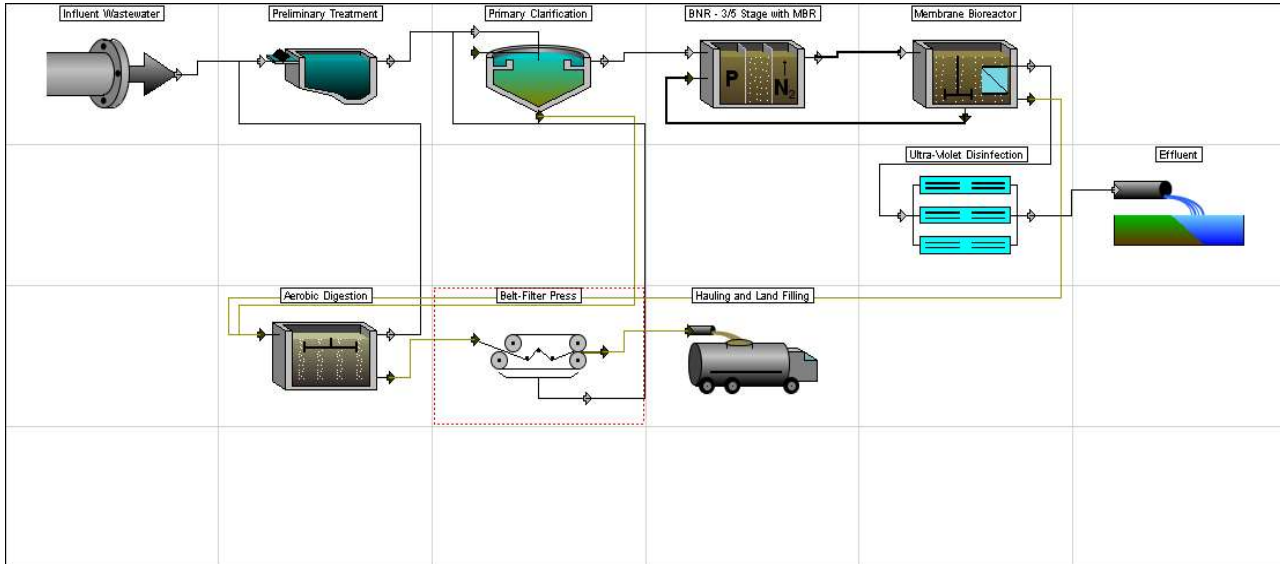


Layout 1 Moroni City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost:	\$6,760,000	\$
Other direct construction costs	\$1,960,000	\$
Other indirect construction costs	\$6,620,000	\$
Total construction costs	\$15,300,000	\$

ANNUAL COSTS

LABOR COSTS

Administration labor cost	\$16,500	\$/yr
Laboratory labor cost	\$124,000	\$/yr
Unit process operation labor cost	\$462,000	\$/yr
Unit process maintenance labor cost	\$223,000	\$/yr
Total labor costs	\$826,000	\$/yr

MATERIAL COSTS

Total material cost	\$157,000	\$/yr
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CHEMICAL COSTS

Total chemical cost	\$23,000	\$/yr
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ENERGY COSTS

Total energy cost	\$167,000	\$/yr
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Total operation and maintenance	\$1,170,000	\$/yr
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CONSTRUCTION COST AMC

Amortization cost for total construction	\$1,470,000	\$/yr
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Total annual project cost	\$2,640,000	\$/yr
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PROJECT SUMMARY

Present worth	\$31,700,000	\$
Total project cost	\$15,300,000	\$
Total operation labor cost	\$603,000	\$/yr
Total maintenance labor cost	\$223,000	\$/yr
Total material cost	\$157,000	\$/yr
Total chemical cost	\$23,000	\$/yr
Total energy cost	\$167,000	\$/yr
Total amortization cost	\$1,470,000	\$/yr

Process Summary

Process	Construction (\$)	Operation (\$/yr)	Maintenance (\$/yr)	Material (\$/yr)	Chemical (\$/yr)	Energy (\$/yr)	Amortization (\$/yr)
Preliminary Treatment	317000	29900	13700	7920	0	1530	26600
Aerobic Digestion	420000	63800	25500	46200	0	47700	36900
Primary Clarification	226000	29600	15000	2170	0	761	21300
Belt-Filter Press	812000	1910	384	0	6320	1280	74300

BNR - 3/5 Stage with MBR	864000	142000	73900	17000	0	50300	81700
Hauling and Land Filling	301000	3530	0	53600	0	0	62700
Membrane Bioreactor	2750000	191000	91100	26800	15500	56700	369000
Ultra-Violet Disinfection	358000	0	3730	3580	1250	8940	30300
Effluent	0	0	0	0	0	0	0
Blower System	714000	0	0	0	0	0	59900
Other Costs	8590000	141000	0	0	0	0	704000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	10	acre
Administration labor hours	321	hr/yr
Laboratory labor hours	2410	hr/yr
Costs		
DIRECT COSTS		
Mobilization	171000	\$
Site preparation	303000	\$
Site electrical	448000	\$
Yard piping	309000	\$
Instrumentation and control	208000	\$
Lab and administration building	526000	\$
Total direct construction costs	1960000	\$
INDIRECT COSTS		
Cost of land	200000	\$
Miscellaneous cost	502000	\$
Legal cost	201000	\$
Engineering design fee	1500000	\$
Inspection cost	201000	\$
Contingency	1000000	\$
Technical	201000	\$
Interest during construction	1500000	\$
Profit	1310000	\$
Total indirect construction cost	6620000	\$
Total of other construction costs	8590000	\$
LABOR COSTS		
Administration labor cost	16500	\$/yr
Laboratory labor cost	124000	\$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	6890	scfm
Safety factor	1.5	
Requested air flow capacity	10300	scfm
Total capacity of blowers	10300	scfm
Number of blowers in use	2	
Total number of blowers	3	
Capacity of individual blowers	5170	scfm
Estimated cost of an installed blower	164000	\$
Blower building area	1360	sqft
Costs		
Construction and equipment cost	714000	\$
Installed Blower Cost	493000	\$
Building Cost	150000	\$
Misc Costs	70800	\$
Operational labor cost	0	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	0	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	59900	\$/yr

Notes
Energy costs are shown at the individual unit processes that require air

Influent Wastewater

Preliminary Treatment

Design Output Data

Description	Value	Units
Preliminary Treatment		
Design Information		
Mechanically Cleaned Bar Screen		
Bar size	0.25	in
Bar spacing	0.375	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.444	ft
Approach velocity	2.5	ft/s

Average flow through velocity (2.5 ft/s
Maximum flow through velocity	3 ft/s
Screen channel width	0.559 ft
Average channel depth	1 ft
Horizontal Flow Grit Chamber	
Maximum flow	4.63 cuft/s
Average flow	1.4 cuft/s
Minimum flow	0.936 cuft/s
Temperature	10.1 deg C
Maximum flow through velocity	1.5 ft/s
Average flow through velocity (1 ft/s
Size of smallest particle 100%	0.2 mm
Specific gravity of particle	2.65
Number of units	2
Maximum flow/unit	2.32 cuft/s
Width of channel	0.386 ft
Depth of channel	4 ft
Length of channel	144 ft
Settling velocity of particle	0.0708 ft/s
Slope of channel bottom	0.00567
Allowance for currents	1.7
Manning coefficient	0.035
Hydraulic retention time	1.6 min
Volume of grit	3.63 cuft/d
Costs	
Construction and equipment co	317000 \$
Operational labor cost	29900 \$/yr
Maintenance labor cost	13700 \$/yr
Material and supply cost	7920 \$/yr
Chemical cost	0 \$/yr
Energy cost	1530 \$/yr
Amortization cost	26600 \$/yr

Aerobic Digestion

Design Output Data

Description	Value	Units
Aerobic Digestion		
Design Information		
Solids retention time	28.2 d	
Design SS	12000 mg/L	
Calculated VSS	7280 mg/L	
Calculated VSS:TSS ratio	0.607 mg VSS/mg SS	
Total volume of reactors	1240 m ³	
Length of parallel train	13 m	
Width of parallel train	10 m	
Sidewater depth	5 m	
Number of batteries	1	
Number of parallel trains per b	2	
Oxygen requirement to meet a	544 kg/d	
Air flow required to meet avera	3010 N m ³ /hr	
Design air flow	40.3 N m ³ /min/1000 m ³	
Volatile solids loading	0.0358 lb/(cuft-d)	
Solids accumulated	1170 lb/d	
Digester capacity	32900 lb	
Volume of wasted sludge	150000 gal(US)	
Quantities		
Operation labor required	1240 pers-hrs/yr	
Maintenance labor required	615 pers-hrs/yr	
Electrical energy required	477000 kWh/yr	
Volume of earthwork required	35200 cuft	
Volume of slab concrete requir	7530 cuft	
Volume of wall concrete requir	6010 cuft	
Handrail length	165 ft	
Number of diffusers per train	78	
Number of swing arm headers	2	
Costs		
Construction and equipment co	420000 \$	
Earthwork Cost	10400 \$	
Wall Concrete Cost	145000 \$	
Slab Concrete Cost	97600 \$	
Handrail Cost	12400 \$	
Installed Aerator Equipment	85800 \$	
Air Piping Cost	27100 \$	
Misc Costs	41600 \$	
Operational labor cost	63800 \$/yr	
Maintenance labor cost	25500 \$/yr	
Material and supply cost	46200 \$/yr	
Chemical cost	0 \$/yr	
Energy cost	47700 \$/yr	
Amortization cost	36900 \$/yr	

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	1140	sqft
Surface area per circular clarifi	570	sqft
Diameter of each circular clarif	27	ft
Number of clarifiers per batter	2	
Number of batteries	1	
Solids loading rate	1.65	lb/(sqft-d)
Hydraulic retention time	2.02	hr
Weir length	301	ft
Volume of sludge generated	3270	gpd(US)
Quantities		
Operation labor required	365	pers-hrs/yr
Maintenance labor required	207	pers-hrs/yr
Electrical energy required	7500	kWh/yr
Volume of earthwork required	15400	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	1340	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	1930	cuft
Costs		
Construction and equipment cc	195000	\$
Earthwork Cost	4550	\$
Wall Concrete Cost	46300	\$
Slab Concrete Cost	17400	\$
Installed Equipment Cost	96800	\$
Misc Costs	29700	\$
Operational labor cost	18800	\$/yr
Maintenance labor cost	8600	\$/yr
Material and supply cost	1950	\$/yr
Chemical cost	0	\$/yr
Energy cost	750	\$/yr
Amortization cost	18400	\$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00327	MGD(US)
Total pumping capacity	0.00327	MGD(US)
Design capacity per pump	1.14	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00327	MGD(US)
Quantities		
Operation labor required	211	pers-hrs/yr
Maintenance labor required	155	pers-hrs/yr
Electrical energy required	111	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	31200	\$
Earthwork Cost	474	\$
Pump Building Cost	22000	\$
Installed Pump Cost	3940	\$
Misc Costs	4760	\$
Operational labor cost	10900	\$/yr
Maintenance labor cost	6410	\$/yr
Material and supply cost	218	\$/yr
Chemical cost	0	\$/yr
Energy cost	11	\$/yr
Amortization cost	2950	\$/yr

Belt-Filter Press**Design Output Data**

Description	Value	Units
Belt-Filter Press		
Design Information		
Belt filter width	1	m
Number of units	1	
Hydraulic loading per unit per r	70	gpm(US)
Hydraulic loading required per	15.5	gpm(US)
Final solids content	15	%
Solids capture fraction	0.996	
Quantities		
Operation labor required	37	pers-hrs/yr
Maintenance labor required	9.26	pers-hrs/yr
Power	12800	kWh/yr
Polymer required	4860	lb/yr
Dry solids produced	1330	lb/d
Belt filter(s)	275000	\$
Building	279000	\$
Installation	68800	\$

Polymer system	82500 \$
Feed pumps	30300 \$
Conveyor system	77000 \$
Costs	
Construction and equipment cost	812000 \$
Building Cost	279000 \$
Polymer System Cost	82500 \$
Feed Pumps Cost	30300 \$
Conveyor System Cost	77000 \$
Installed Belt Filter	344000 \$
Operational labor cost	1910 \$/yr
Maintenance labor cost	384 \$/yr
Material and supply cost	0 \$/yr
Chemical cost	6320 \$/yr
Energy cost	1280 \$/yr
Amortization cost	74300 \$/yr

BNR - 3/5 Stage with MBR

Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		
Design Information		
Influent BOD/TP ratio too small		
3-Stage Biological Phosphorus		
Max. specific growth of nitrifier:	0.379	1/d
Death rate of nitrifiers at winter	0.0604	1/d
Minimum aerobic SRT for nitrification	4.67	d
Design aerobic SRT for nitrification	6.47	d
Total reactor SRT	10.5	d
Design SS	9000	mg/L
Calculated VSS	6360	mg/L
Calculated VSS:TSS ratio	0.706	mg VSS/mg SS
Total volume of anaerobic reactor	0	m3
Total volume of anoxic reactor	207	m3
Total volume of aerobic reactor	332	m3
Total volume of all reactors	539	m3
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per battery	2	
Number of anoxic cells within battery	1	
Number of aerobic cells within battery	1	
Anaerobic hydraulic retention time	0	hr
Anoxic hydraulic retention time	1.44	hr
Aerobic hydraulic retention time	2.32	hr
Amount of sludge generated	462	kg/d
Sludge recycle ratio	300	%
Sludge recycle rate	10300	m3/d
Nitrogen required for biomass	13.3	mg/L
Phosphorus required for biomass	2.67	mg/L
Oxygen required to meet average	725	kg/d
Air flow required to meet average	1200	N m3/hr
Design air flow	60.4	N m3/min/1000 m3
Quantities		
Operation labor required	1380	pers-hrs/yr
Maintenance labor required	657	pers-hrs/yr
Electrical energy required	260000	kWh/yr
Volume of earthwork required	24400	cuft
Volume of slab concrete required	5040	cuft
Volume of wall concrete required	4530	cuft
Handrail length	126	ft
Number of diffusers per train	214	
Fine bubble diffuser floor coverage	22	%
Number of swing arm headers	1	
Required mixing power	3.9	kW
Total number of mixers	4	
Design mixing power per mixer	1.12	kW
Mixing power for each anaerobic	0.975	kW
Costs		
Construction and equipment cost	374000	\$
Earthwork Cost	7220	\$
Wall Concrete Cost	109000	\$
Slab Concrete Cost	65400	\$
Handrail Cost	9450	\$
Installed Aerator Equipment	68100	\$
Air Piping Cost	21100	\$
Installed Mixer Equipment Cost	56200	\$
Misc Costs	37000	\$
Operational labor cost	71200	\$/yr
Maintenance labor cost	27300	\$/yr
Material and supply cost	13600	\$/yr
Chemical cost	0	\$/yr

Energy cost	26000 \$/yr
Amortization cost	35400 \$/yr
Internal Recycle Pumping	
Design Information	
Average daily pumping rate	1.36 MGD(US)
Total pumping capacity	1.36 MGD(US)
Design capacity per pump	473 gpm(US)
Number of pumps	6
Number of batteries	1
Firm pumping capacity	1.36 MGD(US)
Quantities	
Operation labor required	458 pers-hrs/yr
Maintenance labor required	377 pers-hrs/yr
Electrical energy required	91300 kWh/yr
Volume of earthwork required	1820 cuft
Area of pump building	227 sqft
Costs	
Construction and equipment cost	193000 \$
Earthwork Cost	1080 \$
Pump Building Cost	49900 \$
Installed Pump Cost	112000 \$
Misc Costs	29400 \$
Operational labor cost	23600 \$/yr
Maintenance labor cost	15600 \$/yr
Material and supply cost	1350 \$/yr
Chemical cost	0 \$/yr
Energy cost	9130 \$/yr
Amortization cost	18200 \$/yr
Internal Recycle Pumping	
Design Information	
Average daily pumping rate	1.82 MGD(US)
Total pumping capacity	1.82 MGD(US)
Design capacity per pump	631 gpm(US)
Number of pumps	6
Number of batteries	1
Firm pumping capacity	1.82 MGD(US)
Quantities	
Operation labor required	475 pers-hrs/yr
Maintenance labor required	393 pers-hrs/yr
Electrical energy required	122000 kWh/yr
Volume of earthwork required	1890 cuft
Area of pump building	236 sqft
Costs	
Construction and equipment cost	213000 \$
Earthwork Cost	1120 \$
Pump Building Cost	51900 \$
Installed Pump Cost	128000 \$
Misc Costs	32500 \$
Operational labor cost	24500 \$/yr
Maintenance labor cost	16300 \$/yr
Material and supply cost	1490 \$/yr
Chemical cost	0 \$/yr
Energy cost	12200 \$/yr
Amortization cost	20100 \$/yr
Sludge Recycle Pumping	
Design Information	
Average daily pumping rate	0.909 MGD(US)
Total pumping capacity	0.909 MGD(US)
Design capacity per pump	316 gpm(US)
Number of pumps	3
Number of batteries	1
Firm pumping capacity	0.909 MGD(US)
Quantities	
Operation labor required	435 pers-hrs/yr
Maintenance labor required	355 pers-hrs/yr
Electrical energy required	30500 kWh/yr
Volume of earthwork required	1740 cuft
Area of pump building	218 sqft
Costs	
Construction and equipment cost	84300 \$
Earthwork Cost	517 \$
Pump Building Cost	24000 \$
Installed Pump Cost	47000 \$
Misc Costs	12900 \$
Operational labor cost	22400 \$/yr
Maintenance labor cost	14700 \$/yr
Material and supply cost	590 \$/yr
Chemical cost	0 \$/yr
Energy cost	3050 \$/yr
Amortization cost	7980 \$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	4.38	cuyd/d
Truck capacity	19	cuyd
Round trip time to disposal site	1	hr
Truck loading time	0.75	hr
Operational hours per day	8	hr
Number of trucks required	1	
Distance to disposal site	10	miles
Quantities		
Total sludge volume hauled	4.38	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	444	sqft
Width of sludge storage shed	14.9	ft
Length of sludge storage shed	29.8	ft
Volume of earthwork required	1410	cuft
Volume of slab concrete requir	648	cuft
Surface area of canopy roof	444	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per	5000	miles
Sludge hauled	3.88	ton(short)/d
Operation labor required	68.5	pers-hrs/yr
LandFilling cost	35200	\$/yr
Costs		
Construction and equipment co	301000	\$
Earthwork Cost	417	\$
Slab Concrete Cost	8400	\$
Canopy Roof Cost	8870	\$
Vehicle Cost	283000	\$
Operational labor cost	3530	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	53600	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	62700	\$/yr

Membrane Bioreactor**Design Output Data**

Description	Value	Units
Membrane Bioreactor		
Design Information		
Total volume of reactors	18600	cuft
Length of parallel train	27.5	ft
Width of parallel train	13.8	ft
Sidewater depth	16.4	ft
Number of batteries	1	
Number of parallel trains per b	3	
Total Membrane Area	23700	m2
Total Scour Air Requirement	4750	N m3/hr
Quantities		
Operation labor required	2960	pers-hrs/yr
Maintenance labor required	1580	pers-hrs/yr
Electrical energy required	540000	kWh/yr
Volume of earthwork required	19900	cuft
Volume of slab concrete requir	4090	cuft
Volume of wall concrete requir	5390	cuft
Handrail length	309	ft
Number of diffusers per train	117	
Number of swing arm headers	2	
Costs		
Construction and equipment co	2510000	\$
Earthwork Cost	5910	\$
Wall Concrete Cost	130000	\$
Slab Concrete Cost	53000	\$
Handrail Cost	23100	\$
Membrane Cost	2050000	\$
Installed Aerator Equipment	133000	\$
Air Piping Cost	68400	\$
Misc Cost	60200	\$
Operational labor cost	152000	\$/yr
Maintenance labor cost	65700	\$/yr
Material and supply cost	25100	\$/yr
Chemical cost	15500	\$/yr
Energy cost	54000	\$/yr
Amortization cost	346000	\$/yr
Permeate Pumping		
Design Information		
Average daily pumping rate	0.454	MGD(US)

Total pumping capacity	1.5 MGD(US)
Design capacity per pump	580 gpm(US)
Number of pumps	6
Number of batteries	1
Firm pumping capacity	3.34 MGD(US)
Quantities	
Operation labor required	514 pers-hrs/yr
Maintenance labor required	430 pers-hrs/yr
Electrical energy required	27500 kWh/yr
Volume of earthwork required	1860 cuft
Area of pump building	233 sqft
Costs	
Construction and equipment cc	207000 \$
Earthwork Cost	1100 \$
Pump Building Cost	51300 \$
Installed Pump Cost	123000 \$
Misc Costs	31500 \$
Operational labor cost	26500 \$/yr
Maintenance labor cost	17800 \$/yr
Material and supply cost	1450 \$/yr
Chemical cost	0 \$/yr
Energy cost	2750 \$/yr
Amortization cost	19600 \$/yr
Waste Sludge Pumping	
Design Information	
Average daily pumping rate	0.00988 MGD(US)
Total pumping capacity	0.00988 MGD(US)
Design capacity per pump	3.43 gpm(US)
Number of pumps	3
Number of batteries	1
Firm pumping capacity	0.00988 MGD(US)
Quantities	
Operation labor required	243 pers-hrs/yr
Maintenance labor required	182 pers-hrs/yr
Electrical energy required	335 kWh/yr
Volume of earthwork required	1600 cuft
Area of pump building	200 sqft
Costs	
Construction and equipment cc	34100 \$
Earthwork Cost	475 \$
Pump Building Cost	22000 \$
Installed Pump Cost	6410 \$
Misc Costs	5200 \$
Operational labor cost	12500 \$/yr
Maintenance labor cost	7550 \$/yr
Material and supply cost	239 \$/yr
Chemical cost	0 \$/yr
Energy cost	34 \$/yr
Amortization cost	3230 \$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calculati	2.12	gal(US)/(min-W)
Total number of lamps needed	74	
Number of spare channels	1	
Total number of lamps used in	120	
Number of excess lamps	46	
Number of lamps/modules	4	
Number of modules/bank	5	
Number of banks/channel	2	
Number of channels	3	
Calculated headloss	3.28	in
Costs		
Construction and equipment cc	358000	\$
Cost of installation	215000	\$
Total cost of UV lamps	143000	\$
Operational labor cost	0	\$/yr
Maintenance labor cost	3730	\$/yr
Material and supply cost	3580	\$/yr
Chemical cost	1250	\$/yr
Energy cost	8940	\$/yr
Amortization cost	30300	\$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cc	0	\$
Operational labor cost	0	\$/yr

Maintenance labor cost	0 \$/yr
Material and supply cost	0 \$/yr
Chemical cost	0 \$/yr
Energy cost	0 \$/yr
Amortization cost	0 \$/yr