

APPENDIX F
COST ESTIMATE OF
ALTERNATIVES

Construction Cost and Life Cycle Cost Estimate
Alternative 1 - Do Nothing to Existing Millbrook WWTP

CONSTRUCTION COST ESTIMATE

No immediate upgrades Required **\$0**

LIFE CYCLE COST ESTIMATE

Future new Millbrook WWTP to replace existing WWTP; assume same capacity and technology as before

Facilities

New WWTP

Site Works and Retrofits	\$ 1,600,000
Admin and Influent Works	\$ 953,853
Aeration and Secondary Clarifier	\$ 3,447,060
Aeration and MBR	-
Filtration and Disinfection	\$ 1,955,188
Additional Equipment and Building	-
Biosolids Management	\$ 1,264,695
Aeration (Digestion and Storage)	
Raw Sewage Pumping Station	\$ 1,020,000
Excavation	\$ 458,254
Mob/Demob	\$ 160,486
Bonds & Insurance	\$ 213,981

TOTAL PART 2 \$ 11,073,517 Assume replacement plant needed by 2025 (plant life = 50 years)

Land acquisition \$ - assume that replacement WWTP can be built on existing site

15% Construction Contingency \$ 1,661,028

Total Alternative #1 cost \$ 12,734,545

Operating Costs

Item	Number Operating	Q (L/s)	Motor Size (kW)	% Time Running	Power Consumption (kWh/yr)
Coarse Screens	1		1.125	100%	9855
Vortex Grit Tanks	2		1.875	100%	32850
Submersible pumps	1		1.5	5%	657
Aeration Blowers	1		22.5	100%	197100
C&F Clar. Mechanism	2		0.75	100%	13140
RAS Pumps	1	3.645833333	7.50	100%	65700
WAS Pumps	1	0.289351852	7.50	25%	16425
Scum Pumps	1		1.5	10%	1314
Tertiary Filters - Compressors	1		7.5	100%	65700
Tertiary Filter - Waste Pumps	1		3.75	100%	32850
UV System	1		7.632	100%	66856
Chemical Pumps	1		0.2475	100%	2168
Digester to Sludge Thickener	1	0.144675926	7.50	25%	16425
Supernatant Return Pump	1	0.434027778	7.50	25%	16425
Jet Aerators (2 sludge, 2 aerobic digester)	4		18.75	100%	657000

Total Power Consumption 1194465 kWh

Power Cost \$ 0.10

Annual Power Cost \$ 119,447

Maintenance Costs

Total Eqpt	\$ 3,695,963	*Removed UV to be considered separately
Total UV	\$ 104,971	numbers from Millbrook WWTP Cost Estimate - Option 1 - O&M
Maintenance Rate	3%	
UV Maintenance Rate	20%	
Annual Cost	\$ 131,873.06	

Chemical Costs

Ferric Rate	20 kg/day
	7300 kg/year
Price	\$ 0.90 /kg
Cost	\$ 6,570.00 /yr

Tertiary Filters Waste

Waste Rate	20%
Q	2500 m3/day

Total Waste	182,500 m3/yr
Re-treatment cost	\$ 0.53 /m3
Cost	\$ 96,725 /yr

Total O&M Cost Alt 1 \$ 354,615 /yr

(as per 2012 sewer rates - Cavan Monaghan Fianance Report 2012-17 - used 50%)

Construction Cost and Life Cycle Cost Estimate
Alternative 1 - Do Nothing to Existing Millbrook WWTP

Life Cycle Cost		
Assumed Interest Rate	%	3%
Number of Years for Operation	yr	20
Operating and Maintenance Cost	\$/yr	\$ 354,615
		Cumulative Cost
Year		
	0	\$ -
	1	\$ 354,615
	2	\$ 698,901
	3	\$ 1,033,159
	4	\$ 1,357,681
	5	\$ 1,672,752
	6	\$ 1,978,646
	7	\$ 2,275,630
	8	\$ 2,563,964
	9	\$ 2,843,900
	10	\$ 3,115,682
	11	\$ 3,379,549
	12	\$ 3,635,730
	13	\$ 16,618,995
	14	\$ 16,860,470
	15	\$ 17,094,912
	16	\$ 17,322,526
	17	\$ 17,543,510
	18	\$ 17,758,057
	19	\$ 17,966,356
	20	\$ 18,168,588
NPV(20 yr) of O&M Cost		\$ 18,168,588
Total Capital Cost		\$ -
Grand Total Life Cycle Cost		\$ 18,168,588

Assume O&M cost of new and existing WWTP are similar due to the many equipment and structural replacements needed to keep existing WWTP operating

Replacement of existing WWTP with new WWTP; cap cost = \$ 12,734,545

Construction Cost and Life Cycle Cost Estimate
Alternative 2 - Raw Sewage Pumping to Peterborough WWTP

CONSTRUCTION COST ESTIMATE

Facilities - Decommission Ex. WWTP & New SPSs

Retrofit existing Millbrook WWTP to Peterborough sanitary system	\$	1,500,000
Site Works and Retrofits & Decommissioning of ex. plant	\$	1,600,000
Existing Raw Sewage Pumping Station	\$	1,020,000
Excavation	\$	458,254
Mob/Demob (1.5%)	\$	408,273.81
Bonds & Insurance (2%)	\$	544,365
Total Millbrook SPS Upgrade	\$	4,030,893

Intermediate SPS and Odour Control Facilities (3 odour control stations; 2 SPS) **\$ 6,250,000**

New FM to Peterborough Sanitary System

		20000 m
Pipe cost and installation (mat, excav, bedding, backfill) = \$222/m	\$	4,440,000
Dewatering (\$225/m)	\$	4,500,000
Asphalt restoration (\$50/m)	\$	800,000
Traffic control (\$50/m)	\$	1,000,000
Granular backfill (\$115/m)	\$	2,300,000
Connection and upgrades to existing Peterborough sanitary system	\$	2,750,000
Horizontal directional drilling for Hwy 115 crossing (1 crossing)	\$	600,000

In case a new SPS & odour control facility is required at connection point to be able to pump to the Peterborough WWTP
 \$1000/m

Total effluent discharge line	\$	16,390,000
Land Acquisition	\$	500,000
15% Construction Contingency	\$	4,000,634
Total Alternative #2 cost	\$	31,171,527

estimated (real estate in Millbrook - 1/2 acre commercial lot for \$0.2M)

LIFE CYCLE COST ESTIMATE

Equipment

	Number Operatir	Motor Size (kW)	% time running	Power Consumption (kWh/yr)
Grinder/muffin monster	1	4	100.00%	35040
Sewage pumps (1 duty, 1 standby at each of the 2 SPS)	2	10	40.00%	70080
Odour control unit (3 odour control units)	3	5	100.00%	131400
			Total Power Consumption	236520 kWh
			Power Cost \$	0.10 \$/kWh
			Annual Power Cost \$	23,652 /yr

Treatment Cost

Peterborough WWTP operation/treatment fee \$/m3 sewage Treatment cost \$/m3 m3/yr **0.3** 920165 276049.5 \$/yr taken from several reports (ranges from \$0.1-0.3/m3)

Total O&M Cost Alt 2 \$ 299,701.50 /yr

Construction Cost and Life Cycle Cost Estimate
Alternative 2 - Raw Sewage Pumping to Peterborough WWTP

Life Cycle Cost		
Assumed Interest Rate	%	3%
Number of Years for Operation	yr	20
Operating and Maintenance Cost	\$/yr	\$ 299,702
Year	0	\$ -
	1	\$ 299,702
	2	\$ 590,674
	3	\$ 873,171
	4	\$ 1,147,441
	5	\$ 1,413,721
	6	\$ 1,672,247
	7	\$ 1,923,242
	8	\$ 2,166,927
	9	\$ 2,403,514
	10	\$ 2,633,210
	11	\$ 2,856,216
	12	\$ 3,072,727
	13	\$ 3,282,931
	14	\$ 3,487,014
	15	\$ 3,685,152
	16	\$ 3,877,519
	17	\$ 4,064,283
	18	\$ 4,245,607
	19	\$ 4,421,650
	20	\$ 4,592,566
NPV(20 yr) of O&M Cost		\$ 4,592,566
Total Capital Cost		\$ 31,171,527
Grand Total Life Cycle Cost		\$ 35,764,093

Construction Cost and Life Cycle Cost Estimate
Alternative 3 - Expanded Millbrook WWTP with Discharge to Otonabee River

CONSTRUCTION COST ESTIMATE

Facilities		
Expand WWTP		
Site Works and Retrofits	\$	1,120,000
Admin and Influent Works	\$	953,853
Aeration and Secondary Clarifier	\$	3,447,060
Aeration and MBR	-	
Filtration and Disinfection	\$	391,038 minor disinfection process
Additional Equipment and Building	-	
Biosolids Management	\$	1,264,695
Aeration (Digestion and Storage)	\$	-
Raw Sewage Pumping Station	\$	1,020,000
Excavation	\$	458,254
Mob/Demob (1.5%)	\$	129,823
Bonds & Insurance (2%)	\$	173,098
Total Millbrook WWTP Upgrade	\$	8,957,821

Land acquisition 500000 estimated (real estate in Millbrook - 1/2 acre commercial lot for \$0.2M)

New Effluent SPS 1000000 estimate

New FM to Otonabee River		11200 m
Pipe cost and installation (mat, excav, bedding, backfill) = \$222/m	\$	2,486,400
Dewatering (\$225/m)	\$	2,520,000
Asphalt restoration (\$40/m)	\$	448,000
Traffic control (\$50/m)	\$	560,000
New outfall to Otonabee	\$	350,000
Total effluent discharge line	\$	6,364,400
15% Construction Contingency	\$	2,523,333
Total Alternative #3 cost	\$	19,345,555

Construction Cost and Life Cycle Cost Estimate

Alternative 3 - Expanded Millbrook WWTP with Discharge to Otonabee River

LIFE CYCLE COST ESTIMATE

Operating Costs

Item	Number Operating	Q (L/s)	Motor Size (kW)	% Time Running	Power Consumption (kWh/yr)
Coarse Screens	1		1.125	100%	9855
Vortex Grit Tanks	0		1.875	100%	0
Submersible pumps	1		1.5	5%	657
Aeration Blowers	1		22.5	100%	197100
C&F Clar. Mechanism	2		0.75	100%	13140
RAS Pumps	1	3.645833333	7.50	100%	65700
WAS Pumps	1	0.289351852	7.50	25%	16425
Scum Pumps	1		1.5	10%	1314
Tertiary Filters - Compressors	1		7.5	100%	65700
Tertiary Filter - Waste Pumps	1		3.75	100%	32850
UV System	1		7.632	100%	66856
Chemical Pumps	1		0.2475	100%	2168
Digester to Sludge Thickener	1	0.144675926	7.50	25%	16425
Supernatant Return Pump	1	0.434027778	7.50	25%	16425
Jet Aerators (2 sludge storage, 2 aerobic digester)	4		18.75	100%	657000
Effluent pumps (1 duty, 1 standby at Millbrook WTP Effluent PS)	1		7.00	40%	24528
Total Power Consumption					1186143 kWh
Power Cost \$					0.10
Annual Power Cost \$					118,614

Life Cycle Cost		
Assumed Interest Rate	%	3%
Number of Years for Operation	yr	20
Operating and Maintenance Cost	\$/yr	\$ 353,782
Year		0 \$ -
	1	\$ 353,782
	2	\$ 697,260
	3	\$ 1,030,734
	4	\$ 1,354,495
	5	\$ 1,668,826
	6	\$ 1,974,002
	7	\$ 2,270,289
	8	\$ 2,557,947
	9	\$ 2,837,226
	10	\$ 3,108,371
	11	\$ 3,371,618
	12	\$ 3,627,198
	13	\$ 3,875,334
	14	\$ 4,116,242
	15	\$ 4,350,134
	16	\$ 4,577,214
	17	\$ 4,797,679
	18	\$ 5,011,723
	19	\$ 5,219,533
	20	\$ 5,421,290
NPV(20 yr) of O&M Cost		\$ 5,421,290
Total Capital Cost		\$ 19,345,555
Grand Total Life Cycle Cost		\$ 24,766,845

Maintenance Costs

		Total Eqpt
Total Eqpt	\$	3,695,963
Total UV	\$	104,971
Maintenance Rate		3%
UV Maintenance Rate		20%
Annual Cost \$		131,873.06

Chemical Costs

Ferric		
Rate		20 kg/day
		7300 kg/year
Price	\$	0.90 /kg
Cost	\$	6,570.00 /yr

Tertiary Filters Waste

Waste Rate		20%
Q		2500 m3/day
Total Waste		182,500 m3/yr
Re-treatment cost	\$	0.53 /m3
Cost	\$	96,725 /yr

Total O&M Cost Alt 3 \$ 353,782.40 /yr

*As per 2012 Sewer Rates - Cavan Monaghan Finance Report 2012-17 - Used 50%

**Construction Cost and Life Cycle Cost Estimate
Alternative 4 - New Millbrook WWTP**

CONSTRUCTION COST ESTIMATE

Facilities

New WWTP

Deforesting and new Site Works	\$	1,600,000
Decommissioning ex. plant and restoration	\$	1,000,000
Admin and Influent Works	\$	2,453,853
Aeration and Secondary Clarifier	\$	3,447,060
Aeration and MBR	-	
Filtration and Disinfection	\$	2,346,226
Additional Equipment and Building	-	
Biosolids Management	\$	3,264,695
Aeration (Digestion and Storage)	\$	1,000,000
Raw Sewage Pumping Station	\$	1,020,000
Excavation	\$	1,145,636
Mob/Demob (1.5%)	\$	259,162
Bonds & Insurance (2%)	\$	345,549
Total New Millbrook WWTP	\$	17,882,181

Land acquisition \$ **1,000,000** estimated (real estate in Millbrook - 1/2 acre commercial lot for \$0.2M)

15% Construction Contingency \$ **2,832,327**

Total Alternative #4 cost \$ **21,714,508**

LIFE CYCLE COST ESTIMATE

Operating Costs

Item	Number Operating	Q (L/s)	Motor Size (kW)	% Time Running	Power Consumption (kWh/yr)
Coarse Screens	1		1.125	100%	9855
Vortex Grit Tanks	2		1.875	100%	32850
Submersible pumps	1		1.5	5%	657
Aeration Blowers	1		22.5	100%	197100
C&F Clar. Mechanism	2		0.75	100%	13140
RAS Pumps	1	3.645833333	7.50	100%	65700
WAS Pumps	1	0.289351852	7.50	25%	16425
Scum Pumps	1		1.5	10%	1314
Tertiary Filters - Compressors	1		7.5	100%	65700
Tertiary Filter - Waste Pumps	1		3.75	100%	32850
UV System	1		7.632	100%	66856
Chemical Pumps	1		0.2475	100%	2168
Digester to Sludge Thickener	1	0.144675926	7.50	25%	16425
Supernatant Return Pump	1	0.434027778	7.50	25%	16425
Jet Aerators (2 sludge storage, 2 aerobic digest	4		18.75	100%	657000
Total Power Consumption					1194465 kWh
Power Cost					\$ 0.10
Annual Power Cost					\$ 119,447

Construction Cost and Life Cycle Cost Estimate
Alternative 4 - New Millbrook WWTP

Life Cycle Cost		
Assumed Interest Rate	%	3%
Number of Years for Operation	yr	20
Operating and Maintenance Cost	\$/yr	\$ 354,615
Year	0	\$ -
	1	\$ 354,615
	2	\$ 698,901
	3	\$ 1,033,159
	4	\$ 1,357,681
	5	\$ 1,672,752
	6	\$ 1,978,646
	7	\$ 2,275,630
	8	\$ 2,563,964
	9	\$ 2,843,900
	10	\$ 3,115,682
	11	\$ 3,379,549
	12	\$ 3,635,730
	13	\$ 3,884,450
	14	\$ 4,125,925
	15	\$ 4,360,367
	16	\$ 4,587,981
	17	\$ 4,808,965
	18	\$ 5,023,512
	19	\$ 5,231,811
	20	\$ 5,434,043
NPV(20 yr) of O&M Cost		\$ 5,434,043
Total Capital Cost		\$ 21,714,508
Grand Total Life Cycle Cost		\$ 27,148,551

Maintenance Costs

Total Eqpt	\$	3,695,963	*Removed UV to be considered separately
Total UV	\$	104,971	numbers from Millbrook WWTP Cost Estimate - Option 1 - O&M
Maintenance Rate		3%	
UV Maintenance R		20%	
Annual Cost	\$	131,873.06	

Chemical Costs

Ferric		
Rate		20 kg/day
		7300 kg/year
Price	\$	0.90 /kg
Cost	\$	6,570.00 /yr

Tertiary Filters Waste

Waste Rate		20%
Q		2500 m3/day
Total Waste		182,500 m3/yr
Re-treatment cost	\$	0.53 /m3
Cost	\$	96,725 /yr

Total O&M Cost Alt 4 \$ 354,614.60 /yr

*As per 2012 Sewer Rates - Cavan Monaghan Finance Report
2012-17 - Used 50%

**Construction Cost and Life Cycle Cost Estimate
Alternative 5 - Upgraded & Expanded Millbrook WWTP**

CONSTRUCTION COST ESTIMATE

Facilities

Expand WWTP	
Site Works and Retrofits	\$ 1,600,000
Admin and Influent Works	\$ 953,853
Aeration and Secondary Clarifier	\$ 3,447,060
Aeration and MBR	-
Filtration and Disinfection	\$ 1,955,188
Additional Equipment and Building	-
Biosolids Management	\$ 1,264,695
Aeration (Digestion and Storage)	
Raw Sewage Pumping Station	\$ 1,020,000
Excavation	\$ 458,254
Mob/Demob	\$ 160,486
Bonds & Insurance	\$ 213,981
TOTAL PART 2	\$ 11,073,517

Land acquisition \$ **500,000** estimated (real estate in Millbrook - 1/2 acre commercial lot for \$0.2M)

15% Construction Contingency \$ **1,736,028**

Total Alternative #5 cost \$ **13,309,545**

LIFE CYCLE COST ESTIMATE

Operating Costs

Item	Number Operating	Q (L/s)	Motor Size (kW)	% Time Running	Power Consumption (kWh/yr)
Coarse Screens	1		1.125	100%	9855
Vortex Grit Tanks	2		1.875	100%	32850
Submersible pumps	1		1.5	5%	657
Aeration Blowers	1		22.5	100%	197100
C&F Clar. Mechanism	2		0.75	100%	13140
RAS Pumps	1	3.645833333	7.50	100%	65700
WAS Pumps	1	0.289351852	7.50	25%	16425
Scum Pumps	1		1.5	10%	1314
Tertiary Filters - Compressors	1		7.5	100%	65700
Tertiary Filter - Waste Pumps	1		3.75	100%	32850
UV System	1		7.632	100%	66856
Chemical Pumps	1		0.2475	100%	2168
Digester to Sludge Thickener	1	0.144675926	7.50	25%	16425
Supernatant Return Pump	1	0.434027778	7.50	25%	16425
Jet Aerators (2 sludge, 2 aerobic digester)	4		18.75	100%	657000
Total Power Consumption					1194465 kWh
Power Cost \$					0.10
Annual Power Cost \$					119,447

**Construction Cost and Life Cycle Cost Estimate
Alternative 5 - Upgraded & Expanded Millbrook WWTP**

Life Cycle Cost		
Assumed Interest Rate	%	3%
Number of Years for Operation	yr	20
Operating and Maintenance Cost	\$/yr	\$ 354,615
Year	0	\$ -
	1	\$ 354,615
	2	\$ 698,901
	3	\$ 1,033,159
	4	\$ 1,357,681
	5	\$ 1,672,752
	6	\$ 1,978,646
	7	\$ 2,275,630
	8	\$ 2,563,964
	9	\$ 2,843,900
	10	\$ 3,115,682
	11	\$ 3,379,549
	12	\$ 3,635,730
	13	\$ 3,884,450
	14	\$ 4,125,925
	15	\$ 4,360,367
	16	\$ 4,587,981
	17	\$ 4,808,965
	18	\$ 5,023,512
	19	\$ 5,231,811
	20	\$ 5,434,043
NPV(20 yr) of O&M Cost	\$	\$ 5,434,043
Total Capital Cost	\$	\$ 13,309,545
Grand Total Life Cycle Cost		\$ 18,743,588

Maintenance Costs

	Total Eqpt	
Total Eqpt	\$ 3,695,963	*Removed UV to be considered separately
Total UV	\$ 104,971	numbers from Millbrook WWTP Cost Estimate - Option 1 - O&M
Maintenance Rate	3%	
UV Maintenance Rate	20%	
Annual Cost	\$ 131,873.06	

Chemical Costs

Ferric		
Rate	20 kg/day	
	7300 kg/year	
Price	\$ 0.90 /kg	
Cost	\$ 6,570.00 /yr	

Tertiary Filters Waste

Waste Rate	20%	
Q	2500 m3/day	
Total Waste	182,500 m3/yr	
Re-treatment cost	\$ 0.53 /m3	
Cost	\$ 96,725 /yr	

*As per 2012 Sewer Rates - Cavan Monaghan Finance Report 2012-17 - Used 50%

Total O&M Cost Alt 5 \$ 354,614.60 /yr