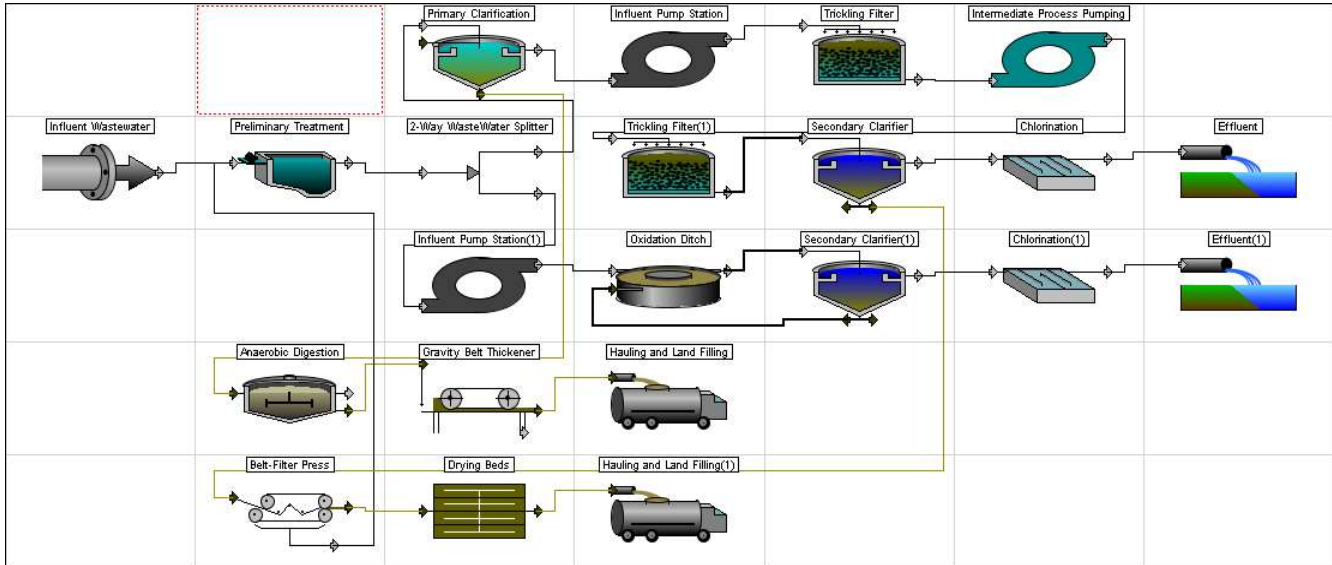


Layout 1 - Central Davis Sewer District



Summary

Equipment Database

Hydomantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost:	\$23,600,000	\$
Other direct construction costs:	\$10,200,000	\$
Other indirect construction costs:	\$25,300,000	\$
Total construction costs	\$59,000,000	\$

ANNUAL COSTS

LABOR COSTS

Administration labor cost	\$126,000	\$/yr
Laboratory labor cost	\$184,000	\$/yr
Unit process operation labor cost	\$981,000	\$/yr
Unit process maintenance labor cost	\$370,000	\$/yr
Total labor costs	\$1,660,000	\$/yr

MATERIAL COSTS

Total material cost	\$380,000	\$/yr
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CHEMICAL COSTS

Total chemical cost	\$243,000	\$/yr
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ENERGY COSTS

Total energy cost	\$675,000	\$/yr
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Total operation and maintenance \$2,960,000 \$/yr

CONSTRUCTION COST AMC

Amortization cost for total construction \$5,170,000 \$/yr

Total annual project cost \$8,130,000 \$/yr

PROJECT SUMMARY

Present worth	\$97,300,000	\$
Total project cost	\$59,000,000	\$
Total operation labor cost	\$1,290,000	\$/yr
Total maintenance labor cost	\$370,000	\$/yr
Total material cost	\$380,000	\$/yr
Total chemical cost	\$243,000	\$/yr
Total energy cost	\$675,000	\$/yr
Total amortization cost	\$5,170,000	\$/yr

Process Summary

Process	Construction (\$)	Operation (\$/yr)	Maintenance (\$/yr)	Material (\$/yr)	Chemical (\$/yr)	Energy (\$/yr)	Amortization (\$/yr)
Preliminary Treatment	1240000	116000	47300	31100	0	5060	104000
Anaerobic Digestion	3110000	55100	29400	41600	0	24300	294000
Belt-Filter Press	812000	864	181	0	2850	614	74300
Primary Clarification	456000	47500	24200	4450	0	957	42400

2-Way WasteWater Splitter	0	0	0	0	0	0	0
Influent Pump Station(1)	1110000	43400	30500	7800	0	40400	99900
Gravity Belt Thickener	812000	4600	963	0	5290	2160	74300
Drying Beds	1520000	28100	10600	13600	0	0	133000
Influent Pump Station	985000	38300	27100	6900	0	39900	87900
Trickling Filter(1)	986000	50700	36200	5030	0	36800	88400
Oxidation Ditch	4710000	207000	0	37800	0	445000	456000
Hauling and Land Filling	367000	18300	0	72000	0	0	68300
Hauling and Land Filling(1)	286000	477	0	53600	0	0	61500
Trickling Filter	2790000	50700	36200	16200	0	36900	241000
Secondary Clarifier	637000	63100	31000	6270	0	1020	59000
Secondary Clarifier(1)	1690000	117000	57900	16800	0	1960	151000
Intermediate Process Pumping	220000	27700	19600	1540	0	15900	20800
Chlorination	884000	50300	7670	32800	94500	11800	84800
Chlorination(1)	970000	61900	11200	32900	140000	12300	94200
Effluent	0	0	0	0	0	0	0
Effluent(1)	0	0	0	0	0	0	0
Other Costs	35400000	309000	0	0	0	0	2930000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	22	acre
Administration labor hours	2440	hr/yr
Laboratory labor hours	3570	hr/yr
Costs		
DIRECT COSTS		
Site preparation	1330000	\$
Site electrical	2970000	\$
Yard piping	1940000	\$
Instrumentation and control	1570000	\$
Lab and administration building	2360000	\$
Total direct construction costs	10200000	\$
INDIRECT COSTS		
Cost of land	440000	\$
Miscellaneous cost	1940000	\$
Legal cost	777000	\$
Engineering design fee	5820000	\$
Inspection cost	777000	\$
Contingency	3880000	\$
Technical	777000	\$
Interest during construction	5780000	\$
Profit	5060000	\$
Total indirect construction cost	25300000	\$
Total of other construction costs	35400000	\$
LABOR COSTS		
Administration labor cost	126000	\$/yr
Laboratory labor cost	184000	\$/yr

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	2.47	ft
Average channel depth	3	ft
Aerated Grit Chamber		
Maximum flow	41.6	cuft/s
Average flow	18.5	cuft/s
Minimum flow	15.4	cuft/s
Temperature	10	deg C
Maximum flow through velocity	0.152	ft/s
Average flow through velocity (0.0676	ft/s
Size of smallest particle 100%	0.2	mm
Specific gravity of particle	2.65	
Number of units	2	
Maximum flow/unit	20.8	cuft/s
Width of channel	22.8	ft
Depth of channel	6	ft

Length of channel	22.8 ft
Settling velocity of particle	0.0707 ft/s
Hydraulic retention time	2.5 min
Volume of grit	48 cuft/d
Air supply	3 cfm
Costs	
Construction and equipment cost	1240000 \$
Operational labor cost	116000 \$/yr
Maintenance labor cost	47300 \$/yr
Material and supply cost	31100 \$/yr
Chemical cost	0 \$/yr
Energy cost	5060 \$/yr
Amortization cost	104000 \$/yr

Anaerobic Digestion

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digester	5	%
Detention time	30	d
Digester depth	26.2	ft
Digester diameter	60	ft
Effective digester volume	162000	cuft
Number of digesters per battery	2	
Number of primary digesters per battery	1	
Number of secondary digesters per battery	1	
Number of batteries	1	
Gas produced	21.7	cuft/min
Heat required	801000	BTU/hr
Digester gas required	30.9	cuft/min
Total natural gas required	960000	cuft/yr
Quantities		
Operation labor required	1070	pers-hrs/yr
Maintenance labor required	682	pers-hrs/yr
Electrical energy required	79600	kWh/yr
Volume of earthwork required	162000	cuft
Slab thickness	10.6	in
Volume of slab concrete required	5510	cuft
Wall thickness	20.6	in
Volume of wall concrete required	20900	cuft
Sidewater depth	26.2	ft
Surface area/floor of 2-story cover	1060	sqft
Piping size	8	in
Length of total piping system	590	ft
Number of 90 degree elbows	26	
Number of tees	51	
Number of plug valves	37	
Total dry solids treated	2.45	ton(short)/d
Costs		
Construction and equipment cost	3110000	\$
Earthwork Cost	47900	\$
Wall Concrete Cost	502000	\$
Slab Concrete Cost	71500	\$
Building Cost	116000	\$
Piping System Cost	377000	\$
Floating Cover Cost	1060000	\$
Gas Recirculation Units Cost	254000	\$
Heating Units Cost	182000	\$
Gas Safety Equipment Cost	120000	\$
Installed Pumps Cost	74800	\$
Operational labor cost	55100	\$/yr
Maintenance labor cost	29400	\$/yr
Material and supply cost	41600	\$/yr
Chemical cost	0	\$/yr
Energy cost	24300	\$/yr
Amortization cost	294000	\$/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 run	70	gpm(US)
Hydraulic loading required per run	17.6	gpm(US)
Final solids content	19	%
Solids capture fraction	0.99	
Quantities		
Operation labor required	16.8	pers-hrs/yr

Maintenance labor required	4.2 pers-hrs/yr
Power	6140 kWh/yr
Polymer required	2190 lb/yr
Dry solids produced	600 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	864 \$/yr
Maintenance labor cost	181 \$/yr
Material and supply cost	0 \$/yr
Chemical cost	2850 \$/yr
Energy cost	614 \$/yr
Amortization cost	74300 \$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	4800	sqft
Surface area per circular clarifier	2400	sqft
Diameter of each circular clarifier	56	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	1.67	lb/(sqft-d)
Hydraulic retention time	1.62	hr
Weir length	720	ft
Volume of sludge generated	18600	gpd(US)
Quantities		
Operation labor required	658	pers-hrs/yr
Maintenance labor required	360	pers-hrs/yr
Electrical energy required	8940	kWh/yr
Volume of earthwork required	60100	cuft
Slab thickness	10.2	in
Volume of slab concrete required	5020	cuft
Wall thickness	11.5	in
Volume of wall concrete required	3760	cuft
Costs		
Construction and equipment cost	419000	\$
Earthwork Cost	17800	\$
Wall Concrete Cost	90500	\$
Slab Concrete Cost	65100	\$
Installed Equipment Cost	182000	\$
Misc Costs	63900	\$
Operational labor cost	33900	\$/yr
Maintenance labor cost	15500	\$/yr
Material and supply cost	4190	\$/yr
Chemical cost	0	\$/yr
Energy cost	894	\$/yr
Amortization cost	39000	\$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0186	MGD(US)
Total pumping capacity	0.0186	MGD(US)
Design capacity per pump	6.46	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0186	MGD(US)
Quantities		
Operation labor required	264	pers-hrs/yr
Maintenance labor required	200	pers-hrs/yr
Electrical energy required	630	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cost	36600	\$
Earthwork Cost	475	\$
Pump Building Cost	22000	\$
Installed Pump Cost	8480	\$
Misc Costs	5580	\$
Operational labor cost	13600	\$/yr
Maintenance labor cost	8620	\$/yr

Material and supply cost	256 \$/yr
Chemical cost	0 \$/yr
Energy cost	63 \$/yr
Amortization cost	3460 \$/yr

2-Way WasteWater Splitter

Design Output Data

Description	Value	Units
2-Way Wastewater Flow Splitter		
Design Information		
Flow to first split (average)	4.8	MGD(US)
Flow to first split (peak)	10.8	MGD(US)
Flow to first split (minimum)	4	MGD(US)
Flow to second split (average)	7.2	MGD(US)
Flow to second split (peak)	16.2	MGD(US)
Flow to second split (minimum)	6	MGD(US)
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

Influent Pump Station(1)

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	2040	cuft
Width of wet well	11.9	ft
Depth of the pumping station	27.9	ft
Length of the pumping station	28.6	ft
Width of the pumping station	41.7	ft
Minimum depth of water in wet well	6.91	ft
Area of pump building	893	sqft
Peak capacity of pumps	23.1	MGD(US)
Firm pumping capacity	23.1	MGD(US)
Total dynamic head - average	34.2	ft
Quantities		
Operation labor required	843	pers-hrs/yr
Maintenance labor required	708	pers-hrs/yr
Electrical energy required	404000	kWh/yr
Volume of earthwork required	186000	cuft
Volume of slab concrete required	9740	cuft
Volume of wall concrete required	6280	cuft
Capacity per pump	8040	gpm(US)
Number of constant speed pumps	1	
Number of variable speed pumps	2	
Diameter of discharge header	28.7	in
Total dynamic head	46.2	ft
Size of selected pump	18	in
Specific speed of pump	4550	
Pump rotating speed	791	rpm
Motor size required	114	HP
Size of selected motor	125	HP
Width of pump system	4.2	ft
Length of pump system	20.7	ft
Length of the dry well	28.6	ft
Width of the dry well	29.7	ft
Costs		
Construction and equipment cost	1110000	\$
Earthwork Cost	55200	\$
Wall Concrete Cost	151000	\$
Slab Concrete Cost	126000	\$
Building Cost	98200	\$
Installed Pump Equipment Cost	487000	\$
Installed Control Module Cost	25800	\$
Misc Costs	170000	\$
Operational labor cost	43400	\$/yr
Maintenance labor cost	30500	\$/yr
Material and supply cost	7800	\$/yr
Chemical cost	0	\$/yr
Energy cost	40400	\$/yr
Amortization cost	99900	\$/yr

Gravity Belt Thickener

Design Output Data

Description	Value	Units
Gravity Belt Thickener		
Design Information		

Belt filter width	1 m
Number of units	1
Hydraulic loading per unit per r	125 gpm(US)
Hydraulic loading required per	18.7 gpm(US)
Final solids content	7 %
Solids capture fraction	0.998
Quantities	
Operation labor required	89.3 pers-hrs/yr
Maintenance labor required	22.3 pers-hrs/yr
Power	21600 kWh/yr
Polymer required	4070 lb/yr
Dry solids produced	2790 lb/d
Costs	
Construction and equipment cc	812000 \$
Building Cost	279000 \$
Polymer System Cost	82500 \$
Feed Pump Cost	30300 \$
Conveyor System Cost	77000 \$
Installed Belt Filter System C	344000 \$
Operational labor cost	4600 \$/yr
Maintenance labor cost	963 \$/yr
Material and supply cost	0 \$/yr
Chemical cost	5290 \$/yr
Energy cost	2160 \$/yr
Amortization cost	74300 \$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		
Total surface area required	100000	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	103	d
Quantities		
Total drying bed surface area	100000	sqft
Number beds	3	
Surface area of each individual	33300	sqft
Length of each bed	1670	ft
Volume of earthwork required	479000	cuft
Volume concrete for dividing w	34300	cuft
Volume of R.C. in-place for tru	7500	cuft
Volume of sand	75000	cuft
Volume of gravel	100000	cuft
Clay pipe diameter	8	in
Total length clay pipe	10000	in
Sludge solids produced	0.249	ton(short)/d
Operational labor required	546	pers-hrs/yr
Maintenance labor required	245	pers-hrs/yr
Costs		
Construction and equipment cc	1520000	\$
Earthwork Cost	142000	\$
Wall Concrete Cost	579000	\$
Slab Concrete Cost	58300	\$
Drying Bed Media Cost	279000	\$
Drain Pipe System Cost	308000	\$
Misc Costs	150000	\$
Operational labor cost	28100	\$/yr
Maintenance labor cost	10600	\$/yr
Material and supply cost	13600	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	133000	\$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	2090	cuft
Width of wet well	10.9	ft
Depth of the pumping station	26.3	ft
Length of the pumping station	32	ft
Width of the pumping station	38.1	ft
Minimum depth of water in wet	5.34	ft
Area of pump building	913	sqft
Peak capacity of pumps	16	MGD(US)
Firm pumping capacity	16	MGD(US)
Total dynamic head - average	44.4	ft
Quantities		
Operation labor required	745	pers-hrs/yr

Maintenance labor required	627 pers-hrs/yr
Electrical energy required	399000 kWh/yr
Volume of earthwork required	170000 cuft
Volume of slab concrete requir	9420 cuft
Volume of wall concrete requir	5950 cuft
Capacity per pump	3690 gpm(US)
Number of constant speed pur	2
Number of variable speed purr	2
Diameter of discharge header	23.8 in
Total dynamic head	58.7 ft
Size of selected pump	12 in
Specific speed of pump	3440
Pump rotating speed	1400 rpm
Motor size required	76.1 HP
Size of selected motor	100 HP
Width of pump system	3 ft
Length of pump system	18.2 ft
Length of the dry well	32 ft
Width of the dry well	27.2 ft
Costs	
Construction and equipment co	985000 \$
Earthwork Cost	50500 \$
Wall Concrete Cost	143000 \$
Slab Concrete Cost	122000 \$
Building Cost	100000 \$
Installed Pump Equipment C	395000 \$
Installed Control Module Cos	23100 \$
Misc Costs	150000 \$
Operational labor cost	38300 \$/yr
Maintenance labor cost	27100 \$/yr
Material and supply cost	6900 \$/yr
Chemical cost	0 \$/yr
Energy cost	39900 \$/yr
Amortization cost	87900 \$/yr

Trickling Filter(1)

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	0.75	gal(US)/(sqft·min)
Recirculation ratio	0	
Number of towers per stage	2	
Number of stages	1	
Depth of filter tower	8	ft
Diameter of filter tower	53.1	ft
Surface area per filter tower	2210	sqft
Total surface area	4430	sqft
Volume per filter tower	17700	cuft
Total volume	35400	cuft
Quantities		
Operation labor required	332	pers-hr/yr
Maintenance labor required	287	pers-hr/yr
Volume of earthwork required	53900	cuft
Volume of slab concrete requir	2950	cuft
Volume of wall concrete requir	4770	cuft
Number of posts per tower	161	
Total length of precast beams	2360	ft
Costs		
Construction and equipment co	767000 \$	
Earthwork Cost	16000 \$	
Wall Concrete Cost	115000 \$	
Slab Concrete Cost	38300 \$	
Concrete Beam Cost	94700 \$	
Media Cost	202000 \$	
Installed Distributor Arm Cos	148000 \$	
Misc Costs	153000 \$	
Operational labor cost	17100 \$/yr	
Maintenance labor cost	12400 \$/yr	
Material and supply cost	3500 \$/yr	
Chemical cost	0 \$/yr	
Energy cost	882 \$/yr	
Amortization cost	67600 \$/yr	
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	10.8	MGD(US)
Total pumping capacity	10.8	MGD(US)
Design capacity per pump	3740	gpm(US)
Number of pumps	3	
Number of batteries	1	

Firm pumping capacity	10.8 MGD(US)
Quantities	
Operation labor required	653 pers-hrs/yr
Maintenance labor required	552 pers-hrs/yr
Electrical energy required	359000 kWh/yr
Volume of earthwork required	3300 cuft
Area of pump building	413 sqft
Costs	
Construction and equipment cost	220000 \$
Earthwork Cost	978 \$
Pump Building Cost	45400 \$
Installed Pump Cost	140000 \$
Misc Costs	33500 \$
Operational labor cost	33600 \$/yr
Maintenance labor cost	23800 \$/yr
Material and supply cost	1540 \$/yr
Chemical cost	0 \$/yr
Energy cost	35900 \$/yr
Amortization cost	20800 \$/yr

Oxidation Ditch

Design Output Data

Description	Value	Units
Oxidation Ditch		
Design Information		
Carbon & Nitrification Design		
Design SRT for design at winter	25	d
Design SS	2500	mg/L
Calculated VSS	2000	mg/L
Calculated VSS:TSS ratio	0.802	mg VSS/mg SS
Total volume of reactors	41300	m ³
Ditch length	104	m
Ditch width	29.1	m
Sidewater depth	3.66	m
Number of batteries	2	
Number of parallel ditches per battery	2	
Number of rotors per ditch	3	
Rotor length for aeration	67	m
Rotor length for mixing	158	m
Installed rotor length per rotor	13.2	m
Rotor horsepower	20	HP
Total installed horsepower per battery	120	HP
Assumed surface velocity	0.46	m/s
Hydraulic retention time	36.3	hr
F/M ratio	0.0658	lb BOD/lb MLSS/d
Volumetric BOD loading	0.132	kg BOD/m ³ /d
Observed yield (VSS basis)	0.61	g VSS/g BOD
Observed yield (TSS basis)	0.761	g TSS/g BOD
Amount of alkalinity required	113	gCaCO ₃ /m ³
Amount of sludge generated	4130	kg/d
Sludge recycle rate	12400	m ³ /d
Nitrogen requirement for biomass	12.1	mg/L
Phosphorus requirement for biomass	2.43	mg/L
Oxygen requirement to meet aeration	8960	kg/d
Quantities		
Ditch bottom width	47.3	ft
Length of straight section	246	ft
Volume of excavation required	743000	cuft
Volume of backfill required per ditch	8830	cuft
Volume of wall concrete required per ditch	27700	cuft
Volume of slab concrete required per ditch	45600	cuft
Length of adjustable weir	56.8	ft
Volume of concrete required per ditch	247	cuft
Total handrail length	0	ft
Operation labor required	4020	pers-hrs/yr
Electrical energy required	4450000	kWh/yr
Costs		
Construction and equipment cost	4710000	\$
Earthwork Cost	220000	\$
Wall Concrete Cost	1360000	\$
Slab Concrete Cost	1180000	\$
Handrail Cost	0	\$
Installed Equipment Cost	1720000	\$
Misc Costs	233000	\$
Operational labor cost	207000	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	37800	\$/yr
Chemical cost	0	\$/yr
Energy cost	445000	\$/yr
Amortization cost	456000	\$/yr

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	22.7	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	22.7	cuyd/d
Maximum anticipated landfill duration	30	d
Anticipated sludge storage height	8	ft
Sludge storage shed area	2300	sqft
Width of sludge storage shed	33.9	ft
Length of sludge storage shed	67.8	ft
Volume of earthwork required	6400	cuft
Volume of slab concrete required	2760	cuft
Surface area of canopy roof	2300	sqft
Round trip haul distance	20	miles
Round trips per day per truck	2	
Distance traveled per year per truck	10000	miles
Sludge hauled	20.1	ton(short)/d
Operation labor required	355	pers-hrs/yr
LandFilling cost	35200	\$/yr
Costs		
Construction and equipment cost	367000	\$
Earthwork Cost	1900	\$
Slab Concrete Cost	35800	\$
Canopy Roof Cost	46000	\$
Vehicle Cost	283000	\$
Operational labor cost	18300	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	72000	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	68300	\$/yr

Hauling and Land Filling(1)

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	0.592	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	0.592	cuyd/d
Maximum anticipated landfill duration	30	d
Anticipated sludge storage height	8	ft
Sludge storage shed area	60	sqft
Width of sludge storage shed	5.48	ft
Length of sludge storage shed	11	ft
Volume of earthwork required	273	cuft
Volume of slab concrete required	135	cuft
Surface area of canopy roof	60	sqft
Round trip haul distance	20	miles
Round trips per day per truck	1	
Distance traveled per year per truck	5000	miles
Sludge hauled	0.524	ton(short)/d
Operation labor required	9.26	pers-hrs/yr
LandFilling cost	35200	\$/yr
Costs		
Construction and equipment cost	286000	\$
Earthwork Cost	81	\$
Slab Concrete Cost	1750	\$
Canopy Roof Cost	1200	\$
Vehicle Cost	283000	\$
Operational labor cost	477	\$/yr
Maintenance labor cost	0	\$/yr
Material and supply cost	53600	\$/yr
Chemical cost	0	\$/yr
Energy cost	0	\$/yr
Amortization cost	61500	\$/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)
Adjusted hydraulic loading rate	0.399	gal(US)/(sqft·min)
Total hydraulic loading rate	0.5	gal(US)/(sqft·min)
Recirculation ratio	0.254	
Number of towers per stage	2	
Number of stages	1	
Depth of filter tower	26.9	ft
Diameter of filter tower	72.8	ft
Surface area per filter tower	4170	sqft
Total surface area	8330	sqft
Volume per filter tower	112000	cuft
Total volume	224000	cuft
Quantities		
Operation labor required	332	pers-hr/yr
Maintenance labor required	287	pers-hr/yr
Volume of earthwork required	104000	cuft
Volume of slab concrete requir	5560	cuft
Volume of wall concrete requir	13000	cuft
Number of posts per tower	297	
Total length of precast beams	4490	ft
Costs		
Construction and equipment cc	2570000	\$
Earthwork Cost	30900	\$
Wall Concrete Cost	312000	\$
Slab Concrete Cost	72000	\$
Concrete Beam Cost	180000	\$
Media Cost	1280000	\$
Installed Distributor Arm Cos	183000	\$
Misc Costs	514000	\$
Operational labor cost	17100	\$/yr
Maintenance labor cost	12400	\$/yr
Material and supply cost	14600	\$/yr
Chemical cost	0	\$/yr
Energy cost	980	\$/yr
Amortization cost	220000	\$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	10.8	MGD(US)
Total pumping capacity	10.8	MGD(US)
Design capacity per pump	3740	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	10.8	MGD(US)
Quantities		
Operation labor required	653	pers-hrs/yr
Maintenance labor required	552	pers-hrs/yr
Electrical energy required	359000	kWh/yr
Volume of earthwork required	3300	cuft
Area of pump building	413	sqft
Costs		
Construction and equipment cc	220000	\$
Earthwork Cost	978	\$
Pump Building Cost	45400	\$
Installed Pump Cost	140000	\$
Misc Costs	33500	\$
Operational labor cost	33600	\$/yr
Maintenance labor cost	23800	\$/yr
Material and supply cost	1540	\$/yr
Chemical cost	0	\$/yr
Energy cost	35900	\$/yr
Amortization cost	20800	\$/yr

Secondary Clarifier**Design Output Data**

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	9570	sqft
Surface area per circular clarifi	4780	sqft
Diameter of each circular clarif	79	ft
Number of clarifiers per batter	2	
Number of batteries	1	
Solids loading rate	0.0542	lb/(sqft·d)
Hydraulic retention time	2.87	hr
Designed surface overflow rate	500	gal(US)/(sqft·d)
Weir length	719	ft
Volume of wasted sludge	6040	gpd(US)

Quantities		
Operation labor required	997	pers-hrs/yr
Maintenance labor required	549	pers-hrs/yr
Electrical energy required	10000	kWh/yr
Volume of earthwork required	125000	cuft
Slab thickness	9.9	in
Volume of slab concrete requir	9380	cuft
Wall thickness	11	in
Volume of wall concrete requir	4540	cuft
Costs		
Construction and equipment cc	604000	\$
Earthwork Cost	36900	\$
Wall Concrete Cost	109000	\$
Slab Concrete Cost	122000	\$
Installed Equipment Cost	245000	\$
Misc Costs	92200	\$
Operational labor cost	51300	\$/yr
Maintenance labor cost	23700	\$/yr
Material and supply cost	6040	\$/yr
Chemical cost	0	\$/yr
Energy cost	1000	\$/yr
Amortization cost	55900	\$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00604	MGD(US)
Total pumping capacity	0.00604	MGD(US)
Design capacity per pump	2.1	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00604	MGD(US)
Quantities		
Operation labor required	228	pers-hrs/yr
Maintenance labor required	169	pers-hrs/yr
Electrical energy required	205	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	32600	\$
Earthwork Cost	474	\$
Pump Building Cost	22000	\$
Installed Pump Cost	5160	\$
Misc Costs	4980	\$
Operational labor cost	11800	\$/yr
Maintenance labor cost	7300	\$/yr
Material and supply cost	228	\$/yr
Chemical cost	0	\$/yr
Energy cost	20	\$/yr
Amortization cost	3090	\$/yr

Secondary Clarifier(1)

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	28800	sqft
Surface area per circular clarifi	14400	sqft
Diameter of each circular clarif	136	ft
Number of clarifiers per batter	2	
Number of batteries	1	
Solids loading rate	7.58	lb/(sqft-d)
Hydraulic retention time	11.5	hr
Designed surface overflow rate	250	gal(US)/(sqft-d)
Weir length	2030	ft
Volume of wasted sludge	132000	gpd(US)
Quantities		
Operation labor required	1940	pers-hrs/yr
Maintenance labor required	1070	pers-hrs/yr
Electrical energy required	15100	kWh/yr
Volume of earthwork required	435000	cuft
Slab thickness	11.9	in
Volume of slab concrete requir	32100	cuft
Wall thickness	15	in
Volume of wall concrete requir	18900	cuft
Costs		
Construction and equipment cc	1640000	\$
Earthwork Cost	129000	\$
Wall Concrete Cost	455000	\$
Slab Concrete Cost	416000	\$
Installed Equipment Cost	391000	\$
Misc Costs	250000	\$
Operational labor cost	99700	\$/yr
Maintenance labor cost	46400	\$/yr

Material and supply cost	16400 \$/yr
Chemical cost	0 \$/yr
Energy cost	1510 \$/yr
Amortization cost	146000 \$/yr
Waste Sludge Pumping	
Design Information	
Average daily pumping rate	0.132 MGD(US)
Total pumping capacity	0.132 MGD(US)
Design capacity per pump	46 gpm(US)
Number of pumps	3
Number of batteries	1
Firm pumping capacity	0.132 MGD(US)
Quantities	
Operation labor required	339 pers-hrs/yr
Maintenance labor required	267 pers-hrs/yr
Electrical energy required	4460 kWh/yr
Volume of earthwork required	1620 cuft
Area of pump building	203 sqft
Costs	
Construction and equipment cost	50600 \$
Earthwork Cost	480 \$
Pump Building Cost	22300 \$
Installed Pump Cost	20100 \$
Misc Costs	7720 \$
Operational labor cost	17500 \$/yr
Maintenance labor cost	11500 \$/yr
Material and supply cost	354 \$/yr
Chemical cost	0 \$/yr
Energy cost	446 \$/yr
Amortization cost	4790 \$/yr

Intermediate Process Pumping

Design Output Data

Description	Value	Units
Intermediate Pumping		
Design Information		
Average daily pumping rate	4.78	MGD(US)
Total pumping capacity	10.8	MGD(US)
Design capacity per pump	3740	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	4.78	MGD(US)
Quantities		
Operation labor required	538	pers-hrs/yr
Maintenance labor required	454	pers-hrs/yr
Electrical energy required	159000	kWh/yr
Volume of earthwork required	3300	cuft
Area of pump building	413	sqft
Costs		
Construction and equipment cost	220000	\$
Earthwork Cost	978	\$
Pump Building Cost	45400	\$
Installed Pump Cost	140000	\$
Misc Costs	33500	\$
Operational labor cost	27700	\$/yr
Maintenance labor cost	19600	\$/yr
Material and supply cost	1540	\$/yr
Chemical cost	0	\$/yr
Energy cost	15900	\$/yr
Amortization cost	20800	\$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	674000	gal(US)
Average chlorine required	398	lb/d
Peak chlorine required	899	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	1.11	/100ml
Quantities		
Operational labor required	976	pers-hrs/yr
Maintenance labor required	178	pers-hrs/yr
Electrical energy required	118000	kWh/yr
Volume of earthwork required	38300	cuft
Volume of slab concrete required	9030	cuft
Volume of wall concrete required	12000	cuft
Number of chlorinators and equipment	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	6	
Area of chlorine storage building	840	sqft

Costs	
Construction and equipment cost	884000 \$
Earthwork Cost	11300 \$
Wall Concrete Cost	290000 \$
Slab Concrete Cost	117000 \$
Installed Equipment Cost	320000 \$
Building Cost	24200 \$
Storage Building Cost	46200 \$
Misc Costs	75200 \$
Operational labor cost	50300 \$/yr
Maintenance labor cost	7670 \$/yr
Material and supply cost	32800 \$/yr
Chemical cost	94500 \$/yr
Energy cost	11800 \$/yr
Amortization cost	84800 \$/yr

Chlorination(1)

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	670000	gal(US)
Average chlorine required	590	lb/d
Peak chlorine required	1340	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	3.72	/100ml
Quantities		
Operational labor required	1200	pers-hrs/yr
Maintenance labor required	260	pers-hrs/yr
Electrical energy required	123000	kWh/yr
Volume of earthwork required	38000	cuft
Volume of slab concrete required	8970	cuft
Volume of wall concrete required	12000	cuft
Number of chlorinators and ev.	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	9	
Area of chlorine storage building	1260	sqft

Costs	
Construction and equipment cost	970000 \$
Earthwork Cost	11300 \$
Wall Concrete Cost	288000 \$
Slab Concrete Cost	116000 \$
Installed Equipment Cost	386000 \$
Building Cost	24200 \$
Storage Building Cost	69300 \$
Misc Costs	74800 \$
Operational labor cost	61900 \$/yr
Maintenance labor cost	11200 \$/yr
Material and supply cost	32900 \$/yr
Chemical cost	140000 \$/yr
Energy cost	12300 \$/yr
Amortization cost	94200 \$/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

Effluent(1)

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