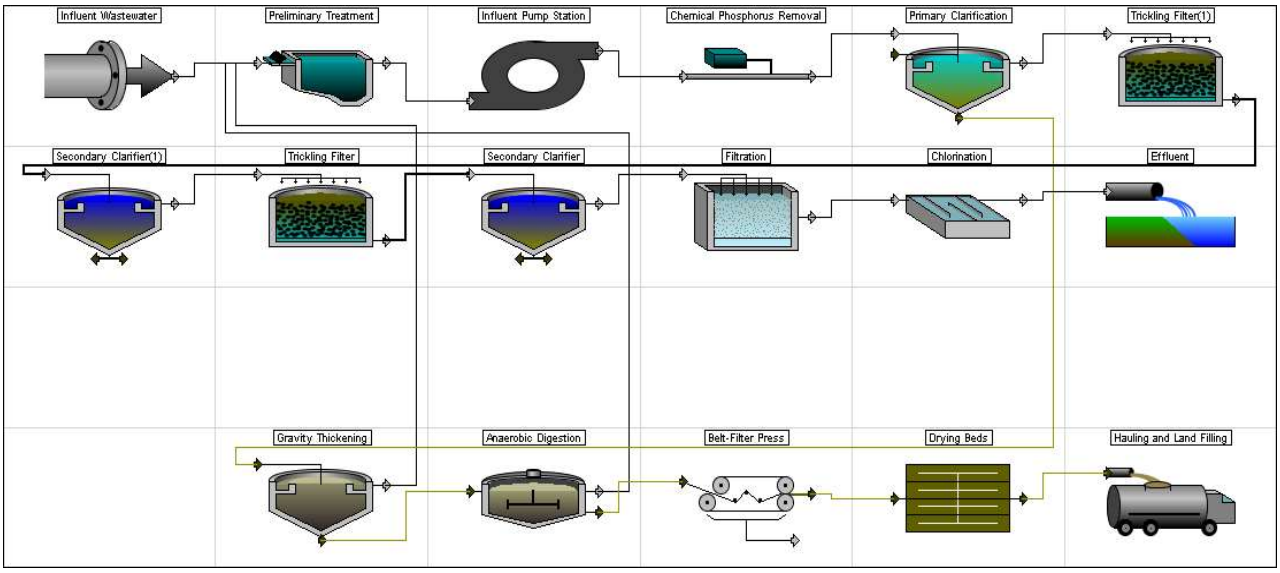
Layout - SDSD South Plant



Summary

Equipment Database

Hydromantis 2014,(USA Avg)

Layout Summary

Description	Value	Units
CONSTRUCTION COSTS		
Unit process construction cost	$14,500,000	$
Other direct construction costs	$5,320,000	$
Other indirect construction cos	$14,900,000	$
Total construction costs	$34,700,000	$
ANNUAL COSTS		
LABOR COSTS		
Administration labor cost	$53,200	$/yr
Laboratory labor cost	$156,000	$/yr
Unit process operation labor c	$669,000	$/yr
Unit process maintenance labc	$298,000	$/yr
Total labor costs	$1,180,000	$/yr
MATERIAL COSTS		
Total material cost	$269,000	$/yr
CHEMICAL COSTS		
Total chemical cost	$453,000	$/yr
ENERGY COSTS		
Total energy cost	$130,000	$/yr
Total operation and maintanen	$2,030,000	$/yr
CONSTRUCTION COST AMC		
Amortization cost for total cons	$3,030,000	$/yr
Total annual project cost	$5,050,000	$/yr
PROJECT SUMMARY		
Present worth	$60,500,000	$
Total project cost	$34,700,000	$
Total operation labor cost	$878,000	$/yr
Total maintenance labor cost	$298,000	$/yr
Total material cost	$269,000	$/yr
Total chemical cost	$453,000	$/yr
Total energy cost	$130,000	$/yr
Total amortization cost	$3,030,000	$/yr

Process Summary

Process	Construction ($)	Operation ($/yr)	Maintenance ($/yr)	Material ($/yr)	Chemical ($/yr)	Energy ($/yr)	Amortization ($/yr)
Secondary Clarifier(1)	677000	67600	33400	6650	0	1140	62500
Preliminary Treatment	670000	52700	23200	16800	0	3040	56200
Trickling Filter	877000	48000	33700	4540	0	34000	79000
Gravity Thickening	126000	16500	11000	1260	0	626	12100

Influent Pump Station	2080000	36300	25300	14500	0	28100	179000
Secondary Clarifier	668000	63200	30300	6590	0	1020	61600
Anaerobic Digestion	2380000	57600	30300	20400	0	8440	226000
Chemical Phosphorus Remova	0	0	0	0	354000	0	0
Filtration	1930000	9080	5120	54700	0	3120	186000
Belt-Filter Press	812000	6100	1260	0	20300	3750	74300
Primary Clarification	464000	48300	24100	4530	0	961	43200
Chlorination	707000	45400	6270	27400	78100	11800	70000
Drying Beds	440000	97500	40100	3960	0	0	38300
Trickling Filter(1)	2140000	48100	33800	12200	0	34200	185000
Effluent	0	0	0	0	0	0	0
Hauling and Land Filling	300000	10200	0	90400	0	0	62700
Alum Feed System	235000	62700	0	4710	0	0	19700
Other Costs	20200000	209000	0	0	0	0	1670000

Summary of Other Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	15	acre
Administration labor hours	1030	hr/yr
Laboratory labor hours	3020	hr/yr
Costs		
DIRECT COSTS		
Mobilization	478000	$
Site preparation	709000	$
Site electrical	1330000	$
Yard piping	892000	$
Instrumentation and control	665000	$
Lab and administration building	1250000	$
Total direct construction costs	5320000	$
INDIRECT COSTS		
Cost of land	300000	$
Miscellaneous cost	1140000	$
Legal cost	456000	$
Engineering design fee	3420000	$
Inspection cost	456000	$
Contingency	2280000	$
Technical	456000	$
Interest during construction	3400000	$
Profit	2970000	$
Total indirect construction cost	14900000	$
Total of other construction cos	20200000	$
LABOR COSTS		
Administration labor cost	53200	$/yr
Laboratory labor cost	156000	$/yr

Summary of Chemical Feed System for Alum

Description	Value	Units
Alum Solution Feed System		
Design Information		
Alum dosage rate as Al2(SO4)	3590	lb/d
Alum dosage rate as equivaler	327	lb/d
Liquid chemical solution fed	670	gpd(US)
Operation labor required	1220	pers-hrs/yr
Costs		
Construction and equipment co	235000	$
Operational labor cost	62700	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	4710	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	19700	$/yr

Influent Wastewater

Secondary Clarifier(1)

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	9980	sqft
Surface area per circular clarifi	4990	sqft
Diameter of each circular clarif	80	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	0.341	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	999	ft

Volume of wasted sludge	39600	gpd(US)
Quantities		
Operation labor required	1020	pers-hrs/yr
Maintenance labor required	563	pers-hrs/yr
Electrical energy required	10100	kWh/yr
Volume of earthwork required	128000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	9850	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	5270	cuft
Costs		
Construction and equipment cc	637000	$
Earthwork Cost	37900	$
Wall Concrete Cost	127000	$
Slab Concrete Cost	128000	$
Installed Equipment Cost	247000	$
Misc Costs	97200	$
Operational labor cost	52600	$/yr
Maintenance labor cost	23900	$/yr
Material and supply cost	6370	$/yr
Chemical cost	0	$/yr
Energy cost	1010	$/yr
Amortization cost	58700	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.0396	MGD(US)
Total pumping capacity	0.0396	MGD(US)
Design capacity per pump	13.7	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.0396	MGD(US)
Quantities		
Operation labor required	291	pers-hrs/yr
Maintenance labor required	223	pers-hrs/yr
Electrical energy required	1340	kWh/yr
Volume of earthwork required	1610	cuft
Area of pump building	201	sqft
Costs		
Construction and equipment cc	40600	$
Earthwork Cost	476	$
Pump Building Cost	22100	$
Installed Pump Cost	11800	$
Misc Costs	6190	$
Operational labor cost	15000	$/yr
Maintenance labor cost	9480	$/yr
Material and supply cost	284	$/yr
Chemical cost	0	$/yr
Energy cost	134	$/yr
Amortization cost	3840	$/yr

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	2.47	ft
Average channel depth	1	ft
Horizontal Flow Grit Chamber		
Maximum flow	15.4	cuft/s
Average flow	6.17	cuft/s
Minimum flow	5.87	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	7.71	cuft/s
Width of channel	1.28	ft
Depth of channel	4	ft
Length of channel	144	ft
Settling velocity of particle	0.0707	ft/s
Slope of channel bottom	0.00137	
Allowance for currents	1.7	

Manning coefficient	0.035	
Hydraulic retention time	1.6	min
Volume of grit	16	cuft/d
Costs		
Construction and equipment cc	670000	$
Operational labor cost	52700	$/yr
Maintenance labor cost	23200	$/yr
Material and supply cost	16800	$/yr
Chemical cost	0	$/yr
Energy cost	3040	$/yr
Amortization cost	56200	$/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	0.75	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	48.3	ft
Surface area per filter tower	1830	sqft
Total surface area	3660	sqft
Volume per filter tower	14600	cuft
Total volume	29300	cuft
Quantities		
Operation labor required	295	pers-hr/yr
Maintenance labor required	256	pers-hr/yr
Volume of earthwork required	44500	cuft
Volume of slab concrete requir	2440	cuft
Volume of wall concrete requir	4310	cuft
Number of posts per tower	134	
Total length of precast beams	1940	ft
Costs		
Construction and equipment cc	666000	$
Earthwork Cost	13200	$
Wall Concrete Cost	104000	$
Slab Concrete Cost	31600	$
Concrete Beam Cost	78000	$
Media Cost	167000	$
Installed Distributor Arm Cos	139000	$
Misc Costs	133000	$
Operational labor cost	15200	$/yr
Maintenance labor cost	10900	$/yr
Material and supply cost	3060	$/yr
Chemical cost	0	$/yr
Energy cost	854	$/yr
Amortization cost	58900	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	9.95	MGD(US)
Total pumping capacity	9.95	MGD(US)
Design capacity per pump	3460	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	9.95	MGD(US)
Quantities		
Operation labor required	636	pers-hrs/yr
Maintenance labor required	538	pers-hrs/yr
Electrical energy required	332000	kWh/yr
Volume of earthwork required	3170	cuft
Area of pump building	396	sqft
Costs		
Construction and equipment cc	212000	$
Earthwork Cost	939	$
Pump Building Cost	43600	$
Installed Pump Cost	135000	$
Misc Costs	32300	$
Operational labor cost	32700	$/yr
Maintenance labor cost	22800	$/yr
Material and supply cost	1480	$/yr
Chemical cost	0	$/yr
Energy cost	33200	$/yr
Amortization cost	20000	$/yr

Gravity Thickening

Design Output Data

Description	Value	Units

Gravity Thickening		
Design Information		
Initial concentration	4	%
Thickened concentration	5	%
Mass loading	10	lb/(sqft·d)
Hydraulic loading	30	gal(US)/(sqft·d)
Hydraulic retention time	53.9	hr
Number of tanks	1	
Tank volume	5390	cuft
Depth	9	ft
Surface area per tank	599	sqft
Tank diameter	28	ft
Quantities		
Amount of sludge generated	2.99	ton(short)/d
Volume of thickened sludge	12300	gpd(US)
Operation labor required	320	pers-hrs/yr
Maintenance labor required	258	pers-hrs/yr
Electrical energy required	6260	kWh/yr
Volume of earthwork required	8170	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	715	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	985	cuft
Costs		
Construction and equipment cc	126000	$
Earthwork Cost	2420	$
Wall Concrete Cost	23700	$
Slab Concrete Cost	9260	$
Installed Equipment Cost	71600	$
Misc Costs	19300	$
Operational labor cost	16500	$/yr
Maintenance labor cost	11000	$/yr
Material and supply cost	1260	$/yr
Chemical cost	0	$/yr
Energy cost	626	$/yr
Amortization cost	12100	$/yr

Influent Pump Station

Design Output Data

Description	Value	Units
Pump Station		
Design Information		
Volume of wet well	26700	cuft
Width of wet well	205	ft
Depth of the pumping station	28.3	ft
Length of the pumping station	21.2	ft
Width of the pumping station	236	ft
Minimum depth of water in wet	7.32	ft
Area of pump building	682	sqft
Peak capacity of pumps	13.6	MGD(US)
Firm pumping capacity	13.6	MGD(US)
Total dynamic head - average	44.5	ft
Quantities		
Operation labor required	706	pers-hrs/yr
Maintenance labor required	595	pers-hrs/yr
Electrical energy required	281000	kWh/yr
Volume of earthwork required	627000	cuft
Volume of slab concrete requir	47000	cuft
Volume of wall concrete requir	19800	cuft
Capacity per pump	9430	gpm(US)
Number of constant speed pur	2	
Number of variable speed pur	0	
Diameter of discharge header	21.9	in
Total dynamic head	60	ft
Size of selected pump	20	in
Specific speed of pump	4060	
Pump rotating speed	888	rpm
Motor size required	166	HP
Size of selected motor	200	HP
Width of pump system	4.6	ft
Length of pump system	21.6	ft
Length of the dry well	21.2	ft
Width of the dry well	30.6	ft
Costs		
Construction and equipment cc	2080000	$
Earthwork Cost	186000	$
Wall Concrete Cost	478000	$
Slab Concrete Cost	610000	$
Building Cost	75000	$
Installed Pump Equipment C	410000	$
Misc Costs	317000	$
Operational labor cost	36300	$/yr

Maintenance labor cost	25300	$/yr
Material and supply cost	14500	$/yr
Chemical cost	0	$/yr
Energy cost	28100	$/yr
Amortization cost	179000	$/yr

Secondary Clarifier

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	9880	sqft
Surface area per circular clarifi	4940	sqft
Diameter of each circular clarif	80	ft
Number of clarifiers per battery	2	
Number of batteries	1	
Solids loading rate	0.0295	lb/(sqft·d)
Hydraulic retention time	4.04	hr
Designed surface overflow rate	400	gal(US)/(sqft·d)
Weir length	995	ft
Volume of wasted sludge	3390	gpd(US)
Quantities		
Operation labor required	1020	pers-hrs/yr
Maintenance labor required	559	pers-hrs/yr
Electrical energy required	10100	kWh/yr
Volume of earthwork required	128000	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	9850	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	5270	cuft
Costs		
Construction and equipment co	637000	$
Earthwork Cost	37900	$
Wall Concrete Cost	127000	$
Slab Concrete Cost	128000	$
Installed Equipment Cost	247000	$
Misc Costs	97200	$
Operational labor cost	52300	$/yr
Maintenance labor cost	23700	$/yr
Material and supply cost	6370	$/yr
Chemical cost	0	$/yr
Energy cost	1010	$/yr
Amortization cost	58700	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.00339	MGD(US)
Total pumping capacity	0.00339	MGD(US)
Design capacity per pump	1.18	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.00339	MGD(US)
Quantities		
Operation labor required	212	pers-hrs/yr
Maintenance labor required	155	pers-hrs/yr
Electrical energy required	115	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment co	31300	$
Earthwork Cost	474	$
Pump Building Cost	22000	$
Installed Pump Cost	4000	$
Misc Costs	4770	$
Operational labor cost	10900	$/yr
Maintenance labor cost	6590	$/yr
Material and supply cost	219	$/yr
Chemical cost	0	$/yr
Energy cost	12	$/yr
Amortization cost	2960	$/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	24.4	ft
Digester diameter	50	ft
Effective digester volume	104000	cuft
Number of digesters per batter	2	

Number of primary digesters p	1	
Number of secondary digester	1	
Number of batteries	1	
Gas produced	17.3	cuft/min
Heat required	369000	BTU/hr
Digester gas required	14.2	cuft/min
Total natural gas required	0	cuft/yr
Quantities		
Operation labor required	1120	pers-hrs/yr
Maintenance labor required	714	pers-hrs/yr
Electrical energy required	84400	kWh/yr
Volume of earthwork required	104000	cuft
Slab thickness	10.1	in
Volume of slab concrete requir	3740	cuft
Wall thickness	19.7	in
Volume of wall concrete requir	15700	cuft
Sidewater depth	24.4	ft
Surface area/floor of 2-story cc	735	sqft
Piping size	6	in
Length of total piping system	520	ft
Number of 90 degree elbows	26	
Number of tees	51	
Number of plug valves	37	
Total dry solids treated	2.7	ton(short)/d
Costs		
Construction and equipment cc	2380000	$
Earthwork Cost	30700	$
Wall Concrete Cost	377000	$
Slab Concrete Cost	48400	$
Building Cost	80900	$
Piping System Cost	247000	$
Floating Cover Cost	789000	$
Gas Recirculation Units Cost	240000	$
Heating Units Cost	152000	$
Gas Safety Equipment Cost	105000	$
Installed Pumps Cost	74800	$
Operational labor cost	57600	$/yr
Maintenance labor cost	30300	$/yr
Material and supply cost	20400	$/yr
Chemical cost	0	$/yr
Energy cost	8440	$/yr
Amortization cost	226000	$/yr

Chemical Phosphorus Removal

Design Output Data

Description	Value	Units
Chemical Phosphorus Removal		
Design Information		
Chemical used	Equivalent Aluminum	
Chemical dosage	9.77	g/m3
Mass of chemical per year	54100	kg/yr
Chemical sludge production	51.5	g/m3
Organic sludge production	5.35	g/m3
Costs		
Construction and equipment cc	0	$
Operational labor cost	0	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	0	$/yr
Chemical cost	354000	$/yr
Energy cost	0	$/yr
Amortization cost	0	$/yr

Filtration

Design Output Data

Description	Value	Units
Filtration		
Design Information		
Surface area	1840	sqft
Depth	9	ft
Terminal headloss through bec	192000	ft
Maximum head for backwashir	19.6	ft
Backwash rate	20	gal(US)/(sqft·min)
Washwater gutter depth	0.704	ft
Washwater needed	184000	gal(US)
Quantities		
Operation labor required	176	pers-hrs/yr
Maintenance labor required	121	pers-hrs/yr
Electrical energy required	31200	kWh
Surface area per filter unit	1840	sqft
Number of cells per filter unit	4	
Number of filter units per batte	1	
Number of batteries	1	

Volume of earthwork for filter	21700	cuft
Volume of concrete for filter	11000	cuft
Volume of surge tank	24600	cuft
Width of surge tank	41.9	ft
Length of surge tank	83.9	ft
Volume of earthwork for surge	51300	cuft
Volume of concrete for surge t	6830	cuft
Costs		
Construction and equipment cc	1930000	$
Earthwork Cost for Filter	6410	$
Earthwork Cost for Surge Ta	15200	$
Concrete Cost for Filter	264000	$
Concrete Cost for Surge Tar	164000	$
Installed Equipment Cost	1090000	$
Misc Costs	386000	$
Operational labor cost	9080	$/yr
Maintenance labor cost	5120	$/yr
Material and supply cost	54700	$/yr
Chemical cost	0	$/yr
Energy cost	3120	$/yr
Amortization cost	186000	$/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	24.9	gpm(US)
Final solids content	19	%
Solids capture fraction	0.998	
Quantities		
Operation labor required	119	pers-hrs/yr
Maintenance labor required	29.6	pers-hrs/yr
Power	37500	kWh/yr
Polymer required	15600	lb/yr
Dry solids produced	4270	lb/d
Belt filter(s)	275000	$
Building	279000	$
Installation	68800	$
Polymer system	82500	$
Feed pumps	30300	$
Conveyor system	77000	$
Costs		
Construction and equipment cc	812000	$
Building Cost	279000	$
Polymer System Cost	82500	$
Feed Pumps Cost	30300	$
Conveyor System Cost	77000	$
Installed Belt Filter	344000	$
Operational labor cost	6100	$/yr
Maintenance labor cost	1260	$/yr
Material and supply cost	0	$/yr
Chemical cost	20300	$/yr
Energy cost	3750	$/yr
Amortization cost	74300	$/yr

Primary Clarification

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	5010	sqft
Surface area per circular clarifi	2510	sqft
Diameter of each circular clarif	57	ft
Number of clarifiers per batter	2	
Number of batteries	1	
Solids loading rate	2.05	lb/(sqft·d)
Hydraulic retention time	2.02	hr
Weir length	1000	ft
Volume of sludge generated	18000	gpd(US)
Quantities		
Operation labor required	675	pers-hrs/yr
Maintenance labor required	370	pers-hrs/yr
Electrical energy required	9000	kWh/yr
Volume of earthwork required	62300	cuft
Slab thickness	10.2	in
Volume of slab concrete requir	5190	cuft
Wall thickness	11.5	in
Volume of wall concrete requir	3820	cuft

Costs		
Construction and equipment cc	427000	$
Earthwork Cost	18500	$
Wall Concrete Cost	92000	$
Slab Concrete Cost	67300	$
Installed Equipment Cost	184000	$
Misc Costs	65200	$
Operational labor cost	34800	$/yr
Maintenance labor cost	15700	$/yr
Material and supply cost	4270	$/yr
Chemical cost	0	$/yr
Energy cost	900	$/yr
Amortization cost	39800	$/yr
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	0.018	MGD(US)
Total pumping capacity	0.018	MGD(US)
Design capacity per pump	6.23	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	0.018	MGD(US)
Quantities		
Operation labor required	262	pers-hrs/yr
Maintenance labor required	199	pers-hrs/yr
Electrical energy required	607	kWh/yr
Volume of earthwork required	1600	cuft
Area of pump building	200	sqft
Costs		
Construction and equipment cc	36400	$
Earthwork Cost	475	$
Pump Building Cost	22000	$
Installed Pump Cost	8340	$
Misc Costs	5550	$
Operational labor cost	13500	$/yr
Maintenance labor cost	8430	$/yr
Material and supply cost	255	$/yr
Chemical cost	0	$/yr
Energy cost	61	$/yr
Amortization cost	3440	$/yr

Chlorination

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	415000	gal(US)
Average chlorine required	329	lb/d
Peak chlorine required	830	lb/d
Influent coliform count	10000000	/100ml
Effluent coliform count	3.72	/100ml
Quantities		
Operational labor required	882	pers-hrs/yr
Maintenance labor required	148	pers-hrs/yr
Electrical energy required	118000	kWh/yr
Volume of earthwork required	23600	cuft
Volume of slab concrete requir	5550	cuft
Volume of wall concrete requir	8130	cuft
Number of chlorinators and ev	1	
Chlorination building area	220	sqft
Number of chlorine cylinders	5	
Area of chlorine storage buildir	700	sqft
Costs		
Construction and equipment cc	707000	$
Earthwork Cost	6990	$
Wall Concrete Cost	196000	$
Slab Concrete Cost	72000	$
Installed Equipment Cost	320000	$
Building Cost	24200	$
Storage Building Cost	38500	$
Misc Costs	49400	$
Operational labor cost	45400	$/yr
Maintenance labor cost	6270	$/yr
Material and supply cost	27400	$/yr
Chemical cost	78100	$/yr
Energy cost	11800	$/yr
Amortization cost	70000	$/yr

Drying Beds

Design Output Data

Description	Value	Units
Sludge Drying Beds		
Design Information		

Total surface area required	30700	sqft
Initial depth of sludge	12	in
Final solids	50	%
Bed holding time	103	d
Quantities		
Total drying bed surface area	30700	sqft
Number beds	11	
Surface area of each individual	2790	sqft
Length of each bed	140	ft
Volume of earthwork required	151000	cuft
Volume concrete for dividing w	10700	cuft
Volume of R.C. in-place for tru	2300	cuft
Volume of sand	23000	cuft
Volume of gravel	30700	cuft
Clay pipe diameter	6	in
Total length clay pipe	3070	in
Sludge solids produced	1.78	ton(short)/d
Operational labor required	1890	pers-hrs/yr
Maintenance labor required	946	pers-hrs/yr
Costs		
Construction and equipment co	440000	$
Earthwork Cost	44900	$
Wall Concrete Cost	180000	$
Slab Concrete Cost	17900	$
Drying Bed Media Cost	85800	$
Drain Pipe System Cost	67600	$
Misc Costs	43600	$
Operational labor cost	97500	$/yr
Maintenance labor cost	40100	$/yr
Material and supply cost	3960	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	38300	$/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	0.772	gal(US)/(sqft·min)
Recirculation ratio	0.0287	
Number of towers per stage	1	
Number of stages	2	
Depth of filter tower	21.2	ft
Diameter of filter tower	68.6	ft
Surface area per filter tower	1850	sqft
Total surface area	3700	sqft
Volume per filter tower	78200	cuft
Total volume	156000	cuft
Quantities		
Operation labor required	297	pers-hr/yr
Maintenance labor required	258	pers-hr/yr
Volume of earthwork required	91800	cuft
Volume of slab concrete requir	4930	cuft
Volume of wall concrete requir	9220	cuft
Number of posts per tower	265	
Total length of precast beams	3970	ft
Costs		
Construction and equipment co	1920000	$
Earthwork Cost	27200	$
Wall Concrete Cost	222000	$
Slab Concrete Cost	63900	$
Concrete Beam Cost	159000	$
Media Cost	891000	$
Installed Distributor Arm Cos	176000	$
Misc Costs	385000	$
Operational labor cost	15300	$/yr
Maintenance labor cost	10900	$/yr
Material and supply cost	10700	$/yr
Chemical cost	0	$/yr
Energy cost	960	$/yr
Amortization cost	165000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	9.99	MGD(US)
Total pumping capacity	9.99	MGD(US)
Design capacity per pump	3470	gpm(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	9.99	MGD(US)

Quantities		
Operation labor required	637	pers-hrs/yr
Maintenance labor required	539	pers-hrs/yr
Electrical energy required	333000	kWh/yr
Volume of earthwork required	3180	cuft
Area of pump building	397	sqft
Costs		
Construction and equipment cc	212000	$
Earthwork Cost	941	$
Pump Building Cost	43700	$
Installed Pump Cost	135000	$
Misc Costs	32300	$
Operational labor cost	32800	$/yr
Maintenance labor cost	22900	$/yr
Material and supply cost	1480	$/yr
Chemical cost	0	$/yr
Energy cost	33300	$/yr
Amortization cost	20000	$/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

Hauling and Land Filling

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	4.22	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	4.22	cuyd/d
Maximum anticipated landfill dc	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	427	sqft
Width of sludge storage shed s	14.6	ft
Length of sludge storage shed	29.2	ft
Volume of earthwork required	1360	cuft
Volume of slab concrete requir	628	cuft
Surface area of canopy roof	427	sqft
Round trip haul distance	60	miles
Round trips per day per truck	1	
Distance traveled per year per	15000	miles
Sludge hauled	3.73	ton(short)/d
Operation labor required	198	pers-hrs/yr
LandFilling cost	35200	$/yr
Costs		
Construction and equipment cc	300000	$
Earthwork Cost	403	$
Slab Concrete Cost	8130	$
Canopy Roof Cost	8540	$
Vehicle Cost	283000	$
Operational labor cost	10200	$/yr
Maintenance labor cost	0	$/yr
Material and supply cost	90400	$/yr
Chemical cost	0	$/yr
Energy cost	0	$/yr
Amortization cost	62700	$/yr