



**DEVELOPMENT SERVICING SCENARIO –
MORRIS LAKE**

Future Serviced Communities

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Halifax Regional Municipality

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Development Servicing Scenario – Morris Lake

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1 Introduction

The Halifax Regional Municipality (HRM), through their Regional Municipal Planning Strategy (Regional Plan), have identified four Future Serviced Communities which require a comprehensive neighbourhood planning process that includes a review of existing servicing infrastructure capacity and constraints. The four study areas are as follows.

- Sandy Lake
- Highway 102 Corridor
- Morris Lake (identified as Eastern Passage in the accompanying Water Servicing Plan)
- Westphal (identified as Akoma Lands in the RFP)

This report summarizes the following with respect to the Westphal development:

- Design criteria and regulatory considerations,
- Development scenarios,
- Potable water serviceability,
- Existing wastewater collection system, and
- Development grading.

Conceptual servicing plan measures to meet the established design criteria, and upgrades required to regional infrastructure for water and wastewater servicing, are also discussed.



2 Background and Design Criteria

2.1 Regulatory Considerations

2.1.1 HALIFAX WATER (HW)

HW's *Design Specifications and Supplementary Standard Specifications for Water, Wastewater & Stormwater Systems*, 2023 Edition (DS & SSS) outline the following objectives relating to the design of new servicing systems. This report is to be read in conjunction with the Eastern Passage Water Servicing Plan report (**Appendix A**).

The watermain system shall:

- Be designed to accommodate the greater of Maximum Day Demand plus fire flow demand, or Peak Hour Demand.
- Average Day Demand corresponds to 375 L/person/day.
- Fire flow demand to be in accordance with latest requirements per Fire Underwriter's Survey (FUS) *Water Supply for Public Fire Protection* (2020), and estimated per DS & SSS Table 3.3:

Land Use	Fire Flow (litres/minute)	Duration (hours)	Number of Fire Hydrants
Single unit dwellings	3300	1.5	1
Two family dwellings	3300	1.5	1
Townhouse	4542	1.75	1
Multi-unit high rise	13620	3	3
Commercial	13620	3	3
Industrial	13620	3	3
Institutional	13620	3	3

- Peaking factors are as per DS & SSS Table 3.1:

Land Use	Minimum Hour	Maximum Day	Peak Hour
Low Density Residential	0.70	1.65	2.50
High Density Residential	0.84	1.30	2.50
Industrial	0.84	1.10	0.90
Commercial	0.84	1.10	1.20
Institutional	0.84	1.10	0.90

- Minimum size for local distribution mains is 200mm, minimum size for Feeder Main is 300mm.



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Additional requirements for watermain are noted in the accompanying Stantec report *Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan (Appendix A)*.

The sanitary system shall (in addition to use of population estimates noted in sections above):

- Average Dry Weather flow corresponds to 300 L/person/day.
- Peak Dry Weather flow to be determined using peaking factor per the Harmon Formula (minimum of 2.0).
- Infiltration / inflow allowance of 24 m³/ha/day to be used.
- Pipe minimum and maximum velocities of 0.75m/s and 4.5 m/s respectively, and up to 6.0 m/s with additional energy dissipation and ventilation measures.
- Mannings Roughness coefficients applied per DS & SSS Table 4.1:

PIPE MATERIAL	MANNING ROUGHNESS
Concrete	0.013
PVC	0.010
Polypropylene	0.012
HDPE (Smooth Interior Wall)	0.012

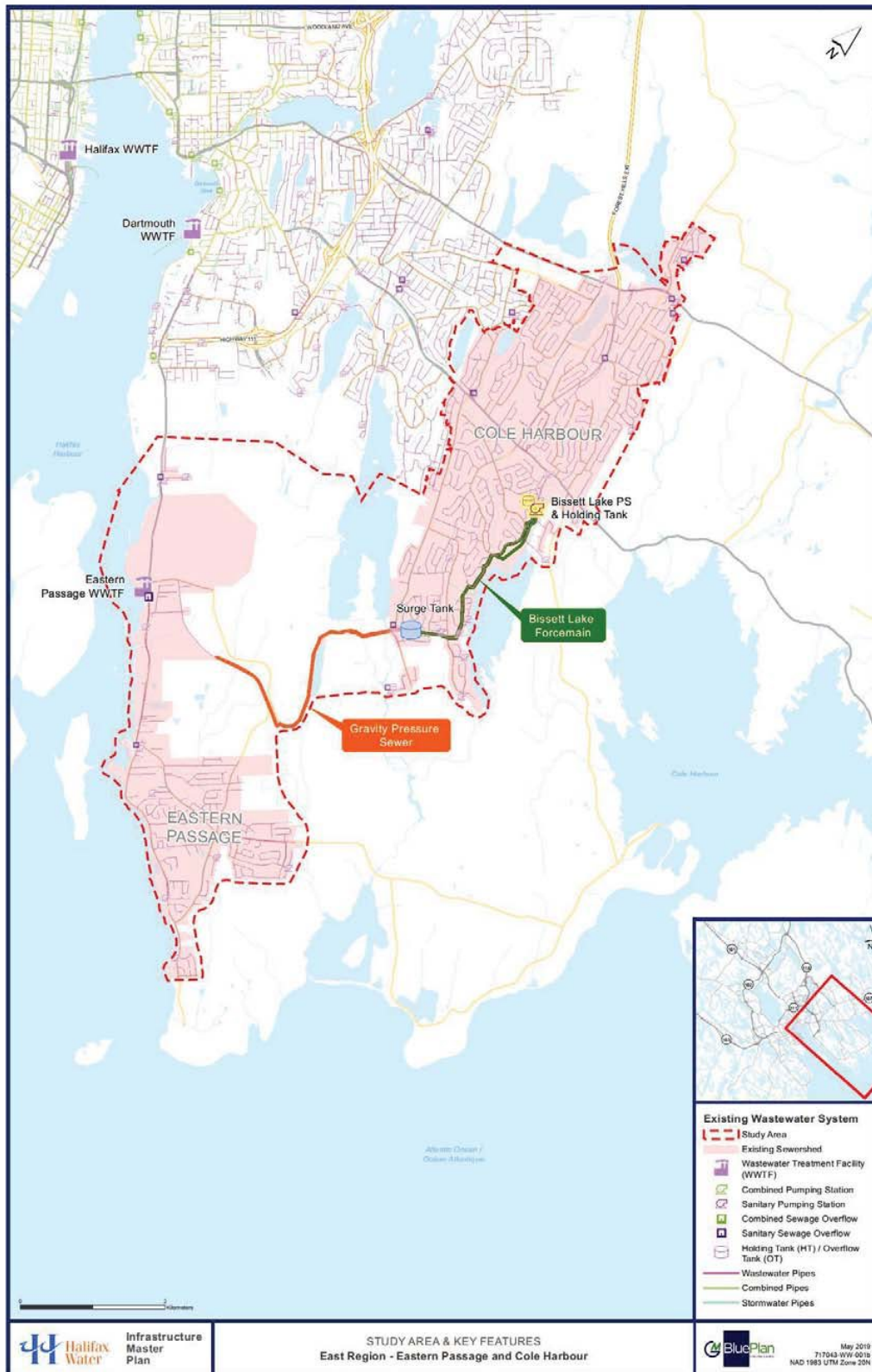
- Minimum wastewater main size of 250mm, and minimum grade of 0.6%.
- Minimum cover is 1.6m, and maximum cover is 5.0m with deeper trunk sewers on exception basis and where a local sanitary sewer for service connections is provided.
- Pump stations classified as Small (firm capacity to 75 L/s), Medium (firm capacity between 75 L/s and 220 L/s), and Large (firm capacity > 220 L/s).

2.2 Infrastructure Master Plan – East Region Wastewater Infrastructure Plan Final Report Volume 5

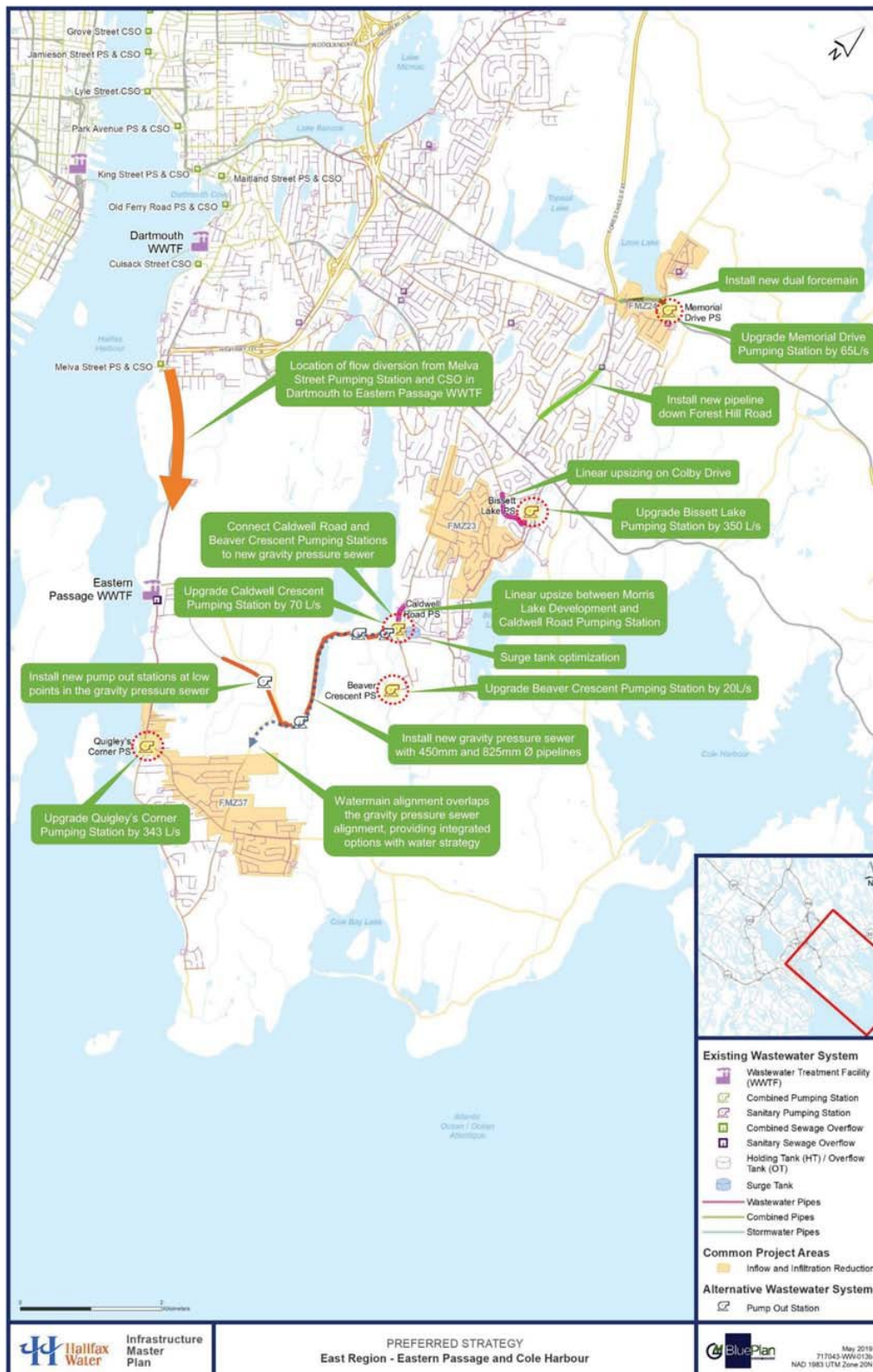
As noted in the Wastewater Infrastructure Plan, growth in this region has been considered to be largely tributary to the gravity pressure trunk sewer to the Eastern Passage WWTF, and potentially via the Caldwell Road PS. Recommendations were made to install new pump out stations at low points in the gravity pressure sewer, at least one of which occurs immediately adjacent to the Morris Lake development area.



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2.3 Morris-Russell Lake Water Service Master Plan

The *Morris-Russell Lake Water Service Master Plan*, completed in 2000 by Vaughan Engineering, analyzed servicing the development around Morris Lake and considered options to improve serviceability to the Eastern Passage/Woodside Low pressure zone, with the aim to provide a secondary source of supply, and improve fire flow in Eastern Passage/Woodside Low zone. The study recommended providing a reservoir at the high point, east of Caldwell Road, where the ground elevation is approx. 40 – 42 m. The report suggested a 72 ft (22 m) diameter reservoir with a top water level of approx. 236 ft (72 m). The 2000 report did not consider development of the Morris Lake Development land being studied as part of the Future Serviced Communities project. The proposed servicing arrangement is presented in **Figure 2-1**. The 2019 Infrastructure Master Plan identified a number of transmission main connections to support and strengthen capacity of the distribution system within the Morris Lake area. As the IMP did not anticipate significant growth in the area, provisions for a reservoir were not included in the later report.

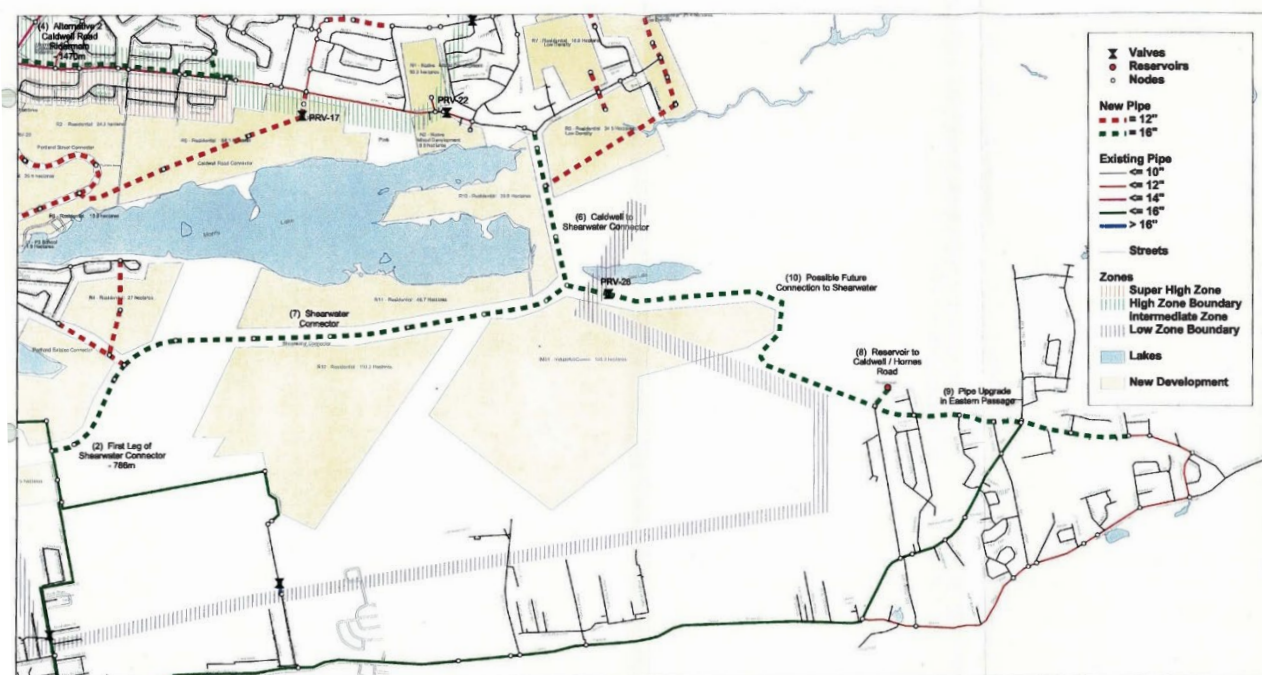


Figure 2-1: Morris-Russell Lake Water Servicing Plan (2000)

2.4 Infrastructure Master Plan – Water Infrastructure Servicing Plan Final Report Volume 2

The 2019 IMP revisited the options presented in the 2000 report in conjunction with infrastructure improvement projects completed since the 2000 report. The IMP concluded that the preferable option is a new connection from Willowdale (from Caldwell Rd at Atholea Drive) to Eastern Passage via a new 400 mm watermain and a new pressure reducing valve (PRV), rather than a new reservoir. The IMP stated that this alternative would be sufficient to meet fire flow objectives, create a loop for redundancy, and

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allow the Woodside/Eastern Passage Low hydraulic grade line (HGL) to be lowered. The proposed new 400 mm watermain would traverse the Eastern Passage Future Serviced Communities land, as shown in the following figure (taken from the 2019 IMP). The new connection would connect to the 24 East High pressure zone (not Atholea Low pressure zone).

The 2019 IMP noted some of the shortcomings of a new tank:

- The new tank would be supplied by the aging 400 mm watermain along Pleasant Drive/Main Drive.
- There could be difficulties operating the tank should growth occur post 2046 or expansion of the servicing boundary such as the Silversands WSP system (*the IMP did not consider the Eastern Passage FSC land as a potential growth area*).
- Does not allow for optimizing Eastern Passage/Woodside Low pressure as they must remain at a certain HGL to operate the tank.
- Operations would be required to ensure proper turnover of water in the reservoir to avoid water quality issues.

Figure 2-2 illustrates the proposed Eastern Passage Servicing improvements per the 2019 IMP.



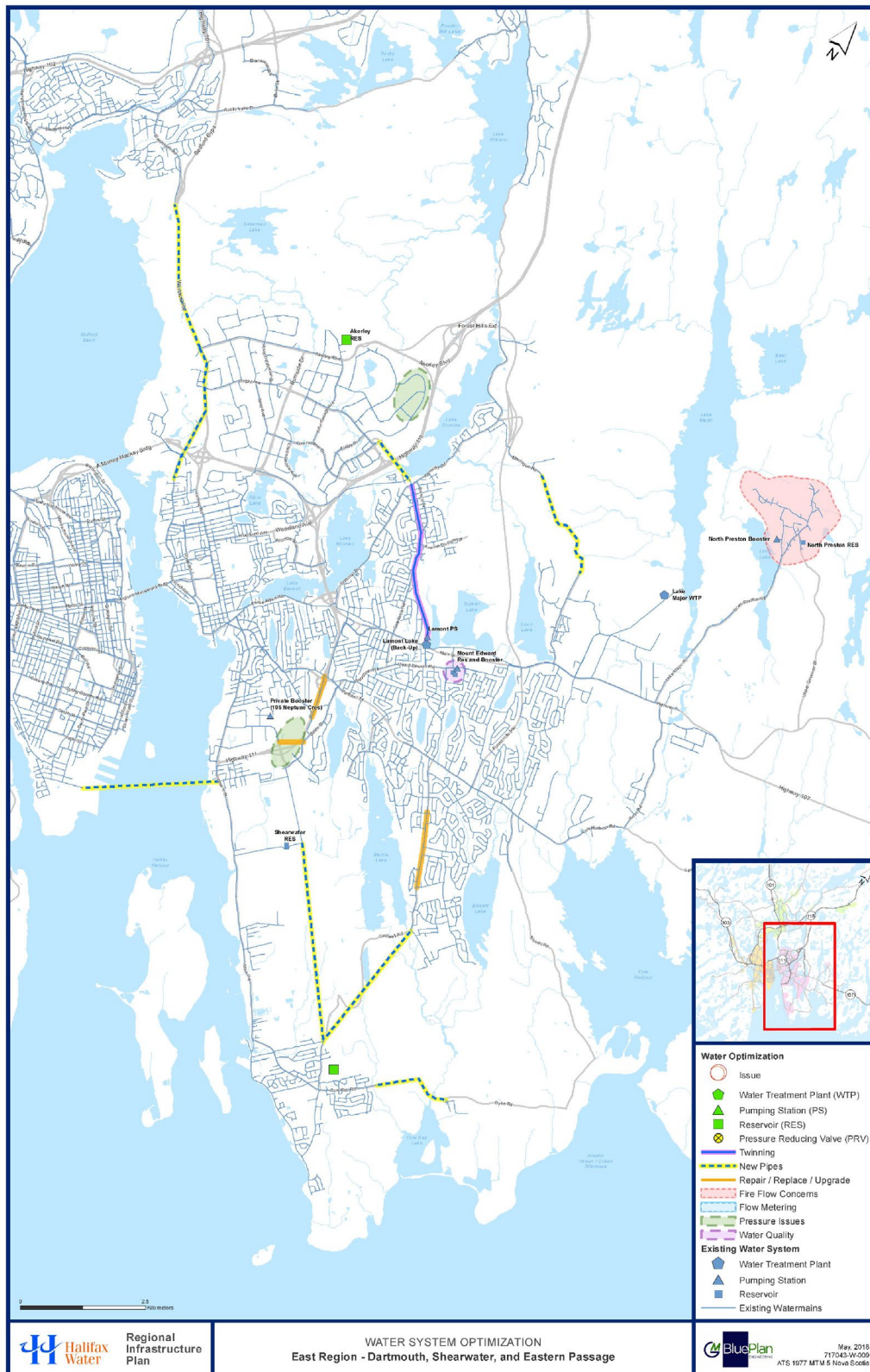
Development Servicing Scenario – Morris Lake



Figure 2-2: 2019 IMP Eastern Passage Servicing Plan



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2.5 Other Regional Considerations

2.5.1 MODELING

It was noted that water modeling was carried out using an isolated steady-state model for each of the four proposed development sites. Stantec's water servicing report (provided in **Appendix A**) recommends that the modeling for the proposed developments should be based on using a full system model so that the effect of the proposed developments on the level of service on the remaining water system can be assessed. Similarly, the report noted that modeling of the development sites only would not identify potential restrictions in the system that may impact the development sites. It was noted that this approach was outside of the scope of the services for the study as the system fall under the Halifax Water Regional Authority. **Considering the scale of the proposed developments and potential impacts on existing water systems and off-site infrastructure upgrades, the recommended full system modeling should be carried out as part of the upcoming update of the Integrated Resource Plan (IRP).**

2.5.2 WASTEWATER

As detailed further in Section 5, the Morris Lake lands are expected to have impacts on the conveyance upgrades identified in the 2020 WIP in particular concerning the pressure-gravity system. This system collects flow from a large area and a number of pump stations before discharging downstream towards the EP WWTF.

As discussed further in Section 5.1, this consideration merits the use of the City's updated hydraulic model assessed in context of regional servicing needs within the framework of the IMP. This includes alternatives evaluations to determine a preferred regional servicing and infrastructure upgrades strategy that best accommodates the broader needs and goals of the HRM and HW. This note is also applicable to the Westphal FSC lands interest and the cumulative impact of both these growth areas should be considered.

It is further recommended that HW and HRM revisit the technical and financial evaluations of the servicing strategy for the EP WWTF. A cost-benefit analysis would enhance the confidence that the implemented servicing strategies to come are best aligned with HW and HRM priorities, while maintaining (or enhancing) service to existing residents and proactively planning those infrastructure upgrades required to maintain this same level of service to future growth areas. Such an analysis would align well within the context and scope of an IMP update.

2.5.3 POTABLE WATER

The 2019 IMP did not consider the Morris Lake Development area as a planned growth area. Therefore, the need for regional water system improvements to service the Morris Lake Development was not previously identified. However, the IMP did recommend a new 400 mm diameter transmission main and PRV through the Morris Lake Development to improve serviceability to the Eastern Passage/Woodside Low pressure zone. The IMP also noted that the Lake Major system supply does not have sufficient capacity to accommodate expected growth to the year 2046. It was estimated that by 2031 75% of the



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supply capacity will be used and by 2041 demands will reach 90% of the supply capacity triggering the need for a new supply source. These proposed timelines did not include servicing the Morris Lake Development (see **Figure 2-3** taken from the 2019 IMP). The IMP noted that it is not possible to increase the withdrawal permit from Lake Major, and that there is little, or no, opportunity to cost effectively develop a new source near the Lake Major network. However, there is a possibility to alleviate some of the demand on Lake Major by a system connection from the Pockwock network.

It is recommended that the current IMP examine the effects of the Morris Lake Development on the existing regional system to identify required infrastructure improvements and/or servicing limitations.

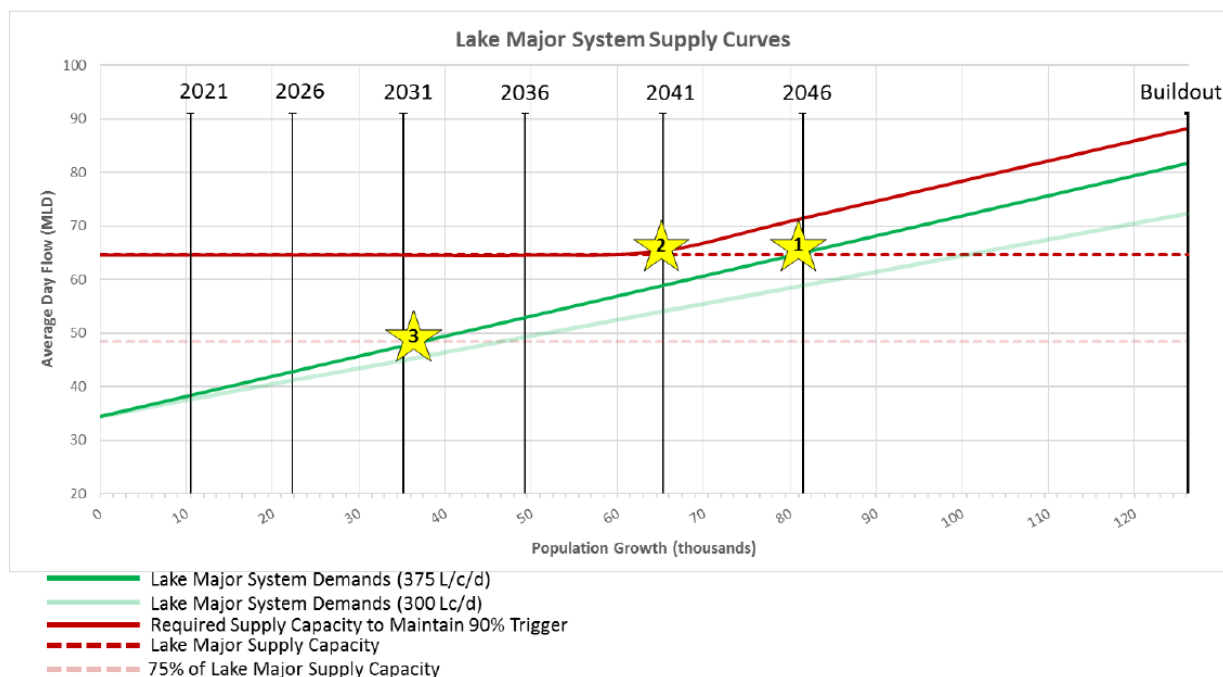


Figure 2-3: Supply Analysis for Lake Major System (taken from 2019 IMP)

2.5.3.1 Potential Regional Water Infrastructure Improvements

Given the relatively small diameter watermain in Caldwell Road (250 and 300 mm), Atholea Drive (250 mm) and Cow Bay Road (250 mm) it is suspected that the full regional water model will identify the need for improvements to existing infrastructure to service the Morris Lake Development. This should be confirmed through the development of the new IMP.

The previously identified new transmission main to improve serviceability to Eastern Passage/Woodside Low pressure zone may also benefit the Morris Lake development area. In particular, the transmission main may improve achievable fire flows in the new development. However, given the proposed 400 mm main would be connecting to a 300 mm diameter main in Caldwell Road, there may still be large head losses in the 300 mm. The 2019 IMP noted that additional capacity could be achieved by upsizing the watermain in Colby Drive and Deerbrook Drive.



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In support of fire flow demands and to ensure no negative impacts within water distribution networks both within the study area and the existing system, provisions for a new reservoir should be made. Based on the Atlantic Canada Guidelines Manual for the Supply, Treatment, Storage and Operation of Drinking Water Supply Systems, growth within the Morris Lake area would require a storage volume of approximately 6.9ML for the high density build-out scenario, and 4.9ML for the low density scenario. Elevations within the study area are not favorable for standpipe storage; Twin standpipes with approximate height of 38m would be needed to achieve the required HGL within the study area, with the potential for a large amount of dead storage. Twin elevated storage tanks are likely a better option to provide the required storage volume. It is also noted that flight path and tank height restrictions are in place relating to the DND Shearwater runways in proximity to the Morris Lake expansion area that are anticipated to restrict any potential reservoir locations. As a further alternative, storage may be located outside of the study area at a higher elevation. The diameter of transmission mains should be reassessed from a regional perspective should corresponding storage tank designs move forward, and identifying further benefits (if any) to the regional water distribution system at large.

The following infrastructure improvements should be analyzed in the regional hydraulic model to further assess the serviceability of the Morris Lake Development in addition to improving Eastern Passage/Woodside Low pressure zone (illustrated in **Figure 2-4**).

- New 400 mm watermain through Caldwell Road from existing 350 mm diameter near Deerbrook Drive to Atholea Drive.
- New 400 mm watermain in Colby Drive and Deerbrook Drive from the existing 400 mm diameter in Colby Drive near Delta Drive to Caldwell Road.
- New 400 mm watermain through Morris Lake Development from Caldwell Road to Cow Bay Road.
- New 400 mm watermain in Cow Bay Road from the Morris Lake Development to the existing 400 mm diameter in Cow Bay Road near Heritage Hills Drive.
- New PRV on the new 400 mm watermain through the Morris Lake Development near the intersection of Caldwell Road and Atholea Drive.
- New reservoir of between 6.9ML and 4.9ML in support of high demand scenarios with location to be assessed based on DND Shearwater flight path restrictions and modeled HGL requirements.



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Figure 2-4: Potential Regional Improvements

2.5.4 CAPITAL COST CONTRIBUTIONS (CCC)

Critical infrastructure that provides a regional benefit would form part of a Capital Cost Contribution Policy (CCC) for the area. Infrastructure that may be eligible for cost-sharing include reservoirs, control chambers, booster stations and watermains that are 400mm and greater in diameter. The cost of the



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applicable portions of reservoir storage, PRVs and main oversizing would form components of a water CCC for the development area.

As noted previously, the study did not analyze the development as part of a full system hydraulic model. As a result, the scope of any required regional infrastructure to support this development is not yet known and any estimates for CCCs based on this study may be incomplete. **It is recommended that the Capital Cost Contribution be updated following completion of the Master Servicing Plan for the Morris Lake Area, and the Regional Infrastructure Plan update.**



3 Development Scenarios

Stantec has attempted to prepare a conceptual development plan considering local and major connecting roadways, residential development areas, commercial development areas, and greenspace and parks. This concept was heavily influenced by previously prepared development plans by major landowners for the area – Oknah Realty, A.J. Giles, and Morris Lake Holdings.

Developer-considered unit density for residential development areas has been superseded for the overall concept in order to develop three density scenarios (identified as Low, Medium, and High) for each development area as described in the *Development Scenario – Eastern Passage Study Area (Stantec, 2024)* report. Recognizing that each development area has unique features and environmental constraints, the following methodology was applied in order to develop residential unit density for each development scenario:

1. Determining the properties comprising each area defined in the HRM Request for Proposals from current Nova Scotia Property Online records.
2. Summing the area of properties recorded in Nova Scotia Property Online records.
3. Subtracting already developed or assigned lands (i.e., lands that have buildings or a designated use such as parkland or road rights-of-way) to determine land available for development.
4. Compiling all development proposed for each study area based on plans or other input from landowners indicating an interest in development to determine the “developer-requested scenario” for each study area.
5. Calculating potential development for remaining lands based on patterns determined from **Step 4** (i.e., assuming remainder lands would be developed with similar density and unit mix as proposed by developers).
6. Determining areas that are wetland and/or 30-metre watercourse buffers (i.e., environmentally constrained) within each area and converting to a percentage for each study area.
7. Excluding the percentage of environmentally constrained land (i.e., wetlands and watercourse buffers) from lands available for development (i.e., subtracting the percentage of land that is environmentally constrained determined for each study area in **Step 6** from land available for development calculated through **Step 3**).
8. Applying an overall population density or similar parameter to create two alternative development scenarios for each study area.
9. Calculating a distribution of residential units by type for each study area based on the distribution of dwelling unit types (i.e., singles, townhouses, apartments) in developer-requested proposals for the specific study area.
10. Calculating commercial space (i.e., gross leasable area or GLA) using the square foot area per person of commercial space provided by developers in submitted plans applied to the total estimated population for each study area and rounded up to the nearest 5,000 square.

Estimates of environmental constraints are based on desktop investigations and measurement in GIS and estimates. The more important consideration is that developer intentions are accurately reflected in



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developer-requested scenarios, that those intentions are reasonably reflected in alternative scenarios, and both estimation and analysis are consistent across the study areas and their component developments.

Eastern Passage – Medium (Developer-requested)

	Land Area (ac.)		Dwelling Units				Estimated Population		Commercial GLA (sq. ft.)	
Developer	Total	Developable	Unit Type	Unit Numbers	Density	Share by Type	Residents	Density	Per Resident	Total Area
Oknah Realty	119	60.7	Ground-based	252	4.2	100.0%	655	10.8	9.6	10,000
A. J. Giles	46	23.4	Singles	12		3.1%	31			
			Multi-unit	372		96.9%	670			
			All types	384	16.4	100.0%	701	30.0	9.6	10,000
Morris Lake Holdings	1,000	511.9	Singles	1,077		20.4%	2,800			
			Townhouses	1,737		32.8%	4,516			
			Cluster Towns	89		1.7%	231			
			4-plexes	100		1.9%	260			
			Mid-rise Multi	1,003		19.0%	1,805			
			High-rise Multi	1,284		24.3%	2,311			
			All types	5,290	10.3	100.0%	11,924	23.3	9.6	115,000
Remainder	7	3.6	Singles	8		20.4%	20			
			Townhouses	14		36.4%	36			
			Multi-unit	16		43.2%	29			
			All types	38	10.3	100.0%	85	23.3	9.6	5,000
STUDY AREA	1,171	599.7	All development	5,964	9.9		13,365	22.3	9.6	130,000

Eastern Passage - Low-density

	Land Area (ac.)		Dwelling Units				Estimated Population		Commercial GLA (sq. ft.)	
Developer	Total	Developable	Unit Type	Unit Numbers	Density	Share by Type	Residents	Density	Per Resident	Total Area
Oknah Realty	119	60.7	Ground-based	373	6.2	100.0%	971	16.0	9.6	10,000
A. J. Giles	46	23.4	Ground-based	144	6.2	100.0%	374	16.0	9.6	5,000
Morris Lake Holdings	1,000	511.9	Ground-based	3,150	6.2	100.0%	8,191	16.0	9.6	80,000
Remainder	7	3.6	Ground-based	22	6.2	100.0%	58	16.0	9.6	5,000
STUDY AREA	1,171	599.7	All development	3,690	6.2		9,594	16.0	9.6	95,000

Eastern Passage - High-density

	Land Area (ac.)		Dwelling Units				Estimated Population		Commercial GLA (sq. ft.)	
Developer	Total	Developable	Unit Type	Unit Numbers	Density	Share by Type	Residents	Density	Per Resident	Total Area
Oknah Realty	119	60.7	Ground-based	840	13.8	100.0%	2,184	36.0	9.6	25,000
A. J. Giles	46	23.4	Singles	14		3.1%	36			
			Multi-unit	448		96.9%	806			
			All types	462	19.7	100%	842	36.0	9.6	10,000
Morris Lake Holdings	1,000	511.9	Singles	1,825		22.9%	4,746			
			Other Ground	3,265		40.9%	8,488			
			Multi-unit	2,887		36.2%	5,196			
			All types	7,977	15.6	100.0%	18,430	36.0	9.6	180,000



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Remainder	7	3.6	Singles	13	22.7%	34			
			Other Ground	23	40.7%	60			
			Multi-unit	21	36.6%	37			
			All types	57	100.0%	131	36.0	9.6	5,000
STUDY AREA	1,171	599.7	All development	9,335	15.6	21,588	36.0	9.6	210,000

Estimated populations have been distributed amongst the development concept area to facilitate local infrastructure sizing and to define capacity constraints for off-site works.



4 Potable Water Infrastructure

To assess the ability of servicing the Morris Lake development by existing pressure zones, and to identify infrastructure required to meet the level of service prescribed in HW's DS & SSS, a steady state water network model of the proposed development was built in Innovyze InfoWater Pro 3.5. The water model was used to assess both the high-density and low-density population scenarios presented in **Section 3**. The following sub-sections summarize the water servicing analysis completed for the Morris Lake development, while **Appendix A** contains the full *Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan – Final Report* (aka. Morris Lake).

4.1 Connectivity to Municipal Infrastructure

The proposed Morris Lake development is located adjacent to the Eastern Passage/Woodside Low, Atholea Low, and 24 East High pressure zones. These pressure zones are included in the Lake Major system and are serviced by the Lake Major Water Treatment Facility.

The hydraulic grade lines (HGL) of the adjacent pressure zones are summarized in the following table and illustrated in **Figure 4-1**:

Pressure Zone	HGL (m)	HGL (ft)
Eastern Passage / Woodside Low	78-81	255-265
Atholea Low	81-82	265-270
24 East High	116-119	380-390

Comparing the serviceable elevation ranges of the adjacent pressure zones to the development elevation ranges indicate that the re-delineation of the Atholea Low and Eastern Passage/Woodside Low zones can accommodate the development from a pressure perspective. The proposed pressure zone re-delineations are illustrated in **Figure 4-2**.



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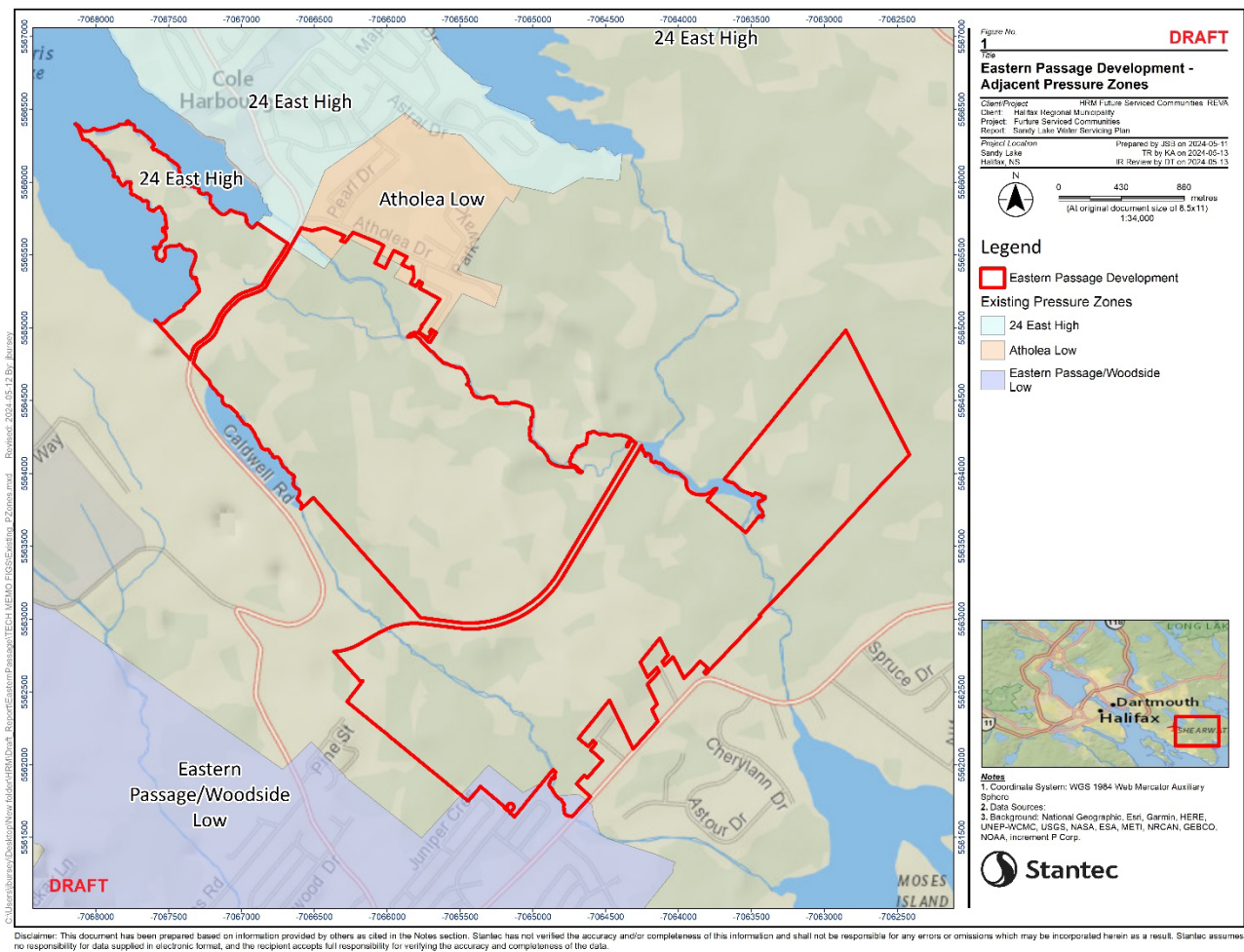


Figure 4-1: Existing Pressure Zones



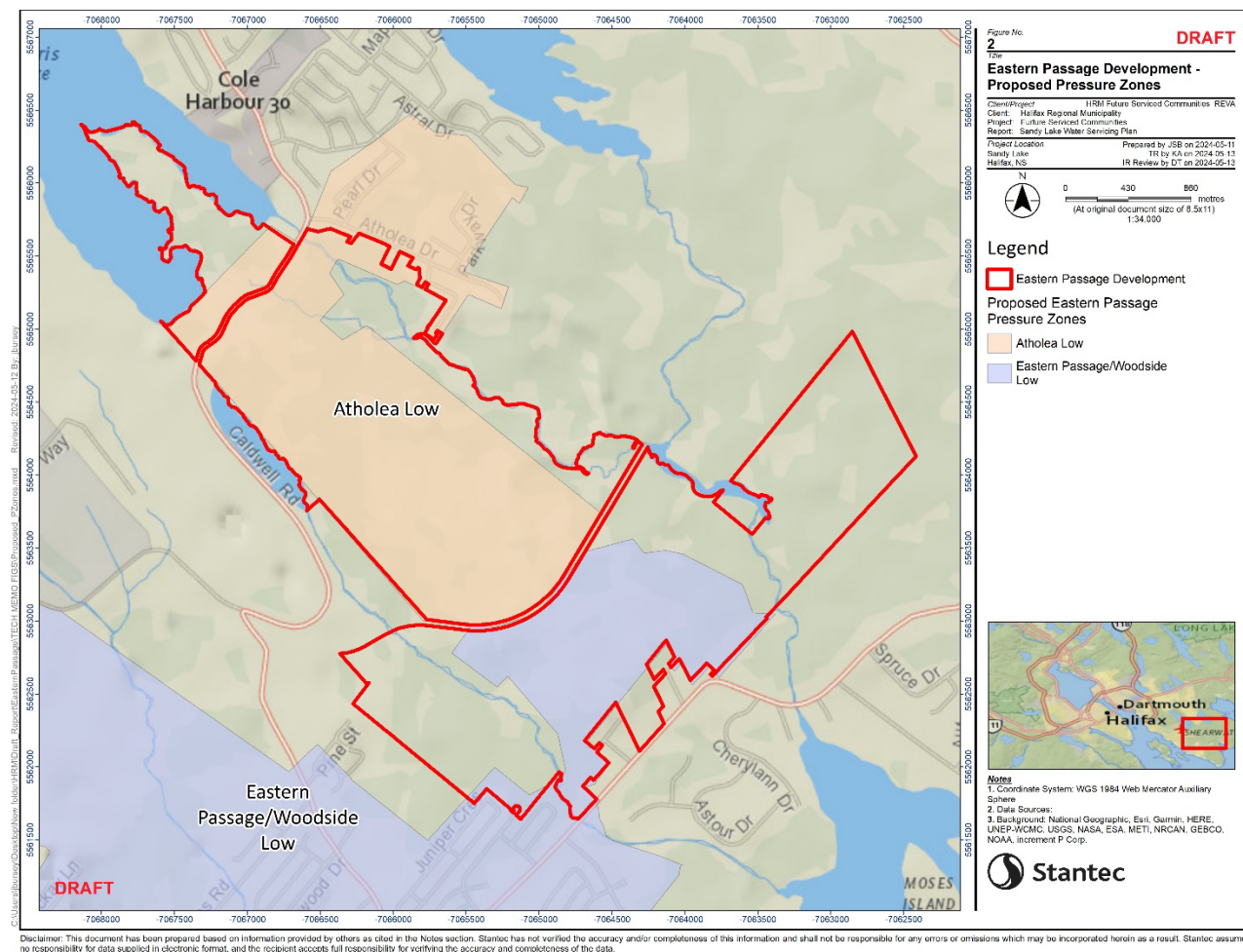


Figure 4-2: Proposed Pressure Zone Re-Delineation

4.2 Water Model

A steady state water network model of the proposed development was built in Innovyze InfoWater Pro 3.5 to assess distribution system requirements within the development to accommodate the MHD, MDD, PHD and MDD+ fire flow (FF) demands for the high-density and low-density scenarios. Reservoirs with fixed head equal to the pressure zones' HGL were used to simulate the connections to the existing Atholea Low and Eastern Passage/Woodside Low pressure zones. It is noted that modelling the existing system in this manner does not reflect the actual system, as it assumes the connecting points are always at a constant HGL regardless of demand scenario and that there is an unlimited supply of water from the zone. However, in the absence of a full system model it is a reasonable assumption.

Currently, the two pressure zone extension areas are modeled as being serviced by single feeds. However, it is anticipated that during detailed design/construction, the watermain within the new serviced area will be connected and isolation valves and/or pressure reducing valves (PRV) used to maintain the pressure boundaries. Such design allows for redundancy; in the event of a watermain break the pressure



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zone boundary valve(s) can be opened and act as a secondary feed until repairs to the watermain can be made. Isolation valves, used to separate the pressure zones, are mimicked in the model by “closing” pipes.

The resultant pressures in consideration of the PHD for the high-density scenario are presented in **Figure 4-3** and available fire flows under MDD and the high-density scenario are shown in **Figure 4-4**. Pressures under the PHD scenario range from approximately 36 psi to 81 psi (36 psi being slightly below the range specified in the DS and SSS). The available fire flow range is approximately 1,500 Lpm to 7,900 Lpm and does not meet the MDD + FF demands.

Additional modeled scenarios are available for review within the *Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan* report presented in **Appendix A**.



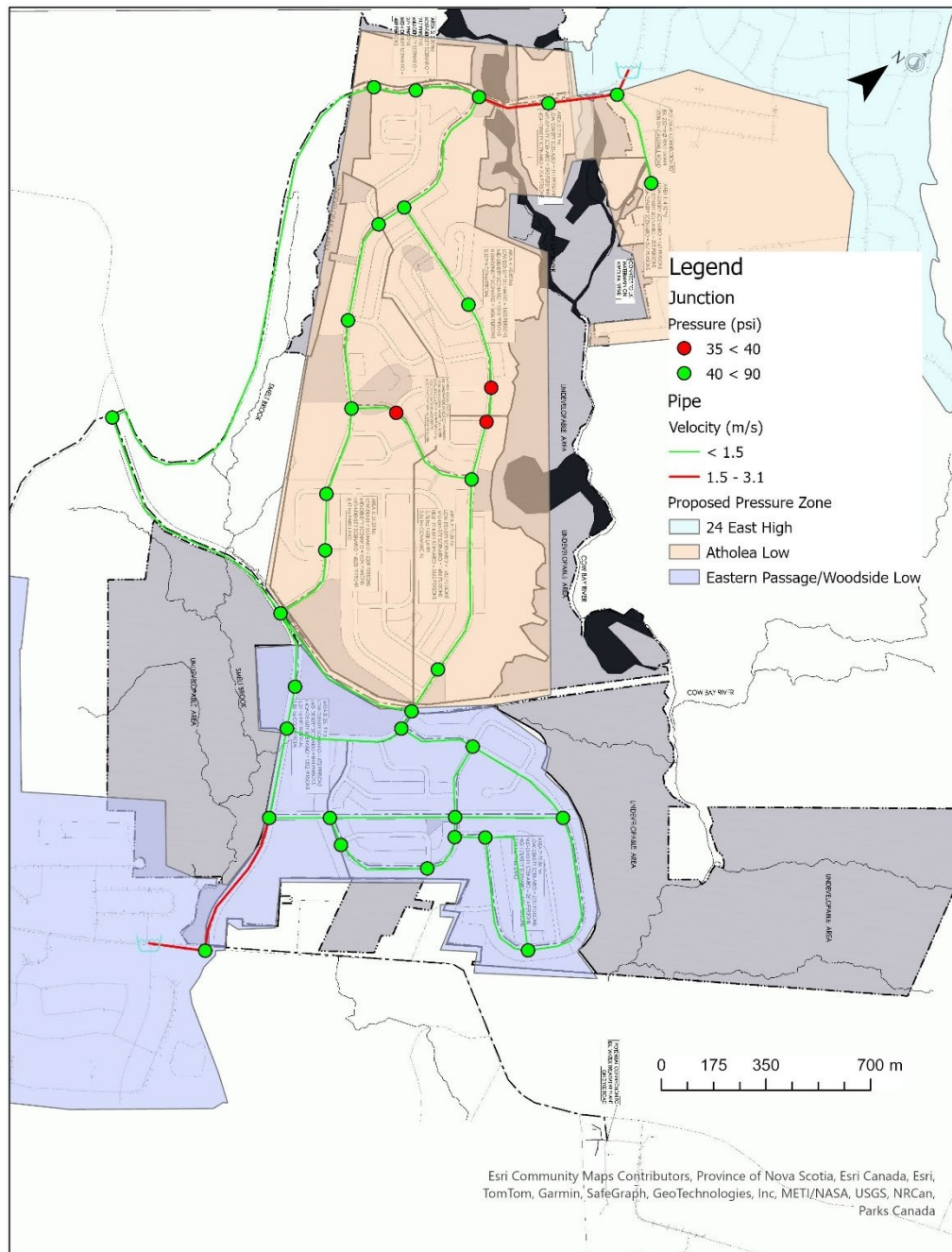


Figure 4-3: Pressure Distribution Under PHD (High-Density Scenario)

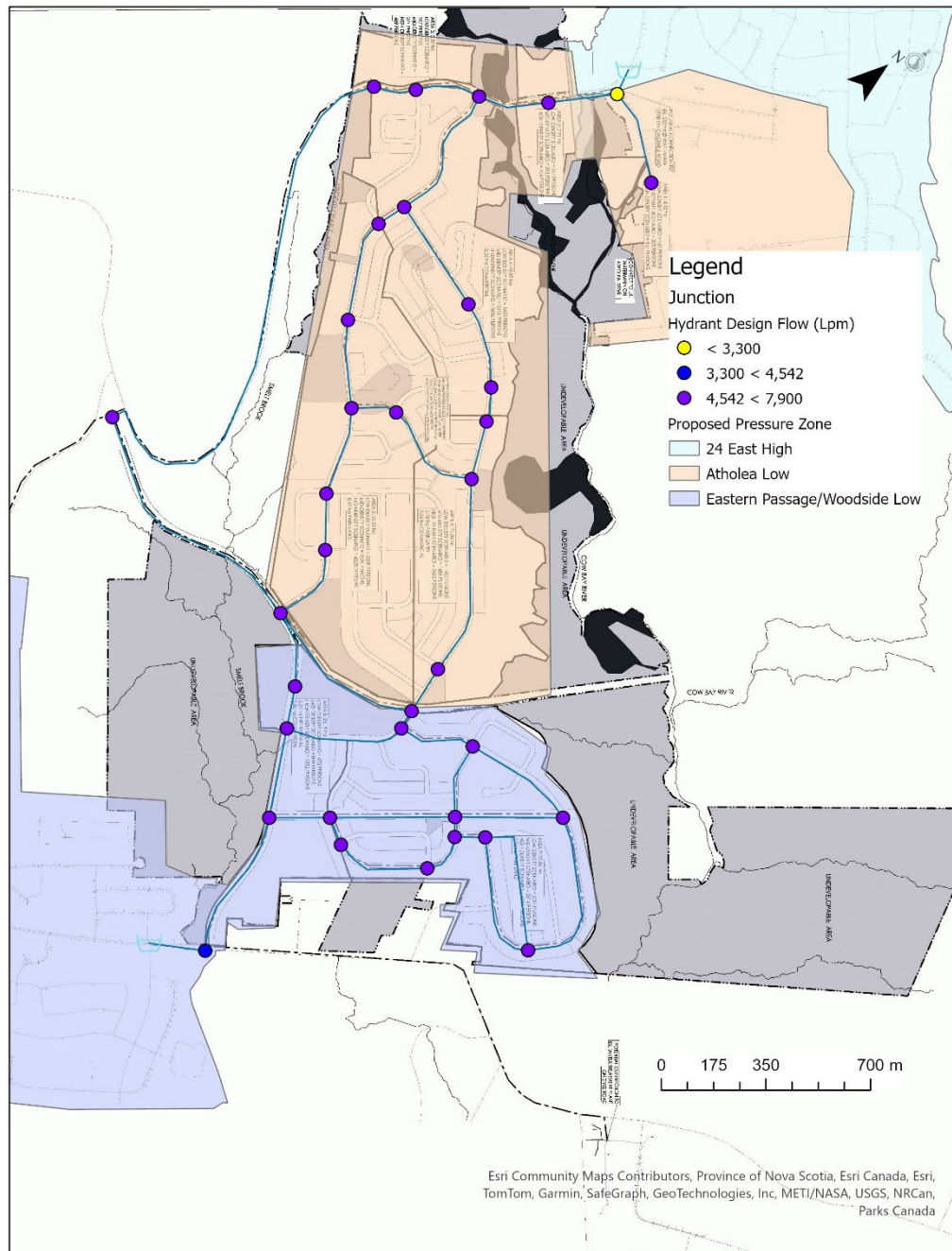


Figure 4-4: Available Hydrant Flow (High-Density Scenario)

4.3 Water Servicing Conclusions and Recommendations

4.3.1 CONCLUSIONS

In the absence of a full regional water model, the water model development assumed that the connection to each existing pressure zone is a constant HGL with unlimited flow (i.e. the connections are modelled as fixed head reservoirs). This assumption does not reflect the actual system, however, in the absence of a full system model it is a reasonable assumption.

The water model results indicate the following for both the high-density and low-density population scenarios:

Flow Scenario	Pressure Range (psi)	Max Velocity (m/s)	Available Fire Flow (Lpm)
MDD High Density	49 – 83	1.9	N/A
PHD High Density	36 - 81	3.1	N/A
MHD High Density	55 - 84	< 1.5	N/A
MDD + FF High Density	> 22	< 2.4	1,500 - 7,900*
MDD Low Density	55 - 84	< 1.5	N/A
PHD Low Density	52 – 84	< 1.5	N/A
MHD Low Density	57 - 85	< 1.5	N/A
MDD + FF Low Density	> 22	< 2.4	4,400 - 9,200*

* Based on the assumptions of a constant HGL at the connections to the existing pressure zones. Therefore, the values for available fire flow should be considered with a low level of confidence.

4.3.2 RECOMMENDATIONS

The presented subdivision plan is preliminary and subject to change, therefore the MHD, MDD, PHD and required FF demands presented in this report may change resulting in changes to proposed water distribution preliminary design. It is recommended that the level of service and distribution system requirements be reassessed during subsequent design stages. Also, during the next stages of design the sizing and placement of regional water infrastructure should be considered.

In the absence of a full system model the effect of the proposed development on the level of service of the remaining system could not be assessed. Also, the effect of potential restrictions within the existing system on the proposed development could not be assessed. In Halifax Water's 2019 IMP, it was recommended that an all-pipe hydraulic model be developed. An all-pipe model can be used to assess fire flow objectives at each property or node in the system. It is recommended that the proposed



Development Servicing Scenario – Morris Lake

development be incorporated in the all-pipe model to perform a more refined fire flow level of service assessment for the development.



5 Wastewater Infrastructure

Although not directly indicated in the East Region Wastewater Infrastructure Plan (GM BluePlan, 2019), it is assumed that the development area will ultimately contribute sanitary flows to the gravity pressure main downstream of the Bissett Lake PS. Existing sanitary sewers within existing residential areas to the southwest along Cow Bay Road are sized to meet only local sanitary contributing flows, and are not intended for downstream conveyance of flows from the Morris Lake development area. It is assumed that local pump stations will be required at point of discharge to the gravity pressure main and ultimately the downstream Eastern Passage WWTF (EP WWTF).

In review of preliminary grading for the development area, it was identified that sufficient grade exists to permit construction of network of gravity sewers for the majority of the development contributing area (northern two-thirds to three-quarters of the development) to a low point adjacent to Smelt Brook where the gravity pressure main makes a northward bend. A new pump station has been demonstrated in this area, as well as at the northerly limit of the development to service lands effectively separated by the alignment of the existing gravity pressure main. Additional small lift stations are anticipated to be required to service trapped low areas south of the Shearwater Trail (Areas R106A, R207A, R110A, and R210A on **Drawing SA-1**). These minor lift stations are anticipated to contribute to the gravity pressure main and conceptual pump station at the Shearwater Trail extension.

A network of gravity sanitary sewers has been conceptualized for the development area as indicated on **Drawing SA-1**. Sizing of the gravity sewers has been completed as per Halifax Water design requirements noted in sections above, and based on population estimates for the development area. Design sheets for the gravity sewer segments are included in **Appendix B**, and are based on the highest (most conservative) population density scenario, excluding minor contributing lands directed to existing sanitary sewers on Atholea Drive.

Table 5-1: Estimated Peak Sanitary Discharge

Development Scenario	Population	ICI Contributing Area (ha)	Total Catchment Area (ha)	Peak Flow (L/s)
Low	9,536	2.85	222.7	220.9
Medium	13,280	2.85	222.7	269.1
High (Developer-Requested)	21,457	2.85	222.7	367.9

Due to grading constraints in areas adjacent to existing watercourses (particularly on the western boundaries of the development area), sanitary sewer depths may exceed the maximum permissible



sewer cover of 5.0m. A local sanitary sewer may be proposed at detailed design to run parallel to the deeper sewer segments to service adjacent residential areas.

5.1 Implications & Master Plan Alignment

The Wastewater Infrastructure Plan (GM Blue Plan, 2020) identified infrastructure needs to maintain the level-of-service goals for Halifax's existing residents and interests, as well as to maintain this as identified growth occurs. The implications of the FSC growth areas on the Wastewater Infrastructure Plan (WIP) recommendations are thus of interest as these growth areas are in addition to those considered in the 2020 WIP. The FSC growth areas represent a significant increase in the service area considered within the planned growth horizon at the time of the completion of the 2020 WIP. As a result, the additional growth areas to be accommodated would be expected to have an impact on regional infrastructure capacity requirements and their planned upgrades - most notably, the gravity trunk sewer and the EP WWTP.

The 2020 WIP identified several upgrades (Strategy 1c: Enhanced Conveyance) in the collection system upstream of the EP WWTF. These are summarized in **Table 5-2**, and shown on **Figure 5-1** as taken from the 2020 WIP report.

Table 5-2: Eastern Passage Required Projects (taken from 2020 WIP Tables 24 and 25)

Project	Year	Description
Install new pressure-gravity sewer with pump out stations	2020	Required immediately as main capacity restriction in sewershed and triggered by growth.
RDII Reduction Program	2020-2036	Long-term program expected. RDII reduction was started in the Eastern Passage and Loon Lake areas, as it impacts upgrades to Pumping Stations. RDII reduction in the Cole Harbour area is delayed due to staggering the program and no growth in the area. However, RDII reduction in Cole Harbour area is scheduled to occur before upgrades to Bisset Lake PS are initiated.

Development Servicing Scenario – Morris Lake

Project	Year	Description
Upgrades to Quigley's Corner Pumping Station and Pumping Station Optimization	2021-2026	Required after RDII Reduction program is completed in EP area, as it will reduce flows to Quigley's Corner PS and upgrades required to remove spills.
Upgrades to Memorial Drive Pumping Station	2031-2036	Required after RDII Reduction program is completed in Loon Lake area, as it will reduce flows to Memorial Drive PS and upgrades required to remove spills.
Linear upgrades (Forest Hills Parkway, Colby Drive and Caldwell Road)	2031-2046	Local linear upgrades are predominantly to resolve existing issues flagged in the wastewater hydraulic model; however, field verification should be completed to determine how soon these projects will be required.
Upgrades to Beaver Crescent Pumping Stations	2036-2041	Upgrades to Beaver Crescent Pumping Station forcemain were underway in 2020. Initiate after upgrades on Beaver Crescent PS forcemain are complete and new pressure-gravity sewers are installed with forcemains reconnected.
Upgrades to Caldwell Road Pumping Station	2039	Required after upgrades along Caldwell Road to remove flow restrictions upstream of the Pumping Station and triggered by growth in the Morris Lake development.



Development Servicing Scenario – Morris Lake

Project	Year	Description
Upgrades to Bissett Lake Pumping Station	2041	Upgrades to Bissett Lake pumping are impacted by numerous projects, including the installation of the pressure-gravity sewers downstream to remove flow restrictions and RDII reduction in catchments upstream of the Pumping Station.
Decommission asbestos pressure-gravity sewer	2043	Decommissioned after new pressure-gravity sewer is installed and operational.

The 2020 WIP does not mention the extent of capacity restrictions associated with the deficiencies identified, nor the capacity gained through the recommended upgrades.

The 2020 WIP also identifies that there were ongoing odour issues due to long retention times in the pressure-gravity system. The high priority for the upgrade of that system aligned with these issues.

Refer to **Figure 5-2** for an overview of how the Morris Lake lands are envisioned to connect to the existing HRM collection system via pressure-gravity sewers.

5.1.1 CONVEYANCE IMPACTS

The most significant impact from the Morris Lake lands on the conveyance upgrades identified in the 2020 WIP would be on the pressure-gravity system. This system collects flow from a large area and a number of pump stations before discharging downstream towards the EP WWTF. It will be important to confirm that added flow from Morris Lake can be accommodated within the existing and planned configurations for the pressure-gravity system. We estimate that the design wet weather flow from Morris Lake reach upwards of 368L/s. Combined with the design wet weather flow from Westphal (566L/s), an additional 934L/s can be expected.

This consideration merits the use of the City's updated hydraulic model assessed in context of Regional servicing needs within the framework of the IMP. This includes alternatives evaluations to determine a preferred regional servicing and infrastructure upgrades strategy that best accommodates the broader needs and goals of the HRM and HW. This note is also applicable to the Westphal FSC lands interest and the cumulative impact of both these growth areas should be considered.



5.1.2 PUMP STATION AND WWTF IMPACTS

The Morris Lake growth area will need to be serviced by 4 pumping stations within the development's service area, but they are not expected to impact the conveyance to any of the existing pump stations within HRM. The internal Morris Lake land pump stations will lift the sewage into the pressure-gravity system and convey directly to the EP WWTF. As such, the planned upgrade of the gravity-pressure sewer and infrastructure at the EP WWTF should be revisited to ensure it can accommodate the additional flow from the Morris Lake growth area. We estimate that the design peak daily dry weather flow from Morris Lake reach upwards of 294L/s. Combined with the design peak daily dry weather flow from Westphal (367L/s), an additional 661L/s can be expected.



Development Servicing Scenario – Morris Lake

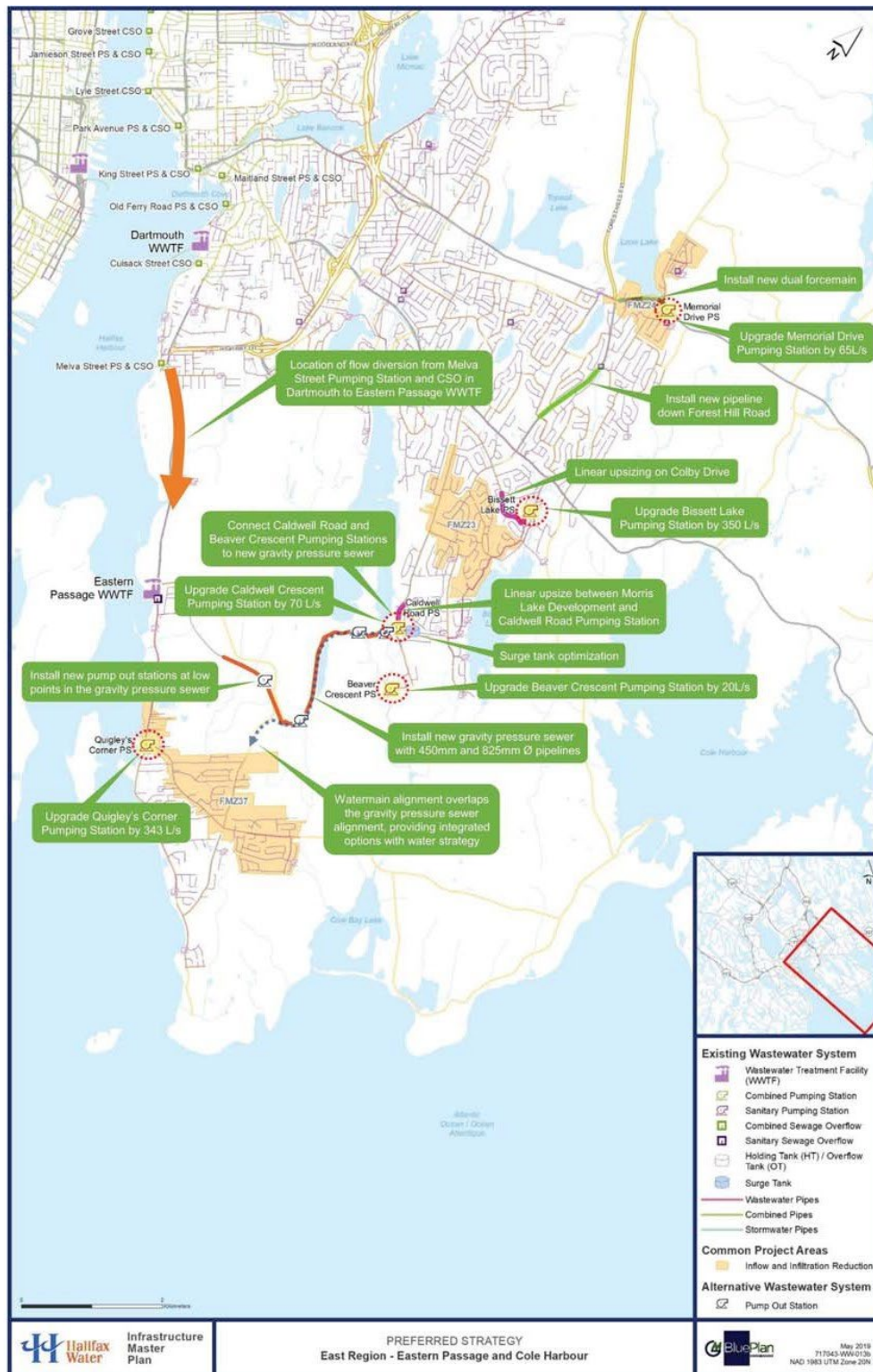


Figure 5-1: Eastern Passage East Region Preferred Servicing Strategy (GM BluePlan, 2020).



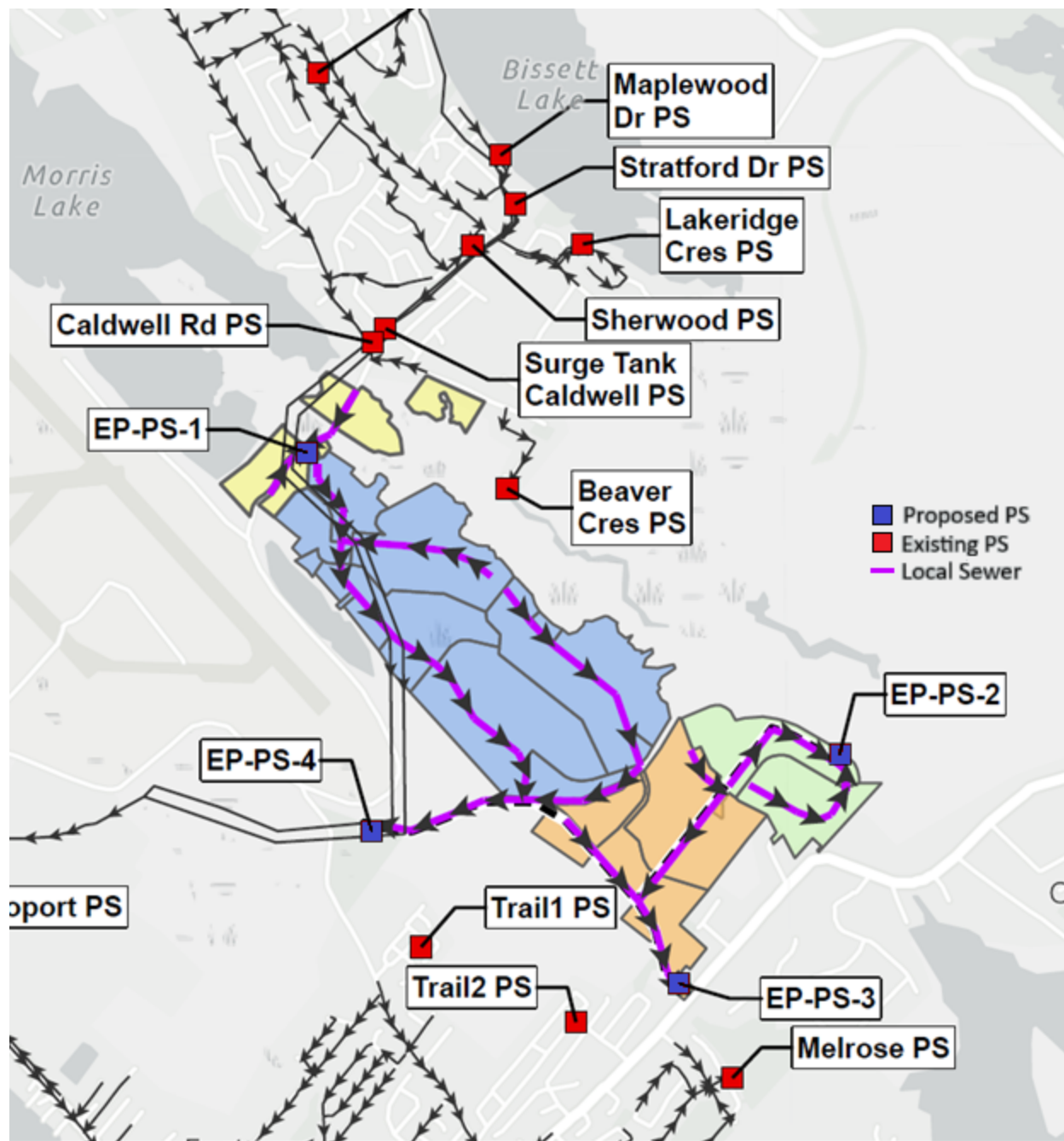


Figure 5-2: Morris Lake Wastewater Servicing.

5.1.3 ADDITIONAL WASTEWATER SERVICING STRATEGIES OF NOTE

The conveyance and pump station / WWTF impacts presented explore how the Morris Lake lands could integrate into the wastewater servicing strategy that was recommended in the 2020 WIP. Other servicing strategies exist however that merit consideration. The 2020 WIP explored several high-level approaches.



Development Servicing Scenario – Morris Lake

The assessed strategies included replacing the pressure-gravity servicing strategy with a range of large trunk sewer tunnelling alignments. These tunnelling alternatives provide the benefit of allowing several existing pumping stations to be ultimately decommissioned in the sewershed upstream of the EP WWTF.

Other items of note with the tunnelling strategies include the mitigation of existing identified odour issues that accompany the pressure-gravity system, as well as potential mitigation of required storage volume expansions and prescribed pumping station capacity upgrades. A transition from pressure-gravity to a deeper tunnel could also be implemented in a phased approach, where the trigger to proceed would consider the ability to expand/upgrade existing infrastructure.

Specific to the Morris Lake growth area, it is possible that a tunnel alternative could be introduced at a deeper alignment that would remove (or significantly reduce) the requirements for pump stations to service the growth area. There are a range of tunnel alignments that were considered feasible in the 2020 WIP, and these included options that saw the tunnel cross through the Shearwater DND property. The evaluation of preferred tunnelling alignment warrants renewed consideration considering the extent of the upstream growth considered in this study. The cost effectiveness and benefits of such a solution could potentially be enhanced when considering a potential need to accommodate servicing within both the Morris Lake and Westphal areas.

We recommend that HW and HRM revisit the technical and financial evaluations of the servicing strategy for the EP WWTF. A cost-benefit analysis would enhance the confidence that the implemented servicing strategies to come are best aligned with HW and HRM priorities, while maintaining (or enhancing) service to existing residents and proactively planning those infrastructure upgrades required to maintain this same level of service to future growth areas. Such an analysis would align well within the context and scope of an IMP update.



6 Grading

The objective of the grading design strategy is to satisfy the stormwater management requirements, adhere to permissible grade raise restrictions where possible for the development area, and provide for minimum cover requirements for storm and sanitary sewers. The grading design also follows any recommendations outlined in the Infrastructure Master Plan where possible, and endeavors to provide an overland route to existing watercourses as described in Stantec's *Morris Lake Watershed and Stormwater Study – Final Report* (2025).

Preliminary grading has been set at conceptual road centerline, with a minimum overland flow slope of 0.1% from high point to high point. Grading endeavours to maintain a road longitudinal slope less than 3% in the majority of development areas to facilitate driveway access and limit requirements for retaining walls at future internal property lines. Tie-ins to existing surrounding Rights-of-Way have been respected based on high level topography as obtained by provincially sourced LiDAR.

Development setbacks should be established based on the worst-case scenario between the regulatory 100-year floodplain, the meander belt width of the watercourse, aquatic setback limit of 15 meters from top-of-bank or 30 meters from normal high water marks whichever is greater; and the slope stability setback.

Based on the above, it is recommended that no active development be permitted within the limits of the 100-year regulatory floodplain. Some reduced-risk uses, such as recreational sports fields and trails, may be considered. This is subject to design considerations that effectively mitigate and/or minimize the impact of such development on the floodplain and protect the riparian corridor functions.

Moreover, any proposed development should adhere to the constraints identified in the LSA constraint mapping. This includes areas of significant wildlife habitat, wetlands, steep slopes, and other environmentally sensitive areas. In areas where development is proposed within or in proximity to the identified floodplain, suitable mitigation measures should be implemented.

Within the Morris Lake development specifically, highly sloped areas are noted under existing conditions in proximity to eastern and western development boundaries at Cow Bay River and Smelt Brook respectively. It is likely that retaining walls will be required to facilitate development and tie-in to surrounding roadways without heavy deviation from current elevations of nearby watercourses.

The conceptual Grading Plan for the development area is indicated on **Drawing GP-1** in **Appendix C**.



7 Preliminary Costing

The scope of work for this project involves costing of infrastructure upgrades. Since many servicing projects would be associated with road improvements, the costing can be found in the Morris Lake Area Summary Report and coordinated with the transportation conclusions.



APPENDICES



Appendix A Potable Water Infrastructure





**HALIFAX REGIONAL MUNICIPALITY
FUTURE SERVICED COMMUNITIES –
EASTERN PASSAGE WATER SERVICING
PLAN**
Final Report

April 9, 2025

Prepared for:
Halifax Regional Municipality

Prepared by:
Stantec Consulting Ltd.

Project Number:
160410459

Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan

Revision	Description	Author	Date	Quality Check	Date	Independent Review	Date
0	Water Servicing Plan Technical Memo	JB	2024-05-07	JS	2024-05-10	DT	2024-05-10
1	Final	JB	2025-04-09			DT	2025-04-09



Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan

The conclusions in the Report titled Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan are Stantec’s professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient’s own risk.

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1 Introduction

The Halifax Regional Municipality (HRM), through their Regional Municipal Planning Strategy (Regional Plan), have identified four Future Serviced Communities which require a comprehensive neighbourhood planning process that includes a review of existing servicing infrastructure capacity and constraints. The four study areas are as follow.

- Sandy Lake
- Highway 102 Corridor
- Eastern Passage (identified as Morris Lake in the RFP)
- Westphal (identified as Akoma Lands in the RFP)

This final report outlines the results from the review of the potable water servicing within the Eastern Passage Development area and summarizes the conceptual water servicing plan required to meet the established level of service and design criteria.

2 Level of Service and Design Criteria

The following resources were used to define the level of service and design criteria for potable water servicing:

- Halifax Water's Design Specifications (June, 2023)
- Halifax Water's Water Infrastructure Servicing Plan Final Report Volume 2 of the Infrastructure Master Plan
- Halifax Water's Regional Pressure Zone Map: West-Central-East (Map Issued April 2023)

2.1 Halifax Water Design Specifications

The Halifax Water Design Specifications was reviewed, and the following items were noted for use in the preliminary water distribution designs:

- Water System extensions must be carried out in conformance with a Water Master Plan.
- Water distribution systems are to be designed to accommodate the greater of Maximum Day Demand plus fire flow demand (MDD + FF), or Peak Hour Demand (PHD).
- Design to be supported by a hydraulic analysis to determine flows, pressures and velocities under Maximum Day Demand plus fire flow demand, Peak Hour Demand and Minimum Hour Demand conditions, describing any impacts on the existing system.



Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan

2 Level of Service and Design Criteria

However, without access to the regional water model the potential effects of a proposed design to the existing system cannot be assessed.

- The analysis is to begin at a location of known hydraulic grade and include demands on the existing system downstream of the known hydraulic grade line, as well as demands generated by the proposed development. Hydrant flow test(s) are to be conducted to confirm the static hydraulic grade line and determine the system curve and available residual pressure at the boundaries of the analysis.
- Hazen Williams 'C' values to be used for the design of water distribution systems, regardless of pipe material, will be:

Table 2-1: Friction Factors from Halifax Water Design Specifications

Diameter of Water Main (mm)	'C' Factor
150	100
200 to 250	110
300 to 600	120
Larger than 600	130

- Estimated fire flow requirements as shown in the table below:

Table 2-2: Fire Flow Requirements

Land Use	Fire Flow (Lpm)	Duration (hrs)	Number of Fire Hydrants
Single Unit Dwellings	3,300	1.5	1
Two Family Dwellings	3,300	1.5	1
Townhouse	4,542	1.75	1
Multi-unit high rise	13,620	3	3
Commercial	13,620	3	3
Industrial	13,620	3	3
Institutional	13,620	3	3

- Maximum pipe velocity is not to exceed the following:

Table 2-3: Maximum Pipe Velocity

Flow Condition	Max Velocity (m/s)
Peak Hour Demands	1.5
Fire Flow	2.4

- Minimum watermain size:



Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan

2 Level of Service and Design Criteria

- 200 mm for local distribution watermain
- 300 mm for feeder mains
- Allowable pressure range:
 - ADD and MDD: 50 – 80 psi
 - Minimum Hour (MHD) and PHD: 40 – 90 psi
 - MDD + FF: > 22 psi
- The per capita average day demand (ADD) is 375 L/per/day.
- The peaking factors used to calculate MHD, PHD and MDD must be based on:
 - Historical information
 - Nova Scotia Environment guidelines, or
 - As directed by the Engineer

Where the proposed development requires a booster station, PRV or storage, peaking factors shall be determined in consultation with the Engineer.

Table 2-4: Peaking Factors

Land Use	Minimum Hour	Maximum Day	Peak Hour
Low Density Residential	0.70	1.65	2.50
High Density Residential	0.84	1.30	2.50
Industrial	0.84	1.10	0.90
Commercial	0.84	1.10	1.20
Institutional	0.84	1.10	0.90

2.2 Halifax Water IMP Volume 2

The following items from the IMP volume 2 were noted for use in the preliminary water distribution design:

- Overview of existing water system network
- Existing Pockwock and Lake Major Distribution Systems Schematic
- Proposed projects to enhance system resiliency. *The 2019 IMP proposed a new 400 mm diameter transmission main and PRV through the Eastern Passage Development lands to improve serviceability to the Eastern Passage/Woodside Low zone.*



2.3 Halifax Water's Regional Pressure Zone Map

Halifax Water provided a copy of the Regional Pressure Zone Map: West-Central-East (Map Issued April 2023). The pressure zone map was used to determine the hydraulic grade line of potential connection points for the proposed development area.

3 Proposed Development

3.1 Site Location

The Eastern Passage Development area is situated to the south of Dartmouth, between Portland Estates and Eastern Passage. The development area is near the 12 Wing Shearwater Airport, which is located to the southwest of the site. The proposed development area borders Caldwell Road to the west, Morris Lake to the north, Atholea Drive to the northeast, Cow Bay River to the east, and Cow Bay Road/Dyke Road to the south. The proposed development area totals approximately 460 hectares of undeveloped land.

3.2 Adjacent System Description

The proposed Eastern Passage development is located adjacent to the Eastern Passage/Woodside Low, Atholea Low, and 24 East High pressure zones. These pressure zones are included in the Lake Major system and are serviced by the Lake Major Water Treatment Facility.

The hydraulic grade lines (HGL) of the adjacent pressure zones are summarized in the following table and illustrated in **Figure 3-1**.

Table 3-1: Adjacent Pressure Zones Hydraulic Grade Lines

Pressure Zone	HGL (ft)	HGL (m)
Eastern Passage/Woodside Low	255 - 265	78 - 81
Atholea Low	265 - 270	81 - 82
24 East High	380 - 390	116 - 119



Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan

3 Proposed Development

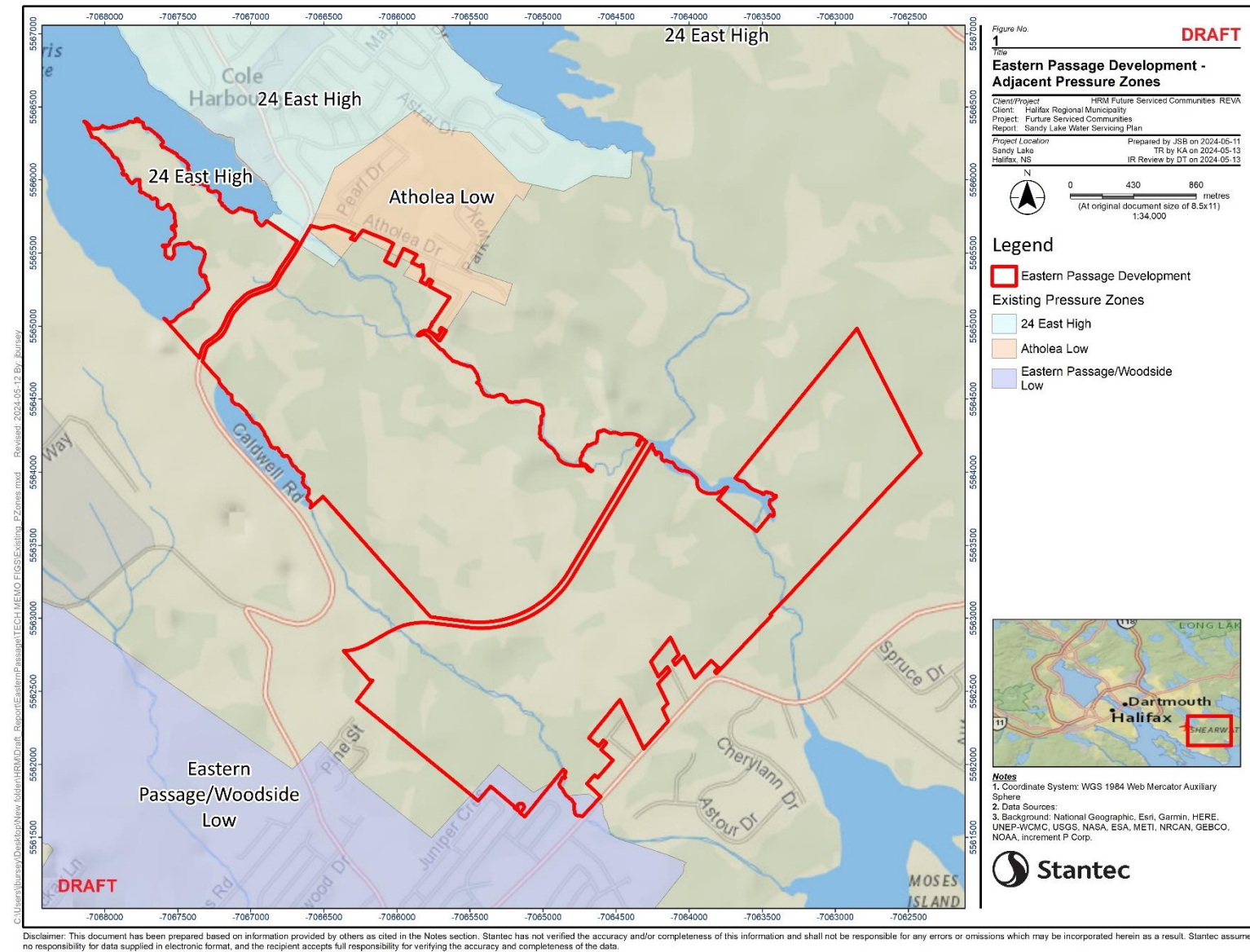


Figure 3-1: Eastern Passage Development - Adjacent Pressure Zones



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3.3 Proposed Development

3.3.1 GRADING

The proposed grading plan (street level) for the Eastern Passage development ranges from approximately 17 m near Cow Bay Road to 38 m near the eastern/center of the proposed development (Figure 3-2).

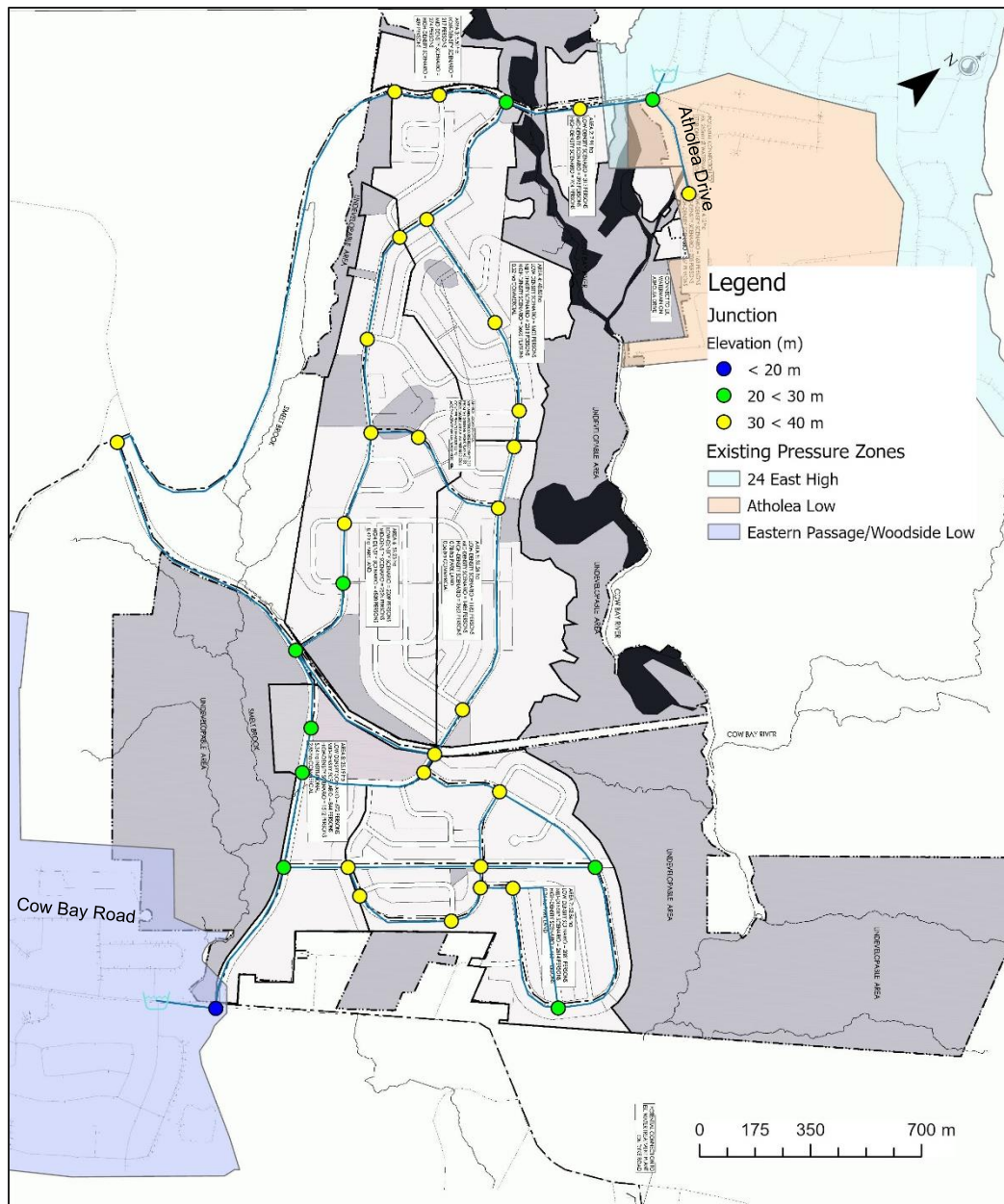


Figure 3-2: Proposed Site Grading



3.3.2 HYDRAULIC GRADE

Halifax Water's water system level of service pressure range is 50 – 80 psi for ADD and MDD and 40 – 90 psi for PHD and MHD. Given the hydraulic grade line of the adjacent pressure zones, the serviceable range of elevations within those pressure zones are presented in **Table 3-2**. Comparing the serviceable elevation ranges to the development elevation ranges indicate that the proposed re-delineation of the Atholea Low and Eastern Passage/Woodside Low pressure zones can accommodate the development from a pressure perspective. The proposed connection points are presented in **Figure 3-4**, and pressure zone re-delineation is illustrated in **Figure 3-3**. Isolation valves, used to separate the pressure zones, are mimicked in the model by “closing” pipes.

Table 3-2: Serviceable Range per Pressure Zone (From 40 to 90 psi)

Pressure Zone	HGL (m)	Serviceable Elevation (m)*	
		Low	High
Eastern Passage/Woodside Low	78 - 81	15 - 18	50 - 53
Atholea Low	81 - 82	18 - 19	53 - 54
24 East High	116 - 119	53 - 56	88 - 91

* Neglecting friction loss

Hydrant flow tests were conducted on Atholea Drive, Cow Bay Road, and Caldwell Road to confirm the static pressure of the connecting pressure zones near the proposed connection point. The test results are presented in **Appendix A**. The static pressure reported during the tests are presented in **Table 3-3**. The approximate ground elevation at each test location and resulting HGL at each test location are also presented in **Table 3-3**. As compared to the table above, a HGL of 79 m for the Atholea Low pressure zone (test #1) is slightly lower than that presented in Halifax Water's Pressure Zone Map, similarly the HGL's recorded at test locations 2 and 3, are slightly below the HGL expected from HW's pressure zone map. The lower HGL for tests #2 and 3 may be attributed to the tests being conducted at the extremities of the pressure zone. However, since test #1 was conducted immediately downstream of the Atholea Drive PRV chamber, it was expected that the static pressure of test #1 would have been between 81 and 82 m. This may be due to discrepancies in the elevation data. It is recommended that the setting of the Atholea Drive PRV be checked.

Table 3-3: Summary of Static Pressures Recorded

Test #	Test Location	Static Pressure (psi)	Approx. Ground Elevation (m)	HGL (m)
1	Atholea Drive near Cadwell Road	70	30	79
2	Cow Bay Road near Smelt Brook	80	19	75
3	Caldwell Road near Hornes Road	54	39	77



Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan

3 Proposed Development

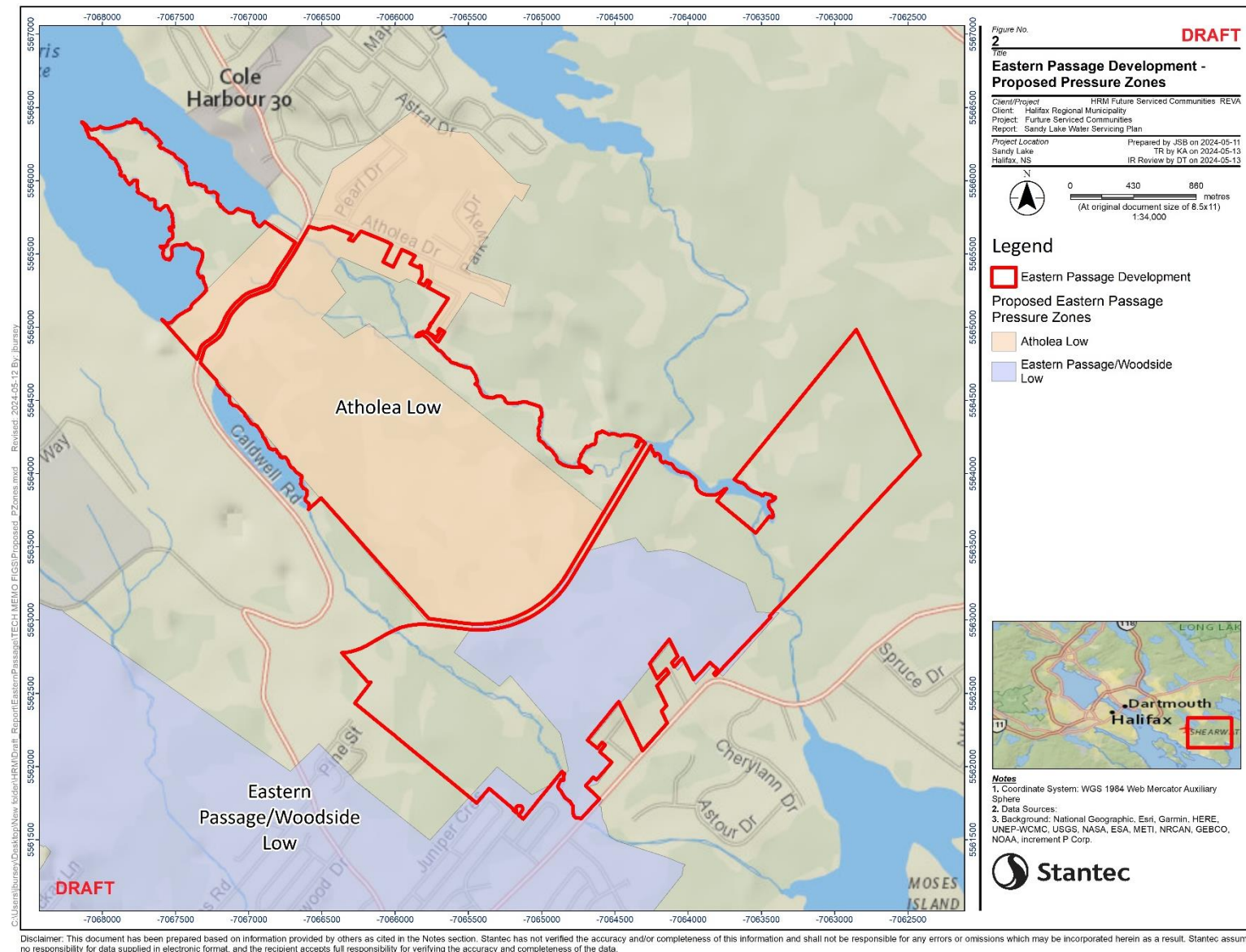


Figure 3-3: Eastern Passage Development - Proposed Pressure Zone Re-Delineation



3 Proposed Development

3.3.3 DEMANDS

Various development scenarios were prepared, considering different land uses/building types to estimate potential population. Populations corresponding to high- and low-density scenarios are described in Section 2 of Stantec's *Halifax Regional Municipality Future Serviced Communities Volume 2: Eastern Passage Area* and presented in **Table 3-4**. The corresponding demands are presented in **Table 3-5**. Peaking factors per Halifax Water's Design Specification (**Section 2.1**) were applied to estimate MHD, MDD and PHD. Blended peaking factors were used for the MHD and MDD high-density scenarios. However, for the low-density scenario only single unit dwellings were considered and therefore the low-residential density peaking factors for MHD and MDD scenarios were used to estimate demands for the low-density scenario. A peaking factor of 2.5 was used for the PHD peaking factor for both the high- and low-density scenarios.

Table 3-4: Population Estimates

Scenario	Population
High Density	21,588
Low Density	9,594

Table 3-5: Proposed Demands

Scenario	ADD (Lpm)	MHD (Lpm)	MDD (Lpm)	PHD (Lpm)
High Density	5,622	4,226	8,550	14,055
Low Density	2,498	1,749	4,122	6,246

3.3.4 WATER MODEL

A steady state water network model of the proposed development was built in Innovyze InfoWater Pro 3.5 to assess distribution system requirements within the development to accommodate the MHD, MDD, PHD and MDD+FF demands for the high-density and low-density scenarios. Per the criteria outlined in **Section 2.1**, water distribution systems are to be designed to accommodate the greater of MDD + FF, or PHD. Reservoirs with fixed head equal to the pressure zones' HGL were used to simulate the connections to the existing Atholea Low and Eastern Passage/Woodside Low pressure zones. The HGL recorded during the pressure tests for each zone was assumed. Modelling the existing system in this manner does not reflect the actual system, as it assumes the connecting points are always at a constant HGL, regardless of demand scenario, and that there is an unlimited supply of water from the zone. However, in the absence of a full system model it is a reasonable assumption. The distribution system within the development was edited to achieve the level of service as described in **Section 2**. Currently, the two pressure zone extension areas are modelled as being serviced by single feeds. However, it is anticipated that during detailed design/construction, the watermains within the new serviced area will be connected and isolation valves and/or pressure reducing valves (PRV) used to maintain the pressure boundaries.



3 Proposed Development

Such design allows for redundancy; in the event of a watermain break the pressure zone boundary valve(s) can be opened and act as a secondary feed until repairs to the watermain can be made. Isolation valves, used to separate the pressure zones, are mimicked in the model by “closing” pipes.

The existing watermain in Caldwell Road and Atholea Drive, where it is expected to connect the Eastern Passage development to the existing Atholea Low zone, are 250 mm diameter mains. The existing watermain in Cow Bay Road, where it is proposed to connect to the Eastern Passage/Woodside Low zone, is also a 250 mm diameter. Assumed points of connection to the existing pressure zones are presented in **Figure 3-4**.

3.3.4.1 High-Density Population Scenario

Figure 3-4 illustrates the distribution of MDD for the high-density scenario throughout the model. The demands were distributed by density of development proposed, and generally (coarsely) placed at the nodes with the highest ground elevation. Placing the demands at the higher elevations is considered conservative from a hydraulics perspective, as the pressure at these nodes will account for headlosses resulting from the total demand and hence will be the lowest in their local areas. **Figure 3-5** presents the anticipated corresponding pressures throughout the development during MDD, which range from 49 psi (near the centre of the development) to 83 psi (near the connection to Cow Bay Road), within the development. These pressures are just below the range proposed for MDD scenario by Halifax Water’s Design Specifications.

Figure 3-5 also illustrates the proposed watermain sizes, which range from 250 mm and 300 mm diameter, with the majority being 250 mm diameter. These pipe sizes represent the backbone watermain for the development and do not include all local pipes. For this scenario, pipe velocities are less than 1.5 m/s (in accordance with Halifax Water’s Design Specifications), with the exception of the existing 250 mm on Atholea Drive, upstream of the proposed new watermain for the development, where the pipe velocity is approximately 1.9 m/s. Pipe diameters of 250 mm were selected for the analysis as the connecting pipes are also 250 mm diameter. If larger pipes were selected the impact of the development on the upstream watermain could go unnoticed in the model. A full water system model is recommended to assess how increasing pipe diameter in the development may affect the existing system.

The distribution of PHD is illustrated in **Figure 3-6**, and the results of the PHD analysis are presented in **Figure 3-6**. Pressures under the PHD scenario range from approximately 36 psi (which is just below the recommended pressure range) to 81 psi. The maximum pipe velocity for the PHD scenario is less than 1.5 m/s throughout most of the proposed system, with the exception of the connections to the existing systems (as shown in **Figure 3-7**). During a peak hour demand, the velocities through the connecting watermain to Atholea Drive is approximately 3.1 m/s, and the velocity in the Cow Bay Road watermain connection is approximately 1.7 m/s. The PHD analysis illustrates the importance of examining the effects of the development and the entire system. For instance, while increasing the size of the connection to Atholea Drive to 400 mm diameter in the model would reduce the velocity to less than 1.5 m/s and give the appearance of meeting all the design criteria, doing so would give the impression that the remainder of the system would also be meeting the design criteria, when it may not.



3 Proposed Development

MHD were also simulated, the distribution of MHDs and the resulting pressures are presented in **Figure 3-8** and **Figure 3-9**, respectively. Pressures under the MHD scenario range from approximately 55 psi to 84 psi.

Fire flow analysis in InfoWater Pro returns the flow available at each hydrant while maintaining residual pressure of 22 psi throughout the system and not exceeding pipe velocities of 2.4 m/s. The fire-flows required per Halifax Water's Design Specification vary by land use type as described in **Section 2.1**. The required fire-flows are presented in **Figure 3-10**. The total MDD + FF demand at each node is presented in **Figure 3-11**. For the high-density scenario multi-unit buildings are assumed throughout the development, and hence have a higher fire flow requirement, per Halifax Water's Design Specification. The results of the fire analysis are presented in **Figure 3-12**. The available fire flow range is approximately 1,500 Lpm to 7,900 Lpm which does **not** meet the total MDD + FF demands. However, it is important to note that these results are based on the assumptions of a constant HGL at the connections to the existing pressure zones and therefore should be considered with caution. Without a full system model, it is unknown if the system can really provide the fire flows presented. Therefore, it is recommended to examine the development's effect on the entire system by using a full (calibrated) system model (including any upstream improvements/upgrades required within the existing system due to the addition of these lands). However, such model development is beyond the scope of this study. Hence the pressures and available fire flows presented in the report should be considered preliminary.



Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan
3 Proposed Development

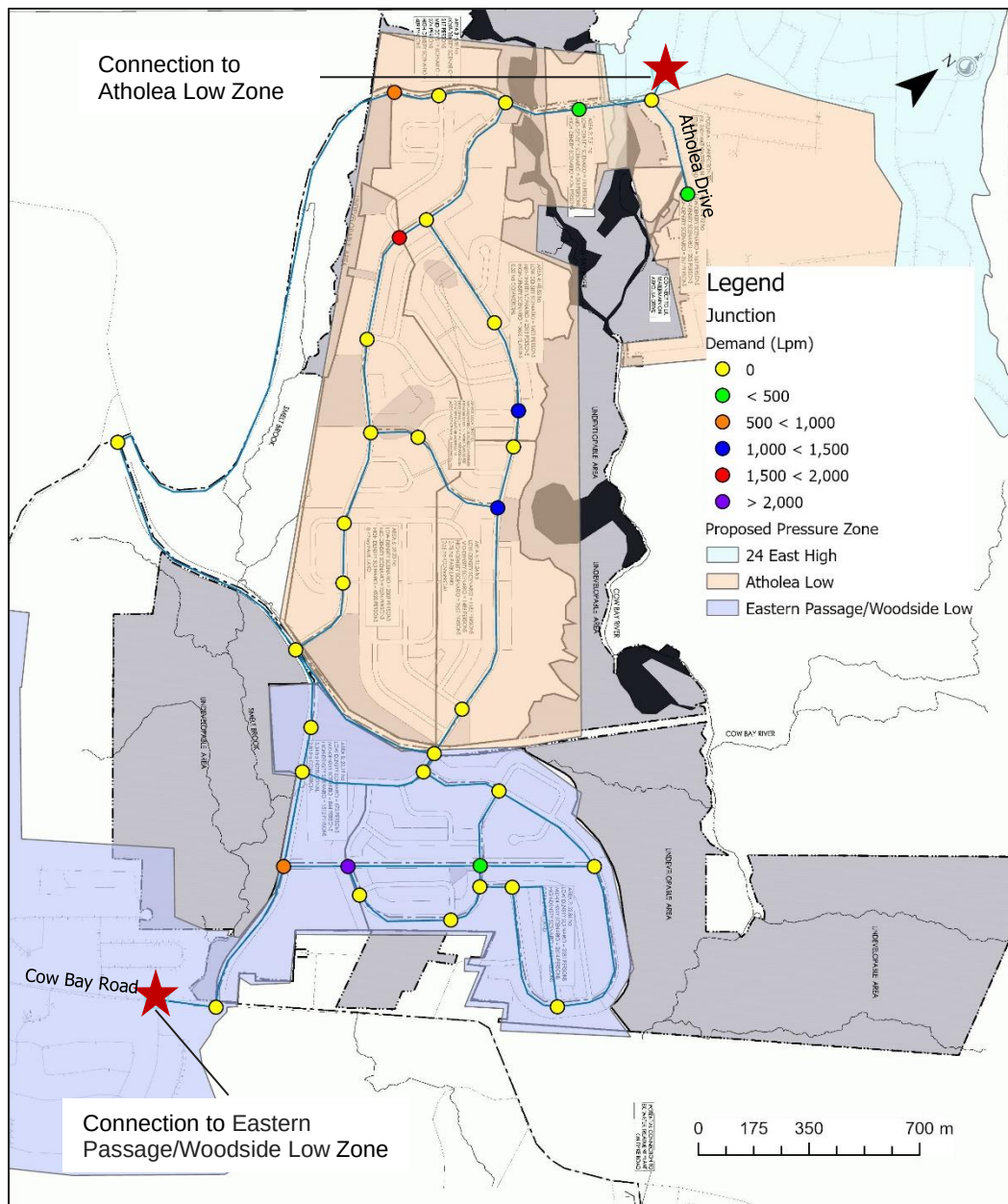


Figure 3-4: MDD Distribution (High-Density Scenario)

Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan

3 Proposed Development

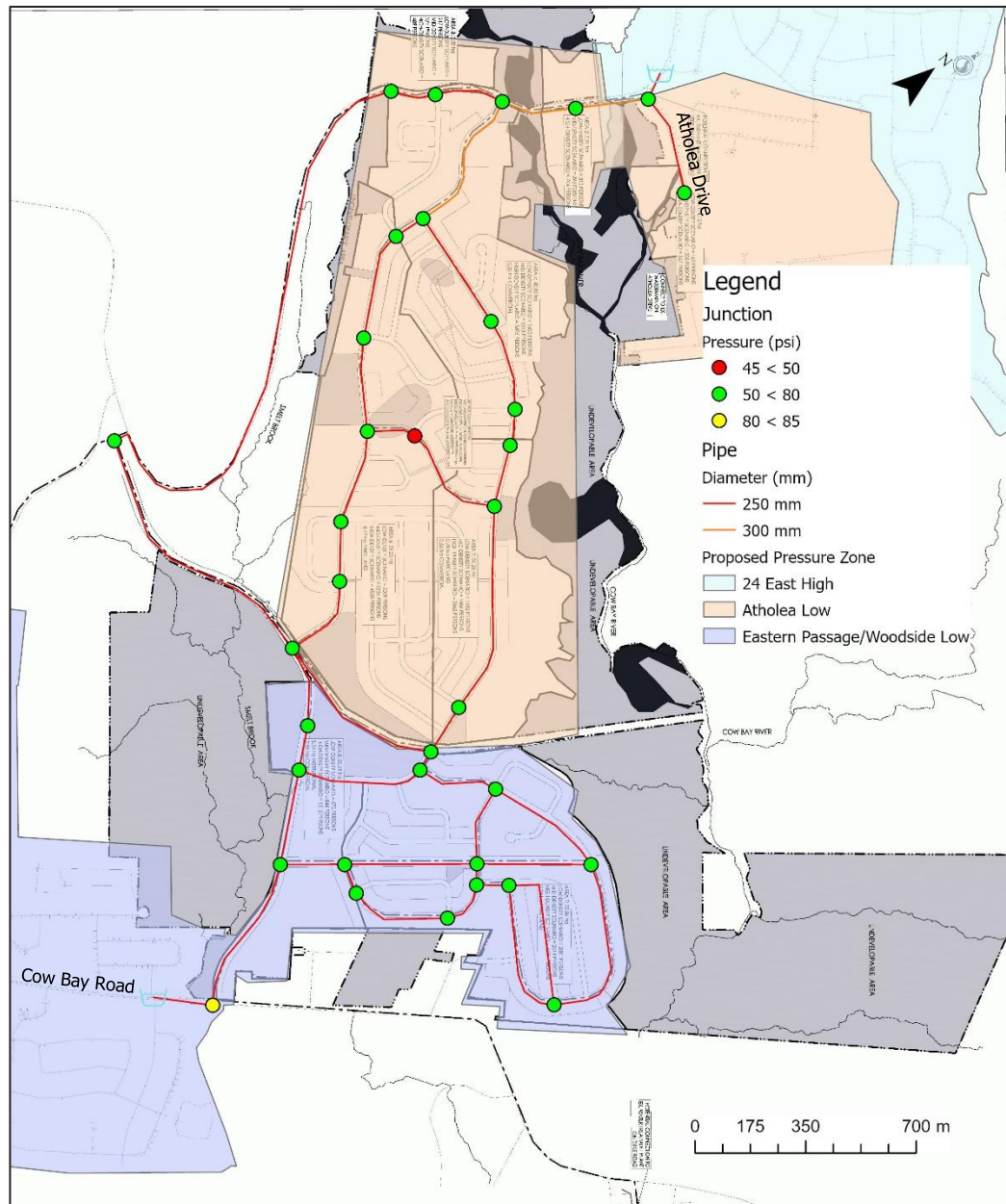


Figure 3-5: Pressure Distribution Under MDD (High-Density Scenario)

Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan
3 Proposed Development

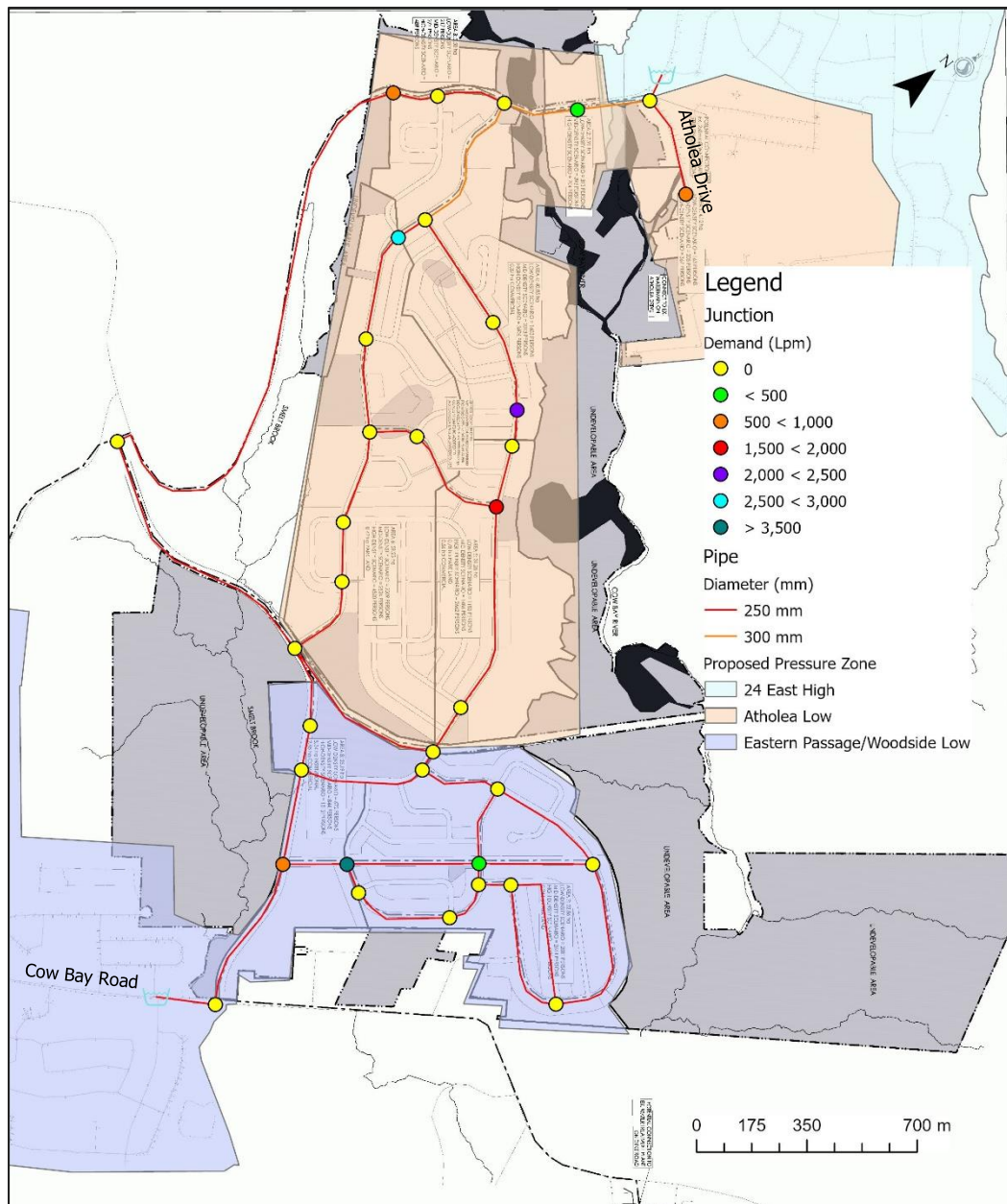


Figure 3-6: PHD Distribution (High-Density Scenario)



Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan

3 Proposed Development

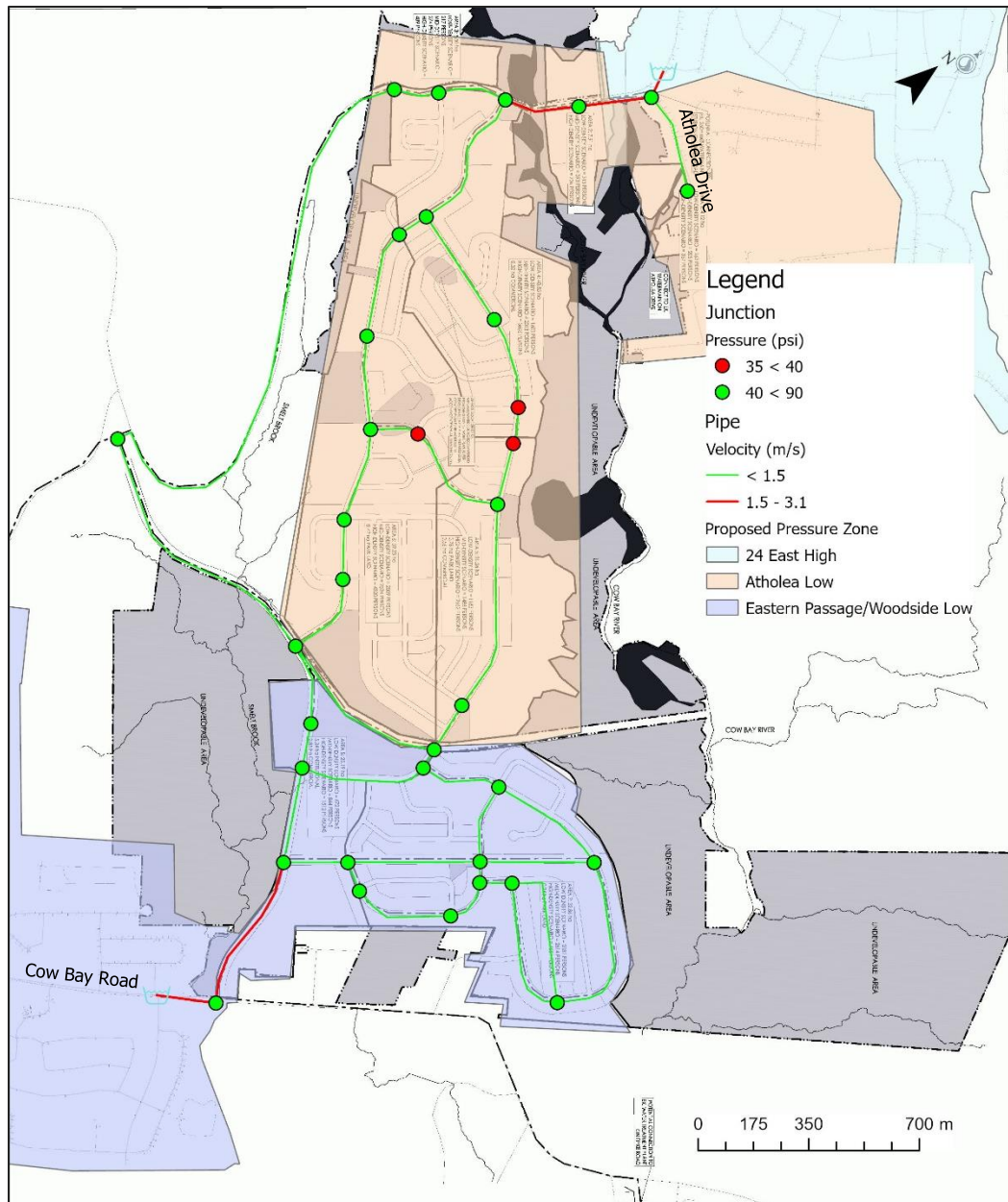


Figure 3-7: Pressure Distribution Under PHD (High-Density Scenario)

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3 Proposed Development

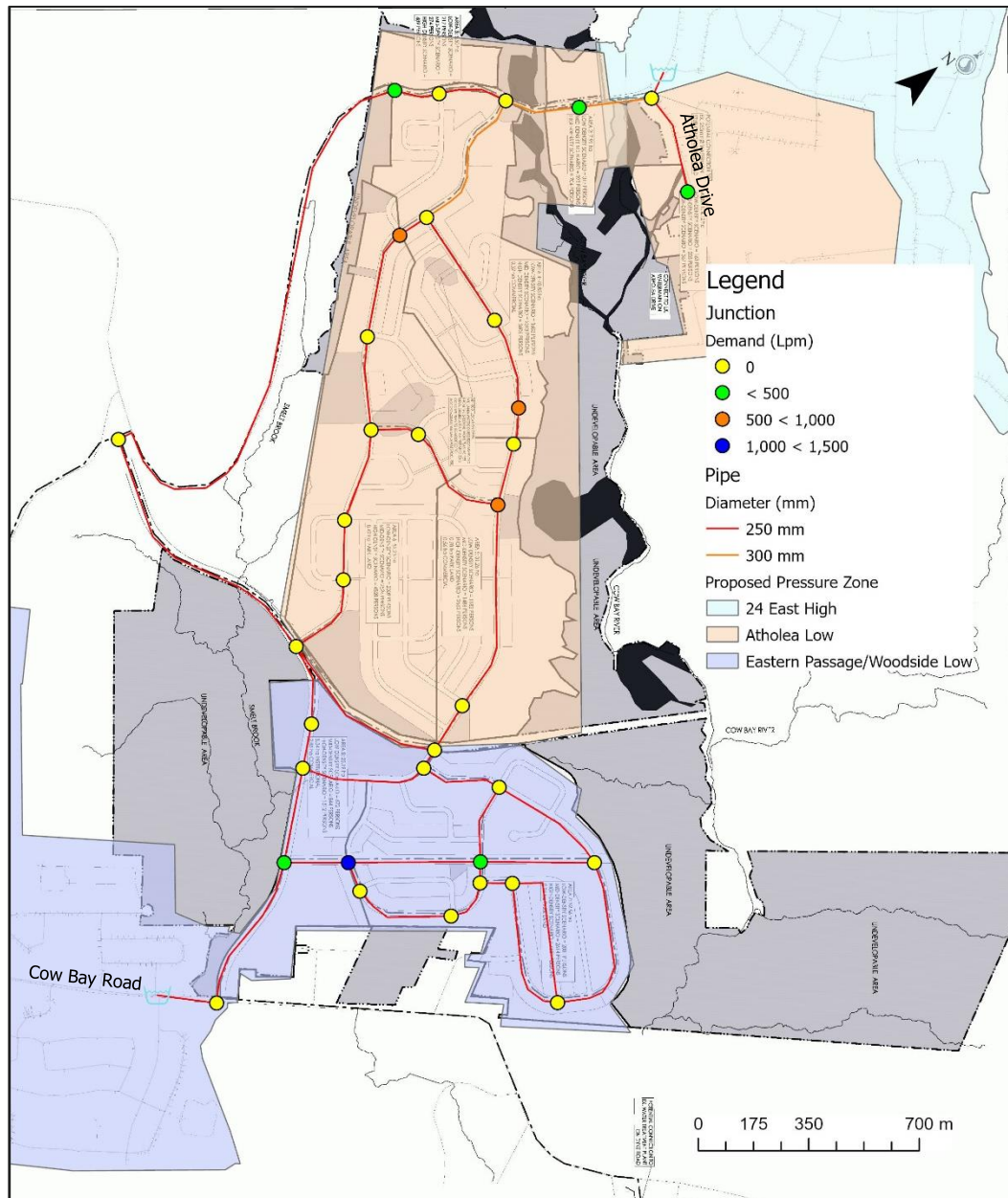


Figure 3-8: MHD Distribution (High-Density Scenario)



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3 Proposed Development

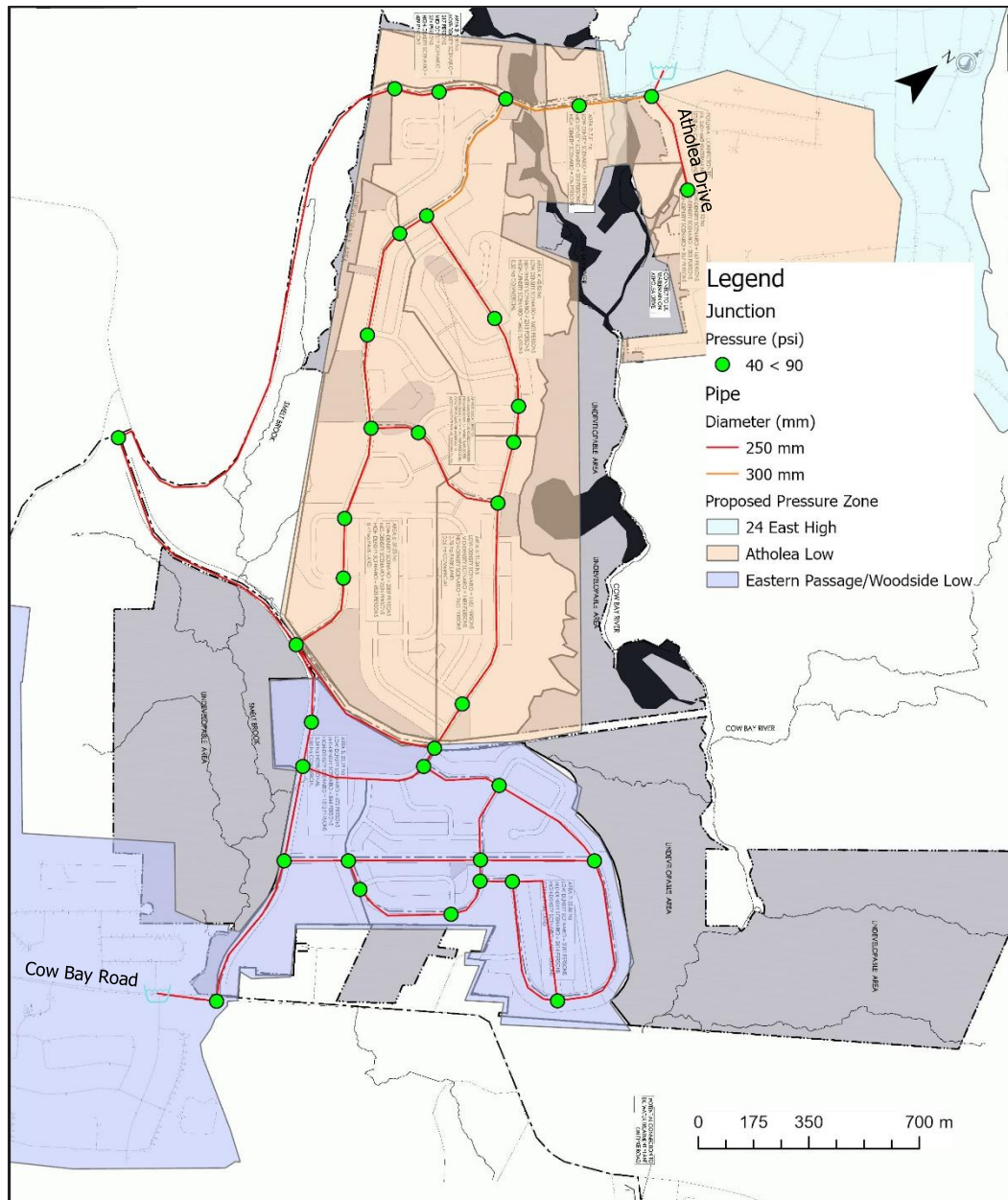


Figure 3-9: Pressure Distribution Under MHD (High-Density Scenario)

Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan
3 Proposed Development

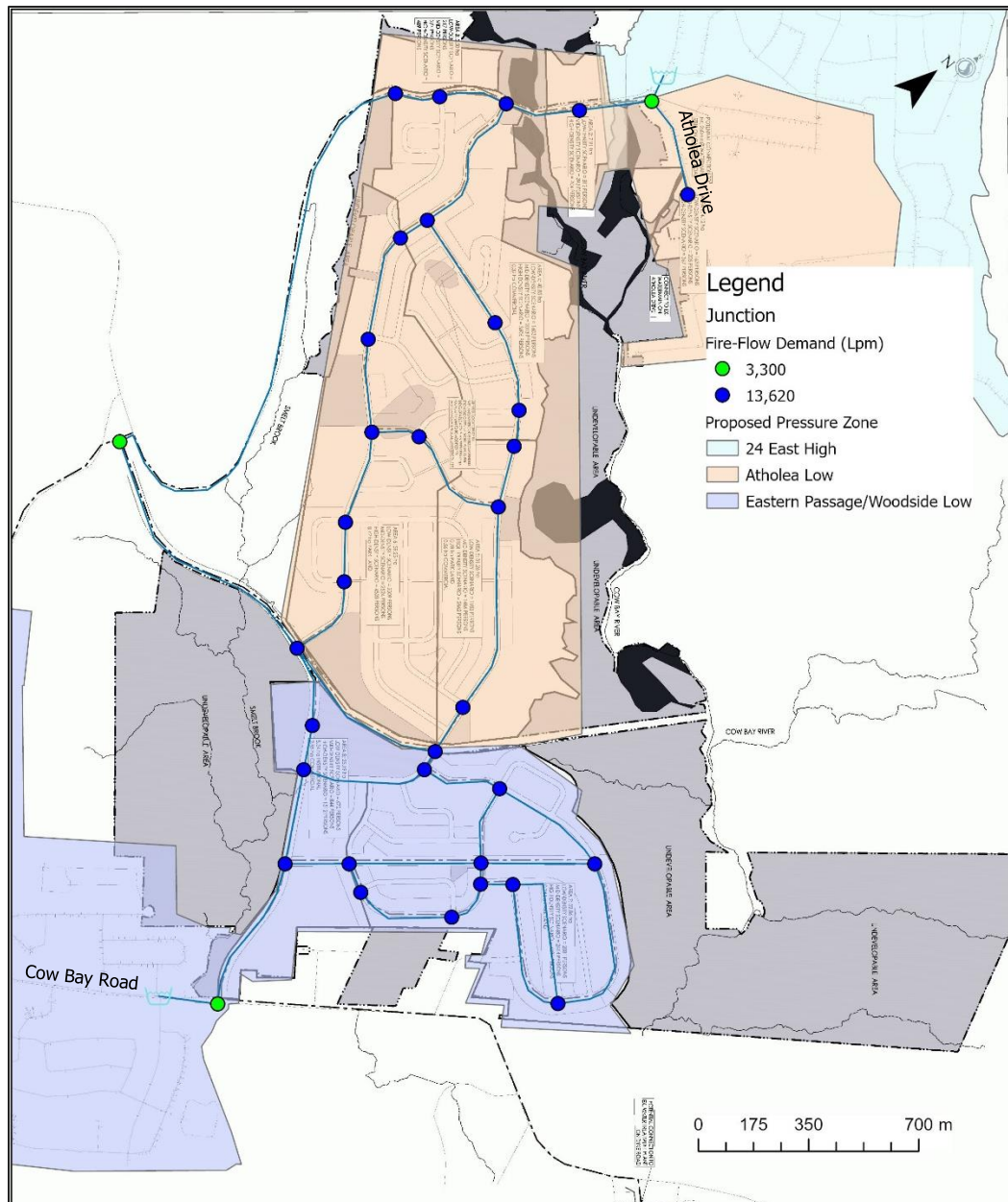


Figure 3-10: Required Fire Flow (High-Density Scenario)

Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan
3 Proposed Development

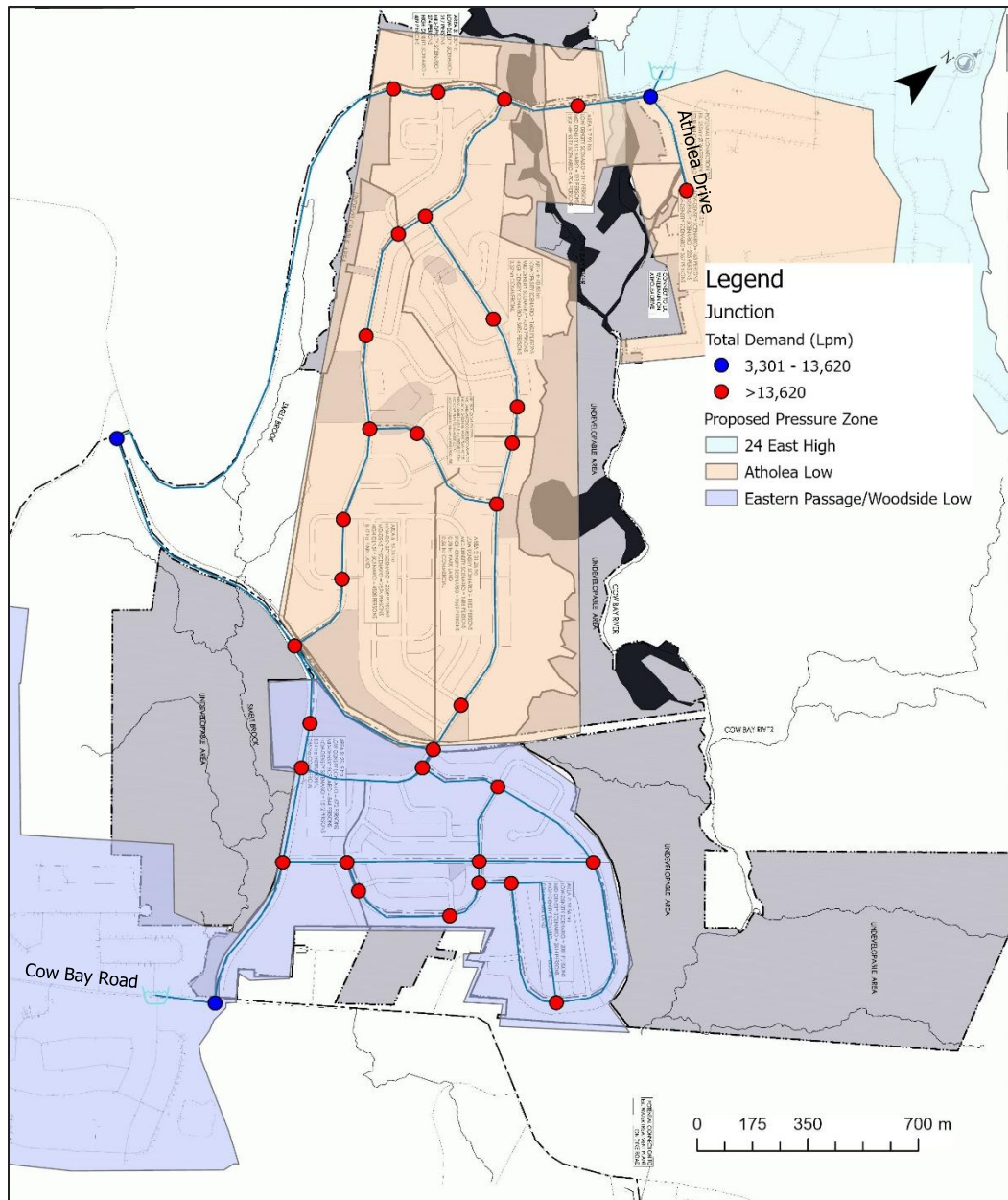


Figure 3-11: Total MDD + FF Demands (High-Density Scenario)



Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan

3 Proposed Development

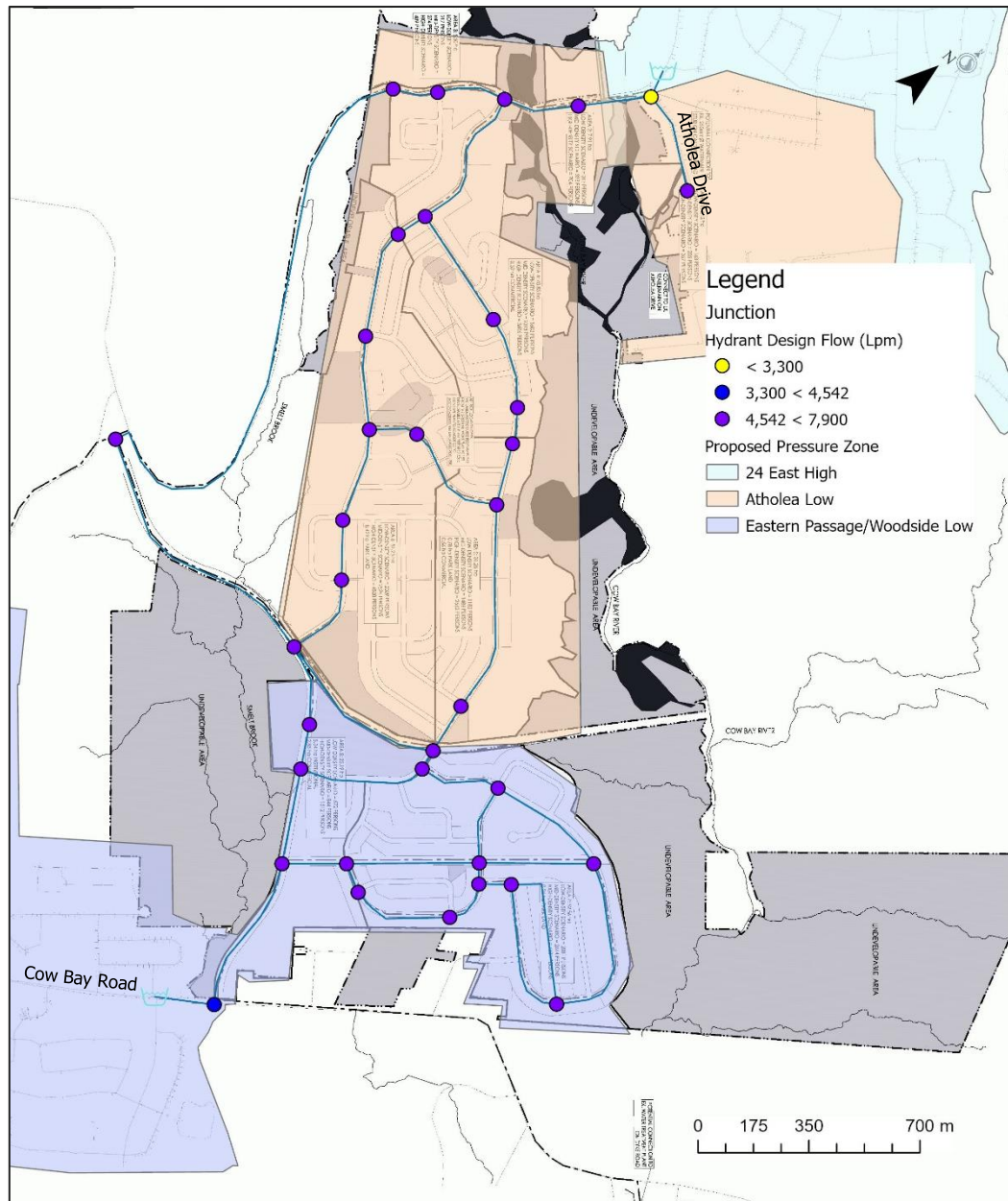


Figure 3-12: Available Hydrant Flow (High-Density Scenario)

3.3.4.2 Low-Density Population Scenario

Figure 3-13 illustrates the distribution of MDD for the low-density scenario throughout the model. As with the high-density scenario, the demands were distributed as described in Section 3.3.4.1. Figure 3-14 presents the anticipated corresponding pressures at each node, which range from 55 psi to 84 psi (at the connection to Cow Bay Road).



3 Proposed Development

The distribution of PHD for the low-density scenario are presented in **Figure 3-15** and the resulting pressures are shown in **Figure 3-16**. Pressures under the PHD scenario range from approximately 52 psi to 84 psi. For this scenario, all pipe velocities are less than 1.5 m/s (in accordance with Halifax Water's Design Specifications).

MHD were also simulated, the distribution of MHDs and the resulting pressures are presented in **Figure 3-17** and **Figure 3-18**, respectively. Pressures under the MHD scenario range from approximately 57 psi to 85 psi.

For the low-density population scenario only single residential homes were considered. Therefore, the required fire flow is 3,300 Lpm throughout the entire development. The total MDD + FF demand at each node is presented in **Figure 3-19**, and the results of the fire analysis are presented in **Figure 3-20**. The available fire flow range is approximately 4,400 Lpm to 9,200 Lpm, which exceeds the total MDD + FF demand at each node.

Also, as stated previously, without a full system model, it is unknown if the existing system can provide the level of service required. Therefore, it is recommended to examine the development's effect on the entire system by using a full (calibrated) system model. Hence the pressures and available fire flows presented in the report should be considered preliminary.



Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan
3 Proposed Development

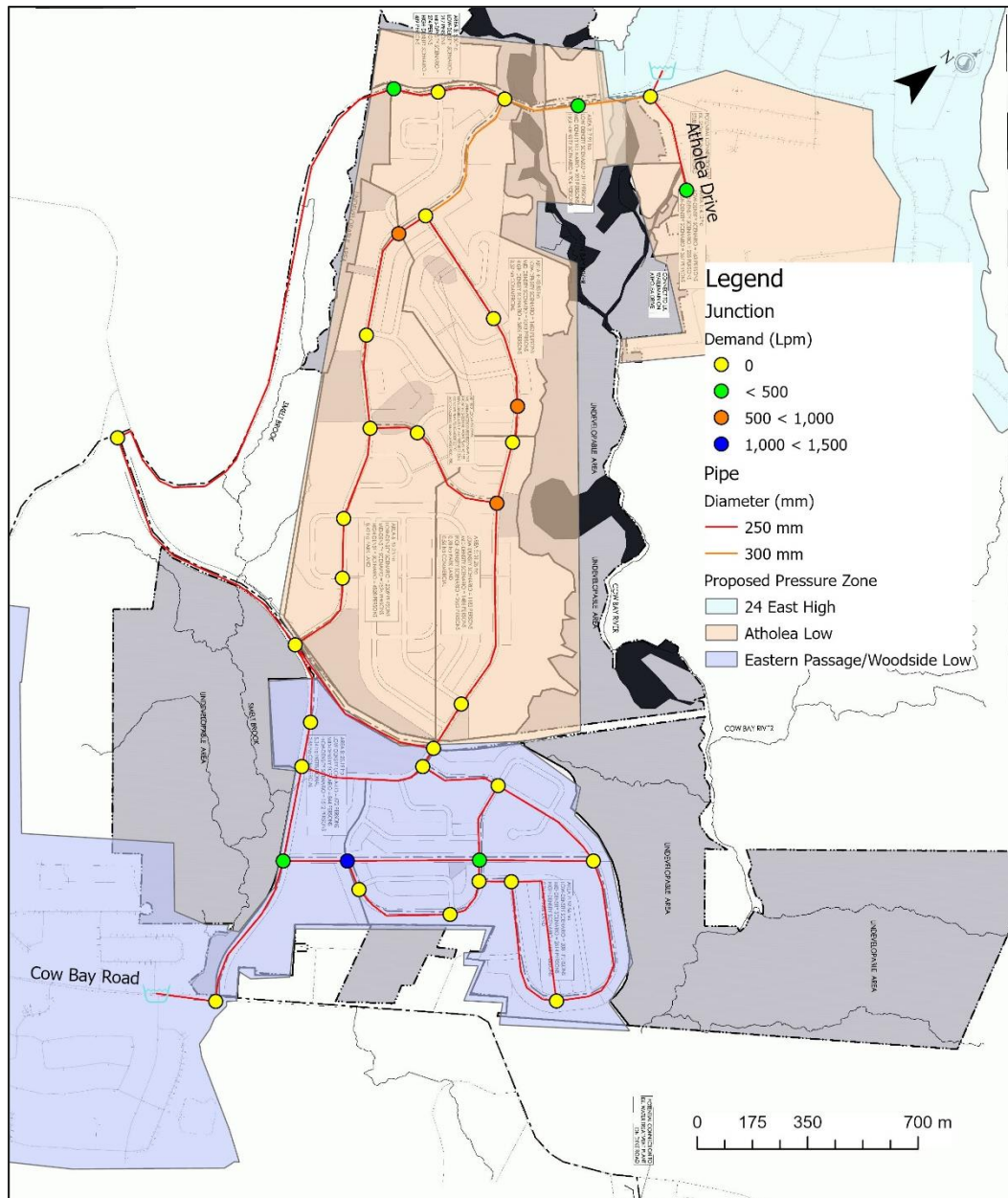


Figure 3-13: MDD Distribution (Low-Density Scenario)

3 Proposed Development

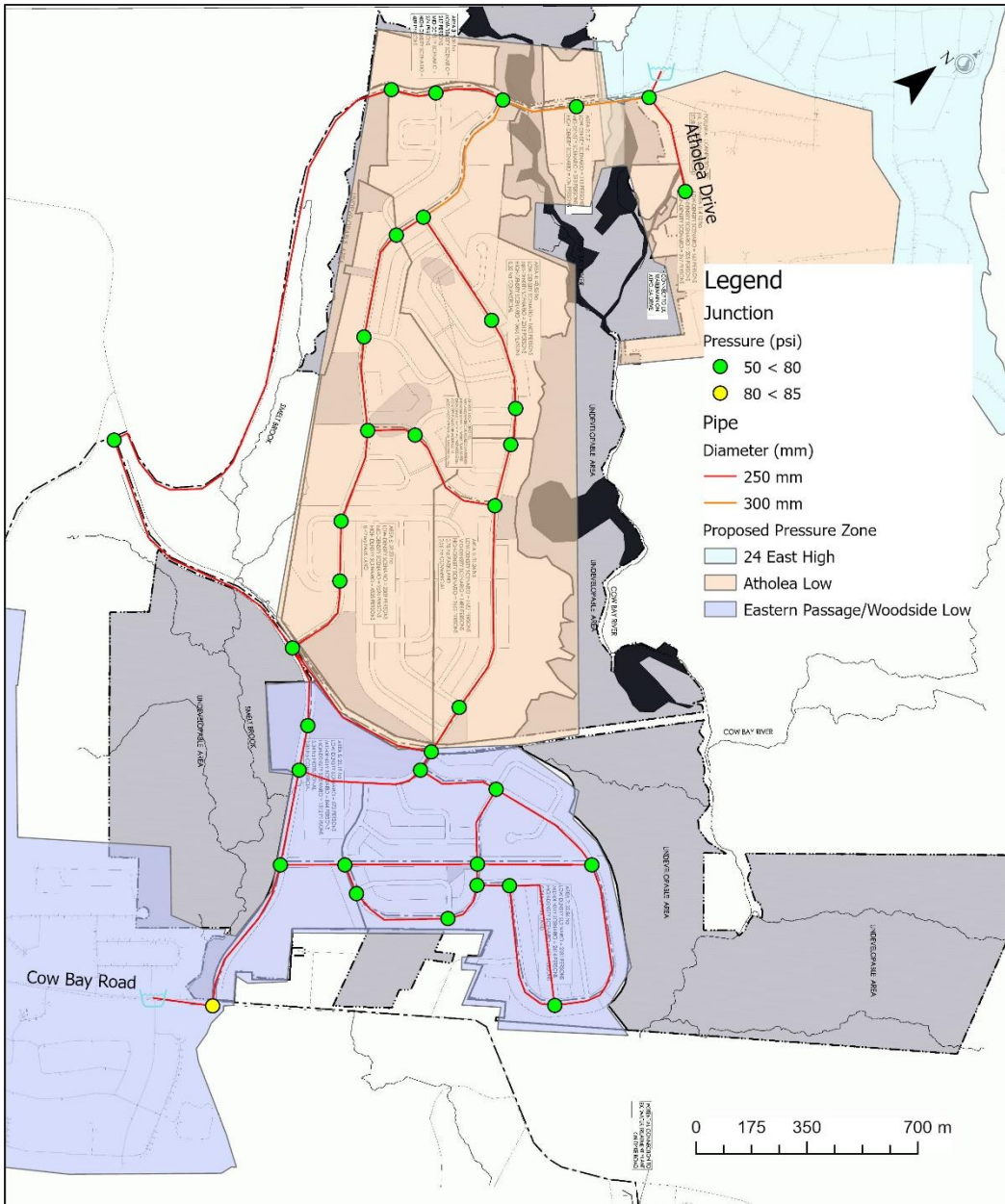


Figure 3-14: Pressure Distribution Under MDD (Low-Density Scenario)

Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan

3 Proposed Development

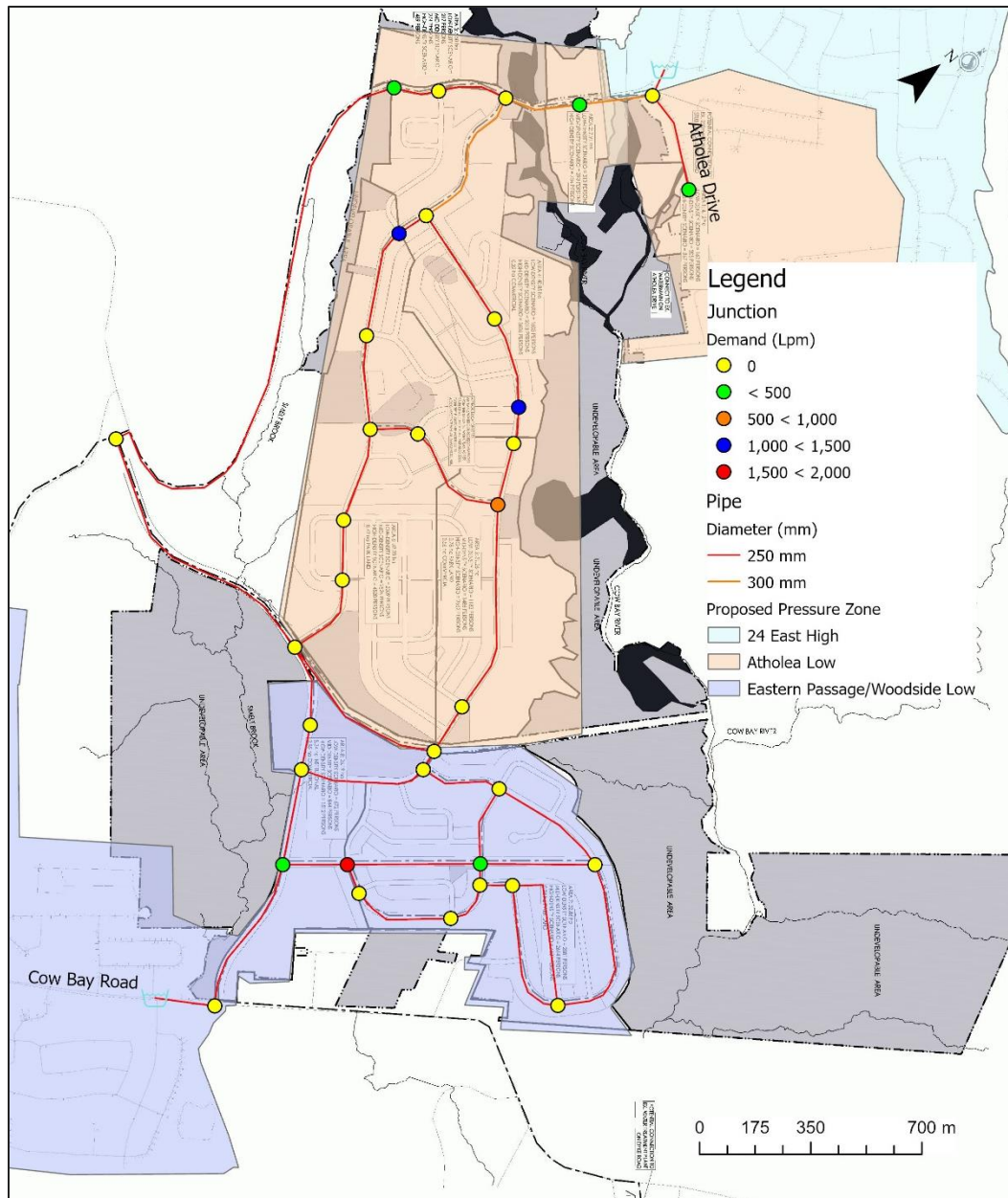


Figure 3-15: PHD Distribution (Low-Density Scenario)

Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan

3 Proposed Development

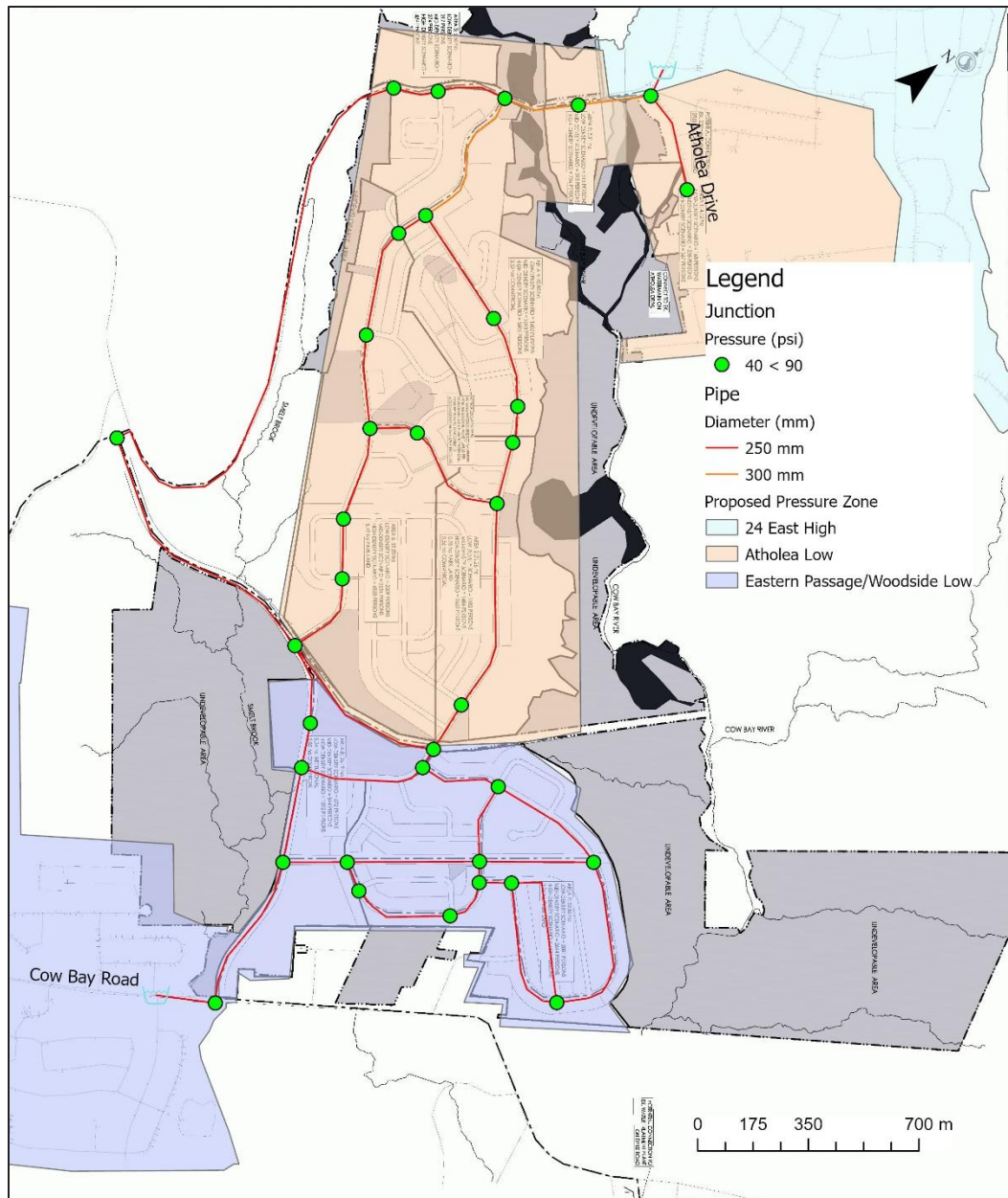


Figure 3-16: Pressure Distribution Under PHD (Low-Density Scenario)

Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan

3 Proposed Development

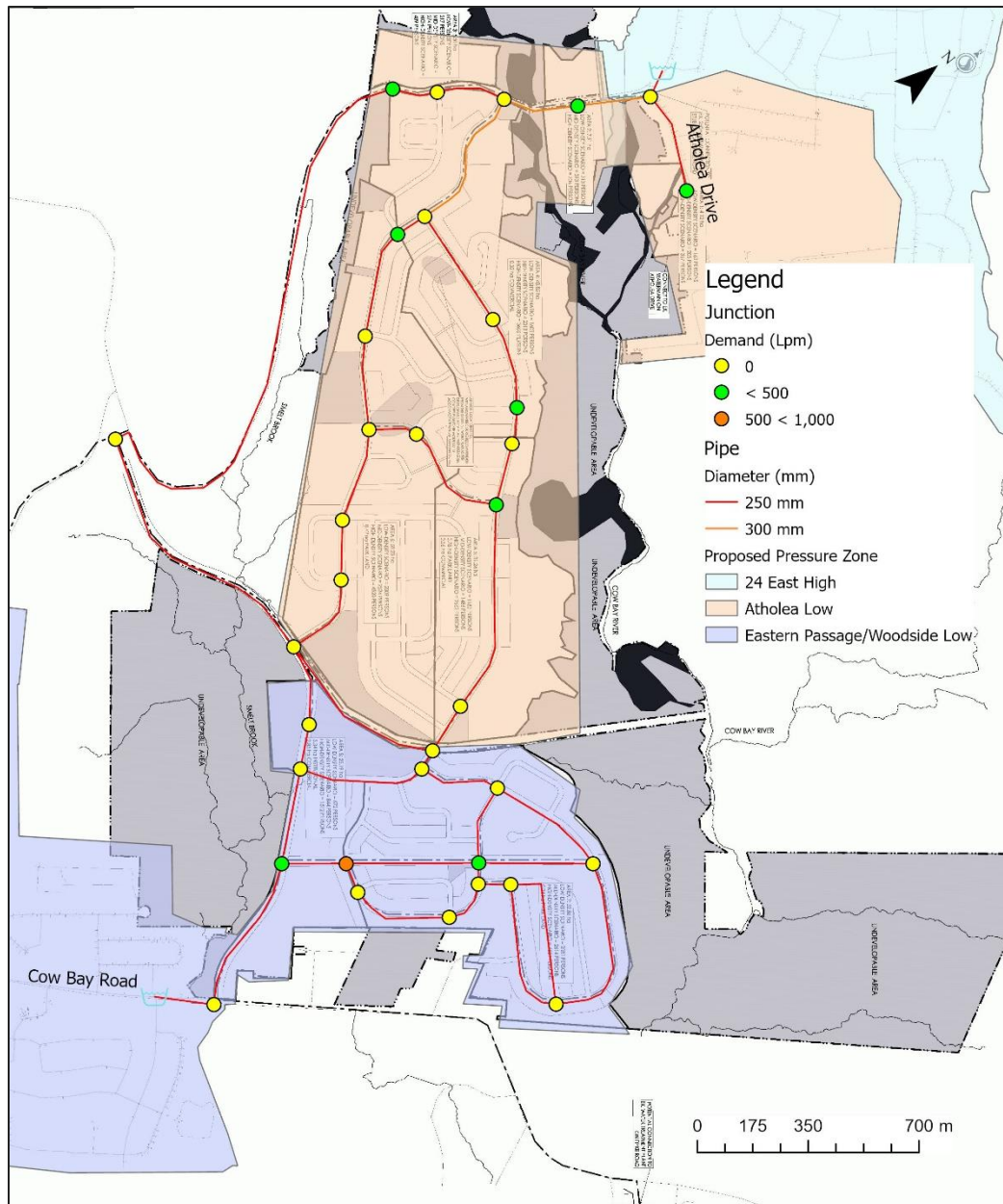


Figure 3-17: MHD Distribution (Low-Density Scenario)

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3 Proposed Development

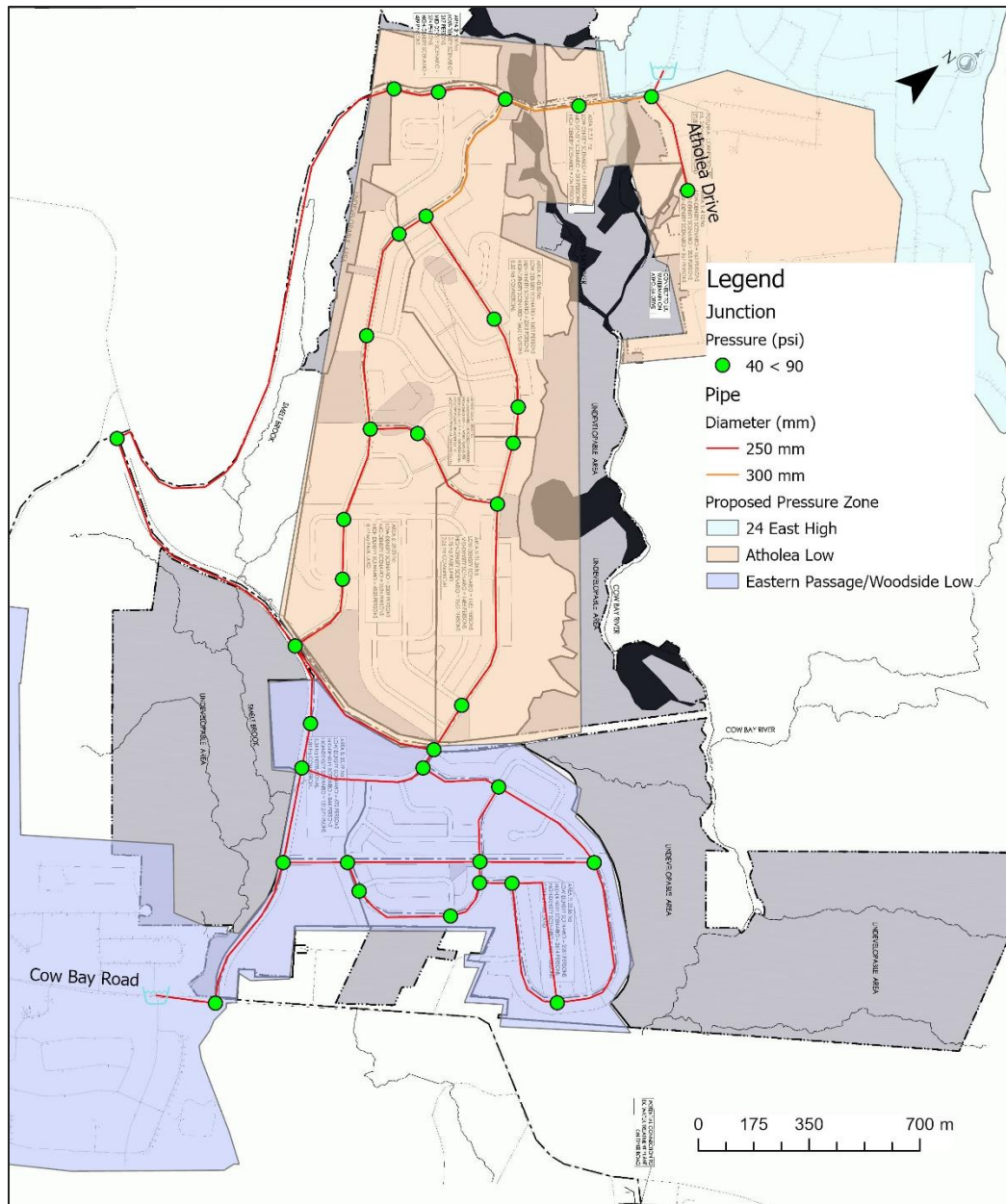


Figure 3-18: Pressure Distribution Under MHD (Low-Density Scenario)

Halifax Regional Municipality Future Serviced Communities – Eastern Passage Water Servicing Plan
3 Proposed Development

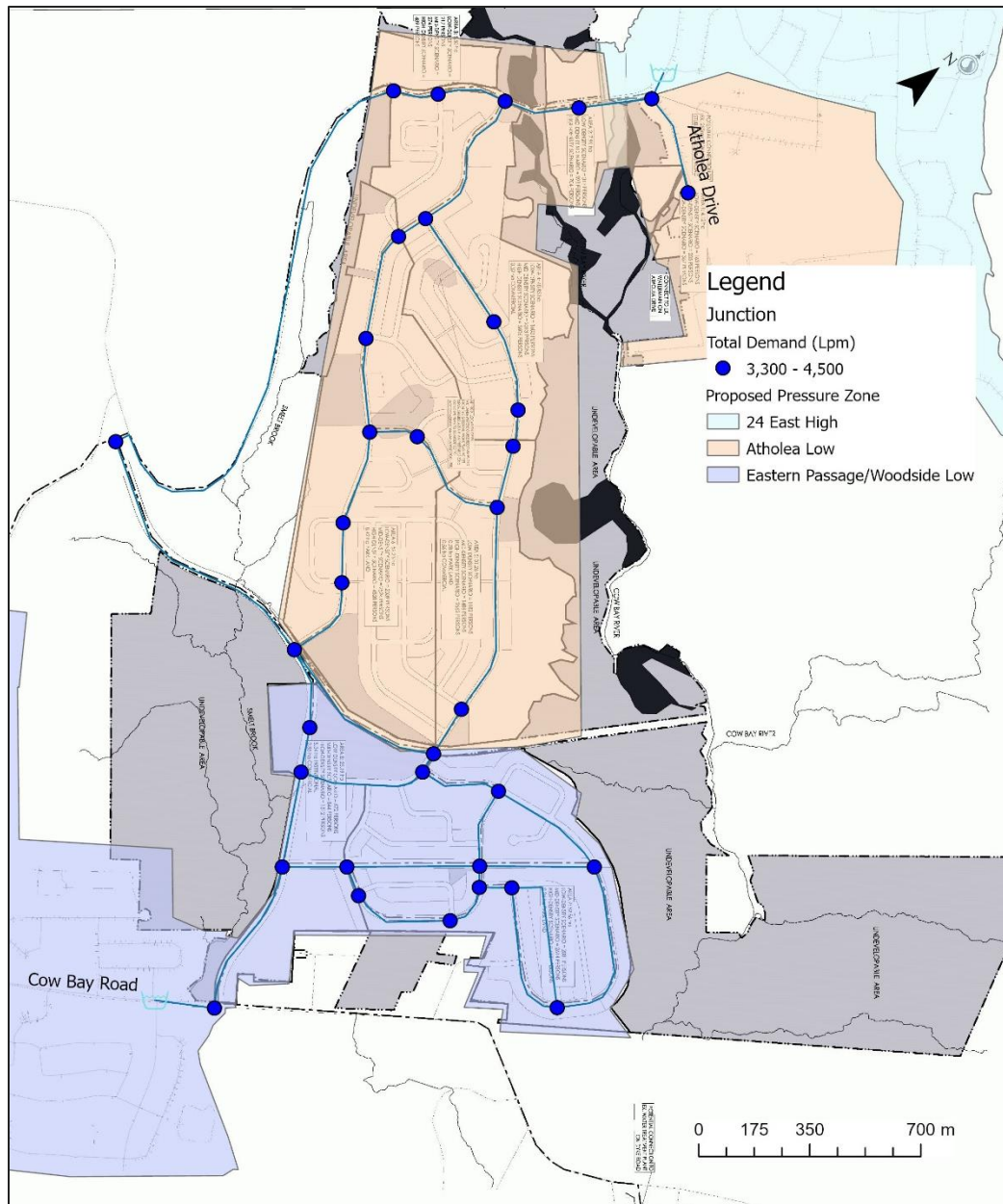


Figure 3-19: Total MDD + FF Demands (Low-Density Scenario)

4 Conclusions and Recommendations

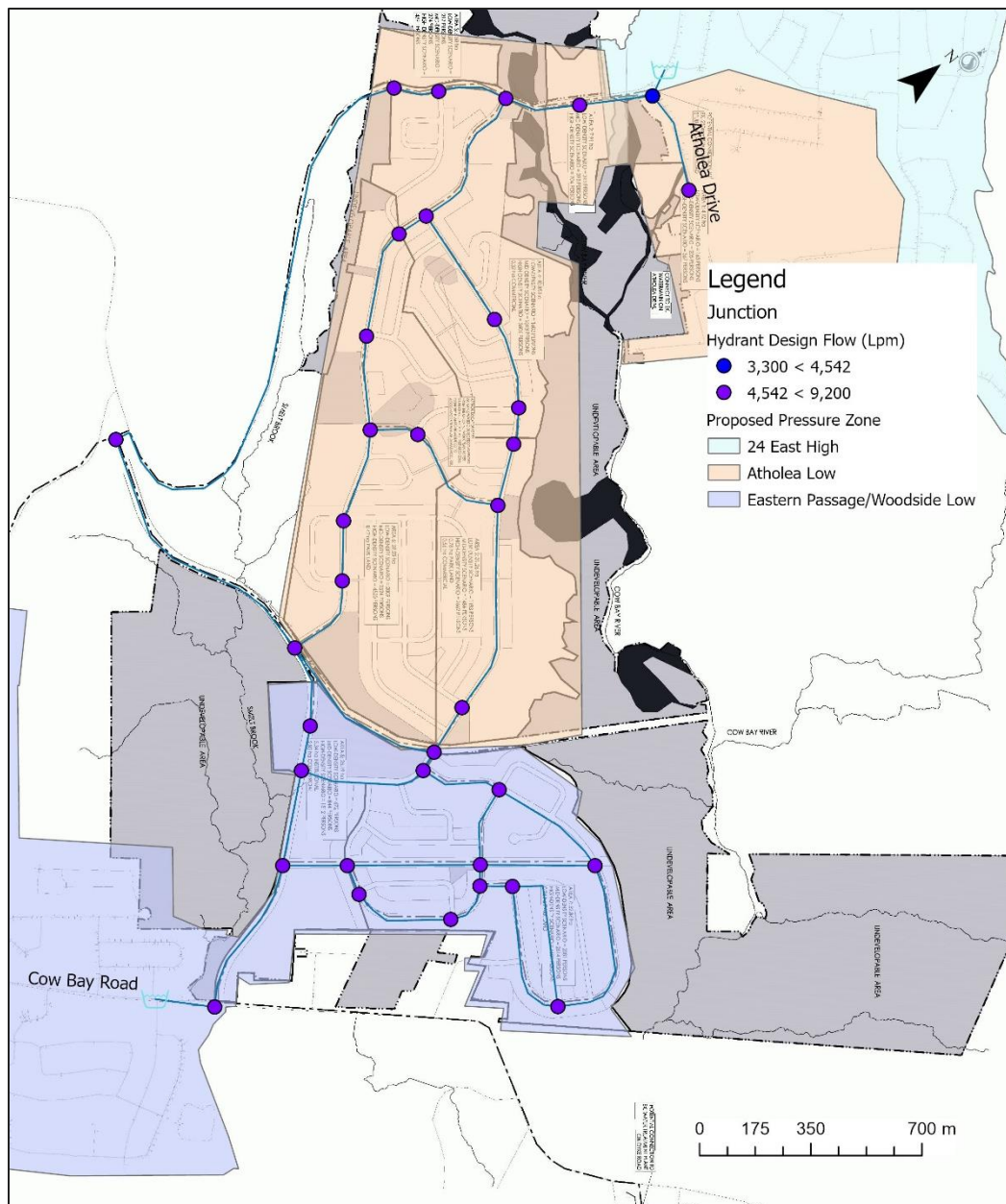


Figure 3-20: Available Hydrant Flow (Low-Density Scenario)

4 Conclusions and Recommendations

4.1 Conclusions

The Eastern Passage development is proposed between Atholea Drive to the north, and Cow Bay Road to the south in southeastern area of HRM. A range of development scenarios were assessed to estimate



4 Conclusions and Recommendations

high- and low-density population projections. These scenarios were used to estimate ADD, MHD, MDD, and PHD for the development. The demands were then used to assess the requirements for servicing the development with potable water from Halifax Water's existing water system network.

A review of the adjacent pressure zones, proposed system improvements, and proposed site grading suggests the development may be serviced with potable water from the existing Atholea Low and Eastern Passage/Woodside Low pressure zones depending on density scenario. A water system model was developed using InfoWater Pro to estimate the development distribution system requirements to achieve the level of service set out in Halifax Water's Design Specifications. The model development assumes that the connection to each existing pressure zone is a constant HGL with unlimited flow (i.e. the connections are modelled as fixed head reservoirs). This assumption does not reflect the actual system, however, in the absence of a full system model, it is a reasonable assumption.

Given the relatively small existing watermain at the proposed connection points (250 mm diameter), and the large flow requirements for the high-density scenario, the model results indicate upgrades are required to the existing system to service the high-density scenario. The proposed watermain sizes range from 250 mm to 300 mm diameter, with the majority being 250 mm diameter. Larger pipe diameters were not considered as the existing watermain at the proposed connection points is 250 mm. During a high-density peak hour demand, the velocities through the connecting watermain to Atholea Drive is approximately 3.1 m/s, and the velocity in the Cow Bay Road watermain connection is approximately 1.7 m/s. The PHD analysis illustrates the importance of examining the effects of the development and the entire system. For instance, while increasing the size of the connection to Atholea Drive to 400 mm diameter in the model would reduce the velocity to less than 1.5 m/s and give the appearance of meeting all the design criteria, doing so would give the impression that the remainder of the system would also be meeting the design criteria, when it may not.

A summary of the water model results is presented in **Table 4-1**.

Table 4-1: Summary of Water Model Results

Flow Scenario	Pressure Range (psi)	Max Velocity (m/s)	Available Fire Flow (Lpm)
MDD High Density	49 – 83	1.9	N/A
PHD High Density	36 - 81	3.1	N/A
MHD High Density	55 - 84	< 1.5	N/A
MDD + FF High Density	> 22	< 2.4	1,500 - 7,900*
MDD Low Density	55 - 84	< 1.5	N/A
PHD Low Density	52 – 84	< 1.5	N/A
MHD Low Density	57 - 85	< 1.5	N/A
MDD + FF Low Density	> 22	< 2.4	4,400 - 9,200*



4 Conclusions and Recommendations

* Based on the assumptions of a constant HGL at the connections to the existing pressure zones. Therefore, the values for available fire flow should be considered with a low level of confidence.

4.2 Recommendations

The presented subdivision plan is preliminary and subject to change, therefore the MHD, MDD, PHD and required FF demands presented in this report may change resulting in changes to proposed water distribution preliminary design. It is recommended that the level of service and distribution system requirements be reassessed during subsequent design stages. Also, during the next stages of design the sizing and placement of regional water infrastructure should be considered.

It is recommended that the setting of the Atholea Drive PRV be checked, as the hydrant test indicated the downstream setting may be slightly lower than that presented in Halifax Water's Regional Pressure Zone Map.

In the absence of a full system model, the effect of the proposed development on the level of service of the remaining system could not be assessed. Also, the effect of potential restrictions within the existing system on the proposed development could not be assessed. In Halifax Water's 2019 IMP, it was recommended that an all-pipe hydraulic model be developed. An all-pipe model can be used to assess fire flow objectives at each property or node in the system. It is recommended that the proposed development be incorporated in the all-pipe model to perform a more refined fire flow level of service assessment for the development.

The scope of the water and wastewater servicing analysis included in the Future Serviced Communities Study does not include wastewater treatment facilities or water treatment plants. Halifax Water has a well-established strategy for water and wastewater infrastructure planning as it relates to asset renewal, compliance, and growth. The Integrated Resource Plan (IRP) shapes Halifax Water's capital program by identifying resource and finance needs. There are three major plans contained within the IRP, those being the Asset Management Plan, Compliance Plan, and Infrastructure Master Plan (IMP). The IRP aims to provide regional water and wastewater infrastructure needed to support planned growth.

The IMP is a comprehensive infrastructure master plan for both water and wastewater that supports growth. As part of the IRP approach, the plan is updated at regular intervals to ensure the consolidated long-term program remains current. Halifax Regional Municipality supplies Halifax Water with growth projections to be considered within the IRP, in this case, the Future Serviced Communities Studies: Sandy Lake, Highway 102 Corridor, Morris Lake Expansion, and Westphal will be incorporated into the upcoming review of the latest iteration of the IRP. Growth projections are used as input to analysis, such as water and wastewater models, which aid in determining preferred servicing strategies.



Appendix A Hydrant Flow Test





Water Flow Test Summary

Pearl Dr. / Atholea Dr.
Stantec

Type of Test: Flow Test Test # : 1
Location: See Below Tested By: Matt Eisan
Municipality: HRM Date: August 15, 2024

*SYSTEM DATA

Size of Main: 10" Dead Ends: _____ Grid: _____ Loop: X
Source Reliable: Yes (CITY) If No - Explain _____
Comments: All flows are in USGPM

*TEST DATA

Location of Hydrants: Residual: Hydrant 18688 - across from civic # 5 Atholea Drive
Flow: Hydrant 18688 - across from civic # 5 Pearl Drive

Normal Pressure: 70 psi Time: 10:08 PM

Test #	# of Outlets	Oriface Size	Pitot Reading (PSIG)	Equivelent Flow (GPM)	Total Flow (GPM)	Residual Pressure (PSIG)	Comments
0	0					70	Used 2 1/2" Hose Monster
1	1	2 1/2"	21	773	773	58	
2	2	2 1/2"	13	608	1216	50	
		2 1/2"	13	608			

