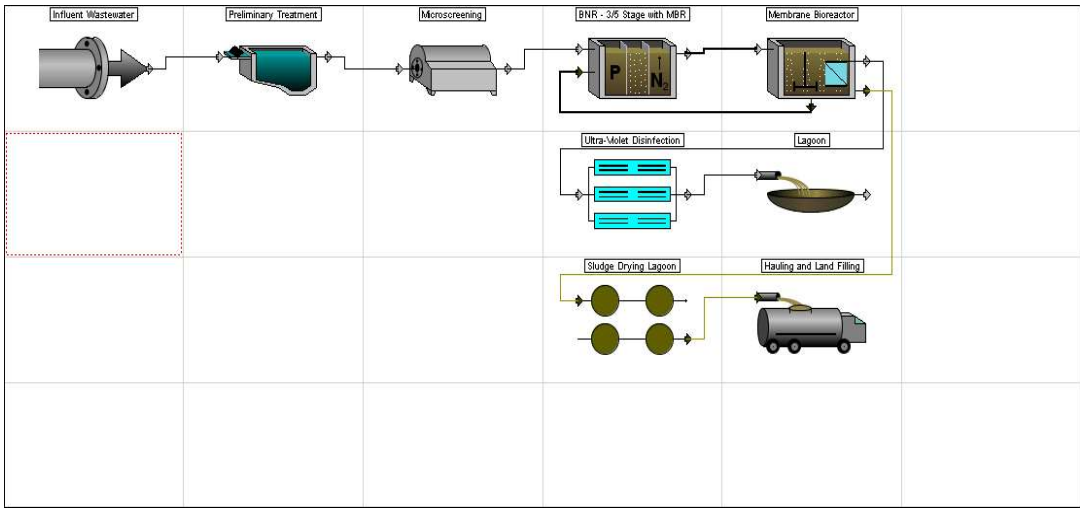
Layout - Santaquin City



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$6,180,000	$
Other direct construction costs	$2,110,000	$
Other indirect construction cos	$6,320,000	$
Total construction costs	$14,600,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$18,000	$/yr
Laboratory labor cost	$126,000	$/yr
Unit process operation labor c	$409,000	$/yr
Unit process maintenance labc	$192,000	$/yr
Total labor costs	$746,000	$/yr
MATERIAL COSTS		
Total material cost	$214,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$16,700	$/yr
ENERGY COSTS		
Total energy cost	$143,000	$/yr
Total operation and maintanen	$1,120,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$1,410,000	$/yr
Total annual project cost	$2,530,000	$/yr
PROJECT SUMMARY		
Present worth	$30,400,000	$
Total project cost	$14,600,000	$
Total operation labor cost	$554,000	$/yr
Total maintenance labor cost	$192,000	$/yr
Total material cost	$214,000	$/yr
Total chemical cost	$16,700	$/yr
Total energy cost	$143,000	$/yr
Total amortization cost	$1,410,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Preliminary Treatment	316000	30900	13900	7910	0	1600	26500
Microscreening	619000	8240	4220	64300	0	13900	68400
BNR - 3/5 Stage with MBR	1020000	156000	79200	21400	0	61800	96000
Ultra-Violet Disinfection	358000	0	3690	3580	1250	8940	30300
Sludge Drying Lagoon	34400	3090	1410	0	0	0	2890
Membrane Bioreactor	2740000	191000	89700	26700	15400	56900	368000
Lagoon	194000	16100	0	0	0	0	20800
Hauling and Land Filling	290000	4080	0	90400	0	0	61900
Blower System	604000	0	0	0	0	0	50600
Other Costs	8430000	144000	0	0	0	0	689000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		

Quantities		
Required land	11	acre
Administration labor hours	349	hr/yr
Laboratory labor hours	2450	hr/yr
Costs		
DIRECT COSTS		
Mobilization	184000	$
Site preparation	322000	$
Site electrical	484000	$
Yard piping	333000	$
Instrumentation and control	225000	$
Lab and administration building	559000	$
Total direct construction costs	2110000	$
INDIRECT COSTS		
Cost of land	220000	$
Miscellaneous cost	476000	$
Legal cost	191000	$
Engineering design fee	1430000	$
Inspection cost	191000	$
Contingency	953000	$
Technical	191000	$
Interest during construction	1430000	$
Profit	1240000	$
Total indirect construction cost	6320000	$
Total of other construction cos	8430000	$
LABOR COSTS		
Administration labor cost	18000	$/yr
Laboratory labor cost	126000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	5020	scfm
Safety factor	1.5	
Requested air flow capacity	7530	scfm
Total capacity of blowers	7530	scfm
Number of blowers in use	2	
Total number of blowers	3	
Capacity of individual blowers	3760	scfm
Estimated cost of an installed b	135000	$
Blower building area	1260	sqft
Costs		
Construction and equipment co	604000	$
Installed Blower Cost	405000	$
Building Cost	138000	$
Misc Costs	59800	$
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	50600	$/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	1.5	in
Slope of bars from horizontal	30	degrees
Head loss through screen	0.0206	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	0.616	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	4.62	cuft/s
Average flow	1.54	cuft/s
Minimum flow	0.77	cuft/s
Temperature	10	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	2.31	cuft/s
Width of channel	0.385	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00562	
Allowance for currents	1.7	

Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	4	cuft/d
Costs		
Construction and equipment cc	316000	$
Operational labor cost	30900	$/yr
Maintenance labor cost	13900	$/yr
Material and supply cost	7910	$/yr
Chemical cost	0	$/yr
Energy cost	1600	$/yr
Amortization cost	26500	$/yr

Microscreening

Design Output Data

Description	Value	Units
Microscreening		
Design Information		
Microscreen loading rate	7	gal(US)/(sqft·min)
Quantity of wash water require	4	%
Area of microscreens required	298	sqft
Quantities		
Number of batteries	1	
Number of units/battery	2	
Drum diameter	10	ft
Drum width	10	ft
Area of selected unit	315	sqft
Area of building	223	sqft
Operation labor required	160	pers-hrs/yr
Maintenance labor required	103	pers-hrs/yr
Electrical energy required	139000	kWh/yr
Volume of wall concrete requir	3440	cuft
Volume of earthwork required	8520	cuft
Costs		
Construction and equipment cc	619000	$
Earthwork Cost	2520	$
Slab Concrete Cost	82700	$
Building Cost	24500	$
Installed Equipment Cost	429000	$
Misc Costs	80800	$
Operational labor cost	8240	$/yr
Maintenance labor cost	4220	$/yr
Material and supply cost	64300	$/yr
Chemical cost	0	$/yr
Energy cost	13900	$/yr
Amortization cost	68400	$/yr

BNR - 3/5 Stage with MBR

Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		
Design Information		
3-Stage Biological Phosphorus		
Design aerobic SRT for nitrifica	12.5	d
Total reactor SRT	25	d
Design SS	9000	mg/L
Calculated VSS	6490	mg/L
Calculated VSS:TSS ratio	0.721	mg VSS/mg SS
Total volume of anaerobic reac	22.1	m3
Total volume of anoxic reactors	531	m3
Total volume of aerobic reacto	554	m3
Total volume of all reactors	1110	m3
Width of parallel train	10	m
Sidewater depth	5	m
Number of batteries	1	
Number of parallel trains per b	2	
Number of anoxic cells within c	1	
Number of aerobic cells within	1	
Anaerobic hydraulic retention t	0.14	hr
Anoxic hydraulic retention time	3.37	hr
Aerobic hydraulic retention tim	3.51	hr
Amount of sludge generated	399	kg/d
Sludge recycle ratio	300	%
Sludge recycle rate	11400	m3/d
Nitrogen required for biomass	12.9	mg/L
Phosphorus required for bioma	2.58	mg/L
Oxygen required to meet avera	794	kg/d
Air flow required to meet avera	1320	N m3/hr
Design air flow	39.7	N m3/min/1000 m3
Quantities		
Operation labor required	1650	pers-hrs/yr
Maintenance labor required	791	pers-hrs/yr
Electrical energy required	351000	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	211	
Fine bubble diffuser floor cove	14.4	%
Number of swing arm headers	2	
Required mixing power	9.1	kW
Total number of mixers	4	
Design mixing power per mixer	3.73	kW

Mixing power for each unaerat	2.28	kW
Costs		
Construction and equipment c	513000	$
Earthwork Cost	10400	$
Wall Concrete Cost	145000	$
Slab Concrete Cost	97600	$
Handrail Cost	12400	$
Installed Aerator Equipment	107000	$
Air Piping Cost	21000	$
Installed Mixer Equipment C	68600	$
Misc Costs	50800	$
Operational labor cost	84800	$/yr
Maintenance labor cost	32400	$/yr
Material and supply cost	17900	$/yr
Chemical cost	0	$/yr
Energy cost	35100	$/yr
Amortization cost	48100	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	1.5	MGD(US)
Total pumping capacity	1.5	MGD(US)
Design capacity per pump	521	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	1.5	MGD(US)
Quantities		
Operation labor required	464	pers-hrs/yr
Maintenance labor required	382	pers-hrs/yr
Electrical energy required	100000	kWh/yr
Volume of earthwork required	1840	cuft
Area of pump building	230	sqft
Costs		
Construction and equipment c	199000	$
Earthwork Cost	1090	$
Pump Building Cost	50500	$
Installed Pump Cost	117000	$
Misc Costs	30400	$
Operational labor cost	23900	$/yr
Maintenance labor cost	15700	$/yr
Material and supply cost	1390	$/yr
Chemical cost	0	$/yr
Energy cost	10000	$/yr
Amortization cost	18800	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	2	MGD(US)
Total pumping capacity	2	MGD(US)
Design capacity per pump	694	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	2	MGD(US)
Quantities		
Operation labor required	481	pers-hrs/yr
Maintenance labor required	399	pers-hrs/yr
Electrical energy required	134000	kWh/yr
Volume of earthwork required	1920	cuft
Area of pump building	239	sqft
Costs		
Construction and equipment c	220000	$
Earthwork Cost	1140	$
Pump Building Cost	52700	$
Installed Pump Cost	133000	$
Misc Costs	33600	$
Operational labor cost	24800	$/yr
Maintenance labor cost	16300	$/yr
Material and supply cost	1540	$/yr
Chemical cost	0	$/yr
Energy cost	13400	$/yr
Amortization cost	20800	$/yr
Sludge Recycle Pumping		
Design Information		
Average daily pumping rate	1	MGD(US)
Total pumping capacity	1	MGD(US)
Design capacity per pump	347	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	1	MGD(US)
Quantities		
Operation labor required	440	pers-hrs/yr
Maintenance labor required	360	pers-hrs/yr
Electrical energy required	33500	kWh/yr
Volume of earthwork required	1760	cuft
Area of pump building	220	sqft
Costs		
Construction and equipment c	87000	$
Earthwork Cost	521	$
Pump Building Cost	24200	$
Installed Pump Cost	49000	$
Misc Costs	13300	$
Operational labor cost	22700	$/yr
Maintenance labor cost	14800	$/yr
Material and supply cost	609	$/yr

Chemical cost	0	$/yr
Energy cost	3350	$/yr
Amortization cost	8220	$/yr

Ultra-Violet Disinfection

Design Output Data

Description	Value	Units
Ultra-Violet Disinfection		
Design Information		
Design based on a model calc	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	3.27	in
Costs		
Construction and equipment c	358000	$
Cost of installation	215000	$
Total cost of UV lamps	143000	$
Operational labor cost	0	$/yr
Maintenance labor cost	3690	$/yr
Material and supply cost	3580	$/yr
Chemical cost	1250	$/yr
Energy cost	8940	$/yr
Amortization cost	30300	$/yr

Sludge Drying Lagoon

Design Output Data

Description	Value	Units
Sludge Drying Lagoon		
Design Information		
Sludge flow	8520	gpd(US)
Initial solids content in sludge	1.2	%
Sludge depth in lagoon	1	ft
Dry solids produced	311000	lb/yr
Lagoon volume	135000	cuft
Total lagoon surface area	135000	sqft
Number of lagoons required	2	
Quantities		
Operation labor required	60.1	pers-hrs/yr
Maintenance labor required	34.3	pers-hrs/yr
Volume of earthwork required	86400	cuft
Volume of wall concrete requir	80	cuft
Surface area per lagoon	67700	sqft
Length of lagoon at top of leve	272	ft
Depth of cut	0.6	ft
Depth of fill	2.4	ft
Costs		
Construction and equipment c	34400	$
Earthwork Cost	25600	$
Wall Concrete Cost	1930	$
Misc Costs	6880	$
Operational labor cost	3090	$/yr
Maintenance labor cost	1410	$/yr
Material and supply cost	0	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	2890	$/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	13.7	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	4730	N m3/hr
Quantities		
Operation labor required	2960	pers-hrs/yr
Maintenance labor required	1580	pers-hrs/yr
Electrical energy required	538000	kWh/yr
Volume of earthwork required	19900	cuft
Volume of slab concrete requir	4080	cuft
Volume of wall concrete requir	5380	cuft
Handrail length	308	ft
Number of diffusers per train	117	
Number of swing arm headers	2	
Costs		
Construction and equipment c	2500000	$
Earthwork Cost	5900	$
Wall Concrete Cost	130000	$
Slab Concrete Cost	52900	$
Handrail Cost	23100	$

Membrane Cost	2040000	$
Installed Aerator Equipment (	133000	$
Air Piping Cost	68200	$
Misc Cost	60100	$
Operational labor cost	152000	$/yr
Maintenance labor cost	64800	$/yr
Material and supply cost	25000	$/yr
Chemical cost	15400	$/yr
Energy cost	53800	$/yr
Amortization cost	345000	$/yr
Permeate Pumping		
Design Information		
Average daily pumping rate	0.5	MGD(US)
Total pumping capacity	1.5	MGD(US)
Design capacity per pump	579	gpm(US)
Number of pumps	6	
Number of batteries	1	
Firm pumping capacity	3.33	MGD(US)
Quantities		
Operation labor required	514	pers-hrs/yr
Maintenance labor required	430	pers-hrs/yr
Electrical energy required	30200	kWh/yr
Volume of earthwork required	1860	cuft
Area of pump building	233	sqft
Costs		
Construction and equipment co	207000	$
Earthwork Cost	1100	$
Pump Building Cost	51200	$
Installed Pump Cost	123000	$
Misc Costs	31500	$
Operational labor cost	26500	$/yr
Maintenance labor cost	17600	$/yr
Material and supply cost	1450	$/yr
Chemical cost	0	$/yr
Energy cost	3020	$/yr
Amortization cost	19500	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00852	MGD(US)
Total pumping capacity	0.00852	MGD(US)
Design capacity per pump	2.96	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00852	MGD(US)
Quantities		
Operation labor required	239	pers-hrs/yr
Maintenance labor required	178	pers-hrs/yr
Electrical energy required	289	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment co	33600	$
Earthwork Cost	474	$
Pump Building Cost	22000	$
Installed Pump Cost	6010	$
Misc Costs	5130	$
Operational labor cost	12300	$/yr
Maintenance labor cost	7300	$/yr
Material and supply cost	235	$/yr
Chemical cost	0	$/yr
Energy cost	29	$/yr
Amortization cost	3180	$/yr

Lagoon

Design Output Data

Description	Value	Units
Facultative Lagoon		
Design Information		
Hydraulic retention time	1.64	d
BOD loading rate	20	lb/(acre·d)
Number of units	2	
Sidewater depth	6	ft
Depth of cut	3.6	ft
Length of unit at water level	147	ft
Surface area per unit	0.416	acre
Total surface area	0.833	acre
Volume of one unit	0.814	Mgal(US)
Total volume	1.63	Mgal(US)
Freeboard	2	ft
Quantities		
Area of lagoon liner	37100	sqft
Operation and maintenance lal	313	pers-hrs/yr
Pipe diameter	18	in
Length of pipe	92	ft
Number of butterfly valves	3	
Diameter of butterfly valves	18	in
Volume of earthwork required	101000	cuft
Volume of slab concrete requir	8	cuft
Volume of wall concrete requir	64	cuft
Costs		
Construction and equipment co	194000	$
Earthwork Cost	29900	$

Wall Concrete Cost	1540	$
Slab Concrete Cost	104	$
Installed Valves Cost	16100	$
Installed Pipe Cost	31100	$
Liner Cost	96200	$
Misc Costs	19200	$
Operational labor cost	16100	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	0	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	20800	$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	1.69	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	30	miles
Quantities		
Total sludge volume hauled	1.69	cuyd/d
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	171	sqft
Width of sludge storage shed	9.24	ft
Length of sludge storage shed	18.5	ft
Volume of earthwork required	621	cuft
Volume of slab concrete requir	298	cuft
Surface area of canopy roof	171	sqft
Round trip haul distance	60	miles
Round trips per day per truck	1	
Distance traveled per year per	15000	miles
Sludge hauled	1.49	ton(short)/d
Operation labor required	79.2	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment c	290000	$
Earthwork Cost	184	$
Slab Concrete Cost	3860	$
Canopy Roof Cost	3420	$
Vehicle Cost	283000	$
Operational labor cost	4080	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	90400	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	61900	$/yr