City of Winnipeg
Water and Waste Department

Combined Sewer Overflow Management Study

PHASE 3 Technical Memoranda

Appendix No. 1

COST ESTIMATES

April 1999
0510-A-38

Internal Document by:

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In Association With:

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1. INTRODUCTION

The following tables and the associated descriptions comprise the bases for the cost estimates used in development the conceptual costs of the various control alternatives discussed in the Phase 3 TM No. 2, "*Control Alternatives*".

The estimates have been organized more or less in the order in which they appear in TM No. 1. The main exception to this approach is the costing for the interceptor modifications. These have been dealt with along with the cost estimates for the tunnel options. The costs for the basic NEWPCC upgrade alternatives were taken from the CG&S "*Report for the Combined Sewer Overflow Control Study – Impacts on the North End WPCC*". The latter document has been included as a separate appendix to the Phase 3 documents.

2. IN-LINE STORAGE COST ESTIMATES

2.1 FIXED FINGER WEIR

The bases for the cost estimates of the finger weir option are provide on Table 5-7 of TM No. 1. This table has been included herein for convenience.

2.2 AUTOMATIC GATE

The conceptual cost estimate for the automatic gate option for in-line control is provided on Table 2-1 (attached). This was based on the preliminary cost estimate for the Clifton pilot and is also based on the construction of a new facility with a new sluice gate. The approach taken would be conservative in that it may be possible to modify existing sluice gate facilities and thereby save money.

Table 5-7 (from TM#1)
IN-LINE STORAGE
BASE COST ESTIMATE
HART SURROGATE
(single unit costs)

EXCAVATION/BACKFILL	$ 45K
SHORING	$265
REINFORCED CONCRETE	$360
Sub Total	$670
MISC. (including gates)- 25%	$170
	$840
OH & PROFIT - 15%	$130
TOTAL CONCEPTUAL DESIGN COST	$970K
+ ALLOWANCES (20% est'g + 20%EAF)	$1.4M

OVERSIZED UNITS
(six tenths rule)

1.5*SINGLE UNIT	$1.8M
2*SINGLE UNIT	$2.1M
3*SINGLE UNIT	$2.7M

ALLOWANCE - OUTLETS W/O INLINE STORAGE
$300K*1.44 = $530K

INLNWIR.wpd

AUTOMATIC GATE
CONCEPTUAL COST ESTIMATE
(BASED ON CLIFTON PILOT PRELIMINARY ESTIMATE)

ITEM	$K
Concrete/rebar/sheeting/shoring Assume a new structure	135
Miscellaneous metal: hatches, ladder rungs anchors, supports etc.	10
Superstructure self-framing building	20
Restoration	10
Heating and hoarding	10
Electrical	20
Mechanical	20
Instrumentation	40
Sluice gate	55
+ 10% allowance for ancillaries	30
TOTAL ESTIMATED BASE COST	**$350K**
PLUS 20% ESTIMATING CONTING. = AND 20% E,A,F	**$500K**

TABLE 2-1

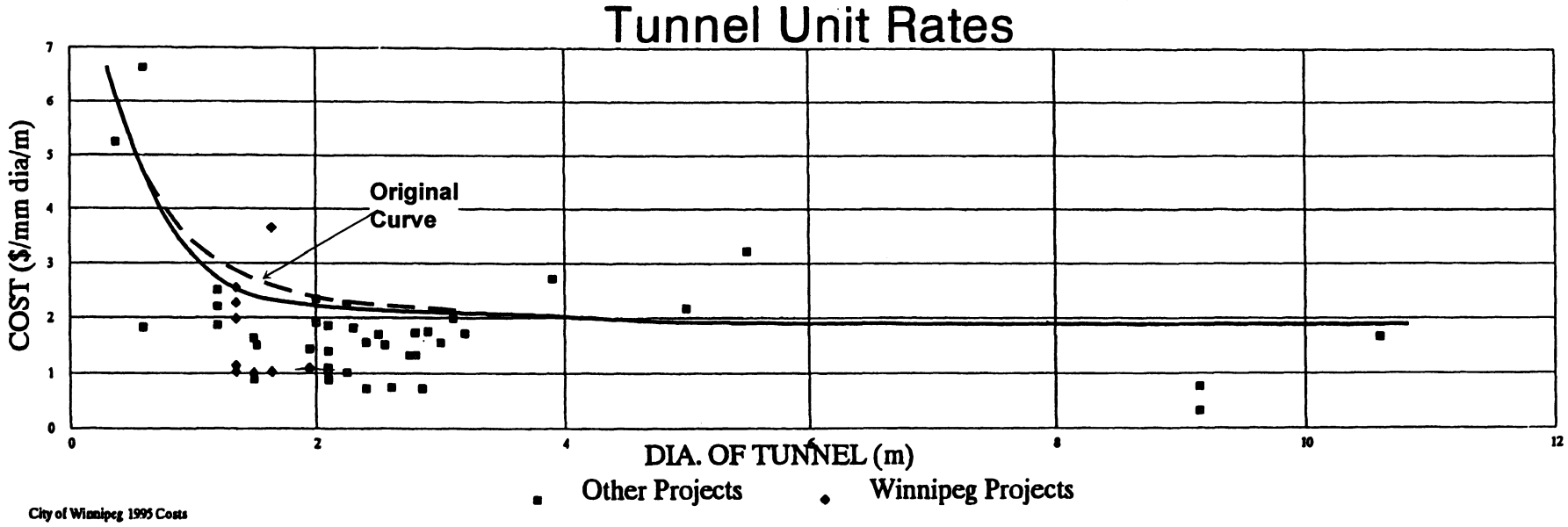
July 8, 1998

3. REGIONAL TUNNEL COSTS

3.1 REVISED TUNNEL COSTS

The costs used in the Phase 3 TM No. 1, for the regional tunnels, were provided on Table 5-22a of the TM. The basis for these costs was provided in Section 5.4.5, "*Costing*". As indicated, the original cost estimate had been carried out on the basis that a certain reach of the tunnels would be undertaken in mixed face and, accordingly, the unit rates were increased by 50% to allow for the increased difficulties. This approach was used for all of the regional tunnels in the Phase 3 TM No. 1, for the 1992 Representative Year. All other estimates, however, had not included this surcharge. Accordingly, in order to develop a standard approach for all tunnel costs in the Phase 3 control alternatives, the basic approach to costing was modified subsequent to the Phase 3 Workshop. The new approach, insofar as the applied unit rates are concerned, comprised the application of the basic CG&S unit rates plus a 10% surcharge to all tunnel sizes. This did not have a major impact on the costs used for Representative Year options, as can be seen by a comparison between the two tables. It did, however, provide a basis for calculating the costs of other tunnel options which used a similar rationale and therefore were comparable.

In addition to modifying the approach to estimating the tunnel costs, the base costs were modified slightly. The costs used in the Phase 3 TM No. 1 were based on a curve prepared by CG&S for Phase 2 of the study. During the course of the Phase 3 investigations, it was believed by local consultant staff that the rates used for the smaller diameter tunnels were too high. Prior to the Phase 3 Workshop a significantly lower curve was used for tunnels 2 m in diameter and less. Subsequent to the workshop this approach was reviewed, and it was felt that a modification to the original CG&S curve would be more appropriate and should not be as low as that used for Phase 3. The reasons for this decision were, again, so that all tunnels would be costed on the same basis and therefore would be comparable. The revised curve is provided in Figure 3-1. Inspection will indicate that the modification to the curve (as compared to that of Figure 5-25 of the Phase 3 TM) is only modest. It does represent a substantial increase as compared to the curve used to estimate interceptor costs as shown on Figure 4-7 of the TM.



Revised Tunnel Unit Rates
Figure 3-1
(Appendix __)

tunirate
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As noted in Section 5.3.3.3 of TM No. 1, "*Operational Considerations*", a means of flushing the shorter lengths of sewer which would not be dewatered at a flow required to generate self-cleaning, would require a flushing system. CG&S has developed such a system, in concept, for the City of Toronto combined sewer storage tunnel. For costing purposes, the geometry of the City of Toronto system was applied to various tunnel diameters, as shown on Table 3-2 (attached). The dewatering shaft cost was based on tunnel cost. The allowance for ancillaries associated with the system comprised a 20% allowance. The flushing tanks were costed on the basis of the CG&S storage tank curves.

Section 3.3.2 provides the summary of tunnel costs for 0 and 1 overflows for the long-term and for the interceptor relief piping. Section 3.3 provides the background for the revised interceptor costs. Section 3.4 provides the background for the costs of the regional tunnel for the 1992 Representative Year, as summarized on Table 3-1.

3.2 TUNNEL COSTS FOR 0 AND 1 OVERFLOWS

The tunnel costs for 0 and 1 overflows for the long-term scenarios are provided in Table 3-3. The only significant change from the costs provided in the TM No. 1 is the 10% additional allowance applied to the budget costs for the tunnels. The unit costs were taken from the CG&S curve as revised (Figure 3-1). All other components of the cost are as discussed in TM No. 1.

3.3 INTERCEPTOR COSTS

The revised cost estimates for the interceptor relief piping is provided in Figure 3-4. In this case, the 10% additional multiplier for tunnel ancillaries and pumping was not included as part of the overall multiplier, since the tunnel would be installed at the same level as the existing interceptor and would tie into the existing pumping station. As can be seen, the cost increases the interceptor upgrade cost by about 50%. This is certainly significant, but does not have a major impact on the costs associated with the overall programs.

Table 3-1: REGIONAL TUNNEL - COST SUMMARY

1992 REPRESENTATIVE YEAR

	WITH IN-LINE STORAGE			WITHOUT IN-LINE STORAGE		
DEWTR RATE	600 ML/d	825 ML/d	1060 ML/d	600 ML/d	825 ML/d	1060 ML/d
0 OVRFLOWS	$M	$M	$M	$M	$M	$M
STRGE VOL.	820,000 m^3	610,000 m^3	530,000 m^3	820,000 m^3	610,000 m^3	530,000 m^3
BASE COST*	556	465	399	661	600	532
FLO CNTROL				12	12	12
IN-LN STRGE	100	100	100			
FLUSHING	33	28	22	39	36	32
NEWPCC	15	36	70	15	36	70
TOTAL 0 O/F	$704M	$629M	$592	$727M	$684M	$646M
4 OVRFLOWS	$M	$M	$M	$M	$M	$M
STRGE VOL.	300,000 m^3	220,000 m^3	185,000 m^3	300,000 m^3	220,000 m^3	185,000 m^3
BASE COST*	261	237	237	436	393	365
FLO CNTROL				12	12	12
IN-LN STRGE	100	100	100			
FLUSHING	16	14	16	24	23	20
NEWPCC	15	36	70	15	36	70
TOTAL 4 O/F	$391M	$387M	$421M	$488M	$464M	$468M

* BASE COSTS INCLUDE MULTIPLIERS

regcost.wpd

TUNNEL FLUSHING SYSTEM - CONCEPTUAL DESIGN AND COSTING

	TUNNEL DIA m	TUNNEL AREA m²	FLUSHING Q m³/s	FLUSHING VEL. m/s	a/A	a m²	d/D	FLUSHING DURATION seconds	FLUSHING VOLUME m³	SUMP VOLUME m³	SUMP DIAM. m	SUMP DEPTH m	DEWATER SHAFT DEPTH m	DEWATER SHAFT COST $M	ANCILL.+ CONTING. *1.2*1.44 $M	+FM ($200K)	FLUSHING TANK BASE$ $M	FLUSHING TANK 1.44*BASE$ $M	TOTAL FLUSHING COST $/2000m
TORONTO EXAMPLE	5.0	19.6	3.0	1.0	0.15	3.01	0.2	180	540	400	14	2.6							
WINNIPEG EQUIVALENTS																			
	1.5	1.8	0.3	1.0	0.15	0.27			48	35	6	1.2	31	$0.4	$0.6	$0.8	$0.2	$0.3	$1.1
	1.6	2.0	0.3	1.0	0.15	0.30			54	40	7	1.2	31	$0.4	$0.7	$0.9	$0.2	$0.3	$1.2
	1.7	2.3	0.3	1.0	0.15	0.34			61	45	7	1.3	31	$0.4	$0.7	$0.9	$0.2	$0.3	$1.2
	1.9	2.8	0.4	1.0	0.15	0.43			77	57	7	1.3	31	$0.4	$0.8	$1.0	$0.2	$0.4	$1.3
	2.0	3.1	0.5	1.0	0.15	0.47			85	63	8	1.4	31	$0.5	$0.8	$1.0	$0.3	$0.4	$1.4
	2.1	3.5	0.5	1.0	0.15	0.52			94	69	8	1.4	32	$0.5	$0.8	$1.0	$0.3	$0.4	$1.4
	2.2	3.8	0.6	1.0	0.15	0.57			103	76	8	1.5	32	$0.5	$0.9	$1.1	$0.3	$0.4	$1.5
	2.3	4.2	0.6	1.0	0.15	0.62			112	83	8	1.5	32	$0.5	$0.9	$1.1	$0.3	$0.4	$1.5
	2.4	4.5	0.7	1.0	0.15	0.68			122	90	9	1.6	32	$0.5	$0.9	$1.1	$0.3	$0.5	$1.6
	2.5	4.9	0.7	1.0	0.15	0.74			133	98	9	1.6	32	$0.5	$0.9	$1.1	$0.3	$0.5	$1.6
	2.6	5.3	0.8	1.0	0.15	0.80			143	106	9	1.7	32	$0.6	$1.0	$1.2	$0.4	$0.5	$1.7
	2.7	5.7	0.9	1.0	0.15	0.86			155	115	9	1.7	32	$0.6	$1.0	$1.2	$0.4	$0.5	$1.7
	2.8	6.2	0.9	1.0	0.15	0.92			166	123	9	1.7	33	$0.6	$1.0	$1.2	$0.4	$0.6	$1.8
	2.9	6.6	1.0	1.0	0.15	0.99			178	132	10	1.8	33	$0.6	$1.1	$1.3	$0.4	$0.6	$1.8
	3.0	7.1	1.1	1.0	0.15	1.06			191	141	10	1.8	33	$0.6	$1.1	$1.3	$0.4	$0.6	$1.9
	3.1	7.5	1.1	1.0	0.15	1.13			204	151	10	1.9	33	$0.6	$1.1	$1.3	$0.4	$0.6	$2.0
	3.2	8.0	1.2	1.0	0.15	1.21			217	161	10	1.9	33	$0.7	$1.2	$1.4	$0.5	$0.7	$2.0
	3.5	9.6	1.4	1.0	0.15	1.44			260	192	11	2.0	34	$0.7	$1.2	$1.4	$0.5	$0.7	$2.2
	3.6	10.2	1.5	1.0	0.15	1.53			275	204	11	2.1	34	$0.7	$1.3	$1.5	$0.5	$0.8	$2.2
	3.9	11.9	1.8	1.0	0.15	1.79			323	239	12	2.2	34	$0.8	$1.4	$1.6	$0.6	$0.8	$2.4
	4	12.6	1.9	1.0	0.15	1.88			339	251	12	2.2	34	$0.8	$1.4	$1.6	$0.6	$0.9	$2.4
	4.3	14.5	2.2	1.0	0.15	2.18			392	290	13	2.3	35	$0.8	$1.5	$1.7	$0.7	$0.9	$2.6
	4.5	15.9	2.4	1.0	0.15	2.39			429	318	13	2.4	35	$0.9	$1.5	$1.7	$0.7	$1.0	$2.7
	5.1	20.4	3.1	1.0	0.15	3.06			552	409	14	2.6	36	$1.0	$1.7	$1.9	$0.8	$1.2	$3.0
	5.2	21.2	3.2	1.0	0.15	3.19			573	425	14	2.6	36	$1.0	$1.7	$1.9	$0.8	$1.2	$3.1
	5.3	22.1	3.3	1.0	0.15	3.31			596	441	14	2.7	36	$1.0	$1.8	$2.0	$0.8	$1.2	$3.2
	5.4	22.9	3.4	1.0	0.15	3.44			618	458	15	2.7	36	$1.0	$1.8	$2.0	$0.9	$1.2	$3.2
	5.5	23.8	3.6	1.0	0.15	3.56			641	475	15	2.7	36	$1.0	$1.8	$2.0	$0.9	$1.3	$3.3
	5.6	24.6	3.7	1.0	0.15	3.69			665	493	15	2.8	36	$1.1	$1.8	$2.0	$0.9	$1.3	$3.3
	5.9	27.3	4.1	1.0	0.15	4.10			738	547	16	2.9	37	$1.1	$1.9	$2.1	$1.0	$1.4	$3.5
	6	28.3	4.2	1.0	0.15	4.24			763	565	16	2.9	37	$1.1	$2.0	$2.2	$1.0	$1.4	$3.5
	6.1	29.2	4.4	1.0	0.15	4.38			789	584	16	2.9	37	$1.1	$2.0	$2.2	$1.0	$1.4	$3.6
	6.5	33.2	5.0	1.0	0.15	4.98			896	664	17	3.1	38	$1.2	$2.1	$2.3	$1.1	$1.5	$3.8
	6.6	34.2	5.1	1.0	0.15	5.13			924	684	17	3.1	38	$1.2	$2.1	$2.3	$1.1	$1.6	$3.9
	8	50.3	7.5	1.0	0.15	7.54			1357	1005	19	3.5	40	$1.5	$2.5	$2.7	$1.4	$2.0	$4.7
	8.3	54.1	8.1	1.0	0.15	8.12			1461	1082	19	3.6	40	$1.5	$2.6	$2.8	$1.4	$2.1	$4.9
	8.8	60.8	9.1	1.0	0.15	9.12			1642	1216	20	3.7	41	$1.6	$2.8	$3.0	$1.5	$2.2	$5.2

TABLE 3-2

TUNNEL COSTS FOR 0 &1 OVERFLOWS
LONG TERM

DEWATERING RATE ML/d	VOLUME m^3	LENGTH m	DIAMETER m	PUMP COSTS $M	TUNNEL COSTS $M	TOTAL NET COSTS $M	TOTAL BUDGET COSTS 1.58*NET $M	FLOW CONTROL $M	FLUSHING $M	NEWPCC $M	TOTAL $M
1 OVERFLOW											
600.00	1,200,000	40,000	6.2	9	470	479	756	12	48	15	831
825.00	1,000,000	40,000	5.6	9	429	438	692	12	43	36	783
1060.00	825,000	40,000	5.1	9	389	398	630	12	39	70	751
0 OVERFLOWS											
600.00	2,438,000	40,000	8.8	9	670	679	1072	12	68	15	1167
825.00	2,175,000	40,000	8.3	9	632	641	1013	12	64	36	1125
1060.00	2,000,000	40,000	8.0	9	606	615	972	12	61	70	1115

TABLE 3-3

INTERCEPTOR RELIEF PIPING
UPDATE - 23/06/98

	DIAMETER mm	TOTAL LENGTH m	UNIT COST $/mm DIA./m	TOTAL ESTIMATED COST (BASE) $M	COST WITH MULTIPLIERS $M (*1.44)
TO CONVEY 825 ML/d					
	610	161.2	4.5	$0.4	
	760	170.7	3.8	$0.5	
	1350	4404.3	2.5	$14.9	
TOTALS		4736.2		$15.8	$22.8
COMPARE	(earlier est.)	4736.2		$10.3	$14.8
TO CONVEY 1060 ML/d					
	450	694.6	5.7	$1.8	
	610	337.7	4.5	$0.9	
	760	64	3.8	$0.2	
	910	913.8	3.3	$2.7	
	1350	0	2.5	$0.0	
	1520	4296	2.35	$15.3	
	1650	4404.3	2.3	$16.7	
	1800	2897.1	2.25	$11.7	
TOTALS		13607.5		$49.4	$71.2
COMPARE	(earlier est.)	13607.5		$32.3	$46.5

FIGURE 3-4

3.4 REGIONAL TUNNEL COSTS FOR THE REPRESENTATIVE YEAR

The detailed calculation sheets for the 12 regional tunnel options, i.e., for 0 and 4 overflows, and for dewatering at 600, 830 and 1,060 ML/day, are provided in Figures 3-5 to 3-16 inclusive.

TABLE 3-5 **REGIONAL TUNNEL -820,000 m³** (0 Overflows; Dewater @ 600mL/d)

DISTRICT	LENGTH m	GROUP LENGTH m	CUMULATIVE LENGTH m	DEWATERING RATE m³/s	STORAGE NEEDED m³ 0 Overflows	GROUP STORAGE m³ 0 Overflows	DIAMETER NEEDED m	DIAMETER USED m	POWER kW	REACH VOLUMES m³	CUM. VOLUMES m³	PUMP STATION $M
DIAMETER							5.8	5.8				
FERRY ROAD	780				24750					20765		
RIVERBEND	650				24750					17304		
TYLEHURST	1040				27500					27686		
CLIFTON/AUBREY	2280				66000					60697		
		4750	4750			143000	6.19	5.80		0	126451	
TUXEDO	830			0.033	8250					23468		
DONCASTER/ASH	2900			0.57	96260					81996		
		3730				104510	5.97	6.00		0		
			8480									
LINK			770	0.603			0.62		79	0		1.7
										0		
CORNISH	970				7700					25823		
COLONY	790				28880					21031		
		1760				36580	5.14	5.80		0		
			10240							0	173305	
JESSIE/RIVER	1730			0.29	59120					59187		
		1730				59120	6.60	6.60		0		
			11970									
LINK			400	0.29			0.43		31	0		1.1
										0		
ASSINIBOINE	1180				16500					31413		
		1180				16500	4.22	5.80		0		
			13150							0	204718	
MISSION	1280			0.179	33000					34075		
LaVERENDRYE/DUMOULI	1460			0.088	17880					38867		
DESPINS	1240									33010		
MARION	890			0.189	41250					23693		
		4870			0	92130	4.91	5.00		0		
			18020							0		
LINK			720	0.456			0.54		58	0		1.5
										0		
BANNATINE	480				23380					12778		
ALEXANDER	1170				23380					31147		
SYNDICATE/BOYLE					15120							
SELKIRK	1160				22000					30881		
ST.JOHN'S	860				44000					22894		
		3670				127880	6.66	5.80		0		
			21690							0	302418	
ROLAND/HART	2130			0.253	49500					56703		
MUNROE	1700			0.241	61880					45256		
		3830				111380	6.08	6.00		0		
			25520							0		
LINK			1150	0.494			0.56		78	0		1.9
										0		
POLSON	1050				28880					27952		
JEFFERSON/NEWTON	1220				57750					32478		
		2270				86630	6.97	5.80		0		
			27790							0	362848	
HAWTHORNE	1220			0.123	25440					32478		
		1220				25440	5.15	5.20		0		
			29010							0		
LINK			1150	0.123			0.28		19	0		1.1
										0		
ARMSTRONG/CONNECTO	1780				16500					47386		
		1780				16500	3.44	5.80		0		
	30790	30790	30790			819670	5.82			819670		
MAIN TUNNEL										838968	410234	
Diameter Required							5.94	5.80				
COCKBURN	1910				31000					33138		
BALTIMORE	1690				30000					29321		
		3600				61000	4.64	4.70		0	62458	
LINK			380	0.091			0.24		10			0.8
METCALFE/MAGER	1840	1840			41000	41000	5.33	5.40		42140		
		5440	5440							943566		
MOORGATE/DOUG. PK	1620				11000							
STRATHMILLAN	1200	2820	2820		4000	15000	2.60	2.6		14972		
LINK			1000	0.109			0.26		16			1.0
WOODHAVEN	1000	1000			5800	5800	2.72	2.75		5940		
										964478		

TOTAL P.S. COST	**$9 M**
TOTAL TUNNEL COST	**$409 M**
TOTAL NET COST	**$418 M**
TOTAL BUDGET COST (1.58*NET)	**$661 M**
FLOW CONTOL COST	**$12 M**
FLUSHING	**$39 M**
NEWPCC	**$15 M**
TOTAL	**$727 M**

TABLE 3-6 **REGIONAL TUNNEL - 820,000 m³** (0 Overflows; Dewater @ 600mL/d)

With In-line Storage

DISTRICT	LENGTH m	GROUP LENGTH m	CUMULATIVE LENGTH m	EWATERIN RATE m/s	STORAGE NEEDED m³ 0 Overflows	GROUP STORAGE m³ 0 Overflows	DIAMETER CALC'D m	DIAMETER USED m	POWER kW	REACH VOLUMES m³	CUM. VOLUMES m³	PUMP STATION $M
DIAMETER							4.5	4.5				
FERRY ROAD	780				20070					12541		
RIVERBEND	650				24460					10451		
TYLEHURST	1040				21100					16722		
CLIFTON/AUBREY	2280				8690					36660		
		4750	4750			74320	4.46	4.50		0	76374	
TUXEDO	830			0.033	7840					13201		
DONCASTER/ASH	2900			0.57	50220					46123		
		3730				58060	4.45	4.50		0		
			8480									
LINK			770	0.603			0.62		79	0		1.7
										0		
CORNISH	970				2100					15596		
COLONY	790				16240					12702		
		1760				18340	3.64	4.50		0		
			10240							0	104673	
JESSIE/RIVER	1730			0.29	47840					47840		
		1730				47840	5.93	5.90		0		
			11970									
LINK			400	0.29			0.43		31	0		1.1
										0		
ASSINIBOINE	1180				8080					18973		
		1180				8080	2.95	4.50		0		
			13150							0	123646	
MISSION	1280			0.179	25380					21272		
LaVERENDRYE/DUMOULI	1460			0.088	17240					24264		
DESPINS	1240									20608		
MARION	890			0.189	37170					14791		
		4870				79790	4.57	4.60		0		
			18020							0		
LINK			720	0.456			0.54		58	0		1.5
										0		
BANNATINE	480				21000					7718		
ALEXANDER	1170				19570					18812		
SYNDICATE/BOYLE					14680							
SELKIRK/SYNDICATE	1160				11750					18651		
ST.JOHN'S	860				19100					13828		
		3670				86100	5.47	4.50		0		
			21690							0	182655	
ROLAND/HART	2130			0.253	13650					20493		
MUNROE	1700			0.241	23520					16356		
		3830				37170	3.52	3.50		0		
			25520							0		
LINK			1150	0.494			0.56		78	0		1.9
										0		
POLSON	1050				5470					16883		
JEFFERSON/NEWTON	1220				42270					19616		
		2270				47740	5.17	4.50		0		
			27790							0	219153	
HAWTHORNE	1220			0.123	21560					21560		
		1220				21560	4.74	4.70		0		
			29010							0		
LINK			1150	0.123			0.28		19	0		1.1
										0		
ARMSTRONG/CONNECTO	1780				16065					28620		
		1780				16065	3.39	4.50		0		
										0		
	30790	30790	30790			495065	4.52			495065		
MAIN TUNNEL										494281	247774	
Diameter Required							4.55					
COCKBURN	1910				30480					31266		
BALTIMORE	1690				28450					27664		
		3600				58930	4.57	4.60				
LINK			380				0.24		10			0.8
				0.091								
METCALFE/MAGER	1840	1840			32460	32460	4.74	4.75		32460		
		5440	5440							585671		
MOORGATE/DOUG. PK	1620				7230							
STRATHMILLAN	1200	2820	2820		3840	11070	2.24	2.25		11070		
LINK			1000				0.26		16			1.0
				0.109								
WOODHAVEN	1000	1000			5700	5700	2.69	2.70		5700		
										602441		

TOTAL P.S. COST	**$9 M**
TOTAL TUNNEL COST	**$343 M**
TOTAL NET COST	**$352 M**
TOTAL BUDGET COST (1.58*NET)	**$556 M**
IN-LINE STORAGE COST	**$100 M**
FLUSHING	**$33 M**
NEWPCC	**$15 M**
TOTAL	**$704 M**

TABLE 3-7 **REGIONAL TUNNEL - 610,000 m³** (0 Overflows; Dewater @ 825mL/d)

DISTRICT	LENGTH m	GROUP LENGTH m	CUMULATIVE LENGTH m	DEWATERING RATE m³/s	STORAGE NEEDED m³ 0 Overflows	GROUP STORAGE m³ 0 Overflows	DIAMETER NEEDED m	DIAMETER m	POWER kW	REACH VOLUMES m³	CUM. VOLUMES m³	PUMP STATION SM
DIAMETER							5.0					
FERRY ROAD	780				18000					15278		
RIVERBEND	650				18000					12732		
TYLEHURST	1040				20000					20371		
CLIFTON/AUBREY	2280				48000					44660		
		4750	4750			104000	5.28	5.00		0	93041	
TUXEDO	830			0.053	6000					16955		
DONCASTER/ASH	2900			0.813	70000					59242		
		3730				76000	5.09	5.10		0		
			8480									
LINK			770	0.866			0.74	0.74	114	0		1.7
										0		
CORNISH	970				5600					19000		
COLONY	790				21000					15474		
		1760				26600	4.39	5.00		0		
			10240							0	127515	
JESSIE/RIVER	1730			0.474	43000					42610		
		1730				43000	5.63	5.60		0		
			11970									
LINK			400	0.474			0.55	0.55	50	0		1.2
										0		
ASSINIBOINE	1180				12000					23113		
		1180				12000	3.60	5.00		0		
			13150							0	150628	
MISSION	1280			0.292	24000					17734		
LaVERENDRYE/DUMOULI	1460			0.144	13000					20228		
DESPINS	1240									17180		
MARION	890			0.309	30000					12330		
		4870				67000	4.19	4.20		0		
			18020							0		
LINK			720	0.745			0.69	0.69	95	0		1.6
										0		
BANNATINE	480				17000					9402		
ALEXANDER	1170				17000					22917		
SYNDICATE/BOYLE					11000							
SELKIRK	1160				16000					22722		
ST.JOHN'S	860				32000					16845		
		3670				93000	5.68	5.00		0		
			21690							0	222514	
ROLAND/HART	2130			0.413	36000					45235		
MUNROE	1700			0.395	45000					36103		
		3830				81000	5.19	5.20		0		
			25520							0		
LINK			1150	0.808			0.72	0.72	127	0		1.9
										0		
POLSON	1050				21000					20567		
JEFFERSON/NEWTON	1220				42000					23897		
		2270				63000	5.94	5.00		0		
			27790							0	266978	
HAWTHORNE	1220			0.201	18500					18551		
		1220				18500	4.39	4.40		0		
			29010							0		
LINK			1150	0.201			0.36	0.36	32	0		1.1
										0		
ARMSTRONG/CONNECTO	1780				5300					34866		
		1780				19000	3.69	5.00		0		
	30790	30790	30790			603100	4.99	5.00		603100		
MAIN TUNNEL										588012	301844	
Diameter Required							5.12	5.00				
COCKBURN	1910				31000					33138		
BALTIMORE	1690				30000					29321		
		3600				61000	4.64	4.70		0	62458	
LINK			380	0.091			0.24		10			0.8
METCALFE/MAGER	1840	1840			41000	41000	5.33	5.35		41363		
		5440	5440							691833		
MOORGATE/DOUG. PK	1620				11000							
STRATHMILLAN	1200	2820	2820		4000	15000	2.60	2.75		16750		
LINK			1000	0.109			0.26		16			0.9
WOODHAVEN	1000	1000			5800	5800	2.72	2.75		5940		
										714522		

TOTAL P.S. COST	5.00	**$9 M**
TOTAL TUNNEL COST		**$371 M**
TOTAL NET COST		**$380 M**
TOTAL BUDGET COST (1.58*NET)		**$600 M**
FLOW CONTROL COST		**$12 M**
FLUSHING		**$36 M**
NEWPCC		**$36 M**
TOTAL		**$684 M**

TABLE 3-8 **REGIONAL TUNNEL - 610,000 m³** (0 Overflows; Dewater @ 825mL/d)

With In-line Storage

DISTRICT	LENGTH m	GROUP LENGTH m	CUMULATIVE LENGTH m	DEWATERING RATE m³/s	STORAGE NEEDED m³ 0 Overflows	GROUP STORAGE m³ 0 Overflows	DIAMETER m	POWER kW	REACH VOLUMES m³	CUM. VOLUMES m³	PUMP STATION SM
DIAMETER							3.4				
FERRY ROAD	780				13320				7187		
RIVERBEND	650				17710				5989		
TYLEHURST	1040				13610				9583		
CLIFTON/AUBREY	2280				0				21008		
		4750	4750			44640	3.46		0	43767	
TUXEDO	830			0.053	5600				6716		
DONCASTER/ASH	2900			0.813	24580				23464		
		3730				30180	3.21		0		
			8480								
LINK			770	0.866			0.74	114	0		1.7
									0		
CORNISH	970				0				8938		
COLONY	790				8360				7279		
		1760				8360	2.46		0		
			10240						0	59983	
JESSIE/RIVER	1730			0.474	31720				31720		
		1730				31720	4.83		0		
			11970								
LINK			400	0.474			0.55	50	0		1.2
									0		
ASSINIBOINE	1180				3580				10873		
		1180				3580	1.97		0		
			13150						0	70856	
MISSION	1280			0.292	16380				14369		
LaVERENDRYE/DUMOULI	1460			0.144	12370				16390		
DESPINS	1240								13920		
MARION	890			0.309	25920				9991		
		4870				54670	3.78		0		
			18020						0		
LINK			720	0.745			0.69	95	0		1.6
									0		
BANNATINE	480				14620				4423		
ALEXANDER	1170				13200				10780		
SYNDICATE/BOYLE					10550						
SELKIRK	1160				5750				10688		
ST.JOHN'S	860				7100				7924		
		3670				51220	4.22		0		
			21690						0	104671	
ROLAND/HART	2130			0.413	2610				5144		
MUNROE	1700			0.395	6640				4106		
		3830				9250	1.75		0		
			25520						0		
LINK			1150	0.808			0.72	127	0		1.9
									0		
POLSON	1050				0				9675		
JEFFERSON/NEWTON	1220				26520				11241		
		2270				31420	4.20		0		
			27790						0	125587	
HAWTHORNE	1220			0.201	14620				14620		
		1220				14620	3.91		0		
			29010						0		
LINK			1150	0.201			0.36	32	0		1.2
									0		
ARMSTRONG/CONNECTO	1780				8940				16401		
		1780				4040	1.70		0		
									0		
	30790	30790	30790			283700	3.43		283700		
MAIN TUNNEL									282428	141988	
Diameter Required							3.44				
COCKBURN	1910				30484				31266		
BALTIMORE	1690				28450				27664		
		3600				58930	4.57				
LINK			380	0.091			0.24	10			0.8
METCALFE/MAGER	1840	1840			32460	32460	4.74		32460		
		5440	5440						373818		
MOORGATE/DOUG. PK	1620				7230						
STRATHMILLAN	1200	2820	2820		3840	11070	2.24		11070		
LINK			1000	0.109			0.26	16			0.9
WOODHAVEN	1000	1000			5700	5700	2.69		5700		
									390588		

TOTAL P.S. COST	**$9 M**
TOTAL TUNNEL COST	**$285 M**
TOTAL NET COST	**$294 M**
TOTAL BUDGET COST (1.58*NET)	**$465 M**
IN-LINE STORAGE COST	**$100 M**
FLUSHING	**$28 M**
NEWPCC	**$36 M**
TOTAL	**$629 M**

TABLE 3-9 **REGIONAL TUNNEL - 530,000 m³** (0 Overflows; Dewater @10 60mL/d)

DISTRICT	LENGTH m	GROUP LENGTH m	CUMULATIVE LENGTH m	EWATERIN RATE m³/s	STORAGE NEEDED m³ 0 Overflows	GROUP STORAGE m³ 0 Overflows	DIAMETER NEEDED m	DIAMETER USED m	POWER kW	REACH VOLUMES m³	CUM. VOLUMES m³	PUMP STATION + FM $M
DIAMETER							4.4	4.4				
FERRY ROAD	780				12900					11806		
RIVERBEND	650				12900					9839		
TYLEHURST	1040				14300					15742		
CLIFTON/AUBREY	2280				34300					34511		
		4750	4750			74400	4.47	4.40		0	71897	
TUXEDO	830			0.074	4300					12620		
DONCASTER/ASH	2900			1.291	50500					44095		
		3730				54800	4.33	4.40		0		
			8480									
LINK			770	1.365			0.93	0.62	179	0		2.3
										0		
CORNISH	970				4000					14682		
COLONY	790				15000					11958		
		1760				19000	3.71	4.40		0		
			10240							0	98537	
JESSIE/RIVER	1730			0.662	30800					31305		
		1730				30800	4.76	4.80		0		
			11970									
LINK			400	0.662			0.65		70	0	0	1.3
										0		
ASSINIBOINE	1180				8600					17861		
		1180				8600	3.05	4.40		0		
			13150							0	116398	
MISSION	1280			0.408	17200					13763		
LaVERENDRYE/DUMOULI	1460			0.188	9900					15698		
DESPINS	1240									13333		
MARION	890			0.387	23900					9569		
		4870			0	51000	3.65	3.70		0		
			18020							0	0	
LINK			720	0.983			0.79		126	0		1.8
										0		
BANNATINE	480				12200					7265		
ALEXANDER	1170				12200					17709		
SYNDICATE/BOYLE					8800							
SELKIRK	1160				11400					17558		
ST.JOHN'S	860				22900					13017		
		3670				67500	4.84	4.40		0		
			21690							0	171948	
ROLAND/HART	2130			0.577	25700					32387		
MUNROE	1700			0.552	32200					25849		
		3830				57900	4.39	4.40		0		
			25520							0	0	
LINK			1150	1.129			0.85		178	0		2.5
										0		
POLSON	1050				15000					15893		
JEFFERSON/NEWTON	1220				30000					18466		
		2270				45000	5.02	4.40		0		
			27790							0	206308	
HAWTHORNE	1220			0.281	13200					13118		
		1220				13200	3.71	3.70		0		
			29010							0	0	
LINK			1150	0.281			0.42		44	0		1.4
										0		
ARMSTRONG/CONNECTO	1780				20900					26943		
		1780				20900	3.87	4.40		0		
					443100					0		
	30790	30790	30790			443100	4.28			466047	0	
MAIN TUNNEL		15410								444989	233250	
Diameter Required							4.41	4.40				
COCKBURN	1910				31000					31742		
BALTIMORE	1690				30000					28086		0
		3600				61000	4.64	4.60		0	59829	
												0.8
LINK			380	0.091			0.24		10			
METCALFE/MAGER	1840	1840			41000	41000	5.33	5.30		40594		
		5440	5440							545411		
MOORGATE/DOUG. PK	1620				11000							
STRATHMILLAN	1200	2820	2820		4000	15000	2.60	2.6		14972		
												1.0
LINK			1000	0.109			0.26		16			
WOODHAVEN	1000	1000			5800	5800	2.72	2.75		5309		
					565900					565693		

TOTAL P.S. COST	**$11 M**
TOTAL TUNNEL COST	**$326 M**
TOTAL NET COST	**$337 M**
TOTAL BUDGET COST (1.58*NET)	**$532 M**
FLOW CONTOL COST	**$12 M**
FLUSHING	**$32 M**
NEWPCC	**$70 M**
TOTAL	**$646 M**

TABLE 3-10 **REGIONAL TUNNEL - 530,000 m³** (0 Overflows; Dewater @10 60mL/d)

With In-line Storage

DISTRICT	LENGTH m	GROUP LENGTH m	CUMULATIVE LENGTH m	EWATERIN RATE m³/s	STORAGE NEEDED m³ 0 Overflows	GROUP STORAGE m³ 0 Overflows	DIAMETER NEEDED m	DIAMETER USED m	POWER kW	REACH VOLUMES m³	CUM. VOLUMES m³	PUMP STATION + PI Gal
DIAMETER							2.6					
FERRY ROAD	780				8220					4110		
RIVERBEND	650				12610					3425		
TYLEHURST	1040				7910					5480		
CLIFTON/AUBREY	2280				0					12015		
		4750	4750			28740	2.78	2.60		0	25030	
TUXEDO	830			0.074	3900					2310		
DONCASTER/ASH	2900			1.291	6480					8070		
		3730				10380	1.88	1.90		0		
			8480									
LINK			770	1.365			0.93		179	0		2.3
										0		
CORNISH	970				0					5111		
COLONY	790				2360					4163		
		1760				2360	1.31	2.60		0		
			10240							0	34305	
JESSIE/RIVER	1730			0.662	19520					19520		
		1730				19520	3.79	3.80		0		
			11970									
LINK			400	0.662			0.65		70	0		1.3
										0		
ASSINIBOINE	1180				180					6218		
		1180				180	0.44	2.60		0		
			13150							0	40523	
MISSION	1280			0.408	9580					10164		
LaVERENDRYE/DUMOULI	1460			0.188	9270					11593		
DESPINS	1240									9846		
MARION	890			0.387	19820					7067		
		4870				38670	3.18	3.20		0		
			18020							0		
LINK			720	0.983			0.79		126	0		1.8
										0		
BANNATINE	480				9820					2529		
ALEXANDER	1170				8400					6165		
SYNDICATE/BOYLE					8350							
SELKIRK/SYNDICATE	1160				1150					6113		
ST.JOHN'S	860				0					4532		
		3670				27720	3.10	2.60		0		
			21690							0	59862	
ROLAND/HART	2130			0.577	0					0		
MUNROE	1700			0.552	0					0		
		3830				0	0.00			0		
			25520							0		
LINK			1150	1.129			0.85		178	0		2.5
										0		
POLSON	1050				0					5533		
JEFFERSON/NEWTON	1220				14520					6429		
		2270				14520	2.85	2.60		0		
			27790							0	71824	
HAWTHORNE	1220			0.281	9320					9320		
		1220				9320	3.12	3.10		0		
			29010							0		
LINK			1150	0.281			0.42		44	0		1.4
										0		
ARMSTRONG/CONNECTO	1780				10840					9380		
		1780				10840	2.78	2.60		0		
					162250					0		
	30790	30790	30790			162250	2.59			162250		
MAIN TUNNEL										159094	81204	
Diameter Required							2.64					
COCKBURN	1910				30480					31742		
BALTIMORE	1690				28450					28086		
		3600				58930	4.57	4.60			59829	
LINK			380				0.24		10			0.8
				0.091								
METCALFE/MAGER	1840	1840			32460	32460	4.74	4.75		32606		
		5440	5440							251529		
MOORGATE/DOUG. PK	1620				7230							
STRATHMILLAN	1200	2820	2820		3840	11070	2.24	2.25		11213		
LINK			1000				0.26		16			1.0
				0.109								
WOODHAVEN	1000	1000			5700	5700	2.69	2.70		5726		
										268467		

TOTAL P.S. COST	**$11 M**
TOTAL TUNNEL COST	**$242 M**
TOTAL NET COST	**$253 M**
TOTAL BUDGET COST (1.58*NET)	**$399 M**
IN-LINE STORAGE COST	**$100 M**
FLUSHING	**$22 M**
NEWPCC	**$70 M**
TOTAL	**$592 M**

TABLE 3-11 **REGIONAL TUNNEL - 300,000 m³**
(4 Overflows; Dewater @ 600mL/d)

DISTRICT	LENGTH m	GROUP LENGTH m	CUMULATIVE LENGTH m	DEWATERING RATE m³/s	STORAGE NEEDED m³ 4 Overflows	GROUP STORAGE m³ 4 Overflows	DIAMETER NEEDED m	DIAMETER USED m	POWER kW	REACH VOLUMES m³	CUM. VOLUMES m³	PUMP STATION + FM $M
DIAMETER							3.5	3.6				
FERRY ROAD	780				9070					7939		
RIVERBEND	650				9070					6616		
TYLEHURST	1040				11510					10586		
CLIFTON/AUBREY	2280				29030					23208		
		4750	4750			58680	3.97	3.60		0	46341	
TUXEDO	830			0.033	2790					8448		
DONCASTER/ASH	2900			0.57	32650					29518		
		3730				35440	3.48	3.60		0		
			8480									
LINK			770	0.603			0.62	0.62	79	0		1.7
										0		
CORNISH	970				2510					9873		
COLONY	790				9490					8041		
		1760				12000	2.95	3.60		0		
			10240							0	64256	
JESSIE/RIVER	1730			0.29	21630					17609		
		1730				21630	3.99	4.00		0		
			11970									
LINK			400	0.29			0.43	0.43	31	0		1.1
										0		
ASSINIBOINE	1180				9770					12011		
		1180				9770	3.25	3.60		0		
			13150							0	76267	
MISSION	1280			0.179	10740					13029		
LaVERENDRYE/DUMOULI	1460			0.088	5230					14861		
DESPINS	1240									12622		
MARION	890			0.189	15350					9059		
		4870				31320	2.86	2.90		0		
			18020							0		
LINK			720	0.456			0.54	0.54	58	0		1.5
										0		
BANNATINE	480				7670					4886		
ALEXANDER	1170				10460					11909		
SYNDICATE/BOYLE					5700							
SELKIRK	1160				6980					11807		
ST.JOHN'S	860				17440					8754		
		3670				48250	4.09	3.60		0		
			21690							0	113623	
ROLAND/HART	2130			0.253	21490					21681		
MUNROE	1700			0.241	18140					17304		
		3830				39630	3.63	3.60		0		
			25520							0		
LINK			1150	0.494			0.56	0.56	78	0		1.9
										0		
POLSON	1050				11160					10688		
JEFFERSON/NEWTON	1220				16740					12418		
		2270				27900	3.96	3.60		0		
			27790							0	136729	
HAWTHORNE	1220			0.123	8370					12418		
		1220				8370	2.96	3.00		0		
			29010							0		
LINK			1150	0.123			0.28	0.28	19	0		1.1
										0		
ARMSTRONG/CONNECTO	1780				7400					18118		
		1780				7400	2.30	3.60		0		
										0		
	30790	30790	30790			300390	3.52			300390		
MAIN TUNNEL										313405	154847	
Diameter Required							3.68	3.60				
COCKBURN	1910				11000					11345		
BALTIMORE	1690				10000					10038		
		3600				21000	2.73	2.75		0	21383	
LINK			380	0.091			0.24		10			0.8
METCALFE/MAGER	1840	1840			14500	14500	3.17	3.20		14798		
		5440	5440							349585		
MOORGATE/DOUG. PK	1620				2900							
STRATHMILLAN	1200	2820	2820		875	3775	1.31	1.3		3743		
LINK			1000	0.109			0.26		16			1.0
WOODHAVEN	1000	1000			1900	1900	1.56	1.6		2011		
										355339		
										313405		

TOTAL P.S. COST	$9 M
TOTAL TUNNEL COST	$267 M
TOTAL NET COST	$276 M
TOTAL BUDGET COST (1.58*NET)	$436 M
FLOW CONTOL COST	$12 M
FLUSHING	$24 M
NEWPCC	$15 M
TOTAL	$488 M

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TABLE 3-12 **REGIONAL TUNNEL - 300,000 m³** (4 Overflows; Dewater @ 600mL/d)

With In-line Storage

DISTRICT	LENGTH m	GROUP LENGTH m	CUMULATIVE LENGTH m	DEWATERING RATE m³/s	STORAGE NEEDED m³ 4 Overflows	GROUP STORAGE m³ 4 Overflows	DIAMETER CALC'D m	DIAMETER USED m	POWER kW	REACH VOLUMES m³	CUM. VOLUMES m³	PUMP STATION + FM $M
DIAMETER							1.8	1.8				
FERRY ROAD	780				4390					1883		
RIVERBEND	650				8780					1569		
TYLEHURST	1040				5120					2511		
CLIFTON/AUBREY	2280				0					5504		
		4750	4750			18290	2.21	1.80		0	11467	
TUXEDO	830			0.033	2390					2004		
DONCASTER/ASH	2900			0.57	0					7001		
		3730				2390	0.90	1.50		0		
			8480									
LINK			770	0.603			0.62		79	0		1.7
										0		
CORNISH	970				0					2342		
COLONY	790				0					1907		
		1760				0	0.00	1.80		0		
			10240							0	15716	
JESSIE/RIVER	1730			0.29	10340					4176		
		1730				10340	2.76	2.75		0		
			11970									
LINK			400	0.29			0.43		31	0		1.1
										0		
ASSINIBOINE	1180				1350					2849		
		1180				1350	1.21	1.50		0		
			13150							0	18564	
MISSION	1280			0.179	3120					3090		
LaVERENDRYE/DUMOULI	1460			0.088	4600					3525		
DESPINS	1240									2993		
MARION	890			0.189	11270					2149		
		4870				18990	2.23	2.25		0		
			18020							0		
LINK			720	0.456			0.54		58	0		1.5
										0		
BANNATINE	480				5300					1159		
ALEXANDER	1170				6660					2824		
SYNDICATE/BOYLE					5250							
SELKIRK/SYNDICATE	1160				0					2800		
ST.JOHN'S	860				0					2076		
		3670				17210	2.44	1.80		0		
			21690							0	27424	
ROLAND/HART	2130			0.253	0					5142		
MUNROE	1700			0.241	0					4104		
		3830				0	0.00	0.00		0		
			25520							0		
LINK			1150	0.494			0.56		78	0		1.9
										0		
POLSON	1050				0					2535		
JEFFERSON/NEWTON	1220				1260					2945		
		2270				1260	0.84	1.80		0		
			27790							0	32904	
HAWTHORNE	1220			0.123	4500					2945		
		1220				4500	2.17	2.20		0		
			29010							0		
LINK			1150	0.123			0.28		19	0		1.1
										0		
ARMSTRONG/CONNECTO	1780				0			1.80		4297		
		1780								0		
										0		
	30790	30790	31100			74330	1.75			74330		
MAIN TUNNEL										74330	37201	
Diameter Required							1.77					
COCKBURN	1910				10480					10043		
BALTIMORE	1690				8450					8887		
		3600				18930	2.59	2.60				
LINK			380	0.091			0.24		10.00			0.8
METCALFE/MAGER	1840	1840			5960	5960	2.03	2.00		5960		
		5440	5440							99220		
MOORGATE/DOUG. PK	1620				0							
STRATHMILLAN	1200	2820	2820		710	710	0.57	1.50		710		
LINK			1000	0.109			0.26	1.50	16			1.0
WOODHAVEN	1000	1000			1800	1800	1.51	1.80		1800		
										101730		

TOTAL P.S. COST	**$9 M**
TOTAL TUNNEL COST	**$156 M**
TOTAL NET COST	**$165 M**
TOTAL BUDGET COST (1.58*NET)	**$261 M**
IN-LINE STORAGE COST	**$100 M**
FLUSHING	**$16 M**
NEWPCC	**$15 M**
TOTAL	**$391 M**

TABLE 3-13 **REGIONAL TUNNEL - 220,000 m³** (4 Overflows; Dewater @ 825mL/d)

DISTRICT	LENGTH m	GROUP LENGTH m	CUMULATIVE LENGTH m	EWATERING RATE m³/s	STORAGE NEEDED m³ 0 Overflows	GROUP STORAGE m³ 0 Overflows	DIAMETER NEEDED m	DIAMETER USED m	POWER kW	REACH VOLUMES m³	CUM. VOLUMES m³	PUMP STATION $M
DIAMETER							3.0	3.1				
FERRY ROAD	780				6500					5887		
RIVERBEND	650				6500					4906		
TYLEHURST	1040				8250					7850		
CLIFTON/AUBREY	2280				20800					17209		
		4750	4750			42050	3.36	3.1		0	33211	
TUXEDO	830			0.053	2000					6265		
DONCASTER/ASH	2900			0.813	23400					21888		
		3730				25400	2.94	3.0		0		
			8480									
LINK			770	0.866			0.74	0.8	114	0		1.7
										0		
CORNISH	970				1800					7321		
COLONY	790				6800					5963		
		1760				8600	2.49	3.1		0		
			10240							0	46495	
JESSIE/RIVER	1730			0.474	15500					13058		
		1730				15500	3.38	3.5		0		
			11970									
LINK			400	0.474			0.55	0.6	50	0		1.2
										0		
ASSINIBOINE	1180				7000					8906		
		1180				7000	2.75	3.1		0		
			13150							0	55402	
MISSION	1280			0.292	7700					9661		
LaVERENDRYE/DUMOULI	1460			0.144	3750					11020		
DESPINS	1240				0					9359		
MARION	890			0.309	11000					6717		
		4870				22450	2.42	2.5		0		
			18020							0		
LINK			720	0.745			0.69	0.7	95	0		1.6
										0		
BANNATINE	480				5500					3623		
ALEXANDER	1170				7500					8831		
SYNDICATE/BOYLE					4080							
SELKIRK	1160				5000					8755		
ST.JOHN'S	860				12500					6491		
		3670				34580	3.46	3.1		0		
			21690							0	83102	
ROLAND/HART	2130			0.413	15400					16077		
MUNROE	1700			0.395	13000					12831		
		3830				28400	3.07	3.1		0		
			25520							0		
LINK			1150	0.808			0.72	0.8	127	0		1.9
										0		
POLSON	1050				8000					7925		
JEFFERSON/NEWTON	1220				12000					9208		
		2270				20000	3.35	3.1		0		
			27790							0	100235	
HAWTHORNE	1220			0.201	6000					9208		
		1220				6000	2.50	2.5		0		
			29010							0		
LINK			1150	0.201			0.36	0.4	32	0		1.1
										0		
ARMSTRONG/CONNECTO	1780				5300					13435		
		1780				5300	1.95	3.1		0		
										0		
	30790	30790	30790			215280	2.98			215280		
MAIN TUNNEL										232393	113670	
Diameter Required							3.12	3.10				
COCKBURN	1910				11000					11345		
BALTIMORE	1690				10000					10038		
		3600				21000	2.73	2.75		0	21383	
LINK			380	0.091			0.24		10			0.8
METCALFE/MAGER	1840	1840			14500	14500	3.17	3.20		14798		
		5440	5440							268574		
MOORGATE/DOUG. PK	1620				2900							
STRATHMILLAN	1200	2820	2820		875	3780	1.31	1.5		4983		
LINK			1000	0.109			0.26		16			0.9
WOODHAVEN	1000	1000			1900	1900	1.56	1.6		2011		
										275568		

TOTAL P.S. COST	**$9 M**
TOTAL TUNNEL COST	**$240 M**
TOTAL NET COST	**$249 M**
TOTAL BUDGET COST (1.58*NET)	**$393 M**
FLOW CONTOL COST	**$12 M**
+ FLUSHING	**$23 M**
NEWPCC	**$36 M**
TOTAL	**$464 M**

TABLE 3-14 **REGIONAL TUNNEL - 220,000 m³** (4 Overflows; Dewater @ 825mL/d)

With In-line Storage

DISTRICT	LENGTH m	GROUP LENGTH m	CUMULATIVE LENGTH m	DEWATERING RATE m³/s	STORAGE NEEDED m³ 4 Overflows	GROUP STORAGE m³ 4 Overflows	DIAMETER NEEDED m	DIAMETER USED m	POWER kW	REACH VOLUMES m³	CUML VOLUMES m³	PUMP STATION SM	
DIAMETER							1.3	1.5					
FERRY ROAD	780				1820					1378			
RIVERBEND	650				6210					1149			
TYLEHURST	1040				1860					1838			
CLIFTON/AUBREY	2280				0					4029			
		4750	4750			9890	1.63	1.50		0	8394		
TUXEDO	830			0.053	1600					1467			
DONCASTER/ASH	2900			0.813	0					5125			
		3730				1600	0.74	1.50		0			
			8480										
LINK			770	0.866			0.74		114	0		1.7	
										0			
CORNISH	970				0					1714			
COLONY	790				0					1396			
		1760				0	0.00	1.50		0			
			10240							0	11504		
JESSIE/RIVER	1730			0.474	4840					3057			
		1730				4840	1.89	1.90		0			
			11970										
LINK			400	0.474			0.55		50	0		1.2	
										0			
ASSINIBOINE	1180				0					2085			
		1180				0	0.00	1.50		0			
			13150							0	13589		
MISSION	1280			0.292	80					2262			
LaVERENDRYE/DUMOULI	1460			0.144	3120					2580			
DESPINS	1240									2191			
MARION	890			0.309	6920					1573			
		4870				10120	1.63	1.60		0			
			18020							0			
LINK			720	0.745			0.69		95	0		1.6	
										0			
BANNATINE	480				3120					848			
ALEXANDER	1170				3700					2068			
SYNDICATE/BOYLE					3630								
SELKIRK	1160				0					2050			
ST.JOHN'S	860				0					1520			
		3670				10450	1.90	1.50		0			
			21690							0	20075		
ROLAND/HART	2130			0.413	0					0			
MUNROE	1700			0.395	0					0			
		3830				0	0.00	0.00		0			
			25520							0			
LINK			1150	0.808			0.72		127	0		1.9	
										0			
POLSON	1050				0					1856			
JEFFERSON/NEWTON	1220				200					2156			
		2270				200	0.33	1.50		0			
			27790							0	24086		
HAWTHORNE	1220			0.201	2120					2156			
		1220				2120	1.49	1.50		0			
			29010							0			
LINK			1150	0.201			0.36		32	0		1.2	
										0			
ARMSTRONG/CONNECTO	1780									3146			
		1780								0			
										0			
	30790	30790	30790			39220	1.27	1.50		54411			
MAIN TUNNEL										47642	27232		
Diameter Required							1.30						
COCKBURN	1910				10480					10141	0		
BALTIMORE	1690				8450					8973	0		
		3600				18930	2.59	2.60					
LINK			380	0.091			0.24		10.00			0.8	0.8
METCALFE/MAGER	1840	1840			5960	5960	2.03	2.10		6373	0		
		5440	5440							73129	27232		
MOORGATE/DOUG. PK	1620				0								
STRATHMILLAN	1200	2820	2820		710	710	0.57	1.50		4983			
LINK			1000	0.109			0.26		16			0.9	1.5
WOODHAVEN	1000	1000			1800	1800	1.51	1.50		1767			
										79879			

TOTAL P.S. COST	**$9 M**
TOTAL TUNNEL COST	**$141 M**
TOTAL NET COST	**$150 M**
TOTAL BUDGET COST (1.58*NET)	**$237 M**
IN-LINE STORAGE COST	**$100 M**
FLUSHING	**$14 M**
NEWPCC	**$36 M**
TOTAL	**$387 M**

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TABLE 3-15 **REGIONAL TUNNEL - 185,000 m³** (4 Overflows; Dewater @10 60mL/d)

DISTRICT	LENGTH	GROUP LENGTH	CUMULATIVE LENGTH	DEWATER RATE	STORAGE NEEDED (Overflow)	GROUP STORAGE	DIAMETER NEEDED	DIAMETER USED	POWER	REACH VOLUME	CUM. VOLUME	PLANT FLOW
DIAMETER							2.7	2.7				
FERRY ROAD	780				4700					4367		
RIVERBEND	650				4600					3639		
TYLEHURST	1040				5900					5823		
CLIFTON/AUBREY	2280				14900					12766		
		4750	4750			30100	2.84	2.70		0	26595	
TUXEDO	830			0.074	1400					4074		
DONCASTER/ASH	2900			1.291	16900					14235		
		3730				18300	2.50	2.50		0		
			8480									
LINK			770	1.365			0.93	0.62	179	0		2.3
										0		
CORNISH	970				1300					5431		
COLONY	790				4900					4423		
		1760				6200	2.12	2.70		0		
			10240							0	36450	
JESSIE/RIVER	1730			0.662	11100					11427		
		1730				11100	2.86	2.90		0		
			11970									
LINK			400	0.662			0.65		70	0	0	1.3
										0		
ASSINIBOINE	1180				5000					6607		
		1180				5000	2.32	2.70		0		
			13150							0	43057	
MISSION	1280			0.408	5500					4433		
LaVERENDRYE/DUMOULI	1460			0.188	2900					5057		
DESPINS	1240									4295		
MARION	890			0.387	8600					3083		
		4870			0	17200	2.12	2.10		0		
			18020							0	0	
LINK			720	0.983			0.79		126	0		1.8
										0		
BANNATINE	480				3900					2688		
ALEXANDER	1170				5400					6551		
SYNDICATE/BOYLE					3300							
SELKIRK	1160				3600					6495		
ST.JOHN'S	860				8900					4815		
		3670				25100	2.95	2.70		0		
			21690							0	63605	
ROLAND/HART	2130			0.577	11000					11309		
MUNROE	1700			0.552	9300					9026		
		3830				20300	2.60	2.60		0		
			25520							0	0	
LINK			1150	1.129			0.85		178	0		2.5
										0		
POLSON	1050				5700					5879		
JEFFERSON/NEWTON	1220				8600					6831		
		2270				14300	2.83	2.70		0		
			27790							0	76315	
HAWTHORNE	1220			0.281	4300					4226		
		1220				4300	2.12	2.10		0		
			29010							0	0	
LINK			1150	0.281			0.42		44	0		1.4
										0		
ARMSTRONG/CONNECTO	1780				5800					9966		
		1780				5800	2.04	2.70		0		
					157700					0		
	30790	30790	30790			157700	2.55			172394	0	
MAIN TUNNEL		15410								157446	86281	
Diameter Required							2.67	4.40				
COCKBURN	1910				11000					11345		
BALTIMORE	1690				10000					10038		0
		3600				21000	2.73	2.75		0	21383	
												0.8
LINK			380	0.091			0.24		10			
METCALFE/MAGER	1840	1840			14500	14500	3.17	3.20		14798		
		5440	5440							193627		
MOORGATE/DOUG. PK	1620				2900							
STRATHMILLAN	1200	2820	2820		900	3800	1.31	1.5		4983		
												1.0
LINK			1000	0.109			0.26		16			
WOODHAVEN	1000	1000			1900	5800	1.56	1.6		1767		
					198900					200377		

TOTAL P.S. COST	**$11 M**
TOTAL TUNNEL COST	**$220 M**
TOTAL NET COST	**$231 M**
TOTAL BUDGET COST (1.58*NET)	**$365 M**
FLOW CONTOL COST	**$12 M**
FLUSHING	**$20 M**
NEWPCC	**$70 M**
TOTAL	**$468 M**

TABLE 3-16 **REGIONAL TUNNEL - 185,000 m³** (Overflows; Dewater @10 60mL/d)

With In-line Storage

DISTRICT	LENGTH m	GROUP LENGTH m	CUMULATIVE LENGTH m	EWATERIN RATE m³/s	STORAGE NEEDED m³ 4 Overflows	GROUP STORAGE m³ 4 Overflows	DIAMETER NEEDED m	DIAMETER USED m	POWER kW	REACH VOLUMES m³	CUM. VOLUMES m³	PUMP STATION + FM $M
DIAMETER							0.9	1.5				
FERRY ROAD	780				25					513		
RIVERBEND	650				4300					427		
TYLEHURST	1040				0					684		
CLIFTON/AUBREY	2280				0					1500		
		4750	4750			4325	1.08	1.50		0	3124	
TUXEDO	830			0.074	1000					223		
DONCASTER/ASH	2900			1.291	0					777		
		3730				1000	0.58	1.50		0		
			8480									
LINK			770	1.365			0.93		179	0		2.3
										0		
CORNISH	970				0					638		
COLONY	790				0					520		
		1760				0	0.00	1.50		0		
			10240							0	4282	
JESSIE/RIVER	1730			0.662	1540					1540		
		1730				1540	1.06	1.50		0		
			11970									
LINK			400	0.662			0.65		70	0		1.3
										0		
ASSINIBOINE	1180				0					776		
		1180				0	0.00	1.50		0		
			13150							0	5058	
MISSION	1280			0.408	0					1837		
LaVERENDRYE/DUMOULI	1460			0.188	2270					2096		
DESPINS	1240									1780		
MARION	890			0.387	4720					1277		
		4870				6990	1.35	1.50		0		
			18020							0		
LINK			720	0.983			0.79		126	0		1.8
										0		
BANNATINE	480				1520					316		
ALEXANDER	1170				1600					769		
SYNDICATE/BOYLE					2850							
SELKIRK/SYNDICATE	1160				0					763		
ST.JOHN'S	860				0					566		
		3670				5970	1.44	1.50		0		
			21690							0	7471	
ROLAND/HART	2130			0.577	0					0		
MUNROE	1700			0.552	0					0		
		3830				0	0.00			0		
			25520							0		
LINK			1150	1.129			0.85		178	0		2.5
										0		
POLSON	1050				0					691		
JEFFERSON/NEWTON	1220				0					802		
		2270				0	0.00	1.50		0		
			27790							0	8964	
HAWTHORNE	1220			0.281	425					425		
		1220				425	0.67	1.50		0		
			29010							0		
LINK			1150	0.281			0.42		44	0		1.4
										0		
ARMSTRONG/CONNECTO	1780				0					1171		
		1780				0	0.00	1.50		0		
					20250					0		
	30790	30790	30790			20250	0.92			20250		
MAIN TUNNEL										20090	10135	
Diameter Required							0.92					
COCKBURN	1910				10480					10141		
BALTIMORE	1690				8450					8973		
		3600				18930	2.59	2.60				0
LINK			380				0.24		10.00			0.8
				0.091								
METCALFE/MAGER	1840	1840			5960	5960	2.03	2.05		6073		
		5440	5440							75661		
MOORGATE/DOUG. PK	1620				0							
STRATHMILLAN	1200	2820	2820		735	735	0.58	1.50		4983		
LINK			1000				0.26		16			1.0
				0.109								
WOODHAVEN	1000	1000			1800	1800	1.51	1.50		1767		
										82412		

TOTAL P.S. COST	**$11 M**
TOTAL TUNNEL COST	**$139 M**
TOTAL NET COST	**$150 M**
TOTAL BUDGET COST (1.58*NET)	**$237 M**
IN-LINE STORAGE COST	**$100 M**
FLUSHING	**$14 M**
NEWPCC	**$70 M**
TOTAL	**$421 M**

4. OFF-LINE STORAGE COSTS

4.1 OVERVIEW

The summary of the off-line storage costs for the 1992 representative year, with and without in-line storage and for the three dewatering scenarios, is shown on Table 4-1. This table replaces Table 5-17 in the Phase 3 TM No. 1.

The increases for seven of the options (of approximately 10%) resulted from an error in multiplying the mark-up percentage to the net costs, i.e., the multiplier used was 1.44 (notwithstanding the fact that it was indicated to be 1.58). The one drop in cost, that is for the 0 overflows with 1,060 ML/day dewatering, with in-line storage, resulted from an application of incorrect unit rates in the tunnel cost calculations.

The unit rates for tunnels used in these revised calculations were based on the revised tunnel unit rates as provided in Figure 3-1 of this appendix.

4.2 BACK-UP

The back-up calculations for all of the off-line storage options for the 1992 representative year, as summarized in Table 4-1, are provided in Tables 4-2 through 4-13 inclusive.

4.3 OFF-LINE STORAGE WITH TRANSFERS

As with some of the other off-line storage options, an incorrect multiplier was used to arrive at the total budget cost, i.e., although a 1.58 multiplier was indicated on the table, only 1.44 was used. In addition to this correction, the cost of the interceptor upgrade for the 825 ML/day dewatering rate was also changed, as discussed earlier. The results of these changes are shown on Tables 4-14 and 4-15, replacing Tables 5-19 and 5-20 in the Phase 3 TM No. 1.

Table 4-1: OFF-LINE STORAGE - COST SUMMARY
1992 REPRESENTATIVE YEAR

	WITH IN-LINE STORAGE			WITHOUT IN-LINE STORAGE		
DEWATERING RATE	600 ML/d	825 ML/d	1060 ML/d	600 ML/d	825 ML/d	1060 ML/d
0 OVERFLOWS	$M	$M	$M	$M	$M	$M
STORAGE VOLUME	820,000 m^3	610,000 m^3	530,000 m^3	820,000 m^3	610,000 m^3	530,000 m^3
BASE COST*	566	420	326	779	645	517
FLOW CONTROL				12	12	12
IN-LINE STORAGE	100	100	100			
FLUSHING	43	31	28	64	50	44
INTERCEPTOR		23	71		23	71
NEWPCC	15	36	70	15	36	70
TOTAL 0 OVERFLOWS	$724M	$610M	$595M	$870M	$765M	$713M
4 OVERFLOWS	$M	$M	$M	$M	$M	$M
STORAGE VOLUME	300,000 m^3	220,000 m^3	185,000 m^3	300,000 m^3	220,000 m^3	185,000 m^3
BASE COST*	161	116	89	356	311	274
FLOW CONTROL				12	12	12
IN-LINE STORAGE	100	100	100			
FLUSHING	16	8	8	26	22	23
INTERCEPTOR		23	71		23	71
NEWPCC	15	36	70	15	36	70
TOTAL 4 OVERFLOWS	$291M	$283M	$339M	$410M	$404M	$449M

* BASE COSTS INCLUDE MULTIPLIERS

OFLNcst1.wpd

TABLE 4-2 OFFLINE STORAGE - 820,000 m³ (0 Overflows; Dewater @ 600mL/d)

DISTRICT	STORAGE NEEDED m³ 0 Overflows	GROUP	OFFLINE UNITS AVAILABLE (5000 m³) (potential)	OFFLINE UNITS USED (5000 m³)	TUNNEL DIAMETER USED m	TUNNEL LENGTH NEEDED m	TUNNEL VOLUME m³	PUMP CAPACITY NEEDED (tanks) m³/s	PIPE DIAMETER (2m/s) m	PIPE LENGTH m	POWER kW	COST TANKS $M	COST TUNNELS $M	COST PUMP $M	COST PUMP STNS+F.M. $M
DIAMETER					4										
FERRY ROAD	24750		8	5		0		1.6	1.0	400	141	7		1.5	2.0
RIVERBEND	24750	A	0		5.10	6910	141159		0.0		0		69	0.0	0.2
TYLEHURST	27500	A	0						0.0		0		0	0.0	0.2
CLIFTON	35750	A	6	6				2.1	1.2	450	185	8	0	1.8	2.4
AUBREY	30250	A	0						0.0				0	0.0	0.2
						0			0.0				0	0.0	
TUXEDO	8250	B	0	0	5.00	5330	104655		0.0				52	0.0	0.2
DONCASTER	6875	B	0						0.0				0	0.0	0.2
ASH	89375	B	0						0.0				0	0.0	0.2
						0			0.0				0	0.0	
CORNISH	7700	A	0						0.0				0	0.0	0.2
COLONY	28880	A	0						0.0				0	0.0	0.2
						0			0.0				0	0.0	
JESSIE	42620	C	5	5	4.00	2715	34118	2.3	1.2	400	203	7	22	1.9	2.5
RIVER	16500	C	0	0				0.0	0.0	0	0	0	0	0.0	0.2
						0			0.0				0	0.0	
ASSINIBOINE	16500	A	0						0.0				0	0.0	0.2
						0			0.0				0	0.0	
MISSION/ROLAND	60500	D	7	7	4.00	3500	43982	3.5	1.5	650	309	9	28	2.6	3.5
LaVERENDRYE/DUMOUL	17880	D	1	1				0.9	0.8	150	79	3	0	1.2	1.4
DESPINS		D							0.0				0	0.0	0.2
MARION	41250	D	7	7				1.8	1.1	250	159	9	0	1.6	2.0
	0					0			0.0				0	0.0	
BANNATINE	23380	E	3	3	3.90	4720	56385	1.2	0.9	300	106	5	37	1.3	1.7
ALEXANDER	23380	E	3	3				1.3	0.9	60	115	5	0	1.3	1.5
SYNDICATE/BOYLE	15125	E	1	1				0.8	0.7	200	71	3	0	1.0	1.3
SELKIRK	22000	E	4	4				1.2	0.9	200	106	6	0	1.3	1.6
ST.JOHN'S	44000	E	6	6				2.4	1.2	80	212	8	0	1.9	2.2
						0			0.0				0	0.0	
HART/MUNROE	83875		4	4	4.00	5083	63875	3.7	1.5	700	326	6	41	2.7	3.7
						0			0.0				0	0.0	
POLSON	28880	E	3	3				1.6	1.0	500	141	5	0	1.5	2.0
JEFFERSON/NEWTON	57750		0	0	4.00	4596	57750		0.0				37	0.0	0.2
						0			0.0				0	0.0	
HAWTHORNE	25440		0	0	4.00	2024	25440		0.0				16	0.0	0.2
													0	0.0	
ARMSTRONG/CONNECT	16500		3	3	4.00	119	1500	0.8	0.7	150	71	5	1	1.0	1.3
						0								0.0	
						0								0.0	
	819660			58			528864							0.0	
TUNNEL														0.0	
Volume Supplied						0								0.0	
TANKAGE				290000										0.0	
Volume Supplied														0.0	
					4									0.0	
COCKBURN	31000	F	5	5	3.5	2183		1.3	0.9	750	197	7	16	1.8	2.5
BALTIMORE	30000	F	3	3				1	0.8	500	152	5	0	1.6	2.1
														0.0	
METCALFE/MAGER	41000		2	2		2467		1.5	1.0	900	147	4	20	1.5	2.3
														0.0	
														0.0	
MOOGATE/DOUG.PARK	11000	G			3.1	2000							13	0.0	0.2
														0.0	
STRATHMILLAN	4000	G											0	0.0	0.2
														0.0	
WOODHAVEN	5800					462							4	0.0	0.2
												$104	$350		$39

TOTAL P.S. COST	$39 M
TOTAL TUNNEL COST	$350 M
TOTAL TANK COST	$104 M
TOTAL NET COST	$493 M
TOTAL BUDGET COST (1.58*NET)	$779 M
+ FLOW CONTROL	$12 M
+ IN-LINE STORAGE	
+ INTERCEPTOR	
+ NEWPCC	$15 M
+ FLUSHING	$64 M
TOTAL ESTIMATED COST	$870 M

TABLE 4-3 OFFLINE STORAGE - 820,000 m³ (0 Overflows; Dewater @ 600mL/d)

With In-line Storage

DISTRICT	STORAGE NEEDED m³ 0 Overflows	GROUP	OFFLINE UNITS AVAILABLE (5000 m³)	OFFLIN UNITS USED (5000 m³	TUNNEL DIAMETER USED m	TUNNEL LENGTH NEEDED m	TUNNEL VOLUM m³	PUMP CAPACITY NEEDED (tanks)	PIPE DIAMETER (2m/s) m	PIPE LENGTH m	POWER kW	COST TANKS $M	COST TUNNELS $M	COST PUMP $M $M	COST PUMP TNS+F.M. $M
DIAMETER					4										
FERRY ROAD	20070		8	4.0				1.6	1.0	400	141	6.4		1.5	2.0
RIVERBEND	24460	A	0	0.0	3.64	6910	71907		0.0				52	0.0	0.2
TYLEHURST	21100	A	0	0.0					0.0				0	0.0	0.2
CLIFTON	8690	A	6	1.8				2.1	1.2	450	185	3.7	0	1.8	2.4
AUBREY	0	A	0	0.0					0.0				0	0.0	0.2
									0.0				0	0.0	
TUXEDO	7840	B	0	0.0	4.45	3730	58012		0.0				32	0.0	0.2
DONCASTER	1260	B	0	0.0					0.0				0	0.0	0.2
ASH	48960	B	0	0.0					0.0				0	0.0	0.2
									0.0				0	0.0	
CORNISH	2100	A	0	0.0					0.0				0	0.0	0.2
COLONY	16240	A	0	0.0					0.0				0	0.0	0.2
									0.0				0	0.0	
JESSIE	35960	C	5	5.0	4.00	1817	22833	2.3	1.2	400	203	7.0	15	1.9	2.5
RIVER	11880	C	0	0.0				0.0	0.0	0	0	0.0	0	0.0	0.2
									0.0				0	0.0	
ASSINIBOINE	8080	A	0	0.0					0.0				0	0.0	0.2
									0.0				0	0.0	
MISSION/ROLAND	30420	D	7	6.1	2.30	3500	14542	3.5	1.5	650	309	8.2	17	2.6	3.5
LaVERENDRYE/DUMOU	17240	D	1	1.0				0.9	0.8	150	79	3.0	0	1.2	1.4
DESPINS		D							0.0				0	0.0	0.2
MARION	37170	D	7	7.0				1.8	1.1	250	159	9.5	0	1.8	2.0
									0.0				0	0.0	
BANNATINE	21000	E	3	3.0	3.05	2810	20530	1.2	0.9	300	106	5.1	18	1.3	1.7
ALEXANDER	19570	E	3	3.0				1.3	0.9	60	115	5.1	0	1.3	1.5
SYNDICATE/BOYLE	14680	E	1	1.0				0.8	0.7	200	71	3.0	0	1.0	1.3
SELKIRK	11750	E	4	2.4				1.2	0.9	200	106	4.4	0	1.3	1.6
ST.JOHN'S	19100	E	6	3.8				2.4	1.2	80	212	6.1	0	1.9	2.2
									0.0				0	0.0	
HART/MUNROE	32130		4	4.0	4.00	965	12130	3.7	1.5	700	326	6.4	8	2.7	3.7
									0.0				0	0.0	
POLSON	5470	E	3	1.1				1.6	1.0	500	141	3.3	0	1.5	2.0
JEFFERSON/NEWTON	42270		0	0.0	4.00	3364	42270		0.0				27	0.0	0.2
									0.0				0	0.0	
HAWTHORNE	21560		0	0.0	4.00	1716	21560		0.0				14	0.0	0.2
													0	0.0	
ARMSTRONG/CONNECT	16060		3	3.0	4.00	84	1060	0.8	0.7	150	71	5.1	1	1.0	1.3
														0.0	
														0.0	
	495060		61	46.2			264845							0.0	
TUNNEL VOL. SUPP.														0.0	
TANKS VOL. SUPP.				231000										0.0	
MAIN TUNNEL														0.0	
Diameter Required					4									0.0	
COCKBURN	30484	F	5	5	3.5	2005	19290	1.3	0.9	750	197	7	14	1.8	2.5
BALTIMORE	28450	F	3	3				1	0.8	500	152	5	0	1.6	2.1
													0	0.0	
METCALFE/MAGER	32462		2	2		1787		1.5	1.0	900	147	4	14	1.5	2.3
													0	0.0	
													0	0.0	
MOORGATE/DOUG.PAR	7230	G			2.7	2000	11451						11	0.0	0.2
													0	0.0	
STRATHMILLAN	3840	G											0	0.0	0.2
													0	0.0	
WOODHAVEN	5700					454							4	0.0	0.2
												$92	$227		$39

TOTAL P.S. COST	**$39 M**
TOTAL TUNNEL COST	**$227 M**
TOTAL TANK COST	**$92 M**
TOTAL NET COST	**$358 M**
TOTAL BUDGET COST (1.58*NET)	**$566 M**
+ FLOW CONTROL	
+ INLINE STORAGE	**$100 M**
+ INTERCEPTOR	
+ NEWPCC	**$15 M**
+ FLUSHING	**$43**
TOTAL ESTIMATED COST	**$724 M**

TABLE 4-4 OFFLINE STORAGE - 610,000 m³ (0 Overflows; Dewater @ 825mL/d)

DISTRICT	STORAGE NEEDED m³ 0 Overflows	GROUP	OFFLINE UNITS AVAILABLE (5000 m³)	OFFLIN UNITS USED (5000 m³)	TUNNEL DIAMETER USED m	TUNNEL LENGTH NEEDED m	TUNNEL VOLUM m³	PUMP CAPACITY NEEDED (tanks)	PIPE IAMETE (2m/s) m	PIPE LENGTH m	POWER kW	COST TANKS $M	COST TUNNELS $M	COST PUMP $M	COST PUMP STNS+F.M. $M
DIAMETER					4										
FERRY ROAD	18000		6	3.6				1.6	1.0	400	141	5.9		1.5	2.0
RIVERBEND	18000	A	0	0.0	4.30	6910	100347		0.0				58	0.0	0.2
TYLEHURST	20000	A	0	0.0					0.0				0	0.0	0.2
CLIFTON	26000	A	6	5.2				2.1	1.2	450	185	7.3		1.8	2.4
AUBREY	22000	A	0						0.0				0	0.0	0.2
									0.0					0.0	
TUXEDO	6000	B	0		5.00	3880	76184		0.0				38	0.0	0.2
DONCASTER	5000	B	0						0.0				0	0.0	0.2
ASH	65000	B	0						0.0				0	0.0	0.2
									0.0					0.0	
CORNISH	5600	A	0						0.0				0	0.0	0.2
COLONY	21000	A	0						0.0				0	0.0	0.2
									0.0					0.0	
JESSIE	31000	C	5	5.0	4.00	1432	17995	2.3	1.2	400	203	7.0	11	1.9	2.5
RIVER	12000	C	1	0.0				0.0	0.0	0	0	0.0	0	0.0	0.2
									0.0					0.0	
ASSINIBOINE	12000	A	0						0.0				0	0.0	0.2
									0.0					0.0	
MISSION/ROLAND	44000	D	7	7.0	2.50	3500	17181	3.5	1.5	650	309	9.5	19	2.6	3.5
LaVERENDRYE/DUMOU	13000	D	1	1.0				0.9	0.8	150	79	3.0	0	1.2	1.4
DESPINS		D							0.0				0	0.0	0.2
MARION	30000	D	7	6.0				1.8	1.1	250	159	8.1	0	1.6	2.0
						0			0.0				0	0.0	
BANNATINE	17000	E	3	3.0	2.20	4720	17942	1.2	0.9	300	106	5.1	23	1.3	1.7
ALEXANDER	17000	E	3	3.0				1.3	0.9	60	115	5.1	0	1.3	1.5
SYNDICATE/BOYLE	11000	E	1	1.0				0.8	0.7	200	71	3.0	0	1.0	1.3
SELKIRK	16000	E	4	3.2				1.2	0.9	200	106	5.4	0	1.3	1.6
ST.JOHN'S	32000	E	6	6.0				2.4	1.2	80	212	8.6	0	1.9	2.2
									0.0					0.0	
HART/MUNROE	61000		4	4.0	4.00	3263	41000	3.7	1.5	700	326	6.4	26	2.7	3.7
									0.0					0.0	
POLSON	21000	E	3	3.0				1.6	1.0	500	141	5.1	0	1.5	2.0
JEFFERSON/NEWTON	42000		0		4.00	3342	42000		0.0				27	0.0	0.2
									0.0					0.0	
HAWTHORNE	18500		0		4.00	1472	18500		0.0				12	0.0	0.2
														0.0	
ARMSTRONG/CONNECT	19000		3	3.0	4.00	318	4000	0.8	0.7	150	71	5.1	3	1.0	1.3
	603100		48	54											
TUNNEL VOL. SUPP.						0	335149								
TANKS VOL. SUPP.				270000											
MAIN TUNNEL								25							
Diameter Required					4										
COCKBURN	31000	F	5	5	3.5	2183	21003	1.3	0.9	750	197	7	16	1.8	2.5
BALTIMORE	30000	F	3	3				1	0.8	500	152	5	0	1.6	2.1
														0.0	
METCALFE/MAGER	41000		2	2	4	2467	31001	1.5	1.0	900	147	4	20	1.5	2.3
														0.0	
														0.0	
MOOGATE/DOUG.PARK	11000	G			3.1	2000							13	0.0	0.2
														0.0	
STRATHMILLAN	4000	G											0	0.0	0.2
														0.0	
WOODHAVEN	5800					462							4	0.0	0.2
												$101	$268		$39

TOTAL P.S. COST	$39 M
TOTAL TUNNEL COST	$268 M
TOTAL TANK COST	$101 M
TOTAL NET COST	$408 M
TOTAL BUDGET COST (1.58*NET)	$645 M
+ FLOW CONTROL	$12 M
+ IN-LINE STORAGE	
+ INTERCEPTOR	$23 M
+ NEWPCC	$36 M
+ FLUSHING	$50 M
TOTAL ESTIMATED COST	$765 M

TABLE 4-5 OFFLINE STORAGE - 610,000 m³ (0 Overflows; Dewater @ 825mL/d)

With In-line Storage

DISTRICT	STORAGE NEEDED m³ 0 Overflows	GROUP	OFFLINE UNITS AVAILABLE (5000 m³)	OFFLIN UNITS USED (5000 m³	TUNNEL DIAMETER USED m	TUNNEL LENGTH NEEDED m	TUNNEL VOLUM m³	PUMP CAPACITY NEEDED (tanks)	PIPE DIAMETER (2m/s) m	PIPE LENGTH m	POWER kW	COST TANKS $M	COST TUNNELS $M	COST PUMP $M	COST PUMP STNS+F.M. $M
DIAMETER					4										
FERRY ROAD	13320		8	2.7				1.6	1.0	400	141	4.9		1.5	2.0
RIVERBEND	17710	A	0	0.0	2.80	6910	42549		0.0				41	0.0	0.2
TYLEHURST	13610	A	0	0.0					0.0				0	0.0	0.2
CLIFTON	0	A	6	0.0				0.0	0.0	450	0	0.0	0	0.0	0.2
AUBREY	0	A	0	0.0					0.0				0	0.0	0.2
									0.0				0	0.0	
TUXEDO	5600	B	0	0.0	3.20	3730	29999		0.0				25	0.0	0.2
DONCASTER	0	B	0	0.0					0.0				0	0.0	0.2
ASH	24580	B	0	0.0					0.0				0	0.0	0.2
									0.0				0	0.0	
CORNISH	0	A	0	0.0					0.0				0	0.0	0.2
COLONY	8360	A	0	0.0					0.0				0	0.0	0.2
									0.0				0	0.0	
JESSIE	24340	C	5	4.9	4.00	587	7376	2.3	1.2	400	203	6.8	5	1.9	2.5
RIVER	7380	C	1	0.0				0.0	0.0	0	0	0.0	0	0.0	0.2
									0.0				0	0.0	
ASSINIBOINE	3580	A	0	0.0					0.0				0	0.0	0.2
									0.0				0	0.0	
MISSION/ROLAND	16380	D	7	3.3	1.60	3500	7037	3.5	1.5	650	309	5.6	13	2.6	3.5
LaVERENDRYE/DUMOU	12370	D	1	1.0				0.9	0.8	150	79	3.0	0	1.2	1.4
DESPINS		D							0.0				0	0.0	0.2
MARION	25920	D	7	5.2				1.8	1.1	250	159	7.3	0	1.6	2.0
									0.0				0	0.0	
BANNATINE	14620	E	3	2.9	3.00	800	5655	1.2	0.9	300	106	5.0	5	1.3	1.7
ALEXANDER	13200	E	3	2.7				1.3	0.9	60	115	4.9	0	1.3	1.5
SYNDICATE/BOYLE	10550	E	1	1.0				0.8	0.7	200	71	3.0	0	1.0	1.3
SELKIRK	5750	E	4	1.2				1.2	0.9	200	106	3.0	0	1.3	1.6
ST.JOHN'S	7100	E	6	1.5				2.4	1.2	80	212	3.3	0	1.9	2.2
									0.0				0	0.0	
HART/MUNROE	9250		4	1.9		0		3.7	1.5	700	326	3.7	0	2.7	3.7
									0.0				0	0.0	
POLSON	0	E	3	0.0				1.6	1.0	500	141	0.0	0	1.5	2.0
JEFFERSON/NEWTON	26520		0	0.0	4.00	2110	26520		0.0				17	0.0	0.2
									0.0				0	0.0	
HAWTHORNE	14620		0	0.0	4.00	1163	14620		0.0				9	0.0	0.2
													0	0.0	
ARMSTRONG/CONNECT	8940		3	1.8				0.8	0.7	150	71	3.7	0	1.0	1.3
	283700		62	30											
TUNNEL VOL. SUPP.						0	133756								
TANKS VOL. SUPP.				150000											
MAIN TUNNEL															
Diameter Required					4										
COCKBURN	30484	F	5	5	3.5	2005	19290	1.3	0.9	750	197	7	15	1.8	2.5
BALTIMORE	28450	F	3	3				1	0.8	500	152	5	0	1.6	2.1
													0	0.0	
METCALFE/MAGER	32462		2	2		1787		1.5	1.0	900	147	4	14	1.5	2.3
													0	0.0	
													0	0.0	
MOORGATE/DOUG.PAR	7230	G			2.7	2000	11451						11	0.0	0.2
													0	0.0	
STRATHMILLAN	3840	G											0	0.0	0.2
													0	0.0	
WOODHAVEN	5700					454							4	0.0	0.2
												$70	$159		$37

TOTAL P.S. COST	$37 M
TOTAL TUNNEL COST	$159 M
TOTAL TANK COST	$70 M
TOTAL NET COST	$266 M
TOTAL BUDGET COST (1.58*NET)	$420 M
+ FLOW CONTROL	
+ INLINE STORAGE	$100 M
+ INTERCEPTOR	$23 M
+ NEWPCC	$36 M
+ FLUSHING	$31 M
TOTAL ESTIMATED COST	$610 M

TABLE 4-6 OFFLINE STORAGE - 530,000 m³ (0 Overflows; Dewater @10 60mL/d)

DISTRICT	STORAGE NEEDED m³/ 0 Overflows	GROUP	OFFLINE UNITS AVAILABLE (5000 m³) (potential)	OFFLIN UNITS USED (5000 m³	TUNNEL DIAMETER USED m	TUNNEL LENGTH NEEDED m	TUNNEL VOLUM m³	PUMP CAPACITY NEEDED (tanks) m³/s	PIPE DIAMETER (2m/s) m	PIPE LENGTH m	POWER kW	COST TANKS $M	COST TUNNELS $M	COST PUMP $M	COST PUMP STN9+F.M. $M
DIAMETER					4										
FERRY ROAD	12900		8	3		0		1.6	1.0	400	141	5		1.5	2.0
RIVERBEND	12900	A	0		3.60	6910	70335		0.0		0		51	0.0	0.2
TYLEHURST	14300	A	0						0.0		0		0	0.0	0.2
CLIFTON	18600	A	6	4				2.1	1.2	450	185	6	0	1.8	2.4
AUBREY	15700	A	0						0.0				0	0.0	0.2
						0			0.0				0	0.0	
TUXEDO	4300	B	0	0	4.30	3730	54167		0.0				32	0.0	0.2
DONCASTER	3600	B	0						0.0				0	0.0	0.2
ASH	46900	B	0						0.0				0	0.0	0.2
						0			0.0				0	0.0	
CORNISH	4000	A	0						0.0				0	0.0	0.2
COLONY	15000	A	0						0.0				0	0.0	0.2
						0			0.0				0	0.0	
JESSIE	22200	C	5	4	4.00	684	8595	2.3	1.2	400	203	7	5	1.9	2.5
RIVER	8600	C	1	0				0.0	0.0	0	0	0	0	0.0	0.2
						0			0.0				0	0.0	
ASSINIBOINE	8600	A	0						0.0				0	0.0	0.2
						0			0.0				0	0.0	
MISSION/ROLAND	31500	D	7	6	1.50	2800	4948	3.5	1.5	650	309	9	10	2.6	3.5
LaVERENDRYE/DUMOUL	9900	D	1	1				0.9	0.8	150	79	3	0	1.2	1.4
DESPINS		D				0			0.0				0	0.0	0.2
MARION	23900	D	7	5		0		1.8	1.1	250	159	7	0	1.6	2.0
	0					0			0.0				0	0.0	
BANNATINE	12200	E	3	2	3.10	500	3774	1.2	0.9	300	106	5	3	1.3	1.7
ALEXANDER	12200	E	3	2		0		1.3	0.9	60	115	5	0	1.3	1.5
SYNDICATE/BOYLE	8800	E	1	1				0.8	0.7	200	71	3	0	1.0	1.3
SELKIRK	11400	E	4	2		0		1.2	0.9	200	106	5	0	1.3	1.6
ST.JOHN'S	22900	E	6	5		0		2.4	1.2	80	212	6	0	1.9	2.2
						0			0.0				0	0.0	
HART/MUNROE	43600		4	4	4.00	1878	23600	3.7	1.5	700	326	6	15	2.7	3.7
						0			0.0				0	0.0	
POLSON	15000	E	3	3		0		1.6	1.0	500	141	5	0	1.5	2.0
JEFFERSON/NEWTON	30000		0	0	4.00	2387	30000		0.0				19	0.0	0.2
						0			0.0				0	0.0	
HAWTHORNE	13200		0	0	4.00	1050	13200		0.0				8	0.0	0.2
													0	0.0	
ARMSTRONG/CONNECT	20900		3	3	4.00	470	5900	0.8	0.7	150	71	5	4	1.0	1.3
						0								0.0	
						0								0.0	
	443100			46			214520							0.0	
TUNNEL														0.0	
Volume Supplied						0								0.0	
TANKAGE														0.0	
Volume Supplied				227900										0.0	
					4									0.0	
COCKBURN	31000	F	5	5	3.5	2183	21003	1.3	0.9	750	197	7	16	1.8	2.5
BALTIMORE	30000	F	3	3				1	0.8	500	152	5	0	1.6	2.1
														0.0	
METCALFE/MAGER	41000		2	2	4	2467	31000	1.5	1.0	900	147	4	20	1.5	2.3
														0.0	
														0.0	
MOOGATE/DOUG.PARK	11000	G			3.1	2000	15095						13	0.0	0.2
														0.0	
STRATHMILLAN	4000	G											0	0.0	0.2
														0.0	
WOODHAVEN	5800					462							4	0.0	0.2
												$92	$196		$39

TOTAL P.S. COST	$39 M
TOTAL TUNNEL COST	$196 M
TOTAL TANK COST	$92 M
TOTAL NET COST	$327 M
TOTAL BUDGET COST (1.58*NET)	$517 M
+ FLOW CONTROL	$12 M
+ IN-LINE STORAGE	
+ INTERCEPTOR	$71 M
NEWPCC UPGRADE	$70 M
+ FLUSHING	$44 M
TOTAL ESTIMATED COST	$713 M

TABLE 4-7 OFFLINE STORAGE - 530,000 m³ (0 Overflows; Dewater @1060mL/d)

With In-line Storage

DISTRICT	STORAGE NEEDED m³ 0 Overflows	GROUP	OFFLINE UNITS AVAILABLE (5000 m³)	OFFLIN UNITS USED (5000 m³	TUNNEL DIAMETER USED m	TUNNEL LENGTH NEEDED m	TUNNEL VOLUM m³	PUMP CAPACITY NEEDED (tanks)	PIPE DIAMETER (2m/s) m	PIPE LENGTH m	POWER kW	COST TANKS $M	COST TUNNELS $M	COST PUMP $M	COST PUMP TNS+F.M. $M
DIAMETER					4										
FERRY ROAD	8220		8	1.6		0		1.6	1.0	400	141	3.5		1.5	2.0
RIVERBEND	12610	A	0	0.0	2.06	6910	23031		0.0				31	0.0	0.2
TYLEHURST	7910	A	0	0.0					0.0				0	0.0	0.2
CLIFTON	0	A	6	0.0		0		0.0	0.0	450	0	0.0	0	0.0	0.2
AUBREY	0	A	0	0.0		0			0.0				0	0.0	0.2
									0.0				0	0.0	
TUXEDO	3900	B	0	0.0	1.90	3730	10576		0.0				16	0.0	0.2
DONCASTER	0	B	0	0.0		0			0.0				0	0.0	0.2
ASH	6480	B	0	0.0					0.0				0	0.0	0.2
									0.0				0	0.0	
CORNISH	0	A	0	0.0		0			0.0				0	0.0	0.2
COLONY	2360	A	0	0.0					0.0				0	0.0	0.2
									0.0				0	0.0	
JESSIE	15540	C	5	3.1	4.00	317	3984	2.3	1.2	400	203	5.3	3	1.9	2.5
RIVER	3980	C	1	0.0				0.0	0.0	0	0	0.0	0	0.0	0.2
									0.0				0	0.0	
ASSINIBOINE	180	A	0	0.0					0.0				0	0.0	0.2
									0.0				0	0.0	
MISSION/ROLAND	9580	D	7	1.9	1.50	2400	4241	3.5	1.5	650	309	3.8	9	2.6	3.5
LaVERENDRYE/DUMOU	9270	D	1	1.0				0.9	0.8	150	79	3.0	0	1.2	1.4
DESPINS		D							0.0				0	0.0	0.2
MARION	19820	D	7	4.0		0		1.8	1.1	250	159	6.1	0	1.6	2.0
									0.0				0	0.0	
BANNATINE	9820	E	3	2.0	2.90	500	3303	1.2	0.9	300	106	3.9	3	1.3	1.7
ALEXANDER	8400	E	3	1.7		0		1.3	0.9	60	115	3.6	0	1.3	1.5
SYNDICATE/BOYLE	6350	E	1	1.0				0.8	0.7	200	71	3.0	0	1.0	1.3
SELKIRK	1150	E	4	0.0				0.0	0.0	200	0	0.0	0	0.0	0.2
ST.JOHN'S	0	E	6	0.0		0		0.0	0.0	80	0	0.0	0	0.0	0.2
									0.0				0	0.0	
HART/MUNROE	0		4	0.0		0		3.7	1.5	700	326	0.0	0	2.7	3.7
									0.0				0	0.0	
POLSON	0	E	3	0.0		0		1.6	1.0	500	141	0.0	0	1.5	2.0
JEFFERSON/NEWTON	14520		0	0.0	4.00	1155	14520		0.0				9	0.0	0.2
									0.0				0	0.0	
HAWTHORNE	9320		0	0.0	4.00	742	9320		0.0				6	0.0	0.2
													0	0.0	
ARMSTRONG/CONNECT	10840		3	2.2		0		0.8	0.7	150	71	4.3	0	1.0	1.3
														0.0	
														0.0	
	162250		62	18.4										0.0	
TUNNEL VOL. SUPPLIED						0	68973							0.0	
TANK VOL. SUPPLIED				92220										0.0	
MAIN TUNNEL														0.0	
Diameter Required					4									0.0	
COCKBURN	30484	F	5	5	3.5	2005		1.3	0.9	750	197	7	14	1.8	2.5
BALTIMORE	28450	F	3	3				1	0.8	500	152	5	0	1.6	2.1
													0	0.0	
METCALFE/MAGER	32462		2	2		1787		1.5	1.0	900	147	4	14	1.5	2.3
													0	0.0	
													0	0.0	
MOORGATE/DOUG.PAR	7230	G			2.7	2000							11	0.0	0.2
													0	0.0	
STRATHMILLAN	3840	G											0	0.0	0.2
													0	0.0	
WOODHAVEN	5700				4	454							4	0.0	0.2
												$53	$120		$34

TOTAL P.S. COST	**$34 M**
TOTAL TUNNEL COST	**$120 M**
TOTAL TANK COST	**$53 M**
TOTAL NET COST	**$206 M**
TOTAL BUDGET COST (1.58*NET)	**$326 M**
+ FLOW CONTROL	
+ INLINE STORAGE	**$100 M**
+ INTERCEPTOR	**$71**
+ NEWPCC	**$70**
+ FLUSHING	**$28**
TOTAL ESTIMATED COST	**$595 M**

TABLE 4-8 OFFLINE STORAGE - 300,000 m³ (4 Overflows; Dewater @ 600mL/d)

DISTRICT	STORAGE NEEDED m³ 4 Overflows	GROUP	OFFLINE UNITS AVAILABLE (5000 m³)	OFFLINE UNITS USED (5000 m³)	TUNNEL DIAMETER USED m	TUNNEL LENGTH NEEDED m	TUNNEL VOLUME m³	PUMP CAPACITY NEEDED (tanks)	PIPE DIAMETER (2m/s) m	PIPE LENGTH m	POWER kW	COST TANKS $M	COST TUNNELS $M	COST PUMP $M	COST PUMP STNS+F.M. $M
DIAMETER					3.6										
FERRY ROAD	9070		8	1.8				1.6	1.0	400	141	3.8		1.5	2.0
RIVERBEND	9070	A	0	0.0	3.09	6910	51819		0.0				44	0.0	0.2
TYLEHURST	11510	A	0	0.0					0.0				0	0.0	0.2
CLIFTON	19540	A	6	4.0				2.1	1.2	450	185	6.4		1.8	2.4
AUBREY	9490	A	0						0.0				0	0.0	0.2
									0.0					0.0	
TUXEDO	2790	B	0		3.48	3730	35478		0.0				27	0.0	0.2
DONCASTER	1950	B	0						0.0				0	0.0	0.2
ASH	30700	B	0						0.0				0	0.0	0.2
									0.0					0.0	
CORNISH	2510	A	0						0.0				0	0.0	0.2
COLONY	9490	A	0						0.0				0	0.0	0.2
									0.0					0.0	
JESSIE	16040	C	5	3.2	3.60	548	5578	2.3	1.2	400	203	5.4	4	1.9	2.5
RIVER	5580	C	1	0.0				0.0	0.0	0	0	0.0	0	0.0	0.2
									0.0					0.0	
ASSINIBOINE	9770	A	0						0.0				0	0.0	0.2
									0.0					0.0	
MISSION/ROLAND	23580	D	7	4.8	0.00	0	0	3.5	1.5	650	309	6.7		2.6	3.5
LaVERENDRYE/DUMOU	5230	D	1	1.0		0		0.9	0.8	150	79	3.1	0	1.2	1.4
DESPINS		D							0.0					0.0	0.2
MARION	15350	D	7	3.0				1.8	1.1	250	159	5.1	0	1.6	2.0
									0.0					0.0	
BANNATINE	7670	E	3	1.6				1.2	0.9	300	106	3.6		1.3	1.7
ALEXANDER	10460	E	3	2.0				1.3	0.9	60	115	4.0		1.3	1.5
SYNDICATE/BOYLE	5700	E	1	1.1		0		0.8	0.7	200	71	3.4	0	1.0	1.3
SELKIRK	6980	E	4	1.4				1.2	0.9	200	106	3.4		1.3	1.6
ST.JOHN'S	17440	E	6	3.5				2.4	1.2	80	212	5.8		1.9	2.2
									0.0					0.0	
HART/MUNROE	26790		4	4.0	3.60	667	6790	3.7	1.5	700	326	6.4	5	2.7	3.7
									0.0					0.0	
POLSON	11160	E	3	2.3				1.6	1.0	500	141	4.4		1.5	2.0
JEFFERSON/NEWTON	16740		0		3.60	1645	16740		0.0				12	0.0	0.2
									0.0					0.0	
HAWTHORNE	8370		0		3.60	822	8370		0.0				6	0.0	0.2
														0.0	
ARMSTRONG/CONNECT	7400		3	1.5				0.8	0.7	150	71	3.3		1.0	1.3
	300380		48	35.286			124775								
TUNNEL VOL. SUPP.						0									
TANKS VOL. SUPP.				176430											
MAIN TUNNEL								25							
Diameter Required					3										
COCKBURN	11000	F	5	2.2		0		1.3	0.9	750	197	4	0	1.8	2.5
BALTIMORE	10000	F	3	2		0		1	0.8	500	152	4	0	1.6	2.1
														0.0	
METCALFE/MAGER	14500		2	2		637		1.5	1.0	900	147	4	4	1.5	2.3
														0.0	
														0.0	
MOORGATE/DOUG.PAR	2900	G			1.55	2000	3774						7	0.0	0.2
														0.0	
STRATHMILLAN	875	G											0	0.0	0.2
														0.0	
WOODHAVEN	1900				3	269	1900						2	0.0	0.2
												$77	$110		$39

TOTAL P.S. COST	$39 M
TOTAL TUNNEL COST	$110 M
TOTAL TANK COST	$77 M
TOTAL NET COST	$226 M
TOTAL BUDGET COST (1.58*NET)	$356 M
+ FLOW CONTROL	$12 M
+ IN-LINE STORAGE	
+ INTERCEPTOR	
+ NEWPCC	$15 M
+ FLUSHING	$26
TOTAL ESTIMATED COST	$410 M

TABLE 4-9 OFFLINE STORAGE - 300,000 m³ (4 Overflows; Dewater @ 600mL/d)

With In-line Storage

DISTRICT	STORAGE NEEDED m³ 4 Overflows	GROUP	OFFLINE UNITS AVAILABLE (5000 m³)	OFFLIN UNITS USED (5000 m³	TUNNEL DIAMETER USED m	TUNNEL LENGTH NEEDED m	TUNNEL VOLUM m³	PUMP CAPACITY NEEDED (tanks)	PIPE DIAMETER (2m/s) m	PIPE LENGTH m	POWER kW	COST TANKS $M	COST TUNNELS $M	COST PUMPS $M	COST PUMP STNS+F.M $M
DIAMETER					3										
FERRY ROAD	4390		8	0.9		0		1.6	1.0	400	141	3.1		1.5	2.0
RIVERBEND	8780	A	0	0.0	1.68	6910	15226		0.0				26	0.0	0.2
TYLEHURST	5120	A	0	0.0					0.0				0	0.0	0.2
CLIFTON	0	A	6	0.0				0.0	0.0	0	0	0.0		0.0	0.2
AUBREY	0	A	0			0			0.0				0	0.0	0.2
									0.0					0.0	
TUXEDO	2300	B	0		2.42	500	2300		0.0				3	0.0	0.2
DONCASTER	0	B	0			0			0.0				0	0.0	0.2
ASH	0	B	0			0			0.0				0	0.0	0.2
									0.0					0.0	
CORNISH	0	A	0			0			0.0				0	0.0	0.2
COLONY	0	A	0			0			0.0				0	0.0	0.2
									0.0					0.0	
JESSIE	9390	C	5	1.9	3.00	136	961	2.3	1.2	400	203	3.9	1	1.9	2.5
RIVER	960	C	0	0.0				0.0	0.0	0	0	0.0		0.0	0.2
									0.0					0.0	
ASSINIBOINE	1350	A	0						0.0				0	0.0	0.2
									0.0					0.0	
MISSION/ROLAND	3120	D	7	0.6		0		3.5	1.5	650	309	2.7		2.6	3.5
LaVERENDRYE/DUMOULI	4600	D	1	0.9		0		0.9	0.8	150	79	3.0		1.2	1.4
DESPINS		D							0.0					0.0	0.2
MARION	11270	D	7	2.3		0		1.8	1.1	250	159	4.3		1.6	2.0
									0.0					0.0	
BANNATINE	5300	E	3	1.1		0		1.2	0.9	300	106	3.2		1.3	1.7
ALEXANDER	6660	E	3	1.3		0		1.3	0.9	60	115	3.1		1.3	1.5
SYNDICATE/BOYLE	5250	E	1	1.1		0		0.8	0.7	200	71	3.2		1.0	1.3
SELKIRK	0	E	4	0.0		0		0.0	0.0	0	0	0.0		0.0	0.2
ST.JOHN'S	0	E	6	0.0				0.0	0.0	0	0	0.0		0.0	0.2
									0.0					0.0	
HART/MUNROE	0		4	0.0		0		0.0	0.0	0	0	0.0	0	0.0	0.2
									0.0					0.0	
POLSON	0	E	3	0.0				0.0	0.0	0	0	0.0		0.0	0.2
JEFFERSON/NEWTON	1260		0		3.00	178	1260		0.0				1	0.0	0.2
									0.0					0.0	
HAWTHORNE	4500		0		3.00	637	4500		0.0				4	0.0	0.2
														0.0	
ARMSTRONG/CONNECT	0		3	0.0				0.0	0.0	0	0	0.0		0.0	0.2
	74250		61	10			24248								
TUNNEL VOL. SUPP.						0									
TANKS VOL. SUPP.				49980											
MAIN TUNNEL															
Diameter Required					3										
COCKBURN	10480	F	5	2.1		0		1.3	0.9	750	197	4.0	0	1.8	2.5
BALTIMORE	8450	F	3	1.7		0		1	0.8	500	152	3.7	0	1.6	2.1
														0.0	
METCALFE/MAGER	5960		2	1.2		0		1.5	1.0	900	147	3.0	0	1.5	2.3
														0.0	
														0.0	
MOORGATE/DOUG.PARK	0	G			1.5	400	707						1	0.0	0.2
														0.0	
STRATHMILLAN	710	G											0	0.0	0.2
														0.0	
WOODHAVEN	1800					255							2	0.0	0.2
												$37	$38		$27

TOTAL P.S. COST	**$27 M**
TOTAL TUNNEL COST	**$38 M**
TOTAL TANK COST	**$37 M**
TOTAL NET COST	**$102 M**
TOTAL BUDGET COST (1.58*NET)	**$161 M**
+ FLOW CONTROL	
+ INLINE STORAGE	**$100 M**
+ INTERCEPTOR	
+ NEWPCC	**$15 M**
+ FLUSHING	**$16 M**
TOTAL ESTIMATED COST	**$291 M**

TABLE 4-10 OFFLINE STORAGE - 220,000 m³ (4 Overflows; Dewater @ 825mL/d)

DISTRICT	STORAGE NEEDED m³ 4 Overflows	GROUP	OFFLINE UNITS AVAILABLE (5000 m³)	OFFLINE UNITS USED (5000 m³)	TUNNEL DIAMETER USED m	TUNNEL LENGTH NEEDED m	TUNNEL VOLUME m³	PUMP CAPACITY NEEDED (tanks)	PIPE DIAMETER (2m/s) m	PIPE LENGTH m	POWER kW	COST TANKS $M	COST TUNNELS $M	COST PUMP $M	COST PUMP STNS+F.M. $M
DIAMETER					3.6										
FERRY ROAD	6500		8	1.30				1.6	1.0	400	141	3.1		1.5	2.0
RIVERBEND	6500	A	0		2.62	6910	37254		0.0				39	0.0	0.2
TYLEHURST	8250	A	0						0.0				0	0.0	0.2
CLIFTON	14000	A	6	2.80		0		2.1	1.2	450	185	4.8	0	1.8	2.4
AUBREY	6800	A	0						0.0				0	0.0	0.2
									0.0				0	0.0	
TUXEDO	2000	B	0		2.94	3730	25322		0.0				23	0.0	0.2
DONCASTER	1400	B	0						0.0				0	0.0	0.2
ASH	22000	B	0						0.0				0	0.0	0.2
									0.0				0	0.0	
CORNISH	1800	A	0						0.0				0	0.0	0.2
COLONY	6800	A	0						0.0				0	0.0	0.2
									0.0				0	0.0	
JESSIE	11500	C	5	2.30	3.60	393	4000	2.3	1.2	400	203	4.1	3	1.9	2.5
RIVER	4000	C	0	0.00				0.0	0.0				0	0.0	0.2
									0.0				0	0.0	
ASSINIBOINE	7000	A	0						0.0				0	0.0	0.2
									0.0				0	0.0	
MISSION/ROLAND	16900	D	7	3.38		0		3.5	1.5	650	309	5.4	0	2.6	3.5
LaVERENDRYE/DUMOU	3750	D	1	0.75		0		0.9	0.8	150	79	3.0	0	1.2	1.4
DESPINS		D							0.0				0	0.0	0.2
MARION	11000	D	7	2.20		0		1.8	1.1	250	159	4.2	0	1.6	2.0
									0.0				0	0.0	
BANNATINE	5500	E	3	1.10		0		1.2	0.9	300	106	3.3	0	1.3	1.7
ALEXANDER	7500	E	3	1.50		0		1.3	0.9	60	115	3.5	0	1.3	1.5
SYNDICATE/BOYLE	4080	E	1	0.82		0		0.8	0.7	200	71	2.9	0	1.0	1.3
SELKIRK	5000	E	4	1.00		0		1.2	0.9	200	106	3.0	0	1.3	1.6
ST.JOHN'S	12500	E	6	2.50		0		2.4	1.2	80	212	4.5	0	1.9	2.2
									0.0				0	0.0	
HART/MUNROE	19200		4	3.84		0		3.7	1.5	700	326	6.0	0	2.7	3.7
									0.0				0	0.0	
POLSON	8000	E	3	1.60		0		1.6	1.0	500	141	3.6	0	1.5	2.0
JEFFERSON/NEWTON	12000		0		3.60	1179	12000		0.0				9	0.0	0.2
									0.0				0	0.0	
HAWTHORNE	6000		0		3.60	589	6000		0.0				4	0.0	0.2
													0	0.0	
ARMSTRONG/CONNECT	5300		3	1.06		0		0.8	0.7	150	71	3.2	0	1.0	1.3
													0		
							84576								
	215280		53	26											
TUNNEL VOL. SUPP.						0									
TANKS VOL. SUPP.				130730											
MAIN TUNNEL								25							
Diameter Required					3										
COCKBURN	11000	F	5	2.2		0		1.3	0.9	750	197	4	0	1.8	2.5
BALTIMORE	10000	F	3	2		0		1	0.8	500	152	4	0	1.6	2.1
														0.0	
METCALFE/MAGER	14500		2	2		637		1.5	1.0	900	147	4	4	1.5	2.3
														0.0	
														0.0	
MOORGATE/DOUG.PAR	2900	G			1.55	2000	3774						7	0.0	0.2
														0.0	
STRATHMILLAN	875	G											0	0.0	0.2
														0.0	
WOODHAVEN	1900					269							2	0.0	0.2
												$67	$91		$39

TOTAL P.S. COST	$39 M
TOTAL TUNNEL COST	$91 M
TOTAL TANK COST	$67 M
TOTAL NET COST	$197 M
TOTAL BUDGET COST (1.58*NET)	$311 M
+ FLOW CONTROL	$12 M
+ IN-LINE STORAGE	
+ INTERCEPTOR	$23 M
+ NEWPCC	$36 M
+ FLUSHING	$22 M
TOTAL ESTIMATED COST	$404 M

TABLE 4-11 OFFLINE STORAGE - 220,000 m³ (4 Overflows; Dewater @ 825mL/d)
With In-line Storage

DISTRICT	STORAGE NEEDED m³ 4 Overflows	GROUP	OFFLINE UNITS AVAILABLE (5000 m³)	OFFLINE UNITS USED (5000 m³)	TUNNEL DIAMETER USED m	TUNNEL LENGT NEEDED m	TUNNEL VOLUME m³	PUMP CAPACITY NEEDED (tanks)	PIPE DIAMETER (2m/s) m	PIPE LENGTH m	POWER kW	COST TANK $M	COST TUNNELS $M	COST PUMP $M	COST PUMP STNS+F.M. $M
DIAMETER					3										
FERRY ROAD	1820	A	8	0.0	2.60	1863	9891	0.0	0.0	400	0	0.0	10	0.0	0.2
RIVERBEND	6210	A	0	0.0			0		0.0				0	0.0	0.2
TYLEHURST	1860	A	0	0.0					0.0				0	0.0	0.2
CLIFTON	0	A	6	0.0				0.0	0.0	0	0	0	0	0.0	0.2
AUBREY	0	A	0	0.0		0			0.0				0	0.0	0.2
									0.0				0	0.0	
TUXEDO	1600	B	0	0.0	2.26	400	1605		0.0				2	0.0	0.2
DONCASTER	0	B	0	0.0		0			0.0				0	0.0	0.2
ASH	0	B	0	0.0		0			0.0				0	0.0	0.2
									0.0				0	0.0	
CORNISH	0	A	0	0.0		0			0.0				0	0.0	0.2
COLONY	0	A	0	0.0		0			0.0				0	0.0	0.2
									0.0				0	0.0	
JESSIE	4840	C	5	1.0		0		2.3	1.2	400	203	3.0	0	1.9	2.5
RIVER	0	C	1	0.0		0			0.0				0	0.0	0.2
									0.0				0	0.0	
ASSINIBOINE	0	A	0	0.0		0			0.0				0	0.0	0.2
									0.0				0	0.0	
MISSION/ROLAND	80	D	7	0.0		0		3.5	1.5	650	309	0.0	0	2.6	3.5
LaVERENDRYE/DUMOU	3120	D	1	0.6		0		0.9	0.8	150	79	3.2	0	1.2	1.4
DESPINS		D							0.0				0	0.0	0.2
MARION	6920	D	7	1.4		0		1.8	1.1	250	159	3.1	0	1.6	2.0
									0.0				0	0.0	
BANNATINE	3120	E	3	0.6		0		1.2	0.9	300	106	3.1	0	1.3	1.7
ALEXANDER	3700	E	3	0.7		0		1.3	0.9	60	115	3.7	0	1.3	1.5
SYNDICATE/BOYLE	3630	E	1	0.7		0		0.8	0.7	200	71	3.6	0	1.0	1.3
SELKIRK	0	E	4	0.0				0.0	0.0	0	0	0.0	0	0.0	0.2
ST.JOHN'S	0	E	9	0.0				0.0	0.0	0	0	0.0	0	0.0	0.2
									0.0				0	0.0	
HART/MUNROE	0		4	0.0		0		0.0	0.0	0	0	0.0	0	0.0	0.2
									0.0				0	0.0	
POLSON	0	E	3	0.0				0.0	0.0	0	0	0.0	0	0.0	0.2
JEFFERSON/NEWTON	0		0	0.0		0			0.0				0	0.0	0.2
									0.0				0	0.0	
HAWTHORNE	2120		0	0.0	3.00	300	2120		0.0				2	0.0	0.2
													0	0.0	
ARMSTRONG/CONNECT	0		3	0.0				0.0	0.0	0	0	0.0		0.0	0.2
	39020		65	5.075			13616								
TUNNEL VOL. SUPP.															
TANKS VOL. SUPP.				25375											
MAIN TUNNEL															
Diameter Required					3										
COCKBURN	10480	F	5	2.1		0		1.3	0.9	750	197	4.2	0	1.8	2.5
BALTIMORE	8450	F	3	1.7		0		1	0.8	500	152	3.6	0	1.6	2.1
													0	0.0	
METCALFE/MAGER	5960		2	1.2		0		1.5	1.0	900	147	3.6	0	1.5	2.3
						0							0	0.0	
						0							0	0.0	
MOORGATE/DOUG.PAR	0	G			1.5	400	707						1	0.0	0.2
						0							0	0.0	
STRATHMILLAN	710	G											0	0.0	0.2
						0							0	0.0	
WOODHAVEN	1800					255							2	0.0	0.2
												$31	$17		$25

TOTAL P.S. COST	$25	M
TOTAL TUNNEL COST	$17	M
TOTAL TANK COST	$31	M
TOTAL NET COST	$74	M
TOTAL BUDGET COST (1.58*NET)	$116	M
+ FLOW CONTROL		
+ INLINE STORAGE	$100	M
+ INTERCEPTOR	$23	M
+ NEWPCC	$36	M
+ FLUSHING	$8	M
TOTAL ESTIMATED COST	$283	M

TABLE 4-12 OFFLINE STORAGE - 185,000 m³ (4 Overflows; Dewater @ 1060mL/d)

DISTRICT	STORAGE NEEDED m³ 4 Overflows	GROUP	OFFLINE UNITS AVAILABLE (5000 m³)	OFFLINE UNITS USED (5000 m³)	TUNNEL DIAMETER USED m	TUNNEL LENGTH NEEDED m	TUNNEL VOLUME m³	PUMP CAPACITY NEEDED (tanks)	PIPE DIAMETER (2m/s) m	PIPE LENGTH m	POWER kW	COST TANKS $M	COST TUNNELS $M	COST PUMP $M	COST PUMP STNS+F.M. $M
DIAMETER					3.6										
FERRY ROAD	4700		8	0.9		0		1.6	1.0	400	141	3.3		1.5	2.0
RIVERBEND	4600	A	0	0.0	2.00	6910	21708		0.0				30	0.0	0.2
TYLEHURST	5900	A	0	0.0					0.0				0	0.0	0.2
CLIFTON	10000	A	6	2.0				2.1	1.2	450	185	4.0		1.8	2.4
AUBREY	4900	A	0						0.0				0	0.0	0.2
									0.0					0.0	
TUXEDO	1400	B	0		2.50	3730	18310		0.0				20	0.0	0.2
DONCASTER	1000	B	0						0.0				0	0.0	0.2
ASH	15900	B	0						0.0				0	0.0	0.2
									0.0					0.0	
CORNISH	1300	A	0						0.0				0	0.0	0.2
COLONY	4900	A	0						0.0				0	0.0	0.2
									0.0					0.0	
JESSIE	8200	C	5	1.6	3.60	285	2901	2.3	1.2	400	203	3.4	2	1.9	2.5
RIVER	2900	C	0	0.0				0.0	0.0	0	0	0.0	0	0.0	0.2
									0.0					0.0	
ASSINIBOINE	5000	A	0	0.0	3.60	491	4998		0.0				4	0.0	0.2
									0.0					0.0	
MISSION/ROLAND	12100	D	7	2.4		0		3.5	1.5	650	309	3.8		2.6	3.5
LaVERENDRYE/DUMOU	2900	D	1	0.6		0		0.9	0.8	150	79	3.0	0	1.2	1.4
DESPINS		D							0.0					0.0	0.2
MARION	8800	D	7	1.8		0		1.8	1.1	250	159	3.7	0	1.6	2.0
									0.0					0.0	
BANNATINE	3900	E	3	0.8		0		1.2	0.9	300	106	2.0		1.3	1.7
ALEXANDER	5400	E	3	1.1		0		1.3	0.9	60	115	3.0		1.3	1.5
SYNDICATE/BOYLE	3300	E	1	0.7		0		0.8	0.7	200	71	2.3	0	1.0	1.3
SELKIRK	3600	E	4	0.7		0		1.2	0.9	200	106	2.5	0	1.3	1.6
ST.JOHN'S	8900	E	6	1.8		0		2.4	1.2	80	212	3.7		1.9	2.2
									0.0					0.0	
HART/MUNROE	13700		4	2.7		0		3.7	1.5	700	326	4.7	0	2.7	3.7
									0.0					0.0	
POLSON	5700	E	3	1.1		0		1.6	1.0	500	141	3.2		1.5	2.0
JEFFERSON/NEWTON	8600		0		3.60	845	8600		0.0				6	0.0	0.2
									0.0					0.0	
HAWTHORNE	4300		0		3.60	422	4300		0.0				3	0.0	0.2
														0.0	
ARMSTRONG/CONNECT	5800		3	1.2		0		0.8	0.7	150	71	2.9		1.0	1.3
	157700		47	19			60817								
TUNNEL VOL. SUPP.															
TANKS VOL. SUPP.				97000											
MAIN TUNNEL								25							
Diameter Required					3										
COCKBURN	11000	F	5	2.2		0		1.3	0.9	750	197	4.2	0	1.8	2.5
BALTIMORE	10000	F	3	2		0		1	0.8	500	152	3.8	0	1.6	2.1
														0.0	
METCALFE/MAGER	14500		2	2	3	637	4500	1.5	1.0	900	147	3.8	4	1.5	2.3
														0.0	
														0.0	
MOORGATE/DOUG.PAR	2900	G			1.55	2000	3774						7	0.0	0.2
														0.0	
STRATHMILLAN	875	G											0	0.0	0.2
														0.0	
WOODHAVEN	1900				3	269	1900						2	0.0	0.2
												$57	$77		$39

TOTAL P.S. COST	**$39 M**
TOTAL TUNNEL COST	**$77 M**
TOTAL TANK COST	**$57 M**
TOTAL NET COST	**$173 M**
TOTAL BUDGET COST (1.58*NET)	**$274 M**
+ FLOW CONTROL	**$12 M**
+ IN-LINE STORAGE	
+ INTERCEPTOR	**$71 M**
+ NEWPCC	**$70 M**
+ FLUSHING	**$23 M**
TOTAL ESTIMATED COST	**$449 M**

TABLE 4-13 OFFLINE STORAGE - 185,000 m³ (4 Overflows; Dewater @ 1060mL/d)

With In-line Storage

DISTRICT	STORAGE NEEDED m³ 4 Overflows	GROUP	OFFLINE UNITS AVAILABLE (5000 m³)	OFFLIN UNITS USED (5000 m³	TUNNEL DIAMETER USED m	TUNNEL LENGTH NEEDED m	TUNNEL VOLUM m³	PUMP CAPACITY NEEDED (tanks)	PIPE DIAMETER (2m/s) m	PIPE LENGTH m	POWER kW	COST TANKS $M	COST TUNNELS $M	COST PUMP $M	COST PUMP STNS+F.M. $M
DIAMETER					3										
FERRY ROAD	25		8	0.0		0		0.0	0.0	400	0	0.0		0.0	0.2
RIVERBEND	4300	A	0	0.0	2.90	650	4293		0.0				4	0.0	0.2
TYLEHURST	0	A	0	0.0		0			0.0				0	0.0	0.2
CLIFTON	0	A	6	0.0				0.0	0.0	0	0	0.0		0.0	0.2
AUBREY	0	A	0			0			0.0				0	0.0	0.2
									0.0					0.0	
TUXEDO	1000	B	0		2.06	300	1000		0.0				2	0.0	0.2
DONCASTER	0	B	0			0			0.0				0	0.0	0.2
ASH	0	B	0			0			0.0				0	0.0	0.2
									0.0					0.0	
CORNISH	0	A	0			0			0.0				0	0.0	0.2
COLONY	0	A	0			0			0.0				0	0.0	0.2
									0.0					0.0	
JESSIE	1540	C	5	0.3		0		2.3	1.2	400	203	2.2	0	1.9	2.5
RIVER	0	C	1	0.0		0		0.0	0.0	0	0	0.0	0	0.0	0.2
									0.0					0.0	
ASSINIBOINE	0	A	0			0			0.0				0	0.0	0.2
									0.0					0.0	
MISSION/ROLAND	0	D	7	0.0		0		0.0	0.0	650	0	0.0		0.0	0.2
LaVERENDRYE/DUMOU	2270	D	1	0.5		0		0.9	0.8	150	79	2.5	0	1.2	1.4
DESPINS		D							0.0					0.0	0.2
MARION	4720	D	7	0.9		0		1.8	1.1	250	159	2.8	0	1.6	2.0
									0.0					0.0	
BANNATINE	1520	E	3	0.3		0		1.2	0.9	300	106	2.1	0	1.3	1.7
ALEXANDER	1600	E	3	0.3		0		1.3	0.9	60	115	2.2	0	1.3	1.5
SYNDICATE/BOYLE	2850	E	1	0.6		0		0.8	0.7	200	71	2.6	0	1.0	1.3
SELKIRK	0	E	4	0.0		0		0.0	0.0	0	0	0.0		0.0	0.2
ST.JOHN'S	0	E	6	0.0				0.0	0.0	0	0	0.0		0.0	0.2
									0.0					0.0	
HART/MUNROE	0		4	0.0		0		0.0	0.0	0	0	0.0	0	0.0	0.2
									0.0					0.0	
POLSON	0	E	3	0.0				0.0	0.0	0	0	0.0		0.0	0.2
JEFFERSON/NEWTON	0		0			0			0.0				0	0.0	0.2
									0.0					0.0	
HAWTHORNE	425		0		2	136	427		0.0				1	0.0	0.2
														0.0	
ARMSTRONG/CONNECT	0		3	0.0				0.0	0.0	0	0	0.0		0.0	0.2
	20250		62	3			5721								
TUNNEL VOL. SUPP.															
TANKS VOL. SUPP.				14500											
MAIN TUNNEL															
Diameter Required					3										
COCKBURN	10480	F	5	2.1		0		1.3	0.9	750	197	4.0	0	1.8	2.5
BALTIMORE	8450	F	3	1.7		0		1	0.8	500	152	3.7	0	1.6	2.1
														0.0	
METCALFE/MAGER	5960		2	1.2		0		1.5	1.0	900	147	3.0	0	1.5	2.3
														0.0	
														0.0	
MOORGATE/DOUG.PAR	0	G			1.5	400	707						1	0.0	0.2
														0.0	
STRATHMILLAN	710	G											0	0.0	0.2
														0.0	
WOODHAVEN	1800					255							2	0.0	0.2
												$25	$10		$22

TOTAL P.S. COST	$22 M
TOTAL TUNNEL COST	$10 M
TOTAL TANK COST	$25 M
TOTAL NET COST	$57 M
TOTAL BUDGET COST (1.58*NET)	$89 M
+ FLOW CONTROL	
+ INLINE STORAGE	$100 M
+ INTERCEPTOR	$71 M
+ NEWPCC	$70 M
+ FLUSHING	$8 M
TOTAL ESTIMATED COST	$339 M

Table 4-14: OFFLINE STORAGE - 80,000 m³ (4 Overflows; Dewater @ 600mL/d)
With In-line Storage,Transfers and Extra Tanks

DISTRICT	STORAGE NEEDED m³ 4 Overflows	OFFLINE UNITS AVAILABLE (5000 m³)	OFFLINE UNITS USED (5000 m³)	TUNNEL DIAMETER USED m	TUNNEL LENGT NEEDE m	PUMP CAPACITY NEEDED (tanks)	PIPE DIAMETER (2m/s) m	PIPE SLOPE	PIPE LENGTH m	POWER kW	COST TANK $M	COST TUNNELS $M	COST PUMPS $M	COST PUMP STNS+F.M. $M	PUMP TO	EXTRA TANKS AT
DIAMETER				3												
FERRY ROAD	4390	8	0.9		0	1.6	1.0		400	141	2.9		1.5	2.0		
RIVERBEND	8780	0	0.0		0	1.3	0.9	0.0	2310	258		0	3.2	5.0	Clifton	
TYLEHURST	5120	0	0.0		724		0.0					5	0.0	0.2		
CLIFTON	0	6	0.0			0.0	0.0		0	0	0.0		0.0	0.2		
AUBREY	0	0			0		0.0					0	0.0	0.2		
							0.0						0.0			
TUXEDO	2300	0			325		0.0					2	0.0	0.2		
DONCASTER	0	0			0		0.0					0	0.0	0.2		
ASH	0	0			0		0.0					0	0.0	0.2		
							0.0						0.0			
CORNISH	0	0			0		0.0					0	0.0	0.2		
COLONY	0	0			0		0.0					0	0.0	0.2		
							0.0						0.0			
JESSIE	9390	5	1.9		0	2.3	1.2		400	203	3.8		1.9	2.5		
RIVER	960	1	0.0		136	0.0	0.0		0	0	0.0	1	0.0	0.2		
							0.0						0.0			
ASSINIBOINE	1350	0			191		0.0					1	0.0	0.2		
							0.0						0.0			
MISSION/ROLAND	3120	7	0.0			3.5	1.5	0.0021	100	282	0.0		2.4	2.7	Roland	
LaVERENDRYE/DUMOU	4600	1	0.0			0.9	0.8	0.0048	2130	161	0.0		1.6	3.0	Roland	
DESPINS							0.0						0.0	0.2		
MARION	11270	7	2.3		0	1.8	1.1		250	159	4.3		1.6	2.0		
							0.0						0.0			
BANNATINE	5300	3	1.1		0	1.2	0.9		300	106	3.2		1.3	1.7		
ALEXANDER	6660	3	1.3		0	1.3	0.9		60	115	3.2		1.3	1.5		
SYNDICATE/BOYLE	5250	1	0.0			0.7	0.7	0.0045	1050	87	0.0		1.2	1.9	Selkirk	
SELKIRK	0	4	0.0			0.0	0.0		0	0	0.0		0.0	0.2		
ST.JOHN'S	0	6	0.0			0.0	0.0		0	0	0.0		0.0	0.2		
							0.0						0.0			
HART/MUNROE	0	4	0.0		0	0.0	0.0		0	0	0.0	0	0.0	0.2		
							0.0						0.0			
POLSON	0	3	0.0			0.0	0.0		0	0	0.0		0.0	0.2		
JEFFERSON/NEWTON	1260	0			178		0.0					1	0.0	0.2		
							0.0						0.0			
HAWTHORNE	4500	0			637		0.0					4	0.0	0.2		
													0.0			
ARMSTRONG/CONNECT	0	3	0.0			0.0	0.0		0	0	0.0		0.0	0.2		
													0.0			
	74250	62	7		2191								0.0			
TRANSFERRED				21750									0.0			
TUNNEL VOL. SUPP.					15490								0.0			
TANKS VOL. SUPP.			37010										0.0			
MAIN TUNNEL													0.0			
Diameter Required				3									0.0			
COCKBURN	10480	5	2.1		0	1.3	0.9		750	197	4	0	1.8	2.5		
BALTIMORE	8450	3	1.7		0	1	0.8		500	152	4	0	1.6	2.1		
													0.0			
METCALFE/MAGER	5960	2	1.2		0	1.5	1.0		900	147	3	0	1.5	2.3		
													0.0			
													0.0			
MOORGATE/DOUG.PAR	0				0							0	0.0	0.2		
													0.0			
STRATHMILLAN	710				100							1	0.0	0.2		
													0.0			
WOODHAVEN	1800				255							2	0.0	0.2		
											$28	$16		$33		

TOTAL P.S. COST	$33 M
TOTAL TUNNEL COST	$16 M
TOTAL TANK COST	$28 M
TOTAL NET COST	$77 M
TOTAL BUDGET COST (1.58*NET)	$122 M
+ FLOW CONTROL	
+ INLINE STORAGE	$100 M
+ INTERCEPTOR	$0
+NEWPCC	$15 M
+ FLUSHING	$15 M
TOTAL ESTIMATED COST	$252 M

Table 4-15: OFFLINE STORAGE - 54,000 m³ (4 Overflows; Dewater @825mL/d)
With In-line Storage,Transfers and Extra Tanks

DISTRICT	STORAGE NEEDED m³ 4 Overflows	OFFLINE UNITS AVAILABLE (5000 m³)	OFFLINE UNITS USED (5000 m³)	TUNNEL DIAMETER USED m	TUNNEL LENGTH NEEDED m	PUMP CAPACITY NEEDED (tanks)	PIPE DIAMETER (2m/s) m	PIPE SLOPE	PIPE LENGTH m	POWER kW	COST TANKS $M	COST TUNNELS $M	COST PUMPS $M	COST PUMP STNS+F.M. $M	PUMP TO	EXTRA TANKS AT
DIAMETER				3												
FERRY ROAD	1820	8	0.4		0	1.6	1.0		400	141	2.5	0	1.5	2.0		
RIVERBEND	6210	0	0.0		0	1.3	0.9	0.0	2310	258		0	3.2	5.0	Clifton	
TYLEHURST	1860	0	0.0		263		0.0					2	0.0	0.2		
CLIFTON	0	6	0.0			0.0	0.0		0	0	0.0		0.0	0.2		
AUBREY	0	0	0.0		0		0.0					0	0.0	0.2		
							0.0						0.0			
TUXEDO	1600	0	0.0		226		0.0					1	0.0	0.2		
DONCASTER	0	0	0.0		0		0.0					0	0.0	0.2		
ASH	0	0	0.0		0		0.0					0	0.0	0.2		
							0.0						0.0			
CORNISH	0	0	0.0		0		0.0					0	0.0	0.2		
COLONY	0	0	0.0		0		0.0					0	0.0	0.2		
							0.0						0.0			
JESSIE	4840	5	1.0		0	2.3	1.2		400	203	2.9	0	1.9	2.5		
RIVER	0	1	0.0		0	0.0	0.0		0	0	0.0	0	0.0	0.2		
							0.0						0.0			
ASSINIBOINE	0	0	0.0		0		0.0					0	0.0	0.2		
							0.0						0.0			
MISSION/ROLAND	80	7	0.0		0	0.0	0.0	0.0021	100	0	0.0	0	0.0	0.2		
LaVERENDRYE/DUMOUL	3120	1	0.0			0.9	0.8	0.0048	2130	161	0.0		1.6	3.0	Roland	
DESPINS							0.0						0.0	0.2		
MARION	6920	7	1.4		0	1.8	1.1		250	159	4.3		1.6	2.0		
							0.0						0.0			
BANNATINE	3120	3	0.6		0	1.2	0.9		300	106	3.1	0	1.3	1.7		
ALEXANDER	3700	3	0.7		0	1.3	0.9		60	115	3.0	0	1.3	1.5		
SYNDICATE/BOYLE	3630	1	0.0		0	0.7	0.7	0.0045	1050	87	0.0	0	1.2	1.9	Selkirk	
SELKIRK	0	4	0.0			0.0	0.0		0	0	0.0	0	0.0	0.2		
ST.JOHN'S	0	6	0.0			0.0	0.0		0	0	0.0	0	0.0	0.2		
							0.0						0.0			
HART/MUNROE	0	4	0.0		0	0.0	0.0		0	0	0.0	0	0.0	0.2		
							0.0						0.0			
POLSON	0	3	0.0			0.0	0.0		0	0	0.0		0.0	0.2		
JEFFERSON/NEWTON	0	0	0.0		0		0.0					0	0.0	0.2		
							0.0						0.0			
HAWTHORNE	2120	0	0.0		300		0.0					2	0.0	0.2		
													0.0			
ARMSTRONG/CONNECT	0	3	0.0			0.0	0.0		0	0	0.0		0.0	0.2		
													0.0			
	39020	62	4		789								0.0			
TRANSFERRED				12960									0.0			
TUNNEL VOL. SUPP.					5580								0.0			
TANKS VOL. SUPP.			20400										0.0			
MAIN TUNNEL													0.0			
Diameter Required				3									0.0			
COCKBURN	10480	5	2.1		0	1.3	0.9		750	197	4	0	1.8	2.5		
BALTIMORE	8450	3	1.7		0	1	0.8		500	152	4	0	1.6	2.1		
													0.0			
METCALFE/MAGER	5960	2	1.2		0	1.5	1.0		900	147	3	0	1.5	2.3		
													0.0			
													0.0			
MOORGATE/DOUG.PAR	0				0							0	0.0	0.2		
													0.0			
STRATHMILLAN	710				100							1	0.0	0.2		
													0.0			
WOODHAVEN	1800				255							2	0.0	0.2		
											$26	$7		$31		

TOTAL P.S. COST	$31	M
TOTAL TUNNEL COST	$7	M
TOTAL TANK COST	$26	M
TOTAL NET COST	$64	M
TOTAL BUDGET COST (1.58*NET)	$102	M
+ FLOW CONTROL		
+ INLINE STORAGE	$100	M
+ INTERCEPTOR	$23	M
+NEWPCC	$36	M
+ FLUSHING	$10	M
TOTAL ESTIMATED COST	$270	M

5. HIGH RATE TREATMENT

5.1 COST MODIFICATIONS

During the course of the Phase 3 Workshop, it became apparent that the retention treatment basins had been costed on a similar basis as would be storage tanks. The basis provides for a significant reduction in unit cost rates as the volume increases. In the case of retention treatment basins, these devices would be sized not only to store the combined sewer overflow but also, once storage is filled, would be sized so as to act as sedimentation basins up to their capacity for this purpose. Accordingly, the RTBs should be sized on the basis of the individual cost for a 5,000 m3 unit, i.e., 50 m long by 20 m wide by 5 m deep. This change was made to Table 4-24 and Table 5-25 in the Phase 3 TM No. 1. The results are shown on Figure 5-1 and 5-2 of this appendix. In addition to this change, the interceptor costs were modified as discussed earlier.

RTB - 220,000 m³ (4 Overflows; Dewater @ 825mL/d)

DISTRICT	STORAGE NEEDED m³ 4 Overflows	GROUP	OFFLINE UNITS AVAILABLE (5000 m³)	OFFLINE UNITS USED (5000 m³)	TUNNEL DIAMETER USED m	TUNNEL LENGTH NEEDED m	TUNNEL VOLUME m³	PUMP CAPACITY NEEDED (tanks)	PIPE DIAMETER (2m/s) m	PIPE LENGTH m	POWER kW	COST TANKS $M	COST TUNNELS $M	COST PUMP $M	COST PUMP STNS+F.M. $M	TOTAL FLOW THROUGH m³	MAXIMUM TREATMENT RATE m³/hr	MAXIMUM TREATMENT RATE ML/d	CAPITAL COST Cl2/deCl2 $M	CHEMICAL COST Cl2/deCl2 $M
DIAMETER					3.6															
FERRY ROAD	5000		8	1.00		0		1.6	1.0	400	141	3.3		1.5	2.0	75,743	10,000	240	1.0	
RIVERBEND	6500	A	0		2.62	6910	37254		0.0				39	0.0	0.2					
TYLEHURST	8250	A	0						0.0				0	0.0	0.2					
CLIFTON	8125	A	6	1.63		0		2.1	1.2	450	185	5.3	0	1.8	2.4	148,656	16,250	390	1.6	
AUBREY	6800	A	0						0.0				0	0.0	0.2					
									0.0				0	0.0						
TUXEDO	2000	B	0		2.94	3730	25322		0.0				23	0.0	0.2					
DONCASTER	1400	B	0						0.0				0	0.0	0.2					
ASH	22000	B	0						0.0				0	0.0	0.2					
									0.0				0	0.0						
CORNISH	1800	A	0						0.0				0	0.0	0.2					
COLONY	6800	A	0						0.0				0	0.0	0.2					
									0.0				0	0.0						
JESSIE	8500	C	5	1.70		0		2.3	1.2	400	203	5.5	0	1.9	2.5	139,572	17,000	408	1.7	
RIVER	0	C	1	0.00		0		0.0	0.0				0	0.0	0.2					
									0.0				0	0.0						
ASSINIBOINE	7000	A	0						0.0				0	0.0	0.2					
									0.0				0	0.0						
MISSION/ROLAND	11250	D	7	2.25		0		3.5	1.5	650	309	7.3	0	2.6	3.5	205,400	22,500	540	2.3	
LaVERENDRYE/DUMOULIN	1250	D	1	0.25		0		0.9	0.8	150	79	0.8	0	1.2	1.4	15,133	2,500	60	0.3	
DESPINS		D							0.0				0	0.0	0.2			0		
MARION	6500	D	7	1.30		0		1.8	1.1	250	159	4.2	0	1.8	2.0	62,634	13,000	312	1.3	
									0.0				0	0.0				0		
BANNATINE	4000	E	3	0.80		0		1.2	0.9	300	106	3.2	0	1.3	1.7	69,987	8,000	192	0.8	
ALEXANDER	5875	E	3	1.18		0		1.3	0.9	60	115	3.8	0	1.3	1.5	89,736	11,750	282	1.2	
SYNDICATE/BOYLE	3125	E	1	0.63		0		0.8	0.7	200	71	3.0	0	1.0	1.3	27,060	6,250	150	0.6	
SELKIRK	3375	E	4	0.68		0		1.2	0.9	200	106	3.2	0	1.3	1.6	62,719	6,750	162	0.7	
ST.JOHN'S	9375	E	6	1.88		0		2.4	1.2	80	212	6.1	0	1.9	2.2	152,304	18,750	450	1.9	
									0.0				0	0.0					0.0	
HART/MUNROE	13500		4	2.70		0		3.7	1.5	700	326	8.8	0	2.7	3.7	243,989	27,000	648	2.7	
						0			0.0				0	0.0						
POLSON	5625	E	3	1.13		0		1.6	1.0	500	141	3.7	0	1.5	2.0	98,188	11,250	270	1.1	
JEFFERSON/NEWTON	12000		0		3.60	1179	12000		0.0				9	0.0	0.2					
									0.0				0	0.0						
HAWTHORNE	6000		0		3.60	589	6000		0.0				4	0.0	0.2					
													0	0.0						
ARMSTRONG/CONNECTOR	2125		3	0.43		0		0.8	0.7	150	71	2.6	0	1.0	1.3	26,743	4,250	102	0.4	
													0							
							80576													
	168175		54	18																
TUNNEL VOL. SUPP.						0														
TANKS VOL. SUPP.				87625																
MAIN TUNNEL								25												
Diameter Required					3															
COCKBURN	3875	F	5	0.775		0		1.3	0.9	750	197	3.3	0	1.8	2.5	120,759	7,750	186	0.8	
BALTIMORE	3125	F	3	0.625		0		1	0.8	500	152	3.0	0	1.6	2.1	84,096	6,250	150	0.6	
														0.0						
METCALFE/MAGER	4625		2	0.925		0		1.5	1.0	900	147	3.4	0	1.5	2.3	88,056	9,250	222	0.9	
														0.0						
														0.0						
MOORGATE/DOUG.PARK	2900	G			1.55	2000	3774						8	0.0	0.2					
														0.0						
STRATHMILLAN	875	G											0	0.0	0.2					
														0.0						
WOODHAVEN	1900					289							2	0.0	0.2					
												$70	$85		$39	1,688,777	198,500	4,764	$20	$2
								25												

TOTAL P.S. COST	$39 M
TOTAL TUNNEL COST	$85 M
TOTAL TANK COST	$70 M
TOTAL NET COST	$195 M
TOTAL BUDGET COST (1.58*NET)	$308 M
+ FLOW CONTROL	$12 M
+ IN-LINE STORAGE	
+ INTERCEPTOR	$23 M
+ NEWPCC	$36 M
+ FLUSHING	$18 M
+ DISINFECTION (CAP. + O&M)	$22 M
TOTAL ESTIMATED COST	$419 M

FIGURE 5-1

RTB - 610,000 m³ (0 Overflows; Dewater @ 825mL/d)

DISTRICT	STORAGE NEEDED m³ 0 Overflows	GROUP	OFFLINE UNITS AVAILABLE (5000 m³)	OFFLINE UNITS USED (5000 m³)	TUNNEL DIAMETER USED m	TUNNEL LENGTH NEEDED m	TUNNEL VOLUME m³	PUMP CAPACITY NEEDED (tanks)	PIPE DIAMETER (2m/s) m	PIPE LENGTH m	POWER kW	COST TANKS $M	COST TUNNELS $M	COST PUMP $M	COST PUMP STNS+F.M. $M	TOTAL FLOW THROUGH m^3	MAXIMUM TREATMENT RATE m^3/hr	MAXIMUM TREATMENT RATE ML/d	CAPITAL COST Cl2/deCl2 $M	CHEMICAL COST Cl2/deCl2 $M
DIAMETER					4															
FERRY ROAD	11250		6	2.3		0		1.6	1.0	400	141	7.3		1.5	2.0	83,057	22,500	540	2.3	
RIVERBEND	18000	A	0	0.0	4.30	6910	100347		0.0				58	0.0	0.2					
TYLEHURST	20000	A	0	0.0					0.0				0	0.0	0.2					
CLIFTON	20000	A	6	4.0				2.1	1.2	450	185	13.0		1.8	2.4	162,906	40,000	960	4.0	
AUBREY	22000	A	0						0.0				0	0.0	0.2					
									0.0					0.0						
TUXEDO	6000	B	0		5.00	3880	76184		0.0				38	0.0	0.2					
DONCASTER	5000	B	0						0.0				0	0.0	0.2					
ASH	65000	B	0						0.0				0	0.0	0.2					
									0.0					0.0						
CORNISH	5600	A	0						0.0				0	0.0	0.2					
COLONY	21000	A	0						0.0				0	0.0	0.2					
									0.0					0.0						
JESSIE	18750	C	5	3.8		0		2.3	1.2	400	203	12.2	0	1.9	2.5	152,475	37,500	900	3.8	
RIVER	4000	C	1	0.0	4.00	318	4000	0.0	0.0	0	0	0.0	3	0.0	0.2					
									0.0					0.0						
ASSINIBOINE	12000	A	0						0.0				0	0.0	0.2					
									0.0					0.0						
MISSION/ROLAND	26250	D	7	5.3		0		3.5	1.5	650	309	17.1	0	2.6	3.5	226,120	52,500	1260	5.3	
LaVERENDRYE/DUMOULI	3125	D	1	0.6		0		0.9	0.8	150	79	3.0	0	1.2	1.4	17,370	6,250	150	0.6	
DESPINS		D				0			0.0				0	0.0	0.2			0		
MARION	18750	D	7	3.8		0		1.8	1.1	250	159	12.2	0	1.8	2.0	78,402	37,500	900	3.8	
						0			0.0				0	0.0				0		
BANNATYNE	9375	E	3	1.9		0		1.2	0.9	300	106	6.1	0	1.3	1.7	76,904	18,750	450	1.9	
ALEXANDER	12500	E	3	2.5		0		1.3	0.9	60	115	8.1	0	1.3	1.5	97,778	25,000	600	2.5	
SYNDICATE/BOYLE	7500	E	1	1.5		0		0.8	0.7	200	71	4.9	0	1.0	1.3	27,762	15,000	360	1.5	
SELKIRK	8125	E	4	1.6		0		1.2	0.9	200	106	5.3	0	1.3	1.6	68,747	16,250	390	1.6	
ST.JOHN'S	21250	E	6	4.3		0		2.4	1.2	80	212	13.8	0	1.9	2.2	166,374	42,500	1020	4.3	
									0.0					0.0					0.0	
HART/MUNROE	31250		4	4.0	4.00	895	11250	3.7	1.5	700	326	13.0	7	2.7	3.7	263,908	40,000	960	4.0	
									0.0					0.0						
POLSON	13750	E	3	2.8		0		1.6	1.0	500	141	8.9	0	1.5	2.0	105,460	27,500	660	2.8	
JEFFERSON/NEWTON	42000		0		4.00	3342	42000		0.0				27	0.0	0.2					
									0.0					0.0						
HAWTHORNE	18500		0		4.00	1472	18500		0.0				12	0.0	0.2					
														0.0						
ARMSTRONG/CONNECTO	6250		3	1.3		0		0.8	0.7	150	71	4.1	0	1.0	1.3	30,381	12,500	300	1.3	
	447225		48	39.375		16818														
TUNNEL VOL. SUPP.							252281													
TANKS VOL. SUPP.				196875																
MAIN TUNNEL								25												
Diameter Required					4															
COCKBURN	12500	F	5	2.5		0		1.3	0.9	750	197	8.1	0	1.8	2.5	126,770	25,000	600	2.5	
BALTIMORE	7500	F	3	1.5		0		1	0.8	500	152	4.9	0	1.6	2.1	69,277	15,000	360	1.5	
														0.0						
METCALFE/MAGER	11250		2	2	4	99	1250	1.5	1.0	900	147	7.3	1	1.5	2.3	96,050	20,000	480	2.0	
														0.0						
														0.0						
MOOGATE/DOUG.PARK	11000	G			3.1	2000							13	0.0	0.2					
														0.0						
STRATHMILLAN	4000	G											0	0.0	0.2					
														0.0						
WOODHAVEN	5800					462							4	0.0	0.2					
												$149	$162		$39	1,849,741	453,750	10,890	$46	$2

TOTAL P.S. COST $39 M
TOTAL TUNNEL COST $162 M
TOTAL TANK COST $149 M
TOTAL NET COST $350 M
TOTAL BUDGET COST (1.58*NET) $553 M
+ FLOW CONTROL $12 M
+ IN-LINE STORAGE
+ INTERCEPTOR $23 M
+ NEWPCC $36 M
+ FLUSHING $35 M
+ DISINFECTION (CAP. + O&M) $48 M
TOTAL ESTIMATED COST $707 M

FIGURE 5-2

6. COST SUMMARIES

The results of the modifications, as discussed in the previous sections, are incorporated in the revised Table 6-1, which is included herein and was also included in TM No. 1. In general, the changes effected in the redevelopment of the spreadsheets, do not have a significant impact on the evaluation of the various options. The one aspect which does change is the projected cost, and therefore cost effectiveness, of the high rate treatment option as developed with the RTB as a surrogate. In the case of the 4-overflow and 0-overflow options (representative year), the overall cost increases by about 15% and about 25%, respectively. The latter change effectively renders the high rate option considerably less attractive, from a total cost perspective, than other less complex alternatives, such as in-line storage in combination with distributed off-line storage or with tunnel transport/storage.

Table 6-1
Evaluation of Candidate Options

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	Plan Number	Dewatering Rate at NEWPCC ML/d	Treatment Cost Millions	Interceptor Cost Millions	Inline Storage Cost or Regulator for Offline[1]	Required Offline Storage Volume m³	New Structural Cost Millions	Flushing (+ disinfection for High Rate)	O & M Cost PV	Total Cost Millions	1992 Number of OF	1992 % Capture	Longterm Median Number of OF	Longterm Median % Capture	Longterm MAX OF	Remarks
Existing Situation																
Existing	0	825								$0	20.8	40%	17.3	32%	29	
Optimizing Existing Infrastructure																
Inline Storage	1	600	$15		$100					$115	7.2	77%	6.8	52%	14.7	
	2	825	$36	$23	$100					$159	6.2	84%	6.2	59%	12.7	
	3	1060	$70	$71	$100					$241	5.3	87%	5.3	62%		
Target of 4 Overflows																
Distributed Offline Storage	4	600	$15		$12	300,000	$356	$26	$19	$428	3.9	83%	5.1	54%	12.2	
	5	825	$36	$23	$12	215,000	$342	$22	$22	$457	3.8	87%	5.3	62%	11	
	6	1060	$70	$71	$12	185,000	$274	$23	$34	$484	4.8	85%	6	58%		
Distributed Inline/Offline Storage	7	600	$15		$100	102,000	$177	$16	$15	$323	3.2	87%	4.4	59%	11.1	
	8	825	$36	$23	$100	66,000	$128	$8	$18	$313	2.9	91%	4.3	64%	9.8	
	9	1060	$70	$71	$100	38,000	$98	$8	$28	$375	3.8	88%	4.3	65%		
Distributed Inline/Offline Storage with Transfers	10	600	$15		$100	80,000	$134	$15	$15	$279	2.6	87%	3.5	59%		
	11	825	$36	$23	$100	54,000	$112	$10	$18	$299	2.3	91%	3.6	64%		
	12	1060	$70	$71	$100											
Tunnel Transport/Storage	13	600	$15		$12	300,000	$436	$24	$13	$500	4	84%	5	54%		
	14	825	$36		$12	215,000	$393	$23	$17	$481	4	86%	5	62%		
	15	1060	$70		$12	185,000	$365	$20	$28	$495	4	86%	5	64%		Estimated not Modelled
Inline withTunnel Transport/Storage	16	600	$15		$100	102,000	$261	$16	$13	$405	4	84%	5	59%		
	17	825	$36		$100	66,000	$237	$14	$17	$404	4	86%	5	64%		
	18	1060	$70		$100	38,000	$237	$16	$28	$451	4	86%	5	64%		Estimated not Modelled
Hirate Treatment RTB	19	825	$36	$23	$12	160,000	$308	$40	$29	$448	4	86%	5	64%		Estimated not Modelled
Target of 0 Overflows - Representative Year																
Distributed Storage	20	600	$15		$12	825,000	$857	$64	$22	$970	0.4	100%	2.4	74%	6.4	
	21	825	$36	$23	$12	600,000	$645	$50	$25	$791	0.1	100%	2.5	74%	6.3	
	22	1060	$70	$71	$12	530,000	$568	$44	$36	$801	0	100%	2.4	74%		Estimated not Modelled
Distributed Inline/Offline Storage	23	600	$15		$100	606,000	$566	$43	$22	$746	0.3	100%	2.4	74%	6.3	
	24	825	$36	$23	$100	393,000	$462	$31	$23	$675	0.1	100%	2.3	74%	6.2	
	25	1060	$70	$71	$100	230,000	$326	$28	$34	$629	0	100%	2.3	74%		Estimated not Modelled
Tunnel Transport/Storage	26	600	$15		$12	825,000	$661	$39	$13	$740	0	100%	2.3	74%		
	27	825	$36		$12	600,000	$600	$36	$17	$701	0	100%	2.3	74%		
	28	1060	$70		$12	530,000	$532	$32	$28	$674	0	100%	2.3	74%		Estimated not Modelled
Inline PlusTunnel Transport/Storage	29	600	$15		$100	606,000	$556	$33	$13	$717	0	100%	2.3	74%		
	30	825	$36		$100	393,000	$465	$28	$17	$646	0	100%	2.3	74%		
	31	1060	$70		$100	230,000	$399	$22	$28	$619	0	100%	2.3	74%		Estimated not Modelled
Hirate Treatment RTB	32	825	$36	$23	$12	385,000	$553	$83	$32	$739	0	100%	2.3	74%		Estimated not Modelled
Target of 1 Overflows - Long Term																
Tunnel Transport/Storage	33	600	$15		$12	1,200,000	$756	$48	$13	$844	0	100%	1	84%		
	34	825	$36		$12	1,000,000	$692	$43	$17	$800	0	100%	1	85%		
	35	1060	$70		$12	825,000	$630	$39	$28	$779	0	100%	1	85%		
Target of 0 Overflows - Long Term																
Tunnel Transport/Storage	36	600	$15		$12	2,438,000	$1,072	$68	$13	$1,180	0	100%	0	100%		
	37	825	$36		$12	2,175,000	$1,013	$64	$17	$1,142	0	100%	0	100%		
	38	1060	$70		$12	2,000,000	$972	$61	$28	$1,143	0	100%	0	100%		
Separation																
	39									$1,500	0	100%	0	100%		