

CAPITAL REGIONAL DISTRICT
CORE AREA WASTEWATER MANAGEMENT PROGRAM

DISCUSSION PAPER 038-DP-1
APPENDIX A – CAPITAL COST INFORMATION &
APPENDIX B - LIFE CYCLE AND CARBON FOOTPRINT ANALYSIS WORKSHEETS

June 19, 2009



In partnership with:



CAPITAL REGIONAL DISTRICT
CORE AREA WASTEWATER MANAGEMENT PROGRAM

DISCUSSION PAPER 038-DP-1
APPENDIX A – CAPITAL COST INFORMATION

June 19, 2009



In partnership with:



Revision Date: 19-Jun-09
 Latest Revision by: M Maynard / D Shiskowski
 File: 20062935.04.E.06.00

**CAPITAL REGIONAL DISTRICT
 CORE AREA WASTEWATER TREATMENT PROGRAM
 PROGRAM DEVELOPMENT PHASE**

STRATEGY - STAGE 1

SUMMARY - ESTIMATED CAPITAL COSTS

Item	Saanich East WWTF	Clover Point Wet-Weather TF	South Colwood WWTF	Macaulay Point/McLoughlin Point WWTF	Solids Processing Facility	Wastewater Conveyance Modifications	Total
	\$Million	\$Million	\$Million	\$Million	\$Million	\$Million	\$Million
PLANT - LIQUID STREAM							
Stage 1	\$78	\$141	\$88	\$346			\$653
PLANT - SOLID STREAM							
Stage 1			\$48				\$48
PLANT RELATED CONVEYANCE							
Stage 1		\$19		\$20			\$39
OUTFALLS							
Stage 1	\$14	\$5.9	\$12	\$18			\$50
HEAT RECOVERY SYSTEM/PIPING							
Stage 1	\$1.1		\$1.6	\$5.1			\$8
LAND PURCHASE							
Stage 1	\$6.5	\$4.5	\$2.0	\$7.4	\$2.1		\$22
WASTEWATER CONVEYANCE MODIFICATIONS							
Stage 1						\$71	\$71
SOLIDS PROCESSING FACILITY							
Stage 1					\$165		\$165
STAGE 1 TOTAL ESTIMATED CAPITAL COSTS	\$99	\$171	\$152	\$396	\$167	\$71	\$1,056

Note:
 1. Costs are in 2008 dollars and include indirect costs and land costs.

Capital Cost Escalation:
 Year of capital costs = 2008
 Mid-point of construction = 2014
 Annual inflation allowance = 2.0% per year
 Calculated escalation factor = 1.13

STAGE 1 TOTAL ESTIMATED CAPITAL COSTS (2014 dollars)	\$112	\$193	\$171	\$446	\$188	\$79	\$1,189
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**CAPITAL REGIONAL DISTRICT
 CORE AREA WASTEWATER TREATMENT PROGRAM
 PROGRAM DEVELOPMENT PHASE**

STRATEGY - ALL STAGES

SUMMARY - ESTIMATED CAPITAL COSTS

Item	Saanich East WWTF	Clover Point Wet-Weather TF	South Colwood WWTF	Macaulay Point/McLoughlin Point WWTF	Solids Processing Facility	Wastewater Conveyance Modifications	Total
	\$Million	\$Million	\$Million	\$Million	\$Million	\$Million	\$Million
PLANT - LIQUID STREAM							
Stage 1	\$78	\$141	\$88	\$346			\$653
Stage 2	\$7		\$47	\$7			\$61
PLANT - SOLID STREAM							
Stage 1			\$48				\$48
PLANT RELATED CONVEYANCE							
Stage 1		\$19		\$20			\$39
OUTFALLS							
Stage 1	\$14	\$6	\$12	\$18			\$50
HEAT RECOVERY SYSTEM/PIPING							
Stage 1	\$1.1		\$1.6	\$5			\$8
LAND PURCHASE							
	\$7	\$5	\$2.0	\$7	\$2		\$22
WASTEWATER CONVEYANCE MODIFICATIONS							
Stage 1						\$71	\$71
SOLIDS PROCESSING FACILITY							
Stage 1					\$165		\$165
TOTAL ESTIMATED CAPITAL COSTS¹	\$106	\$171	\$199	\$403	\$167	\$71	\$1,117

Note:

1. Costs are in 2008 dollars and include indirect costs and land costs

Revision Date: 19-Jun-09
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**CAPITAL REGIONAL DISTRICT
 CORE AREA WASTEWATER TREATMENT PROGRAM
 PROGRAM DEVELOPMENT PHASE**

STRATEGY

ESTIMATED CAPITAL COSTS

Item	Percentage	Saanich East WWTF			Clover Point Wet-Weather TF			South Colwood WWTF				Macaulay Point/McLoughlin Point WWTF				Wastewater Conveyance Modifications	Solids Processing Facility	Totals
		Plant - Liquid Stream	Outfall	Heat Recovery System	Plant - Liquid Stream	Outfall	Plant Related Conveyance	Plant - Liquid Stream	Plant - Solids Stream	Outfall	Heat Recovery System	Influent sewer	Plant - Liquid Stream	Outfall	Heat Recovery System			
Direct Costs																		
Base Construction Cost Estimate																		
Influent sewer																		
Plant - Liquid Stream		\$54,500,000			\$90,680,000		\$86,700,000					\$12,565,000						
Plant - Solids Stream								\$30,937,000					\$226,000,000				\$105,811,500	
Plant Related Conveyance						\$12,202,000												
Outfall			\$8,654,000			\$3,809,000				\$7,909,000			\$11,856,000					
Heat Recovery System/Piping				\$701,000						\$1,051,000				\$3,257,000				
Other																		
Subtotal		\$54,500,000	\$8,654,000	\$701,000	\$90,680,000	\$3,809,000	\$12,202,000	\$86,700,000	\$30,937,000	\$7,909,000	\$1,051,000	\$12,565,000	\$226,000,000	\$11,856,000	\$3,257,000	\$45,199,000	\$105,811,500	
Design Contingency	10.0	\$5,450,000	\$865,400	\$70,100	\$9,068,000	\$380,900	\$1,220,200	\$8,670,000	\$3,093,700	\$790,900	\$105,100	\$1,256,500	\$22,600,000	\$1,185,600	\$325,700	\$4,519,900	\$10,581,150	
Construction Contingency	15.0	\$8,175,000	\$1,298,100	\$105,150	\$13,602,000	\$571,350	\$1,830,300	\$13,005,000	\$4,640,550	\$1,186,350	\$157,650	\$1,884,750	\$33,900,000	\$1,778,400	\$488,550	\$6,779,850	\$15,871,725	
Subtotal		\$68,125,000	\$10,817,500	\$876,250	\$113,350,000	\$4,761,250	\$15,252,500	\$108,375,000	\$38,671,250	\$9,886,250	\$1,313,750	\$15,706,250	\$282,500,000	\$14,820,000	\$4,071,250	\$56,498,750	\$132,264,375	
Indirect Costs																		
Engineering	15.0	\$10,218,750	\$1,622,625	\$131,438	\$17,002,500	\$714,188	\$2,287,875	\$16,256,250	\$5,800,688	\$1,482,938	\$197,063	\$2,355,938	\$42,375,000	\$2,223,000	\$610,688	\$8,474,813	\$19,839,656	
Administration	3.0	\$2,043,750	\$324,525	\$26,288	\$3,400,500	\$142,838	\$457,575	\$3,251,250	\$1,160,138	\$296,588	\$39,413	\$471,188	\$8,475,000	\$444,600	\$122,138	\$1,694,963	\$3,967,931	
Miscellaneous	2.0	\$1,362,500	\$216,350	\$17,525	\$2,267,000	\$95,225	\$305,050	\$2,167,500	\$773,425	\$197,725	\$26,275	\$314,125	\$5,650,000	\$296,400	\$81,425	\$1,129,975	\$2,645,288	
Subtotal		\$81,750,000	\$12,981,000	\$1,051,500	\$136,020,000	\$5,713,500	\$18,303,000	\$130,050,000	\$46,405,500	\$11,863,500	\$1,576,500	\$18,847,500	\$339,000,000	\$17,784,000	\$4,885,500	\$67,798,500	\$158,717,250	
GST	0.0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Interim Financing	4.0	\$3,270,000	\$519,240	\$42,060	\$5,440,800	\$228,540	\$732,120	\$5,202,000	\$1,856,220	\$474,540	\$63,060	\$753,900	\$13,560,000	\$711,360	\$195,420	\$2,711,940	\$6,348,690	
Inflation to Mid-Point of Construction	0.0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
TOTAL CAPITAL COST (excluding land purchase)		\$85,020,000	\$13,500,240	\$1,093,560	\$141,460,800	\$5,942,040	\$19,035,120	\$135,252,000	\$48,261,720	\$12,338,040	\$1,639,560	\$19,601,400	\$352,560,000	\$18,495,360	\$5,080,920	\$70,510,440	\$165,065,940	
Land Purchase		\$6,512,000			\$4,500,000			\$1,989,000					\$7,350,000				\$2,100,000	
TOTAL CAPITAL COST (including land purchase)		\$91,532,000	\$13,500,240	\$1,093,560	\$145,960,800	\$5,942,040	\$19,035,120	\$137,241,000	\$48,261,720	\$12,338,040	\$1,639,560	\$19,601,400	\$359,910,000	\$18,495,360	\$5,080,920	\$70,510,440	\$167,165,940	
STAGED CAPITAL COST (excluding land purchase)																		
Stage																		
1		\$78,218,400	\$13,500,240	\$1,093,560	\$141,460,800	\$5,942,040	\$19,035,120	\$87,913,800	\$48,261,720	\$12,338,040	\$1,639,560	\$19,601,400	\$345,508,800	\$18,495,360	\$5,080,920	\$70,510,440	\$165,065,940	
2		\$6,801,600						\$47,338,200					\$7,051,200				\$61,191,000	
TOTAL STAGED CAPITAL COST (excluding land purchase)		\$84,730,400	\$13,500,240	\$1,093,560	\$145,960,800	\$5,942,040	\$19,035,120	\$89,902,800	\$48,261,720	\$12,338,040	\$1,639,560	\$19,601,400	\$352,858,800	\$18,495,360	\$5,080,920	\$70,510,440	\$167,165,940	
Land Purchase		\$6,801,600						\$47,338,200					\$7,051,200				\$61,191,000	
TOTAL STAGED CAPITAL COST (including land purchase)		\$91,532,000	\$13,500,240	\$1,093,560	\$145,960,800	\$5,942,040	\$19,035,120	\$137,241,000	\$48,261,720	\$12,338,040	\$1,639,560	\$19,601,400	\$359,910,000	\$18,495,360	\$5,080,920	\$70,510,440	\$167,165,940	

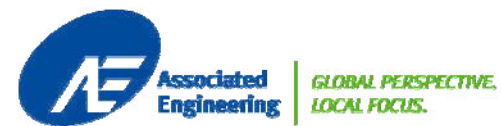
Notes:
 1 Costs are in 2008 dollars.

CAPITAL REGIONAL DISTRICT
CORE AREA WASTEWATER MANAGEMENT PROGRAM

DISCUSSION PAPER 038-DP-1

APPENDIX B - LIFE CYCLE AND CARBON FOOTPRINT ANALYSIS WORKSHEETS

June 19, 2009



In partnership with:



Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Strategy

Last Revision: **June 18, 2009**

Generic Assumptions
For Life Cycle and Carbon
Footprint Analyses

Yellow-shaded cell denotes assumed/input value

GENERIC ASSUMPTIONS

NPV Analysis:

first year in analysis =	2008	
investment rate of return =	7.0%	/yr
capital works / land lease inflation rate =	3.0%	/yr
labour inflation rate =	3.0%	/yr
electricity inflation rate =	3.0%	/yr
natural gas/biomethane inflation rate =	3.0%	/yr
diesel fuel inflation rate =	3.0%	/yr
effluent heat inflation rate =	3.0%	/yr
chemicals inflation rate =	3.0%	/yr
reclaimed water inflation rate =	3.0%	/yr
dried WW sludges / woodchip inflation rate =	3.0%	/yr
maintenance inflation rate =	3.0%	/yr
administration inflation rate =	3.0%	/yr
GHG CO2e price inflation rate =	3.0%	/yr
2065 \$	81	/tonne CO2e

Note: Values for Discount Rate Base scenario.

Note / Ref: Year 2065 CO2e cost assumed to vary between US\$15 and US\$155 t / CO2e, as per 032-DP-1 and based on Tirpak (2008).

Labour:

annual average staff cost =	\$ 75,000	per year
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Energy and Carbon Equivalents:

unit electrical price =	\$ 0.07	/kWh
unit diesel fuel price =	\$ 1.50	/L
unit CO2e price =	\$ 15	/t CO2e
unit natural gas / biomethane price =	\$ 10.00	/GJ

Ref: Based on a 2009 value of \$15 t / CO2e per the Province of British Columbia Carbon Tax (2008).

Chemical Phosphorus Removal Chemicals:

liquid-stream alum requirement =	110	mg/L of alum product
alum product specification =	638	mg alum/mL product
unit alum product cost =	\$ 0.40	per L of alum product

Ref: Medicine Hat WWTF.

Ref: Based on General Chemical information in Feb 4/09 e-mail from T. Znajewski. Includes allowance for polymer.

Wet-Weather CEPT Chemicals:

liquid-stream alum requirement =	80	mg/L of alum product
alum product specification =	638	mg alum/mL product
unit alum product cost =	\$ 0.40	per L of alum product

Ref: Based on General Chemical information in Feb 4/09 e-mail from T. Znajewski. Includes allowance for polymer.

Raw Sludge Thickening and Truck Transport:

unit wastewater BOD generation rate =	0.070	kg BOD/d - pe
combined PS + WBS production rate =	0.85	kg TSS/kg BOD removed
solids content of thickened sludge =	6.0%	
specific gravity of thickened sludge =	1.02	
thickening polymer requirement =	8	kg polymer/dry tonne
thickening polymer unit cost =	\$ 10.00	/kg polymer
transport truck volume =	22	m3/truck
truck diesel fuel consumption =	1.6	km/L

Odour Control Chemicals:

unit scrubber chemical cost =	\$ 0.0053	/d per m3/d of ADWF treated wastewater
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Ref: Based on Jan 15/09 TM from T. Dokken.

Membrane Cleaning Chemicals:

unit chemical cost =	\$ 0.0020	/d per m3/d of ADWF treated wastewater
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Ref: Based on Jan 19/09 e-mail from T. Dokken.

Maintenance:

unit allowance (new treatment facilities) =	1.0%	of capital works
unit allowance (new interceptors, pump stations, forcemains, outfalls) =	0.25%	of capital works

Administration:

lump sum annual allowance (treatment facilities) =	\$ 100,000	/yr
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Saleable Wastewater/Effluent Heat:

unit natural gas / power utility energy price =	\$ 16.10	/GJ
profit and overhead allowance for third-party energy utility =	15.0%	
maximum unit price paid for heat energy by third-party utility =	\$ 14.00	

Ref: This is the typical price (i.e. "market price") of energy available from the power and natural gas utilities, based on a variety of assumptions on energy used in existing areas/redevelopment and new development. See notes in file based on information provided in M. Homenuke Feb 10/09 e-mail.

Note: The actual price that the CRD could sell the heat energy to the third party "heat recovery" utility depends on the cost of the utilities infrastructure. See the LCA sheets for WWTF-specific assumptions.

Saleable Reclaimed Water:

unit CRD potable water supply price (2008) =	\$ 0.90	/m3
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Ref: Average 2008 consumption charges across the CRD. per the CRD web-site.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Strategy

Last Revision: **June 18, 2009**

Generic Assumptions
For Life Cycle and Carbon
Footprint Analyses

value of reclaimed water relative to CRD potable water =	80%	Note: Assumes use of same sunnly infrastructure for effluent heat. The "value" adjustment considers public perception of reclaimed water relative to CRD potable water
unit reclaimed water price =	\$ 0.72 /m3	Note: For both irrigation and toilet flushing.
GHG Sources:		
BC Hydro-supplied electricity (average annual) =	72 g CO2e/kWh	Ref: Average value - BC Hydro's (2005) prediction for 2010 was 72 t/ GWh, which is a large increase from the 33 value predicted for 2005 and actual values of 46 and 22 for 2000 and 2003, respectively. No other future projections were found. Heating Season value based on KWL (2008), West Shore C WWTP Concept Review Final Report.
BC Hydro-supplied electricity (average heating season) =	100 g CO2e/kWh	
diesel fuel combustion (mobile truck) =	2,757 g CO2e/L	Ref: Table A13-5, EC (2006). Moderately controlled HDDV.
production of sludge thickening polymer =	1.2 kg CO2e/kg product	Ref: de Haas et al (2008)
GHG Off-sets (heat recovery):		
effluent heat recovery coefficient of performance (COP) =	4.0	Ref: Heat recovery off-set information and calculations provided by W. Wong (KWL) in Dec 9/08 e-mail.
natural gas furnace / boiler efficiency (η) =	0.95	
energy extracted from effluent heat (x) =	1.00 GJ	
energy for heating delivered by heat pump =	0.75 GJ	
electrical energy required by heat pump =	0.33 GJ electrical power /GJ effluent heat	
energy required for heating from natural gas combustion, equivalent to units of energy replaced via effluent heat =	1.40 GJ	
natural gas off-set via using effluent heat =	1.07 GJ	
therefore, unitless equivalence factor =	1.07 GJ of natural gas off-set by GJ of effluent heat	
natural gas combustion (stationary) =	0.0562 g CO2e/kJ	Ref: Table 2.5, IPCC (2006). Tier 1 Value is for residential category and commercial/institutional category.
1 J =	0.0002778 Wh	
BC Hydro-supplied electricity (average heating season) =	0.0278 g CO2e/kJ	Ref: Based on information in Feb 10/ 9 e-mail from M. Homenuke.
fraction of effluent heat off-setting "natural gas heat" =	60%	
fraction of effluent heat off-setting "electric heat" =	40%	

Existing CRD Trunk Sewer System

annual operations and maintenance cost (2008) =	\$ 4,600,000 /yr	Ref: The Path Forward work. ADWF Macaulay and Clover pumping energy and costs are small, therefore did not remove from annual cost value.
annual average increase in operations and maintenance expenditures =	0.5% /yr	Note: Accounts for potential future increases in maintenance costs as system ages.

REFERENCED PUBLICATIONS

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Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Marigold Pump Station

Last Revision: June 18, 2009

Strategy
Material Flows
and Carbon Footprint Analysis

Yellow-shaded cell denotes assumed/input values

Year	Wastewater ADWF		ADWF Friction Losses		TDH (m)	Velocity (m/s)	Pump Energy (kW)	Materials Electricity (kWh/yr)	GHG Sources Electricity Purchased (t CO2e/yr)	Total GHG Emissions (t CO2e/yr)
	(m3/d)	(L/s)	Unit (m/m)	Total (m)						
2008										
2009										
2010										
2011										
2012										
2013										
2014										
2015	17,437	202	0.000943	3.49	33.5	0.71	94.7	829,693	60	60
2016	17,441	202	0.000943	3.49	33.5	0.71	94.7	829,912	60	60
2017	17,445	202	0.000943	3.49	33.5	0.71	94.8	830,132	60	60
2018	17,449	202	0.000944	3.49	33.5	0.71	94.8	830,351	60	60
2019	17,452	202	0.000944	3.49	33.5	0.71	94.8	830,571	60	60
2020	17,456	202	0.000945	3.49	33.5	0.71	94.8	830,790	60	60
2021	17,460	202	0.000945	3.50	33.5	0.71	94.9	831,010	60	60
2022	17,464	202	0.000945	3.50	33.5	0.71	94.9	831,229	60	60
2023	17,468	202	0.000946	3.50	33.5	0.72	94.9	831,449	60	60
2024	17,472	202	0.000946	3.50	33.5	0.72	94.9	831,668	60	60
2025	17,476	202	0.000946	3.50	33.5	0.72	95.0	831,888	60	60
2026	17,480	202	0.000947	3.50	33.5	0.72	95.0	832,108	60	60
2027	17,483	202	0.000947	3.50	33.5	0.72	95.0	832,327	60	60
2028	17,487	202	0.000948	3.51	33.5	0.72	95.0	832,547	60	60
2029	17,491	202	0.000948	3.51	33.5	0.72	95.1	832,767	60	60
2030	17,495	202	0.000948	3.51	33.5	0.72	95.1	832,987	60	60
2031	17,517	203	0.000951	3.52	33.5	0.72	95.2	834,249	60	60
2032	17,539	203	0.000953	3.53	33.5	0.72	95.4	835,512	60	60
2033	17,562	203	0.000955	3.53	33.5	0.72	95.5	836,775	60	60
2034	17,584	204	0.000957	3.54	33.5	0.72	95.7	838,040	60	60
2035	17,606	204	0.000960	3.55	33.6	0.72	95.8	839,305	60	60
2036	17,628	204	0.000962	3.56	33.6	0.72	96.0	840,571	61	61
2037	17,650	204	0.000964	3.57	33.6	0.72	96.1	841,837	61	61
2038	17,673	205	0.000966	3.58	33.6	0.72	96.2	843,105	61	61
2039	17,695	205	0.000969	3.58	33.6	0.72	96.4	844,373	61	61
2040	17,717	205	0.000971	3.59	33.6	0.73	96.5	845,642	61	61
2041	17,739	205	0.000973	3.60	33.6	0.73	96.7	846,911	61	61
2042	17,761	206	0.000975	3.61	33.6	0.73	96.8	848,182	61	61
2043	17,784	206	0.000978	3.62	33.6	0.73	97.0	849,453	61	61
2044	17,806	206	0.000980	3.63	33.6	0.73	97.1	850,725	61	61
2045	17,828	206	0.000982	3.63	33.6	0.73	97.3	851,997	61	61
2046	17,800	206	0.000979	3.62	33.6	0.73	97.1	850,384	61	61
2047	17,772	206	0.000976	3.61	33.6	0.73	96.9	848,771	61	61
2048	17,744	205	0.000973	3.60	33.6	0.73	96.7	847,160	61	61
2049	17,715	205	0.000971	3.59	33.6	0.73	96.5	845,550	61	61
2050	17,687	205	0.000968	3.58	33.6	0.72	96.3	843,941	61	61
2051	17,659	204	0.000965	3.57	33.6	0.72	96.2	842,334	61	61
2052	17,631	204	0.000962	3.56	33.6	0.72	96.0	840,728	61	61
2053	17,603	204	0.000959	3.55	33.5	0.72	95.8	839,122	60	60
2054	17,575	203	0.000956	3.54	33.5	0.72	95.6	837,519	60	60
2055	17,547	203	0.000954	3.53	33.5	0.72	95.4	835,916	60	60
2056	17,518	203	0.000951	3.52	33.5	0.72	95.2	834,314	60	60
2057	17,490	202	0.000948	3.51	33.5	0.72	95.1	832,714	60	60
2058	17,462	202	0.000945	3.50	33.5	0.71	94.9	831,115	60	60
2059	17,434	202	0.000942	3.49	33.5	0.71	94.7	829,517	60	60
2060	17,406	201	0.000939	3.48	33.5	0.71	94.5	827,920	60	60
2061	17,378	201	0.000937	3.47	33.5	0.71	94.3	826,324	59	59
2062	17,349	201	0.000934	3.46	33.5	0.71	94.1	824,730	59	59
2063	17,321	200	0.000931	3.44	33.4	0.71	94.0	823,137	59	59
2064	17,293	200	0.000928	3.43	33.4	0.71	93.8	821,545	59	59
2065	17,265	200	0.000925	3.42	33.4	0.71	93.6	819,954	59	59
Totals =								42,650,797	3,071	3,071

MARIGOLD PUMP STATION

static head = 30.0 m
friction C value = 120
forcemain diameter = 600 mm
forcemain X-area = 0.2827 m²
forcemain length = 3,700 m
pump efficiency = 70%
fluid specific weight = 9.81 kN/m³

Ref: Flow and pumping information from M. Homenuke Feb 2/09 e-mail and attached ConveyanceFlows_forDean_20090202.xls.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Marigold Pump Station

Last Revision: June 18, 2009

Strategy
Life Cycle Analysis

Yellow-shaded cell denotes assumed/input values

Year	Capital Costs (Note 1)		Operation & Maintenance Costs				GHG CO2e		Total	
	Total Cost	Net Present Value	Electricity		Maintenance (Note 1)		Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value
			Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value				
2008										
2009										
2010										
2011										
2012										
2013										
2014		\$0							\$0	\$0
2015		\$0	\$58,078	\$44,135	\$0	\$0	\$896	\$681	\$58,078	\$44,135
2016		\$0	\$58,094	\$42,449	\$0	\$0	\$896	\$655	\$58,094	\$42,449
2017		\$0	\$58,109	\$40,827	\$0	\$0	\$897	\$630	\$58,109	\$40,827
2018		\$0	\$58,125	\$39,267	\$0	\$0	\$897	\$606	\$58,125	\$39,267
2019		\$0	\$58,140	\$37,767	\$0	\$0	\$897	\$583	\$58,140	\$37,767
2020		\$0	\$58,155	\$36,324	\$0	\$0	\$897	\$560	\$58,155	\$36,324
2021		\$0	\$58,171	\$34,936	\$0	\$0	\$897	\$539	\$58,171	\$34,936
2022		\$0	\$58,186	\$33,601	\$0	\$0	\$898	\$518	\$58,186	\$33,601
2023		\$0	\$58,201	\$32,317	\$0	\$0	\$898	\$499	\$58,201	\$32,317
2024		\$0	\$58,217	\$31,082	\$0	\$0	\$898	\$480	\$58,217	\$31,082
2025		\$0	\$58,232	\$29,895	\$0	\$0	\$898	\$461	\$58,232	\$29,895
2026		\$0	\$58,248	\$28,753	\$0	\$0	\$899	\$444	\$58,248	\$28,753
2027		\$0	\$58,263	\$27,654	\$0	\$0	\$899	\$427	\$58,263	\$27,654
2028		\$0	\$58,278	\$26,597	\$0	\$0	\$899	\$410	\$58,278	\$26,597
2029		\$0	\$58,294	\$25,581	\$0	\$0	\$899	\$395	\$58,294	\$25,581
2030		\$0	\$58,309	\$24,604	\$0	\$0	\$900	\$380	\$58,309	\$24,604
2031		\$0	\$58,397	\$23,693	\$0	\$0	\$901	\$366	\$58,397	\$23,693
2032		\$0	\$58,486	\$22,817	\$0	\$0	\$902	\$352	\$58,486	\$22,817
2033		\$0	\$58,574	\$21,972	\$0	\$0	\$904	\$339	\$58,574	\$21,972
2034		\$0	\$58,663	\$21,159	\$0	\$0	\$905	\$326	\$58,663	\$21,159
2035		\$0	\$58,751	\$20,376	\$0	\$0	\$906	\$314	\$58,751	\$20,376
2036		\$0	\$58,840	\$19,622	\$0	\$0	\$908	\$303	\$58,840	\$19,622
2037		\$0	\$58,929	\$18,896	\$0	\$0	\$909	\$292	\$58,929	\$18,896
2038		\$0	\$59,017	\$18,196	\$0	\$0	\$911	\$281	\$59,017	\$18,196
2039		\$0	\$59,106	\$17,523	\$0	\$0	\$912	\$270	\$59,106	\$17,523
2040		\$0	\$59,195	\$16,874	\$0	\$0	\$913	\$260	\$59,195	\$16,874
2041		\$0	\$59,284	\$16,249	\$0	\$0	\$915	\$251	\$59,284	\$16,249
2042		\$0	\$59,373	\$15,648	\$0	\$0	\$916	\$241	\$59,373	\$15,648
2043		\$0	\$59,462	\$15,069	\$0	\$0	\$917	\$232	\$59,462	\$15,069
2044		\$0	\$59,551	\$14,511	\$0	\$0	\$919	\$224	\$59,551	\$14,511
2045		\$0	\$59,640	\$13,973	\$0	\$0	\$920	\$216	\$59,640	\$13,973
2046		\$0	\$59,527	\$13,411	\$0	\$0	\$918	\$207	\$59,527	\$13,411
2047		\$0	\$59,414	\$12,870	\$0	\$0	\$917	\$199	\$59,414	\$12,870
2048		\$0	\$59,301	\$12,352	\$0	\$0	\$915	\$191	\$59,301	\$12,352
2049		\$0	\$59,189	\$11,854	\$0	\$0	\$913	\$183	\$59,189	\$11,854
2050		\$0	\$59,076	\$11,377	\$0	\$0	\$911	\$176	\$59,076	\$11,377
2051		\$0	\$58,963	\$10,918	\$0	\$0	\$910	\$168	\$58,963	\$10,918
2052		\$0	\$58,851	\$10,478	\$0	\$0	\$908	\$162	\$58,851	\$10,478
2053		\$0	\$58,739	\$10,056	\$0	\$0	\$906	\$155	\$58,739	\$10,056
2054		\$0	\$58,626	\$9,651	\$0	\$0	\$905	\$149	\$58,626	\$9,651
2055		\$0	\$58,514	\$9,262	\$0	\$0	\$903	\$143	\$58,514	\$9,262
2056		\$0	\$58,402	\$8,888	\$0	\$0	\$901	\$137	\$58,402	\$8,888
2057		\$0	\$58,290	\$8,530	\$0	\$0	\$899	\$132	\$58,290	\$8,530
2058		\$0	\$58,178	\$8,186	\$0	\$0	\$898	\$126	\$58,178	\$8,186
2059		\$0	\$58,066	\$7,856	\$0	\$0	\$896	\$121	\$58,066	\$7,856
2060		\$0	\$57,954	\$7,540	\$0	\$0	\$894	\$116	\$57,954	\$7,540
2061		\$0	\$57,843	\$7,236	\$0	\$0	\$892	\$112	\$57,843	\$7,236
2062		\$0	\$57,731	\$6,944	\$0	\$0	\$891	\$107	\$57,731	\$6,944
2063		\$0	\$57,620	\$6,664	\$0	\$0	\$889	\$103	\$57,620	\$6,664
2064		\$0	\$57,508	\$6,395	\$0	\$0	\$887	\$99	\$57,508	\$6,395
2065		\$0	\$57,397	\$6,137	\$0	\$0	\$886	\$95	\$57,397	\$6,137

Total Capital =	\$0									
Total Net Present Value =		\$0	\$998,970		\$0	\$15,413	\$2,985,556			\$998,970

Notes:
1. No capital costs. Annual O&M cost assumed to be included in Existing Trunk Sewers LCA.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Currie Road Pump Station

Last Revision: June 18, 2009

Strategy
Material Flows
and Carbon Footprint Analysis

Yellow-shaded cell denotes assumed/input values

Year	Wastewater ADFW		ADWF Friction Losses		TDH (m)	Velocity (m/s)	Pump Energy (kW)	Materials Electricity (kWh/yr)	GHG Sources Electricity Purchased (t CO2e/yr)	Total GHG Emissions (t CO2e/yr)
	(m3/d)	Done (L/s)	Unit (m/m)	Total (m)						
2008										
2009										
2010										
2011										
2012										
2013										
2014										
2015	14,433	167	0.000224	0.40	20.4	0.38	47.8	418,436	30	30
2016	14,409	167	0.000224	0.40	20.4	0.38	47.7	417,729	30	30
2017	14,386	167	0.000223	0.40	20.4	0.38	47.6	417,022	30	30
2018	14,362	166	0.000222	0.40	20.4	0.38	47.5	416,315	30	30
2019	14,339	166	0.000222	0.40	20.4	0.38	47.4	415,608	30	30
2020	14,315	166	0.000221	0.40	20.4	0.38	47.4	414,901	30	30
2021	14,292	165	0.000220	0.40	20.4	0.37	47.3	414,195	30	30
2022	14,268	165	0.000220	0.40	20.4	0.37	47.2	413,488	30	30
2023	14,245	165	0.000219	0.39	20.4	0.37	47.1	412,782	30	30
2024	14,221	165	0.000218	0.39	20.4	0.37	47.0	412,075	30	30
2025	14,198	164	0.000218	0.39	20.4	0.37	47.0	411,369	30	30
2026	14,174	164	0.000217	0.39	20.4	0.37	46.9	410,663	30	30
2027	14,151	164	0.000216	0.39	20.4	0.37	46.8	409,957	30	30
2028	14,127	164	0.000216	0.39	20.4	0.37	46.7	409,252	29	29
2029	14,104	163	0.000215	0.39	20.4	0.37	46.6	408,546	29	29
2030	14,080	163	0.000214	0.39	20.4	0.37	46.6	407,840	29	29
2031	14,078	163	0.000214	0.39	20.4	0.37	46.6	407,788	29	29
2032	14,077	163	0.000214	0.39	20.4	0.37	46.5	407,736	29	29
2033	14,075	163	0.000214	0.39	20.4	0.37	46.5	407,684	29	29
2034	14,073	163	0.000214	0.39	20.4	0.37	46.5	407,632	29	29
2035	14,071	163	0.000214	0.39	20.4	0.37	46.5	407,580	29	29
2036	14,070	163	0.000214	0.39	20.4	0.37	46.5	407,528	29	29
2037	14,068	163	0.000214	0.39	20.4	0.37	46.5	407,477	29	29
2038	14,066	163	0.000214	0.39	20.4	0.37	46.5	407,425	29	29
2039	14,064	163	0.000214	0.38	20.4	0.37	46.5	407,373	29	29
2040	14,063	163	0.000214	0.38	20.4	0.37	46.5	407,321	29	29
2041	14,061	163	0.000214	0.38	20.4	0.37	46.5	407,269	29	29
2042	14,059	163	0.000214	0.38	20.4	0.37	46.5	407,217	29	29
2043	14,057	163	0.000214	0.38	20.4	0.37	46.5	407,165	29	29
2044	14,056	163	0.000214	0.38	20.4	0.37	46.5	407,113	29	29
2045	14,054	163	0.000214	0.38	20.4	0.37	46.5	407,061	29	29
2046	14,036	162	0.000213	0.38	20.4	0.37	46.4	406,533	29	29
2047	14,019	162	0.000213	0.38	20.4	0.37	46.3	406,006	29	29
2048	14,001	162	0.000212	0.38	20.4	0.37	46.3	405,478	29	29
2049	13,984	162	0.000212	0.38	20.4	0.37	46.2	404,951	29	29
2050	13,966	162	0.000211	0.38	20.4	0.37	46.2	404,424	29	29
2051	13,948	161	0.000211	0.38	20.4	0.37	46.1	403,897	29	29
2052	13,931	161	0.000210	0.38	20.4	0.36	46.0	403,370	29	29
2053	13,913	161	0.000210	0.38	20.4	0.36	46.0	402,842	29	29
2054	13,896	161	0.000209	0.38	20.4	0.36	45.9	402,315	29	29
2055	13,878	161	0.000209	0.38	20.4	0.36	45.9	401,789	29	29
2056	13,860	160	0.000208	0.37	20.4	0.36	45.8	401,262	29	29
2057	13,843	160	0.000208	0.37	20.4	0.36	45.7	400,735	29	29
2058	13,825	160	0.000207	0.37	20.4	0.36	45.7	400,208	29	29
2059	13,808	160	0.000207	0.37	20.4	0.36	45.6	399,681	29	29
2060	13,790	160	0.000206	0.37	20.4	0.36	45.6	399,155	29	29
2061	13,772	159	0.000206	0.37	20.4	0.36	45.5	398,628	29	29
2062	13,755	159	0.000205	0.37	20.4	0.36	45.4	398,102	29	29
2063	13,737	159	0.000205	0.37	20.4	0.36	45.4	397,575	29	29
2064	13,720	159	0.000204	0.37	20.4	0.36	45.3	397,049	29	29
2065	13,702	159	0.000204	0.37	20.4	0.36	45.3	396,522	29	29
Totals =								20,752,068	1,494	1,494

CURRIE ROAD PUMP STATION

static head = 20.0 m
friction C value = 120
forcemain diameter = 750 mm
forcemain X-area = 0.4418 m²
forcemain length = 1,800 m
pump efficiency = 70%
fluid specific weight = 9.81 kN/m³

Ref: Flow and pumping information from M. Homenuke Feb 2/09 e-mail and attached ConveyanceFlows_forDean_20090202.xls.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Currie Road Pump Station

Last Revision: June 18, 2009

Strategy
Life Cycle Analysis

Yellow-shaded cell denotes assumed/input values

Year	Capital Costs (Note 1)		Operation & Maintenance Costs				GHG CO2e		Total	
	Total Cost	Net Present Value	Electricity		Maintenance (Note 1)		Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value
			Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value				
2008										
2009										
2010										
2011										
2012										
2013										
2014		\$0							\$0	\$0
2015		\$0	\$29,291	\$22,258	\$0	\$0	\$452	\$343	\$29,291	\$22,258
2016		\$0	\$29,241	\$21,366	\$0	\$0	\$451	\$330	\$29,241	\$21,366
2017		\$0	\$29,192	\$20,510	\$0	\$0	\$450	\$316	\$29,192	\$20,510
2018		\$0	\$29,142	\$19,687	\$0	\$0	\$450	\$304	\$29,142	\$19,687
2019		\$0	\$29,093	\$18,898	\$0	\$0	\$449	\$292	\$29,093	\$18,898
2020		\$0	\$29,043	\$18,140	\$0	\$0	\$448	\$280	\$29,043	\$18,140
2021		\$0	\$28,994	\$17,413	\$0	\$0	\$447	\$269	\$28,994	\$17,413
2022		\$0	\$28,944	\$16,715	\$0	\$0	\$447	\$258	\$28,944	\$16,715
2023		\$0	\$28,895	\$16,044	\$0	\$0	\$446	\$248	\$28,895	\$16,044
2024		\$0	\$28,845	\$15,401	\$0	\$0	\$445	\$238	\$28,845	\$15,401
2025		\$0	\$28,796	\$14,783	\$0	\$0	\$444	\$228	\$28,796	\$14,783
2026		\$0	\$28,746	\$14,190	\$0	\$0	\$444	\$219	\$28,746	\$14,190
2027		\$0	\$28,697	\$13,621	\$0	\$0	\$443	\$210	\$28,697	\$13,621
2028		\$0	\$28,648	\$13,074	\$0	\$0	\$442	\$202	\$28,648	\$13,074
2029		\$0	\$28,598	\$12,550	\$0	\$0	\$441	\$194	\$28,598	\$12,550
2030		\$0	\$28,549	\$12,046	\$0	\$0	\$440	\$186	\$28,549	\$12,046
2031		\$0	\$28,545	\$11,582	\$0	\$0	\$440	\$179	\$28,545	\$11,582
2032		\$0	\$28,542	\$11,135	\$0	\$0	\$440	\$172	\$28,542	\$11,135
2033		\$0	\$28,538	\$10,705	\$0	\$0	\$440	\$165	\$28,538	\$10,705
2034		\$0	\$28,534	\$10,292	\$0	\$0	\$440	\$159	\$28,534	\$10,292
2035		\$0	\$28,531	\$9,895	\$0	\$0	\$440	\$153	\$28,531	\$9,895
2036		\$0	\$28,527	\$9,513	\$0	\$0	\$440	\$147	\$28,527	\$9,513
2037		\$0	\$28,523	\$9,146	\$0	\$0	\$440	\$141	\$28,523	\$9,146
2038		\$0	\$28,520	\$8,793	\$0	\$0	\$440	\$136	\$28,520	\$8,793
2039		\$0	\$28,516	\$8,454	\$0	\$0	\$440	\$130	\$28,516	\$8,454
2040		\$0	\$28,512	\$8,128	\$0	\$0	\$440	\$125	\$28,512	\$8,128
2041		\$0	\$28,509	\$7,814	\$0	\$0	\$440	\$121	\$28,509	\$7,814
2042		\$0	\$28,505	\$7,513	\$0	\$0	\$440	\$116	\$28,505	\$7,513
2043		\$0	\$28,502	\$7,223	\$0	\$0	\$440	\$111	\$28,502	\$7,223
2044		\$0	\$28,498	\$6,944	\$0	\$0	\$440	\$107	\$28,498	\$6,944
2045		\$0	\$28,494	\$6,676	\$0	\$0	\$440	\$103	\$28,494	\$6,676
2046		\$0	\$28,457	\$6,411	\$0	\$0	\$439	\$99	\$28,457	\$6,411
2047		\$0	\$28,420	\$6,156	\$0	\$0	\$438	\$95	\$28,420	\$6,156
2048		\$0	\$28,383	\$5,912	\$0	\$0	\$438	\$91	\$28,383	\$5,912
2049		\$0	\$28,347	\$5,677	\$0	\$0	\$437	\$88	\$28,347	\$5,677
2050		\$0	\$28,310	\$5,452	\$0	\$0	\$437	\$84	\$28,310	\$5,452
2051		\$0	\$28,273	\$5,235	\$0	\$0	\$436	\$81	\$28,273	\$5,235
2052		\$0	\$28,236	\$5,027	\$0	\$0	\$436	\$78	\$28,236	\$5,027
2053		\$0	\$28,199	\$4,828	\$0	\$0	\$435	\$74	\$28,199	\$4,828
2054		\$0	\$28,162	\$4,636	\$0	\$0	\$435	\$72	\$28,162	\$4,636
2055		\$0	\$28,125	\$4,452	\$0	\$0	\$434	\$69	\$28,125	\$4,452
2056		\$0	\$28,088	\$4,275	\$0	\$0	\$433	\$66	\$28,088	\$4,275
2057		\$0	\$28,051	\$4,105	\$0	\$0	\$433	\$63	\$28,051	\$4,105
2058		\$0	\$28,015	\$3,942	\$0	\$0	\$432	\$61	\$28,015	\$3,942
2059		\$0	\$27,978	\$3,785	\$0	\$0	\$432	\$58	\$27,978	\$3,785
2060		\$0	\$27,941	\$3,635	\$0	\$0	\$431	\$56	\$27,941	\$3,635
2061		\$0	\$27,904	\$3,491	\$0	\$0	\$431	\$54	\$27,904	\$3,491
2062		\$0	\$27,867	\$3,352	\$0	\$0	\$430	\$52	\$27,867	\$3,352
2063		\$0	\$27,830	\$3,219	\$0	\$0	\$429	\$50	\$27,830	\$3,219
2064		\$0	\$27,793	\$3,091	\$0	\$0	\$429	\$48	\$27,793	\$3,091
2065		\$0	\$27,757	\$2,968	\$0	\$0	\$428	\$46	\$27,757	\$2,968

Total Capital =	\$0									
Total Net Present Value =		\$0	\$490,157		\$0	\$7,562	\$1,452,645			\$490,157

Notes:
1. Capital costs included in CS Mods LCA. Existing annual O&M cost assumed to be included in Existing Trunk Sewers LCA.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Colwood Diversion Pump Station

Last Revision: June 18, 2009

Strategy
Material Flows
and Carbon Footprint Analysis

Yellow-shaded cell denotes assumed/input values

Year	Wastewater ADWF		ADWF Friction Losses		TDH	Velocity	Pump Energy	Materials Electricity	GHG Sources Electricity Purchased	Total GHG Emissions
	(m3/d)	(L/s)	Unit (m/m)	Total (m)						
2008										
2009										
2010										
2011										
2012										
2013										
2014										
2015	10,248	119	0.000049	0.13	25.1	0.19	41.8	365,889	26	26
2016	10,818	125	0.000054	0.14	25.1	0.20	44.1	386,439	28	28
2017	11,388	132	0.000060	0.15	25.2	0.21	46.5	407,021	29	29
2018	11,957	138	0.000065	0.17	25.2	0.22	48.8	427,636	31	31
2019	12,527	145	0.000071	0.18	25.2	0.23	51.2	448,286	32	32
2020	13,097	152	0.000077	0.20	25.2	0.24	53.5	468,971	34	34
2021	13,667	158	0.000084	0.22	25.2	0.25	55.9	489,694	35	35
2022	14,237	165	0.000090	0.23	25.2	0.26	58.3	510,455	37	37
2023	14,806	171	0.000097	0.25	25.3	0.27	60.6	531,256	38	38
2024	15,376	178	0.000104	0.27	25.3	0.28	63.0	552,099	40	40
2025	15,946	185	0.000111	0.29	25.3	0.29	65.4	572,984	41	41
2026	16,516	191	0.000119	0.31	25.3	0.30	67.8	593,914	43	43
2027	17,086	198	0.000126	0.33	25.3	0.31	70.2	614,888	44	44
2028	17,655	204	0.000134	0.35	25.3	0.32	72.6	635,910	46	46
2029	18,225	211	0.000142	0.37	25.4	0.33	75.0	656,980	47	47
2030	18,795	218	0.000151	0.39	25.4	0.34	77.4	678,099	49	49
2031	19,059	221	0.000155	0.40	25.4	0.35	78.5	687,910	50	50
2032	19,324	224	0.000159	0.41	25.4	0.35	79.6	697,733	50	50
2033	19,588	227	0.000163	0.42	25.4	0.36	80.8	707,567	51	51
2034	19,852	230	0.000167	0.43	25.4	0.36	81.9	717,413	52	52
2035	20,116	233	0.000171	0.44	25.4	0.37	83.0	727,269	52	52
2036	20,381	236	0.000175	0.45	25.5	0.37	84.1	737,138	53	53
2037	20,645	239	0.000179	0.47	25.5	0.38	85.3	747,018	54	54
2038	20,909	242	0.000183	0.48	25.5	0.38	86.4	756,909	54	54
2039	21,173	245	0.000188	0.49	25.5	0.39	87.5	766,813	55	55
2040	21,438	248	0.000192	0.50	25.5	0.39	88.7	776,729	56	56
2041	21,702	251	0.000196	0.51	25.5	0.39	89.8	786,657	57	57
2042	21,966	254	0.000201	0.52	25.5	0.40	90.9	796,597	57	57
2043	22,230	257	0.000205	0.53	25.5	0.40	92.1	806,550	58	58
2044	22,495	260	0.000210	0.55	25.5	0.41	93.2	816,515	59	59
2045	22,759	263	0.000215	0.56	25.6	0.41	94.3	826,493	60	60
2046	23,021	267	0.000220	0.57	25.6	0.42	95.7	836,473	60	60
2047	23,282	271	0.000226	0.59	25.6	0.43	97.0	846,464	61	61
2048	23,543	274	0.000231	0.60	25.6	0.43	98.4	856,466	62	62
2049	23,804	278	0.000237	0.62	25.6	0.44	99.7	866,479	63	63
2050	24,065	281	0.000243	0.63	25.6	0.44	101.1	876,503	64	64
2051	24,326	285	0.000248	0.65	25.6	0.45	102.4	886,537	65	65
2052	24,587	289	0.000254	0.66	25.7	0.45	103.8	896,581	65	65
2053	24,848	292	0.000260	0.68	25.7	0.46	105.2	906,635	66	66
2054	25,109	296	0.000266	0.69	25.7	0.47	106.5	916,699	67	67
2055	25,370	299	0.000272	0.71	25.7	0.47	107.9	926,773	68	68
2056	25,631	303	0.000278	0.72	25.7	0.48	109.3	936,857	69	69
2057	25,892	307	0.000284	0.74	25.7	0.48	110.6	946,951	70	70
2058	26,153	310	0.000291	0.76	25.8	0.49	112.0	957,055	71	71
2059	26,414	314	0.000297	0.77	25.8	0.49	113.4	967,169	72	72
2060	26,675	318	0.000303	0.79	25.8	0.50	114.7	977,293	72	72
2061	26,936	321	0.000310	0.80	25.8	0.50	116.1	987,427	73	73
2062	27,197	325	0.000316	0.82	25.8	0.51	117.5	997,571	74	74
2063	27,458	328	0.000323	0.84	25.8	0.52	118.9	1,007,725	75	75
2064	27,719	332	0.000329	0.86	25.9	0.52	120.3	1,017,889	76	76
2065	27,980	336	0.000336	0.87	25.9	0.53	121.7	1,028,063	77	77

Totals = 38,724,658 2,788 2,788

COLWOOD DIVERSION PUMP STATION

static head = 25.0 m
 friction C value = 120
 forcemain diameter = 900 mm
 forcemain X-area = 0.6362 m²
 forcemain length = 2,600 m
 pump efficiency = 70%
 fluid specific weight = 9.81 kN/m³

Ref: Flow and pumping information from M. Homenuke Feb 2/09 e-mail and attached ConveyanceFlows_forDean_20090202.xls.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Colwood Diversion Pump Station

Last Revision: June 18, 2009

Strategy
Life Cycle Analysis

Yellow-shaded cell denotes assumed/input values

Year	Capital Costs (Note 1)		Operation & Maintenance Costs				GHG CO2e		Total	
	Total Cost	Net Present Value	Electricity		Maintenance (Note 1)		Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value
			Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value				
2008										
2009										
2010										
2011										
2012										
2013										
2014		\$0							\$0	\$0
2015		\$0	\$25,612	\$19,463	\$0	\$0	\$395	\$300	\$25,612	\$19,463
2016		\$0	\$27,051	\$19,766	\$0	\$0	\$417	\$305	\$27,051	\$19,766
2017		\$0	\$28,491	\$20,018	\$0	\$0	\$440	\$309	\$28,491	\$20,018
2018		\$0	\$29,935	\$20,223	\$0	\$0	\$462	\$312	\$29,935	\$20,223
2019		\$0	\$31,380	\$20,384	\$0	\$0	\$484	\$314	\$31,380	\$20,384
2020		\$0	\$32,828	\$20,504	\$0	\$0	\$506	\$316	\$32,828	\$20,504
2021		\$0	\$34,279	\$20,587	\$0	\$0	\$529	\$318	\$34,279	\$20,587
2022		\$0	\$35,732	\$20,634	\$0	\$0	\$551	\$318	\$35,732	\$20,634
2023		\$0	\$37,188	\$20,649	\$0	\$0	\$574	\$319	\$37,188	\$20,649
2024		\$0	\$38,647	\$20,634	\$0	\$0	\$596	\$318	\$38,647	\$20,634
2025		\$0	\$40,109	\$20,591	\$0	\$0	\$619	\$318	\$40,109	\$20,591
2026		\$0	\$41,574	\$20,522	\$0	\$0	\$641	\$317	\$41,574	\$20,522
2027		\$0	\$43,042	\$20,430	\$0	\$0	\$664	\$315	\$43,042	\$20,430
2028		\$0	\$44,514	\$20,315	\$0	\$0	\$687	\$313	\$44,514	\$20,315
2029		\$0	\$45,989	\$20,181	\$0	\$0	\$710	\$311	\$45,989	\$20,181
2030		\$0	\$47,467	\$20,029	\$0	\$0	\$732	\$309	\$47,467	\$20,029
2031		\$0	\$48,945	\$19,867	\$0	\$0	\$754	\$307	\$48,945	\$19,867
2032		\$0	\$50,423	\$19,697	\$0	\$0	\$775	\$305	\$50,423	\$19,697
2033		\$0	\$51,901	\$19,519	\$0	\$0	\$796	\$303	\$51,901	\$19,519
2034		\$0	\$53,379	\$19,334	\$0	\$0	\$817	\$301	\$53,379	\$19,334
2035		\$0	\$54,857	\$19,142	\$0	\$0	\$838	\$299	\$54,857	\$19,142
2036		\$0	\$56,335	\$18,943	\$0	\$0	\$859	\$297	\$56,335	\$18,943
2037		\$0	\$57,813	\$18,738	\$0	\$0	\$880	\$295	\$57,813	\$18,738
2038		\$0	\$59,291	\$18,527	\$0	\$0	\$901	\$293	\$59,291	\$18,527
2039		\$0	\$60,769	\$18,311	\$0	\$0	\$922	\$291	\$60,769	\$18,311
2040		\$0	\$62,247	\$18,090	\$0	\$0	\$943	\$289	\$62,247	\$18,090
2041		\$0	\$63,725	\$17,864	\$0	\$0	\$964	\$287	\$63,725	\$17,864
2042		\$0	\$65,203	\$17,634	\$0	\$0	\$985	\$285	\$65,203	\$17,634
2043		\$0	\$66,681	\$17,400	\$0	\$0	\$1,006	\$283	\$66,681	\$17,400
2044		\$0	\$68,159	\$17,162	\$0	\$0	\$1,027	\$281	\$68,159	\$17,162
2045		\$0	\$69,637	\$16,920	\$0	\$0	\$1,048	\$279	\$69,637	\$16,920
2046		\$0	\$71,115	\$16,674	\$0	\$0	\$1,069	\$277	\$71,115	\$16,674
2047		\$0	\$72,593	\$16,425	\$0	\$0	\$1,090	\$275	\$72,593	\$16,425
2048		\$0	\$74,071	\$16,173	\$0	\$0	\$1,111	\$273	\$74,071	\$16,173
2049		\$0	\$75,549	\$15,918	\$0	\$0	\$1,132	\$271	\$75,549	\$15,918
2050		\$0	\$77,027	\$15,660	\$0	\$0	\$1,153	\$269	\$77,027	\$15,660
2051		\$0	\$78,505	\$15,399	\$0	\$0	\$1,174	\$267	\$78,505	\$15,399
2052		\$0	\$80,000	\$15,135	\$0	\$0	\$1,195	\$265	\$80,000	\$15,135
2053		\$0	\$81,495	\$14,868	\$0	\$0	\$1,216	\$263	\$81,495	\$14,868
2054		\$0	\$83,000	\$14,598	\$0	\$0	\$1,237	\$261	\$83,000	\$14,598
2055		\$0	\$84,505	\$14,325	\$0	\$0	\$1,258	\$259	\$84,505	\$14,325
2056		\$0	\$86,010	\$14,049	\$0	\$0	\$1,279	\$257	\$86,010	\$14,049
2057		\$0	\$87,515	\$13,770	\$0	\$0	\$1,300	\$255	\$87,515	\$13,770
2058		\$0	\$89,020	\$13,488	\$0	\$0	\$1,321	\$253	\$89,020	\$13,488
2059		\$0	\$90,525	\$13,203	\$0	\$0	\$1,342	\$251	\$90,525	\$13,203
2060		\$0	\$92,030	\$12,915	\$0	\$0	\$1,363	\$249	\$92,030	\$12,915
2061		\$0	\$93,535	\$12,624	\$0	\$0	\$1,384	\$247	\$93,535	\$12,624
2062		\$0	\$95,040	\$12,330	\$0	\$0	\$1,405	\$245	\$95,040	\$12,330
2063		\$0	\$96,545	\$12,033	\$0	\$0	\$1,426	\$243	\$96,545	\$12,033
2064		\$0	\$98,050	\$11,733	\$0	\$0	\$1,447	\$241	\$98,050	\$11,733
2065		\$0	\$99,555	\$11,430	\$0	\$0	\$1,468	\$239	\$99,555	\$11,430

Total Capital =	\$0									
Total Net Present Value =		\$0		\$779,797		\$0	\$12,031	\$2,710,726		\$779,797

Notes:
1. Capital costs included in CS Mods LCA. Existing annual O&M cost assumed to be included in Existing Trunk Sewers LCA.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Craigflower Pump Station

Last Revision: June 18, 2009

Strategy
Material Flows
and Carbon Footprint Analysis

Yellow-shaded cell denotes assumed/input values

Year	Wastewater ADFW		ADWF Friction Losses		TDH	Velocity	Pump Energy	Materials Electricity	GHG Sources Electricity Purchased	Total GHG Emissions
	(m3/d)	(L/s)	Unit (m/m)	Total (m)						
2008										
2009										
2010										
2011										
2012										
2013										
2014										
2015	7,156	83	0.000181	0.47	35.5	0.29	41.2	360,674	26	26
2016	7,438	86	0.000195	0.51	35.5	0.30	42.8	375,260	27	27
2017	7,720	89	0.000209	0.54	35.5	0.32	44.5	389,887	28	28
2018	8,002	93	0.000223	0.58	35.6	0.33	46.2	404,555	29	29
2019	8,284	96	0.000238	0.62	35.6	0.34	47.9	419,267	30	30
2020	8,566	99	0.000253	0.66	35.7	0.35	49.5	434,024	31	31
2021	8,848	102	0.000269	0.70	35.7	0.36	51.2	448,826	32	32
2022	9,130	106	0.000285	0.74	35.7	0.37	52.9	463,676	33	33
2023	9,413	109	0.000301	0.78	35.8	0.39	54.6	478,573	34	34
2024	9,695	112	0.000318	0.83	35.8	0.40	56.3	493,520	36	36
2025	9,977	115	0.000336	0.87	35.9	0.41	58.1	508,519	37	37
2026	10,259	119	0.000353	0.92	35.9	0.42	59.8	523,569	38	38
2027	10,541	122	0.000371	0.97	36.0	0.43	61.5	538,672	39	39
2028	10,823	125	0.000390	1.01	36.0	0.44	63.2	553,831	40	40
2029	11,105	129	0.000409	1.06	36.1	0.45	65.0	569,045	41	41
2030	11,387	132	0.000429	1.11	36.1	0.47	66.7	584,316	42	42
2031	11,662	135	0.000448	1.16	36.2	0.48	68.4	599,264	43	43
2032	11,937	138	0.000468	1.22	36.2	0.49	70.1	614,269	44	44
2033	12,212	141	0.000488	1.27	36.3	0.50	71.8	629,332	45	45
2034	12,487	145	0.000508	1.32	36.3	0.51	73.6	644,453	46	46
2035	12,762	148	0.000529	1.38	36.4	0.52	75.3	659,635	47	47
2036	13,037	151	0.000550	1.43	36.4	0.53	77.0	674,878	49	49
2037	13,312	154	0.000572	1.49	36.5	0.54	78.8	690,182	50	50
2038	13,588	157	0.000594	1.54	36.5	0.56	80.5	705,551	51	51
2039	13,863	160	0.000617	1.60	36.6	0.57	82.3	720,983	52	52
2040	14,138	164	0.000639	1.66	36.7	0.58	84.1	736,481	53	53
2041	14,413	167	0.000663	1.72	36.7	0.59	85.9	752,046	54	54
2042	14,688	170	0.000686	1.78	36.8	0.60	87.6	767,679	55	55
2043	14,963	173	0.000710	1.85	36.8	0.61	89.4	783,380	56	56
2044	15,238	176	0.000735	1.91	36.9	0.62	91.2	799,152	58	58
2045	15,513	180	0.000759	1.97	37.0	0.64	93.0	814,994	59	59
2046	15,788	182	0.000777	2.02	37.0	0.64	94.3	826,136	59	59
2047	15,898	184	0.000795	2.07	37.1	0.65	95.6	837,313	60	60
2048	16,091	186	0.000812	2.11	37.1	0.66	96.9	848,526	61	61
2049	16,284	188	0.000831	2.16	37.2	0.67	98.1	859,776	62	62
2050	16,477	191	0.000849	2.21	37.2	0.67	99.4	871,063	63	63
2051	16,669	193	0.000867	2.25	37.3	0.68	100.7	882,387	64	64
2052	16,862	195	0.000886	2.30	37.3	0.69	102.0	893,748	64	64
2053	17,055	197	0.000905	2.35	37.4	0.70	103.3	905,148	65	65
2054	17,247	200	0.000924	2.40	37.4	0.71	104.6	916,586	66	66
2055	17,440	202	0.000943	2.45	37.5	0.71	105.9	928,063	67	67
2056	17,633	204	0.000962	2.50	37.5	0.72	107.3	939,579	68	68
2057	17,825	206	0.000982	2.55	37.6	0.73	108.6	951,134	68	68
2058	18,018	209	0.001002	2.60	37.6	0.74	109.9	962,729	69	69
2059	18,211	211	0.001021	2.66	37.7	0.75	111.2	974,365	70	70
2060	18,404	213	0.001042	2.71	37.7	0.75	112.6	986,041	71	71
2061	18,596	215	0.001062	2.76	37.8	0.76	113.9	997,758	72	72
2062	18,789	217	0.001082	2.81	37.8	0.77	115.2	1,009,516	73	73
2063	18,982	220	0.001103	2.87	37.9	0.78	116.6	1,021,316	74	74
2064	19,174	222	0.001124	2.92	37.9	0.78	117.9	1,033,157	74	74
2065	19,367	224	0.001145	2.98	38.0	0.79	119.3	1,045,042	75	75

Totals = 36,827,875 2,652 2,652

CRAIGFLOWER PUMP STATION

static head = 35.0 m
 friction C value = 120
 forcemain diameter = 600 mm
 forcemain X-area = 0.2827 m²
 forcemain length = 2,600 m
 pump efficiency = 70%
 fluid specific weight = 9.81 kN/m³

Ref: Flow and pumping information from M. Homenuke Feb 2/09 e-mail and attached ConveyanceFlows_forDean_20090202.xls.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Craigflower Pump Station

Last Revision: June 18, 2009

Strategy
Life Cycle Analysis

Yellow-shaded cell denotes assumed/input values

Year	Capital Costs (Note 1)		Operation & Maintenance Costs				GHG CO2e		Total	
	Total Cost	Net Present Value	Electricity		Maintenance (Note 1)		Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value
			Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value				
2008										
2009										
2010										
2011										
2012										
2013										
2014		\$0							\$0	\$0
2015		\$0	\$25,247	\$19,186	\$0	\$0	\$390	\$296	\$25,247	\$19,186
2016		\$0	\$26,268	\$19,194	\$0	\$0	\$405	\$296	\$26,268	\$19,194
2017		\$0	\$27,292	\$19,175	\$0	\$0	\$421	\$296	\$27,292	\$19,175
2018		\$0	\$28,319	\$19,131	\$0	\$0	\$437	\$295	\$28,319	\$19,131
2019		\$0	\$29,349	\$19,064	\$0	\$0	\$453	\$294	\$29,349	\$19,064
2020		\$0	\$30,382	\$18,976	\$0	\$0	\$469	\$293	\$30,382	\$18,976
2021		\$0	\$31,418	\$18,869	\$0	\$0	\$485	\$291	\$31,418	\$18,869
2022		\$0	\$32,457	\$18,743	\$0	\$0	\$501	\$289	\$32,457	\$18,743
2023		\$0	\$33,500	\$18,601	\$0	\$0	\$517	\$287	\$33,500	\$18,601
2024		\$0	\$34,546	\$18,445	\$0	\$0	\$533	\$285	\$34,546	\$18,445
2025		\$0	\$35,596	\$18,274	\$0	\$0	\$549	\$282	\$35,596	\$18,274
2026		\$0	\$36,650	\$18,091	\$0	\$0	\$565	\$279	\$36,650	\$18,091
2027		\$0	\$37,707	\$17,897	\$0	\$0	\$582	\$276	\$37,707	\$17,897
2028		\$0	\$38,768	\$17,693	\$0	\$0	\$598	\$273	\$38,768	\$17,693
2029		\$0	\$39,833	\$17,480	\$0	\$0	\$615	\$270	\$39,833	\$17,480
2030		\$0	\$40,902	\$17,259	\$0	\$0	\$631	\$266	\$40,902	\$17,259
2031		\$0	\$41,949	\$17,020	\$0	\$0	\$647	\$263	\$41,949	\$17,020
2032		\$0	\$42,999	\$16,775	\$0	\$0	\$663	\$259	\$42,999	\$16,775
2033		\$0	\$44,053	\$16,525	\$0	\$0	\$680	\$255	\$44,053	\$16,525
2034		\$0	\$45,112	\$16,271	\$0	\$0	\$696	\$251	\$45,112	\$16,271
2035		\$0	\$46,174	\$16,014	\$0	\$0	\$712	\$247	\$46,174	\$16,014
2036		\$0	\$47,241	\$15,754	\$0	\$0	\$729	\$243	\$47,241	\$15,754
2037		\$0	\$48,313	\$15,492	\$0	\$0	\$745	\$239	\$48,313	\$15,492
2038		\$0	\$49,389	\$15,227	\$0	\$0	\$762	\$235	\$49,389	\$15,227
2039		\$0	\$50,469	\$14,962	\$0	\$0	\$779	\$231	\$50,469	\$14,962
2040		\$0	\$51,554	\$14,696	\$0	\$0	\$795	\$227	\$51,554	\$14,696
2041		\$0	\$52,643	\$14,429	\$0	\$0	\$812	\$223	\$52,643	\$14,429
2042		\$0	\$53,738	\$14,163	\$0	\$0	\$829	\$219	\$53,738	\$14,163
2043		\$0	\$54,837	\$13,896	\$0	\$0	\$846	\$214	\$54,837	\$13,896
2044		\$0	\$55,941	\$13,631	\$0	\$0	\$863	\$210	\$55,941	\$13,631
2045		\$0	\$57,050	\$13,367	\$0	\$0	\$880	\$206	\$57,050	\$13,367
2046		\$0	\$57,829	\$13,028	\$0	\$0	\$892	\$201	\$57,829	\$13,028
2047		\$0	\$58,612	\$12,697	\$0	\$0	\$904	\$196	\$58,612	\$12,697
2048		\$0	\$59,397	\$12,372	\$0	\$0	\$916	\$191	\$59,397	\$12,372
2049		\$0	\$60,184	\$12,054	\$0	\$0	\$929	\$186	\$60,184	\$12,054
2050		\$0	\$60,974	\$11,742	\$0	\$0	\$941	\$181	\$60,974	\$11,742
2051		\$0	\$61,767	\$11,437	\$0	\$0	\$953	\$176	\$61,767	\$11,437
2052		\$0	\$62,562	\$11,139	\$0	\$0	\$965	\$172	\$62,562	\$11,139
2053		\$0	\$63,360	\$10,847	\$0	\$0	\$978	\$167	\$63,360	\$10,847
2054		\$0	\$64,161	\$10,562	\$0	\$0	\$990	\$163	\$64,161	\$10,562
2055		\$0	\$64,964	\$10,283	\$0	\$0	\$1,002	\$159	\$64,964	\$10,283
2056		\$0	\$65,771	\$10,010	\$0	\$0	\$1,015	\$154	\$65,771	\$10,010
2057		\$0	\$66,579	\$9,743	\$0	\$0	\$1,027	\$150	\$66,579	\$9,743
2058		\$0	\$67,391	\$9,483	\$0	\$0	\$1,040	\$146	\$67,391	\$9,483
2059		\$0	\$68,206	\$9,228	\$0	\$0	\$1,052	\$142	\$68,206	\$9,228
2060		\$0	\$69,023	\$8,980	\$0	\$0	\$1,065	\$139	\$69,023	\$8,980
2061		\$0	\$69,843	\$8,737	\$0	\$0	\$1,078	\$135	\$69,843	\$8,737
2062		\$0	\$70,666	\$8,500	\$0	\$0	\$1,090	\$131	\$70,666	\$8,500
2063		\$0	\$71,492	\$8,268	\$0	\$0	\$1,103	\$128	\$71,492	\$8,268
2064		\$0	\$72,321	\$8,043	\$0	\$0	\$1,116	\$124	\$72,321	\$8,043
2065		\$0	\$73,153	\$7,822	\$0	\$0	\$1,129	\$121	\$73,153	\$7,822

Total Capital =	\$0									
Total Net Present Value =		\$0		\$729,275		\$0		\$11,252	\$2,577,951	\$729,275

Notes:
1. Capital costs included in CS Mods LCA. Existing annual O&M cost assumed to be included in Existing Trunk Sewers LCA.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Saanich East WWTF Strategy

Last Revision: June 18, 2009

Material Flows and Carbon Footprint Analysis

Yellow-shaded cell denotes assumed input values

Year	Equivalent Population (pe)	Wastewater ADWF (m3/d)	Sludge Production and Truck Transport		Saleable Effluent Heat ¹ (GJ/yr)	Saleable Reclaimed Water (Irrigation only) (m3/yr)	Materials			GHG Sources			GHG Offsets Avoided Natural Gas/Elect Use via Effluent Heat (t CO2e/yr)	Total GHG Emissions (t CO2e/yr)
			Mass (dry t/yr)	Thickened Volume (m3/yr)			Electricity (kWh/yr)	Diesel Fuel (L/yr)	Sludge Thickening Polymer (kg/yr)	Electricity Purchased (t CO2e/yr)	Diesel Fuel Combusted (t CO2e/yr)	Sludge Thickening Polymer Used (t CO2e/yr)		
2008														
2009														
2010														
2011														
2012														
2013														
2014														
2015	47,656	16,125	1,035	0	36,488	29,428	3,972,797	-	0	286	0.0	0.0	-1,385	-1,099
2016	48,074	16,157	1,044	0	44,864	29,487	3,980,681	-	0	287	0.0	0.0	-1,703	-1,417
2017	48,491	16,189	1,053	0	53,241	29,545	3,988,565	-	0	287	0.0	0.0	-2,021	-1,734
2018	48,909	16,221	1,062	0	61,617	29,603	3,996,449	-	0	288	0.0	0.0	-2,339	-2,052
2019	49,326	16,253	1,071	0	69,994	29,662	4,004,333	-	0	288	0.0	0.0	-2,657	-2,369
2020	49,744	16,285	1,080	0	78,371	29,720	4,012,217	-	0	289	0.0	0.0	-2,975	-2,687
2021	50,161	16,317	1,089	0	86,747	29,779	4,020,101	-	0	289	0.0	0.0	-3,294	-3,004
2022	50,579	16,349	1,098	0	95,124	29,837	4,027,985	-	0	290	0.0	0.0	-3,612	-3,322
2023	50,996	16,381	1,108	0	103,500	29,895	4,035,869	-	0	291	0.0	0.0	-3,930	-3,639
2024	51,414	16,413	1,117	0	111,877	29,954	4,043,753	-	0	291	0.0	0.0	-4,248	-3,956
2025	51,831	16,445	1,126	0	120,253	30,012	4,051,637	-	0	292	0.0	0.0	-4,566	-4,274
2026	52,249	16,477	1,135	0	128,630	30,071	4,059,521	-	0	292	0.0	0.0	-4,884	-4,591
2027	52,666	16,509	1,144	0	137,007	30,129	4,067,405	-	0	293	0.0	0.0	-5,202	-4,909
2028	53,084	16,541	1,153	0	145,383	30,187	4,075,289	-	0	293	0.0	0.0	-5,520	-5,226
2029	53,501	16,573	1,162	0	153,760	30,246	4,083,173	-	0	294	0.0	0.0	-5,838	-5,544
2030	53,919	16,605	1,171	0	162,136	30,304	4,091,057	-	0	295	0.0	0.0	-6,156	-5,861
2031	54,470	16,673	1,183	0	163,871	30,428	4,107,794	-	0	296	0.0	0.0	-6,222	-5,926
2032	55,021	16,741	1,195	0	165,605	30,552	4,124,531	-	0	297	0.0	0.0	-6,287	-5,991
2033	55,573	16,809	1,207	0	167,339	30,676	4,141,268	-	0	298	0.0	0.0	-6,353	-6,055
2034	56,124	16,877	1,219	0	169,074	30,800	4,158,005	-	0	299	0.0	0.0	-6,419	-6,120
2035	56,675	16,945	1,231	0	170,808	30,924	4,174,742	-	0	301	0.0	0.0	-6,485	-6,184
2036	57,226	17,013	1,243	0	172,543	31,048	4,191,479	-	0	302	0.0	0.0	-6,551	-6,249
2037	57,777	17,081	1,255	0	174,277	31,172	4,208,216	-	0	303	0.0	0.0	-6,617	-6,314
2038	58,329	17,148	1,267	0	176,011	31,296	4,224,953	-	0	304	0.0	0.0	-6,683	-6,378
2039	58,880	17,216	1,279	0	177,746	31,420	4,241,691	-	0	305	0.0	0.0	-6,748	-6,443
2040	59,431	17,284	1,291	0	179,480	31,544	4,258,428	-	0	307	0.0	0.0	-6,814	-6,508
2041	59,982	17,352	1,303	0	181,215	31,668	4,275,165	-	0	308	0.0	0.0	-6,880	-6,572
2042	60,533	17,420	1,315	0	182,949	31,792	4,291,902	-	0	309	0.0	0.0	-6,946	-6,637
2043	61,085	17,488	1,327	0	184,683	31,916	4,308,639	-	0	310	0.0	0.0	-7,012	-6,702
2044	61,636	17,556	1,339	0	186,418	32,040	4,325,376	-	0	311	0.0	0.0	-7,078	-6,766
2045	62,187	17,624	1,351	0	188,152	32,164	4,342,113	-	0	313	0.0	0.0	-7,144	-6,831
2046	62,252	17,602	1,352	0	195,957	32,123	4,336,631	-	0	312	0.0	0.0	-7,440	-7,128
2047	62,317	17,580	1,353	0	203,762	32,083	4,331,149	-	0	312	0.0	0.0	-7,736	-7,424
2048	62,382	17,557	1,355	0	211,566	32,042	4,325,667	-	0	311	0.0	0.0	-8,033	-7,721
2049	62,447	17,535	1,356	0	219,371	32,001	4,320,186	-	0	311	0.0	0.0	-8,329	-8,018
2050	62,512	17,513	1,358	0	227,176	31,961	4,314,704	-	0	311	0.0	0.0	-8,625	-8,314
2051	62,576	17,491	1,359	0	234,981	31,920	4,309,222	-	0	310	0.0	0.0	-8,921	-8,611
2052	62,641	17,468	1,360	0	242,785	31,880	4,303,740	-	0	310	0.0	0.0	-9,218	-8,908
2053	62,706	17,446	1,362	0	250,590	31,839	4,298,258	-	0	309	0.0	0.0	-9,514	-9,205
2054	62,771	17,424	1,363	0	258,395	31,798	4,292,776	-	0	309	0.0	0.0	-9,810	-9,501
2055	62,836	17,402	1,365	0	266,200	31,758	4,287,295	-	0	309	0.0	0.0	-10,107	-9,798
2056	62,901	17,379	1,366	0	274,004	31,717	4,281,813	-	0	308	0.0	0.0	-10,403	-10,095
2057	62,966	17,357	1,367	0	281,809	31,677	4,276,331	-	0	308	0.0	0.0	-10,699	-10,392
2058	63,031	17,335	1,369	0	289,614	31,636	4,270,849	-	0	308	0.0	0.0	-10,996	-10,688
2059	63,096	17,313	1,370	0	290,628	31,595	4,265,367	-	0	307	0.0	0.0	-11,034	-10,727
2060	63,161	17,290	1,372	0	291,307	31,555	4,259,885	-	0	307	0.0	0.0	-11,060	-10,753
2061	63,225	17,268	1,373	0	291,987	31,514	4,254,404	-	0	306	0.0	0.0	-11,086	-10,779
2062	63,290	17,246	1,375	0	292,666	31,473	4,248,922	-	0	306	0.0	0.0	-11,112	-10,806
2063	63,355	17,224	1,376	0	293,346	31,433	4,243,440	-	0	306	0.0	0.0	-11,137	-10,832
2064	63,420	17,201	1,377	0	294,025	31,392	4,237,958	-	0	305	0.0	0.0	-11,163	-10,858
2065	63,485	17,179	1,379	0	294,705	31,352	4,232,476	-	0	305	0.0	0.0	-11,189	-10,884
Totals =					9,434,036	1,582,046	213,576,205	0		15,377	0	0	-358,180	-342,803

SAANICH EAST WWTF ASSUMPTIONS

Electricity:
 "base" unit power requirement = 0.600 kW-hr/d per m3/d of ADWF treated wastewater
 wastewater strength adjustment = 0 x "base" unit power requirement
 influent pumping power adjustment = 0.075 x "base" unit power requirement
 UV disinfection power adjustment = 0 x "base" unit power requirement
 effluent pumping power adjustment = 0.05 x "base" unit power requirement
 raw sludge thickening adjustment = 0 x "base" unit power requirement
 total unit power requirement = 0.675 kW-hr/d per m3/d of ADWF treated wastewater
Ref: Based on Jan 15/09 TM from T. Dokken.
Note: Not required as WW BOD = 260 mg/L (i.e. typical)
Ref: Based on Table 1.4, WEF ____.
Note: Not required - effluent to marine environment.
Note: Not required for ADWF effluent disposal. Allowance is for heat recovery pumping; i.e. pumping effluent to a nearby District Energy System for use by others.
Note: Not required - sludge to sewer.

Raw Sludge Thickening and Truck Transport:
 thickening required (1 = yes, 0 = no)? 0
 chemical-P removal chemical sludge production allowance = 0% of combined PS + WBS
 round-trip transport distance to solids processing facility = 0 km

Saleable Reclaimed Water:
 mean fraction of annual ADWF volume sold for landscape irrigation = 0.50%/yr
Note: See dnt_eff_irr_ds.xls for assumptions and details. Reclaimed water used for toilet flushing handled separately in analysis. See Flush Rev LCA worksheet.

Notes:
 1. Data from M. Homenuke in Feb 4/09 e-mail, DES SaleableHeatEnergy.xls, Saleable.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Saanich East WWTF Strategy

Last Revision: June 18, 2009

Life Cycle Analysis

Yellow-shaded cell denotes assumed input values

Year	Capital Costs		Operation & Maintenance Costs										GHG CO2e		Heat Revenues		Reclaimed Water Revenues (irrigation only)		Total				
	Total Cost	Net Present Value	Labour		Electricity		Diesel Fuel		Chemicals		Maintenance		Administration		Total Annual Cost	Net Present Value	Total Annual Rev	Net Present Value	Total Annual Rev	Net Present Value	Total Annual Cost	Net Present Value	
			Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value									
2008																							
2009																							
2010																							
2011																							
2012																							
2013																							
2014	\$85,823,960	\$67,827,922																				\$85,823,960	\$67,827,922
2015		\$0	\$375,000	\$284,969	\$278,096	\$211,330	\$0	\$0	\$63,498	\$48,253	\$858,240	\$652,192	\$100,000	\$75,992	\$16,489	\$12,530	-\$195,245	-\$148,371	-\$21,188	-\$16,101	\$1,441,910	\$1,095,733	
2016		\$0	\$375,000	\$274,009	\$278,648	\$203,605	\$0	\$0	\$63,624	\$46,489	\$858,240	\$627,107	\$100,000	\$73,069	\$21,251	\$15,528	-\$240,069	-\$175,416	-\$21,230	-\$15,513	\$1,392,961	\$1,017,823	
2017		\$0	\$375,000	\$263,470	\$279,200	\$196,162	\$0	\$0	\$63,750	\$44,790	\$858,240	\$602,988	\$100,000	\$70,259	-\$26,013	-\$18,276	-\$284,892	-\$200,161	-\$21,272	-\$14,946	\$1,344,012	\$944,285	
2018		\$0	\$375,000	\$253,337	\$279,751	\$188,990	\$0	\$0	\$63,876	\$43,152	\$858,240	\$579,796	\$100,000	\$67,556	-\$30,775	-\$20,791	-\$329,715	-\$222,743	-\$21,314	-\$14,399	\$1,295,063	\$874,898	
2019		\$0	\$375,000	\$243,593	\$280,303	\$182,080	\$0	\$0	\$64,002	\$41,574	\$858,240	\$557,496	\$100,000	\$64,958	-\$35,537	-\$23,084	-\$374,538	-\$243,292	-\$21,356	-\$13,873	\$1,246,114	\$809,452	
2020		\$0	\$375,000	\$234,224	\$280,855	\$175,421	\$0	\$0	\$64,128	\$40,054	\$858,240	\$536,054	\$100,000	\$62,460	-\$40,299	-\$25,171	-\$419,361	-\$261,931	-\$21,398	-\$13,365	\$1,197,164	\$747,745	
2021		\$0	\$375,000	\$225,215	\$281,407	\$169,006	\$0	\$0	\$64,254	\$38,589	\$858,240	\$515,436	\$100,000	\$60,057	-\$45,061	-\$27,062	-\$464,184	-\$278,777	-\$21,441	-\$12,877	\$1,148,215	\$689,588	
2022		\$0	\$375,000	\$216,553	\$281,959	\$162,824	\$0	\$0	\$64,380	\$37,178	\$858,240	\$495,612	\$100,000	\$57,748	-\$49,823	-\$28,771	-\$509,007	-\$293,939	-\$21,483	-\$12,406	\$1,099,266	\$634,799	
2023		\$0	\$375,000	\$208,224	\$282,511	\$156,868	\$0	\$0	\$64,506	\$35,818	\$858,240	\$476,550	\$100,000	\$55,526	-\$54,585	-\$30,309	-\$553,830	-\$307,522	-\$21,525	-\$11,952	\$1,050,317	\$583,204	
2024		\$0	\$375,000	\$200,216	\$283,063	\$151,129	\$0	\$0	\$64,632	\$34,507	\$858,240	\$458,221	\$100,000	\$53,391	-\$59,347	-\$31,686	-\$598,653	-\$319,626	-\$21,567	-\$11,515	\$1,001,368	\$534,638	
2025		\$0	\$375,000	\$192,515	\$283,615	\$145,600	\$0	\$0	\$64,758	\$33,245	\$858,240	\$440,597	\$100,000	\$51,337	-\$64,109	-\$32,912	-\$643,476	-\$330,343	-\$21,609	-\$11,093	\$952,419	\$488,946	
2026		\$0	\$375,000	\$185,111	\$284,166	\$140,273	\$0	\$0	\$64,884	\$32,029	\$858,240	\$423,651	\$100,000	\$49,363	-\$68,871	-\$33,997	-\$688,299	-\$339,764	-\$21,651	-\$10,687	\$903,470	\$445,978	
2027		\$0	\$375,000	\$177,991	\$284,718	\$135,139	\$0	\$0	\$65,010	\$30,856	\$858,240	\$407,357	\$100,000	\$47,464	-\$73,633	-\$34,949	-\$733,122	-\$347,971	-\$21,693	-\$10,296	\$854,520	\$405,592	
2028		\$0	\$375,000	\$171,145	\$285,270	\$130,194	\$0	\$0	\$65,136	\$29,727	\$858,240	\$391,689	\$100,000	\$45,639	-\$78,395	-\$35,778	-\$777,945	-\$355,044	-\$21,735	-\$9,920	\$805,571	\$367,652	
2029		\$0	\$375,000	\$164,563	\$285,822	\$125,428	\$0	\$0	\$65,262	\$28,639	\$858,240	\$376,624	\$100,000	\$43,883	-\$83,157	-\$36,492	-\$822,768	-\$361,058	-\$21,777	-\$9,556	\$756,622	\$332,031	
2030		\$0	\$375,000	\$158,233	\$286,374	\$120,837	\$0	\$0	\$65,388	\$27,591	\$858,240	\$361,562	\$100,000	\$42,196	-\$87,919	-\$37,098	-\$867,591	-\$366,085	-\$21,819	-\$9,207	\$7,577,289	\$3,197,278	
2031	\$6,801,600	\$2,869,972	\$375,000	\$152,147	\$287,546	\$116,665	\$0	\$0	\$65,514	\$26,638	\$858,240	\$347,454	\$100,000	\$40,573	-\$88,888	-\$37,064	-\$876,872	-\$365,770	-\$21,908	-\$8,889	\$766,788	\$311,106	
2032		\$0	\$375,000	\$146,296	\$288,717	\$112,635	\$0	\$0	\$65,640	\$25,718	\$858,240	\$333,342	\$100,000	\$39,012	-\$89,858	-\$35,056	-\$886,152	-\$364,707	-\$21,997	-\$8,582	\$757,888	\$295,668	
2033		\$0	\$375,000	\$140,669	\$289,889	\$108,742	\$0	\$0	\$65,766	\$24,829	\$858,240	\$319,230	\$100,000	\$37,512	-\$90,828	-\$34,071	-\$895,433	-\$363,892	-\$22,087	-\$8,285	\$748,987	\$280,958	
2034		\$0	\$375,000	\$135,258	\$291,060	\$104,982	\$0	\$0	\$65,892	\$23,971	\$858,240	\$305,118	\$100,000	\$36,069	-\$91,797	-\$33,110	-\$904,714	-\$363,021	-\$22,176	-\$7,999	\$740,087	\$266,941	
2035		\$0	\$375,000	\$130,056	\$292,232	\$101,351	\$0	\$0	\$66,018	\$23,142	\$858,240	\$291,006	\$100,000	\$34,682	-\$92,767	-\$32,173	-\$913,995	-\$362,146	-\$22,265	-\$7,722	\$731,186	\$253,587	
2036		\$0	\$375,000	\$125,054	\$293,404	\$97,843	\$0	\$0	\$66,144	\$22,341	\$858,240	\$276,894	\$100,000	\$33,348	-\$93,737	-\$31,259	-\$923,275	-\$360,892	-\$22,355	-\$7,455	\$722,286	\$240,866	
2037		\$0	\$375,000	\$120,244	\$294,575	\$94,456	\$0	\$0	\$66,270	\$21,567	\$858,240	\$262,782	\$100,000	\$32,065	-\$94,706	-\$30,368	-\$932,556	-\$359,025	-\$22,444	-\$7,197	\$713,385	\$228,748	
2038		\$0	\$375,000	\$115,620	\$295,747	\$91,184	\$0	\$0	\$66,396	\$20,820	\$858,240	\$248,670	\$100,000	\$30,832	-\$95,676	-\$29,499	-\$941,837	-\$357,866	-\$22,533	-\$6,947	\$704,485	\$217,206	
2039		\$0	\$375,000	\$111,173	\$296,918	\$88,024	\$0	\$0	\$66,522	\$20,099	\$858,240	\$234,558	\$100,000	\$29,646	-\$96,646	-\$28,522	-\$951,118	-\$356,969	-\$22,622	-\$6,707	\$695,584	\$206,213	
2040		\$0	\$375,000	\$106,997	\$298,090	\$84,973	\$0	\$0	\$66,648	\$19,402	\$858,240	\$220,446	\$100,000	\$28,506	-\$97,615	-\$27,826	-\$960,398	-\$356,098	-\$22,712	-\$6,474	\$686,683	\$195,745	
2041		\$0	\$375,000	\$102,785	\$299,262	\$82,026	\$0	\$0	\$66,774	\$18,729	\$858,240	\$206,334	\$100,000	\$27,409	-\$98,585	-\$27,022	-\$969,679	-\$355,183	-\$22,801	-\$6,250	\$677,783	\$185,776	
2042		\$0	\$375,000	\$98,832	\$300,433	\$79,180	\$0	\$0	\$66,900	\$18,079	\$858,240	\$192,222	\$100,000	\$26,355	-\$99,555	-\$26,238	-\$978,960	-\$354,331	-\$22,890	-\$6,033	\$668,882	\$176,285	
2043		\$0	\$375,000	\$95,031	\$301,605	\$76,431	\$0	\$0	\$67,026	\$17,452	\$858,240	\$178,110	\$100,000	\$25,342	-\$100,524	-\$25,474	-\$988,240	-\$353,465	-\$22,979	-\$5,823	\$659,982	\$167,250	
2044		\$0	\$375,000	\$91,376	\$302,776	\$73,777	\$0	\$0	\$67,152	\$16,846	\$858,240	\$164,002	\$100,000	\$24,367	-\$101,494	-\$24,731	-\$997,521	-\$352,599	-\$23,069	-\$5,621	\$651,081	\$158,648	
2045		\$0	\$375,000	\$87,861	\$303,948	\$71,214	\$0	\$0	\$67,278	\$16,260	\$858,240	\$150,894	\$100,000	\$23,430	-\$102,464	-\$24,007	-\$1,006,802	-\$351,732	-\$23,158	-\$5,426	\$642,181	\$150,461	
2046		\$0	\$375,000	\$84,482	\$305,120	\$68,789	\$0	\$0	\$67,404	\$15,615	\$858,240	\$137,786	\$100,000	\$22,529	-\$103,436	-\$23,276	-\$1,016,618	-\$350,865	-\$23,246	-\$5,211	\$633,276	\$142,613	
2047		\$0	\$375,000	\$81,233	\$306,291	\$66,675	\$0	\$0	\$67,530	\$15,000	\$858,240	\$124,678	\$100,000	\$21,662	-\$104,408	-\$22,563	-\$1,026,530	-\$350,000	-\$23,335	-\$5,004	\$624,371	\$134,163	
2048		\$0	\$375,000	\$78,108	\$307,462	\$64,669	\$0	\$0	\$67,656	\$14,414	\$858,240	\$111,570	\$100,000	\$20,829	-\$105,378	-\$21,850	-\$1,036,442	-\$349,131	-\$23,424	-\$4,805	\$615,466	\$126,605	
2049		\$0	\$375,000	\$75,104	\$308,633	\$62,667	\$0	\$0	\$67,782	\$13,829	\$858,240	\$98,462	\$100,000	\$20,028	-\$106,350	-\$21,127	-\$1,046,354	-\$348,204	-\$23,513	-\$4,615	\$606,561	\$119,038	
2050		\$0	\$375,000	\$72,216	\$309,804	\$60,665	\$0	\$0	\$67,908	\$13,244	\$858,240	\$85,354	\$100,000	\$19,257	-\$107,322	-\$20,404	-\$1,056,266	-\$347,277	-\$23,602	-\$4,431	\$597,656	\$111,471	
2051		\$0	\$375,000	\$69,438	\$310,975	\$58,663	\$0	\$0	\$68,034	\$12,659	\$858,240	\$72,246	\$100,000	\$18,517	-\$108,296	-\$19,681	-\$1,066,178	-\$346,350	-\$23,691	-\$4,256	\$588,751	\$103,884	
2052		\$0	\$375,000	\$66,767	\$312,146	\$56,661	\$0	\$0	\$68,160	\$12,074	\$858,240	\$59,138	\$100,000	\$17,805	-\$109,268	-\$19,154	-\$1,076,090	-\$345,423	-\$23,780	-\$4,087	\$580,846	\$96,297	
2053		\$0	\$375,000	\$64,199	\$313,317	\$54,659	\$0	\$0	\$68,286	\$11,489	\$858,240	\$46,030	\$100,000	\$17,120	-\$110,240								

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: South Colwood WWTF (Liquid-Stream) Strategy

Last Revision: June 18, 2009

Material Flows and Carbon Footprint Analysis

Yellow-shaded cell denotes assumed input values

Year	Equivalent Population (pe)	Wastewater ADFW (m3/d)	Sludge Production and Truck Transport		Saleable Effluent Heat ¹ (GJ/yr)	Saleable Reclaimed Water (Irrigation only) (m3/yr)	Materials			GHG Sources			GHG Offsets Avoided Natural Gas/Elect Use via Effluent Heat ² (t CO2e/yr)	Total GHG Emissions (t CO2e/yr)
			Mass (dry t/yr)	Thickened Volume (m3/yr)			Electricity (kWh/yr)	Diesel Fuel (L/yr)	Sludge Thickening Polymer (kg/yr)	Electricity Purchased (t CO2e/yr)	Diesel Fuel Combusted (t CO2e/yr)	Sludge Thickening Polymer Used (t CO2e/yr)		
2008														
2009														
2010														
2011														
2012														
2013														
2014														
2015	47,329	11,750	1,028	0	43,861	10,722	3,023,569	-	0	218	0.0	0.0	0	218
2016	50,922	12,510	1,106	0	56,341	11,415	3,219,016	-	0	232	0.0	0.0	0	232
2017	54,516	13,269	1,184	0	68,821	12,108	3,414,463	-	0	246	0.0	0.0	0	246
2018	58,109	14,029	1,262	0	81,301	12,801	3,609,909	-	0	260	0.0	0.0	0	260
2019	61,703	14,788	1,340	0	93,781	13,494	3,805,356	-	0	274	0.0	0.0	0	274
2020	65,296	15,548	1,418	0	106,260	14,187	4,000,803	-	0	288	0.0	0.0	0	288
2021	68,890	16,307	1,496	0	118,740	14,880	4,196,250	-	0	302	0.0	0.0	0	302
2022	72,483	17,067	1,574	0	131,220	15,573	4,391,697	-	0	316	0.0	0.0	0	316
2023	76,077	17,826	1,652	0	143,700	16,266	4,587,144	-	0	330	0.0	0.0	0	330
2024	79,670	18,586	1,730	0	156,180	16,960	4,782,591	-	0	344	0.0	0.0	0	344
2025	83,264	19,345	1,808	0	168,660	17,653	4,978,038	-	0	358	0.0	0.0	0	358
2026	86,857	20,105	1,886	0	181,140	18,346	5,173,485	-	0	372	0.0	0.0	0	372
2027	90,451	20,864	1,964	0	193,620	19,039	5,368,932	-	0	387	0.0	0.0	0	387
2028	94,044	21,624	2,042	0	206,100	19,732	5,564,379	-	0	401	0.0	0.0	0	401
2029	97,638	22,383	2,120	0	218,580	20,425	5,759,826	-	0	415	0.0	0.0	0	415
2030	101,231	23,143	2,198	0	231,060	21,118	5,955,272	-	0	429	0.0	0.0	0	429
2031	103,684	23,585	2,252	0	232,183	21,521	6,068,993	-	0	437	0.0	0.0	0	437
2032	106,138	24,027	2,305	0	233,305	21,925	6,182,713	-	0	445	0.0	0.0	0	445
2033	108,591	24,469	2,358	0	234,428	22,328	6,296,434	-	0	453	0.0	0.0	0	453
2034	111,045	24,911	2,412	0	235,551	22,731	6,410,154	-	0	462	0.0	0.0	0	462
2035	113,498	25,353	2,465	0	236,674	23,134	6,523,875	-	0	470	0.0	0.0	0	470
2036	115,951	25,795	2,518	0	237,797	23,538	6,637,595	-	0	478	0.0	0.0	0	478
2037	118,405	26,237	2,571	0	238,920	23,941	6,751,316	-	0	486	0.0	0.0	0	486
2038	120,858	26,678	2,625	0	240,043	24,344	6,865,036	-	0	494	0.0	0.0	0	494
2039	123,312	27,120	2,678	0	241,165	24,747	6,978,757	-	0	502	0.0	0.0	0	502
2040	125,765	27,562	2,731	0	242,288	25,151	7,092,477	-	0	511	0.0	0.0	0	511
2041	128,218	28,004	2,785	0	243,411	25,554	7,206,198	-	0	519	0.0	0.0	0	519
2042	130,672	28,446	2,838	0	244,534	25,957	7,319,918	-	0	527	0.0	0.0	0	527
2043	133,125	28,888	2,891	0	245,657	26,360	7,433,639	-	0	535	0.0	0.0	0	535
2044	135,579	29,330	2,944	0	246,780	26,764	7,547,359	-	0	543	0.0	0.0	0	543
2045	138,032	29,772	2,998	0	247,903	27,167	7,661,080	-	0	552	0.0	0.0	0	552
2046	140,567	30,200	3,053	0	252,956	27,568	7,771,318	-	0	560	0.0	0.0	0	560
2047	143,102	30,629	3,108	0	258,008	27,949	7,881,556	-	0	567	0.0	0.0	0	567
2048	145,637	31,057	3,163	0	263,061	28,340	7,991,794	-	0	575	0.0	0.0	0	575
2049	148,173	31,486	3,218	0	268,114	28,731	8,102,032	-	0	583	0.0	0.0	0	583
2050	150,708	31,914	3,273	0	273,167	29,122	8,212,270	-	0	591	0.0	0.0	0	591
2051	153,243	32,342	3,328	0	278,220	29,512	8,322,508	-	0	599	0.0	0.0	0	599
2052	155,778	32,771	3,383	0	283,273	29,903	8,432,746	-	0	607	0.0	0.0	0	607
2053	158,313	33,199	3,438	0	288,326	30,294	8,542,984	-	0	615	0.0	0.0	0	615
2054	160,848	33,628	3,493	0	293,379	30,685	8,653,222	-	0	623	0.0	0.0	0	623
2055	163,384	34,056	3,548	0	298,431	31,076	8,763,460	-	0	631	0.0	0.0	0	631
2056	165,919	34,484	3,603	0	303,484	31,467	8,873,698	-	0	639	0.0	0.0	0	639
2057	168,454	34,913	3,658	0	308,537	31,858	8,983,936	-	0	647	0.0	0.0	0	647
2058	170,989	35,341	3,713	0	313,590	32,249	9,094,174	-	0	655	0.0	0.0	0	655
2059	173,524	35,770	3,769	0	318,643	32,640	9,204,412	-	0	663	0.0	0.0	0	663
2060	176,059	36,198	3,824	0	323,696	33,031	9,314,650	-	0	671	0.0	0.0	0	671
2061	178,594	36,626	3,879	0	328,749	33,422	9,424,888	-	0	679	0.0	0.0	0	679
2062	181,130	37,055	3,934	0	333,802	33,813	9,535,126	-	0	687	0.0	0.0	0	687
2063	183,665	37,483	3,989	0	338,854	34,203	9,645,364	-	0	694	0.0	0.0	0	694
2064	186,200	37,912	4,044	0	343,907	34,594	9,755,602	-	0	702	0.0	0.0	0	702
2065	188,735	38,340	4,099	0	348,960	34,985	9,865,841	-	0	710	0.0	0.0	0	710
Totals =						11,819,162	1,245,312	351,177,861	0	25,285	0	0	0	25,285

SOUTH COLWOOD WWTF ASSUMPTIONS (Liquid-Stream)

Electricity:			
"base" unit power requirement =	0.600	kW-hr/d per m3/d of ADFW treated wastewater	Ref: Based on Jan 15/09 TM from T. Dokken.
wastewater strength adjustment =	0	x "base" unit power requirement	Note: Not required as WW BOD = 260 mg/L (i.e. typical)
influent pumping power adjustment =	0.075	x "base" unit power requirement	Ref: Based on Table 1.4. WEF
recycled centrate aeration power adjustment =	0.050	x "base" unit power requirement	Note: Assuming extra N load is 15% of total facility N load and aeration electrical demand makes up one-half of total facility electrical demand.
UV disinfection power adjustment =	0	x "base" unit power requirement	Note: Not required - effluent to marine environment.
effluent pumping power adjustment =	0.05	x "base" unit power requirement	Note: Not required for ADFW effluent disposal. Allowance is for heat recovery pumping; i.e. pumping effluent to a nearby District Energy System for use by others.
raw sludge thickening adjustment =	0	x "base" unit power requirement	Note: Not required - sludge to sewer.
total unit power requirement =	0.705	kW-hr/d per m3/d of ADFW treated wastewater	
Raw Sludge Thickening and Truck Transport:			
thickening required (1 = yes, 0 = no)?	0		
chemical-P removal chemical sludge production allowance =	0%	of combined PS + WBS	
round-trip transport distance to solids processing facility =	0	km	
Saleable Reclaimed Water:			
mean fraction of annual ADFW volume sold for landscape irrigation =	0.25%	/yr	Note: See dnt_eff_irr_ds.xls for assumptions and details. Reclaimed water used for toilet flushing handled separately in analysis. See Flush Rev LCA worksheet.

Notes:
 1. Data from M. Homenuke in Feb 4/09 e-mail, DES_SaleableHeatEnergy.xls, Saleable.
 2. Set to zero since heat would not be sold - see LCA sheet.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: South Colwood WWTF
(Liquid-Stream)
Strategy
Life Cycle Analysis

Last Revision: June 18, 2009

Yellow-shaded cell denotes assumed/input values

Year	Capital Costs ¹		Operation & Maintenance Costs												GHG CO2e		Heat Revenues		Reclaimed Water Revenues (irrigation only)		Total	
	Total Cost	Net Present Value	Labour		Electricity		Diesel Fuel		Chemicals		Maintenance		Administration		Total Annual Cost	Net Present Value	Total Annual Rev	Net Present Value	Total Annual Rev	Net Present Value	Total Annual Cost	Net Present Value
			Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value								
2008																						
2009																						
2010																						
2011																						
2012																						
2013																						
2014	\$91,542,360	\$72,347,257																				
2015			\$450,000	\$341,963	\$211,650	\$160,836	\$0	\$0	\$46,270	\$35,161	\$915,424	\$695,647	\$100,000	\$75,992	\$3,265	\$2,481	\$0	\$0	\$-7,720	-\$5,866	\$1,718,889	\$1,306,214
2016			\$450,000	\$328,811	\$225,331	\$164,647	\$0	\$0	\$49,261	\$35,994	\$915,424	\$668,891	\$100,000	\$73,069	\$3,477	\$2,540	\$0	\$0	-\$8,219	-\$6,005	\$1,735,273	\$1,267,947
2017			\$450,000	\$316,164	\$239,012	\$167,927	\$0	\$0	\$52,252	\$36,711	\$915,424	\$643,164	\$100,000	\$70,259	\$3,688	\$2,591	\$0	\$0	-\$8,718	-\$6,125	\$1,751,657	\$1,230,691
2018			\$450,000	\$304,004	\$252,694	\$170,711	\$0	\$0	\$55,242	\$37,320	\$915,424	\$618,427	\$100,000	\$67,556	\$3,899	\$2,634	\$0	\$0	-\$9,217	-\$6,227	\$1,768,042	\$1,194,426
2019			\$450,000	\$292,311	\$266,375	\$173,032	\$0	\$0	\$58,233	\$37,827	\$915,424	\$594,642	\$100,000	\$64,958	\$4,110	\$2,670	\$0	\$0	-\$9,716	-\$6,311	\$1,784,426	\$1,159,129
2020			\$450,000	\$281,069	\$280,056	\$174,922	\$0	\$0	\$61,224	\$38,241	\$915,424	\$571,771	\$100,000	\$62,699	\$4,321	\$2,699	\$0	\$0	-\$10,215	-\$6,380	\$1,800,810	\$1,124,781
2021			\$450,000	\$270,258	\$293,738	\$176,411	\$0	\$0	\$64,215	\$38,566	\$915,424	\$549,780	\$100,000	\$60,057	\$4,532	\$2,722	\$0	\$0	-\$10,714	-\$6,434	\$1,817,194	\$1,091,360
2022			\$450,000	\$259,864	\$307,419	\$177,527	\$0	\$0	\$67,206	\$38,810	\$915,424	\$528,634	\$100,000	\$57,748	\$4,743	\$2,739	\$0	\$0	-\$11,213	-\$6,475	\$1,833,579	\$1,058,846
2023			\$450,000	\$249,869	\$321,100	\$178,295	\$0	\$0	\$70,197	\$39,076	\$915,424	\$508,302	\$100,000	\$55,526	\$4,964	\$2,751	\$0	\$0	-\$11,712	-\$6,503	\$1,849,963	\$1,027,219
2024			\$450,000	\$240,259	\$334,781	\$178,743	\$0	\$0	\$73,188	\$39,076	\$915,424	\$488,752	\$100,000	\$53,391	\$5,165	\$2,758	\$0	\$0	-\$12,211	-\$6,519	\$1,866,347	\$996,458
2025			\$450,000	\$231,018	\$348,463	\$178,891	\$0	\$0	\$76,179	\$39,108	\$915,424	\$469,954	\$100,000	\$51,337	\$5,376	\$2,760	\$0	\$0	-\$12,710	-\$6,525	\$1,882,732	\$966,544
2026			\$450,000	\$222,133	\$362,144	\$178,764	\$0	\$0	\$79,170	\$39,080	\$915,424	\$451,879	\$100,000	\$49,363	\$5,587	\$2,758	\$0	\$0	-\$13,209	-\$6,520	\$1,899,116	\$937,457
2027			\$450,000	\$213,589	\$375,825	\$178,383	\$0	\$0	\$82,161	\$38,997	\$915,424	\$434,498	\$100,000	\$47,464	\$5,798	\$2,752	\$0	\$0	-\$13,708	-\$6,506	\$1,915,500	\$909,178
2028			\$450,000	\$205,374	\$389,507	\$177,766	\$0	\$0	\$85,152	\$38,862	\$915,424	\$417,787	\$100,000	\$45,639	\$6,010	\$2,745	\$0	\$0	-\$14,207	-\$6,484	\$1,931,884	\$881,687
2029			\$450,000	\$197,475	\$403,188	\$176,932	\$0	\$0	\$88,143	\$38,680	\$915,424	\$401,719	\$100,000	\$43,882	\$6,221	\$2,730	\$0	\$0	-\$14,706	-\$6,453	\$1,948,269	\$854,966
2030		\$47,338,200	\$450,000	\$189,880	\$416,869	\$175,900	\$0	\$0	\$91,134	\$38,454	\$1,388,806	\$586,014	\$100,000	\$42,196	\$6,432	\$2,714	\$0	\$0	-\$15,205	-\$6,416	\$4,776,235	\$21,003,350
2031		\$19,974,608	\$450,000	\$182,577	\$424,830	\$172,365	\$0	\$0	\$92,874	\$37,681	\$1,388,806	\$563,475	\$100,000	\$40,573	\$6,555	\$2,659	\$0	\$0	-\$15,495	-\$6,287	\$2,447,568	\$993,043
2032			\$450,000	\$175,555	\$432,790	\$168,841	\$0	\$0	\$94,614	\$36,911	\$1,388,806	\$541,803	\$100,000	\$39,012	\$6,677	\$2,605	\$0	\$0	-\$15,786	-\$6,158	\$2,457,101	\$958,568
2033			\$450,000	\$168,803	\$440,750	\$165,333	\$0	\$0	\$96,354	\$36,144	\$1,388,806	\$520,964	\$100,000	\$37,512	\$6,800	\$2,551	\$0	\$0	-\$16,076	-\$6,030	\$2,466,635	\$925,276
2034			\$450,000	\$162,310	\$448,711	\$161,845	\$0	\$0	\$98,095	\$35,382	\$1,388,806	\$500,927	\$100,000	\$36,069	\$6,923	\$2,497	\$0	\$0	-\$16,366	-\$5,903	\$2,476,168	\$893,127
2035			\$450,000	\$156,067	\$456,671	\$158,381	\$0	\$0	\$99,835	\$34,624	\$1,388,806	\$481,661	\$100,000	\$34,682	\$7,046	\$2,444	\$0	\$0	-\$16,657	-\$5,777	\$2,485,701	\$862,082
2036			\$450,000	\$150,065	\$464,632	\$154,944	\$0	\$0	\$101,575	\$33,873	\$1,388,806	\$463,135	\$100,000	\$33,348	\$7,169	\$2,391	\$0	\$0	-\$16,947	-\$5,651	\$2,495,234	\$832,104
2037			\$450,000	\$144,293	\$472,592	\$151,537	\$0	\$0	\$103,315	\$33,128	\$1,388,806	\$445,322	\$100,000	\$32,065	\$7,291	\$2,338	\$0	\$0	-\$17,237	-\$5,527	\$2,504,767	\$803,157
2038			\$450,000	\$138,743	\$480,553	\$148,163	\$0	\$0	\$105,056	\$32,391	\$1,388,806	\$428,195	\$100,000	\$30,832	\$7,414	\$2,286	\$0	\$0	-\$17,528	-\$5,404	\$2,514,300	\$775,206
2039			\$450,000	\$133,407	\$488,513	\$144,825	\$0	\$0	\$106,796	\$31,661	\$1,388,806	\$411,726	\$100,000	\$29,646	\$7,537	\$2,234	\$0	\$0	-\$17,818	-\$5,282	\$2,523,834	\$748,216
2040			\$450,000	\$128,276	\$496,473	\$141,524	\$0	\$0	\$108,536	\$30,939	\$1,388,806	\$395,890	\$100,000	\$28,506	\$7,660	\$2,184	\$0	\$0	-\$18,108	-\$5,162	\$2,533,367	\$722,156
2041			\$450,000	\$123,342	\$504,434	\$138,262	\$0	\$0	\$110,277	\$30,226	\$1,388,806	\$380,664	\$100,000	\$27,409	\$7,783	\$2,133	\$0	\$0	-\$18,399	-\$5,043	\$2,542,900	\$696,994
2042			\$450,000	\$118,598	\$512,394	\$135,043	\$0	\$0	\$112,017	\$29,522	\$1,388,806	\$366,023	\$100,000	\$26,355	\$7,906	\$2,084	\$0	\$0	-\$18,689	-\$4,926	\$2,552,433	\$672,699
2043			\$450,000	\$114,037	\$520,355	\$131,866	\$0	\$0	\$113,757	\$28,828	\$1,388,806	\$351,945	\$100,000	\$25,342	\$8,028	\$2,035	\$0	\$0	-\$18,980	-\$4,810	\$2,561,966	\$649,242
2044			\$450,000	\$109,651	\$528,315	\$128,734	\$0	\$0	\$115,497	\$28,143	\$1,388,806	\$338,408	\$100,000	\$24,367	\$8,151	\$1,986	\$0	\$0	-\$19,270	-\$4,695	\$2,571,499	\$626,594
2045			\$450,000	\$105,434	\$536,276	\$125,648	\$0	\$0	\$117,238	\$27,468	\$1,388,806	\$325,393	\$100,000	\$23,430	\$8,274	\$1,939	\$0	\$0	-\$19,560	-\$4,583	\$2,581,033	\$604,728
2046			\$450,000	\$101,378	\$544,237	\$122,554	\$0	\$0	\$118,925	\$26,792	\$1,388,806	\$312,878	\$100,000	\$22,529	\$8,393	\$1,891	\$0	\$0	-\$19,842	-\$4,470	\$2,590,274	\$583,551
2047			\$450,000	\$97,479	\$552,197	\$119,512	\$0	\$0	\$120,612	\$26,127	\$1,388,806	\$300,844	\$100,000	\$21,662	\$8,512	\$1,844	\$0	\$0	-\$20,123	-\$4,359	\$2,599,515	\$563,109
2048			\$450,000	\$93,730	\$560,158	\$116,522	\$0	\$0	\$122,298	\$25,473	\$1,388,806	\$289,273	\$100,000	\$20,829	\$8,631	\$1,798	\$0	\$0	-\$20,405	-\$4,250	\$2,608,756	\$543,375
2049			\$450,000	\$90,125	\$568,122	\$113,586	\$0	\$0	\$123,985	\$24,832	\$1,388,806	\$278,147	\$100,000	\$20,028	\$8,750	\$1,752	\$0	\$0	-\$20,686	-\$4,143	\$2,617,997	\$524,327
2050			\$450,000	\$86,659	\$576,085	\$110,703	\$0	\$0	\$125,672	\$24,201	\$1,388,806	\$267,449	\$100,000	\$19,257	\$8,869	\$1,708	\$0	\$0	-\$20,967	-\$4,038	\$2,627,239	\$505,940
2051			\$450,000	\$83,326	\$584,048	\$107,874	\$0	\$0	\$127,359	\$23,583	\$1,388,806	\$257,163	\$100,000	\$18,517	\$8,988	\$1,664	\$0	\$0	-\$21,249	-\$3,935	\$2,636,480	\$488,192
2052			\$450,000	\$80,121	\$592,012	\$105,099	\$0	\$0	\$129,046	\$22,976	\$1,388,806	\$247,272	\$100,000	\$17,805	\$9,107	\$1,622	\$0	\$0	-\$21,530	-\$3,833	\$2,645,721	\$471,061
2053			\$450,000	\$77,039	\$599,975	\$102,378	\$0	\$0	\$130,733	\$22,381	\$1,388,806	\$237,761	\$100,000	\$17,120	\$9,226	\$1,580	\$0	\$0	-\$21,812	-\$3,734	\$2,654,962	\$454,525
2054			\$450,000	\$74,076	\$607,938	\$99,711	\$0	\$0	\$132,420	\$21,798	\$1,388,806	\$228,617	\$100,000	\$16,461	\$9,345	\$1,538	\$0	\$0	-\$22,093	-\$3,637	\$2,664,204	\$438,565
2055			\$450,000	\$71,227	\$615,901	\$97,097	\$0	\$0	\$134,107	\$21,227	\$1,388,806	\$219,824	\$100,000	\$15,828	\$9,465	\$1,498	\$0	\$0	-\$22,375	-\$3,542	\$2,673,445	\$423,160
2056			\$450,000	\$68,488	\$623,864	\$94,537	\$0	\$0	\$135,794	\$20,667	\$1,											

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Last Revision: June 18, 2009

Subject: Macaulay/McLoughlin WWTF
(Liquid-Stream)
Strategy
Material Flows
and Carbon Footprint Analysis

Yellow-shaded cell denotes assumed/input values

Year	Equivalent Population (pe)	Wastewater ADWF (m3/d)	Sludge Production and Truck Transport		Saleable Effluent Heat ¹ (GJ/yr)	Saleable Reclaimed Water (Irrigation only) (m3/yr)	Materials			GHG Sources			GHG Offsets Avoided Natural Gas/Elect Use via Effluent Heat ² (t CO2e/yr)	Total GHG Emissions (t CO2e/yr)
			Mass (dry t/yr)	Thickened Volume (m3/yr)			Electricity (kWh/yr)	Diesel Fuel (L/yr)	Sludge Thickening Polymer (kg/yr)	Electricity Purchased (t CO2e/yr)	Diesel Fuel Combusted (t CO2e/yr)	Sludge Thickening Polymer Used (t CO2e/yr)		
2008														
2009														
2010														
2011														
2012														
2013														
2014														
2015	309,137	83,326	6,714	0	334,921	149,029	17,932,849	-	0	1,291	0.0	0.0	0	1,291
2016	311,083	83,381	6,756	0	361,090	149,127	17,944,657	-	0	1,292	0.0	0.0	0	1,292
2017	313,029	83,436	6,798	0	387,260	149,225	17,956,465	-	0	1,293	0.0	0.0	0	1,293
2018	314,974	83,491	6,840	0	413,430	149,323	17,968,273	-	0	1,294	0.0	0.0	0	1,294
2019	316,920	83,545	6,883	0	439,599	149,421	17,980,081	-	0	1,295	0.0	0.0	0	1,295
2020	318,866	83,600	6,925	0	465,769	149,519	17,991,889	-	0	1,295	0.0	0.0	0	1,295
2021	320,812	83,655	6,967	0	491,938	149,617	18,003,697	-	0	1,296	0.0	0.0	0	1,296
2022	322,758	83,710	7,009	0	518,108	149,715	18,015,505	-	0	1,297	0.0	0.0	0	1,297
2023	324,703	83,765	7,052	0	544,278	149,814	18,027,313	-	0	1,298	0.0	0.0	0	1,298
2024	326,649	83,820	7,094	0	570,447	149,912	18,039,121	-	0	1,299	0.0	0.0	0	1,299
2025	328,595	83,875	7,136	0	596,617	150,010	18,050,929	-	0	1,300	0.0	0.0	0	1,300
2026	330,541	83,930	7,179	0	622,786	150,108	18,062,737	-	0	1,301	0.0	0.0	0	1,301
2027	332,487	83,984	7,221	0	648,956	150,206	18,074,545	-	0	1,301	0.0	0.0	0	1,301
2028	334,432	84,039	7,263	0	675,125	150,304	18,086,353	-	0	1,302	0.0	0.0	0	1,302
2029	336,378	84,094	7,305	0	701,295	150,402	18,098,161	-	0	1,303	0.0	0.0	0	1,303
2030	338,324	84,149	7,348	0	727,465	150,500	18,109,969	-	0	1,304	0.0	0.0	0	1,304
2031	340,270	84,204	7,391	0	753,635	150,598	18,121,777	-	0	1,305	0.0	0.0	0	1,305
2032	342,216	84,259	7,434	0	779,805	150,696	18,133,585	-	0	1,306	0.0	0.0	0	1,306
2033	344,162	84,314	7,477	0	805,975	150,794	18,145,393	-	0	1,307	0.0	0.0	0	1,307
2034	346,108	84,369	7,520	0	832,145	150,892	18,157,201	-	0	1,308	0.0	0.0	0	1,308
2035	348,054	84,424	7,563	0	858,315	150,990	18,169,009	-	0	1,309	0.0	0.0	0	1,309
2036	350,000	84,479	7,606	0	884,485	151,088	18,180,817	-	0	1,310	0.0	0.0	0	1,310
2037	351,946	84,534	7,649	0	910,655	151,186	18,192,625	-	0	1,311	0.0	0.0	0	1,311
2038	353,892	84,589	7,692	0	936,825	151,284	18,204,433	-	0	1,312	0.0	0.0	0	1,312
2039	355,838	84,644	7,735	0	962,995	151,382	18,216,241	-	0	1,313	0.0	0.0	0	1,313
2040	357,784	84,699	7,778	0	989,165	151,480	18,228,049	-	0	1,314	0.0	0.0	0	1,314
2041	359,730	84,754	7,821	0	1,015,335	151,578	18,239,857	-	0	1,315	0.0	0.0	0	1,315
2042	361,676	84,809	7,864	0	1,041,505	151,676	18,251,665	-	0	1,316	0.0	0.0	0	1,316
2043	363,622	84,864	7,907	0	1,067,675	151,774	18,263,473	-	0	1,317	0.0	0.0	0	1,317
2044	365,568	84,919	7,950	0	1,093,845	151,872	18,275,281	-	0	1,318	0.0	0.0	0	1,318
2045	367,514	84,974	7,993	0	1,120,015	151,970	18,287,089	-	0	1,319	0.0	0.0	0	1,319
2046	369,460	85,029	8,036	0	1,146,185	152,068	18,298,897	-	0	1,320	0.0	0.0	0	1,320
2047	371,406	85,084	8,079	0	1,172,355	152,166	18,310,705	-	0	1,321	0.0	0.0	0	1,321
2048	373,352	85,139	8,122	0	1,198,525	152,264	18,322,513	-	0	1,322	0.0	0.0	0	1,322
2049	375,298	85,194	8,165	0	1,224,695	152,362	18,334,321	-	0	1,323	0.0	0.0	0	1,323
2050	377,244	85,249	8,208	0	1,250,865	152,460	18,346,129	-	0	1,324	0.0	0.0	0	1,324
2051	379,190	85,304	8,251	0	1,277,035	152,558	18,357,937	-	0	1,325	0.0	0.0	0	1,325
2052	381,136	85,359	8,294	0	1,303,205	152,656	18,369,745	-	0	1,326	0.0	0.0	0	1,326
2053	383,082	85,414	8,337	0	1,329,375	152,754	18,381,553	-	0	1,327	0.0	0.0	0	1,327
2054	385,028	85,469	8,380	0	1,355,545	152,852	18,393,361	-	0	1,328	0.0	0.0	0	1,328
2055	386,974	85,524	8,423	0	1,381,715	152,950	18,405,169	-	0	1,329	0.0	0.0	0	1,329
2056	388,920	85,579	8,466	0	1,407,885	153,048	18,416,977	-	0	1,330	0.0	0.0	0	1,330
2057	390,866	85,634	8,509	0	1,434,055	153,146	18,428,785	-	0	1,331	0.0	0.0	0	1,331
2058	392,812	85,689	8,552	0	1,460,225	153,244	18,440,593	-	0	1,332	0.0	0.0	0	1,332
2059	394,758	85,744	8,595	0	1,486,395	153,342	18,452,401	-	0	1,333	0.0	0.0	0	1,333
2060	396,704	85,799	8,638	0	1,512,565	153,440	18,464,209	-	0	1,334	0.0	0.0	0	1,334
2061	398,650	85,854	8,681	0	1,538,735	153,538	18,476,017	-	0	1,335	0.0	0.0	0	1,335
2062	400,596	85,909	8,724	0	1,564,905	153,636	18,487,825	-	0	1,336	0.0	0.0	0	1,336
2063	402,542	85,964	8,767	0	1,591,075	153,734	18,499,633	-	0	1,337	0.0	0.0	0	1,337
2064	404,488	86,019	8,810	0	1,617,245	153,832	18,511,441	-	0	1,338	0.0	0.0	0	1,338
2065	406,434	86,074	8,853	0	1,643,415	153,930	18,523,249	-	0	1,339	0.0	0.0	0	1,339
2065	396,535	87,483	8,612	0	1,496,227	156,463	18,827,490	-	0	1,356	0.0	0.0	0	1,356
Totals =					43,954,251	7,807,454	939,483,736	0		67,643	0	0	0	67,643

MACAULAY/MCLOUGHLIN WWTF ASSUMPTIONS (Liquid-Stream)

Electricity:

"base" unit power requirement =	0.445	kWh-hr/d per m3/d of ADWF treated wastewater
wastewater strength adjustment =	0.050	x "base" unit power requirement
influent pumping power adjustment =	0.075	x "base" unit power requirement
recycled centrate aeration power adjustment =	0.050	x "base" unit power requirement
Hartland landfill leachate aeration power adjustment =	0.150	x "base" unit power requirement
UV disinfection power adjustment =	0	x "base" unit power requirement
effluent pumping power adjustment =	0	x "base" unit power requirement
raw sludge thickening adjustment =	0	x "base" unit power requirement
total unit power requirement =	0.590	kWh-hr/d per m3/d of ADWF treated wastewater

Ref: Based on Jan 15/09 TM from T. Dokken.
Note: To account for Saanich East WWTF sludge impact on liquid-stream system.
Ref: Based on Table 1.4. WEF

Note: To account for leachate impact on liquid-stream system.
Note: Not required - effluent to marine environment.
Note: See MM OUT sheets for outfall pumping. See MM Heat for pumping to/from Victoria.
Note: Accounted for in solids-stream calculations.

Raw Sludge Thickening and Truck Transport:

thickening required (1 = yes, 0 = no)?	0
chemical-P removal chemical sludge production allowance =	0% of combined PS + WBS
round-trip transport distance to solids processing facility =	0 km

Note: Yes, but not from a trucking perspective.

Saleable Reclaimed Water:

mean fraction of annual ADWF volume sold for landscape irrigation =	0.49% /yr
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Note: See dnt_eff_irr_ds.xls for assumptions and details. Reclaimed water used for toilet flushing handled separately in analysis. See Flush Rev LCA worksheet.

Notes:

- Data from M. Homenuke in Feb 4/09 e-mail, DES_SaleableHeatEnergy.xls, Saleable.
- Set to zero since heat would not be sold - see LCA sheet.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Last Revision: June 18, 2009

Subject: Macaulay/McLoughlin WWTF
(Liquid-Stream)
Strategy
Life Cycle Analysis

Yellow-shaded cell denotes assumed/input values

Year	Capital Costs ¹		Operation & Maintenance Costs												GHG CO2e		Heat Revenues		Reclaimed Water Revenues (Irrigation only)		Total		
	Total Cost	Net Present Value	Labour		Electricity		Diesel Fuel		Chemicals		Maintenance		Administration		Total Annual Cost	Net Present Value	Total Annual Rev	Net Present Value	Total Annual Rev	Net Present Value	Total Annual Cost	Net Present Value	
			Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value									
2008																							
2009																							
2010																							
2011																							
2012																							
2013																							
2014	\$357,939,720	\$282,884,960																					
2015			\$1,275,000	\$968,895	\$1,255,299	\$953,924	\$0	\$0	\$328,125	\$249,348	\$3,579,397	\$2,720,048	\$100,000	\$75,992	\$19,367	\$14,718	\$0	\$0	-\$107,301	-\$81,540	\$6,449,889	\$4,901,385	
2016			\$1,275,000	\$931,630	\$1,256,126	\$917,839	\$0	\$0	\$328,341	\$239,916	\$3,579,397	\$2,615,430	\$100,000	\$73,069	\$19,380	\$14,161	\$0	\$0	-\$107,371	-\$78,455	\$6,450,873	\$4,713,590	
2017			\$1,275,000	\$895,798	\$1,256,953	\$883,118	\$0	\$0	\$328,557	\$230,840	\$3,579,397	\$2,514,837	\$100,000	\$70,259	\$19,393	\$13,625	\$0	\$0	-\$107,442	-\$75,487	\$6,451,858	\$4,532,990	
2018			\$1,275,000	\$861,344	\$1,257,779	\$849,710	\$0	\$0	\$328,773	\$222,107	\$3,579,397	\$2,418,112	\$100,000	\$67,556	\$19,406	\$13,110	\$0	\$0	-\$107,513	-\$72,632	\$6,452,843	\$4,359,309	
2019			\$1,275,000	\$828,216	\$1,258,606	\$817,566	\$0	\$0	\$328,989	\$213,705	\$3,579,397	\$2,325,108	\$100,000	\$64,958	\$19,418	\$12,614	\$0	\$0	-\$107,583	-\$69,884	\$6,453,827	\$4,192,283	
2020			\$1,275,000	\$796,361	\$1,259,432	\$786,638	\$0	\$0	\$329,205	\$205,621	\$3,579,397	\$2,235,681	\$100,000	\$62,460	\$19,431	\$12,137	\$0	\$0	-\$107,654	-\$67,240	\$6,454,812	\$4,031,657	
2021			\$1,275,000	\$765,732	\$1,260,259	\$756,879	\$0	\$0	\$329,421	\$197,842	\$3,579,397	\$2,149,693	\$100,000	\$60,057	\$19,444	\$11,678	\$0	\$0	-\$107,724	-\$64,697	\$6,455,797	\$3,877,184	
2022			\$1,275,000	\$736,281	\$1,261,085	\$728,245	\$0	\$0	\$329,637	\$190,357	\$3,579,397	\$2,067,013	\$100,000	\$57,748	\$19,457	\$11,236	\$0	\$0	-\$107,795	-\$62,249	\$6,456,782	\$3,728,630	
2023			\$1,275,000	\$707,962	\$1,261,912	\$700,695	\$0	\$0	\$329,853	\$183,156	\$3,579,397	\$1,987,512	\$100,000	\$55,526	\$19,469	\$10,811	\$0	\$0	-\$107,866	-\$59,894	\$6,457,766	\$3,585,768	
2024			\$1,275,000	\$680,733	\$1,262,738	\$674,186	\$0	\$0	\$330,070	\$176,227	\$3,579,397	\$1,911,069	\$100,000	\$53,391	\$19,482	\$10,402	\$0	\$0	-\$107,936	-\$57,628	\$6,458,751	\$3,448,380	
2025			\$1,275,000	\$654,551	\$1,263,565	\$648,680	\$0	\$0	\$330,286	\$169,560	\$3,579,397	\$1,837,567	\$100,000	\$51,337	\$19,495	\$10,006	\$0	\$0	-\$108,007	-\$55,448	\$6,459,736	\$3,316,255	
2026			\$1,275,000	\$629,376	\$1,264,392	\$624,139	\$0	\$0	\$330,502	\$163,145	\$3,579,397	\$1,766,891	\$100,000	\$49,363	\$19,508	\$9,630	\$0	\$0	-\$108,078	-\$53,350	\$6,460,720	\$3,189,193	
2027			\$1,275,000	\$605,169	\$1,265,218	\$600,526	\$0	\$0	\$330,718	\$156,973	\$3,579,397	\$1,698,934	\$100,000	\$47,464	\$19,521	\$9,255	\$0	\$0	-\$108,148	-\$51,332	\$6,461,705	\$3,066,998	
2028			\$1,275,000	\$581,893	\$1,266,044	\$577,806	\$0	\$0	\$330,934	\$151,034	\$3,579,397	\$1,633,590	\$100,000	\$45,639	\$19,533	\$8,915	\$0	\$0	-\$108,219	-\$49,390	\$6,462,690	\$2,949,487	
2029			\$1,275,000	\$559,513	\$1,266,871	\$555,946	\$0	\$0	\$331,150	\$145,220	\$3,579,397	\$1,570,760	\$100,000	\$43,889	\$19,546	\$8,577	\$0	\$0	-\$108,290	-\$47,521	\$6,463,675	\$2,836,478	
2030	\$7,051,200	\$2,975,292	\$1,275,000	\$537,993	\$1,267,698	\$534,912	\$0	\$0	\$331,366	\$139,822	\$3,649,909	\$1,540,099	\$100,000	\$42,196	\$19,559	\$8,253	\$0	\$0	-\$108,360	-\$45,723	\$13,586,371	\$5,732,849	
2031			\$1,275,000	\$517,301	\$1,270,300	\$515,394	\$0	\$0	\$332,046	\$134,720	\$3,649,909	\$1,480,864	\$100,000	\$40,573	\$19,599	\$7,952	\$0	\$0	-\$108,583	-\$44,055	\$6,538,271	\$2,652,749	
2032			\$1,275,000	\$497,405	\$1,272,902	\$496,587	\$0	\$0	\$332,726	\$129,804	\$3,649,909	\$1,423,908	\$100,000	\$39,012	\$19,638	\$7,662	\$0	\$0	-\$108,805	-\$42,447	\$6,541,372	\$2,551,930	
2033			\$1,275,000	\$478,274	\$1,275,504	\$478,463	\$0	\$0	\$333,406	\$125,066	\$3,649,909	\$1,369,142	\$100,000	\$37,512	\$19,679	\$7,382	\$0	\$0	-\$109,028	-\$40,898	\$6,544,472	\$2,454,941	
2034			\$1,275,000	\$459,879	\$1,278,107	\$460,999	\$0	\$0	\$334,087	\$120,501	\$3,649,909	\$1,316,483	\$100,000	\$36,069	\$19,719	\$7,113	\$0	\$0	-\$109,250	-\$39,405	\$6,547,572	\$2,361,639	
2035			\$1,275,000	\$442,191	\$1,280,709	\$444,171	\$0	\$0	\$334,767	\$116,103	\$3,649,909	\$1,265,849	\$100,000	\$34,682	\$19,760	\$6,853	\$0	\$0	-\$109,473	-\$37,967	\$6,550,672	\$2,271,882	
2036			\$1,275,000	\$425,184	\$1,283,311	\$427,955	\$0	\$0	\$335,447	\$111,864	\$3,649,909	\$1,217,162	\$100,000	\$33,348	\$19,800	\$6,603	\$0	\$0	-\$109,695	-\$36,581	\$6,553,772	\$2,185,535	
2037			\$1,275,000	\$408,831	\$1,285,913	\$412,330	\$0	\$0	\$336,127	\$107,780	\$3,649,909	\$1,170,349	\$100,000	\$32,065	\$19,840	\$6,362	\$0	\$0	-\$109,917	-\$35,245	\$6,556,872	\$2,102,470	
2038			\$1,275,000	\$393,106	\$1,288,516	\$397,273	\$0	\$0	\$336,807	\$103,844	\$3,649,909	\$1,125,353	\$100,000	\$30,832	\$19,880	\$6,129	\$0	\$0	-\$110,140	-\$33,958	\$6,559,972	\$2,022,562	
2039			\$1,275,000	\$377,987	\$1,291,118	\$382,765	\$0	\$0	\$337,488	\$100,052	\$3,649,909	\$1,082,053	\$100,000	\$29,646	\$19,920	\$5,906	\$0	\$0	-\$110,362	-\$32,718	\$6,563,072	\$1,945,690	
2040			\$1,275,000	\$363,449	\$1,293,720	\$368,785	\$0	\$0	\$338,168	\$96,397	\$3,649,909	\$1,040,436	\$100,000	\$28,506	\$19,960	\$5,690	\$0	\$0	-\$110,585	-\$31,523	\$6,566,173	\$1,871,740	
2041			\$1,275,000	\$349,470	\$1,296,322	\$355,314	\$0	\$0	\$338,848	\$92,876	\$3,649,909	\$1,000,419	\$100,000	\$27,409	\$20,000	\$5,482	\$0	\$0	-\$110,807	-\$30,372	\$6,569,273	\$1,800,599	
2042			\$1,275,000	\$336,029	\$1,298,924	\$342,334	\$0	\$0	\$339,528	\$89,483	\$3,649,909	\$961,941	\$100,000	\$26,355	\$20,041	\$5,282	\$0	\$0	-\$111,030	-\$29,262	\$6,572,373	\$1,732,163	
2043			\$1,275,000	\$323,105	\$1,301,527	\$329,827	\$0	\$0	\$340,208	\$86,214	\$3,649,909	\$924,943	\$100,000	\$25,342	\$20,081	\$5,089	\$0	\$0	-\$111,252	-\$28,193	\$6,575,473	\$1,666,327	
2044			\$1,275,000	\$310,678	\$1,304,129	\$317,775	\$0	\$0	\$340,889	\$83,064	\$3,649,909	\$889,969	\$100,000	\$24,367	\$20,121	\$4,903	\$0	\$0	-\$111,474	-\$27,163	\$6,578,573	\$1,602,992	
2045			\$1,275,000	\$298,728	\$1,306,731	\$306,163	\$0	\$0	\$341,569	\$80,028	\$3,649,909	\$855,162	\$100,000	\$23,430	\$20,161	\$4,724	\$0	\$0	-\$111,697	-\$26,170	\$6,581,673	\$1,542,065	
2046			\$1,275,000	\$287,239	\$1,309,291	\$294,514	\$0	\$0	\$342,249	\$77,093	\$3,649,909	\$822,271	\$100,000	\$22,529	\$20,178	\$4,544	\$0	\$0	-\$111,920	-\$25,214	\$6,584,773	\$1,482,905	
2047			\$1,275,000	\$276,191	\$1,311,850	\$283,307	\$0	\$0	\$342,929	\$74,267	\$3,649,909	\$790,646	\$100,000	\$21,662	\$20,178	\$4,371	\$0	\$0	-\$112,143	-\$24,295	\$6,587,873	\$1,426,015	
2048			\$1,275,000	\$265,569	\$1,314,410	\$272,527	\$0	\$0	\$343,609	\$71,450	\$3,649,909	\$760,236	\$100,000	\$20,829	\$20,187	\$4,205	\$0	\$0	-\$112,366	-\$23,316	\$6,590,973	\$1,371,307	
2049			\$1,275,000	\$255,354	\$1,316,970	\$262,158	\$0	\$0	\$344,289	\$68,642	\$3,649,909	\$730,996	\$100,000	\$20,028	\$20,196	\$4,045	\$0	\$0	-\$112,589	-\$22,376	\$6,594,073	\$1,318,698	
2050			\$1,275,000	\$245,533	\$1,319,529	\$252,183	\$0	\$0	\$344,969	\$65,918	\$3,649,909	\$702,881	\$100,000	\$19,257	\$20,204	\$3,891	\$0	\$0	-\$112,812	-\$21,476	\$6,597,173	\$1,268,107	
2051			\$1,275,000	\$236,089	\$1,322,088	\$242,587	\$0	\$0	\$345,649	\$63,244	\$3,649,909	\$675,847	\$100,000	\$18,517	\$20,213	\$3,743	\$0	\$0	-\$113,035	-\$20,606	\$6,600,273	\$1,219,457	
2052			\$1,275,000	\$227,009	\$1,324,647	\$233,356	\$0	\$0	\$346,329	\$60,619	\$3,649,909	\$649,853	\$100,000	\$17,805	\$20,221	\$3,600	\$0	\$0	-\$113,258	-\$19,765	\$6,603,373	\$1,172,674	
2053			\$1,275,000	\$218,278	\$1,327,206	\$224,477	\$0	\$0	\$347,009	\$58,044	\$3,649,909	\$624,859	\$100,000	\$17,120	\$20,230	\$3,463	\$0	\$0	-\$113,481	-\$18,944	\$6,606,473	\$1,127,685	
2054			\$1,275,000	\$209,883	\$1,329,765	\$215,935	\$0	\$0	\$347,689	\$													

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Macaulay/McLoughlin WWTF Outfall Pumping Strategy

Last Revision: June 18, 2009

Material Flows and Carbon Footprint Analysis

Yellow-shaded cell denotes assumed/input values
Note: Coloured cells contain data linked to external spreadsheets

Year	Effluent ADWF		ADWF Friction Losses		TDH	Velocity	Pump Energy	Materials Electricity	GHG Sources Electricity Purchased	Total GHG Emissions
	(m3/d)	(L/s)	Unit (m/m)	Total (m)						
2008										
2009										
2010										
2011										
2012										
2013										
2014										
2015	83,326	964	0.000197	0.43	5.2	0.55	69.9	612,484	44	44
2016	83,381	965	0.000197	0.43	5.2	0.55	70.0	612,950	44	44
2017	83,436	966	0.000198	0.43	5.2	0.55	70.0	613,416	44	44
2018	83,491	966	0.000198	0.44	5.2	0.55	70.1	613,882	44	44
2019	83,545	967	0.000198	0.44	5.2	0.55	70.1	614,348	44	44
2020	83,600	968	0.000198	0.44	5.2	0.55	70.2	614,815	44	44
2021	83,655	968	0.000199	0.44	5.2	0.55	70.2	615,281	44	44
2022	83,710	969	0.000199	0.44	5.2	0.55	70.3	615,748	44	44
2023	83,765	970	0.000199	0.44	5.2	0.55	70.3	616,215	44	44
2024	83,820	970	0.000199	0.44	5.2	0.55	70.4	616,682	44	44
2025	83,875	971	0.000200	0.44	5.2	0.55	70.5	617,149	44	44
2026	83,930	971	0.000200	0.44	5.2	0.55	70.5	617,616	44	44
2027	83,984	972	0.000200	0.44	5.2	0.55	70.6	618,083	45	45
2028	84,039	973	0.000200	0.44	5.2	0.55	70.6	618,550	45	45
2029	84,094	973	0.000201	0.44	5.2	0.55	70.7	619,018	45	45
2030	84,149	974	0.000201	0.44	5.2	0.55	70.7	619,485	45	45
2031	84,222	976	0.000202	0.44	5.2	0.55	70.9	620,958	45	45
2032	84,494	978	0.000202	0.45	5.2	0.55	71.1	622,432	45	45
2033	84,667	980	0.000203	0.45	5.2	0.55	71.2	623,907	45	45
2034	84,840	982	0.000204	0.45	5.2	0.56	71.4	625,383	45	45
2035	85,013	984	0.000205	0.45	5.2	0.56	71.6	626,861	45	45
2036	85,185	986	0.000205	0.45	5.2	0.56	71.7	628,340	45	45
2037	85,358	988	0.000206	0.45	5.2	0.56	71.9	629,820	45	45
2038	85,531	990	0.000207	0.46	5.2	0.56	72.1	631,301	45	45
2039	85,704	992	0.000208	0.46	5.2	0.56	72.2	632,783	46	46
2040	85,876	994	0.000208	0.46	5.2	0.56	72.4	634,266	46	46
2041	86,049	996	0.000209	0.46	5.2	0.56	72.6	635,751	46	46
2042	86,222	998	0.000210	0.46	5.2	0.56	72.7	637,237	46	46
2043	86,395	1,000	0.000211	0.46	5.2	0.57	72.9	638,724	46	46
2044	86,567	1,002	0.000212	0.47	5.2	0.57	73.1	640,212	46	46
2045	86,740	1,004	0.000212	0.47	5.2	0.57	73.3	641,701	46	46
2046	86,777	1,004	0.000213	0.47	5.2	0.57	73.3	642,022	46	46
2047	86,814	1,005	0.000213	0.47	5.2	0.57	73.3	642,343	46	46
2048	86,851	1,005	0.000213	0.47	5.2	0.57	73.4	642,663	46	46
2049	86,889	1,006	0.000213	0.47	5.2	0.57	73.4	642,984	46	46
2050	86,926	1,006	0.000213	0.47	5.2	0.57	73.4	643,304	46	46
2051	86,963	1,007	0.000213	0.47	5.2	0.57	73.5	643,625	46	46
2052	87,000	1,007	0.000214	0.47	5.2	0.57	73.5	643,946	46	46
2053	87,037	1,007	0.000214	0.47	5.2	0.57	73.5	644,267	46	46
2054	87,074	1,008	0.000214	0.47	5.2	0.57	73.6	644,588	46	46
2055	87,111	1,008	0.000214	0.47	5.2	0.57	73.6	644,909	46	46
2056	87,149	1,009	0.000214	0.47	5.2	0.57	73.7	645,230	46	46
2057	87,186	1,009	0.000214	0.47	5.2	0.57	73.7	645,551	46	46
2058	87,223	1,010	0.000215	0.47	5.2	0.57	73.7	645,872	47	47
2059	87,260	1,010	0.000215	0.47	5.2	0.57	73.8	646,193	47	47
2060	87,297	1,010	0.000215	0.47	5.2	0.57	73.8	646,515	47	47
2061	87,334	1,011	0.000215	0.47	5.2	0.57	73.8	646,836	47	47
2062	87,372	1,011	0.000215	0.47	5.2	0.57	73.9	647,157	47	47
2063	87,409	1,012	0.000215	0.47	5.2	0.57	73.9	647,479	47	47
2064	87,446	1,012	0.000216	0.47	5.2	0.57	73.9	647,800	47	47
2065	87,483	1,013	0.000216	0.47	5.2	0.57	74.0	648,122	47	47
Totals =								32,226,803	2,320	2,320

MACAULAY / MCLOUGHLIN WWTF OUTFALL PUMPING

static head =	2.03 m	Ref: M. Maynard file est_Outfall&Interceptor Cost Estimates_20090206.xls.
effluent discharge depth =	61.0 m	
effluent density @ 20°C =	998.2 kg/m ³	Ref: Assumes effluent is fresh water. Table A.1, Fischer et al (1979).
ocean water density @ 10°C =	1026.2 kg/m ³	Ref: Assumes ocean salinity of 34 o/oo. Table A.2, Fischer et al (1979).
seawater density adjustment =	1.7 m	
diffuser exit loss allowance =	1.0 m	
friction C value =	120	
forcemain diameter =	1500 mm	
forcemain X-area =	1.7671 m ²	
forcemain length =	2,200 m	
pump efficiency =	70%	
fluid specific weight =	9.81 kN/m ³	

File: 20062935.04.E.03.06 Subject: Macaulay/McLouglin WWTF
 Outfall Pumping
 Strategy
 Life Cycle Analysis

Last Revision: **June 18, 2009**

Yellow-shaded cell denotes assumed/input values

Year	Operations Costs		GHG CO2e		Total	
	Electricity		Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value
	Total Annual Cost	Net Present Value				
2008						
2009						
2010						
2011						
2012						
2013						
2014						
2015	\$42,874	\$32,581	\$661	\$503	\$43,535	\$33,083
2016	\$42,906	\$31,351	\$662	\$484	\$43,568	\$31,835
2017	\$42,939	\$30,168	\$662	\$465	\$43,602	\$30,634
2018	\$42,972	\$29,030	\$663	\$448	\$43,635	\$29,478
2019	\$43,004	\$27,935	\$663	\$431	\$43,668	\$28,366
2020	\$43,037	\$26,881	\$664	\$415	\$43,701	\$27,296
2021	\$43,070	\$25,867	\$665	\$399	\$43,734	\$26,266
2022	\$43,102	\$24,891	\$665	\$384	\$43,767	\$25,275
2023	\$43,135	\$23,951	\$666	\$370	\$43,801	\$24,321
2024	\$43,168	\$23,048	\$666	\$356	\$43,834	\$23,403
2025	\$43,200	\$22,178	\$667	\$342	\$43,867	\$22,520
2026	\$43,233	\$21,341	\$667	\$329	\$43,900	\$21,670
2027	\$43,266	\$20,536	\$668	\$317	\$43,933	\$20,853
2028	\$43,299	\$19,761	\$668	\$305	\$43,967	\$20,066
2029	\$43,331	\$19,015	\$669	\$293	\$44,000	\$19,309
2030	\$43,364	\$18,298	\$669	\$282	\$44,033	\$18,580
2031	\$43,467	\$17,636	\$671	\$272	\$44,138	\$17,908
2032	\$43,570	\$16,998	\$672	\$262	\$44,242	\$17,260
2033	\$43,673	\$16,383	\$674	\$253	\$44,347	\$16,635
2034	\$43,777	\$15,790	\$675	\$244	\$44,452	\$16,033
2035	\$43,880	\$15,218	\$677	\$235	\$44,557	\$15,453
2036	\$43,984	\$14,668	\$679	\$226	\$44,662	\$14,894
2037	\$44,087	\$14,137	\$680	\$218	\$44,768	\$14,355
2038	\$44,191	\$13,625	\$682	\$210	\$44,873	\$13,835
2039	\$44,295	\$13,132	\$683	\$203	\$44,978	\$13,334
2040	\$44,399	\$12,656	\$685	\$195	\$45,084	\$12,851
2041	\$44,503	\$12,198	\$687	\$188	\$45,189	\$12,386
2042	\$44,607	\$11,756	\$688	\$181	\$45,295	\$11,938
2043	\$44,711	\$11,330	\$690	\$175	\$45,400	\$11,505
2044	\$44,815	\$10,920	\$691	\$168	\$45,506	\$11,088
2045	\$44,919	\$10,524	\$693	\$162	\$45,612	\$10,687
2046	\$44,942	\$10,125	\$693	\$156	\$45,635	\$10,281
2047	\$44,964	\$9,740	\$694	\$150	\$45,658	\$9,890
2048	\$44,986	\$9,370	\$694	\$145	\$45,680	\$9,515
2049	\$45,009	\$9,014	\$694	\$139	\$45,703	\$9,153
2050	\$45,031	\$8,672	\$695	\$134	\$45,726	\$8,806
2051	\$45,054	\$8,343	\$695	\$129	\$45,749	\$8,471
2052	\$45,076	\$8,026	\$695	\$124	\$45,772	\$8,149
2053	\$45,099	\$7,721	\$696	\$119	\$45,794	\$7,840
2054	\$45,121	\$7,428	\$696	\$115	\$45,817	\$7,542
2055	\$45,144	\$7,145	\$697	\$110	\$45,840	\$7,256
2056	\$45,166	\$6,874	\$697	\$106	\$45,863	\$6,980
2057	\$45,189	\$6,613	\$697	\$102	\$45,886	\$6,715
2058	\$45,211	\$6,362	\$698	\$98	\$45,909	\$6,460
2059	\$45,234	\$6,120	\$698	\$94	\$45,931	\$6,215
2060	\$45,256	\$5,888	\$698	\$91	\$45,954	\$5,978
2061	\$45,279	\$5,664	\$699	\$87	\$45,977	\$5,751
2062	\$45,301	\$5,449	\$699	\$84	\$46,000	\$5,533
2063	\$45,324	\$5,242	\$699	\$81	\$46,023	\$5,323
2064	\$45,346	\$5,043	\$700	\$78	\$46,046	\$5,121
2065	\$45,369	\$4,851	\$700	\$75	\$46,069	\$4,926

Total Net Present Value =		\$747,490	\$11,533	\$2,290,681	\$759,022
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Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Macaulay/McLoughlin WWTF Heat Recovery Pumping to/from Victoria Strategy Material Flows and Carbon Footprint Analysis

Last Revision: June 18, 2009

Yellow-shaded cell denotes assumed/input values
 Note: Other coloured cells contain data linked to external spreadsheets

Year	Ratio of Effluent Pumped to/from Victoria		Effluent Pumped to/from Victoria		ADWF Friction Losses		TDH	Velocity	Pump Energy	Materials Electricity	GHG Sources Electricity Purchased	Total GHG Emissions
	(annual basis)	(m3/d)	(L/s)	Unit	Total	(m/m)						
2008												
2009												
2010												
2011												
2012												
2013												
2014												
2015	0.298	24,800	287	0.000252	0.38	3.4	0.45	13.6	119,007	9	9	
2016	0.318	26,532	307	0.000285	0.43	3.4	0.48	14.8	129,210	9	9	
2017	0.339	28,237	327	0.000320	0.48	3.5	0.51	15.9	139,611	10	10	
2018	0.359	29,917	346	0.000356	0.53	3.5	0.54	17.1	150,217	11	11	
2019	0.379	31,571	365	0.000393	0.59	3.6	0.57	18.4	161,031	12	12	
2020	0.398	33,201	384	0.000431	0.65	3.6	0.60	19.6	172,058	12	12	
2021	0.418	34,807	403	0.000471	0.71	3.7	0.63	20.9	183,302	13	13	
2022	0.437	36,389	421	0.000511	0.77	3.8	0.66	22.2	194,763	14	14	
2023	0.455	37,948	439	0.000552	0.83	3.8	0.69	23.6	206,442	15	15	
2024	0.474	39,484	457	0.000595	0.89	3.9	0.72	24.9	218,342	16	16	
2025	0.492	40,998	475	0.000637	0.96	4.0	0.75	26.3	230,461	17	17	
2026	0.510	42,490	492	0.000681	1.02	4.0	0.77	27.7	242,799	17	17	
2027	0.528	43,962	509	0.000725	1.09	4.1	0.80	29.2	255,354	18	18	
2028	0.545	45,412	526	0.000770	1.16	4.2	0.83	30.6	268,126	19	19	
2029	0.562	46,843	542	0.000816	1.22	4.2	0.85	32.1	281,111	20	20	
2030	0.579	48,253	558	0.000862	1.29	4.3	0.88	33.6	294,308	21	21	
2031	0.581	48,412	560	0.000867	1.30	4.3	0.88	33.8	295,816	21	21	
2032	0.583	48,568	562	0.000872	1.31	4.3	0.88	33.9	297,309	21	21	
2033	0.585	48,722	564	0.000877	1.32	4.3	0.89	34.1	298,787	22	22	
2034	0.587	48,875	566	0.000882	1.32	4.3	0.89	34.3	300,250	22	22	
2035	0.588	49,025	567	0.000887	1.33	4.3	0.89	34.4	301,699	22	22	
2036	0.590	49,173	569	0.000892	1.34	4.3	0.89	34.6	303,133	22	22	
2037	0.592	49,320	571	0.000897	1.35	4.3	0.90	34.8	304,554	22	22	
2038	0.594	49,465	573	0.000902	1.35	4.4	0.90	34.9	305,960	22	22	
2039	0.595	49,607	574	0.000907	1.36	4.4	0.90	35.1	307,353	22	22	
2040	0.597	49,748	576	0.000912	1.37	4.4	0.91	35.2	308,732	22	22	
2041	0.599	49,887	577	0.000916	1.37	4.4	0.91	35.4	310,098	22	22	
2042	0.600	50,025	579	0.000921	1.38	4.4	0.91	35.6	311,451	22	22	
2043	0.602	50,160	581	0.000926	1.39	4.4	0.91	35.7	312,790	23	23	
2044	0.604	50,295	582	0.000930	1.40	4.4	0.92	35.9	314,117	23	23	
2045	0.605	50,427	584	0.000935	1.40	4.4	0.92	36.0	315,432	23	23	
2046	0.626	52,190	604	0.000996	1.49	4.5	0.95	38.0	333,287	24	24	
2047	0.647	53,938	624	0.001059	1.59	4.6	0.98	40.1	351,651	25	25	
2048	0.668	55,672	644	0.001123	1.68	4.7	1.01	42.3	370,528	27	27	
2049	0.689	57,391	664	0.001188	1.78	4.8	1.04	44.5	389,919	28	28	
2050	0.709	59,097	684	0.001254	1.88	4.9	1.08	46.8	409,829	30	30	
2051	0.730	60,787	704	0.001321	1.98	5.0	1.11	49.1	430,259	31	31	
2052	0.750	62,465	723	0.001389	2.08	5.1	1.14	51.5	451,210	32	32	
2053	0.770	64,128	742	0.001458	2.19	5.2	1.17	54.0	472,683	34	34	
2054	0.789	65,778	761	0.001529	2.29	5.3	1.20	56.5	494,680	36	36	
2055	0.809	67,414	780	0.001600	2.40	5.4	1.23	59.0	517,200	37	37	
2056	0.829	69,037	799	0.001672	2.51	5.5	1.26	61.7	540,242	39	39	
2057	0.848	70,647	818	0.001744	2.62	5.6	1.29	64.4	563,808	41	41	
2058	0.867	72,244	836	0.001818	2.73	5.7	1.31	67.1	587,894	42	42	
2059	0.886	73,828	854	0.001893	2.84	5.8	1.34	69.9	612,500	44	44	
2060	0.905	75,400	873	0.001968	2.95	6.0	1.37	72.8	637,625	46	46	
2061	0.924	76,959	891	0.002044	3.07	6.1	1.40	75.7	663,266	48	48	
2062	0.942	78,506	909	0.002120	3.18	6.2	1.43	78.7	689,422	50	50	
2063	0.961	80,041	926	0.002198	3.30	6.3	1.46	81.7	716,089	52	52	
2064	0.979	81,563	944	0.002276	3.41	6.4	1.48	84.8	743,265	54	54	
2065	0.997	83,074	962	0.002354	3.53	6.5	1.51	88.0	770,947	56	56	

Totals = 18,579,926 1,338 1,338

MACAULAY / MCGLOUGHLIN WWTF HEAT RECOVERY PUMPING

static head = 3.0 m
 friction C value = 120
 forcemain diameter = 900 mm
 forcemain X-area = 0.6362 m²
 forcemain length = 1,500 m
 pump efficiency = 70%
 fluid specific weight = 9.81 kN/m³

Ref: M. Maynard information, Feb 18/09.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06 Subject: Macaulay/McLouglin WWTF Heat Recovery
 D. Shiskowski Pumping to/from Victoria
 Last Revision: February 6, 2009 Strategy
 D. Shiskowski Life Cycle Analysis

Yellow-shaded cell denotes assumed/input values

Year	Operation & Maintenance Costs		GHG CO2e		Total	
	Electricity		Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value
	Total Annual Cost	Net Present Value				
2008						
2009						
2010						
2011						
2012						
2013						
2014						
2015	\$8,330	\$6,330	\$129	\$98	\$8,459	\$6,428
2016	\$9,045	\$6,609	\$140	\$102	\$9,184	\$6,711
2017	\$9,773	\$6,866	\$151	\$106	\$9,924	\$6,972
2018	\$10,515	\$7,104	\$162	\$110	\$10,677	\$7,213
2019	\$11,272	\$7,322	\$174	\$113	\$11,446	\$7,435
2020	\$12,044	\$7,523	\$186	\$116	\$12,230	\$7,639
2021	\$12,831	\$7,706	\$198	\$119	\$13,029	\$7,825
2022	\$13,633	\$7,873	\$210	\$121	\$13,844	\$7,994
2023	\$14,451	\$8,024	\$223	\$124	\$14,674	\$8,148
2024	\$15,284	\$8,160	\$236	\$126	\$15,520	\$8,286
2025	\$16,132	\$8,282	\$249	\$128	\$16,381	\$8,410
2026	\$16,996	\$8,390	\$262	\$129	\$17,258	\$8,519
2027	\$17,875	\$8,484	\$276	\$131	\$18,151	\$8,615
2028	\$18,769	\$8,566	\$290	\$132	\$19,058	\$8,698
2029	\$19,678	\$8,635	\$304	\$133	\$19,981	\$8,768
2030	\$20,602	\$8,693	\$318	\$134	\$20,919	\$8,827
2031	\$20,707	\$8,401	\$319	\$130	\$21,027	\$8,531
2032	\$20,812	\$8,119	\$321	\$125	\$21,133	\$8,244
2033	\$20,915	\$7,846	\$323	\$121	\$21,238	\$7,967
2034	\$21,018	\$7,581	\$324	\$117	\$21,342	\$7,698
2035	\$21,119	\$7,324	\$326	\$113	\$21,445	\$7,437
2036	\$21,219	\$7,076	\$327	\$109	\$21,547	\$7,185
2037	\$21,319	\$6,836	\$329	\$105	\$21,648	\$6,941
2038	\$21,417	\$6,603	\$330	\$102	\$21,748	\$6,705
2039	\$21,515	\$6,378	\$332	\$98	\$21,847	\$6,477
2040	\$21,611	\$6,160	\$333	\$95	\$21,945	\$6,256
2041	\$21,707	\$5,950	\$335	\$92	\$22,042	\$6,042
2042	\$21,802	\$5,746	\$336	\$89	\$22,138	\$5,834
2043	\$21,895	\$5,549	\$338	\$86	\$22,233	\$5,634
2044	\$21,988	\$5,358	\$339	\$83	\$22,327	\$5,441
2045	\$22,080	\$5,173	\$341	\$80	\$22,421	\$5,253
2046	\$23,330	\$5,256	\$360	\$81	\$23,690	\$5,337
2047	\$24,616	\$5,332	\$380	\$82	\$24,995	\$5,415
2048	\$25,937	\$5,402	\$400	\$83	\$26,337	\$5,486
2049	\$27,294	\$5,466	\$421	\$84	\$27,715	\$5,551
2050	\$28,688	\$5,525	\$443	\$85	\$29,131	\$5,610
2051	\$30,118	\$5,577	\$465	\$86	\$30,583	\$5,663
2052	\$31,585	\$5,624	\$487	\$87	\$32,072	\$5,710
2053	\$33,088	\$5,665	\$510	\$87	\$33,598	\$5,752
2054	\$34,628	\$5,700	\$534	\$88	\$35,162	\$5,788
2055	\$36,204	\$5,730	\$559	\$88	\$36,763	\$5,819
2056	\$37,817	\$5,756	\$583	\$89	\$38,400	\$5,844
2057	\$39,467	\$5,776	\$609	\$89	\$40,075	\$5,865
2058	\$41,153	\$5,791	\$635	\$89	\$41,788	\$5,880
2059	\$42,875	\$5,801	\$662	\$90	\$43,537	\$5,891
2060	\$44,634	\$5,807	\$689	\$90	\$45,322	\$5,896
2061	\$46,429	\$5,808	\$716	\$90	\$47,145	\$5,898
2062	\$48,260	\$5,805	\$745	\$90	\$49,004	\$5,894
2063	\$50,126	\$5,797	\$773	\$89	\$50,900	\$5,887
2064	\$52,029	\$5,786	\$803	\$89	\$52,831	\$5,875
2065	\$53,966	\$5,771	\$833	\$89	\$54,799	\$5,860

Total Net Present Value = \$337,841 \$5,212 \$1,320,661 \$343,054

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Clover Point Wet-Weather Treatment Facility Strategy

Last Revision: June 18, 2009

Material Flows and Carbon Footprint Analysis

Yellow-shaded cell denotes assumed/input values

Year	Equivalent Population (pe)	Wastewater ADWF (to Mac/McL WWTF)		ADWF Friction Losses		TDH (m)	Velocity (m/s)	Pump Energy (kW)	Materials Electricity (kWh/yr)	GHG Sources Electricity Purchased (t CO2e/yr)	Total GHG Emissions (t CO2e/yr)
		(m3/d)	(L/s)	Unit (m/m)	Total (m)						
2008											
2009											
2010											
2011											
2012											
2013											
2014											
2015	131,016	38,561	446	0.001382	6.56	28.6	1.01	178.7	1,721,545	124	124
2016	131,488	38,510	446	0.001378	6.55	28.5	1.01	178.3	1,718,285	124	124
2017	131,960	38,458	445	0.001375	6.53	28.5	1.01	178.0	1,715,029	123	123
2018	132,431	38,407	445	0.001372	6.52	28.5	1.01	177.6	1,711,776	123	123
2019	132,903	38,356	444	0.001368	6.50	28.5	1.00	177.3	1,708,527	123	123
2020	133,375	38,305	443	0.001365	6.48	28.5	1.00	177.0	1,705,282	123	123
2021	133,847	38,253	443	0.001362	6.47	28.5	1.00	176.6	1,702,040	123	123
2022	134,319	38,202	442	0.001358	6.45	28.5	1.00	176.3	1,698,802	122	122
2023	134,790	38,151	442	0.001355	6.44	28.4	1.00	176.0	1,695,568	122	122
2024	135,262	38,100	441	0.001351	6.42	28.4	1.00	175.6	1,692,338	122	122
2025	135,734	38,048	440	0.001348	6.40	28.4	1.00	175.3	1,689,111	122	122
2026	136,206	37,997	440	0.001345	6.39	28.4	1.00	175.0	1,685,887	121	121
2027	136,678	37,946	439	0.001341	6.37	28.4	0.99	174.6	1,682,668	121	121
2028	137,149	37,895	439	0.001338	6.36	28.4	0.99	174.3	1,679,452	121	121
2029	137,621	37,843	438	0.001335	6.34	28.3	0.99	174.0	1,676,239	121	121
2030	138,093	37,792	437	0.001331	6.32	28.3	0.99	173.6	1,673,030	120	120
2031	138,565	37,741	437	0.001328	6.31	28.3	0.99	173.3	1,669,823	120	120
2032	139,037	37,690	436	0.001325	6.29	28.3	0.99	173.0	1,666,617	120	120
2033	140,005	37,639	436	0.001322	6.28	28.3	0.99	172.7	1,663,413	120	120
2034	140,973	37,588	435	0.001319	6.26	28.3	0.98	172.3	1,660,210	120	120
2035	141,941	37,537	435	0.001316	6.25	28.2	0.98	172.0	1,657,008	119	119
2036	142,909	37,486	434	0.001313	6.23	28.2	0.98	171.6	1,653,807	119	119
2037	143,877	37,435	434	0.001310	6.22	28.2	0.98	171.3	1,650,607	119	119
2038	144,845	37,384	433	0.001307	6.21	28.2	0.98	171.0	1,647,407	118	118
2039	145,813	37,333	432	0.001304	6.20	28.2	0.98	170.6	1,644,207	118	118
2040	146,781	37,282	431	0.001301	6.18	28.2	0.98	170.3	1,641,007	118	118
2041	147,749	37,231	430	0.001298	6.17	28.1	0.97	169.9	1,637,807	117	117
2042	148,717	37,180	429	0.001295	6.16	28.1	0.97	169.5	1,634,607	117	117
2043	149,685	37,129	428	0.001292	6.15	28.1	0.97	169.2	1,631,407	117	117
2044	150,653	37,078	427	0.001289	6.14	28.1	0.97	168.8	1,628,207	117	117
2045	151,621	37,027	426	0.001286	6.13	28.1	0.97	168.5	1,625,007	117	117
2046	152,589	36,976	425	0.001283	6.12	28.1	0.97	168.1	1,621,807	117	117
2047	153,557	36,925	424	0.001280	6.11	28.1	0.97	167.8	1,618,607	117	117
2048	154,525	36,874	423	0.001277	6.10	28.1	0.97	167.4	1,615,407	117	117
2049	155,493	36,823	422	0.001274	6.09	28.1	0.97	167.1	1,612,207	117	117
2050	156,461	36,772	421	0.001271	6.08	28.1	0.97	166.7	1,609,007	117	117
2051	157,429	36,721	420	0.001268	6.07	28.1	0.97	166.4	1,605,807	117	117
2052	158,397	36,670	419	0.001265	6.06	28.1	0.97	166.0	1,602,607	117	117
2053	159,365	36,619	418	0.001262	6.05	28.1	0.97	165.7	1,599,407	117	117
2054	160,333	36,568	417	0.001259	6.04	28.1	0.97	165.3	1,596,207	117	117
2055	161,301	36,517	416	0.001256	6.03	28.1	0.97	165.0	1,593,007	117	117
2056	162,269	36,466	415	0.001253	6.02	28.1	0.97	164.6	1,589,807	117	117
2057	163,237	36,415	414	0.001250	6.01	28.1	0.97	164.3	1,586,607	117	117
2058	164,205	36,364	413	0.001247	6.00	28.1	0.97	163.9	1,583,407	117	117
2059	165,173	36,313	412	0.001244	5.99	28.1	0.97	163.6	1,580,207	117	117
2060	166,141	36,262	411	0.001241	5.98	28.1	0.97	163.2	1,577,007	117	117
2061	167,109	36,211	410	0.001238	5.97	28.1	0.97	162.9	1,573,807	117	117
2062	168,077	36,160	409	0.001235	5.96	28.1	0.97	162.5	1,570,607	117	117
2063	169,045	36,109	408	0.001232	5.95	28.1	0.97	162.2	1,567,407	117	117
2064	170,013	36,058	407	0.001229	5.94	28.1	0.97	161.8	1,564,207	117	117
2065	170,981	36,007	406	0.001226	5.93	28.1	0.97	161.5	1,561,007	117	117
Totals =								85,605,106	6,164	6,164	

CLOVER POINT WET-WEATHER TF ASSUMPTIONS

Dry-Weather Flow Pumping Station:

static head =	22.0 m	Ref: M. Maynard file est_Outfall&Interceptor Cost Estimates_20090206.xls.
friction C value =	120	
forcemain diameter =	750 mm	
forcemain X-area =	0.4418 m ²	
forcemain length =	4,750 m	
pump efficiency =	70%	
fluid specific weight =	9.81 kN/m ³	

Electricity:
wet-weather treatment and pumping adjustment = 0.10 x dry-weather flow pumping requirement

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Clover Point Wet-Weather Treatment Facility Strategy Life Cycle Analysis

Last Revision: June 18, 2009

Yellow-shaded cell denotes assumed/input values

Year	Capital Costs ¹		Operation & Maintenance Costs										GHG CO2e		Total		
	Total Cost	Net Present Value	Labour		Electricity		Chemicals		Maintenance		Administration		Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	
			Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value					
2008																	
2009																	
2010																	
2011																	
2012																	
2013																	
2014	\$145,960,800	\$115,354,940													\$145,960,800	\$115,354,940	
2015	\$0	\$0	\$75,000	\$56,994	\$120,508	\$91,576	\$251,082	\$190,802	\$1,459,608	\$1,109,182	\$100,000	\$75,992	\$1,859	\$1,413	\$2,008,058	\$1,525,959	
2016	\$0	\$0	\$75,000	\$54,802	\$120,280	\$87,887	\$250,749	\$183,219	\$1,459,608	\$1,066,521	\$100,000	\$73,069	\$1,856	\$1,356	\$2,007,492	\$1,466,855	
2017	\$0	\$0	\$75,000	\$52,694	\$120,052	\$84,347	\$250,415	\$175,938	\$1,459,608	\$1,025,501	\$100,000	\$70,259	\$1,852	\$1,301	\$2,006,927	\$1,410,040	
2018	\$0	\$0	\$75,000	\$50,667	\$119,824	\$80,949	\$250,081	\$168,946	\$1,459,608	\$986,059	\$100,000	\$67,556	\$1,849	\$1,249	\$2,006,362	\$1,355,426	
2019	\$0	\$0	\$75,000	\$48,719	\$119,597	\$77,688	\$249,747	\$162,231	\$1,459,608	\$948,134	\$100,000	\$64,958	\$1,845	\$1,199	\$2,005,797	\$1,302,928	
2020	\$0	\$0	\$75,000	\$46,845	\$119,370	\$74,558	\$249,413	\$155,783	\$1,459,608	\$911,667	\$100,000	\$62,460	\$1,842	\$1,150	\$2,005,233	\$1,252,462	
2021	\$0	\$0	\$75,000	\$45,043	\$119,143	\$71,554	\$249,079	\$149,591	\$1,459,608	\$876,603	\$100,000	\$60,057	\$1,838	\$1,104	\$2,004,668	\$1,203,952	
2022	\$0	\$0	\$75,000	\$43,311	\$118,916	\$68,671	\$248,746	\$143,644	\$1,459,608	\$842,887	\$100,000	\$57,748	\$1,835	\$1,059	\$2,004,105	\$1,157,320	
2023	\$0	\$0	\$75,000	\$41,645	\$118,690	\$65,904	\$248,412	\$137,934	\$1,459,608	\$810,469	\$100,000	\$55,526	\$1,831	\$1,017	\$2,003,541	\$1,112,495	
2024	\$0	\$0	\$75,000	\$40,043	\$118,464	\$63,249	\$248,078	\$132,451	\$1,459,608	\$779,297	\$100,000	\$53,391	\$1,828	\$976	\$2,002,977	\$1,069,406	
2025	\$0	\$0	\$75,000	\$38,503	\$118,238	\$60,700	\$247,744	\$127,185	\$1,459,608	\$749,324	\$100,000	\$51,337	\$1,824	\$937	\$2,002,414	\$1,027,986	
2026	\$0	\$0	\$75,000	\$37,022	\$118,012	\$58,254	\$247,410	\$122,129	\$1,459,608	\$720,504	\$100,000	\$49,363	\$1,821	\$899	\$2,001,851	\$988,170	
2027	\$0	\$0	\$75,000	\$35,598	\$117,787	\$55,907	\$247,077	\$117,273	\$1,459,608	\$692,792	\$100,000	\$47,464	\$1,817	\$863	\$2,001,289	\$949,896	
2028	\$0	\$0	\$75,000	\$34,229	\$117,562	\$53,654	\$246,743	\$112,610	\$1,459,608	\$666,146	\$100,000	\$45,639	\$1,814	\$828	\$2,000,726	\$913,105	
2029	\$0	\$0	\$75,000	\$32,913	\$117,337	\$51,491	\$246,409	\$108,133	\$1,459,608	\$640,525	\$100,000	\$43,883	\$1,810	\$794	\$2,000,164	\$877,739	
2030	\$0	\$0	\$75,000	\$31,647	\$117,112	\$49,416	\$246,075	\$103,833	\$1,459,608	\$615,889	\$100,000	\$42,196	\$1,807	\$762	\$1,999,602	\$843,743	
2031	\$0	\$0	\$75,000	\$30,429	\$117,213	\$47,556	\$246,225	\$99,900	\$1,459,608	\$592,201	\$100,000	\$40,573	\$1,808	\$734	\$1,999,854	\$811,394	
2032	\$0	\$0	\$75,000	\$29,259	\$117,314	\$45,767	\$246,375	\$96,116	\$1,459,608	\$569,424	\$100,000	\$39,012	\$1,810	\$706	\$1,999,106	\$780,284	
2033	\$0	\$0	\$75,000	\$28,134	\$117,414	\$44,044	\$246,524	\$92,475	\$1,459,608	\$547,523	\$100,000	\$37,512	\$1,812	\$680	\$1,998,358	\$750,368	
2034	\$0	\$0	\$75,000	\$27,052	\$117,515	\$42,387	\$246,674	\$88,973	\$1,459,608	\$526,465	\$100,000	\$36,069	\$1,813	\$654	\$1,997,611	\$721,599	
2035	\$0	\$0	\$75,000	\$26,011	\$117,616	\$40,791	\$246,824	\$85,603	\$1,459,608	\$506,216	\$100,000	\$34,682	\$1,815	\$629	\$1,996,863	\$693,932	
2036	\$0	\$0	\$75,000	\$25,011	\$117,717	\$39,256	\$246,974	\$82,360	\$1,459,608	\$486,746	\$100,000	\$33,348	\$1,816	\$606	\$1,996,115	\$667,327	
2037	\$0	\$0	\$75,000	\$24,049	\$117,818	\$37,779	\$247,123	\$79,240	\$1,459,608	\$468,025	\$100,000	\$32,065	\$1,818	\$583	\$1,995,368	\$641,741	
2038	\$0	\$0	\$75,000	\$23,124	\$117,919	\$36,357	\$247,273	\$76,239	\$1,459,608	\$450,024	\$100,000	\$30,832	\$1,819	\$561	\$1,994,620	\$617,137	
2039	\$0	\$0	\$75,000	\$22,235	\$118,021	\$34,988	\$247,423	\$73,351	\$1,459,608	\$432,716	\$100,000	\$29,646	\$1,821	\$540	\$1,993,872	\$593,476	
2040	\$0	\$0	\$75,000	\$21,379	\$118,122	\$33,672	\$247,573	\$70,573	\$1,459,608	\$416,073	\$100,000	\$28,506	\$1,822	\$520	\$1,993,125	\$570,722	
2041	\$0	\$0	\$75,000	\$20,557	\$118,223	\$32,404	\$247,723	\$67,899	\$1,459,608	\$400,070	\$100,000	\$27,409	\$1,824	\$500	\$1,992,378	\$548,840	
2042	\$0	\$0	\$75,000	\$19,766	\$118,324	\$31,185	\$247,872	\$65,327	\$1,459,608	\$384,683	\$100,000	\$26,355	\$1,826	\$481	\$1,991,630	\$527,797	
2043	\$0	\$0	\$75,000	\$19,006	\$118,426	\$30,011	\$248,022	\$62,853	\$1,459,608	\$369,887	\$100,000	\$25,342	\$1,827	\$463	\$1,990,883	\$507,562	
2044	\$0	\$0	\$75,000	\$18,275	\$118,527	\$28,881	\$248,172	\$60,472	\$1,459,608	\$355,661	\$100,000	\$24,367	\$1,829	\$446	\$1,990,136	\$488,101	
2045	\$0	\$0	\$75,000	\$17,572	\$118,629	\$27,794	\$248,322	\$58,181	\$1,459,608	\$341,982	\$100,000	\$23,430	\$1,830	\$429	\$1,989,388	\$469,388	
2046	\$0	\$0	\$75,000	\$16,896	\$118,730	\$26,711	\$248,472	\$55,964	\$1,459,608	\$328,828	\$100,000	\$22,529	\$1,827	\$412	\$1,988,640	\$451,200	
2047	\$0	\$0	\$75,000	\$16,247	\$118,831	\$25,694	\$248,622	\$53,838	\$1,459,608	\$316,181	\$100,000	\$21,662	\$1,823	\$395	\$1,987,892	\$433,717	
2048	\$0	\$0	\$75,000	\$15,622	\$118,932	\$24,660	\$248,772	\$51,802	\$1,459,608	\$304,020	\$100,000	\$20,829	\$1,819	\$379	\$1,987,144	\$416,911	
2049	\$0	\$0	\$75,000	\$15,021	\$119,033	\$23,567	\$248,922	\$49,850	\$1,459,608	\$292,327	\$100,000	\$20,028	\$1,816	\$364	\$1,986,396	\$400,757	
2050	\$0	\$0	\$75,000	\$14,443	\$119,134	\$22,615	\$249,072	\$47,980	\$1,459,608	\$281,084	\$100,000	\$19,257	\$1,812	\$349	\$1,985,648	\$385,228	
2051	\$0	\$0	\$75,000	\$13,888	\$119,235	\$21,701	\$249,222	\$46,190	\$1,459,608	\$270,273	\$100,000	\$18,517	\$1,808	\$335	\$1,984,900	\$370,302	
2052	\$0	\$0	\$75,000	\$13,353	\$119,336	\$20,824	\$249,372	\$44,448	\$1,459,608	\$259,878	\$100,000	\$17,805	\$1,805	\$321	\$1,984,152	\$355,953	
2053	\$0	\$0	\$75,000	\$12,840	\$119,437	\$19,982	\$249,522	\$42,746	\$1,459,608	\$249,883	\$100,000	\$17,120	\$1,801	\$308	\$1,983,404	\$342,161	
2054	\$0	\$0	\$75,000	\$12,346	\$119,538	\$19,175	\$249,672	\$41,179	\$1,459,608	\$240,272	\$100,000	\$16,461	\$1,797	\$296	\$1,982,656	\$328,903	
2055	\$0	\$0	\$75,000	\$11,871	\$119,639	\$18,400	\$249,822	\$39,645	\$1,459,608	\$231,030	\$100,000	\$15,828	\$1,794	\$284	\$1,981,908	\$316,159	
2056	\$0	\$0	\$75,000	\$11,415	\$119,740	\$17,656	\$250,000	\$38,149	\$1,459,608	\$222,145	\$100,000	\$15,219	\$1,790	\$272	\$1,981,160	\$303,909	
2057	\$0	\$0	\$75,000	\$10,976	\$119,841	\$16,943	\$250,150	\$36,679	\$1,459,608	\$213,601	\$100,000	\$14,634	\$1,786	\$261	\$1,980,412	\$292,133	
2058	\$0	\$0	\$75,000	\$10,553	\$119,942	\$16,258	\$250,300	\$35,227	\$1,459,608	\$205,385	\$100,000	\$14,071	\$1,783	\$251	\$1,979,664	\$280,814	
2059	\$0	\$0	\$75,000	\$10,148	\$120,043	\$15,600	\$250,450	\$33,822	\$1,459,608	\$197,486	\$100,000	\$13,530	\$1,779	\$241	\$1,978,916	\$269,933	
2060	\$0	\$0	\$75,000	\$9,757	\$120,144	\$14,970	\$250,600	\$32,446	\$1,459,608	\$189,890	\$100,000	\$13,010	\$1,775	\$231	\$1,978,168	\$259,474	
2061	\$0	\$0	\$75,000	\$9,382	\$120,245	\$14,365	\$250,750	\$31,099	\$1,459,608	\$182,587	\$100,000	\$12,509	\$1,772	\$222	\$1,977,420	\$249,420	
2062	\$0	\$0	\$75,000	\$9,021	\$120,346	\$13,784	\$250,900	\$29,782	\$1,459,608	\$175,564	\$100,000	\$12,028	\$1,768	\$213	\$1,976,672	\$239,756	
2063	\$0	\$0	\$75,000	\$8,674	\$120,447	\$13,227	\$251,050	\$27,494	\$1,459,608	\$168,812	\$100,000	\$11,566	\$1,764	\$204	\$1,975,924	\$230,466	
2064	\$0	\$0	\$75,000	\$8,341	\$120,548	\$12,692	\$251,200	\$26,243	\$1,459,608	\$162,319	\$100,000	\$11,121	\$1,761	\$196	\$1,975,176	\$221,536	
2065	\$0	\$0	\$75,000	\$8,020	\$120,649	\$12,179	\$251,350	\$25,027	\$1,459,608	\$156,076	\$100,000	\$10,693	\$1,757	\$188	\$1,974,428	\$212,952	

Total Capital =	\$145,960,800															
Total Net Present Value =		\$115,354,940	\$1,281,346	\$2,019,438	\$4,231,594	\$24,936,837	\$1,708,461	\$31,157	\$247,989,160	\$149,563,774						

CLOVER POINT WET-WEATHER TF ASSUMPTIONS

Labour:</

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Outfalls (Saanich East, Royal Bay,
Macaulay / McLoughlin, Clover)
Strategy
Life Cycle Analysis

Last Revision: June 18, 2009

Yellow-shaded cell denotes assumed/input values

Year	Capital Costs		Maintenance		Total	
	Total Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value
2008						
2009						
2010						
2011						
2012						
2013						
2014	\$50,275,680	\$39,733,600			\$50,275,680	\$39,733,600
2015		\$0	\$125,689	\$95,513	\$125,689	\$95,513
2016		\$0	\$125,689	\$91,840	\$125,689	\$91,840
2017		\$0	\$125,689	\$88,308	\$125,689	\$88,308
2018		\$0	\$125,689	\$84,911	\$125,689	\$84,911
2019		\$0	\$125,689	\$81,645	\$125,689	\$81,645
2020		\$0	\$125,689	\$78,505	\$125,689	\$78,505
2021		\$0	\$125,689	\$75,486	\$125,689	\$75,486
2022		\$0	\$125,689	\$72,582	\$125,689	\$72,582
2023		\$0	\$125,689	\$69,791	\$125,689	\$69,791
2024		\$0	\$125,689	\$67,106	\$125,689	\$67,106
2025		\$0	\$125,689	\$64,525	\$125,689	\$64,525
2026		\$0	\$125,689	\$62,044	\$125,689	\$62,044
2027		\$0	\$125,689	\$59,657	\$125,689	\$59,657
2028		\$0	\$125,689	\$57,363	\$125,689	\$57,363
2029		\$0	\$125,689	\$55,157	\$125,689	\$55,157
2030		\$0	\$125,689	\$53,035	\$125,689	\$53,035
2031		\$0	\$125,689	\$50,995	\$125,689	\$50,995
2032		\$0	\$125,689	\$49,034	\$125,689	\$49,034
2033		\$0	\$125,689	\$47,148	\$125,689	\$47,148
2034		\$0	\$125,689	\$45,335	\$125,689	\$45,335
2035		\$0	\$125,689	\$43,591	\$125,689	\$43,591
2036		\$0	\$125,689	\$41,915	\$125,689	\$41,915
2037		\$0	\$125,689	\$40,302	\$125,689	\$40,302
2038		\$0	\$125,689	\$38,752	\$125,689	\$38,752
2039		\$0	\$125,689	\$37,262	\$125,689	\$37,262
2040		\$0	\$125,689	\$35,829	\$125,689	\$35,829
2041		\$0	\$125,689	\$34,451	\$125,689	\$34,451
2042		\$0	\$125,689	\$33,126	\$125,689	\$33,126
2043		\$0	\$125,689	\$31,852	\$125,689	\$31,852
2044		\$0	\$125,689	\$30,627	\$125,689	\$30,627
2045		\$0	\$125,689	\$29,449	\$125,689	\$29,449
2046		\$0	\$125,689	\$28,316	\$125,689	\$28,316
2047		\$0	\$125,689	\$27,227	\$125,689	\$27,227
2048		\$0	\$125,689	\$26,180	\$125,689	\$26,180
2049		\$0	\$125,689	\$25,173	\$125,689	\$25,173
2050		\$0	\$125,689	\$24,205	\$125,689	\$24,205
2051		\$0	\$125,689	\$23,274	\$125,689	\$23,274
2052		\$0	\$125,689	\$22,379	\$125,689	\$22,379
2053		\$0	\$125,689	\$21,518	\$125,689	\$21,518
2054		\$0	\$125,689	\$20,690	\$125,689	\$20,690
2055		\$0	\$125,689	\$19,894	\$125,689	\$19,894
2056		\$0	\$125,689	\$19,129	\$125,689	\$19,129
2057		\$0	\$125,689	\$18,393	\$125,689	\$18,393
2058		\$0	\$125,689	\$17,686	\$125,689	\$17,686
2059		\$0	\$125,689	\$17,006	\$125,689	\$17,006
2060		\$0	\$125,689	\$16,352	\$125,689	\$16,352
2061		\$0	\$125,689	\$15,723	\$125,689	\$15,723
2062		\$0	\$125,689	\$15,118	\$125,689	\$15,118
2063		\$0	\$125,689	\$14,537	\$125,689	\$14,537
2064		\$0	\$125,689	\$13,978	\$125,689	\$13,978
2065		\$0	\$125,689	\$13,440	\$125,689	\$13,440

Total Capital =	\$50,275,680					
Total Net Present Value =		\$39,733,600	\$2,147,351	\$56,685,829	\$41,880,951	

Notes:

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Conveyance System Modifications Strategy

Last Revision: June 18, 2009

Life Cycle Analysis

Yellow-shaded cell denotes assumed/input values

Year	Capital Costs ¹		Maintenance		Total	
	Total Cost	Net Present Value	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value
2008						
2009						
2010						
2011						
2012						
2013						
2014	\$109,146,960	\$86,260,428			\$109,146,960	\$86,260,428
2015		\$0	\$272,867	\$207,357	\$272,867	\$207,357
2016		\$0	\$272,867	\$199,382	\$272,867	\$199,382
2017		\$0	\$272,867	\$191,713	\$272,867	\$191,713
2018		\$0	\$272,867	\$184,339	\$272,867	\$184,339
2019		\$0	\$272,867	\$177,249	\$272,867	\$177,249
2020		\$0	\$272,867	\$170,432	\$272,867	\$170,432
2021		\$0	\$272,867	\$163,877	\$272,867	\$163,877
2022		\$0	\$272,867	\$157,574	\$272,867	\$157,574
2023		\$0	\$272,867	\$151,514	\$272,867	\$151,514
2024		\$0	\$272,867	\$145,686	\$272,867	\$145,686
2025		\$0	\$272,867	\$140,083	\$272,867	\$140,083
2026		\$0	\$272,867	\$134,695	\$272,867	\$134,695
2027		\$0	\$272,867	\$129,514	\$272,867	\$129,514
2028		\$0	\$272,867	\$124,533	\$272,867	\$124,533
2029		\$0	\$272,867	\$119,743	\$272,867	\$119,743
2030		\$0	\$272,867	\$115,138	\$272,867	\$115,138
2031		\$0	\$272,867	\$110,709	\$272,867	\$110,709
2032		\$0	\$272,867	\$106,451	\$272,867	\$106,451
2033		\$0	\$272,867	\$102,357	\$272,867	\$102,357
2034		\$0	\$272,867	\$98,420	\$272,867	\$98,420
2035		\$0	\$272,867	\$94,635	\$272,867	\$94,635
2036		\$0	\$272,867	\$90,995	\$272,867	\$90,995
2037		\$0	\$272,867	\$87,495	\$272,867	\$87,495
2038		\$0	\$272,867	\$84,130	\$272,867	\$84,130
2039		\$0	\$272,867	\$80,894	\$272,867	\$80,894
2040		\$0	\$272,867	\$77,783	\$272,867	\$77,783
2041		\$0	\$272,867	\$74,791	\$272,867	\$74,791
2042		\$0	\$272,867	\$71,915	\$272,867	\$71,915
2043		\$0	\$272,867	\$69,149	\$272,867	\$69,149
2044		\$0	\$272,867	\$66,489	\$272,867	\$66,489
2045		\$0	\$272,867	\$63,932	\$272,867	\$63,932
2046		\$0	\$272,867	\$61,473	\$272,867	\$61,473
2047		\$0	\$272,867	\$59,109	\$272,867	\$59,109
2048		\$0	\$272,867	\$56,835	\$272,867	\$56,835
2049		\$0	\$272,867	\$54,649	\$272,867	\$54,649
2050		\$0	\$272,867	\$52,547	\$272,867	\$52,547
2051		\$0	\$272,867	\$50,526	\$272,867	\$50,526
2052		\$0	\$272,867	\$48,583	\$272,867	\$48,583
2053		\$0	\$272,867	\$46,714	\$272,867	\$46,714
2054		\$0	\$272,867	\$44,918	\$272,867	\$44,918
2055		\$0	\$272,867	\$43,190	\$272,867	\$43,190
2056		\$0	\$272,867	\$41,529	\$272,867	\$41,529
2057		\$0	\$272,867	\$39,932	\$272,867	\$39,932
2058		\$0	\$272,867	\$38,396	\$272,867	\$38,396
2059		\$0	\$272,867	\$36,919	\$272,867	\$36,919
2060		\$0	\$272,867	\$35,499	\$272,867	\$35,499
2061		\$0	\$272,867	\$34,134	\$272,867	\$34,134
2062		\$0	\$272,867	\$32,821	\$272,867	\$32,821
2063		\$0	\$272,867	\$31,559	\$272,867	\$31,559
2064		\$0	\$272,867	\$30,345	\$272,867	\$30,345
2065		\$0	\$272,867	\$29,178	\$272,867	\$29,178

Total Capital = \$109,146,960

Total Net Present Value = \$86,260,428 \$4,661,834 \$123,063,197 \$90,922,262

Notes:

1. Includes dry-weather Clover Point forcemain and influent sewer for Macaulay / McLoughling WWTF.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Existing Trunk Sewer System

Last Revision: June 18, 2009

Strategy
Life Cycle Analysis

Yellow-shaded cell denotes assumed/input values

Year	Operation and Maintenance		Total	
	Total Annual Cost	Net Present Value	Total Annual Cost	Net Present Value
2008				
2009				
2010				
2011				
2012				
2013				
2014				
2015	\$4,763,435	\$3,619,819	\$4,763,435	\$3,619,819
2016	\$4,787,252	\$3,497,998	\$4,787,252	\$3,497,998
2017	\$4,811,189	\$3,380,277	\$4,811,189	\$3,380,277
2018	\$4,835,245	\$3,266,518	\$4,835,245	\$3,266,518
2019	\$4,859,421	\$3,156,587	\$4,859,421	\$3,156,587
2020	\$4,883,718	\$3,050,356	\$4,883,718	\$3,050,356
2021	\$4,908,137	\$2,947,700	\$4,908,137	\$2,947,700
2022	\$4,932,677	\$2,848,498	\$4,932,677	\$2,848,498
2023	\$4,957,341	\$2,752,635	\$4,957,341	\$2,752,635
2024	\$4,982,127	\$2,659,998	\$4,982,127	\$2,659,998
2025	\$5,007,038	\$2,570,479	\$5,007,038	\$2,570,479
2026	\$5,032,073	\$2,483,973	\$5,032,073	\$2,483,973
2027	\$5,057,233	\$2,400,378	\$5,057,233	\$2,400,378
2028	\$5,082,520	\$2,319,596	\$5,082,520	\$2,319,596
2029	\$5,107,932	\$2,241,532	\$5,107,932	\$2,241,532
2030	\$5,133,472	\$2,166,096	\$5,133,472	\$2,166,096
2031	\$5,159,139	\$2,093,199	\$5,159,139	\$2,093,199
2032	\$5,184,935	\$2,022,754	\$5,184,935	\$2,022,754
2033	\$5,210,860	\$1,954,681	\$5,210,860	\$1,954,681
2034	\$5,236,914	\$1,888,898	\$5,236,914	\$1,888,898
2035	\$5,263,099	\$1,825,330	\$5,263,099	\$1,825,330
2036	\$5,289,414	\$1,763,900	\$5,289,414	\$1,763,900
2037	\$5,315,861	\$1,704,538	\$5,315,861	\$1,704,538
2038	\$5,342,440	\$1,647,174	\$5,342,440	\$1,647,174
2039	\$5,369,153	\$1,591,740	\$5,369,153	\$1,591,740
2040	\$5,395,998	\$1,538,172	\$5,395,998	\$1,538,172
2041	\$5,422,978	\$1,486,407	\$5,422,978	\$1,486,407
2042	\$5,450,093	\$1,436,383	\$5,450,093	\$1,436,383
2043	\$5,477,344	\$1,388,044	\$5,477,344	\$1,388,044
2044	\$5,504,730	\$1,341,331	\$5,504,730	\$1,341,331
2045	\$5,532,254	\$1,296,190	\$5,532,254	\$1,296,190
2046	\$5,559,915	\$1,252,568	\$5,559,915	\$1,252,568
2047	\$5,587,715	\$1,210,414	\$5,587,715	\$1,210,414
2048	\$5,615,653	\$1,169,679	\$5,615,653	\$1,169,679
2049	\$5,643,732	\$1,130,315	\$5,643,732	\$1,130,315
2050	\$5,671,950	\$1,092,275	\$5,671,950	\$1,092,275
2051	\$5,700,310	\$1,055,516	\$5,700,310	\$1,055,516
2052	\$5,728,812	\$1,019,994	\$5,728,812	\$1,019,994
2053	\$5,757,456	\$985,667	\$5,757,456	\$985,667
2054	\$5,786,243	\$952,496	\$5,786,243	\$952,496
2055	\$5,815,174	\$920,441	\$5,815,174	\$920,441
2056	\$5,844,250	\$889,464	\$5,844,250	\$889,464
2057	\$5,873,471	\$859,530	\$5,873,471	\$859,530
2058	\$5,902,839	\$830,604	\$5,902,839	\$830,604
2059	\$5,932,353	\$802,651	\$5,932,353	\$802,651
2060	\$5,962,015	\$775,639	\$5,962,015	\$775,639
2061	\$5,991,825	\$749,535	\$5,991,825	\$749,535
2062	\$6,021,784	\$724,311	\$6,021,784	\$724,311
2063	\$6,051,893	\$699,935	\$6,051,893	\$699,935
2064	\$6,082,152	\$676,379	\$6,082,152	\$676,379
2065	\$6,112,563	\$653,617	\$6,112,563	\$653,617

Total Capital =				
Total Net Present Value =		\$88,792,213	\$275,938,128	\$88,792,213

Notes:

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Last Revision: June 17, 2009

Subject: Combined S. Colwood and "Off-site" WWTF Solids Processing Systems and Biosolids Drying Facility, and Biosolids Land Application / Willow Coppice Program Strategy Material Flows and GHG Emissions

Note: Coloured cells contain data linked to external spreadsheets

Year	Materials					GHG Sources								GHG Offsets		Total GHG Emissions			
	Electricity		Biogas (WW Sludges)			Biomethane (WW Sludges)		Diesel Fuel		Willow Coppice	Natural Gas	Dried WW Biosolids	Electricity Purchased ⁴	Biogas Lost	Natural Gas Combusted		Diesel Fuel Combusted	Avoided Natural Gas Use via Biomethane	Avoided Coal Use via Dried WW Biosolids
	Done WW Sludges (kWh/yr)	Done Total (kWh/yr)	Done Boiler (m3/yr)	Done for Biomethane (m3/yr)	Done System Loss (m3/yr)	Done Available for Sale (GJ/yr)	Done WW Sludges ¹ (L/yr)	Done Total (L/yr)	Done (odt/yr)										
2008																			
2009																			
2010																			
2011																			
2012																			
2013																			
2014																			
2015																			
2016	1,981,000	1,981,000	2,369,141	1,681,970	40,511	37,299	43,571	43,571	0	42,800	4,833	143	401	2,407	120		-2,098	-6,933	-5,960
2017	1,999,700	1,999,700	2,393,156	1,717,658	41,108	38,091	43,597	43,597	0	43,430	4,904	144	407	2,443	120		-2,142	-7,035	-6,063
2018	2,018,200	2,018,200	2,417,172	1,753,346	41,705	38,882	42,167	42,167	96	44,060	4,975	145	413	2,478	116		-2,187	-7,137	-6,171
2019	2,036,900	2,036,900	2,441,187	1,789,035	42,302	39,674	44,176	44,176	96	44,690	5,047	147	419	2,514	122		-2,231	-7,239	-6,270
2020	2,055,600	2,055,600	2,465,203	1,824,723	42,899	40,465	44,202	44,202	96	45,320	5,118	148	425	2,549	122		-2,276	-7,341	-6,374
2021	2,074,100	2,074,100	2,489,218	1,860,411	43,496	41,256	44,228	44,228	96	45,950	5,189	149	430	2,584	122		-2,320	-7,443	-6,478
2022	2,092,800	2,092,800	2,513,234	1,896,099	44,093	42,048	44,255	44,255	96	46,580	5,260	151	436	2,620	122		-2,365	-7,546	-6,582
2023	2,111,400	2,111,400	2,537,249	1,931,787	44,690	42,839	44,281	44,281	96	47,210	5,331	152	442	2,655	122		-2,409	-7,648	-6,686
2024	2,130,000	2,130,000	2,561,265	1,967,475	45,287	43,631	46,290	46,290	96	47,840	5,403	153	448	2,691	128		-2,454	-7,750	-6,784
2025	2,148,700	2,148,700	2,585,280	2,003,164	45,884	44,422	46,317	46,317	96	48,470	5,474	155	454	2,726	128		-2,499	-7,852	-6,888
2026	2,167,300	2,167,300	2,609,296	2,038,852	46,481	45,214	46,343	46,343	96	49,100	5,545	156	460	2,762	128		-2,543	-7,954	-6,992
2027	2,185,900	2,185,900	2,633,311	2,074,540	47,079	46,005	46,369	46,369	96	49,730	5,616	157	466	2,797	128		-2,588	-8,056	-7,096
2028	2,204,500	2,204,500	2,657,327	2,110,228	47,676	46,796	46,396	46,396	96	50,360	5,688	159	472	2,832	128		-2,632	-8,159	-7,200
2029	2,223,200	2,223,200	2,681,342	2,145,916	48,273	47,588	46,422	46,422	96	50,990	5,759	160	478	2,868	128		-2,677	-8,261	-7,304
2030	2,241,800	2,241,800	2,705,357	2,181,604	48,870	48,379	48,430	48,430	96	51,620	5,830	161	484	2,903	134		-2,721	-8,363	-7,402
2031	2,257,300	2,257,300	2,729,373	2,208,492	49,379	48,976	48,453	48,453	96	52,160	5,891	163	489	2,934	134		-2,755	-8,450	-7,486
2032	2,273,000	2,273,000	2,753,388	2,235,379	49,888	49,572	51,675	51,675	96	52,700	5,952	164	494	2,964	142		-2,788	-8,537	-7,561
2033	2,288,500	2,288,500	2,777,404	2,262,267	50,397	50,168	51,697	51,697	96	53,240	6,012	165	499	2,994	143		-2,822	-8,624	-7,645
2034	2,304,000	2,304,000	2,801,419	2,289,155	50,906	50,764	51,720	51,720	96	53,780	6,073	166	504	3,025	143		-2,855	-8,711	-7,730
2035	2,319,500	2,319,500	2,825,435	2,316,042	51,415	51,361	51,742	51,742	96	54,310	6,134	167	509	3,055	143		-2,889	-8,799	-7,814
2036	2,335,200	2,335,200	2,849,450	2,342,930	51,924	51,957	55,204	55,204	96	54,850	6,194	168	514	3,085	152		-2,922	-8,886	-7,899
2037	2,350,700	2,350,700	2,873,466	2,369,817	52,433	52,553	55,226	55,226	96	55,390	6,255	169	519	3,115	152		-2,956	-8,973	-7,973
2038	2,366,200	2,366,200	2,897,481	2,396,705	52,942	53,149	55,249	55,249	96	55,930	6,316	170	524	3,146	152		-2,989	-9,060	-8,057
2039	2,381,900	2,381,900	2,921,497	2,423,592	53,451	53,746	53,815	53,815	96	56,460	6,377	171	529	3,176	148		-3,023	-9,147	-8,145
2040	2,397,400	2,397,400	2,945,512	2,450,480	53,960	54,342	53,837	53,837	96	57,000	6,437	173	534	3,206	148		-3,056	-9,234	-8,230
2041	2,413,000	2,413,000	2,969,528	2,477,367	54,469	54,938	53,860	53,860	96	57,540	6,498	174	539	3,236	148		-3,090	-9,321	-8,314
2042	2,428,500	2,428,500	2,993,543	2,504,255	54,978	55,534	55,864	55,864	96	58,080	6,559	175	544	3,267	154		-3,124	-9,408	-8,392
2043	2,444,100	2,444,100	3,017,559	2,531,142	55,487	56,131	55,887	55,887	96	58,610	6,620	176	549	3,296	154		-3,157	-9,495	-8,477
2044	2,459,600	2,459,600	3,041,574	2,558,030	55,996	56,727	55,909	55,909	96	59,150	6,680	177	554	3,327	154		-3,191	-9,583	-8,561
2045	2,475,100	2,475,100	3,065,590	2,584,917	56,505	57,323	55,932	55,932	96	59,690	6,741	178	559	3,357	154		-3,224	-9,670	-8,645
2046	2,486,500	2,486,500	3,089,605	2,599,571	56,892	57,648	55,949	55,949	96	60,100	6,787	179	563	3,380	154		-3,242	-9,736	-8,702
2047	2,497,800	2,497,800	3,113,620	2,614,225	57,278	57,973	55,966	55,966	96	60,510	6,833	180	567	3,403	154		-3,261	-9,802	-8,758
2048	2,509,000	2,509,000	3,137,636	2,628,879	57,665	58,298	55,983	55,983	96	60,910	6,879	181	571	3,426	154		-3,279	-9,868	-8,816
2049	2,520,400	2,520,400	3,161,651	2,643,533	58,052	58,623	57,983	57,983	96	61,320	6,925	181	575	3,449	160		-3,297	-9,934	-8,867
2050	2,531,700	2,531,700	3,185,667	2,658,187	58,439	58,948	58,000	58,000	96	61,730	6,972	182	578	3,472	160		-3,316	-10,001	-8,924
2051	2,543,000	2,543,000	3,209,682	2,672,841	58,825	59,273	58,017	58,017	96	62,140	7,018	183	582	3,495	160		-3,334	-10,067	-8,980
2052	2,554,200	2,554,200	3,233,698	2,687,495	59,212	59,598	58,034	58,034	96	62,550	7,064	184	586	3,518	160		-3,352	-10,133	-9,037
2053	2,565,600	2,565,600	3,257,713	2,702,149	59,599	59,923	58,051	58,051	96	62,960	7,110	185	590	3,541	160		-3,370	-10,199	-9,094
2054	2,576,900	2,576,900	3,281,729	2,716,803	59,985	60,248	58,068	58,068	96	63,370	7,156	186	594	3,564	160		-3,389	-10,265	-9,150
2055	2,588,100	2,588,100	3,305,744	2,731,457	60,372	60,573	58,085	58,085	96	63,770	7,202	186	597	3,587	160		-3,407	-10,331	-9,208
2056	2,599,400	2,599,400	3,329,760	2,746,111	60,759	60,898	58,102	58,102	96	64,180	7,248	187	601	3,610	160		-3,425	-10,398	-9,264
2057	2,610,700	2,610,700	3,353,775	2,760,765	61,145	61,223	59,575	59,575	96	64,590	7,295	188	605	3,633	164		-3,443	-10,464	-9,317
2058	2,622,000	2,622,000	3,377,791	2,775,419	61,532	61,548	61,574	61,574	96	65,000	7,341	189	609	3,656	170		-3,462	-10,530	-9,368
2059	2,633,300	2,633,300	3,401,806	2,790,073	61,919	61,873	64,891	64,891	96	65,410	7,387	190	613	3,679	179		-3,480	-10,596	-9,416
2060	2,644,600	2,644,600	3,425,822	2,804,727	62,305	62,198	63,452	63,452	96	65,820	7,433	190	617	3,702	175		-3,498	-10,662	-9,477
2061	2,655,900	2,655,900	3,449,837	2,819,381	62,692	62,523	63,469	63,469	96	66,220	7,479	191	620	3,725	175		-3,517	-10,728	-9,534
2062	2,667,300	2,667,300	3,473,853	2,834,035	63,079	62,848	63,486	63,486	96	66,630	7,525	192	624	3,748	175		-3,535	-10,795	-9,591
2063	2,678,500	2,678,500	3,497,868	2,848,689	63,466	63,173	63,503	63,503	96	67,040	7,571	193	628	3,771	175		-3,553	-10,861	-9,647
2064	2,689,800	2,689,800	3,521,884	2,863,343	63,852	63,497	63,520	63,520	96	67,450	7,617	194	632	3,794	175		-3,571	-10,927	-9,704
2065	2,701,100	2,701,100	3,545,899	2,877,997	64,239	63,822	63,537	63,537	96	67,860	7,664	194	636	3,817	175		-3,590	-10,993	-9,761
Totals =	119,040,900	119,040,900	147,875,996	119,703,060	2,675,791	2,654,535	2,682,347	2,682,347	4,608	2,826,600	319,217	8,571	26,482	158,981	7,394		-149,303	-457,905	-405,780

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Total Core Area
Saleable Reclaimed Water for
Toilet Flushing Purposes.
Life Cycle Analysis

Last Revision: June 17, 2009

Yellow-shaded cell denotes assumed/input values

Year	Total Core Area			Reclaimed Water Revenues (toilet flushing only)	
	Option 1 ADWF (m3/d)	Option 3 ADWF (m3/d)	Option 1 Saleable Reclaimed Water (toilet flushing only) (m3/yr)	Total Annual Rev	Net Present Value
2008					
2009					
2010					
2011					
2012					
2013					
2014					
2015	111,202	111,202	0	\$0	\$0
2016	112,048	112,048	0	\$0	\$0
2017	112,895	112,895	0	\$0	\$0
2018	113,741	113,741	0	\$0	\$0
2019	114,588	114,588	0	\$0	\$0
2020	115,434	114,852	212,530	-\$153,021	-\$95,577
2021	116,280	115,116	425,059	-\$306,043	-\$183,801
2022	117,127	115,380	637,589	-\$459,064	-\$265,098
2023	117,973	115,644	850,118	-\$612,085	-\$339,869
2024	118,820	115,908	1,062,648	-\$765,106	-\$408,497
2025	119,666	116,172	1,275,177	-\$918,128	-\$471,342
2026	120,512	116,436	1,487,707	-\$1,071,149	-\$528,749
2027	121,359	116,701	1,700,236	-\$1,224,170	-\$581,043
2028	122,205	116,965	1,912,766	-\$1,377,191	-\$628,532
2029	123,052	117,229	2,125,295	-\$1,530,213	-\$671,509
2030	123,898	117,493	2,337,825	-\$1,683,234	-\$710,250
2031	124,581	117,766	2,487,426	-\$1,790,947	-\$726,634
2032	125,263	118,038	2,637,028	-\$1,898,660	-\$740,708
2033	125,946	118,311	2,786,629	-\$2,006,373	-\$752,624
2034	126,628	118,584	2,936,230	-\$2,114,086	-\$762,528
2035	127,311	118,856	3,085,832	-\$2,221,799	-\$770,557
2036	127,993	119,129	3,235,433	-\$2,329,512	-\$776,840
2037	128,676	119,402	3,385,034	-\$2,437,225	-\$781,500
2038	129,358	119,674	3,534,636	-\$2,544,938	-\$784,652
2039	130,041	119,947	3,684,237	-\$2,652,651	-\$786,405
2040	130,723	120,220	3,833,838	-\$2,760,364	-\$786,864
2041	131,406	120,492	3,983,440	-\$2,868,077	-\$786,123
2042	132,088	120,765	4,133,041	-\$2,975,790	-\$784,276
2043	132,771	121,038	4,282,642	-\$3,083,502	-\$781,407
2044	133,453	121,310	4,432,244	-\$3,191,215	-\$777,599
2045	134,136	121,583	4,581,845	-\$3,298,928	-\$772,929
2046	134,579	121,616	4,731,623	-\$3,406,768	-\$767,495
2047	135,023	121,649	4,881,400	-\$3,514,608	-\$761,337
2048	135,466	121,682	5,031,178	-\$3,622,448	-\$754,516
2049	135,909	121,715	5,180,956	-\$3,730,288	-\$747,094
2050	136,353	121,748	5,330,734	-\$3,838,128	-\$739,127
2051	136,796	121,781	5,480,511	-\$3,945,968	-\$730,668
2052	137,239	121,814	5,630,289	-\$4,053,808	-\$721,766
2053	137,682	121,847	5,780,067	-\$4,161,648	-\$712,468
2054	138,126	121,880	5,929,845	-\$4,269,488	-\$702,817
2055	138,569	121,913	6,079,622	-\$4,377,328	-\$692,855
2056	139,012	121,945	6,229,400	-\$4,485,168	-\$682,619
2057	139,456	121,978	6,379,178	-\$4,593,008	-\$672,146
2058	139,899	122,011	6,528,956	-\$4,700,848	-\$661,469
2059	140,342	122,044	6,678,733	-\$4,808,688	-\$650,618
2060	140,786	122,077	6,828,511	-\$4,916,528	-\$639,624
2061	141,229	122,110	6,978,289	-\$5,024,368	-\$628,513
2062	141,672	122,143	7,128,067	-\$5,132,208	-\$617,311
2063	142,115	122,176	7,277,844	-\$5,240,048	-\$606,040
2064	142,559	122,209	7,427,622	-\$5,347,888	-\$594,724
2065	143,002	122,242	7,577,400	-\$5,455,728	-\$583,381
Total Net Present Value =				-\$136,898,433	-\$30,122,500

Notes:

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Facility Construction
GHG Emissions (all facilities)

Last Revision: June 18, 2009

Strategy

Yellow-shaded cell denotes assumed/input values

Year	Facility					Total GHG Emissions (t CO2e/yr)	GHG CO2e	
	Saanich East WWTF (t CO2e/yr)	Clover Point Wet Weather TF (t CO2e/yr)	South Colwood WWTF (t CO2e/yr)	Macaulay/McLoughlin WWTF (t CO2e/yr)	Off-Site Solids Processing Facility (t CO2e/yr)		Total Annual Cost	Net Present Value
2008								
2009								
2010								
2011								
2012								
2013								
2014	2,640	7,680	8,041	12,660	3,050	34,072	\$511,074	\$403,909
2015						0	\$0	\$0
2016						0	\$0	\$0
2017						0	\$0	\$0
2018						0	\$0	\$0
2019						0	\$0	\$0
2020						0	\$0	\$0
2021						0	\$0	\$0
2022						0	\$0	\$0
2023						0	\$0	\$0
2024						0	\$0	\$0
2025						0	\$0	\$0
2026						0	\$0	\$0
2027						0	\$0	\$0
2028						0	\$0	\$0
2029						0	\$0	\$0
2030						0	\$0	\$0
2031						0	\$0	\$0
2032						0	\$0	\$0
2033						0	\$0	\$0
2034						0	\$0	\$0
2035						0	\$0	\$0
2036						0	\$0	\$0
2037						0	\$0	\$0
2038						0	\$0	\$0
2039						0	\$0	\$0
2040						0	\$0	\$0
2041						0	\$0	\$0
2042						0	\$0	\$0
2043						0	\$0	\$0
2044						0	\$0	\$0
2045						0	\$0	\$0
2046						0	\$0	\$0
2047						0	\$0	\$0
2048						0	\$0	\$0
2049						0	\$0	\$0
2050						0	\$0	\$0
2051						0	\$0	\$0
2052						0	\$0	\$0
2053						0	\$0	\$0
2054						0	\$0	\$0
2055						0	\$0	\$0
2056						0	\$0	\$0
2057						0	\$0	\$0
2058						0	\$0	\$0
2059						0	\$0	\$0
2060						0	\$0	\$0
2061						0	\$0	\$0
2062						0	\$0	\$0
2063						0	\$0	\$0
2064						0	\$0	\$0
2065						0	\$0	\$0
Totals =						34,072	\$	403,909

ASSUMPTIONS

Saanich East:	
concrete volume (liquid stream) =	7,700 m3
excavation volume (liquid stream) =	27,500 m3
Clover Point:	
concrete volume (liquid stream) =	23,000 m3
excavation volume (liquid stream) =	65,000 m3
South Colwood:	
concrete volume (liquid stream) =	17,900 m3
concrete volume (solids stream) =	5,300 m3
excavation volume (liquid stream) =	67,200 m3
excavation volume (solids stream) =	22,900 m3
Macaulay/McLoughlin:	
concrete volume (liquid stream) =	37,000 m3
excavation volume (liquid stream) =	130,000 m3
Off-Site Solids Processing:	
concrete volume (solids stream) =	8,500 m3
excavation volume (solids stream) =	41,700 m3

Unit GHG Emission Factors:	
concrete purchased =	0.30 t CO2e/m3
ground excavated =	0.006 t CO2e/m3
excavation factor =	2.0
excavation and transport =	0.012 g CO2e/m3

Notes and References:

- Concrete and excavation volumes provided by M. Maynard on June 9/09. See file for details.
- Since the "ultimate" facilities will largely be constructed in Stage 1, all GHG emissions allocated to this time frame.
- Unit concrete GHG emission factor from Flower and Sanjayan (2007). See information in file.
- Unit ground excavation GHG emission factor from dnt_ghg_excavation_kb.xls. See info in file
- Excavation factor allows for rock excavation and material transport off-site.

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: On-Site Systems
GHG Emissions

Last Revision: June 18, 2009

Strategy

Yellow-shaded cell denotes assumed/input values

Year	Residential Population			GHG Sources Methane Formation in System (t CO2e/yr)	Total GHG Emissions (t CO2e/yr)	GHG CO2e	
	Total (p = pe)	Sewered (p = pe)	Non-Sewered (p = pe)			Total Annual Cost	Net Present Value
2008							
2009							
2010							
2011							
2012							
2013							
2014							
2015	181,093	165,051	16,042	2,828	2,828	\$42,422	\$32,237
2016	183,431	168,459	14,973	2,640	2,640	\$39,594	\$28,931
2017	185,770	171,867	13,903	2,451	2,451	\$36,766	\$25,831
2018	188,108	175,275	12,834	2,262	2,262	\$33,937	\$22,927
2019	190,447	178,683	11,764	2,074	2,074	\$31,109	\$20,208
2020	192,785	182,091	10,695	1,885	1,885	\$28,281	\$17,664
2021	195,124	185,499	9,625	1,697	1,697	\$25,453	\$15,286
2022	197,462	188,907	8,556	1,508	1,508	\$22,625	\$13,065
2023	199,801	192,314	7,486	1,320	1,320	\$19,797	\$10,992
2024	202,139	195,722	6,417	1,131	1,131	\$16,969	\$9,060
2025	204,478	199,130	5,347	943	943	\$14,141	\$7,259
2026	206,816	202,538	4,278	754	754	\$11,312	\$5,584
2027	209,155	205,946	3,208	566	566	\$8,484	\$4,027
2028	211,493	209,354	2,139	377	377	\$5,656	\$2,581
2029	213,832	212,762	1,069	189	189	\$2,828	\$1,241
2030	216,170	216,170	0	0	0	\$0	\$0
2031	218,823	218,823	0	0	0	\$0	\$0
2032	221,476	221,476	0	0	0	\$0	\$0
2033	224,129	224,129	0	0	0	\$0	\$0
2034	226,782	226,782	0	0	0	\$0	\$0
2035	229,435	229,435	0	0	0	\$0	\$0
2036	232,088	232,088	0	0	0	\$0	\$0
2037	234,741	234,741	0	0	0	\$0	\$0
2038	237,393	237,393	0	0	0	\$0	\$0
2039	240,046	240,046	0	0	0	\$0	\$0
2040	242,699	242,699	0	0	0	\$0	\$0
2041	245,352	245,352	0	0	0	\$0	\$0
2042	248,005	248,005	0	0	0	\$0	\$0
2043	250,658	250,658	0	0	0	\$0	\$0
2044	253,311	253,311	0	0	0	\$0	\$0
2045	255,964	255,964	0	0	0	\$0	\$0
2046	258,179	258,179	0	0	0	\$0	\$0
2047	260,393	260,393	0	0	0	\$0	\$0
2048	262,608	262,608	0	0	0	\$0	\$0
2049	264,823	264,823	0	0	0	\$0	\$0
2050	267,037	267,037	0	0	0	\$0	\$0
2051	269,252	269,252	0	0	0	\$0	\$0
2052	271,467	271,467	0	0	0	\$0	\$0
2053	273,681	273,681	0	0	0	\$0	\$0
2054	275,896	275,896	0	0	0	\$0	\$0
2055	278,111	278,111	0	0	0	\$0	\$0
2056	280,325	280,325	0	0	0	\$0	\$0
2057	282,540	282,540	0	0	0	\$0	\$0
2058	284,754	284,754	0	0	0	\$0	\$0
2059	286,969	286,969	0	0	0	\$0	\$0
2060	289,184	289,184	0	0	0	\$0	\$0
2061	291,398	291,398	0	0	0	\$0	\$0
2062	293,613	293,613	0	0	0	\$0	\$0
2063	295,828	295,828	0	0	0	\$0	\$0
2064	298,042	298,042	0	0	0	\$0	\$0
2065	300,257	300,257	0	0	0	\$0	\$0
Totals =				22,625	22,625	\$	216,896

ON-SITE SYSTEM ASSUMPTIONS

unit wastewater BOD generation rate = 0.070 kg BOD/d - pe
 fraction of BOD converted to CH₄ = 0.30 kg CH₄ formed / kg BOD entering on-site system
 CH₄ global warming potential = 23 kg CO_{2e} / kg CH₄

Ref: IPCC (2006)

Notes:

1. Data from dnt_WW_load_analysis_ds.xls, KWL Projections (2).

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: WWTF Bioreactor N2O
GHG Emissions (all WWTFs)

Last Revision: June 18, 2009

Strategy

Yellow-shaded cell denotes assumed/input values

Year	Total Sewered Equivalent Population (pe)	GHG Sources Bioreactor N ₂ O emissions (t CO ₂ e/yr)	Total GHG Emissions (t CO ₂ e/yr)	GHG CO ₂ e	
				Total Annual Cost	Net Present Value
2008					
2009					
2010					
2011					
2012					
2013					
2014					
2015	403,043	8,896	8,896	\$133,434	\$101,399
2016	409,072	9,029	9,029	\$135,430	\$98,957
2017	415,100	9,162	9,162	\$137,425	\$96,553
2018	421,129	9,295	9,295	\$139,421	\$94,188
2019	427,158	9,428	9,428	\$141,417	\$91,862
2020	433,187	9,561	9,561	\$143,413	\$89,575
2021	439,215	9,694	9,694	\$145,409	\$87,329
2022	445,244	9,827	9,827	\$147,405	\$85,123
2023	451,273	9,960	9,960	\$149,401	\$82,957
2024	457,302	10,093	10,093	\$151,397	\$80,832
2025	463,330	10,226	10,226	\$153,393	\$78,748
2026	469,359	10,359	10,359	\$155,389	\$76,704
2027	475,388	10,492	10,492	\$157,384	\$74,701
2028	481,417	10,625	10,625	\$159,380	\$72,739
2029	487,445	10,758	10,758	\$161,376	\$70,817
2030	493,474	10,891	10,891	\$163,372	\$68,936
2031	498,614	11,005	11,005	\$165,074	\$66,975
2032	503,754	11,118	11,118	\$166,776	\$65,063
2033	508,894	11,232	11,232	\$168,477	\$63,199
2034	514,034	11,345	11,345	\$170,179	\$61,382
2035	519,174	11,459	11,459	\$171,881	\$59,611
2036	524,314	11,572	11,572	\$173,582	\$57,886
2037	529,454	11,686	11,686	\$175,284	\$56,205
2038	534,595	11,799	11,799	\$176,986	\$54,568
2039	539,735	11,912	11,912	\$178,687	\$52,974
2040	544,875	12,026	12,026	\$180,389	\$51,421
2041	550,015	12,139	12,139	\$182,091	\$49,910
2042	555,155	12,253	12,253	\$183,793	\$48,439
2043	560,295	12,366	12,366	\$185,494	\$47,007
2044	565,435	12,480	12,480	\$187,196	\$45,614
2045	570,575	12,593	12,593	\$188,898	\$44,258
2046	574,480	12,679	12,679	\$190,190	\$42,847
2047	578,385	12,766	12,766	\$191,483	\$41,479
2048	582,289	12,852	12,852	\$192,776	\$40,153
2049	586,194	12,938	12,938	\$194,069	\$38,868
2050	590,099	13,024	13,024	\$195,361	\$37,622
2051	594,004	13,110	13,110	\$196,654	\$36,414
2052	597,908	13,196	13,196	\$197,947	\$35,244
2053	601,813	13,283	13,283	\$199,239	\$34,109
2054	605,718	13,369	13,369	\$200,532	\$33,010
2055	609,623	13,455	13,455	\$201,825	\$31,945
2056	613,527	13,541	13,541	\$203,118	\$30,913
2057	617,432	13,627	13,627	\$204,410	\$29,914
2058	621,337	13,714	13,714	\$205,703	\$28,945
2059	625,242	13,800	13,800	\$206,996	\$28,007
2060	629,146	13,886	13,886	\$208,289	\$27,098
2061	633,051	13,972	13,972	\$209,581	\$26,217
2062	636,956	14,058	14,058	\$210,874	\$25,364
2063	640,861	14,144	14,144	\$212,167	\$24,538
2064	644,765	14,231	14,231	\$213,459	\$23,738
2065	648,670	14,317	14,317	\$214,752	\$22,963
Totals =		605,244	605,244	\$ 2,815,321	

BIOREACTOR N2O GENERATION ASSUMPTIONS

unit wastewater TKN generation rate = 0.013 kg TKN-N/d - pe **Ref:** Tchobanoglous et al (2003)
 bioreactor N₂O generation = 0.010 kg N₂O-N generated / kg wastewater TKN-N entering WWTF **Note:** placeholder assumption
 N₂O global warming potential = 296 kg CO₂e / kg N₂O **Ref:** IPCC (2006)

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Effluent N2O
GHG Emissions (all WWTFs)

Last Revision: June 18, 2009

Strategy

Yellow-shaded cell denotes assumed/input values

Year	Effluent ADWF (m3/d)	GHG Sources Effluent N ₂ O emissions (t CO ₂ e/yr)	Total GHG Emissions (t CO ₂ e/yr)	GHG CO ₂ e	
				Total Annual Cost	Net Present Value
2008					
2009					
2010					
2011					
2012					
2013					
2014					
2015	111,201	94	94	\$1,416	\$1,076
2016	112,047	95	95	\$1,427	\$1,042
2017	112,894	96	96	\$1,438	\$1,010
2018	113,740	97	97	\$1,448	\$978
2019	114,587	97	97	\$1,459	\$948
2020	115,433	98	98	\$1,470	\$918
2021	116,279	99	99	\$1,481	\$889
2022	117,126	99	99	\$1,491	\$861
2023	117,972	100	100	\$1,502	\$834
2024	118,819	101	101	\$1,513	\$808
2025	119,665	102	102	\$1,524	\$782
2026	120,511	102	102	\$1,535	\$757
2027	121,358	103	103	\$1,545	\$733
2028	122,204	104	104	\$1,556	\$710
2029	123,051	104	104	\$1,567	\$688
2030	123,897	105	105	\$1,578	\$666
2031	124,580	106	106	\$1,586	\$644
2032	125,262	106	106	\$1,595	\$622
2033	125,945	107	107	\$1,604	\$602
2034	126,627	107	107	\$1,612	\$582
2035	127,310	108	108	\$1,621	\$562
2036	127,993	109	109	\$1,630	\$543
2037	128,675	109	109	\$1,638	\$525
2038	129,358	110	110	\$1,647	\$508
2039	130,040	110	110	\$1,656	\$491
2040	130,723	111	111	\$1,665	\$474
2041	131,406	112	112	\$1,673	\$459
2042	132,088	112	112	\$1,682	\$443
2043	132,771	113	113	\$1,691	\$428
2044	133,453	113	113	\$1,699	\$414
2045	134,136	114	114	\$1,708	\$400
2046	134,579	114	114	\$1,714	\$386
2047	135,023	115	115	\$1,719	\$372
2048	135,466	115	115	\$1,725	\$359
2049	135,909	115	115	\$1,731	\$347
2050	136,353	116	116	\$1,736	\$334
2051	136,796	116	116	\$1,742	\$323
2052	137,239	117	117	\$1,748	\$311
2053	137,682	117	117	\$1,753	\$300
2054	138,126	117	117	\$1,759	\$290
2055	138,569	118	118	\$1,764	\$279
2056	139,012	118	118	\$1,770	\$269
2057	139,456	118	118	\$1,776	\$260
2058	139,899	119	119	\$1,781	\$251
2059	140,342	119	119	\$1,787	\$242
2060	140,786	120	120	\$1,793	\$233
2061	141,229	120	120	\$1,798	\$225
2062	141,672	120	120	\$1,804	\$217
2063	142,115	121	121	\$1,810	\$209
2064	142,559	121	121	\$1,815	\$202
2065	143,002	121	121	\$1,821	\$195
Totals =		5,600	5,600	\$	27,004

EFFLUENT N2O GENERATION ASSUMPTIONS

effluent total N concentration = 10 mg TN-N/L
 marine N₂O generation = 0.00050 kg N₂O-N generated / kg effluent TN-N entering ocean
 0.00079 kg N₂O generated / kg effluent TN-N entering ocean

N₂O global warming potential = 296 kg CO₂e / kg N₂O

Note: reasonable for MBR
Note: Low end of IPCC (2006) values recognizing open marine rather than estuary discharge
Ref: IPCC (2006)

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: CFA and LCA Summary

Last Revision: June 19, 2009

Strategy

Year	GHG			Operations and Maintenance		Revenues		Capital		Total	
	Total Annual Emissions (t CO2e/yr)	Total Annual Costs	GHG CO2 Net Present Value	Total Annual Costs	Net Present Value	Total Annual Revenues	Net Present Value	Total Capital Cost	Net Present Value	Total Annual Cost	Net Present Value
2008											
2009											
2010											
2011											
2012											
2013											
2014	34,072	\$511,074	\$403,909					\$840,689,480	\$664,409,108	\$841,200,554	\$664,813,017
2015	12,546	\$177,271	\$134,712	\$17,293,621	\$13,141,731	-\$331,454	-\$251,878	\$215,427,660	\$163,707,316	\$232,567,098	\$176,731,881
2016	6,233	\$176,450	\$128,930	\$22,230,297	\$16,243,460	-\$883,782	-\$645,771	\$0	\$0	\$21,522,964	\$15,726,619
2017	5,774	\$175,629	\$123,394	\$22,290,564	\$15,661,055	-\$939,131	-\$659,821	\$0	\$0	\$21,527,061	\$15,124,628
2018	5,312	\$174,807	\$118,093	\$22,273,573	\$15,047,228	-\$1,003,980	-\$678,253	\$0	\$0	\$21,444,399	\$14,487,068
2019	4,860	\$173,986	\$113,018	\$22,339,620	\$14,511,391	-\$1,059,329	-\$688,120	\$0	\$0	\$21,454,276	\$13,936,289
2020	4,401	\$173,164	\$108,158	\$22,400,209	\$13,991,105	-\$1,267,700	-\$791,801	\$0	\$0	\$21,305,674	\$13,307,461
2021	3,943	\$172,343	\$103,505	\$22,461,027	\$13,489,511	-\$1,475,970	-\$886,429	\$0	\$0	\$21,157,400	\$12,706,586
2022	3,485	\$171,521	\$99,049	\$22,521,003	\$13,005,318	-\$1,684,340	-\$972,664	\$0	\$0	\$21,008,184	\$12,131,703
2023	3,027	\$170,700	\$94,784	\$22,582,016	\$12,538,992	-\$1,892,710	-\$1,050,955	\$0	\$0	\$20,860,005	\$11,582,821
2024	2,575	\$169,878	\$90,699	\$22,649,774	\$12,092,900	-\$2,101,081	-\$1,121,784	\$0	\$0	\$20,718,572	\$11,061,815
2025	2,117	\$169,057	\$86,789	\$22,710,186	\$11,658,802	-\$2,309,351	-\$1,185,559	\$0	\$0	\$20,569,892	\$10,560,032
2026	1,659	\$168,236	\$83,046	\$22,771,637	\$11,240,720	-\$2,517,721	-\$1,242,818	\$0	\$0	\$20,422,152	\$10,080,948
2027	1,201	\$167,414	\$79,462	\$22,833,336	\$10,837,670	-\$2,726,091	-\$1,293,919	\$0	\$0	\$20,274,659	\$9,623,213
2028	743	\$166,593	\$76,031	\$22,895,183	\$10,449,063	-\$2,934,461	-\$1,339,250	\$0	\$0	\$20,127,314	\$9,185,844
2029	285	\$165,771	\$72,746	\$22,955,986	\$10,073,858	-\$3,142,732	-\$1,379,136	\$0	\$0	\$19,979,026	\$8,767,468
2030	-168	\$164,950	\$69,601	\$23,016,789	\$9,708,656	-\$3,351,102	-\$1,414,015	\$61,191,000	\$25,819,872	\$81,641,390	\$34,449,024
2031	-189	\$164,129	\$66,616	\$23,079,692	\$9,387,505	-\$3,554,000	-\$1,454,969	\$0	\$0	\$20,382,094	\$8,269,552
2032	-202	\$163,311	\$63,631	\$23,142,595	\$9,070,354	-\$3,756,893	-\$1,505,923	\$0	\$0	\$20,371,144	\$7,947,221
2033	-224	\$170,081	\$63,800	\$23,858,908	\$8,949,877	-\$3,726,777	-\$1,397,977	\$0	\$0	\$20,302,213	\$7,615,701
2034	-245	\$171,791	\$61,963	\$23,914,559	\$8,625,724	-\$3,852,035	-\$1,389,388	\$0	\$0	\$20,234,315	\$7,298,300
2035	-267	\$173,502	\$60,173	\$23,970,344	\$8,313,312	-\$3,977,293	-\$1,379,391	\$0	\$0	\$20,166,552	\$6,994,094
2036	-279	\$175,212	\$58,429	\$24,116,493	\$8,042,307	-\$4,102,552	-\$1,368,109	\$0	\$0	\$20,189,154	\$6,732,628
2037	-301	\$176,923	\$56,730	\$24,172,549	\$7,750,962	-\$4,227,810	-\$1,355,653	\$0	\$0	\$20,121,662	\$6,452,039
2038	-323	\$178,633	\$55,076	\$24,228,642	\$7,470,143	-\$4,353,068	-\$1,342,132	\$0	\$0	\$20,054,207	\$6,183,086
2039	-349	\$180,343	\$53,465	\$24,204,386	\$7,175,639	-\$4,478,227	-\$1,327,616	\$0	\$0	\$19,906,503	\$5,901,487
2040	-370	\$182,054	\$51,896	\$24,259,855	\$6,915,464	-\$4,603,485	-\$1,312,260	\$0	\$0	\$19,838,424	\$5,655,100
2041	-392	\$183,764	\$50,369	\$24,316,469	\$6,665,003	-\$4,728,743	-\$1,296,121	\$0	\$0	\$19,771,490	\$5,419,250
2042	-408	\$185,474	\$48,882	\$24,379,817	\$6,425,352	-\$4,854,002	-\$1,279,282	\$0	\$0	\$19,711,289	\$5,194,952
2043	-430	\$187,185	\$47,436	\$24,436,611	\$6,192,615	-\$4,979,260	-\$1,261,822	\$0	\$0	\$19,644,536	\$4,978,229
2044	-452	\$188,895	\$46,028	\$24,493,741	\$5,968,358	-\$5,104,418	-\$1,243,787	\$0	\$0	\$19,578,218	\$4,770,599
2045	-473	\$190,606	\$44,658	\$24,550,912	\$5,752,201	-\$5,229,677	-\$1,225,297	\$0	\$0	\$19,511,841	\$4,571,563
2046	-729	\$191,904	\$43,233	\$24,599,343	\$5,541,874	-\$5,384,130	-\$1,212,966	\$0	\$0	\$19,407,118	\$4,372,141
2047	-985	\$193,202	\$41,852	\$24,648,746	\$5,339,426	-\$5,538,583	-\$1,199,771	\$0	\$0	\$19,303,366	\$4,181,507
2048	-1,241	\$194,501	\$40,512	\$24,698,420	\$5,144,410	-\$5,693,036	-\$1,185,797	\$0	\$0	\$19,199,886	\$3,999,126
2049	-1,491	\$195,799	\$39,214	\$24,754,789	\$4,957,838	-\$5,847,389	-\$1,171,103	\$0	\$0	\$19,103,199	\$3,825,949
2050	-1,747	\$197,098	\$37,956	\$24,803,931	\$4,776,615	-\$6,001,841	-\$1,155,804	\$0	\$0	\$18,999,187	\$3,658,767
2051	-2,003	\$198,396	\$36,737	\$24,854,155	\$4,602,199	-\$6,156,294	-\$1,139,950	\$0	\$0	\$18,896,257	\$3,498,986
2052	-2,258	\$199,694	\$35,555	\$24,904,655	\$4,434,183	-\$6,310,747	-\$1,123,606	\$0	\$0	\$18,793,602	\$3,346,132
2053	-2,514	\$200,993	\$34,410	\$24,954,353	\$4,272,146	-\$6,465,100	-\$1,106,815	\$0	\$0	\$18,690,245	\$3,199,740
2054	-2,769	\$202,291	\$33,300	\$25,005,227	\$4,116,207	-\$6,619,553	-\$1,089,670	\$0	\$0	\$18,587,965	\$3,059,837
2055	-3,025	\$203,589	\$32,225	\$25,056,080	\$3,965,940	-\$6,774,006	-\$1,072,207	\$0	\$0	\$18,485,663	\$2,925,958
2056	-3,280	\$204,888	\$31,183	\$25,106,325	\$3,821,051	-\$6,928,459	-\$1,054,475	\$0	\$0	\$18,382,754	\$2,797,759
2057	-3,532	\$206,186	\$30,174	\$25,242,411	\$3,694,003	-\$7,082,912	-\$1,036,521	\$0	\$0	\$18,365,685	\$2,687,655
2058	-3,782	\$207,484	\$29,196	\$25,300,630	\$3,560,118	-\$7,237,265	-\$1,018,375	\$0	\$0	\$18,270,849	\$2,570,939
2059	-3,770	\$208,783	\$28,248	\$25,408,537	\$3,437,790	-\$7,355,379	-\$995,187	\$0	\$0	\$18,261,941	\$2,470,851
2060	-3,759	\$210,081	\$27,331	\$25,377,856	\$3,301,576	-\$7,471,705	-\$972,044	\$0	\$0	\$18,116,232	\$2,356,862
2061	-3,744	\$211,380	\$26,442	\$25,429,940	\$3,181,108	-\$7,588,031	-\$949,210	\$0	\$0	\$18,053,289	\$2,258,340
2062	-3,728	\$212,678	\$25,581	\$25,482,322	\$3,065,058	-\$7,704,256	-\$926,681	\$0	\$0	\$17,990,743	\$2,163,958
2063	-3,713	\$213,976	\$24,748	\$25,533,779	\$2,953,122	-\$7,820,582	-\$904,493	\$0	\$0	\$17,927,174	\$2,073,376
2064	-3,697	\$215,275	\$23,940	\$25,586,535	\$2,845,408	-\$7,936,908	-\$882,641	\$0	\$0	\$17,864,902	\$1,986,706
2065	-3,682	\$216,573	\$23,158	\$25,639,482	\$2,741,630	-\$8,053,234	-\$861,132	\$0	\$0	\$17,802,822	\$1,903,656
Totals =	31,712	\$10,013,109	\$3,463,129	\$1,221,631,565	\$396,854,018	-\$230,885,673.22	-\$56,654,978.08	\$ 1,117,308,140	\$ 853,936,296	\$2,118,067,141	\$1,197,598,465

Capital Regional District - Core Area Wastewater Management Strategy: Program Development Phase, Distributed Wastewater Management Strategy Activity 036

File: 20062935.04.E.03.06

Subject: Revenue Summary

Last Revision: June 18, 2009

Strategy

Year	Effluent Heat		Reclaimed Water Irrigation		Reclaimed Water Toilet Flushing		Dried WW Sludges		Biomethane		Woodchips		Total	
	Total Annual Revenues	Net Present Value	Total Annual Revenues	Net Present Value	Total Annual Revenues	Net Present Value	Total Annual Revenues	Net Present Value	Total Annual Revenues	Net Present Value	Total Annual Revenues	Net Present Value	Total Annual Revenues	Net Present Value
2008														
2009														
2010														
2011														
2012														
2013														
2014														
2015	-\$195,245	-\$148,371	-\$136,209	-\$103,507	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	-\$331,454	-\$251,878
2016	-\$240,069	-\$175,416	-\$136,820	-\$99,973	\$0	\$0	-\$133,900	-\$97,839	-\$372,994	-\$272,543	\$0	\$0	-\$883,782	-\$645,771
2017	-\$284,892	-\$200,161	-\$137,432	-\$96,558	\$0	\$0	-\$135,900	-\$95,482	-\$380,908	-\$267,621	\$0	\$0	-\$939,131	-\$659,821
2018	-\$329,715	-\$222,743	-\$138,044	-\$93,257	\$0	\$0	-\$137,800	-\$93,093	-\$388,822	-\$262,674	-\$9,600	-\$6,485	-\$1,003,980	-\$678,253
2019	-\$374,538	-\$243,292	-\$138,655	-\$90,068	\$0	\$0	-\$139,800	-\$90,811	-\$396,736	-\$257,712	-\$9,600	-\$6,236	-\$1,059,329	-\$688,120
2020	-\$419,361	-\$261,931	-\$139,267	-\$86,986	-\$153,021	-\$95,577	-\$141,800	-\$88,568	-\$404,651	-\$252,744	-\$9,600	-\$5,996	-\$1,267,700	-\$791,801
2021	-\$464,184	-\$278,777	-\$139,879	-\$84,008	-\$306,043	-\$183,801	-\$143,700	-\$86,302	-\$412,565	-\$247,776	-\$9,600	-\$5,766	-\$1,475,970	-\$886,429
2022	-\$509,007	-\$293,939	-\$140,491	-\$81,130	-\$459,064	-\$265,098	-\$145,700	-\$84,138	-\$420,479	-\$242,816	-\$9,600	-\$5,544	-\$1,684,340	-\$972,664
2023	-\$553,830	-\$307,522	-\$141,102	-\$78,349	-\$612,085	-\$339,869	-\$147,700	-\$82,013	-\$428,393	-\$237,872	-\$9,600	-\$5,331	-\$1,892,710	-\$1,050,955
2024	-\$598,653	-\$319,626	-\$141,714	-\$75,662	-\$75,106	-\$408,497	-\$149,700	-\$79,926	-\$436,307	-\$232,948	-\$9,600	-\$5,126	-\$2,101,081	-\$1,121,784
2025	-\$643,476	-\$330,343	-\$142,326	-\$73,066	-\$918,128	-\$471,342	-\$151,600	-\$77,827	-\$444,222	-\$228,051	-\$9,600	-\$4,928	-\$2,309,351	-\$1,185,559
2026	-\$688,299	-\$339,764	-\$142,937	-\$70,558	-\$1,071,149	-\$528,749	-\$153,600	-\$75,821	-\$452,136	-\$223,187	-\$9,600	-\$4,739	-\$2,517,721	-\$1,242,818
2027	-\$733,122	-\$347,971	-\$143,549	-\$68,135	-\$1,224,170	-\$581,043	-\$155,600	-\$73,854	-\$460,050	-\$218,359	-\$9,600	-\$4,557	-\$2,726,091	-\$1,293,919
2028	-\$777,945	-\$355,044	-\$144,161	-\$65,793	-\$1,377,191	-\$628,532	-\$157,600	-\$71,927	-\$467,964	-\$213,573	-\$9,600	-\$4,381	-\$2,934,461	-\$1,339,250
2029	-\$822,768	-\$361,058	-\$144,773	-\$63,531	-\$1,530,213	-\$671,509	-\$159,500	-\$69,994	-\$475,878	-\$208,831	-\$9,600	-\$4,213	-\$3,142,732	-\$1,379,136
2030	-\$867,591	-\$366,085	-\$145,384	-\$61,346	-\$1,683,234	-\$710,250	-\$161,500	-\$68,146	-\$483,793	-\$204,139	-\$9,600	-\$4,051	-\$3,351,102	-\$1,414,015
2031	-\$876,872	-\$355,770	-\$145,986	-\$59,230	-\$1,790,947	-\$726,634	-\$163,200	-\$66,215	-\$489,755	-\$198,707	-\$9,600	-\$3,895	-\$3,476,360	-\$1,410,451
2032	-\$886,152	-\$345,707	-\$146,588	-\$57,187	-\$1,898,660	-\$740,708	-\$164,900	-\$64,331	-\$495,718	-\$193,390	-\$9,600	-\$3,745	-\$3,601,619	-\$1,405,069
2033	-\$895,433	-\$335,892	-\$147,190	-\$55,214	-\$2,006,373	-\$752,624	-\$166,500	-\$62,457	-\$501,880	-\$188,189	-\$9,600	-\$3,601	-\$3,726,777	-\$1,397,977
2034	-\$904,714	-\$326,321	-\$147,792	-\$53,307	-\$2,114,086	-\$762,528	-\$168,200	-\$60,668	-\$507,643	-\$183,101	-\$9,600	-\$3,463	-\$3,852,035	-\$1,389,388
2035	-\$913,995	-\$316,988	-\$148,395	-\$51,466	-\$2,221,799	-\$770,557	-\$169,900	-\$58,924	-\$513,605	-\$178,127	-\$9,600	-\$3,329	-\$3,977,293	-\$1,379,391
2036	-\$923,275	-\$307,892	-\$148,997	-\$49,687	-\$2,329,512	-\$776,840	-\$171,600	-\$57,225	-\$519,568	-\$173,264	-\$9,600	-\$3,201	-\$4,102,552	-\$1,368,109
2037	-\$932,556	-\$299,025	-\$149,599	-\$47,969	-\$2,437,225	-\$781,500	-\$173,300	-\$55,569	-\$525,531	-\$168,512	-\$9,600	-\$3,078	-\$4,227,810	-\$1,355,653
2038	-\$941,837	-\$290,386	-\$150,201	-\$46,310	-\$2,544,938	-\$784,652	-\$175,000	-\$53,956	-\$531,493	-\$163,869	-\$9,600	-\$2,960	-\$4,353,068	-\$1,342,132
2039	-\$951,118	-\$281,969	-\$150,803	-\$44,707	-\$2,652,651	-\$786,405	-\$176,600	-\$52,355	-\$537,456	-\$159,334	-\$9,600	-\$2,846	-\$4,478,227	-\$1,327,616
2040	-\$960,398	-\$273,769	-\$151,405	-\$43,159	-\$2,760,364	-\$786,864	-\$178,300	-\$50,826	-\$543,418	-\$154,906	-\$9,600	-\$2,737	-\$4,603,485	-\$1,312,260
2041	-\$969,679	-\$265,783	-\$152,007	-\$41,664	-\$2,868,077	-\$786,123	-\$180,000	-\$49,337	-\$549,381	-\$150,582	-\$9,600	-\$2,631	-\$4,728,743	-\$1,296,121
2042	-\$978,960	-\$258,007	-\$152,609	-\$40,220	-\$2,975,790	-\$784,276	-\$181,700	-\$47,887	-\$555,344	-\$146,362	-\$9,600	-\$2,530	-\$4,854,002	-\$1,279,282
2043	-\$988,240	-\$250,435	-\$153,211	-\$38,826	-\$3,083,502	-\$781,407	-\$183,400	-\$46,476	-\$561,306	-\$142,244	-\$9,600	-\$2,433	-\$4,979,260	-\$1,261,822
2044	-\$997,521	-\$243,065	-\$153,813	-\$37,479	-\$3,191,215	-\$777,599	-\$185,000	-\$45,079	-\$567,269	-\$138,226	-\$9,600	-\$2,339	-\$5,104,418	-\$1,243,787
2045	-\$1,006,802	-\$235,891	-\$154,415	-\$36,179	-\$3,298,928	-\$772,929	-\$186,700	-\$43,743	-\$573,231	-\$134,306	-\$9,600	-\$2,249	-\$5,229,677	-\$1,225,297
2046	-\$1,048,565	-\$236,226	-\$154,715	-\$34,855	-\$3,406,768	-\$767,495	-\$188,000	-\$42,354	-\$576,481	-\$129,873	-\$9,600	-\$2,163	-\$5,384,130	-\$1,212,966
2047	-\$1,090,328	-\$236,188	-\$155,015	-\$33,579	-\$3,514,608	-\$761,337	-\$189,300	-\$41,006	-\$579,731	-\$125,582	-\$9,600	-\$2,080	-\$5,538,583	-\$1,199,771
2048	-\$1,132,092	-\$235,802	-\$155,315	-\$32,350	-\$3,622,448	-\$754,516	-\$190,600	-\$39,700	-\$582,980	-\$121,428	-\$9,600	-\$2,000	-\$5,693,036	-\$1,185,797
2049	-\$1,173,855	-\$235,097	-\$155,615	-\$31,166	-\$3,730,288	-\$747,094	-\$191,800	-\$38,413	-\$586,230	-\$117,409	-\$9,600	-\$1,923	-\$5,847,389	-\$1,171,103
2050	-\$1,215,618	-\$234,098	-\$155,915	-\$30,025	-\$3,838,128	-\$739,127	-\$193,100	-\$37,186	-\$589,480	-\$113,519	-\$9,600	-\$1,849	-\$6,001,841	-\$1,155,804
2051	-\$1,257,382	-\$232,827	-\$156,215	-\$28,926	-\$3,945,968	-\$730,668	-\$194,400	-\$35,997	-\$592,729	-\$109,755	-\$9,600	-\$1,778	-\$6,156,294	-\$1,139,950
2052	-\$1,299,145	-\$231,308	-\$156,515	-\$27,867	-\$4,053,808	-\$721,766	-\$195,700	-\$34,844	-\$595,979	-\$106,112	-\$9,600	-\$1,709	-\$6,310,747	-\$1,123,606
2053	-\$1,340,908	-\$229,561	-\$156,815	-\$26,847	-\$4,161,648	-\$712,468	-\$196,900	-\$33,709	-\$599,229	-\$102,587	-\$9,600	-\$1,644	-\$6,465,100	-\$1,106,815
2054	-\$1,382,671	-\$227,607	-\$157,116	-\$25,863	-\$4,269,488	-\$702,817	-\$198,200	-\$32,626	-\$602,478	-\$99,176	-\$9,600	-\$1,580	-\$6,619,553	-\$1,089,670
2055	-\$1,424,435	-\$225,463	-\$157,416	-\$24,916	-\$4,377,328	-\$692,855	-\$199,500	-\$31,577	-\$605,728	-\$95,876	-\$9,600	-\$1,520	-\$6,774,006	-\$1,072,207
2056	-\$1,466,198	-\$223,148	-\$157,716	-\$24,003	-\$4,485,168	-\$682,619	-\$200,800	-\$30,561	-\$608,978	-\$92,683	-\$9,600	-\$1,461	-\$6,928,459	-\$1,054,475
2057	-\$1,507,961	-\$220,677	-\$158,016	-\$23,124	-\$4,593,008	-\$672,146	-\$202,100	-\$29,576	-\$612,227	-\$89,594	-\$9,600	-\$1,405	-\$7,082,912	-\$1,036,521
2058	-\$1,549,725	-\$218,066	-\$158,316	-\$22,277	-\$4,700,848	-\$661,469	-\$203,300	-\$28,607	-\$615,477	-\$86,605	-\$9,600	-\$1,351	-\$7,237,265	-\$1,018,375
2059	-\$1,555,148	-\$210,413	-\$158,616	-\$21,461	-\$4,808,688	-\$650,618	-\$204,600	-\$27,683	-\$618,727	-\$83,714	-\$9,600	-\$1,299	-\$7,355,379	-\$995,187
2060	-\$1,558,785	-\$202,793	-\$158,916	-\$20,674	-\$4,916,528	-\$639,624	-\$205,900	-\$26,787	-\$621,976	-\$80,917	-\$9,600	-\$1,249	-\$7,471,705	-\$972,044
2061	-\$1,562,421	-\$195,448	-\$159,216	-\$19,917	-\$5,024,368	-\$628,513	-\$207,200	-\$25,919	-\$625,226	-\$78,211	-\$9,600	-\$1,201	-\$7,588,031	-\$949,210
2062	-\$1,566,057	-\$188,368	-\$159,516	-\$19,187	-\$5,132,208	-\$617,311	-\$208,400	-\$25,067	-\$628,476	-\$75,594	-\$9,600	-\$1,155	-\$7,704,256	-\$926,681
2063	-\$1,569,693	-\$181,544	-\$159,816	-\$18,484	-\$5,240,048	-\$606,040	-\$209,700	-\$24,253	-\$631,725	-\$73,063	-\$9,600	-\$1,110	-\$7,820,582	-\$904,493
2064	-\$1,573,329	-\$174,966	-\$160,116	-\$17,806	-\$5,347,888	-\$594,724	-\$211,000	-\$23,465	-\$634,975	-\$70,614	-\$9,600	-\$1,068	-\$7,936,908	-\$882,641
2065	-\$1,576,965	-\$168,625	-\$160,416	-\$17,153	-\$5,455,728	-\$583,381	-\$212,300	-\$22,701	-\$638,225	-\$68,245	-\$9,600	-\$1,027	-\$8,053,234	-\$861,132
Totals =	-\$50,481,525	-\$13,247,165	-\$7,657,065	-\$2,495,014	-\$136,898,433	-\$30,122,500	-\$8,842,500	-\$2,682,819	-\$26,545,350.60	-\$7,964,522.36	-\$460,800	-\$142,958	-\$230,885,673	-\$56,654,978

On-Site Systems	
Scope 1 GHG Sources	
Item	Mass (t CO2e)
CH4 emitted	22,625
Scope 2 GHG Sources	
Item	Mass (t CO2e)
none included	0
Scope 3 GHG Sources	
Item	Mass (t CO2e)
none included	0
total =	22,625

Wastewater Collection	
Scope 1 GHG Sources	
Item	Mass (t CO2e)
none included	0
Scope 2 GHG Sources	
Item	Mass (t CO2e)
electricity purchased	10,005
Scope 3 GHG Sources	
Item	Mass (t CO2e)
none included	0
total =	10,005

Origin	GHG Source Mass (t CO2e)	GHG Off-Set Mass (t CO2e)
On-Site Systems	22,625	--
Wastewater Collection	10,005	--
Liquid-Stream Treatment	748,869	--
Solids Processing	198,949	-149,303
Effluent Management	9,258	-358,180
Biosolids Management	7,394	-457,905
totals =	997,100	-965,388
net =	31,712	

Liquid-Stream Treatment	
Scope 1 GHG Sources	
Item	Mass (t CO2e)
bioreactor N2O emitted	605,244
diesel fuel combusted - site excavation & material transport	3,476
Scope 2 GHG Sources	
Item	Mass (t CO2e)
electricity purchased	114,469
Scope 3 GHG Sources	
Item	Mass (t CO2e)
concrete purchased	25,680
total =	748,869

Effluent Management	
Scope 1 GHG Sources	
Item	Mass (t CO2e)
marine N2O generated	5,600
Scope 2 GHG Sources	
Item	Mass (t CO2e)
electricity purchased	3,658
Scope 3 GHG Sources	
Item	Mass (t CO2e)
none included	0
total =	9,258

GHG Off-Sets	
Item	Mass (t CO2e)
avoided natural gas & electricity via effluent heat	-358,180
total =	-358,180

Solids Processing	
Scope 1 GHG Sources	
Item	Mass (t CO2e)
biogas (CH4) lost	26,482
natural gas combusted - biosolids drying	158,981
diesel fuel combusted - site excavation & material transport	775
Scope 2 GHG Sources	
Item	Mass (t CO2e)
electricity purchased	8,571
Scope 3 GHG Sources	
Item	Mass (t CO2e)
concrete purchased	4,140
total =	198,949

Biosolids Management	
Scope 1 GHG Sources	
Item	Mass (t CO2e)
diesel fuel combusted - biosolids transport & application	7,394
Scope 2 GHG Sources	
Item	Mass (t CO2e)
none included	0
Scope 3 GHG Sources	
Item	Mass (t CO2e)
none included	0
total =	7,394

GHG Off-Sets	
Item	Mass (t CO2e)
avoided natural gas via biomethane	-149,303
total =	-149,303

GHG Off-Sets	
Item	Mass (t CO2e)
avoided coal via dried biosolids	-457,905
total =	-457,905

Figure 6. Carbon Footprint Analysis Boundary and Total Carbon Footprint Breakdown (sum of all emissions and off-sets between Years 2015 and 2065).

Origin	GHG Source Mass (t CO2e)	GHG Off-Set Mass (t CO2e)
On-Site Systems	22,625	--
Wastewater Collection	10,005	--
Liquid-Stream Treatment	748,869	--
Solids Processing	198,949	-149,303
Effluent Management	9,258	-358,180
Biosolids Management	7,394	-457,905
totals =	997,100	-965,388
net =	31,712	

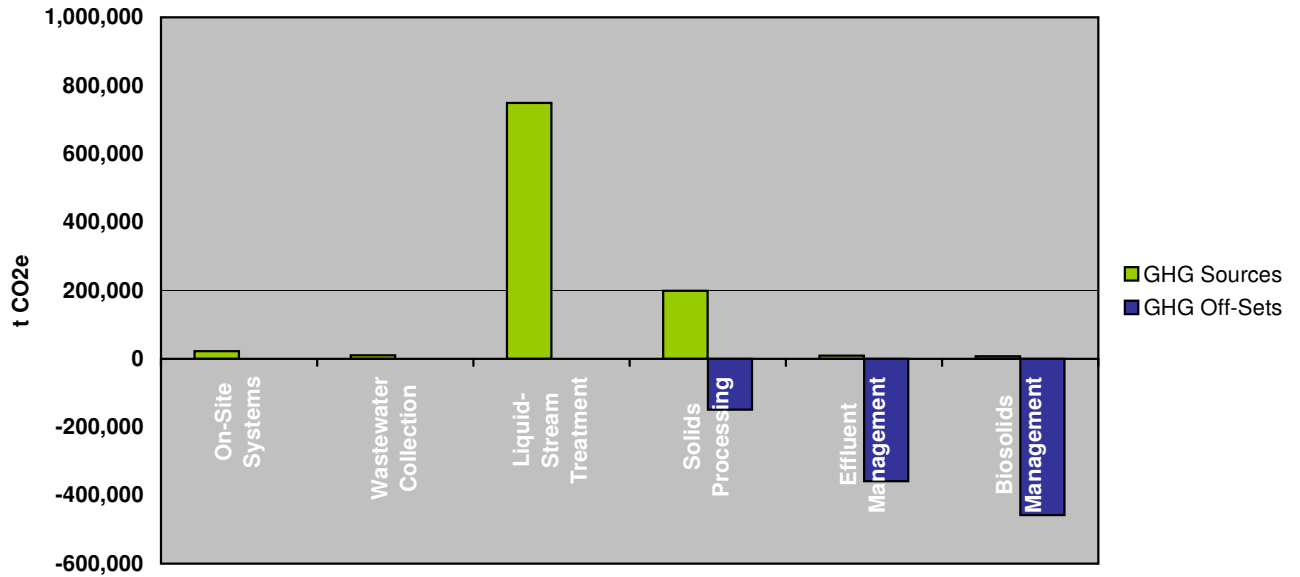


Figure 7. Total Carbon Footprint and Breakdown (sum of all emissions and off-sets between Years 2015 and 2065).