Project No: 221-10826-00

February 15, 2023

Anthony Girolami
Fengate Asset Management
2275 Upper Middle Road East, Unit 700
Oakville, ON L6H 0C3

Subject: 3054 Homestead Drive Development – Watermain Hydraulic Analysis

Dear Mr. Girolami,

WSP Canada Inc. (WSP) is pleased to present the results of the watermain hydraulic analysis for the proposed 3054 Homestead Drive development in the City of Hamilton. This analysis reflects the most up-to-date water servicing plan for the development.

The analysis in this report includes hydraulic simulation of the Average Day, Maximum Day, Maximum Day plus Fire Flow and the Peak Hour demand scenarios at the proposed development for 2021 (present) and 2031 (future) planning horizons. The hydraulic analysis was completed using a WaterGEMS model of the Hamilton water distribution network for Pressure District (PD) 6.

The modelling shows that the development can achieve the hydraulic requirements prescribed by the City of Hamilton, the Ministry of the Environment, Conservation and Parks (MECP) watermain design criteria and the Ontario Building Code (OBC) Compendium under ADD and MDD conditions. Under PHD conditions, the system cannot maintain the minimum required pressure of 275 kPa throughout the site with the top tank water level at HDR05. WSP conducted baseline analyses without the proposed development to examine the impact on the existing network. If any changes or discrepancies are contemplated with the final design plan, the analysis in this report should be updated with required fire flows.

If you have any questions, please do not hesitate to call.

Yours truly,

WSP Canada Inc.

Antoine Lahaie, P.Eng., PMP
Project Manager, Hydraulics

Charlotte Xie, E.I.T.,
B.A.Sc., Hydraulics

100 Commerce Valley Drive West
Thornhill, ON, Canada L3T 0A1

Tel.: +1 905 882-1100
Fax: +1 905 882-0055
wsp.com

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

The 3054 Homestead Drive development will be located at the northwest corner of Homestead Drive and Airport Road in the City of Hamilton, Ontario. The purpose of this report is to complete the water servicing analysis for the proposed development, consisting of 4 industrial buildings.

The proposed development is located within Pressures District 6 (PD6) of the City of Hamilton water distribution network and will be built in two phases. Building D will be built as part of Phase 1 while Building A, B, and C will be built as part of Phase 2. The Phase 1 development will be serviced by a 300mm connection to the existing 400mm watermain along Airport Road to the south. The ultimate buildout of the development will be serviced by the proposed 300mm network with two connections to the existing 400mm watermains on Airport Road and Homestead Drive. **Figure 1-1** shows the site plan of the proposed development. Please note that the ultimate buildout of this development does not consider the alternative looping highlight in red. It will be considered in a sensitivity analysis to provide additional looping in the system if the proposed site cannot meet the fire flow requirement.

The proposed water servicing system layout, including the proposed pipe diameters, can be found in **Appendix A** of the report.

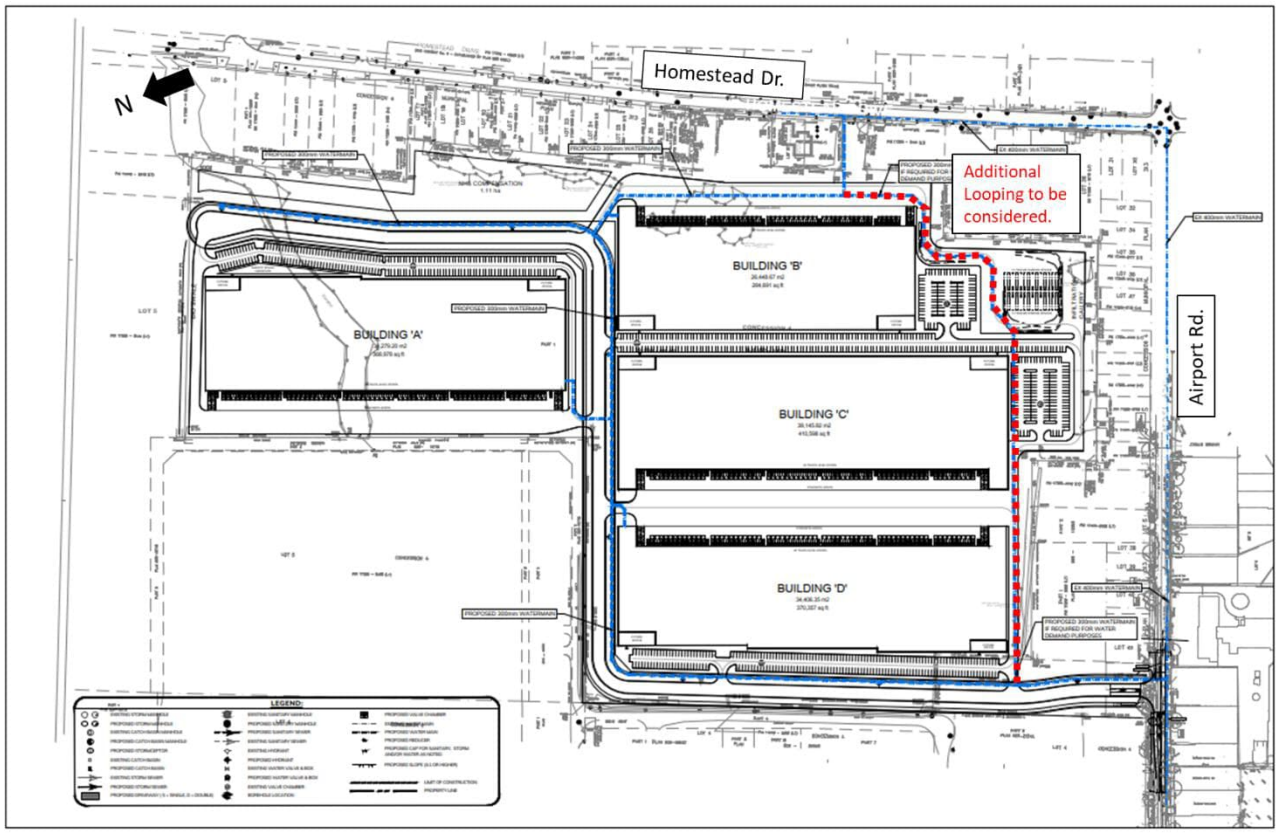


Figure 1- 1: The Proposed 3054 Homestead Drive Development Site Plan

2 DESIGN CRITERIA

2.1 DOMESTIC WATER DEMANDS

The domestic demands for the 3054 Homestead Drive development were calculated using the City of Hamilton's Engineering Guidelines for Servicing Land under Development Applications, December 2012. Population density for industrial units were determined according to the City of Hamilton Development Charge Background Study by Watson & Associates Economists Ltd, October 2019. Accordingly, the density for Industrial properties of 125 person/ha was applied for the calculation. **Table 2–1** lists the factors used to determine the demands for the development.

Table 2-1: Demand Factors and Inputs

DEMAND FACTORS AND INPUTS	VALUE
Single Family Detached Homes	3.39 persons/unit
Townhomes	2.45 persons/unit
Industrial	125 persons/ha
Residential Average Day Demand	360 L/Person/day
ICI Average Day Demand	260 L/Perons/day
Maximum Day Peaking Factor	1.9
Peak Hour Factor	3.0

Detailed calculations of domestic demands are shown in **Appendix A**. Domestic demands for the development were calculated by multiplying the estimated footprint area for the each building and the population density for industrial sites, and allocated to the closest junctions along the proposed watermains in the water model. Demands external to the development, including the Dickenson and Shelby Developments, were unchanged.

2.2 PRESSURES

As outlined in the City of Hamilton Water and Waste Water Master Plan, 2006 (WWWMP), the acceptable pressures under normal conditions are between 275 kPa (40 psi) and 690 kPa (100 psi).

The minimum allowable pressure under Maximum Day Demand plus Fire Flow is 140 kPa at the location of the fire and/or everywhere else in the pressure district.

2.3 REQUIRED FIRE FLOW

Required Fire Flow calculations were not available at the time of this analysis. As part of the City of Hamilton's fire flow requirement, the RFF targets for this development should be the higher of the calculated fire flows using OBC method or the fire flow targets from the City's policy as shown in **Table 2–2.**

Table 2-2: Summary of Target Available Fire Flow

LAND USE	TARGET AVAILABLE FIRE FLOW (L/S)
Commercial	150
Small I/I (<1800m³) [1]	100
Industrial	250
Institutional	150
Residential Multi [2]	150
Residential Medium (3 or less units) [3]	125
Residential Single	75
Residential Single (Dead End)	50

1) 1800m³ represents a maximum building volume that qualifies as "Small ICI"
2) Residential Multi is defined as a residential dwelling with > 3 units
3) Residential Medium is defined as a residential dwelling with ≤ 3 units

As a conservative approach, the required fire flow (RFF) of 250 L/s for industrial sites was applied to all hydrants within the proposed 3054 Homestead Drive development.

3 HYDRAULIC MODEL

The proposed development will be located within Pressure District (PD) 6 of the City of Hamilton's water network. It will be supplied by the HD06A (Stone Church Road at Garth) and HD06B (Stone Church Road at Tunbridge Crescent).

The development was added to an existing hydraulic model of the City of Hamilton received by WSP in March 2017 in the context of the Pressure District Characterization Study. As part of the modeling completed in this study, WSP updated the total demands in each City of Hamilton Pressure District (PD) as to have them match the 2006 Master Plan Demands. Since the time of receipt, WSP has been updating the model with various developments (either approved or under review).

3.1 BOUNDARY CONDITIONS

PD6 is a closed zone that is supplied by two (2) booster pumping stations: HD06A (Stone Church Road at Garth) and HD06B (Stone Church Road at Tunbridge Crescent). The HD06A pumping station is supplied by the HDR05 reservoir while the HD06B pumping station receives water through a 1,200 mm PD5 trunk main.

The analysis was carried out with the hydraulic grade line (HGL) in the HDR05 reservoir, set to 232.32m and 233.88m for all 2021 and 2031 scenarios of both planning horizons. These water levels represent a tank at approximately 50% and 70% full, respectively.

Additionally, the Lavender Drive and Upper Paradise Road PRVs in PD6 were open (active) in the model during these conditions and had HGL settings of 238.80 m and 252.49 m, respectively.

The modelled discharge pressure at HD06A pumping station was limited to 480kPa via recirculation through a PSV. This is consistent with the City of Hamilton's Water Outstation Process Narrative for HD06A. The status of each pump during all modelled scenarios of this analysis is outlined in **Table 3-1**.

Table 3-1: Pump Status at HD06A and HD06B PS under the simulated 2021 and 2031 planning horizons

Pump Station	Pump	2021 AVG	2021 MDD	2021 PHD	2021 MDD+FF[2]	2031 AVG	2031 MDD	2031 PHD	2031 MDD+FF[2]
HDO6A[1]	HLP1	OFF	ON	ON	ON	OFF	ON	ON	ON
	HLP3	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	HLP4	ON	ON	ON	ON	ON	ON	ON	ON
	HLP5	OFF	ON	ON	ON	OFF	ON	ON	ON
HDO6B	HLP1	ON	ON	ON	ON	ON	ON	ON	ON
	HLP2	OFF	OFF	ON	ON	OFF	OFF	ON	ON
	HLP4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

Note:
1. The discharge pressure at the pump station, HD06A, was kept just under 480kPa for all the scenarios based on the Water Outstation Process Control Narrative (section 5.4.2.2 in appendix at page 13 of 29).
2. Under the 2021 and 2031 MDD+FF conditions, the pump status was adjusted to be the same as the PHD conditions to meet the required fire flow target.

3.2 3054 HOMESTEAD DRIVE DEVELOPMENT

The proposed watermains and water services were added to the PD6 pressure district and reflect the proposed servicing plan provided by the Client on December 16th, 2022. The servicing plan was added to **Appendix A** for ease of reference.

Elevation information within the development was taken as the finished grade elevation at the centerline of the road or applicable adjacent proposed grade point. Service elevations range from 229 m to 235.4 m within the proposed development.

The friction (C) factors for all new pipes added to the model were assigned according to the Ministry of the Environment, Conservation and Parks (MECP) watermain Design criteria as listed in **Table 3-1**. Internal diameters of the pipes were modelled to improve the accuracy of results.

Table 3–2: Hazen-Williams C-Factors

DIAMETER (NOMINAL)	C-FACTOR
150 mm (ID 152.5mm)	100
200 mm (ID 204mm)	110
300 mm (ID 290mm)	120

The proposed layout of the water distribution system is intended to satisfy the requirements of the City of Hamilton. All pipes and nodes added for the development are shown and identified in **Appendix A**.

3.3 VERIFICATION OF MODEL CALIBRATION

The hydraulic model calibration was verified using the results of hydrant flow tests conducted by WSP. These tests were completed by the City on October 22nd, 2022 at the following locations:

1. Hydrant GJ10H011 on 9079 Airport Road West, Mount Hope, ON.
2. Hydrant GJ10H006 on 3026 Homestead Drive, Mount Hope, ON.

Results of these hydrant flow tests are included in **Appendix E**. A comparison between the results of the hydrant flow tests and the modeled hydrant flow curves was done at the locations of the proposed development site. It was found that the modeled static pressures were within 5% of the hydrant flow test static pressures and that the modeled flows at 140 kPa (20 psi) were conservative in that the flow estimated by the model is lower than that calculated from the hydrant test. **Appendix E** provides detailed results of the hydrant test and model validation.

Additionally, the head at various junctions in the model were compared to the results from GM BluePlan's City of Hamilton Master Plan model to further validate and ensure consistency with WSP's City-wide model. As part of the calibration, WSP added a missing altitude valve at the HD018 pumping station (closed) to match the Master Plan infrastructures from the City's consultant model.The corresponding junctions of interest and the result of each correction are outlined in **Table 3–3**.

Table 3–3: PD6 Comparison with GM BluePlan's Model

JUNCTION LABEL	2031 PHD – GM BLUEPLAN	2031 PHD - WSP - NO CHANGE		2031 PHD - WSP – ALTITUDE VALVE ADDED		2031 PHD - WSP - REDUCED DEMANDS AND ALTITUDE VALVE ADDED	
	Head (m)	Head (m)	Delta (m)	Head (m)	Delta (m)	Head (m)	Delta (m)
HC61T018	271.3	241.4	30	262.2	9	266.7	5
GJ09T001	268.6	248.4	20	257.8	11	263.6	5
GJ10C001	268.4	246.0	22	255.4	13	262.0	6
HC51T005	272.2	256.5	16	263.9	8	268.0	4
HC70T008	272.4	252.8	20	262.3	10	266.8	6
GJ08T007	270.4	250.4	20	259.8	11	265.0	5
GK15T002	270.1	249.3	21	258.7	11	264.3	6
GK16R001	269.8	248.4	21	257.8	12	263.6	6

It should be noted that the pressure wide district demands were not reduced for this analysis and only the altitude valve was added into the model. As outlined in, the average difference in pressure is approximately 108 kPa under this scenario. Thus, the model output results are conservative.

4 HYDRAULIC ANALYSIS

The suggested watermain layout was modelled for Average Day, Maximum Day, Maximum Day plus Fire Flow and Peak Hour scenarios under the present (2021) and ultimate buildout (2031) planning horizons using a WaterGEMS V8i model of the PD6 network as described in Section 3.

The piping layout within the development were sized to meet the greater requirement of Peak Hour Demands or Maximum Day Demand plus Fire Flow requirements. A detailed summary of demands is shown in **Appendix A** including the proposed pipe diameters for servicing the development.

4.1 SYSTEM PRESSURES

As outlined in the City of Hamilton WWWMP, the acceptable pressures under normal conditions range between 275 kPa (40 psi) and 690 kPa (100 psi). The modeling indicates that the expected service pressures range between approximately 212 kPa and 448 kPa for Phase 1 of the development and between 198 kPa and 483 kPa for ultimate buildout under all modeled scenarios. Modeled service pressures are summarized in **Table 4-1** to **Table 4–4**. Detailed pipe and node result tables can be found in **Appendix B**.

Table 4–1: Simulated Pressures for Phase 1 with 50% TWL

SCENARIO	AVERAGE DAY (kPa)	MAXIMUM DAY (kPa)	PEAK HOUR (kPa)
2021	377 - 403	354 - 380	262 - 288[1]
2031	360 - 386	323 - 350	212 - 238[2]

Note:

1. The simulated pressure under 2031 PHD ranged between 276 kPa and 303 kPa by increasing the HDR05 tank water level to 70% full (see Table 4–2).
2. The simulated pressure under 2031 PHD ranged between 247 kPa to 274 kPa by increasing the HDR05 tank water level to 99% full.

Table 4–2: Simulated Pressures for Phase 1 with 70% TWL

SCENARIO	AVERAGE DAY (kPa)	MAXIMUM DAY (kPa)	PEAK HOUR (kPa)
2021	422 - 448	369 - 395	276 – 303
2031	407 - 433	338 - 364	226 - 253[1]

Note:

1. The simulated pressure under 2031 PHD ranged between 247 kPa to 274 kPa by increasing the HDR05 tank water level to 99% full.

Table 4-3: Simulated Pressures for Ultimate Buildout with 50% TWL

SCENARIO	AVERAGE DAY (kPa)	MAXIMUM DAY (kPa)	PEAK HOUR (kPa)
2021	376 - 438	349 - 412	251 – 314[1]
2031	358 - 420	317 - 379	198 - 261[2]

Note:

1. The simulated pressure under 2021 PHD ranged between 280 kPa to 342 kPa by increasing the HDR05 tank water level to 90% full.
2. The simulated pressure under 2031 PHD ranged between 234 kPa to 296 kPa by increasing the HDR05 tank water level to 99% full.

Table 4-4: Simulated Pressures for Ultimate Buildout with 70% TWL

SCENARIO	AVERAGE DAY (kPa)	MAXIMUM DAY (kPa)	PEAK HOUR (kPa)
2021	421 - 483	364 - 427	266 – 328[1]
2031	407 - 438	332 - 394	213 – 275[2]

Note:

1. The simulated pressure under 2021 PHD ranged between 280 kPa to 342 kPa by increasing the HDR05 tank water level to 90% full.
2. The simulated pressure under 2031 PHD ranged between 234 kPa to 296 kPa by increasing the HDR05 tank water level to 99% full.

The modelling results indicate that the expected service pressures within the development can meet the minimum pressure requirement of 275 kPa under most of the scenarios with the exception of the PHD condition.

During Phase 1 of the development, a minimum tank water level (TWL) of 70% is required to maintain pressure above 275 kPa within the site under 2021 planning horizon. Under 2031 planning horizon, the modelled pressures within the development were simulated below 275 kPa. WSP conducted additional run by increasing the tank water level at HDR05 to 99% full, and the simulated pressure range increased to 247 kPa and 274 kPa, which is below the minimum pressure requirement of 275 kPa.

Similarly, during the ultimate buildout of the development, the expected service pressures under PHD were simulated below 275 kPa in both 2021 and 2031 planning horizons. WSP ran additional simulation by increasing the tank water level at HDR05 to 90% full in 2021 planning horizon, and the simulated pressure range increased to 279 kPa and 342 kPa under PHD condition, which is able to maintain the pressure requirement. In the 2031 planning horizon, WSP increased the tank water level of HDR05 to 99% full, and the expected service pressure within the site ranged between 233 kPa and 295 kPa under PHD condition, which is below the pressure requirement of 275 kPa.

To examine the impact on the existing network with the addition of the proposed site, WSP ran the baseline scenario under the worst-case scenario (2031 PHD) with 70% TWL without the proposed development. The expected service pressure along the existing 400mm watermains along Airport Rd. and Homestead Dr. near the proposed site ranged between 214 kPa and 266 kPa under 2031 PHD condition. Conclusively, the addition of the proposed domestic demand has little impact on the existing network, and with the addition of looping under ultimate buildout, the service pressure increased insignificantly on two existing junctions along the 400m Homestead Dr. watermain.

4.1.2 PHD – REDUCED DEMAND

WSP completed additional analyses under PHD with reduced demand in PD6 to match the 2006 City of Hamilton's Master Plan and the 2022 GMBlue Plan Master Plan Model, respectively. **Table 4–5** compares the model PHD demands for PD6 between the WSP model, 2006 City of Hamilton Master Plan future demand projection, and the 2022 GMBlue Plan Master Model, and **Table 4-6** summarizes and compares the simulated results under PHD with 50% TWL between the WSP model and the reduced demand scenarios.

Table 4–5: Domestic Demand Projects in PD6 Under PHD

SCENARIO	WSP MODEL (L/S)	2006 CITY'S MASTER PLAN (L/S)	2022 GMBLUE MASTER PLAN (L/S)
2021	1,596	1,421	1,309
2031	1,778	1,597	1,455

Table 4–6: Simulated PHD Pressure for Ultimate Buildout with 50% TWL

SCENARIO	WSP MODEL (KPA)	2006 CITY'S MASTER PLAN (KPA)	2022 GMBLUE MASTER PLAN (KPA)
2021	251 – 314	278 - 341	294 - 357
2031	198 - 261	232 - 295[1]	257 - 320[2]

Note:

1. The simulated pressure under 2031 PHD ranged between 268 kPa to 330 kPa with 70% TWL.
2. The simulated pressure under 2031 PHD ranged between 293 kPa to 355 kPa with 70% TWL.

WSP globally adjusted the PD6 demands in the model to match the 2006 City's Master Plan future demand project and the 2022 GMBlue Master Plan demand project. In 2021 planning horizon, the proposed network can maintain the minimum pressure requirement of 275 kPa under PHD with 50% TWL. In 2031 planning horizon, all junctions within the proposed development were simulated above the minimum pressure with 70% TWL and the global demand for PD6 matching the 2022 GMBlue Plan Master Plan model.

Similarly, the minimum pressure requirement can be met under PHD with 50% TWL and PD6 demand matching the 2006 City's Master Plan project in 2021 planning horizon. In 2031 planning horizon, four (4) junctions within the site with elevation greater than 234.8m were simulated below 275 kPa with 70% TWL.

4.2 AVAILABLE FIRE FLOW

The minimum allowable pressure under Maximum Day Demand plus Fire Flow is 140 kPa (20 psi) at the location of the fire or anywhere else in the pressure district. The fire flow scenarios were simulated under Maximum Day Demand conditions for the 2021 and 2031 planning horizons.

Table 4–7 and **Table 4–8** summarize the simulated available fire flows for Phase 1 and ultimate buildout of the proposed development under 2021 and 2031 planning horizons. A detailed analysis of fire flow availability at all nodes within the proposed development is included in **Appendix C**.

Table 4–7: Simulated Available Fire Flows at Hydrants Under Phase 1

SCENARIO	2021 MDD+FF AFF (L/S)	2031 MDD+FF AFF (L/S)
50% TWL	155 – 231	136 – 201
70% TWL	161 - 240	143 - 210
99% TWL	170 - 253	152 - 224

Table 4–8: Simulated Available Fire Flows at Hydrants Under Ultimate Buildout

SCENARIO	2021 MDD+FF AFF (L/S)	2031 MDD+FF AFF (L/S)
50% TWL	188 - 232	167 – 200
70% TWL	194 - 241	174 - 209
99% TWL	203 - 255	183 - 223

Steady State modelling results of the fire flows indicate that all fire flows can be met within the development while the simulated pressures at ground level at all nodes within Pressure District 6 (PD6) are above 140 kPa under 2021 and 2031 Maximum Day Demand plus Fire Flow conditions.

As shown in **Table 4-7** and **Table 4–8,** the Available Fire Flows (AFF) were simulated below the Required Fire Flow of 250 L/s for industrial site under both 2021 and 2031 planning horizon. WSP ran additional simulation by increasing the tank water level at HDR05 to 99%, and the simulated AFFs increased by roughly 10 L/s; however, they were still below the minimum fire flow requirement. Additional looping as highlighted in red in **Figure 1-1,** was also considered under Ulitmate buildout with 99% TWL. An insignificant increase in fire flow was observed on Hydrant H-185 and H-184 located just north of Airport Rd. The proposed site was still not able to achieve the targeted fire flow of 250 L/s; however, all hydrants were simulated with AFF higher than 150 L/s which is the highest possible required fire flow calculated using the OBC method.

To examine the impact on the fire flow capacity on the existing network with the addition of the proposed site, WSP ran the baseline scenario (without the proposed development) under 2021 and 2031 MDD+FF with 70% TWL. The simulated fire flow on the existing hydrants along Homestead Dr. and Airport Rd. ranged between 146 L/s and 269 L/s under 2021 planning horizon and 130 L/s and 236 L/s under 2031 planning horizon. These additional fire flow runs demonstrated that the development will cause the existing fire flows to drop by less than 1%, and with the addition of looping, the simulated fire flow on a few existing hydrants on Airport Rd. increased. These results indicate that the addition of the proposed site has little impact on the existing network capacity to maintain the existing level of service for fire flows. **Table 4–9** summarizes and compares the simulated fire flow on the existing hydrants under Baseline and Ultimate Buildout condition with 70% TWL in both 2021 and 2031 planning horizons.

Table 4–9: Simulated Available Fire Flows on Existing Hydrants with 70% TWL

SCENARIO	2021 MDD+FF AFF (L/S)	2031 MDD+FF AFF (L/S)
Baseline (without the development)	146 - 269	130 – 236
Ultimate Buildout	145 - 270	130 - 238

In addition, the client confirms that the proposed development will be constructed with sprinkler system to provide fire protection, which may reduce the required fire flow target used in this analysis. Detailed fire flow calculations need to be completed, and further analysis will be required to ensure the minimum HGL can be achieved for the sprinkler system once construction details become available.

4.2.1 AVAILABLE FIRE FLOW – REDUCED DEMAND

WSP completed additional analyses under MDD+FF with reduced demand in PD6 to match the 2006 City of Hamilton's Master Plan and the 2022 GMBlue Plan Master Plan Model, respectively. **Table 4–10** compares the model MDD demands for PD6 between the WSP model, 2006 City of Hamilton Master Plan future demand projection, and the 2022 GMBlue Plan Master Model, and **Table 4–11** summarizes and compares the simulated fire flows under MDD+FF with 50% TWL between the WSP model and the reduced demand scenarios.

Table 4–10: Domestic Demand Projects in PD6 Under MDD

SCENARIO	WSP MODEL (L/S)	2006 CITY'S MASTER PLAN (L/S)	2022 GMBLUE MASTER PLAN (L/S)
2021	1,047	948	873
2031	1,173	1,064	969

Table 4–11: Simulated AFF for Ultimate Buildout under MDD+FF with 50% TWL

SCENARIO	WSP MODEL (L/S)	2006 CITY'S MASTER PLAN (L/S)	2022 GM BLUE MASTER PLAN (L/S)
2021	188 - 232	194 - 242	199 - 249
2031	167 – 200	176 - 214	184 - 225

WSP adjusted the PD6 demands globally to match the 2006 City's Master Plan demand projection, and the simulated fire flow within the proposed development increased by 4% in average during 2021 planning horizon and by 7% during 2031 planning horizon with 50%TWL; however, it was still not able to achieve the targeted fire flow of 250 L/s for industrial site with 50% TWL. Similarly, with adjusted PD6 demands matching the 2022 GMBlue Master Plan model, the simulated AFF within the site increased by 7% during 2021 planning horizon and by 10% during 2031 planning horizon; however, they are still below the RFF of 250 L/s.

4.3 TRANSIENT PRESSURES

According to the MECP Watermain Design Criteria, all watermains shall be designed so that pipes and joints are able to withstand the maximum operating pressure plus the surge pressure that would be created by stopping a water column moving at 0.6 m/s.

AWWA C900-compliant PVC pipe has a pressure rating of 150 psi (or greater) and this is consistent with the City of Hamilton's Specification for the Installation of Watermains (April 2014) that requires PVC pipe to be of Class 150 DR18. A PVC pipe with dimension ratio (DR) of 18 will experience a pressure surge of 240 kPa for a 0.6 m/s instantaneous flow velocity change (Joukowski).

The maximum operating pressure plus transient pressure is calculated as approximately 723 kPa (483 kPa + 240 kPa): well under 1620 kPa (235 psi) allowance. All pipe restraints and thrust blocks should be designed to a minimum 1030 kPa (150 psi) design pressure.

4.4 SYSTEM FLUSHING

A modeled flushing test was performed for the proposed water distribution network, under existing (2021) Average Day conditions for the Phase 1 and full-buildout constructions to determine the achievable flushing velocities of the system. The MOECP watermain design criterion requires a minimum flushing velocity of 0.8 m/s.

WaterGEMS software allows for testing of flushing by representing a modeled hydrant as a flow emitter with an emitter coefficient K equivalent to the components of the hydrant including the lateral, valve, bends and outlet. Hydrants were added to the model with a K value taken as 11.2 $l/s/m^{0.5}$ (150 $gpm/psi^{0.5}$) which is the minimum value prescribed by the American Water Works Association (AWWA) standard for flow calculations through a single 60 mm (2.5") outlet.

For the flushing simulation under Phase 1, a total of four (4) proposed hydrants were selected within the site with one-port open. Based on the simulation, all watermains can meet the required flushing velocity of 0.8 m/s. To achieve this, it is required all proposed hydrants be flushed with a single port within the development. The achievable flushing velocity within the Phase 1 of the development ranges from 0.95 to 0.99 m/s.

For the flushing simulation under full-buildout, a total of seven (7) proposed hydrants were selected within the site with two-port open. Based on the simulation, all watermains can meet the required flushing velocity of 0.8 m/s. A blow-off valve was required at the dead end to Building A to flush the dead-ended pipe. To achieve this, it is required all proposed hydrants be flushed with two ports opened within the development. The achievable flushing velocity within the Phase 1 of the development ranges from 0.88 to 1.83 m/s.

A detailed flushing report is provided in **Appendix D**.

5 CONCLUSIONS

The proposed watermain system for the 3054 Homestead Drive Development site can achieve hydraulic requirements as prescribed by the Ministry of the Environment, Conservation and Parks (MECP), and the City of Hamilton watermain design criteria as summarized below:

1 The service pressures under existing conditions (2021) and under Phase 1 and ultimate build-out conditions (2031) are expected to range between 212 kPa and 448 kPa and between 198 kPa and 483 kPa, respectively. The simulated pressures under ADD and MDD presented herein are within standards established by the MECP and City of Hamilton Guidelines.

   During Phase 1 of the construction, a minimum TWL of 70% is required to maintain the pressure requirement in PHD conidtion within the site under 2021 planning horizon, and the expected pressure ranged between 276 kPa to 303 kPa. In 2031 planning horizon, the expected service pressure within the site ranged between 247 kPa and 274 kPa with HDR05 TWL at 99%.

   During the full-buildout of the development, a minimum TWL of 90% is required to maintain pressure requirement in PHD conidtion under 2021 planning horizon, and the expected pressure ranged between 279 kPa to 342 kPa. In 2031 planning horizon, the expected service pressure within the site ranged between 233 kPa and 295 kPa with HDR05 TWL at 99%.

   Baseline scenario (without the development) was run to examine the impact on the existing network with the addtion of the proposed site. It can be concluded that the addition of the proposed domestic demand for the proposed site has little impact on the existing system, and with the addition of looping under ultimate buildout, the service pressure increased on the existing 400mm Homestead Dr. watermain.

   In addition, WSP globally adjusted the PD6 demand to match the 2006 City of Hamilton's Master Plan demand projection and the 2022 GMBlue Plan Master Plan Model and conducted sensitiviy analyses under PHD condition with 50% TWL. With PD6 global demand matching the GMBlue Plan Master model, the minimum pressure requirement can be met under 2021 PHD condition with 50% TWL and under 2031 PHD condition with 70% TWL. Similarly, with PD6 global demand matching the 2006 City's Master Plan projection, the minimum pressure can be maintained under 2021 PHD condition with 50% TWL, while under 2031 PHD condition with 70% TWL, four junctions with elevations higher than 234.8m were simulated below 275 kPa with a margin of 7 kPa.

2 Based on the City of Hamilton's fire flow policy, the required fire flow (RFF) for industiral site targets 250 L/s. In 2021 planning horizon, the simulated AFF ranged between 161 L/s and 240 L/s under Phase 1 and between 194 L/s to 241 L/s under full-buildout. In 2031 planning horizon, the simulated AFF ranged between 143 L/s and 210 L/s under Phase 1 and between 174 L/s to 209 L/s under full-buildout. Additional simulations were completed with 99% TWL at HDR05, and the RFF target of 250 L/s cannot be maintained.

   To examine the impact on the fire flow capacity on the existing network with the addition of the proposed site, WSP ran the baseline scenario under 2021 and 2031 MDD+FF with 70% TWL under both Phase 1 and full-buildout conidtions. The results indicate that the addition of the proposed site has little impact on the existing network capacity to maintain the existing level of service for fire flows.

   In addition, WSP globally adjusted the PD6 demand to match the 2006 City of Hamilton's Master Plan demand projection and the 2022 GMBlue Plan Master Plan Model and conducted sensitiviy analyses under MDD+FF condition with 50% TWL. With PD6 global demand matching the GMBlue Plan Master model, the simulated AFFs increased by 4-7% in average with 50% TWL. Similarly, with PD6 global demand matching the 2006 City's Master Plan projection, the simulated AFF increased by 7-10% with 50% TWL ; however, the targeted fire flow of 250 L/s cannot be met even with reduced demand in PD6.

3 Under Maximum Day plus Fire Flow for existing (2021) and ultimate buildout (2031) conditions, the PD23 distribution system is able to maintain pressure above 140 kPa at ground level at all modeled nodes within the district;

4 When installing AWWA C900-compliant PVC pipe with a pressure rating of 150 psi (or greater), the watermains in the proposed development can withstand transient pressure created by stopping a water column moving at 0.6 m/s plus maximum operating pressure; and,

5 All proposed watermains can achieve a minimum flushing velocity of 0.8 m/s given the requirements outlined in Section 4.4.

These conclusions remain valid as long as the proposed water distribution system and the City's network configuration remain as described herein. If significant changes are contemplated, this analysis should be updated.

APPENDIX

A

DEMANDS AND PROPOSED SYSTEM LAYOUT

APPENDIX A

WATER DEMANDS

3054 Homestead Drive Development

Demands

Population (Single Family)	3.39	ppu
Population (Townhomes)	2.45	ppu
Population (Apartments)	1.76	ppu
Density (Townhouses)	110.00	pha
Industrial	125	pha
Average Day Residential Demand	360	L/cap/day
Average Day Commercial Demand	260	L/cap/day

Peaking Factors

Maximum Hour	3.00
Maximum Day	1.90

Demand Rate Calculation

Building	SINGLE FAMILY (No. of Units)	TOWNHOMES (No. of Units)	BUILDING AREA (Ha)	POPULATION	AVERAGE DAY (L/S)	MAX DAY (L/S)	PEAK HOUR (L/S)
Building D			3.44	430	1.29	2.46	3.88
Phase 1 Total			3.44	430	1.29	2.46	3.88
Building A			3.43	429	1.29	2.45	3.87
Building B			2.64	330	0.99	1.89	2.98
Building C			3.81	476	1.43	2.72	4.30
Total	0	0	13.32	1665	5.01	9.52	15.03

PROPOSED 300mm WATERMAIN

PROPOSED 300mm WATERMAIN

EX 400mm WATERMAIN

PROPOSED 300mm WATERMAIN IF REQUIRED FOR WATER DEMAND PURPOSES

EX 400mm WATERMAIN

NHS COMPENSATION
1.11 ha

BUILDING 'A'
34,279,20 m2
368,978 sq ft

BUILDING 'B'
26,448,67 m2
284,691 sq ft

BUILDING 'C'
38,145,82 m2
410,598 sq ft

BUILDING 'D'
34,406,35 m2
370,357 sq ft

PROPOSED 300mm WATERMAIN

PROPOSED 300mm WATERMAIN

EX 400mm WATERMAIN

PROPOSED 300mm WATERMAIN IF REQUIRED FOR WATER DEMAND PURPOSES

BIO SWALE

INFILTRATION GALLERY

SWAMP

HOMESTEAD DRIVE (OLD HIGHWAY No. 6 – ESTABLISHED BY PLAN 529 MISC.)

REGIONAL ROAD No. 52 (FORMERLY HAMILTON AND PORT DOVER PLANK ROAD)

CONCESSION 4

LOT 5

LEGEND:

- EXISTING STORM MANHOLE
- PROPOSED STORM MANHOLE
- EXISTING CATCH BASIN MANHOLE
- PROPOSED CATCH BASIN MANHOLE
- PROPOSED STORMCEPTOR
- EXISTING CATCH BASIN
- PROPOSED CATCH BASIN
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- PROPOSED DRIVEWAY (S = SINGLE, D = DOUBLE)
- EXISTING SANITARY MANHOLE
- PROPOSED SANITARY MANHOLE
- PROPOSED SANITARY SEWER
- EXISTING SANITARY SEWER
- EXISTING HYDRANT
- PROPOSED HYDRANT
- EXISTING WATER VALVE & BOX
- PROPOSED WATER VALVE & BOX
- EXISTING VALVE CHAMBER
- BOREHOLE LOCATION
- PROPOSED VALVE CHAMBER
- EXISTING WATER MAIN
- PROPOSED WATER MAIN
- PROPOSED REDUCER
- PROPOSED CAP FOR SANITARY, STORM AND/OR WATER AS NOTED
- PROPOSED SLOPE (3:1 OR HIGHER)
- LIMIT OF CONSTRUCTION
- PROPERTY LINE

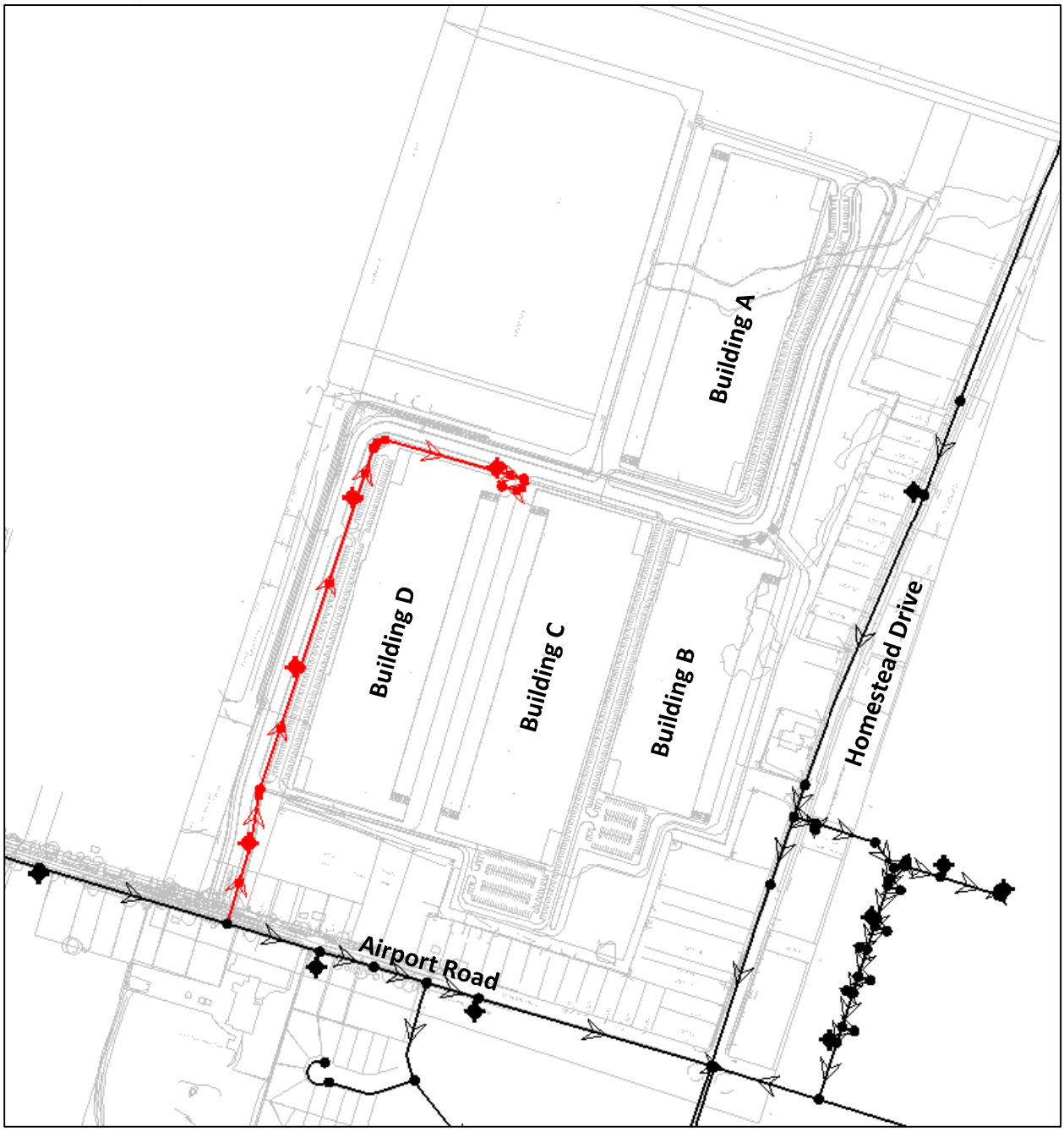


Figure A1 – Proposed Phase 1 3054 Homestead Drive Development System Layout Highlighted in Red

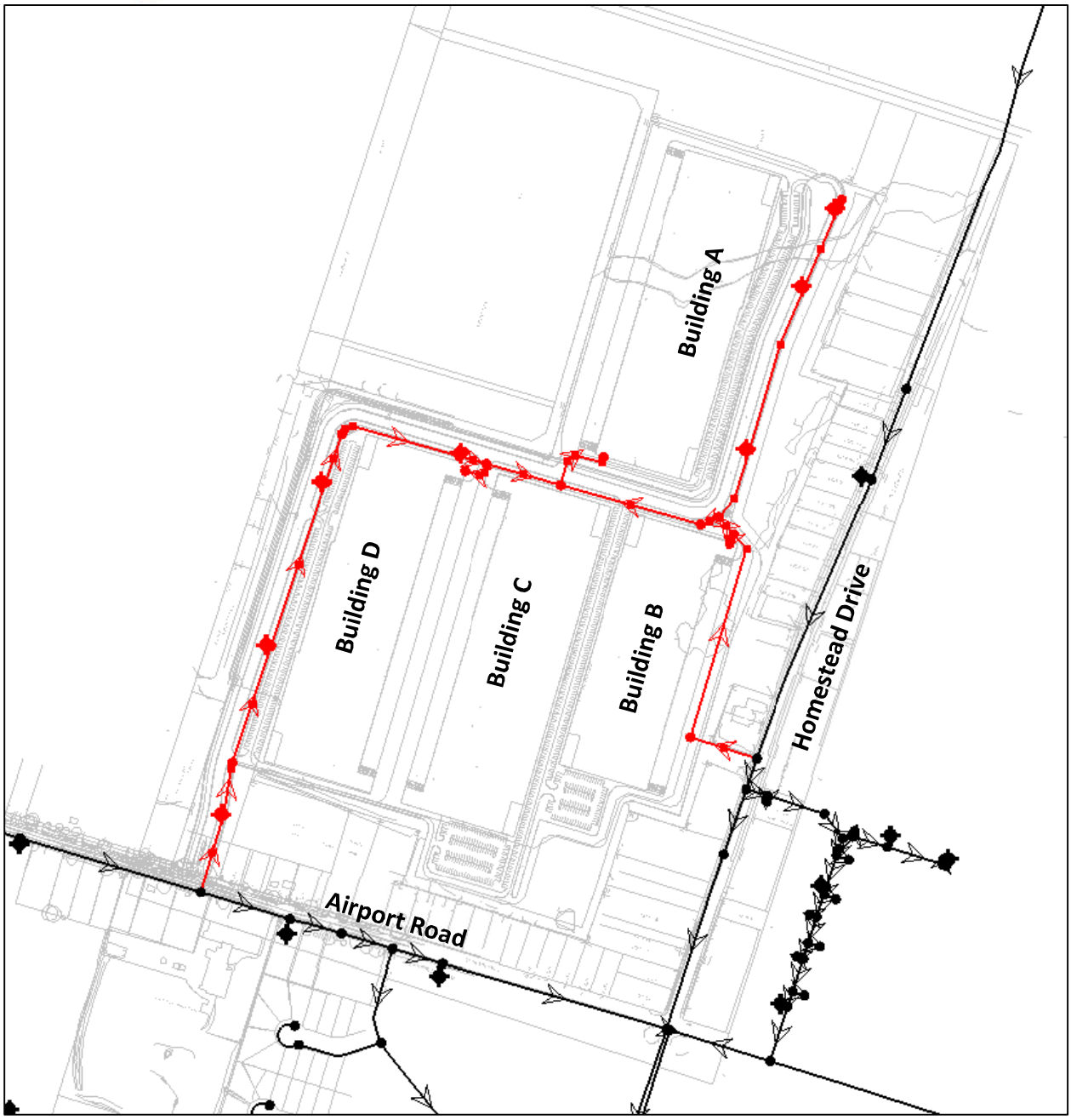


Figure A2 – Proposed 3054 Homestead Drive Development System Layout Highlighted in Red

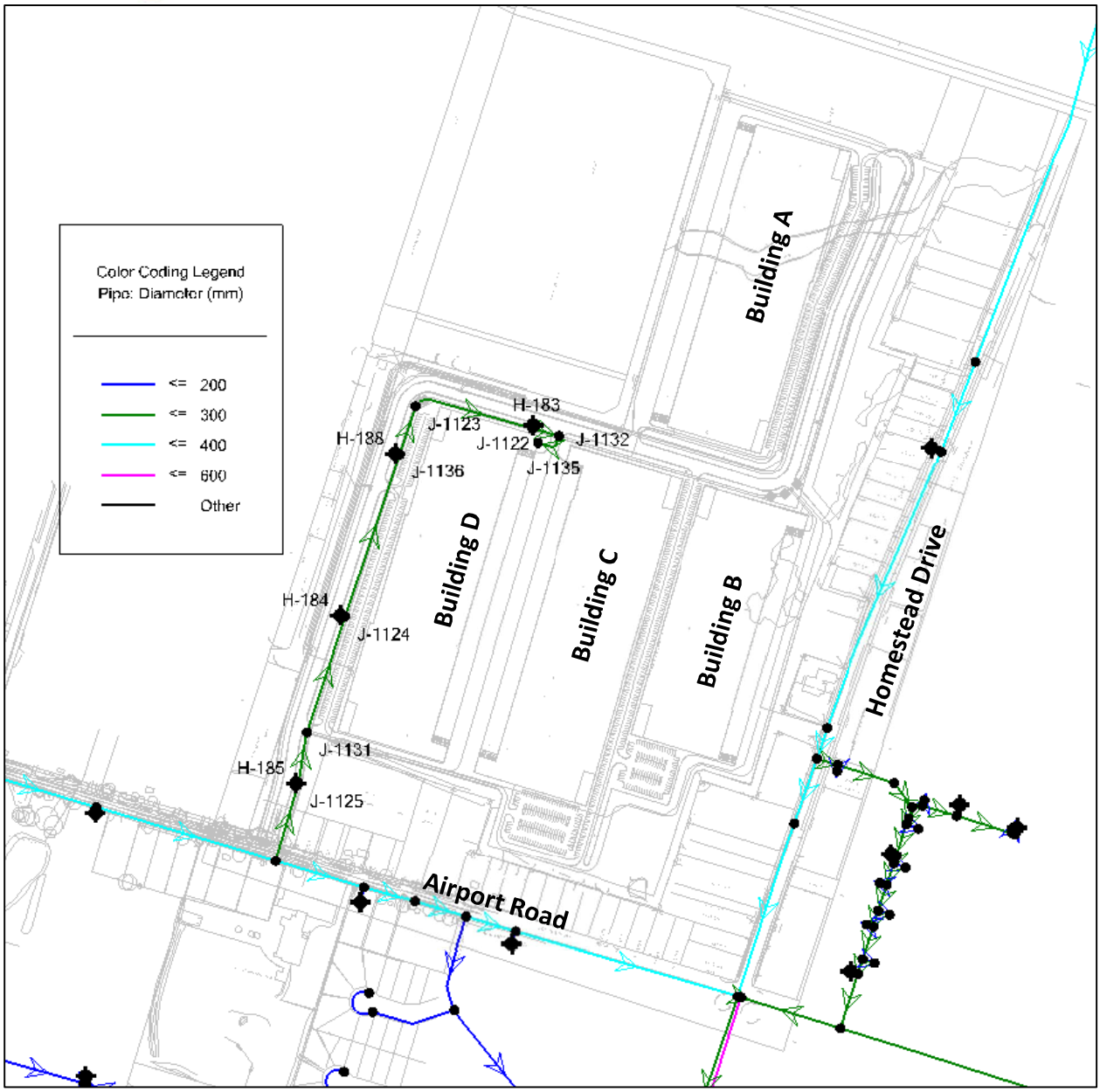


Figure A3 – Proposed Phase 1 3054 Homestead Drive Development System Layout with Junction and Hydrant IDs

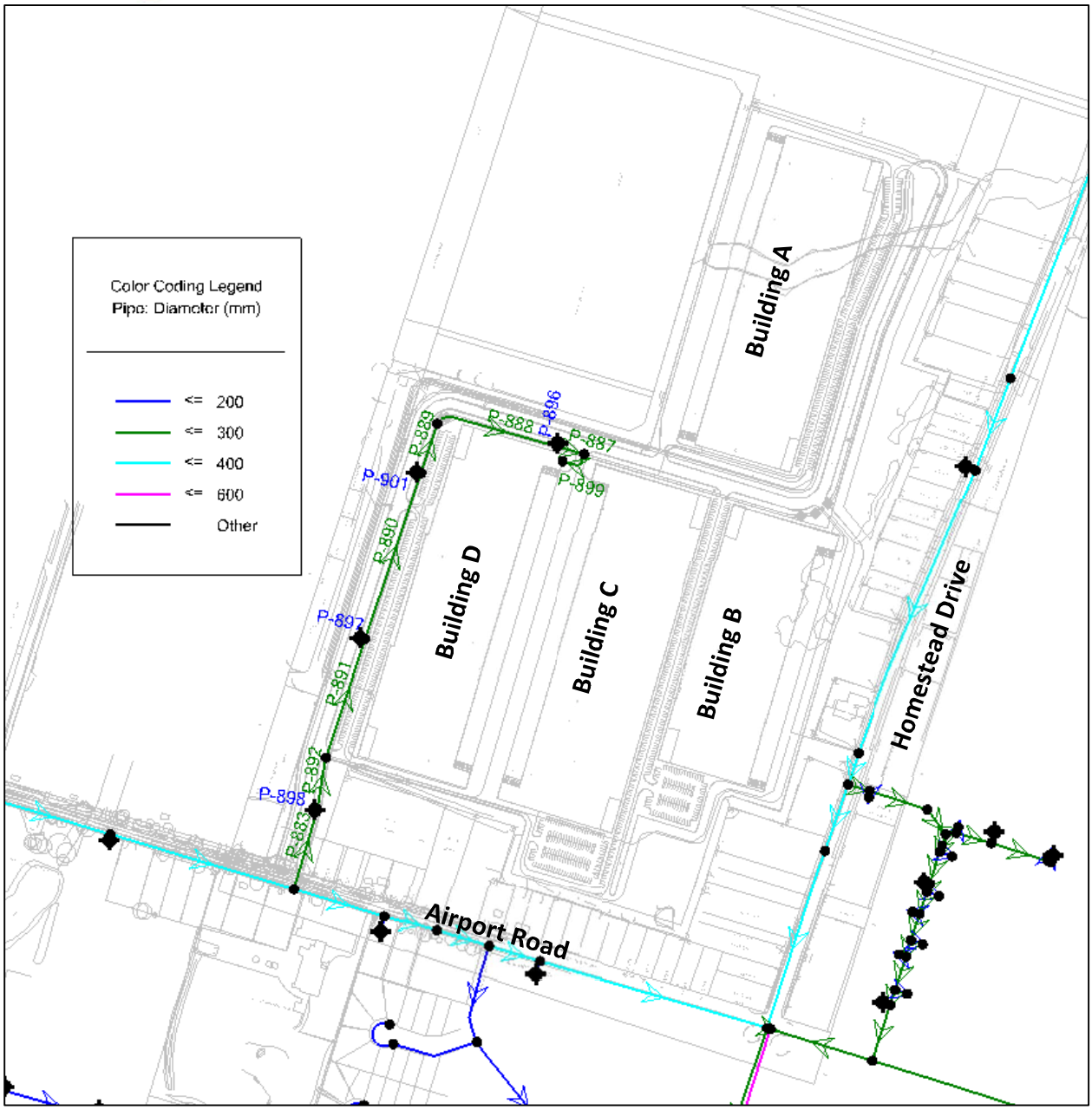


Figure A4 – Proposed Phase 1 3054 Homestead Drive Development System Layout with Pipe IDs

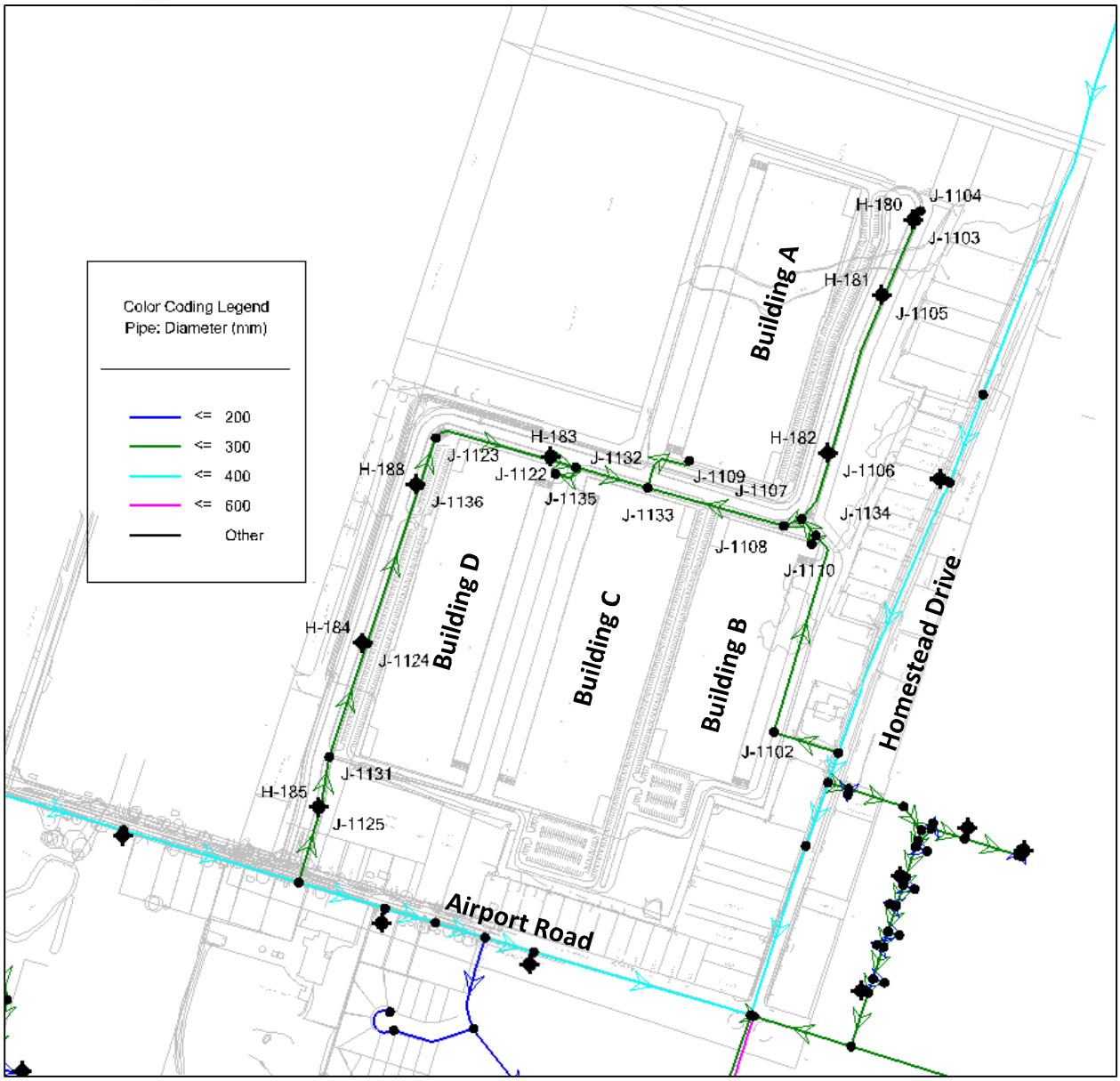


Figure A5 – Proposed 3054 Homestead Drive Development System Layout with Junction and Hydrant IDs

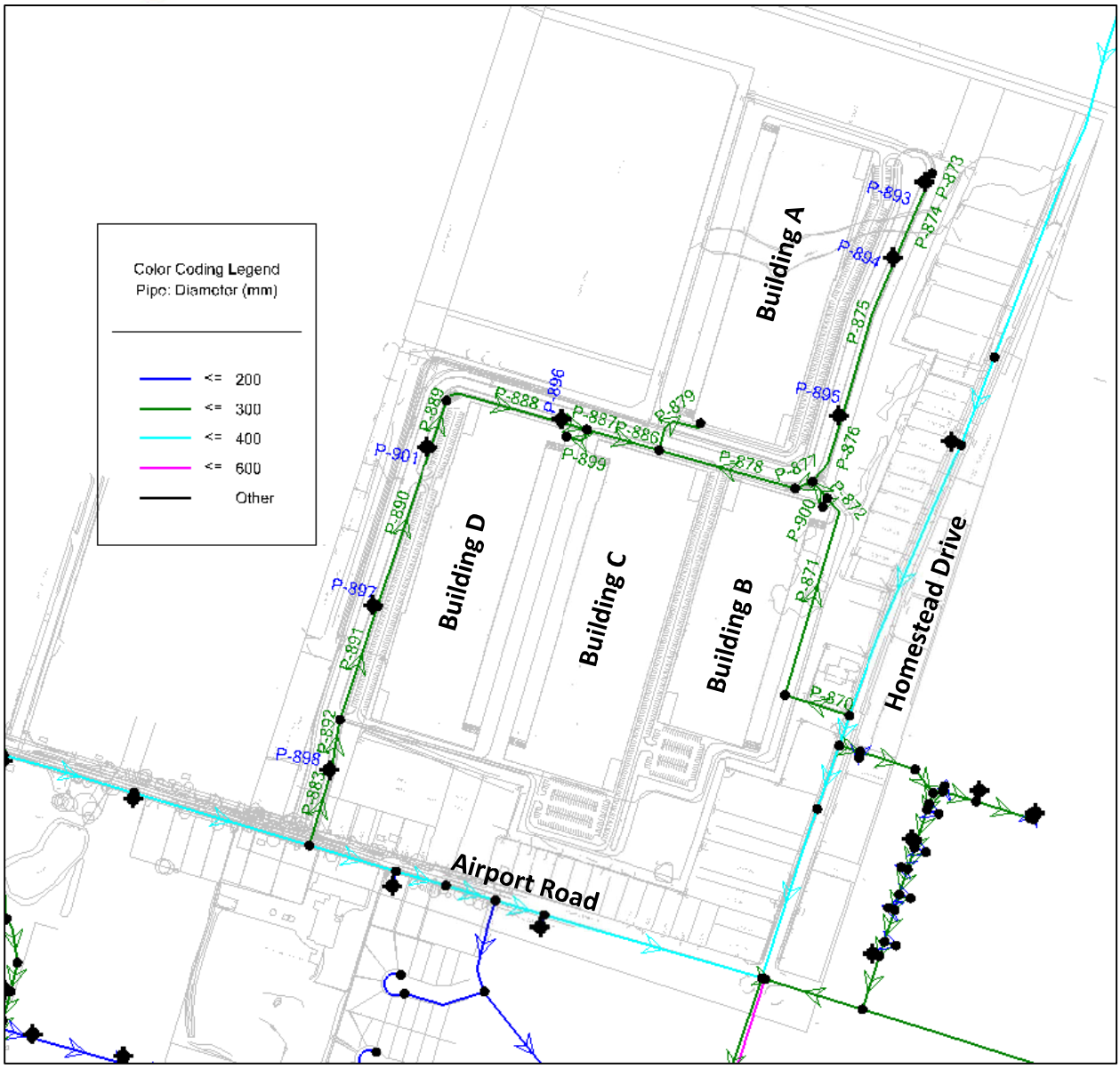


Figure A6 – Proposed 3054 Homestead Drive Development System Layout with Pipe IDs

APPENDIX

B

PIPE AND JUNCTION TABLES

2021 ADD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1122	234.91	0.00	273.92	382
J-1123	235.40	0.00	273.92	377
J-1124	234.54	0.00	273.92	385
J-1125	232.70	0.00	273.92	403
J-1131	232.92	0.00	273.92	401
J-1132	234.43	0.00	273.92	386
J-1135	234.98	1.29	273.92	381
J-1136	234.85	0.00	273.92	382
	Sum of Demand:	**1.29**	**Min**	**377**
			Max	**403**

2021 MDD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1122	234.91	0.00	271.54	359
J-1123	235.40	0.00	271.54	354
J-1124	234.54	0.00	271.54	362
J-1125	232.70	0.00	271.55	380
J-1131	232.92	0.00	271.55	378
J-1132	234.43	0.00	271.54	363
J-1135	234.98	2.46	271.54	358
J-1136	234.85	0.00	271.54	359
	Sum of Demand:	**2.46**	**Min**	**354**
			Max	**380**

2021 PHD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1122	234.91	0.00	262.14	267
J-1123	235.40	0.00	262.15	262
J-1124	234.54	0.00	262.15	270
J-1125	232.70	0.00	262.15	288
J-1131	232.92	0.00	262.15	286
J-1132	234.43	0.00	262.14	271
J-1135	234.98	3.88	262.14	266
J-1136	234.85	0.00	262.15	267
	Sum of Demand:	**3.88**	**Min**	**262**
			Max	**288**

2021 ADD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-883	J-1125	J-1129	84.12	300	120	-1.29	0.02	0.00
P-887	J-1132	J-1122	28.96	300	120	-1.29	0.02	0.00
P-888	J-1122	J-1123	130.15	300	120	-1.29	0.02	0.00
P-889	J-1123	J-1136	53.34	300	120	-1.29	0.02	0.00
P-890	J-1136	J-1124	179.22	300	120	-1.29	0.02	0.00
P-891	J-1124	J-1131	128.32	300	120	-1.29	0.02	0.00
P-892	J-1131	J-1125	54.86	300	120	-1.29	0.02	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-899	J-1132	J-1135	30.18	300	120	1.29	0.02	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00

2021 MDD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-883	J-1125	J-1129	84.12	300	120	-2.46	0.04	0.01
P-887	J-1132	J-1122	28.96	300	120	-2.46	0.04	0.01
P-888	J-1122	J-1123	130.15	300	120	-2.46	0.04	0.01
P-889	J-1123	J-1136	53.34	300	120	-2.46	0.04	0.01
P-890	J-1136	J-1124	179.22	300	120	-2.46	0.04	0.01
P-891	J-1124	J-1131	128.32	300	120	-2.46	0.04	0.01
P-892	J-1131	J-1125	54.86	300	120	-2.46	0.04	0.01
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-899	J-1132	J-1135	30.18	300	120	2.46	0.04	0.01
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00

2021 PHD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-883	J-1125	J-1129	84.12	300	120	-3.88	0.06	0.02
P-887	J-1132	J-1122	28.96	300	120	-3.88	0.06	0.02
P-888	J-1122	J-1123	130.15	300	120	-3.88	0.06	0.02
P-889	J-1123	J-1136	53.34	300	120	-3.88	0.06	0.02
P-890	J-1136	J-1124	179.22	300	120	-3.88	0.06	0.02
P-891	J-1124	J-1131	128.32	300	120	-3.88	0.06	0.02
P-892	J-1131	J-1125	54.86	300	120	-3.88	0.06	0.02
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-899	J-1132	J-1135	30.18	300	120	3.88	0.06	0.02
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00

2021 ADD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1122	234.91	0.00	278.52	427
J-1123	235.40	0.00	278.52	422
J-1124	234.54	0.00	278.52	430
J-1125	232.70	0.00	278.52	448
J-1131	232.92	0.00	278.52	446
J-1132	234.43	0.00	278.52	431
J-1135	234.98	1.29	278.52	426
J-1136	234.85	0.00	278.52	427
	Sum of Demand:	**1.29**	**Min**	**422**
			Max	**448**

2021 MDD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1122	234.91	0.00	273.09	374
J-1123	235.40	0.00	273.09	369
J-1124	234.54	0.00	273.09	377
J-1125	232.70	0.00	273.09	395
J-1131	232.92	0.00	273.09	393
J-1132	234.43	0.00	273.09	378
J-1135	234.98	2.46	273.09	373
J-1136	234.85	0.00	273.09	374
	Sum of Demand:	**2.46**	**Min**	**369**
			Max	**395**

2021 PHD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1122	234.91	0.00	263.61	281
J-1123	235.40	0.00	263.61	276
J-1124	234.54	0.00	263.62	285
J-1125	232.70	0.00	263.62	303
J-1131	232.92	0.00	263.62	300
J-1132	234.43	0.00	263.61	286
J-1135	234.98	3.88	263.61	280
J-1136	234.85	0.00	263.61	282
	Sum of Demand:	**3.88**	**Min**	**276**
			Max	**303**

Pipe Tables
Phase 1 - 70% TWL

2021 ADD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-883	J-1125	J-1129	84.12	300	120	-1.29	0.02	0.00
P-887	J-1132	J-1122	28.96	300	120	-1.29	0.02	0.00
P-888	J-1122	J-1123	130.15	300	120	-1.29	0.02	0.00
P-889	J-1123	J-1136	53.34	300	120	-1.29	0.02	0.00
P-890	J-1136	J-1124	179.22	300	120	-1.29	0.02	0.00
P-891	J-1124	J-1131	128.32	300	120	-1.29	0.02	0.00
P-892	J-1131	J-1125	54.86	300	120	-1.29	0.02	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-899	J-1132	J-1135	30.18	300	120	1.29	0.02	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00

2021 MDD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-883	J-1125	J-1129	84.12	300	120	-2.46	0.04	0.01
P-887	J-1132	J-1122	28.96	300	120	-2.46	0.04	0.01
P-888	J-1122	J-1123	130.15	300	120	-2.46	0.04	0.01
P-889	J-1123	J-1136	53.34	300	120	-2.46	0.04	0.01
P-890	J-1136	J-1124	179.22	300	120	-2.46	0.04	0.01
P-891	J-1124	J-1131	128.32	300	120	-2.46	0.04	0.01
P-892	J-1131	J-1125	54.86	300	120	-2.46	0.04	0.01
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-899	J-1132	J-1135	30.18	300	120	2.46	0.04	0.01
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00

2021 PHD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-883	J-1125	J-1129	84.12	300	120	-3.88	0.06	0.02
P-887	J-1132	J-1122	28.96	300	120	-3.88	0.06	0.02
P-888	J-1122	J-1123	130.15	300	120	-3.88	0.06	0.02
P-889	J-1123	J-1136	53.34	300	120	-3.88	0.06	0.02
P-890	J-1136	J-1124	179.22	300	120	-3.88	0.06	0.02
P-891	J-1124	J-1131	128.32	300	120	-3.88	0.06	0.02
P-892	J-1131	J-1125	54.86	300	120	-3.88	0.06	0.02
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-899	J-1132	J-1135	30.18	300	120	3.88	0.06	0.02
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00

Junctions Tables
Phase 1 - 50% TWL

2031 ADD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1122	234.91	0.00	272.14	364
J-1123	235.40	0.00	272.14	360
J-1124	234.54	0.00	272.14	368
J-1125	232.70	0.00	272.14	386
J-1131	232.92	0.00	272.14	384
J-1132	234.43	0.00	272.14	369
J-1135	234.98	1.29	272.14	364
J-1136	234.85	0.00	272.14	365
	Sum of Demand:	**1.29**	**Min**	**360**
			Max	**386**

2031 MDD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1122	234.91	0.00	268.41	328
J-1123	235.40	0.00	268.41	323
J-1124	234.54	0.00	268.41	332
J-1125	232.70	0.00	268.42	350
J-1131	232.92	0.00	268.42	347
J-1132	234.43	0.00	268.41	333
J-1135	234.98	2.46	268.41	327
J-1136	234.85	0.00	268.41	328
	Sum of Demand:	**2.46**	**Min**	**323**
			Max	**350**

2031 PHD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1122	234.91	0.00	257.04	217
J-1123	235.40	0.00	257.05	212
J-1124	234.54	0.00	257.05	220
J-1125	232.70	0.00	257.05	238
J-1131	232.92	0.00	257.05	236
J-1132	234.43	0.00	257.04	221
J-1135	234.98	3.88	257.04	216
J-1136	234.85	0.00	257.05	217
	Sum of Demand:	**3.88**	**Min**	**212**
			Max	**238**

Pipe Tables
Phase 1 - 50% TWL

2031 ADD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-883	J-1125	J-1129	84.12	300	120	-1.29	0.02	0.00
P-887	J-1132	J-1122	28.96	300	120	-1.29	0.02	0.00
P-888	J-1122	J-1123	130.15	300	120	-1.29	0.02	0.00
P-889	J-1123	J-1136	53.34	300	120	-1.29	0.02	0.00
P-890	J-1136	J-1124	179.22	300	120	-1.29	0.02	0.00
P-891	J-1124	J-1131	128.32	300	120	-1.29	0.02	0.00
P-892	J-1131	J-1125	54.86	300	120	-1.29	0.02	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-899	J-1132	J-1135	30.18	300	120	1.29	0.02	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00

2031 MDD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-883	J-1125	J-1129	84.12	300	120	-2.46	0.04	0.01
P-887	J-1132	J-1122	28.96	300	120	-2.46	0.04	0.01
P-888	J-1122	J-1123	130.15	300	120	-2.46	0.04	0.01
P-889	J-1123	J-1136	53.34	300	120	-2.46	0.04	0.01
P-890	J-1136	J-1124	179.22	300	120	-2.46	0.04	0.01
P-891	J-1124	J-1131	128.32	300	120	-2.46	0.04	0.01
P-892	J-1131	J-1125	54.86	300	120	-2.46	0.04	0.01
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-899	J-1132	J-1135	30.18	300	120	2.46	0.04	0.01
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00

2031 PHD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-883	J-1125	J-1129	84.12	300	120	-3.88	0.06	0.02
P-887	J-1132	J-1122	28.96	300	120	-3.88	0.06	0.02
P-888	J-1122	J-1123	130.15	300	120	-3.88	0.06	0.02
P-889	J-1123	J-1136	53.34	300	120	-3.88	0.06	0.02
P-890	J-1136	J-1124	179.22	300	120	-3.88	0.06	0.02
P-891	J-1124	J-1131	128.32	300	120	-3.88	0.06	0.02
P-892	J-1131	J-1125	54.86	300	120	-3.88	0.06	0.02
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-899	J-1132	J-1135	30.18	300	120	3.88	0.06	0.02
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00

Junctions Tables
Phase 1 - 70% TWL

2031 ADD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1122	234.91	0.00	276.96	414
J-1123	235.40	0.00	276.96	409
J-1124	234.54	0.00	276.97	417
J-1125	232.70	0.00	276.98	435
J-1131	232.92	0.00	276.98	433
J-1132	234.43	0.00	276.96	418
J-1135	234.98	1.29	276.96	413
J-1136	234.85	0.00	276.96	414
	Sum of Demand:	**1.29**	**Min**	**409**
			Max	**435**

2031 MDD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1122	234.91	0.00	269.92	343
J-1123	235.40	0.00	269.93	338
J-1124	234.54	0.00	269.93	346
J-1125	232.70	0.00	269.93	364
J-1131	232.92	0.00	269.93	362
J-1132	234.43	0.00	269.92	347
J-1135	234.98	2.46	269.92	342
J-1136	234.85	0.00	269.93	343
	Sum of Demand:	**2.46**	**Min**	**338**
			Max	**364**

2031 PHD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1122	234.91	0.00	258.49	231
J-1123	235.40	0.00	258.50	226
J-1124	234.54	0.00	258.50	234
J-1125	232.70	0.00	258.50	253
J-1131	232.92	0.00	258.50	250
J-1132	234.43	0.00	258.49	235
J-1135	234.98	3.88	258.49	230
J-1136	234.85	0.00	258.50	231
	Sum of Demand:	**3.88**	**Min**	**226**
			Max	**253**

Junctions Tables
Phase 1 - 70% TWL

2031 PHD Junction Results - 99% TWL				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1123	235.40	0.00	260.68	247
J-1135	234.98	3.88	260.67	251
J-1122	234.91	0.00	260.67	252
J-1136	234.85	0.00	260.68	253
J-1124	234.54	0.00	260.68	256
J-1132	234.43	0.00	260.67	257
J-1131	232.92	0.00	260.68	272
J-1125	232.70	0.00	260.68	274
	Sum of Demand:	**3.88**	**Min**	**247**
			Max	**274**

Pipe Tables
Phase 1 - 70% TWL

2031 ADD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-883	J-1125	J-1129	84.12	300	120	-1.29	0.02	0.00
P-887	J-1132	J-1122	28.96	300	120	-1.29	0.02	0.00
P-888	J-1122	J-1123	130.15	300	120	-1.29	0.02	0.00
P-889	J-1123	J-1136	53.34	300	120	-1.29	0.02	0.00
P-890	J-1136	J-1124	179.22	300	120	-1.29	0.02	0.00
P-891	J-1124	J-1131	128.32	300	120	-1.29	0.02	0.00
P-892	J-1131	J-1125	54.86	300	120	-1.29	0.02	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-899	J-1132	J-1135	30.18	300	120	1.29	0.02	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00

2031 MDD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-883	J-1125	J-1129	84.12	300	120	-2.46	0.04	0.01
P-887	J-1132	J-1122	28.96	300	120	-2.46	0.04	0.01
P-888	J-1122	J-1123	130.15	300	120	-2.46	0.04	0.01
P-889	J-1123	J-1136	53.34	300	120	-2.46	0.04	0.01
P-890	J-1136	J-1124	179.22	300	120	-2.46	0.04	0.01
P-891	J-1124	J-1131	128.32	300	120	-2.46	0.04	0.01
P-892	J-1131	J-1125	54.86	300	120	-2.46	0.04	0.01
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-899	J-1132	J-1135	30.18	300	120	2.46	0.04	0.01
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00

2031 PHD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-883	J-1125	J-1129	84.12	300	120	-3.88	0.06	0.02
P-887	J-1132	J-1122	28.96	300	120	-3.88	0.06	0.02
P-888	J-1122	J-1123	130.15	300	120	-3.88	0.06	0.02
P-889	J-1123	J-1136	53.34	300	120	-3.88	0.06	0.02
P-890	J-1136	J-1124	179.22	300	120	-3.88	0.06	0.02
P-891	J-1124	J-1131	128.32	300	120	-3.88	0.06	0.02
P-892	J-1131	J-1125	54.86	300	120	-3.88	0.06	0.02
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-899	J-1132	J-1135	30.18	300	120	3.88	0.06	0.02
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00

Junctions Tables
Full Buildout - 50% TWL

2021 ADD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1123	235.40	0.00	273.77	376
J-1135	234.98	1.29	273.77	380
J-1122	234.91	0.00	273.77	380
J-1136	234.85	0.00	273.77	381
J-1124	234.54	0.00	273.77	384
J-1132	234.43	0.00	273.77	385
J-1133	234.00	1.43	273.76	389
J-1102	233.87	0.00	273.77	390
J-1108	233.73	0.00	273.76	392
J-1110	233.44	0.99	273.76	395
J-1107	233.41	0.00	273.76	395
J-1109	232.98	1.29	273.76	399
J-1134	232.97	0.00	273.76	399
J-1131	232.92	0.00	273.77	400
J-1125	232.70	0.00	273.78	402
J-1106	232.22	0.00	273.76	407
J-1103	229.11	0.00	273.76	437
J-1104	229.04	0.00	273.76	438
J-1105	229.00	0.00	273.76	438
	Sum of Demand:	**5.01**	**Min**	**376**
			Max	**438**

Junctions Tables
Full Buildout - 50% TWL

2021 MDD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1123	235.40	0.00	271.08	349
J-1135	234.98	2.46	271.07	353
J-1122	234.91	0.00	271.07	354
J-1136	234.85	0.00	271.09	355
J-1124	234.54	0.00	271.10	358
J-1132	234.43	0.00	271.07	359
J-1133	234.00	2.72	271.07	363
J-1102	233.87	0.00	271.07	364
J-1108	233.73	0.00	271.07	365
J-1110	233.44	1.89	271.07	368
J-1107	233.41	0.00	271.07	369
J-1109	232.98	2.45	271.07	373
J-1134	232.97	0.00	271.07	373
J-1131	232.92	0.00	271.11	374
J-1125	232.70	0.00	271.12	376
J-1106	232.22	0.00	271.07	380
J-1103	229.11	0.00	271.07	411
J-1104	229.04	0.00	271.07	411
J-1105	229.00	0.00	271.07	412
	Sum of Demand:	**9.52**	**Min**	**349**
			Max	**412**

Junctions Tables
Full Buildout - 50% TWL

2021 PHD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1123	235.40	0.00	261.07	251
J-1135	234.98	3.88	261.04	255
J-1122	234.91	0.00	261.05	256
J-1136	234.85	0.00	261.08	257
J-1124	234.54	0.00	261.10	260
J-1132	234.43	0.00	261.05	260
J-1133	234.00	4.30	261.04	265
J-1102	233.87	0.00	261.04	266
J-1108	233.73	0.00	261.04	267
J-1110	233.44	2.98	261.04	270
J-1107	233.41	0.00	261.04	270
J-1109	232.98	3.87	261.04	275
J-1134	232.97	0.00	261.04	275
J-1131	232.92	0.00	261.12	276
J-1125	232.70	0.00	261.13	278
J-1106	232.22	0.00	261.04	282
J-1103	229.11	0.00	261.04	312
J-1104	229.04	0.00	261.04	313
J-1105	229.00	0.00	261.04	314
	Sum of Demand:	**15.03**	**Min**	**251**
			Max	**314**

Pipe Tables
Full Buildout - 50% TWL

2021 ADD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-893	J-1103	H-180	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-873	J-1103	J-1104	11.28	300	120	0.00	0.00	0.00
P-874	J-1103	J-1105	88.09	300	120	0.00	0.00	0.00
P-875	J-1105	J-1106	178.92	300	120	0.00	0.00	0.00
P-895	J-1106	H-182	6.10	150	100	0.00	0.00	0.00
P-894	J-1105	H-181	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-876	J-1106	J-1107	78.33	300	120	0.00	0.00	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00
P-872	J-1134	J-1107	23.77	300	120	0.50	0.01	0.00
P-877	J-1107	J-1108	20.12	300	120	0.50	0.01	0.00
P-878	J-1108	J-1133	151.79	300	120	0.50	0.01	0.00
P-870	J-1130	J-1102	72.54	300	120	1.57	0.02	0.00
P-871	J-1102	J-1134	224.64	300	120	1.57	0.02	0.00
P-900	J-1134	J-1110	10.36	300	120	1.07	0.02	0.00
P-879	J-1133	J-1109	70.41	300	120	1.39	0.02	0.00
P-899	J-1132	J-1135	30.18	300	120	1.39	0.02	0.00
P-886	J-1133	J-1132	80.47	300	120	-2.44	0.03	0.01
P-888	J-1122	J-1123	130.15	300	120	-3.83	0.05	0.02
P-887	J-1132	J-1122	28.96	300	120	-3.83	0.05	0.02
P-889	J-1123	J-1136	53.34	300	120	-3.83	0.05	0.02
P-890	J-1136	J-1124	179.22	300	120	-3.83	0.05	0.02
P-891	J-1124	J-1131	128.32	300	120	-3.83	0.05	0.02
P-892	J-1131	J-1125	54.86	300	120	-3.83	0.05	0.02
P-883	J-1125	J-1129	84.12	300	120	-3.83	0.05	0.02

Pipe Tables
Full Buildout - 50% TWL

2021 MDD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-895	J-1106	H-182	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-894	J-1105	H-181	6.10	150	100	0.00	0.00	0.00
P-873	J-1103	J-1104	11.28	300	120	0.00	0.00	0.00
P-874	J-1103	J-1105	88.09	300	120	0.00	0.00	0.00
P-876	J-1106	J-1107	78.33	300	120	0.00	0.00	0.00
P-875	J-1105	J-1106	178.92	300	120	0.00	0.00	0.00
P-893	J-1103	H-180	6.10	150	100	0.00	0.00	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-878	J-1108	J-1133	151.79	300	120	-0.90	0.01	0.00
P-877	J-1107	J-1108	20.12	300	120	-0.90	0.01	0.00
P-872	J-1134	J-1107	23.77	300	120	-0.90	0.01	0.00
P-900	J-1134	J-1110	10.36	300	120	1.89	0.03	0.01
P-870	J-1130	J-1102	72.54	300	120	0.98	0.01	0.00
P-871	J-1102	J-1134	224.64	300	120	0.98	0.01	0.00
P-879	J-1133	J-1109	70.41	300	120	2.45	0.03	0.01
P-899	J-1132	J-1135	30.18	300	120	2.46	0.03	0.01
P-886	J-1133	J-1132	80.47	300	120	-6.08	0.09	0.04
P-887	J-1132	J-1122	28.96	300	120	-8.54	0.12	0.08
P-888	J-1122	J-1123	130.15	300	120	-8.54	0.12	0.08
P-889	J-1123	J-1136	53.34	300	120	-8.54	0.12	0.08
P-890	J-1136	J-1124	179.22	300	120	-8.54	0.12	0.08
P-883	J-1125	J-1129	84.12	300	120	-8.54	0.12	0.08
P-891	J-1124	J-1131	128.32	300	120	-8.54	0.12	0.08
P-892	J-1131	J-1125	54.86	300	120	-8.54	0.12	0.08

Pipe Tables
Full Buildout - 50% TWL

2021 PHD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-895	J-1106	H-182	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-894	J-1105	H-181	6.10	150	100	0.00	0.00	0.00
P-873	J-1103	J-1104	11.28	300	120	0.00	0.00	0.00
P-874	J-1103	J-1105	88.09	300	120	0.00	0.00	0.00
P-876	J-1106	J-1107	78.33	300	120	0.00	0.00	0.00
P-875	J-1105	J-1106	178.92	300	120	0.00	0.00	0.00
P-893	J-1103	H-180	6.10	150	100	0.00	0.00	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-878	J-1108	J-1133	151.79	300	120	0.05	0.00	0.00
P-877	J-1107	J-1108	20.12	300	120	0.05	0.00	0.00
P-872	J-1134	J-1107	23.77	300	120	0.05	0.00	0.00
P-900	J-1134	J-1110	10.36	300	120	2.98	0.04	0.01
P-870	J-1130	J-1102	72.54	300	120	3.03	0.04	0.01
P-871	J-1102	J-1134	224.64	300	120	3.03	0.04	0.01
P-879	J-1133	J-1109	70.41	300	120	3.87	0.05	0.02
P-899	J-1132	J-1135	30.18	300	120	3.88	0.05	0.02
P-886	J-1133	J-1132	80.47	300	120	-8.12	0.11	0.07
P-887	J-1132	J-1122	28.96	300	120	-12.00	0.17	0.15
P-888	J-1122	J-1123	130.15	300	120	-12.00	0.17	0.15
P-889	J-1123	J-1136	53.34	300	120	-12.00	0.17	0.15
P-890	J-1136	J-1124	179.22	300	120	-12.00	0.17	0.15
P-883	J-1125	J-1129	84.12	300	120	-12.00	0.17	0.15
P-891	J-1124	J-1131	128.32	300	120	-12.00	0.17	0.15
P-892	J-1131	J-1125	54.86	300	120	-12.00	0.17	0.15

Junctions Tables
Full Buildout - 70% TWL

2021 ADD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1123	235.40	0.00	278.37	421
J-1135	234.98	1.29	278.36	425
J-1122	234.91	0.00	278.36	425
J-1136	234.85	0.00	278.37	426
J-1124	234.54	0.00	278.37	429
J-1132	234.43	0.00	278.36	430
J-1133	234.00	1.43	278.36	434
J-1102	233.87	0.00	278.36	435
J-1108	233.73	0.00	278.36	437
J-1110	233.44	0.99	278.36	440
J-1107	233.41	0.00	278.36	440
J-1109	232.98	1.29	278.36	444
J-1134	232.97	0.00	278.36	444
J-1131	232.92	0.00	278.38	445
J-1125	232.70	0.00	278.38	447
J-1106	232.22	0.00	278.36	452
J-1103	229.11	0.00	278.36	482
J-1104	229.04	0.00	278.36	483
J-1105	229.00	0.00	278.36	483
	Sum of Demand:	**5.01**	**Min**	**421**
			Max	**483**

Junctions Tables
Full Buildout - 70% TWL

2021 MDD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1123	235.40	0.00	272.60	364
J-1135	234.98	2.46	272.59	368
J-1122	234.91	0.00	272.59	369
J-1136	234.85	0.00	272.61	370
J-1124	234.54	0.00	272.62	373
J-1132	234.43	0.00	272.59	373
J-1133	234.00	2.72	272.59	378
J-1102	233.87	0.00	272.59	379
J-1108	233.73	0.00	272.59	380
J-1110	233.44	1.89	272.59	383
J-1107	233.41	0.00	272.59	383
J-1109	232.98	2.45	272.59	388
J-1134	232.97	0.00	272.59	388
J-1131	232.92	0.00	272.63	389
J-1125	232.70	0.00	272.64	391
J-1106	232.22	0.00	272.59	395
J-1103	229.11	0.00	272.59	425
J-1104	229.04	0.00	272.59	426
J-1105	229.00	0.00	272.59	427
	Sum of Demand:	**9.52**	**Min**	**364**
			Max	**427**

Junctions Tables
Full Buildout - 70% TWL

2021 PHD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1123	235.40	0.00	262.54	266
J-1135	234.98	3.88	262.51	269
J-1122	234.91	0.00	262.52	270
J-1136	234.85	0.00	262.54	271
J-1124	234.54	0.00	262.57	274
J-1132	234.43	0.00	262.51	275
J-1133	234.00	4.30	262.51	279
J-1102	233.87	0.00	262.51	280
J-1108	233.73	0.00	262.51	282
J-1110	233.44	2.98	262.51	284
J-1107	233.41	0.00	262.51	285
J-1109	232.98	3.87	262.50	289
J-1134	232.97	0.00	262.51	289
J-1131	232.92	0.00	262.59	290
J-1125	232.70	0.00	262.60	293
J-1106	232.22	0.00	262.51	296
J-1103	229.11	0.00	262.51	327
J-1104	229.04	0.00	262.51	328
J-1105	229.00	0.00	262.51	328
	Sum of Demand:	**15.03**	**Min**	**266**
			Max	**328**

Junctions Tables
Full Buildout - 70% TWL

2021 PHD Junction Results - 90% TWL				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1123	235.40	0.00	264.01	280
J-1135	234.98	3.88	263.98	284
J-1122	234.91	0.00	263.99	285
J-1136	234.85	0.00	264.02	285
J-1124	234.54	0.00	264.04	289
J-1132	234.43	0.00	263.98	289
J-1133	234.00	4.30	263.98	293
J-1102	233.87	0.00	263.98	295
J-1108	233.73	0.00	263.98	296
J-1110	233.44	2.98	263.98	299
J-1107	233.41	0.00	263.98	299
J-1109	232.98	3.87	263.98	303
J-1134	232.97	0.00	263.98	303
J-1131	232.92	0.00	264.06	305
J-1125	232.70	0.00	264.07	307
J-1106	232.22	0.00	263.98	311
J-1103	229.11	0.00	263.98	341
J-1104	229.04	0.00	263.98	342
J-1105	229.00	0.00	263.98	342
	Sum of Demand:	**15.03**	**Min**	**280**
			Max	**342**

Pipe Tables
Full Buildout - 50% TWL

2021 ADD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-895	J-1106	H-182	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-894	J-1105	H-181	6.10	150	100	0.00	0.00	0.00
P-873	J-1103	J-1104	11.28	300	120	0.00	0.00	0.00
P-874	J-1103	J-1105	88.09	300	120	0.00	0.00	0.00
P-876	J-1106	J-1107	78.33	300	120	0.00	0.00	0.00
P-875	J-1105	J-1106	178.92	300	120	0.00	0.00	0.00
P-893	J-1103	H-180	6.10	150	100	0.00	0.00	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-878	J-1108	J-1133	151.79	300	120	-0.99	0.01	0.00
P-877	J-1107	J-1108	20.12	300	120	-0.99	0.01	0.00
P-872	J-1134	J-1107	23.77	300	120	-0.99	0.01	0.00
P-900	J-1134	J-1110	10.36	300	120	0.99	0.01	0.00
P-870	J-1130	J-1102	72.54	300	120	0.00	0.00	0.00
P-871	J-1102	J-1134	224.64	300	120	0.00	0.00	0.00
P-879	J-1133	J-1109	70.41	300	120	1.29	0.02	0.00
P-899	J-1132	J-1135	30.18	300	120	1.29	0.02	0.00
P-886	J-1133	J-1132	80.47	300	120	-3.72	0.05	0.02
P-887	J-1132	J-1122	28.96	300	120	-5.01	0.07	0.03
P-888	J-1122	J-1123	130.15	300	120	-5.01	0.07	0.03
P-889	J-1123	J-1136	53.34	300	120	-5.01	0.07	0.03
P-890	J-1136	J-1124	179.22	300	120	-5.01	0.07	0.03
P-883	J-1125	J-1129	84.12	300	120	-5.01	0.07	0.03
P-891	J-1124	J-1131	128.32	300	120	-5.01	0.07	0.03
P-892	J-1131	J-1125	54.86	300	120	-5.01	0.07	0.03

Pipe Tables
Full Buildout - 50% TWL

2021 MDD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-895	J-1106	H-182	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-894	J-1105	H-181	6.10	150	100	0.00	0.00	0.00
P-873	J-1103	J-1104	11.28	300	120	0.00	0.00	0.00
P-874	J-1103	J-1105	88.09	300	120	0.00	0.00	0.00
P-876	J-1106	J-1107	78.33	300	120	0.00	0.00	0.00
P-875	J-1105	J-1106	178.92	300	120	0.00	0.00	0.00
P-893	J-1103	H-180	6.10	150	100	0.00	0.00	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-878	J-1108	J-1133	151.79	300	120	-0.95	0.01	0.00
P-877	J-1107	J-1108	20.12	300	120	-0.95	0.01	0.00
P-872	J-1134	J-1107	23.77	300	120	-0.94	0.01	0.00
P-900	J-1134	J-1110	10.36	300	120	1.89	0.03	0.00
P-870	J-1130	J-1102	72.54	300	120	0.94	0.01	0.00
P-871	J-1102	J-1134	224.64	300	120	0.94	0.01	0.00
P-879	J-1133	J-1109	70.41	300	120	2.45	0.03	0.01
P-899	J-1132	J-1135	30.18	300	120	2.46	0.03	0.01
P-886	J-1133	J-1132	80.47	300	120	-6.12	0.09	0.04
P-887	J-1132	J-1122	28.96	300	120	-8.58	0.12	0.08
P-888	J-1122	J-1123	130.15	300	120	-8.58	0.12	0.08
P-889	J-1123	J-1136	53.34	300	120	-8.58	0.12	0.08
P-890	J-1136	J-1124	179.22	300	120	-8.58	0.12	0.08
P-883	J-1125	J-1129	84.12	300	120	-8.58	0.12	0.08
P-891	J-1124	J-1131	128.32	300	120	-8.58	0.12	0.08
P-892	J-1131	J-1125	54.86	300	120	-8.58	0.12	0.08

Pipe Tables
Full Buildout - 50% TWL

2021 PHD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-895	J-1106	H-182	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-894	J-1105	H-181	6.10	150	100	0.00	0.00	0.00
P-873	J-1103	J-1104	11.28	300	120	0.00	0.00	0.00
P-874	J-1103	J-1105	88.09	300	120	0.00	0.00	0.00
P-876	J-1106	J-1107	78.33	300	120	0.00	0.00	0.00
P-875	J-1105	J-1106	178.92	300	120	0.00	0.00	0.00
P-893	J-1103	H-180	6.10	150	100	0.00	0.00	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-878	J-1108	J-1133	151.79	300	120	0.03	0.00	0.00
P-877	J-1107	J-1108	20.12	300	120	0.03	0.00	0.00
P-872	J-1134	J-1107	23.77	300	120	0.03	0.00	0.00
P-900	J-1134	J-1110	10.36	300	120	2.98	0.04	0.01
P-870	J-1130	J-1102	72.54	300	120	3.01	0.04	0.01
P-871	J-1102	J-1134	224.64	300	120	3.01	0.04	0.01
P-879	J-1133	J-1109	70.41	300	120	3.87	0.05	0.02
P-899	J-1132	J-1135	30.18	300	120	3.88	0.05	0.02
P-886	J-1133	J-1132	80.47	300	120	-8.14	0.12	0.07
P-887	J-1132	J-1122	28.96	300	120	-12.03	0.17	0.15
P-888	J-1122	J-1123	130.15	300	120	-12.03	0.17	0.15
P-889	J-1123	J-1136	53.34	300	120	-12.03	0.17	0.15
P-890	J-1136	J-1124	179.22	300	120	-12.03	0.17	0.15
P-883	J-1125	J-1129	84.12	300	120	-12.03	0.17	0.15
P-891	J-1124	J-1131	128.32	300	120	-12.03	0.17	0.15
P-892	J-1131	J-1125	54.86	300	120	-12.03	0.17	0.15

Junctions Tables
Full Buildout - 50% TWL

2031 ADD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1123	235.40	0.00	271.93	358
J-1135	234.98	1.29	271.93	362
J-1122	234.91	0.00	271.93	362
J-1136	234.85	0.00	271.93	363
J-1124	234.54	0.00	271.94	366
J-1132	234.43	0.00	271.93	367
J-1133	234.00	1.43	271.93	371
J-1102	233.87	0.00	271.93	372
J-1108	233.73	0.00	271.93	374
J-1110	233.44	0.99	271.93	377
J-1107	233.41	0.00	271.93	377
J-1109	232.98	1.29	271.93	381
J-1134	232.97	0.00	271.93	381
J-1131	232.92	0.00	271.94	382
J-1125	232.70	0.00	271.94	384
J-1106	232.22	0.00	271.93	389
J-1103	229.11	0.00	271.93	419
J-1104	229.04	0.00	271.93	420
J-1105	229.00	0.00	271.93	420
	Sum of Demand:	**5.01**	**Min**	**358**
			Max	**420**

Junctions Tables
Full Buildout - 50% TWL

2031 MDD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1123	235.40	0.00	267.76	317
J-1135	234.98	2.46	267.74	321
J-1122	234.91	0.00	267.74	321
J-1136	234.85	0.00	267.76	322
J-1124	234.54	0.00	267.78	325
J-1132	234.43	0.00	267.74	326
J-1133	234.00	2.72	267.74	330
J-1102	233.87	0.00	267.74	331
J-1108	233.73	0.00	267.74	333
J-1110	233.44	1.89	267.74	336
J-1107	233.41	0.00	267.74	336
J-1109	232.98	2.45	267.74	340
J-1134	232.97	0.00	267.74	340
J-1131	232.92	0.00	267.79	341
J-1125	232.70	0.00	267.80	344
J-1106	232.22	0.00	267.74	348
J-1103	229.11	0.00	267.74	378
J-1104	229.04	0.00	267.74	379
J-1105	229.00	0.00	267.74	379
	Sum of Demand:	**9.52**	**Min**	**317**
			Max	**379**

Junctions Tables
Full Buildout - 50% TWL

2031 PHD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1123	235.40	0.00	255.67	198
J-1135	234.98	3.88	255.63	202
J-1122	234.91	0.00	255.64	203
J-1136	234.85	0.00	255.68	204
J-1124	234.54	0.00	255.71	207
J-1132	234.43	0.00	255.64	208
J-1133	234.00	4.30	255.63	212
J-1102	233.87	0.00	255.63	213
J-1108	233.73	0.00	255.63	214
J-1110	233.44	2.98	255.62	217
J-1107	233.41	0.00	255.63	217
J-1109	232.98	3.87	255.63	222
J-1134	232.97	0.00	255.63	222
J-1131	232.92	0.00	255.74	223
J-1125	232.70	0.00	255.75	226
J-1106	232.22	0.00	255.63	229
J-1103	229.11	0.00	255.63	260
J-1104	229.04	0.00	255.63	260
J-1105	229.00	0.00	255.63	261
	Sum of Demand:	**15.03**	**Min**	**198**
			Max	**261**

Pipe Tables
Full Buildout - 50% TWL

2031 ADD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-895	J-1106	H-182	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-894	J-1105	H-181	6.10	150	100	0.00	0.00	0.00
P-873	J-1103	J-1104	11.28	300	120	0.00	0.00	0.00
P-874	J-1103	J-1105	88.09	300	120	0.00	0.00	0.00
P-876	J-1106	J-1107	78.33	300	120	0.00	0.00	0.00
P-875	J-1105	J-1106	178.92	300	120	0.00	0.00	0.00
P-893	J-1103	H-180	6.10	150	100	0.00	0.00	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-878	J-1108	J-1133	151.79	300	120	-0.50	0.01	0.00
P-877	J-1107	J-1108	20.12	300	120	-0.50	0.01	0.00
P-872	J-1134	J-1107	23.77	300	120	-0.50	0.01	0.00
P-900	J-1134	J-1110	10.36	300	120	0.99	0.01	0.00
P-870	J-1130	J-1102	72.54	300	120	0.49	0.01	0.00
P-871	J-1102	J-1134	224.64	300	120	0.49	0.01	0.00
P-879	J-1133	J-1109	70.41	300	120	1.29	0.02	0.00
P-899	J-1132	J-1135	30.18	300	120	1.29	0.02	0.00
P-886	J-1133	J-1132	80.47	300	120	-3.23	0.05	0.01
P-887	J-1132	J-1122	28.96	300	120	-4.52	0.06	0.02
P-888	J-1122	J-1123	130.15	300	120	-4.52	0.06	0.02
P-889	J-1123	J-1136	53.34	300	120	-4.52	0.06	0.02
P-890	J-1136	J-1124	179.22	300	120	-4.52	0.06	0.02
P-883	J-1125	J-1129	84.12	300	120	-4.52	0.06	0.02
P-891	J-1124	J-1131	128.32	300	120	-4.52	0.06	0.02
P-892	J-1131	J-1125	54.86	300	120	-4.52	0.06	0.02

Pipe Tables
Full Buildout - 50% TWL

2031 MDD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-895	J-1106	H-182	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-894	J-1105	H-181	6.10	150	100	0.00	0.00	0.00
P-873	J-1103	J-1104	11.28	300	120	0.00	0.00	0.00
P-874	J-1103	J-1105	88.09	300	120	0.00	0.00	0.00
P-876	J-1106	J-1107	78.33	300	120	0.00	0.00	0.00
P-875	J-1105	J-1106	178.92	300	120	0.00	0.00	0.00
P-893	J-1103	H-180	6.10	150	100	0.00	0.00	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-878	J-1108	J-1133	151.79	300	120	-1.90	0.03	0.00
P-877	J-1107	J-1108	20.12	300	120	-1.90	0.03	0.00
P-872	J-1134	J-1107	23.77	300	120	-1.90	0.03	0.00
P-900	J-1134	J-1110	10.36	300	120	1.89	0.03	0.01
P-870	J-1130	J-1102	72.54	300	120	-0.02	0.00	0.00
P-871	J-1102	J-1134	224.64	300	120	-0.02	0.00	0.00
P-879	J-1133	J-1109	70.41	300	120	2.45	0.03	0.01
P-899	J-1132	J-1135	30.18	300	120	2.46	0.03	0.01
P-886	J-1133	J-1132	80.47	300	120	-7.08	0.10	0.06
P-887	J-1132	J-1122	28.96	300	120	-9.54	0.13	0.10
P-888	J-1122	J-1123	130.15	300	120	-9.54	0.13	0.10
P-889	J-1123	J-1136	53.34	300	120	-9.54	0.13	0.10
P-890	J-1136	J-1124	179.22	300	120	-9.54	0.13	0.10
P-883	J-1125	J-1129	84.12	300	120	-9.54	0.13	0.10
P-891	J-1124	J-1131	128.32	300	120	-9.54	0.13	0.10
P-892	J-1131	J-1125	54.86	300	120	-9.54	0.13	0.10

Pipe Tables
Full Buildout - 50% TWL

2031 PHD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-895	J-1106	H-182	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-894	J-1105	H-181	6.10	150	100	0.00	0.00	0.00
P-873	J-1103	J-1104	11.28	300	120	0.00	0.00	0.00
P-874	J-1103	J-1105	88.09	300	120	0.00	0.00	0.00
P-876	J-1106	J-1107	78.33	300	120	0.00	0.00	0.00
P-875	J-1105	J-1106	178.92	300	120	0.00	0.00	0.00
P-893	J-1103	H-180	6.10	150	100	0.00	0.00	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-878	J-1108	J-1133	151.79	300	120	-2.18	0.03	0.01
P-877	J-1107	J-1108	20.12	300	120	-2.18	0.03	0.01
P-872	J-1134	J-1107	23.77	300	120	-2.18	0.03	0.01
P-900	J-1134	J-1110	10.36	300	120	2.98	0.04	0.01
P-870	J-1130	J-1102	72.54	300	120	0.80	0.01	0.00
P-871	J-1102	J-1134	224.64	300	120	0.80	0.01	0.00
P-879	J-1133	J-1109	70.41	300	120	3.87	0.05	0.02
P-899	J-1132	J-1135	30.18	300	120	3.88	0.05	0.02
P-886	J-1133	J-1132	80.47	300	120	-10.35	0.15	0.11
P-887	J-1132	J-1122	28.96	300	120	-14.23	0.20	0.20
P-888	J-1122	J-1123	130.15	300	120	-14.23	0.20	0.20
P-889	J-1123	J-1136	53.34	300	120	-14.23	0.20	0.20
P-890	J-1136	J-1124	179.22	300	120	-14.23	0.20	0.20
P-883	J-1125	J-1129	84.12	300	120	-14.23	0.20	0.20
P-891	J-1124	J-1131	128.32	300	120	-14.23	0.20	0.20
P-892	J-1131	J-1125	54.86	300	120	-14.23	0.20	0.20

Junctions Tables
Full Buildout - 70% TWL

2031 ADD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1123	235.40	0.00	276.96	407
J-1135	234.98	1.29	276.96	411
J-1122	234.91	0.00	276.96	412
J-1136	234.85	0.00	276.96	412
J-1124	234.54	0.00	276.97	415
J-1132	234.43	0.00	276.96	416
J-1133	234.00	1.43	276.96	420
J-1102	233.87	0.00	276.96	422
J-1108	233.73	0.00	276.96	423
J-1110	233.44	0.99	276.96	426
J-1107	233.41	0.00	276.96	426
J-1109	232.98	1.29	276.96	430
J-1134	232.97	0.00	276.96	430
J-1131	232.92	0.00	276.98	431
J-1125	232.70	0.00	276.98	433
J-1106	232.22	0.00	276.96	438
J-1103	229.11	0.00	276.96	468
J-1104	229.04	0.00	276.96	469
J-1105	229.00	0.00	276.96	469
	Sum of Demand:	**5.01**	**Min**	**407**
			Max	**469**

Junctions Tables
Full Buildout - 70% TWL

2031 MDD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1123	235.40	0.00	269.31	332
J-1135	234.98	2.46	269.29	336
J-1122	234.91	0.00	269.29	337
J-1136	234.85	0.00	269.31	337
J-1124	234.54	0.00	269.33	340
J-1132	234.43	0.00	269.29	341
J-1133	234.00	2.72	269.29	345
J-1102	233.87	0.00	269.29	347
J-1108	233.73	0.00	269.29	348
J-1110	233.44	1.89	269.29	351
J-1107	233.41	0.00	269.29	351
J-1109	232.98	2.45	269.29	355
J-1134	232.97	0.00	269.29	355
J-1131	232.92	0.00	269.34	356
J-1125	232.70	0.00	269.35	359
J-1106	232.22	0.00	269.29	363
J-1103	229.11	0.00	269.29	393
J-1104	229.04	0.00	269.29	394
J-1105	229.00	0.00	269.29	394
	Sum of Demand:	**9.52**	**Min**	**332**
			Max	**394**

Junctions Tables
Full Buildout - 70% TWL

2031 PHD Junction Results				
Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1123	235.40	0.00	257.12	213
J-1135	234.98	3.88	257.08	216
J-1122	234.91	0.00	257.09	217
J-1136	234.85	0.00	257.13	218
J-1124	234.54	0.00	257.16	221
J-1132	234.43	0.00	257.08	222
J-1133	234.00	4.30	257.07	226
J-1102	233.87	0.00	257.07	227
J-1108	233.73	0.00	257.07	228
J-1110	233.44	2.98	257.07	231
J-1107	233.41	0.00	257.07	232
J-1109	232.98	3.87	257.07	236
J-1134	232.97	0.00	257.07	236
J-1131	232.92	0.00	257.19	238
J-1125	232.70	0.00	257.20	240
J-1106	232.22	0.00	257.07	243
J-1103	229.11	0.00	257.07	274
J-1104	229.04	0.00	257.07	274
J-1105	229.00	0.00	257.07	275
	Sum of Demand:	**15.03**	**Min**	**213**
			Max	**275**

Junctions Tables
Full Buildout - 70% TWL

2031 PHD Junction Results - 99% TWL				
J-1123	235.40	0.00	259.29	234
J-1135	234.98	3.88	259.25	238
J-1122	234.91	0.00	259.26	238
J-1136	234.85	0.00	259.30	239
J-1124	234.54	0.00	259.33	243
J-1132	234.43	0.00	259.25	243
J-1133	234.00	4.30	259.24	247
J-1102	233.87	0.00	259.24	248
J-1108	233.73	0.00	259.24	250
J-1110	233.44	2.98	259.24	253
J-1107	233.41	0.00	259.24	253
J-1109	232.98	3.87	259.24	257
J-1134	232.97	0.00	259.24	257
J-1131	232.92	0.00	259.36	259
J-1125	232.70	0.00	259.37	261
J-1106	232.22	0.00	259.24	264
J-1103	229.11	0.00	259.24	295
J-1104	229.04	0.00	259.24	296
J-1105	229.00	0.00	259.24	296
	Sum of Demand:	**15.03**	**Min**	**234**
			Max	**296**

Pipe Tables
Full Buildout - 70% TWL

2031 ADD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-895	J-1106	H-182	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-894	J-1105	H-181	6.10	150	100	0.00	0.00	0.00
P-873	J-1103	J-1104	11.28	300	120	0.00	0.00	0.00
P-874	J-1103	J-1105	88.09	300	120	0.00	0.00	0.00
P-876	J-1106	J-1107	78.33	300	120	0.00	0.00	0.00
P-875	J-1105	J-1106	178.92	300	120	0.00	0.00	0.00
P-893	J-1103	H-180	6.10	150	100	0.00	0.00	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-878	J-1108	J-1133	151.79	300	120	-1.42	0.02	0.00
P-877	J-1107	J-1108	20.12	300	120	-1.42	0.02	0.00
P-872	J-1134	J-1107	23.77	300	120	-1.42	0.02	0.00
P-900	J-1134	J-1110	10.36	300	120	0.99	0.01	0.00
P-870	J-1130	J-1102	72.54	300	120	-0.42	0.01	0.00
P-871	J-1102	J-1134	224.64	300	120	-0.42	0.01	0.00
P-879	J-1133	J-1109	70.41	300	120	1.29	0.02	0.00
P-899	J-1132	J-1135	30.18	300	120	1.29	0.02	0.00
P-886	J-1133	J-1132	80.47	300	120	-4.14	0.06	0.02
P-887	J-1132	J-1122	28.96	300	120	-5.43	0.08	0.03
P-888	J-1122	J-1123	130.15	300	120	-5.43	0.08	0.03
P-889	J-1123	J-1136	53.34	300	120	-5.43	0.08	0.03
P-890	J-1136	J-1124	179.22	300	120	-5.43	0.08	0.03
P-883	J-1125	J-1129	84.12	300	120	-5.43	0.08	0.03
P-891	J-1124	J-1131	128.32	300	120	-5.43	0.08	0.03
P-892	J-1131	J-1125	54.86	300	120	-5.43	0.08	0.03

Pipe Tables
Full Buildout - 70% TWL

2031 MDD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-895	J-1106	H-182	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-894	J-1105	H-181	6.10	150	100	0.00	0.00	0.00
P-873	J-1103	J-1104	11.28	300	120	0.00	0.00	0.00
P-874	J-1103	J-1105	88.09	300	120	0.00	0.00	0.00
P-876	J-1106	J-1107	78.33	300	120	0.00	0.00	0.00
P-875	J-1105	J-1106	178.92	300	120	0.00	0.00	0.00
P-893	J-1103	H-180	6.10	150	100	0.00	0.00	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-878	J-1108	J-1133	151.79	300	120	-1.93	0.03	0.00
P-877	J-1107	J-1108	20.12	300	120	-1.93	0.03	0.01
P-872	J-1134	J-1107	23.77	300	120	-1.93	0.03	0.00
P-900	J-1134	J-1110	10.36	300	120	1.89	0.03	0.01
P-870	J-1130	J-1102	72.54	300	120	-0.05	0.00	0.00
P-871	J-1102	J-1134	224.64	300	120	-0.05	0.00	0.00
P-879	J-1133	J-1109	70.41	300	120	2.45	0.03	0.01
P-899	J-1132	J-1135	30.18	300	120	2.46	0.03	0.01
P-886	J-1133	J-1132	80.47	300	120	-7.11	0.10	0.06
P-887	J-1132	J-1122	28.96	300	120	-9.57	0.14	0.10
P-888	J-1122	J-1123	130.15	300	120	-9.57	0.14	0.10
P-889	J-1123	J-1136	53.34	300	120	-9.57	0.14	0.10
P-890	J-1136	J-1124	179.22	300	120	-9.57	0.14	0.10
P-883	J-1125	J-1129	84.12	300	120	-9.57	0.14	0.10
P-891	J-1124	J-1131	128.32	300	120	-9.57	0.14	0.10
P-892	J-1131	J-1125	54.86	300	120	-9.57	0.14	0.10

Pipe Tables
Full Buildout - 70% TWL

2031 PHD Pipe Results								
Label	Start Node	Stop Node	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
P-895	J-1106	H-182	6.10	150	100	0.00	0.00	0.00
P-898	J-1125	H-185	6.10	150	100	0.00	0.00	0.00
P-894	J-1105	H-181	6.10	150	100	0.00	0.00	0.00
P-873	J-1103	J-1104	11.28	300	120	0.00	0.00	0.00
P-874	J-1103	J-1105	88.09	300	120	0.00	0.00	0.00
P-876	J-1106	J-1107	78.33	300	120	0.00	0.00	0.00
P-875	J-1105	J-1106	178.92	300	120	0.00	0.00	0.00
P-893	J-1103	H-180	6.10	150	100	0.00	0.00	0.00
P-901	J-1136	H-188	6.10	150	100	0.00	0.00	0.00
P-896	J-1122	H-183	6.10	150	100	0.00	0.00	0.00
P-897	J-1124	H-184	6.10	150	100	0.00	0.00	0.00
P-878	J-1108	J-1133	151.79	300	120	-2.20	0.03	0.01
P-877	J-1107	J-1108	20.12	300	120	-2.20	0.03	0.01
P-872	J-1134	J-1107	23.77	300	120	-2.20	0.03	0.01
P-900	J-1134	J-1110	10.36	300	120	2.98	0.04	0.01
P-870	J-1130	J-1102	72.54	300	120	0.78	0.01	0.00
P-871	J-1102	J-1134	224.64	300	120	0.78	0.01	0.00
P-879	J-1133	J-1109	70.41	300	120	3.87	0.05	0.02
P-899	J-1132	J-1135	30.18	300	120	3.88	0.05	0.02
P-886	J-1133	J-1132	80.47	300	120	-10.37	0.15	0.11
P-887	J-1132	J-1122	28.96	300	120	-14.25	0.20	0.20
P-888	J-1122	J-1123	130.15	300	120	-14.25	0.20	0.20
P-889	J-1123	J-1136	53.34	300	120	-14.25	0.20	0.20
P-890	J-1136	J-1124	179.22	300	120	-14.25	0.20	0.20
P-883	J-1125	J-1129	84.12	300	120	-14.25	0.20	0.20
P-891	J-1124	J-1131	128.32	300	120	-14.25	0.20	0.20
P-892	J-1131	J-1125	54.86	300	120	-14.25	0.20	0.20

APPENDIX

C

FIRE FLOW REPORT

2021 MDD + FF - 50% TWL											
Label	Elevation (m)	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Satisfies Fire Flow Constraints?	Hydraulic Grade (m)	Pressure (Residual Lower Limit) (kPa)	Pressure (Zone Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated Zone Lower Limit) (kPa)	Junction w/ Minimum Pressure (System)	Junction w/ Minimum Pressure (Zone)
H-183	234.91	250	155	FALSE	272	140	140	140	180	HB15T012	J-1135
H-184	234.54	250	191	FALSE	272	140	140	140	184	HB15T012	NASH_J1
H-185	232.70	250	231	FALSE	272	140	140	140	183	HB15T012	NASH_J1
H-188	234.85	250	170	FALSE	272	140	140	140	183	HB15T012	J-1123

Minimum	**155**
Maximum	**231**

2021 MDD + FF - 70% TWL											
Label	Elevation (m)	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Satisfies Fire Flow Constraints?	Hydraulic Grade (m)	Pressure (Residual Lower Limit) (kPa)	Pressure (Zone Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated Zone Lower Limit) (kPa)	Junction w/ Minimum Pressure (System)	Junction w/ Minimum Pressure (Zone)
H-183	234.91	250	161	FALSE	273	140	140	140	183	HB15T012	J-1135
H-184	234.54	250	199	FALSE	273	140	140	140	197	HB15T012	J-1123
H-185	232.70	250	240	FALSE	273	140	140	140	196	HB15T012	NASH_J1
H-188	234.85	250	177	FALSE	273	140	140	140	187	HB15T012	J-1123

Minimum	**161**
Maximum	**240**

2021 MDD + FF - 99% TWL											
Label	Elevation (m)	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Satisfies Fire Flow Constraints?	Hydraulic Grade (m)	Pressure (Residual Lower Limit) (kPa)	Pressure (Zone Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated Zone Lower Limit) (kPa)	Junction w/ Minimum Pressure (System)	Junction w/ Minimum Pressure (Zone)
H-183	234.91	250	170	FALSE	276	140	140	140	188	HB15T012	J-1135
H-184	234.54	250	210	FALSE	276	140	140	140	204	HB15T012	J-1123
H-185	232.70	250	253	TRUE	276	140	140	140	215	HB15T012	J-1123
H-188	234.85	250	187	FALSE	276	140	140	140	193	HB15T012	J-1123

Minimum	**170**
Maximum	**253**

2031 MDD + FF - 50%											
Label	Elevation (m)	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Satisfies Fire Flow Constraints?	Hydraulic Grade (m)	Pressure (Residual Lower Limit) (kPa)	Pressure (Zone Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated Zone Lower Limit) (kPa)	Junction w/ Minimum Pressure (System)	Junction w/ Minimum Pressure (Zone)
H-183	234.91	250	136	FALSE	269	140	140	140	172	SA03E016	J-1135
H-184	234.54	250	167	FALSE	269	140	140	140	173	SA03E016	NASH_J1
H-185	232.70	250	201	FALSE	269	140	140	140	171	SA03E016	NASH_J1
H-188	234.85	250	149	FALSE	269	140	140	140	173	SA03E016	J-1123

Minimum	**136**
Maximum	**201**

2031 MDD + FF - 70%											
Label	Elevation (m)	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Satisfies Fire Flow Constraints?	Hydraulic Grade (m)	Pressure (Residual Lower Limit) (kPa)	Pressure (Zone Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated Zone Lower Limit) (kPa)	Junction w/ Minimum Pressure (System)	Junction w/ Minimum Pressure (Zone)
H-183	234.91	250	143	FALSE	270	140	140	140	175	SA03E016	J-1135
H-184	234.54	250	175	FALSE	270	140	140	140	183	SA03E016	J-1123
H-185	232.70	250	210	FALSE	270	140	140	140	185	SA03E016	NASH_J1
H-188	234.85	250	156	FALSE	270	140	140	140	176	SA03E016	J-1123

Minimum	**143**
Maximum	**210**

2031 MDD + FF - 99%											
Label	Elevation (m)	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Satisfies Fire Flow Constraints?	Hydraulic Grade (m)	Pressure (Residual Lower Limit) (kPa)	Pressure (Zone Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated Zone Lower Limit) (kPa)	Junction w/ Minimum Pressure (System)	Junction w/ Minimum Pressure (Zone)
H-183	234.91	250	152	FALSE	273	140	140	140	179	SA03E016	J-1135
H-184	234.54	250	186	FALSE	273	140	140	140	189	SA03E016	J-1123
H-185	232.70	250	224	FALSE	273	140	140	140	195	SA03E016	J-1123
H-188	234.85	250	167	FALSE	273	140	140	140	182	SA03E016	J-1123

Minimum	**152**
Maximum	**224**

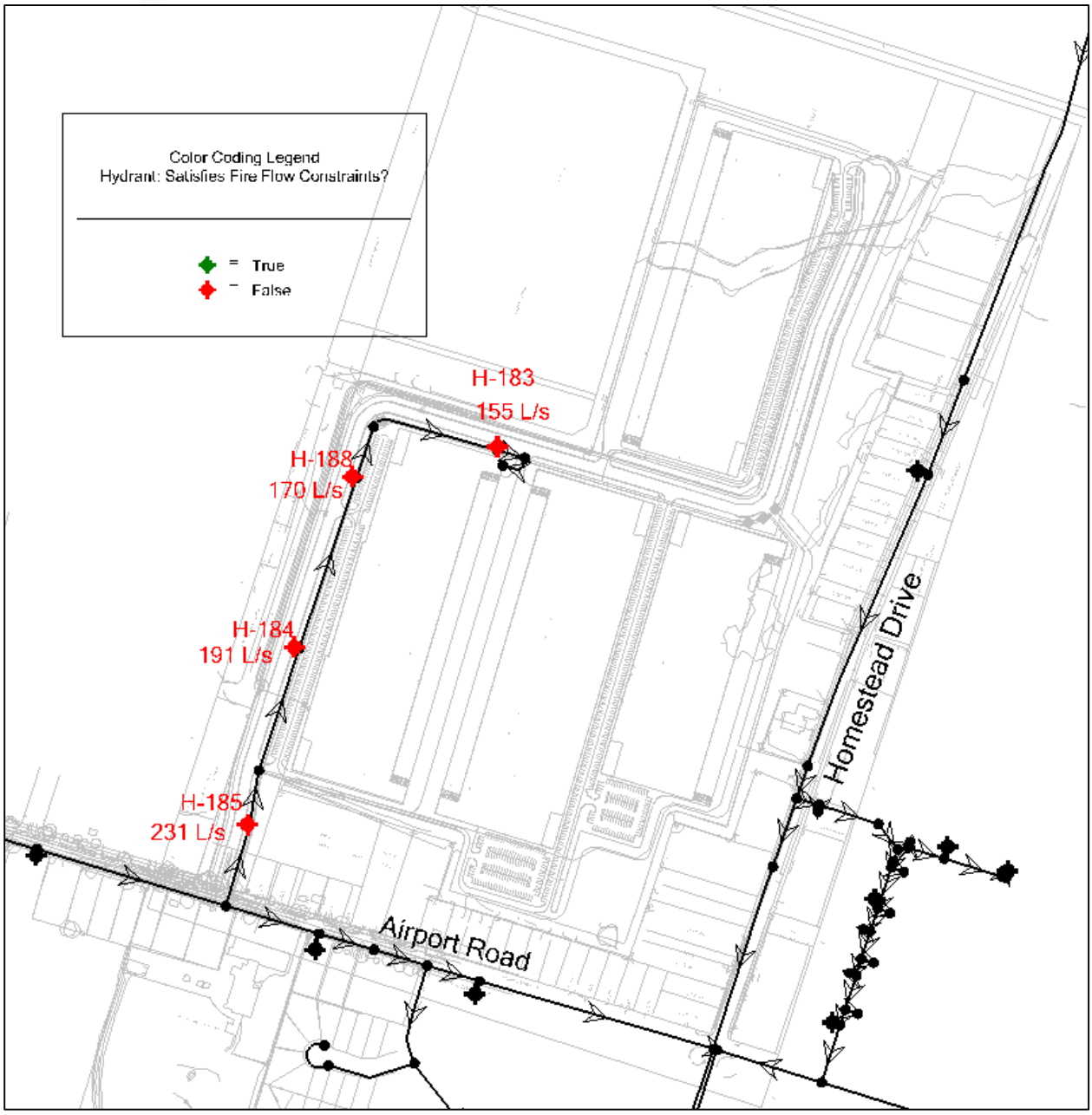


Figure C1 – Simulated AFF under 2021 MDD+FF with 50% TWL (Phase 1)

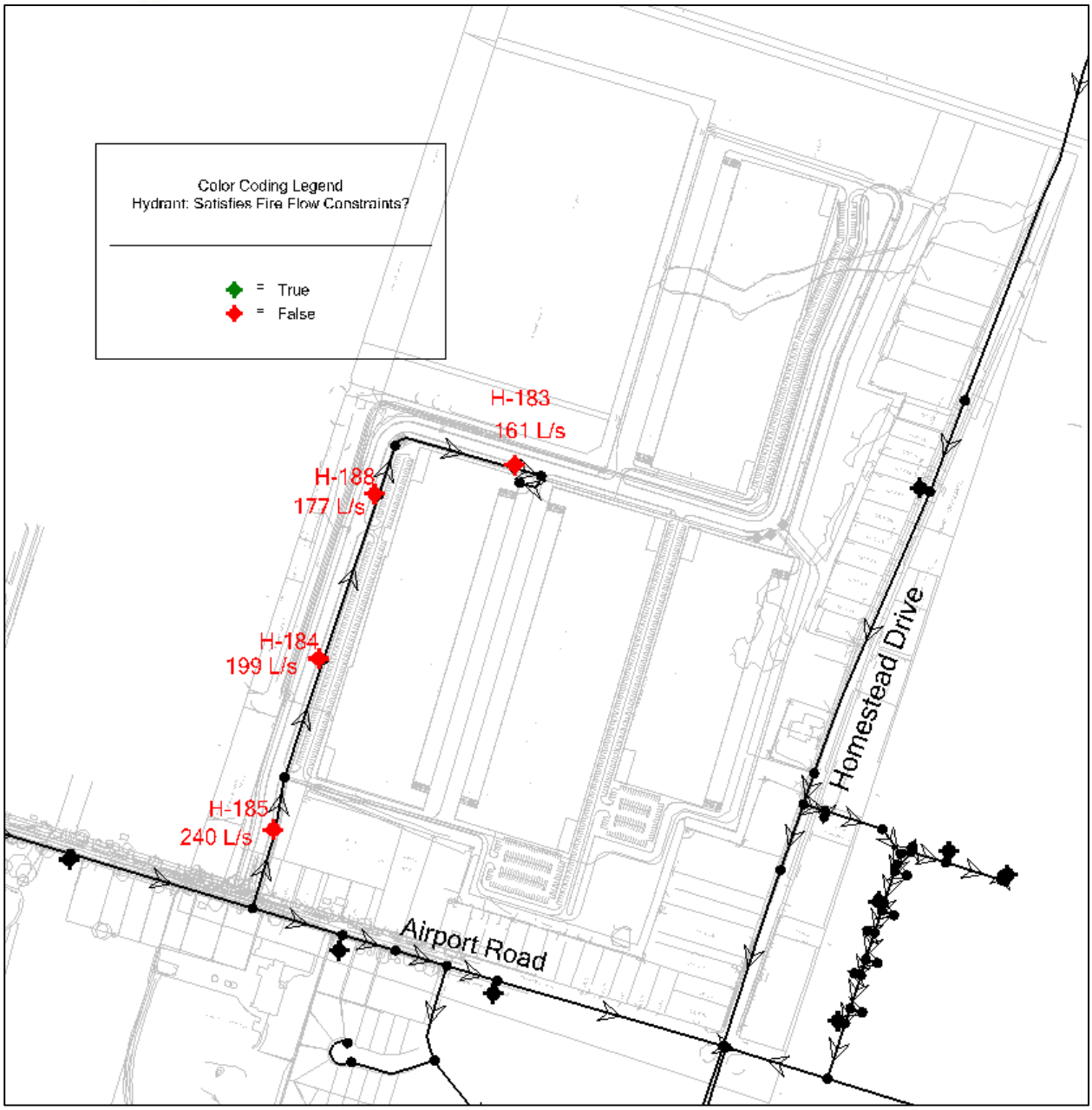


Figure C2 – Simulated AFF under 2021 MDD+FF with 70% TWL (Phase 1)

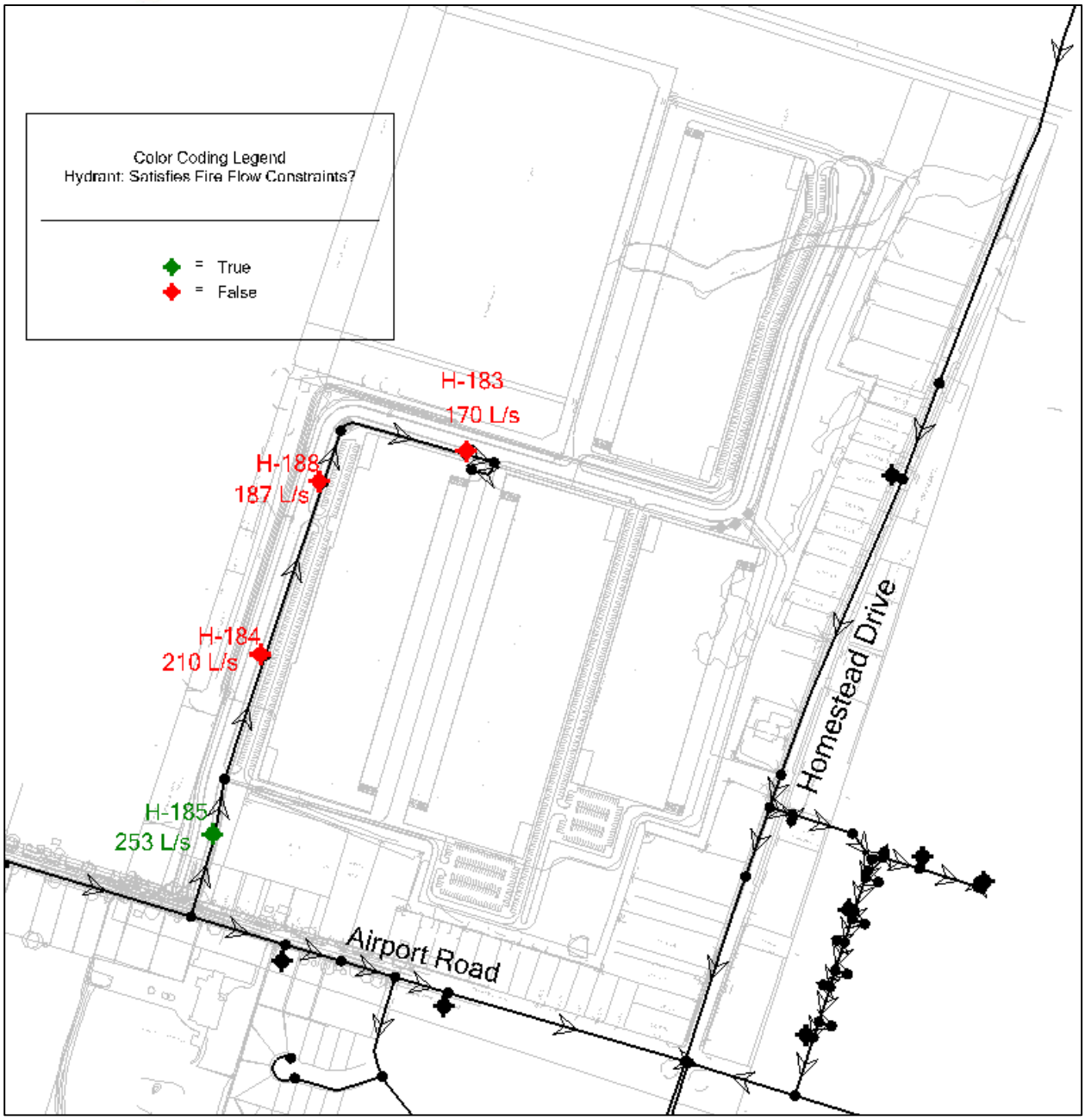


Figure C3 – Simulated AFF under 2021 MDD+FF with 99% TWL (Phase 1)

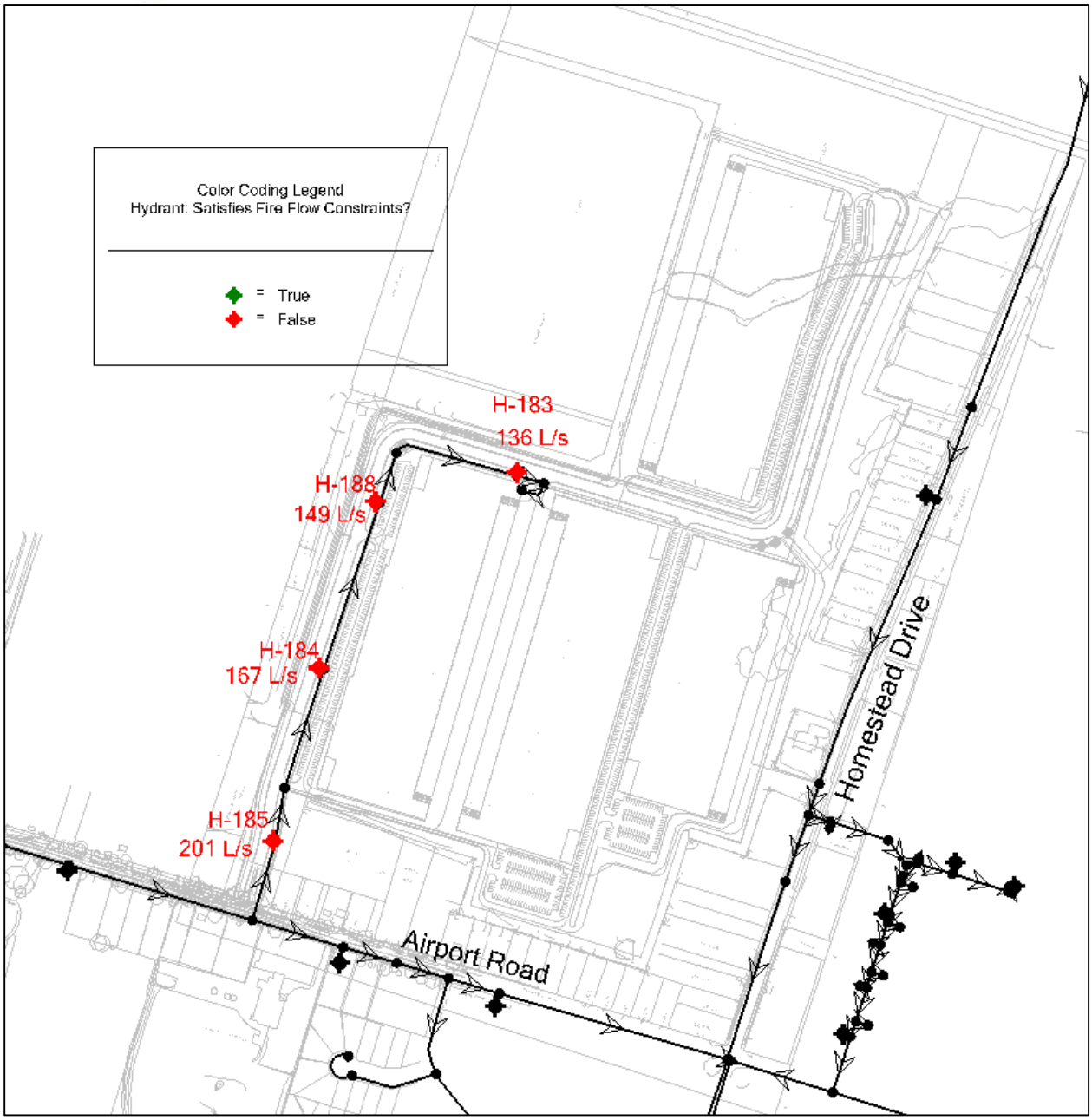


Figure C4 – Simulated AFF under 2031 MDD+FF with 50% TWL (Phase 1)

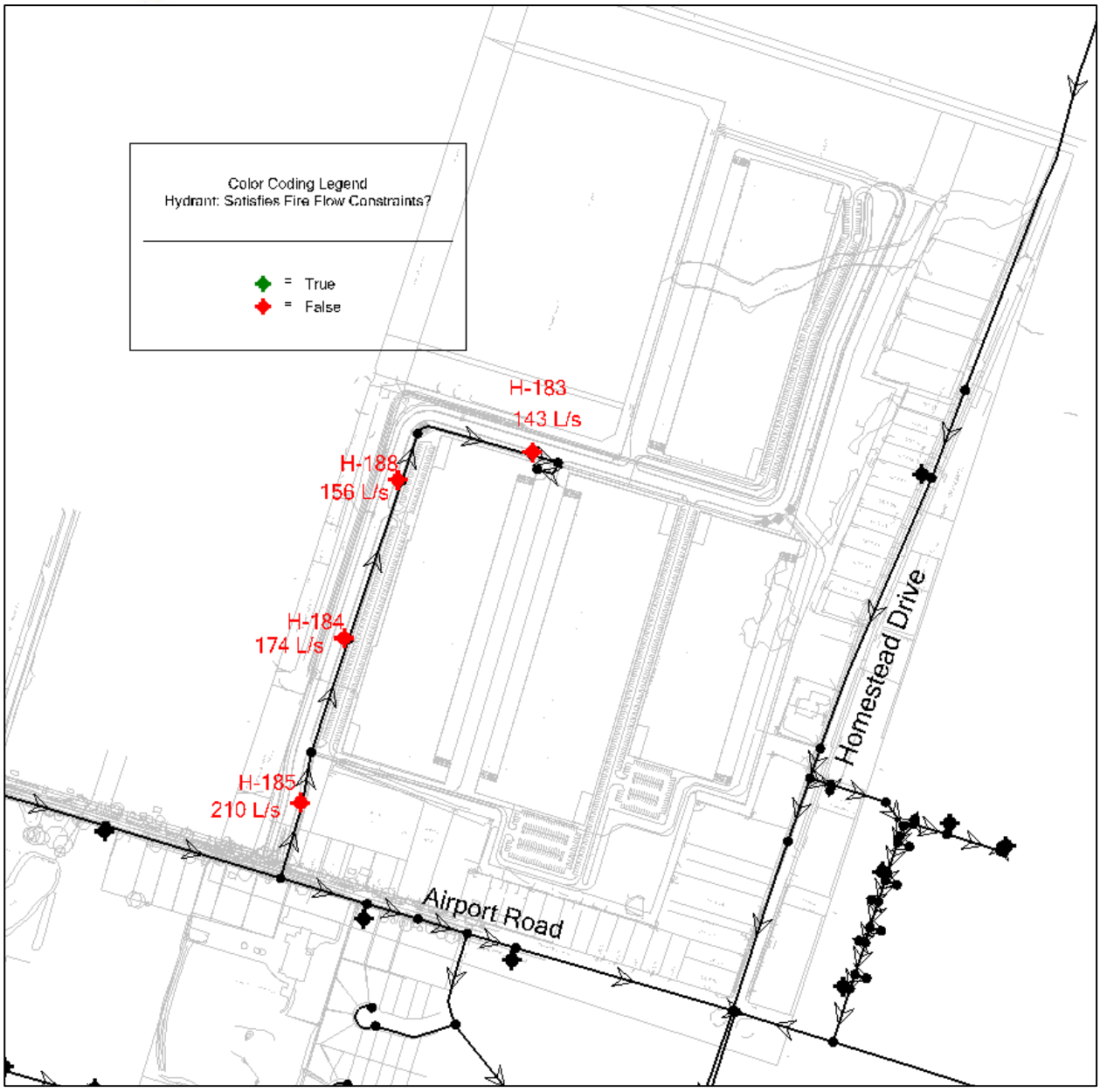


Figure C5 – Simulated AFF under 2031 MDD+FF with 70% TWL (Phase 1)

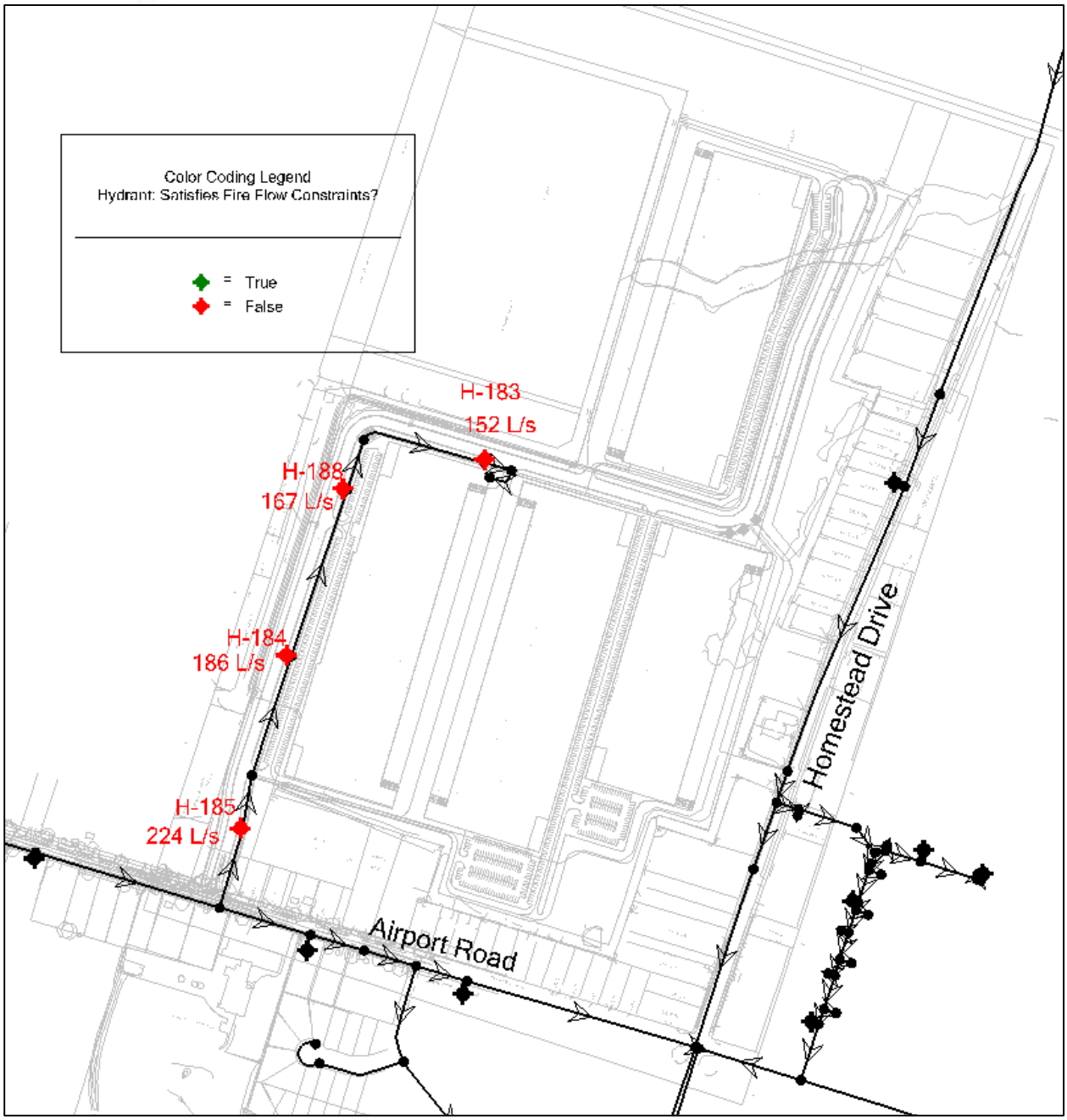


Figure C6 – Simulated AFF under 2031 MDD+FF with 99% TWL (Phase 1)

2021 MDD + FF - 50% TWL											
Label	Elevation (m)	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Satisfies Fire Flow Constraints?	Hydraulic Grade (m)	Pressure (Residual Lower Limit) (kPa)	Pressure (Zone Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated Zone Lower Limit) (kPa)	Junction w/ Minimum Pressure (System)	Junction w/ Minimum Pressure (Zone)
H-180	229.11	250	188	FALSE	271	140	140	140	184	HB15T012	NASH_J1
H-181	229.00	250	198	FALSE	271	140	140	140	184	HB15T012	NASH_J1
H-182	232.22	250	206	FALSE	271	140	140	140	183	HB15T012	NASH_J1
H-183	234.91	250	198	FALSE	271	140	140	140	184	HB15T012	NASH_J1
H-184	234.54	250	208	FALSE	271	140	140	140	183	HB15T012	NASH_J1
H-185	232.70	250	232	FALSE	271	140	140	140	182	HB15T012	NASH_J1
H-188	234.85	250	200	FALSE	271	140	140	140	183	HB15T012	NASH_J1

Minimum	**188**
Maximum	**232**

2021 MDD + FF - 70% TWL											
Label	Elevation (m)	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Satisfies Fire Flow Constraints?	Hydraulic Grade (m)	Pressure (Residual Lower Limit) (kPa)	Pressure (Zone Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated Zone Lower Limit) (kPa)	Junction w/ Minimum Pressure (System)	Junction w/ Minimum Pressure (Zone)
H-180	229.11	250	194	FALSE	273	140	140	140	198	HB15T012	NASH_J1
H-181	229.00	250	204	FALSE	273	140	140	140	197	HB15T012	NASH_J1
H-182	232.22	250	213	FALSE	273	140	140	140	197	HB15T012	NASH_J1
H-183	234.91	250	206	FALSE	273	140	140	140	197	HB15T012	NASH_J1
H-184	234.54	250	216	FALSE	273	140	140	140	197	HB15T012	NASH_J1
H-185	232.70	250	241	FALSE	273	140	140	140	196	HB15T012	NASH_J1
H-188	234.85	250	208	FALSE	273	140	140	140	197	HB15T012	NASH_J1

Minimum	**194**
Maximum	**241**

2021 MDD + FF - 99% TWL											
Label	Elevation (m)	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Satisfies Fire Flow Constraints?	Hydraulic Grade (m)	Pressure (Residual Lower Limit) (kPa)	Pressure (Zone Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated Zone Lower Limit) (kPa)	Junction w/ Minimum Pressure (System)	Junction w/ Minimum Pressure (Zone)
H-180	229.11	250	203	FALSE	275	140	140	140	208	HB15T012	J-1103
H-181	229.00	250	214	FALSE	275	140	140	140	213	HB15T012	J-1103
H-182	232.22	250	225	FALSE	275	140	140	140	218	HB15T012	NASH_J1
H-183	234.91	250	218	FALSE	275	140	140	140	218	HB15T012	J-1122
H-184	234.54	250	229	FALSE	275	140	140	140	218	HB15T012	NASH_J1
H-185	232.70	250	255	TRUE	275	140	140	140	216	HB15T012	NASH_J1
H-188	234.85	250	221	FALSE	275	140	140	140	217	HB15T012	J-1123

Minimum		**203**
Maximum		**255**

Fire Flow Tables
Full Buildout

2031 MDD + FF - 50% TWL											
Label	Elevation (m)	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Satisfies Fire Flow Constraints?	Hydraulic Grade (m)	Pressure (Residual Lower Limit) (kPa)	Pressure (Zone Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated Zone Lower Limit) (kPa)	Junction w/ Minimum Pressure (System)	Junction w/ Minimum Pressure (Zone)
H-180	229.11	250	167	FALSE	268	140	140	140	172	SA03E016	NASH_J1
H-181	229.00	250	176	FALSE	268	140	140	140	172	SA03E016	NASH_J1
H-182	232.22	250	179	FALSE	268	140	140	140	172	SA03E016	NASH_J1
H-183	234.91	250	169	FALSE	268	140	140	140	172	SA03E016	NASH_J1
H-184	234.54	250	178	FALSE	268	140	140	140	172	SA03E016	NASH_J1
H-185	232.70	250	200	FALSE	268	140	140	140	171	SA03E016	NASH_J1
H-188	234.85	250	171	FALSE	268	140	140	140	172	SA03E016	NASH_J1

Minimum	**167**
Maximum	**200**

2031 MDD + FF - 70% TWL											
Label	Elevation (m)	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Satisfies Fire Flow Constraints?	Hydraulic Grade (m)	Pressure (Residual Lower Limit) (kPa)	Pressure (Zone Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated Zone Lower Limit) (kPa)	Junction w/ Minimum Pressure (System)	Junction w/ Minimum Pressure (Zone)
H-180	229.11	250	174	FALSE	270	140	140	140	186	SA03E016	NASH_J1
H-181	229.00	250	182	FALSE	270	140	140	140	185	SA03E016	NASH_J1
H-182	232.22	250	187	FALSE	270	140	140	140	185	SA03E016	NASH_J1
H-183	234.91	250	178	FALSE	270	140	140	140	186	SA03E016	NASH_J1
H-184	234.54	250	187	FALSE	270	140	140	140	185	SA03E016	NASH_J1
H-185	232.70	250	209	FALSE	270	140	140	140	184	SA03E016	NASH_J1
H-188	234.85	250	180	FALSE	270	140	140	140	185	SA03E016	NASH_J1

Minimum	**174**
Maximum	**209**

2031 MDD + FF - 99% TWL											
Label	Elevation (m)	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Satisfies Fire Flow Constraints?	Hydraulic Grade (m)	Pressure (Residual Lower Limit) (kPa)	Pressure (Zone Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated Zone Lower Limit) (kPa)	Junction w/ Minimum Pressure (System)	Junction w/ Minimum Pressure (Zone)
H-180	229.11	250	183	FALSE	272	140	140	140	196	SA03E016	J-1103
H-181	229.00	250	192	FALSE	272	140	140	140	200	SA03E016	H-180
H-182	232.22	250	199	FALSE	272	140	140	140	205	SA03E016	J-1106
H-183	234.91	250	191	FALSE	272	140	140	140	200	SA03E016	J-1122
H-184	234.54	250	200	FALSE	272	140	140	140	205	SA03E016	J-1123
H-185	232.70	250	223	FALSE	272	140	140	140	200	SA03E016	J-1123
H-188	234.85	250	193	FALSE	272	140	140	140	199	SA03E016	J-1123

Minimum	**183**
Maximum	**223**

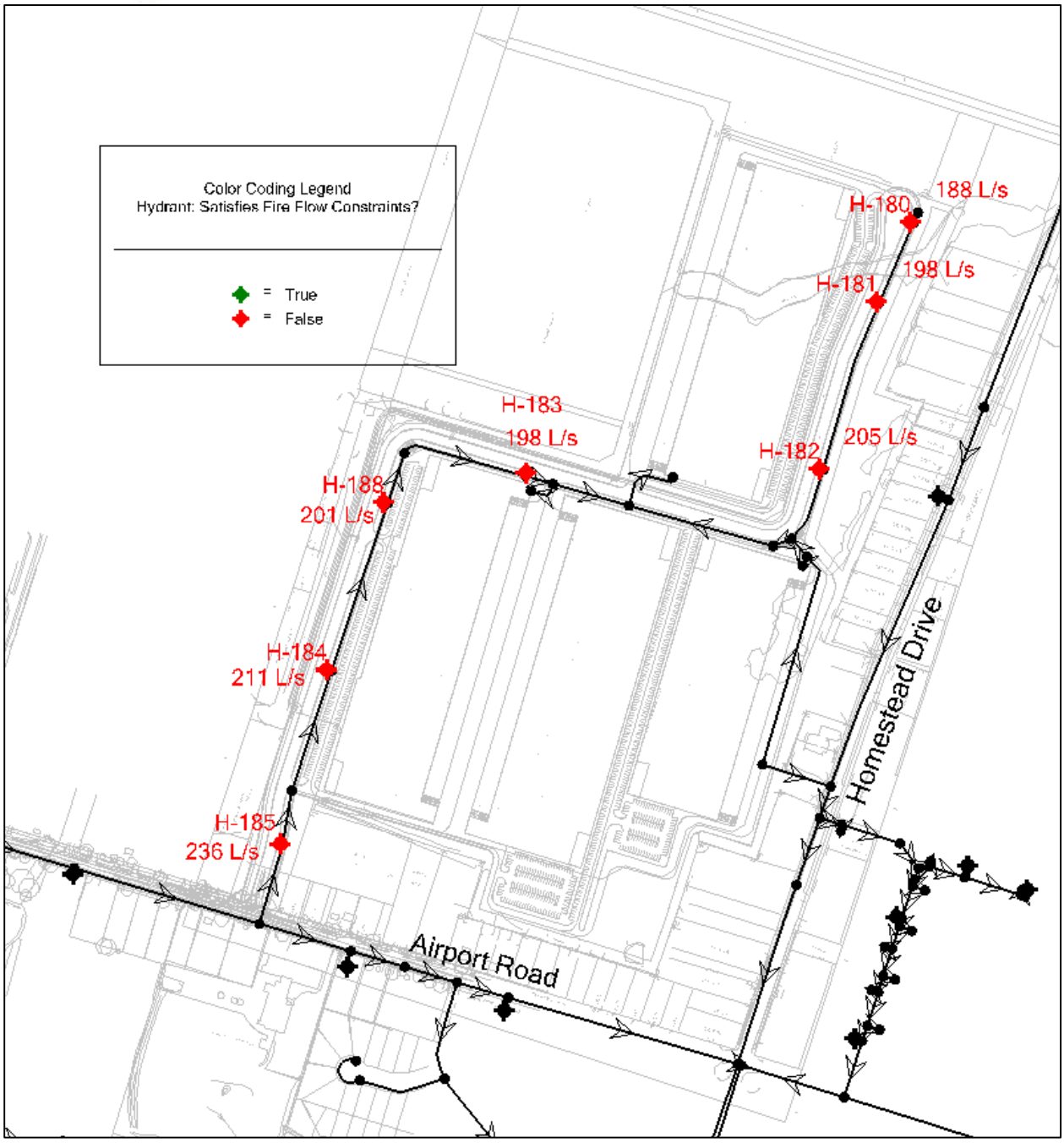


Figure C7 – Simulated AFF under 2021 MDD+FF with 50% TWL (Ultimate Buildout)

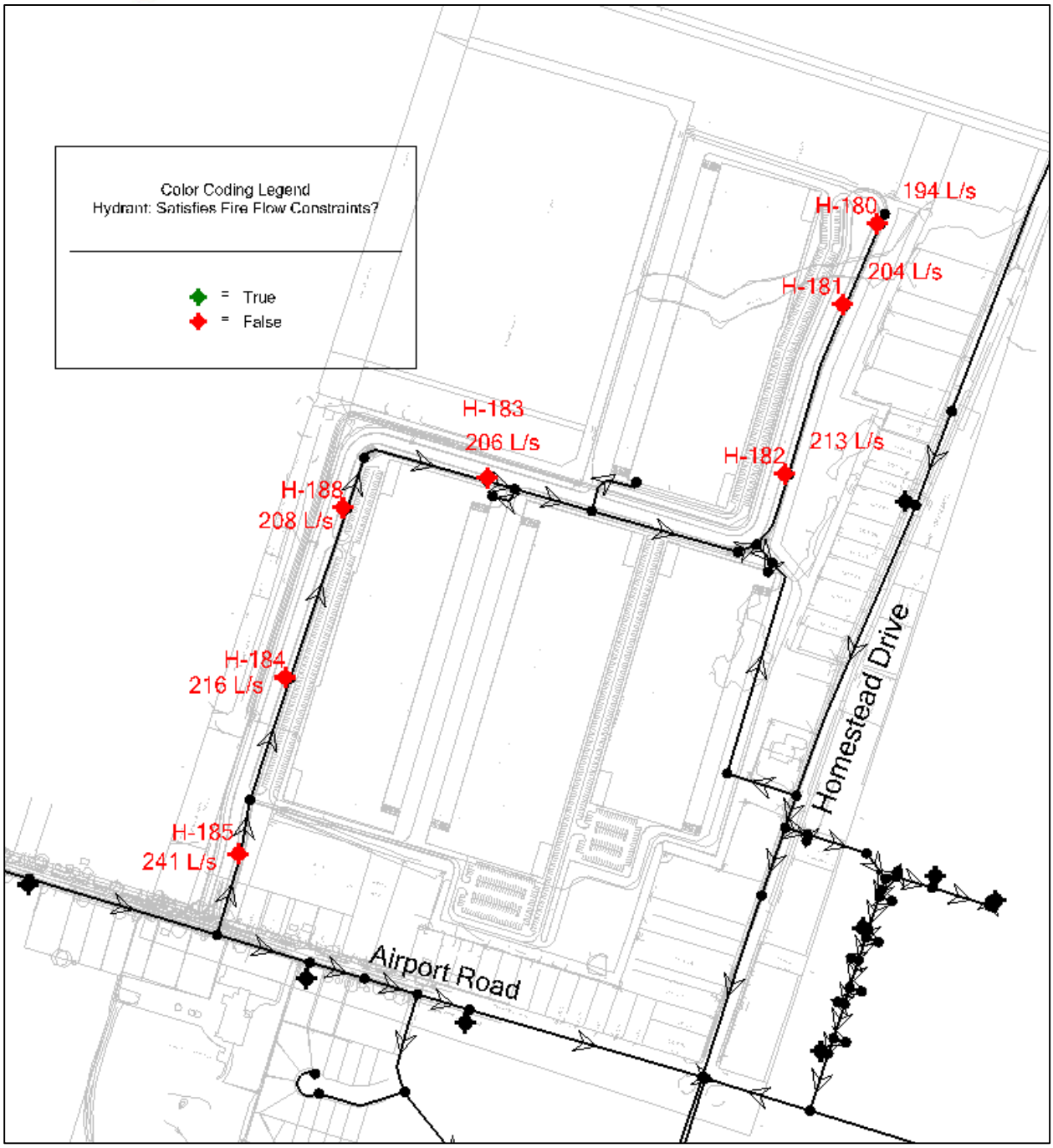


Figure C8 – Simulated AFF under 2021 MDD+FF with 70% TWL (Ultimate Buildout)

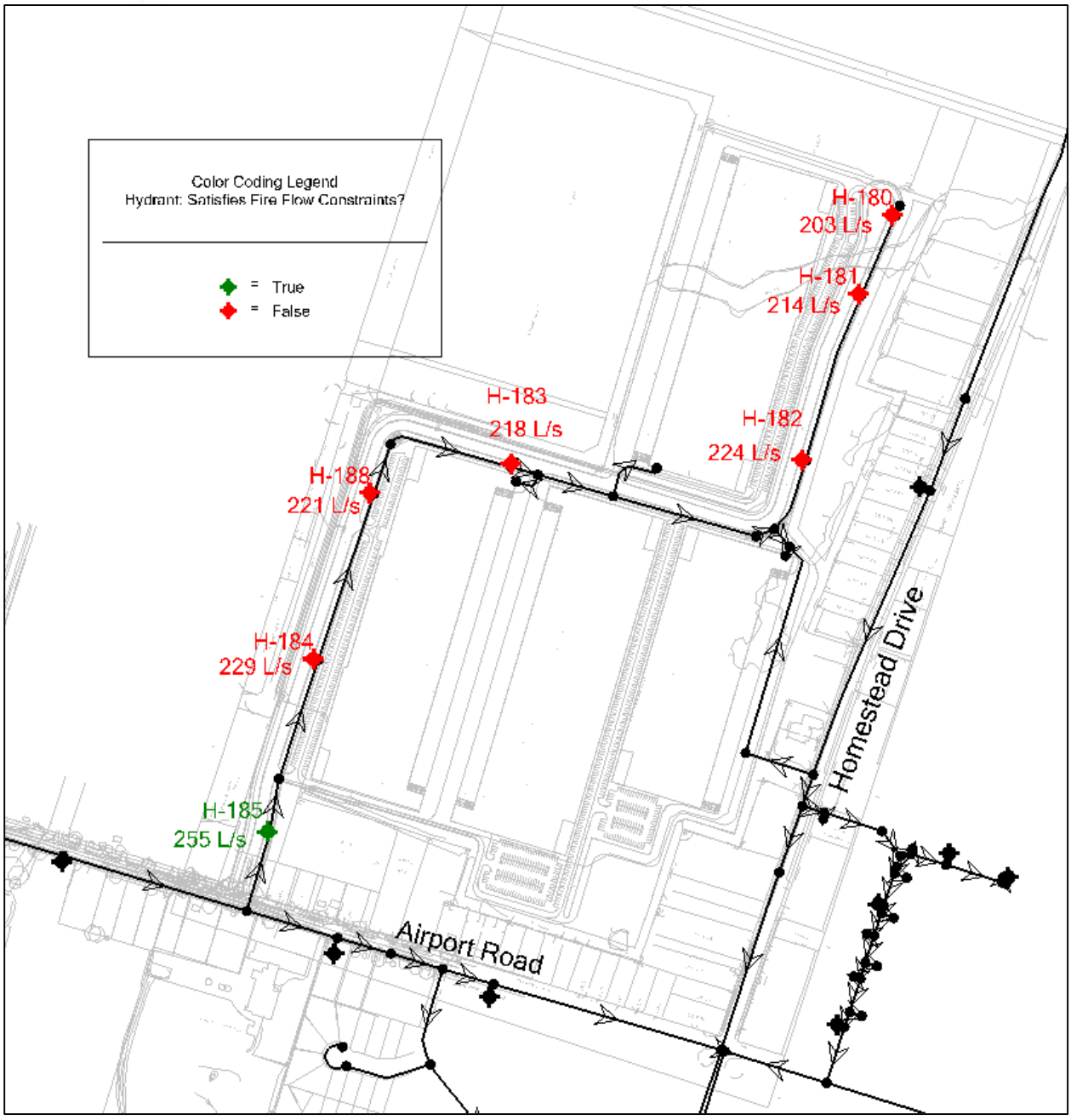


Figure C9 – Simulated AFF under 2021 MDD+FF with 99% TWL (Ultimate Buildout)

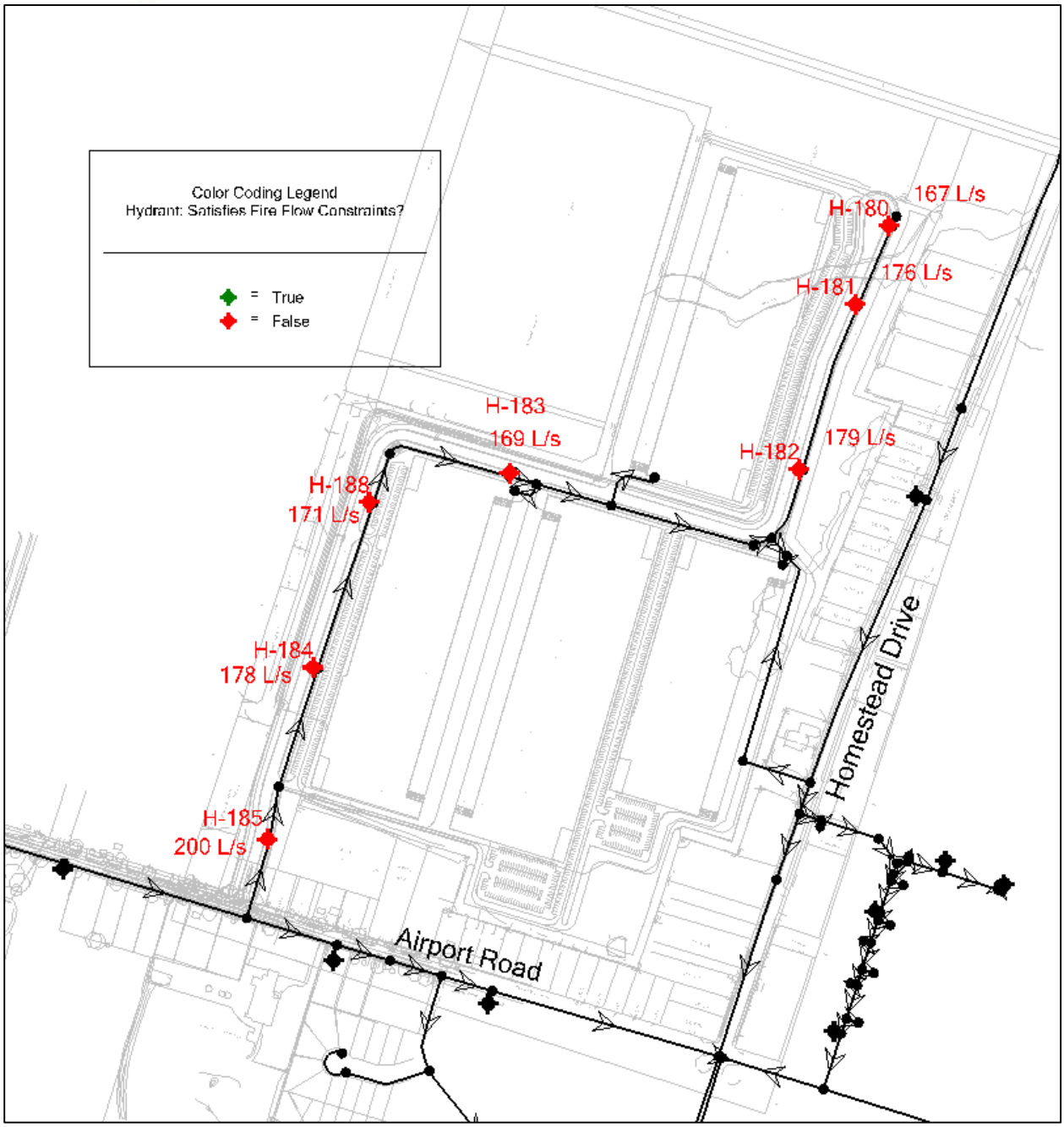


Figure C10 – Simulated AFF under 2031 MDD+FF with 50% TWL (Ultimate Buildout)

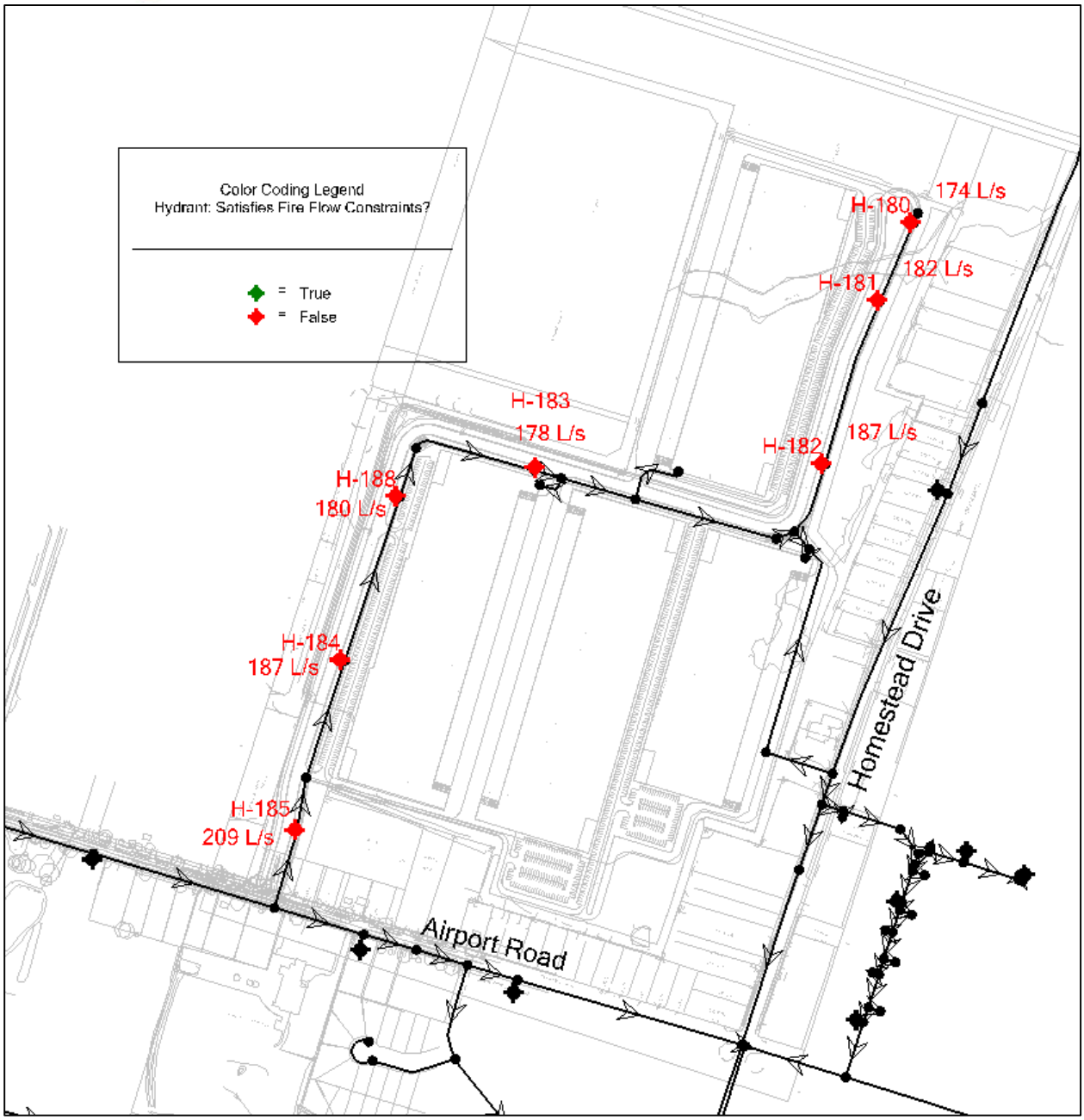


Figure C11 – Simulated AFF under 2031 MDD+FF with 70% TWL (Ultimate Buildout)

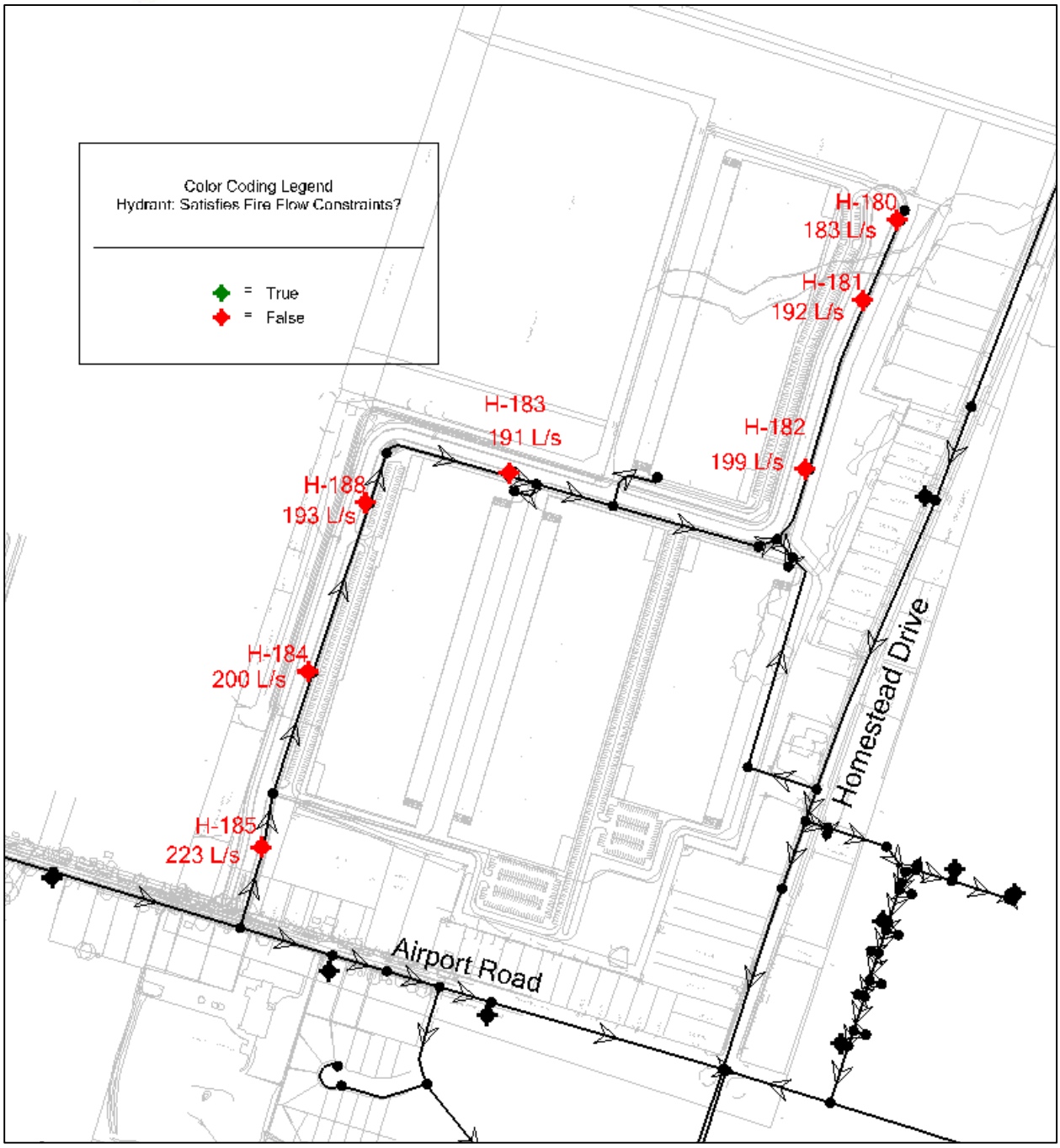


Figure C12 – Simulated AFF under 2031 MDD+FF with 99% TWL (Ultimate Buildout)

APPENDIX

D

FLUSHING REPORT

Flushing Reports
Phase 1

Label	Length (m)	Diameter (mm)	Flushing Event	Velocity (Maximum Flushing) (m/s)	Satisfies Flushing Target Velocity?	Flow (Absolute) (L/s)
P-888	130.15	300.00	Event [J-1135]	0.95	TRUE	1.39
P-887	28.96	300.00	Event [J-1135]	0.95	TRUE	1.39
P-899	30.18	300.00	Event [J-1135]	0.95	TRUE	1.39
P-889	53.34	300.00	Event [J-1135]	0.95	TRUE	1.39
P-883	84.12	300.00	Event [H-185]	0.99	TRUE	1.39
P-891	128.32	300.00	Event [H-184]	0.96	TRUE	1.39
P-892	54.86	300.00	Event [H-184]	0.96	TRUE	1.39
P-890	179.22	300.00	Event [H-188]	0.95	TRUE	1.39

Minimum	0.95
Maximum	0.99

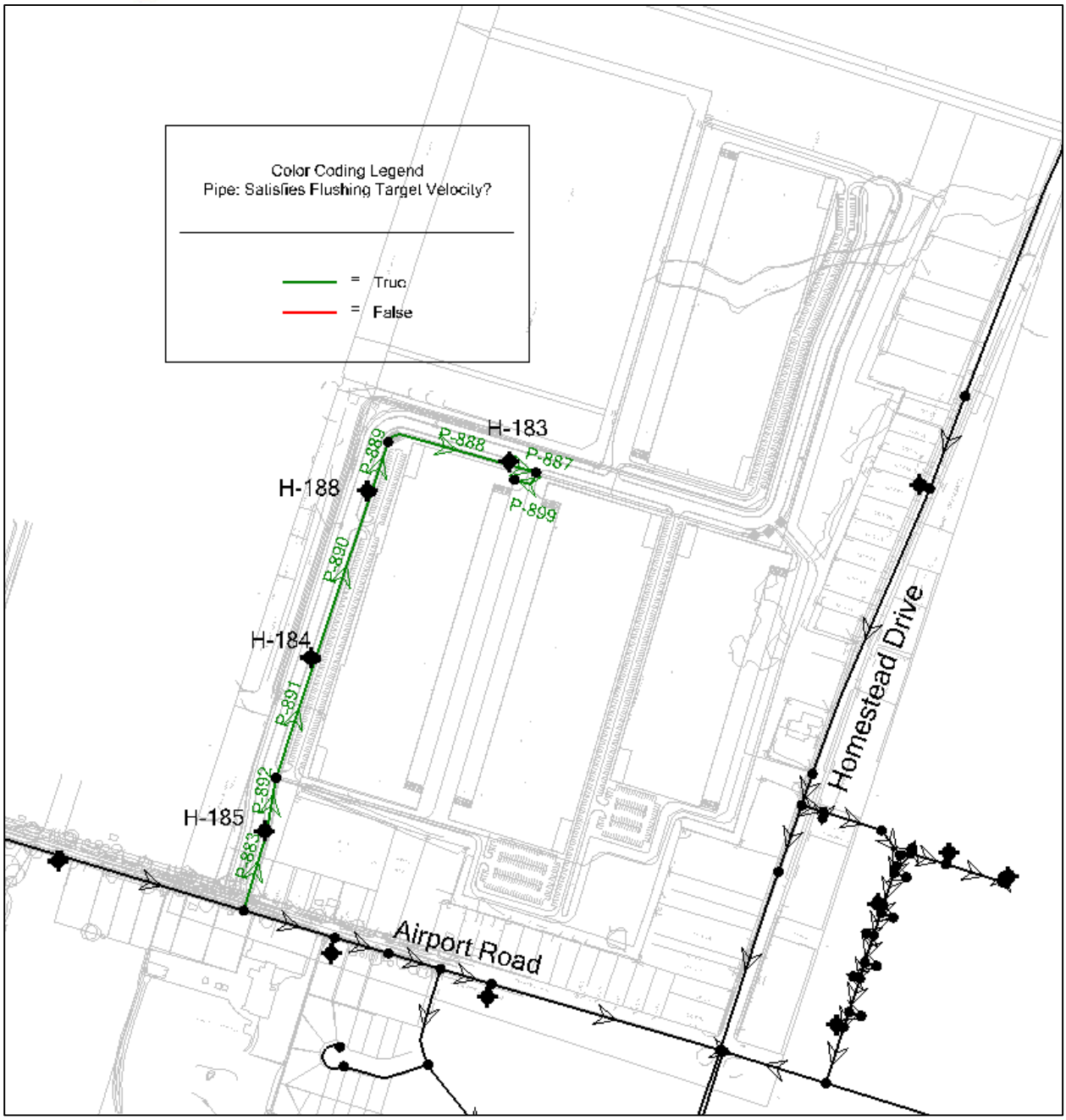


Figure D1 – Flushing Results for the Proposed 3054 Homestead Drive Development (Phase 1)

Label	Length (m)	Diameter (mm)	Flushing Event	Velocity (Maximum Flushing) (m/s)	Satisfies Flushing Target Velocity?	Flow (Absolute) (L/s)
P-887	28.96	300	Event [J-1135]	0.88	TRUE	3.83
P-888	130.15	300	Event [J-1135]	0.88	TRUE	3.83
P-889	53.34	300	Event [J-1135]	0.88	TRUE	3.83
P-886	80.47	300	Event [J-1135]	0.9	TRUE	2.44
P-877	20.12	300	Event [J-1135]	0.95	TRUE	0.5
P-878	151.79	300	Event [J-1135]	0.95	TRUE	0.5
P-890	179.22	300	Event [H-188]	1.01	TRUE	3.83
P-872	23.77	300	Event [J-1104]	1.17	TRUE	0.5
P-891	128.32	300	Event [H-184]	1.18	TRUE	3.83
P-892	54.86	300	Event [H-184]	1.18	TRUE	3.83
P-870	72.54	300	Event [J-1104]	1.19	TRUE	1.57
P-871	224.64	300	Event [J-1104]	1.19	TRUE	1.57
P-883	84.12	300	Event [H-185]	1.45	TRUE	3.83
P-873	11.28	300	Event [J-1104]	1.83	TRUE	0
P-874	88.09	300	Event [J-1104]	1.83	TRUE	0
P-875	178.92	300	Event [J-1104]	1.83	TRUE	0
P-876	78.33	300	Event [J-1104]	1.83	TRUE	0

Minimum	0.88
Maximum	1.83

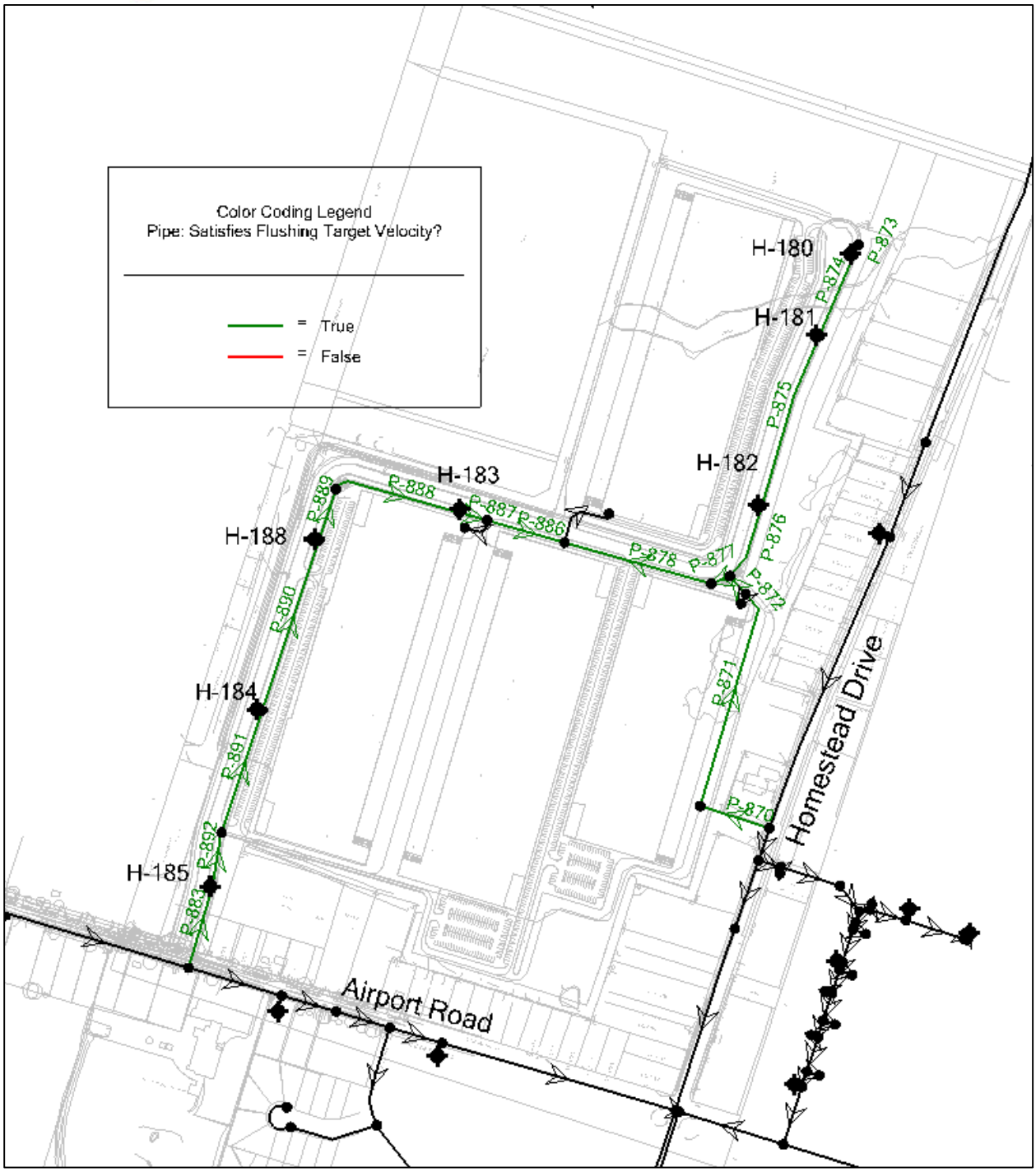


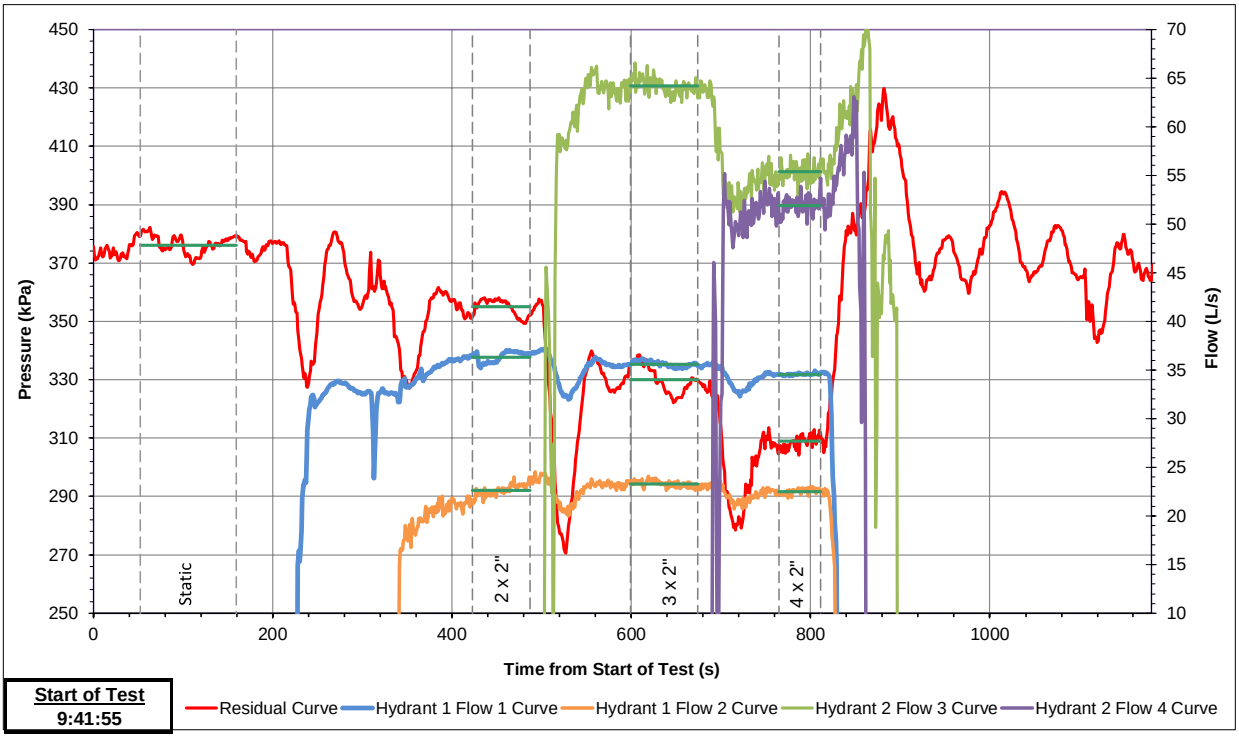
Figure D2 – Flushing Results for the Proposed 3054 Homestead Drive Development (Ultimate Buildout)

APPENDIX

E

HYDRANT FLOW TEST RESULTS

9079 Airport Rd (GJ10H011)



Subject Watermain Details

Diameter:	400 mm	**Material:**	DI
Area:	0.126 m2		

Subject Hydrant & Valve Details

Residual Hydrant:	GJ10H011
Flow Hydrant 1:	GJ10H012
Flow Hydrant 2:	GJ10H010

TABLE A: TESTED PRESSURES AND FLOWS

Point	Time		Residual (GJ10H011)		Flow Hydrant 1 (GJ10H012)				Flow Hydrant 2 (GJ10H010)				Total Flow		Velocity
			Residual (S1)		Flow 1 (S2)		Flow 2 (S3)		Flow 3 (S4)		Flow 4 (S5)				
	Start	Finish	(kPa)	(psi)	(L/s)	(GPM)	(L/s)	(GPM)	(L/s)	(GPM)	(L/s)	(GPM)	(L/s)	(GPM)	(m/s)
Static	52	159	376	54.5	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1 x 2"			0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2 x 2"	423	487	355	51.5	36.3	575	22.6	358	0.0	0	0.0	0	58.9	934	0.5
3 x 2"	599	674	330	47.9	35.6	564	23.3	369	64.2	1018	0.0	0	123.1	1951	1.0
4 x 2"	765	811	309	44.8	34.5	547	22.5	357	55.4	878	51.9	823	164.3	2604	1.3

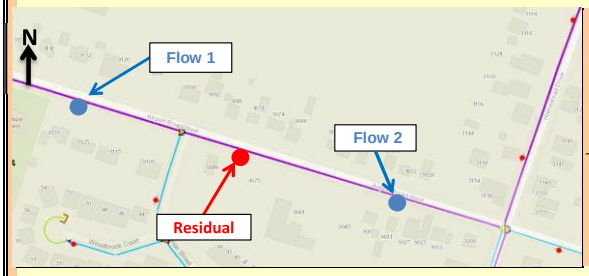
9079 Airport Rd (GJ10H011)

HYDRANT FLOW TEST RESULTS

Date: 13-Oct-22 Time: 9:41 (hh/mm) Municipality: City of Hamilton

Operator:

Tested By: Sen, Issac Test No: **1**



Conditions before Test (STATIC)

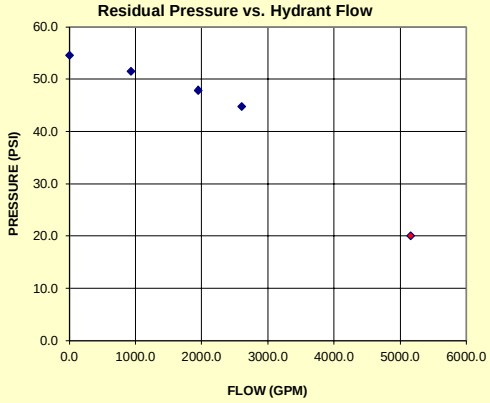
Residual Hydrant:	54.5 psi	376 kPa
Hydrant that will Flow:	54.5 psi	376 kPa
Δ pressure:	0.0 psi	0 kPa
Elevation Difference: (Flow El. - Residual El.)	0.0 ft	0.0 m

Test Notes:

TEST		TEST FLOW		RESIDUAL PRESSURE (psi)		Minimum Residual P_r (psi)	Fire Flow at Minimum Residual, Q_r (USGPM)	Fire Flow at Minimum Residual, Q_r (L/s)	10% Pressure Drop Achieved?
Port Size (in)	Nozzle Pressure (psi)	(USGPM)	(L/s)	Monitoring Hydrant	Flow Hydrant (Corrected) *				
STATIC	n/a	0	0	54.5	54.5				
Single Hydrant Test									
1 x 2"	0.0	0.0	0.0			20			
2 x 2"	8.9	933.0	58.9	51.5	51.5	20	3469	219	NO
3 x 2"									
Hydrant 1	8.9	933.0	58.9	47.9	47.9	20	4755	300	YES
Hydrant 2	37.0	1018.0	64.2						
4 x 2"									
Hydrant 1	8.4	904.0	57.0	44.8	44.8	20	5162	326	YES
Hydrant 2	25.8	1701.0	107.3						

* Pressure correction is equal to the elevation difference. Column 2 (and Table A) show the nozzle pressure while flowing.

Residual Pressure vs. Hydrant Flow



Results			
Static Pressure		Flow at 20 psi (140kPa)*	
(psi)	(kPa)	(gpm)	(L/s)
54.5	376	5200	328

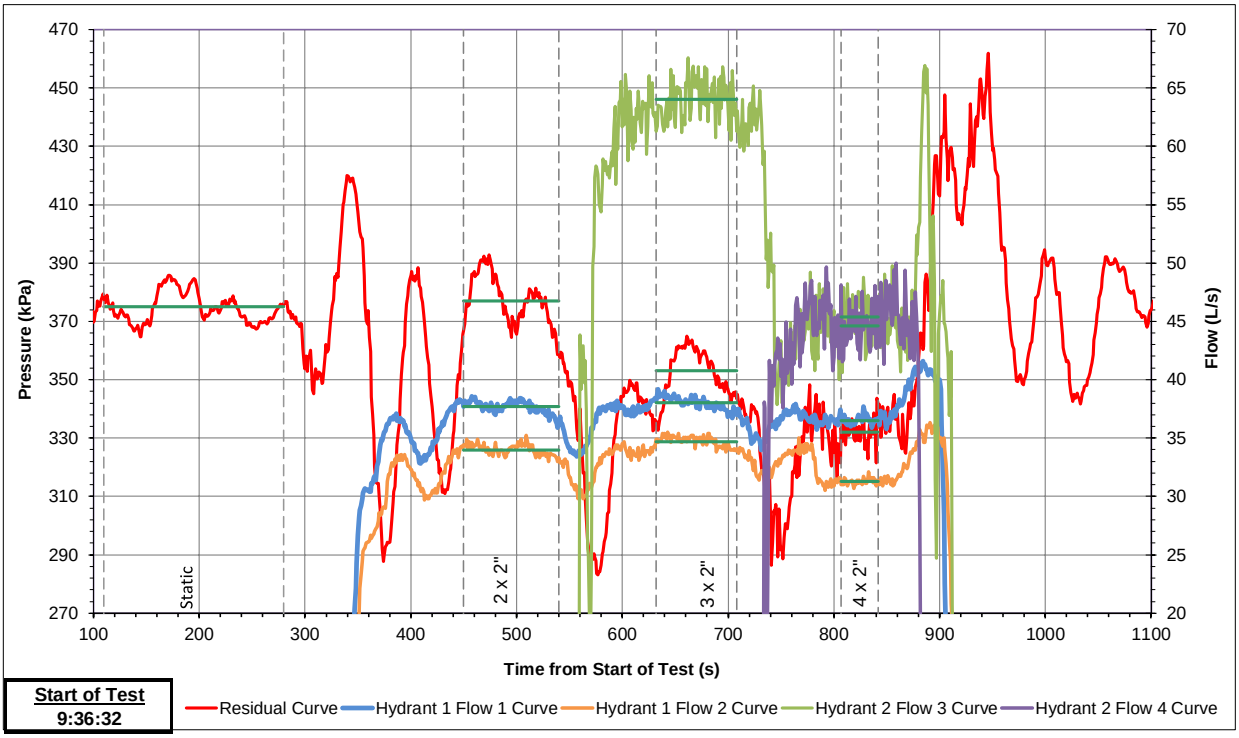
* Results carried to nearest 50 gpm or 100 gpm if over 1000 gpm

Hydrant Classification as per NFPA 291			
Class	AA	Color	BLUE

Water Discharged During Test:	43500 L

Rounded up to closest 100L

3026 Homestead Dr (GJ10H006)



Subject Watermain Details

Diameter:	400 mm	**Material:**	DI
Area:	0.126 m2		

Subject Hydrant & Valve Details

Residual Hydrant:	GJ10H006
Flow Hydrant 1:	GJ10H008
Flow Hydrant 2:	GJ10H007

TABLE A: TESTED PRESSURES AND FLOWS

Point	Time		Residual (GJ10H006)		Flow Hydrant 1 (GJ10H008)				Flow Hydrant 2 (GJ10H007)				Total Flow		Velocity
			Residual (S1)		Flow 1 (S2)		Flow 2 (S3)		Flow 3 (S4)		Flow 4 (S5)				
	Start	Finish	(kPa)	(psi)	(L/s)	(GPM)	(L/s)	(GPM)	(L/s)	(GPM)	(L/s)	(GPM)	(L/s)	(GPM)	(m/s)
Static	110	280	375	54.4	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1 x 2"			0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2 x 2"	450	540	377	54.7	37.7	598	34.0	539	0.0	0	0.0	0	71.7	1136	0.6
3 x 2"	632	708	353	51.2	38.0	602	34.7	550	64.0	1014	0.0	0	136.7	2167	1.1
4 x 2"	807	842	332	48.2	36.5	579	31.3	496	45.4	720	44.6	707	157.8	2501	1.3

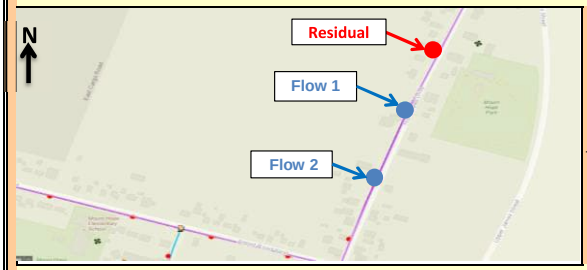
3026 Homestead Dr (GJ10H006)

HYDRANT FLOW TEST RESULTS

Date: 19-Oct-22 Time: 9:36 (hh/mm) Municipality: City of Hamilton

Operator:

Tested By: Sen, Issac Test No: **2**



Conditions before Test (STATIC)

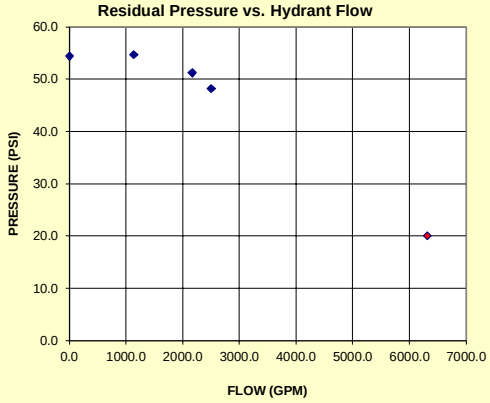
Residual Hydrant:	54.4 psi	375 kPa
Hydrant that will Flow:	54.4 psi	375 kPa
Δ pressure:	0.0 psi	0 kPa
Elevation Difference: (Flow El. - Residual El.)	0.0 ft	0.0 m

Test Notes: A pump may have started during test

TEST		TEST FLOW		RESIDUAL PRESSURE (psi)		Minimum Residual P_r (psi)	Fire Flow at Minimum Residual, Q_r (USGPM)	Fire Flow at Minimum Residual, Q_r (L/s)	10% Pressure Drop Achieved?
Port Size (in)	Nozzle Pressure (psi)	(USGPM)	(L/s)	Monitoring Hydrant	Flow Hydrant (Corrected) *				
STATIC	n/a	0	0	54.4	54.4				
Single Hydrant Test									
1 x 2"	0.0	0.0	0.0			20			
2 x 2"	13.3	1137.0	71.7	54.7	54.7	20	N.A.	N.A.	NO
3 x 2"									
Hydrant 1	13.6	1152.0	72.7	51.2	51.2	20	7822	494	NO
Hydrant 2	36.7	1014.0	64.0						
4 x 2"									
Hydrant 1	11.9	1075.0	67.8	48.2	48.2	20	6316	399	YES
Hydrant 2	18.2	1427.0	90.0						

* Pressure correction is equal to the elevation difference. Column 2 (and Table A) show the nozzle pressure while flowing.

Residual Pressure vs. Hydrant Flow



Results			
Static Pressure		Flow at 20 psi (140kPa)*	
(psi)	(kPa)	(gpm)	(L/s)
54.4	375	6300	397

* Results carried to nearest 50 gpm or 100 gpm if over 1000 gpm

Hydrant Classification as per NFPA 291			
Class	AA	Color	BLUE

Water Discharged During Test:	39300 L

Rounded up to closest 100L

Table E1: Hydrant Flow Test vs. Simulated Flow Test Results @ Hydrant GJ10H011

GJ10H011				
Source	Static Pressure (kPa)	Residual Pressure (kPa)	Test Flow (L/s)	Theoretical Flow Available at 20 psi Residual (L/s)
Hydrant Test	376	309	164	328
Model Curve	364	243	164	240

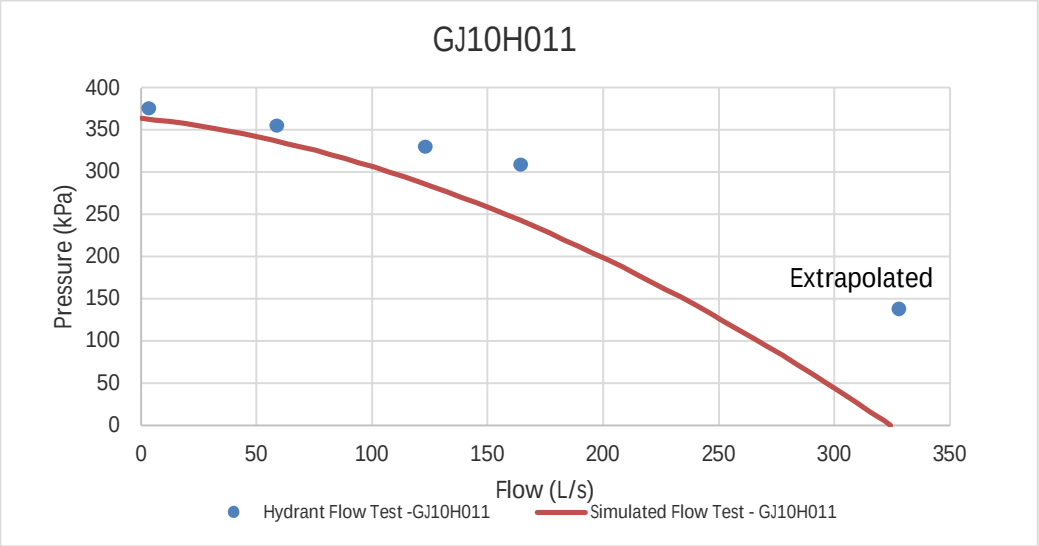


Figure E1: Hydrant Flow Test vs. Simulated Flow Test Results @ Hydrant GJ10H011

Table E2: Hydrant Flow Test vs. Simulated Flow Test Results @ Hydrant GJ10H006

GJ10H006				
Source	Static Pressure (kPa)	Residual Pressure (kPa)	Test Flow (L/s)	Theoretical Flow Available at 20 psi Residual (L/s)
Hydrant Test	377	332	158	398
Model Curve	373	260	158	246

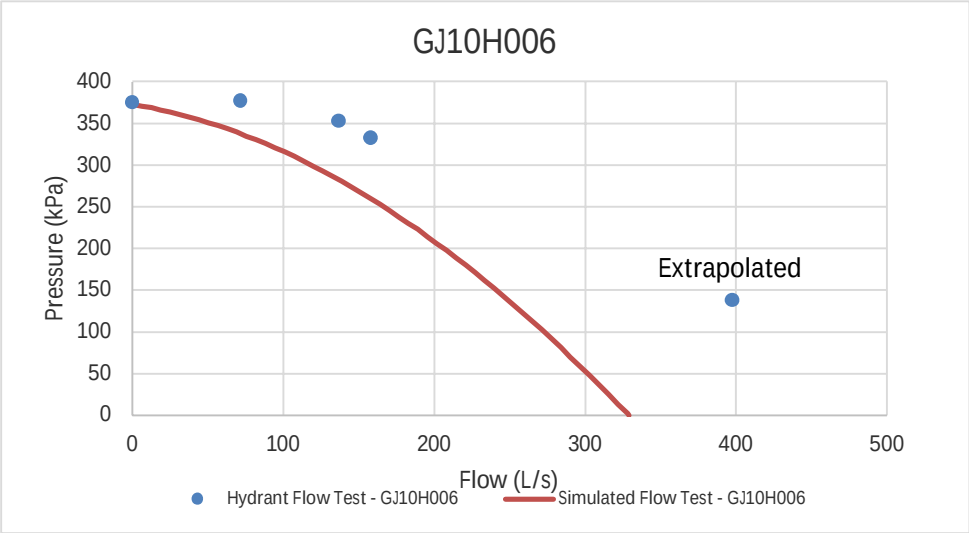


Figure E2: Hydrant Flow Test vs. Simulated Flow Test Results @ Hydrant GJ10H006