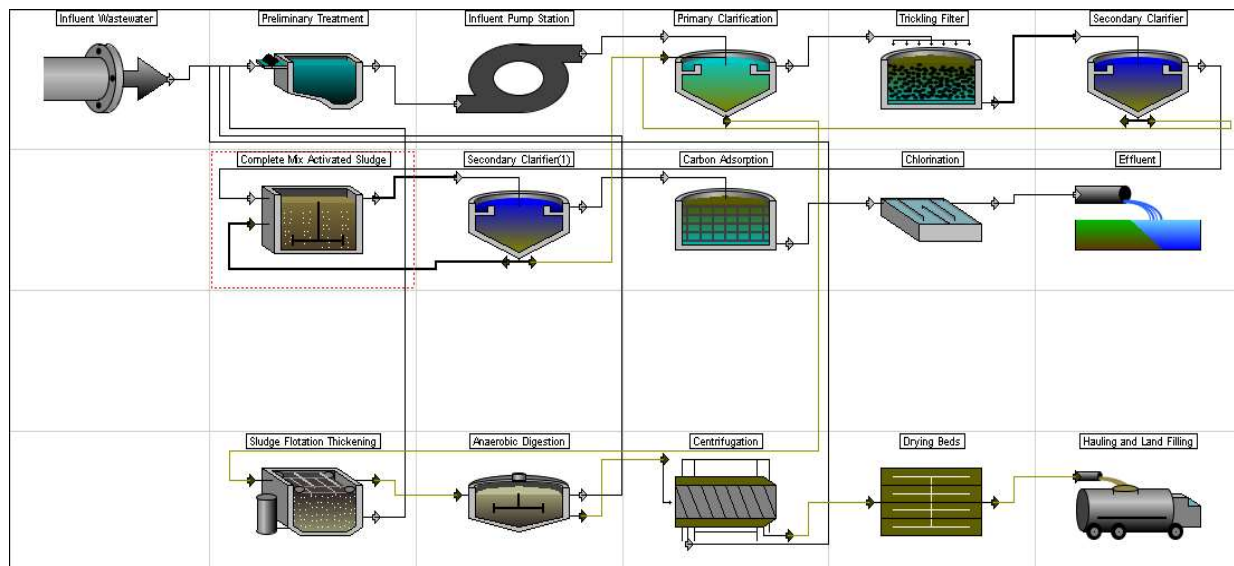


Layout - Provo City



Summary

Equipment Database

Hydromantis 2014, (USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	\$95,700,000	\$
Other direct construction costs	\$16,400,000	\$
Other indirect construction costs	\$82,900,000	\$
Total construction costs	\$195,000,000	\$

ANNUAL COSTS

LABOR COSTS

Administration labor cost	\$195,000	\$/yr
Laboratory labor cost	\$210,000	\$/yr
Unit process operation labor cost	\$2,960,000	\$/yr
Unit process maintenance labor cost	\$975,000	\$/yr
Total labor costs	\$4,340,000	\$/yr

MATERIAL COSTS

Total material cost	\$730,000	\$/yr
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CHEMICAL COSTS

Total chemical cost	\$531,000	\$/yr
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ENERGY COSTS

Total energy cost	\$1,110,000	\$/yr
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Total operation and maintenance	\$6,720,000	\$/yr
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CONSTRUCTION COST AMC

Amortization cost for total construction	\$16,700,000	\$/yr
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Total annual project cost	\$23,400,000	\$/yr
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PROJECT SUMMARY

Present worth	\$280,000,000	\$
Total project cost	\$195,000,000	\$
Total operation labor cost	\$3,370,000	\$/yr
Total maintenance labor cost	\$975,000	\$/yr
Total material cost	\$730,000	\$/yr
Total chemical cost	\$531,000	\$/yr
Total energy cost	\$1,110,000	\$/yr
Total amortization cost	\$16,700,000	\$/yr

Process Summary

Process	Construction (\$)	Operation (\$/yr)	Maintenance (\$/yr)	Material (\$/yr)	Chemical (\$/yr)	Energy (\$/yr)	Amortization (\$/yr)
Preliminary Treatment	1710000	189000	78000	42800	0	6570	144000
Complete Mix Activated Sludge	2860000	96900	53000	43900	0	79100	254000
Sludge Flotation Thickening	3600000	240000	42600	36700	10600	118000	343000
Influent Pump Station	13300000	74000	57000	92800	0	75100	1130000

Secondary Clarifier(1)	2450000	158000	82400	24400	0	2260	222000
Anaerobic Digestion	8300000	163000	94700	72300	0	30900	791000
Primary Clarification	1590000	113000	60200	15700	0	1900	146000
Carbon Adsorption	41200000	362000	31900	87800	0	600000	3600000
Centrifugation	2920000	643000	39300	94400	105000	29200	237000
Trickling Filter	10700000	109000	79000	62300	0	152000	919000
Chlorination	1510000	110000	34600	39700	415000	15200	147000
Drying Beds	2340000	522000	236000	21000	0	0	203000
Secondary Clarifier	2490000	163000	86200	24700	0	2960	226000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	366000	18200	0	72000	0	0	68200
Blower System	398000	0	0	0	0	0	33400
Other Costs	99300000	405000	0	0	0	0	8280000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	29	acre
Administration labor hours	3780	hr/yr
Laboratory labor hours	4090	hr/yr
Costs		
DIRECT COSTS		
Mobilization	1500000	\$
Site preparation	1820000	\$
Site electrical	4470000	\$
Yard piping	2890000	\$
Instrumentation and control	2420000	\$
Lab and administration building	3270000	\$
Total direct construction costs	16400000	\$
INDIRECT COSTS		
Cost of land	580000	\$
Miscellaneous cost	6440000	\$
Legal cost	2580000	\$
Engineering design fee	19300000	\$
Inspection cost	2580000	\$
Contingency	12900000	\$
Technical	2580000	\$
Interest during construction	19100000	\$
Profit	16800000	\$
Total indirect construction cost	82900000	\$
Total of other construction costs	99300000	\$
LABOR COSTS		
Administration labor cost	195000	\$/yr
Laboratory labor cost	210000	\$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	2160	scfm
Safety factor	1.5	
Requested air flow capacity	3250	scfm
Total capacity of blowers	3250	scfm
Number of blowers in use	1	
Total number of blowers	2	
Capacity of individual blowers	3250	scfm
Estimated cost of an installed blower	123000	\$
Blower building area	1010	sqft
Costs		
Construction and equipment cost	398000	\$
Installed Blower Cost	247000	\$
Building Cost	112000	\$
Misc Costs	39400	\$
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	33400	\$/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	0.5 in
Slope of bars from horizontal	30 degrees
Head loss through screen	0.176 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	13 ft
Average channel depth	1 ft
Horizontal Flow Grit Chamber	
Maximum flow	69.5 cuft/s
Average flow	32.5 cuft/s
Minimum flow	20.2 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	34.7 cuft/s
Width of channel	5.79 ft
Depth of channel	4 ft
Length of channel	144 ft
Settling velocity of particle	0.0707 ft/s
Slope of channel bottom	0.000344
Allowance for currents	1.7
Manning coefficient	0.035
Hydraulic retention time	1.6 min
Volume of grit	84.4 cuft/d
Costs	
Construction and equipment co	1710000 \$
Operational labor cost	189000 \$/yr
Maintenance labor cost	78000 \$/yr
Material and supply cost	42800 \$/yr
Chemical cost	0 \$/yr
Energy cost	6570 \$/yr
Amortization cost	144000 \$/yr

Complete Mix Activated Sludge

Design Output Data

Description	Value	Units
Complete Mix Activated Sludge		
Design Information		
Carbon Only Design		
Design SRT for design at wint	10 d	
Design SS	2500 mg/L	
Calculated VSS	1930 mg/L	
Calculated VSS:TSS ratio	0.771 mg VSS/mg SS	
Total volume of reactors	5570 m ³	
Length of parallel train	14 m	
Width of parallel train	10 m	
Sidewater depth	5 m	
Number of batteries	1	
Number of parallel trains per b	8	
Number of cells within one train	1	
Total number of dividing walls	0	
Hydraulic retention time	1.68 hr	
F/M ratio	0.1 lb BOD/lb MLSS/d	
Volumetric BOD loading	0.193 kg BOD/m ³ /d	
Observed yield (VSS basis)	0.747 g VSS/g BOD	
Observed yield (TSS basis)	0.968 g TSS/g BOD	
Amount of sludge generated	1390 kg/d	
Sludge recycle rate	26500 m ³ /d	
Nitrogen requirement for biom:	0.685 mg/L	
Phosphorus requirement for bi	0.137 mg/L	
Oxygen requirement to meet a	1570 kg/d	
Air flow required to meet avera	3660 N m ³ /hr	
Design air flow	10.9 N m ³ /min/1000 m ³	
Quantities		
Operation labor required	1320 pers-hrs/yr	
Maintenance labor required	659 pers-hrs/yr	
Electrical energy required	558000 kWh/yr	
Volume of earthwork required	132000 cuft	
Volume of slab concrete requir	73400 cuft	
Volume of wall concrete requir	29100 cuft	
Handrail length	1570 ft	
Number of diffusers per train	136	
Fine bubble diffuser floor cover	3.99 %	
Number of swing arm headers	2	
Costs		
Construction and equipment co	2610000 \$	

Earthwork Cost	39100 \$
Wall Concrete Cost	701000 \$
Slab Concrete Cost	951000 \$
Handrail Cost	117000 \$
Installed Aerator Equipment	390000 \$
Air Piping Cost	152000 \$
Misc Costs	259000 \$
Operational labor cost	67800 \$/yr
Maintenance labor cost	30700 \$/yr
Material and supply cost	42200 \$/yr
Chemical cost	0 \$/yr
Energy cost	55800 \$/yr
Amortization cost	231000 \$/yr
Sludge Recycle Pumping	
Design Information	
Average daily pumping rate	7 MGD(US)
Total pumping capacity	14 MGD(US)
Design capacity per pump	4860 gpm(US)
Number of pumps	3
Number of batteries	1
Firm pumping capacity	7 MGD(US)
Quantities	
Operation labor required	565 pers-hrs/yr
Maintenance labor required	480 pers-hrs/yr
Electrical energy required	234000 kWh/yr
Volume of earthwork required	3810 cuft
Area of pump building	476 sqft
Costs	
Construction and equipment cost	248000 \$
Earthwork Cost	1130 \$
Pump Building Cost	52400 \$
Installed Pump Cost	157000 \$
Misc Costs	37800 \$
Operational labor cost	29100 \$/yr
Maintenance labor cost	22300 \$/yr
Material and supply cost	1740 \$/yr
Chemical cost	0 \$/yr
Energy cost	23400 \$/yr
Amortization cost	23500 \$/yr

Sludge Flotation Thickening

Design Output Data

Description	Value	Units
Sludge Flotation Thickening		
Design Information		
Air to solids ratio	0.02	
Air pressure	60	psig
Solids loading rate	10	lb/(sqft·d)
Recycle flow	2.35	MGD(US)
Surface area required	4480	sqft
Volume of pressure tank	436	cuft
Volume of flotation tank	41500	cuft
Pressure tank detention time	2	min
Flotation tank detention time	3	hr
Polymer required	22.4	lb/d
Quantities		
Number units	4	
Surface area per flotation unit	1250	sqft
Diameter per flotation unit	39.9	ft
Amount of sludge generated	22.4	ton(long)/d
Area of flotation building	7520	sqft
Volume of earthwork required	61700	cuft
Slab thickness	10.1	in
Volume of slab concrete required	5330	cuft
Wall thickness	11.3	in
Volume of wall concrete required	5020	cuft
Sidewater depth	8.62	ft
Operation labor required	2410	pers-hrs/yr
Maintenance labor required	915	pers-hrs/yr
Electrical energy required	1180000	kWhr/yr
Costs		
Construction and equipment cost	3540000	\$
Earthwork Cost	18300	\$
Wall Concrete Cost	121000	\$
Slab Concrete Cost	69100	\$
Building Cost	621000	\$
Installed Equipment Cost	2170000	\$
Misc Costs	540000	\$
Operational labor cost	124000	\$/yr
Maintenance labor cost	42600	\$/yr
Material and supply cost	35400	\$/yr
Chemical cost	0	\$/yr

Energy cost	118000 \$/yr
Amortization cost	343000 \$/yr
Polymer Feed System	
Quantities	
Polymer dosage	22.4 lb/d
Liquid chemical solution fed	1070 gpd(US)
O&M labor required	1580 pers-hrs/yr
Dry material handling and mixii	665 pers-hrs/yr
Total operation labor required	2240 pers-hrs/yr
Costs	
Construction and equipment cc	64000 \$
Operational labor cost	115000 \$/yr
Maintenance labor cost	0 \$/yr
Material and supply cost	1280 \$/yr
Chemical cost	10600 \$/yr
Energy cost	0 \$/yr
Amortization cost	0 \$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	225000	cuft
Width of wet well	1150	ft
Depth of the pumping station	34.3	ft
Length of the pumping station	30	ft
Width of the pumping station	1190	ft
Minimum depth of water in wet	13.3	ft
Area of pump building	1310	sqft
Peak capacity of pumps	61.6	MGD(US)
Firm pumping capacity	61.6	MGD(US)
Total dynamic head - average	43.8	ft
Quantities		
Operation labor required	1440	pers-hrs/yr
Maintenance labor required	1230	pers-hrs/yr
Electrical energy required	751000	kWh/yr
Volume of earthwork required	4510000	cuft
Volume of slab concrete requir	442000	cuft
Volume of wall concrete requir	115000	cuft
Capacity per pump	42800	gpm(US)
Number of constant speed pur	2	
Number of variable speed purr	0	
Diameter of discharge header	46.7	in
Total dynamic head	51.8	ft
Size of selected pump	42	in
Specific speed of pump	6430	
Pump rotating speed	373	rpm
Motor size required	336	HP
Size of selected motor	350	HP
Width of pump system	9	ft
Length of pump system	32.7	ft
Length of the dry well	30	ft
Width of the dry well	41.7	ft
Costs		
Construction and equipment cc	13300000	\$
Earthwork Cost	1340000	\$
Wall Concrete Cost	2770000	\$
Slab Concrete Cost	5720000	\$
Building Cost	144000	\$
Installed Pump Equipment C	1250000	\$
Misc Costs	2020000	\$
Operational labor cost	74000	\$/yr
Maintenance labor cost	57000	\$/yr
Material and supply cost	92800	\$/yr
Chemical cost	0	\$/yr
Energy cost	75100	\$/yr
Amortization cost	1130000	\$/yr

Secondary Clarifier(1)

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	52500	sqft
Surface area per circular clarifi	13100	sqft
Diameter of each circular clarif	130	ft
Number of clarifiers per batterj	4	
Number of batteries	1	
Solids loading rate	11.1	lb/(sqft-d)
Hydraulic retention time	4.04	hr
Designed surface overflow rat	400	gal(US)/(sqft-d)

Weir length	3000 ft
Volume of wasted sludge	35700 gpd(US)
Quantities	
Operation labor required	2780 pers-hrs/yr
Maintenance labor required	1550 pers-hrs/yr
Electrical energy required	21400 kWh/yr
Volume of earthwork required	781000 cuft
Slab thickness	10.2 in
Volume of slab concrete requir	50100 cuft
Wall thickness	11.5 in
Volume of wall concrete requir	16900 cuft
Costs	
Construction and equipment cc	2410000 \$
Earthwork Cost	231000 \$
Wall Concrete Cost	407000 \$
Slab Concrete Cost	650000 \$
Installed Equipment Cost	752000 \$
Misc Costs	367000 \$
Operational labor cost	143000 \$/yr
Maintenance labor cost	72100 \$/yr
Material and supply cost	24100 \$/yr
Chemical cost	0 \$/yr
Energy cost	2140 \$/yr
Amortization cost	218000 \$/yr
Waste Sludge Pumping	
Design Information	
Average daily pumping rate	0.0357 MGD(US)
Total pumping capacity	0.0357 MGD(US)
Design capacity per pump	12.4 gpm(US)
Number of pumps	3
Number of batteries	1
Firm pumping capacity	0.0357 MGD(US)
Quantities	
Operation labor required	287 pers-hrs/yr
Maintenance labor required	220 pers-hrs/yr
Electrical energy required	1210 kWh/yr
Volume of earthwork required	1610 cuft
Area of pump building	201 sqft
Costs	
Construction and equipment cc	39900 \$
Earthwork Cost	476 \$
Pump Building Cost	22100 \$
Installed Pump Cost	11300 \$
Misc Costs	6090 \$
Operational labor cost	14800 \$/yr
Maintenance labor cost	10200 \$/yr
Material and supply cost	280 \$/yr
Chemical cost	0 \$/yr
Energy cost	121 \$/yr
Amortization cost	3780 \$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	5	%
Detention time	25	d
Digester depth	28	ft
Digester diameter	70	ft
Effective digester volume	475000	cuft
Number of digesters per batter	4	
Number of primary digesters p	3	
Number of secondary digester:	1	
Number of batteries	1	
Gas produced	142	cuft/min
Heat required	2660000	BTU/hr
Digester gas required	103	cuft/min
Total natural gas required	0	cuft/yr
Quantities		
Operation labor required	3160	pers-hrs/yr
Maintenance labor required	2030	pers-hrs/yr
Electrical energy required	309000	kWh/yr
Volume of earthwork required	474000	cuft
Slab thickness	11	in
Volume of slab concrete requir	15400	cuft
Wall thickness	21.5	in
Volume of wall concrete requir	53700	cuft
Sidewater depth	28	ft
Surface area/floor of 2-story cc	2390	sqft
Piping size	8	in

Length of total piping system	1320 ft
Number of 90 degree elbows	52
Number of tees	102
Number of plug valves	74
Total dry solids treated	17.9 ton(short)/d
Costs	
Construction and equipment cost	8300000 \$
Earthwork Cost	140000 \$
Wall Concrete Cost	1290000 \$
Slab Concrete Cost	200000 \$
Building Cost	263000 \$
Piping System Cost	769000 \$
Floating Cover Cost	2810000 \$
Gas Recirculation Units Cost	841000 \$
Heating Units Cost	779000 \$
Gas Safety Equipment Cost	240000 \$
Installed Pumps Cost	150000 \$
Operational labor cost	163000 \$/yr
Maintenance labor cost	94700 \$/yr
Material and supply cost	72300 \$/yr
Chemical cost	0 \$/yr
Energy cost	30900 \$/yr
Amortization cost	791000 \$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	26700	sqft
Surface area per circular clarifier	6680	sqft
Diameter of each circular clarifier	93	ft
Number of clarifiers per battery	4	
Number of batteries	1	
Solids loading rate	2.87	lb/(sqft-d)
Hydraulic retention time	2.02	hr
Weir length	4540	ft
Volume of sludge generated	134000	gpd(US)
Quantities		
Operation labor required	1850	pers-hrs/yr
Maintenance labor required	1030	pers-hrs/yr
Electrical energy required	14500	kWh/yr
Volume of earthwork required	358000	cuft
Slab thickness	10.2	in
Volume of slab concrete required	26300	cuft
Wall thickness	11.5	in
Volume of wall concrete required	12200	cuft
Costs		
Construction and equipment cost	1540000	\$
Earthwork Cost	106000	\$
Wall Concrete Cost	294000	\$
Slab Concrete Cost	340000	\$
Installed Equipment Cost	563000	\$
Misc Costs	235000	\$
Operational labor cost	95300	\$/yr
Maintenance labor cost	47800	\$/yr
Material and supply cost	15400	\$/yr
Chemical cost	0	\$/yr
Energy cost	1450	\$/yr
Amortization cost	141000	\$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.134	MGD(US)
Total pumping capacity	0.134	MGD(US)
Design capacity per pump	46.6	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.134	MGD(US)
Quantities		
Operation labor required	340	pers-hrs/yr
Maintenance labor required	268	pers-hrs/yr
Electrical energy required	4520	kWh/yr
Volume of earthwork required	1620	cuft
Area of pump building	203	sqft
Costs		
Construction and equipment cost	50700	\$
Earthwork Cost	480	\$
Pump Building Cost	22300	\$
Installed Pump Cost	20200	\$
Misc Costs	7740	\$
Operational labor cost	17500	\$/yr
Maintenance labor cost	12500	\$/yr

Material and supply cost	355 \$/yr
Chemical cost	0 \$/yr
Energy cost	452 \$/yr
Amortization cost	4800 \$/yr

Carbon Adsorption

Design Output Data

Description	Value	Units
Carbon Adsorption		
Design Information		
Gravity concrete adsorber		
Surface area per adsorber	1300	sqft
Number of adsorber trains	4	
Total number of adsorbers	8	
Depth of adsorption bed	20.1	ft
Backwash flow rate	7800	gpm(US)
Total volume of backwash per	936000	gal(US)
Carbon in system	2980000	lb
Adsorber service life	155	d
Regeneration rate	10800	lb/d
Width of gravity adsorber	25.5	ft
Length of gravity adsorber	51	ft
Height of adsorber columns	17	ft
Adsorber building area	2270	sqft
Volume of wall concrete requir	185000	cuft
Volume of earthwork required	196000	cuft
Number of flow control gates	16	
Quantities		
Operation labor required for ad	3630	pers-hrs/yr
Energy required for adsorption	1490000	kWh/yr
Costs		
Construction and equipment co	38900000	\$
Earthwork Cost	58100	\$
Wall Concrete Cost	4450000	\$
First Fill Carbon Cost	20300000	\$
Underdrain System Cost	865000	\$
Control Gate Cost	946000	\$
Backwash System Cost	454000	\$
Carbon Handling System Co	74700	\$
Building Cost	250000	\$
Misc Costs	11500000	\$
Operational labor cost	187000	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	38900	\$/yr
Chemical cost	0	\$/yr
Energy cost	149000	\$/yr
Amortization cost	3350000	\$/yr
Carbon Regeneration		
Design Information		
Number of furnaces	1	
Inside diameter of furnace	8.5	ft
Outside diameter of furnace	10.8	ft
Effective area per hearth	269	sqft
Spent carbon storage	2360	cuft
Reactivated carbon storage	2900	cuft
Quantities		
Operation labor required for re	2590	pers-hrs/yr
Energy required for regenerati	56900	kWh/yr
Steam required for regenerati	2360000	lb/yr
Fuel required for regeneration	17400000000	BTU/yr
Carbon make-up required	276000	lb/yr
Costs		
Construction and equipment co	1430000	\$
Furnace Cost	1150000	\$
Misc Cost	286000	\$
Operational labor cost	133000	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	42900	\$/yr
Chemical cost	0	\$/yr
Energy cost	381000	\$/yr
Amortization cost	168000	\$/yr
Pumping		
Design Information		
Average daily pumping rate	21	MGD(US)
Total pumping capacity	45	MGD(US)
Design capacity per pump	15600	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	21	MGD(US)
Quantities		
Operation labor required	816	pers-hrs/yr
Maintenance labor required	686	pers-hrs/yr

Electrical energy required	698000 kWh/yr
Volume of earthwork required	8700 cuft
Area of pump building	1090 sqft
Costs	
Construction and equipment cc	847000 \$
Earthwork Cost	2580 \$
Pump Building Cost	120000 \$
Installed Pump Cost	596000 \$
Misc Costs	129000 \$
Operational labor cost	42000 \$/yr
Maintenance labor cost	31900 \$/yr
Material and supply cost	5930 \$/yr
Chemical cost	0 \$/yr
Energy cost	69800 \$/yr
Amortization cost	80100 \$/yr

Centrifugation

Design Output Data

Description	Value	Units
Centrifugation		
Design Information		
Total power required	185	HP
Power required per unit	92.3	HP
Excess capacity factor	1.25	
Number of units	2	
Chemical dose	1	% dry wt
Chemicals required	38.8	lb/hr
Sludge flow	148	gpm(US)
Initial solid conc	5	%
Operational hours per day	8	hr
Operational days per week	5	d
Quantities		
Number of centrifuges	2	
Power required per unit	92.3	HP
Area of building	499	sqft
Dry solids produced	10.6	ton(short)/d
Operation labor required	4970	pers-hrs/yr
Maintenance labor required	845	pers-hrs/yr
Electrical energy required	292000	kWh/yr
Costs		
Construction and equipment cc	2360000	\$
Operational labor cost	256000	\$/yr
Maintenance labor cost	39300	\$/yr
Material and supply cost	83300	\$/yr
Chemical cost	0	\$/yr
Energy cost	29200	\$/yr
Amortization cost	237000	\$/yr
Polymer Feed System		
Quantities		
Polymer dosage	310	lb/d
Liquid chemical solution fed	14900	gpd(US)
O&M labor required	6110	pers-hrs/yr
Dry material handling and mixii	1400	pers-hrs/yr
Total operation labor required	7510	pers-hrs/yr
Costs		
Construction and equipment cc	552000	\$
Operational labor cost	387000	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	11000	\$/yr
Chemical cost	105000	\$/yr
Energy cost	0	\$/yr
Amortization cost	0	\$/yr

Trickling Filter

Design Output Data

Description	Value	Units
Trickling Filtration		
Design Information		
Reaction rate constant	0.00156	
Hydraulic loading rate	0.75	gal(US)/(sqft·min)
Total hydraulic loading rate	0.833	gal(US)/(sqft·min)
Recirculation ratio	0.111	
Number of towers per stage	2	
Number of stages	2	
Depth of filter tower	22.9	ft
Diameter of filter tower	112	ft
Surface area per filter tower	4920	sqft
Total surface area	19700	sqft
Volume per filter tower	225000	cuft
Total volume	899000	cuft
Quantities		
Operation labor required	1020	pers-hr/yr

Maintenance labor required	693 pers-hr/yr
Volume of earthwork required	548000 cuft
Volume of slab concrete requir	26200 cuft
Volume of wall concrete requir	36800 cuft
Number of posts per tower	682
Total length of precast beams	21500 ft
Costs	
Construction and equipment cc	9860000 \$
Earthwork Cost	162000 \$
Wall Concrete Cost	887000 \$
Slab Concrete Cost	340000 \$
Concrete Beam Cost	864000 \$
Media Cost	5130000 \$
Installed Distributor Arm Cos	507000 \$
Misc Costs	1970000 \$
Operational labor cost	52500 \$/yr
Maintenance labor cost	32300 \$/yr
Material and supply cost	56300 \$/yr
Chemical cost	0 \$/yr
Energy cost	1810 \$/yr
Amortization cost	838000 \$/yr
Internal Recycle Pumping	
Design Information	
Average daily pumping rate	45.2 MGD(US)
Total pumping capacity	45.2 MGD(US)
Design capacity per pump	15700 gpm(US)
Number of pumps	3
Number of batteries	1
Firm pumping capacity	45.2 MGD(US)
Quantities	
Operation labor required	1100 pers-hrs/yr
Maintenance labor required	1000 pers-hrs/yr
Electrical energy required	1500000 kWh/yr
Volume of earthwork required	8740 cuft
Area of pump building	1090 sqft
Costs	
Construction and equipment cc	853000 \$
Earthwork Cost	2590 \$
Pump Building Cost	120000 \$
Installed Pump Cost	600000 \$
Misc Costs	130000 \$
Operational labor cost	56600 \$/yr
Maintenance labor cost	46700 \$/yr
Material and supply cost	5970 \$/yr
Chemical cost	0 \$/yr
Energy cost	150000 \$/yr
Amortization cost	80700 \$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	937000	gal(US)
Average chlorine required	1750	lb/d
Peak chlorine required	3750	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	29.2	/100ml
Quantities		
Operational labor required	2140	pers-hrs/yr
Maintenance labor required	744	pers-hrs/yr
Electrical energy required	152000	kWh/yr
Volume of earthwork required	53100	cuft
Volume of slab concrete requir	12600	cuft
Volume of wall concrete requir	16000	cuft
Number of chlorinators and ev:	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	27	
Area of chlorine storage buildir	3780	sqft
Costs		
Construction and equipment cc	1510000	\$
Earthwork Cost	15700	\$
Wall Concrete Cost	384000	\$
Slab Concrete Cost	163000	\$
Installed Equipment Cost	611000	\$
Building Cost	24200	\$
Storage Building Cost	208000	\$
Misc Costs	101000	\$
Operational labor cost	110000	\$/yr
Maintenance labor cost	34600	\$/yr
Material and supply cost	39700	\$/yr
Chemical cost	415000	\$/yr

Energy cost	15200 \$/yr
Amortization cost	147000 \$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	168000	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	49.6	d
Quantities		
Total drying bed surface area	168000	sqft
Number beds	57	
Surface area of each individual	2950	sqft
Length of each bed	147	ft
Volume of earthwork required	827000	cuft
Volume concrete for dividing w	54800	cuft
Volume of R.C. in-place for tru	12600	cuft
Volume of sand	126000	cuft
Volume of gravel	168000	cuft
Clay pipe diameter	6	in
Total length clay pipe	16800	in
Sludge solids produced	9.5	ton(short)/d
Operational labor required	10100	pers-hrs/yr
Maintenance labor required	5060	pers-hrs/yr
Costs		
Construction and equipment co	2340000	\$
Earthwork Cost	245000	\$
Wall Concrete Cost	923000	\$
Slab Concrete Cost	98000	\$
Drying Bed Media Cost	469000	\$
Drain Pipe System Cost	370000	\$
Misc Costs	232000	\$
Operational labor cost	522000	\$/yr
Maintenance labor cost	236000	\$/yr
Material and supply cost	21000	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	203000	\$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	53100	sqft
Surface area per circular clarifi	13300	sqft
Diameter of each circular clarif	131	ft
Number of clarifiers per batter	4	
Number of batteries	1	
Solids loading rate	0.385	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	4520	ft
Volume of wasted sludge	238000	gpd(US)
Quantities		
Operation labor required	2800	pers-hrs/yr
Maintenance labor required	1560	pers-hrs/yr
Electrical energy required	21600	kWh/yr
Volume of earthwork required	795000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	50900	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	17000	cuft
Costs		
Construction and equipment co	2430000	\$
Earthwork Cost	236000	\$
Wall Concrete Cost	410000	\$
Slab Concrete Cost	659000	\$
Installed Equipment Cost	757000	\$
Misc Costs	371000	\$
Operational labor cost	144000	\$/yr
Maintenance labor cost	72600	\$/yr
Material and supply cost	24300	\$/yr
Chemical cost	0	\$/yr
Energy cost	2160	\$/yr
Amortization cost	220000	\$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.238	MGD(US)

Total pumping capacity	0.238 MGD(US)
Design capacity per pump	82.7 gpm(US)
Number of pumps	3
Number of batteries	1
Firm pumping capacity	0.238 MGD(US)
Quantities	
Operation labor required	366 pers-hrs/yr
Maintenance labor required	291 pers-hrs/yr
Electrical energy required	8010 kWh/yr
Volume of earthwork required	1640 cuft
Area of pump building	205 sqft
Costs	
Construction and equipment cost	57900 \$
Earthwork Cost	485 \$
Pump Building Cost	22500 \$
Installed Pump Cost	26100 \$
Misc Costs	8830 \$
Operational labor cost	18800 \$/yr
Maintenance labor cost	13600 \$/yr
Material and supply cost	405 \$/yr
Chemical cost	0 \$/yr
Energy cost	801 \$/yr
Amortization cost	5470 \$/yr

Effluent

Design Output Data

Description	Value	Units
Costs		
Construction and equipment cost	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	

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	22.6	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	22.6	cuyd/d
Maximum anticipated landfill duration	30	d
Anticipated sludge storage height	8	ft
Sludge storage shed area	2280	sqft
Width of sludge storage shed	33.8	ft
Length of sludge storage shed	67.6	ft
Volume of earthwork required	6360	cuft
Volume of slab concrete required	2750	cuft
Surface area of canopy roof	2280	sqft
Round trip haul distance	20	miles
Round trips per day per truck	2	
Distance traveled per year per truck	10000	miles
Sludge hauled	20	ton(short)/d
Operation labor required	353	pers-hrs/yr
LandFilling cost	35200	\$/yr
Costs		
Construction and equipment cost	366000	\$
Earthwork Cost	1890	\$
Slab Concrete Cost	35600	\$
Canopy Roof Cost	45700	\$
Vehicle Cost	283000	\$
Operational labor cost	18200	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	72000	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	68200	\$/yr