APPENDIX K

Cost Breakdown

Appendix K1 – Mechanical Treatment Process Costs

Appendix K2 – Lagoon Treatment Process Costs

Appendix K1 – Mechanical Treatment Process Costs

Table K1 - Mechanical Treatment Procee Capital, O&M and Life Cycle Cost Summary

Process	Sub-Total Capital Cost[1]	Contingency (15%)	Engineering (15%)	Total Capital Cost[1]	Annual O&M Cost[2]	20-Year O&M[3]	Life Cycle Costs[4]
RBC	4,964,481	744,672	744,672	6,453,825	141,000	2,820,000	9,273,825
SBR	5,025,399	753,810	753,810	6,533,019	134,000	2,680,000	9,213,019
EA	5,278,833	791,825	791,825	6,862,483	153,000	3,060,000	9,922,483
CAS	5,216,744	782,512	782,512	6,781,768	151,000	3,020,000	9,801,768

Notes:

[1] See Table K2 - Mechanical Treatment Process Breakdown of Estimated Capital Costs

[2]See Table K3 - Mechanical Treatment Process Estimated Annual Operating Costs

[3] 20-Year O&M Costs are calculated by multiplying the Annual O&M Cost by 20

[4] Life Cycle Costs are calculated by adding the Total Capital Cost to the the 20-Year O&M Cost

Table K2 - Mechanical Treatment Process Breakdown of Estimated Capital Costs

	Treatment Plant Alternative			
	RBC	**SBR**	**EA**	**CAS**
General condition	$310,106	$310,106	$310,106	$310,106
Site work	$534,204	$968,440	$1,046,540	$968,440
Concrete	$624,800	$920,018	$937,200	$797,401
Miscellaneous metals	$117,150	$177,287	$180,411	$167,915
Pre-fabricated metal building	$44,000	$44,000	$44,000	$44,000
Process Equipment [1]	$2,062,621	$1,052,788	$1,209,379	$1,399,552
Mechanical	$77,000	$77,000	$77,000	$77,000
Elecrical	$468,600	$749,760	$748,198	$726,330
Outfall sewer	$726,000	$726,000	$726,000	$726,000
subtotal	$4,964,481	$5,025,399	$5,278,833	$5,216,744
Contingency (15%)	$744,672	$753,810	$791,825	$782,512
Engineering (15%)	$744,672	$753,810	$791,825	$782,512
Total	**$6,453,825**	**$6,533,019**	**$6,862,483**	**$6,781,767**

Note

1- enclosure included in the cost of RBC equipment

Table K3 - Mechanical Treatment Process Estimated Annual Operating Costs

Extended Aeration Process
Operating Costs
Liquid Treatment System

Equipment	Power (in kW)	No. of Units	Typ. Operating Hours (hrs)	Total Power per day(KwH)
Coarse Screen With grinder	3.5	1	20	70
Septage Pump with VFD	2.5	1	8	20
Mixer (anoxic)	2	2	24	96
Aeration Blowers	19.5	2	24	936
Secondary Clarifier Drive Unit	2	2	24	96
RAS/WAS pumps	7.5	2	24	360
Scum Pumps	3	2	1	6
Alum feed system-duty	0.3	1	24	7.2
Alum feed system - standby	0.3	1	5	1.5
UV	0.37	2	24	17.76
Automatic Samplers	0.25	1	2	0.5
Solids treatment System				
Digester Blowers	7.5	1	24	180
Digested Sludge Transfer pump	2	1	1	2
overall efficiency				0.8
Power costs per Kwh				0.1
Sub Total power cost				$ 156.88
chemical costs for treatment				$ 63.84
Total DailyOperating Cost (power + chemical) at 900 m3/d				$221
Annual (power + chemical) cost				$81,000
Annual Labour cost[1]		Prod. rate	unit cost	47000
biosolids handling cost		5.5 L/m3	13.77	$24,879
Annual O&M cost				**$152,879**

CAS
Operating Costs
Liquid Treatment System

Equipment	Power (in kW)	No. of Units	Typ. Operating Hours (hrs)	Total Power per day(KwH)
Coarse Screen With grinder	3.5	1	20	70
Septage Pump with VFD	2.5	1	8	20
Mixer (anoxic)	2	2	24	96
Aeration Blowers	10.3	2	24	494.4
primary/Secondary Clarifier Drive Unit	4	4	24	384
RAS/WAS pumps	7.5	2	24	360
Scum Pumps	3	2	1	6
Alum feed system-duty	0.3	1	24	7.2
Alum feed system - standby	0.3	1	5	1.5
UV	0.37	2	24	17.76
Automatic Samplers	0.25	1	2	0.5
Solids treatment System				
Digester Blowers	7.5	1	24	180
Digested Sludge Transfer pump	2	1	1	2
overall efficiency				0.8
Power costs per Kwh				0.1
Sub Total power cost				$ 143.44
chemical costs for treatment				$ 63.84
Total DailyOperating Cost (power + chemical) at 900 m3/d				$207
Annual (power + chemical) cost				$76,000
Annual Labour cost[2]				$49,835
biosolids handling cost		5.5 L/m3	13.77	$24,879
Annual O&M cost				**$150,714**

Notes:
[1] See Table K3(a) Extended Aeration Process Breakdown of Annual Labour Costs
[2] See Table K3(b) CAS Breakdown of Annual Labour Costs
[3] See Table K3(c) SBR Process Breakdown of Annual Labour Costs
[4] See Table K3(d) RBC Process Breakdown of Annual Labour Costs

Table K3 - Mechanical Treatment Process Estimated Annual Operating Costs

SBR-ISAM
Operating Costs
Liquid Treatment System

Equipment	Power (in kW)	No. of Units	Typ. Operating Hours (hrs)	Total Power per day(KwH)
Coarse Screen With grinder	3.5	1	20	70
Septage Pump with VFD	2.5	1	8	20
WasteSludge Pump	2.2	2	1.5	6.67
Aeration Blowers	20.02	2	15	600.6
Aspirator Pump	7.5	2	6	90
Jet pumps	t1.12	2	4	88.92
Equalization Tank Pumps	7.5	1	18	135
Alum feed system-duty	0.3	1	24	7.2
Alum feed system - standby	0.3	1	5	t.5
UV	0.37	2	24	17.76
Automatic Samplers	0.25	1	2	0.5
Decanter actuator	0.3705	2	2.5	1.8525
Solids treatment System				
Digester Blowers	7.5	1	24	180
Digested Sludge Transfer pump	2	1	1	2
overall efficiency				0.8
Power costs per Kwh				0.1
Sub Total power cost				$ t06.93
chemical costs for treatment				$63.84
Total DailyOperating Cost (power + chemical) at 900 m3/d				$171
Annual (power + chemical) cost				$62,000
Annual Labour cost[3]				$49,800
biosolids handling cost		5 L/m3	13.77	$22,617
Annual O&M cost				**$134,417**

RBC
Operating Costs
Liquid Treatment System

Equipment	Power (in kW)	No. of Units	Typ. Operating Hours (hrs)	Total Power per day(KwH)
Coarse Screen With grinder	3.5	1	20	70
Septage Pump with VFD	2.5	1	8	20
WasteSludge Pump	0.5	1	1.5	0.75
rotor motor	7.45	4	24	715.2
primary/Secondary Clarifier Drive Unit	4	4	24	384
Scum Pumps	3	2	1	6
Equalization Tank Pumps	7.5	1	18	135
Alum feed system-duty	0.3	1	24	7.2
Alum feed system - standby	0.3	1	5	1.5
UV	0.37	2	24	17.76
Automatic Samplers	0.25	1	2	0.5
effluent pump	0.3705	1	24	8.892
Solids treatment System				
Digester Blowers	7.5	1	24	180
Digested Sludge Transfer pum	2	1	1	2
overall efficiency				0.8
Power costs per Kwh				0.1
Sub Total power cost				135.5202
chemical costs for treatment				63.84463
Total DailyOperating Cost (power + chemical) at 900 m3/d				199.3648
Annual (power + chemical) cost				73000
Annual Labour cost[4]				45716
biosolids handling cost			13.77	22000
Annual O&M cost				**$140,716**

Notes:
[1] See Table K3(a) Extended Aeration Process Breakdown of Annual Labour Costs
[2] See Table K3(b) CAS Breakdown of Annual Labour Costs
[3] See Table K3(c) SBR Process Breakdown of Annual Labour Costs
[4] See Table K3(d) RBC Process Breakdown of Annual Labour Costs

Table K3(a) - Extended Aeration Process Breakdown fo Annual Labour Cost

item	Task	skills	weekly Average (hr.)
1	**INITIAL OVERALL INSPECTION**		
a	quick visual inspection	Operator II	0.56
b	check maintenance schedule	Operator II	0.28
c	record maintenance jobs	Operator I	0.25
2	**CHECK AND MAINTAIN EQUIPMENT AND TANKS**		
a	Maintain Inlet area		
	- hand cleaning of screens	helper	0.75
	- removal/disposal of debris	helper	0.5
	- communitor cleaning	operator I	0.5
	- communitor maintenance	Operator II	0.12
	- clean inlet area	helper	0.56
b	Maintain blower equipment		
	- check blower and equipment	operator I	0.28
	- clean filter	operator I	0.12
	- blower & pump oil change	operator II	0.06
c	Clean aeration tank		
	- check,scrap and hosedown aeration tank	helper	0.5
d	Maintain air and return equipment		
	- inspect equipment	operator II	0.56
	- clean air diffusers	helper	0.25
	- operate foam equipment	operator I	0.13
	- clean foam equipment	helper	0.12
	- adjust sludge return	operator II	0.38
	- clean sludge return	helper	0.5
	- operate skimmer return	operator I	0.16
	- clean skimmer return	helper	0.12
e	Clean clarifier		
	- clean sidewalks, weirs, and still box	helper	1.75
	- scrape clarifier hopper	helper	1.12
f	Sludge removal		
	- sludge wasting	operator II	1
	- disposal of sludge	operator I	2
	- clean sludge system	helper	0.5
g	Chlorinator maintenance		
	- inspect and adjust chlorinator	operator II	0.56
	- clean chlorinator and feed line	operator I	0.25
	- refill chlorinator system	operator I	0.25
h	chemical feed system maintenance		
	- inspect and adjust chemical feed system	operator II	0.67
	- clean chemical pump and feed line	operator I	0.25
	- refill chemical	operator I	0.25

Table K3(a) - Extended Aeration Process Breakdown fo Annual Labour Cost

i other		
- clean decks, weirs and troughs	helper	3.5
- clean and store maintenance equipment	helper	3.5
3 PERFORM TESTS AND MAINTAIN OPERATIONAL LOG		
- influent characteristics	operator I	0.14
- aeration characteristics	operator II	0.56
- clarifier characteristics	operator II	0.14
- effluent characteristics	operator I	0.14
- 30 minute settleability test	operator II	1.12
- DO test	operator II	1.12
- pH test	operator I	0.56
- chlorine residual test	operator I	0.56
- BOD test	opertor II	0.4
- suspended solids test	operator II	1
- daily flow	operator I	0.56
- other recordings	operator I	1.12
- maintain books and test site, other test preparations	operator II	3.5
4 MAKE OPERATIONAL ADJUSTMENTS		
- remedial measures -other	operator II	1
5 FINAL AND PERIODIC OPERATION		
- maintain control system	operator II	0.25
- clean up plant site	helper	4
- outside contacts and other maintenance	operator II	1.12

Reference

Table 16-2 of Wastewater Treatment Facilities for Sewered small Communities, EPA Process Design Manual

TOTALs

		rate/hr.
helper (hr./wk)	17.67	$12.0
operator I	7.52	$25.0
operator II	14.40	$35.0
annual labour cost	**$47,014**	

Table K3(b) - CAS Breakdown of Annual Labour Costs

item	Task	skills	weekly Average (hr.)
1	**INITIAL OVERALL INSPECTION**		
a	quick visual inspection	Operator II	0.56
b	check maintenance schedule	Operator II	0.28
c	record maintenance jobs	Operator I	0.25
2	**CHECK AND MAINTAIN EQUIPMENT AND TANKS**		
a	Maintain Inlet area		
	- hand cleaning of screens	helper	0.75
	- removal/disposal of debris	helper	0.5
	- communitor cleaning	operator I	0.5
	- communitor maintenance	Operator II	0.12
	- clean inlet area	helper	0.56
b	Maintain blower equipment		
	- check blower and equipment	operator I	0.28
	- clean filter	operator I	0.12
	- blower oil change	operator II	0.06
c	Clean aeration tank		
	- check,scrap and hosedown aeration tank	helper	0.25
d	Maintain air and return equipment		
	- inspect equipment	operator II	0.56
	- clean air diffusers	helper	0.25
	- operate foam equipment	operator I	0.13
	- clean foam equipment	helper	0.12
	- adjust sludge return	operator II	0.38
	- clean sludge return	helper	0.5
	- operate skimmer return	operator I	0.16
	- clean skimmer return	helper	0.12
e	Clean clarifier		
	- clean sidewalks, weirs, and still box	helper	1.75
	- scrape clarifier hopper	helper	1.12
f	Sludge removal		
	- sludge wasting	operator II	1
	- disposal of sludge	operator I	2.2
	- clean sludge system	helper	0.5
g	Chlorinator maintenance		
	- inspect and adjust chlorinator	operator II	0.56
	- clean chlorinator and feed line	operator I	0.25
	- refill chlorinator system	operator I	0.25
h	chemical feed system maintenance		
	- inspect and adjust chemical feed system	operator II	0.67
	- clean chemical pump and feed line	operator I	0.25
	- refill chemical	operator I	0.25
i	other		
	- clean decks, weirs and troughs	helper	3.5
	- clean and store maintenance equipment	helper	3.5
3	**PERFORM TESTS AND MAINTAIN OPERATIONAL LOG**		
	- influent characteristics	operator I	0.14
	- aeration characteristics	operator II	0.56
	- clarifier characteristics	operator II	0.14
	- effluent characteristics	operator I	0.14
	- 30 minute settleability test	operator II	1.12
	- DO test	operator II	1.12
	- pH test	operator I	0.56
	- chlorine residual test	operator I	0.56
	- BOD test	opertor II	0.4
	- suspended solids test	operator II	1
	- daily flow	operator I	0.56
	- other recordings	operator I	1.12
	- maintain books and test site, other test preparations	operator II	3.5

Table K3(b) - CAS Breakdown of Annual Labour Costs

4 MAKE OPERATIONAL ADJUSTMENTS			
- remedial measures -other	operator II	1	
5 FINAL AND PERIODIC OPERATION			
- maintain control system	operator II	0.25	
- clean up plant site	helper	4	
- outside contacts and other maintenance	operator II	1.12	
TOTALs			
			rate/hr.
helper		17.42 hr/wk	$15.0
operator I		7.72	$25.0
operator II		14.40	$35.0
annual labour cost	**$49,835**		

Table K3 (c) - SBR Process Breakdown of Annual Labour Costs

item	Task	skills	weekly Average (hr.)
	1 INITIAL OVERALL INSPECTION		
a	quick visual inspection	Operator II	0.56
b	check maintenance schedule	Operator II	0.28
c	record maintenance jobs	Operator I	0.25
	2 CHECK AND MAINTAIN EQUIPMENT AND TANKS		
a	Maintain Inlet area		
	- hand cleaning of screens	helper	0.75
	- removal/disposal of debris	helper	0.5
	- communitor cleaning	operator I	0.5
	- communitor maintenance	Operator II	0.12
	- clean inlet area	helper	0.56
b	Maintain blower equipment		
	- check blower and equipment	operator I	0.28
	- clean filter	operator I	0.12
	- blower oil change	operator II	0.06
c	Clean aeration tank		
	- check,scrap and hosedown aeration tank	helper	0.5
d	Maintain air and return equipment		
	- inspect equipment	operator II	0.56
	- clean air diffusers	helper	0.25
	- operate foam equipment	operator I	0.13
	- clean foam equipment	helper	0.12
	- adjust sludge return	operator II	0.38
	- clean sludge return	helper	0.5
	- operate skimmer return	operator I	0.16
	- clean skimmer return	helper	0.12
e	Clean clarifier		
	- clean sidewalks, weirs, and still box	helper	1.75
	- scrape clarifier hopper	helper	1.12
f	Sludge removal		
	- sludge wasting	operator II	1
	- disposal of sludge	operator I	2
	- clean sludge system	helper	0.5
g	Chlorinator maintenance		
	- inspect and adjust chlorinator	operator II	0.56
	- clean chlorinator and feed line	operator I	0.25
	- refill chlorinator system	operator I	0.25
h	Chemical feed system maintenance		
	- inspect and adjust chemical feed pumps	operator II	0.672
	- clean feed line and pump and tank	operator I	0.25
	- refill chemical tank	operator I	0.25
i	other		
	- clean decks, weirs and troughs	helper	3.5
	- clean and store maintenance equipment	helper	3.5
	3 PERFORM TESTS AND MAINTAIN OPERATIONAL LOG		
	- influent characteristics	operator I	0.14
	- aeration characteristics	operator II	0.56
	- clarifier characteristics	operator II	0.14
	- effluent characteristics	operator I	0.14
	- 30 minute settleability test	operator II	1.12
	- DO test	operator II	1.12
	- pH test	operator I	0.56
	- chlorine residual test	operator I	0.56
	- BOD test	opertor II	0.4
	- suspended solids test	operator II	1
	- daily flow	operator I	0.56
	- other recordings	operator I	1.12
	- maintain books and test site, other test preparations	operator II	3.5

Table K3 (c) - SBR Process Breakdown of Annual Labour Costs

4 MAKE OPERATIONAL ADJUSTMENTS				
- remedial measures -other	operator II	1		
5 FINAL AND PERIODIC OPERATION				
- maintain control system	operator II	0.25		
- clean up plant site	helper	4		
- outside contacts and other maintenance	operator II	1.12		
TOTALs				
				rate/hr.
helper		17.67	hr/wk	$15.0
operator I		7.52		$25.0
operator II		14.402		$35.0
annual labour cost	**$49,770**			

Table K3(d) - RBC Process Breakdown of Annual Labour Costs

item	Task	skills	weekly Average (hr.)
1	**INITIAL OVERALL INSPECTION**		
a	quick visual inspection	Operator II	0.56
b	check maintenance schedule	Operator II	0.28
c	record maintenance jobs	Operator I	0.25
2	**CHECK AND MAINTAIN EQUIPMENT AND TANKS**		
a	Maintain Inlet area		
	- hand cleaning of screens	helper	0.75
	- removal/disposal of debris	helper	0.5
	- communitor cleaning	operator I	0.5
	- communitor maintenance	Operator II	0.12
	- clean inlet area	helper	0.56
b	Maintain blower equipment		
	- check equipment	operator I	0.28
	- oil change	operator II	0.0612
c	Clean clarifier		
	- clean sidewalks, weirs, and still box	helper	1.75
	- scrape clarifier hopper	helper	1.12
d	Sludge removal		
	- sludge wasting	operator II	0.5
	- disposal of sludge	operator I	2.2
	- clean sludge system	helper	0.5
e	Chlorinator maintenance		
	- inspect and adjust chlorinator	operator II	0.56
	- clean chlorinator and feed line	operator I	0.25
	- refill chlorinator system	operator I	0.25
f	Chemical feed system maintenance		
	- inspect and adjust chemical feed pumps	operator II	0.672
	- clean feed line and pump and tank	operator I	0.25
	- refill chemical tank	operator I	0.25
g	other		
	- clean decks, weirs and troughs	helper	3.5
	- clean and store maintenance equipment	helper	3.5
3	**PERFORM TESTS AND MAINTAIN OPERATIONAL LOG**		
	- influent characteristics	operator I	0.14
	- aeration characteristics	operator II	0.56
	- clarifier characteristics	operator II	0.14
	- effluent characteristics	operator I	0.14
	- 30 minute settleability test	operator II	1.12
	- DO test	operator II	1.12

Table K3(d) - RBC Process Breakdown of Annual Labour Costs

- pH test	operator I	0.56
- chlorine residual test	operator I	0.56
- BOD test	opertor II	0.4
- suspended solids test	operator II	1
- daily flow	operator I	0.56
- other recordings	operator I	1.12
- maintain books and test site, other test preparations	operator II	3.5
4 MAKE OPERATIONAL ADJUSTMENTS		
- remedial measures -other	operator II	1
5 FINAL AND PERIODIC OPERATION		
- maintain control system	operator II	0.25
- clean up plant site	helper	4
- outside contacts and other maintenance	operator II	1.12

TOTALs

		rate/hr.
helper (hr./wk)	16.18	$15.0
operator I	7.31	$25.0
operator II	12.9632	$35.0
annual labour cost	**$45,716**	

Appendix K2 – Lagoon Treatment Process Costs

Table K4 - Lagoon Treatment Process Capital, O&M and Life Cycle Cost Summary

	Lagoon Treatment Process Estimated Cost[1]	Forcemain & Site Servicing[2]	Outfall[3]	Hydro Servicing	Sub-Total	Engineering (15%)	Estimated Capital Cost	20-Year O&M[4]	Life Cycle Costs[5]
Area 1	$2,265,500	$2,107,789	$1,945,229	$108,900	$6,427,418	$964,113	$7,392,000	$2,180,000	$9,572,000
Area 2	$2,265,500	$2,569,076	$271,084	$168,300	$5,273,960	$791,094	$6,065,000	$2,060,000	$8,125,000
Area 3	$2,265,500	$3,678,299	$3,214,895	$220,000	$9,378,694	$1,406,804	$10,785,000	$2,380,000	$13,165,000
Area 4	$2,265,500	$4,071,593	$855,525	$276,100	$7,468,718	$1,120,308	$8,589,000	$2,440,000	$11,029,000
Area 5	$2,265,500	$4,471,533	$855,525	$331,100	$7,923,658	$1,188,549	$9,112,000	$2,400,000	$11,512,000

Notes:

[1]See Table K5 Capital Cost Breakdown for Aerated Lagoon at Area 1, 2, 3, 4, 5, includes 15% contingency allowance.

[2]See Table K6 Lagoon Site Servicing & Forcemain Costs

[3]See Table K7 Lagoon Site Outfall Cost Estimate

[4]See Table K8 Annual O&M Cost Estimate For Lagoon Treatment Process

[5] Life Cycle Costs are calculated by adding the Estimated Capital Cost and 20-Year O&M Costs

Table K5 - Capital Cost Breakdown for Aerated Lagoon at Area 1, 2, 3, 4 or 5

Division 1	
general condition (7%)	$135,100
Performance bond and insurance (0.8%)	$15,520
Sub-total General Condition of contract	**$150,620**
Division 2	
Clearing and grub	$63,756
stripping and stockpiling	$34,650
Excavating trenching grading and filing	$560,399
synthetic liner	$398,030
Siltation control and storm mgmt	$1,650
sluice gates	$21,450
interconnecting sewers	$33,000
precast conc. chambers	$24,200
Tree, Seed and Sod, Top soil and Sod	$6,794
access road	$33,000
chain link fencing and gate	$80,164
subtotal-site works	**$1,257,091**
Division 3- Concrete Sub-total	**$59,400**
Building-sub-total	**$33,000**
Miscellaneous Metals- sub-totals	**$22,000**
Division 11	
General Clauses & Inst.	**$6,600**
aerationequipment	**$154,000**
chemical feed system	**$65,340**
subtotal -process equipment	**$225,940**
general mechanical	
mechanical system controls	
sub-total- mechanical	**$6,600**
Division 16	
electrical sub-totals	**$220,000**
Total	**$1,970,000**
contingency (15%)	**$295,500**
engineering (15%)	**$295,500**
Total	**$2,561,000**

Table K6 - Lagoon Forcemain & Site Servicicing Costs

Area 1

		Unit	Estimated Cost/Unit	Total Cost
Approximate Length of Forcemain	900	m	330	297,000
Gas Pipeline Crossings	0	each	247,500	0
Rail Crossings	1	each	357,500	357,500
Creek Crossings	0	each	16,500	0
# of Lift Stations c/w genset	1	each	770,000	770,000
Road Reconstruction	700	m	220	154,000
Service Road Construction	200	m	440	88,000
Highway Crossing	0		126,500	0
Telephone	200	m	33	6,600
Electricity	200	m	110	22,000
Water - municipal service	200	m	220	44,000
sub-total				1,739,100
Genral condition of contract				107,824
Contingency(15%)				260,865
Total				**2,107,789**

Approx. Elevation Difference +16 m

Area 2

		Unit	Estimated Cost/Unit	Total Cost
Approximate Length of Forcemain	1700	m	330	561,000
Gas Pipeline Crossings	0	each	247,500	0
Rail Crossings	1	each	357,500	357,500
Creek Crossings	0	each	16,500	0
# of Lift Stations c/w genset	1	each	770,000	770,000
Road Reconstruction	1230	m	220	270,600
Service Road Construction	200	m	440	88,000
Highway Crossing	0		126,500	0
Telephone	200		33	6,600
Electricity	200		110	22,000
Water - municipal service	200		220	44,000
sub-total				2,119,700
Genral condition of contract				131,421
Contingency(15%)				317,955
Total				**2,569,076**

Approx. Elevation Difference +9 m

Area 3

		Unit	Estimated Cost/Unit	Total Cost
Approximate Length of Forcemain	1700	m	330	561,000
Gas Pipeline Crossings	1	each	247,500	247,500
Rail Crossings	3	each	357,500	1,072,500
Creek Crossings	1	each	16,500	16,500
# of Lift Stations c/w genset	1	each	770,000	770,000
Road Reconstruction	0	m	220	0
Service Road Construction	300	m	440	132,000
Highway Crossing	1		126,500	126,500
Telephone	300	m	33	9,900
Electricity	300	m	110	33,000
Water - Municipal Service	300	m	220	66,000
sub-total				3,034,900
Genral condition of contract				188,164
Contingency(%)				455,235
Total				**3,678,299**

Approx. Elevation Difference +20 m (potential for greater change depending on final location)

Area 4

		Unit	Estimated Cost/Unit	Total Cost
Approximate Length of Forcemain	3600	m	330	1,188,000
Gas Pipeline Crossings	0	each	247,500	0
Rail Crossings	3	each	357,500	1,072,500
Creek Crossings	1	each	16,500	16,500
# of Lift Stations c/w genset	1	each	770,000	770,000
Road Reconstruction	0	m	220	0
Service Road Construction	300	m	440	132,000
Highway Crossing	1		126,500	126,500
Telephone	300	m	33	9,900
Electricity	300	m	110	33,000
Water - on site well	1	each	11,000	11,000
sub-total				3,359,400
Genral condition of contract				208,283
Contingency(%)				503,910
Total				**4,071,593**

Approx. Elevation Difference +17 m

Area 5

		Unit	Estimated Cost/Unit	Total Cost
Approximate Length of Forcemain	4600	m	330	1,518,000
Gas Pipeline Crossings	0	each	247,500	0
Rail Crossings	3	each	357,500	1,072,500
Creek Crossings	1	each	16,500	16,500
# of Lift Stations c/w genset	1	each	770,000	770,000
Road Reconstruction	0	m	220	0
Service Road Construction	300	m	440	132,000
Highway Crossing	1	each	126,500	126,500
Telephone	300	m	33	9,900
Electricity	300	m	110	33,000
Water - on site well	1	each	11,000	11,000
sub-total				3,689,400
Genral condition of contract				228,743
Contingency(%)				553,410
Total				**4,471,553**

Approx. Elevation Difference +13 m

Estimates do not include:

Rock excavation if required.

Cost of on-site well will vary by depth and if treatment is required.

Table K7 - Lagoon Site Outfall Cost Estimate

Area 1

		Unit	Estimated Cost/Unit	Total Cost
Approximate Length of outfall	1065	m	330	351,450
Rail Crossings	2	each	357,500	715,000
outfall in the lake	600	m	880	528,000
sub-total				1,594,450
Genral condition of contract				111,612
contingency (15%)				239,168
Total				**1,945,229**

Area 2

Approximate Length of outfall	640	m	330	211,200
headwall	1	ea.	11,000	11,000
sub-total				222,200
Genral condition of contract				15,554
contingency (15%)				33,330
Total				**271,084**

Area 3

		Unit	Estimated Cost/Unit	Total Cost
Approximate Length of outfall	1800	m	330	594,000
Gas Pipeline Crossings	1	each	247,500	247,500
Rail Crossings	3	each	357,500	1,072,500
Creek Crossings	1	each	16,500	16,500
Highway Crossing	1		126,500	126,500
outfall in the lake	657	m	880	578,160
sub-total				2,635,160
Genral condition of contract				184,461
contingency (15%)				395,274
Total				**3,214,895**

Area 4 and 5

Approximate Length of outfall	625	m	330	206,250
Rail Crossings	1	each	357,500	357,500
headwall	1	each	11,000	11,000
Highway Crossing	1	each	126,500	126,500
sub-total				701,250
Genral condition of contract				49,088
contingency (15%)				105,188
Total				**$855,525**

Table K8 - Annual O&M Cost Estimate Summary for Lagoon Treatment Process

	Annual Pumping Energy Cost	Annual Plant Process Energy Cost[1]	Annual Chemical Cost[2]	Annual Labour Cost[3]	Total Annual O&M Cost	20-Year O&M Costs[4]
Area 1	$26,546	$42,629	$23,313	$17,000	$109,000	$2,180,000
Area 2	$19,713	$42,629	$23,313	$17,000	$103,000	$2,060,000
Area 3	$35,485	$42,629	$23,313	$17,000	$119,000	$2,380,000
Area 4	$38,792	$42,629	$23,313	$17,000	$122,000	$2,440,000
Area 5	$37,061	$42,629	$23,313	$17,000	$120,000	$2,400,000

Notes:

[1]See Table K9 Annual Plant Process Energy Cost Estimate

[2]See Table K10 Annual Chemical Cost Estimate

[3]See Table K11 Aerated Lagoon Breadown of Annual Labour Costs

[4]20-Year O&M Costs are calculated by multiplying the Annual O&M Cost by 20

Table K9 Annual Plant Process Energy Cost Estimate

Aerated Lagoon-Aspirator
Operating Costs

Equipment	Power (kW)	No. of Units Operating	Typ. Operating Hours (hrs)	Total Power per day (KwH)
aspirators	3.73	9	24	805.68
chemical feed system	0.373	1	24	8.952

Plant Design daily average flow (cum/d)	900
overall efficiency	0.6975
Power costs per Kwh	0.1
Sub Total power cost/day	$116.8
Estimated Annual Plant Process Energy Cost	**$42,629**

Table K10 - Annual Chemical Cost Estimate

alum dose calculation

for 75% removal of P Alum to P weight ratio needed	15	Wat. & WW calc. manual P701
raw phosporous concentration	4	mg/L
biological P uptake (10%)	0.4	mg/L
effluent P required	1	mg/L
P removal required	2.6	mg/L
daily phosphorous loading	2.34	kg/d
alum dosage	39	mg/L
average day plant flow	900000	L/d
daily alum required	35.1	kg/d
alum conc.	45 - 55	%
take conc. Alum	48.8	%
sp. Gravity of alum	1.335	
conc. Alum	651480	mg/L
quantity of liquid alum needed per day	53.9	L/d
	2.2448886	L/hr.
Quantity of alum daily required	53.9	L/d
Quantity of alum monthly required	1617	L/month
Total Cost (@$1.185/L)	**$23,313.10**	

Table K11 - Aerated Lagoon Breakdown of Annual Labour Costs

item	Task	weekly Average (hr.)	
	1 INITIAL OVERALL INSPECTION		
	a quick visual inspection	0.56	
	b check maintenance schedule	0.28	
	c record maintenance jobs	0.25	
	2 CHECK AND MAINTAIN EQUIPMENT AND TANKS		
	b Maintain aerator equipment and pumps		
	- check equipment	0.28	
	- oil change	0.06	
	h chemical feed system maintenance		
	- inspect and adjust chemical feed system	0.67	
	- clean chemical pump and feed line	0.25	
	- refill chemical	0.25	
	3 PERFORM TESTS AND MAINTAIN OPERATIONAL LOG		
	- influent characteristics	0.14	
	- aeration characteristics	0.56	
	- clarifier characteristics	0.14	
	- effluent characteristics	0.14	
	- DO test	1.12	
	- pH test	0.56	
	- BOD test	0.4	
	- suspended solids test	1	
	- daily flow	0.56	
	- other recordings	1.12	
	- maintain books and test site, other test preparations & reports	1	
	4 MAKE OPERATIONAL ADJUSTMENTS		
	- remedial measures -other	0.5	
	5 FINAL AND PERIODIC OPERATION		
	- maintain control system	0.0625	
	- clean up plant site	0.5	
	- outside contacts and other maintenance	0.5	
	TOTALs	10.9	hr./week
	rate	$25	per hr.
		$272.61	
	annual cost	**$17,011**	