WEST HANTS MUNICIPALITY
Committee of the Whole – Budget Meeting Agenda
April 28, 2022, 6:00 p.m.
Sanford Council Chambers 76 Morison Dr, Windsor, NS
(also held via virtual via Zoom and Facebook livestreamed)
Agenda is subject to changes up to and including during the meeting

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1. Call to Order

2. Attendance

3. Approval of the Agenda, including additions or deletions

4. Declaration(s) of Conflict of Interest

5. Announcements

6. 6:00-8:15 Budget Recap

7. 8:15-9:30 Discussion of Council

8. 9:30-9:45 Motions & Resolutions – Pending Council Discussions
   a. Budget Approval Motion
   b. Taxing Resolution
   c. HMCC Resolution
   d. Information Technology Services – Postponed Motion
   e. Tax Exemption List - Revised Motion
   f. Property Owners Association Resolutions

9. Public Participation Period

10. Next Meeting Date / Adjournment

    a. TBD

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WEST HANTS REGIONAL MUNICIPALITY BUDGET

REVENUE	2020-2021 BUDGET	2020-2021 ACTUAL		2021-2022 BUDGET	2021-2022 PROJECTED		2022-2023 ESTIMATES
TAXES	$ 21,932,536	$ 23,171,965		$ 23,394,992	$ 24,536,654		$ 25,244,512
GRANTS IN LIEU OF TAXES	$ 114,548	$ 248,610		$ 85,521	$ 249,464		$ 90,386
SERVICES PROVIDED TO OTHER GOVERNMENTS	$ 1,085,044	$ 1,134,127		$ 1,284,811	$ 1,317,276		$ 1,104,673
SALES OF SERVICES	$ 569,676	$ 419,704		$ 989,269	$ 604,246		$ 1,009,116
OTHER REVENUE FROM OWN SOURCES	$ 697,216	$ 736,830		$ 660,918	$ 783,939		$ 619,246
UNCONDITIONAL TRANSFERS FROM OTHER GOVERNMENTS	$ 557,223	$ 766,969		$ 558,915	$ 1,282,373		$ 558,915
CONDITIONAL TRANSFERS FROM FEDERAL OR PROVINCIAL GOVT. OR AGENCIES	$ 98,637	$ -		$ 64,450	$ 189,063		$ 64,450
CONDITIONAL TRANSFERS FROM OTHER LOCAL GOVERNMENTS	$ 117,520	$ 123,167		$ 182,035	$ 104,199		$ 166,257
TOTAL	$ 25,172,400	$ 26,601,372	5.7%	$ 27,220,911	$ 29,067,214	6.8%	$ 28,857,554
EXPENSES							
GENERAL GOVERNMENT SERVICES	$ 3,252,430	$ 3,143,303		$ 3,398,287	$ 3,396,633		$ 3,512,529
PROTECTIVE SERVICES	$ 8,893,654	$ 8,921,729		$ 8,535,488	$ 8,167,405		$ 8,896,755
TRANSPORTATION	$ 1,939,501	$ 1,904,190		$ 1,901,417	$ 1,626,333		$ 1,749,094
ENVIRONMENTAL HEALTH SERVICES	$ 3,520,815	$ 3,160,998		$ 3,291,185	$ 3,082,500		$ 3,427,553
PUBLIC HEALTH SERVICES	$ 155,344	$ 148,949		$ 214,993	$ 194,220		$ 276,825
ENVIRONMENTAL DEVELOPMENT SERVICES	$ 1,002,594	$ 728,877		$ 1,035,245	$ 966,317		$ 1,276,357
RECREATION AND CULTURAL SERVICES	$ 1,702,114	$ 1,936,503		$ 2,554,275	$ 2,317,107		$ 2,750,088
EDUCATION	$ 4,683,280	$ 4,360,800		$ 4,855,570	$ 4,623,048		$ 4,680,811
INTEREST ON LONG-TERM BORROWING		$ 469,044			$ 398,344		
EXTRAORDINARY OR SPECIAL ITEMS	$ -	$ -		$ -	$ -		$ -
NET EXPENSES	$ 25,149,732	$ 24,774,393	-1.5%	$ 25,786,461	$ 24,771,906	-3.9%	$ 26,570,011
DEBENTURE AND TERM LOAN PRINCIPAL INSTALLMENTS	$ 1,526,242	$ 1,503,707		$ 1,765,889	$ 1,780,553		$ 2,084,167
NET TRANSFERS FROM (TO) OWN RESERVE, FUNDS AND AGENCIES	$ (1,503,574)	$ (386,168)		$ (331,438)	$ 298,836		$ 203,377
TOTAL	$ 25,172,400	$ 25,891,932	2.9%	$ 27,220,911	$ 26,851,295	-1.4%	$ 28,857,554
SURPLUS / DEFICIT	$ -	$ 709,440		$ -	$ 2,215,919		$ -

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	2021-2022				2022-2023
	February Actuals	*Projections to March 31*	*Budget*	*% Budget to Projections*	*Budget Estimates*
TOTAL REVENUES					
ASSESSABLE PROTERTIES					
RESIDENTIAL	6,173,743	6,173,743	6,178,409		6,724,672
COMMERCIAL	1,199,473	1,199,473	1,195,625		1,191,303
SPECIAL TAX AGREEMENT	53,803	53,803	53,346		53,346
RESOURCE	243,278	243,278	251,811		282,027
WEST HANTS AREA RATES	6,896,768	6,896,768	6,955,875		7,543,304
HANTSPORT AREA RATES	672,682	672,682	673,541		703,329
WINDSOR AREA RATES	4,076,432	4,076,432	4,139,250		4,301,814
TOTAL	19,316,180	19,316,180	19,447,857	-0.7%	20,799,795
SEWER UTILITY REVENUE					
WEST HANT SEWER	893,067	1,182,442	1,124,977		1,217,564
WINDSOR SEWER	724,267	964,025	999,000		1,019,968
TOTAL	1,617,333	2,146,467	2,123,977	1.1%	2,237,532
BUSINESS PROPERTY					
MT&T	79,380	79,380	79,380		79,380
NS POWER	204,319	204,319	207,445		207,445
TOTAL	283,699	283,699	286,825	-1.1%	286,825
OTHER					
DEED TRANSFER TAX	2,354,670	2,662,847	1,415,972		1,800,000
5% SUBDIVISION	17,250	17,250	8,000		8,000
TOTAL	2,371,920	2,680,097	1,423,972	88.2%	1,808,000
GRANTS-IN-LIEU					
FEDERAL	131,377	131,377	47,760		50,497
PROVINCIAL	118,087	118,087	37,761		39,889
TOTAL	249,464	249,464	85,521	191.7%	90,386
LOCAL GOVERNMENT					
GENERAL GOV SERVICES	2,616	2,621	2,500		2,500
RECYCLING/ENFORCEMENT - TFR FROM DEFFERED REVENUE	-	67,627	99,730		83,430
HOST COMMUNITY FEES	462,311	462,311	373,000		373,000
COURTHOUSE	71,998	71,998	77,834		83,753
CLOSED LANDFILL - TFR FROM RESERVE	-	49,725	75,579		66,600
ADMINISTRATION FEES	13,613	665,615	661,204		500,424
KINGS COUNTY FIRE GRANT	23,153	23,153	58,811		60,787
GLOOSCAP FIRE GRANT	7,065	7,065	7,065		7,065
CAPITAL FIRE GRANT - KINGS	25,214	25,214	84,160		66,404
MISC GLOOSCAP	41,125	48,768	30,000		30,000
TOTAL	647,095	1,424,096	1,469,883	-3.1%	1,273,963
LICENSES & PERMITS					
LICENCES	1,000	1,000	5,194		5,298
WH BUILDING	67,695	76,831	46,755		47,690
TOTAL	68,695	77,831	51,949	49.8%	52,988
FINES	25,358	26,450	44,962	-41.2%	45,861
RENTALS					
RENTALS	3,875	67,335	96,810		70,311
LEASES	37,838	37,838	35,100		30,500
TOTAL	41,713	105,173	131,910	-20.3%	100,811
RETURN ON INTESTMENT	44,461	63,572	67,310	-5.6%	68,656
INTEREST & PENALTIES					
INTEREST & PENALTIES	340,109	365,292	307,153		313,296
TOTAL	340,109	365,292	307,153	18.9%	313,296
OTHER					
TAX CERTIFICATES	12,850	13,600	14,000		14,000
SUBDIVISION FEE	-	-	2,000		2,000

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	2021-2022 February Actuals	2021-2022 Projections to March 31	2021-2022 Budget	% Budget to Projections	2022-2023 Budget Estimates
WIND FARMS	172,656	172,656	171,168		174,158
WATER SALES	32,843	32,843	20,000		-
MISC	85,422	96,559	18,600		18,000
TOTAL	303,771	315,658	225,768	39.8%	208,158
COMMUNITY DEVELOPMENT					
RECREATION	99,393	106,133	216,875		212,125
RECREATION - FACILITIES	199,805	325,458	504,574		533,775
	299,198	431,590	721,449	-40.2%	745,900
SERVICE NS & MUN RELATIONS					
EQUALIZATION GRANTS	984,739	1,125,416	463,476		463,476
FARM PROPERTY ACREAGE	89,139	89,139	89,139		89,139
HST OFFSET GRANT	110,211	110,211	112,360		112,360
911 COST RECOVERY	-	6,300	6,300		6,300
TOTAL	1,184,089	1,331,066	671,275	98.3%	671,275
FEDERAL GOVERNMENT GRANTS	194,087	189,063	156,502	20.8%	153,508
OTHER FUNDS GENERAL	19,082	61,518	4,600		600
TOTAL REVENUE	**27,006,254**	**29,067,214**	**27,220,913**	**6.8%**	**28,857,554**

	2021-2022 February Actuals	2021-2022 Projections to March 31	2021-2022 Budget		2022-2023 Budget Estimates
TOTAL EXPENDITURES					
LEGISLATIVE					
WARDEN	47,565	54,597	56,954		60,029
COUNCIL	283,626	327,673	332,116		350,135
CONSOLIDATION & TRANSITION	42,436	42,436	-		
OTHER LEGISLATIVE	26,881	28,197	28,000		28,000
TOTAL	400,508	452,903	417,070	8.6%	438,164
GENERAL ADMINISTRATION					
ADMINISTRATIVE MANAGMENT	*92,035*	*102,719*	*89,274*		*98,610*
ADMINISTRATIVE SALARIES & BENEFITS	*287,085*	*327,537*	*352,178*		*348,275*
ADMINISTRATIVE MANAGEMENT TOTAL	379,120	430,255	441,452	-2.5%	446,885
FINANCIAL MANAGEMENT	*40,906*	*43,700*	*38,850*		*44,350*
FINANCIAL MANAGEMENT SALARIES AND BENEFITS	*660,644*	*781,845*	*836,532*		*935,682*
FINANCIAL MANAGEMENT TOTAL	701,550	825,545	875,382	-5.7%	980,032
LEGAL/AUDITOR	45,413	60,345	87,677		70,257
TAXATION	125,997	118,814	130,565		130,398
COMMON SERVICES	1,508	1,665	3,250		5,500
OTHER GENERAL ADMIN					
OFFICE ADMIN	108,153	113,591	120,411		117,891
FACILITIES	214,146	240,914	157,563		173,396
FACILITIES - SALARIES AND BENEFITS	40,408	45,668	62,881		50,675
LIBRARIES	41,603	47,013	23,300		40,236
LIBRARIES - SALARLIES AND BENEFITS	8,144	9,232	9,000		7,080
DATA SERVICES	*180,702*	*233,269*	*323,233*		*324,919*
DATA SERVICES SALARIES & BENEFITS	*86,045*	*81,163*	*83,801*		*86,446*
DATA SERVICES CONSULTANT	*66,226*	*71,745*	*74,825*		*74,825*
DATA SERVICES TOTAL	332,973	386,177	481,859	-19.9%	486,190
INSURANCE	173,714	173,714	196,982		207,588
GRANTS TO ORGANIZATIONS	17,500	17,500	23,500		23,500
OTHER	187,405	213,570	78,670		66,500
TOTAL	2,377,633	2,684,002	2,692,492	-0.3%	2,806,128
PROTECTIVE SERVICES					
POLICE	3,720,028	4,877,232	4,892,357		5,171,360
POLICE - SALARIES AND BENEFITS	47,049	50,823	56,541		60,171
LAW ENFORCEMENT	16,431	19,322	49,122		35,812
LAW ENFORCEMENT - SALARIES AND BENEFITS	107,575	123,742	135,040		144,789

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	2021-2022				2022-2023
	February Actuals	Projections to March 31	Budget	% Budget to Projections	Budget Estimates
FIRE FIGHTING	2,153,615	2,314,745	2,473,513		2,511,789
EMERGENCY	22,116	24,139	48,727		29,780
EMERGENCY - SALARIES AND BENEFITS	26,448	26,448	42,872		13,550
BUILDING INSPECTION	21,206	25,374	43,216		55,397
BUILDING INSPECTION - SALARIES AND BENEFITS	276,978	309,590	339,671		358,855
FOOD BANK	11,279	11,579	11,965		14,040
TOTAL	6,402,725	7,782,994	8,093,024	-3.8%	8,395,543
TRANSPORTATION					
ROADS & STREETS - ADMIN					
SALARIES AND BENEFITS	139,182	315,995	389,185		313,150
ADMINISTRATION	112,241	216,450	128,293		102,119
VEHICLE COSTS	55,531	62,043	39,000		39,000
EQUIPMENT COSTS	64,079	74,037	87,200		65,100
DOT	188,404	188,404	188,404		191,230
STREET MAINTENANCE	479	479	10,000		10,000
ROADS & STREETS - ADMIN TOTAL	559,915	857,408	842,082	1.8%	720,599
ROADS & STREETS - WEST HANTS					
SNOW & ICE CONTORL	11,351	12,379	55,000		55,000
STREET/STORM/SIDEWALK MAINTENANCE	49,212	50,781	70,000		70,000
ADMINISTRATION	-	20,612	20,612		-
SNOW EQUIPMENT MAINTENANCE	2,903	4,995	8,800		8,800
ROADS - MATERIALS	-	-	12,000		12,000
PW COST DISTRIBUTION	17,752	20,219	22,560		33,000
SALARIES AND BENEFITS	50,366	35,955	35,955		45,500
STREET BETTERMENT - CLOVER LANE	-	-	1,800		-
ROADS & STREETS - WEST HANTS TOTAL	131,584	144,941	226,727	-36.1%	224,300
ROADS & STREETS - WINDSOR					
SNOW & ICE CONTROL	41,473	45,102	66,000		96,000
STREET MAINTENANCE	129,148	129,291	120,000		120,000
SIDEWALK MAINTENANCE	14,154	14,154	36,000		36,000
SNOW EQUIPMENT MAINTENANCE	9,898	17,030	30,000		
PW COST DISTRIBUTION	17,752	20,219	23,060		24,500
SALARIES AND BENEFITS	193,329	126,900	126,900		167,500
ADMINISTRATION	-	46,926	46,926		-
PARKING LOT LEASE	6,257	6,257	7,300		7,300
STREET LIGHTS	38,994	44,997	60,000		47,000
ROADS & STREETS - WINDSOR TOTAL	451,006	450,877	516,186	-12.7%	498,300
ROADS & STREETS - HANTSPORT					
SNOW & ICE CONTROL	17,723	19,114	75,000		69,000
STREET MAINTENANCE	18,880	18,920	7,000		30,000
SIDEWALK MAINTENANCE	8,466	8,466	6,000		6,000
SNOW EQUIPMENT MAINTENANCE	7,446	10,299	12,000		
PW COST DISTRIBUTION	15,398	17,454	23,800		20,500
SALARIES AND BENEFITS	73,084	48,645	48,645		62,300
ADMINISTRATION	-	19,895	19,895		-
STREET LIGHTS	25,677	30,313	26,500		26,500
ROADS & STREETS - HANTSPORT TOTAL	166,674	173,107	218,840	-20.9%	214,300
TRANSPORTATION TOTAL	1,309,180	1,626,333	1,803,835	-9.8%	1,657,499
ENVIRONMENTAL HEALTH SERVICES					
WEST HANTS SEWER					
ADMINISTRATION	129,289	573,929	482,920		599,436
SALARIES AND BENEFITS	241,160	274,842	290,500		293,350
OPERATING COSTS	188,859	205,519	233,600		206,821
LONG TERM DEBT	110,689	110,689	117,957		117,957
WINDSOR SEWER					
ADMINISTRATION	104,147	179,428	112,907		123,151
SALARIES AND BENEFITS	240,805	273,100	250,720		279,400
OPERATING COSTS	212,803	232,892	262,550		244,594
LONG TERM DEBT	121,472	354,313	372,823		372,823
SUB-TOTAL	*1,349,223*	*2,204,711*	*2,123,977*	*3.8%*	*2,237,532*

	2021-2022				2022-2023
	February Actuals	*Projections to March 31*	*Budget*	*% Budget to Projections*	*Budget Estimates*
GARBAGE & RECYCLING					
GARBAGE & WASTE - WEST HANTS	896,669	1,035,450	1,016,610		1,048,210
GARBAGE & WASTE - WEST HANTS - SALARIES AND BENEFITS	31,674	36,709	42,180		46,150
GARBAGE & WASTE - WINDSOR	137,661	145,288	251,845		263,890
GARBAGE & WASTE - WINDSOR - SALARIES AND BENEFITS	29,088	33,770	37,659		45,300
CLOSED LANDFILL	40,059	45,111	68,471		61,300
CLOSED LANDFILL - SALARIES AND BENEFITS	4,039	4,614	7,108		5,300
RECYCLING/ENFORCEMENT	3,555	5,451	36,400		16,100
RECYCLING/ENFORCEMENT - SALARIES AND BENEFITS	54,391	62,176	63,330		67,330
SUB-TOTAL	*1,197,136*	*1,368,568*	*1,523,603*	*-10.2%*	*1,553,580*
TOTAL ENVIRO HEALTH SERVICES	2,546,359	3,573,280	3,647,580	-2.0%	3,791,112
ENVIRONMENTAL DEVELOPMENT SERVICES					
PLANNING	28,336	38,504	33,127		39,250
PLANNING - SALARIES AND BENEFITS	508,363	584,286	626,207		817,336
MCAPP/VCFN/REN/TOURISM	89,605	94,805	132,041		146,149
INDUSTRIAL PARK	3,063	8,677	8,000		8,600
TOTAL	629,366	726,271	799,375	-9.1%	1,011,335
RECREATION & CULTURAL SERVICES					
ADMINISTATION	38,668	43,178	45,325		82,930
ADMINISTATION - SALARIES AND BENEFITS	245,645	290,907	261,380		312,179
RECREATION SITES & MAINTENANCE	174,928	216,649	215,916		263,610
RECREATION SITES & MAINTENANCE - SALARIES AND BENEFITS	200,050	212,144	227,170		198,503
PROGRAMS	271,059	282,952	210,400		234,000
PROGRAMS - SALARIES AND BENEFITS	244,649	278,894	318,704		293,720
POOL	108,069	67,195	65,310		67,148
POOL - SALARIES AND BENEFITS	55,131	55,131	101,733		128,878
COMMUNITY CENTRE	67,611	79,205	93,650		88,088
COMMUNITY CENTRE - SALARIES AND BENEFITS	77,869	89,769	105,983		110,032
SPORT COMPLEX	214,616	237,064	320,549		340,078
SPORT COMPLEX - SALARIES AND BENEFITS	165,546	202,995	284,086		260,028
COMMUNITY ECONOMIC DEVELOPMENT	109,919	127,386	124,822		158,172
COMMUNITY ECONOMIC DEVELOPMENT - SALARIES AND BENEFITS	101,341	112,660	155,588		155,499
HMCC	73,283	85,234	86,340		90,349
MAPLEWOOD CEMETERY	-	34,821	34,821		52,493
RIVERBANK CEMETERY	-	31,260	31,260		29,332
TOTAL	2,148,384	2,447,446	2,683,037	-8.8%	2,865,039
FISCAL SERVICES					
VALUATION ALLOWANCE & BAD DEBTS	-	-	-		-
HOUSING AUTHORITY	128,139	128,139	148,912		195,000
ASSESSMENT	333,473	333,473	333,473		330,544
CORRECTIONAL	189,120	252,159	252,159		255,941
REGIONAL LIBRARY	119,543	119,543	123,000		123,000
EDUCATION	4,237,794	4,623,048	4,855,570		4,680,811
TOTAL	5,008,069	5,456,362	5,713,114	-4.5%	5,585,296
COURTHOUSE	79,516	96,478	46,620		66,603
COURTHOUSE - SALARIES AND BENEFITS	16,217	18,273	31,214		17,150
COURTHOUSE TOTAL	95,733	114,752	77,834	47.4%	83,753
LONG TERM DEBT	912,865	1,688,117	1,673,452		2,016,376
TRANSFER TO RESERVES	-	298,836	(381,434)		203,377
TOTAL EXPENDTURES	**21,830,823**	**26,851,295**	**27,219,379**	**-1.4%**	**28,853,622**
SURPLUS/(DEFICIT)		**2,215,919**	**1,534**		**3,932**

WEST HANTS REGIONAL MUNICIPALITY REPORT

Information ☑	Recommendation ☐	Decision Request ☐	Councillor Activity ☐

To: Members of Council

Submitted by: ______________________________
Todd Richard, Director of Public Works

Date: April 26, 2022

Subject: Maintaining Current & Future Water Capacity – Falmouth / Windsor Water Systems – Capital Improvements & Planning

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LEGISLATIVE AUTHORITY

Nova Scotia Municipal Government Act, Section 65 authorizes Council to expend funds for municipal purposes.

RECOMMENDATION or DECISION REQUEST

Council to determine interest in directing staff to continue to plan for water system upgrades to meet the current and future system demands. This is not currently being presented as a recommendation to Council; it only being presented as additional information for budget discussion purposes.

BACKGROUND

Property ☑	Public Opinion ☑	Environment ☐	Social ☑	Economic	Councillor Activity ☐

Recent discussions around the forecasted water utility capital budget and water system requirements, system storage and capacity. The report has been prepared to give information on the need for continued investment in the water utilities through capital improvements and replacements.

DISCUSSION

Attached to this information report are supporting documentation that provides details and facts on the water systems in the following areas;

- History of systems
- Water Demands
- Source Water Quality, Capacity, Infrastructure
- Treatment
- Distribution
- Viability of a Combined system (Windsor / Falmouth)
- Moving towards a Regional Water System

Key Points:

Both the Windsor and Falmouth potable water treatment, storage and supply systems will require upgrades in the coming years to maintain the current level of service standards. Staff have been working with engineering consultants to determine an overall preferred strategy for the now consolidated West Hants Regional Municipality to invest in the water systems that supply each community. Many opportunities have been identified by exploring the long-term infrastructure planning options whereby the overall investment is more feasible and efficient if the two systems are combined.

As identified in the attached report both Windsor and Falmouth systems have insufficient storage for both domestic and fire volumes along with not meeting the requirements for filter redundancy.

Due to the age both Water Treatment Facilities require major process maintenance / repairs, current systems do not have filter and process redundancy to allow systems to be taken offline for the amount of time required for the upgrades. Without the forecasted capital projects being approved will put the systems are great risk of failure along with increased service interruptions along with not meeting current and future day demands and/or fire flow requirements.

Several projects have been identified for the Windsor system and must be carried out regardless of whether the systems are eventually combined (connected). These systems include the addition of a 3rd process treatment train and associated upgrades, a new water storage tank and upgrades to the Mill Lakes Dam and control structures.

For continued separate system operation the Falmouth system will require both upgrades to the source (dam) and treatment plant to meet the expected capacity requirements for the 2040 horizon. If the recent development increase continues the 2040 date will push to a much shorter time frame.

For combined system operation the Windsor plant alone (even with the 3rd train installed) cannot meet the 2040 flow requirements. However, the future flows can be met with the combined name plate capacity of the two treatment plants.

A combined system along with increased system storage (water tank) would significantly enhance the ability to deal with planned shutdowns for maintenance and or respond to emergencies.

NEXT STEPS

Capital Planning is shown in the 5-year budget

High Priority Items

- New Water Storage Tank
- Mill Lakes Dam and Control Structures Upgrades
- Panuke Road Booster Station
- 3rd Process Train

Medium Priority Items

- Windsor Falmouth Interconnection
- Regional Long Term Water Supply Investigation

Longer Term Items (outside projected 5-year capital)

- Falmouth Plant Process Upgrades
- Additional Water Source Development

FINANCIAL IMPLICATIONS

Outlined in capital budget

ALTERNATIVES

N/A

ATTACHMENTS

Windsor-West Hants Water System Review – Final Report April 2021

Windsor Water Storage Expansion – Recommendation Report, October 12, 2021

CHIEF ADMINISTRATIVE OFFICER REVIEW

To support the budget process and deliberations regarding the addition of a storage tank for the Windsor Water System, the above report was drafted. The report highlights the current deficiencies with the Falmouth and Windsor systems. These deficiencies are supported by the "Windsor-West Hants Water System Review – Final Report April 2021" and further by direction of Council in October of 2021 to carryout engineering and design work for this added tank. In addition to the deficiencies the issue of future capacity and water supply for both domestic and firefighting must be considered as we are currently within a housing and development boom. This uptake in development may accelerate the need for the recommendations within the report.

For further support and clarity, I recommend the review of the attached report and recommendation sections within the "Windsor-West Hants Water System Review – Final Report April 2021".

Report Prepared by: J. Richard ___________________________

(Name and Title)

Report Approved by:

____

Mark Phillips, Chief Administrative Officer

Windsor-West Hants Water System Review

Final Report

201026.00 • April 2021

	Final Report		26-Apr-21	
	Draft Report	J. Clair	19-Mar-21	A. Gates
	Issue or Revision	**Reviewed By:**	**Date**	**Issued By:**

CBCL

April 26, 2021

Todd Richard
Director of Public Works
West Hants Regional Municipality
100 King Street
PO Box 3000
Windsor, NS B0N 2T0

Dear Mr. Richard:

RE: Windsor-West Hants Water System Review – Final Report

Please find enclosed the Final Report for the above noted project. Should you require support regarding subsequent project planning or presentations to council or other stakeholders we would be pleased to assist.

Yours very truly,

CBCL Limited

Prepared by:
Andrew Gates, P.Eng.
VP Infrastructure
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E-Mail: andrewg@cbcl.ca

Reviewed by:
Jeff Clair, P.Eng.
Municipal Engineer

Project No: 201026.00

Contents

Chapter 1 Background

1.1 History of Systems

The Windsor and Falmouth water utilities operate independent water supply systems to service their respective communities, which are separated by the Avon River (Pesaquid Lake) by approximately 630 meters. Each system consists of a surface water source, a water treatment plant (WTP), a water storage reservoir and water distribution network.

The Windsor system services a population of approximately 6,500 (2012, CBCL) which includes Three Mile Plains. The original water supply system was constructed in 1890. Numerous upgrades have been constructed since, including a 400 mm (16") diameter water transmission main in 1974 between the WTP and downtown Windsor to increase system capacity. The WTP, completed in 2002, has treatment capacity and storage meeting that of the maximum demand. While a water storage reservoir exists on the system, located in the industrial park off Ivey lane, it was constructed to address fire protection issues in the park and is not intended to supply peak balancing storage for the Town. As a result of the limited storage in the system during periods of peak demand, pressure fluctuations occur. Two pressure reducing valve chambers were installed in 2015 to create a new pressure zone servicing downtown, the low pressure zone. The PRVs are located on Clifton Avenue and King Street.

The community of Falmouth has a population of 1368 (2016, Statscan). Water leaves the WTP and is lifted by pumps to the storage standpipe located off Wilewood Drive. Water is delivered to the distribution network by gravity from the standpipe. The original distribution system was constructed in 1969, with extensions constructed since that time. The current potable water standpipe was constructed after 1993, and the WTP was constructed in 1999.

Source water for both Windsor and Falmouth is from impounded streams. The Falmouth water source is French Mill Brook located west of Falmouth proper. The Mill Lakes Watershed supplies the Windsor system, and is located approximately 10 km southeast of the Falmouth WTP.

Both the Windsor and Falmouth potable water treatment, storage and supply systems will require upgrades in the coming years to maintain the current level of service standards. The purpose of this study is to determine an overall preferred strategy for the now amalgamated West Hants to invest in the water systems that supply each community. There are opportunities to explore long term infrastructure planning options whereby the overall investment may be more efficient if the two systems are combined to some degree.

Chapter 2 Status of Existing Systems

2.1 Falmouth

2.1.1 Water Demands

The 2015 – 2020 annual reports for Falmouth were reviewed to establish the historical Average Day Demands (ADD) and Maximum Day Demands (MDD). The Maximum Day Factor (MDF) was calculated from these values. There was a noticeable growth trend in demand from 2015 to 2020 which equated to 3.75% annually. These figures are summarized in Table 1.

Table 1: Summary of Historical Demands

Year	Estimated Population	ADD (MLD)	MDD (MLD)	MDF
2015	-	0.62	1.01	1.64
2016	1,368 (census)	0.65	1.14	1.74
2017	-	0.63	1.66	2.64
2018	-	0.64	1.38	2.16
2019	-	0.71	1.21	1.72
2020	1,585[1]	0.74	1.40	1.88

1. The number of service connections in 2020 is 780. With an estimated population of 1585 based on 3.75% annual growth, this equates to 2.0 persons per connection.

Previous studies have assumed an annual growth rate of 2.5% for a 20 year horizon and this is the growth rate used for this project. Therefore, the estimated future population (2040) of Falmouth is 2,597 which is an increase in the 2016 population of 1,229 persons.

The 2020 demands have been utilized as Current demands. The max day factor varied from 1.64 to 2.64 from 2015 to 2020 with an average of 1.97. For the 2040 year, the max day factor of 1.97 was selected. The current and future demands utilized as the basis of the analysis for this report have been summarized in Table 2.

Table 2: Current and Future Demands

Year	Current	Future (2040)
ADD (MLD)	**0.74**	**1.22**
MDD (MLD)	**1.40**	**2.40**
MDF	**1.88**	**1.97**

2.1.2 Source Water Quality, Capacity, Infrastructure

The Dillion (2013) Falmouth Water System Assessment Report summarizes the water source for the Falmouth system. The French Mill Brook watershed provides the source water for the WTP. Water flows through the French Mill Brook to the impoundment, located approximately 100 m northwest of the WTP. Water is drawn from the impoundment through an intake structure to a low lift pump building where it is pumped to the WTP. The manmade dam, constructed in 1968, controls flow downstream of the impoundment.

The source water is tested regularly at the Falmouth WTP. Generally, the quality is typical of surface water supplies across Atlantic Canada, with low – neutral pH values between 6 and 7, low alkalinity from <10 to 20 mg/L as $CaCO_3$, and variable turbidity between 2 and 10 NTU, which is highly dependent on watershed activity and rainfall/erosion events. Raw water organic content is not measured routinely; however, quarterly sampling indicates typical total organic carbon (TOC) concentrations between 2 and 6 mg/L. Manganese sampling is also undertaken quarterly, and the raw water is subject to seasonally elevated concentrations: up to 0.358 mg/L in 2020. The plant includes potassium permanganate addition to oxidize and remove manganese from the source water; this is significant as manganese is no longer considered an aesthetic parameter of concern by Health Canada/NSE, and as of 2019 has been assigned a health-based maximum acceptable concentration (MAC) in drinking water of 0.120 mg/L. As with manganese, quarterly iron sampling indicates widely variable concentrations in the source water. Seasonal fluctuation of iron and manganese is not uncommon in surface water supplies in the region.

The Falmouth WTP water withdrawal approval (2018-102523-00) states the following withdrawal limits:

- Average Rate of Withdrawal of 1.0 MLD, averaged over 1 year.
- Maximum Rate of Withdrawal of 1.4 MLD averaged over 30 days.

It is understood that the maximum rate of withdrawal of 1.4 MLD can be exceeded on any given day and is not intended to be a daily maximum withdrawal.

A yield update was completed by Hatch Mott & Macdonald (2010) *Falmouth Dam Water Usage/Yield & Cost Estimate* Update and concluded that the French Mill Brook Impoundment (source water reservoir) "would not have the capacity to support the Water Utility in the historically driest years" based on projected growth. Projected growth considered yearly growth scenarios of 2.5% and 3.0% and allowed for a required maintenance flow of 5 L/s for 30 days in the driest years. The report recommended that the Municipality consider raising the dam to increase system yield. The following yields were included in the report (see notes of Tables 3.2 and 3.3) which were based on 120% of average day demands for a period of 90 days:

- Existing Dam Elevation of 19.3m: 1.08 MLD.
- Raised Dam to Elevation 21.4 m: 1.30 MLD (allows for 0.3 m of storage for DFO Maintenance flow).
- Raised Dam to Elevation 22.0 m: 1.69 MLD (allows for 0.3 m of storage for DFO Maintenance flow).

The Hatch Mott MacDonald report was based on 724 residential connections with an ADD of 0.67 MLD for 2009. As of 2020, residential connections are 780 with an ADD of 0.74 MLD. The average of water demands for June to August 2020 was 0.85 MLD and was the 90 day period with the highest average demand for that year.

The 2020 withdrawal rates remain within the yield of the existing dam at current crest elevation. However, the ADD is expected to exceed the current yield within 10 years. Raising of the dam elevation will be required to satisfy the demands within the 2040 horizon. Probable costs for raising the dam crest elevations to 21.4 and 22.0 m were included in the Hatch Mott MacDonald report. These amounts are shown below and include contingency, engineering and geotechnical investigation and have been adjusted for inflation (assumed at 3.7% annually) to 2020 dollars as follows:

- Raised Dam to Elevation of 21.4m: $2,984,000.
- Raised Dam to Elevation of 22.0m: $3,487,000.

2.1.3 Treatment

The Falmouth WTP was constructed in 1999 and features a combined coagulation/ flocculation, sedimentation clarifier and rapid gravity filtration packaged plant. The plant is fed from a low lift pump station next to the French Mill Brook impoundment, with intake screens and duplex raw water pumps operating in a duty/standby configuration. The plant starts based on clearwell level and runs at a fixed flowrate. Filtered water stored in the clearwell is pumped to the Falmouth distribution system based on the level in the standpipe. The standpipe and WTP communicate via radio link. Filtered water is chlorinated after high lift pumping, in a separate outbuilding which houses chlorine gas storage and injection systems. Primary disinfection (chlorine contact time / “CT”) is achieved in the transmission main.

The raw water flow (i.e. plant production rate) is not regulated, as the flow control valve at the inlet to the package plant has been disabled. The rate of low lift pumping is based on the low lift pump capacity – the original plant design intended to fix the production rate regardless of raw water pumping capacity using this flow control valve. Pre-treatment chemical addition is flow-paced based on an inlet flowmeter at the plant; coagulant, soda ash, polymer and potassium permanganate are each flow-paced on the raw water flow. The raw water piping configuration includes a dead-end raw water connection that may have been intended to provide for a raw water bypass of the WTP. However, this was not completed and there does not appear to be a need for this function.


The WTP building is a concrete block wall construction with metal cladding and wood truss with asphalt shingled roof and is divided into four interior areas – chemical room, process room, office, and electrical room. The chemical systems are relatively straightforward – wall mounted metering pumps and HDPE batching and dosing tanks for each chemical in use at the plant. The exception is chlorine gas which is dosed in an outbuilding (the original chlorination building which existed prior to the WTP construction). A staged replacement and upgrade of the existing chemical storage and feed systems is underway at the facility and is scheduled to proceed over the next several years.

The main plant controller was provided with the package process tankage and is located in a floor-mounted cabinet in the process area. Instrumentation for monitoring and control at the WTP is constrained, due to limitations of the original package plant controller (i.e. I/O availability). There are online instruments at the facility which are in use but are not connected to the main plant PLC and SCADA system as a result, and this includes settled water turbidity. An expansion or upgrade of the existing PLC would be required to expand the available capacity and incorporate the existing online instrumentation along with future upgrades.

The process wastewater from the facility is directed to a settling lagoon with a bottom drain connected to an accessible manhole. Discharge from the lagoon is by gravity to a perforated pipe, wrapped with a filter fabric and imbedded in a sand berm protected with a clearstone layer at one end of the lagoon. The perforated pipe terminates in a ditch which drains towards the impoundment. There appears to be considerable potential for wastewater supernatant to make its way back to the plant intake.

2.1.3.1 Process Commentary

The package treatment system installed at the Falmouth WTP was intended to provide a suitable conventional process with a relatively compact footprint. The WTP building was purpose built to accommodate the package system; however, it was not built with any obvious intent for a future expansion of the facility to add pre-treatment (flocculation and clarification) or filtration capacity. In addition, the settling clarifier is highly sensitive to process upsets; the formation of floc is required as with the DAF clarifier in Windsor, but also the size and density of the flocs produced has a significant impact on the settleability of the floc and consequently on the performance of the clarifier and on filtration capacity and headloss/runtimes. Generally, the existing Falmouth package plant is not well-suited to handle rapidly changing source water conditions without significant operator input. For a source water with high variability, this results in inconsistent performance which can be actively managed by operators but occasionally results in inconvenient and potentially significant shutdowns of the facility. Without significant modifications to process monitoring and control systems, or major upgrades to the package system in place (i.e. replacement of the existing clarification technology), this trend is likely to continue for the life of the facility.

Currently, the facility operates based on level switches and runs at a fixed rate, peaking at approximately 900 L/min with one low lift pump online. When the plant is in operation and the process is tuned to the source water, performance is very good during a typical operating run. Starting and stopping this conventional treatment process decreases operating efficiency, but when source water quality is consistent the impact is less significant. The original plant design called for the facility to run at a higher flowrate, near its design capacity, with a focus on encouraging sufficient hydraulic mixing energy in the flocculation stage; however, CBCL Limited (CBCL) would recommend evaluating plant performance at various flowrates with variable source water conditions to delineate the performance limits and impact of each factor. Based on experience with similar systems and water sources, treatment performance may be significantly improved, particularly during adverse raw water quality events, at lower hydraulic loading rates. This possibility, combined with the fact that the current average demand from the community is significantly less than the current normal plant operating flowrate, results in a potential opportunity to improve overall plant performance by reducing hydraulic loading rate and the number of starts/stops. Ideally, the plant could operate continuously at the lowest possible loading rate either to meet demand, or to not exceed the allowable withdrawal rates from the source water. If necessary CBCL can provide guidance on optimizing performance at lower flows.

2.1.3.2 Process and Filtration Redundancy

The nominal capacity of the Falmouth WTP packaged treatment system is 1,500 L/min (2.16 MLD) with both filters in service, operating under the design conditions summarized below in Table 3.

Table 3: Falmouth WTP Design Summary

Scenario	Plant Design Specification	Normal WTP Operating Conditions	1.0 MLD	Current MDD
Flow	2.16 MLD	1.3 MLD	1.0 MLD	1.4 MLD
Flocculation Time	30 minutes	50 minutes	65 minutes	46 minutes
Clarifier HLR	3.42 m/h (1.37 USgpm/ft^2)	2.05 m/h (0.82 USgpm/ft^2)	1.58 m/h (0.63 USgpm/ft^2)	2.21 m/h (0.88 USgpm/ft^2)
Filter HLR	7.53 m/h (3.01 USgpm/ft^2)	4.52 m/h (1.81 USgpm/ft^2)	3.48 m/h (1.39 USgpm/ft^2)	4.88 m/h (1.94 USgpm/ft^2)
Filter HLR (n-1)	*15 m/h*	*9.04 m/h* (3.62 USgpm/ft^2)	*6.95 m/h (2.78 USgpm/ft^2)*	*9.75 m/h (3.9 USgpm/ft^2)*

In accordance with the Nova Scotia Environment *Treatment Standards for Municipal Drinking Water Systems,* filtration redundancy is required where filters are being used for pathogen reduction. To qualify as redundant, the filters must be capable of supplying the maximum day demand with the largest filter out of service, where the *maximum day demand* means the highest daily use rate during the year.

- As the historical MDD is 1.40 MLD and each filter is rated for only 1.08 MLD, the Falmouth WTP does not currently meet regulatory requirements for filter redundancy.
- The WTP can meet the future ADD of 1.22 MLD with two filters in service operating at the current normal plant operating conditions.
- In 20 years, the WTP can only provide approximately 89% of the MDD of 2.43 MLD with two filters in service operating at the rated plant capacity.
- The permitted annual average withdrawal from the source water is only 1.0 MLD with a maximum monthly average of 1.4 MLD; this is not sufficient to meet future ADD or MDD.

If we consider a combined Windsor-Falmouth system where two treatment plants feed one distribution system, it is possible that that the maximum combined production rate from two facilities (with either the largest overall filter or the largest overall filter in each facility offline) could be used to meet the filter redundancy requirements. It is not clear how NSE would view this approach and we are not aware that it has relieved filter redundancy standards in any other jurisdictions; however, CBCL believes this is a reasonable approach for the determination of adequate system filtration redundancy.

As noted above in Table 3 (Falmouth WTP Design Summary), the "n-1" filtration loading rate of the Falmouth WTP is 9.04 m/h, meaning that with one filter offline and the plant running at its normal flow (900 L/min) this would be the resulting filter loading rate on a single filter. An examination of the actual filtration capacity at the facility may be warranted, as the 'design' filter loading rates are relatively low compared to industry standards. For example, the 'n-1' loading rate of 9.75 m/h may be within the actual filter capacity at the maximum withdrawal rate of 1.4 MLD, provided that pre-treatment and clarification processes are optimized. Further testing and documentation of the filter performance at various loading rates at full scale would be required to confirm actual performance limitations and potentially meet filter redundancy requirements via this approach.

In addition to the need for filtration redundancy, the best practice in design is to minimize the critical points of failure which exist in all treatment plants. There are several primary systems which do not incorporate redundancy at the Falmouth facility:

- Raw water transmission.
- Chemical metering pumps.
- Clarification.
- “n-1” filtration (based on maximum daily demand).
- Backwash pump.
- Chlorine booster pumps and ejector.
- Plant PLC.
- Solids handling lagoon.

While the risk of critical failures varies with each of the components above, it is practical to be aware of critical points of failure in the overall system and develop contingency and/or emergency plans as needed to address each scenario.

Despite the forgoing, the general condition and upkeep of the plant appeared to be better than expected given the age of the facility based on our site visit of February 12, 2021.

2.1.4 Distribution

The Falmouth distribution system consists of a WTP, distribution piping and a standpipe for storage. The Falmouth WTP draws from the French Mill Brook located west of Falmouth. The WTP cycles on and off to meet the daily demands of the community based on the level of the standpipe. Two distribution pumps draw from a small clearwell (200 m^3) and based on discussions with Falmouth operators, pumps directly into the distribution system. Supply from the WTP flows through a 250 mm transmission main along Curry Road to the Falmouth Back Road. From there the flow branches into smaller distribution watermains and ultimately fills the standpipe. Flow leaving the WTP is measured by a flow meter. The two distribution pumps are shown as 40 hp and rated for 1,680 L/min @ 62.5 m of head according to the O&M manual. The standpipe is located on 22 Wilewood Drive and constructed after 1993.

A hydraulic analysis of the Falmouth water distribution system had been undertaken in the CBCL (2019) *Windsor/Falmouth Interconnection Pre-Design Study*. It was found, in general, the system would adequately convey current and future domestic demands. Based on geography, there are areas of high pressure and in some cases, pressures exceed 390 kPa (100 psi). The high pressures occur predominantly in the low-lying areas of the system with the highest system pressure of 737 kPa (107 psi) was predicted at the dead end on Highway 1 which.

2.1.4.1 Storage

The *Atlantic Canada Guidelines for the Supply, Treatment, Storage, Distribution and Operation of Drinking Water Supply Systems, 2004* (herein referred to as the Atlantic Canada Guidelines) provides guidance on reservoir sizing criteria and is based on the following formula:

S = A + B + C

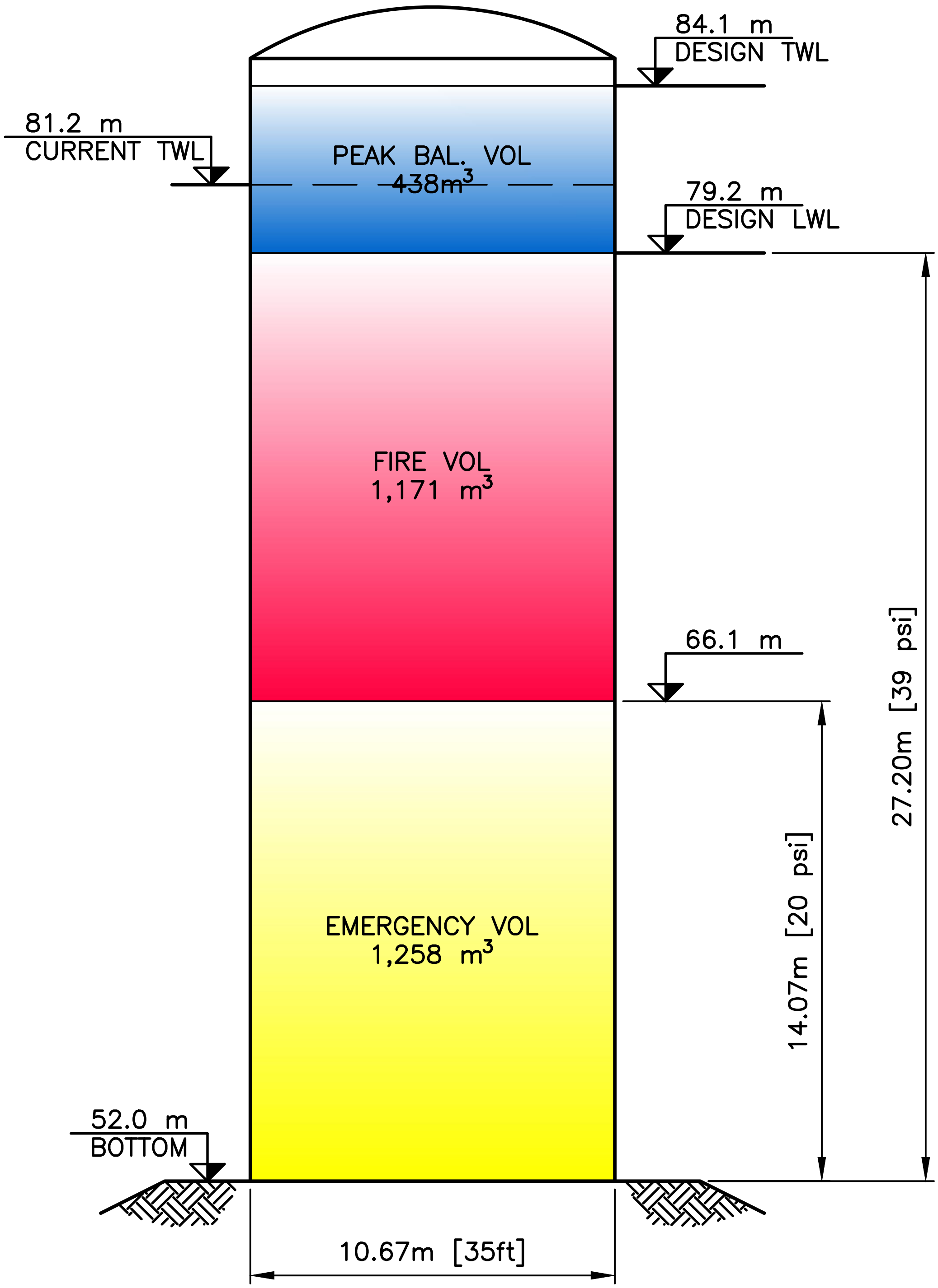
Where:
S = Total Storage Requirement, m^3
A = Fire Storage, m^3 (equal to required fire flow over required duration)
B = Peak Balancing Storage, m^3 (25% of Maximum Day Demand)
C = Emergency Storage, m^3 (A minimum of 25% of A + B is recommended)

The above equation is based on a water supply rate to the storage equal to Maximum Day Demand (MDD). The Atlantic Canada Guidelines recommend a maximum 72 hour turnover to prevent deterioration of water quality and loss of disinfection residual as a result of water age.

The Falmouth standpipe is constructed of welded steel with a diameter of 10.67m and a total height 32.96 m. The design Top Water Level (TWL) for the standpipe is 84.1 m, however, it is currently operated between 79.2 m and 81.2 m. A storage schematic with allocations for Peak Balancing, Fire and Emergency volume was developed and is shown in Figure 1. The bottom of the fire volume is based on a minimum pressure of 140 kPa (20 psi) which is the minimum allowable pressure within the system in a design fire flow event.

The Fire Underwriters Survey (FUS) (2013) *Water Supply Review* of Falmouth reviewed existing buildings within Falmouth to establish the fire flow requirement for the system. The required fire flow in the report was estimated at 4,560 L/min to 14,100 L/min (1,000 Igpm to 3,100 Igpm). The required fire storage duration (thus storage) is established by FUS *Public Water Supplies for Fire Protection* and is a function of required fire flow. The duration is 1.64 hrs at a flow of 4,560 L/min and 3.0 hours for 14,100 L/min resulting in storage volumes of 449 m^3 to 2,540 m^3, respectively. FUS conducted hydrant testing for the report with recorded flows varying from 2,040 L/min (450 IGPM) on Town Rd to 6,780 L/min (1,493 IGPM) on Halewood Drive near the standpipe.

A summary of the design and available storage amounts are shown in Table 4. The design values are based on the future MDD established in the previous sections and assumptions noted above.



No.	Description	No.	Description	No.	Description

Date	Scale	Designed	Drawn	Checked	Approved	CBCL No.	Contract
FEB 5/21	N.T.S.	JC	JC			201026.00	

CBCL

WINDSOR-WEST HANTS
WATER SYSTEM REVIEW

FALMOUTH
STANDPIPE SCHEMATIC

FIGURE
1

Table 4: Summary of Design and Available Storage

Volumes	2040 Design	Available
Fire Storage, A (m^3)	449 – 2,540	1,171
Peak Balancing Storage, B (m^3)	597	438
Emergency, C (m^3)	261 – 784	1,258
TOTAL STORAGE, S (m^3)	**1,320 – 3,919**	**2,867**

The existing Falmouth Standpipe provides peak balancing volumes that would satisfy 2.5% annual growth to 2029. Fire storage is lower than recommended for the largest fire flows in the community. However, given the size of many of the mains in the system (150 and 200 mm diameter) its likely that the higher fire flows noted could not be achieved regardless of the fire storage capacity. A more thorough analysis of fire flows available could be carried out to determine the flows available should the Municipality wish. Operational items that should be considered include:

- Turn over times of approximately 4 days (on average) which is higher than the recommended 72 hours.
- The reservoir drawings show a single 200 mm diameter inlet/outlet pipe located near a wall at the bottom of the tank. This type of configuration does not encourage mixing and likely results in stratification due to temperature gradients. There is greater risk of formation of ice at the top of the tank which can damage the tank coating and structure.

To address these operational issues, it is recommended that a mixing system be added to the tank.

2.2 Windsor

2.2.1 Water Demands

Like Falmouth, the Windsor WTP 2015 – 2020 annual reports for were reviewed to establish the recent ADD and MDD and to calculate the MDF. Unlike Falmouth, there was no noticeable trend in demand from 2015 to 2020. The demands are summarized in Table 5.

The Windsor WTP supplies the Town of Windsor, The Windsor/West Hants Industrial Park and Three Mile Plains (TMP). The TMP system is metered but only average demands are available. The Town of Windsor ADD is calculated by subtracting TMP from the Windsor WTP ADD. The Windsor/West Hants Industrial Park demands are included within the Town of Windsor.

Table 5: Summary of Historical Demands

Year	Town of Windsor	Three Mile Plains	Windsor WTP		
	ADD (MLD)	ADD (MLD)	ADD (MLD)	MDD (MLD)	MDF
2015	-		3.52	5.67	1.61
2016	2.00	1.12	3.12	5.31	1.71
2017	2.33	1.19	3.52	5.18	1.47
2018	2.10	1.25	3.35	5.61	1.67
2019	2.39	1.36	3.75	5.70	1.52
2020	-	-	3.03	4.28	1.41

To establish a baseline of current demands for this study, all the years were averaged. The MDF was calculated from these ADD and MDD values at 1.57. The 2040 demands were calculated from these ADD and MDD values assuming a 1% annual growth. This growth rate has been used for previous studies.

The current and future demands utilized as the basis of the analysis for this report have been summarized in Table 6 below. Based on the above data, TMP accounts for approximately 35.8% of demands. Exact water consumption records for the Industrial Park are not available, however, it was estimated in 2020 that average consumption was 0.36 MLD or 11.9% of WTP 2020 production. The remaining 52.3% of water produced was consumed within the Town of Windsor.

Table 6: Summary of Current and Future Demands

Demands	Current (MLD)	Future (2040) (MLD)
Total ADD	**3.38**	**4.13**
Industrial Park (est.)	0.40	0.49
Three Mile Plains	1.21	1.48
Windsor	1.77	2.16
Total MDD	**5.29**	**6.46**
Industrial Park (est.)	0.63	0.77
Three Mile Plains	1.90	2.32
Windsor	2.77	3.38

2.2.2 Source Water Quality, Capacity and Infrastructure

The Windsor WTP source water originates at Mill Lakes located approximately 3.3 km south of the WTP building. A small earthen dam is located at the Mill Lakes outlet where water flows through a control structure and continues down Fall Brook to the impoundment at the Windsor WTP. The WTP intakes draw raw water from the impoundment upstream of the concrete spillway. Water flowing over the spillway continues down Fall Brook terminating at Lebreau Creek Brook. According to CBCL (2003) *Mill Lakes Watershed*

Assessment Study, the Mill Lakes watershed covers an area of 1,150 Ha with an estimated volume of 1.9 million cubic metres at current overflow level.

The Town's Water Withdrawal Approval (2012-083562-01) expires on March 31, 2028 and stipulates the following limits:

- Average Water Withdrawal Rate not to exceed 5.4 MLD averaged of 30 days.
- Maximum Withdrawal Rate shall not exceed 6.8 MLD over 24 hours.

The maximum water flow rate through the WTP intakes is restricted to 5.68 MLD from March 1st to April 30th to maintain screen approach velocities to acceptable levels (below 0.038 m/s). This restriction may extend beyond April 30th should juvenile eels be observed.

The Town is required to maintain an Ecological Maintenance Flow (EMF) of 0.3 m^3/s immediately downstream of the spillway at all times. The EMF is measured at the spillway using a calibrated Stage-Discharge curve. Flows in Fall Brook are controlled by the position of a sluice gate in the Mill Lakes outlet control structure. According to the annual report, flow over the spillway was less than EMF for at least one reading per month from July to October. Therefore, in accordance with Section 6g of the approval, Windsor may wish to undertake the investigation the operation of the sluice gate to optimize flows in Fall Brook when the EMF is not met.

The Stantec (2019) *Mill Lakes Water Supply, Dam Safety Review* study noted that the earthen dam structure was in fair to poor condition. The following are the key recommendations for the Mill Lakes Dam from the Stantec report:

- Conduct a flood and dam break study to assess potential breach.
- Raise the dam crest to meet minimum freeboard requirements determined via a new flood study.
- Install a sheet pile wall to prevent loss or migration of fines through the existing stone wall.
- Replace the overflow spillway channel to meet CDA guidelines.
- Riprap / erosion protection should be installed on the upstream slope.
- Undertake a geotechnical investigation to determine subsurface condition for future analysis and design.

The water drawn from the impoundment is tested regularly at the Windsor WTP. Generally, the water quality is again typical of surface water supplies across Atlantic Canada but is slightly more acidic and less buffered than the Falmouth supply. Windsor's source water has slightly lower pH values between 5.5 and 6.5, negligible alkalinity (<5 mg/L as $CaCO_3$), and very low turbidity <1.5 NTU even under "upset" source water conditions. Generally, the supply may be considered high quality. Organic content is measured routinely as colour, which ranges between 20 and 60 TCU. Quarterly sampling indicates typical total organic carbon (TOC) concentrations between 3.9 and 7.1 mg/L in 2020. This water quality is well suited to the treatment process in place, with regularly elevated dissolved organic content but low turbidity. Manganese sampling is also undertaken quarterly and was measured up to 0.110 mg/L in 2020, close to the MAC of 0.12 mg/L. The treatment process in place is not inherently designed for manganese removal; however, based on sample results, passive removal of total manganese using conventional treatment has been adequate to reduce levels well below the MAC. Seasonal fluctuation of iron and manganese is not uncommon in surface water supplies in the region.

2.2.3 Treatment

The Town of Windsor Water Treatment Plant was constructed in 2002, replacing an existing chlorination/pH adjustment plant which remained in place and in use for pre-lime addition. A low lift pump station is fed from the old WTP/lime dosing building where the raw water is screened and pumped to the main WTP. The WTP feeds coagulant prior to a dual-train packaged treatment system, with mechanical flocculation, DAF and dual-media rapid gravity filtration. Chlorine gas is added for disinfection; combined contact time in the minimum volume maintained in the clearwell and in the transmission main leaving the WTP are used to achieve primary disinfection CT requirements. Process wastewater produced from backwashing and DAF sludge removal are dosed with polymer and pumped to settling lagoons. The supernatant from the lagoons overflows to an effluent discharge pipe which is routed back to the impoundment.

Like the Falmouth plant, which was constructed two years earlier, the Windsor WTP treatment system was manufactured by BCA Industrial Controls Limited, presently known as AWC Water Solutions, based in British Columbia. Unlike the Falmouth facility, the Windsor plant uses dissolved air flotation (DAF) for clarification, which allows for significantly higher hydraulic loading rates – where the Falmouth WTP has a maximum clarifier HLR of 3.4 m/h, the Windsor WTP is designed to run at 11.5 m/h.

2.2.3.1 Process Commentary

The Windsor WTP was one of the first DAF plants installed in the province, and the process remains among the best available technologies for the treatment of surface water with similar characteristics. In addition, DAF is well suited as a base treatment for emerging concerns in surface waters across the province; namely, the increasing risk of harmful algal blooms in surface waters influenced by warming temperatures and increasing pH and biological activity. This is representative of several potential issues associated with the current treatment process – while the WTP may not be equipped currently to deal with significant changes in source water quality or regulatory requirements, the existing process is robust and provides an excellent platform to support further enhancements like pre-oxidation or PAC addition, if required, in the future. While the Windsor WTP does not currently provide a system for pre-oxidation of dissolved metals, if required in the future this addition could be made alongside existing systems, in either the WTP building or alongside lime dosing/low lift pumping. Other upgrades to the intake, controls, monitoring equipment, and other systems identified for upgrades at the facility (e.g. lime building HVAC, lagoon pump) should be completed as needed to ensure the long term reliability and operability of the facility.

2.2.3.2 Process and Filtration Redundancy

The nominal capacity of the Windsor WTP treatment system is 6.8 MLD with both filters in service, operating under the design conditions summarized in Table 7.

Table 7: Windsor WTP Design Summary

Parameter	Plant Design Flow	Normal WTP Operating Conditions	Maximum MDD 2018-2020
Flow	6.8 MLD	3.36 MLD	5.7 MLD
Flocculation Time	26 minutes	53 minutes	31 minutes
Clarifier HLR	11.5 m/h (4.7 USgpm/ft^2)	5.68 m/h (2.32 USgpm/ft^2)	9.64 m/h (3.94 USgpm/ft^2)
Filter HLR	9.2 m/h (3.8 USgpm/ft^2)	4.55 m/h (1.86 USgpm/ft^2)	3.48 m/h (1.39 USgpm/ft^2)
Filter HLR (n-1)	*18.4 m/h (7.6 USgpm/ft^2)*	9.09 m/h (3.72 USgpm/ft^2)	*15.42 m/h (6.16 USgpm/ft^2)*

The issues associated with Windsor WTP filtration redundancy are well documented, and are similar in terms of plant capacity vs. MDD to the apparent filter redundancy regulatory issue at the Falmouth WTP. It can be seen from the WTP Design Summary in Table 7 that the plant normally operates at close to 50% of its capacity (based on treated water flows from 2018 through 2020); therefore, with one filter offline (50% of filtration capacity removed) the facility can still meet the average demand of the Town of Windsor and Three Mile Plains – currently. However, the WTP cannot meet the MDD with one filter out of service, and the WTP total flow setpoint (capacity) is automatically reduced by 50% when one filter is taken out of service (for backwashing, regular maintenance, etc.).

The situation has been carefully and successfully managed by the Windsor WTP operators for many years. However, under the current MDD scenario, the filter HLR would exceed 15 m/h, well above the design HLR of 9.2 m/h. Accounting for long-term future population growth and corresponding growth in demand, the inability of the plant to meet MDD with a filter out of service will be further exacerbated. In addition, the age of the facility means that many electrical, electromechanical and process equipment is either overdue for major overhaul, or significant maintenance activities are expected to be required in the near future. Exemplifying this is the current state of the existing filters at the Windsor WTP – the performance of one of the two filters has been in decline in recent years, as evidenced by filter headloss, filter runtime, and apparent backwash performance. A brief investigation was conducted in 2018, draining the filter tank for inspection of the underdrain where apparent damage was anticipated. No evidence of obvious damage of other issues in the filter underdrain was noted, however, and the investigation was halted in order to put the filter back in service. A more thorough examination of the filter, which would include media excavation, could not be considered due to the need for an extended shutdown of the filter. This demonstrates the intent behind the NSE *Treatment Standards*, to ensure that in the event of a significant issue with one filter that it could be taken offline for an extended period of time without compromising the facility's ability to meet the community demand.

CBCL (2019) *Town of Windsor – Water Treatment Facility Conceptual Design Upgrades* report provided a concept design for upgrades to the existing Windsor WTP, including the addition of a third complete train of flocculation, clarification and filtration, providing for process redundancy without increasing the actual nameplate capacity of the facility. After completing the upgrade, the "n-1" capacity of the Windsor WTP would be equal to the current "n" capacity. This upgrade would not have a significant impact on much of the existing auxiliary process equipment at the facility, such as low lift pumps, chemical feed systems, and backwash pumps. Some equipment would require upgrade, including the existing PLC at the facility. Total Opinion of Probable Cost for the proposed work was $3,038,000 exclusive of geotechnical work, engineering, and taxes. Given the backwashing and filter underdrain concerns regarding one of the filters at the facility as noted above, we believe the addition of the 3rd train should be considered a priority project by the Municipality.

As the future ADD and MDD of the Windsor WTP is 5.44 and 6.64 MLD respectively, the facility with its rated production capacity of 6.80 MLD is well suited to meet the future demands of the Windsor system. The limitation on withdrawals during certain months can be lifted with the addition of a new intake screening system – this should be included as a planned future capital project and should not significantly affect long term planning for the regional utility approach.

2.2.4 Distribution

The WTP supplies treated water to the Town of Windsor and Three Mile Plans. The WTP feeds the distribution system by gravity and operates at a HWL of 80.4 m and a LWL of 78.9 m. The Windsor distribution system consists of watermains ranging in size from 100 mm to 400 mm in diameter with some piping initially constructed in 1890. Water is supplied through 250, 300 and 400 mm diameter transmission mains from the plant to Windsor Back Road. From Windsor Back Road, the flow splits into two 400 mm diameter transmission mains that supply Windsor with a third line that is the primary feed to the Three Mile plans system. The WTP is the primary source of water storage with a total volume of 1,820 m^3 for which 1,210 m^3 is designated for distribution storage. The remaining storage is designated for backwashing.

The System is operated in four distinct zones:

- Windsor High Pressure Zone.
- Three Mile Plains Metered Zone.
- Windsor Low Pressure Zone.
- Windsor/West Hants Industrial Park Pressure Zone.

The Windsor High and Three Miles plains zones operate at the same hydraulic grade line, matching that of the WTP. The two zones are interconnected in a total of four (4) locations which are metered. The Windsor Low zone is pressure reduced with a HGL of 64.0 m and is bounded by PRVs installed on Clifton Avenue and King Street to lower pressures in the downtown core.

The Windsor/West Hants Industrial Park zone includes a 1,400 m^3 water storage standpipe which is located east of HWY 101. The standpipe was designed to service the existing and future development within the Industrial Park. An altitude valve located on Centennial Drive controls the water level in the standpipe by opening to refill the standpipe when the standpipe elevation is 72.2 m and closes once the level reaches an elevation of 76.2 m. The primary function of the valve is to fill the standpipe; however, the valve can open and back feed to the distribution system if the supply side drops below an HGL of 70.1m. Therefore, the standpipe can act as additional storage on the distribution system, primarily for high demand events.

Generally, the Windsor / TMP system has adequate pressure under various domestic demands. The pressures in the Windsor high zone do exceed 620 kPa (90 psi) but are less than 690 kPa (100 psi). Pressures in the Windsor Low zone fall within 413 – 551 kPa (60 to 80 psi). Pressures adjacent to the Industrial standpipe in the industrial zone are around 276 kPa (40 psi) or lower when the tank is low but are above this pressure when the tank is full, with pressures elsewhere in the industrial zone around 620 kPa (90 psi).

The Windsor Water Utility has included the following transmission and distribution upgrade work as part of the 5 year capital budgeting to fiscal 2024/25. The planned upgrades are attributed to depreciation of the asset and are summarized in Table 8.

Table 8: Transmission and Distribution 5 Year Capital Budget

Project	Budget
Transmission Main Upgrades	
King Street (Town Limits to O'Brien Street	$1,535,100
College Road (King to Manning Street)	$626,440
Distribution System Upgrades (10 Projects)	$2,235,330
TOTAL CAPITAL BUDGET	**$4,396,870**

2.2.4.1 Storage

The WTP acts as the primary water storage for the Windsor High, Low and TMP's zones. Previous studies have noted that there is insufficient storage for both domestic and fire volumes. The CBCL (2013) *Town of Windsor Water Storage Reservoir Study* had previously calculated the required storage volume to be 4,281 m^3. The required storage volumes have been updated to align with 2040 demands (see Table 6) which are summarized in Table 9.

Table 9: Summary of Design Storage Requirements

Volumes	Design
Fire Storage, A (m^3)	1,800
Peak Balancing Storage, B (m^3)	1,463
Emergency, C (m^3)	816
TOTAL STORAGE, S (m^3)	**4,079**

The existing WTP storage is assumed to not contribute to the required distribution storage due to the following:

- The new reservoir will likely operate at different HGLs.
- Should the storage float on the system it will need to be filled in cycles to encourage turnover. Therefore, the WTP (and its storage) will need to be hydraulically isolated from the system when not filling.
- The WTP storage will act as a buffering volume to allow the WTP to continue treating water while not filling the reservoir.

The industrial tank is also assumed not to contribute to the Windsor / TMP zone storage requirements. While it can back-feed when the Windsor High Zone HGL drops, its not clear how this will contribute to the zone. For the purposes of this analysis, the Industrial tank storage will be relied upon as backup or contingency storage for the Windsor / TMP zones.

The CBCL study identified three possible locations for siting the storage:

- Option 1: Dill Road High lands, near Kimball Drive.
- Option 2: Buried Concrete at the WTP.
- Option 3: Downstream of WTP Site.

Option 2 was eliminated in the CBCL (2013) report due to anticipated capital costs associated with buried concrete storage. The tank siting for Option 1 was based on a ground elevation of 50.0 m. The height of the tank is driven by the design TWL which is a function of location and hydraulics. A TWL of 77.0 m was chosen for Option 1. Option 3 was to be situated on high lands with a ground elevation of 68.0 and a TWL of 79.0m with a tank volume matching that of the required storage volume.

As part of this study, CBCL was requested to consider other reservoir siting locations as land acquisitions for Option 1 may be difficult. We have considered alternative locations for Option 1 as follows:

- Option 1A: 176 Tongue Hill, Garlands Crossing.
- Option 1B: Lot 101-A, Garlands Crossing.
- Option 1C: 9 Brightman Avenue, Curry's Corner.

The pertinent details for each option are outlined below and the locations are shown in Figure 2. Ground elevations are taken obtained the 1m digital elevation model from LiDAR obtained from GeoNova. Note the highest ground elevations at the Option 1 Tank location on Dill Road

High Lands near Kimball Dr is 52.7 m. For the purpose of the study, the ground elevation of 50.0 m as identified in the previous report was used.

Option 1A

- The standpipe would be located on private farmlands (PID 45003423).
- ground elevation of 49.5 m
- Assumed 184 m long access road from Hatfield Lane.
- 350 m long standpipe connection to Tongue Hill transmission main.

Option 1B

- Approximate ground elevation of 52.5 m.
- Located in undeveloped private lands (PID 45004348).
- 300 m long standpipe connection to Tongue Hill Transmission Main.
- Assumed 350 m long access rod from Kimbal Drive through private lands (PID 4522242).

Option 1C:

- Approximate Ground elevation is 48.5 m.
- Located in partially developed private lands (PID 45004355). The standpipe would be located adjacent to an existing 250 mm watermain.
- It is assumed that the 420 m long reservoir feed would parallel the existing watermain and connect to the Tongue Hill transmission main.
- Assumed 170 m long access road constructed off Brightman Avenue main through PID 45363355.

Refer to Figure 3 for all 5 of the storage schematics of possible siting options. Note that Options 1A and 1C are drawn at 50.0 m elevation in the figure. Modelling and further analysis for the three alternative options is recommend prior to selecting for the basis of design.

Class D “Order of Magnitude” Opinion of Probable Costs for each option have been prepared and exclude land acquisition costs. The construction cost presented in CBCL (2013) report for Option 1 was updated to reflect recent tank pricing and contingency and engineering was added. Options 1A and 1C have the same ground elevation as Option 1 so the tank cost would be the same. Tank costs are based on AWWA D103 Bolted Steel and have been estimated based on quotes for similar tanks in recent years. The tank estimates assume suitable geotechnical conditions. The CBCL (2013) report noted a risk of gypsum which may make a location not feasible.

Table 10: Windsor Storage Opinion of Probable Costs (2020 Dollars)

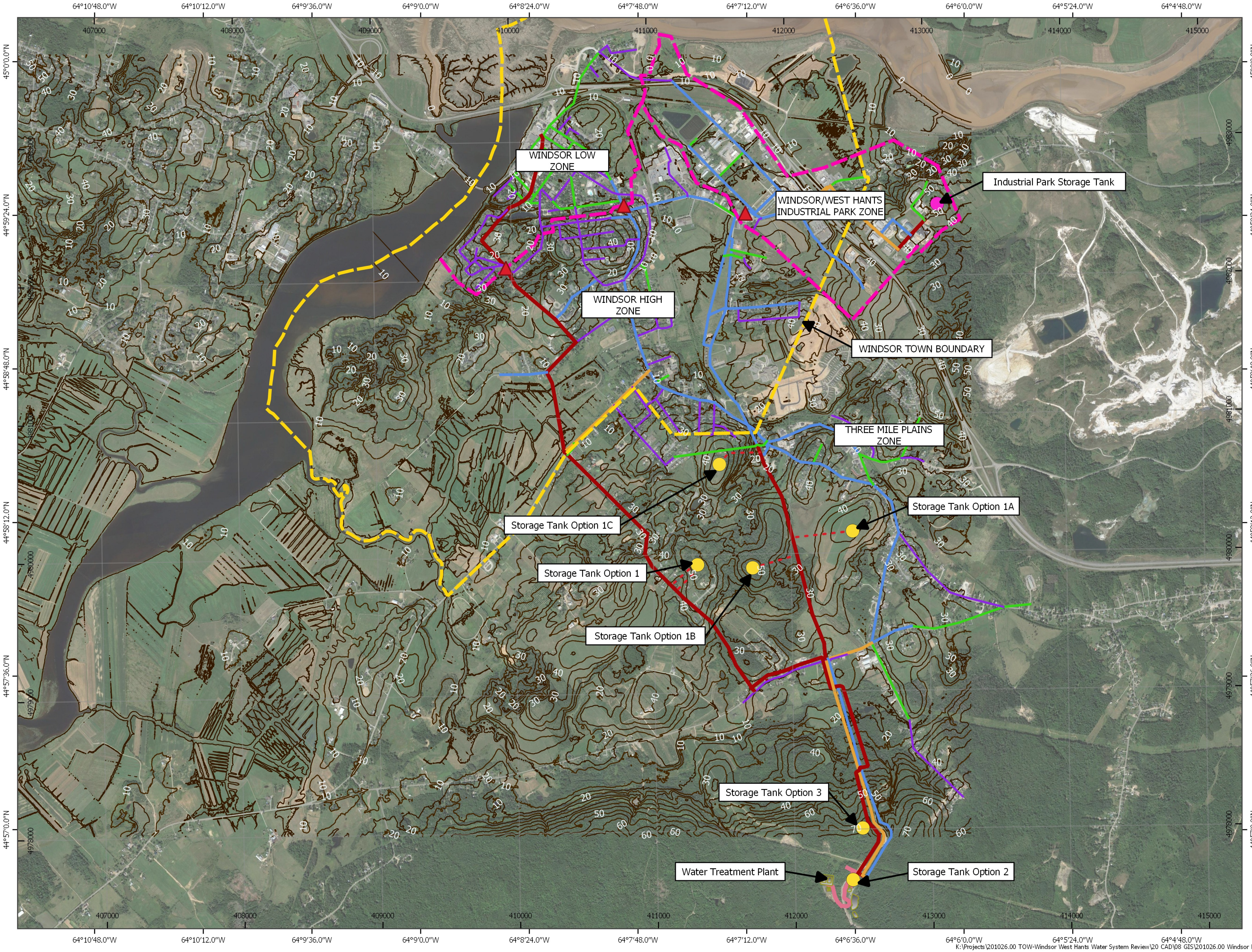
Item	Option 1	Option 1A	Option 1B	Option 1C	Option 3
Tank	$1,880,000	$1,880,000	$1,800,000	$1,880,000	$1,380,000
Inlet Control Chamber	$200,000	$200,000	$200,000	$200,000	$200,000
Piping	$160,000	$210,000	$180,000	$250,000	$30,000
Sitework & Access Rd	$130,000	$100,000	$140,000	$100,000	$50,000
Sub-total	*$2,370,000*	*$2,390,000*	*$2,320,000*	*$2,430,000*	*$1,660,000*
Engineering (12%)	$280,000	$290,000	$280,000	$290,000	$200,000
Contingency (25%)	$590,000	$600,000	$580,000	$610,000	$420,000
TOTAL (excl HST)	**$3,240,000**	**$3,280,000**	**$3,180,000**	**$3,330,000**	**$2,280,000**

Opinions of probable cost are presented on the basis of experience, qualifications, and best judgement. They have been prepared in accordance with acceptable principles and practices. Sudden market trends, non-competitive bidding situations, unforeseen labour and material adjustments, and the like are beyond the control of CBCL, and as such, we cannot warrant or guarantee that actual costs will not vary significantly from the opinion provided.

The Windsor Water Utility has included the required storage tank in the 5 year capital budget. The storage tank capital budget is shown in Table 11.

Table 11: Storage Tank Capital Budget

Project	Budget
Land Purchase (2021/2022)	$113,940
Storage Tank (2022/2023)	$2,193,280
TOTAL CAPITAL BUDGET	**$2,307,220**



LEGEND

Storage Tanks
- Existing Storage Tank
- Storage Tank Options
- PRVs

Water Distribution Pipes
- Pipes to Options
- 18"
- 16"
- 12"
- 10"
- 8"
- 6"
- Zone Boundaries
- Windsor Town Boundary
- 5m Contours

NOTE: Contours from 1 metre digital elevation model dated 2018 from Nova Scotia DataLocator - Elevation Explorer

WWH WINDSOR / WEST HANTS TOGETHER

WINDSOR / WEST HANTS
WATER SYSTEM REVIEW

Figure 3
WINDSOR RESERVOIR SITING OPTIONS

CBCL

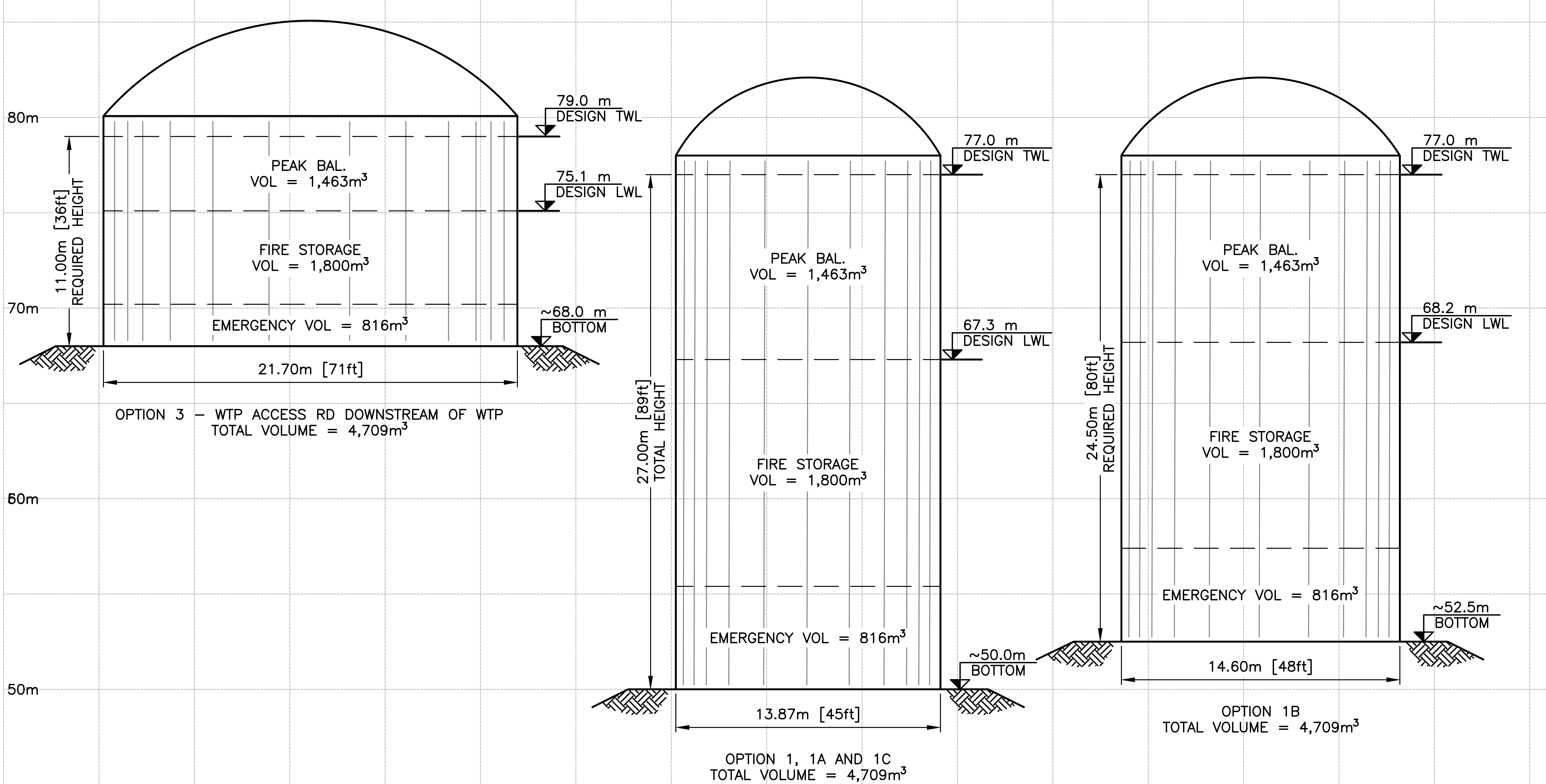
Date: 2021-03-30
Drawn: LM
Checked: JC

0 800 1600 m

CRS: ATS77 MTM Zone 5
Projection: Transverse Mercator
Datum: North American 1983

K:\Projects\201026.00 TOW-Windsor West Hants Water System Review\20 CAD\08 GIS\201026.00 Windsor Reservoir Location Map.qgz 201026.00 Windsor Reservoir Location Map.qgz

DRAWING NAME: K:\PROJECTS\201026.00 TOW-WINDSOR WEST HANTS WATER SYSTEM REVIEW\20 CAD\01 CIVIL\04 DRAWING SHEETS\201026.00.REPORT FIGURES.STORAGE SCHEMATIC.DWG LAYOUT NAME: WINDSOR PLOT DATE:April 25, 2021 11:09:46 PM CAD OPERATOR: JCLAIR



No.	Description

Date	Scale	Designed	Drawn	Checked	Approved	CBCL No.	Contract
MAR 2021	N.T.S.	JC	JC	JC		201026.00	

CBCL

WINDSOR-WEST HANTS
WATER SYSTEM REVIEW

WINDSOR STORAGE SCHEMATIC OPTIONS

FIGURE
3

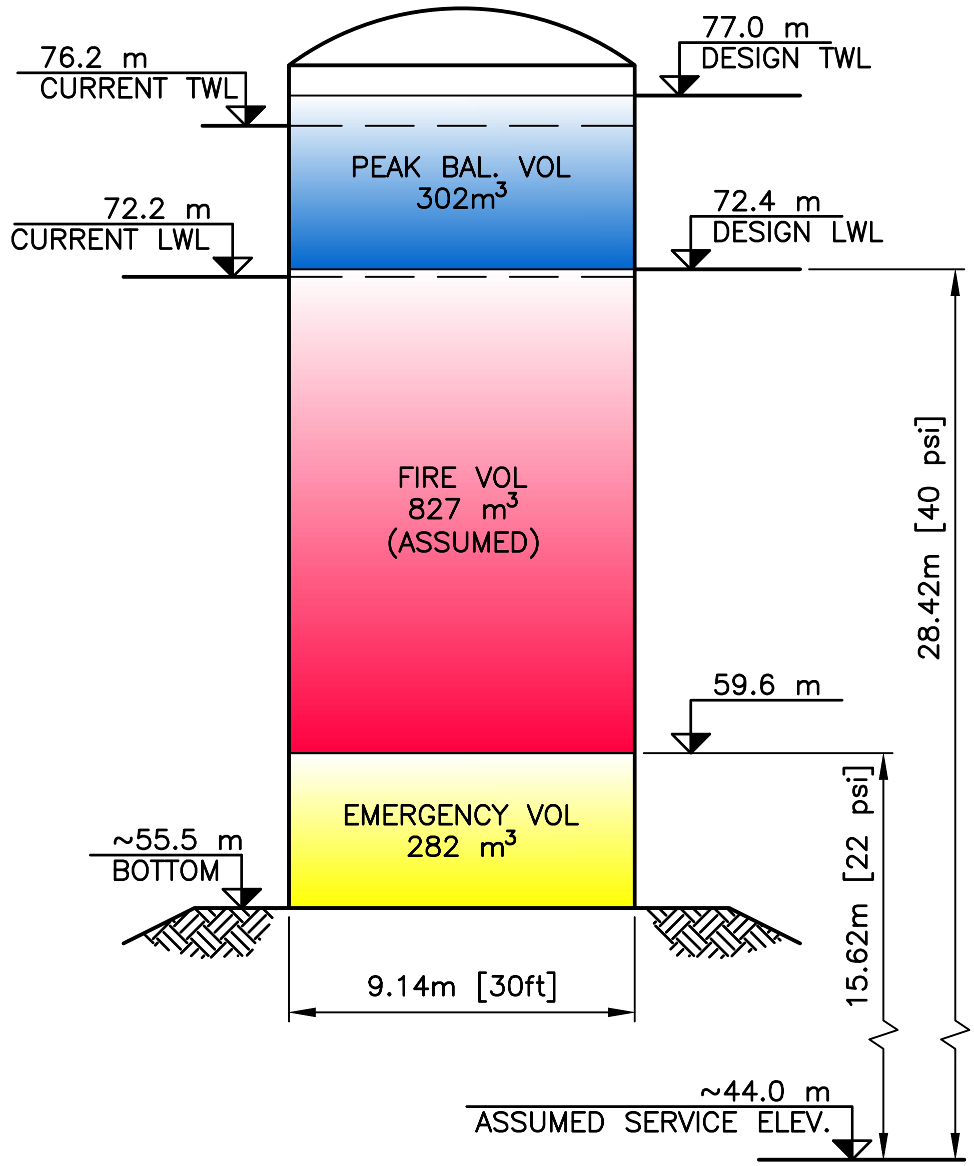
Windsor/West Hants Industrial Tank

The original design storage allocation for the industrial tank is unknown. For the purposes of the study, storages volume allocation has been established based on calculations consistent with the *Atlantic Canada Guidelines*. The CBCL (2013) study noted that the maximum peak balancing volume was likely 302 m^3. The remaining volume was then allocated to both Fire and Emergency volumes to satisfy the storage volume calculation. The resulting storage schematic is shown in Figure 4.

Table 12: Summary of Assumed Storage Allocation for the Industrial Tank

Volumes	Available
Fire Storage, A (m^3)	827
Peak Balancing Storage, B (m^3)	302
Emergency, C (m^3)	282
TOTAL STORAGE, S (m^3)	**1,411**

The calculated peak balancing storage for the Industrial zone to satisfy future demands is 180 m^3 (25% of 718 m^3) and is less then the 302 m^3 available. Fire storage of 827 m^3 equates to 6,900 l/min for a 2-hour duration though actual fire flow capacity is a function of system hydraulics and required fire flows. For the purpose of the report is assumed that the existing fire storage is sufficient, and no additional storage is needed.



No.	Description	No.	Description	No.	Description

Date	Scale	Designed	Drawn	Checked	Approved	CBCL No.	Contract
FEB 5/21	N.T.S.	JC	JC			201026.00	

CBCL

WINDSOR-WEST HANTS
WATER SYSTEM REVIEW

WINDSOR-WEST HANTS INDUSTRIAL PARK
STANDPIPE SCHEMATIC

FIGURE

DRAWING NAME: K:\PROJECTS\201026.00 TOW-WINDSOR WEST HANTS WATER SYSTEM REVIEW\20 CAD\01 CIVIL\04 DRAWING SHEETS\201026.00.REPORT FIGURES.STORAGE SCHEMATIC.DWG LAYOUT NAME: INDUSTRIAL PLOT DATE:February 5, 2021 3:13:54 PM CAD OPERATOR: JCLAIR

Chapter 3 Combined System

3.1 Viability of a Combined System

A number of significant projects have been identified for both the Falmouth and Windsor systems going forward. Most have been previously studied, and concepts and costs have been developed. Addressing the filter redundancy issues at the Falmouth plant has been identified in the Dillion (2013) *Falmouth Water System Assessment Report* but not costed. Generally, the major projects identified for each system include:

Windsor

- New treatment train at the Water Treatment Plant.
- Upgrades to the withdrawal structure at Mill Lakes and dam safety upgrades.
- New storage reservoir.

Falmouth

- Dam upgrades to increase withdrawal capacity for the French Mill Brook Impoundment.
- Address filter redundancy issues at Falmouth Plant.

The concept of a combined system, i.e., a system where the Windsor plant would treat water conveyed to the Falmouth system, would defer or eliminate the two major projects identified for the Falmouth system. The remaining Windsor system related projects must proceed regardless of interconnection. Additional infrastructure required to connect the two systems would offset the savings associated with deferring or eliminating the major Falmouth projects. This is discussed in more detail below.

While combining the two systems may generally be seen as a greater benefit to the Falmouth system than the Windsor system, as the potential for growth in Falmouth versus available WTP capacity is relatively limited, there are benefits to both systems. Connecting the two systems (and creating one larger system) would allow the FWTP to operate at lower than the current operating flowrate and still provide a net contribution to the Windsor distribution system of 0.26 MLD (based on 2020 Falmouth demand). The reduced operating flow would be expected to improve the FWTP performance in terms of water quality and efficiency, and generally the FWTP process would benefit from constant operation at a fixed flowrate. A contribution of 0.26 MLD would reduce the Windsor WTP production needs by 8.5% based on current demands; the net contribution from the FWTP will decrease over time with growing demand from the Falmouth system, until the FWTP production is less than the Falmouth ADD at which time the Windsor system will provide a net contribution to Falmouth. At the current projected Falmouth demand growth this is expected to occur in approximately 12 years. A summary of the current and future demands from the Windsor, Falmouth and combined systems, along with the balance of flow between the two systems based on ADDs, is presented below in Table 13.

Table 13: Combined System Flow Balancing Table

Scenario	Windsor	Falmouth	Combined	Windsor to Falmouth Net Flow (m^3)	
				(FWTP @ 1.0 MLD)	(FWTP @ 2.2 MLD)
Current ADD (MLD)	3.38	0.74	4.12	-0.26	-1.46
Current MDD (MLD)	5.29	1.40	6.69	0.40	-0.80
5-Year Projection					
Population	3,834	1,793	5,627	-	-
Future ADD (MLD)	3.55	0.84	4.39	-0.16	-1.36
Future MDD (MLD)	5.56	1.58	7.15	0.58	-0.62
20-Year Projection					
Population	4,451	2,597	7,048	-	-
Future ADD (MLD)	4.13	1.22	5.34	0.22	-0.99
Future MDD (MLD)	6.46	2.39	8.85	1.39	0.19
Available Average WTP Flow (MLD)	5.40	1.00	6.40		
Maximum Available Daily WTP Flow (MLD)	6.80	2.20	9.00		

3.2 Windsor-Falmouth Interconnection

A hydraulic analysis was undertaken to determine suitability of two interconnecting options. The analysis was based the Windsor Distribution system supply all Falmouth demands. An example being when the Falmouth WTP is not available.

- Option A – Gravity Connection from Windsor High to Falmouth.
- Option B – Pump Connection from Windsor Low to Falmouth.

The analysis was based on supplying all storage tanks in the combined system to TWL under a MDD scenario. Interconnection of the two systems may be expected to improve the available fire flows to some degree, but not substantially as the flows will still come primarily from the existing storage reservoirs. For this analysis fire flows have not been considered.

Under future conditions with Falmouth demand added to the Windsor distribution system, the Industrial Park Tank would not fill to TWL. It is assumed for the purpose of this study that this result is due to model assumptions, rather than real world conditions. Therefore, further study is necessary to verify that the system operate as designed.

For this analysis we have assumed a single piped connection between the systems. Best practices would be for an additional connection for redundancy.

Option A

A 2,500 m long, 300 mm diameter pipe was modelled to interconnect Falmouth and Windsor High upstream of the Clifton Avenue PRV station. The interconnecting pipe was routed through the Haliburton House lands to Lakeview Drive heading northeast to Cedar St turning northwest to Highway 1. The pipe would cross the Avon River via the existing bridge and continue to Highway 1 terminating at the intersection with Falmouth Back Road.

This option is not considered viable due to:

- The Windsor WTP operates at a lower HGL than the TWL of the Falmouth Tank, therefore, it is not possible to fill the tank to design TWL by gravity. With the construction of new storage in Windsor, the HGL will fluctuate more than the WTP.
- Under an MDD scenario, the Falmouth Tank HGL is falls into fire storage volume and is not an acceptable level of service.

Option B

This option consists of an ~800 m long 200 mm diameter interconnecting pipe between the Windsor Low zone and Falmouth. The pipe is assumed to connect to the Windsor Low Zone at the intersection of Alberta Street continuing along Highway 1 across the Avon River and connecting to the existing 150 mm diameter pipe in Falmouth. A pump station will be required to boost pressures from the Windsor Low zone to supply the Falmouth tank to TWL. The pump station can be located on either the Falmouth or Windsor side of the Avon River.

The HGL within the Windsor Low zone will be negligibly affected by the additional demand from the Falmouth system. This interconnection option appears to be viable, However, the following should be considered:

- The velocities through existing 150 mm diameter pipe on Highway 1 in Falmouth are acceptable under future demands (~1.5 m/s). However, the pressures in the pipe are modelled to increase when the pump is running. The age and condition of this pipe and its ability to handle higher (and cyclical) pressures are unknown. Replacement, or twinning, of this main may be warranted. Its possible that this can be deferred to a later date provided flows are reduced and the Falmouth tank is operated at HGLs lower than design. Additional study is warranted as replacement of the piping is a large capital expense.
- Under MDD demands with both Windsor PRVs stations available, the model predicts that flow through the smaller PRVs falls within available capacity. However, should one of the PRV's become unavailable, flow will exceed the capacity of the one available smaller PRVs, however, the larger PRV may open to supplement at a reduced pressure.
- Coordination with NSTIR will be required to obtain permission to attach a watermain to the existing bridge. We also note that the bridge is curved which will require attention to watermain selection and deflection capabilities during design.

In a reverse flow scenario, Falmouth would supply the Windsor Low zone and a PRV will be required to reduce pressures. Consideration will need to be made with regards to the Windsor Low Zone demands and intended flow from Falmouth.

Class D "Order of Magnitude" Opinion of Probable Costs for the interconnection are summarized in Table 14. A provisional cost for main replacement on Evangeline Trail from the point of interconnection to the intersection with Falmouth back Road has been included. Land acquisition costs are excluded. Other locations for the station could be reviewed once project planning is undertaken.

Table 14: Windsor/Falmouth Interconnection Probable Costs (2020 Dollars)

Item	Option 2
Pipe c/w Reinstatement	$444,000
Pipe on Avon River Bridge	$483,000
Booster Pump / PRV Station	$460,000
Sub-total	*$1,388,000*
Engineering (15%)	$208,000
Contingency (30%)	$416,000
TOTAL (excl HST)	**$2,012,000**
PROVISIONAL 1km Evangeline Trail Main Replacement	**$1,240,000**

Opinions of probable cost are presented on the basis of experience, qualifications, and best judgement. They have been prepared in accordance with acceptable principles and practices. Sudden market trends, non-competitive bidding situations, unforeseen labour and material adjustments, and the like are beyond the control of CBCL, and as such, we cannot warrant or guarantee that actual costs will not vary significantly from the opinion provided.

3.3 Combined System – Discussion and Recommendation

The Falmouth WTP in its current condition appears to require some investment related to asset renewal and process upgrades to improve reliability, monitoring and control. Many of these upgrades may be considered a low priority and deferred for a number of years. If the Windsor and Falmouth systems are interconnected there is no short-term need to increase the FWTP capacity, and therefore several major capital projects that may otherwise be required can be deferred for some time. As outlined previously, these include a dam upgrade and addition of a third filter unit and/or second clarifier, which would require a building expansion. These upgrades together will cost significantly more than the cost of connecting the Falmouth distribution system to Windsor, which is fed from a much larger treatment facility.

With exception of small renewal and minor upgrades (chemical storage and feed system replacements, geotubes, PLC replacement, watershed maintenance, etc.) the cost of continuing to operate the FWTP is limited to O&M costs (power, labour, chemicals, and maintenance). Idling the facility and reducing maintenance input as a backup system would further reduce these costs – however, some portion of these savings would be offset by additional costs at the Windsor WTP (e.g. increased chemical usage and power costs).

While the Windsor WTP could meet the total flow requirements from a combined system currently, a contribution to the combined system from the Falmouth WTP in a combined MDD scenario is projected to be required within a relatively short timeframe (i.e. within 5 years – see Table 13). Therefore, shutting down the Falmouth WTP based on current demands may result in the need to reopen the plant within this timeframe. Continuing to utilize the facility in the interim is advisable from a practical perspective, as well as technical where ‘hibernating’ the facility for several years may result in more significant and costly problems becoming apparent upon restart.

Based on the forgoing it would appear to be the correct decision fiscally to combine the two systems as projects that are deferred result in greater savings than the connection costs. Additionally, and significantly, it would also result in a system that is better able to respond to planned shutdowns, maintenance procedures and emergencies. However, maintaining the Falmouth as operational also appears to be warranted.

The additional flow required from the Windsor WTP in the long term, as Windsor begins to make a net contribution to the Falmouth demands, would place some additional stress on the ability of the Windsor source to provide the required maintenance flows under all conditions. Though it is expected that improvements to the discharge structure will address this to some degree, the extent to which this will be a complete long-term solution to this issue is unknown currently.

The Falmouth plant represents a significant asset that for the most part reliably produces water of acceptable quality. In addition, future flows of a combined system exceed the rated capacity of the Windsor plant. For these reasons we have considered the option of maintaining the Falmouth plant at a lower fixed flow.

3.3.1 Maintaining FWTP Operation Indefinitely at Reduced Rated Capacity

Reduced flow requirements from the Falmouth system and connection to the Windsor system for supply of peak or higher flows would alleviate both the need to increase the capacity of the source and the need for filter redundancy for the Falmouth plant. The FWTP normal operating mode is to produce a fixed flow of approximately 900 L/min (1.3 MLD). This exceeds the allowable average withdrawal from the source water; therefore, in these terms the FWTP is oversized. While the interconnection would provide excess flows to Falmouth in a Falmouth MDD scenario, under all scenarios the FWTP production rate could be reduced to a fixed 1.0 MLD of raw water withdrawal, equalling the maximum average daily withdrawal allowable under the NSE withdrawal approval. This is summarized above in Table 13.

Reducing the rated capacity of the Falmouth plant should allow the plant to meet the filter redundancy requirements as a stand-alone facility. This would result in filtration rates within the original design (750 L/min/filter = 1MLD/filter). Ultimately, with the creation of a combined system with two treatment plants, we would anticipate that NSE should treat the two WTPs as one system, with an 'n-1' rated capacity which will equal the total current capacity of the two plants if a 3rd train is added to the Windsor WTP.

As the current plant operating flow of 900 L/min is currently divided between two filters, some additional investigation on operating each filter at its design maximum loading rate is warranted to establish a practical maximum capacity of the facility with one or both filters in service. As the demand from the combined system grows over the 20 year horizon, the need to operate the Falmouth WTP at higher rates to meet combined MDDs above the capacity of the "Windsor WTP (6.8 MLD) + 1 MLD = 7.8 MLD" will become more pronounced, particularly in the 10-20 year timeframe.

3.3.2 Combined System Water Quality Considerations

The source water quality for the FWTP and WWTP has some minor differences in terms of average organic content, turbidity and metals concentrations; however, these values have broad overlap and the filtered water quality produced at each facility is substantively equal. This is not surprising, as the watersheds feeding each facility are separated by less than 10 kilometers and each facility employs conventional treatment processes. The CBCL (2019) *Windsor/Falmouth Interconnection Pre-Design Study* noted, however, that the treatment process in place in Windsor utilizes a polyphosphate blended product for corrosion control/sequestration in filtered water, where the Falmouth system adds no phosphate. This is the most significant difference in water quality between the two distribution systems. Introducing polyphosphate to the Falmouth distribution system after interconnection could potentially result in significant release of long-established corrosion by-products from pipe interior walls, resulting in aesthetic water quality impacts and, more significantly, high levels of lead and copper. Setting aside the determination of long-term need and potential benefit of polyphosphate addition in Windsor, the introduction of polyphosphate to Falmouth's distribution system likely represents an unacceptable risk from a water quality perspective. At the same time, removing the blended phosphate from the Windsor supply without substitution may also result in negative aesthetic or health-based water quality issues in the Windsor system.

Corrosion in distribution systems as a result of significant water quality changes, or blending of various sources, is a well documented issue. The West Hants utility must ensure that if a combined approach is taken that finished water quality in both systems is comparable for the water quality indexes most important for corrosion control – namely pH, alkalinity, dissolved oxygen, phosphate-based additives and free chlorine residual. Potential mitigation of these impacts may include substitution of the polyphosphate addition in Windsor with an orthophosphate chemical, with or without the addition of pre-treatment manganese oxidant in Windsor to reduce finished water iron and manganese as needed. Addition of orthophosphate in Falmouth, and adjustment of finished water quality chemistry in both systems to align as closely as possible, should be considered well in advance of interconnection.

3.4 Summary – Key Points

The amalgamation of Windsor and West Hants allows for long term infrastructure planning for the water systems. Based on the analysis presented herein connection of the two systems appears warranted. The Falmouth system particularly will require changes to meet the increased flows that population increase will bring. Some key points identified in the study are noted below:

- Several projects have been identified for the Windsor system and must be carried out regardless of whether the systems are eventually combined. These include the addition of the 3rd treatment train and associated upgrades, a new reservoir and upgrades to the Mill Lakes outlet system.

- For continued separate system operation the Falmouth system will require both upgrades to the source (dam) and treatment plant to meet the expected capacity requirements for the 2040 horizon. The dam upgrades will be required within the next 10 years.
- For Combined system operation the Windsor plant alone (even with the 3rd train installed) cannot meet the 2040 flow requirements. However, the future flows can be met with the combined name plate capacities of the two treatment plants.
- For a combined system, a piped connection and a booster station are required to allow the Windsor system to provide the necessary pressures in the Falmouth system.
- A combined system would significantly enhance the ability to deal with planned shutdowns or respond to emergencies.
- The estimated costs of the infrastructure required to connect the systems (pipeline and booster station) is less than the costs estimated for the upgrades to the Falmouth system (dam and plant improvements) should the systems remain separate.

3.5 Towards a Regional System

In carrying out this project we briefly discussed the possibility of Davidson Lake (Hantsport system) connecting into a combined system. The routing and costs of such a connection are beyond the scope of this study. However, we are aware that the yield study carried out on Davidson Lake indicated that it was a marginal supply with respect to capacity. It is therefore striking that each of the 3 sources for the 3 systems under operation by the municipality have capacity issues. Development of additional water resources for the municipality may eventually be warranted. Residential development pressures in the area are also expected to increase as 100 Series highway twinning in the area is completed. The municipality has already been approached regarding significant residential developments in Falmouth and Hants Border.

With the closing of Minas Basin Pulp and Paper the Halfway River system, which was used as a supply for the mill, may have available capacity. We are also aware that many years ago Hantsport developed wells in the vicinity of the abandoned open reservoir to augment the supply from Davidson Lake. However, these wells were abandoned due to iron and manganese issues.

Longer term interconnection of the systems combined with additional water resources could greatly increase the security of supply for all 3 systems.

3.6 Phasing

Numerous projects have been identified and referenced in this report for the two systems. We have provided a general outline for phasing of the major projects below based on the recommendation for a combined system.

High Priority (2021 – 2023)

- 3rd treatment train at Windsor plant.
- Mill Lakes Watershed upgrades.
- New reservoir in Windsor system.

Medium Priority (2023-2024)

- Windsor- Falmouth Interconnection and booster station.
- Regional Long Term Water Supply Investigation.

Longer Term (2025 and Beyond)

- Falmouth Plant upgrades.
- Additional water source development.

Prepared by:
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WEST HANTS REGIONAL MUNICIPALITY REPORT

Information ☐	Recommendation ☑	Decision Request ☐	Councillor Activity ☐

To: Committee of the Whole

Submitted by: ____
Todd Richard

Date: October 12, 2021

Subject: Windsor Water Storage Expansion

LEGISLATIVE AUTHORITY

Nova Scotia Municipal Government Act, Section 65 authorizes Council to expend funds for municipal purposes.

RECOMMENDATION or DECISION REQUEST

It is recommended for Committee of the Whole to recommend to Council that:

Council approve the award of tender WWHPW21-13 for engineering and design work for the Windsor Water Storage Expansion to the low compliant bidder, CBCL Limited, for the tendered price of $139,200 plus applicable taxes.

BACKGROUND

Property	Public Opinion	Environment	Social	Economic	Councillor Activity
☑	☐	☐	☐	☐	☐

Public Works intends to construct a second water storage standpipe or tank, with all necessary controls and water transmission mains to accommodate the new storage facility. Final site location has not yet been determined and will require additional land feasibility discussion with potential property owners prior to making a final selection.

In April 2021, the feasibility study for this proposed project was completed by CBCL.

In September 2021, Public Works requested proposals from pre-qualified engineering consultants to support this project from design through final construction.

1. Provide engineering and design services to meet all water treatment, storage and distribution standards;
2. Include hydrology and engineering review to meet plant withdraw limit permits and meet DFO regulations;
3. Include environmental planning and permitting required for the execution of all work;
4. Include transportation (NSTAT) planning and permitting required for the execution of all work;
5. Include quality control field and laboratory testing services; and
6. Include overall project management, construction site monitoring and providing final close-out report.

DISCUSSION

The design contract provides for the engagement of a pre-qualified professional engineering consultant to support the project from design through final construction. Inspection services during the key phases of construction will be carried out by the engineering consultant, with available support of municipal staff.

Request is for pricing and proposal to provide the following:

- Initial site visits to evaluate the site conditions and existing infrastructure;
- Start-up meeting with municipal staff to review the project and confirm the consultants understanding of the project;
- Obtain and submit any required approvals and/or permits for necessary work;
- Preliminary design to include 50% design;
- Detailed design will include advancing the 50% design based on discussions with municipal staff and comments during the preliminary design review;
- 95% review for comments and a “Class A” cost estimate c/w detailed quantity take off;
- 100% design package for Tender;
- Tender package to include contract documents, design drawings and technical specifications based on applicable municipal and provincial Municipal Standard Specifications;
- Review of all tenders submitted together with all accompanying documentation along with written recommendation letter to municipality to support award of tender;
- Approval of shop drawings;
- Inspection support during keys phases of construction;
- Review and final approval of project close-out documents; and

- Issuance of record drawings.

The intent is to proceed with Option 1, 1A, 1B or 1C as identified by CBCL in the April 2021 report, with a new reservoir acting as supplemental volume when the Windsor WTP is not capable of meeting distribution demands directly from the plant.

The municipality would like to be prepared to call for tenders for a spring/summer construction start, with project completion within the 2022/23 fiscal period. Design and tender documents are to be prepared by the successful consultant in accordance with the latest edition of the Municipal Standard Specifications.

On September 2, 2021 staff issued a Invitation for Proposal (RFP) for Design Services for this project to CBCL Limited based on their vast in-depth knowledge and experience with design/construction of the Windsor water distribution system. This bid closed on October 1, 2021. The proposal was evaluated for completeness and technical ability to execute the scope of work.

• Engineering and Design	$ 108,100.
• Construction Services	$ 31,100.
Total Proposal Cost:	**$ 139,200.**

CBCL was deemed to be the low compliant bidder and has substantial previous experience and qualification with the Windsor Water Utility distribution system; as such has been recommended to Council for award of this contract.

If Council chooses not to proceed the construction of the additional reservoir in the next (2022/23) fiscal budget, then the Construction Services portion of the proposal would then be reduced by $31,100. This portion of the proposal will only apply following coordination of the construction portion of this proposed project.

NEXT STEPS

Pending approval of Council; staff will award formal contract to CBCL to proceed with engineering and design work in accordance with their proposal.

FINANCIAL IMPLICATIONS

Council has previously approved $140,000 in the 2021/22 capital budget for the Windsor Water Storage Tank Facility or Windsor/Falmouth Water Interconnection Design. This budget figure includes allowance for the engineering and design contract for the proposed water storage expansion only.

The total cost to the Water Utility for the design work will be $145,171.68, to come from the Windsor Water Utility depreciation reserve. There is capacity within the Windsor Water Utility depreciation reserve to offset the additional draw of $5,171.68. The Windsor Water Utility depreciation reserve was projected on March 31, 2022, to have a balance of $2,540,290.

The construction of the new water tank facility is budgeted in 2022-23, at an estimated $3,000,000 of which 30% is estimated to come from depreciation reserve and 70% from long term debt. Water Utility borrowing does not impact the debt ratio of the Municipality. This project would be contingent on Council's approval of the 2022-23 Capital Budget, and the Nova Scotia Utility and Review Board.

ALTERNATIVES

1. Council may choose to not to proceed with this capital project.

ATTACHMENTS

None

CHIEF ADMINISTRATIVE OFFICER REVIEW

The report is in keeping with the discussions by the Director at the time the 2021/22 budget was approved and in support of the ongoing strategy to protect and expand the water capacity for the Region.

There is protection provided to the municipality that the full payment or contract will not be awarded should the construction project phase not be approved by Council during future budget deliberations.

I support the recommendation.

Report Prepared by: ____
Brad Carrigan, P.Eng., Capital Projects Engineer

Report Reviewed by: ____
Todd Richard, Director of Public Works

Report Approved by: ____
Mark Phillips, Chief Administrative Officer