

4.2 Existing System Maximum Day Demand Analysis

A summary of the boundary conditions used in the WaterCAD hydraulic analysis for each facility in the water distribution system for the maximum day demand scenario are shown in **Table 4-2**.

Table 4-2: Existing System MDD – WaterCAD Hydraulic Analysis Boundary Conditions

Water Treatment Plant		Mountview Reservoir and Pump Station	
HLP 101 – 900 HP	OFF	P1 – 150 HP	OFF
HLP 102 – 700 HP	ON	P2 – 150 HP	OFF
HLP 103 – 350 HP	OFF	P3 – 150 HP	OFF
HLP 104 – 900 HP	OFF	Station Outflow	0.0 L/s
Station Outflow	441.2 L/s	Hydraulic Grade Setpoint	940 m
Hydraulic Grade Setpoint	919 m ¹	Reservoir Fill Rate	0.0 L/s
Glendale Reservoir and Pump Station		Lancaster Reservoir and Pump Station	
P1 – 200 HP – Emergency Pump	OFF	P1 – 75 HP	ON
P2 – 125 HP	ON	P2 – 75 HP	OFF
P3 – 125 HP	OFF	P3 – 75 HP	OFF
P4 – 125 HP	OFF	P4 – 75 HP	OFF
Station Outflow	213.5 L/s	Station Outflow	137.5 L/s
Hydraulic Grade Setpoint	919 m	Hydraulic Grade Setpoint	940 m
Reservoir Fill Rate	0.0 L/s	Reservoir Fill Rate	0.0 L/s
Clearview Booster Station		Queens Business Park Reservoir and Pump Station	
P1 – 125 HP	ON	P1 – 75 HP	ON
P2 – 125 HP	OFF	P2 – 100 HP	OFF
P3 – 125 HP	OFF	P3 – 150 HP	OFF
P4 – 125 HP	OFF	P4 – 150 HP	OFF
Station Outflow	145.5 L/s	Station Outflow	45.8 L/s
Hydraulic Grade Setpoint	940 m	Hydraulic Grade Setpoint	950 m
		Reservoir Fill Rate	0.0 L/s ²

¹ The original design of the WTPPZ was based on a HGL setpoint of 919 m. The setpoint was recently set to 917 m to reduce the non-revenue water demand (i.e., water losses). Both set points were simulated in the WaterCAD hydraulic modeling, but the original setpoint (i.e., 919 m) showed better performance in meeting the LOS described in **Table 2-8**.

² The City indicated in their "2021 Updates to the Existing Water System Model" technical memorandum that the Queens Business Park has been filling continuously. However, it is recommended to pause filling during the maximum day demand period to reduce the burden on the water supply system.



**Water Model Update
Existing System Analysis**

A summary of the system pressures and velocity in the existing system during the MDD scenario are presented in **Figure 4-8** and **Figure 4-9**.

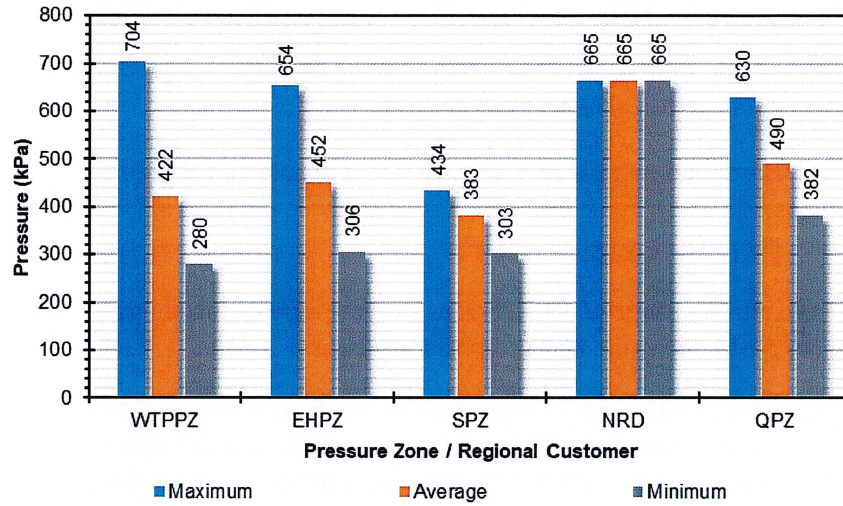


Figure 4-8: Pressure Statistics of the Existing System at MDD

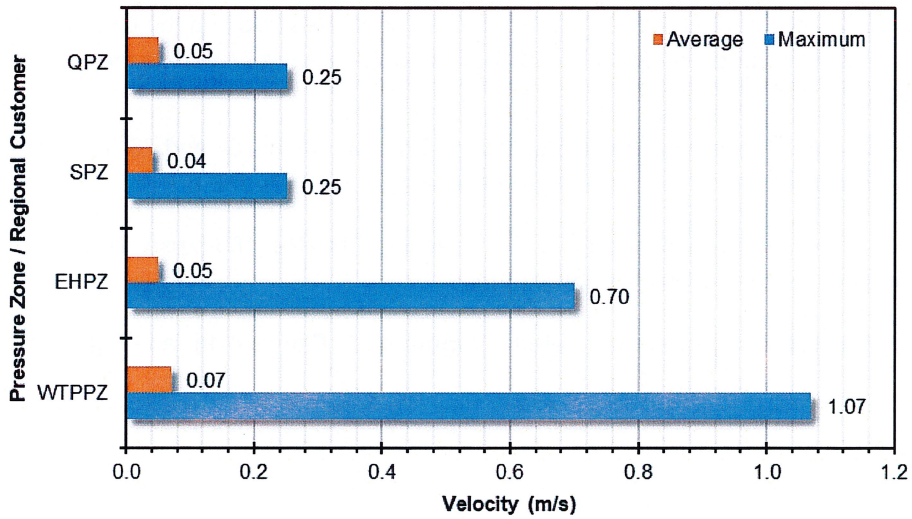


Figure 4-9: Velocity Statistics of the Existing System at MDD

Note: The line feeding the NRDRWSC was included in the WTPPZ.



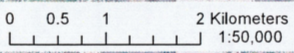
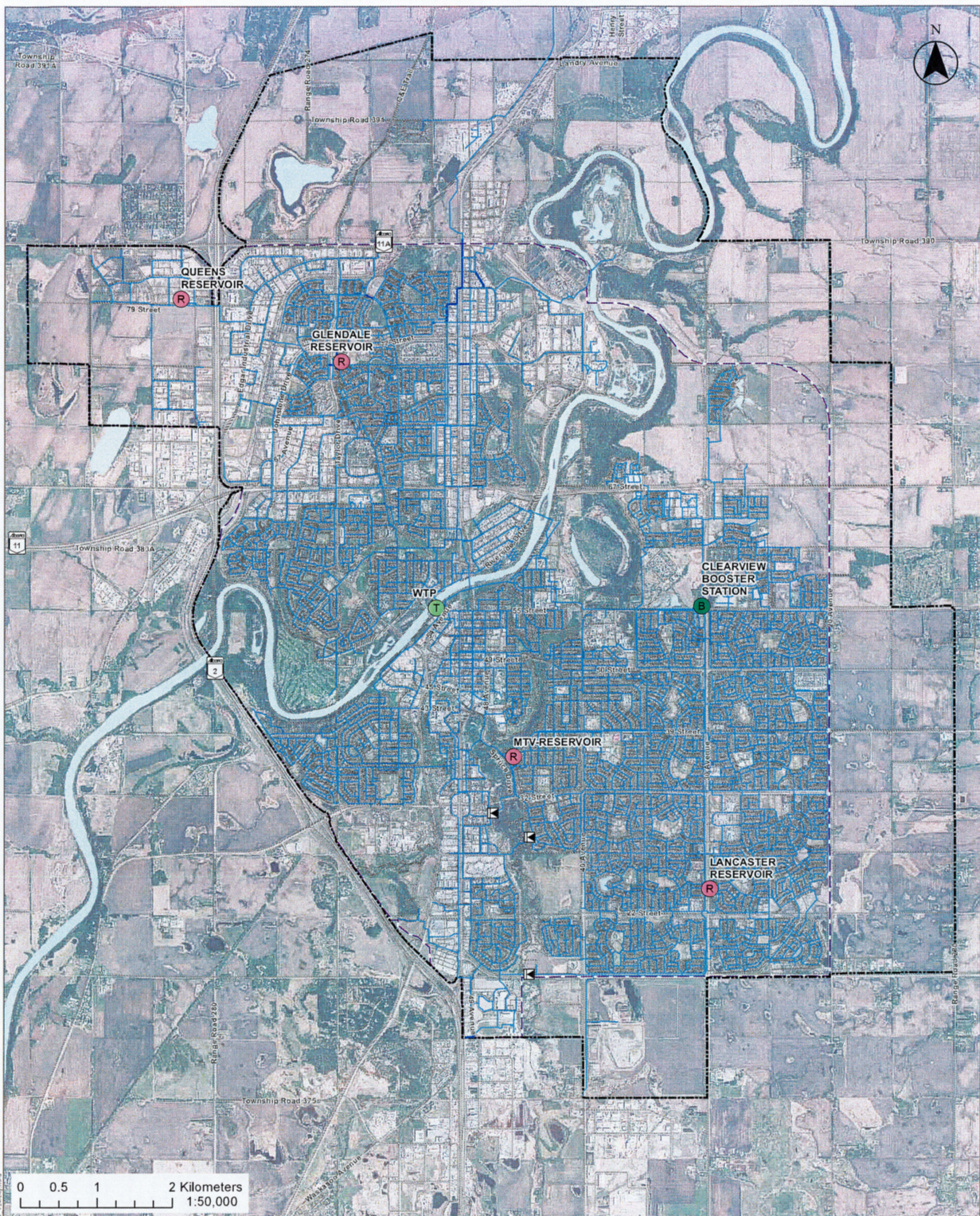
4.2.1 Discussion on Existing System Maximum Day Demand Analysis

The City's existing water distribution system performs well during the maximum day demand scenario. The following are discussion points emerging from the existing system MDD analysis.

1. All pipe velocities in the system were below 1.5 m/s during the MDD scenario which shows that all pipes are sized adequately to satisfy the MDD scenario.
2. The hydraulic analysis shows that the HGL of the WTPPZ should be set at 919 m to minimize the number of junctions with pressures below 300 kPa. In addition, the HGL of the SPZ should be set at 922 m to eliminate the pressures below 300 kPa.
3. Due to the high ground elevations at some locations, nine junctions in the model that show pressure below 300 kPa (43.5 psi) during the MDD scenario, as follows:
 - Two junctions are located on the fill line of the Queens Business Park Station directly upstream of the station, showing pressure of 178 kPa (27.1 psi) and 256 kPa (37.1 psi). There are ground elevations in this area that exceed 890 m. This does not pose an issue since there are no service connections on the fill line.
 - Two other junctions are located directly upstream of the Clearview Station showing pressures of 291 kPa (41.7 psi) and 296 (42.5 psi) as the elevations in this area reach approximately 888 m.
 - Four junctions are located directly south of the Glendale Reservoir on the Greenhouse PI Road showing pressures between 290 kPa (42.1 psi) and 299 kPa (43.4 psi) as the ground elevation is approximately 888 m.
 - The last junction is located at the intersection of Edgar Industrial Dr and 76 Street showing a pressure of 299 kPa (43.4 psi) as the ground elevation reaches 888 m.
4. There was one junction that exceeded 700 kPa, reaching 714 kPa (103.5 psi). This junction is located on 40 Avenue by the Wastewater Treatment Plant.

The results from the MDD analysis are illustrated in **Figure 4-10**, **Figure 4-11**, and **Figure 4-12**.





- Pressure Reducing Valve
- Red Deer City Limits
- Existing Service Boundary (Infill Development)

- Facilities
- Booster Station
 - Reservoir
 - Water Treatment Plant/Reservoir

- Velocity
- >1.5 m/s
 - 1.25 – 1.5 m/s
 - 1.0 – 1.25 m/s
 - 0.5 – 1.0 m/s
 - 0.0 – 0.5 m/s

Map Date: 08/02/2022 15:52:44 User: albert
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Completed By: AL
 Date: 07/29/2022

Project No.: 110170064

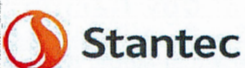


Figure 4-11: Existing System - Maximum Day Demand Pipe Velocity

City of Red Deer Water Model Update
 City of Red Deer

4.3 Existing System Peak Hour Demand Analysis

A summary of the boundary conditions used in the WaterCAD hydraulic analysis for each facility in the water distribution system for the peak hour demand scenario is shown in **Table 4-3**.

Table 4-3: Existing System PHD – WaterCAD Hydraulic Analysis Boundary Conditions

Water Treatment Plant		Mountview Reservoir and Pump Station	
HLP 101 - 900 HP	ON	P1 - 150 HP	ON
HLP 102 - 700 HP	OFF	P2 - 150 HP	OFF
HLP 103 - 350 HP	OFF	P3 - 150 HP	OFF
HLP 104 - 900 HP	OFF	Station Outflow	114.6 L/s
Station Outflow	734.4 L/s	Hydraulic Grade Setpoint	940 m
Hydraulic Grade Setpoint	919 m	Reservoir Fill Rate	0.0 L/s
Glendale Reservoir and Pump Station		Lancaster Reservoir and Pump Station	
P1 - 200 HP - Emergency Pump	OFF	P1 - 75 HP	ON
P2 - 125 HP	ON	P2 - 75 HP	OFF
P3 - 125 HP	OFF	P3 - 75 HP	OFF
P4 - 125 HP	OFF	P4 - 75 HP	OFF
Station Outflow	217.1 L/s	Station Outflow	139.5 L/s
Hydraulic Grade Setpoint	919 m	Hydraulic Grade Setpoint	940 m
Reservoir Fill Rate	0.0 L/s	Reservoir Fill Rate	0.0 L/s
Clearview Booster Station		Queens Business Park Reservoir and Pump Station	
P1 - 125 HP	ON	P1 - 75 HP	OFF
P2 - 125 HP	OFF	P2 - 100 HP	OFF
P3 - 125 HP	OFF	P3 - 150 HP	ON
P4 - 125 HP	OFF	P4 - 150 HP	OFF
Station Outflow	235.5 L/s	Station Outflow	115.3 L/s
Hydraulic Grade Setpoint	940 m	Hydraulic Grade Setpoint	950 m
		Reservoir Fill Rate	0.0 L/s

¹ The original design of the WTPPZ was based on a HGL setpoint of 919. The setpoint was recently set to 917 m to reduce the non-revenue water demand (i.e., water losses). Both set points were simulated in the WaterCAD hydraulic modeling, but the original setpoint (i.e., 919 m) showed better performance in meeting the LOS described in Table 2-8.

² The City indicated in their "2021 Updates to the Existing Water System Model" technical memorandum that the Queens Business Park has been filling continuously. However, it is recommended to pause filling during the maximum day demand – including the peak hour – to reduce the burden on the water system.



**Water Model Update
Existing System Analysis**

A summary of the system pressures and velocity in the existing system during the PHD scenario are presented in **Figure 4-13** and **Figure 4-14**.

Figure 4-13: Pressure Statistics of the Existing System at PHD

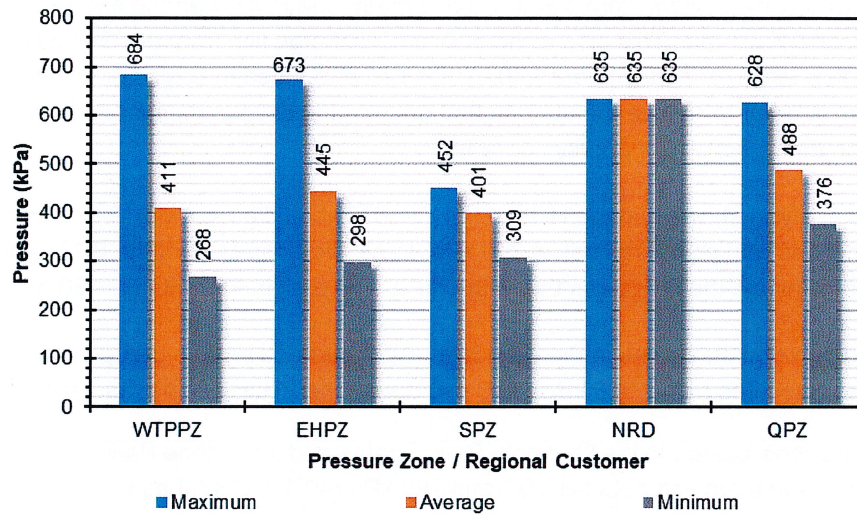
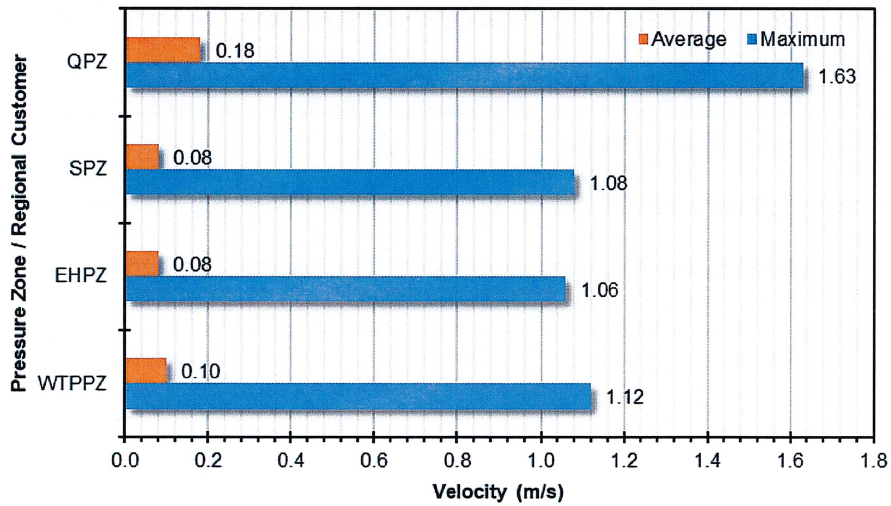


Figure 4-14: Velocity Statistics of the Existing System at PHD



Note: The line feeding the NRDRWSC was included in the WTPPZ.



4.3.1 Discussion on Existing System Peak Hour Demand Analysis

The City's existing water distribution system performs well during a peak hour demand scenario. The following are discussion points emerging from the existing system PHD analysis.

1. All pipe velocities in the system were below 1.5 m/s during the PHD scenario except for one pipe that showed a velocity of 2.1 m/s. This pipe is the 500 mm discharge line from the Glendale Station to 59 Avenue with a length of approximately 40 m. It is recommended to upsize or twin this discharge line to 750 mm in order to reduce the velocity and headloss to save pumping energy in this section of pipe. However, this is not a high priority upgrade.
2. The hydraulic analysis shows that the HGL of the WTPPZ should be set at 919 m to minimize the number of junctions with pressures below 300 kPa. In addition, the HGL of the SPZ should be set at least 924 m to eliminate the pressures below 300 kPa. The design SPZ HGL is 930 m.
3. Due to the high ground elevations in the Glendale neighbourhood area, a group of junctions in the model showed pressures below 300 kPa (43.5 psi) during the PHD scenario as per the following:
 - Sixteen junctions located in the Glendale Park Estates and Johnstone Park neighborhoods showed pressures ranging between 277 and 298 kPa (40.1 and 43.3 psi).
 - Two junctions are located directly upstream in the fill line of the Queens Business Park Station showed pressures of 176 kPa (25.5 psi) and 244 kPa (35.4 psi). There are ground elevations in this area that exceed 890 m, which are of no concern.
 - Two junctions are located on Parsons Close showing pressures down to 295 kPa (42.8 psi), marginally below 300 kPa.
 - Eight junctions located at Central Park (by Township Rd 391) with pressures ranging between 284 and 292 kPa (41.2 and 42.4 psi).
4. No junctions exceeded the pressure limit of 700 kPa. The maximum was 691 kPa.

The results from the PHD analysis are illustrated in **Figure 4-15**, **Figure 4-16**, and **Figure 4-17**.

