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REPORT

Town of Drumheller

Water Distribution System Master Servicing Study

FEBRUARY 2024

EXECUTIVE SUMMARY

1 BACKGROUND

The Town of Drumheller has engaged Associated Engineering to undertake an update of their 2004 Water Master Plan. The Town requires a plan which clearly identifies and prioritizes necessary upgrades to the existing distribution system to meet the desired level of service. This includes watermains downstream of the existing WTP including pumping and storage facilities. The Master Plan will also identify potential servicing concepts for future growth areas to help guide future development.

The report objective is to provide the Town with a comprehensive Water Master Plan which will outline recommended upgrades to the existing water distribution system and present servicing concepts for future development. Key project tasks include:

- Data collection and review
- Establish design criteria
- Develop a staged growth plan
- Existing water system hydraulic assessment and improvement
- Future water system planning
- Master plan update Report
- Project Management

2 ASSESSMENT

The existing WaterCAD model was updated and expanded to reflect current development and the adopted design criteria. Following model updating, the existing distribution system was analyzed to determine typical operating pressures and maximum day plus fire flow capabilities. Pressure was generally found to be low in the Town of Drumheller with several locations experiencing pressure below 345 kPa (50 psi) in some scenarios. Extremely low pressures below 280 kPa (40 psi) occur in the following areas:

- Northwest and east of Bankview Tower up to S. Dinosaur Trail
- Residences north of N. Dinosaur Trail
- Supply to Royal Tyrell Museum
- West Nacmine along S. Dinosaur Trail

Some locations within Rosedale will experience less than the minimum recommended pressure based on the operating levels at the Rosedale Water Tower. Minimum pressure targets are met in areas south of Rosedale.

A number of locations within the distribution system did not fully satisfy the Maximum Day plus Fire Flow criteria.

There is sufficient pumping capacity at the WTP to meet the projected Peak Hour demands including maximum day supply to regional. Maximum day plus fire flow demands are met through a combination of WTP pumping and contribution from the water towers. As such, there is adequate pumping capacity.

There is sufficient treated water storage to meet the current and projected future needs of both Drumheller and Rosedale. Although, much of the total water tower storage is not useful/practical due to its low elevation relative to its service area.

3 UPGRADES

Water towers within portions of the urban Drumheller service area (Bankview, Greentree, Newcastle and Central), are proposed to be abandoned and replaced with a single new reservoir and pumphouse. It is envisioned that the facility would operate in conjunction with the WTP to meet peak demand periods including fire flows. It is proposed that the WTP and new pumphouse operate at an HGL of 735 m, which will increase system pressure and eliminate the need for the Huntington Booster Station (which can be decommissioned following construction and commissioning of the new system).

It is assumed that approximately 2,000 m^3 storage reservoir will be constructed at the new reservoir site. The required volume will depend on the findings of the Water Treatment Plant Master Plan, which is currently in progress (at the time of this report).

A Booster Station is proposed in Rosedale to increase outgoing pressure from the Rosedale Water Tower.

A new 500 mm watermain is proposed to twin the existing 500 mm concrete pressure pipe (Hyprescon), which heads west from the WTP and is known to be in poor condition. Local watermain upgrades in Drumheller and Rosedale are also proposed to increase available fire flow in developed areas.

4 EXPANSION

Detailed servicing concepts have not been established for future development areas as further work will be required to determine the limits of developable lands within these areas. Some new development areas will require additional infrastructure to accommodate rising topography. These may include booster stations, private cisterns, and pumps (country residential). Additional considerations/infrastructure for new areas are identified where relevant. Water demands for all future development areas have been incorporated into the water model, such that proposed upgrades to the existing system consider the ultimate design demands.

The proposed water system to serve future development areas assumes that all recommended upgrades to the existing system have been completed, including construction of a new reservoir and pumphouse, removal of the four Drumheller water towers and booster station/flow control valve at the Rosedale Water Tower.

Future increase in the peak regional demands as well as re-supply to the proposed reservoir and pumphouse will require that the 250 mm watermain be increased to 450 mm in diameter along S. Dinosaur Trail.

A fire/standby pump may be required to operate at the proposed Rosedale booster station in future development stages. This may be required for expansion into higher elevation expansion areas in which the water tower cannot maintain sufficient pressure during fire flow conditions. Alternatively, local booster stations could be installed to service new development areas where required.

5 COST ESTIMATES

A summary of capital cost estimates is provided in **Table ES-1** for upgrades which are recommended for the existing water system. Costs are not provided for future expansion of the distribution system as all watermains are 300 mm or smaller (typically developer responsibility). Costs for upgrades of the existing system required to support future servicing requirements are identified. Note that WTP Pumping Upgrade costs will be determined following completion of the WTP Master Plan. Estimated cost for replacement of the 500 mm Hyprescon supply main are included in the Ultimate Development Stage.

Table ES-1 Capital Cost Estimates

Upgrades to Existing System	
Watermains	$19,020,000
New Reservoir and Pump Station	$4,000,000
WTP Pumping Upgrade	TBD
Rosedale Booster Station and Control Valve	$2,000,000
Decommission Water Towers	$1,470,000
Decommission Huntington Booster Station	$200,000
Total Upgrades to Existing System	**$26,690,000**
Priority Development Scenario	
Watermains	$5,250,000
Rosedale Standby/Fire Pump	$300,000
Total Stage 1	**$5,550,000**
Ultimate Development Scenario	
Watermains	$5,470,000
Total Ultimate	**$5,470,000**

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1 BACKGROUND

1.1 Background

The Town of Drumheller has engaged Associated Engineering to undertake an update of their Water Master Plan, which was last updated in 2004. The Town requires a plan which clearly identifies and prioritizes necessary upgrades to the existing distribution system to meet the desired level of service. This includes watermains downstream of the existing WTP including pumping and storage facilities. The Master Plan will also identify potential servicing concepts for future growth areas to help guide future development.

1.2 Study Area

The Town of Drumheller is located approximately 135 Km northeast of Calgary along the Red Deer River. The Drumheller Water Treatment Plant (WTP) services the Town of Drumheller which includes Rosedale, Cambria, and East Coulee. The WTP also supplies water to the CLV Co-op, Churchill Co-op, Aqua 7, and Starland County. Refer to **Figure 1-1** for a Location Plan.

The topography of the area generally falls toward the Red Deer River, which is generally located along the north edge of Drumheller.

1.3 Report Objectives and Scope

The report objective is to provide the Town with a comprehensive Water Master Plan which will outline recommended upgrades to the existing water distribution system and present servicing concepts for future development. Key project tasks include:

- Data collection and review
- Establish design criteria
- Develop a staged growth plan
- Existing water system assessment and improvement
- Future water system planning
- Master plan update Report
- Project Management

1.4 References

The following information has been reviewed in preparation of this report:

1. Town of Drumheller Water Distribution System Analysis, Urban Systems, October 2004
2. Town of Drumheller Water Treatment Plan Master Plan, Stantec, February 2002
3. Kneehill Regional Water Services Committee Regional Water System Concept Report, Urban Systems, June 2002
4. Town of Drumheller Municipal Development Plan
5. WaterCAD Model
6. GIS Data (including land use)
7. Water Records (2016-2022)
8. LIDAR Contour Data
9. Area Structure Plans

10. Available Record Drawings
11. Available Pumps Curves
12. Pumphouse Operating Philosophy

We wish to take the opportunity to acknowledge the Town of Drumheller staff, who provided a great deal of assistance and collaboration on the project.

1.5 Abbreviations

AC	Asbestos Cement
CI	Cast Iron
fps	feet per second
ft^3/s	cubic feet per second
ft^3	cubic feet
ig	imperial gallons
igpcd	imperial gallons per capita day
igpm	imperial gallons per minute
km	kilometre
L/s	Litres per second
L	Litre
Lpcd	Litres per capita day
m	metre
m/s	metres per second
m^3/s	cubic metres per second
m^3	cubic metres
mig	million imperial gallons
mm	millimetre
PRV	Pressure Reducing Valve
PVC	Polyvinyl Chloride
AE	Associated Engineering Alberta Ltd.
USGPM	United States Gallons per Minute

1.6 Metric Conversions

To Convert From	To	Multiply By
cubic metres (m^3)	cubic feet (ft^3)	35.31
cubic metres (m^3)	imp gal (ig)	219.97
cubic metres/hour (m^3/hr)	igpm	3.667
kilopascals (kPa)	psi	0.145
kilowatts (kw)	horsepower (hp)	1.341
litres/sec (L/s)	igpm	13.2
megalitres (ML)	imp gal (ig)	219974
metres (m)	ft	3.281
millimetres (mm)	inches	0.0394

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FIGURE 1-1

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

LOCATION PLAN

2 DESIGN CRITERIA

2.1 Population

A key variable in assessing a community's municipal water servicing is the population. It provides a measure of the quantity of water required. In addition, the population density has an impact on the demand placed on the distribution system.

Table 2-1 presents historical population data for the Town of Drumheller from 1976 through 2021. Based on the data, the population in Drumheller has stayed relatively stable over the last 45 years, with a slight overall increase of 0.56% per year. The two time periods which saw the most growth were 1996 to 2001, with an average annual growth rate of 3.4% and 2008 to 2011, with an average annual growth rate of 2.20%. However, the population has been in a slight decline over the past 10 years (from 2011 through 2021).

Table 2-1 Historic Population Statistics

Year	Population	Source	% Change Between Census Years	
1976	6,154	Federal Census Data		45 year: 0.56%
1981	6,508	Federal Census Data	1.12%	
1986	6,366	Federal Census Data	-0.44%	
1991	6,275	Federal Census Data	-0.29%	
1996	6,587	Federal Census Data	0.98%	
2001	7,785	Federal Census Data	3.40%	20 year: 0.08%
2006	7,932	Federal Census Data	0.37%	
2008	7,532	Municipal Census Data	-2.55%	
2011	8,039	Federal Census Data	2.20%	10 year: -0.16%
2016	7,985	Federal Census Data	-0.13%	5 year: -0.19%
2021	7,909	Federal Census Data	-0.19%	

Based on the stability of the population over the last several years, an annual growth rate of 0.5% is proposed for planning purposes; this growth rate is consistent with the 45-year growth rate shown above. A projection of the Town's population based on 0.5% annual growth yields a population of 9,049 in 2048.

Table 2-2 presents the projected population for the next 25 years, based on a growth rate of 0.5%, in 5-year increments. The 2023 population has been derived from the 2021 census population and applying an average annual growth rate of 0.5%.

Table 2-2 Projected 25 Year Population

Year	Population
2023	7,988
2028	8,190
2033	8,397
2038	8,609
2043	8,826
2048	9,049

2.2 Population Density

Population densities are used in conjunction with the per capita daily consumption rate to estimate the water demands.

Based on our experience working with other local municipalities, the densities presented in Table 2-3 are proposed to be used to assess existing and future development.

Table 2-3 Population Densities by Land Use

Land Use	Population Density [1]
Country Residential	5 people/ha
Low Density (Single Family) Residential	40 people/ha
Medium Density Residential	80 people/ha
High Density Residential	160 people/ha
Commercial/Institutional	37 ep/ha [2]
Industrial	30 ep/ha

Notes:
[1] Population densities are per gross hectare.
[2] ep/ha = equivalent population per gross hectare.

Population densities for future development areas will be applied to the gross developable land areas. The gross developable land areas will be determined by the Town's Municipal Development Plan, current Area Structure Plans, and through discussions with the Town.

2.3 Land Use

2.3.1 Existing Land Use

The Town has provided shapefiles containing land use information. We have supplemented the information contained in the shapefiles by a desktop review of existing development within the Town. The land use is used to establish contributing populations, system demands, and fire flow requirements. Refer to **Figures 2-1** through **2-3** for the Town's existing land use maps.

2.3.2 Future Staged Growth Areas

Based on Figure 24 of the Municipal Development Plan, as well as discussions with the Town, the future growth areas shown on **Figures 2-4** through **2-6** were identified. Three levels of potential growth areas are identified in the Municipal Development Plan:

Level I high priority, due to their ability to be serviced efficiently as extensions of existing infrastructure.

Level II medium priority, due to the presence of challenges and/or restrictions; not as easily serviced as Level I areas.

Level III low priority/long term opportunities, to be considered once the Level I and Level II areas have been developed.

Through discussions with the Town, it was decided that two development thresholds would be considered for this assessment: priority development, and ultimate build-out. Priority development growth areas consist of primarily Level I areas, with a few Level II areas included; ultimate build-out of the Town encompasses the remainder of future growth areas identified in the Municipal Development Plan. Anticipated land uses for the future growth areas are also indicated on **Figures 2-4** through **2-6**.

As identified in the Municipal Development Plan, the future growth areas are above the flood zone resulting from a river flow rate of 2100 cms.

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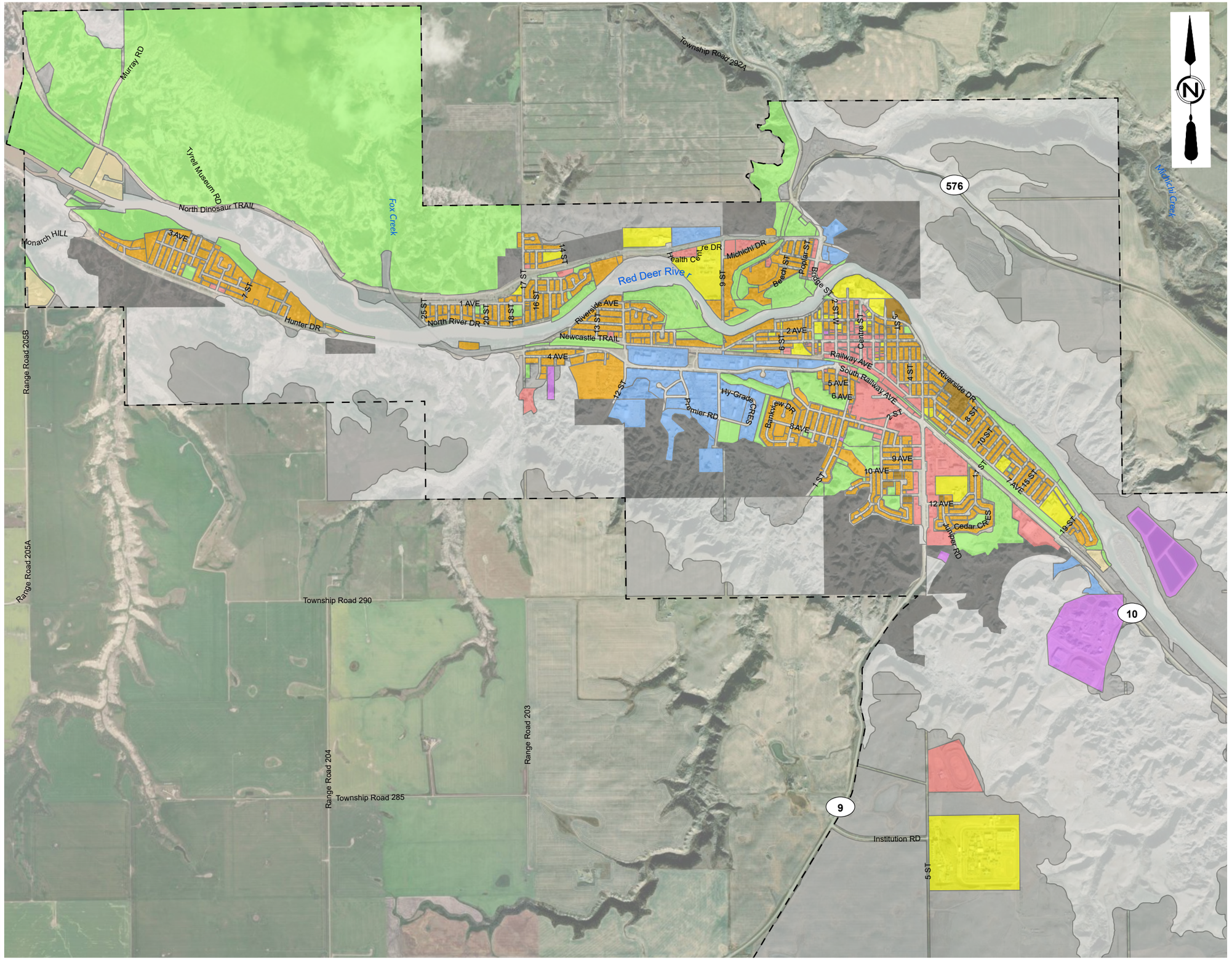

LEGEND:

- Town Boundary

Land Use

- Commercial
- Industrial
- Country Residential
- Single Family Residential
- High Density Residential
- Institutional
- Public Utility
- Parks / Open Space
- Undeveloped
- Rural Development District
- Badlands District

FIGURE 2-1

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

EXISTING LAND USE - DRUMHELLER

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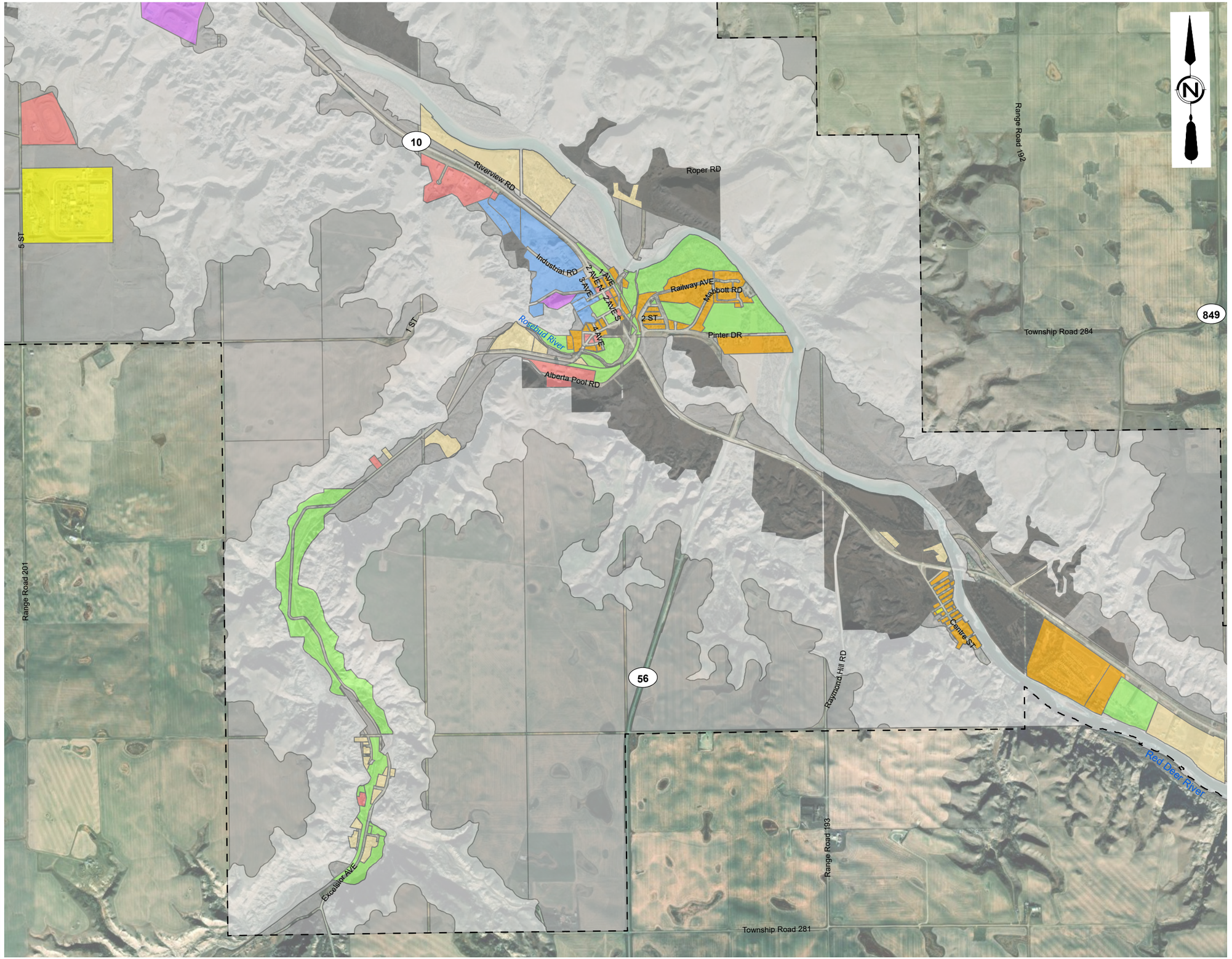

LEGEND:

- Town Boundary

Land Use

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FIGURE 2-2

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

EXISTING LAND USE - ROSEDALE

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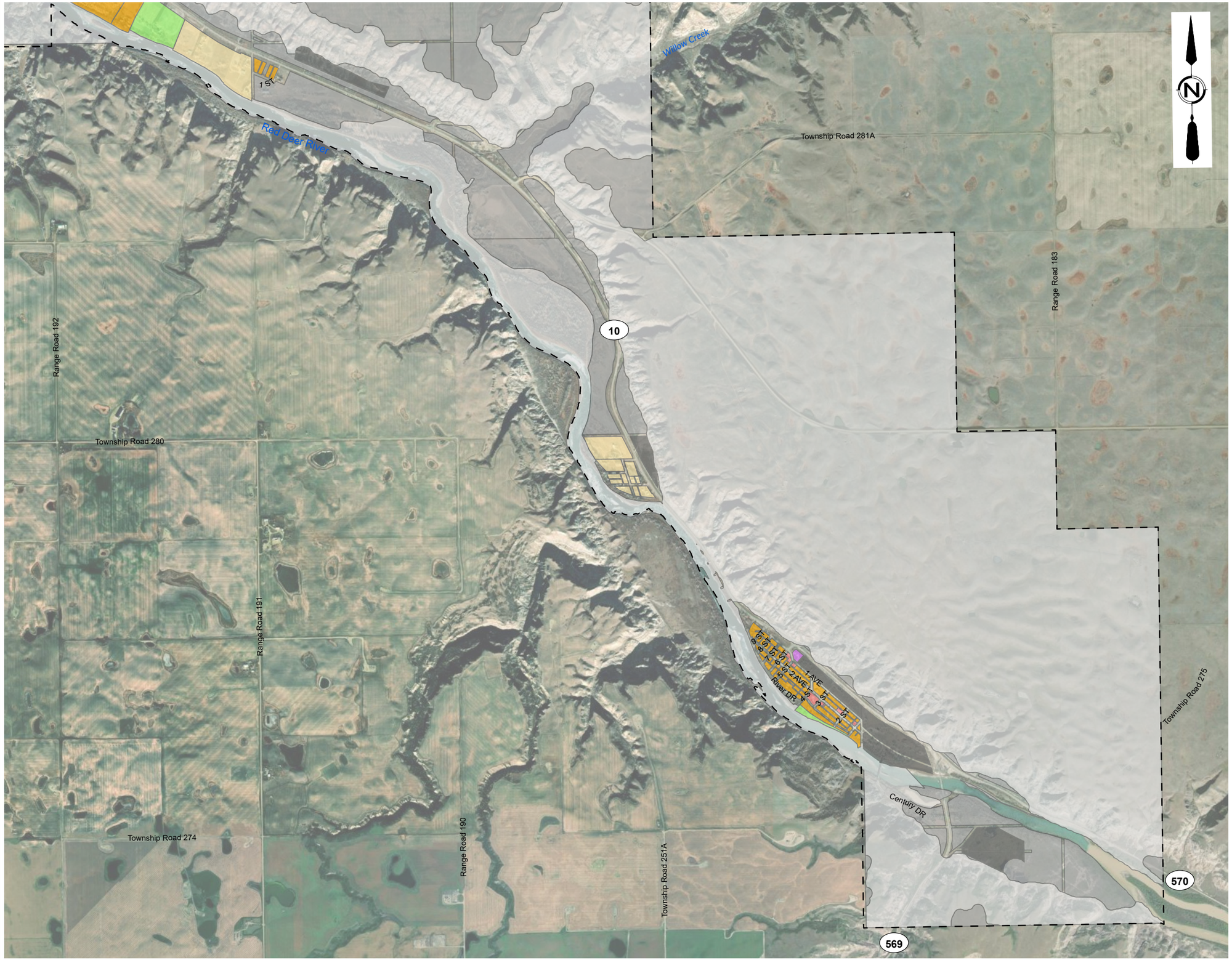

LEGEND:

- Town Boundary

Land Use

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FIGURE 2-3

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

EXISTING LAND USE - EAST COULEE

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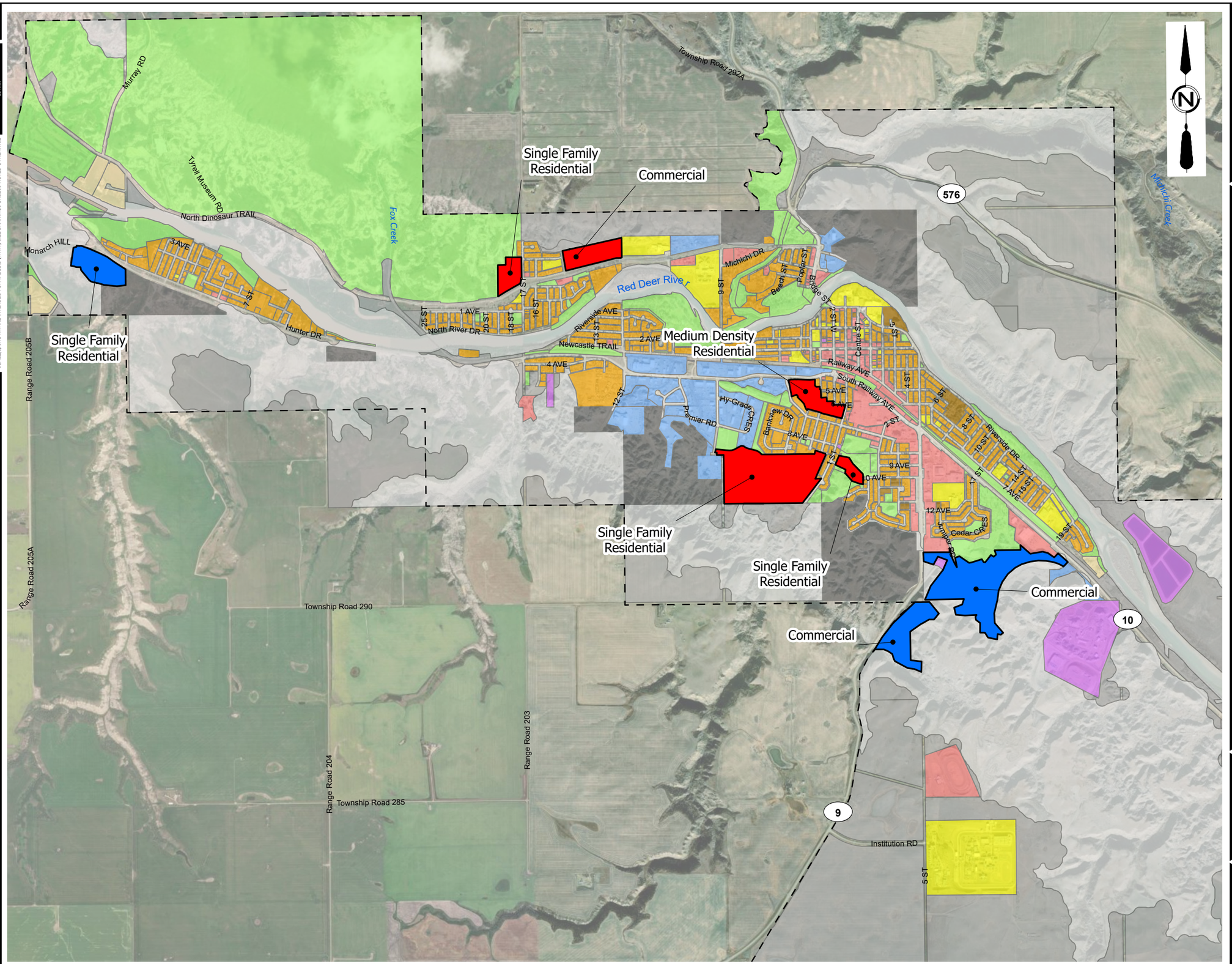

LEGEND:

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Land Use

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- Rural Development District
- Badlands District

Future Land Use

- Short-term Growth
- Long-term Growth

FIGURE 2-4

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

FUTURE GROWTH - DRUMHELLER

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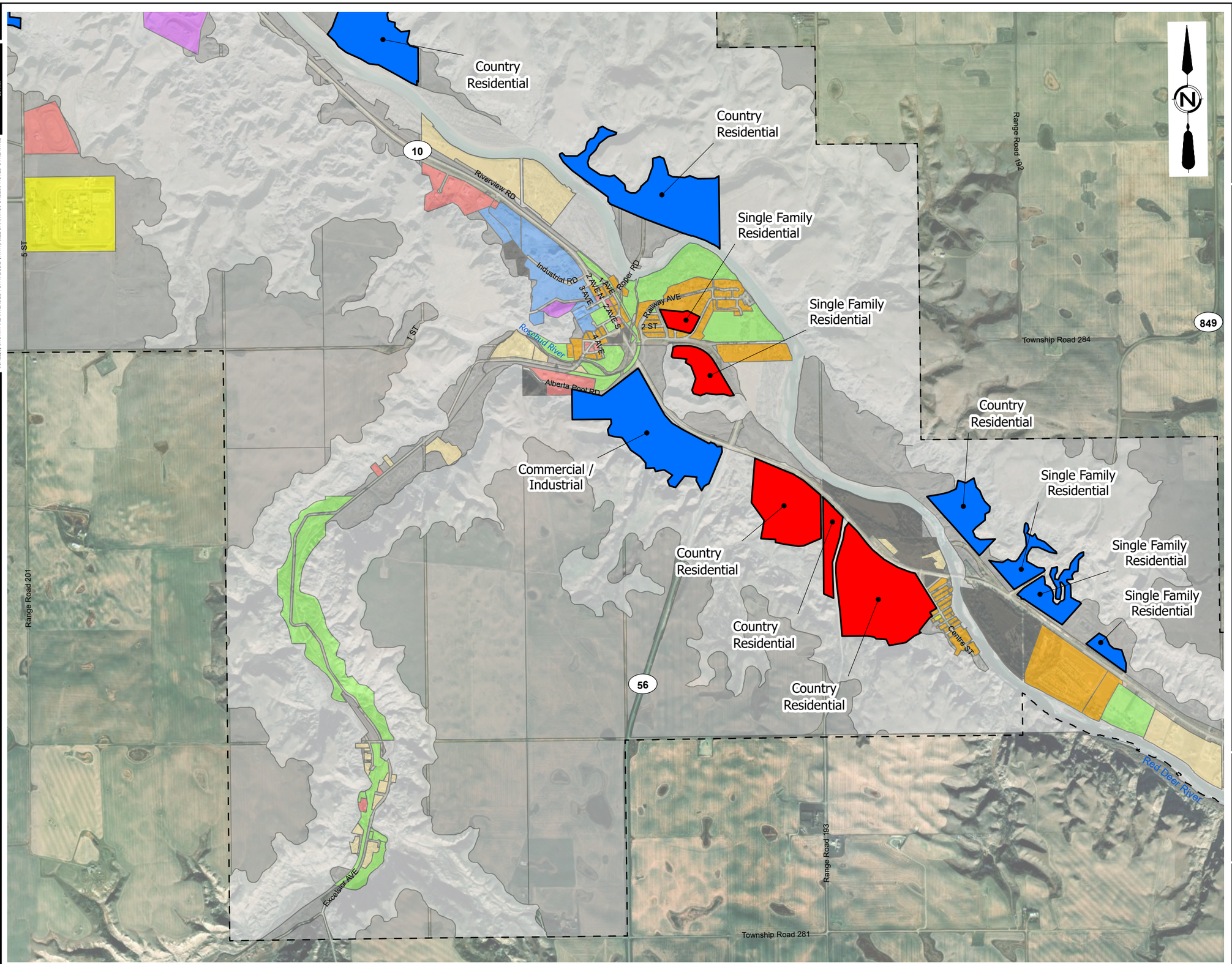

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Future Land Use

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FIGURE 2-5

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

FUTURE GROWTH - ROSEDALE

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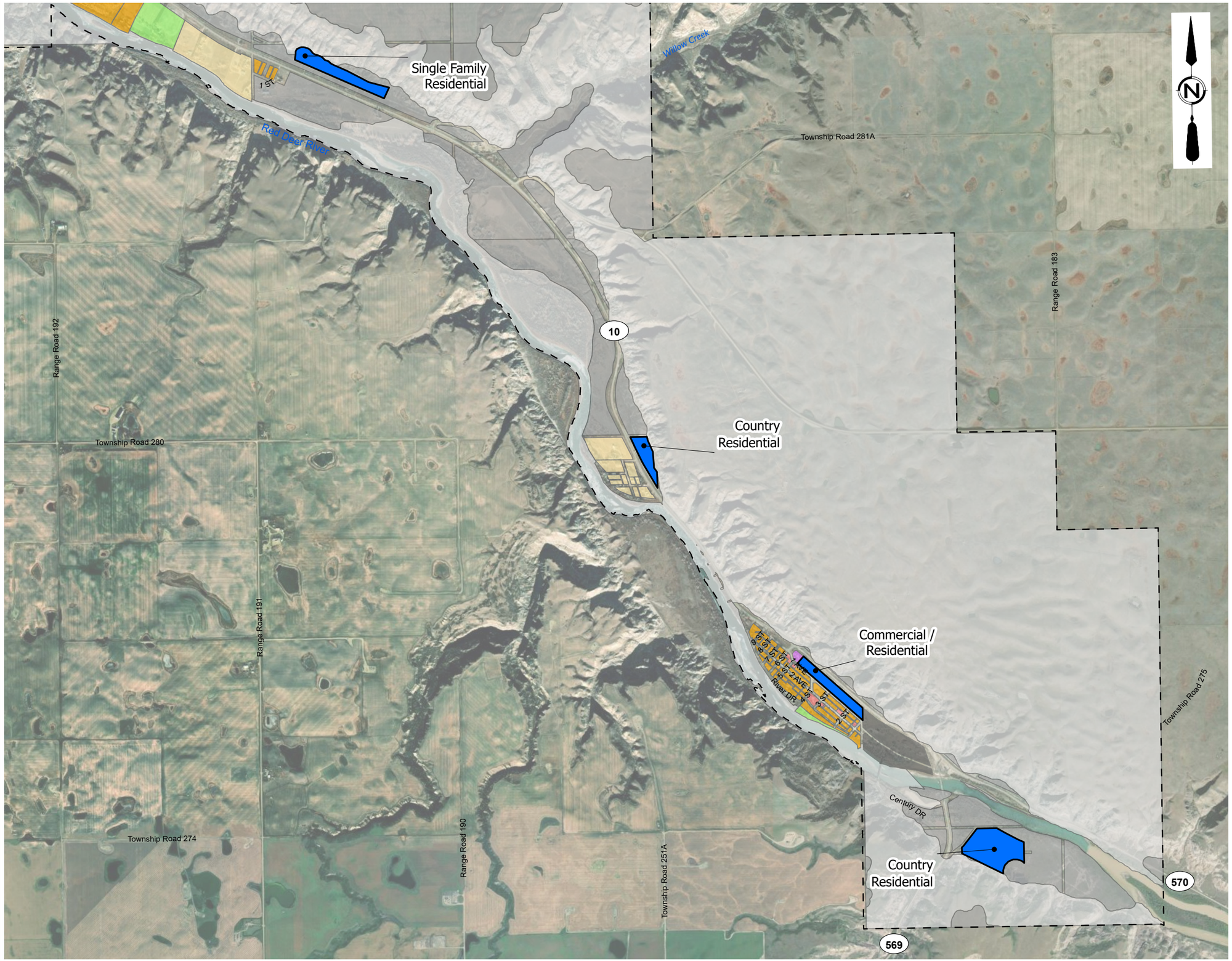

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Future Land Use

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- Long-term Growth

FIGURE 2-6

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

FUNCTIONAL GROWTH - EAST COULEE

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2.4 Water Usage

2.4.1 Water Demand

Water demand is critical in determining the distribution network, pumping capability, and storage requirements. Three critical rates of demand are normally used: average day, maximum day, and peak hour demand. Fire flows, in conjunction with the maximum day flows, are also used to test the system's capability to deliver water and meet demands.

Average Day Demand

The average day demand (ADD) is determined by dividing the total annual consumption by 365 days. By dividing this rate by the population served, the per capita per day demand is derived. This rate is used primarily as a basis for the projection of the total water demand.

Maximum Day Demand

The maximum day demand (MDD) is determined by the single day of maximum consumption observed at the Water Treatment Plant over one year. In using the single day of maximum flow, one must ensure that the record is not distorted by fire fighting demand, equipment malfunction, or watermain breaks. The peaking factor is determined by comparing the maximum day demand to the average day demand. The maximum day demand is used in determining the delivery capacity required of supply mains, treatment facilities, storage facilities, and pumping facilities. In conjunction with the fire flow, it is used to test the water system's capacity to concurrently supply the fire and maximum day demand.

Peak Hour Demand

The peak hour demand (PHD) is the expected maximum demand observed during a short period of the day and excludes the anomalous types of events summarized above. Most facilities are not equipped to record peak hour demands in such detail; therefore, the rate is established based on experience and judgement. The peak hour rate is used in determining pumping requirements.

2.4.2 Historic Water Usage

The Town of Drumheller provided water consumption records for the past 7 years, summarized in **Table 2-4**.

Table 2-4 Historic Water Usage – Town of Drumheller

	2016	2017	2018	2019	2020	2021	2022 [5]	Average
Population – Drumheller/Rosedale	**7,985**	**7,970**	**7,955**	**7,939**	**7,924**	**7,909**	**7,949**	
Total Water Usage – Distribution System								
Water Treatment Plant Output (m^3/year)	1,601,826	1,589,015	1,742,000	1,410,531	1,387,297	1,336,104	1,399,688	
Average Day								
Water Treatment Plant Output (m^3/day)[1]	4,377	4,353	4,773	3,864	3,790	3,661	3,835	
Total - Churchill Co-op (Kneehill) (m^3/day)	21	25	17	25	33	49	52	
Total – Kirkpatrick (Aqua 7) (m^3/day)	1,485	1,521	1,616	1,407	1,416	1,460	1,580	
Total - Munson Booster (Starland Regional) (m^3/day)	182	221	230	184	192	217	248	
Total – CLV Co-op (Starland Regional) (m^3/day)	41	48	55	40	38	57	51	
Total – Penitentiary [2] (m^3/day)	Unknown	309	Unknown	268	255	216	185	
Total – Stampede [2] Barn (m^3/day)	Unknown	0.6	Unknown	1.8	0.1	0.3	0.5	
Total – Drumheller/Rosedale Residents (m^3/day)	2,647	2,230	2,855	1,939	1,857	1,661	1,719	
Total Per Capita – Drumheller/Rosedale Residents (L/c/d)	-	280	-	244	234	210	216	237 [3]
Maximum Day								
Maximum Day (m^3/day) [4]	7,574	8,673	9,185	7,297	6,398	7,535	7,328	
Peaking Factor	-	**2.0**	-	**1.9**	**1.7**	**2.1**	**1.9**	**1.9** [3]

Notes:

1. The Water Treatment Plant Output represents the total volume of treated water that left the Water Treatment Plant to the distribution system.
2. No water consumption data for the Penitentiary nor Stampede Barn is available for the years 2016 and 2018.
3. The average does not include data from years 2016 and 2018 as the data for those years is incomplete.
4. The Maximum Day values provided represent the total maximum volume of treated water that left the Water Treatment Plant to the distribution system.
5. The 2022 population is estimated based on the 2021 population and projected at the proposed growth rate of 0.5%.

As shown in **Table 2-4**, the per capita water consumption ranged from 210 to 280 L/c/d with a general declining trend. This trend is consistent with other Albertan communities. The average per capita water consumption over the time period data was available (excluding years 2016 and 2018) is calculated to be 237 L/c/d. A per capita water consumption rate of 250 L/c/d is proposed, which exceeds water usage over the past 4 years and provides 5% conservatism above the calculated average. The pumping assessment will be based on the per capita water consumption rate as well as the projected growth over the timeline assessed.

Table 2-5 summarizes the regional demands over the last 7 years.

Table 2-5 Historic Water Consumption – Regional Demands

Year	Aqua 7 (Kirkpatrick) Point Load (L/s)	Munson Booster Point Load (Starland Regional) (L/s)	CLV Point Load (Starland Rural) (L/s)	Churchill Point Load (Kneehill) (L/s)	Total (L/s)
2016	17.2	2.1	0.5	0.2	**20.0**
2017	17.6	2.6	0.6	0.3	**21.0**
2018	18.7	2.7	0.6	0.2	**22.2**
2019	16.3	2.1	0.5	0.3	**19.2**
2020	16.4	2.2	0.4	0.4	**19.4**
2021	16.9	2.5	0.7	0.6	**20.6**
2022	18.3	2.9	0.6	0.6	**22.3**
Average	**17.3**	**2.4**	**0.5**	**0.4**	
Recommended Point Load	**18.3**	**2.9**	**0.6**	**0.6**	

As shown in **Table 2-5**, regional water consumption has generally been increasing in recent years; therefore, we propose to use the 2022 demands in our assessment of the Town's existing water distribution system.

Table 2-6 summarizes the demands from the Penitentiary and Stampede Barn over the last 7 years.

Table 2-6 Historic Water Consumption – Miscellaneous Demands

Year	Penitentiary Point Load (L/s)	Stampede Barn Point Load (L/s)	Total (L/s)
2016	Unknown	Unknown	**Unknown**
2017	3.6	0.014	**3.6**
2018	Unknown	Unknown	**Unknown**
2019	3.1	0.038	**3.1**
2020	2.9	0.004	**3.0**
2021	2.5	0.007	**2.5**
2022	2.1	0.012	**2.1**
Average	**2.9**	**0.015**	

2.4.3 Recommended Fire Flows

In accordance with Water Supply for Public Fire Protection (Fire Underwriters Survey, 2020), the fire flows in **Table 2-7** are proposed for developments within the Town boundary. These target fire flows are in general conformance with the previous reports prepared for the Town by others, as well as other local communities and the typical values we have used for similar assessments in Alberta.

Table 2-7 Proposed Fire Flow

Type of Development	Minimum Fire Flow
Residential	
Single Family (low density)	75 L/s
Multi-family (medium density)	133 L/s
High Density (walk-up apartments)	200 L/s
Commercial	
Standard	183 L/s
High Value Properties (multi-storey hotels, etc.)	233 L/s
Industrial	183 L/s
Schools	
Elementary	167 L/s
High School	183 L/s
Institutional	
Standard	183 L/s
Churches	100 L/s
High Value Properties (hospital)	233 L/s

Typically, the higher residential value of 200 L/s is proposed to be applied to all new residential locations (future development areas). This will allow for potential high density neighbourhood development (walk-up apartments) and will also provide for additional fire flow flexibility in these locations.

No fire flow will be provided to Country Residential developments This includes existing development on the eastern edge of Drumheller, as well as existing and future locations in the Rosedale area.

2.4.4 Proposed Design Demands

Based on the recent water usage data, the water demands for the Town's water distribution system presented in **Table 2-8** are proposed.

Table 2-8 Proposed Design Demands

Demand Scenario	Per Capita Demand	Peaking Factor
Average Day Demand (ADD)	250 L/c/d	
Maximum Day Demand (MDD)	500 L/c/d	2.0
Peak Hour Demand (PHD)	750 L/c/d	3.0

The proposed ADD of 250 L/c/d is a conservative estimate as it captures the maximum value over the last 4 years and is approximately 5% higher than the calculated average. A conservative ADD will help allow for a "buffer" to accommodate years with higher water consumption.

Based on the assessment of the historical water consumption from 2016 onward, the proposed Maximum Day peaking factor of 2 is reasonable and is consistent with our experience for similar communities in Alberta. The proposed peak hour peaking factor of 3 is based on industry practice and our experience for similar communities in Alberta.

Projected Design Demands

Table 2-9 presents the projected design demands for 25 years (for the pumping and storage assessments) as well as projected design demands for the priority development and ultimate build-out growth horizons, based on the areas illustrated on **Figures 2-4** through **2-6.**

Based on a growth rate of 0.5%, the Town is anticipated to reach the priority development population of 11,153 by 2090 (67 years of growth) and the ultimate build-out population of 13,337 by 2126 (103 years of growth).

Table 2-9 Projected Design Demands

	2023	2028	2033	2038	2043	2048	Priority Dev. [6]	Ultimate Build-out [7]
Drumheller/Rosedale								
Estimated Population	7,988	8,190	8,397	8,609	8,826	9,049	11,153	13,337
Average Day Demand (L/s)	23.1	23.7	24.3	24.9	25.5	26.2	32.3	38.6
Regional Connections (ADD in L/s)								
Munson Booster Starland Regional)	3.0	3.8	4.2	4.7	5.2	5.7	5.7	5.7
CLV Co-op (Starland)	0.6	0.7	0.8	0.9	1.0	1.1	1.1	1.1
Aqua 7 (Kirkpatrick)	18.7	20.6	23.9	27.7	32.1	37.2	37.2	37.2
Churchill Co-op (Kneehill)	0.7	1.5	1.6	1.8	2.0	2.2	2.2	2.2
Other Demands (ADD in L/s)								
Penitentiary	2.9	2.9	3.0	3.1	3.2	3.2	3.2	3.2
Stampede Barn	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

	2023	2028	2033	2038	2043	2048	Priority Dev. [6]	Ultimate Build-out [7]
TOTALS								
Average Day Demand (L/s)	49.0	53.3	57.9	63.1	69.0	75.6	81.7	88
Maximum Day Demand (L/s)	97.9	107	116	126	138	151	163	176
Peak Hour Demand (L/s)	121	130	140	151	163	177	196	215
Max. Day + Fire Flow (L/s)	331	340	349	359	371	384	396	409

Notes:
1. The projected 25 year demands for the regional connections, as well as the Penitentiary and Stampede Barn, were applied in each growth scenario. No additional growth beyond 25 years was calculated for the Penitentiary, Stampede Barn, or regional connections.
2. The 2023 projection and the following 5 years of growth for the regional connections were calculated based on 5.0% (Munson), 4.0% (CLV), 2.0% (Aqua 7), and 16% (Churchill), based on the historic average annual growth from 2016 to 2022 (estimated from historic water consumption).
3. The remainder of the 25 years of growth projections for the regional connections were calculated based on 2.0% growth for all regional connections, with the exception of Aqua 7 (3.0%).
4. The Penitentiary was assumed to have a growth rate of 0.5%, to be consistent with the rest of the Town.
5. The demand associated with the Stampede Barn is assumed to remain constant.
6. The ADD for the priority development growth scenario is based on the priority development growth areas identified on **Figures 2-4** through **2-6**.
7. The ADD for the ultimate-buildout scenario is based on the ultimate build-out growth areas identified on **Figures 2-4** through **2-6**.

2.5 Operating Pressure

The operating pressures presented in **Table 2-10** are proposed, in accordance with industry best practice and previous reports completed for the Town by others.

Table 2-10 Recommended Operating Pressures

Scenario	Pressure
Maximum allowable pressure in the system	550 kPa (80 psi)
Minimum allowable pressure during PHD	280 kPa (40 psi)
Minimum residual pressure in the system during a fire (MDD + fire flow)	140 kPa (20 psi)

A minimum pressure of 140 kPa (20 psi) is proposed to be used at regional connections.

2.6 Hazen-Williams C Factors

Based on our experience, we are proposing the Hazen-Williams C roughness factors presented in **Table 2-11**.

Table 2-11 Recommended C Factors

Pipe Material	C Factor
Steel	110
Concrete Pressure Pipe	110
Cast Iron (CI)	110
Ductile Iron (DI)	120
Asbestos Cement (AC)	120
PVC/HDPE	130

Proposed watermains are assumed to be PVC and to have a pipe roughness factor of 130.

2.7 Velocity

We recommend a maximum velocity of 1.5 m/s during normal system operation and 3.0 m/s during fire flow scenarios. High velocities and sudden changes in these velocities can result in pressure surges and negative pressure, which can cause serious pipe and/or equipment damage. Increased velocities require higher pumping heads and can result in higher energy costs.

2.8 Minimum Pipe Size

The minimum pipe sizes presented in **Table 2-12** are based on industry best practice and are recommended to be used in the water distribution system.

Table 2-12 Minimum Pipe Sizes

Land Use	Diameter
Single Family Residential	200 mm
Multi-Family Residential	250 mm
Industrial/Commercial/Institutional	300 mm

Proposed pipe sizes will be determined based on the results of the hydraulic network analysis. Larger mains may be required in high fire flow locations such as walk-up apartments and in some commercial/industrial and institutional locations.

3 EXISTING WATER DISTRIBUTION SYSTEM

3.1 Existing Facilities

The Town of Drumheller's existing water system consists of the following:

- Raw Water System
  - Intake
  - Intake Pumping Station
  - Raw Water Storage Reservoirs
  - Low Lift Pumphouse
- Water Treatment Plant (WTP) and Pumphouse
- Water Distribution System
- Water Towers
  - Bankview
  - Central
  - Greentree
  - Newcastle
  - Rosedale
- Booster Stations
  - Huntington Booster Station
  - Penitentiary Booster Station
- East Coulee Bulk Water Station
- Rosedale Valve Station

The Town also supplies potable water to downstream customers and regional users, as outlined below:

- Churchill Water Co-op Meter Station (Kneehill)
- Kirkpatrick Reservoir (Aqua 7)
- Munson Booster Station (Starland Regional)
- CLV Water Co-op Meter Station (Starland Regional)
- Drumheller Penitentiary Reservoir
- Stampede Barn

Figure 3-1 and **Figure 3-2** present the locations of the key facilities.

3.1.1 Raw Water System

The raw water system is outside of the current scope of work and will not be described or assessed in this study.

3.1.2 Water Treatment Plant and Pumphouse

The WTP is outside of the current scope of work and will not be described or assessed in this study. Refer to the Water Treatment Master Plan which is currently ongoing.

The WTP pumphouse contains three potable water pumps as outlined below. It is understood that the pumps operate in a lead-lag configuration with the 60 hp operating as the lead pump; however an operator is required to start the second pump. In the summer, one of the 80 hp pumps operates as the lead pump.

- 1 x 60 hp vertical turbine pump with a capacity of 80 L/s at 42 m head – Pump 3
- 2 x 80 hp vertical turbine pumps with a capacity of 105 L/s at 49 m head – Pumps 1 and 2

A pressure relief valve operates to limit the maximum outgoing pressure to 450 kPa (65 psi). This is equivalent to an HGL of 735.3 m based on a header elevation of 689.5 m at the WTP pumphouse. Outgoing pressure is primarily constrained by the tower water levels; however, the PRV is thought to operate during pump start and if two pumps are in operation.

Generally, one pump operates at a time based on water tower volumes (excluding the Rosedale Tower). The operating pump starts at a volume of 6900 m^3 and stops at a volume of 7900 m^3. Either the small pump or one of two larger pumps will operate.

A second pump is occasionally required to operate, mainly during fire flow scenarios. This must be turned on by hand, as it will not turn on automatically based on tower volume or system pressure.

Treated water reservoir capacity of 2,763 m^3 is located at the WTP (based on pump shutdown level).

3.1.3 Water Distribution System

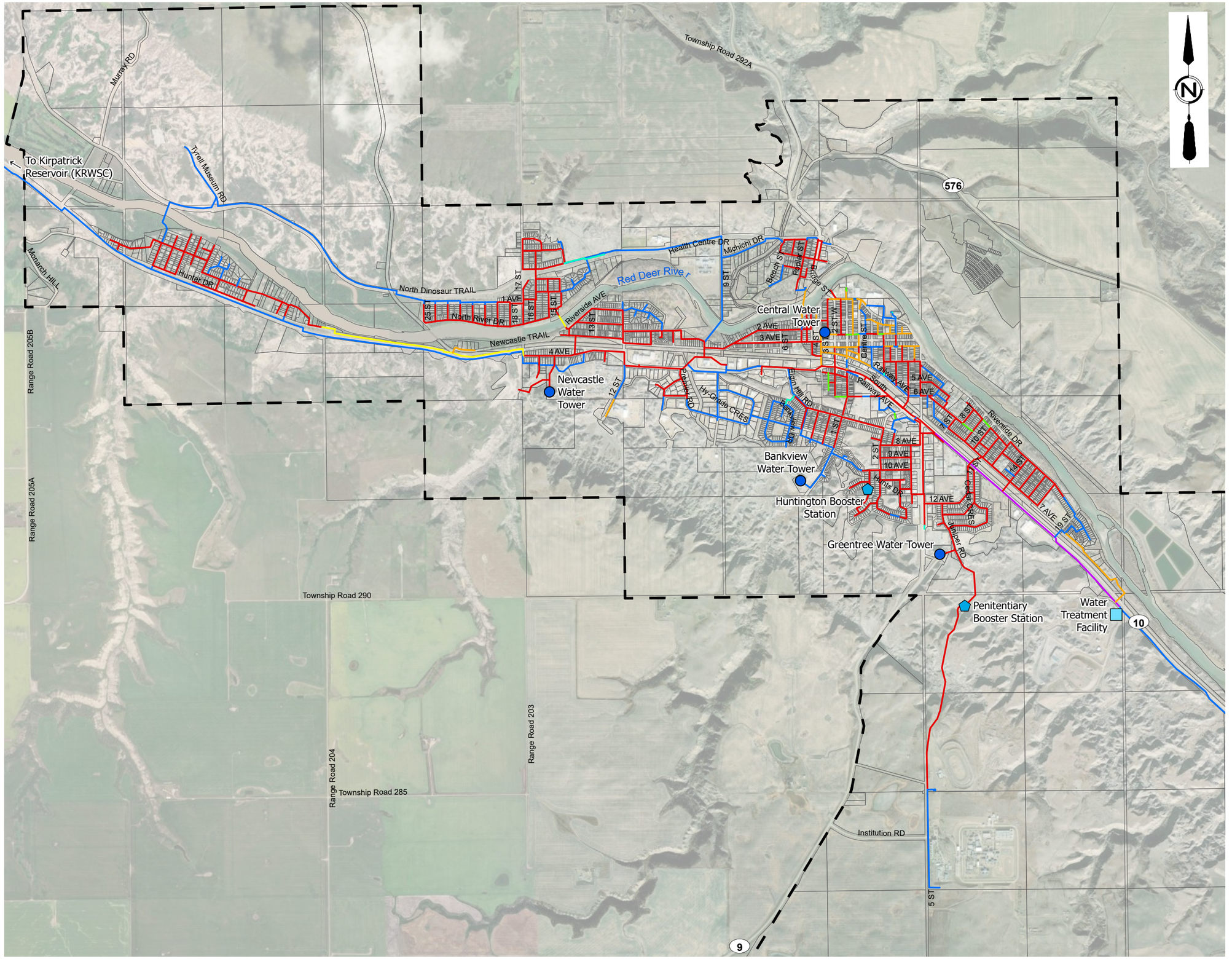
The existing distribution system is comprised of Asbestos Cement, Cast Iron, HDPE, PVC, Steel, Ductile Iron and Concrete Pressure Pipe (Hyprescon) (refer to **Figure 3-1** and **Figure 3-2**). Pipe material has been updated using the GIS information provided.

Pipe sizes range from 50 mm to 500 mm. **Figure 3-3** and **Figure 3-4** indicate the pipe sizes of the existing water distribution system.

There are four (4) pressure zones located within the existing distribution system as show in **Figure 3-3** and **Figure 3-4**:

1. The majority of the distribution system is supplied directly by the WTP and forms the primary pressure zone.
2. A small pressure zone is located downstream of the Huntington Booster Station. Closed valves isolate this area from the remainder of the system.
3. A small pressure zone is located downstream of the Penitentiary Booster Station.
4. Rosedale (and downstream) operates as separate pressure zone.

It is understood that a new 300 mm crossing of the Red Deer River will be constructed in the near future, from a location north of the river to 3 St W and 2 Ave W. This main has been included in the exiting water model and the current 200 mm steel crossing is assumed to be abandoned.



LEGEND:

- Water Treatment Plant
- Water Tower
- Booster Station
- Town Boundary

Distribution System - Pipe Material

- AC
- PVC
- HDPE
- Cast Iron
- Ductile Iron
- Hyprescon
- Steel

FIGURE 3-1

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

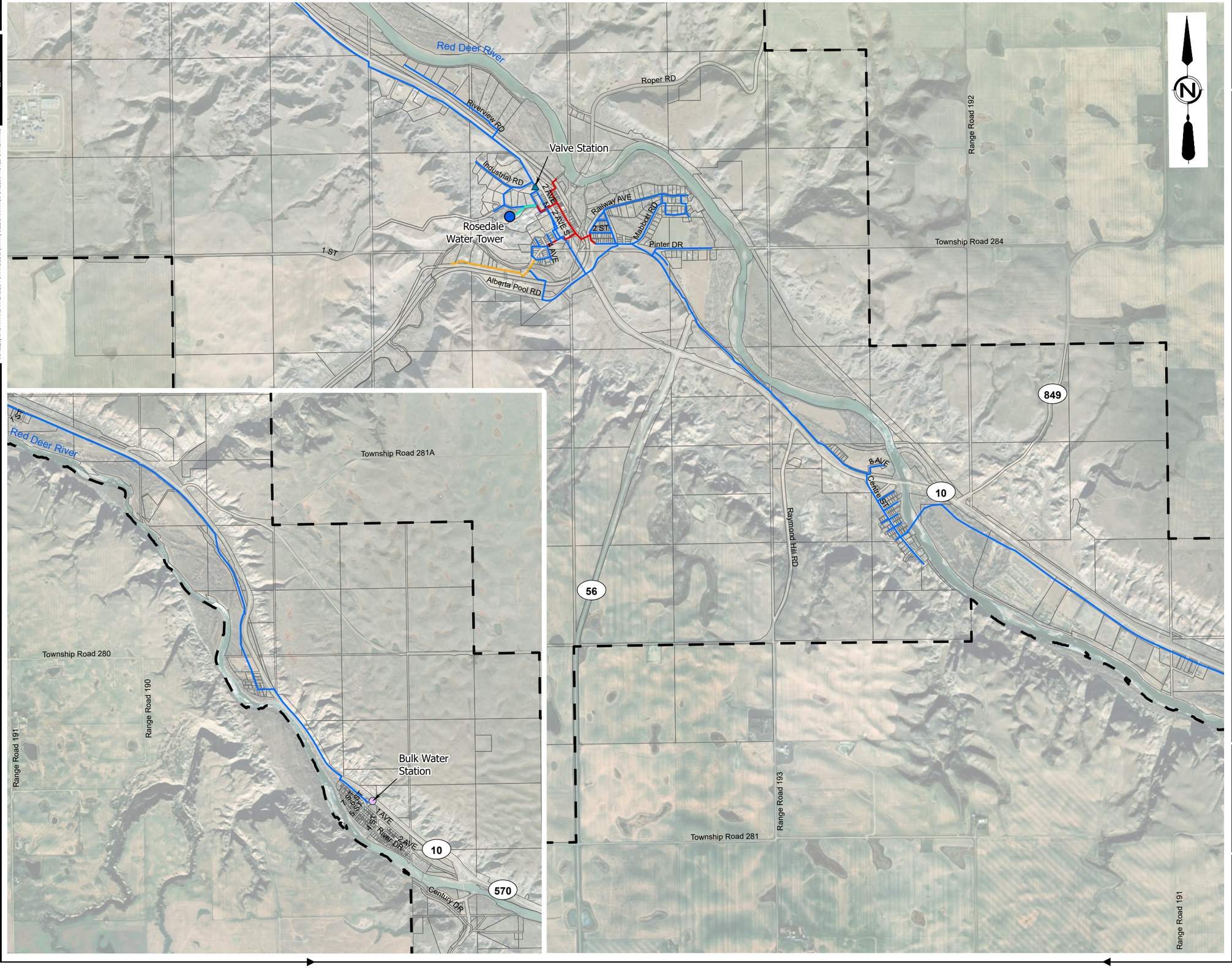
EXISTING WATER DISTRIBUTION SYSTEM
PIPE MATERIALS

AE PROJECT No.	2023-3628-00
SCALE	1:30,000
DATE	2024FEB22
PROJECTION	NAD 1983 CSRS 3TM 114
DRAWN BY	KR
CHECKED BY	DK
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



LEGEND:

- Water Tower
- Valve Station
- Bulk Water Station
- Town Boundary

Distribution System - Pipe Material

- AC
- PVC
- HDPE
- Cast Iron
- Ductile Iron
- Hyprescon
- Steel

FIGURE 3-2

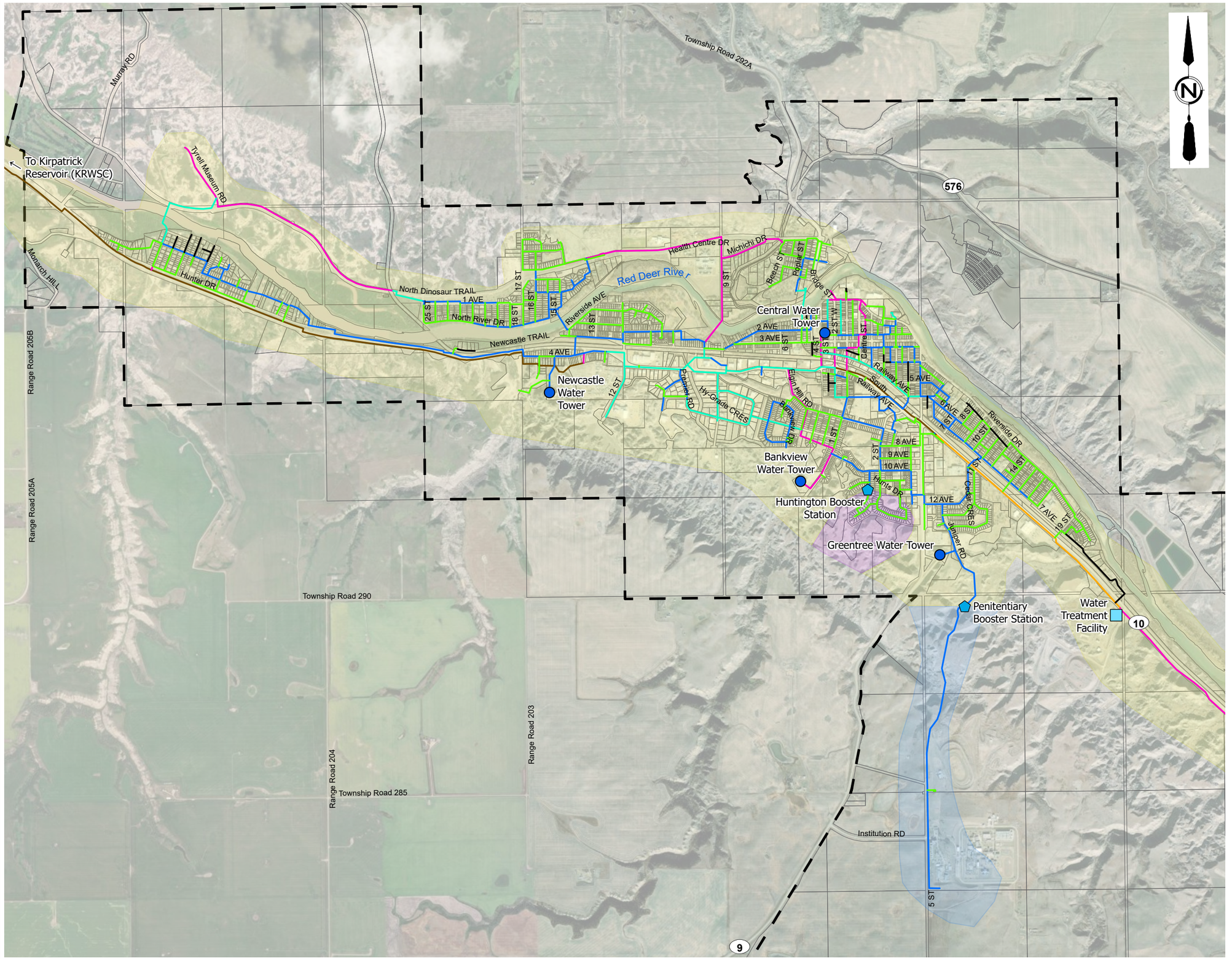
TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

EXISTING WATER DISTRIBUTION SYSTEM
PIPE MATERIALS

AE PROJECT No.	2023-3628-00
SCALE	1:30,000 (INSET 1:45,000)
DATE	2023DEC06
PROJECTION	NAD 1983 CSRS 3TM 114
DRAWN BY	KR
CHECKED BY	DK
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

SAVE DATE: 11/20/2023 1:41 PM SAVED BY:
DRAWING PATH: E:\gis\2023_3628_Drumheller_Water\Drumheller_Water_2023.aprx
DATA SOURCE: World Imagery; Maxar;



LEGEND:

- Water Treatment Plant
- Water Tower
- Booster Station
- Town Boundary

Pipe Size

- Existing ≤100 mmø
- Existing 150 mmø
- Existing 200 mmø
- Existing 250 mmø
- Existing 300 mmø
- Existing 450 mmø
- Existing 500 mmø

Pressure Zone

- Zone 1
- Zone 2
- Zone 3
- Zone 4

FIGURE 3-3

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

EXISTING WATER DISTRIBUTION SYSTEM
PIPE DIAMETERS

AE PROJECT No.	2023-3628-00
SCALE	1:30,000
DATE	2024FEB22
PROJECTION	NAD 1983 CSRS 3TM 114
DRAWN BY	KR
CHECKED BY	DK
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

Red Deer River
Roper RD
Riverview RD
Valve Station
Industrial RD
2 AVE
2 AVE S
Railway AVE
Rosedale
Water Tower
1 ST
1 AVE
2 ST
Mabbott RD
Pinter DR
Alberta Pool RD
Township Road 284
Range Road 192
849
8 AVE
Centre ST
10
Raymond Hill RD
56
Township Road 281
Range Road 193
Range Road 191

Red Deer River
Township Road 281A
Township Road 280
Range Road 190
Range Road 191
Bulk Water
Station
1 AVE
2 AVE
River DR
10
570
Century DR

N

LEGEND:

- Water Tower
- Valve Station
- Bulk Water Station
- Town Boundary

Pipe Size

- Existing ≤100 mmø
- Existing 150 mmø
- Existing 200 mmø
- Existing 250 mmø
- Existing 300 mmø
- Existing 450 mmø
- Existing 500 mmø

Pressure Zone

- Zone 1
- Zone 2
- Zone 3
- Zone 4

Associated Engineering

BEST MANAGED COMPANIES CANADA Platinum member

FIGURE 3-4

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

EXISTING WATER DISTRIBUTION SYSTEM
PIPE DIAMETERS

AE PROJECT No.	2023-3628-00
SCALE	1:30,000 (INSET 1:45,000)
DATE	2023DEC06
PROJECTION	NAD 1983 CSRS 3TM 114
DRAWN BY	KR
CHECKED BY	DK
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

SAVE DATE: 11/20/2023 1:43 PM SAVED BY:
DRAWING PATH: E:\pw\2023-3628_Drumheller_Water\Drumheller_Water_2023.aprx
DATA SOURCE: World Imagery, Earthstar Geographics;

3.1.4 Water Towers

The Town of Drumheller operates five (5) water towers within the distribution system. Detailed drawings of most of the towers were not available for use on this project. Water Tower information including the Base, Minimum, and Maximum water level elevations have been adopted from the 2006 WaterCAD Model provided. Water Tower volumes have been obtained from numerous previous reports. All information is assumed to be correct; however, cannot be verified at this time. The Central Water Tower is elevated, while all other towers are partially above ground water reservoirs constructed at higher elevations. Water Tower locations are presented on **Figure 3-3** and **Figure 3-4**. Available water tower information is outlined in **Table 3-1** below:

Table 3-1 Water Tower Information

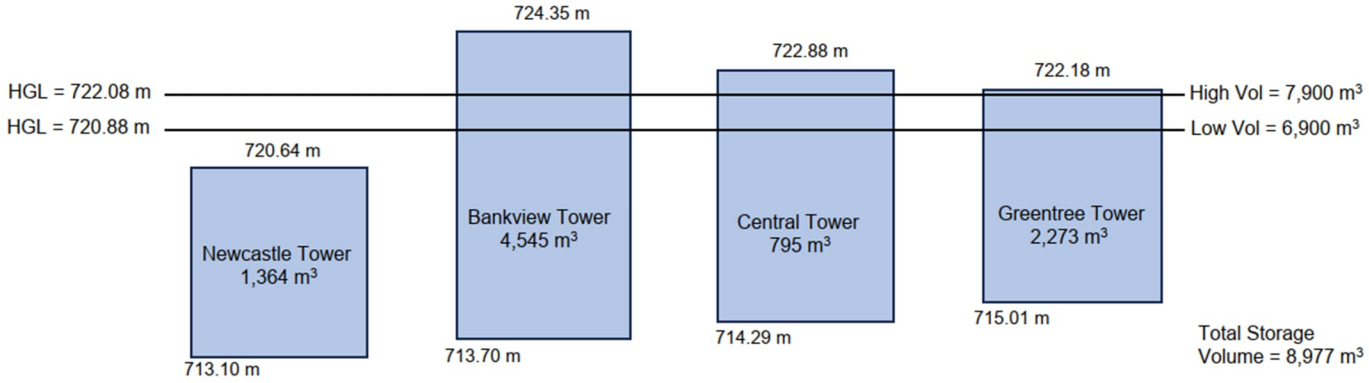
Water Tower	Elevation (m)			Volume
	Base	Minimum	Maximum	(m^3)
Bankview	713.7	713.7	724.35	4545
Central	714.21	714.29	722.88	795
Greentree	715.01	715.01	722.18	2273
Newcastle	713.1	713.1	720.64	1364
Rosedale	711.09	711.09	715.01	1136

3.1.4.1 Water Tower Operating Range

The Town has indicated that the WTP pumps operate based on the volume of water contained within the distribution water towers, including Newcastle, Bankview, Central, and Greentree. The duty pump will turn on when the storage is calculated to be 6,900 m^3 and will turn off when the volume reaches 7,900 m^3. It is assumed that the total volume is based on water levels monitored within each water tower.

As detailed water level operating data has not been provided, it has been necessary to estimate the typical water levels associated with the operational volumes. **Figure 3-5** presents the approach taken to estimate the operating levels. As shown on the Figure, the water towers were compared to each other based on the minimum and maximum elevations. Each tower was assumed to be a consistent diameter (cylinder) to simplify the assessment.

Figure 3-5 Water Tower Operating Levels



It was determined that the low volume of 6,900 m^3 was equivalent to an HGL of 720.88 m and the high volume of 7,900 m^3 was equivalent to an HGL of 722.08 m^3. The results were simplified to a pump start at 720.9 m HGL and stop at 722.1 m HGL. It is acknowledged that this is a simplification of the system and that individual water tower HGLs may vary minimally due to their location within the distribution system.

Based on the assumptions and as shown on the Figure, the Central and Greentree Towers are functioning near the top of their operating range and the Newcastle Tower may not be functioning at all (draining or filling). This is corroborated by the Town which indicated that Newcastle Tower rarely opens. The Bankview Water Tower drawing identifies a control valve which is assumed to close based on high water level within the water tower. The drawings also identify a bypass with check valve which allows for draining of the tower. Presumably, high distribution system pressure could result in the water tower neither filling nor draining (assuming it is already full), which is assumed to be the case for the Newcastle Tower. Drawings for the Newcastle Tower were unavailable; however, it is assumed to be designed similarly to the Bankview Tower.

3.1.4.2 Rosedale Tower

As outlined in previous reports and confirmed by the Town, the Water Tower in Rosedale is operated through a valve chamber located on the 300 mm PVC transmission line. Water level in the water tower is regulated by float switches. The automatic valve within the valve chamber will close when the tower is at 3.9 m full which allows the tower to supply the Rosedale and East Coulee service areas. When the tower level falls to 3 m, the automatic valve will open to fill the tower and supply Rosedale and East Coulee.

3.1.5 Booster Stations

3.1.5.1 Huntington Booster Station

Information regarding the Huntington Booster Station is not available. The information contained within the WaterCAD model provided will be maintained for the current assessment. As identified in the model, there is one pump operating at a duty point of 28.4 L/s at 21.3 m head. It is unknown whether there are additional pumps and pressure control at the station. Based on the model, there is no provision for pumped fire flow at this location (other than the singular pump capacity).

3.1.5.2 Penitentiary Booster Station

The Penitentiary Booster Station provides water to the Churchill Water Co-op, Rodeo Grounds, and the Penitentiary. The booster station was recently constructed, in early 2023, above the existing booster vault. The station contains three (3) pumps, each rated at 10.8 L/s at 152 m head. The design flow for the station is based on two pumps operating, for a total flow of 21 L/s. A PRV limits the outgoing pressure to a maximum of 1,791 kPa (260 psi), or an HGL of 883.1 m based on a header elevation of 700.1 m.

3.1.6 East Coulee Bulk Water Station

No information is available for the East Coulee Bulk Water Station. It is understood that very little flow is delivered to this area currently.

3.1.7 Rosedale Valve Station

The Rosedale Valve Station operates to allow for filling/draining of the Rosedale Water Tower based on water level within the tower.

3.2 Model Development

The WaterCAD model provided was updated to reflect the current distribution system using GIS information and LIDAR. Water demand estimates were input to reflect current water usage and land use information, and fire flow requirements were input based on current land use information. Water Tower and pump setpoints were input based on updated information where available, otherwise the existing model information was maintained.

3.3 Boundary Conditions

Boundary conditions are based on the water tower operating range (in HGL) and whether pumps are in operation. The following conditions have been assumed based on the various demand scenarios modelled:

- Average Day Demand Scenario (typically the highest system pressure)
    - High operating water elevation of 722.1 m at the Bankview, Central, and Greentree Water Towers.
    - Newcastle tower is at 720.6 m and is therefore closed (exceeds maximum water level).
    - One pump in operation at the WTP.
    - This reflects that a WTP pump is in operation and has essentially filled the towers. The pump would soon turn off.
    - Rosedale:
        - High operating water elevation of 715 m at the Rosedale Water Tower.
        - The valve station is closed, and all pressure is supplied by the Rosedale Water Tower.
- Maximum Day Demand Scenario
    - Low operating water elevation of 720.9 at the Bankview, Central, and Greentree Water Towers.
    - Newcastle tower is at 720.6 m and is therefore closed (exceeds maximum water level).
    - One pump in operation at the WTP.
    - This reflects that the water tower levels have fallen, and that one pump has recently started at the WTP.

    - Rosedale:
        - Low operating water elevation of 714.1 m at the Rosedale Water Tower.
        - The valve station is open, and the Rosedale Water Tower is being filled by the Drumheller distribution system (as the WTP pumps are assumed to be off).
- Peak Hour Demand Scenario (typically the lowest system pressure)
    - Low operating water elevation of 720.9 at the Bankview, Central, and Greentree Water Towers
    - Newcastle tower is at 720.6 m. The Tower is considered to be open as no pumps are operating and water will drain from the towers as the HGL falls.
    - No pumps are operating, and all water is delivered from the water towers. This assumes that the water level is falling in the towers and is approaching the level which will cause the WTP pumps to start.
    - This reflects that the water tower levels have fallen and that a pump will soon turn on at the WTP.
    - Rosedale:
        - Low operating water elevation of 714.1 m at the Rosedale Water Tower.
        - The valve station is open, and the Rosedale Water Tower is being filled by the Drumheller distribution system (as the WTP pumps are assumed to be off).
- Maximum Day plus Fire Flow Scenario
    - Low operating water elevation of 720.9 at the Bankview, Central, and Greentree Water Towers.
    - Newcastle tower is at 720.6 m. The Tower is considered to provide fire flow as required.
    - Two pumps are operating at the WTP. The second pump will be turned on by operators as required.
        - The worst case scenario is that no pumps are operating at the WTP; however, pumps are likely to be turned on as necessary to contribute to fire fighting.
    - Rosedale:
        - Low operating water elevation of 714.1 m at the Rosedale Water Tower.
        - The valve station is open, and the Rosedale Water Tower is being filled by the Drumheller distribution system. The WTP pumps are assumed to be on due to fire flow conditions.
            - It is assumed that the valve station can be opened remotely upon fire flow conditions in Rosedale regardless of the water tower elevation.

3.4 Model Validation

The Town provided 2021 Hydrant Flushing Data for numerous locations throughout Drumheller. The static pressure data provided was mapped showing both static pressure and HGL (using LIDAR ground information). The results were reviewed with consideration for typical water tower operating HGLs. In general, the recorded static pressure (and calculated HGLs) fell within the typical operating HGL for the nearby water towers. Some pressures/HGLs were outside the expected values and are likely erroneous. This may potentially be attributed to a faulty pressure gauge or human error during the test.

The static pressure and HGL Hydrant Figures are enclosed in **Appendix A**.

3.5 Existing System Assessment

Following model updating, the existing distribution system was analyzed to determine the average day pressures, peak hour pressures, and maximum day plus fire flow capabilities. Many locations experienced pressure within the recommended targets; however, a number of locations fell below the recommended minimum pressure. The following describes each scenario in detail.

3.5.1 Average Day Scenario

The Average Day Demand Scenario was run to assess typical distribution system pressure. **Table 3-2** presents the minimum and maximum pressures, based on the boundary conditions outlined in **Section 3.3**.

Table 3-2 Average Day Pressure Results

Area	Pressure Zone	Average Day Pressure kPa (psi)	
		Minimum	Maximum
Drumheller Primary	Zone 1	158 (23)	441 (64)
Huntington Booster	Zone 2	462 (67)	524 (76)
Penitentiary Booster	Zone 3	551 (80)	1791 (260)
Rosedale/East Cambria	Zone 4	214 (31)	358 (52)

Pressure was generally found to be low in the primary pressure zone (Zone 1) with several locations experiencing pressure below 345 kPa (50 psi) in the Average Day Demand Scenario. Extremely low pressures below 280 kPa (40 psi) occur in the following areas:

- Northwest and east of Bankview Tower
- Residences north of N. Dinosaur Trail
- Royal Tyrell Museum (158 kPa/23 psi)

Locations within the Huntington Booster Station Zone (Zone 2) fall within the target operating pressure range.

The pressure leaving the Penitentiary Booster Station is 1,791 kPa (260 psi), controlled by the PRV within the station. The pressure rating of the Asbestos Cement and PVC mains is not known and have therefore not been assessed. The supply pressure at the Penitentiary is 80 psi based on the average day design demand.

Some locations within Rosedale will experience less than the minimum recommended pressure based on the operating levels at the Rosedale Water Tower during the average day scenario (tower is draining). Minimum pressure targets are met in areas south of Rosedale.

It is understood that the Royal Tyrell Museum has pumping and storage facilities on site, so distribution pressure can fall below the minimum normally required for municipal services. However, it is recommended that a minimum pressure of 140 kPa (20 psi) be maintained during all demand scenarios.

Pressures of over 206 kPa (30 psi) are achieved at all regional connections and at the Penitentiary Booster Station.

3.5.2 Maximum Day Scenario

The Maximum Day Scenario is generally modelled to ensure that downstream customer maximum day demands can be delivered in conjunction with meeting the local maximum day demand requirements. **Table 3-3** presents the minimum and maximum pressures, based on the boundary conditions outlined in **Section 3.3**.

Table 3-3 Maximum Day Pressure Results

Location	Pressure Zone	Maximum Day Pressure kPa (psi)	
		Minimum	Maximum
Drumheller Primary	Zone 1	124 (18)	427 (62)
Huntington Booster	Zone 2	448 (65)	510 (74)
Penitentiary Booster	Zone 3	551 (80)	1791 (260)
Rosedale/East Cambria	Zone 4	200 (29)	351 (51)

The distribution system pressure is anticipated to fall during the maximum day demand scenario, in comparison to average day demand pressures. The model results indicate that the Bankview Tower will continue to drain until the water levels rise slightly in the Greentree and Central Towers, increasing the system HGL (assuming one WTP pump operating).

Pressure was again generally found to be low in the primary pressure zone (Zone 1) with additional locations experiencing pressure below 345 kPa (50 psi) in the Average Day Demand Scenario. Extremely low pressures below 280 kPa (40 psi) occur in the following areas:

- Northwest and east of Bankview Tower
- Residences north of N. Dinosaur Trail
- Royal Tyrell Museum (124 kPa/18 psi)
- West Nacmine along S. Dinosaur Trail

Locations within the Huntington Booster Station Zone (Zone 2) will fall within the target operating pressure range.

Pressure immediately downstream of the Penitentiary Booster Station is 1,791 kPa (260 psi), controlled by the PRV within the station. The supply pressure at the Penitentiary is 550 kPa (80 psi) based on the peak hour design demand.

Although it is understood that the Royal Tyrell Museum has pumping and storage facilities on site, the minimum delivery pressure of 140 kPa (20 psi) is not achieved during the maximum day demand scenario.

Some locations within Rosedale will experience less than the minimum recommended pressure based on the operating levels at the Rosedale Water Tower during the maximum day scenario (tower is draining). Minimum pressure targets are met in areas south of Rosedale.

Supply pressures of over 206 kPa (30 psi) are achieved at all regional connections and to the Penitentiary Booster Station.

3.5.3 Peak Hour Scenario

This is the worst case scenario modelled, where the water tower levels are at the low water level just prior to pump start. Table 3-4 presents the minimum and maximum pressures, based on the boundary conditions outlined in Section 3.3.

Table 3-4 Peak Hour Pressure Results

Location	Pressure Zone	Peak Hour Pressure kPa (psi)	
		Minimum	Maximum
Drumheller Primary	Zone 1	124 (18)	407 (59)
Huntington Booster	Zone 2	441 (64)	496 (72)
Penitentiary Booster	Zone 3	551 (80)	1791 (260)
Rosedale/Cambria	Zone 4	207 (30)	351 (51)

Pressure was again generally found to be low in the primary pressure zone (Zone 1) with additional locations experiencing pressure below 345 kPa (50 psi) in the Average Day Demand Scenario. Extremely low pressures below 280 kPa (40 psi) occur in the following areas:

- Northwest and east of Bankview Tower up to S. Dinosaur Trail
- Residences north of N. Dinosaur Trail
- Royal Tyrell Museum (124 kPa/18 psi)
- West Nacmine along S. Dinosaur Trail

Locations within the Huntington Booster Station Zone (Zone 2) will fall within the target operating pressure range. Pressure downstream of the Penitentiary Booster Station is 1,791 kPa (260 psi), controlled by the PRV within the station. The supply pressure at the Penitentiary is 550 kPa (80 psi) based on the peak hour design demand.

During the peak hour scenario (tower is filling), some locations within Rosedale will experience less than the minimum recommended pressure based on the operating levels at the Rosedale Water Tower. Minimum pressure targets are met in areas south of Rosedale.

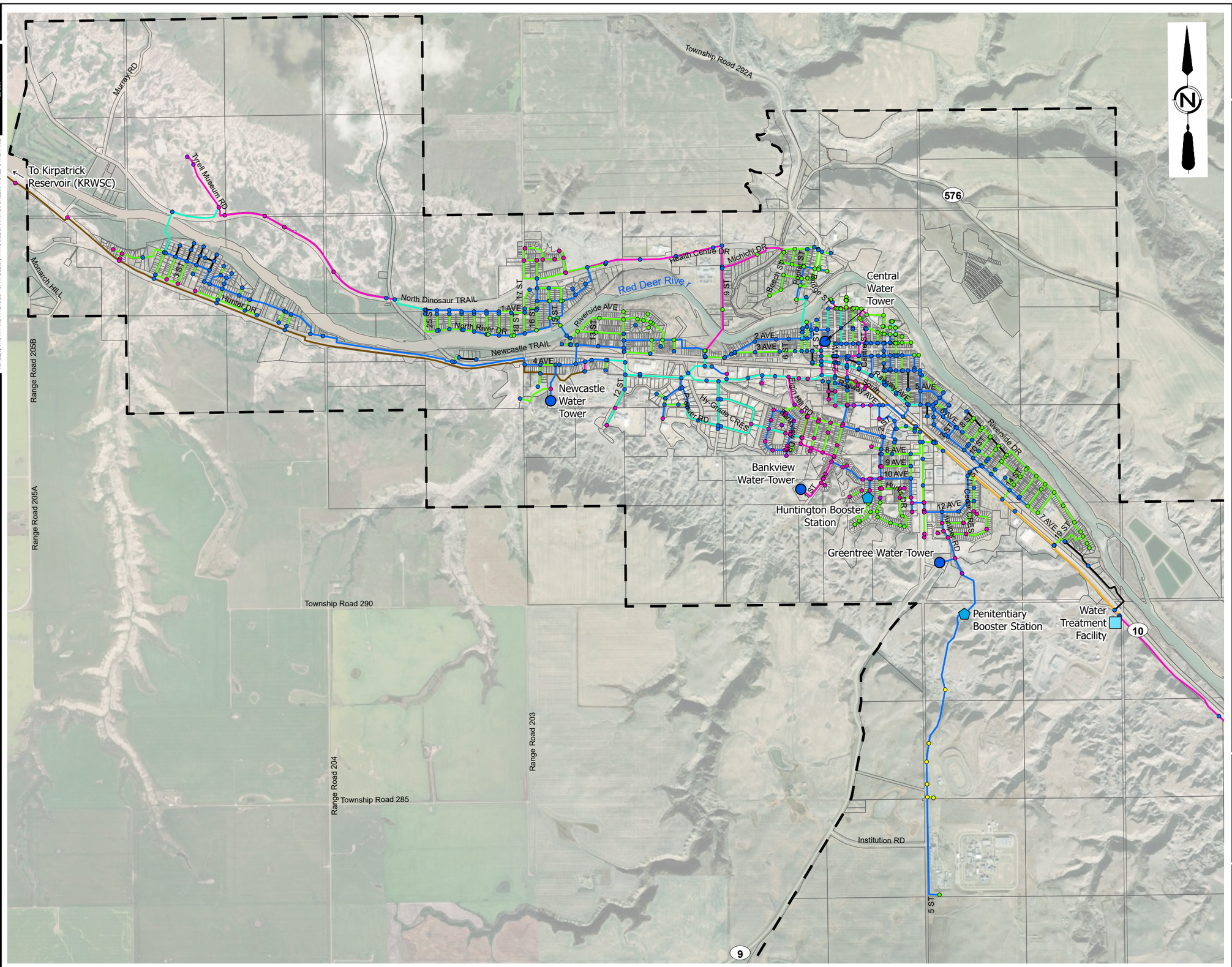
Although it is understood that the Royal Tyrell Museum has pumping and storage facilities on site, the minimum delivery pressure of 140 kPa (20 psi) is not achieved during the maximum day demand scenario.

Pressures of over 206 kPa (30 psi) are achieved at all regional connections and at the Penitentiary Booster Station.

Figure 3-6 and Figure 3-7 present the peak hour pressures for the existing distribution system.

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

- Water Treatment Plant
- Water Tower
- Booster Station
- Town Boundary

Peak Hour Pressure

- <30 psi (200 kPa)
- 30 - 40 psi (200 kPa - 280 kPa)
- 40 - 50 psi (280 kPa - 350 kPa)
- 50 - 80 psi (350 kPa - 550 kPa)
- >80 psi (>550 k Pa)

Distribution System

- Existing ≤100 mmø
- Existing 150 mmø
- Existing 200 mmø
- Existing 250 mmø
- Existing 300 mmø
- Existing 450 mmø
- Existing 500 mmø

FIGURE 3-6

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

EXISTING WATER DISTRIBUTION SYSTEM
EXISTING SYSTEM - PEAK HOUR PRESSURE

AE PROJECT No.	2023-3628-00
SCALE	1:30,000
DATE	2024FEB22
PROJECTION	NAD 1983 CSRS 3TM 114
DRAWN BY	KR
CHECKED BY	DK
DESCRIPTION	ISSUED FOR REPORT

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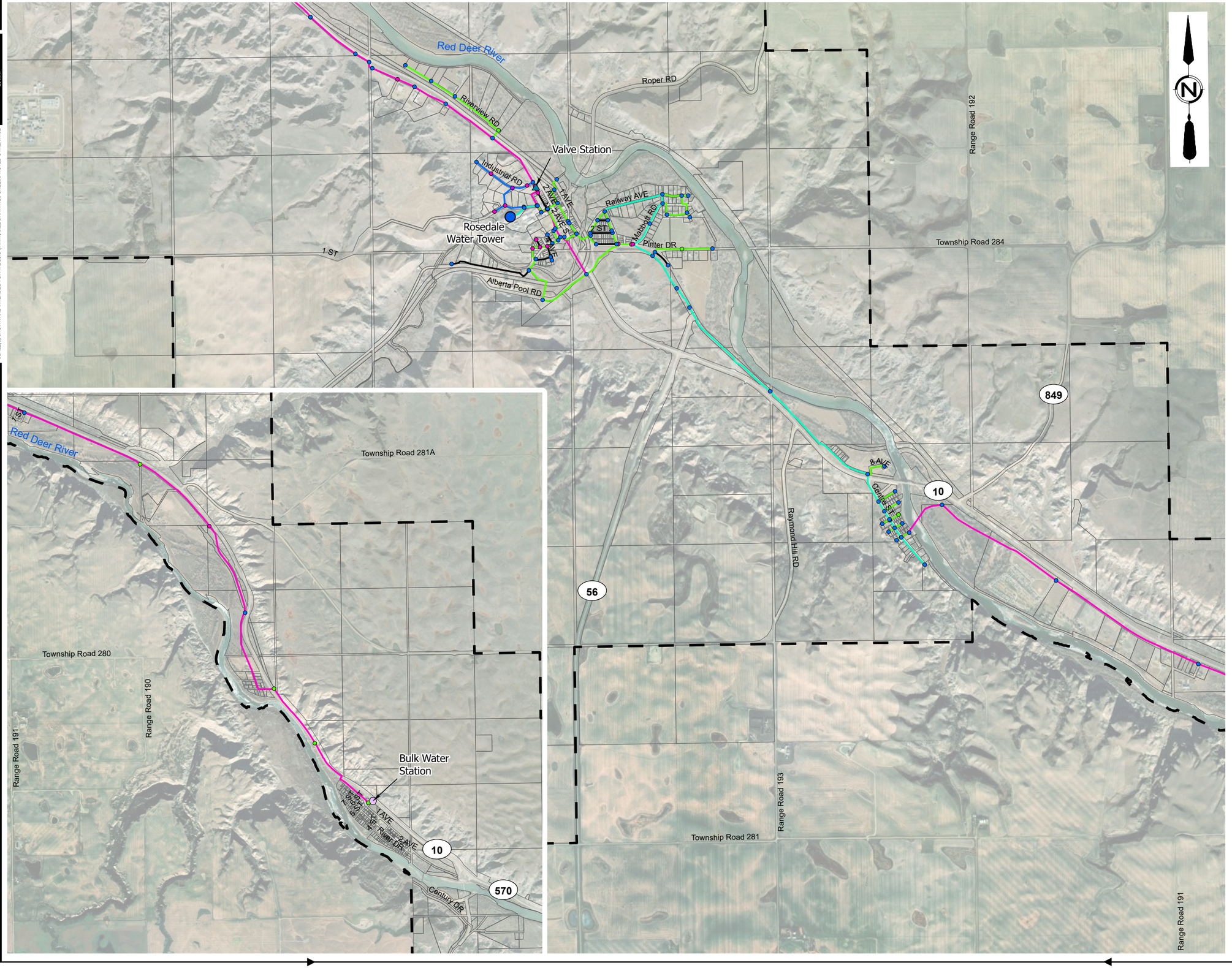
DRAWING PATH: E:\gis\2023-3628_Drumheller_Water_kr\Drumheller_Water_2023.aprx
DATA SOURCE: World Imagery; Maxar,

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

Associated Engineering

BEST MANAGED COMPANIES Platinum member



LEGEND:

- Water Tower
- Valve Station
- Bulk Water Station
- Town Boundary

Peak Hour Pressure

- <30 psi (200 kPa)
- 30 - 40 psi (200 kPa - 280 kPa)
- 40 - 50 psi (280 kPa - 350 kPa)
- 50 - 80 psi (350 kPa - 550 kPa)
- >80 psi (>550 k Pa)

Distribution System

- Existing ≤100 mmø
- Existing 150 mmø
- Existing 200 mmø
- Existing 250 mmø
- Existing 300 mmø
- Existing 450 mmø
- Existing 500 mmø

FIGURE 3-7

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

EXISTING WATER DISTRIBUTION SYSTEM
EXISTING SYSTEM - PEAK HOUR PRESSURE

AE PROJECT No.	2023-3628-00
SCALE	1:30,000 (INSET 1:45,000)
DATE	2023DEC07
PROJECTION	NAD 1983 CSRS 3TM 114
DRAWN BY	KR
CHECKED BY	DK
DESCRIPTION	ISSUED FOR REPORT

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SAVE DATE: 12/7/2023 4:24 PM SAVED BY:
DRAWING PATH: E:\gis\2023-3628_Drumheller_Water_kr\Drumheller_Water_2023.aprx
DATA SOURCE: World Imagery; Maxar,

3.5.4 Maximum Day plus Fire Flow Scenario

A number of locations within the distribution system did not fully satisfy the Maximum Day plus Fire Flow criteria. Some areas which did not meet the criteria include:

- Entire Huntington Booster Zone
- Residences north of N. Dinosaur Trail
- Bridge Street area
- Nacmine
- Rosedale/Cambria
- High Value/high fire flow properties
- Cul-de-sacs and dead end mains
- Long blocks without intermediate looping
- Areas serviced with small diameter mains (100 mm and less)

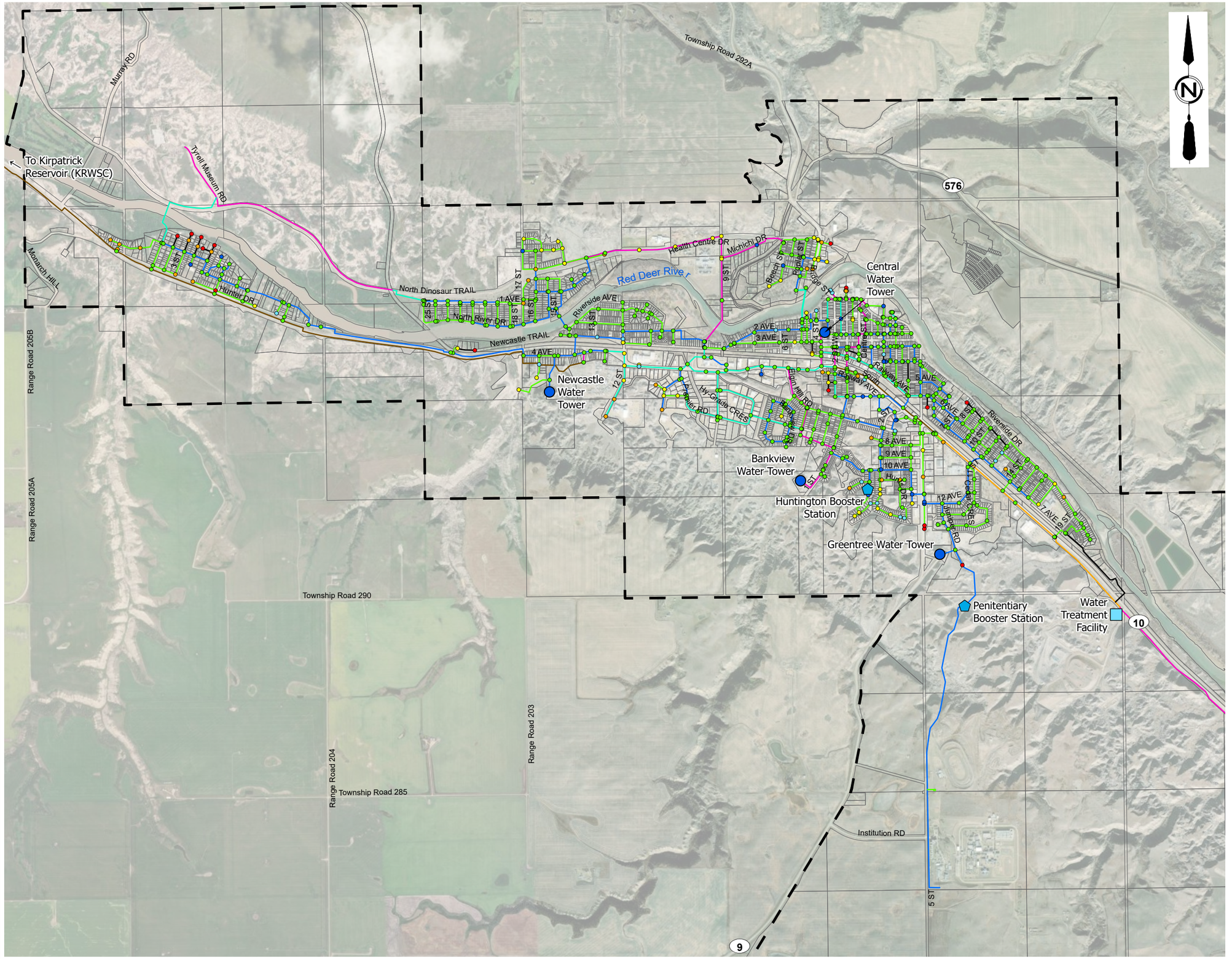
Figure 3-8 and **Figure 3-9** present the Maximum Day plus Fire Flow results, including locations which did not meet the recommended criteria. Water for fire fighting will be available at these locations, however, may not meet the target fire flow rate. It is recommended that the Town review fire flow requirements with the fire department. The Figure identifies the percent of recommended fire flow which can be delivered to each location. This scenario was run with two pumps on at the WTP and Water Towers at the low operating levels identified in **Section 3.3**.

It should be noted that the pressure within the 300 mm watermain which supplies the Royal Tyrell Museum was too low to operate the fire flow simulation. The nodes adjacent to the Museum (and nearby locations along N. Dinosaur Trail) were therefore removed from the simulation to allow the model to run. This identifies that the minimum recommended pressure of 140 kPa (20 psi) WILL NOT be maintained in this area during any fire flow simulations. The distribution system in the area is therefore at risk of extreme low pressures during high flow events. It is understood that the Royal Tyrell Museum has pumping and storage facilities on site to accommodate the domestic and fire flow needs. Fire flow within the Museum site was therefore not assessed.

Based on the model provided, there does not appear to be provision for full pumped fire flow at the Huntington Booster Station. The model includes a check valve located on Hunts Drive south near 11 Ave SE, which will allow contribution from the primary pressure zone during periods of high flow/low pressure in the Huntington Booster Zone. It is not clear whether this check valve actually exists in the distribution system at this time. Fire flow provision appears to be 50 L/s or greater within this zone, assuming a check valve is in operation.

Most locations within Rosedale do not meet the fire flow targets. The fire flow target for single family residential development has been reduced to 60 L/s and is met in a small area of the distribution system. Few commercial/industrial locations meet the full fire flow target. This is mainly due to long, undersized waterlines which have likely not been designed to provide the target fire flow.

Available fire flow in Cambria is below 40 L/s. Fire flow has not been assessed for County Residential areas or development south of Cambria.



Associated Engineering

CANADA BEST MANAGED COMPANIES
Platinum member

LEGEND:

- Water Treatment Plant
- Water Tower
- Booster Station
- Town Boundary

Fire Flow Availability

- Exceeds Fire Flow Requirements
- 90% - 99%
- 80% - 90%
- 60% - 80%
- 40% - 60%
- 0% - 40%

Distribution System

- Existing ≤100 mmø
- Existing 150 mmø
- Existing 200 mmø
- Existing 250 mmø
- Existing 300 mmø
- Existing 450 mmø
- Existing 500 mmø

Note: Supply Mains, County Residential Development and Rural Areas have not been assessed for fire flow.

FIGURE 3-8

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

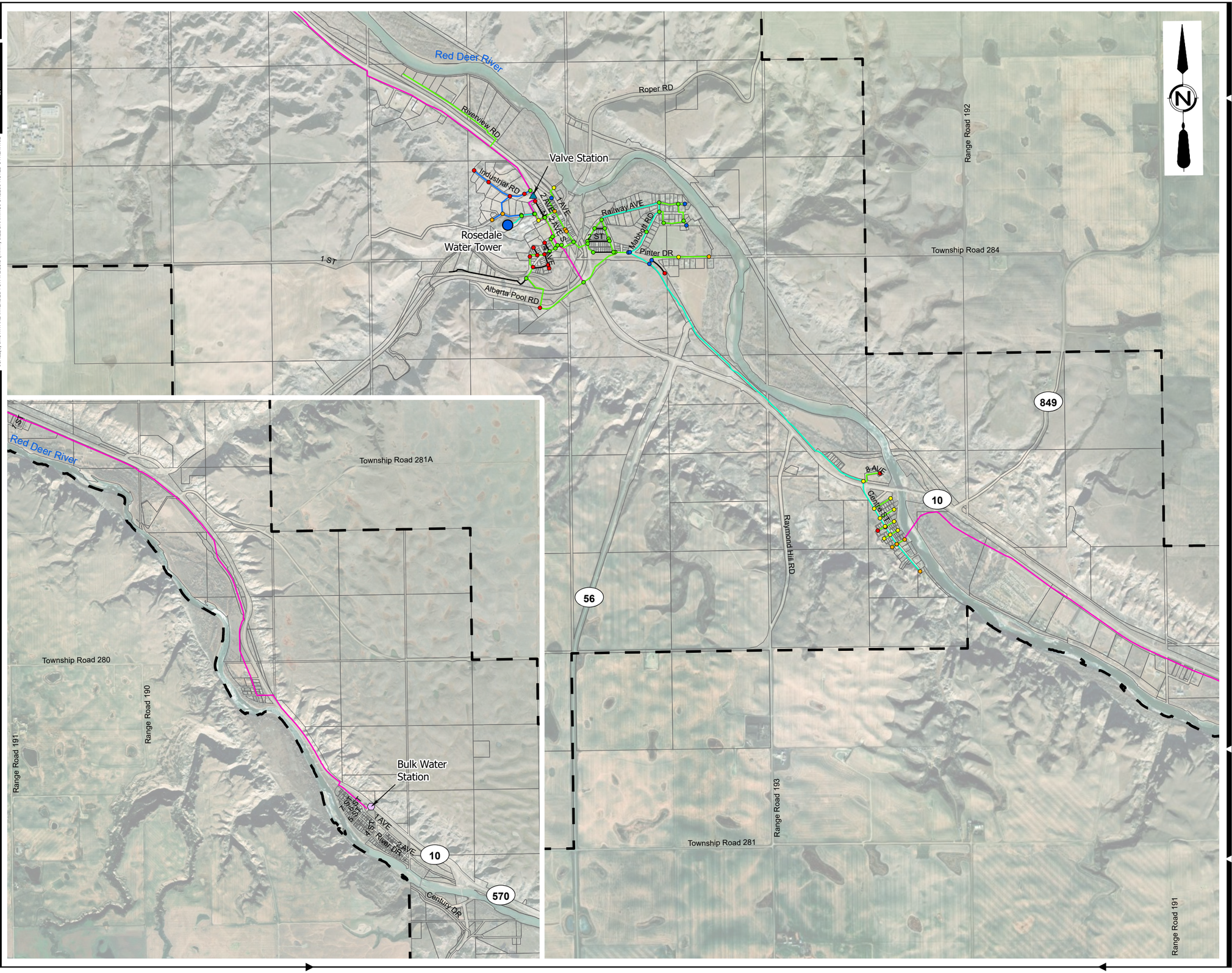
EXISTING WATER DISTRIBUTION SYSTEM
EXISTING SYSTEM - PEAK DAY + FIRE FLOW

AE PROJECT No.	2023-3628-00
SCALE	1:30,000
DATE	2024FEB22
PROJECTION	NAD 1983 CSRS 3TM 114
DRAWN BY	KR
CHECKED BY	DK
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

IF NOT 25 mm ADJUST SCALES 25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



LEGEND:

- Water Tower
- Valve Station
- Bulk Water Station
- Town Boundary

Fire Flow Availability

- Exceeds Fire Flow Requirements
- 90% - 99%
- 80% - 90%
- 60% - 80%
- 40% - 60%
- 0% - 40%

Distribution System

- Existing ≤100 mmø
- Existing 150 mmø
- Existing 200 mmø
- Existing 250 mmø
- Existing 300 mmø
- Existing 450 mmø
- Existing 500 mmø

Note: Supply Mains, County Residential Development and Rural Areas have not been assessed for fire flow.

FIGURE 3-9

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

EXISTING WATER DISTRIBUTION SYSTEM
EXISTING SYSTEM - PEAK DAY + FIRE FLOW

AE PROJECT No.	2023-3628-00
SCALE	1:30,000 (INSET 1:45,000)
DATE	2023DEC06
PROJECTION	NAD 1983 CSRS 3TM 114
DRAWN BY	KR
CHECKED BY	DK
DESCRIPTION	ISSUED FOR REPORT

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DATA SOURCE: World Imagery; Maxar,

3.5.5 Distribution Pumping Capacity Analysis

Table 3-5 presents the WTP pumping capacity analysis for the various demand scenarios modelled. The analysis is exclusive of any contribution or filling of the water towers.

Table 3-5 Pumping Capacity Analysis

Criteria						
Year	**2023**	**2028**	**2033**	**2038**	**2043**	**2048**
Estimated Population	7,988	8,190	8,397	8,609	8,826	9,049
Average Day Demand (L/s), including Regional	49	53	58	63	69	76
Maximum Day Demand (L/s), including Regional [1]	98	106	116	126	138	151
Peak Hour Analysis						
Peak Hour Demand (L/s), including MDD Regional [2]	121	130	140	151	164	177
WTP Distribution Pumping Capacity (L/s) [3]	185	185	185	185	185	185
Surplus/Deficit (L/s)	64	55	45	34	21	8
Maximum Day + Fire Flow Analysis						
Maximum Day plus Fire Flow Demand (L/s), incl. Regional	331	339	349	359	371	384
WTP Distribution Pumping Capacity (L/s) [3]	185	185	185	185	185	185
Minimum Water Tower Contribution (L/s)	146	154	164	174	186	199

Notes:
1. Average Day demands were peaked by 2 for Maximum Day and by 3 for Peak Hour.
2. Supply to all regional customers, the Penitentiary, and the East Coulee Bulk Water Station were peaked by 2 for Maximum Day and Peak Hour.
3. One 105 L/s and the 80 L/s pump were assumed to be operating, for a total capacity of 185 L/s. One 105 L/s pump has been retained as backup.

As shown in the Table above, there is sufficient pumping capacity at the WTP to meet the projected peak hour demands including maximum day supply to Regional.

The Table identifies that the water towers will be required to contribute a minimum of 146 L/s during the 2023 maximum day plus fire flow conditions. Modelling has shown that the water towers can provide the required flow, and the pumping shortfall is therefore not considered to be a system deficiency.

The capacity of the Huntington Booster Station is not well understood. It appears that the current pumping capacity may far exceed the normal operating requirements to meet the peak hour demand for the zone. However, there may be insufficient pumping capacity to meet the target residential fire flow demands within the zone. Further investigation is required to confirm maximum capacity of this pumping station. Full fire flow capacity may not be required if a check valve is confirmed to be installed and based on model results.

The Penitentiary Booster Station pumping capacity is understood to be in the order of 21 L/s. This exceeds both the estimated current maximum day demand of 7 L/s as well as the projected 25 year demand of 10.8 L/s.

3.5.6 Water Storage

As per AEP, minimum water storage requirements are as follows:

- Equalization Storage: 25% of maximum day flow; plus
- Fire Storage; plus
- The greater of:
  - Emergency Storage (in the event of supply interruption): 15% of average day flow; or
  - Disinfection Contact Time (T_{10}) storage.

Table 3-6 below presents the water storage capacity assessment for Drumheller. Although there appears to be ample water tower storage, the water towers are located at a low elevation in comparison to current development. As such, much of the storage is not useful/practical as the resulting system pressure would fall to extremely low values at low water levels. Given that the water towers stop filling at a cumulative storage volume of 7,900 m^3, any available storage beyond this volume has not been considered. Active water tower storage is limited by the minimum operating volume of 6,900 m^3 (when the WTP pumps start); however, this may be an overly conservative approach when assessing total storage capacity. For the storage assessment, the water level in the Town water towers has been allowed to fall below the normal operating level by an arbitrary one metre to 719.9 m, resulting in an additional storage volume of approximately 836 m^3 (beyond the active storage volume of 1,000 m^3). The available water tower storage volume is therefore assumed to be the normal system operating range of 1,836 m^3.

The WTP active storage volume (available for emergency and equalization) is 2,763 m^3, based on the plant start and pump stop levels within the clearwell. The storage volume below the pump stop level (available for disinfection contact time) is excluded from the Table below and is addressed under a separate study.

Table 3-6 Storage Capacity Analysis – Drumheller

Year	Existing Storage (m^3)[1]	Estimated Population[2]	Average Day Flow (m^3/day)	Maximum Day Flow (m^3/day)	Equalization[3] (m^3/day)	Fire Flow[4] (m^3)	Emergency[5] (m^3/day)	Total Required Storage (m^3)	Remaining Storage (Surplus/Deficit) (m^3)
2023	4,599	7,988	1,997	3,994	999	2,516	635	4,150	449
2028	4,599	8,190	2,048	4,095	1,024	2,516	691	4,231	368
2033	4,599	8,397	2,099	4,199	1,050	2,516	750	4,316	283
2038	4,599	8,609	2,152	4,305	1,076	2,516	818	4,410	189
2043	4,599	8,826	2,207	4,413	1,103	2,516	894	4,514	85
2048	4,599	9,049	2,262	4,525	1,131	2,516	980	4,627	-28

1. Existing Storage is comprised of 4,545 m^3 in the Bankview Tower, 795 m^3 in the Central Tower, 2,273 m^3 in the Greentree Tower and 1,364 m^3 in the Newcastle Tower. Water tower storage assumed at one metre below the normal low operating level for a total of approximately 1,836 m^3.
   Water Treatment Plant storage of 2,763 m^3 has been included. Total storage is comprised of accessible water tower storage plus WTP storage for a total of 4,599 m^3.
2. Estimated population is based on Statistics Canada 2021 Census and an annual population growth rate of 0.5%. Population for Rosedale and further south is included in a separate assessment
3. Equalization storage does not include Regional Demands or the Penitentiary
4. Fire Flow requirements are based on 233 L/s for 3 hours
5. Emergency storage includes Regional Demands and Penitentiary
6. Rosedale Water Tower is included in a separate assessment

Based on the assessment, there is sufficient storage to meet the existing demands and nearly meet the projected 2048 demands based on a water level of one metre below the normal low operating level. As such, no additional storage is required at this time.

It should be noted that this calculation does not consider disinfection contact time requirements, which is addressed in the Water Treatment Plant Master Plan. The Table above assumes that emergency storage requirements are greater than the disinfection contact time requirements (or will be in the near future). It is understood that disinfection contact time requirements can be achieved without using the clearwell, and that emergency volumes are appropriate for this assessment. Refer to the Water Treatment Plant Master Plan for more detail.

The Rosedale Water Tower has a storage volume of 1,136 m^3. Equalization and Emergency storage volumes for Rosedale have been accounted for at the WTP (**Table 3-6**). Available storage at the Rosedale Water Tower can therefore be applied against fire storage requirements. Based on a maximum target fire flow of 183 L/s for 2.5 hours, the resulting fire flow storage would be 1,482 m^3, resulting in a storage shortfall of 346 m^3. It is not necessary to increase Rosedale storage at this time, as there is ample available fire flow storage available in the Drumheller system. It is assumed that simultaneous fires will not occur in both Drumheller and Rosedale.

Based on the assessments presented above, there is sufficient treated water storage to meet the current and projected future needs of both Drumheller and Rosedale.

4 UPGRADES TO EXISTING SYSTEM

Upgrades are proposed to improve the level of service for normal operating pressure and available fire flow. Operation of the existing water towers presents the following challenges:

- The existing water towers do not provide sufficient minimum pressure to some areas of the distribution system
- The existing water towers within Drumheller cannot be modified to increase pressure without reconstructing them.
- It is likely that the Newcastle Tower does not regularly turn over. As such, the distribution system may experience water turnover/quality issues in some areas.
    - A direct feed to each tower could potentially be required to achieve sufficient turnover. This is likely impractical for the Drumheller system due to its length. As well, this will not improve the level of service within the community.
- Recent condition assessments (by others) have identified that there are significant costs associated with maintaining and/or repairing the existing water towers. Refer to **Section 6** for a summary of the estimated costs.
- Based on the current water tower service area, additional booster stations may be required to accommodate new developments.
- Although the total water tower storage volume is considerable, much of this volume cannot be accessed without causing low distribution system pressure.

4.1 Servicing Concept West of WTP

Based on the above considerations, it is proposed that the water towers within the urban Drumheller service area (Bankview, Greentree, Newcastle, and Central), be abandoned and replaced with a new reservoir and pumphouse. It is envisioned that the new facility would operate in conjunction with the WTP to meet peak demand periods including fire flows. The facility could operate in "Turnover Mode" during set periods until a minimum volume has been discharged, and would also operate as required to maintain minimum distribution system pressure due to high demands, fire flow, flushing etc. The volume pumped would be calculated to achieve a target reservoir turnover rate, such as every 5 days. When not pumping, the reservoir would be re-supplied at a constant rate over several hours (primarily overnight) to reduce the effect on the distribution system.

Alternatively, additional storage and pumping capacity could be considered at the WTP rather than at a new facility. Considerations for each option are outlined below:

- WTP storage and pumping expansion:
    - Larger supply mains (and additional pipe upgrades) will be required should all storage be located at the WTP, as mains will need to accommodate the entire maximum day plus fire flow, which is considerable.
    - Further review would be required to determine if there is available room to accommodate additional storage and pumping at the WTP and if there are additional constraints.
- New Reservoir and Pumphouse:
    - Building an additional storage and pumping facility provides system redundancy should an issue arise at the WTP.
    - Fewer supply main upgrades will be required as fire flow will be provided from two sources.

- Pumping costs will be higher as water provided from a new pumphouse will already have been pumped once from the WTP.
- It is assumed that the cost to maintain two facilities will be higher than to maintain a single facility.

Following review with the Town, a new Reservoir and Pumphouse facility was selected for the purpose of this assessment.

It is proposed that the WTP and new pumphouse operate at an HGL of 735 m, which is equivalent to the current WTP PRV setpoint. It is understood that the distribution system currently experiences this pressure during periods of pump start/stop. As such, the increase in normal operating pressure is not anticipated to have a significant effect on the distribution system.

Operating the WTP and proposed pumphouse at an HGL of 735 m will eliminate the need for the Huntington Booster Station, which can be decommissioned following construction and commissioning of the new system.

It is assumed that approximately 2,000 m^3 storage reservoir will be constructed at the new reservoir site within Drumheller. The required volume will depend on the findings of the Water Treatment Plant Master Plan, which is not currently complete. For the purpose of this assessment, it is assumed that the reservoir will be fully turned over every 5 days, at 400 m^3/day. If replenished over 8 hours (from 10 pm to 6 am), this would require a fill rate of 14 L/s. This demand has been included in the Average Day and Maximum Day Demand scenarios, to ensure the distribution system can accommodate filling of the proposed reservoir while meeting system demands. The reservoir will not be filled during the Maximum Day plus Fire Flow scenario, as it will be supplying the distribution system.

4.2 Distribution System West of WTP

The proposed distribution system upgrades are based on construction of a new reservoir and pumphouse and removal of the four urban water towers operating within Drumheller. Refer to **Figure 4-1** for the Peak Hour Pressure Results and location of the proposed reservoir and pumphouse.

It is understood from the Town that the existing 500 mm Hyprescon pipe heading west from the WTP is in poor condition. As shown in the Figure, this main is proposed to be twinned by a new 500 mm watermain. This pipe size will provide capacity to accommodate the projected long term growth, in conjunction with operation of the proposed new reservoir and pumphouse. Note that a 500 mm nominal pipe diameter has been assumed. Pipe material with smaller internal diameters (such as HDPE) will need to upsized. The original watermain will remain in service, to provide redundancy in case of a pipe break or maintenance.

A new 450 mm watermain is proposed to be constructed from the new reservoir and pumphouse site, interconnecting the existing 450 mm watermain to the existing 250 mm watermain to the east. It is anticipated that the new facility would be constructed along this new watermain.

Additional upgrades to the distribution system are presented on **Figure 4-1** and are recommended to satisfy fire flow criteria. The proposed upgrades are as follows:

- 300 mm/250 mm on Highway 9 from Highway 56 to the Extra Foods
- 250 mm on 11 St SE, Hunts Drive, 2 St SE
- 250 mm 3 St SE south of Highway 56
- 250 mm on Premier Crescent, Premier Rd

- 250 mm on Highway 5 and Poplar St
- 250 mm 1 St W
- 250 mm on 5 St W from 2 Ave W to 3 Ave W
- 250 mm on 3 Ave W from 3 St W to 5 St W
- 250 mm 12 St E from 7 Ave E to 6 Ave E
- 250 mm 7 Ave E and 17 St E at the High School
- S. Dinosaur Trail east of 1 St SW
- 200 mm 17a St NW
- 200 mm on 2 Ave W from alley west of 1 St W to alley east of 1 St W
- 200 mm interconnections to existing 450 mm at two locations: 6 St Nacmine and west of Red Deer Ln
- 200 mm miscellaneous looping in Nacmine. Note that looping in this area may not be required should the existing 100 mm watermains be replaced and increased in size
- 200 mm connection from existing 300 mm main on N. Dinosaur Trail to 150 mm watermain in East Midlandvale
- 200 mm Newcastle Trail
- 250 mm 4 St W south of 3 Ave W
- 200 mm 5 Ave SW and alley west of 2 St SW

The upgrades presented are those required to meet the recommended fire flow criteria. However, it is recommended that mains be upsized to the minimum recommended diameter when the opportunity arises. It is recommended that a minimum of 200 mm diameter pipes be installed in all single family residential areas, a minimum of 250 mm in multi-family areas, and 300 mm in all high density residential, commercial, and industrial areas. Increasing to this minimum standard will improve fire flow availability in local areas and increase the capacity of the distribution system over time.

Note that a hydrant coverage assessment is not within the current scope of work. Prior to implementing local upgrades it is recommended that a hydrant spacing review be undertaken to identify whether additional hydrants are required. It is unclear whether some small diameter mains which have been identified for upgrading (due to fire flow deficiencies), were intended as domestic service only.

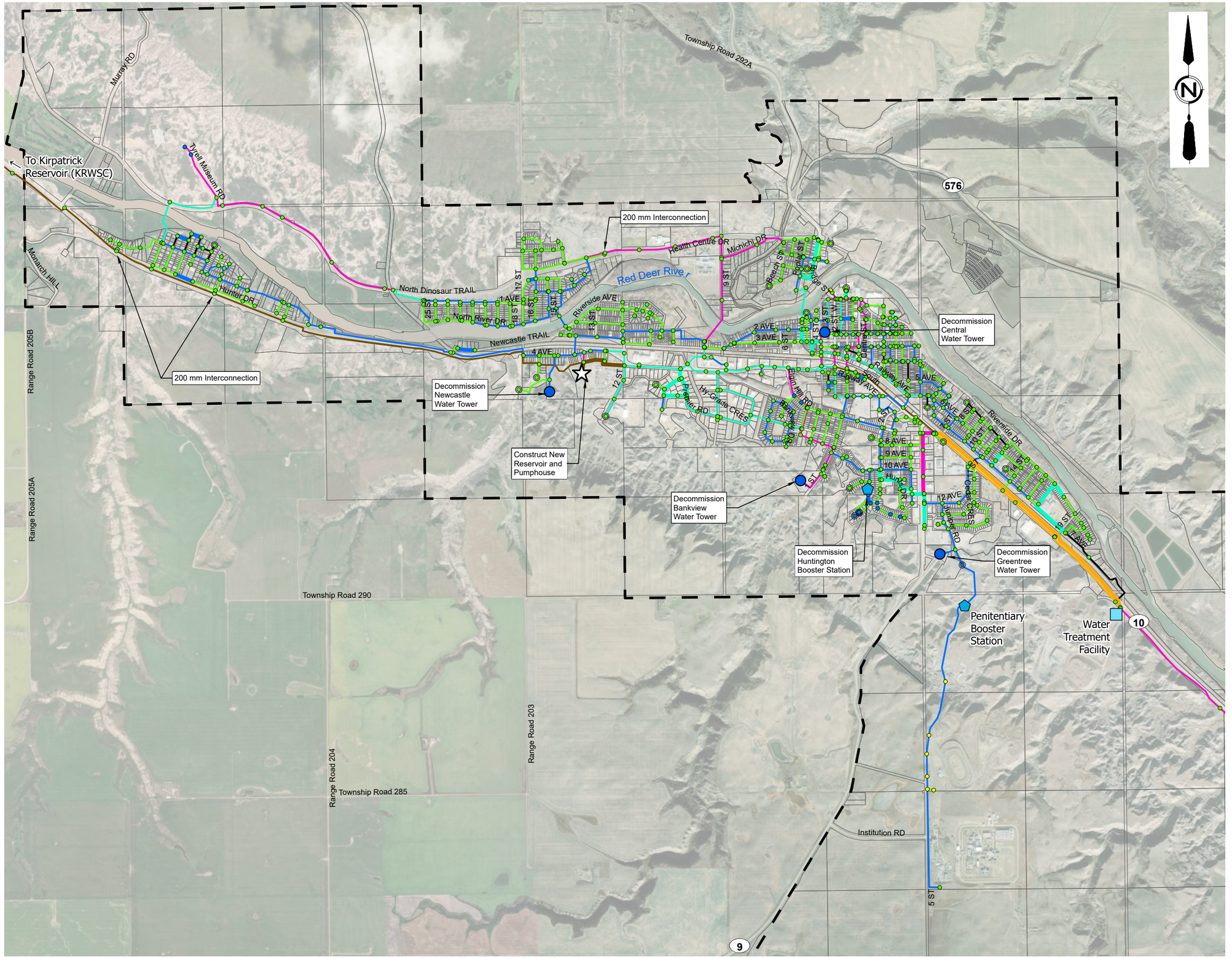
It is also recommended that continuity of major waterlines be considered during replacement projects. For example, there are a number of locations within the Town where a 250 mm or 300 mm waterline is connected on either end by smaller pipe diameters. Should these smaller pipes required replacement in the future, they should be upsized to maintain pipe size continuity.

Following the proposed upgrades there are a number of locations which are not anticipated to fully meet the recommended fire flow criteria. A brief discussion is provided below:

- Some dead ends will require future adjacent development and watermain looping to fully satisfy the fire flow criteria.
- Some cul-de-sacs found to be deficient are not proposed for upgrading at this time, as it is assumed that fire will primarily be fought from the main roadway. It is recommended that this approach be reviewed with the fire department to ensure it is appropriate for Drumheller. When mains are replaced, the recommended minimum pipe size should be installed.
- Some high value locations (commercial, institutional, and medium density residential) are minimally short of the fire flow targets (less than 10% short).

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



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DATA SOURCE: World Imagery: Maxar,

Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

- Water Treatment Plant
- Water Tower
- Booster Station
- Proposed Reservoir & Pumphouse
- Proposed Booster Station
- Town Boundary
- Does Not Meet Fire Flow Requirements

Peak Hour Pressure

- <30 psi (200 kPa)
- 30 - 40 psi (200 kPa - 280 kPa)
- 40 - 50 psi (280 kPa - 350 kPa)
- 50 - 80 psi (350 kPa - 550 kPa)
- >80 psi (>550 k Pa)

Distribution System

- Existing ≤100 mmø
- Existing 150 mmø
- Existing 200 mmø
- Existing 250 mmø
- Existing 300 mmø
- Existing 450 mmø
- Existing 500 mmø
- Proposed 200 mmø
- Proposed 250 mmø
- Proposed 300 mmø
- Proposed 450 mmø
- Proposed 500 mmø

Note: Supply Mains, County Residential Development and Rural Areas have not been assessed for fire flow.

FIGURE 4-1

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

EXISTING WATER SYSTEM WITH UPGRADES

AE PROJECT No.	2023-3628-00
SCALE	1:30,000
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CHECKED BY	DK
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

Table 4-1 presents locations west of the WTP with deficient fire flows following completion of the recommended upgrades.

Table 4-1 Fire Flow Deficient Locations West of WTP

Node	Location	Target FF (L/s)	Avail FF (L/s)	Reason
J-43	5 St 3 Ave Nacmine	75	47.4	Cul-de-sac
J-57	16 Street SW	75	77.3	Within 10%
J-199	Badlands Amphitheatre		54.4	Private
J-58	South end of 12 St SW	183	170.8	Within 10%
J-67	Premier Crescent (cul-de-sac)	183	124.4	Cul-de-sac
J-103	South end Beech Street	75	65.2	Cul-de-sac
J-104	Alley north of Poplar Street	183	109.8	Suspected Service
CLV	Hwy 56 at N. Dinosaur Trail	183	109.4	Supply to Water Co-op - no FF
J-97	Alley east of 5 St W and 7 St W	75	66.8	Suspected Service
J-960	Hwy 56 at N. Dinosaur Trail	183	175.9	Within 10%
J-819	1 St W north of 1 Ave W	183	78.8	Suspected Service
J-92	West of 2 St SE, south of 7 Ave SE	183	116.5	Dead End
J-80	Twin Hill Close	75	67.8	Cul-de-sac
J-81	Huntington Park	75	62.5	Cul-de-sac
J-1040	Huntington Park	75	72.4	Cul-de-sac
J-658	Alley east of 5 St E, south of 6 Ave E	100	48.8	Suspected Service
J-107	Alley south of Riverside Dr E, west of 8 St E	200	46.5	Suspected Service
J-108	East of Hope College	183	117.8	Unsure of wm purpose

It should be noted that the North Dinosaur Trail and Royal Tyrell Museum supply watermains are included in the upgraded fire flow assessment (excluded in existing system assessment). This is possible due to the increase in typical operating pressure resulting from removal of the existing water towers and construction of a new reservoir and pumphouse. As such, minimum system pressure of 140 kPa (20 psi) will be achieved, allowing fire flow simulations to occur.

4.3 Servicing Concept East of WTP

It is beneficial to maintain operation of the Rosedale Tower due to the distance from the WTP and the potential for supply interruption. As well, the Rosedale Water Tower appears to be in reasonably good condition and requires few upgrades. The Rosedale Water Tower also improves fire flow availability for Rosedale and further downstream.

Two key pieces of infrastructure will be required to improve the operating pressure in Rosedale:

- Flow control valve on the Rosedale Water Tower fill line:
  - Record drawings of the Rosedale Water Tower are not available. It has been assumed that a valve chamber exists which is similar to the Bankview Water Tower valve chamber, as the water towers were constructed around the same time.
  - It is assumed that the current flow control is limited to open/shut, and that a new valve will be required which can control the flowrate into the water tower.
  - It is assumed that a bypass line with check valve exists (bypassing the control valve).
- Booster Station at Rosedale Water Tower

The current control philosophy is proposed to be maintained, whereby the control valve on the supply line will open to fill the Rosedale Water Tower based on water level. A new flow control valve is proposed to be installed within the water tower valve chamber to reduce the flow rate to a maximum of 20 L/s. This will result in increased pressure in Rosedale and further downstream, when supplied directly from the WTP at the proposed operating HGL of 735 m (assuming construction of the new reservoir and pumphouse). The bypass with check valve allows the water tower to flow back into the distribution system when not filling (supply line control valve is closed).

As the water tower operating level is too low to maintain a minimum pressure of 280 kPa (40 psi) throughout Rosedale, it will be necessary to install a booster station to increase operating pressure. The pumps would operate on low pressure directly related to draining of the water tower, pumping to an HGL of approximately 730 m. Installation of fire/standby pump is not necessary in the short term; however provision for a future pump should be included in the design of the facility. It would be necessary to program the booster pumps to stop and the bypass valve to open, to allow flow directly from the water tower to the distribution system during extreme high flow events (exceeding pump capacity). Should additional fire flow be desired, a fire/standby pump could be installed in the booster station.

4.4 Distribution System East of WTP

Areas east of the WTP were assessed differently than the more urbanized areas to the west, as follows:

- A lower residential fire flow target of 60 L/s was applied.
- Upgrades were not proposed for non-residential locations outside of the central Rosedale area.
- Upgrades specific to Cambria and further south were not proposed.

Upgrades to the Rosedale distribution system are presented on **Figure 4-2** and are recommended to improve operating pressure and satisfy fire flow criteria. The proposed upgrades are as follows:

- 300 mm watermain from downstream of the valve station on the 300 mm supply main, installed along 1 Ave N
- 300 mm watermain along 1 St N and the extension of 1 Ave N
- 250 mm watermain extending from the 300 mm supply main east along Centre Street
- 250 mm watermain extending from the 300 mm supply main east along 1 St S
- 300 mm/250 mm watermain extending from the 300 mm supply main west along 1 St S and 4 Ave S
- 300 mm extending along Alberta Pool Rd

IF NOT 25 mm ADJUST SCALES
25 mm

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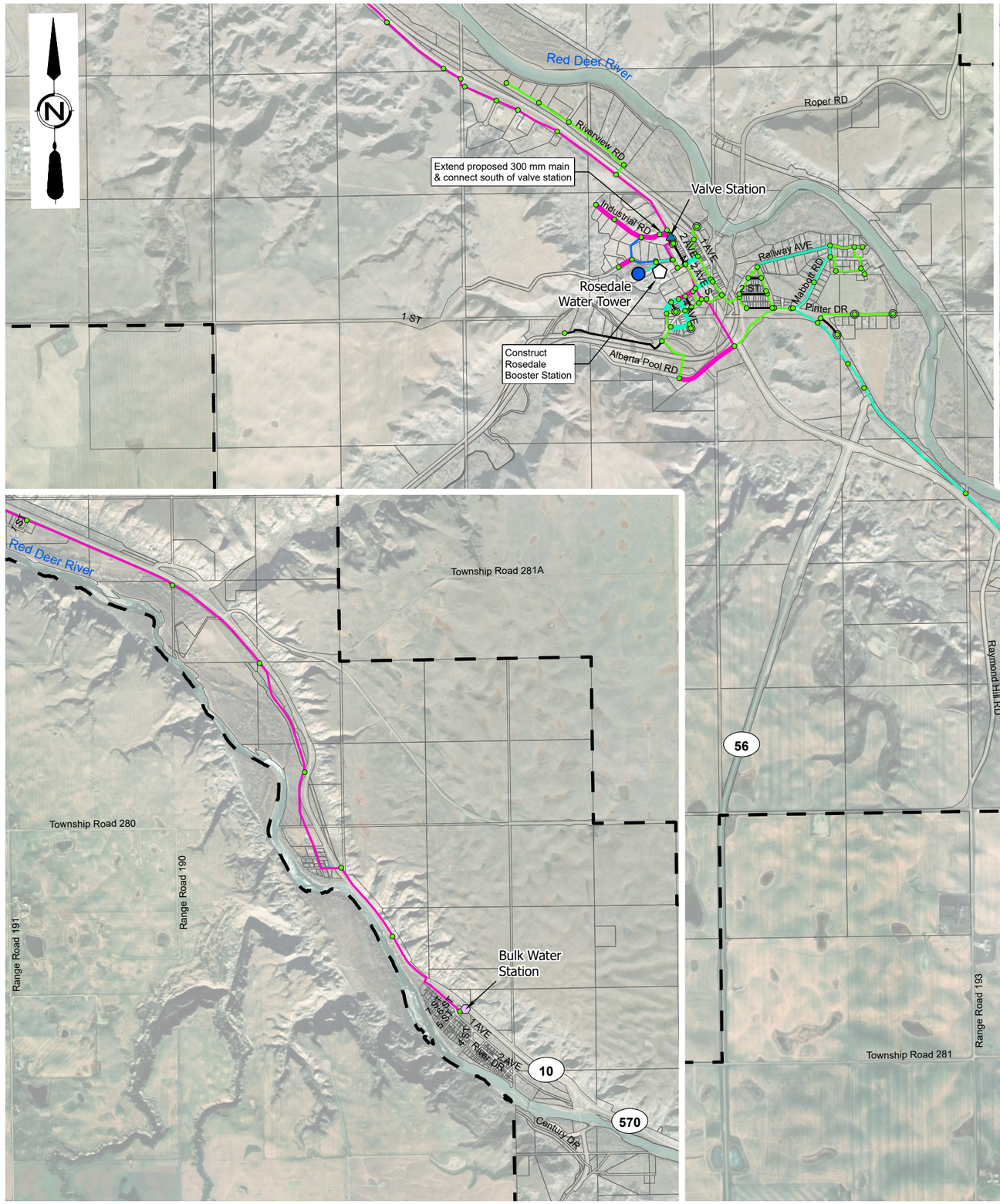

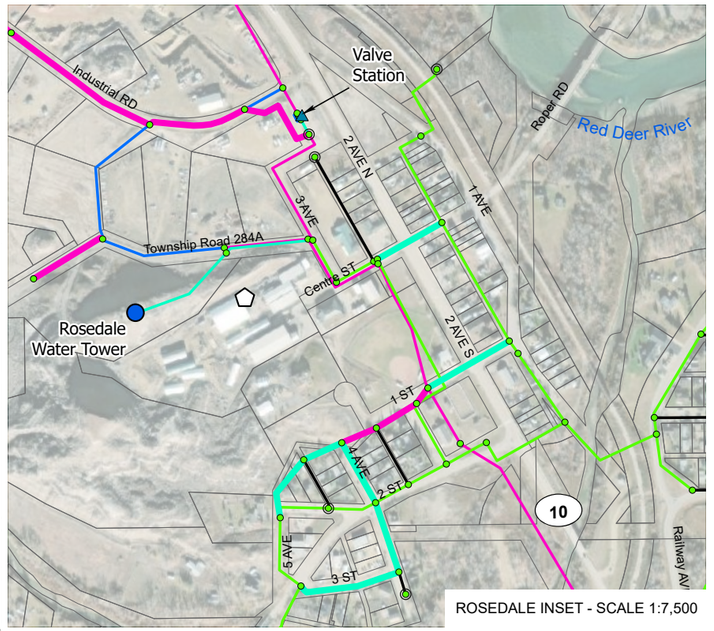

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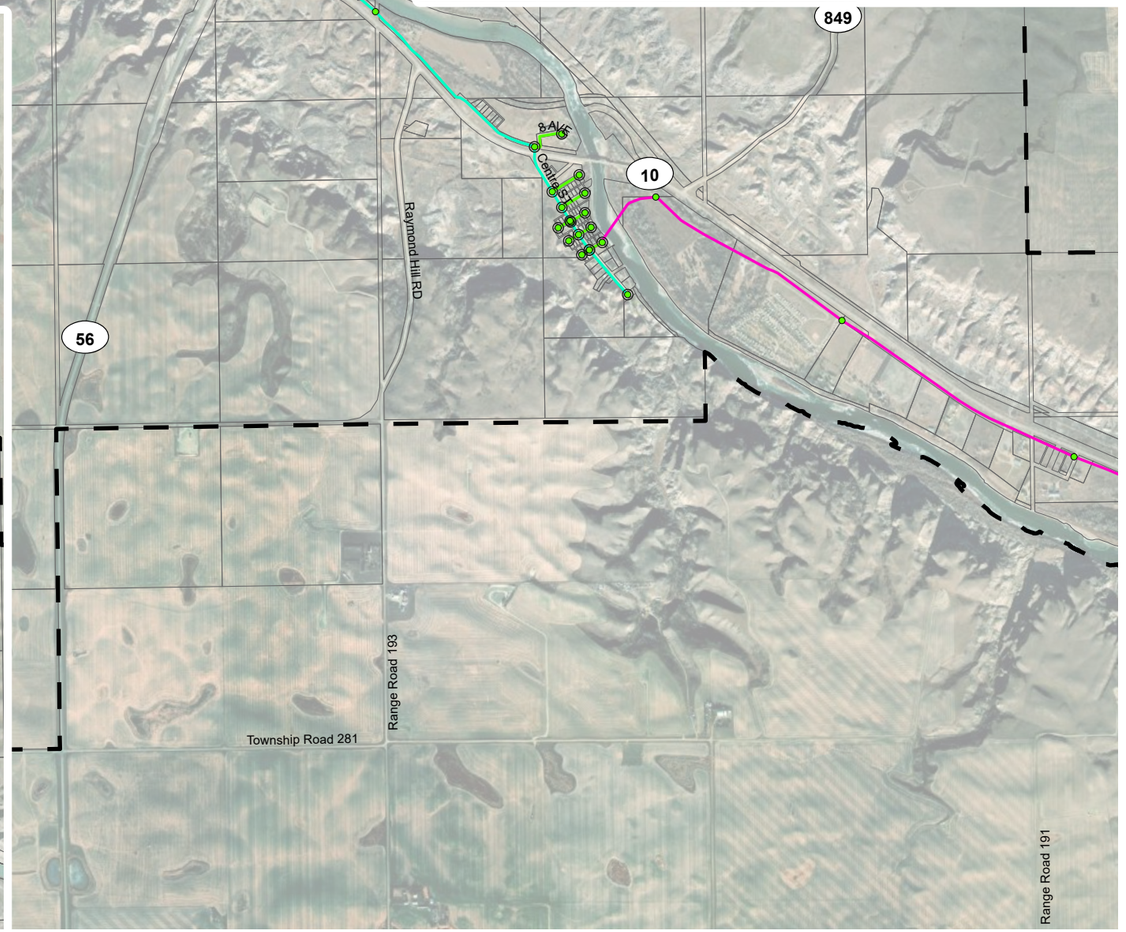

Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

- Water Tower
- Valve Station
- Bulk Water Station
- Proposed Reservoir & Pumphouse
- Proposed Booster Station
- Town Boundary
- Does Not Meet Fire Flow Requirements

Peak Hour Pressure

- <30 psi (200 kPa)
- 30 - 40 psi (200 kPa - 280 kPa)
- 40 - 50 psi (280 kPa - 350 kPa)
- 50 - 80 psi (350 kPa - 550 kPa)
- >80 psi (>550 k Pa)

Distribution System

- Existing ≤100 mmø
- Existing 150 mmø
- Existing 200 mmø
- Existing 250 mmø
- Existing 300 mmø
- Existing 450 mmø
- Existing 500 mmø
- Proposed 200 mmø
- Proposed 250 mmø
- Proposed 300 mmø
- Proposed 450 mmø
- Proposed 500 mmø

Note: Supply Mains, County Residential Development and Rural Areas have not been assessed for fire flow.

FIGURE 4-2

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

EXISTING WATER SYSTEM WITH UPGRADES

AE PROJECT No.	2023-3628-00
SCALE	1:30,000 (INSET 1:45,000)
DATE	2023DEC07
PROJECTION	NAD 1983 CSRS 3TM 114
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DESCRIPTION	ISSUED FOR REPORT

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DATA SOURCE: World Imagery: Earthstar Geographics
World Imagery; Maxar,

It is noted that existing 150 mm and 200 mm watermains within commercial/industrial areas in north and south Rosedale are PVC pipe material and are likely quite new. Upgrades to 300 mm are proposed to be undertaken when advantageous, and if the Town wishes to achieve full urban fire flow in these areas. Further review is recommended. Upgrades within Cambria have not been proposed as this community is reliant upon a single 250 mm waterline (without storage) and local upgrades will not improve fire flow results.

Following upgrading, some locations east of the WTP will continue to fall short of the fire flow targets:

- Cul-de-sacs and dead end mains
- High value properties outside of the central Rosedale area
- County residential areas which have been excluded from all fire flow assessments

Table 4-2 presents locations east of the WTP with deficient fire flows following completion of the recommended upgrades.

Table 4-2 Fire Flow Deficient Locations East of WTP

Node	Location	Target FF (L/s)	Avail FF (L/s)	Reason
J-172	South of Pinter Drive	60	6.3	Suspected Service
J-170	Pinter Drive	60	49	Cul-de-sac
J-171	Pinter Drive	60	40.6	Cul-de-sac
J-156	4 Ave S	60	36.4	Suspected Service
J-155	2 St South	183	151.3	Other upgrades recommended
J-150	East of Roper Road	60	56.1	Within 10%
Several	Cambria	60	44.6-46.6	Rural, south of Rosedale

4.5 Pressure Improvements

Following the construction of the proposed reservoir and pumphouse and recommended distribution system upgrades, system pressure will improve significantly as presented in Table 4-3.

Table 4-3 Average Day Pressure Results (with Upgrades)

Location	Pressure Zone	Average Day Pressure - kPa (psi)	
		Minimum	Maximum
Drumheller Primary	Zone 1	275 (39)	556 (81)
Huntington Booster	Zone 2	N/A	N/A
Penitentiary Booster	Zone 3	551 (80)	1791 (260)
Rosedale/East Cambria	Zone 4	357 (52)	525 (76)

Pressure west of the WTP will be between 280 and 550 kPa (40 and 80 psi) during all normal operating scenarios in all locations other than supply to the Tyrell Museum (minimum 39 psi during the average day demand and 36 psi during the maximum day demand). Note that two locations will exceed 550 kPa (80 psi); however these are not located at service connections. The maximum day demand scenario is the most conservative scenario in the west, as the proposed reservoir is in fill mode rather than discharge. East of the WTP, pressure will fall between 350 and 550 kPa (50 and 80 psi) during all normal operating scenarios.

4.6 Pumping

Under normal operating conditions, the maximum distribution pumping requirements will be maximum day demand to Drumheller and Regional including re-supply of approximately 14 L/s to the proposed reservoir. It is intended that the proposed pumphouse will supplement the peak hour demands, reducing the pumping requirement at the WTP.

As shown in **Table 3-5**, there is ample pumping capacity at the WTP to meet typical demands. Approximately 50 m of pumping head is estimated to be required at the WTP to meet the proposed target HGL of 735 m, under normal operating conditions. As the current pumps are rated at 80 L/s at 42 m and 105 L/at 49 m, some reduction in total output is anticipated. It is anticipated that the pumps will meet the design maximum day demands plus re-supply to the proposed reservoir. There will be ample remaining capacity for the WTP to contribute to fire flow scenarios, as required.

As such, the WTP has adequate pumping capacity to meet current needs based on the existing system operation with water towers, and to meet the future needs based on the proposed system with a new reservoir and pumphouse constructed.

Further review of the WTP pumping capacity and requirements should be undertaken during future design stages (design of proposed reservoir and pumphouse, or condition upgrades at WTP). It may be advantageous to utilize the remaining pump bay and provide a range of pumping rates to accommodate smaller design flows from the WTP (average day and overnight). It will be necessary to ensure that the existing pumps can operate at low rates (smaller pump, VFDs) or can relieve to the reservoir.

At the proposed reservoir and pumphouse location, distribution pumping will be sized to achieve regular turnover of the reservoir and to contribute to peak hour demands. As a minimum, distribution pumps will be sized to achieve the target turnover within the desired operating period, although modelling results indicate that the new pumphouse could contribute over 50% of the peak hour demands (if desired). It is recommended that the proposed pumphouse not “over-contribute” to the distribution system, as all water leaving this facility will have been pumped twice, increasing energy costs. Assuming a daily pumped volume of 400 m^3 occurring over 4 hours, typical pumping rates may be in the order of 30 L/s.

Standby/Fire pumping at the new facility will be required to meet the target maximum day plus fire flow demand in conjunction with operation of the WTP. A minimum of a 200 mm L/s Standby/Fire pump will be required, based on the current WTP pumping capacity. Further analysis will be required to determine optimal operation of this facility.

In the proposed Rosedale booster station, pumps will be sized to boost from a low water tower level of 711 m to a target operating HGL of 730 m, for a total of 19 m pumping head. Flow rates will range from low overnight usage to the peak hour demand for Rosedale and downstream. Further assessment will be required to confirm target pumping rates.

4.7 Storage

As identified above, it is assumed that a new reservoir will be constructed within the Town of Drumheller, approximately 5 km west of the existing WTP site. Future storage requirements are currently being assessed as part of the Water Treatment Plant Master Plan and are not finalized. For the purpose of this assignment, it is assumed that a storage reservoir of approximately 2,000 m^3 will be constructed.

5 FUTURE WATER DISTRIBUTION SYSTEM

5.1 General

The future water system concept is presented in two phases: Priority Development and Ultimate Growth. The future water system assumes that all recommended upgrades to the existing system have been completed, including construction of a new reservoir and pumphouse, removal of the four Drumheller Water Towers and booster station/flow control valve at the Rosedale Water Tower.

Detailed servicing concepts have not been established for future development areas as further work will be required to determine the limits of developable lands within these areas. Generally, a single pipe has been routed through these areas for modelling purposes. Some new development areas will require additional infrastructure to accommodate rising topography. These may include booster stations, private cisterns, and pumps (country residential). Additional considerations/infrastructure for new areas are identified in the relevant servicing concept figures.

Water demands for all future development areas have been incorporated into the water model, such that proposed upgrades to the existing system consider the ultimate design demands.

5.2 Priority Development

5.2.1 Distribution System

The Priority Development Stage includes servicing new development areas as well as meeting the projected 25 year Regional demands, as presented in **Figure 5-1** and **Figure 5-2**.

It is anticipated that upgrades will be required to the existing 250 mm AC watermain located along S. Dinosaur Trail between the existing 450 mm watermain and the proposed 450 mm watermain east of the future reservoir and pumphouse. Increase in the peak regional demands as well as re-supply to the proposed reservoir and pumphouse will require that the 250 mm watermain be increased to 450 mm in diameter. This main is not required to accommodate proposed local development. Upsizing should be considered when the waterline is being replaced due to age, or when Regional demands increase significantly.

It is understood that an extension of the existing 250 mm watermain located south of the Royal Tyrell Museum may be required to service development within Starland County. The watermain extension has been included in the Priority Development Stage. It is assumed that demands will be relatively low, and that fire flow will not be required at the Town boundary. Pressure at the Town Boundary is anticipated to fall with the target criteria.

A 250 mm watermain is proposed in Rosedale between the 300 mm supply main and the 250 mm supply main to meet fire flow targets in the local expansion area. This will also increase available fire flow within Cambria and provide additional capacity to the 250 mm supply main which is currently supplied by two 150 mm mains at the south end of Rosedale.

The following provides a summary of the servicing requirements for the various future development areas in the Priority Development Stage. Service areas are identified in **Figure 5-1** and **Figure 5-2**.

- **A – Single Family Residential**
  - Pressure will fall within the target range and residential fire flows will be met.
  - No additional infrastructure will be required to service this area.

- **B – Commercial**
  - Pressure will fall within the target range and commercial fire flows will be met.
  - No additional infrastructure will be required to service this area.
- **C – Multi-Family Residential (Elgin Hill)**
  - Significant site grading will be required in this area in keeping with the adjacent road design. It is assumed that the maximum elevation within the site will not exceed 702 m.
  - Based on this maximum elevation, operating pressure in this area is anticipated to range between 296 and 351 kPa (43 and 51 psi), meeting minimum targets.
  - Multi-Family (row housing) fire flows will be met.
  - No additional infrastructure will be required to service this area.
- **D - Single Family Residential**
  - Operating pressure in this area is anticipated to range between 282 and 331 kPa (41 and 48 psi), meeting minimum targets.
  - Residential fire flows will be met.
  - No additional infrastructure will be required to service this area.
- **E – Single Family Residential**
  - Development is already occurring in this area.
  - Pressure will fall within the target range and residential fire flows will be met.
  - No additional infrastructure will be required to service this area.
- **F – Single Family Residential**
  - Pressure will fall within the target range and residential fire flows will be met.
  - No additional infrastructure will be required to service this area.
- **G – Single Family Residential**
  - Pressure will fall within the target range and residential fire flows will be met.
  - No additional infrastructure will be required to service this area.
- **H, I, J – Country Residential**
  - Minimum pressure may not fall within the target range in the far southwest corner of Area J
    - Private cistern and pump may be required for some County Residential lots in this area.
    - Alternatively, the service area may be revised/reduced and/or a booster pump installed for this service area.
  - Fire Flow was not simulated for County Residential developments.

5.2.2 Pumping

A fire/standby pump may be required to operate at the proposed Rosedale booster station in the Priority Development Stage. This specifically relates to expansion into higher elevation areas H, I, and J, to which the water tower cannot maintain sufficient pressure during fire flow conditions. Alternatively, local booster stations could be installed to service some/all of the new development areas. The model currently assumes that a fire/standby pump will be installed; however, further review will be required. Fire Flow will need to be supplemented from the WTP as the Rosedale Water Tower does not have sufficient storage to accommodate large fire flows.

IF NOT 25 mm ADJUST SCALES
25 mm

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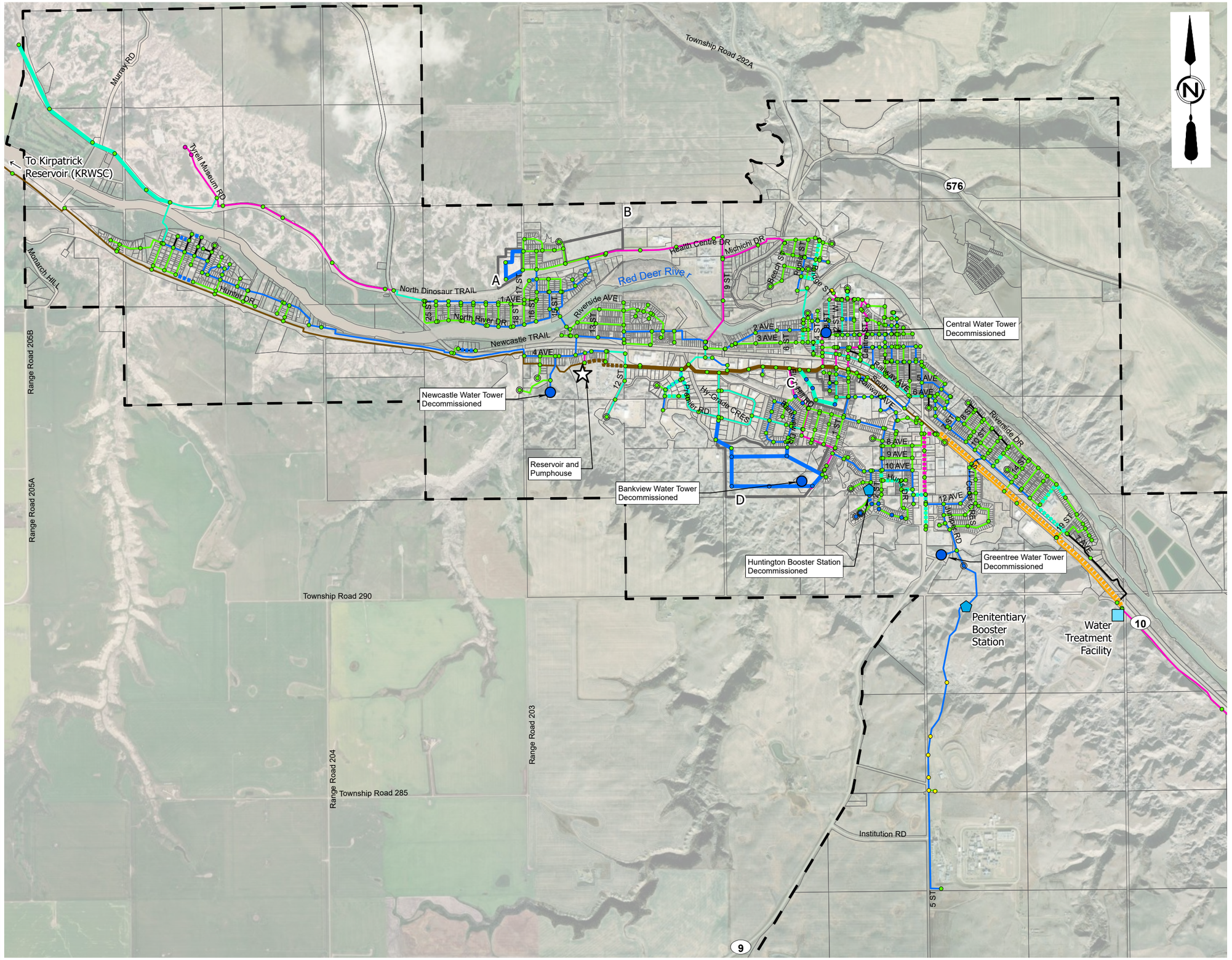

Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

- Water Treatment Plant
- Water Tower
- Booster Station
- Proposed Reservoir & Pumphouse
- Town Boundary
- Priority Growth Area
- Does Not Meet Fire Flow Requirements

Peak Hour Pressure

- <30 psi (200 kPa)
- 30 - 40 psi (200 kPa - 280 kPa)
- 40 - 50 psi (280 kPa - 350 kPa)
- 50 - 80 psi (350 kPa - 550 kPa)
- >80 psi (>550 k Pa)

Distribution System

- Existing ≤100 mmø
- Existing 150 mmø
- Existing 200 mmø
- Existing 250 mmø
- Existing 300 mmø
- Existing 450 mmø
- Existing 500 mmø
- Proposed 150 mmø
- Proposed 200 mmø
- Proposed 250 mmø
- Proposed 300 mmø
- Proposed 450 mmø
- Proposed 500 mmø

Note: Upgrades from previous stages are shown as dashed lines.

Note: Supply Mains, County Residential Development and Rural Areas have not been assessed for fire flow.

FIGURE 5-1

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

EXISTING WATER SYSTEM WITH UPGRADES
PRIORITY DEVELOPMENT

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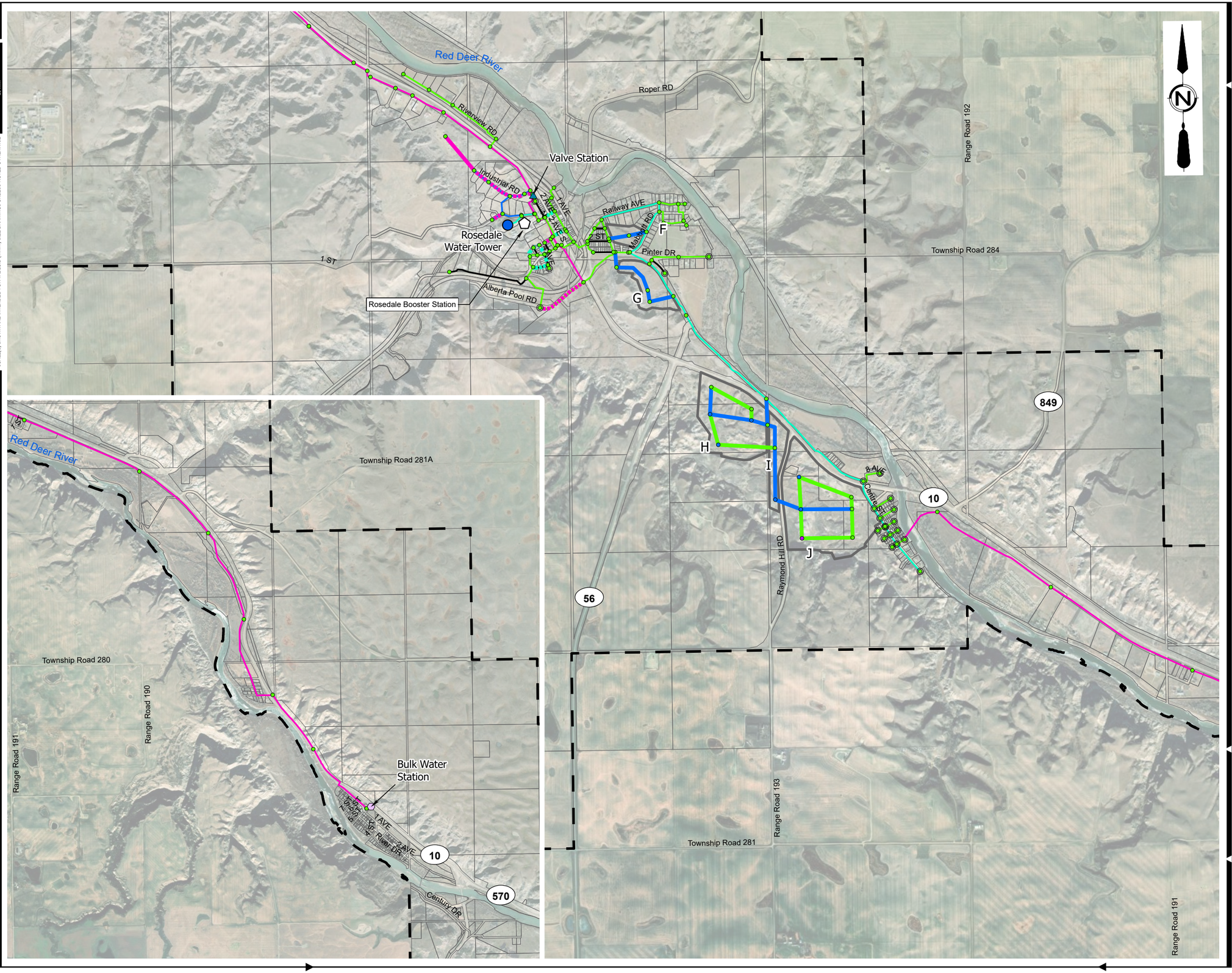

LEGEND:

- Water Tower
- Valve Station
- Bulk Water Station
- Proposed Booster Station
- Town Boundary
- Priority Growth Area
- Does Not Meet Fire Flow Requirements

Peak Hour Pressure

- <30 psi (200 kPa)
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Distribution System

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- Existing 300 mmø
- Existing 450 mmø
- Existing 500 mmø
- Proposed 150 mmø
- Proposed 200 mmø
- Proposed 250 mmø
- Proposed 300 mmø
- Proposed 450 mmø
- Proposed 500 mmø

Note: Upgrades from previous stages are shown as dashed lines.

Note: Supply Mains, County Residential Development and Rural Areas have not been assessed for fire flow.

FIGURE 5-2

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

EXISTING WATER SYSTEM WITH UPGRADES
PRIORITY DEVELOPMENT

AE PROJECT No.	2023-3628-00
SCALE	1:30,000 (INSET 1:45,000)
DATE	2023DEC07
PROJECTION	NAD 1983 CSRS 3TM 114
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DATA SOURCE: World Imagery: Earthstar Geographics;

5.2.3 Storage

Based on the historical growth rate, full build-out of the priority development area is well beyond the 25 year time frame (anticipated at 67 years). It is recommended that the volume associated with the priority development area be reviewed prior to design of the proposed reservoir and pumphouse. It is likely that additional storage will be required in the future should the full priority development area be realized and based on the final design of the reservoir.

5.3 Ultimate System

5.3.1 Distribution System

The Ultimate Development Stage includes servicing new development areas as well as meeting the projected 25 year Regional demands, as presented in **Figure 5-3** and **Figure 5-4**.

The existing 500 mm Hyprescon supply main is shown as replaced in the Ultimate System. The Town wishes to maintain dual supply mains to protect themselves against potential future supply main breaks. A 500 mm watermain is assumed for the purpose of this report, however, design flowrates would be reviewed prior to a future pipe replacement. The desire to maintain twin supply mains can be reviewed at that time.

As new development occurs between Rosedale and Cambria, it is recommended that a secondary supply line be constructed through new development areas. This will service new development as well as to provide a redundant waterline as backup to the existing 250 mm watermain. There is no storage currently located south of Rosedale, so it is vital that water supply is maintained at all times.

A distribution system has not been identified within East Coulee at this time, although adjacent proposed developments have been incorporated into the Ultimate System model. Modelled pressures indicate that a domestic distribution system could be constructed in the area; however, fire flow would be limited (and is not currently considered in rural areas). Local storage and pumping would likely be required to achieve fire flow in the area.

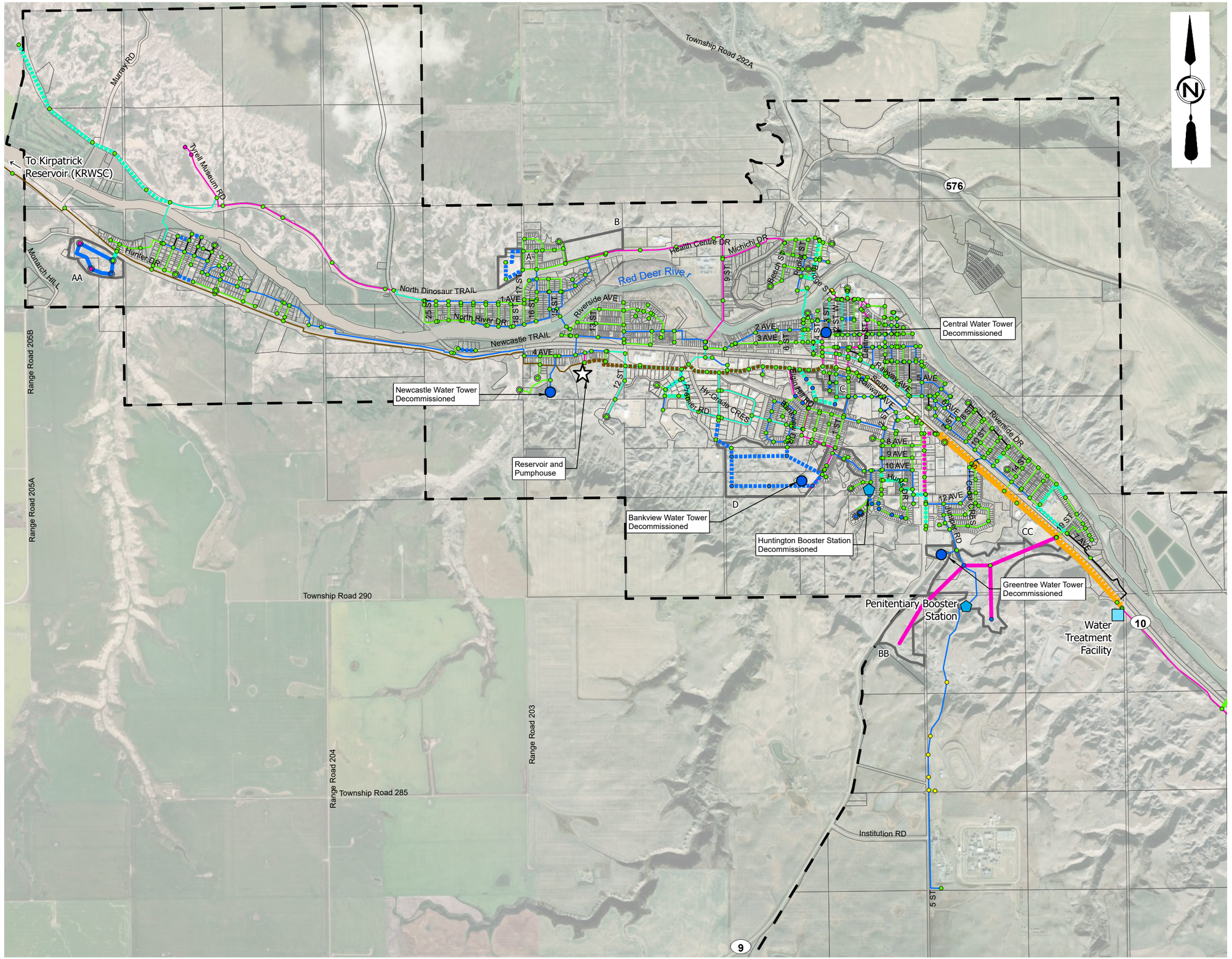
The following provides a description of the high level servicing requirements for the various future development areas in the Ultimate Development Stage. Service areas are identified in **Figure 5-3** and **Figure 5-4.**

- AA – Single Family Residential
  - Based on the service area and LIDAR ground elevations, minimum pressure may not be achieved in some portions of this development.
    - The service area may need to be revised and/or regraded.
    - Alternatively, a booster station including fire/standby pump could be required.
- BB – Commercial
  - A booster station will be required to achieve minimum pressure and fire flow in this area.
    - Although the Penitentiary Booster Station may be capable of meeting normal demands (requires review and confirmation), it will not be sufficiently sized to accommodate fire flow. The Penitentiary supply main will also be significantly undersized to supply fire flow.
- CC – Commercial
  - Pressure will fall within the target range and commercial fire flows will be met.
  - No additional infrastructure will be required to service this area.
- DD – Country Residential
  - Pressure will fall within the target range.

- Fire Flow was not simulated for County Residential developments.
- No additional infrastructure will be required to service this area.

- EE – Country Residential
  - Minimum pressure may not fall within the target range in the far southeast corner.
    - As much of the area can achieve the target pressure, the service area may be revised and/or a booster pump installed for all or some of this area.
    - In addition, private cisterns and pumps may be required for some County Residential lots in this area should sufficient minimum pressure not be achieved.
  - Fire Flow was not simulated for County Residential developments.
- FF – Commercial/Industrial
  - It will not be practical to achieve full fire flow in this area without construction of significant additional infrastructure.
    - Should full urban commercial fire flow of 183 L/s be required, then it will be necessary to twin the existing 300 mm waterline with an additional 300 mm waterline from the Rosedale Water Tower to the development limits.
  - Pressure will fall within the target range and commercial fire flows will be met.
- GG – Country Residential
  - Pressure will fall within the target range.
  - Fire Flow was not simulated for County Residential developments.
  - No additional infrastructure will be required to service this area.
- HH/II/JJ – Single Family Residential
  - Pressure will fall within the target range and rural residential fire flows will be met (60 L/s).
  - No additional infrastructure will be required to service this area.
- KK – Single Family Residential
  - Pressure will fall within the target range and rural residential fire flows will be met (60 L/s).
  - No additional infrastructure will be required to service this area.
- LL – Country Residential
  - Pressure will fall within the target range.
  - Fire Flow was not simulated for County Residential developments.
  - No additional infrastructure will be required to service this area.
- MM – Commercial/Residential
  - Pressure will fall within the target range.
  - Fire flows in the order of 47 L/s will be achieved, which will not satisfy the rural residential or commercial fire flow targets.
  - Upgrades to achieve full fire flow have not been considered south of Cambria, due to remote location.
  - No additional infrastructure will be required to service this area.
- NN – Country Residential
  - Pressure will fall within the target range.
  - Fire Flow was not simulated for County Residential developments.
  - No additional infrastructure will be required to service this area.

IF NOT 25 mm ADJUST SCALES
25 mm
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



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DATA SOURCE: World Imagery, Maxar,

Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

- Water Treatment Plant
- Water Tower
- Booster Station
- Proposed Reservoir & Pumphouse
- Town Boundary
- AA Ultimate Growth Area
- Does Not Meet Fire Flow Requirements

Peak Hour Pressure

- <30 psi (200 kPa)
- 30 - 40 psi (200 kPa - 280 kPa)
- 40 - 50 psi (280 kPa - 350 kPa)
- 50 - 80 psi (350 kPa - 550 kPa)
- >80 psi (>550 k Pa)

Distribution System

- Existing ≤100 mmø
- Existing 150 mmø
- Existing 200 mmø
- Existing 250 mmø
- Existing 300 mmø
- Existing 450 mmø
- Existing 500 mmø
- Proposed 150 mmø
- Proposed 200 mmø
- Proposed 250 mmø
- Proposed 300 mmø
- Proposed 450 mmø
- Proposed 500 mmø

Note: Upgrades from previous stages are shown as dashed lines.

Note: Supply Mains, County Residential Development and Rural Areas have not been assessed for fire flow.

FIGURE 5-3

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

ULTIMATE WATER DISTRIBUTION SYSTEM

AE PROJECT No.	2023-3628-00
SCALE	1:30,000
DATE	2024FEB22
PROJECTION	NAD 1983 CSRS 3TM 114
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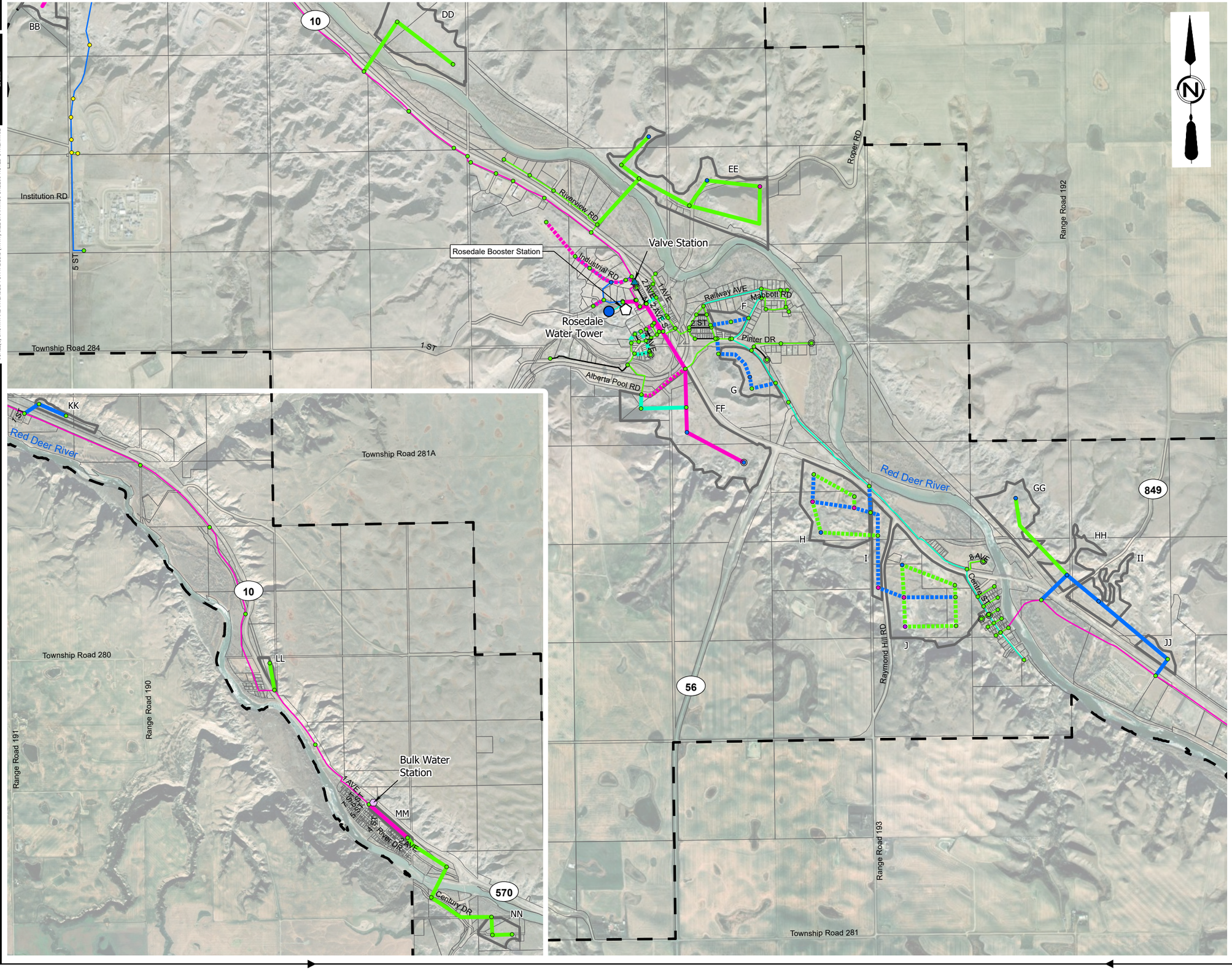
CHECKED BY	DK
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m



IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

Associated Engineering

CANADA BEST MANAGED COMPANIES
Platinum member

LEGEND:

- Water Tower
- Valve Station
- Bulk Water Station
- Proposed Booster Station
- Town Boundary
- AA Ultimate Growth Area
- Does Not Meet Fire Flow Requirements

Peak Hour Pressure

- <30 psi (200 kPa)
- 30 - 40 psi (200 kPa - 280 kPa)
- 40 - 50 psi (280 kPa - 350 kPa)
- 50 - 80 psi (350 kPa - 550 kPa)
- >80 psi (>550 k Pa)

Distribution System

- Existing ≤100 mmø
- Existing 150 mmø
- Existing 200 mmø
- Existing 250 mmø
- Existing 300 mmø
- Existing 450 mmø
- Existing 500 mmø
- Proposed 150 mmø
- Proposed 200 mmø
- Proposed 250 mmø
- Proposed 300 mmø
- Proposed 450 mmø
- Proposed 500 mmø

Note: Upgrades from previous stages are shown as dashed lines.

Note: Supply Mains, County Residential Development and Rural Areas have not been assessed for fire flow.

FIGURE 5-4

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

ULTIMATE WATER DISTRIBUTION SYSTEM

AE PROJECT No.	2023-3628-00
SCALE	1:30,000 (INSET 1:45,000)
DATE	2023DEC07
PROJECTION	NAD 1983 CSRS 3TM 114
DRAWN BY	KR
CHECKED BY	DK
DESCRIPTION	ISSUED FOR REPORT

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DATA SOURCE: World Imagery: Maxar,

5.3.2 Pumping

A fire/standby pump will be required at the proposed Rosedale booster station in the Ultimate Development Stage. This will be required to maintain minimum pressure in higher elevation expansion areas to which the water tower cannot maintain sufficient pressure during fire flow conditions. Alternatively, multiple booster stations could be installed to service several new development areas. The model currently assumes that a fire/standby pump will be installed; however, further review will be required. Fire Flow will need to be supplemented from the WTP as the Rosedale Water Tower does not have sufficient storage to accommodate large fire flows.

5.3.3 Storage

Based on the historical growth rate, full build-out of the Ultimate Development Stage is well beyond the 25 year time frame, potentially 100 years or more. It is likely that additional storage will be required in the future should the full Ultimate Development area be realized and based on the final design of the reservoir.

6 OPINION OF PROBABLE COSTS

A summary of capital cost estimates is provided in **Table 6-1** for upgrades which are recommended for the existing water system. **Figure 6-1** is enclosed as a summary of proposed upgrades for the existing system. Costs are not provided for future expansion of the distribution system as all watermains are 300 mm or smaller (typically developer responsibility). Costs for upgrades of the existing system required to support future servicing requirements are identified. Estimated cost for replacement of the 500 mm Hyprescon supply main are included in the Ultimate Development Stage.

The estimates presented include an allowance for engineering (15%) and contingency (15%), but do not include GST. The costs are based on 2023 construction dollars. Detailed estimates are provided in **Appendix B**.

Table 6-1 Capital Cost Estimates

Upgrades to Existing System	
Watermains	$19,020,000
New Reservoir and Pump Station	$4,000,000
WTP Pumping Upgrade	TBD
Rosedale Booster Station and Control Valve	$2,000,000
Decommission Water Towers	$1,470,000
Decommission Huntington Booster Station	$200,000
Total Upgrades to Existing System	**$26,690,000**
Priority Development Scenario	
Watermains	$5,250,000
Rosedale Standby/Fire Pump	$300,000
Total Stage 1	**$5,550,000**
Ultimate Development Scenario	
Watermains	$5,470,000
Total Ultimate	**$5,470,000**

WTP Pumping Upgrade costs will be determined following completion of the WTP Master Plan.

RJC Engineers undertook a structural condition assessment of the five Water Towers operating in the Drumheller water system in 2022. A summary of recommendations and estimated costs is provided in **Table 6.2**.

Table 6-2 Summary of Upgrades – Town of Drumheller Reservoir Structural Condition Reports, RJC Engineers

Location	Constructed	Age	Upgrade	Cost
Bankview	1982	41 Years	Structural Investigation and Monitoring	$15,000
			Localized Structural Repair Recommendations	$26,000
			Interior Waterproof Coating	$550,000
			General Maintenance Recommendations	$10,000
			Subtotal	**$601,000**
Greentree	1982	41 Years	Structural Investigation and Monitoring	$15,000
			Structural Repair Recommendations	$100,000
			General Maintenance Recommendations	$25,000
			Subtotal	**$140,000**
Newcastle	1982	41 Years	Structural Repair Recommendations	$90,000
			Interior Condition Assessment and Exploratory Excavation	$20,000
			General Maintenance Recommendations	$10,000
			Subtotal	**$120,000**
Central	1937	86 Years	Replacement of Roofing Membrane	$435,000
			Removal of Paint and Re-Coating of Structural Steel	$925,000
			General Maintenance Recommendations	$35,000
			Subtotal	**$1,395,000**
			Total – Drumheller Urban Water Town Costs	**$2,256,000**
Rosedale	1982	41 Years	Structural Repair Recommendations	$1,000
			General Maintenance Recommendations	$15,000
			Interior Condition Assessment	$15,000
			Total - Rosedale Water Tower Costs	**$31,000**

Note: Inspections undertaken in 2022
Highest estimated cost range was included

As show in **Table 6-1**, over $2,200,000 in upgrades are outlined for the four water towers servicing Drumheller (excluding Rosedale). However, upgrades to the water towers will not address level of service or water quality considerations. If the water towers are retained, a direct feed to each tower could potentially be required to achieve sufficient turnover. This is likely impractical for the Drumheller system due to its length. As well, this will not improve the level of service within the community.

It is recommended that the Town direct these funds towards construction of a new reservoir and pumphouse and decommissioning of the water towers.

IF NOT 25 mm ADJUST SCALES
25 mm

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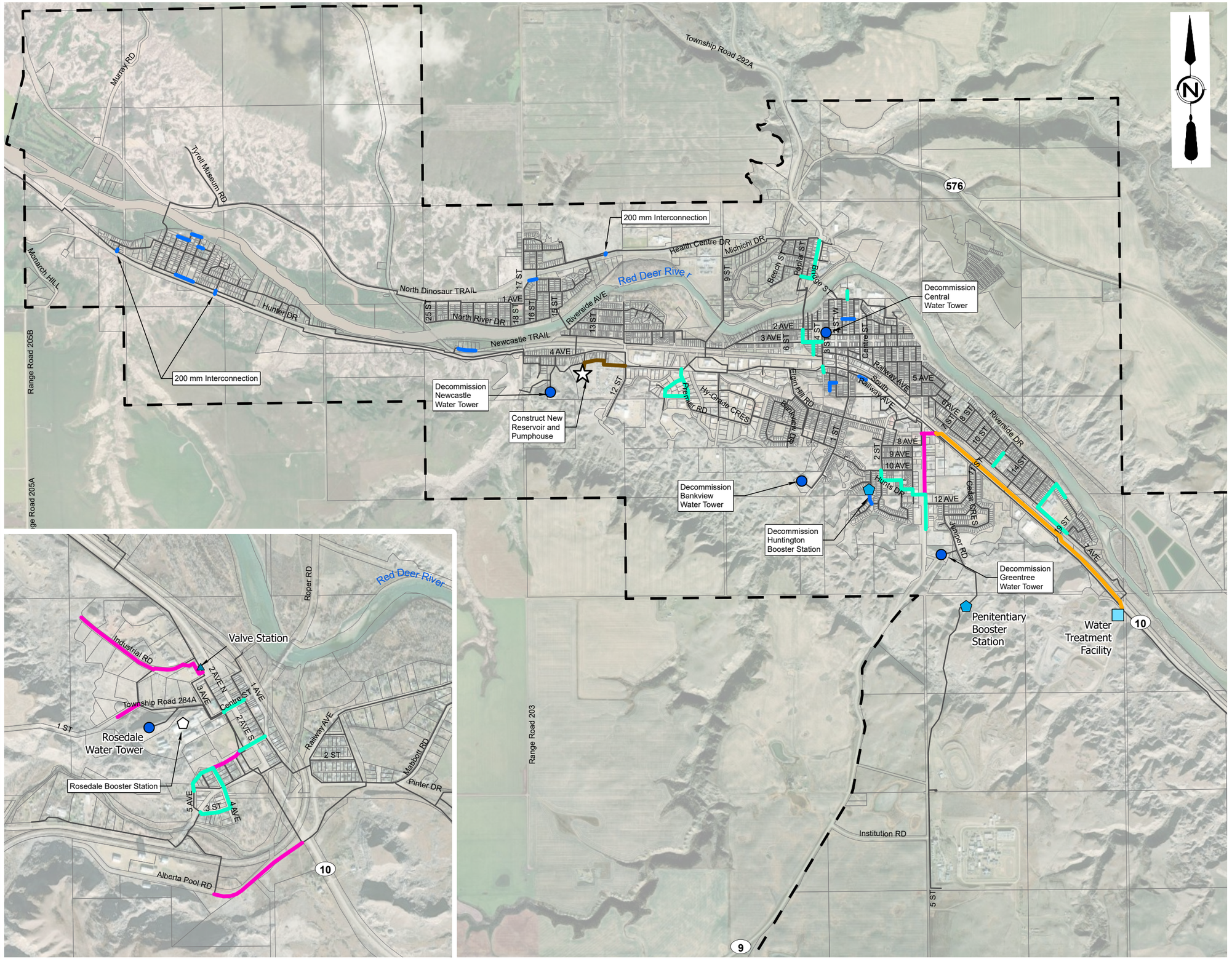

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Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

- Water Treatment Plant
- Water Tower
- Booster Station
- Valve Station
- Proposed Reservoir & Pumphouse
- Proposed Booster Station
- Town Boundary
- Existing Watermain

Watermain Upgrades

- Proposed 200 mmø
- Proposed 250 mmø
- Proposed 300 mmø
- Proposed 450 mmø
- Proposed 500 mmø

FIGURE 6-1

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

SUMMARY OF PROPOSED UPGRADES TO EXISTING SYSTEM

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0 500 1,000 m

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

- The Drumheller WTP provides municipal water servicing to the Town of Drumheller and south to Rosedale, Cambria, and East Coulee.
- The Town of Drumheller also supplies potable water to several customers and regional users:
  - Churchill Water Co-op Meter Station (Kneehill)
  - Kirkpatrick Reservoir (Aqua 7)
  - Munson Booster Station (Starland Regional)
  - CLV Water Co-op Meter Station (Starland Regional)
  - Drumheller Penitentiary Reservoir
- The distribution system is serviced by the WTP and five Water Towers: Bankview, Central, Greentree, Newcastle, and Rosedale.
- There are four pressure zones within the study area
- The Water Treatment pumps are understood to operate based on water tower volumes, resulting in operation of the reservoirs between 720.9 m HGL and 722.1 m HGL.
  - It is suspected that this may exceed the maximum operating level of Newcastle Tower, and the tower is unlikely to be operating regularly.
- Based on the model results, minimum pressure targets are not achieved in some locations in Drumheller and Rosedale
- Some locations within the Drumheller and Rosedale systems did not fully satisfy the Maximum Day plus Fire Flow criteria.
- There is sufficient pumping capacity at the WTP to meet the peak hour demand. The maximum day plus fire flow demand can be met with additional contribution from the water towers.
- There appears to be sufficient treated water storage at the WTP and water towers to meet the existing and 25 year requirements, should the operating level in the Water Towers be allowed to fall by an additional one metre (i.e. to 719.9 m). Refer to the Water Treatment Plant Master Plan for more detail on the WTP storage requirements and study results.
- Based on the information provided, the Huntington Booster Station does not appear to provide full fire flow.
- Following upgrading of the distribution system, some locations will continue to fall short of the target fire flows. These areas include:
  - Dead end mains
  - Cul-de-sacs
  - High value land uses within 10% of the target fire flow
  - Rural Rosedale, Cambria, and East Coulee
- A Water Tower Condition Assessment was undertaken in 2022 including upgrading recommendations with estimated costs. It is understood that a significant capital investment will be required to maintain operation of the water towers.

7.2 Recommendations

- Proceed with the watermain upgrading recommendations shown on **Figure 4-1** and **Figure 4-2.**
  - Additional study will be required to further develop the proposed concept and identify the following key items:
    - Optimal location of proposed reservoir and pumphouse.
    - Required pumping at the WTP and proposed reservoir and pumphouse.
    - Operating philosophy.
- Construct a new pumphouse and 2,000 m^3 reservoir within the Town of Drumheller.
  - Size and location to be determined.
  - WTP pumping upgrades/modifications to be determined.
- Confirm the Elgin Park development concept will not exceed the assumed maximum elevation of 702 m.
- Operate the WTP and new pumphouse at 735 m HGL.
- Decommission the four water towers located within Drumheller.
  - Rosedale Water Tower is to be maintained.
- Install a new flow control valve at the Rosedale Water Tower valve station.
- Construct a booster Station at Rosedale Water Tower.
- Install minimum watermain sizes as follows:
  - Single Family Residential 200 mm
  - Multi-Family Residential 250 mm
  - Commercial/Industrial/Institutional 300 mm
- Undertake a hydrant coverage review.
- Plan for staged expansion of the water system as presented in **Figure 5-1** through **Figure 5-4.**

CLOSURE

This report was prepared for the Town of Drumheller to provide a Water Distribution System Master Plan.

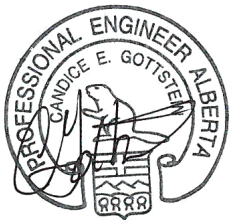
The services provided by Associated Engineering Alberta Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,

Associated Engineering Alberta Ltd.

2024-02-26
ID: 92359

Samantha Marcy, P.Eng.
Project Manager



2024-02-26
ID: 63124

Candice Gottstein, P.Eng.
Senior Hydraulic Modeller

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING ALBERTA LTD.

RM Signature _____

Lee Hang-Liu ID 69554 2024-Feb-27

PERMIT NUMBER: P 03979
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

APPENDIX A - STATIC PRESSURE AND HGL HYDRANT FIGURES

IF NOT 25 mm ADJUST SCALES 25 mm

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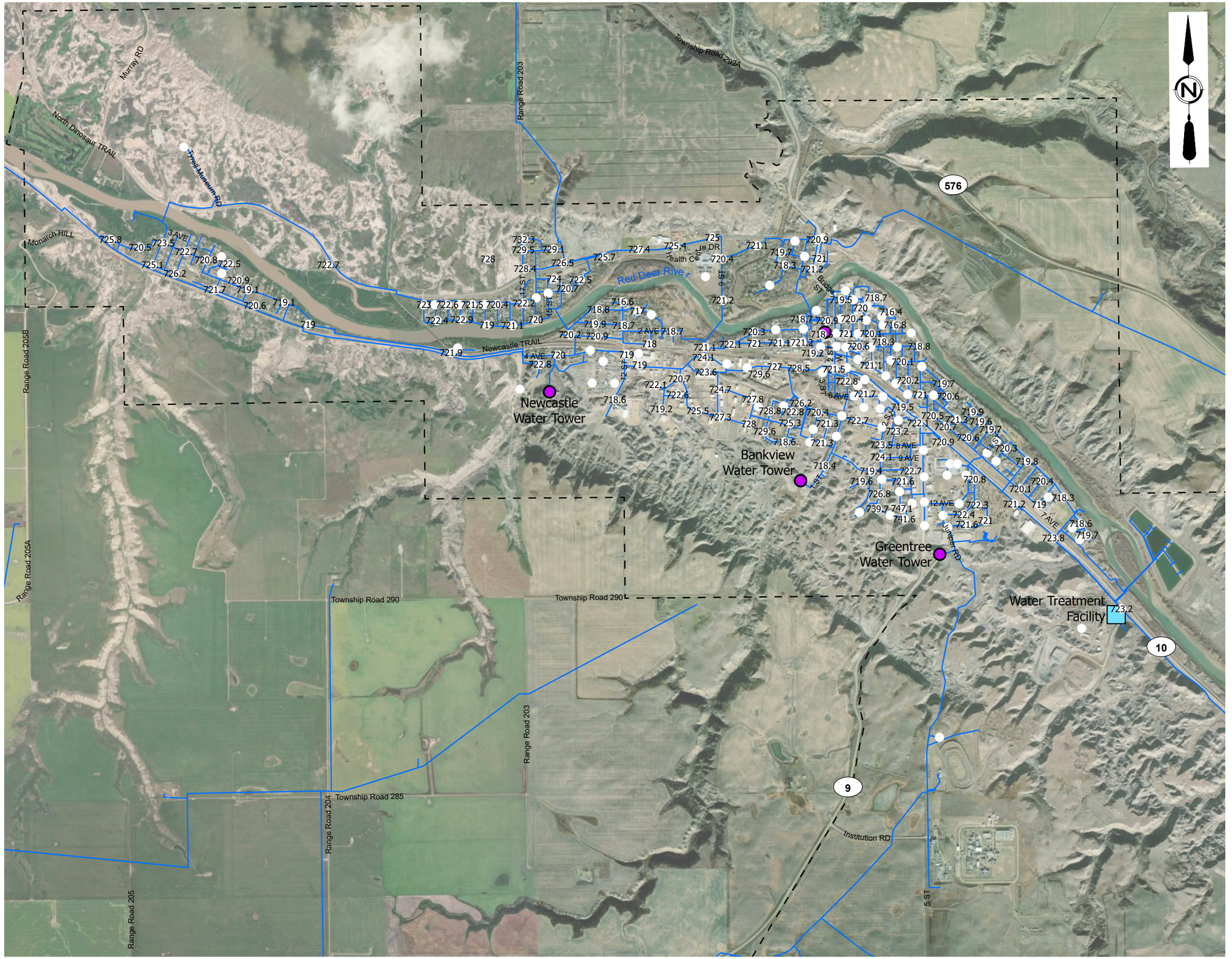

LEGEND:

- Hydrant HGL

FIGURE A-2

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

HYDRANTS

AE PROJECT No.	2023-3628-00
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DATE	2023JUN21
PROJECTION	NAD 1983 CSRS 3TM 114
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CHECKED BY	
DESCRIPTION	DRAFT

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DATA SOURCE: World Imagery, Earthstar Geographics;

LEGEND:

- Hydrant HGL

FIGURE 4-X

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

HYDRANTS

AE PROJECT No.	2023-3628-00
SCALE	1:30,000
DATE	2023JUN21
PROJECTION	NAD 1983 CSRS 3TM 114
DRAWN BY	KR
CHECKED BY	
DESCRIPTION	DRAFT

0 500 1,000 m

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DATA SOURCE: World Imagery; Earthstar Geographics;

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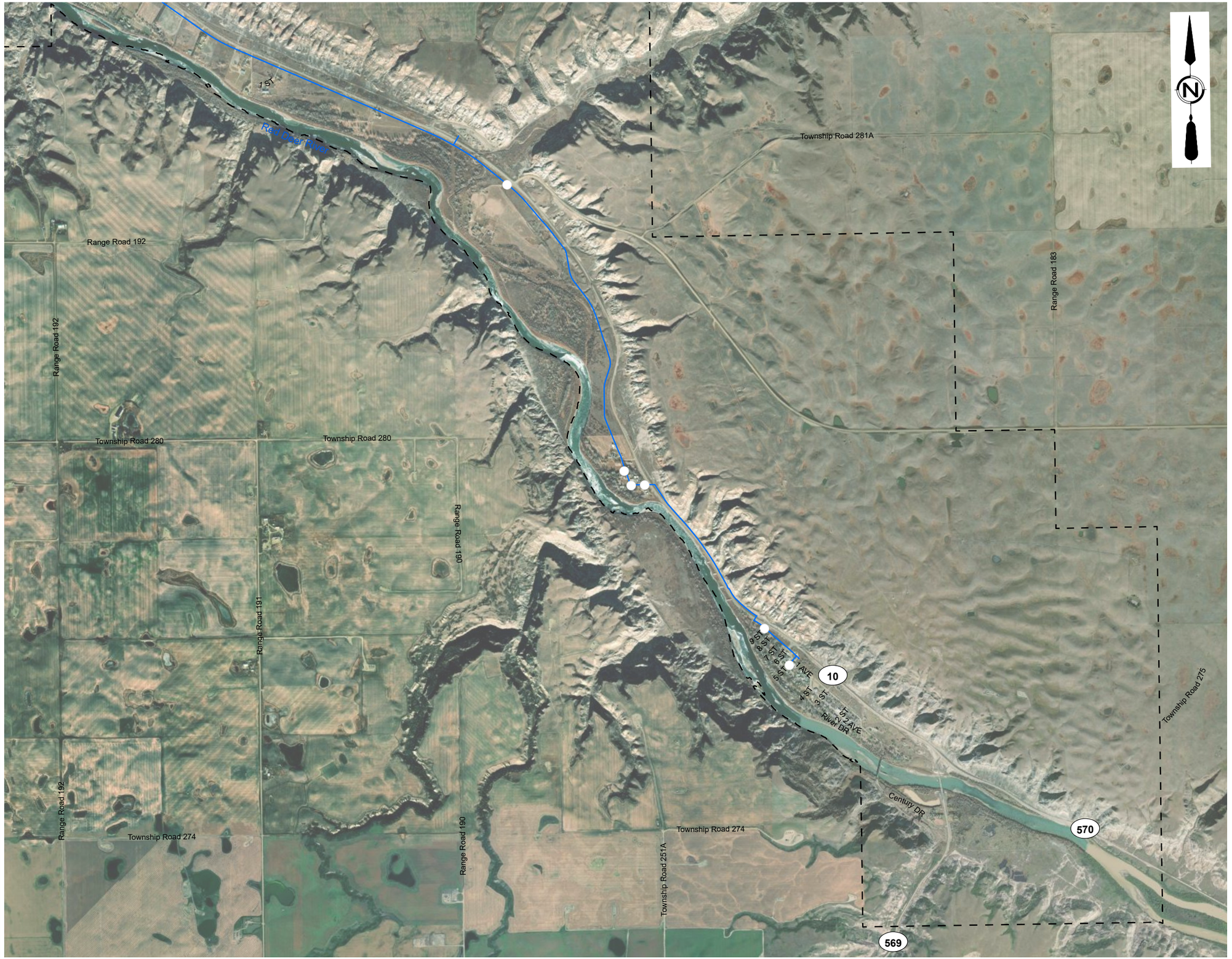
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



LEGEND:

- Hydrant HGL

FIGURE 4-X

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

HYDRANTS

AE PROJECT No.	2023-3628-00
SCALE	1:30,000
DATE	2023JUN21
PROJECTION	NAD 1983 CSRS 3TM 114
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DATA SOURCE: World Imagery, Maxar,

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

Murray RD
Tyrrell Museum RD
Monarch HILL
3 AVE
4 ST
2 ST
Hunter DR
Range Road 205B
Range Road 205A
Range Road 205
Range Road 204
Range Road 203
Township Road 290A
Township Road 290
Township Road 285
North Dinosaur TRAIL
Newcastle TRAIL
Red Deer River
Health Centre DR
17 ST
9 ST
Bridge ST
2 AVE
4 AVE
7 ST
Newcastle Water Tower
Bankview Water Tower
1 ST
8 AVE
9 AVE
10 AVE
12 AVE
3 ST
6 AVE
10 ST SW
4 ST
5 AVE
7 AVE
9 ST
Greentree Water Tower
Water Treatment Facility
Institution RD
5 ST
576
10
9

LEGEND:

Hydrant PSI

FIGURE A-1

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

HYDRANTS - PSI

AE PROJECT No.	2023-3628-00
SCALE	1:30,000
DATE	2023JUN21
PROJECTION	NAD 1983 CSRS 3TM 114
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DESCRIPTION	DRAFT

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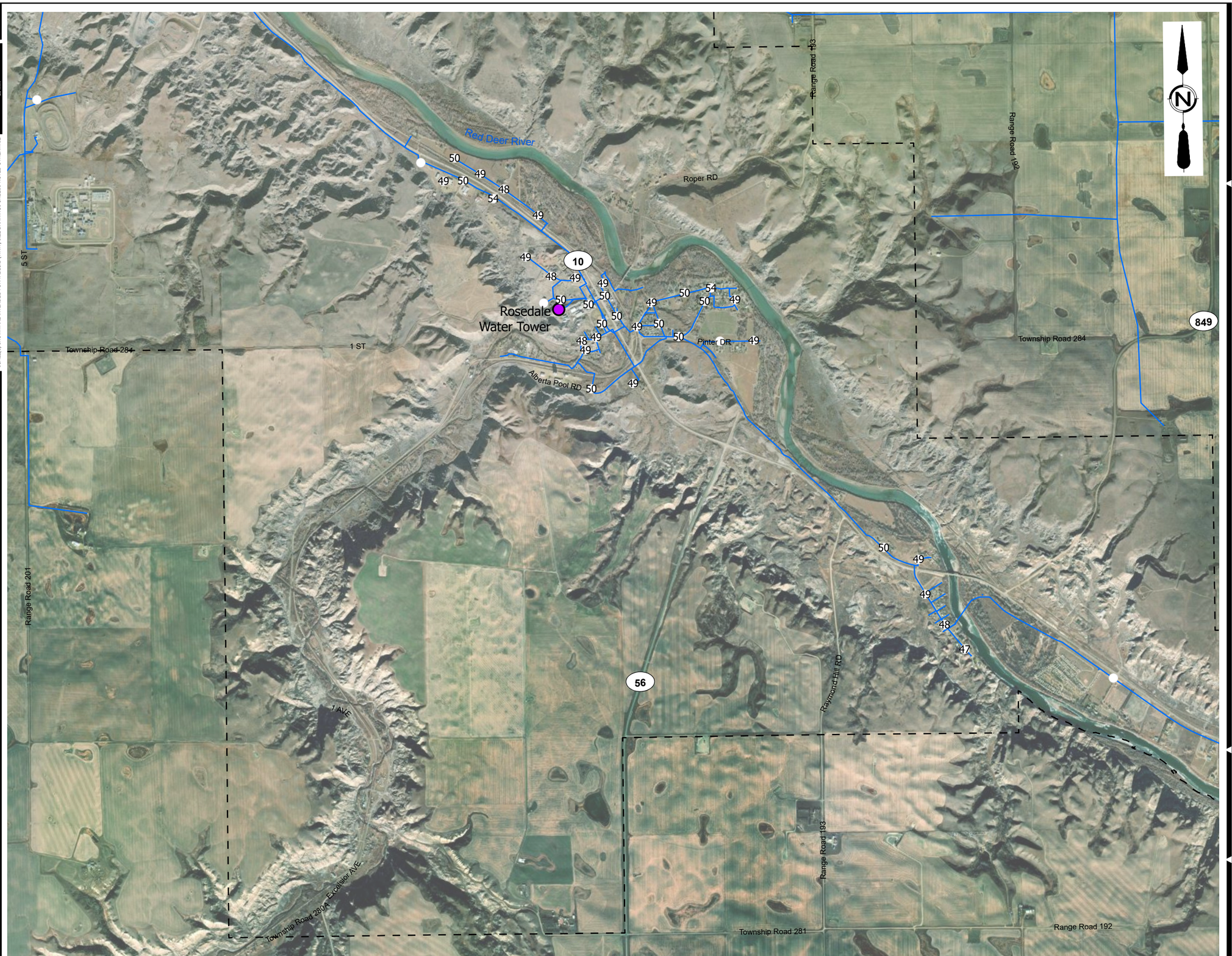

LEGEND:

- Hydrant PSI

FIGURE 4-X

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

HYDRANTS - PSI

AE PROJECT No.	2023-3628-00
SCALE	1:30,000
DATE	2023JUN21
PROJECTION	NAD 1983 CSRS 3TM 114
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DESCRIPTION	DRAFT

0 500 1,000 m

IF NOT 25 mm ADJUST SCALES
25 mm

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DATA SOURCE: World Imagery; Earthstar Geographics;

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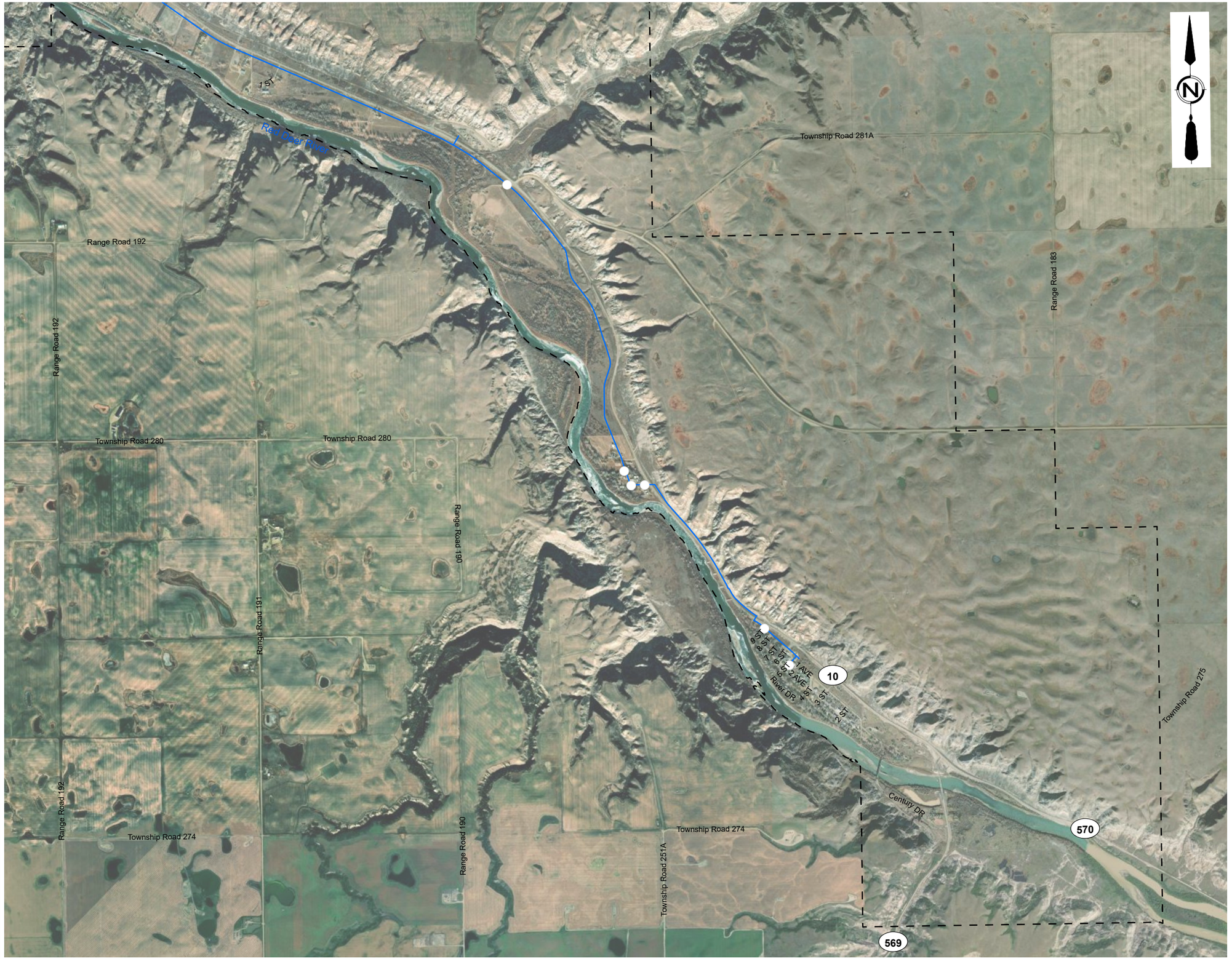

LEGEND:

Hydrant PSI

FIGURE 4-X

TOWN OF DRUMHELLER
WATER MASTER SERVICING STUDY

HYDRANTS - PSI

AE PROJECT No.	2023-3628-00
SCALE	1:30,000
DATE	2023JUN21
PROJECTION	NAD 1983 CSRS 3TM 114
DRAWN BY	KR
CHECKED BY	
DESCRIPTION	DRAFT

0 500 1,000 m

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DATA SOURCE: World Imagery, Maxar,

APPENDIX B - DETAILED COST ESTIMATES

Table B-1
Town of Drumheller
Cost Breakdown - Water System

Upgrades to Existing Watermains

Location	From	Start Node	To	Stop Node	Length (m)	Diameter (mm)	Unit Cost ($/m)	Pipe Cost ($)
Highway 56	WTP	J-1221	5 St E	J-1032	1300	500	$2,850	$3,705,000
Highway 56	WTP	J-1232	5 St E	J-1298	800	500	$2,200	$1,760,000
4 Ave West	13 St SW	J-123	12 St SW	J-851	370	450	$2,590	$958,300
Highway 9	Highway 56	J-1021	11 Ave SE	J-738	630	300	$2,010	$1,266,300
Highway 9	11 Ave SE	J-738	Extra Foods	J-764	280	250	$1,860	$520,800
Hunts Drive	Highway 9	J-738	10 Ave SE	J-746	565	250	$1,860	$1,050,900
Premier Crescent / Premier Road		J-825		J-799	670	250	$1,860	$1,246,200
Poplar Crescent / Poplar Street		J-1154		J-1130	410	250	$1,860	$762,600
3 Ave W	5 St W	J-978	3 St W	J-1185	160	250	$1,860	$297,600
5 St W	2 Ave W	J-901	3 Ave W	J-978	100	250	$1,860	$186,000
4 St W	3 Ave W	J-1167	3 St W	J-1072	105	250	$1,860	$195,300
3 St SW	S. Dinosaur Trail	J-35	Alley south of S. Dinosaur Trail	J-1137	50	250	$1,860	$93,000
1 St SW	1 Ave W	J-961	Skate Park	J-659	67	250	$1,860	$124,620
12 St E	7 Ave E	J-918	6 Ave E	J-829	135	250	$1,860	$251,100
7 Ave E / 17 St E / Riverside Dr E		J-783		J-1081	700	250	$1,860	$1,302,000
1 St SE		J-675		J-211	75	200	$1,750	$131,250
5 Ave SW and Alley west of 2 St SW		J-888		J-88	120	200	$1,750	$210,000
S. Railway Ave east of 1 St SW		J-90		J-1303	65	200	$1,750	$113,750
2 Ave W near 1 St W		J-1086		J-1131	100	200	$1,750	$175,000
N. Dinosaur Trail connection East Midlandvale		J-314		J-1299	12	200	$1,750	$21,000
2 Ave NW	16 St NW	J-1009	West	J-53	65	200	$1,750	$113,750
Newcastle Trail		J-193		J-192	145	200	$1,750	$253,750
Hunter Drive (Nacmine)	3 St	J-1271	5 St	J-45	155	200	$1,750	$271,250
Two connections to 450 mm WM in Nacmine					50	200	$1,750	$87,500
3 Ave (Nacmine)	2 St	J-40	3 St	J-209	100	200	$1,750	$175,000
North of 3 Ave (Nacmine)	3 St	J-41	4 St	J-42	85	200	$1,750	$148,750
3 Ave (Nacmine)	4 St	J-210	East	J-44	45	200	$1,750	$78,750
1 Ave N (Rosedale) d/s of valve station		J-896		J-137	235	300	$2,010	$472,350
1 Ave N (Rosedale)		J-137		J-139	365	300	$2,010	$733,650
1 St N (Rosedale)		J-140		J-141	100	300	$2,010	$201,000
1 St S (Rosedale)	East of 2 Ave S	J-302	4 Ave S	J-303	135	300	$2,010	$271,350
Alberta Pool Road (Rosedale)	Hwy 10	J-147	DDR Centre	J-1231	435	300	$1,360	$591,600
4 Ave S / 3 St S (Rosedale)		J-720		J-719	450	250	$1,860	$837,000
Centre St (Rosedale)	West of Hwy 10	J-304	East of Hwy 10	J-1019	100	250	$1,860	$186,000
1 St S (Rosedale)	West of Hwy 10	J-302	East of Hwy 10	J-1030	120	250	$1,860	$223,200
Total Upgrades to Existing Watermains								$19,020,000

Upgrades to Existing Facilities

Item	Quanitity	Unit Cost ($/each)	Total Cost
New Reservoir/Pump Station	2,000	$2,000	$4,000,000
WTP pumping upgrade	1	Lump Sum	TBD
Rosedale Booster Staton and Control Valve	1	Lump Sum	$2,000,000
Decommission Newcastle Tower	1	Lump Sum	$166,000
Decommission Bankview Tower	1	Lump Sum	$470,000
Decommission Central Tower	1	Lump Sum	$455,000
Decommission Greentree Tower	1	Lump Sum	$375,000
Decommission Huntington Booster Station	1	Lump Sum	$200,000
Total Upgrades to Existing Facilities			$7,670,000

Priority Development Watermains

Location	From	Start Node	To	Stop Node	Length (m)	Diameter (mm)	Unit Cost ($/m)	Pipe Cost ($)
S. Railway Ave	12 St SW	J-851	2 St SW	J-682	1800	450	$2,590	$4,662,000
Railway Ave / 1 St E (Rosedale)	Hwy 10	J-147	Aerial Cres	J-1120	485	250	$1,210	$586,850
Total Stage 1 Watermains								$5,250,000

Priority Development Facilities

Item	Quanitity	Unit Cost ($/each)	Total Cost
Rosedale Standby/Fire Pump	1	$300,000	$300,000
Total Priority Development Facilities			$300,000

Ultimate Development Watermains

Location	From	Start Node	To	Stop Node	Length (m)	Diameter (mm)	Unit Cost ($/m)	Pipe Cost ($)
Highway 56	WTP	J-1221	5 St E	J-1032	1300	500	$2,850	$3,705,000
Highway 56	WTP	J-1232	5 St E	J-1298	800	500	$2,200	$1,760,000
Total Ultimate Watermains								$5,470,000