Town of Okotoks

Zone 3S Reservoir Feasibility – Phase 2

Technical Memorandum

CIMA+ file number: C04-00459
August 6, 2025 – Final

Town of Okotoks

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Technical Memorandum

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Review and submission register			
Review No.	Reviewed by	Date	Description of the change or submission
DRAFT	JP / SD	04-28-2022	Draft report
DRAFT Rev 2	JP / SD	07-28-2022	Revised draft report to address Town comments and elaborate on the OSL considerations
DRAFT Rev 3	JP / SD	08-15-2022	Updated OSL considerations
Final	JP / SD	08-06-2025	Updated to Final

Executive Summary

This report is Phase 2 of the Zone 3S Reservoir Feasibility Study. Phase 1 reviewed and updated the pressure zone boundaries, justified the need for a new reservoir, established the reservoir location and ultimate volume, and recommended a new reservoir location.

Phase 2 had the following objectives:

+ Operational assessment of various reservoir fill scenarios:
+ Determine pumping requirements for existing and future demands
+ Develop proposed phasing plan for reservoir and pump stations
+ Estimate capital and operating costs
+ Identify probable benefitting areas, and percent benefit to existing system and future growth areas

Assessment of Operational Scenarios

The results of the operational scenarios assessment is that the proposed 450 mm twin fill lines can support Max Day Demand Flows beyond the Long Term growth scenario. To support the Full Buildout, the water line would have to be upgraded from either of the supply line tie ins back to the South Reservoir. For the sake of redundancy, the Town may wish to upgrade from both tie in locations.

Pump Station Requirements

Two different pump station configurations were investigated. The first is a single set of pumps discharging into the higher Zone 3S pressure zone, with flows going through a PRV to reach Zone 2S. The second is separate pumps distributing into each of the Zone 3S and Zone 2S pressure zones.

Zone 3S has a discharge head of approximately 52 m, and Zone 2S has a discharge head of approximately 23 m.

Scenario	Single Pump Station (HP)	Dual Pump Station (HP)	
		Zone 3S	Zone 2S
Existing + WO NASP	263	235	110
Medium	299	256	120
Long	333	283	131
Buildout	425	376	131

Reservoir and Pump Station Phasing

The reservoir is recommended to be phased in three cells. The first cell would support past the buildout of the West Okotoks NASP. The next two cells would be of equal size, with the first supporting past the Long Term growth scenario, and the second supporting past the Full Buildout.

The full reservoir footprint is estimated to be 75 m x 75 m

+ Phase 1 – 8,100 m^3 Cell, approximately 75 m x 26 m
+ Phase 2 – 7,200 m^3 Cell, approximately 37.5 m x 48 m
+ Phase 3 – 7,200 m^3 Cell, approximately 37.5 m x 48 m

Pump station phasing investigated both single zone and dual zone pump station configurations. Under each configuration, it was assumed that there were dual / redundant fire pumps. Zone 3S fire pumps were 220 HP, and Zone 2S fire pumps were 100 HP.

The following table summarizes the additional pumps and their upgrades for each growth scenario, with the fire pumps staying consistent throughout.

Scenario	Single Pump Station	Dual Pump Station	
		Zone 3S	Zone 2S
Existing + WO NASP	2 x 25 HP	1 x 15 HP	1 x 15 HP
Medium Term	3 x 25 HP	2 x 15 HP	2 x 15 HP
Long Term	4x 25 HP	2 x 30 HP	2 x 15 HP
Full Buildout	2 x 75 HP 2 x 25 HP	2 x 80 HP	2 x 15 HP

Capital and Operating Costs

Estimates were made of the capital costs for constructing the proposed reservoir, pump station, and supply lines, along with estimated annual operating costs of the facilities.

The following table summarizes these estimates for each of the facility configurations.

Single Zone Configuration

Scenario	Pump Station	Reservoir	Supply Line	Total
Existing + WO NASP	$ 3,250,000	$ 10,500,000	$ 2,400,000	$ 16,150,000
Medium Term	$ 3,400,000	$ 19,860,000	$ 2,400,000	$ 25,660,000
Long Term	$ 3,550,000		$ 2,400,000	$ 25,810,000
Full Buildout	$ 3,850,000	$ 29,250,000	$ 5,900,000	$ 39,000,000

Dual Zone Configuration

Scenario	Pump Station	Reservoir	Supply Line	Total
Existing + WO NASP	$ 3,750,000	$ 10,500,000	$ 2,400,000	$ 16,650,000
Medium Term	$ 3,900,000	$ 19,860,000	$ 2,400,000	$ 26,160,000
Long Term	$ 4,000,000		$ 2,400,000	$ 26,260,000
Full Buildout	$ 4,300,000	$ 29,250,000	$ 5,900,000	$ 39,450,000

All capital and operating cost estimates presented in this report are expressed in **2022 dollars**, reflecting the year in which the original analysis and pricing assumptions were completed.

Benefitting Areas Review

A high-level review of the benefitting areas in the existing system and future growth areas was performed to give guidance on what share of the capital costs each area will be responsible for.

+ Zone 1S – 50% Benefitting
+ Existing Zone 2S – 75% Benefitting
+ Future Zone 2S – 100% Benefitting
+ Zone 3S – 100% Benefitting

The following table summarizes the benefitting areas under each of these categories.

Scenario	Zone 1S – 50% (ha)	Existing Zone 2S – 75% (ha)	Future Zone 2S – 100% (ha)	Zone 3S – 100% (ha)	Total Area (ha)
Existing	304	153	-	17	**474**
Existing + WO NASP	304	153	30	48	**535**
Medium Term	304	153	159	48	**664**
Long Term	406	153	238	109	**905**
Full Buildout	426	153	477	249	**1305**

Recommendations

Recommendations will be finalized following discussion with the Town.

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1. Introduction

In September 2021, the Town of Okotoks retained CIMA+ to prepare a feasibility study for a proposed new reservoir servicing the southern portion of Okotoks. This study is to be delivered in two phases.

This first phase will address the immediate needs of the Town, such as whether the reservoir is required, how large it needs to be, and where it should be built. The second phase will take a deeper investigation into the hydraulic impacts of the reservoir, reservoir and pump station phasing, and the financial feasibility of the reservoir.

1.1 Background

A reservoir on the southern side of Okotoks has been considered for several years. This project has been proposed in previous Master Plans, and the Town has been collecting levies for this infrastructure.

As of September 2021, the West Okotoks NASP is in active development. It Is located on NW ¼ 20-20-29-W4. As it is located in one of the highest elevation areas in the southern portion of Okotoks, it had been determined by the Town that this was a probable location for the proposed reservoir. The Town made it a requirement to set aside land for the reservoir in the NASP. As such, a 3 acre parcel was set aside in the southeast corner of the NASP area for the reservoir in the preliminary land use concept.

Phase 1 of this report was delivered and gave further guidance on the reservoir location and Top Water Level, reservoir sizing and high level staging. The alternative location proposed was adopted into the NASP.

1.2 Objectives

The stated objectives of Phase 2 of the study are as follows:

+ Operational assessment of the following fill scenarios:
    - Reservoir being filled by Zone 1S HGL – Single feed from Big Rock Booster tie in
    - Reservoir being filled by Zone 1S HGL – Single feed from Big Rock Trail / Westland Rd tie in
    - Reservoir being filled by Zone 1S HGL – Both feed lines
+ Determine pumping requirements for existing and future demands
+ Develop proposed phasing plan for reservoir and pump stations
+ Perform hydraulic assessment of reservoir servicing Zone 1S, 2S and 3S
+ Estimate capital and operating costs, including:
    - Reservoir and pump station capital costs, according to proposed phasing
    - Water supply line capital costs
    - Reservoir and pump station operational costs

  - Consideration of surrender of assets benefit for booster stations, in conjunction with total lifecycle cost of booster stations
- Identify probable benefitting areas, and percent benefit to existing system and future growth areas

1.3 Results from Phase 1

The following is a high-level summary of the results from Phase 1 of this study:

- Reservoir Operation – The proposed reservoir will pump water into zones 2S and 3S, and will feed zone 1S by gravity through the supply lines
- Top Water Level of Proposed Reservoir – 1106 m, with a bottom/low elevation of 1102 m
- Supply Lines – Reservoir supply lines are proposed to be twinned 450 mm pipes for redundant operation
- Pressure Zones – Sheep River Heights and Westmount Point will be incorporated into Zone 3S, with a maximum HGL of 1158 m. Zone 2S-1 and Zone 2S-2 will be merged into a single pressure zone, with a maximum HGL of 1128 m.
- Reservoir Volume - Ultimate reservoir volume was determined to be 22,000 m^3
- Scenario Demands – The following table summarizes the maximum day demands for each growth scenario, and the recommended reservoir size.

Table 1-1 Buildout Scenario Max Day Demands

Scenario	Max Day Demand (L/s)	Max Day Demand (m^3)	Recommended Storage Volume (m^3)
Existing	73	6,340	6,500
Existing + WO NASP	93	8,040	8,000
Mid Term	110	9,531	10,000
Long Term	144	12,460	12,500
Full Buildout	253	21,878	22,000

2. Assessment of Operational Scenarios

The previous review of the reservoir supply lines in Phase 1 indicated that twin 450 mm diameter mains would be ideal to support the filling of the proposed reservoir up to full buildout, assuming an available hydraulic grade line of at least 1109 m from the connection to the existing system.

Further review was needed to determine how the existing water distribution system operated while filling the proposed reservoir.

The existing hydraulic water model developed for the Water Master Plan was updated to represent current operating conditions.

Proposed Supply Lines

Using the updated model, the following operational scenarios were investigated:

2.1

+ Reservoir being filled by Zone 1S HGL – Single feed from Big Rock Booster tie in
+ Reservoir being filled by Zone 1S HGL – Single feed from Big Rock Trail / Westland Rd tie in
+ Reservoir being filled by Zone 1S HGL – Both feed lines

These scenarios were used to determine the maximum supply flows that can be provided to the proposed reservoir under the existing system, and determine potential network upgrades required to service the full buildout of south Okotoks.

The reservoir water level was set to 1104 m (half full). This represents the average fill rate of the reservoirs, with the fill rate increasing with a lower reservoir level, and decreasing with a higher reservoir level. The scenarios were run under Maximum Day Demand of the existing system.

The following table summarizes the average fill rate under each of the operational scenarios:

Table 2-1 Reservoir Supply Operational Scenarios – Average Fill Rates

Operational Scenario	Average Fill Rate (L/s)	Average Fill Rate (m^3/day)
Single Feed - Big Rock Tie In	112	9,677
Single Feed - Westland Tie In	123	10,584
Both Feed Lines	180	15,552

2.2

As the above table shows, with both supply lines active, the existing distribution system can support up to a maximum day demand of approximately 15,500 m^3 per day. This is beyond the Long Term growth scenario.

Upgraded Water Network

To support the Full Buildout growth scenario, upgrades to existing water lines from where the supply lines connect back to the South Reservoir are likely required. As such, the following additional scenarios were investigated. Both supply lines were active in these scenarios:

+ Line from Big Rock tie in upgraded to 450 mm back to South Reservoir

- Line from Westland tie in upgraded to 450 mm back to South Reservoir
- Both lines upgraded to 450 mm back to South Reservoir

Table 2-2 Reservoir Supply Operational Scenarios – Upgraded Water Network

Operational Scenario	Average Fill Rate (L/s)	Average Fill Rate (m^3/day)
Upgraded from Big Rock Tie In	251	21,686
Upgraded From Westland Tie In	249	21,514
Both Lines Upgraded	275	23,760

As the above table shows, upgrading the water line from either of the tie ins back to the South Reservoir gets within 1% of the estimated Max Day Demand for the Full Buildout scenario, and either option should be adequate. For the sake of redundancy, the Town may want to consider upgrading both lines.

The proposed water network upgrades can be found on Figure 2.2 on the following page.

2.3 No Oversize Scenario

In order to determine the extent of oversize required to support the existing areas, an additional scenario was investigated with the existing demands removed. This serves to determine the pipe size needed to support the growth to full buildout, and the oversize costs that the town would be responsible for.

As per the analysis performed in Phase 1, the existing system has a Max Day Demand of 73 L/s, and the full buildout has a Max Day Demand of 253 L/s. With the existing system removed, the supply lines would have to be able to support a maximum flow rate of 180 L/s.

For the Full Buildout scenario, with both lines upgraded to 450 mm back to the South reservoir, the minimum pipe size of the new supply lines would have to be at least 300 mm diameter to support a 180 L/s MDD.

2.4 Additional Considerations

These operational scenarios reviewed the capacity of the distribution system to provide adequate fill rates to the proposed reservoir. In the case of the Full Buildout scenario, the existing distribution and fire pumps in the South Reservoir can potentially provide the requisite flows, however this results in no pump redundancy, as all existing pumps were online to provide those flows.

The Town should consider additional pumps or pump upgrades to retain pump redundancy when servicing the Full Buildout scenario.

Furthermore, these scenarios assume adequate supply of potable water. Currently the production wells are being exceeded on peak days. Investigating the future raw water supply and the water treatment plant capacity was not within the scope of this report.

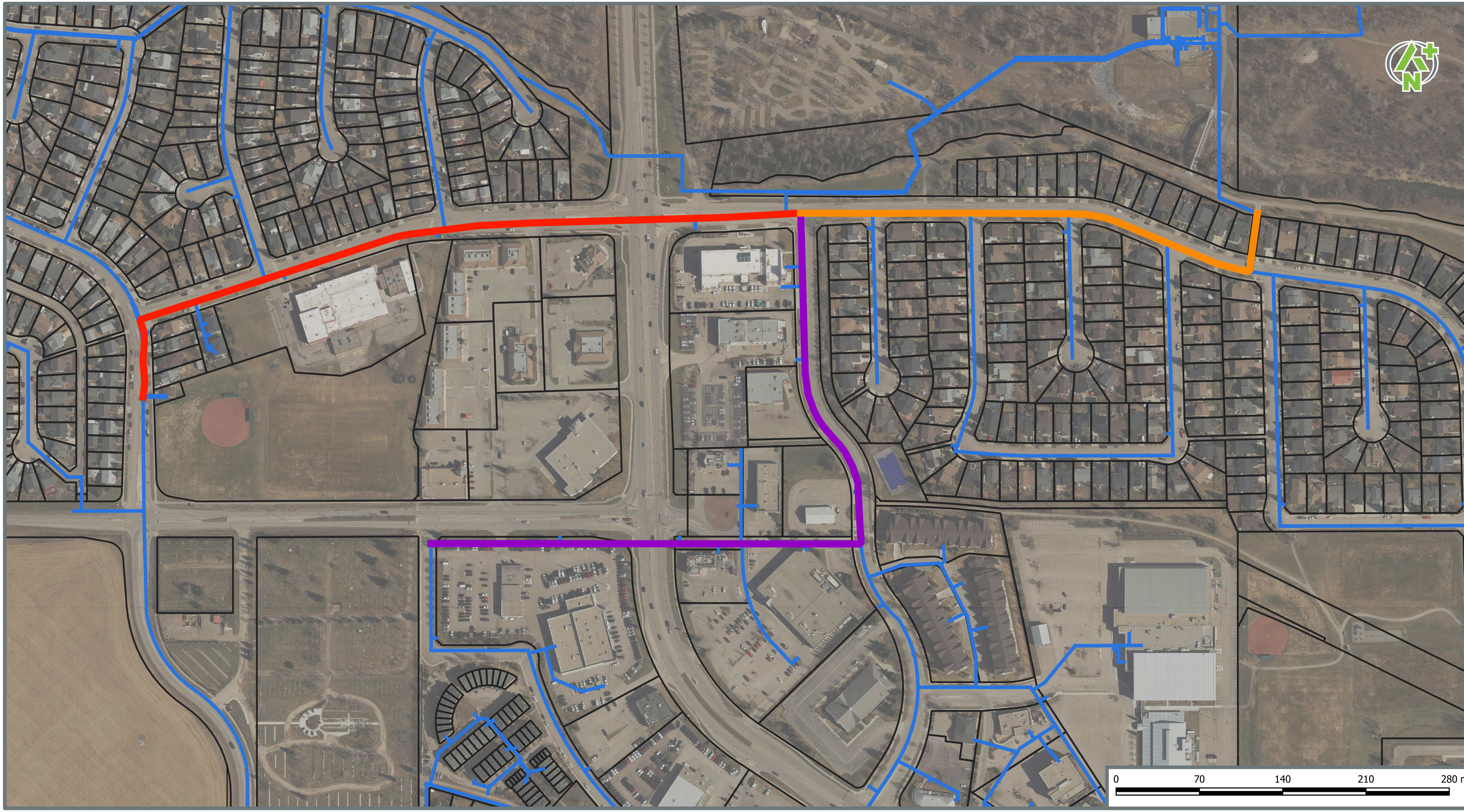

Figure 2.2 - Supply Line Upgrades

Scale 1:20,000

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APRIL 2022

Big Rock Tie In
Westland Tie In
Either Tie In / Both

3. Pump Station Requirements

This section will assess the requirements for the pump station that will distribute water into the Zone 2S and 3S areas for each growth scenario.

This will look at the necessary pumping capacity to support peak flow rates, and high-level horsepower requirements. This information will assist in determining capital and operating costs, and supplement the proposed pump station phasing.

Two different pump station configurations will be assessed. The first is a single set of pumps discharging all flows at the Zone 3S pressures, with any flows to Zone 2S passing through a PRV. The second is different pumps supplying the Zone 2S and Zone 3S areas independently – this is a similar configuration as the Town's existing Zone 3N/4N reservoir.

Pump stations need to be capable of discharging at the peak flow rate, which is generally the greater of Max Day Demand + Fire Flow, or Peak Hourly Demand.

Required available fire flow was assumed to be 225 L/s, in order to support the industrial land uses to the south. Peak hour demand was assumed to be 2x Max Day Demand.

Flows out of each pump station configuration were determined using the water model.

3.1 Single Zone Pump Station

This pump station configuration would consist of a single set of pumps discharging at the Zone 3S pressure, which is an HGL of 1158 m. With an assumed pump station elevation of 1106 m, this means the pumps will be discharging at 52 m (approximately 75 psi).

The following are the Average Day, Max Day + Fire Flow, and Peak Hour flows out of the pump station.

Table 3-1 Single Zone Pump Station Flows

Scenario	ADD (L/s)	MDD+FF (L/s)	PHD (L/s)
Existing + WO NASP	30	269	88
Medium	45	293	135
Long	65	320	190
Buildout	140	435	420

As the above table shows, the MDD+FF is the flow rate requirement for all scenarios. As such, that will be the value used to determine the estimated pump horsepower requirements. Average day demand flows will be used to calculate annual electricity costs.

Table 3-2 Single Zone Pump Station Total Pump Power

Scenario	ADD (kW)	MDD+FF (kW)	MDD+FF (HP)
Existing + WO NASP	22	196	263
Medium	33	213	286
Long	47	233	312
Buildout	102	317	425

The above table shows the average pump power, and total pump power needed for each growth scenario.

The major benefit of this operational set up is it would likely result in a lower upfront capital cost, as there would only be a single discharge header and set of pumps. The major downside is likely increased energy costs, and increased infrastructure and system connectivity between the zones at the start of development.

3.2 Dual Zone Pump Station

This pump station configuration would consist of two different sets of pumps, one for discharging into Zone 3S and one for discharging into Zone 2S. With an assumed pump elevation of 1106 m, the Zone 3S pumps will be discharging at 52 m (approximately 75 psi) and the Zone 2S pumps will be discharging at 23 m (approximately 35 psi).

A set of fire pumps would provide fire flow to both zones, discharging through Zone 3S.

The following are the Average Day, Max Day, Fire Flow, and Peak Hour flows out of each of the pump stations.

Due to the network connectivity, after the Long Term scenario hydraulic modelling has indicated that flow to Zone 2S will tend to route through Zone 3S. As such the MDD and PHD flows for the Zone 2S are the same in the Long Term and Full Buildout scenarios.

Table 3-3 Dual Zone Pump Station Flows

Scenario	ADD (L/s)	MDD (L/s)	Fire Flow (L/s)	PHD (L/s)	ADD (L/s)	MDD (L/s)	PHD (L/s)
	Zone 3S				Zone 2S		
Existing + WO NASP	10	16	225	31	20	30	57
Medium	15	38	225	75	30	52	87
Long	35	65	225	130	30	78	101
Buildout	90	160	225	320	50	78	101

As the above table shows, the PHD is the flow rate requirement for all scenarios. As such, that will be the value used to determine high level pump horsepower requirements for the distribution pumps. Average day demand flows will be used to calculate annual electricity costs.

Table 3-4 Dual Zone Pump Station Total Pump Power

Scenario	ADD (kW)	Fire Pumps (kW)	MDD+FF (HP)	PHD (kW)	PHD (HP)	ADD (kW)	PHD (kW)	PHD (HP)
	Zone 3S					Zone 2S		
Existing + WO NASP	7	164	220	23	30	6	18	25
Medium	11	164	220	55	73	10	28	38
Long	26	164	220	95	127	10	33	44
Buildout	66	164	220	233	312	16	33	44

The above table shows the average pump power, and total pump power needed for each growth scenario.

The major benefit of this operational set up is it would likely result in lower energy costs, as the flows are split between higher and lower pressure zones. The major downside is likely higher upfront capital costs, as there would be two discharge headers and two sets of pumps operating independently.

4. Reservoir and Pump Station Phasing

As discussed in Phase 1 of this report, the growth scenarios were divided into four stages:

+ Existing + Buildout of the West Okotoks NASP
+ Medium Term Scenario – This is the equivalent of the Year 2044 scenario in the Water Master Plan, updated to include the estimated full buildout of the WO NASP.
+ Long Term Scenario - This is the equivalent of the Year 2069 scenario in the Water Master Plan, updated to include the estimated full buildout of the WO NASP.
+ Full Buildout – This scenario represents the full buildout to the existing Town limits

The proposed phasing will generally follow these scenarios. The scenarios can be seen in Figure 4-1 on the following page.

4.1 Reservoir Phasing

The initial phase of the reservoir should be able to support the existing demands, along with the buildout of the West Okotoks NASP. As discussed previously, this is a total volume of approximately 8,000 m^3.

Since the reservoir area cannot be divided into four equal cells and have the first cell support the first growth scenario, an alternative phasing layout will be needed.

The simplest phasing layout to design and construct, within the constraints of an approximate total reservoir area of 75 m x 75 m, is for the first phase to be the full length of the footprint in one dimension, and as wide as it needs to be to get the requisite volume.

For a reservoir 4 m deep, a footprint of 75 m x 26 m = 8,100 m^3. The remaining two phases would occupy the remainder of the footprint. This would result in two equal sized cells, with approximate footprints of 37.5 m x 48 m, for a volume of 7,200 m^3 each. Figure 4-2 shows the proposed phasing layout.

Figure 4-1 Growth Scenarios

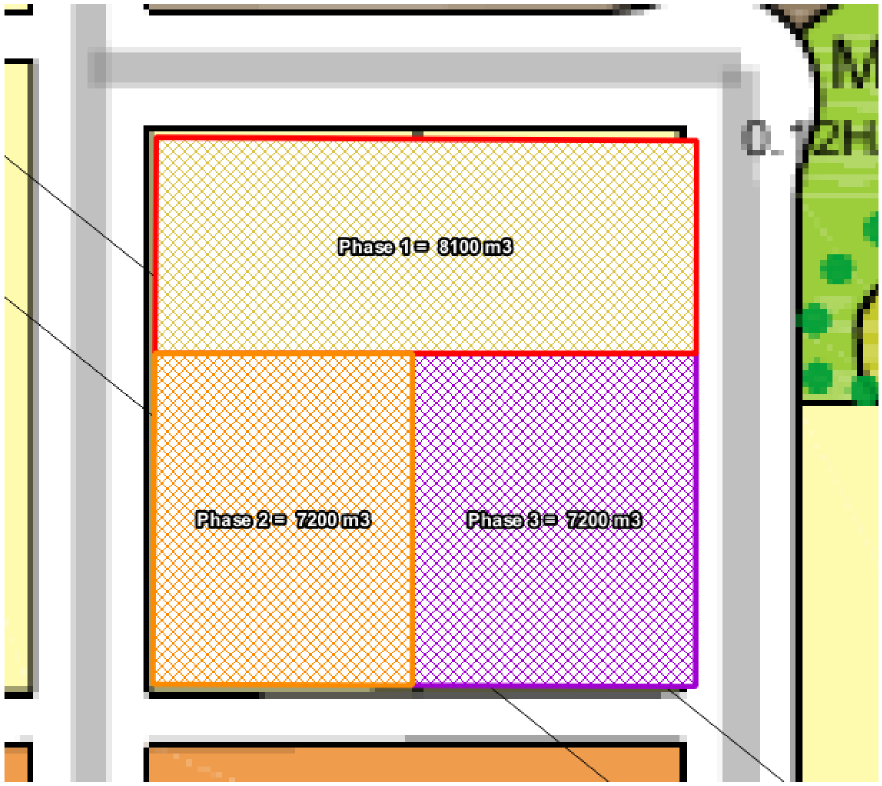

Figure 4-2 Reservoir Phasing

4.2 Pump Station Phasing

The pump station can be phased primarily by adding additional pumps as needed. The intent is to have the sum total horsepower of the pumps equal the total horsepower required to serve the peak flows, as determined in Section 3.

Pump phasing will be investigated for both the Single Zone Pump Station and Dual Zone Pump Station options.

Distribution pumps and fire pumps are both assumed to have a fully redundant pump included.

4.2.1 Single Zone Pump Station Phasing

As shown in Section 3.1, the total horsepower required for each growth scenario is as follows:

- Existing + WO NASP – 263 HP
- Medium Term – 286 HP
- Long Term – 312 HP
- Full Buildout – 425 HP

A maximum of 6 pumps will be considered for this pump station configuration. Fire pumps capable of 225 L/s @ 52 m head are approximately 220 HP.

Existing + WO NASP

Recommended pump configuration:

+ 2 x 220 HP pumps for fire flow scenarios
+ 2 x 25 HP pumps for low flow operation

Medium Term

Recommended pump configuration:

+ 2 x 220 HP pumps for fire flow scenarios
+ 3 x 25 HP pumps for low flow operation

Long Term

Recommended pump configuration:

+ 2 x 220 HP pumps for fire flow scenarios
+ 4 x 25 HP pumps for low flow operation

Full Buildout

Recommended pump configuration:

+ 2 x 220 HP pumps for fire flow / peak flow scenarios
+ 2 x 75 HP pumps for medium flow operation
+ 2 x 25 HP pumps for low flow operation

4.2.2 Dual Zone Pump Station Phasing

As shown in Section 3.2, the total horsepower required for each growth scenario is as follows:

+ Existing + WO NASP
    - Zone 3S – 30 HP
    - Zone 2S – 25 HP
    - Fire Pumps – 220 HP
+ Medium Term
    - Zone 3S – 75 HP
    - Zone 2S – 40 HP
    - Fire Pumps – 220 HP

- Long Term
  - Zone 3S – 130 HP
  - Zone 2S – 45 HP
  - Fire Pumps – 220 HP
- Full Buildout
  - Zone 3S – 315 HP
  - Zone 2S – 45 HP
  - Fire Pumps – 220 HP

A maximum of 4 distribution pumps will be considered for each distribution zone for this pump station configuration. Fire pumps capable of 225 L/s @ 52 m head discharging from Zone 3S are approximately 220 HP

Existing + WO NASP

Recommended pump configuration for Zone 3S:

- 2 x 220 HP pumps for fire flow scenarios
- 2 x 45 HP pump for PHD operation

Recommended pump configuration for Zone 2S:

- 2 x 25 HP pump for PHD operation

Medium Term

Recommended pump configuration for Zone 3S:

- 2 x 220 HP pumps for fire flow scenarios
- 3 x 45 HP pump for PHD operation

Recommended pump configuration for Zone 2S:

- 3 x 25 HP pump for PHD operation

Long Term

Recommended pump configuration for Zone 3S:

- 2 x 220 HP pumps for fire flow scenarios
- 4 x 45 HP pump for PHD operation

Recommended pump configuration for Zone 2S:

- 3 x 25 HP pump for PHD operation

Full Buildout

Recommended pump configuration for Zone 3S:

- 2 x 220 HP pumps for fire flow scenarios
- 4 x 100 HP pump for PHD operation

Recommended pump configuration for Zone 2S:

- 3 x 25 HP pump for PHD operation

5. Pressure Zone Modifications

In addition to the proposed reservoir and pumping station, additional pressure zone modifications will likely need to take place. Primarily this will include the southwest portion of Sheep River Heights, which was proposed in Phase 1 to be included in the Pressure Zone 3S.

Modifying this area to be in the Zone 3S would involve connecting Sheep River Heights to the higher pressure side of the future water lines along Big Rock Trail, and isolating this area from the Zone 2S areas through two PRVs. An additional PRV would likely be required to complete the pressure zone transition towards Sheep River Ct.

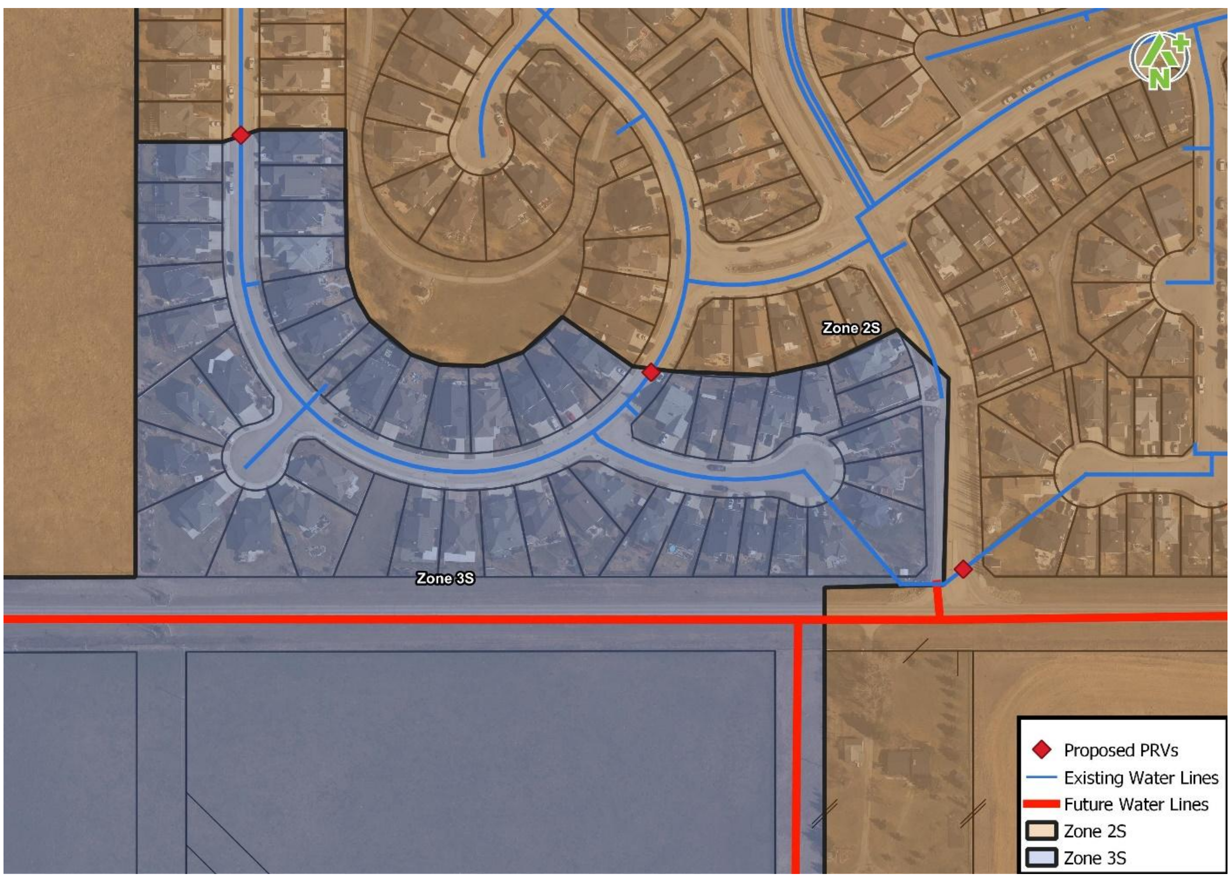

Figure 5-1 Sheep River Heights Pressure Zone Modification

6. Capital and Operating Costs

The following is an estimate of the capital costs for constructing the proposed reservoir, pump station, and supply lines, along with estimated annual operating costs.

Cost estimates and operating costs will be assigned to the proposed phasing for the reservoir and pump station. The twin supply lines are assumed to be constructed during the first phase of the reservoir. Existing water line upgrades will be needed prior to the third cell of the reservoir being constructed.

6.1 Capital Costs

Note: All cost estimates provided in this section are presented in **2022 dollars**. These estimates reflect unit rates and construction assumptions available at the time the draft report was prepared and do not include escalation to 2025 or beyond.

6.1.1 Reservoir

The proposed reservoir phasing was divided into three total cells, in order to reduce design and construction costs as much as possible.

- Phase 1 (8,100 m^3) - $10,500,000
- Phase 2 (7,200 m^3) - $9,400,000
- Phase 3 (7,200 m^3) - $9,400,000
- Total Capital Cost - $29,300,000

6.1.2 Pump Stations

The following are the estimated capital costs for both of the proposed pump station configurations.

Pump Station – Single Zone

The proposed pump station is phased between the four growth scenarios, with each phase adding or replacing pumps as needed.

- Phase 1 (Existing + WO NASP) - $3,250,000
- Phase 2 (Medium Term) - $150,000
- Phase 3 (Long Term) - $150,000
- Phase 4 (Full Buildout) - $300,000
- Total Capital Cost - $3,850,000

Pump Station – Dual Zone

The proposed pump station is phased between the four growth scenarios, with each phase adding or replacing pumps as needed.

- Phase 1 (Existing + WO NASP) - $3,750,000
- Phase 2 (Medium Term) - $150,000

- Phase 3 (Long Term) - $100,000
- Phase 4 (Full Buildout) - $300,000
- Total Capital Cost - $4,300,000

6.1.3 Supply Lines

The following are the estimated capital costs for the reservoir supply lines, and proposed network upgrades back to the South Reservoir. All new and upgraded lines are 450 mm PVC, with the exception of the no oversize scenario, where the new supply lines are 300 mm. Cost estimates were as per City of Calgary Development Agreement Rates with a 30% contingency.

Twin Supply Lines

- Total Capital Cost - $2,560,000

Twin Supply Lines (No Oversize)

- Total Capital Cost - $1,820,000

Upgraded Network

- Big Rock Upgraded - $2,800,000
- Westland Upgraded - $3,000,000
- Both Upgraded - $4,110,000

6.1.4 Pressure Zone Modifications

The following are the estimated capital costs for the PRV installations in order to bring a portion of Sheep River Heights into Zone 3S, and to ensure Sheep River CT remains in Zone 2S.

Sheep River Heights

- Total Capital Cost - $600,000

Sheep River CT

- Total Capital Cost - $300,000

6.1.5 Capital Costs Summary

The following tables summarize the total capital costs for each pump configuration and growth scenario:

Table 6-1 Capital Costs Summary – Single Zone Configuration

Scenario	Pump Station	Reservoir	Supply Line	Total
Existing + WO NASP	$ 3,250,000	$ 10,500,000	$ 2,560,000	$ 16,310,000
Medium Term	$ 3,400,000	$ 19,860,000	$ 2,560,000	$ 25,820,000
Long Term	$ 3,550,000		$ 2,560,000	$ 25,970,000
Full Buildout	$ 3,850,000	$ 29,250,000	$ 6,670,000	$ 39,770,000

Table 6-2 Capital Costs Summary – Dual Zone Configuration

Scenario	Pump Station	Reservoir	Supply Line	Total
Existing + WO NASP	$ 3,750,000	$ 10,500,000	$ 2,560,000	$ 16,810,000
Medium Term	$ 3,900,000	$ 19,860,000	$ 2,560,000	$ 26,320,000
Long Term	$ 4,000,000		$ 2,560,000	$ 26,420,000
Full Buildout	$ 4,300,000	$ 29,250,000	$ 6,670,000	$ 40,220,000

6.2 Operating Costs

Operating costs were developed as a yearly cost for each of the pump station configurations under each of the growth scenarios.

The operating costs are a sum of the following:

+ Electricity – Estimated at a conservative $0.15 per kWh using the calculated power needed for Average Day Demands
+ Heat – Heating was assumed to be a flat rate of $15 per day for each facility
+ Manpower – Manpower for daily operations is assumed to be 1 hour per facility every day, at a rate of $100 / hr, with the reservoir and pump station being considered separate facilities
+ Maintenance – Annual / regular maintenance was assumed to be 0.5% of the capital cost for each facility

The following is the estimated yearly operating costs for the proposed reservoir and each pressure zone pump station configuration for each growth scenario. All costs are in 2022 dollars.

Table 6-3 Single Zone Pump Station Annual Operating Costs

Scenario	Electricity	Heat	Operations	Maintenance	Total
Existing + WO NASP	$ 28,700.00	$ 11,000.00	$ 73,000.00	$ 68,750.00	$ 181,450.00
Medium Term	$ 43,100.00	$ 11,000.00	$ 73,000.00	$ 116,300.00	$ 243,400.00
Long Term	$ 62,200.00	$ 11,000.00	$ 73,000.00	$ 117,050.00	$ 263,250.00
Full Buildout	$ 134,100.00	$ 11,000.00	$ 73,000.00	$ 165,500.00	$ 383,600.00

Table 6-4 Dual Zone Pump Station Annual Operating Costs

Scenario	Electricity	Heat	Operations	Maintenance	Total
Existing + WO NASP	$ 18,000.00	$ 11,000.00	$ 73,000.00	$ 71,250.00	$ 173,250.00
Medium Term	$ 27,100.00	$ 11,000.00	$ 73,000.00	$ 118,800.00	$ 229,900.00
Long Term	$ 46,200.00	$ 11,000.00	$ 73,000.00	$ 119,300.00	$ 249,500.00
Full Buildout	$ 107,400.00	$ 11,000.00	$ 73,000.00	$ 167,750.00	$ 359,150.00

As the above table shows, due to overall lower energy usage, the dual zone pump station configuration has a lower yearly operating cost than the single zone configuration

6.3 Comparison of Single Zone to Dual Zone Pump Station

To determine the preferred pump station configuration, the capital costs of each of the pump station need to be compared against the operating costs. The number of years it takes for any excess in operating costs versus savings in capital cost can inform this decision.

Table 6-5 Single Zone VS Dual Zone – Capital and Operating Costs

Scenario	Single Zone Pump Station - Capital Cost	Dual Zone Pump Station - Capital Cost	Single Zone Pump Station - Operating Cost	Dual Zone Pump Station - Operating Cost	Recovery Period (years)
Existing + WO NASP	$3,250,000.00	$3,750,000.00	$181,450.00	$ 173,250.00	61
Medium Term	$3,400,000.00	$3,900,000.00	$243,400.00	$ 229,900.00	37
Long Term	$3,550,000.00	$4,000,000.00	$263,250.00	$ 249,500.00	33
Full Buildout	$3,850,000.00	$4,300,000.00	$383,600.00	$ 359,150.00	18

As the above table shows, the amount of time it would take the operational savings of the dual zone configuration to outpace the lower capital cost of the single zone configuration is approximately 61 years for the first growth scenario, and 18 years for the farthest growth scenario – assuming electricity costs remain constant.

This does indicate that from a financial standpoint, the single zone configuration may be preferable, as there is a significant time for the increased operating costs to outpace the difference in capital costs.

However, this does not consider additional infrastructure that may be required, such as the pressure reducing valves that would be required to go from Zone 3S to Zone 2S.

7. Off Site Levy Considerations

A high-level review of the benefitting areas in the existing system and future growth areas was performed to give guidance on what share of the capital costs each area will be responsible for. Each portion of the capital costs, including the supply lines, reservoir, pump station, and pressure zone modifications were considered.

The relative share for each growth area was determined through residential unit counts, and residential unit equivalents for Industrial, Commercial and Institutional (ICI) areas. For the purpose of this study, Industrial, Commercial and Institutional (ICI) areas were assumed to have the following residential unit equivalents:

+ 5.5 Units per acre in existing areas
+ 12 Units per acre in future growth areas

Residential units in existing areas was estimated through legal parcel lot counts for detached and semi detached housing, and estimates for labeled units in multifamily developments.

Residential units in future growth areas were assumed to have a unit density of 12 units per acre.

These offsite levy considerations were up to the Short Term scenario, which equates to the full buildout of the West Okotoks NASP.

Cost figures used to support levy calculations are based on **2022 dollars** and may require adjustment depending on the final bylaw implementation year.

The following table shows the unit counts for each growth area, separated by pressure zone and growth scenario:

Table 7-1 Offsite Levy Unit Counts

Offsite Levy Unit Counts					
OSL Area	Residential Units	ICI Area	ICI Unit Equivalents	Total Units	Growth Scenario
Zone 1S (Existing)	2900	88	1200	4100	Existing
Zone 2S-1 (Existing)	1200	5	100	1300	Existing
Zone 2S-2 (Existing)	500	12	200	700	Existing
Zone 3S (Existing)	100	-	-	100	Existing
WO NASP (Growth)	1800	-	-	1800	Short Term

7.1 Treated Water Reservoir

The proposed treated water reservoir is considered to be fully driven by growth, and as such 100% of the benefitting area would be attributed to growth.

7.2 Pump Station

Only Zones 2S and 3S were considered to benefit from the proposed pump station, as Zone 1S will be fed by gravity through the water supply lines. In the short term, only the Big Rock pump station will be decommissioned, as the Westmount pump station is still well within its life cycle. As such, only Zone 2S-1, the area supported by Big Rock booster, is part of the benefitting area for the pump station.

Table 7-2 Pump Station - OSL

Pump Station - Phase 1		
OSL Area	**Units**	**% Benefitting**
Existing Area	1400	44%
Growth Area	1800	56%
Total	**3200**	

7.3 Supply Lines

The proposed supply lines are considered to be fully driven by growth, however the supply lines are sized to accommodate the existing system. As such, the existing areas should be responsible for the oversize costs on supply lines.

Table 7-3 Supply Lines - OSL

Supply Line		
Cost Description	**Capital Cost**	**OSL Area**
Total Cost	$ 2,560,000.00	All
Cost Without Oversize	$ 1,820,000.00	Growth
Oversize Cost	$ 740,000.00	Existing

8. Recommendations

The following are recommendations for the water network upgrade options, and for the pump station configurations.

8.1 Water Network Upgrades

In order to support filling the proposed reservoir under the Full Buildout growth scenario, the existing water network will need to be upgraded. Overall there are three options – upgrade from the Big Rock tie in back to the South Reservoir, from the Westland tie in back to the South Reservoir, or both.

The following summarizes the pros and cons for each of the scenarios:

Pros	Cons
Big Rock Tie In	
+ Cost effective + Marginally higher flow rate than Westland tie in	+ More disruptive – portion of Zone 1S with a single feed from this line + No redundancy
Westland Tie In	
+ Cost effective + Least disruptive to install	+ Marginally lower flow rate than big rock tie in + No redundancy
Both	
+ Highest flow rate + Full redundancy in supply lines	+ Most disruptive to install + Most expensive option

In order to maintain the full redundancy that was initiated with the Twin supply lines, it is recommended that both tie in locations get upgraded back to the South Reservoir to support the full buildout scenario.

8.2 Pump Station Configurations

There were two different configurations proposed for the pump station – one set of pumps discharging into the higher Zone 3S pressure zone with any flows to Zone 2S passing through a PRV, and one with separate pumps discharging into both Zone 3S and Zone 2S.

The following summarizes the pros and cons for each of the scenarios:

Pros	Cons
Single Zone Pump Station	
+ Lower capital cost + Less complex pump station – easier to operate and maintain	+ Higher energy requirement + Overall higher operational costs + More complex water network required, including PRVs to Zone 2S
Dual Zone Pump Station	
+ Lower energy requirement + Overall lower operational costs + Simpler water network – each zone can develop independently	+ Higher capital cost + Lower operational costs take a long time to offset capital costs + More complex pump station – more difficult to operate and maintain

The Town has indicated that their preference is to implement the Dual Zone pump station, as it is in line with other pump station configurations in the North pressure zones.

A

Appendix A
Supply Line Cost Estimates

Town of Okotoks
South Reservoir Supply Lines

Summary

Construction

Schedule	Description	Estimated Cost of Construction
A	Underground Utilities	$ 1,440,000.00
B	Surface Works	$ 290,000.00
	Subtotal	**$ 1,730,000.00**

Engineering

Engineering	$ 170,000.00
Quality Control	$ 70,000.00
Subtotal	**$ 240,000.00**

Contingency

Contingency - 30%	$ 590,000.00
Subtotal	**$ 590,000.00**
Total	**$ 2,560,000.00**

Town of Okotoks

South Reservoir Supply Lines

Schedule A - Underground Utilities

Construction

Item	Description	Quantity	Unit		Unit Price		Total
1	Mobilization	1	LS	$	100,000.00	$	100,000.00
2	Remove and dispose of existing asphalt	1800	SM	$	20.00	$	36,000.00
3	Road core	700	CM	$	4.80	$	3,360.00
4	Supply and Install 450 mm Water Line	2500	LM	$	500.00	$	1,250,000.00
5	Allowance for traffic control and signage	1	LS	$	50,000.00	$	50,000.00
					Subtotal	**$**	**1,440,000.00**

Engineering

Engineering	$	144,000.00
Quality Control	$	57,600.00
Subtotal	**$**	**200,000.00**
Total	**$**	**1,640,000.00**

Town of Okotoks

South Reservoir Supply Lines

Schedule B - Surface Works

Construction

Item	Description	Quantity	Unit	Unit Price		Total	
1	Mobilization	1	LS	$	100,000.00	$	100,000.00
2	Subgrade Preparation	1800	SM	$	2.15	$	3,870.00
3	Supply and place pit-run gravel (300mm compacted depth)	1800	SM	$	16.30	$	29,340.00
4	Supply and place road crushed gravel (100mm compacted depth)	1800	SM	$	7.15	$	12,870.00
5	Supply and place prime coat	1800	SM	$	0.85	$	1,530.00
6	Supply and place Asphaltic Hot Mix "A" (160 mm compacted depth)	1800	SM	$	38.50	$	69,300.00
7	Supply and place tack coat	1800	SM	$	1.40	$	2,520.00
8	Supply and place Asphaltic Hot Mix "B" (40 mm compacted depth)	1800	SM	$	13.40	$	24,120.00
9	Allowance for traffic control and signage	1	LS	$	50,000.00	$	50,000.00
					Subtotal	**$**	**290,000.00**

Engineering

Engineering	$	29,000.00
Quality Control	$	11,600.00
Subtotal	**$**	**40,000.00**
Total	**$**	**330,000.00**

Town of Okotoks

South Reservoir Supply Lines (No Oversize)

Summary

Construction

Schedule	Description		Estimated Cost of Construction
A	Underground Utilities		$ 940,000.00
B	Surface Works		$ 290,000.00
		Subtotal	**$ 1,230,000.00**

Engineering

Engineering		$ 120,000.00
Quality Control		$ 50,000.00
	Subtotal	**$ 170,000.00**

Contingency

Contingency - 30%		$ 420,000.00
	Subtotal	**$ 420,000.00**

	Total	**$ 1,820,000.00**

Town of Okotoks

South Reservoir Supply Lines (No Oversize)

Schedule A - Underground Utilities

Construction

Item	Description	Quantity	Unit	Unit Price		Total	
1	Mobilization	1	LS	$	100,000.00	$	100,000.00
2	Remove and dispose of existing asphalt	1800	SM	$	20.00	$	36,000.00
3	Road core	700	CM	$	4.80	$	3,360.00
4	Supply and Install 300 mm Water Line	2500	LM	$	300.00	$	750,000.00
5	Allowance for traffic control and signage	1	LS	$	50,000.00	$	50,000.00
					Subtotal	**$**	**940,000.00**

Engineering

Engineering	$	94,000.00
Quality Control	$	37,600.00
Subtotal	**$**	**130,000.00**

Total	**$**	**1,070,000.00**

Town of Okotoks

South Reservoir Supply Lines (No Oversize)

Schedule B - Surface Works

Construction

Item	Description	Quantity	Unit	Unit Price		Total	
1	Mobilization	1	LS	$	100,000.00	$	100,000.00
2	Subgrade Preparation	1800	SM	$	2.15	$	3,870.00
3	Supply and place pit-run gravel (300mm compacted depth)	1800	SM	$	16.30	$	29,340.00
4	Supply and place road crushed gravel (100mm compacted depth)	1800	SM	$	7.15	$	12,870.00
5	Supply and place prime coat	1800	SM	$	0.85	$	1,530.00
6	Supply and place Asphaltic Hot Mix "A" (160 mm compacted depth)	1800	SM	$	38.50	$	69,300.00
7	Supply and place tack coat	1800	SM	$	1.40	$	2,520.00
8	Supply and place Asphaltic Hot Mix "B" (40 mm compacted depth)	1800	SM	$	13.40	$	24,120.00
9	Allowance for traffic control and signage	1	LS	$	50,000.00	$	50,000.00
					Subtotal	**$**	**290,000.00**

Engineering

Engineering	$	29,000.00
Quality Control	$	11,600.00
Subtotal	**$**	**40,000.00**
Total	**$**	**330,000.00**

Town of Okotoks

South Reservoir Supply Lines - Upgrades to Existing (Both Tie Ins)

Summary

Construction

Schedule	Description	Estimated Cost of Construction	
A	Underground Utilities	$	1,420,000.00
B	Surface Works	$	1,350,000.00
	Subtotal	**$**	**2,770,000.00**

Engineering

Engineering		$	280,000.00
Quality Control		$	110,000.00
	Subtotal	**$**	**390,000.00**

Contingency

Contingency - 30%		$	950,000.00
	Subtotal	**$**	**950,000.00**
	Total	**$**	**4,110,000.00**

Town of Okotoks

South Reservoir Supply Lines - Upgrades to Existing (Both Tie Ins)

Schedule A - Underground Utilities

Construction

Item	Description	Quantity	Unit	Unit Price		Total	
1	Mobilization	1	LS	$	100,000.00	$	100,000.00
2	Remove and dispose of existing asphalt	14400	SM	$	20.00	$	288,000.00
3	Road core	7000	CM	$	4.80	$	33,600.00
4	Supply and Install 450 mm Water Line	1800	LM	$	500.00	$	900,000.00
5	Allowance for traffic control and signage	1	LS	$	100,000.00	$	100,000.00
				Subtotal		**$**	**1,420,000.00**

Engineering

Engineering	$	142,000.00
Quality Control	$	56,800.00
Subtotal	**$**	**200,000.00**

Total	**$**	**1,620,000.00**

Town of Okotoks

South Reservoir Supply Lines - Upgrades to Existing (Both Tie Ins)

Schedule B - Surface Works

Construction

Item	Description	Quantity	Unit		Unit Price		Total
1	Mobilization	1	LS	$	100,000.00	$	100,000.00
2	Subgrade Preparation	14400	SM	$	2.15	$	30,960.00
3	Supply and place pit-run gravel (300mm compacted depth)	14400	SM	$	16.30	$	234,720.00
4	Supply and place road crushed gravel (100mm compacted depth)	14400	SM	$	7.15	$	102,960.00
5	Supply and place prime coat	14400	SM	$	0.85	$	12,240.00
6	Supply and place Asphaltic Hot Mix "A" (160 mm compacted depth)	14400	SM	$	38.50	$	554,400.00
7	Supply and place tack coat	14400	SM	$	1.40	$	20,160.00
8	Supply and place Asphaltic Hot Mix "B" (40 mm compacted depth)	14400	SM	$	13.40	$	192,960.00
9	Allowance for traffic control and signage	1	LS	$	100,000.00	$	100,000.00
					Subtotal	**$**	**1,350,000.00**

Engineering

Engineering	$	135,000.00
Quality Control	$	54,000.00
Subtotal	**$**	**190,000.00**

Total	**$**	**1,540,000.00**