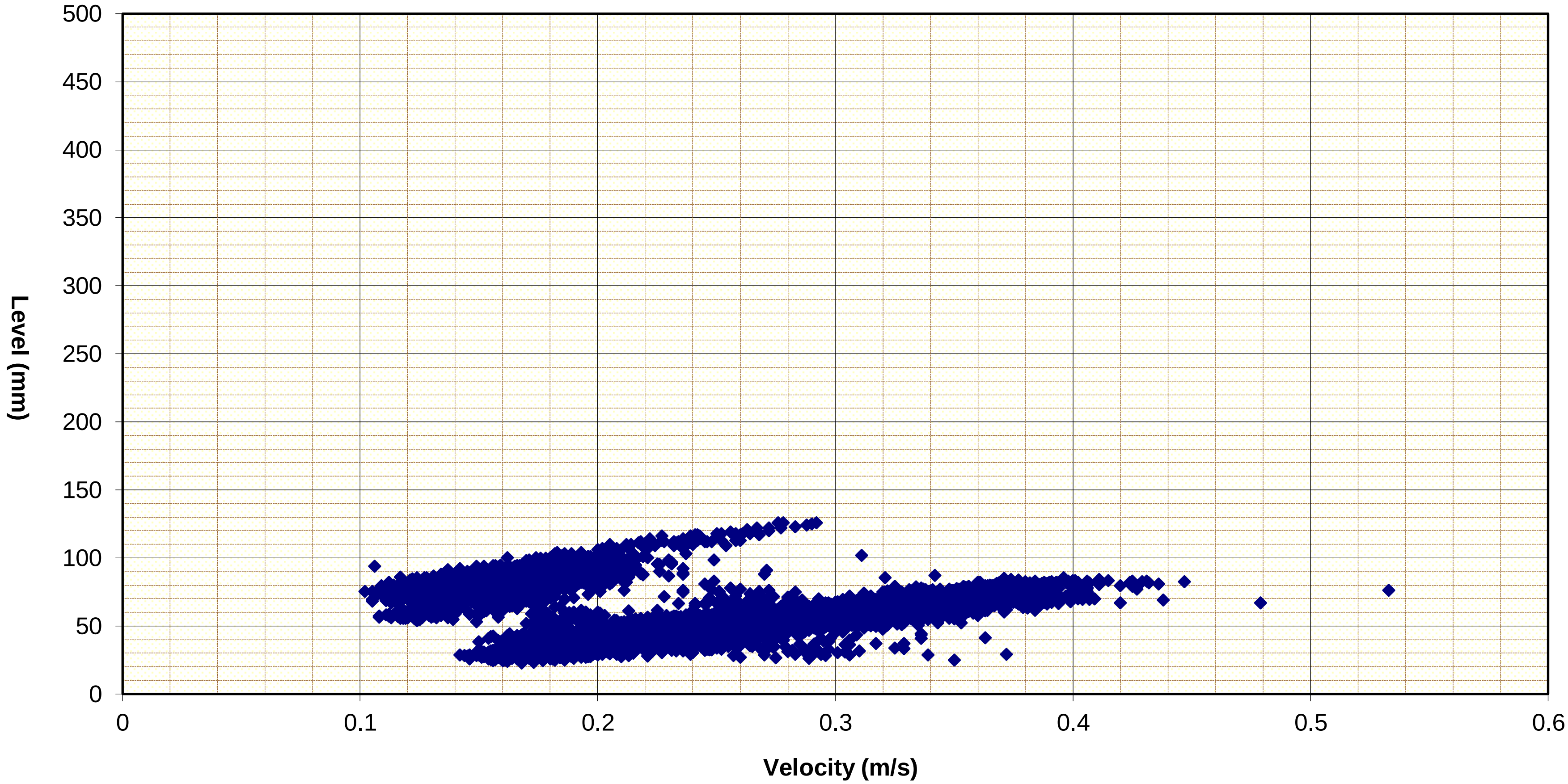
City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
March 1 to 31 2014



City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
March 1 to 31 2014



City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
March 1 to 31 2014



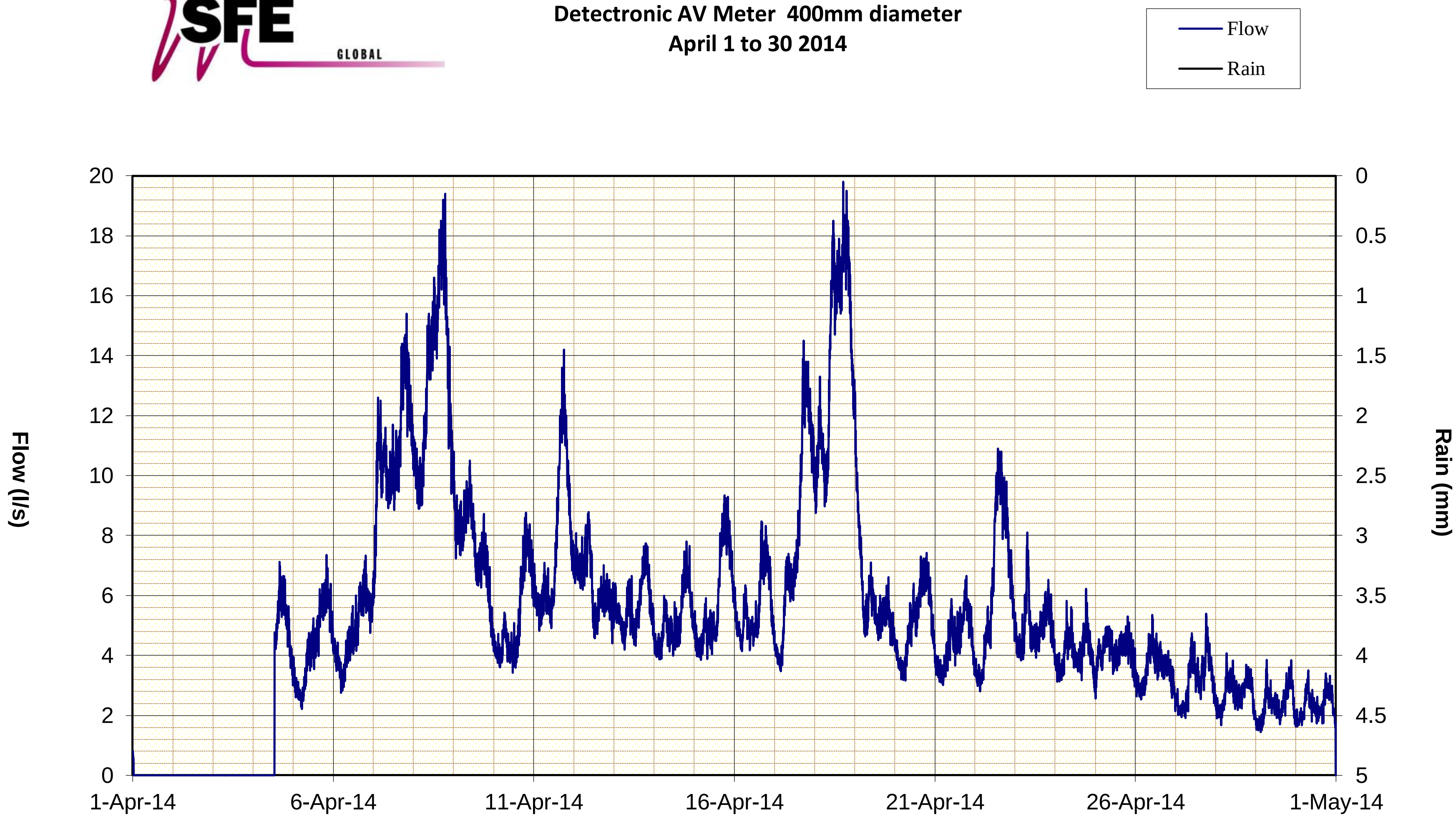
City of Prince George, BC
Site #414E - Site 5 MH #OK14E
Detectronic AV - 400mm Dia
behind 5850 Kovachich Road
March 1 to 31 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Mar-14	3.09	1.26	7.84	267.31	0.0
02-Mar-14	2.77	1.17	6.00	239.42	0.0
03-Mar-14	3.10	1.57	4.65	267.97	0.0
04-Mar-14	3.18	1.51	6.08	274.88	0.0
05-Mar-14	3.25	1.69	6.91	280.96	0.0
06-Mar-14	3.37	1.84	5.53	291.06	0.0
07-Mar-14	3.20	1.69	5.54	276.15	0.0
08-Mar-14	4.98	2.16	9.92	430.06	0.0
09-Mar-14	5.01	2.70	7.96	432.56	0.0
10-Mar-14	4.92	2.90	8.38	425.32	0.0
11-Mar-14	3.83	2.58	6.66	331.24	0.0
12-Mar-14	3.89	1.83	8.88	336.40	0.0
13-Mar-14	3.01	2.04	4.49	260.36	0.0
14-Mar-14	3.38	1.52	5.97	292.43	0.0
15-Mar-14	3.78	2.52	6.16	326.76	0.0
16-Mar-14	4.80	3.04	6.85	415.11	0.0
17-Mar-14	4.26	3.11	6.23	368.39	0.0
18-Mar-14	3.06	2.09	4.46	264.50	0.0
19-Mar-14	3.13	1.79	5.12	270.54	0.0
20-Mar-14	2.86	1.90	4.05	246.78	0.0
21-Mar-14	2.54	1.56	3.87	219.48	0.0
22-Mar-14	2.28	1.39	3.68	196.84	0.0
23-Mar-14	2.14	1.09	4.03	185.13	0.0
24-Mar-14	1.91	1.04	2.82	165.17	0.0
25-Mar-14	1.80	0.93	2.97	155.77	0.0
26-Mar-14	1.63	0.98	2.53	140.92	0.0
27-Mar-14	1.41	0.71	2.55	122.02	0.0
28-Mar-14	1.38	0.63	2.55	119.61	0.0
29-Mar-14	1.22	0.55	2.31	105.62	0.0
30-Mar-14	1.34	0.56	2.55	115.76	0.0
31-Mar-14	1.54	0.48	3.74	133.33	0.0

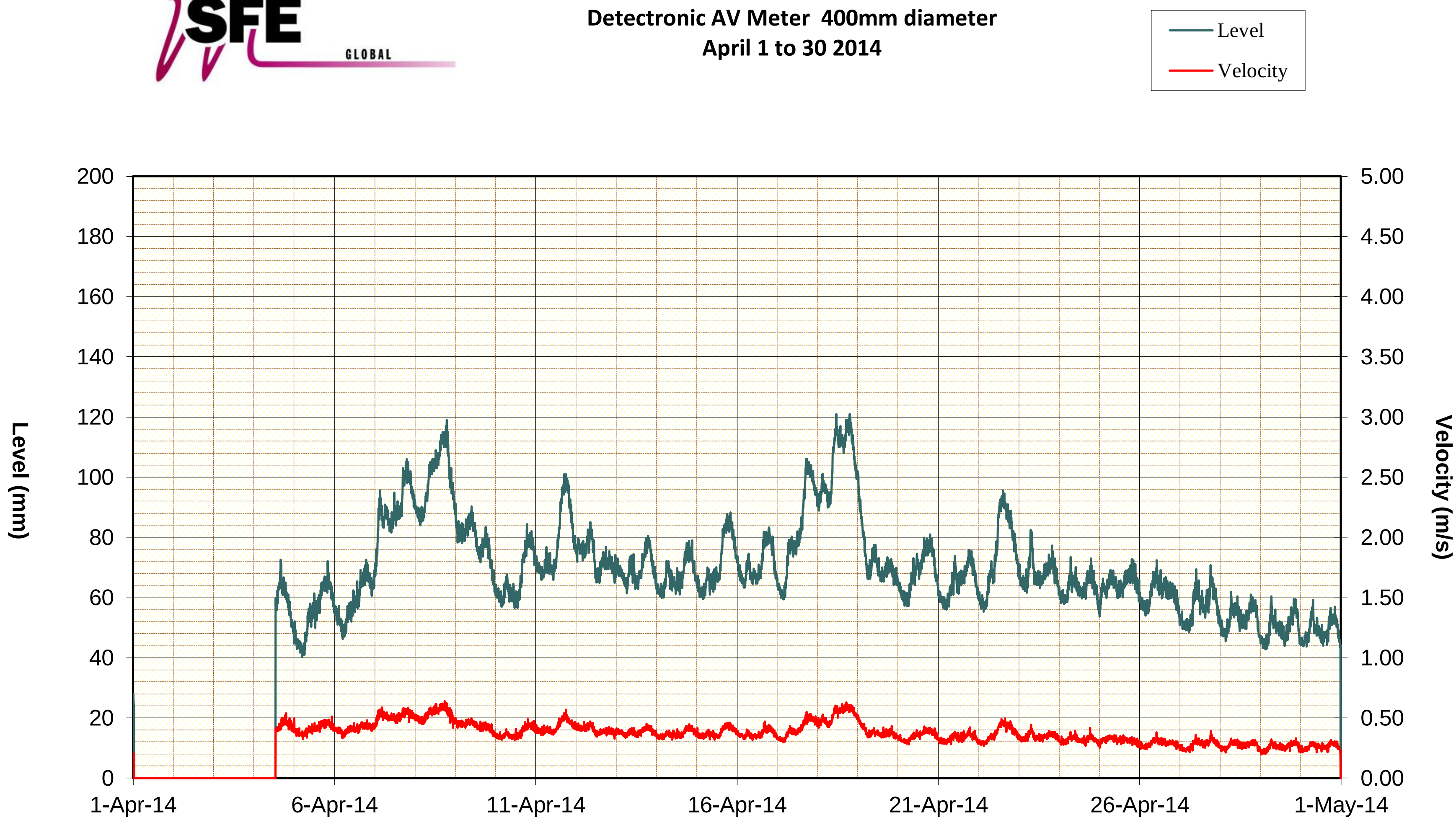
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
7957.846	0.480	9.920	0.0

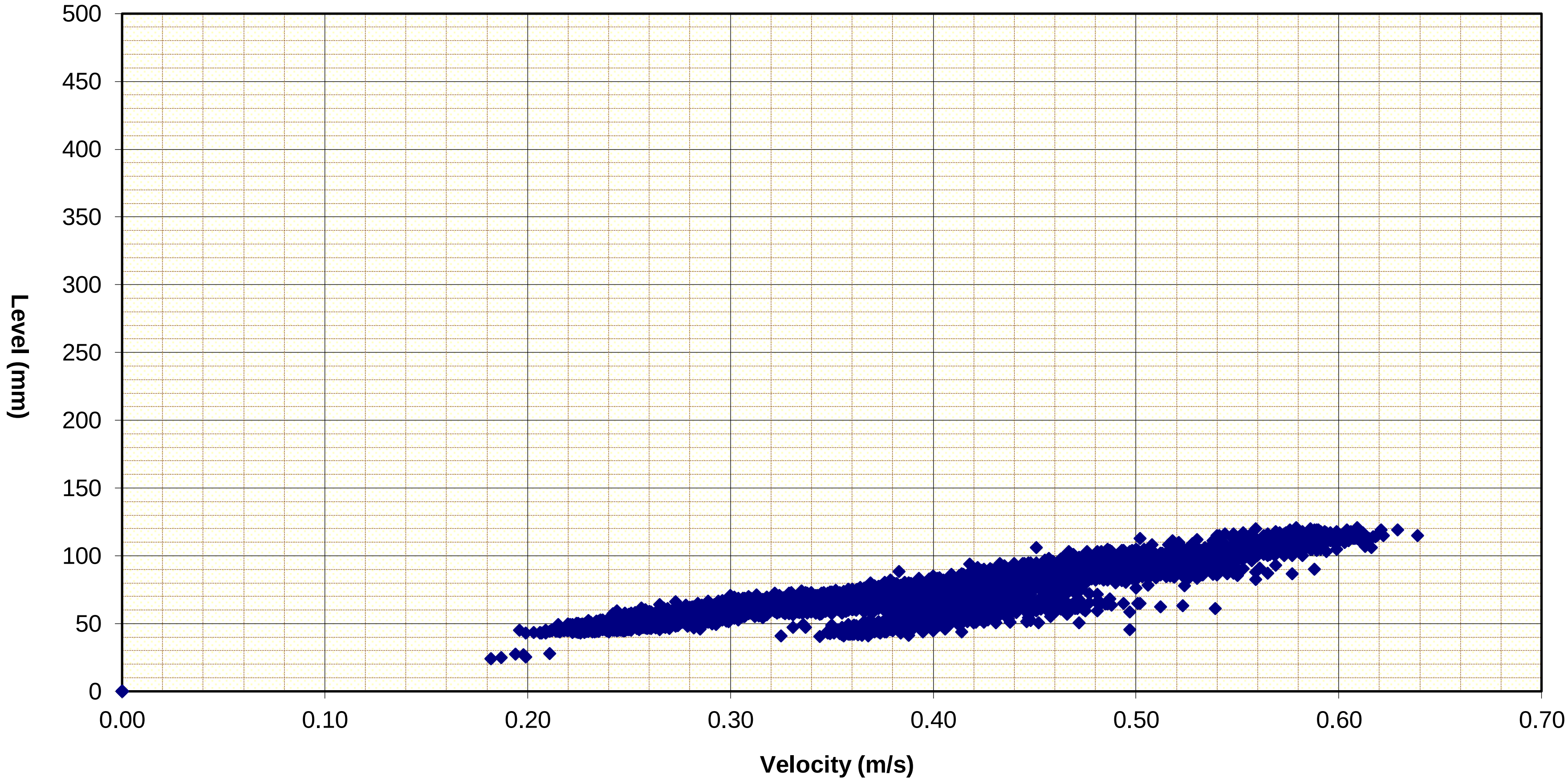
City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
April 1 to 30 2014



City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
April 1 to 30 2014



City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
April 1 to 30 2014



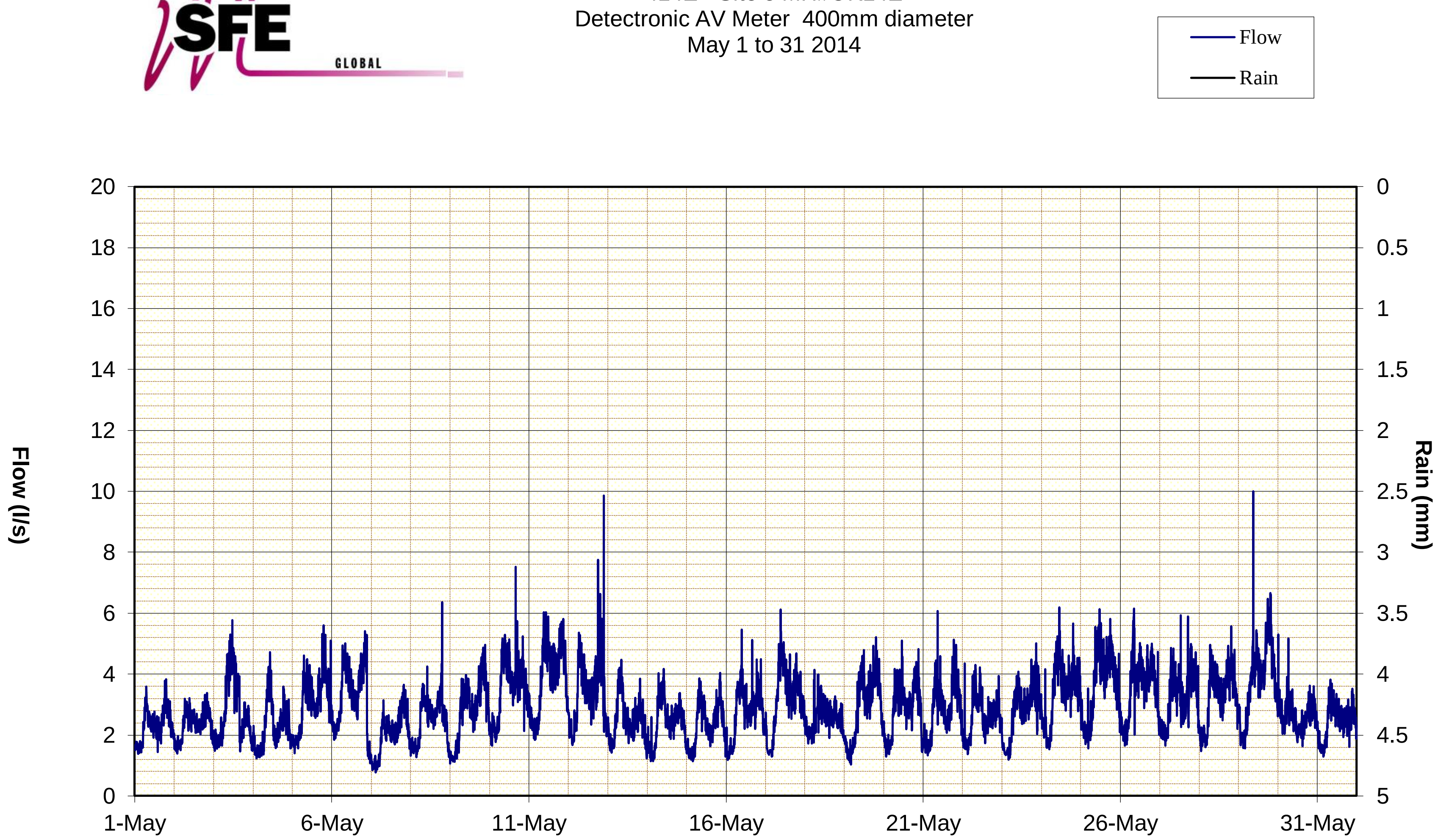
City of Prince George, BC
Site #414E - Site 5 MH #OK14E
Detectronic AV - 400mm Dia
behind 5850 Kovachich Road
April 1 to 30 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-Apr-14	0.02	0.00	0.82	1.40	0.0
02-Apr-14	0.00	0.00	0.00	0.00	0.0
03-Apr-14	0.00	0.00	0.00	0.00	0.0
04-Apr-14	2.36	0.00	7.12	204.33	0.0
05-Apr-14	4.35	2.21	7.35	375.61	0.0
06-Apr-14	4.76	2.75	7.33	411.64	0.0
07-Apr-14	10.94	5.75	15.40	945.18	0.0
08-Apr-14	13.34	8.89	19.40	1152.83	0.0
09-Apr-14	7.68	4.34	10.80	663.55	0.0
10-Apr-14	5.26	3.42	8.76	454.28	0.0
11-Apr-14	7.72	4.82	14.20	666.75	0.0
12-Apr-14	6.35	4.40	8.78	548.51	0.0
13-Apr-14	5.65	4.19	7.74	488.55	0.0
14-Apr-14	5.18	3.87	7.80	447.14	0.0
15-Apr-14	5.88	3.85	9.34	508.30	0.0
16-Apr-14	5.61	4.14	8.47	485.13	0.0
17-Apr-14	7.95	3.47	14.50	686.82	0.0
18-Apr-14	14.13	8.75	19.80	1220.54	0.0
19-Apr-14	6.11	4.33	12.80	528.10	0.0
20-Apr-14	5.12	3.16	7.42	442.26	0.0
21-Apr-14	4.46	3.01	6.65	385.47	0.0
22-Apr-14	6.36	2.80	10.90	549.40	0.0
23-Apr-14	4.98	3.69	8.10	430.08	0.0
24-Apr-14	4.08	2.78	6.22	352.37	0.0
25-Apr-14	4.15	2.56	5.30	358.31	0.0
26-Apr-14	3.54	2.14	5.35	305.48	0.0
27-Apr-14	3.16	1.91	5.39	273.30	0.0
28-Apr-14	2.73	1.67	4.07	236.15	0.0
29-Apr-14	2.38	1.44	3.85	206.03	0.0
30-Apr-14	2.32	0.00	3.50	200.86	0.0

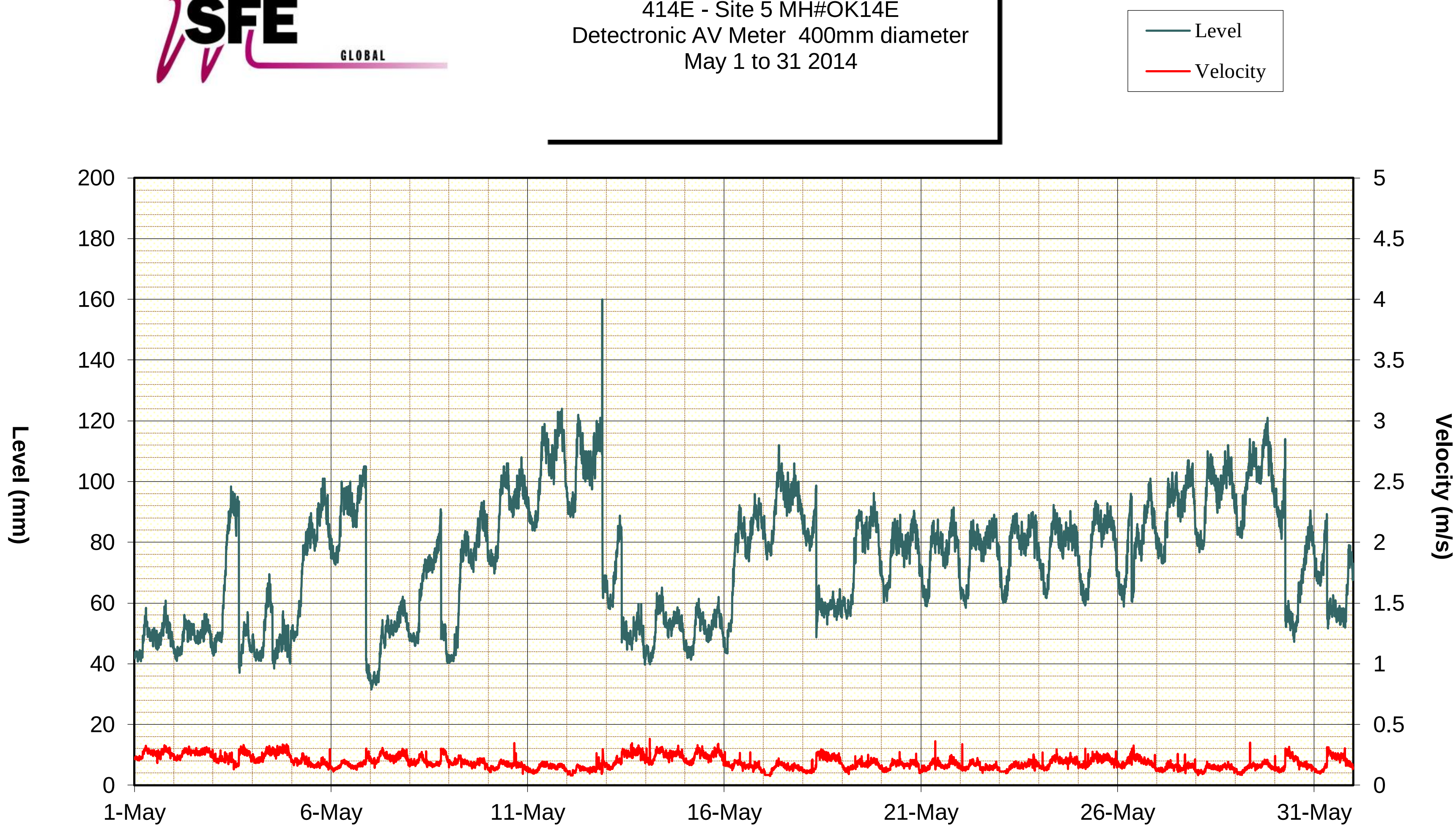
Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
13528.345	0.000	19.800	0.0

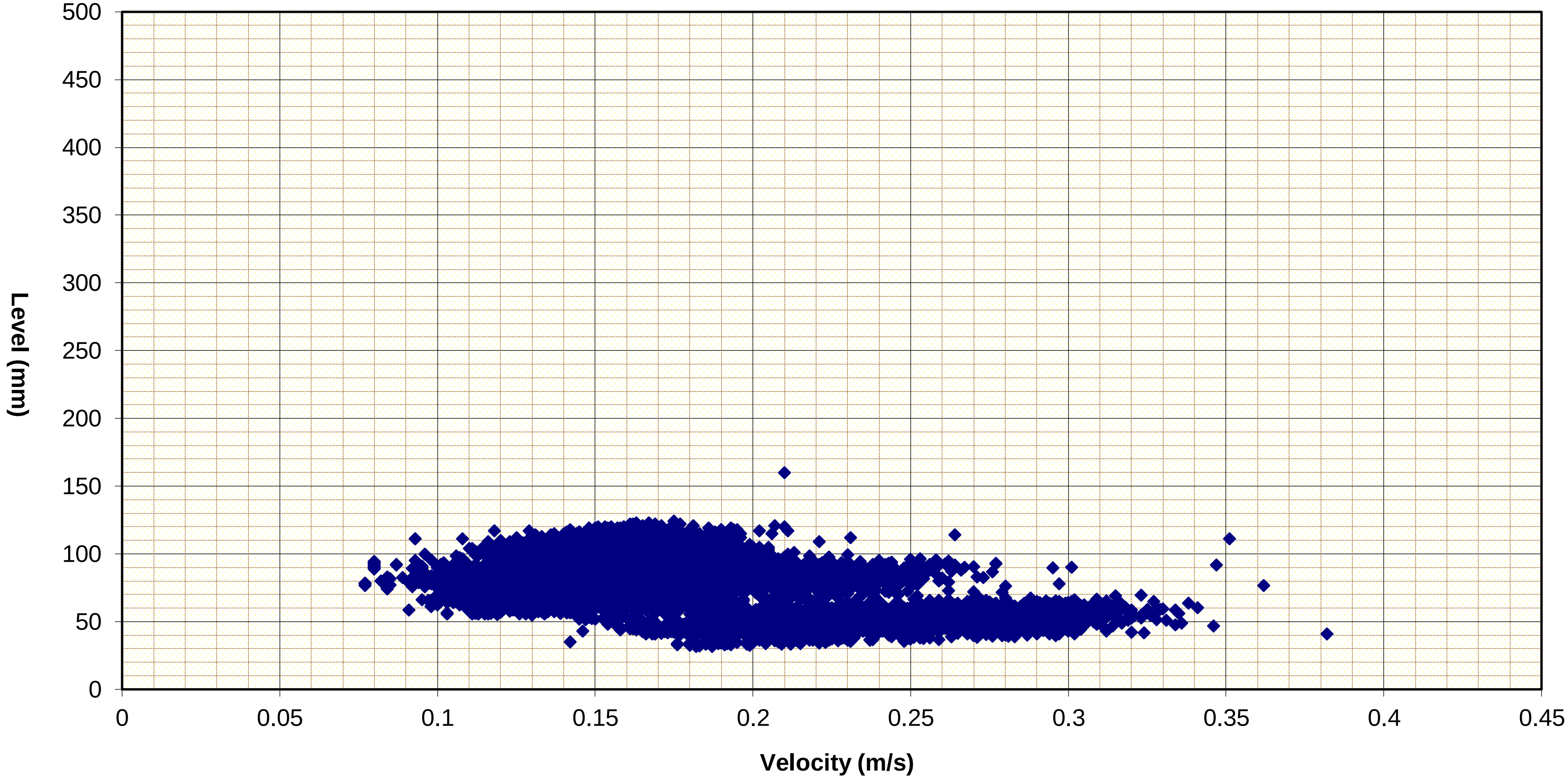
City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
May 1 to 31 2014



City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
May 1 to 31 2014



City of Prince George, BC
414E - Site 5 MH#OK14E
Detectronic AV Meter 400mm diameter
May 1 to 31 2014



City of Prince George, BC
Site #414E - Site 5 MH #OK14E
Detectronic AV - 400mm Dia
behind 5850 Kovachich Road
May 1 to 31 2014

Date	Avg Flow	Min Flow	Max Flow	Total Flow	Total Rain
	(l/s)	(l/s)	(l/s)	(m3d)	(mm)
01-May-14	2.32	1.38	3.83	200.22	0.0
02-May-14	2.32	1.39	3.38	200.33	0.0
03-May-14	2.79	1.46	5.77	240.68	0.0
04-May-14	2.27	1.23	4.72	195.77	0.0
05-May-14	3.08	1.40	5.60	265.84	0.0
06-May-14	3.25	1.07	5.41	280.70	0.0
07-May-14	2.05	0.77	3.65	177.01	0.0
08-May-14	2.50	1.26	6.36	216.01	0.0
09-May-14	2.82	1.06	4.96	243.93	0.0
10-May-14	3.52	1.65	7.52	303.93	0.0
11-May-14	3.86	1.84	6.03	333.31	0.0
12-May-14	3.41	1.67	9.86	294.44	0.0
13-May-14	2.48	1.23	4.47	214.57	0.0
14-May-14	2.41	1.14	4.17	208.53	0.0
15-May-14	2.31	1.14	4.04	199.81	0.0
16-May-14	2.73	1.18	5.46	236.21	0.0
17-May-14	3.17	1.29	6.12	273.80	0.0
18-May-14	2.54	1.72	4.14	219.35	0.0
19-May-14	2.88	1.03	5.21	248.61	0.0
20-May-14	2.84	1.29	5.10	245.34	0.0
21-May-14	2.84	1.33	6.07	245.09	0.0
22-May-14	2.61	1.37	4.35	225.46	0.0
23-May-14	2.75	1.19	5.01	237.76	0.0
24-May-14	3.40	1.53	6.19	293.40	0.0
25-May-14	3.60	1.56	6.13	311.46	0.0
26-May-14	3.53	1.65	6.15	304.86	0.0
27-May-14	3.21	1.65	5.93	277.70	0.0
28-May-14	3.31	1.47	5.57	285.99	0.0
29-May-14	3.82	1.56	10.00	329.97	0.0
30-May-14	2.66	1.63	5.30	229.82	0.0
31-May-14	2.42	1.29	3.82	209.29	0.0

Statistics

Total Flow	Min Flow	Max Flow	Total Rain
(m3)	(l/s)	(l/s)	(mm)
7749.165	0.771	10.000	0.0