DESARROLLO DE COSTOS PRELIMINARES CON EL SOFTWARE CAPDETWORKS

Para ayudar a la evaluación comparativa de alternativas de tratamiento de la PTAR Canoas en la fase conceptual del proyecto, CDM Smith utilizó el software CAPDETWorks, de la Compañía Hydromantis.

El CAPDETWorks fue inspirado en una herramienta que fue desarrollada por el Cuerpo de Ingenieros de los Estados Unidos para la Agencia de Protección Ambiental del mismo país en la década de los 70s, cuando los Estados Unidos se encontraban en la era de la ejecución de los proyectos de saneamiento en todo su territorio. Por esto y buscando facilitar el análisis de alternativas en el proceso de planeación de PTARs, el Cuerpo de Ingenieros desarrollo el software CAPDET (por sus siglas en inglés Computer Assisted Procedure for the Design and Evaluation of Wastewater Treatment Systems).

EL CAPDET está basado técnicas de diseño aprobadas en ese entonces, en conjunto con el establecimiento de curvas de costos, y permitía un desarrollo de costos paramétrico.

El CAPDETWorks de Hydromantis recopiló la idea inicial y le añadió nuevas técnicas de estimación de costos, así como la flexibilidad de utilizar estimación e costos paramétricos o por unidades de proceso. Además, le añadió la gran flexibilidad de poder modificar los costos para reflejar condiciones locales, y permitió la utilización de índices de costos para reflejar el cambio de los costos a través del tiempo, entre muchas otras cosas.

Debido a que uno de los objetivo del Producto 3 en este Contrato es el de la evaluación de alternativas de tratamiento, y teniendo en cuenta todo lo previamente dicho, CDM Smith consideró que la utilización de esta herramienta resulta muy beneficiosa para ayudar a la EAB a tomar decisiones en esta etapa.

INFORMACIÓN DE ENTRADA AL CAPDETWORKS.

Parámetros de entrada

1. Caudal y caracterización del agua.
   Se utilizó la caracterización promedio del agua residual estimada para la PTAR Canoas. (Ver sección de este informe)

   Como flujo máximo se especificó el caudal máximo hidráulico que soportará la planta. (32 m^3/s)

2. Valores unitarios, índices y otros parámetros de entrada.

El Cuadro A-1 contiene el resumen de todos valores unitarios, índices y otros parámetros de entrada utilizados en el CAPDETWorks.

Cuadro A-1 – Valores unitarios, índices y otros parámetros de entrada CAPDETWorks

Appendices		
Unit Costs		
Description	**Value**	**Units**
Building Cost	$46.50	$/sqft
Excavation	$0.42	$/cuft
Wall Concrete	$12.40	$/cuft
Slab Concrete	$11.00	$/cuft
Crane Rental	$333.00	$/hr
Canopy Roof	$6.50	$/sqft
Electricity	$0.20	$/kWh
Hand Rail	$11.30	$/ft
Land Costs	$0.00	$/acre
Construction Labor Rate	$8.00	$/hr
Operator Labor Rate	$8.00	$/hr
Administration Labor Rate [1]	$5.00	$/hr
Laboratory Labor Rate	$8.00	$/hr
Hydrated Lime-[Ca(OH)2]	$0.18	$/lb
Al2(SO4)3*14H2O	$0.27	$/lb
Ferric Chloride	$0.27	$/lb
Polymer	$2.27	$/lb
Interest Rate	4	%
Construction Period	3	years
Operating Life of Plant	40	years
Engineering Design Fee	15	%
Miscellaneous [2]	21	%
Administration/Legal	2	%
Inspection	2	%
Contingency	10	%
Technical	2	%
Profit and Overhead	15	%
Cost Indices		
Description	**Value**	**Units**
Marshall and Swift Index [3]	1500	
Engineering News Records Cost Index [4]	13400	
Pipe Cost Index [5]	739	
User Cost Index 1	100	
User Cost Index 2	100	
User Cost Index 3	100	
Additional Site-Specific Costs		
Description	**Value**	**Units**
Override Foundation Estimate	TRUE	
	$0.00	$
Override Effluent Pumping Estimate	TRUE	
	$0.00	$
Override Outfall Diffuser Estimate	TRUE	
	$0.00	$
Override Mobilization Estimate	FALSE	
	$0.00	$
Override Site Preparation Estimate	FALSE	
	$0.00	$
Override Site Electrical Estimate	FALSE	
	$0.00	$
Override Yard Piping Estimate	FALSE	
	$0.00	$
Override Instrumentation and Control Estimate	FALSE	
	$0.00	$
Override Lab and Administration Building Estim	FALSE	
	$0.00	$
Override Raw Sewage Pumping Estimate	TRUE	
	$0.00	$
Override Outfall Estimate	TRUE	
	$0.00	$

1. Índice Marshall and Swift. Este índice normalmente utilizado en la industria petroquímica de los Estados Unidos, es compuesto de dos componentes principales - media del costo de equipos de la industria de procesos industriales y la media de los equipos industriales generales. equipos de toda la industria media. Algunas industrias consideradas en el promedio del equipo procesos industriales incluyen los productos químicos, productos derivados del petróleo, caucho y papel. El promedio de toda la industria abarca 47 tipos diferentes de industriales, comerciales y equipamiento de la vivienda. Este índice es publicado por la revista Chemical Engineering. SE utilizó el valor por defecto de CAPDETWorks.
2. Índice ENR. Este índice está compuesto por los índices de proyectos de construcción generales e incluye precios de cantidades fiajs de acero estrcutural, cemento, madera, y mano de obra. Es comparable en Colombia al índice Construdata.
3. Índice Pipe Cost. Este índice es también publicado por Chemical Engineering y hace un seguimiento a los precios de las tuberías utilizados en la industria química, que son generalmente aceptados en la industria de infraestructura. Se utilizó el valor por defecto.
4. Costos Específicos del sitio Adicionales. Estos costos permiten al usuario de ingresar información de costos que solo es adecuada a cada sitio específico. Para el Caso de Canoas no se tuvieron en cuenta estos ítems, dado que se considera que todas las alternativas son similares desde estos puntos de vista.

Procesos y Operaciones unitarias

El Cuadro A-2 Contiene el resumen de los datos de entrada a CAPDETWorks. Cabe anotar que los datos que fueron calculados por los algoritmos del CAPDETWorks son alimentados por los parámetros de entrada dados anteriormente, por lo que concuerdan con las alternativas evaluadas.

Cuadro A-2 – Detalle de Datos de Entrada al CAPDETWorks

Unidad o proceso	Subproceso	Predimensionamiento de estructuras		Costo de capital utilizado		Costo de operación utilizado	
		CAPDETWorks	Diseño del consultor	Paramétrico de CAPDETWorks	Costo de proceso del consultor	Paramétrico de CAPDETWorks	Costo de proceso del consultor
Línea de Líquidos							
Tratamiento preliminar		☑		☑		☑	
Tratamiento primario			☑		☑	☑	
Coagulación y floculación			☑	☑		☑	
Tratamiento secundario							
	Alimentación escalonada (lodos Activados)		☑	☑		☑	
	Filtros percoladores		☑			☑	
	BAFs		☑		☑		
Tratamiento terciario							
	Alimentación escalonada (BNR)		☑	☑		☑	
	BAFs		☑		☑		☑
	Filtros desnitrificadores		☑	☑		☑	
Desinfección			☑	☑		☑	
Línea de sólidos							
Espesamiento							
	Espesador de gravedad		☑	☑			☑
	Mesa espesadora de gravedad		☑		☑		☑
	Pre-deshidratación por centrifugas (alternativa THP)		☑		☑		☑
Digestión anaeróbica							
	Sistema de Hidrólisis Térmica (THP)		☑		☑		☑
	Digestores anaeróbicos mesofílicos		☑		☑		☑
Deshidratación			☑				
	Filtros prensa de banda		☑		☑		☑
	Centrifugas		☑		☑		☑
Disposición de Lodos			☑				
	Disposición en relleno sanitario	☑			☑	☑	
Otros							
Aprovechamiento del biogás			☑		☑		☑

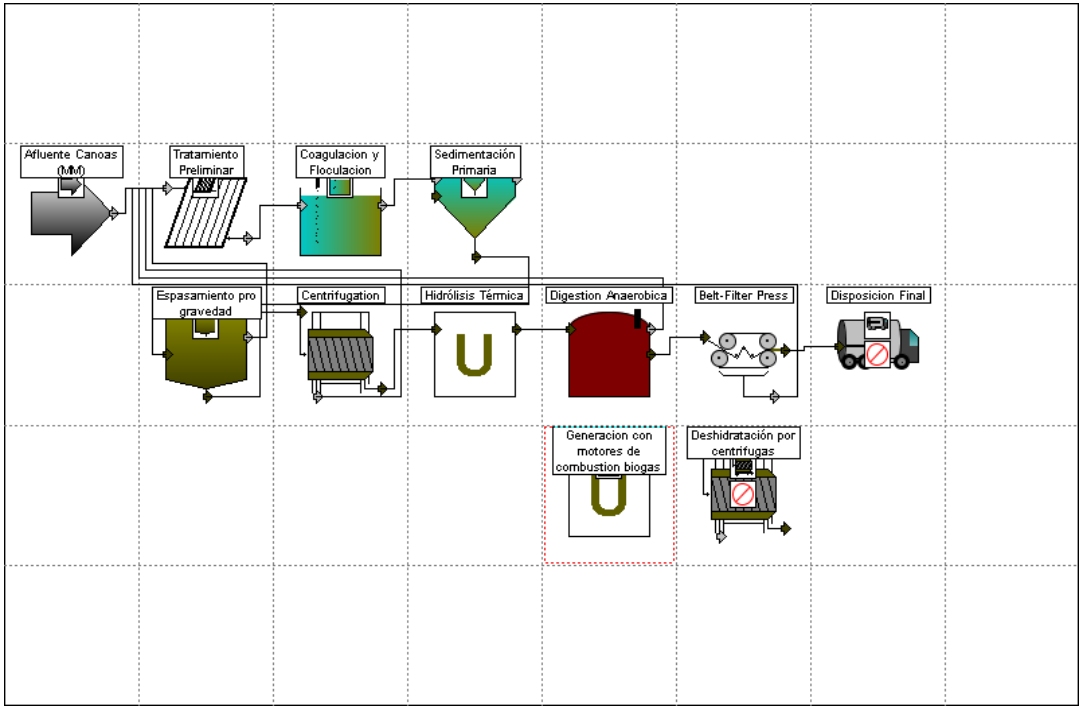
La determinación de costos por parte del consultor para los proceso notados anteriormente, provino de las experiencias del Consultor en proyectos similares y de las bases de datos internas de los profesionales de estimación de costos de CDM Smith.

FASE I. TRATAMIENTO PRIMARIO CON ASISTENCIA QUÍMICA (TPQA)

Layout Comparison Summary

Layout Name	Present Worth	Project	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
FI- CEPT+THP	$1,070,000,000	$592,000,000	$2,570,000	$1,930,000	$1,280,000	$7,060,000	$3,240,000	$21,200,000
FI- CEPT+AD	$1,200,000,000	$589,000,000	$2,430,000	$1,560,000	$8,090,000	$8,410,000	$3,610,000	$20,000,000

FI- TPQA+THP



Summary

Equipment Database

Sept 2007,(USA Avg)

Layout Summary

Present Worth	Project	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
$1,070,000,000	$592,000,000	$2,570,000	$1,930,000	$1,280,000	$7,060,000	$3,240,000	$21,200,000

Process Summary

Process	Construction	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
Tratamiento Preliminar	$13,100,000	$357,000	$112,000	$328,000	$0	$49,300	$662,000
Coagulacion y Floculacion	$0	$0	$0	$0	$4,410,000	$0	$0
Sedimentación Primaria	$36,000,000	$72,300	$40,700	$142,000	$0	$21,700	$806,000
Espasamiento pro gravedad	$2,350,000	$48,200	$22,800	$23,500	$0	$7,060	$148,000
Centrifugation	$32,000,000	$224,000	$280,000	$0	$891,000	$1,860,000	$3,540,000
Hidrólisis Térmica	$46,700,000	$161,000	$161,000	$69,000	$345,000	$331,000	$4,550,000
Digestion Anaerobica	$43,400,000	$148,000	$88,000	$119,000	$0	$315,000	$3,740,000
Belt-Filter Press	$6,350,000	$398,000	$398,000	$0	$1,420,000	$653,000	$660,000
Generacion con motores de c	$25,000,000	$830,000	$830,000	$550,000	$0	$0	$7,000,000
Iron Feed System	$2,250,000	$43,900	$0	$45,000	$0	$0	$114,000
Other Costs	$385,000,000	$293,000	$0	$0	$0	$0	$0

Summary of Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	210	acre
Administration labor hours	35400	hr/yr
Laboratory labor hours	14500	hr/yr
Costs		
DIRECT COSTS		
Mobilization	$14,500,000	$
Site preparation	$12,500,000	$
Site electrical	$48,400,000	$
Yard piping	$29,600,000	$
Instrumentation and control	$30,300,000	$
Lab and administration building	$23,100,000	$
Unit process construction costs	$207,000,000	$
Profit	$54,800,000	$
Total construction costs	$420,000,000	$
INDIRECT COSTS		
Miscellaneous cost	$21,000,000	$
Legal cost	$8,410,000	$
Engineering design fee	$63,100,000	$
Inspection cost	$8,410,000	$
Contingency	$42,000,000	$
Technical	$8,410,000	$
Total indirect costs	$151,000,000	$
MISC		
Cost of land	$0	$
Interest during construction	$20,700,000	$
LABOR COSTS		
Administration labor cost	$177,000	$/yr
Laboratory labor cost	$116,000	$/yr
Unit process operation labor co	$2,280,000	$/yr
Unit process maintenance labo	$1,930,000	$/yr
Total labor costs	$4,510,000	$/yr
PROJECT SUMMARY		
Present worth	$1,070,000,000	$
Total project cost	$592,000,000	$
Total operation labor cost	$2,570,000	$/yr
Total maintenance labor cost	$1,930,000	$/yr
Total material cost	$1,280,000	$/yr
Total chemical cost	$7,060,000	$/yr
Total energy cost	$3,240,000	$/yr
Total amortization cost	$21,200,000	$/yr

Summary of Chemical Feed System for Iron

Description	Value	Units
Iron Salt Solution Feed System		
Quantities		
Ferric chloride dosage rate	44400	lb/d

Iron salt dosage rate as equiva		15300	lb/d
Liquid chemical solution fed		0,0125	MGD(US)
Operation labor required		5480	pers-hrs/yr
Costs			
Construction and equipment cc	$2,250,000		$
Operational labor cost	$43,900		$/yr
Material and supply cost	$45,000		$/yr
Amortization cost	$114,000		$/yr

Afluente Canoas (MM)

User Input Data

Description	Value		Units
Average Flow		365	MGD(US)
Minimum Flow		320	MGD(US)
Maximum Flow		730	MGD(US)
Suspended Solids		226	mg/L
% Volatile Solids		75	%
BOD		271	mg/L
Soluble BOD		80	mg/L
COD		550	mg/L
Soluble COD		350	mg/L
TKN		70,4	mgN/L
Soluble TKN		35,2	mgN/L
Ammonia		26	mgN/L
Total Phosphorus		9,7	mgP/L
pH		7,3	
Cations		160	mg/L
Anions		160	mg/L
Settleable Solids		50	mL/L
Oil and Grease		100	mg/L
Nitrite		0	mgN/L
Nitrate		0	mgN/L
Non-Degradable Fraction of VS		40	%
Average Summer		68	deg F
Average Winter		60,8	deg F

Tratamiento Preliminar

User Input Data

Screening

Description	Value		Units
Cleaning Method	Mechanically Cleane		
Mechanically Cleaned Depth		9,84	ft
Manually Cleaned Depth		2	ft
Width		0,25	in
Space		0,235	in
Slope		15	degrees
Shape Factor		1,8	
Approach		1,31	ft/s
Max		3	ft/s
Ave		1,31	ft/s

Grit Removal

Description	Value		Units
Particle Size		0,00786	in
Specific Gravity		2	
Type of Grit Removal	Aerated		

Number of Units		1	
Design By	Depth		
Depth		14,8	ft
Width		65,6	ft
Current Allowance		1,7	
Manning Coefficient		0,035	
Volume of Grit		40	cuft grit/MGal(US)
Detention Time		10	min
Air Supply per Unit Length of T		3	scfm/ft
Surface Velocity		1,5	ft/s
Tank Floor Velocity		1	ft/s
Capital Cost		40	years

Cost Override

Description	**Value**		**Units**
Override Construction Cost	FALSE		
	$0.00		$
Override Annual Operational C	FALSE		
	$0.00		$
Override Annual Maintenance	FALSE		
	$0.00		$
Override Annual Materials Cos	FALSE		
	$0.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$
Override Annual Energy Cost	FALSE		
	$0.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	**Value**		**Units**
Mechanically Cleaned Bar Screen			
Design Information			
Bar size		0,25	in
Bar spacing		0,235	in
Slope of bars from horizontal		15	degrees
Head loss through screen		2,6965E+308	ft
Approach velocity		1,31	ft/s
Average flow through velocity (		1,31	ft/s
Maximum flow through velocity		3	ft/s
Screen channel width		43,7	ft
Average channel depth		9,84	ft
Aerated Grit Chamber			
Design Information			
Maximum flow		728	MGD(US)
Average flow		365	MGD(US)
Minimum flow		319	MGD(US)
Temperature		60,8	deg F
Maximum flow through velocity		0,356	ft/s
Average flow through velocity (		0,178	ft/s
Size of smallest particle 100%		0,00786	in
Specific gravity of particle		2	
Number of units		1	
Maximum flow/unit		728	MGD(US)
Width of channel		214	ft

Depth of channel		14,8	ft
Length of channel		214	ft
Settling velocity of particle		0,0513	ft/s
Hydraulic retention time		10	min
Volume of grit		0,109	MGD(US)
Air supply		3	cfm
Costs			
Construction and equipment cc	$13,100,000		$
Operational labor cost	$357,000		$/yr
Maintenance labor cost	$112,000		$/yr
Material and supply cost	$328,000		$/yr
Energy cost	$49,300		$/yr
Amortization cost	$662,000		$/yr

Espasamiento pro gravedad

User Input Data

Gravity Thickening

Description	Value		Units
Underflow Concentration		5	%
Depth		14	ft
Based On	Mass Loading		
Mass Loading		24	lb/(sqft·d)
Settling Velocity		0,000694	ft/s
Initial Height		4	ft
Intercept		3	ft
Override Design	TRUE		
Surface Area per Thickener		4500	sqft
Number of Units		7	
Override Database Costs	FALSE		
Standard 90 ft Diameter Thicke	$145,000.00		$
Thickener		20	years
Structural		40	years

Cost Override

Description	Value		Units
Override Construction Cost	FALSE		
	$0.00		$
Override Annual Operational C	FALSE		
	$0.00		$
Override Annual Maintenance	FALSE		
	$0.00		$
Override Annual Materials Cos	FALSE		
	$0.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$
Override Annual Energy Cost	FALSE		
	$0.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	Value		Units
Gravity Thickening			
Design Information			
Initial concentration		4	%
Thickened concentration		5	%

Mass loading	24	lb/(sqft·d)
Hydraulic loading	42,6	gal(US)/(sqft·d)
Hydraulic retention time	59	hr
Number of tanks	7	
Tank volume	441000	cuft
Depth	14	ft
Surface area per tank	4500	sqft
Tank diameter	76	ft
Quantities		
Amount of sludge generated	448000	lb/d
Volume of thickened sludge	0,92	MGD(US)
Operation labor required	6020	pers-hrs/yr
Maintenance labor required	2930	pers-hrs/yr
Electrical energy required	35300	kWh/yr
Volume of earthwork required	401000	cuft
Slab thickness	11,4	in
Volume of slab concrete requir	35100	cuft
Wall thickness	14	in
Volume of wall concrete requir	31100	cuft
Costs		
Construction and equipment cc	$2,350,000	$
Operational labor cost	$48,200	$/yr
Maintenance labor cost	$22,800	$/yr
Material and supply cost	$23,500	$/yr
Energy cost	$7,060	$/yr
Amortization cost	$148,000	$/yr

Coagulacion y Floculacion

User Input Data

Chemical Phosphorus Removal

Description	Value	Units
Metal Precipitant	Equivalent Iron	
Effluent Phosphorus	30	mg/L
Override Design	TRUE	
Chemical Dosage	5	mg/L

Cost Override

Description	Value	Units
Override Construction Cost	FALSE	
	$0.00	$
Override Annual Operational C	FALSE	
	$0.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	
	$0.00	$
Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization (	FALSE	
	$0.00	$

Design Output Data

Description	Value	Units
Chemical Phosphorus Removal		

Design Information			
Chemical used	Equivalent Iron		
Chemical dosage		5	mg/L
Mass of chemical per year		2530000	kg/yr
Chemical sludge production		-22	mg/L
Organic sludge production		2,8	mg/L
Costs			
Chemical cost	$4,410,000		$/yr

Centrifugation

User Input Data

Centrifugation

Description	**Value**		**Units**
Cake Solids Content		10	%
Solids Capture		90	%
Power Requirement		1	HP/gpm(US)
Daily Operating Time		8	hr/d
Weekly Operating Time		5	d/wk
Number of Units		2	
Excess Capacity Factor		1,25	
Chemical Dose		1	% dry wt
Override Database Costs	FALSE		
Standard 50 hp Centrifuge	$271,000.00		$
Centrifuge		15	years
Structural		40	years

Cost Override

Description	**Value**	**Units**
Override Construction Cost	TRUE	
	$32,000,000.00	$
Override Annual Operational C	TRUE	
	$224,000.00	$
Override Annual Maintenance	TRUE	
	$280,000.00	$
Override Annual Materials Cos	TRUE	
	$0.00	$
Override Annual Chemical Cos	TRUE	
	$891,000.00	$
Override Annual Energy Cost	TRUE	
	$1,860,000.00	$
Override Annual Amortization (	TRUE	
	$3,540,000.00	$

Design Output Data

Description	**Value**		**Units**
Centrifugation			
Design Information			
Total power required		3360	HP
Power required per unit		197	HP
Excess capacity factor		1,25	
Number of units		17	
Chemical dose		1	% dry wt
Chemicals required		16900	lb/d
Sludge flow		3,87	MGD(US)
Initial solid conc		5	%
Operational hours per day		8	hr

Operational days per week	5	d
Quantities		
Number of centrifuges	17	
Power required per unit	197	HP
Area of building	4650	sqft
Dry solids produced	384000	lb/d
Operation labor required	62900	pers-hrs/yr
Maintenance labor required	10200	pers-hrs/yr
Electrical energy required	4270000	kWh/yr
Polymer Feed System		
Quantities		
Polymer dosage	5640	lb/d
Liquid chemical solution fed	0,27	MGD(US)
O&M labor required	39900	pers-hrs/yr
Dry material handling and mixi	3180	pers-hrs/yr
Total operation labor required	43100	pers-hrs/yr

Sedimentación Primaria

User Input Data

Primary Clarification

Description	Value		Units
Design Basis	Peak Flow		
Surface Overflow Rate		2400	gal(US)/(sqft·d)
Sidewater Depth		16	ft
Specific Gravity		1,05	
Underflow Concentration		4	%
Weir Overflow Rate		15000	gal(US)/(ft·d)
Type of Clarifier	Circular		
Suspended Solids		65	%
BOD		40	%
COD		40	%
TKN		5	%
Phosphorus		5	%
Override Design	TRUE		
Length-Rectangular Only		0	ft
Width-Rectangular Only		0	ft
Diameter-Circular Only		165	ft
Excavation Depth		4	ft
Number of Tanks per Battery		4	
Number of Batteries		4	
Override Database Costs	FALSE		
Standard 20 X 120 ft Rectangu	$119,000.00		$
Standard 90 ft Diameter Circul	$97,600.00		$
Standard 3000 gpm Pump and	$19,500.00		$
Mechanical		20	years
Structural		40	years
Pump		25	years

Cost Override

Description	Value		Units
Override Construction Cost	TRUE		
	$36,000,000.00		$
Override Annual Operational C	FALSE		
	$0.00		$
Override Annual Maintenance	FALSE		
	$0.00		$

Override Annual Materials Cos	FALSE		
	$0.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$
Override Annual Energy Cost	FALSE		
	$0.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	Value		Units
Primary Clarification			
Design Information			
Surface area		342000	sqft
Surface area per circular clarifi		21400	sqft
Diameter of each circular clarif		165	ft
Number of clarifiers per battery		4	
Number of batteries		4	
Solids loading rate		2,01	lb/(sqft·d)
Hydraulic retention time		2,68	hr
Weir length		48800	ft
Volume of sludge generated		1,34	MGD(US)
Surface overflow rate		2140	gal(US)/(sqft·d)
Quantities			
Operation labor required		8580	pers-hrs/yr
Maintenance labor required		4860	pers-hrs/yr
Electrical energy required		63700	kWh/yr
Volume of earthwork required		5580000	cuft
Slab thickness		11,9	in
Volume of slab concrete requir		374000	cuft
Wall thickness		15	in
Volume of wall concrete requir		183000	cuft
Costs			
Operational labor cost	$68,700		$/yr
Maintenance labor cost	$37,700		$/yr
Material and supply cost	$141,000		$/yr
Energy cost	$12,700		$/yr
Amortization cost	$802,000		$/yr
Notes			
Effluent soluble TKN adjusted to satisfy user-specified TKN removal.			
Waste Sludge Pumping			
Design Information			
Average daily pumping rate		1,34	MGD(US)
Total pumping capacity		1,34	MGD(US)
Design capacity per pump		0,671	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		1,34	MGD(US)
Quantities			
Operation labor required		457	pers-hrs/yr
Maintenance labor required		376	pers-hrs/yr
Electrical energy required		44900	kWh/yr
Volume of earthwork required		1810	cuft
Area of pump building		226	sqft
Costs			
Operational labor cost	$3,660		$/yr

Maintenance labor cost	$2,920	$/yr
Material and supply cost	$517	$/yr
Energy cost	$8,990	$/yr
Amortization cost	$4,820	$/yr

Hidrólisis Térmica

User Input Data

User Specified Sludge Process

Description	Value	Units
Volume Reduction	0	%
Percent Volatile Solids Destroy	0	%

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$46,700,000.00	$
Override Annual Operational C	TRUE	
	$161,000.00	$
Override Annual Maintenance	TRUE	
	$161,000.00	$
Override Annual Materials Cos	TRUE	
	$69,000.00	$
Override Annual Chemical Cos	TRUE	
	$345,000.00	$
Override Annual Energy Cost	TRUE	
	$331,000.00	$
Override Annual Amortization (	TRUE	
	$4,550,000.00	$

Design Output Data

Description	Value	Units
User Specified Sludge Treatment Process		
Design Information		
No Design Data		

Digestion Anaerobica

User Input Data

Anaerobic Digestion

Description	Value	Units
Specific Gravity	1,05	
Percent Volatile Solids Destroy	45	%
Concentration in Digester	3,4	%
Minimum Detention Time in Pri	15	d
Location	Warm-Winter > 10 D	
Raw Wastewater	60,8	deg F
Digester	104	deg F
Fraction of Influent Flow Retur	2	%
Suspended Solids	6250	mg/L
BOD	1000	mg/L
COD	2150	mg/L
TKN	950	mgN/L
Ammonia	650	mg/L
Override Design	TRUE	
Diameter	90	ft
Sidewater Depth	75	ft
Number of Primary Digester Ta	10	

Number of Secondary Digester		0	
Number of Batteries		1	
Override Database Costs	FALSE		
Standard 70 ft Diameter Floatir	$444,000.00		$
Standard 60 ft Diameter Gas C	$131,000.00		$
Standard 1 Million Btu/Hr Heat	$55,300.00		$
Standard 2 in Diameter Gas Sa	$43,400.00		$
Standard Size Sludge Pump 8(	$5,960.00		$
Natural Gas Per 1000 cuft	$21.10		$
Floating Cover		20	years
Gas Circulation Unit		20	years
Heating Unit		20	years
Gas Safety Equipment		20	years
Sludge Pump		25	years
Structural		40	years

Cost Override

Description	**Value**	**Units**
Override Construction Cost	TRUE	
	$43,400,000.00	$
Override Annual Operational C	TRUE	
	$148,000.00	$
Override Annual Maintenance	TRUE	
	$88,000.00	$
Override Annual Materials Cos	TRUE	
	$119,000.00	$
Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	TRUE	
	$315,000.00	$
Override Annual Amortization (	TRUE	
	$3,740,000.00	$

Design Output Data

Description	**Value**	**Units**
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	45	%
Solids concentration in digeste	3,4	%
Detention time	15	d
Digester depth	75	ft
Digester diameter	90	ft
Effective digester volume	5010000	cuft
Number of digesters per batter	10	
Number of primary digesters p(	10	
Number of secondary digesters	0	
Number of batteries	1	
Gas produced	0,164	MGD(US)
Heat required	14300000	BTU/hr
Digester gas required	5,92	MGD(US)
Total natural gas required	0,284	MGD(US)
Quantities		
Operation labor required	22200	pers-hrs/yr
Maintenance labor required	13100	pers-hrs/yr
Electrical energy required	1970000	kWh/yr
Volume of earthwork required	2230000	cuft

Slab thickness	22,3	in
Volume of slab concrete requir	125000	cuft
Wall thickness	45	in
Volume of wall concrete requir	885000	cuft
Sidewater depth	75	ft
Surface area/floor of 2-story cc	9880	sqft
Piping size	10	in
Length of total piping system	4430	ft
Number of 90 degree elbows	130	
Number of tees	255	
Number of plug valves	185	
Total dry solids treated	363000	lb/d

Notes

Mass balance based on user input

Generacion con motores de combustion biogas

User Input Data

User Specified Sludge Process

Description	Value	Units
Volume Reduction	0	%
Percent Volatile Solids Destroy	0	%

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$25,000,000.00	$
Override Annual Operational C	TRUE	
	$830,000.00	$
Override Annual Maintenance	TRUE	
	$830,000.00	$
Override Annual Materials Cos	TRUE	
	$550,000.00	$
Override Annual Chemical Cos	TRUE	
	$0.00	$
Override Annual Energy Cost	TRUE	
	$-14,300,000.00	$
Override Annual Amortization (	TRUE	
	$7,000,000.00	$

Design Output Data

Description	Value	Units

Belt-Filter Press

User Input Data

Belt-Filter Press

Description	Value	Units
Cake Solids Content	32	%
Density of Cake	75	lb/cuft
Operating Schedule per Day	8	hr/d
Days Operating per Week	5	d/wk
Hydraulic Loading per Metre of	0,1	MGD(US)
Polymer Dose	1	% dry wt
Filtrate Solids Concentration	100	mg/L
Override Design	FALSE	
Building Size Requirement	11100	sqft
Number of Belt Filters	26	

Override Database Costs	FALSE		
1m Belt Filter System	$250,000.00		$
2m Belt Filter System	$276,000.00		$
Belt Filter		20	years
Structural		40	years

Cost Override

Description	**Value**		**Units**
Override Construction Cost	TRUE		
	$6,350,000.00		$
Override Annual Operational C	TRUE		
	$398,000.00		$
Override Annual Maintenance	TRUE		
	$398,000.00		$
Override Annual Materials Cos	TRUE		
	$0.00		$
Override Annual Chemical Cos	TRUE		
	$1,420,000.00		$
Override Annual Energy Cost	TRUE		
	$653,000.00		$
Override Annual Amortization (	TRUE		
	$660,000.00		$

Design Output Data

Description	**Value**		**Units**
Belt-Filter Press			
Design Information			
Belt filter width		6,56	ft
Number of units		26	
Hydraulic loading per unit per r		0,1	MGD(US)
Hydraulic loading required per		5,1	MGD(US)
Final solids content		32	%
Solids capture fraction		0,997	
Quantities			
Operation labor required		11500	pers-hrs/yr
Maintenance labor required		2870	pers-hrs/yr
Power		2570000	kWh/yr
Polymer required		4130	lb/d
Dry solids produced		413000	lb/d
Belt filter(s)	$7,180,000		$
Building	$513,000		$
Installation	$1,790,000		$
Polymer system	$2,660,000		$
Feed pumps	$789,000		$
Conveyor system	$1,790,000		$

Deshidratación por centrifugas

User Input Data

Centrifugation

Description	**Value**		**Units**
Cake Solids Content		19	%
Solids Capture		90	%
Power Requirement		1	HP/gpm(US)
Daily Operating Time		8	hr/d
Weekly Operating Time		7	d/wk
Number of Units		5	

Excess Capacity Factor		1,25	
Chemical Dose		1	% dry wt
Override Database Costs	FALSE		
Standard 50 hp Centrifuge	$271,000.00		$
Centrifuge		15	years
Structural		40	years

Cost Override

Description	**Value**		**Units**
Override Construction Cost	TRUE		
	$15,000,000.00		$
Override Annual Operational C	TRUE		
	$300,000.00		$
Override Annual Maintenance	TRUE		
	$350,000.00		$
Override Annual Materials Cos	TRUE		
	$0.00		$
Override Annual Chemical Cos	TRUE		
	$4,000,000.00		$
Override Annual Energy Cost	TRUE		
	$2,800,000.00		$
Override Annual Amortization (	TRUE		
	$1,500,000.00		$

Design Output Data

Description	**Value**		**Units**

Disposicion Final

User Input Data

Hauling and Land Filling

Description	**Value**		**Units**
Distance to Disposal Site		15,5	miles
Daily Operation		8	hr
Loading Time per Vehicle		0,75	hr
Hauling Time per Trip		1	hr
Disposal Cost Based On	Sludge Disposal per		
Override Database Costs	TRUE		
Standard 22 cuyd Vehicle	$314,000.00		$
Annual Charge of Land Fill	$43,100.00		$
Sludge Disposal per cuyd	$23.60		$
Sludge Disposal per ton	$28.00		$
Vehicle		6	years
Structural		40	years

Cost Override

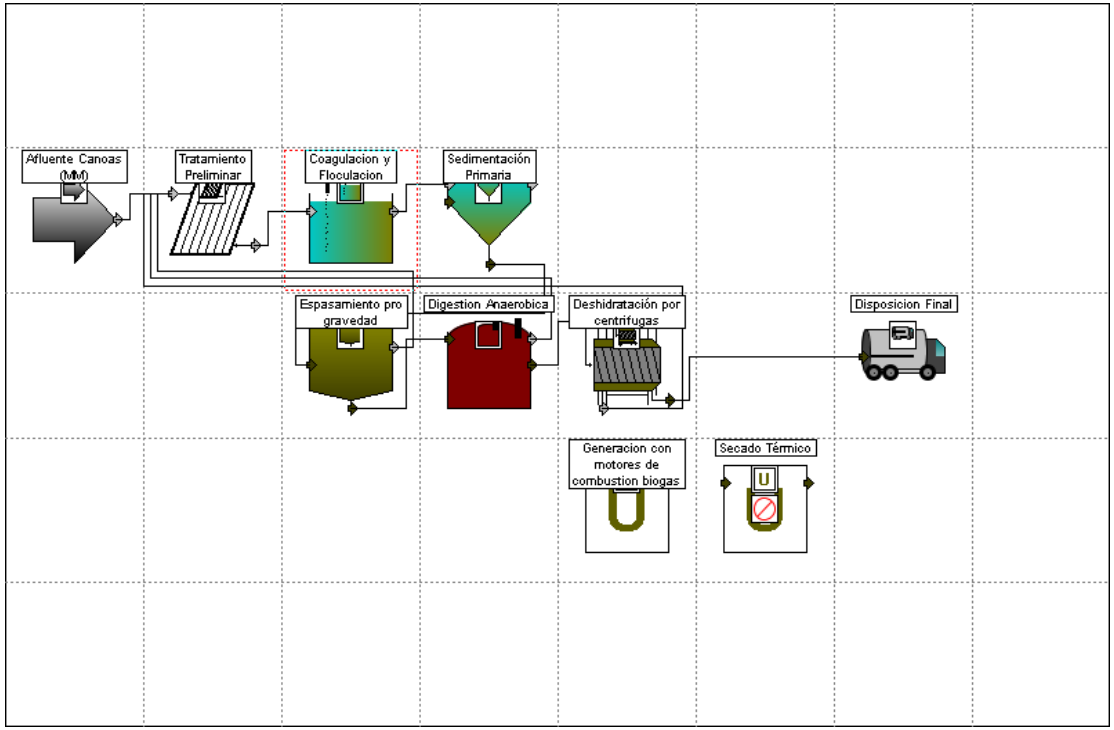
Description	**Value**		**Units**
Override Construction Cost	FALSE		
	$0.00		$
Override Annual Operational C	FALSE		
	$0.00		$
Override Annual Maintenance	FALSE		
	$0.00		$
Override Annual Materials Cos	FALSE		
	$0.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$

Override Annual Energy Cost	FALSE		
	$0.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	Value		Units
Sludge Hauling and Land Filling			
Design Information			
Volume of sludge hauled		0,128	MGD(US)
Truck capacity		810	cuft
Round trip time to disposal site		1	hr
Truck loading time		0,75	hr
Operational hours per day		8	hr
Number of trucks required		5	
Distance to disposal site		15,5	miles
Quantities			
Total sludge volume hauled		0,128	MGD(US)
Maximum anticipated landfill d		30	d
Anticipated sludge storage hei		8	ft
Sludge storage shed area		64500	sqft
Width of sludge storage shed s		180	ft
Length of sludge storage shed		359	ft
Volume of earthwork required		165000	cuft
Volume of slab concrete requir		66900	cuft
Surface area of canopy roof		64500	sqft
Round trip haul distance		31,1	miles
Round trips per day per truck		5	
Distance traveled per year per		38800	miles
Sludge hauled		1130000	lb/d
Operation labor required		15500	pers-hrs/yr
LandFilling cost	$5,480,000		$/yr

FI- TPQA+DA



Summary

Equipment Database

Sept 2007,(USA Avg)

Layout Summary

Present Worth	Project	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
$1,200,000,000	$589,000,000	$2,430,000	$1,560,000	$8,090,000	$8,410,000	$3,610,000	$20,000,000

Process Summary

Process	Construction	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
Tratamiento Preliminar	$13,100,000	$357,000	$111,000	$328,000	$0	$49,300	$662,000
Coagulacion y Floculacion	$0	$0	$0	$0	$4,410,000	$0	$0
Sedimentación Primaria	$36,000,000	$72,300	$40,400	$142,000	$0	$22,200	$806,000
Espasamiento pro gravedad	$2,350,000	$50,000	$23,300	$23,500	$0	$7,260	$148,000
Digestion Anaerobica	$108,000,000	$346,000	$206,000	$279,000	$0	$735,000	$9,300,000
Deshidratación por centrifugas	$15,000,000	$300,000	$350,000	$0	$4,000,000	$2,800,000	$1,500,000
Disposicion Final	$3,320,000	$138,000	$0	$6,720,000	$0	$0	$443,000
Generacion con motores de co	$25,000,000	$830,000	$830,000	$550,000	$0	$0	$7,000,000
Iron Feed System	$2,250,000	$43,900	$0	$45,100	$0	$0	$114,000
Other Costs	$384,000,000	$293,000	$0	$0	$0	$0	$0

Summary of Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	210	acre
Administration labor hours	35400	hr/yr
Laboratory labor hours	14500	hr/yr
Costs		
DIRECT COSTS		
Mobilization	$14,500,000	$
Site preparation	$12,500,000	$
Site electrical	$48,400,000	$
Yard piping	$29,600,000	$
Instrumentation and control	$30,300,000	$
Lab and administration building	$23,100,000	$
Unit process construction costs	$205,000,000	$
Profit	$54,500,000	$
Total construction costs	$418,000,000	$
INDIRECT COSTS		
Miscellaneous cost	$20,900,000	$
Legal cost	$8,360,000	$
Engineering design fee	$62,700,000	$
Inspection cost	$8,360,000	$
Contingency	$41,800,000	$
Technical	$8,360,000	$
Total indirect costs	$150,000,000	$
MISC		
Cost of land	$0	$
Interest during construction	$20,600,000	$
LABOR COSTS		
Administration labor cost	$177,000	$/yr
Laboratory labor cost	$116,000	$/yr
Unit process operation labor co	$2,140,000	$/yr
Unit process maintenance labo	$1,560,000	$/yr
Total labor costs	$3,990,000	$/yr
PROJECT SUMMARY		
Present worth	$1,200,000,000	$
Total project cost	$589,000,000	$
Total operation labor cost	$2,430,000	$/yr
Total maintenance labor cost	$1,560,000	$/yr
Total material cost	$8,090,000	$/yr
Total chemical cost	$8,410,000	$/yr
Total energy cost	$3,610,000	$/yr
Total amortization cost	$20,000,000	$/yr

Summary of Chemical Feed System for Iron

Description	Value	Units
Iron Salt Solution Feed System		
Quantities		
Ferric chloride dosage rate	44400	lb/d

Iron salt dosage rate as equiva		15300	lb/d
Liquid chemical solution fed		0,0125	MGD(US)
Operation labor required		5490	pers-hrs/yr
Costs			
Construction and equipment cc	$2,250,000		$
Operational labor cost	$43,900		$/yr
Material and supply cost	$45,100		$/yr
Amortization cost	$114,000		$/yr

Afluente Canoas (MM)

User Input Data

Description	Value		Units
Average Flow		365	MGD(US)
Minimum Flow		320	MGD(US)
Maximum Flow		730	MGD(US)
Suspended Solids		226	mg/L
% Volatile Solids		75	%
BOD		271	mg/L
Soluble BOD		80	mg/L
COD		550	mg/L
Soluble COD		350	mg/L
TKN		70,4	mgN/L
Soluble TKN		35,2	mgN/L
Ammonia		26	mgN/L
Total Phosphorus		9,7	mgP/L
pH		7,3	
Cations		160	mg/L
Anions		160	mg/L
Settleable Solids		50	mL/L
Oil and Grease		100	mg/L
Nitrite		0	mgN/L
Nitrate		0	mgN/L
Non-Degradable Fraction of VS		40	%
Average Summer		68	deg F
Average Winter		60,8	deg F

Tratamiento Preliminar

User Input Data

Screening

Description	Value		Units
Cleaning Method	Mechanically Cleane		
Mechanically Cleaned Depth		9,84	ft
Manually Cleaned Depth		2	ft
Width		0,25	in
Space		0,235	in
Slope		15	degrees
Shape Factor		1,8	
Approach		1,31	ft/s
Max		3	ft/s
Ave		1,31	ft/s

Grit Removal

Description	Value		Units
Particle Size		0,00786	in
Specific Gravity		2	
Type of Grit Removal	Aerated		

Number of Units		1	
Design By	Depth		
Depth		14,8	ft
Width		65,6	ft
Current Allowance		1,7	
Manning Coefficient		0,035	
Volume of Grit		40	cuft grit/MGal(US)
Detention Time		10	min
Air Supply per Unit Length of T		3	scfm/ft
Surface Velocity		1,5	ft/s
Tank Floor Velocity		1	ft/s
Capital Cost		40	years

Cost Override

Description	**Value**		**Units**
Override Construction Cost	FALSE		
	$0.00		$
Override Annual Operational C	FALSE		
	$0.00		$
Override Annual Maintenance	FALSE		
	$0.00		$
Override Annual Materials Cos	FALSE		
	$0.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$
Override Annual Energy Cost	FALSE		
	$0.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	**Value**		**Units**
Mechanically Cleaned Bar Screen			
Design Information			
Bar size		0,25	in
Bar spacing		0,235	in
Slope of bars from horizontal		15	degrees
Head loss through screen		2,6965E+308	ft
Approach velocity		1,31	ft/s
Average flow through velocity (		1,31	ft/s
Maximum flow through velocity		3	ft/s
Screen channel width		43,7	ft
Average channel depth		9,84	ft
Aerated Grit Chamber			
Design Information			
Maximum flow		728	MGD(US)
Average flow		365	MGD(US)
Minimum flow		319	MGD(US)
Temperature		60,8	deg F
Maximum flow through velocity		0,356	ft/s
Average flow through velocity (		0,178	ft/s
Size of smallest particle 100%		0,00786	in
Specific gravity of particle		2	
Number of units		1	
Maximum flow/unit		728	MGD(US)
Width of channel		214	ft

Depth of channel		14,8	ft
Length of channel		214	ft
Settling velocity of particle		0,0513	ft/s
Hydraulic retention time		10	min
Volume of grit		0,109	MGD(US)
Air supply		3	cfm
Costs			
Construction and equipment cc	$13,100,000		$
Operational labor cost	$357,000		$/yr
Maintenance labor cost	$111,000		$/yr
Material and supply cost	$328,000		$/yr
Energy cost	$49,300		$/yr
Amortization cost	$662,000		$/yr

Coagulacion y Floculacion

User Input Data

Chemical Phosphorus Removal

Description	Value		Units
Metal Precipitant	Equivalent Iron		
Effluent Phosphorus		30	mg/L
Override Design	TRUE		
Chemical Dosage		5	mg/L

Cost Override

Description	Value		Units
Override Construction Cost	FALSE		
	$0.00		$
Override Annual Operational C	FALSE		
	$0.00		$
Override Annual Maintenance	FALSE		
	$0.00		$
Override Annual Materials Cos	FALSE		
	$0.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$
Override Annual Energy Cost	FALSE		
	$0.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	Value		Units
Chemical Phosphorus Removal			
Design Information			
Chemical used	Equivalent Iron		
Chemical dosage		5	mg/L
Mass of chemical per year		2530000	kg/yr
Chemical sludge production		-22	mg/L
Organic sludge production		2,8	mg/L
Costs			
Chemical cost	$4,410,000		$/yr

Espasamiento pro gravedad

User Input Data

Gravity Thickening

Description	Value		Units

Underflow Concentration		5	%
Depth		14	ft
Based On	Mass Loading		
Mass Loading		24	lb/(sqft·d)
Settling Velocity		0,000694	ft/s
Initial Height		4	ft
Intercept		3	ft
Override Design	TRUE		
Surface Area per Thickener		4500	sqft
Number of Units		7	
Override Database Costs	FALSE		
Standard 90 ft Diameter Thick	$145,000.00		$
Thickener		20	years
Structural		40	years

Cost Override

Description	Value		Units
Override Construction Cost	FALSE		
	$0.00		$
Override Annual Operational C	FALSE		
	$0.00		$
Override Annual Maintenance	FALSE		
	$0.00		$
Override Annual Materials Cos	FALSE		
	$0.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$
Override Annual Energy Cost	FALSE		
	$0.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	Value		Units
Gravity Thickening			
Design Information			
Initial concentration		4	%
Thickened concentration		5	%
Mass loading		24	lb/(sqft·d)
Hydraulic loading		44,8	gal(US)/(sqft·d)
Hydraulic retention time		56,1	hr
Number of tanks		7	
Tank volume		441000	cuft
Depth		14	ft
Surface area per tank		4500	sqft
Tank diameter		76	ft
Quantities			
Amount of sludge generated		471000	lb/d
Volume of thickened sludge		0,967	MGD(US)
Operation labor required		6250	pers-hrs/yr
Maintenance labor required		3030	pers-hrs/yr
Electrical energy required		36300	kWh/yr
Volume of earthwork required		401000	cuft
Slab thickness		11,4	in
Volume of slab concrete requir		35100	cuft
Wall thickness		14	in

Volume of wall concrete requir		31100	cuft
Costs			
Construction and equipment cc	$2,350,000		$
Operational labor cost	$50,000		$/yr
Maintenance labor cost	$23,300		$/yr
Material and supply cost	$23,500		$/yr
Energy cost	$7,260		$/yr
Amortization cost	$148,000		$/yr

Sedimentación Primaria

User Input Data

Primary Clarification

Description	**Value**		**Units**
Design Basis	Peak Flow		
Surface Overflow Rate		2400	gal(US)/(sqft·d)
Sidewater Depth		16	ft
Specific Gravity		1,05	
Underflow Concentration		4	%
Weir Overflow Rate		15000	gal(US)/(ft·d)
Type of Clarifier	Circular		
Suspended Solids		65	%
BOD		40	%
COD		40	%
TKN		5	%
Phosphorus		5	%
Override Design	TRUE		
Length-Rectangular Only		0	ft
Width-Rectangular Only		0	ft
Diameter-Circular Only		165	ft
Excavation Depth		4	ft
Number of Tanks per Battery		4	
Number of Batteries		4	
Override Database Costs	FALSE		
Standard 20 X 120 ft Rectangu	$119,000.00		$
Standard 90 ft Diameter Circul	$97,600.00		$
Standard 3000 gpm Pump and	$19,500.00		$
Mechanical		20	years
Structural		40	years
Pump		25	years

Cost Override

Description	**Value**	**Units**
Override Construction Cost	TRUE	
	$36,000,000.00	$
Override Annual Operational C	FALSE	
	$0.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	
	$0.00	$
Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization (	FALSE	
	$0.00	$

Design Output Data

Description	Value		Units
Primary Clarification			
Design Information			
Surface area		342000	sqft
Surface area per circular clarifi		21400	sqft
Diameter of each circular clarif		165	ft
Number of clarifiers per battery		4	
Number of batteries		4	
Solids loading rate		2,11	lb/(sqft·d)
Hydraulic retention time		2,68	hr
Weir length		48800	ft
Volume of sludge generated		1,41	MGD(US)
Surface overflow rate		2140	gal(US)/(sqft·d)
Quantities			
Operation labor required		8580	pers-hrs/yr
Maintenance labor required		4860	pers-hrs/yr
Electrical energy required		63700	kWh/yr
Volume of earthwork required		5580000	cuft
Slab thickness		11,9	in
Volume of slab concrete requir		374000	cuft
Wall thickness		15	in
Volume of wall concrete requir		183000	cuft
Costs			
Operational labor cost	$68,700		$/yr
Maintenance labor cost	$37,500		$/yr
Material and supply cost	$141,000		$/yr
Energy cost	$12,700		$/yr
Amortization cost	$802,000		$/yr
Notes			
Effluent soluble TKN adjusted to satisfy user-specified TKN removal.			
Waste Sludge Pumping			
Design Information			
Average daily pumping rate		1,41	MGD(US)
Total pumping capacity		1,41	MGD(US)
Design capacity per pump		0,705	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		1,41	MGD(US)
Quantities			
Operation labor required		460	pers-hrs/yr
Maintenance labor required		379	pers-hrs/yr
Electrical energy required		47200	kWh/yr
Volume of earthwork required		1820	cuft
Area of pump building		228	sqft
Costs			
Operational labor cost	$3,680		$/yr
Maintenance labor cost	$2,920		$/yr
Material and supply cost	$527		$/yr
Energy cost	$9,440		$/yr
Amortization cost	$4,910		$/yr

Digestion Anaerobica

User Input Data

Anaerobic Digestion

Description	Value		Units
Specific Gravity		1,05	
Percent Volatile Solids Destroy		45	%
Concentration in Digester		3,4	%
Minimum Detention Time in Pri		15	d
Location	Warm-Winter > 10 D		
Raw Wastewater		60,8	deg F
Digester		104	deg F
Fraction of Influent Flow Returi		2	%
Suspended Solids		6250	mg/L
BOD		1000	mg/L
COD		2150	mg/L
TKN		950	mgN/L
Ammonia		650	mg/L
Override Design	TRUE		
Diameter		90	ft
Sidewater Depth		75	ft
Number of Primary Digester Ta		10	
Number of Secondary Digester		0	
Number of Batteries		1	
Override Database Costs	FALSE		
Standard 70 ft Diameter Floatir	$444,000.00		$
Standard 60 ft Diameter Gas C	$131,000.00		$
Standard 1 Million Btu/Hr Heat	$55,300.00		$
Standard 2 in Diameter Gas Sa	$43,400.00		$
Standard Size Sludge Pump 8(	$5,960.00		$
Natural Gas Per 1000 cuft	$21.10		$
Floating Cover		20	years
Gas Circulation Unit		20	years
Heating Unit		20	years
Gas Safety Equipment		20	years
Sludge Pump		25	years
Structural		40	years

Cost Override

Description	Value		Units
Override Construction Cost	TRUE		
	$108,000,000.00		$
Override Annual Operational C	TRUE		
	$346,000.00		$
Override Annual Maintenance	TRUE		
	$206,000.00		$
Override Annual Materials Cos	TRUE		
	$279,000.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$
Override Annual Energy Cost	TRUE		
	$735,000.00		$
Override Annual Amortization (	TRUE		
	$9,300,000.00		$

Design Output Data

Description	Value		Units
Anaerobic Digestion			
Design Information			
Percent VSS destroyed		45	%

Solids concentration in digeste	3,4	%
Detention time	15	d
Digester depth	75	ft
Digester diameter	90	ft
Effective digester volume	5010000	cuft
Number of digesters per batter	10	
Number of primary digesters pe	10	
Number of secondary digesters	0	
Number of batteries	1	
Gas produced	17,8	MGD(US)
Heat required	23000000	BTU/hr
Digester gas required	9,55	MGD(US)
Total natural gas required	0	MGD(US)
Quantities		
Operation labor required	25200	pers-hrs/yr
Maintenance labor required	14800	pers-hrs/yr
Electrical energy required	2230000	kWh/yr
Volume of earthwork required	2230000	cuft
Slab thickness	22,3	in
Volume of slab concrete requir	125000	cuft
Wall thickness	45	in
Volume of wall concrete requir	885000	cuft
Sidewater depth	75	ft
Surface area/floor of 2-story cc	9880	sqft
Piping size	10	in
Length of total piping system	4430	ft
Number of 90 degree elbows	130	
Number of tees	255	
Number of plug valves	185	
Total dry solids treated	424000	lb/d
Notes		
Mass balance based on user input		

Deshidratación por centrifugas

User Input Data

Centrifugation

Description	Value		Units
Cake Solids Content		19	%
Solids Capture		90	%
Power Requirement		1	HP/gpm(US)
Daily Operating Time		8	hr/d
Weekly Operating Time		7	d/wk
Number of Units		5	
Excess Capacity Factor		1,25	
Chemical Dose		1	% dry wt
Override Database Costs	FALSE		
Standard 50 hp Centrifuge	$271,000.00		$
Centrifuge		15	years
Structural		40	years

Cost Override

Description	Value		Units
Override Construction Cost	TRUE		
	$15,000,000.00		$
Override Annual Operational C	TRUE		
	$300,000.00		$

Override Annual Maintenance	TRUE	
	$350,000.00	$
Override Annual Materials Cos	TRUE	
	$0.00	$
Override Annual Chemical Cos	TRUE	
	$4,000,000.00	$
Override Annual Energy Cost	TRUE	
	$2,800,000.00	$
Override Annual Amortization (	TRUE	
	$1,500,000.00	$

Design Output Data

Description	Value	Units
Centrifugation		
Design Information		
Total power required	2310	HP
Power required per unit	193	HP
Excess capacity factor	1,25	
Number of units	12	
Chemical dose	1	% dry wt
Chemicals required	7940	lb/d
Sludge flow	2,67	MGD(US)
Initial solid conc	3,4	%
Operational hours per day	8	hr
Operational days per week	7	d
Quantities		
Number of centrifuges	12	
Power required per unit	193	HP
Area of building	3290	sqft
Dry solids produced	252000	lb/d
Operation labor required	43500	pers-hrs/yr
Maintenance labor required	7080	pers-hrs/yr
Electrical energy required	2890000	kWh/yr
Polymer Feed System		
Quantities		
Polymer dosage	2650	lb/d
Liquid chemical solution fed	0,127	MGD(US)
O&M labor required	24500	pers-hrs/yr
Dry material handling and mixi	2560	pers-hrs/yr
Total operation labor required	27000	pers-hrs/yr

Generacion con motores de combustion biogas

User Input Data

User Specified Sludge Process

Description	Value	Units
Volume Reduction	0	%
Percent Volatile Solids Destroy	0	%

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$25,000,000.00	$
Override Annual Operational C	TRUE	
	$830,000.00	$
Override Annual Maintenance	TRUE	
	$830,000.00	$

Override Annual Materials Cos	TRUE		
	$550,000.00		$
Override Annual Chemical Cos	TRUE		
	$0.00		$
Override Annual Energy Cost	TRUE		
	$-14,300,000.00		$
Override Annual Amortization (	TRUE		
	$7,000,000.00		$

Design Output Data

Description	Value	Units

Secado Térmico

User Input Data

User Specified Sludge Process

Description	Value	Units
Volume Reduction	70	%
Percent Volatile Solids Destroy	90	%

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$45,000,000.00	$
Override Annual Operational C	TRUE	
	$1,620,000.00	$
Override Annual Maintenance	TRUE	
	$1,310,000.00	$
Override Annual Materials Cos	TRUE	
	$462,000.00	$
Override Annual Chemical Cos	TRUE	
	$0.00	$
Override Annual Energy Cost	TRUE	
	$8,100,000.00	$
Override Annual Amortization (	TRUE	
	$4,550,000.00	$

Design Output Data

Description	Value	Units

Disposicion Final

User Input Data

Hauling and Land Filling

Description	Value	Units
Distance to Disposal Site	15,5	miles
Daily Operation	8	hr
Loading Time per Vehicle	0,75	hr
Hauling Time per Trip	1	hr
Disposal Cost Based On	Sludge Disposal per	
Override Database Costs	TRUE	
Standard 22 cuyd Vehicle	$314,000.00	$
Annual Charge of Land Fill	$43,100.00	$
Sludge Disposal per cuyd	$23.60	$
Sludge Disposal per ton	$28.00	$
Vehicle	6	years
Structural	40	years

Cost Override

Description	Value	Units
Override Construction Cost	FALSE	
	$0.00	$
Override Annual Operational C	FALSE	
	$0.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	
	$0.00	$
Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization (	FALSE	
	$0.00	$

Design Output Data

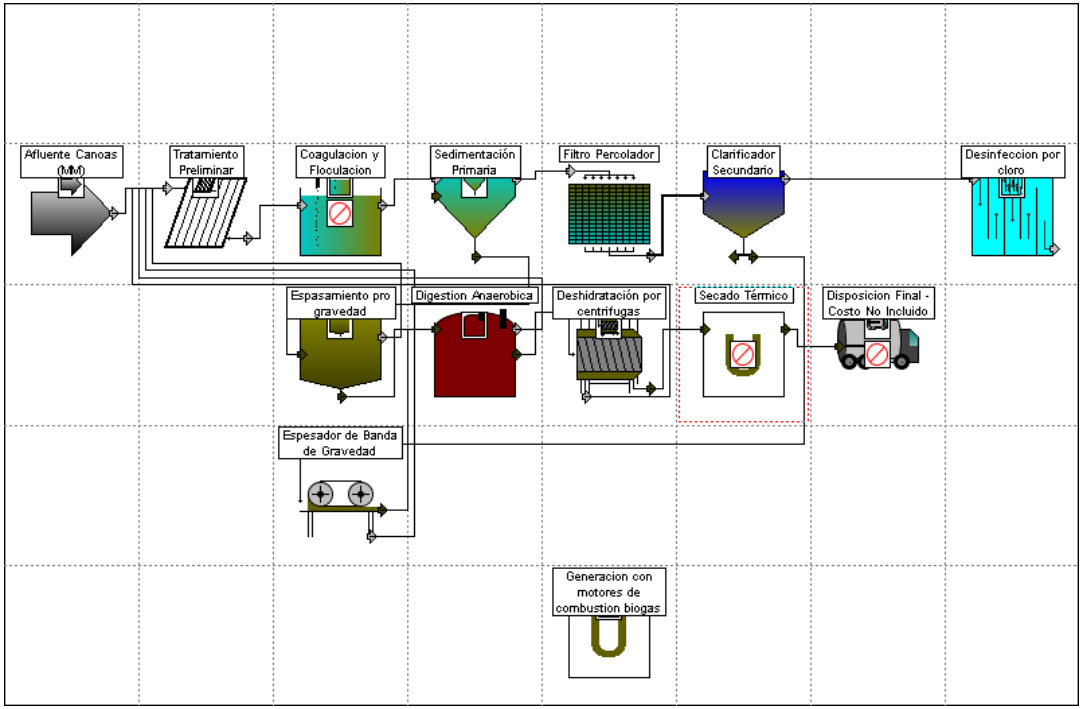
Description	Value		Units
Sludge Hauling and Land Filling			
Design Information			
Volume of sludge hauled		0,143	MGD(US)
Truck capacity		810	cuft
Round trip time to disposal site		1	hr
Truck loading time		0,75	hr
Operational hours per day		8	hr
Number of trucks required		6	
Distance to disposal site		15,5	miles
Quantities			
Total sludge volume hauled		0,143	MGD(US)
Maximum anticipated landfill d		30	d
Anticipated sludge storage hei		8	ft
Sludge storage shed area		71700	sqft
Width of sludge storage shed s		189	ft
Length of sludge storage shed		379	ft
Volume of earthwork required		183000	cuft
Volume of slab concrete requir		74300	cuft
Surface area of canopy roof		71700	sqft
Round trip haul distance		31,1	miles
Round trips per day per truck		4	
Distance traveled per year per		31100	miles
Sludge hauled		1250000	lb/d
Operation labor required		17200	pers-hrs/yr
LandFilling cost	$6,100,000		$/yr
Costs			
Construction and equipment cc	$3,320,000		$
Operational labor cost	$138,000		$/yr
Material and supply cost	$6,720,000		$/yr
Amortization cost	$443,000		$/yr

ALTERNATIVAS PARA FASE II – EXTENSIÓN DE LA PTAR A UN TRATAMIENTO BIOLÓGICO CONVENCIONAL

Layout Comparison Summary

Layout Name	Present Worth	Project	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
FII-Alt 2-FP	$2,050,000,000	$1,180,000,000	$2,940,000	$1,900,000	$3,090,000	$15,100,000	$10,700,000	$39,500,000
FII-Alt3-BAF	$3,410,000,000	$1,660,000,000	$3,040,000	$2,060,000	$2,510,000	$16,600,000	$20,300,000	$88,000,000
FII-Alt 1- Alim Esc	$2,360,000,000	$1,090,000,000	$2,950,000	$1,940,000	$2,360,000	$16,200,000	$27,400,000	$39,800,000

FII-Alt 2-FP



Summary

Equipment Database

Sept 2007,(USA Avg)

Layout Summary

Present Worth	Project	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
$2,050,000,000	$1,180,000,000	$2,940,000	$1,900,000	$3,090,000	$15,100,000	$10,700,000	$39,500,000

Process Summary

Process	Construction	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
Tratamiento Preliminar	$13,100,000	$359,000	$119,000	$329,000	$0	$49,400	$664,000
Sedimentación Primaria	$36,000,000	$72,400	$43,100	$142,000	$0	$23,400	$807,000
Filtro Percolador	$226,000,000	$265,000	$141,000	$1,390,000	$0	$5,820,000	$11,800,000
Clarificador Secundario	$61,000,000	$91,200	$54,300	$198,000	$0	$34,400	$1,120,000
Desinfeccion por cloro	$10,300,000	$78,300	$97,200	$140,000	$8,940,000	$53,700	$657,000
Espasamiento pro gravedad	$2,350,000	$54,800	$26,900	$23,500	$0	$7,790	$148,000
Digestion Anaerobica	$14,700,000	$398,000	$23,700	$322,000	$0	$846,000	$15,000,000
Deshidratación por centrifugas	$48,000,000	$438,000	$547,000	$0	$5,420,000	$3,640,000	$7,070,000
Espesador de Banda de Grav	$30,500,000	$61,000	$15,700	$0	$782,000	$264,000	$1,170,000
Generacion con motores de c	$37,500,000	$830,000	$830,000	$550,000	$0	$0	$1,050,000
Other Costs	$696,000,000	$293,000	$0	$0	$0	$0	$0

Summary of Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	210	acre
Administration labor hours	35400	hr/yr
Laboratory labor hours	14500	hr/yr
Costs		
DIRECT COSTS		
Mobilization	$14,500,000	$
Site preparation	$12,500,000	$
Site electrical	$48,400,000	$
Yard piping	$29,600,000	$
Instrumentation and control	$30,300,000	$
Lab and administration building	$23,100,000	$
Unit process construction costs	$479,000,000	$
Profit	$95,600,000	$
Total construction costs	$733,000,000	$
INDIRECT COSTS		
Miscellaneous cost	$154,000,000	$
Legal cost	$14,700,000	$
Engineering design fee	$110,000,000	$
Inspection cost	$14,700,000	$
Contingency	$73,300,000	$
Technical	$14,700,000	$
Total indirect costs	$381,000,000	$
MISC		
Cost of land	$0	$
Interest during construction	$61,100,000	$
LABOR COSTS		
Administration labor cost	$177,000	$/yr
Laboratory labor cost	$116,000	$/yr
Unit process operation labor co	$2,650,000	$/yr
Unit process maintenance labo	$1,900,000	$/yr
Total labor costs	$4,840,000	$/yr
PROJECT SUMMARY		
Present worth	$2,050,000,000	$
Total project cost	$1,180,000,000	$
Total operation labor cost	$2,940,000	$/yr
Total maintenance labor cost	$1,900,000	$/yr
Total material cost	$3,090,000	$/yr
Total chemical cost	$15,100,000	$/yr
Total energy cost	$10,700,000	$/yr
Total amortization cost	$39,500,000	$/yr

Afluente Canoas (MM)
Tratamiento Preliminar
Design Output Data

Description	Value	Units
Mechanically Cleaned Bar Screen		

Design Information		
Bar size	0,25	in
Bar spacing	0,235	in
Slope of bars from horizontal	15	degrees
Head loss through screen	2,6965E+308	ft
Approach velocity	1,31	ft/s
Average flow through velocity (	1,31	ft/s
Maximum flow through velocity	3	ft/s
Screen channel width	44	ft
Average channel depth	9,84	ft
Aerated Grit Chamber		
Design Information		
Maximum flow	731	MGD(US)
Average flow	368	MGD(US)
Minimum flow	322	MGD(US)
Temperature	60,8	deg F
Maximum flow through velocity	0,357	ft/s
Average flow through velocity (	0,179	ft/s
Size of smallest particle 100%	0,00786	in
Specific gravity of particle	2	
Number of units	1	
Maximum flow/unit	731	MGD(US)
Width of channel	214	ft
Depth of channel	14,8	ft
Length of channel	214	ft
Settling velocity of particle	0,0513	ft/s
Hydraulic retention time	10	min
Volume of grit	0,11	MGD(US)
Air supply	3	cfm
Costs		
Construction and equipment cc	$13,100,000	$
Operational labor cost	$359,000	$/yr
Maintenance labor cost	$119,000	$/yr
Material and supply cost	$329,000	$/yr
Energy cost	$49,400	$/yr
Amortization cost	$664,000	$/yr

Coagulacion y Floculacion

Design Output Data

Description	Value	Units
Chemical Phosphorus Removal		
Design Information		
Chemical used	Equivalent Iron	
Chemical dosage	5	mg/L
Mass of chemical per year	2550000	kg/yr
Chemical sludge production	31,9	mg/L
Organic sludge production	2,8	mg/L

Espasamiento pro gravedad

Design Output Data

Description	Value	Units
Gravity Thickening		
Design Information		
Initial concentration	4	%
Thickened concentration	5	%
Mass loading	24	lb/(sqft·d)

Hydraulic loading		50,4	gal(US)/(sqft·d)
Hydraulic retention time		49,8	hr
Number of tanks		7	
Tank volume		441000	cuft
Depth		14	ft
Surface area per tank		4500	sqft
Tank diameter		76	ft
Quantities			
Amount of sludge generated		530000	lb/d
Volume of thickened sludge		1,09	MGD(US)
Operation labor required		6850	pers-hrs/yr
Maintenance labor required		3270	pers-hrs/yr
Electrical energy required		39000	kWh/yr
Volume of earthwork required		401000	cuft
Slab thickness		11,4	in
Volume of slab concrete requir		35100	cuft
Wall thickness		14	in
Volume of wall concrete requir		31100	cuft
Costs			
Construction and equipment cc	$2,350,000		$
Operational labor cost	$54,800		$/yr
Maintenance labor cost	$26,900		$/yr
Material and supply cost	$23,500		$/yr
Energy cost	$7,790		$/yr
Amortization cost	$148,000		$/yr

Espesador de Banda de Gravedad

Design Output Data

Description	Value		Units
Gravity Belt Thickener			
Design Information			
Belt filter width		6,56	ft
Number of units		32	
Hydraulic loading per unit per r		0,18	MGD(US)
Hydraulic loading required per		11,5	MGD(US)
Final solids content		7	%
Solids capture fraction		0,99	
Quantities			
Operation labor required		7620	pers-hrs/yr
Maintenance labor required		1910	pers-hrs/yr
Power		1320000	kWh/yr
Polymer required		945	lb/d
Dry solids produced		236000	lb/d
Belt filter(s)	$8,830,000		$
Building	$604,000		$
Installation	$2,210,000		$
Polymer system	$3,270,000		$
Feed pumps	$972,000		$
Conveyor system	$2,210,000		$
Costs			
Operational labor cost	$61,000		$/yr
Maintenance labor cost	$15,700		$/yr
Chemical cost	$782,000		$/yr
Energy cost	$264,000		$/yr
Amortization cost	$1,170,000		$/yr

Sedimentación Primaria

Design Output Data

Description	Value		Units
Primary Clarification			
Design Information			
Surface area		342000	sqft
Surface area per circular clarifi		21400	sqft
Diameter of each circular clarif		165	ft
Number of clarifiers per battery		4	
Number of batteries		4	
Solids loading rate		2,66	lb/(sqft·d)
Hydraulic retention time		2,66	hr
Weir length		49000	ft
Volume of sludge generated		1,59	MGD(US)
Surface overflow rate		2150	gal(US)/(sqft·d)
Quantities			
Operation labor required		8580	pers-hrs/yr
Maintenance labor required		4860	pers-hrs/yr
Electrical energy required		63700	kWh/yr
Volume of earthwork required		5580000	cuft
Slab thickness		11,9	in
Volume of slab concrete requir		374000	cuft
Wall thickness		15	in
Volume of wall concrete requir		183000	cuft
Costs			
Operational labor cost	$68,700		$/yr
Maintenance labor cost	$40,000		$/yr
Material and supply cost	$141,000		$/yr
Energy cost	$12,700		$/yr
Amortization cost	$802,000		$/yr
Notes			
Effluent soluble TKN adjusted to satisfy user-specified TKN removal.			
Waste Sludge Pumping			
Design Information			
Average daily pumping rate		1,59	MGD(US)
Total pumping capacity		1,59	MGD(US)
Design capacity per pump		0,794	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		1,59	MGD(US)
Quantities			
Operation labor required		467	pers-hrs/yr
Maintenance labor required		385	pers-hrs/yr
Electrical energy required		53200	kWh/yr
Volume of earthwork required		1850	cuft
Area of pump building		231	sqft
Costs			
Operational labor cost	$3,740		$/yr
Maintenance labor cost	$3,170		$/yr
Material and supply cost	$552		$/yr
Energy cost	$10,600		$/yr
Amortization cost	$5,140		$/yr

Digestion Anaerobica

Design Output Data

Description	Value	Units

Anaerobic Digestion		
Design Information		
Percent VSS destroyed	45	%
Solids concentration in digeste	3,4	%
Detention time	15	d
Digester depth	75	ft
Digester diameter	90	ft
Effective digester volume	7010000	cuft
Number of digesters per batter	14	
Number of primary digesters pe	14	
Number of secondary digesters	0	
Number of batteries	1	
Gas produced	25,4	MGD(US)
Heat required	34100000	BTU/hr
Digester gas required	14,2	MGD(US)
Total natural gas required	0	MGD(US)
Quantities		
Operation labor required	39200	pers-hrs/yr
Maintenance labor required	22600	pers-hrs/yr
Electrical energy required	3390000	kWh/yr
Volume of earthwork required	3130000	cuft
Slab thickness	22,3	in
Volume of slab concrete requir	175000	cuft
Wall thickness	45	in
Volume of wall concrete require	1240000	cuft
Sidewater depth	75	ft
Surface area/floor of 2-story co	14100	sqft
Piping size	10	in
Length of total piping system	6200	ft
Number of 90 degree elbows	182	
Number of tees	357	
Number of plug valves	259	
Total dry solids treated	715000	lb/d
Notes		
Mass balance based on user input		

Filtro Percolador

Design Output Data

Description	Value	Units
Trickling Filtration		
Design Information		
Reaction rate constant	0,00191	
Hydraulic loading rate	1080	gal(US)/(sqft·d)
Total hydraulic loading rate	1260	gal(US)/(sqft·d)
Recirculation ratio	0,167	
Number of towers per stage	48	
Number of stages	1	
Depth of filter tower	19,7	ft
Diameter of filter tower	180	ft
Surface area per filter tower	25400	sqft
Total surface area	1220000	sqft
Volume per filter tower	501000	cuft
Total volume	24000000	cuft
Quantities		
Operation labor required	12800	pers-hr/yr
Maintenance labor required	5200	pers-hr/yr

Volume of earthwork required		20800000	cuft
Volume of slab concrete requir		814000	cuft
Volume of wall concrete requir		692000	cuft
Number of posts per tower		1710	
Total length of precast beams		679000	ft
Costs			
Construction and equipment cc	$214,000,000		$
Operational labor cost	$102,000		$/yr
Maintenance labor cost	$42,800		$/yr
Material and supply cost	$1,310,000		$/yr
Energy cost	$26,700		$/yr
Amortization cost	$11,000,000		$/yr
Internal Recycle Pumping			
Design Information			
Average daily pumping rate		879	MGD(US)
Total pumping capacity		879	MGD(US)
Design capacity per pump		27,5	MGD(US)
Number of pumps		5	
Number of batteries		8	
Firm pumping capacity		879	MGD(US)
Quantities			
Operation labor required		20300	pers-hrs/yr
Maintenance labor required		12000	pers-hrs/yr
Electrical energy required		29000000	kWh/yr
Volume of earthwork required		152000	cuft
Area of pump building		18900	sqft
Costs			
Construction and equipment cc	$12,000,000		$
Operational labor cost	$163,000		$/yr
Maintenance labor cost	$98,500		$/yr
Material and supply cost	$84,000		$/yr
Energy cost	$5,800,000		$/yr
Amortization cost	$783,000		$/yr

Deshidratación por centrifugas

Design Output Data

Description	Value		Units
Centrifugation			
Design Information			
Total power required		4280	HP
Power required per unit		194	HP
Excess capacity factor		1,25	
Number of units		22	
Chemical dose		1	% dry wt
Chemicals required		14700	lb/d
Sludge flow		4,93	MGD(US)
Initial solid conc		3,4	%
Operational hours per day		8	hr
Operational days per week		7	d
Quantities			
Number of centrifuges		22	
Power required per unit		194	HP
Area of building		5900	sqft
Dry solids produced		466000	lb/d
Operation labor required		74500	pers-hrs/yr
Maintenance labor required		12000	pers-hrs/yr

Electrical energy required		5100000	kWh/yr
Polymer Feed System			
Quantities			
Polymer dosage		4890	lb/d
Liquid chemical solution fed		0,234	MGD(US)
O&M labor required		36400	pers-hrs/yr
Dry material handling and mixi		3050	pers-hrs/yr
Total operation labor required		39400	pers-hrs/yr

Generacion con motores de combustion biogas

Design Output Data

Description	Value	Units

Clarificador Secundario

Design Output Data

Description	Value		Units
Secondary Clarification			
Design Information			
Surface area		509000	sqft
Surface area per circular clarifi		25400	sqft
Diameter of each circular clarif		180	ft
Number of clarifiers per battery		4	
Number of batteries		5	
Solids loading rate		0,462	lb/(sqft·d)
Hydraulic retention time		3,67	hr
Weir length		48900	ft
Volume of wasted sludge		2,74	MGD(US)
Surface overflow rate		1440	gal(US)/(sqft·d)
Quantities			
Operation labor required		10900	pers-hrs/yr
Maintenance labor required		6190	pers-hrs/yr
Electrical energy required		80300	kWh/yr
Volume of earthwork required		8660000	cuft
Slab thickness		11,6	in
Volume of slab concrete requir		540000	cuft
Wall thickness		14,4	in
Volume of wall concrete requir		223000	cuft
Costs			
Operational labor cost	$87,200		$/yr
Maintenance labor cost	$50,900		$/yr
Material and supply cost	$197,000		$/yr
Energy cost	$16,100		$/yr
Amortization cost	$1,110,000		$/yr
Waste Sludge Pumping			
Design Information			
Average daily pumping rate		2,74	MGD(US)
Total pumping capacity		2,74	MGD(US)
Design capacity per pump		1,37	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		2,74	MGD(US)
Quantities			
Operation labor required		501	pers-hrs/yr
Maintenance labor required		418	pers-hrs/yr
Electrical energy required		91600	kWh/yr
Volume of earthwork required		2030	cuft

Area of pump building		254	sqft
Costs			
Operational labor cost	$4,010		$/yr
Maintenance labor cost	$3,440		$/yr
Material and supply cost	$685		$/yr
Energy cost	$18,300		$/yr
Amortization cost	$6,390		$/yr

Secado Térmico

Design Output Data

Description	Value		Units
User Specified Sludge Treatment Process			
Design Information			
No Design Data			

Disposicion Final - Costo No Incluido

Design Output Data

Description	Value		Units
Sludge Hauling and Land Filling			
Design Information			
Volume of sludge hauled		0,0502	MGD(US)
Truck capacity		810	cuft
Round trip time to disposal site		1	hr
Truck loading time		0,75	hr
Operational hours per day		8	hr
Number of trucks required		2	
Distance to disposal site		10	miles
Quantities			
Total sludge volume hauled		0,0502	MGD(US)
Maximum anticipated landfill dc		30	d
Anticipated sludge storage heig		8	ft
Sludge storage shed area		25200	sqft
Width of sludge storage shed s		112	ft
Length of sludge storage shed		224	ft
Volume of earthwork required		65100	cuft
Volume of slab concrete requir		26700	cuft
Surface area of canopy roof		25200	sqft
Round trip haul distance		20	miles
Round trips per day per truck		5	
Distance traveled per year per		25000	miles
Sludge hauled		440000	lb/d
Operation labor required		3890	pers-hrs/yr
LandFilling cost	$43,100		$/yr

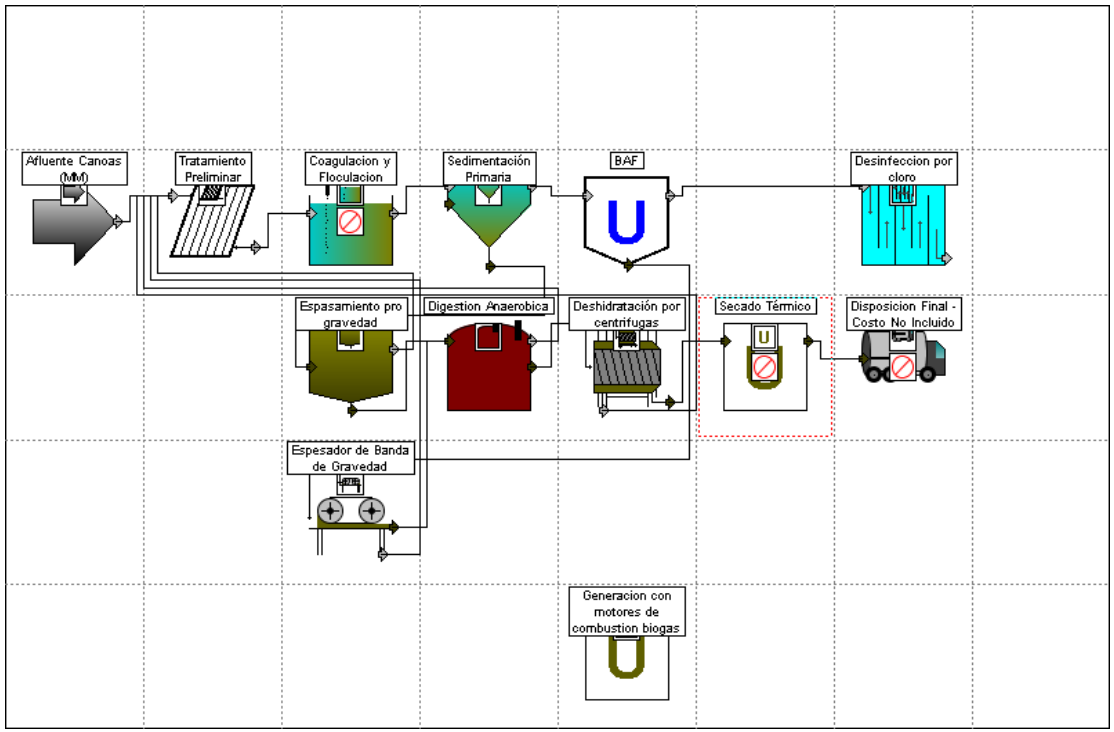
Desinfeccion por cloro

Design Output Data

Description	Value		Units
Chlorination			
Design Information			
Volume of tank		2030000	cuft
Average chlorine required		30400	lb/d
Peak chlorine required		60900	lb/d
Influent coliform count		10000000	/100mL
Effluent coliform count		29,2	/100mL
Quantities			
Operational labor required		9790	pers-hrs/yr

Maintenance labor required		11800	pers-hrs/yr
Electrical energy required		269000	kWh/yr
Volume of earthwork required		731000	cuft
Volume of slab concrete requir		204000	cuft
Volume of wall concrete require		167000	cuft
Number of chlorinators and eva		4	
Chlorination building area		1440	sqft
Number of chlorine cylinders		457	
Area of chlorine storage buildir		64000	sqft
Costs			
Construction and equipment co	$10,300,000		$
Operational labor cost	$78,300		$/yr
Maintenance labor cost	$97,200		$/yr
Material and supply cost	$140,000		$/yr
Chemical cost	$8,940,000		$/yr
Energy cost	$53,700		$/yr
Amortization cost	$657,000		$/yr

FII-Alt3-BAF



Summary

Equipment Database

Sept 2007,(USA Avg)

Layout Summary

Present Worth	Project	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
$3,410,000,000	$1,660,000,000	$3,040,000	$2,060,000	$2,510,000	$16,600,000	$20,300,000	$88,000,000

Process Summary

Process	Construction	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
Tratamiento Preliminar	$13,300,000	$370,000	$122,000	$332,000	$0	$50,200	$671,000
Sedimentación Primaria	$36,000,000	$72,400	$43,000	$142,000	$0	$23,800	$807,000
BAF	$550,000,000	$330,000	$330,000	$1,000,000	$0	$15,000,000	$56,000,000
Desinfeccion por cloro	$10,300,000	$78,300	$96,800	$140,000	$8,940,000	$53,700	$656,000
Espasamiento pro gravedad	$2,350,000	$56,400	$27,400	$23,500	$0	$7,960	$148,000
Digestion Anaerobica	$14,700,000	$398,000	$23,700	$322,000	$0	$846,000	$15,000,000
Deshidratación por centrifugas	$48,000,000	$438,000	$547,000	$0	$5,420,000	$3,640,000	$7,070,000
Espesador de Banda de Grave	$30,500,000	$173,000	$44,300	$0	$2,200,000	$694,000	$6,620,000
Generacion con motores de co	$37,500,000	$830,000	$830,000	$550,000	$0	$0	$1,050,000
Other Costs	$919,000,000	$293,000	$0	$0	$0	$0	$0

Summary of Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	210	acre
Administration labor hours	35400	hr/yr
Laboratory labor hours	14500	hr/yr
Costs		
DIRECT COSTS		
Mobilization	$14,500,000	$
Site preparation	$12,500,000	$
Site electrical	$48,400,000	$
Yard piping	$29,600,000	$
Instrumentation and control	$30,300,000	$
Lab and administration buildinç	$23,100,000	$
Unit process construction costs	$743,000,000	$
Profit	$135,000,000	$
Total construction costs	$1,040,000,000	$
INDIRECT COSTS		
Miscellaneous cost	$218,000,000	$
Legal cost	$20,700,000	$
Engineering design fee	$155,000,000	$
Inspection cost	$20,700,000	$
Contingency	$104,000,000	$
Technical	$20,700,000	$
Total indirect costs	$539,000,000	$
MISC		
Cost of land	$0	$
Interest during construction	$86,400,000	$
LABOR COSTS		
Administration labor cost	$177,000	$/yr
Laboratory labor cost	$116,000	$/yr
Unit process operation labor cc	$2,750,000	$/yr
Unit process maintenance labo	$2,060,000	$/yr
Total labor costs	$5,100,000	$/yr
PROJECT SUMMARY		
Present worth	$3,410,000,000	$
Total project cost	$1,660,000,000	$
Total operation labor cost	$3,040,000	$/yr
Total maintenance labor cost	$2,060,000	$/yr
Total material cost	$2,510,000	$/yr
Total chemical cost	$16,600,000	$/yr
Total energy cost	$20,300,000	$/yr
Total amortization cost	$88,000,000	$/yr

Afluente Canoas (MM)
Tratamiento Preliminar
Design Output Data

Description	Value	Units
Mechanically Cleaned Bar Screen		
Design Information		

Bar size	0,25	in
Bar spacing	0,235	in
Slope of bars from horizontal	15	degrees
Head loss through screen	2,6965E+308	ft
Approach velocity	1,31	ft/s
Average flow through velocity (	1,31	ft/s
Maximum flow through velocity	3	ft/s
Screen channel width	45,6	ft
Average channel depth	9,84	ft
Aerated Grit Chamber		
Design Information		
Maximum flow	744	MGD(US)
Average flow	380	MGD(US)
Minimum flow	335	MGD(US)
Temperature	60,8	deg F
Maximum flow through velocity	0,36	ft/s
Average flow through velocity (	0,184	ft/s
Size of smallest particle 100%	0,00786	in
Specific gravity of particle	2	
Number of units	1	
Maximum flow/unit	744	MGD(US)
Width of channel	216	ft
Depth of channel	14,8	ft
Length of channel	216	ft
Settling velocity of particle	0,0513	ft/s
Hydraulic retention time	10	min
Volume of grit	0,114	MGD(US)
Air supply	3	cfm
Costs		
Construction and equipment cc	$13,300,000	$
Operational labor cost	$370,000	$/yr
Maintenance labor cost	$122,000	$/yr
Material and supply cost	$332,000	$/yr
Energy cost	$50,200	$/yr
Amortization cost	$671,000	$/yr

Coagulacion y Floculacion

Design Output Data

Description	Value	Units
Chemical Phosphorus Removal		
Design Information		
Chemical used	Equivalent Iron	
Chemical dosage	5	mg/L
Mass of chemical per year	2640000	kg/yr
Chemical sludge production	30,9	mg/L
Organic sludge production	2,81	mg/L

Espasamiento pro gravedad

Design Output Data

Description	Value	Units
Gravity Thickening		
Design Information		
Initial concentration	4	%
Thickened concentration	5	%
Mass loading	24	lb/(sqft·d)
Hydraulic loading	52,3	gal(US)/(sqft·d)

Hydraulic retention time		48	hr
Number of tanks		7	
Tank volume		441000	cuft
Depth		14	ft
Surface area per tank		4500	sqft
Tank diameter		76	ft
Quantities			
Amount of sludge generated		550000	lb/d
Volume of thickened sludge		1,13	MGD(US)
Operation labor required		7050	pers-hrs/yr
Maintenance labor required		3340	pers-hrs/yr
Electrical energy required		39800	kWh/yr
Volume of earthwork required		401000	cuft
Slab thickness		11,4	in
Volume of slab concrete requir		35100	cuft
Wall thickness		14	in
Volume of wall concrete requir		31100	cuft
Costs			
Construction and equipment cc	$2,350,000		$
Operational labor cost	$56,400		$/yr
Maintenance labor cost	$27,400		$/yr
Material and supply cost	$23,500		$/yr
Energy cost	$7,960		$/yr
Amortization cost	$148,000		$/yr

Espesador de Banda de Gravedad

Design Output Data

Description	Value		Units
Gravity Belt Thickener			
Design Information			
Belt filter width		6,56	ft
Number of units		182	
Hydraulic loading per unit per r		0,18	MGD(US)
Hydraulic loading required per		65,4	MGD(US)
Final solids content		7	%
Solids capture fraction		0,98	
Quantities			
Operation labor required		21700	pers-hrs/yr
Maintenance labor required		5410	pers-hrs/yr
Power		3470000	kWh/yr
Polymer required		2660	lb/d
Dry solids produced		664000	lb/d
Belt filter(s)	$50,200,000		$
Building	$2,870,000		$
Installation	$12,600,000		$
Polymer system	$18,600,000		$
Feed pumps	$5,530,000		$
Conveyor system	$12,600,000		$
Costs			
Operational labor cost	$173,000		$/yr
Maintenance labor cost	$44,300		$/yr
Chemical cost	$2,200,000		$/yr
Energy cost	$694,000		$/yr
Amortization cost	$6,620,000		$/yr

Sedimentación Primaria

Design Output Data

Description	Value		Units
Primary Clarification			
Design Information			
Surface area		342000	sqft
Surface area per circular clarifi		21400	sqft
Diameter of each circular clarif		165	ft
Number of clarifiers per battery		4	
Number of batteries		4	
Solids loading rate		2,76	lb/(sqft·d)
Hydraulic retention time		2,57	hr
Weir length		49800	ft
Volume of sludge generated		1,65	MGD(US)
Surface overflow rate		2180	gal(US)/(sqft·d)
Quantities			
Operation labor required		8580	pers-hrs/yr
Maintenance labor required		4860	pers-hrs/yr
Electrical energy required		63700	kWh/yr
Volume of earthwork required		5580000	cuft
Slab thickness		11,9	in
Volume of slab concrete requir		374000	cuft
Wall thickness		15	in
Volume of wall concrete requir		183000	cuft
Costs			
Operational labor cost	$68,700		$/yr
Maintenance labor cost	$39,800		$/yr
Material and supply cost	$141,000		$/yr
Energy cost	$12,700		$/yr
Amortization cost	$802,000		$/yr
Notes			
Effluent soluble TKN adjusted to satisfy user-specified TKN removal.			
Waste Sludge Pumping			
Design Information			
Average daily pumping rate		1,65	MGD(US)
Total pumping capacity		1,65	MGD(US)
Design capacity per pump		0,824	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		1,65	MGD(US)
Quantities			
Operation labor required		469	pers-hrs/yr
Maintenance labor required		388	pers-hrs/yr
Electrical energy required		55200	kWh/yr
Volume of earthwork required		1860	cuft
Area of pump building		233	sqft
Costs			
Operational labor cost	$3,750		$/yr
Maintenance labor cost	$3,170		$/yr
Material and supply cost	$560		$/yr
Energy cost	$11,000		$/yr
Amortization cost	$5,220		$/yr

Digestion Anaerobica

Design Output Data

Description	Value		Units
Anaerobic Digestion			

Design Information		
Percent VSS destroyed	45	%
Solids concentration in digeste	3,4	%
Detention time	15	d
Digester depth	75	ft
Digester diameter	90	ft
Effective digester volume	7010000	cuft
Number of digesters per batter	14	
Number of primary digesters pe	14	
Number of secondary digesters	0	
Number of batteries	1	
Gas produced	50,6	MGD(US)
Heat required	45800000	BTU/hr
Digester gas required	19,1	MGD(US)
Total natural gas required	0	MGD(US)
Quantities		
Operation labor required	59100	pers-hrs/yr
Maintenance labor required	33400	pers-hrs/yr
Electrical energy required	5000000	kWh/yr
Volume of earthwork required	3130000	cuft
Slab thickness	22,3	in
Volume of slab concrete requir	175000	cuft
Wall thickness	45	in
Volume of wall concrete require	1240000	cuft
Sidewater depth	75	ft
Surface area/floor of 2-story co	14100	sqft
Piping size	10	in
Length of total piping system	6200	ft
Number of 90 degree elbows	182	
Number of tees	357	
Number of plug valves	259	
Total dry solids treated	1160000	lb/d
Notes		
Mass balance based on user input		

BAF

Design Output Data

Description	Value	Units
User Specified Wastewater Process		
Design Information		
No Design Data		

Deshidratación por centrifugas

Design Output Data

Description	Value	Units
Centrifugation		
Design Information		
Total power required	6240	HP
Power required per unit	195	HP
Excess capacity factor	1,25	
Number of units	32	
Chemical dose	1	% dry wt
Chemicals required	21400	lb/d
Sludge flow	7,19	MGD(US)
Initial solid conc	3,4	%
Operational hours per day	8	hr

Operational days per week	7	d
Quantities		
Number of centrifuges	32	
Power required per unit	195	HP
Area of building	8510	sqft
Dry solids produced	680000	lb/d
Operation labor required	104000	pers-hrs/yr
Maintenance labor required	16600	pers-hrs/yr
Electrical energy required	7240000	kWh/yr
Polymer Feed System		
Quantities		
Polymer dosage	7140	lb/d
Liquid chemical solution fed	0,342	MGD(US)
O&M labor required	46500	pers-hrs/yr
Dry material handling and mixi	3390	pers-hrs/yr
Total operation labor required	49900	pers-hrs/yr

Generacion con motores de combustion biogas

Design Output Data

Description	Value	Units

Secado Térmico

Design Output Data

Description	Value	Units
User Specified Sludge Treatment Process		
Design Information		
No Design Data		

Desinfeccion por cloro

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	2030000	cuft
Average chlorine required	30400	lb/d
Peak chlorine required	60900	lb/d
Influent coliform count	10000000	/100mL
Effluent coliform count	29,2	/100mL
Quantities		
Operational labor required	9790	pers-hrs/yr
Maintenance labor required	11800	pers-hrs/yr
Electrical energy required	269000	kWh/yr
Volume of earthwork required	731000	cuft
Volume of slab concrete requir	204000	cuft
Volume of wall concrete requir	167000	cuft
Number of chlorinators and ev	4	
Chlorination building area	1440	sqft
Number of chlorine cylinders	457	
Area of chlorine storage buildir	64000	sqft
Costs		
Construction and equipment cc	$10,300,000	$
Operational labor cost	$78,300	$/yr
Maintenance labor cost	$96,800	$/yr
Material and supply cost	$140,000	$/yr
Chemical cost	$8,940,000	$/yr
Energy cost	$53,700	$/yr

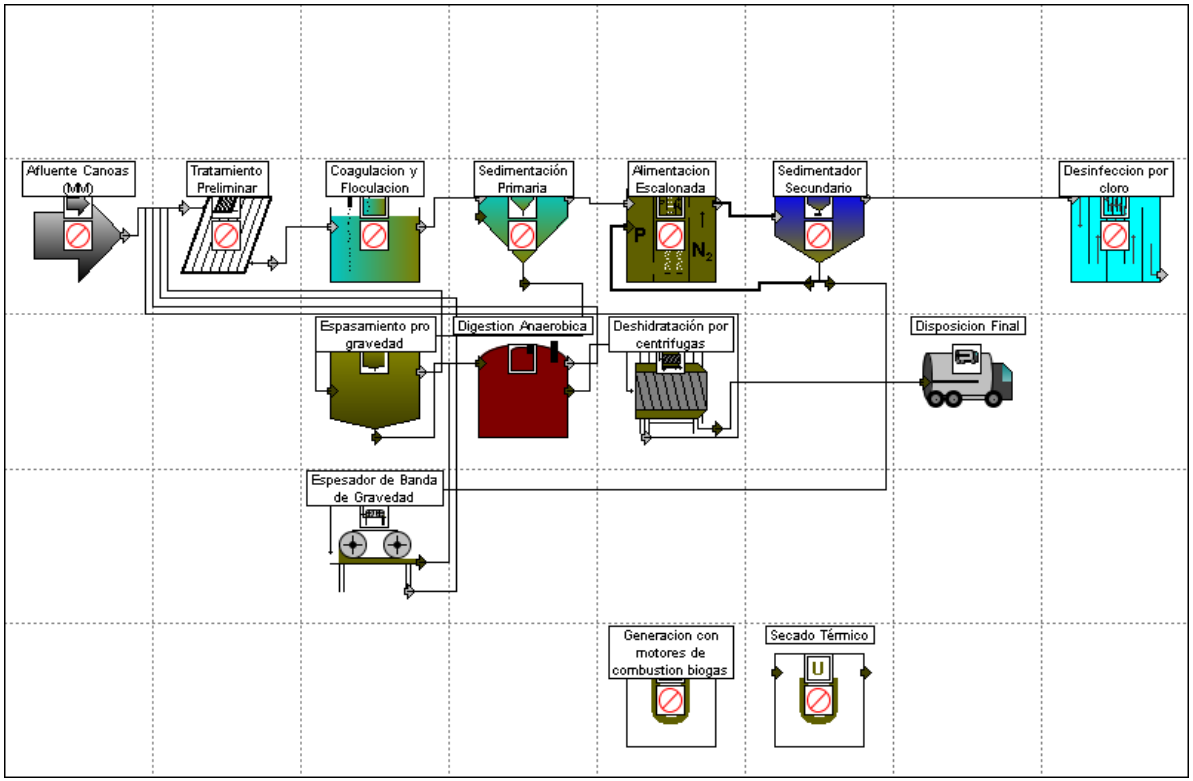
Amortization cost	$656,000		$/yr

Disposicion Final - Costo No Incluido

Design Output Data

Description	Value		Units
Sludge Hauling and Land Filling			
Design Information			
Volume of sludge hauled		0,0733	MGD(US)
Truck capacity		810	cuft
Round trip time to disposal site		1	hr
Truck loading time		0,75	hr
Operational hours per day		8	hr
Number of trucks required		3	
Distance to disposal site		10	miles
Quantities			
Total sludge volume hauled		0,0733	MGD(US)
Maximum anticipated landfill dc		30	d
Anticipated sludge storage heig		8	ft
Sludge storage shed area		36800	sqft
Width of sludge storage shed s		136	ft
Length of sludge storage shed		271	ft
Volume of earthwork required		94500	cuft
Volume of slab concrete requir		38600	cuft
Surface area of canopy roof		36800	sqft
Round trip haul distance		20	miles
Round trips per day per truck		5	
Distance traveled per year per		25000	miles
Sludge hauled		643000	lb/d
Operation labor required		5680	pers-hrs/yr
LandFilling cost	$43,100		$/yr

FIII/FII-línea de lodos THP



Summary

Equipment Database

Sept 2007,(USA Avg)

Layout Summary

Present Worth	Project	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
$1,140,000,000	$402,000,000	$1,390,000	$915,000	$13,000,000	$6,950,000	$5,250,000	$22,600,000

Process Summary

Process	Construction	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
Espasamiento pro gravedad	$10.000.000	$58.200	$28.600	$23.500	$0	$8.150	$148.000
Digestion Anaerobica	$149.000.000	$518.000	$308.000	$418.000	$0	$1.100.000	$15.000.000
Deshidratación por centrifugas	$23.000.000	$438.000	$547.000	$0	$5.420.000	$3.640.000	$7.070.000
Disposicion Final	$5.760.000	$254.000	$0	$12.500.000	$0	$0	$422.000
Espesador de Banda de Grave	$30.500.000	$120.000	$31.300	$0	$1.530.000	$494.000	$0
Other Costs	$184.000.000	$0	$0	$0	$0	$0	$0

Summary of Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	8,57	acre
Administration labor hours	0	hr/yr
Laboratory labor hours	0	hr/yr
Costs		
DIRECT COSTS		
Unit process construction costs	$218,000,000	$
Profit	$32,700,000	$
Total construction costs	$251,000,000	$
INDIRECT COSTS		
Miscellaneous cost	$52,700,000	$
Legal cost	$5,020,000	$
Engineering design fee	$37,700,000	$
Inspection cost	$5,020,000	$
Contingency	$25,100,000	$
Technical	$5,020,000	$
Total indirect costs	$131,000,000	$
MISC		
Cost of land	$0	$
Interest during construction	$20,900,000	$
LABOR COSTS		
Administration labor cost	$0	$/yr
Laboratory labor cost	$0	$/yr
Unit process operation labor co	$1,390,000	$/yr
Unit process maintenance labo	$915,000	$/yr
Total labor costs	$2,300,000	$/yr
PROJECT SUMMARY		
Present worth	$1,140,000,000	$
Total project cost	$402,000,000	$
Total operation labor cost	$1,390,000	$/yr
Total maintenance labor cost	$915,000	$/yr
Total material cost	$13,000,000	$/yr
Total chemical cost	$6,950,000	$/yr
Total energy cost	$5,250,000	$/yr
Total amortization cost	$22,600,000	$/yr

Afluente Canoas (MM)
Tratamiento Preliminar
Design Output Data

Description	Value	Units
Mechanically Cleaned Bar Screen		
Design Information		
Bar size	0,25	in
Bar spacing	0,235	in
Slope of bars from horizontal	15	degrees
Head loss through screen	2,6965E+308	ft
Approach velocity	1,31	ft/s
Average flow through velocity (	1,31	ft/s
Maximum flow through velocity	3	ft/s
Screen channel width	45,3	ft
Average channel depth	9,84	ft
Aerated Grit Chamber		
Design Information		
Maximum flow	742	MGD(US)
Average flow	378	MGD(US)

Minimum flow	333	MGD(US)
Temperature	60,8	deg F
Maximum flow through velocity	0,359	ft/s
Average flow through velocity (	0,183	ft/s
Size of smallest particle 100%	0,00786	in
Specific gravity of particle	2	
Number of units	1	
Maximum flow/unit	742	MGD(US)
Width of channel	216	ft
Depth of channel	14,8	ft
Length of channel	216	ft
Settling velocity of particle	0,0513	ft/s
Hydraulic retention time	10	min
Volume of grit	0,113	MGD(US)
Air supply	3	cfm

Coagulacion y Floculacion

Design Output Data

Description	Value		Units
Chemical Phosphorus Removal			
Design Information			
Chemical used	Equivalent Iron		
Chemical dosage		12	mg/L
Mass of chemical per year		6300000	kg/yr
Chemical sludge production		40	mg/L
Organic sludge production		6,71	mg/L

Espasamiento pro gravedad

Design Output Data

Description	Value		Units
Gravity Thickening			
Design Information			
Initial concentration		1	%
Thickened concentration		5	%
Mass loading		24	lb/(sqft·d)
Hydraulic loading		218	gal(US)/(sqft·d)
Hydraulic retention time		11,5	hr
Number of tanks		7	
Tank volume		441000	cuft
Depth		14	ft
Surface area per tank		4500	sqft
Tank diameter		76	ft
Quantities			
Amount of sludge generated		572000	lb/d
Volume of thickened sludge		1,18	MGD(US)
Operation labor required		7270	pers-hrs/yr
Maintenance labor required		3430	pers-hrs/yr
Electrical energy required		40800	kWh/yr
Volume of earthwork required		401000	cuft
Slab thickness		11,4	in
Volume of slab concrete requir		35100	cuft
Wall thickness		14	in
Volume of wall concrete requir		31100	cuft
Costs			
Operational labor cost	$58,200		$/yr
Maintenance labor cost	$28,600		$/yr
Material and supply cost	$23,500		$/yr
Energy cost	$8,150		$/yr
Amortization cost	$148,000		$/yr

Espesador de Banda de Gravedad

Design Output Data

Description	Value		Units
Gravity Belt Thickener			

Design Information			
Belt filter width		6,56	ft
Number of units		94	
Hydraulic loading per unit per r		0,18	MGD(US)
Hydraulic loading required per		33,8	MGD(US)
Final solids content		6	%
Solids capture fraction		0,985	
Quantities			
Operation labor required		15000	pers-hrs/yr
Maintenance labor required		3750	pers-hrs/yr
Power		2470000	kWh/yr
Polymer required		1850	lb/d
Dry solids produced		463000	lb/d
Belt filter(s)	$25,900,000		$
Building	$1,540,000		$
Installation	$6,490,000		$
Polymer system	$9,600,000		$
Feed pumps	$2,850,000		$
Conveyor system	$6,490,000		$
Costs			
Operational labor cost	$120,000		$/yr
Maintenance labor cost	$31,300		$/yr
Chemical cost	$1,530,000		$/yr
Energy cost	$494,000		$/yr

Sedimentación Primaria

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	342000	sqft
Surface area per circular clarifi	21400	sqft
Diameter of each circular clarif	165	ft
Number of clarifiers per battery	4	
Number of batteries	4	
Solids loading rate	2,85	lb/(sqft·d)
Hydraulic retention time	2,59	hr
Weir length	49700	ft
Volume of sludge generated	6,86	MGD(US)
Surface overflow rate	2180	gal(US)/(sqft·d)
Quantities		
Operation labor required	8580	pers-hrs/yr
Maintenance labor required	4860	pers-hrs/yr
Electrical energy required	63700	kWh/yr
Volume of earthwork required	5580000	cuft
Slab thickness	11,9	in
Volume of slab concrete requir	374000	cuft
Wall thickness	15	in
Volume of wall concrete requir	183000	cuft
Notes		
Effluent soluble TKN adjusted to satisfy user-specified TKN removal.		
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	6,86	MGD(US)
Total pumping capacity	6,86	MGD(US)
Design capacity per pump	3,43	MGD(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	6,86	MGD(US)
Quantities		
Operation labor required	564	pers-hrs/yr
Maintenance labor required	479	pers-hrs/yr
Electrical energy required	229000	kWh/yr
Volume of earthwork required	2680	cuft

Area of pump building	335	sqft

Digestion Anaerobica

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	43	%
Solids concentration in digeste	3,4	%
Detention time	15	d
Digester depth	75	ft
Digester diameter	90	ft
Effective digester volume	7010000	cuft
Number of digesters per batter	14	
Number of primary digesters p	14	
Number of secondary digesters	0	
Number of batteries	1	
Gas produced	29,5	MGD(US)
Heat required	43300000	BTU/hr
Digester gas required	18	MGD(US)
Total natural gas required	0	MGD(US)
Quantities		
Operation labor required	51200	pers-hrs/yr
Maintenance labor required	29100	pers-hrs/yr
Electrical energy required	4360000	kWh/yr
Volume of earthwork required	3130000	cuft
Slab thickness	22,3	in
Volume of slab concrete requir	175000	cuft
Wall thickness	45	in
Volume of wall concrete requir	1240000	cuft
Sidewater depth	75	ft
Surface area/floor of 2-story cc	14100	sqft
Piping size	10	in
Length of total piping system	6200	ft
Number of 90 degree elbows	182	
Number of tees	357	
Number of plug valves	259	
Total dry solids treated	982000	lb/d
Notes		
Mass balance based on user input		

Alimentacion Escalonada

Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		
Design Information		
Design Override Enabled - sizi		
5-Stage Biological Phosphorus		
Design aerobic SRT for nitrifica	5	d
Total reactor SRT	10	d
Design SS	2260	mg/L
Calculated VSS	1390	mg/L
Calculated VSS:TSS ratio	0,613	lb VSS/lb SS
Total volume of anaerobic reac	366000	cuft
Total volume of anoxic reactors	16000000	cuft
Total volume of aerobic reacto	16400000	cuft
Total volume of all reactors	32800000	cuft
Width of parallel train	262	ft
Sidewater depth	16,4	ft
Number of batteries	1	
Number of parallel trains per b	24	
Number of anoxic cells within c	3	
Number of aerobic cells within	3	
Anaerobic hydraulic retention t	0,176	hr

Anoxic hydraulic retention time	7,72	hr
Aerobic hydraulic retention tim	7,9	hr
Amount of sludge generated	464000	lb/d
Sludge recycle ratio	51	%
Sludge recycle rate	190	MGD(US)
Nitrogen required for biomass	14,9	mg/L
Phosphorus required for bioma	2,98	mg/L
Oxygen required to meet avera	944000	lb/d
Air flow required to meet avera	277000	scfm
Design air flow	16,9	scfm/1000 cuft
Design air flow	6,65	scfm/ft2
Quantities		
Operation labor required	19800	pers-hrs/yr
Maintenance labor required	14900	pers-hrs/yr
Electrical energy required	81000000	kWh/yr
Volume of earthwork required	14200000	cuft
Volume of slab concrete requir	4250000	cuft
Volume of wall concrete requir	578000	cuft
Handrail length	15400	ft
Number of diffusers per train	5770	
Fine bubble diffuser floor cover	6,12	%
Number of swing arm headers	13	
Required mixing power	8100	HP
Total number of mixers	288	
Required mixing power per mix	28,1	HP
Design mixing power per mixer	5	HP
Mixing power for each unaerat	84,4	HP

Notes

Minimum SRT not calculated, design SRT specified by user

Design is based on user specified design overrides - Performance data is assumed to be correct.

WARNING: Anoxic HRT is out of the normal range, consider changing your design override values

WARNING: Anaerobic HRT is out of the normal range, consider changing your design override values

Required hp per mixer exceeds the maximum allowed of 5 hp/mixer, consider increasing number of mixers per tank

Aerobic-Anoxic internal recycle pumps sized for 4x the influent flow

Internal Recycle Pumping

Design Information

Average daily pumping rate	62,2	MGD(US)
Total pumping capacity	62,2	MGD(US)
Design capacity per pump	20,7	MGD(US)
Number of pumps	96	
Number of batteries	1	
Firm pumping capacity	62,2	MGD(US)
Quantities		
Operation labor required	1450	pers-hrs/yr
Maintenance labor required	1230	pers-hrs/yr
Electrical energy required	2060000	kWh/yr
Volume of earthwork required	11400	cuft
Area of pump building	1430	sqft

Notes

Pumps are sized based on an individual battery of internal pumps for each train

Sludge Recycle Pumping

Design Information

Average daily pumping rate	373	MGD(US)
Total pumping capacity	373	MGD(US)
Design capacity per pump	23,3	MGD(US)
Number of pumps	5	
Number of batteries	4	
Firm pumping capacity	373	MGD(US)
Quantities		
Operation labor required	8530	pers-hrs/yr
Maintenance labor required	5630	pers-hrs/yr
Electrical energy required	12300000	kWh/yr
Volume of earthwork required	65200	cuft
Area of pump building	8160	sqft

Deshidratación por centrifugas

Design Output Data

Description	Value	Units
Centrifugation		
Design Information		
Total power required	6290	HP
Power required per unit	196	HP
Excess capacity factor	1,25	
Number of units	32	
Chemical dose	1	% dry wt
Chemicals required	21600	lb/d
Sludge flow	7,24	MGD(US)
Initial solid conc	3,4	%
Operational hours per day	8	hr
Operational days per week	7	d
Quantities		
Number of centrifuges	32	
Power required per unit	196	HP
Area of building	8550	sqft
Dry solids produced	685000	lb/d
Operation labor required	104000	pers-hrs/yr
Maintenance labor required	16700	pers-hrs/yr
Electrical energy required	7280000	kWh/yr
Polymer Feed System		
Quantities		
Polymer dosage	7190	lb/d
Liquid chemical solution fed	0,345	MGD(US)
O&M labor required	46700	pers-hrs/yr
Dry material handling and mixi	3400	pers-hrs/yr
Total operation labor required	50100	pers-hrs/yr

Generacion con motores de combustion biogas

Design Output Data

Description	Value	Units

Sedimentador Secundario

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	509000	sqft
Surface area per circular clarifi	25400	sqft
Diameter of each circular clarif	180	ft
Number of clarifiers per battery	5	
Number of batteries	4	
Solids loading rate	20,9	lb/(sqft·d)
Hydraulic retention time	4,16	hr
Weir length	49200	ft
Volume of wasted sludge	8,06	MGD(US)
Surface overflow rate	733	gal(US)/(sqft·d)
Quantities		
Operation labor required	10900	pers-hrs/yr
Maintenance labor required	6190	pers-hrs/yr
Electrical energy required	80300	kWh/yr
Volume of earthwork required	8660000	cuft
Slab thickness	12,2	in
Volume of slab concrete requir	566000	cuft
Wall thickness	15,5	in
Volume of wall concrete requir	273000	cuft
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	8,06	MGD(US)
Total pumping capacity	8,06	MGD(US)

Design capacity per pump		4,03	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		8,06	MGD(US)
Quantities			
Operation labor required		592	pers-hrs/yr
Maintenance labor required		502	pers-hrs/yr
Electrical energy required		269000	kWh/yr
Volume of earthwork required		2870	cuft
Area of pump building		359	sqft

Secado Térmico

Design Output Data

Description	Value	Units

Disposicion Final

Design Output Data

Description	Value		Units
Sludge Hauling and Land Filling			
Design Information			
Volume of sludge hauled		0,263	MGD(US)
Truck capacity		810	cuft
Round trip time to disposal site		1	hr
Truck loading time		0,75	hr
Operational hours per day		8	hr
Number of trucks required		10	
Distance to disposal site		15,5	miles
Quantities			
Total sludge volume hauled		0,263	MGD(US)
Maximum anticipated landfill d		30	d
Anticipated sludge storage hei		8	ft
Sludge storage shed area		132000	sqft
Width of sludge storage shed s		257	ft
Length of sludge storage shed		514	ft
Volume of earthwork required		336000	cuft
Volume of slab concrete requir		136000	cuft
Surface area of canopy roof		132000	sqft
Round trip haul distance		31,1	miles
Round trips per day per truck		5	
Distance traveled per year per		38800	miles
Sludge hauled		2310000	lb/d
Operation labor required		31700	pers-hrs/yr
LandFilling cost	$11,200,000		$/yr
Costs			
Construction and equipment c	$5,760,000		$
Operational labor cost	$254,000		$/yr
Material and supply cost	$12,500,000		$/yr
Amortization cost	$422,000		$/yr

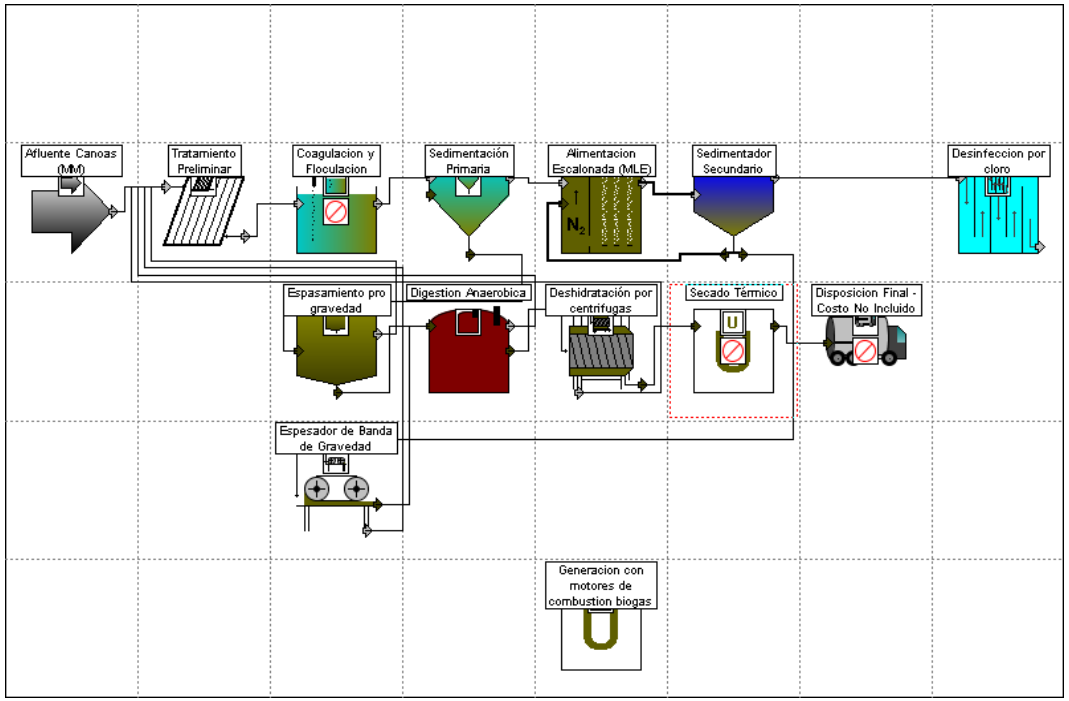
Desinfeccion por cloro

Design Output Data

Description	Value		Units
Chlorination			
Design Information			
Volume of tank		2030000	cuft
Average chlorine required		30400	lb/d
Peak chlorine required		60900	lb/d
Influent coliform count		10000000	/100mL
Effluent coliform count		29,2	/100mL
Quantities			
Operational labor required		9790	pers-hrs/yr
Maintenance labor required		11800	pers-hrs/yr
Electrical energy required		269000	kWh/yr
Volume of earthwork required		731000	cuft

Volume of slab concrete requir	204000	cuft
Volume of wall concrete requir	167000	cuft
Number of chlorinators and eva	4	
Chlorination building area	1440	sqft
Number of chlorine cylinders	457	
Area of chlorine storage buildir	64000	sqft

FII-Alt 1- Alim Esc



Summary
Equipment Database
Sept 2007,(USA Avg)

Layout Summary

Present Worth	Project	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
$2,360,000,000	$1,090,000,000	$2,950,000	$1,940,000	$2,360,000	$16,200,000	$27,400,000	$39,800,000

Process Summary

Process	Construction	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
Tratamiento Preliminar	$13,200,000	$363,000	$122,000	$330,000	$0	$49,700	$666,000
Sedimentación Primaria	$36,000,000	$72,400	$43,700	$142,000	$0	$23,500	$807,000
Alimentacion Escalonada (MLE	$89,400,000	$184,000	$151,000	$678,000	$0	$22,100,000	$6,120,000
Sedimentador Secundario	$61,000,000	$91,700	$55,600	$174,000	$0	$59,600	$1,000,000
Desinfeccion por cloro	$10,300,000	$78,300	$98,600	$140,000	$8,940,000	$53,700	$656,000
Espasamiento pro gravedad	$2,350,000	$55,500	$27,500	$23,500	$0	$7,860	$148,000
Digestion Anaerobica	$14,700,000	$398,000	$23,700	$322,000	$0	$846,000	$15,000,000
Deshidratación por centrifugas	$48,000,000	$438,000	$547,000	$0	$5,420,000	$3,640,000	$7,070,000
Espesador de Banda de Grave	$30,500,000	$145,000	$37,900	$0	$1,860,000	$590,000	$2,800,000
Generacion con motores de cc	$37,500,000	$830,000	$830,000	$550,000	$0	$0	$1,050,000
Blower System	$88,400,000	$0	$0	$0	$0	$0	$4,470,000
Other Costs	$656,000,000	$293,000	$0	$0	$0	$0	$0

Summary of Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	210	acre
Administration labor hours	35400	hr/yr
Laboratory labor hours	14500	hr/yr
Costs		
DIRECT COSTS		
Mobilization	$14,500,000	$
Site preparation	$12,500,000	$
Site electrical	$48,400,000	$
Yard piping	$29,600,000	$
Instrumentation and control	$30,300,000	$
Lab and administration buildin	$23,100,000	$
Unit process construction cost	$431,000,000	$
Profit	$88,500,000	$
Total construction costs	$678,000,000	$
INDIRECT COSTS		
Miscellaneous cost	$142,000,000	$
Legal cost	$13,600,000	$
Engineering design fee	$102,000,000	$
Inspection cost	$13,600,000	$
Contingency	$67,800,000	$
Technical	$13,600,000	$
Total indirect costs	$353,000,000	$
MISC		
Cost of land	$0	$
Interest during construction	$56,500,000	$
LABOR COSTS		
Administration labor cost	$177,000	$/yr
Laboratory labor cost	$116,000	$/yr
Unit process operation labor c	$2,660,000	$/yr
Unit process maintenance labc	$1,940,000	$/yr
Total labor costs	$4,880,000	$/yr
PROJECT SUMMARY		
Present worth	$2,360,000,000	$
Total project cost	$1,090,000,000	$
Total operation labor cost	$2,950,000	$/yr
Total maintenance labor cost	$1,940,000	$/yr
Total material cost	$2,360,000	$/yr
Total chemical cost	$16,200,000	$/yr
Total energy cost	$27,400,000	$/yr
Total amortization cost	$39,800,000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		

Design Information			
Minimum air flow capacity		349000	scfm
Safety factor		1,5	
Requested air flow capacity		524000	scfm
Total capacity of blowers		524000	scfm
Number of blowers in use		6	
Total number of blowers		7	
Capacity of individual blowers		87400	scfm
Estimated cost of an installed l	$11,400,000		$
Blower building area		3730	sqft
Costs			
Construction and equipment c	$88,400,000		$
Amortization cost	$4,470,000		$/yr
Notes			
Energy costs are shown at the individual unit processes that require air			

Afluente Canoas (MM)
Tratamiento Preliminar
Design Output Data

Description	**Value**		**Units**
Mechanically Cleaned Bar Screen			
Design Information			
Bar size		0,25	in
Bar spacing		0,235	in
Slope of bars from horizontal		15	degrees
Head loss through screen		2,6965E+308	ft
Approach velocity		1,31	ft/s
Average flow through velocity (		1,31	ft/s
Maximum flow through velocity		3	ft/s
Screen channel width		44,5	ft
Average channel depth		9,84	ft
Aerated Grit Chamber			
Design Information			
Maximum flow		735	MGD(US)
Average flow		371	MGD(US)
Minimum flow		326	MGD(US)
Temperature		60,8	deg F
Maximum flow through velocity		0,358	ft/s
Average flow through velocity (		0,181	ft/s
Size of smallest particle 100%		0,00786	in
Specific gravity of particle		2	
Number of units		1	
Maximum flow/unit		735	MGD(US)
Width of channel		215	ft
Depth of channel		14,8	ft
Length of channel		215	ft
Settling velocity of particle		0,0513	ft/s
Hydraulic retention time		10	min
Volume of grit		0,111	MGD(US)
Air supply		3	cfm
Costs			
Construction and equipment c	$13,200,000		$
Operational labor cost	$363,000		$/yr

Maintenance labor cost	$122,000		$/yr
Material and supply cost	$330,000		$/yr
Energy cost	$49,700		$/yr
Amortization cost	$666,000		$/yr

Coagulacion y Floculacion

Design Output Data

Description	Value		Units
Chemical Phosphorus Removal			
Design Information			
Chemical used	Equivalent Iron		
Chemical dosage		5	mg/L
Mass of chemical per year		2580000	kg/yr
Chemical sludge production		31,4	mg/L
Organic sludge production		2,8	mg/L

Espasamiento pro gravedad

Design Output Data

Description	Value		Units
Gravity Thickening			
Design Information			
Initial concentration		4	%
Thickened concentration		5	%
Mass loading		24	lb/(sqft·d)
Hydraulic loading		51,2	gal(US)/(sqft·d)
Hydraulic retention time		49,1	hr
Number of tanks		7	
Tank volume		441000	cuft
Depth		14	ft
Surface area per tank		4500	sqft
Tank diameter		76	ft
Quantities			
Amount of sludge generated		538000	lb/d
Volume of thickened sludge		1,11	MGD(US)
Operation labor required		6930	pers-hrs/yr
Maintenance labor required		3300	pers-hrs/yr
Electrical energy required		39300	kWh/yr
Volume of earthwork required		401000	cuft
Slab thickness		11,4	in
Volume of slab concrete requir		35100	cuft
Wall thickness		14	in
Volume of wall concrete requir		31100	cuft
Costs			
Construction and equipment c	$2,350,000		$
Operational labor cost	$55,500		$/yr
Maintenance labor cost	$27,500		$/yr
Material and supply cost	$23,500		$/yr
Energy cost	$7,860		$/yr
Amortization cost	$148,000		$/yr

Espesador de Banda de Gravedad

Design Output Data

Description	Value	Units

Gravity Belt Thickener			
Design Information			
Belt filter width		6,56	ft
Number of units		77	
Hydraulic loading per unit per r		0,18	MGD(US)
Hydraulic loading required per		27,5	MGD(US)
Final solids content		7	%
Solids capture fraction		0,99	
Quantities			
Operation labor required		18200	pers-hrs/yr
Maintenance labor required		4540	pers-hrs/yr
Power		2950000	kWh/yr
Polymer required		2250	lb/d
Dry solids produced		563000	lb/d
Belt filter(s)	$21,300,000		$
Building	$1,280,000		$
Installation	$5,310,000		$
Polymer system	$7,860,000		$
Feed pumps	$2,340,000		$
Conveyor system	$5,310,000		$
Costs			
Operational labor cost	$145,000		$/yr
Maintenance labor cost	$37,900		$/yr
Chemical cost	$1,860,000		$/yr
Energy cost	$590,000		$/yr
Amortización cost	$2,800,000		$/yr

Sedimentación Primaria

Design Output Data

Description	**Value**		**Units**
Primary Clarification			
Design Information			
Surface area		342000	sqft
Surface area per circular clarifi		21400	sqft
Diameter of each circular clarif		165	ft
Number of clarifiers per battery		4	
Number of batteries		4	
Solids loading rate		2,7	lb/(sqft·d)
Hydraulic retention time		2,63	hr
Weir length		49200	ft
Volume of sludge generated		1,61	MGD(US)
Surface overflow rate		2160	gal(US)/(sqft·d)
Quantities			
Operation labor required		8580	pers-hrs/yr
Maintenance labor required		4860	pers-hrs/yr
Electrical energy required		63700	kWh/yr
Volume of earthwork required		5580000	cuft
Slab thickness		11,9	in
Volume of slab concrete requir		374000	cuft
Wall thickness		15	in
Volume of wall concrete requir		183000	cuft
Costs			
Operational labor cost	$68,700		$/yr

Maintenance labor cost	$40,500		$/yr
Material and supply cost	$141,000		$/yr
Energy cost	$12,700		$/yr
Amortization cost	$802,000		$/yr
Notes			
Effluent soluble TKN adjusted to satisfy user-specified TKN removal.			
Waste Sludge Pumping			
Design Information			
Average daily pumping rate		1,61	MGD(US)
Total pumping capacity		1,61	MGD(US)
Design capacity per pump		0,806	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		1,61	MGD(US)
Quantities			
Operation labor required		468	pers-hrs/yr
Maintenance labor required		386	pers-hrs/yr
Electrical energy required		54000	kWh/yr
Volume of earthwork required		1850	cuft
Area of pump building		232	sqft
Costs			
Operational labor cost	$3,740		$/yr
Maintenance labor cost	$3,220		$/yr
Material and supply cost	$555		$/yr
Energy cost	$10,800		$/yr
Amortization cost	$5,180		$/yr

Digestion Anaerobica

Design Output Data

Description	Value		Units
Anaerobic Digestion			
Design Information			
Percent VSS destroyed		45	%
Solids concentration in digeste		3,4	%
Detention time		15	d
Digester depth		75	ft
Digester diameter		90	ft
Effective digester volume		7010000	cuft
Number of digesters per batter		14	
Number of primary digesters p		14	
Number of secondary digesters		0	
Number of batteries		1	
Gas produced		37,8	MGD(US)
Heat required		42800000	BTU/hr
Digester gas required		17,8	MGD(US)
Total natural gas required		0	MGD(US)
Quantities			
Operation labor required		54200	pers-hrs/yr
Maintenance labor required		30800	pers-hrs/yr
Electrical energy required		4610000	kWh/yr
Volume of earthwork required		3130000	cuft
Slab thickness		22,3	in
Volume of slab concrete requir		175000	cuft

Wall thickness	45	in
Volume of wall concrete requir	1240000	cuft
Sidewater depth	75	ft
Surface area/floor of 2-story cc	14100	sqft
Piping size	10	in
Length of total piping system	6200	ft
Number of 90 degree elbows	182	
Number of tees	357	
Number of plug valves	259	
Total dry solids treated	1050000	lb/d
Notes		
Mass balance based on user input		

Alimentacion Escalonada (MLE)

Design Output Data

Description	Value	Units
Pre-Denitrification Activated Sludge		
Design Information		
Design Override Enabled - sizi		
Predenitrification Design		
Design aerobic SRT for nitrifica	3	d
Total reactor SRT	3,27	d
Design SS	3060	mg/L
Calculated VSS	2330	mg/L
Calculated VSS:TSS ratio	0,76	lb VSS/lb SS
Total volume of anoxic reactor	802000	cuft
Total volume of aerobic reacto	8820000	cuft
Total volume of all reactors	9630000	cuft
Width of parallel train	22	ft
Sidewater depth	16,4	ft
Number of batteries	1	
Number of parallel trains per b	7	
Number of anoxic cells within c	1	
Number of aerobic cells within	3	
Total number of dividing walls	21	
Anoxic hydraulic retention time	0,387	hr
Aerobic hydraulic retention tim	4,26	hr
Amount of sludge generated	562000	lb/d
Sludge recycle rate	164	MGD(US)
Nitrogen requirement for bioma	13,8	mg/L
Phosphorus requirement for bi	2,76	mg/L
Oxygen requirement to meet a	983000	lb/d
Air flow required to meet avera	349000	scfm
Design air flow	39,6	scfm/1000 cuft
Design air flow	4,55	scfm/ft2
Quantities		
Operation labor required	17900	pers-hrs/yr
Maintenance labor required	14100	pers-hrs/yr
Electrical energy required	90700000	kWh/yr
Volume of earthwork required	4400000	cuft
Volume of slab concrete requir	1150000	cuft
Volume of wall concrete requir	985000	cuft
Handrail length	42200	ft

Number of diffusers per train		25000	
Fine bubble diffuser floor cove		14,4	%
Number of swing arm headers		153	
Required mixing power		396	HP
Total number of mixers		21	
Required mixing power per mi		18,9	HP
Design mixing power per mixe		5	HP
Mixing power for each unaerat		56,6	HP
Costs			
Construction and equipment c	$72,600,000		$
Operational labor cost	$143,000		$/yr
Maintenance labor cost	$118,000		$/yr
Material and supply cost	$561,000		$/yr
Energy cost	$18,100,000		$/yr
Amortization cost	$5,030,000		$/yr

Notes

Minimum winter SRT not calculated, design SRT specified by user

WARNING: User inputs for autotrophic kinetics and/or SRT suggest system may not nitrify, consider changing inputs

Design is based on user specified design overrides - Performance data is assumed to be correct.

WARNING: Anoxic HRT is out of the normal range

Required hp per mixer exceeds the maximum allowed of 5 hp/mixer, consider increasing number of mixers per tank

Internal Recycle Pumping

Design Information			
Average daily pumping rate		62,8	MGD(US)
Total pumping capacity		126	MGD(US)
Design capacity per pump		20,9	MGD(US)
Number of pumps		28	
Number of batteries		2	
Firm pumping capacity		62,8	MGD(US)
Quantities			
Operation labor required		1460	pers-hrs/yr
Maintenance labor required		1240	pers-hrs/yr
Electrical energy required		2080000	kWh/yr
Volume of earthwork required		23000	cuft
Area of pump building		2880	sqft
Costs			
Construction and equipment c	$12,300,000		$
Operational labor cost	$11,700		$/yr
Maintenance labor cost	$10,300		$/yr
Material and supply cost	$86,100		$/yr
Energy cost	$2,920,000		$/yr
Amortization cost	$803,000		$/yr

Notes

Pumps are sized based on an individual battery of internal pumps for each train

Sludge Recycle Pumping

Design Information			
Average daily pumping rate		164	MGD(US)
Total pumping capacity		327	MGD(US)
Design capacity per pump		27,3	MGD(US)
Number of pumps		5	
Number of batteries		3	
Firm pumping capacity		164	MGD(US)
Quantities			

Operation labor required		3710	pers-hrs/yr
Maintenance labor required		2720	pers-hrs/yr
Electrical energy required		5420000	kWh/yr
Volume of earthwork required		56400	cuft
Area of pump building		7060	sqft
Costs			
Construction and equipment c	$4,460,000		$
Operational labor cost	$29,600		$/yr
Maintenance labor cost	$22,700		$/yr
Material and supply cost	$31,200		$/yr
Energy cost	$1,080,000		$/yr
Amortization cost	$291,000		$/yr

Deshidratación por centrifugas

Design Output Data

Description	Value		Units
Centrifugation			
Design Information			
Total power required		6260	HP
Power required per unit		195	HP
Excess capacity factor		1,25	
Number of units		32	
Chemical dose		1	% dry wt
Chemicals required		21500	lb/d
Sludge flow		7,21	MGD(US)
Initial solid conc		3,4	%
Operational hours per day		8	hr
Operational days per week		7	d
Quantities			
Number of centrifuges		32	
Power required per unit		195	HP
Area of building		8520	sqft
Dry solids produced		681000	lb/d
Operation labor required		104000	pers-hrs/yr
Maintenance labor required		16600	pers-hrs/yr
Electrical energy required		7250000	kWh/yr
Polymer Feed System			
Quantities			
Polymer dosage		7150	lb/d
Liquid chemical solution fed		0,343	MGD(US)
O&M labor required		46600	pers-hrs/yr
Dry material handling and mixi		3400	pers-hrs/yr
Total operation labor required		49900	pers-hrs/yr

Generacion con motores de combustion biogas

Design Output Data

Description	Value	Units

Sedimentador Secundario

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		

Surface area		509000	sqft
Surface area per circular clarifi		25400	sqft
Diameter of each circular clarif		180	ft
Number of clarifiers per battery		4	
Number of batteries		5	
Solids loading rate		26,8	lb/(sqft·d)
Hydraulic retention time		2,21	hr
Weir length		49100	ft
Volume of wasted sludge		6,54	MGD(US)
Surface overflow rate		730	gal(US)/(sqft·d)
Quantities			
Operation labor required		10900	pers-hrs/yr
Maintenance labor required		6190	pers-hrs/yr
Electrical energy required		80300	kWh/yr
Volume of earthwork required		8660000	cuft
Slab thickness		10,1	in
Volume of slab concrete requir		473000	cuft
Wall thickness		11,5	in
Volume of wall concrete requir		116000	cuft
Costs			
Operational labor cost	$87,200		$/yr
Maintenance labor cost	$51,600		$/yr
Material and supply cost	$173,000		$/yr
Energy cost	$16,100		$/yr
Amortization cost	$992,000		$/yr
Waste Sludge Pumping			
Design Information			
Average daily pumping rate		6,54	MGD(US)
Total pumping capacity		6,54	MGD(US)
Design capacity per pump		3,27	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		6,54	MGD(US)
Quantities			
Operation labor required		560	pers-hrs/yr
Maintenance labor required		475	pers-hrs/yr
Electrical energy required		218000	kWh/yr
Volume of earthwork required		2630	cuft
Area of pump building		329	sqft
Costs			
Operational labor cost	$4,480		$/yr
Maintenance labor cost	$3,960		$/yr
Material and supply cost	$987		$/yr
Energy cost	$43,600		$/yr
Amortization cost	$9,200		$/yr

Secado Térmico

Design Output Data

Description	Value	Units
User Specified Sludge Treatment Process		
Design Information		
No Design Data		

Disposicion Final - Costo No Incluido

Design Output Data

Description	Value		Units
Sludge Hauling and Land Filling			
Design Information			
Volume of sludge hauled		0,0735	MGD(US)
Truck capacity		810	cuft
Round trip time to disposal site		1	hr
Truck loading time		0,75	hr
Operational hours per day		8	hr
Number of trucks required		3	
Distance to disposal site		10	miles
Quantities			
Total sludge volume hauled		0,0735	MGD(US)
Maximum anticipated landfill d		30	d
Anticipated sludge storage hei		8	ft
Sludge storage shed area		36800	sqft
Width of sludge storage shed s		136	ft
Length of sludge storage shed		271	ft
Volume of earthwork required		94700	cuft
Volume of slab concrete requir		38700	cuft
Surface area of canopy roof		36800	sqft
Round trip haul distance		20	miles
Round trips per day per truck		5	
Distance traveled per year per		25000	miles
Sludge hauled		644000	lb/d
Operation labor required		5690	pers-hrs/yr
LandFilling cost	$43,100		$/yr

Desinfeccion por cloro

Design Output Data

Description	Value		Units
Chlorination			
Design Information			
Volume of tank		2030000	cuft
Average chlorine required		30400	lb/d
Peak chlorine required		60900	lb/d
Influent coliform count		10000000	/100mL
Effluent coliform count		29,2	/100mL
Quantities			
Operational labor required		9790	pers-hrs/yr
Maintenance labor required		11800	pers-hrs/yr
Electrical energy required		269000	kWh/yr
Volume of earthwork required		731000	cuft
Volume of slab concrete requir		204000	cuft
Volume of wall concrete requir		167000	cuft
Number of chlorinators and eva		4	
Chlorination building area		1440	sqft
Number of chlorine cylinders		457	
Area of chlorine storage buildir		64000	sqft
Costs			
Construction and equipment co	$10,300,000		$
Operational labor cost	$78,300		$/yr

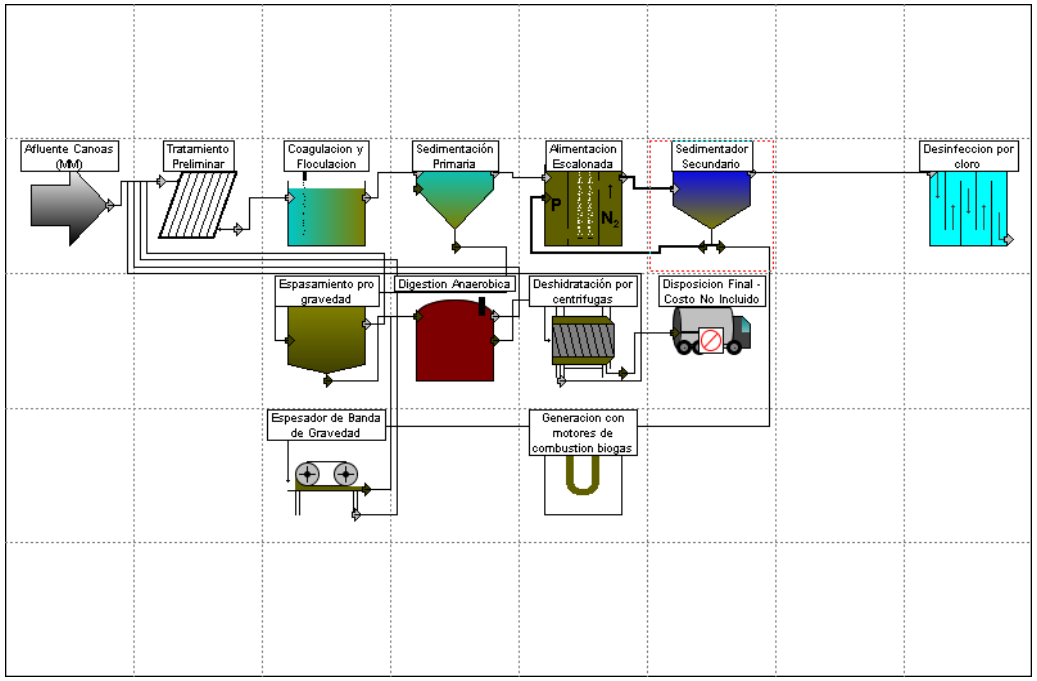
Maintenance labor cost	$98,600	$/yr
Material and supply cost	$140,000	$/yr
Chemical cost	$8,940,000	$/yr
Energy cost	$53,700	$/yr
Amortization cost	$656,000	$/yr

ALTERNATIVAS PARA FASE III – EXTENSIÓN DE LA PTAR A UN TRATAMIENTO CON REMOCIÓN DE NITRÓGENO Y FÓSFORO

Layout Comparison Summary

Layout Name	Present Worth	Project	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
FIII-Alt 4- Alim Esc	$1,370,000,000	$522,000,000	$1,540,000	$1,060,000	$4,220,000	$6,950,000	$15,900,000	$29,400,000
FIII-Alt 3-FP+BAF+FDN	$3,950,000,000	$2,930,000,000	$4,470,000	$3,660,000	$5,830,000	$36,400,000	$36,200,000	$49,400,000
FIII-Alt2-BAF+FDN	$3,650,000,000	$2,260,000,000	$4,350,000	$3,500,000	$4,110,000	$40,000,000	$39,400,000	$42,100,000
FIII-Alt 1- Alim Esc+FDNs	$3,470,000,000	$1,660,000,000	$3,940,000	$3,170,000	$4,240,000	$36,400,000	$38,600,000	$49,300,000

FIII-Alt 4- Alim Esc



Summary

Equipment Database

Sept 2007,(USA Avg)

Layout Summary

Present Worth	Project	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
$2,600,000,000	$1,660,000,000	$3,440,000	$2,590,000	$3,010,000	$20,400,000	$33,800,000	$28,900,000

Process Summary

Process	Construction	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
Tratamiento Preliminar	$13,300,000	$368,000	$123,000	$331,000	$0	$50,100	$669,000
Coagulacion y Floculacion	$0	$0	$0	$0	$4,560,000	$0	$0
Sedimentación Primaria	$36,000,000	$73,100	$44,400	$142,000	$0	$56,500	$811,000
Alimentacion Escalonada	$250,000,000	$238,000	$181,000	$964,000	$0	$28,600,000	$7,680,000
Sedimentador Secundario	$61,000,000	$91,900	$55,700	$209,000	$0	$68,100	$1,180,000
Desinfeccion por cloro	$10,300,000	$78,300	$98,500	$140,000	$8,940,000	$53,700	$656,000
Espasamiento pro gravedad	$10,000,000	$56,200	$27,700	$23,500	$0	$7,930	$148,000
Digestion Anaerobica	$149,000,000	$398,000	$237,000	$322,000	$0	$846,000	$3,880,000
Deshidratación por centrifugas	$50,000,000	$438,000	$547,000	$0	$5,420,000	$3,640,000	$3,990,000
Espesador de Banda de Grave	$30,500,000	$116,000	$30,300	$0	$1,480,000	$480,000	$3,350,000
Generacion con motores de co	$37,500,000	$1,240,000	$1,240,000	$833,000	$0	$0	$1,800,000
Blower System	$90,500,000	$0	$0	$0	$0	$0	$4,570,000
Iron Feed System	$2,370,000	$44,900	$0	$47,300	$0	$0	$120,000
Other Costs	$917,000,000	$293,000	$0	$0	$0	$0	$0

Summary of Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	210	acre
Administration labor hours	35400	hr/yr
Laboratory labor hours	14500	hr/yr
Costs		
DIRECT COSTS		
Mobilization	$14,500,000	$
Site preparation	$12,500,000	$
Site electrical	$48,400,000	$
Yard piping	$29,600,000	$
Instrumentation and control	$30,300,000	$
Lab and administration building	$23,100,000	$
Unit process construction costs	$741,000,000	$
Profit	$135,000,000	$
Total construction costs	$1,030,000,000	$
INDIRECT COSTS		
Miscellaneous cost	$217,000,000	$
Legal cost	$20,700,000	$
Engineering design fee	$155,000,000	$
Inspection cost	$20,700,000	$
Contingency	$103,000,000	$
Technical	$20,700,000	$
Total indirect costs	$538,000,000	$
MISC		
Cost of land	$0	$
Interest during construction	$86,200,000	$
LABOR COSTS		
Administration labor cost	$177,000	$/yr
Laboratory labor cost	$116,000	$/yr
Unit process operation labor co	$3,140,000	$/yr
Unit process maintenance labo	$2,590,000	$/yr
Total labor costs	$6,020,000	$/yr
PROJECT SUMMARY		
Present worth	$2,600,000,000	$
Total project cost	$1,660,000,000	$
Total operation labor cost	$3,440,000	$/yr
Total maintenance labor cost	$2,590,000	$/yr
Total material cost	$3,010,000	$/yr
Total chemical cost	$20,400,000	$/yr
Total energy cost	$33,800,000	$/yr
Total amortization cost	$28,900,000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	277000	scfm

Safety factor		2	
Requested air flow capacity		554000	scfm
Total capacity of blowers		554000	scfm
Number of blowers in use		6	
Total number of blowers		7	
Capacity of individual blowers		92300	scfm
Estimated cost of an installed l	$11,600,000		$
Blower building area		3780	sqft
Costs			
Construction and equipment cc	$90,500,000		$
Amortization cost	$4,570,000		$/yr
Notes			
Energy costs are shown at the individual unit processes that require air			

Summary of Chemical Feed System for Iron

Description	Value		Units
Iron Salt Solution Feed System			
Quantities			
Ferric chloride dosage rate		45900	lb/d
Iron salt dosage rate as equiva		15800	lb/d
Liquid chemical solution fed		0,013	MGD(US)
Operation labor required		5610	pers-hrs/yr
Costs			
Construction and equipment cc	$2,370,000		$
Operational labor cost	$44,900		$/yr
Material and supply cost	$47,300		$/yr
Amortization cost	$120,000		$/yr

Afluente Canoas (MM)

User Input Data

Description	Value		Units
Average Flow		365	MGD(US)
Minimum Flow		320	MGD(US)
Maximum Flow		730	MGD(US)
Suspended Solids		226	mg/L
% Volatile Solids		75	%
BOD		271	mg/L
Soluble BOD		80	mg/L
COD		550	mg/L
Soluble COD		350	mg/L
TKN		70,4	mgN/L
Soluble TKN		35,2	mgN/L
Ammonia		26	mgN/L
Total Phosphorus		9,7	mgP/L
pH		7,3	
Cations		160	mg/L
Anions		160	mg/L
Settleable Solids		50	mL/L
Oil and Grease		100	mg/L
Nitrite		0	mgN/L
Nitrate		0	mgN/L
Non-Degradable Fraction of VS		40	%
Average Summer		68	deg F
Average Winter		60,8	deg F

Tratamiento Preliminar

User Input Data

Screening

Description	Value	Units
Cleaning Method	Mechanically Cleane	
Mechanically Cleaned Depth	9,84	ft
Manually Cleaned Depth	2	ft
Width	0,25	in
Space	0,235	in
Slope	15	degrees
Shape Factor	1,8	
Approach	1,31	ft/s
Max	3	ft/s
Ave	1,31	ft/s

Grit Removal

Description	Value	Units
Particle Size	0,00786	in
Specific Gravity	2	
Type of Grit Removal	Aerated	
Number of Units	1	
Design By	Depth	
Depth	14,8	ft
Width	65,6	ft
Current Allowance	1,7	
Manning Coefficient	0,035	
Volume of Grit	40	cuft grit/MGal(US)
Detention Time	10	min
Air Supply per Unit Length of T	3	scfm/ft
Surface Velocity	1,5	ft/s
Tank Floor Velocity	1	ft/s
Capital Cost	40	years

Cost Override

Description	Value	Units
Override Construction Cost	FALSE	
	$0.00	$
Override Annual Operational C	FALSE	
	$0.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	
	$0.00	$
Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization (	FALSE	
	$0.00	$

Design Output Data

Description	Value	Units
Mechanically Cleaned Bar Screen		
Design Information		
Bar size	0,25	in
Bar spacing	0,235	in
Slope of bars from horizontal	15	degrees

Head loss through screen		2,6965E+308	ft
Approach velocity		1,31	ft/s
Average flow through velocity (		1,31	ft/s
Maximum flow through velocity		3	ft/s
Screen channel width		45,2	ft
Average channel depth		9,84	ft
Aerated Grit Chamber			
Design Information			
Maximum flow		741	MGD(US)
Average flow		378	MGD(US)
Minimum flow		332	MGD(US)
Temperature		60,8	deg F
Maximum flow through velocity		0,359	ft/s
Average flow through velocity (		0,183	ft/s
Size of smallest particle 100%		0,00786	in
Specific gravity of particle		2	
Number of units		1	
Maximum flow/unit		741	MGD(US)
Width of channel		216	ft
Depth of channel		14,8	ft
Length of channel		216	ft
Settling velocity of particle		0,0513	ft/s
Hydraulic retention time		10	min
Volume of grit		0,113	MGD(US)
Air supply		3	cfm
Costs			
Construction and equipment cc	$13,300,000		$
Operational labor cost	$368,000		$/yr
Maintenance labor cost	$123,000		$/yr
Material and supply cost	$331,000		$/yr
Energy cost	$50,100		$/yr
Amortization cost	$669,000		$/yr

Coagulacion y Floculacion

User Input Data

Chemical Phosphorus Removal

Description	**Value**		**Units**
Metal Precipitant	Equivalent Iron		
Effluent Phosphorus		5	mg/L
Override Design	TRUE		
Chemical Dosage		5	mg/L

Cost Override

Description	**Value**	**Units**
Override Construction Cost	FALSE	
	$0.00	$
Override Annual Operational C	FALSE	
	$0.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	
	$0.00	$
Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$

Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	Value		Units
Chemical Phosphorus Removal			
Design Information			
Chemical used	Equivalent Iron		
Chemical dosage		5	mg/L
Mass of chemical per year		2620000	kg/yr
Chemical sludge production		30,9	mg/L
Organic sludge production		2,8	mg/L
Costs			
Chemical cost	$4,560,000		$/yr

Espasamiento pro gravedad

User Input Data

Gravity Thickening

Description	Value		Units
Underflow Concentration		5	%
Depth		14	ft
Based On	Mass Loading		
Mass Loading		24	lb/(sqft·d)
Settling Velocity		0,000694	ft/s
Initial Height		4	ft
Intercept		3	ft
Override Design	TRUE		
Surface Area per Thickener		4500	sqft
Number of Units		7	
Override Database Costs	FALSE		
Standard 90 ft Diameter Thick	$145,000.00		$
Thickener		20	years
Structural		40	years

Cost Override

Description	Value		Units
Override Construction Cost	TRUE		
	$10,000,000.00		$
Override Annual Operational C	FALSE		
	$0.00		$
Override Annual Maintenance	FALSE		
	$0.00		$
Override Annual Materials Cos	FALSE		
	$0.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$
Override Annual Energy Cost	FALSE		
	$0.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	Value		Units
Gravity Thickening			
Design Information			
Initial concentration		1	%

Thickened concentration		5	%
Mass loading		24	lb/(sqft·d)
Hydraulic loading		208	gal(US)/(sqft·d)
Hydraulic retention time		12,1	hr
Number of tanks		7	
Tank volume		441000	cuft
Depth		14	ft
Surface area per tank		4500	sqft
Tank diameter		76	ft
Quantities			
Amount of sludge generated		547000	lb/d
Volume of thickened sludge		1,12	MGD(US)
Operation labor required		7020	pers-hrs/yr
Maintenance labor required		3330	pers-hrs/yr
Electrical energy required		39700	kWh/yr
Volume of earthwork required		401000	cuft
Slab thickness		11,4	in
Volume of slab concrete requir		35100	cuft
Wall thickness		14	in
Volume of wall concrete requir		31100	cuft
Costs			
Operational labor cost	$56,200		$/yr
Maintenance labor cost	$27,700		$/yr
Material and supply cost	$23,500		$/yr
Energy cost	$7,930		$/yr
Amortization cost	$148,000		$/yr

Espesador de Banda de Gravedad

User Input Data

Gravity Belt Thickener

Description	**Value**		**Units**
Cake Solids Content		6	%
Density of Cake		65	lb/cuft
Operating Schedule per Day		8	hr/d
Days Operating per Week		5	d/wk
Hydraulic Loading per Metre of		0,18	MGD(US)
Polymer Dose		0,004	lb/lb
Filtrate Solids Concentration		100	mg/L
Override Design	FALSE		
Building Size Requirement		13300	sqft
Number of Belt Filters		33	
Override Database Costs	FALSE		
1m Belt Filter System	$250,000.00		$
2m Belt Filter System	$276,000.00		$
Belt Filter		20	years
Structural		40	years

Cost Override

Description	**Value**	**Units**
Override Construction Cost	TRUE	
	$30,500,000.00	$
Override Annual Operational C	FALSE	
	$0.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	

	$0.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$
Override Annual Energy Cost	FALSE		
	$0.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	**Value**		**Units**
Gravity Belt Thickener			
Design Information			
Belt filter width		6,56	ft
Number of units		92	
Hydraulic loading per unit per r		0,18	MGD(US)
Hydraulic loading required per		32,8	MGD(US)
Final solids content		6	%
Solids capture fraction		0,985	
Quantities			
Operation labor required		14500	pers-hrs/yr
Maintenance labor required		3640	pers-hrs/yr
Power		2400000	kWh/yr
Polymer required		1790	lb/d
Dry solids produced		448000	lb/d
Belt filter(s)	$25,400,000		$
Building	$1,510,000		$
Installation	$6,350,000		$
Polymer system	$9,400,000		$
Feed pumps	$2,790,000		$
Conveyor system	$6,350,000		$
Costs			
Operational labor cost	$116,000		$/yr
Maintenance labor cost	$30,300		$/yr
Chemical cost	$1,480,000		$/yr
Energy cost	$480,000		$/yr
Amortization cost	$3,350,000		$/yr

Sedimentación Primaria

User Input Data

Primary Clarification

Description	**Value**		**Units**
Design Basis	Peak Flow		
Surface Overflow Rate		2400	gal(US)/(sqft·d)
Sidewater Depth		16	ft
Specific Gravity		1,05	
Underflow Concentration		1	%
Weir Overflow Rate		15000	gal(US)/(ft·d)
Type of Clarifier	Circular		
Suspended Solids		58	%
BOD		32	%
COD		40	%
TKN		5	%
Phosphorus		5	%
Override Design	TRUE		
Length-Rectangular Only		0	ft
Width-Rectangular Only		0	ft

Diameter-Circular Only		165	ft
Excavation Depth		4	ft
Number of Tanks per Battery		4	
Number of Batteries		4	
Override Database Costs	FALSE		
Standard 20 X 120 ft Rectangu	$119,000.00		$
Standard 90 ft Diameter Circul	$97,600.00		$
Standard 3000 gpm Pump and	$19,500.00		$
Mechanical		20	years
Structural		40	years
Pump		25	years

Cost Override

Description	**Value**		**Units**
Override Construction Cost	TRUE		
	$36,000,000.00		$
Override Annual Operational C	FALSE		
	$0.00		$
Override Annual Maintenance	FALSE		
	$0.00		$
Override Annual Materials Cos	FALSE		
	$0.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$
Override Annual Energy Cost	FALSE		
	$0.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	**Value**		**Units**
Primary Clarification			
Design Information			
Surface area		342000	sqft
Surface area per circular clarifi		21400	sqft
Diameter of each circular clarif		165	ft
Number of clarifiers per battery		4	
Number of batteries		4	
Solids loading rate		2,72	lb/(sqft·d)
Hydraulic retention time		2,59	hr
Weir length		49600	ft
Volume of sludge generated		6,55	MGD(US)
Surface overflow rate		2180	gal(US)/(sqft·d)
Quantities			
Operation labor required		8580	pers-hrs/yr
Maintenance labor required		4860	pers-hrs/yr
Electrical energy required		63700	kWh/yr
Volume of earthwork required		5580000	cuft
Slab thickness		11,9	in
Volume of slab concrete requir		374000	cuft
Wall thickness		15	in
Volume of wall concrete requir		183000	cuft
Costs			
Operational labor cost	$68,700		$/yr
Maintenance labor cost	$40,500		$/yr
Material and supply cost	$141,000		$/yr

Energy cost	$12,700		$/yr
Amortization cost	$802,000		$/yr
Notes			
Effluent soluble TKN adjusted to satisfy user-specified TKN removal.			
Waste Sludge Pumping			
Design Information			
Average daily pumping rate		6,55	MGD(US)
Total pumping capacity		6,55	MGD(US)
Design capacity per pump		3,28	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		6,55	MGD(US)
Quantities			
Operation labor required		560	pers-hrs/yr
Maintenance labor required		475	pers-hrs/yr
Electrical energy required		219000	kWh/yr
Volume of earthwork required		2630	cuft
Area of pump building		329	sqft
Costs			
Operational labor cost	$4,480		$/yr
Maintenance labor cost	$3,960		$/yr
Material and supply cost	$988		$/yr
Energy cost	$43,700		$/yr
Amortization cost	$9,210		$/yr

Digestion Anaerobica

User Input Data

Anaerobic Digestion

Description	**Value**		**Units**
Specific Gravity		1,05	
Percent Volatile Solids Destroy		50	%
Concentration in Digester		3,4	%
Minimum Detention Time in Pri		15	d
Location	Warm-Winter > 10 D		
Raw Wastewater		60,8	deg F
Digester		104	deg F
Fraction of Influent Flow Returi		2	%
Suspended Solids		6250	mg/L
BOD		1000	mg/L
COD		2150	mg/L
TKN		950	mgN/L
Ammonia		650	mg/L
Override Design	TRUE		
Diameter		90	ft
Sidewater Depth		75	ft
Number of Primary Digester Ta		14	
Number of Secondary Digester		0	
Number of Batteries		1	
Override Database Costs	FALSE		
Standard 70 ft Diameter Floatir	$444,000.00		$
Standard 60 ft Diameter Gas C	$131,000.00		$
Standard 1 Million Btu/Hr Heat	$55,300.00		$
Standard 2 in Diameter Gas Sa	$43,400.00		$
Standard Size Sludge Pump 8(	$5,960.00		$
Natural Gas Per 1000 cuft	$21.10		$
Floating Cover		20	years

Gas Circulation Unit	20	years
Heating Unit	20	years
Gas Safety Equipment	20	years
Sludge Pump	25	years
Structural	40	years

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$149,000,000.00	$
Override Annual Operational C	TRUE	
	$398,000.00	$
Override Annual Maintenance	TRUE	
	$237,000.00	$
Override Annual Materials Cos	TRUE	
	$322,000.00	$
Override Annual Chemical Cos	TRUE	
	$0.00	$
Override Annual Energy Cost	TRUE	
	$846,000.00	$
Override Annual Amortization (	FALSE	
	$0.00	$

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	3,4	%
Detention time	15	d
Digester depth	75	ft
Digester diameter	90	ft
Effective digester volume	7010000	cuft
Number of digesters per batter	14	
Number of primary digesters p	14	
Number of secondary digesters	0	
Number of batteries	1	
Gas produced	33,8	MGD(US)
Heat required	42100000	BTU/hr
Digester gas required	17,5	MGD(US)
Total natural gas required	0	MGD(US)
Quantities		
Operation labor required	49500	pers-hrs/yr
Maintenance labor required	28200	pers-hrs/yr
Electrical energy required	4230000	kWh/yr
Volume of earthwork required	3130000	cuft
Slab thickness	22,3	in
Volume of slab concrete requir	175000	cuft
Wall thickness	45	in
Volume of wall concrete requir	1240000	cuft
Sidewater depth	75	ft
Surface area/floor of 2-story cc	14100	sqft
Piping size	10	in
Length of total piping system	6200	ft
Number of 90 degree elbows	182	
Number of tees	357	

Number of plug valves		259	
Total dry solids treated		944000	lb/d
Costs			
Amortization cost	$3,880,000		$/yr
Notes			
Mass balance based on user input			

Alimentacion Escalonada

User Input Data

Biological Nutrient Removal - 3/5 Stage

Description	**Value**		**Units**
Number of Stages	5-Stage		
Internal Recycle From Anoxic t	No		
Internal Recycle From Oxic to /	Yes		
Aeration Type	Diffused Aeration		
Effluent TKN		20	mgN/L
Effluent Total Phosphorus		2	mgP/L
Design Basis	Specify Design SRT		
Total Reactor SRT		10	d
Safety Factor for Calculated SI		1,5	
Maximum Heterotrophic Specif		6	1/d
Heterotrophic Decay Rate		0,24	1/d
Maximum Autotrophic Specific		0,75	1/d
Autotrophic Decay Rate		0,08	1/d
Biomass Yield		0,4	
Minimum Influent BOD to P Ra		20	
Fraction of Influent RB COD us		0,7	
Total P Content of PAOs		0,1	mg P/mg PAO VSS
Suspended Solids		3200	mg/L
Bubble Size	Fine Bubble		
Alpha Factor for Oxygen Trans		0,5	
Beta Factor for Oxygen Satura		0,95	
Coarse Bubble Minimum Air Fl		19,8	scfm/1000 cuft
Fine Bubble Minimum Air Flow		0,12	scfm/ft2
Standard Oxygen Transfer Effi		40	%
Override Design	TRUE		
Aerobic Volume		16400000	cuft
Anoxic Volume		16000000	cuft
Anaerobic Volume		366000	cuft
Tank Width		262	ft
Tank Depth		16,4	ft
Pipe Gallery Width		55	ft
Excavation Depth		4,27	ft
Number of Tanks		24	
Number of Batteries		1	
Required Air Flow - Diffused A		16,9	scfm/1000 cuft
Required Horsepower - Mecha		0	HP
Number of Mixers per Unaerat		3	
Override Database Costs	FALSE		
Slow Speed 20 hp Aerator	$21,700.00		$
Standard 2 scfm Fine Bubble I	$54.20		$
Standard 12 scfm Coarse Bubl	$32.50		$
Standard 550 scfm Swing Arm	$15,200.00		$
5 hp Vertical Turbine Mixer	$9,700.00		$
Standard 3000 gpm Pump and	$19,500.00		$
Mechanical Aerator		20	years

Fine Bubble Diffuser	10	years
Coarse Bubble Diffuser	20	years
Swing Arm Diffuser	20	years
Turbine Mixer	20	years
Pump	25	years
Structural	40	years

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$250,000,000.00	$
Override Annual Operational C	FALSE	
	$20,000,000.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	
	$0.00	$
Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization (	FALSE	
	$0.00	$

Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		
Design Information		
Design Override Enabled - sizi		
5-Stage Biological Phosphorus		
Design aerobic SRT for nitrifica	5	d
Total reactor SRT	10	d
Design SS	2190	mg/L
Calculated VSS	1380	mg/L
Calculated VSS:TSS ratio	0,628	lb VSS/lb SS
Total volume of anaerobic reac	366000	cuft
Total volume of anoxic reactors	16000000	cuft
Total volume of aerobic reactor	16400000	cuft
Total volume of all reactors	32800000	cuft
Width of parallel train	262	ft
Sidewater depth	16,4	ft
Number of batteries	1	
Number of parallel trains per ba	24	
Number of anoxic cells within c	3	
Number of aerobic cells within	3	
Anaerobic hydraulic retention ti	0,176	hr
Anoxic hydraulic retention time	7,72	hr
Aerobic hydraulic retention time	7,9	hr
Amount of sludge generated	449000	lb/d
Sludge recycle ratio	48,7	%
Sludge recycle rate	181	MGD(US)
Nitrogen required for biomass g	14,9	mg/L
Phosphorus required for bioma	2,99	mg/L
Oxygen required to meet avera	947000	lb/d
Air flow required to meet avera	277000	scfm
Design air flow	16,9	scfm/1000 cuft

Design air flow		6,65	scfm/ft2
Quantities			
Operation labor required		19800	pers-hrs/yr
Maintenance labor required		14900	pers-hrs/yr
Electrical energy required		81000000	kWh/yr
Volume of earthwork required		14200000	cuft
Volume of slab concrete requir		4250000	cuft
Volume of wall concrete requir		578000	cuft
Handrail length		15400	ft
Number of diffusers per train		5770	
Fine bubble diffuser floor cover		6,12	%
Number of swing arm headers		13	
Required mixing power		8100	HP
Total number of mixers		288	
Required mixing power per mix		28,1	HP
Design mixing power per mixer		5	HP
Mixing power for each unaerate		84,4	HP
Costs			
Operational labor cost	$159,000		$/yr
Maintenance labor cost	$124,000		$/yr
Material and supply cost	$783,000		$/yr
Energy cost	$16,200,000		$/yr
Amortization cost	$5,990,000		$/yr

Notes

Minimum SRT not calculated, design SRT specified by user

Design is based on user specified design overrides - Performance data is assumed to be correc

WARNING: Anoxic HRT is out of the normal range, consider changing your design override valu

WARNING: Anaerobic HRT is out of the normal range, consider changing your design override

Required hp per mixer exceeds the maximum allowed of 5 hp/mixer, consider increasing numbe

Aerobic-Anoxic internal recycle pumps sized for 4x the influent flow

Internal Recycle Pumping

Design Information			
Average daily pumping rate		62,1	MGD(US)
Total pumping capacity		62,1	MGD(US)
Design capacity per pump		20,7	MGD(US)
Number of pumps		96	
Number of batteries		1	
Firm pumping capacity		62,1	MGD(US)
Quantities			
Operation labor required		1450	pers-hrs/yr
Maintenance labor required		1230	pers-hrs/yr
Electrical energy required		2060000	kWh/yr
Volume of earthwork required		11400	cuft
Area of pump building		1430	sqft
Costs			
Operational labor cost	$11,600		$/yr
Maintenance labor cost	$10,300		$/yr
Material and supply cost	$146,000		$/yr
Energy cost	$9,890,000		$/yr
Amortization cost	$1,360,000		$/yr

Notes

Pumps are sized based on an individual battery of internal pumps for each train

Sludge Recycle Pumping

Design Information			
Average daily pumping rate		373	MGD(US)
Total pumping capacity		373	MGD(US)

Design capacity per pump		23,3	MGD(US)
Number of pumps		5	
Number of batteries		4	
Firm pumping capacity		373	MGD(US)
Quantities			
Operation labor required		8520	pers-hrs/yr
Maintenance labor required		5630	pers-hrs/yr
Electrical energy required		12300000	kWh/yr
Volume of earthwork required		65200	cuft
Area of pump building		8150	sqft
Costs			
Operational labor cost	$68,200		$/yr
Maintenance labor cost	$46,900		$/yr
Material and supply cost	$34,800		$/yr
Energy cost	$2,460,000		$/yr
Amortization cost	$325,000		$/yr

Deshidratación por centrifugas

User Input Data

Centrifugation

Description	Value		Units
Cake Solids Content		28	%
Solids Capture		90	%
Power Requirement		1	HP/gpm(US)
Daily Operating Time		8	hr/d
Weekly Operating Time		7	d/wk
Number of Units		5	
Excess Capacity Factor		1,25	
Chemical Dose		1	% dry wt
Override Database Costs	FALSE		
Standard 50 hp Centrifuge	$271,000.00		$
Centrifuge		15	years
Structural		40	years

Cost Override

Description	Value		Units
Override Construction Cost	TRUE		
	$50,000,000.00		$
Override Annual Operational C	TRUE		
	$438,000.00		$
Override Annual Maintenance	TRUE		
	$547,000.00		$
Override Annual Materials Cos	TRUE		
	$0.00		$
Override Annual Chemical Cos	TRUE		
	$5,420,000.00		$
Override Annual Energy Cost	TRUE		
	$3,640,000.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	Value		Units
Centrifugation			
Design Information			
Total power required		5620	HP

Power required per unit		194	HP
Excess capacity factor		1,25	
Number of units		29	
Chemical dose		1	% dry wt
Chemicals required		19300	lb/d
Sludge flow		6,48	MGD(US)
Initial solid conc		3,4	%
Operational hours per day		8	hr
Operational days per week		7	d
Quantities			
Number of centrifuges		29	
Power required per unit		194	HP
Area of building		7700	sqft
Dry solids produced		612000	lb/d
Operation labor required		94600	pers-hrs/yr
Maintenance labor required		15100	pers-hrs/yr
Electrical energy required		6570000	kWh/yr
Costs			
Amortization cost	$3,990,000		$/yr
Polymer Feed System			
Quantities			
Polymer dosage		6430	lb/d
Liquid chemical solution fed		0,308	MGD(US)
O&M labor required		43400	pers-hrs/yr
Dry material handling and mixi		3300	pers-hrs/yr
Total operation labor required		46700	pers-hrs/yr

Generacion con motores de combustion biogas

User Input Data

User Specified Sludge Process

Description	Value		Units
Volume Reduction		0	%
Percent Volatile Solids Destroy		0	%

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$37,500,000.00	$
Override Annual Operational C	TRUE	
	$1,240,000.00	$
Override Annual Maintenance	TRUE	
	$1,240,000.00	$
Override Annual Materials Cos	TRUE	
	$833,000.00	$
Override Annual Chemical Cos	TRUE	
	$0.00	$
Override Annual Energy Cost	TRUE	
	$-11,100,000.00	$
Override Annual Amortization (	TRUE	
	$1,800,000.00	$

Design Output Data

Description	Value	Units

Sedimentador Secundario

User Input Data

Secondary Clarifier

Description	Value		Units
Design Basis	Average Flow		
Surface Overflow Rate		1370	gal(US)/(sqft·d)
Sidewater Depth		17	ft
Specific Gravity		1,03	
Underflow Concentration		0,67	%
Weir Overflow Rate - Maximun		15000	gal(US)/(ft·d)
Effluent Suspended Solids		20	mg/L
Type of Clarifier	Circular		
Override Design	TRUE		
Length-Rectangular Only		0	ft
Width-Rectangular Only		0	ft
Diameter-Circular Only		180	ft
Excavation Depth		4	ft
Number of Tanks per Battery		5	
Number of Batteries		4	
Override Database Costs	FALSE		
Rectangular Clarifier Mechanis	$119,000.00		$
Circular Clarifier Mechanism-9	$97,600.00		$
Standard 3000 gpm Pump and	$19,500.00		$
Mechanical		20	years
Structural		40	years
Pump		25	years

Cost Override

Description	Value		Units
Override Construction Cost	TRUE		
	$61,000,000.00		$
Override Annual Operational C	FALSE		
	$0.00		$
Override Annual Maintenance	FALSE		
	$0.00		$
Override Annual Materials Cos	FALSE		
	$0.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$
Override Annual Energy Cost	FALSE		
	$0.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	Value		Units
Secondary Clarification			
Design Information			
Surface area		509000	sqft
Surface area per circular clarifi		25400	sqft
Diameter of each circular clarif		180	ft
Number of clarifiers per battery		5	
Number of batteries		4	
Solids loading rate		19,9	lb/(sqft·d)
Hydraulic retention time		4,17	hr
Weir length		49200	ft
Volume of wasted sludge		7,81	MGD(US)
Surface overflow rate		732	gal(US)/(sqft·d)

Quantities			
Operation labor required		10900	pers-hrs/yr
Maintenance labor required		6190	pers-hrs/yr
Electrical energy required		80300	kWh/yr
Volume of earthwork required		8660000	cuft
Slab thickness		12,2	in
Volume of slab concrete requir		566000	cuft
Wall thickness		15,5	in
Volume of wall concrete requir		273000	cuft
Costs			
Operational labor cost	$87,200		$/yr
Maintenance labor cost	$51,600		$/yr
Material and supply cost	$208,000		$/yr
Energy cost	$16,100		$/yr
Amortization cost	$1,170,000		$/yr
Waste Sludge Pumping			
Design Information			
Average daily pumping rate		7,81	MGD(US)
Total pumping capacity		7,81	MGD(US)
Design capacity per pump		3,9	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		7,81	MGD(US)
Quantities			
Operation labor required		586	pers-hrs/yr
Maintenance labor required		497	pers-hrs/yr
Electrical energy required		260000	kWh/yr
Volume of earthwork required		2830	cuft
Area of pump building		354	sqft
Costs			
Operational labor cost	$4,690		$/yr
Maintenance labor cost	$4,140		$/yr
Material and supply cost	$1,070		$/yr
Energy cost	$52,000		$/yr
Amortization cost	$9,940		$/yr

Disposicion Final - Costo No Incluido

User Input Data

Hauling and Land Filling

Description	**Value**		**Units**
Distance to Disposal Site		15,5	miles
Daily Operation		8	hr
Loading Time per Vehicle		0,75	hr
Hauling Time per Trip		1	hr
Disposal Cost Based On	Sludge Disposal per		
Override Database Costs	TRUE		
Standard 22 cuyd Vehicle	$314,000.00		$
Annual Charge of Land Fill	$43,100.00		$
Sludge Disposal per cuyd	$23.60		$
Sludge Disposal per ton	$28.00		$
Vehicle		15	years
Structural		40	years

Cost Override

Description	**Value**	**Units**
Override Construction Cost	FALSE	

	$0.00	$
Override Annual Operational C	FALSE	
	$0.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	
	$0.00	$
Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization (	TRUE	
	$0.00	$

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	0,235	MGD(US)
Truck capacity	810	cuft
Round trip time to disposal site	1	hr
Truck loading time	0,75	hr
Operational hours per day	8	hr
Number of trucks required	9	
Distance to disposal site	15,5	miles
Quantities		
Total sludge volume hauled	0,235	MGD(US)
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	118000	sqft
Width of sludge storage shed s	243	ft
Length of sludge storage shed	486	ft
Volume of earthwork required	300000	cuft
Volume of slab concrete requir	122000	cuft
Surface area of canopy roof	118000	sqft
Round trip haul distance	31,1	miles
Round trips per day per truck	5	
Distance traveled per year per	38800	miles
Sludge hauled	2070000	lb/d
Operation labor required	28400	pers-hrs/yr
LandFilling cost	$10,100,000	$/yr

Desinfeccion por cloro

User Input Data

Chlorination

Description	Value	Units
Contact Time At Peak Flow	30	min
Chlorine Dose	10	mg/L
Influent Coliform Count	10000000	/100mL
Override Design	FALSE	
Volume of Tank	2030000	cuft
Override Database Costs	FALSE	
1 Ton of Chlorine	$1,610.00	$
Standard 2000 lb/d Chlorinator	$37,900.00	$
Chlorinator	15	years
Structural	40	years

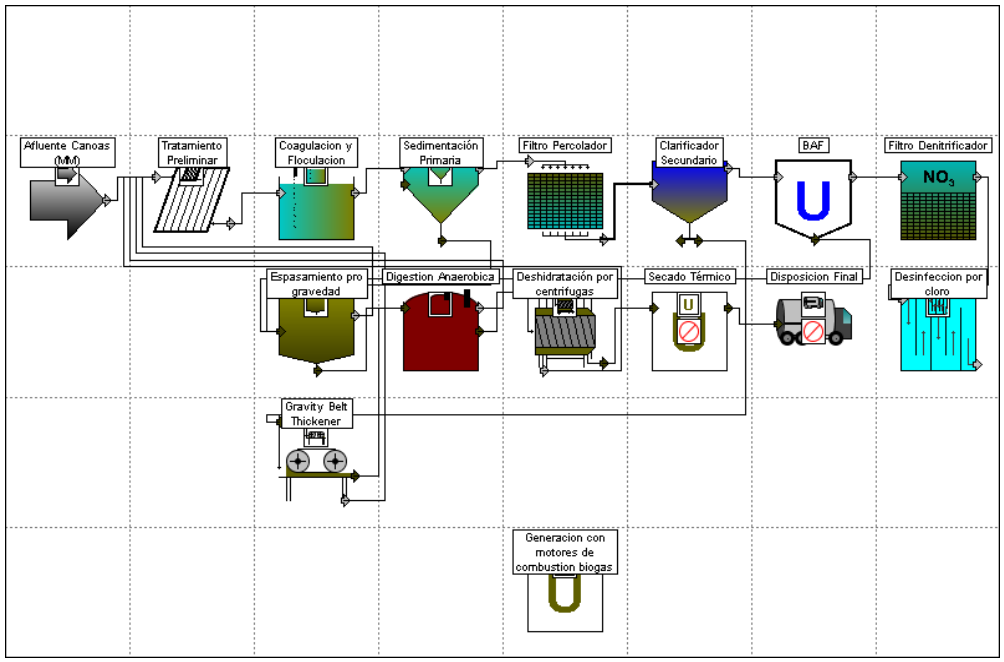
Cost Override

Description	Value	Units
Override Construction Cost	FALSE	
	$0.00	$
Override Annual Operational C	FALSE	
	$0.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	
	$0.00	$
Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization (	FALSE	
	$0.00	$

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	2030000	cuft
Average chlorine required	30400	lb/d
Peak chlorine required	60900	lb/d
Influent coliform count	10000000	/100mL
Effluent coliform count	29,2	/100mL
Quantities		
Operational labor required	9790	pers-hrs/yr
Maintenance labor required	11800	pers-hrs/yr
Electrical energy required	269000	kWh/yr
Volume of earthwork required	731000	cuft
Volume of slab concrete requir	204000	cuft
Volume of wall concrete requir	167000	cuft
Number of chlorinators and eva	4	
Chlorination building area	1440	sqft
Number of chlorine cylinders	457	
Area of chlorine storage buildir	64000	sqft
Costs		
Construction and equipment co	$10,300,000	$
Operational labor cost	$78,300	$/yr
Maintenance labor cost	$98,500	$/yr
Material and supply cost	$140,000	$/yr
Chemical cost	$8,940,000	$/yr
Energy cost	$53,700	$/yr
Amortization cost	$656,000	$/yr

FIII-Alt 3-FP+BAF+FDN*



Summary
Equipment Database
Sept 2007,(USA Avg)

Layout Summary

Present Worth	Project	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
$3,950,000,000	$2,930,000,000	$4,470,000	$3,660,000	$5,830,000	$36,400,000	$36,200,000	$49,400,000

Process Summary

Process	Construction	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
Tratamiento Preliminar	$13,300,000	$373,000	$130,000	$333,000	$0	$50,400	$673,000
Coagulacion y Floculacion	$0	$0	$0	$0	$11,100,000	$0	$0
Sedimentación Primaria	$36,000,000	$73,400	$46,600	$142,000	$0	$67,000	$812,000
Filtro Percolador	$226,000,000	$267,000	$150,000	$1,390,000	$0	$5,820,000	$11,800,000
Clarificador Secundario	$61,000,000	$88,100	$55,500	$256,000	$0	$33,800	$1,520,000
BAF	$720,000,000	$520,000	$520,000	$1,570,000	$0	$15,000,000	$4,000,000
Filtro Denitrificador	$107,000,000	$322,000	$484,000	$555,000	$10,100,000	$10,100,000	$6,260,000
Espasamiento pro gravedad	$10,000,000	$120,000	$54,700	$23,500	$0	$14,200	$148,000
Digestion Anaerobica	$149,000,000	$518,000	$308,000	$418,000	$0	$1,100,000	$15,000,000
Deshidratación por centrifugas	$23,000,000	$438,000	$547,000	$0	$5,420,000	$3,640,000	$7,070,000
Desinfeccion por cloro	$10,300,000	$78,300	$103,000	$140,000	$8,940,000	$53,700	$656,000
Gravity Belt Thickener	$30,500,000	$61,100	$16,600	$0	$783,000	$264,000	$0
Generacion con motores de cc	$37,500,000	$1,240,000	$1,240,000	$833,000	$0	$0	$1,050,000
Iron Feed System	$8,420,000	$79,800	$0	$168,000	$0	$0	$425,000
Other Costs	$1,500,000,000	$293,000	$0	$0	$0	$0	$0

Summary of Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	210	acre
Administration labor hours	35400	hr/yr
Laboratory labor hours	14500	hr/yr
Costs		
DIRECT COSTS		
Mobilization	$14,500,000	$
Site preparation	$12,500,000	$
Site electrical	$48,400,000	$
Yard piping	$29,600,000	$
Instrumentation and control	$30,300,000	$
Lab and administration building	$23,100,000	$
Unit process construction costs	$1,430,000,000	$
Profit	$238,000,000	$
Total construction costs	$1,830,000,000	$
INDIRECT COSTS		
Miscellaneous cost	$384,000,000	$
Legal cost	$36,600,000	$
Engineering design fee	$274,000,000	$
Inspection cost	$36,600,000	$
Contingency	$183,000,000	$
Technical	$36,600,000	$
Total indirect costs	$951,000,000	$
MISC		
Cost of land	$0	$
Interest during construction	$152,000,000	$
LABOR COSTS		
Administration labor cost	$177,000	$/yr
Laboratory labor cost	$116,000	$/yr
Unit process operation labor co	$4,180,000	$/yr
Unit process maintenance labo	$3,660,000	$/yr
Total labor costs	$8,130,000	$/yr
PROJECT SUMMARY		
Present worth	$3,950,000,000	$
Total project cost	$2,930,000,000	$
Total operation labor cost	$4,470,000	$/yr
Total maintenance labor cost	$3,660,000	$/yr
Total material cost	$5,830,000	$/yr
Total chemical cost	$36,400,000	$/yr
Total energy cost	$36,200,000	$/yr
Total amortization cost	$49,400,000	$/yr

Summary of Chemical Feed System for Iron

Description	Value	Units
Iron Salt Solution Feed System		
Quantities		
Ferric chloride dosage rate	112000	lb/d

Iron salt dosage rate as equiva		38500	lb/d
Liquid chemical solution fed		0,0317	MGD(US)
Operation labor required		9980	pers-hrs/yr
Costs			
Construction and equipment cc	$8,420,000		$
Operational labor cost	$79,800		$/yr
Material and supply cost	$168,000		$/yr
Amortization cost	$425,000		$/yr

Afluente Canoas (MM)

Tratamiento Preliminar

Design Output Data

Description	Value		Units
Mechanically Cleaned Bar Screen			
Design Information			
Bar size		0,25	in
Bar spacing		0,235	in
Slope of bars from horizontal		15	degrees
Head loss through screen		2,6965E+308	ft
Approach velocity		1,31	ft/s
Average flow through velocity (		1,31	ft/s
Maximum flow through velocity		3	ft/s
Screen channel width		45,9	ft
Average channel depth		9,84	ft
Aerated Grit Chamber			
Design Information			
Maximum flow		747	MGD(US)
Average flow		383	MGD(US)
Minimum flow		338	MGD(US)
Temperature		60,8	deg F
Maximum flow through velocity		0,361	ft/s
Average flow through velocity (		0,185	ft/s
Size of smallest particle 100%		0,00786	in
Specific gravity of particle		2	
Number of units		1	
Maximum flow/unit		747	MGD(US)
Width of channel		217	ft
Depth of channel		14,8	ft
Length of channel		217	ft
Settling velocity of particle		0,0513	ft/s
Hydraulic retention time		10	min
Volume of grit		0,115	MGD(US)
Air supply		3	cfm
Costs			
Construction and equipment cc	$13,300,000		$
Operational labor cost	$373,000		$/yr
Maintenance labor cost	$130,000		$/yr
Material and supply cost	$333,000		$/yr
Energy cost	$50,400		$/yr
Amortization cost	$673,000		$/yr

Coagulacion y Floculacion

Design Output Data

Description	Value		Units
Chemical Phosphorus Removal			
Design Information			

Chemical used	Equivalent Iron		
Chemical dosage		12	mg/L
Mass of chemical per year		6390000	kg/yr
Chemical sludge production		39,9	mg/L
Organic sludge production		6,7	mg/L
Costs			
Chemical cost	$11,100,000		$/yr

Espasamiento pro gravedad

Design Output Data

Description	Value		Units
Gravity Thickening			
Design Information			
Initial concentration		1	%
Thickened concentration		5	%
Mass loading		24	lb/(sqft·d)
Hydraulic loading		560	gal(US)/(sqft·d)
Hydraulic retention time		4,49	hr
Number of tanks		7	
Tank volume		441000	cuft
Depth		14	ft
Surface area per tank		4500	sqft
Tank diameter		76	ft
Quantities			
Amount of sludge generated		1470000	lb/d
Volume of thickened sludge		3,02	MGD(US)
Operation labor required		15000	pers-hrs/yr
Maintenance labor required		6280	pers-hrs/yr
Electrical energy required		71000	kWh/yr
Volume of earthwork required		401000	cuft
Slab thickness		11,4	in
Volume of slab concrete requir		35100	cuft
Wall thickness		14	in
Volume of wall concrete requir		31100	cuft
Costs			
Operational labor cost	$120,000		$/yr
Maintenance labor cost	$54,700		$/yr
Material and supply cost	$23,500		$/yr
Energy cost	$14,200		$/yr
Amortization cost	$148,000		$/yr

Gravity Belt Thickener

Design Output Data

Description	Value		Units
Gravity Belt Thickener			
Design Information			
Belt filter width		6,56	ft
Number of units		33	
Hydraulic loading per unit per r		0,18	MGD(US)
Hydraulic loading required per		11,5	MGD(US)
Final solids content		6	%
Solids capture fraction		0,99	
Quantities			
Operation labor required		7630	pers-hrs/yr
Maintenance labor required		1910	pers-hrs/yr
Power		1320000	kWh/yr

Polymer required		946	lb/d
Dry solids produced		237000	lb/d
Belt filter(s)	$9,110,000		$
Building	$619,000		$
Installation	$2,280,000		$
Polymer system	$3,370,000		$
Feed pumps	$1,000,000		$
Conveyor system	$2,280,000		$
Costs			
Operational labor cost	$61,100		$/yr
Maintenance labor cost	$16,600		$/yr
Chemical cost	$783,000		$/yr
Energy cost	$264,000		$/yr

Sedimentación Primaria

Design Output Data

Description	Value		Units
Primary Clarification			
Design Information			
Surface area		342000	sqft
Surface area per circular clarifi		21400	sqft
Diameter of each circular clarif		165	ft
Number of clarifiers per battery		4	
Number of batteries		4	
Solids loading rate		3,37	lb/(sqft·d)
Hydraulic retention time		2,55	hr
Weir length		50000	ft
Volume of sludge generated		8,13	MGD(US)
Surface overflow rate		2190	gal(US)/(sqft·d)
Quantities			
Operation labor required		8580	pers-hrs/yr
Maintenance labor required		4860	pers-hrs/yr
Electrical energy required		63700	kWh/yr
Volume of earthwork required		5580000	cuft
Slab thickness		11,9	in
Volume of slab concrete requir		374000	cuft
Wall thickness		15	in
Volume of wall concrete requir		183000	cuft
Costs			
Operational labor cost	$68,700		$/yr
Maintenance labor cost	$42,300		$/yr
Material and supply cost	$141,000		$/yr
Energy cost	$12,700		$/yr
Amortization cost	$802,000		$/yr
Notes			
Effluent soluble TKN adjusted to satisfy user-specified TKN removal.			
Waste Sludge Pumping			
Design Information			
Average daily pumping rate		8,13	MGD(US)
Total pumping capacity		8,13	MGD(US)
Design capacity per pump		4,07	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		8,13	MGD(US)
Quantities			
Operation labor required		594	pers-hrs/yr

Maintenance labor required		504	pers-hrs/yr
Electrical energy required		271000	kWh/yr
Volume of earthwork required		2880	cuft
Area of pump building		360	sqft
Costs			
Operational labor cost	$4,750		$/yr
Maintenance labor cost	$4,380		$/yr
Material and supply cost	$1,090		$/yr
Energy cost	$54,200		$/yr
Amortization cost	$10,100		$/yr

Digestion Anaerobica

Design Output Data

Description	Value		Units
Anaerobic Digestion			
Design Information			
Percent VSS destroyed		43	%
Solids concentration in digeste		3,4	%
Detention time		15	d
Digester depth		75	ft
Digester diameter		90	ft
Effective digester volume		7010000	cuft
Number of digesters per batter		14	
Number of primary digesters p		14	
Number of secondary digesters		0	
Number of batteries		1	
Gas produced		64	MGD(US)
Heat required		65600000	BTU/hr
Digester gas required		27,3	MGD(US)
Total natural gas required		0	MGD(US)
Quantities			
Operation labor required		75600	pers-hrs/yr
Maintenance labor required		42300	pers-hrs/yr
Electrical energy required		6330000	kWh/yr
Volume of earthwork required		3130000	cuft
Slab thickness		22,3	in
Volume of slab concrete requir		175000	cuft
Wall thickness		45	in
Volume of wall concrete requir		1240000	cuft
Sidewater depth		75	ft
Surface area/floor of 2-story cc		14100	sqft
Piping size		10	in
Length of total piping system		6200	ft
Number of 90 degree elbows		182	
Number of tees		357	
Number of plug valves		259	
Total dry solids treated		1560000	lb/d
Notes			
Mass balance based on user input			

Filtro Percolador

Design Output Data

Description	Value		Units
Trickling Filtration			
Design Information			
Reaction rate constant		0,00191	

Hydraulic loading rate	1080	gal(US)/(sqft·d)
Total hydraulic loading rate	1240	gal(US)/(sqft·d)
Recirculation ratio	0,149	
Number of towers per stage	48	
Number of stages	1	
Depth of filter tower	19,7	ft
Diameter of filter tower	180	ft
Surface area per filter tower	25400	sqft
Total surface area	1220000	sqft
Volume per filter tower	501000	cuft
Total volume	24000000	cuft
Quantities		
Operation labor required	13000	pers-hr/yr
Maintenance labor required	5290	pers-hr/yr
Volume of earthwork required	20800000	cuft
Volume of slab concrete requir	814000	cuft
Volume of wall concrete requir	692000	cuft
Number of posts per tower	1710	
Total length of precast beams	679000	ft
Costs		
Construction and equipment cc	$214,000,000	$
Operational labor cost	$104,000	$/yr
Maintenance labor cost	$46,000	$/yr
Material and supply cost	$1,310,000	$/yr
Energy cost	$26,700	$/yr
Amortization cost	$11,000,000	$/yr
Internal Recycle Pumping		
Design Information		
Average daily pumping rate	879	MGD(US)
Total pumping capacity	879	MGD(US)
Design capacity per pump	27,5	MGD(US)
Number of pumps	5	
Number of batteries	8	
Firm pumping capacity	879	MGD(US)
Quantities		
Operation labor required	20300	pers-hrs/yr
Maintenance labor required	12000	pers-hrs/yr
Electrical energy required	29000000	kWh/yr
Volume of earthwork required	152000	cuft
Area of pump building	18900	sqft
Costs		
Construction and equipment cc	$12,000,000	$
Operational labor cost	$163,000	$/yr
Maintenance labor cost	$104,000	$/yr
Material and supply cost	$84,000	$/yr
Energy cost	$5,800,000	$/yr
Amortization cost	$783,000	$/yr

Deshidratación por centrifugas

Design Output Data

Description	Value	Units
Centrifugation		
Design Information		
Total power required	8670	HP
Power required per unit	197	HP
Excess capacity factor	1,25	

Number of units	44	
Chemical dose	1	% dry wt
Chemicals required	29700	lb/d
Sludge flow	9,99	MGD(US)
Initial solid conc	3,4	%
Operational hours per day	8	hr
Operational days per week	7	d
Quantities		
Number of centrifuges	44	
Power required per unit	197	HP
Area of building	11700	sqft
Dry solids produced	944000	lb/d
Operation labor required	138000	pers-hrs/yr
Maintenance labor required	22000	pers-hrs/yr
Electrical energy required	9810000	kWh/yr
Polymer Feed System		
Quantities		
Polymer dosage	9910	lb/d
Liquid chemical solution fed	0,475	MGD(US)
O&M labor required	57500	pers-hrs/yr
Dry material handling and mixi	3730	pers-hrs/yr
Total operation labor required	61200	pers-hrs/yr

Generacion con motores de combustion biogas

Design Output Data

Description	Value	Units

Clarificador Secundario

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	479000	sqft
Surface area per circular clarifi	7480	sqft
Diameter of each circular clarif	98	ft
Number of clarifiers per battery	16	
Number of batteries	4	
Solids loading rate	0,492	lb/(sqft·d)
Hydraulic retention time	3,37	hr
Weir length	49500	ft
Volume of wasted sludge	2,75	MGD(US)
Quantities		
Operation labor required	10500	pers-hrs/yr
Maintenance labor required	5960	pers-hrs/yr
Electrical energy required	77500	kWh/yr
Volume of earthwork required	6460000	cuft
Slab thickness	11,6	in
Volume of slab concrete requir	531000	cuft
Wall thickness	14,4	in
Volume of wall concrete requir	393000	cuft
Costs		
Operational labor cost	$84,100	$/yr
Maintenance labor cost	$51,900	$/yr
Material and supply cost	$256,000	$/yr
Energy cost	$15,500	$/yr
Amortization cost	$1,520,000	$/yr

Waste Sludge Pumping			
Design Information			
Average daily pumping rate		2,75	MGD(US)
Total pumping capacity		2,75	MGD(US)
Design capacity per pump		1,37	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		2,75	MGD(US)
Quantities			
Operation labor required		501	pers-hrs/yr
Maintenance labor required		418	pers-hrs/yr
Electrical energy required		91700	kWh/yr
Volume of earthwork required		2030	cuft
Area of pump building		254	sqft
Costs			
Operational labor cost	$4,010		$/yr
Maintenance labor cost	$3,640		$/yr
Material and supply cost	$685		$/yr
Energy cost	$18,300		$/yr
Amortization cost	$6,390		$/yr

Secado Térmico

Design Output Data

Description	Value	Units
User Specified Sludge Treatment Process		
Design Information		
No Design Data		

BAF

Design Output Data

Description	Value	Units
User Specified Wastewater Process		
Design Information		
No Design Data		

Disposicion Final

Design Output Data

Description	Value	Units
Sludge Hauling and Land Filling		
Design Information		
Volume of sludge hauled	0,109	MGD(US)
Truck capacity	810	cuft
Round trip time to disposal site	1	hr
Truck loading time	0,75	hr
Operational hours per day	8	hr
Number of trucks required	4	
Distance to disposal site	15,5	miles
Quantities		
Total sludge volume hauled	0,109	MGD(US)
Maximum anticipated landfill d	30	d
Anticipated sludge storage hei	8	ft
Sludge storage shed area	55000	sqft
Width of sludge storage shed s	166	ft
Length of sludge storage shed	332	ft
Volume of earthwork required	141000	cuft
Volume of slab concrete requir	57300	cuft

Surface area of canopy roof		55000	sqft
Round trip haul distance		31,1	miles
Round trips per day per truck		5	
Distance traveled per year per		38800	miles
Sludge hauled		961000	lb/d
Operation labor required		13200	pers-hrs/yr
LandFilling cost	$4,680,000		$/yr

Filtro Denitrificador

Design Output Data

Description	Value		Units
Attached Growth Denitrification			
Design Information			
Surface removal rate		0,0061	lb/(sqft·d)
Total media surface area		1380000	sqft
Total volume of media needed		33600	cuft
Total column area		338000	sqft
Actual media volume		4050000	cuft
Hydraulic retention time		120	min
Daily methanol required		195000	lb/d
Total backwash required		4860	MGD(US)
Quantities			
Number of batteries		4	
Number of columns per battery		32	
Height of columns		23	ft
Cross-sectional length of colun		103	ft
Cross-sectional width of colum		103	ft
Methanol Feed Rate		0,033	MGD(US)
Methanol Storage Volume		92900	cuft
Operation labor required		49200	pers-hrs/yr
Maintenance labor required		31000	pers-hrs/yr
Electrical energy required		38700000	kWhr/yr
Volume of earthwork required		3090000	cuft
Volume of slab concrete requir		1010000	cuft
Volume of wall concrete requir		283000	cuft
Costs			
Construction and equipment cc	$96,300,000		$
Operational labor cost	$248,000		$/yr
Maintenance labor cost	$428,000		$/yr
Material and supply cost	$481,000		$/yr
Chemical cost	$10,100,000		$/yr
Energy cost	$7,740,000		$/yr
Amortization cost	$5,580,000		$/yr
Internal Recycle Pumping			
Design Information			
Average daily pumping rate		365	MGD(US)
Total pumping capacity		730	MGD(US)
Design capacity per pump		26,1	MGD(US)
Number of pumps		5	
Number of batteries		7	
Firm pumping capacity		365	MGD(US)
Quantities			
Operation labor required		8340	pers-hrs/yr
Maintenance labor required		5520	pers-hrs/yr
Electrical energy required		12000000	kWh/yr
Volume of earthwork required		126000	cuft

Area of pump building		15800	sqft
Costs			
Construction and equipment cc	$9,890,000		$
Operational labor cost	$66,700		$/yr
Maintenance labor cost	$48,000		$/yr
Material and supply cost	$69,200		$/yr
Energy cost	$2,410,000		$/yr
Amortization cost	$645,000		$/yr
Wash Water Pumping			
Design Information			
Average daily pumping rate		38	MGD(US)
Total pumping capacity		38	MGD(US)
Design capacity per pump		19	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		38	MGD(US)
Quantities			
Operation labor required		946	pers-hrs/yr
Maintenance labor required		897	pers-hrs/yr
Electrical energy required		1730	kWh/yr
Volume of earthwork required		7600	cuft
Area of pump building		949	sqft
Costs			
Construction and equipment cc	$588,000		$
Operational labor cost	$7,560		$/yr
Maintenance labor cost	$7,800		$/yr
Material and supply cost	$4,110		$/yr
Energy cost	$346		$/yr
Amortization cost	$38,400		$/yr

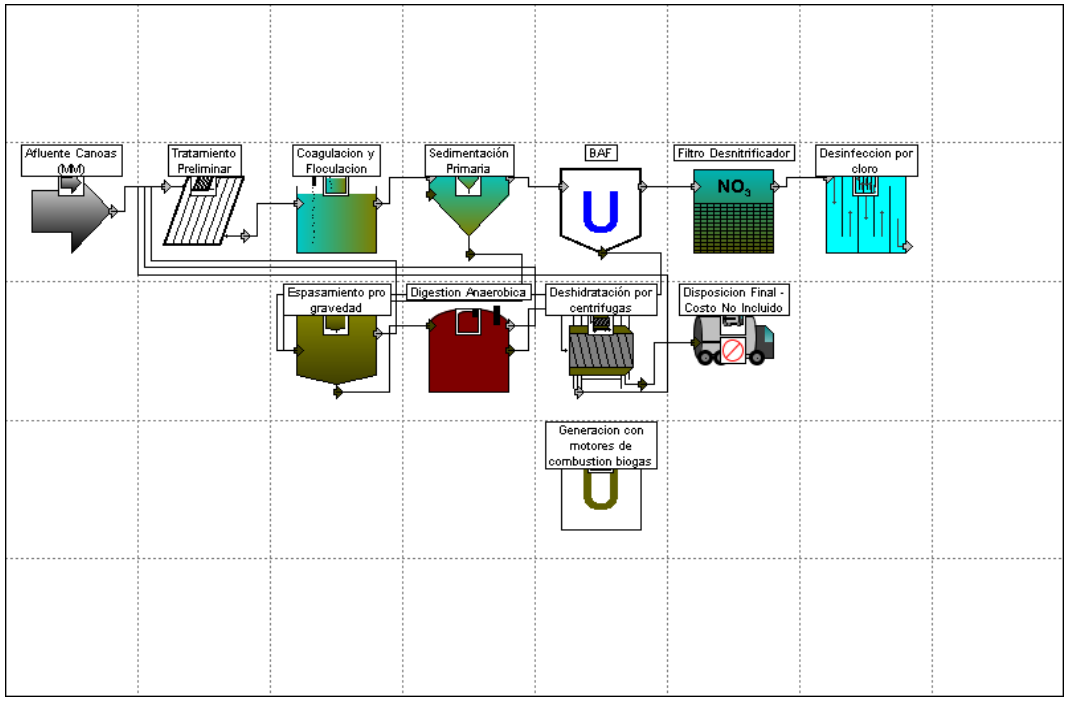
Desinfeccion por cloro

Design Output Data

Description	Value		Units
Chlorination			
Design Information			
Volume of tank		2030000	cuft
Average chlorine required		30400	lb/d
Peak chlorine required		60900	lb/d
Influent coliform count		10000000	/100mL
Effluent coliform count		29,2	/100mL
Quantities			
Operational labor required		9790	pers-hrs/yr
Maintenance labor required		11800	pers-hrs/yr
Electrical energy required		269000	kWh/yr
Volume of earthwork required		731000	cuft
Volume of slab concrete requir		204000	cuft
Volume of wall concrete requir		167000	cuft
Number of chlorinators and eva		4	
Chlorination building area		1440	sqft
Number of chlorine cylinders		457	
Area of chlorine storage buildir		64000	sqft
Costs			
Construction and equipment cc	$10,300,000		$
Operational labor cost	$78,300		$/yr
Maintenance labor cost	$103,000		$/yr
Material and supply cost	$140,000		$/yr

Chemical cost	$8,940,000	$/yr
Energy cost	$53,700	$/yr
Amortization cost	$656,000	$/yr

FIII-Alt2-BAF+FDN



Summary
Equipment Database
Sept 2007,(USA Avg)

Layout Summary

Present Worth	Project	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
$3,200,000,000	$2,240,000,000	$3,940,000	$3,370,000	$3,900,000	$31,300,000	$37,800,000	$30,700,000

Process Summary

Process	Construction	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
Tratamiento Preliminar	$13,400,000	$376,000	$130,000	$334,000	$0	$50,600	$675,000
Coagulacion y Floculacion	$0	$0	$0	$0	$4,680,000	$0	$0
Sedimentación Primaria	$36,000,000	$73,500	$46,300	$142,000	$0	$70,300	$812,000
BAF	$640,000,000	$520,000	$520,000	$1,500,000	$0	$23,000,000	$10,000,000
Filtro Desnitrificador	$106,000,000	$322,000	$480,000	$553,000	$12,300,000	$10,100,000	$6,240,000
Desinfeccion por cloro	$10,300,000	$78,300	$102,000	$140,000	$8,940,000	$53,700	$656,000
Espasamiento pro gravedad	$10,000,000	$154,000	$66,400	$23,500	$0	$17,100	$148,000
Digestion Anaerobica	$149,000,000	$398,000	$237,000	$322,000	$0	$846,000	$4,100,000
Deshidratación por centrifugas	$50,000,000	$438,000	$547,000	$0	$5,420,000	$3,640,000	$6,150,000
Generacion con motores de combustion biogas	$37,500,000	$1,240,000	$1,240,000	$833,000	$0	$0	$1,800,000
Iron Feed System	$2,450,000	$45,600	$0	$49,100	$0	$0	$124,000
Other Costs	$1,180,000,000	$293,000	$0	$0	$0	$0	$0

Summary of Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	210	acre
Administration labor hours	35400	hr/yr
Laboratory labor hours	14500	hr/yr
Costs		
DIRECT COSTS		
Mobilization	$14,500,000	$
Site preparation	$12,500,000	$
Site electrical	$48,400,000	$
Yard piping	$29,600,000	$
Instrumentation and control	$30,300,000	$
Lab and administration buildings	$23,100,000	$
Unit process construction costs	$1,060,000,000	$
Profit	$182,000,000	$
Total construction costs	$1,400,000,000	$
INDIRECT COSTS		
Miscellaneous cost	$293,000,000	$
Legal cost	$27,900,000	$
Engineering design fee	$209,000,000	$
Inspection cost	$27,900,000	$
Contingency	$140,000,000	$
Technical	$27,900,000	$
Total indirect costs	$726,000,000	$
MISC		
Cost of land	$0	$
Interest during construction	$116,000,000	$
LABOR COSTS		
Administration labor cost	$177,000	$/yr
Laboratory labor cost	$116,000	$/yr
Unit process operation labor cost	$3,650,000	$/yr
Unit process maintenance labor cost	$3,370,000	$/yr
Total labor costs	$7,310,000	$/yr
PROJECT SUMMARY		
Present worth	$3,200,000,000	$
Total project cost	$2,240,000,000	$
Total operation labor cost	$3,940,000	$/yr
Total maintenance labor cost	$3,370,000	$/yr
Total material cost	$3,900,000	$/yr
Total chemical cost	$31,300,000	$/yr
Total energy cost	$37,800,000	$/yr
Total amortization cost	$30,700,000	$/yr

Summary of Chemical Feed System for Iron

Description	Value	Units
Iron Salt Solution Feed System		
Quantities		
Ferric chloride dosage rate	47100	lb/d
Iron salt dosage rate as equivalent iron	16200	lb/d

Liquid chemical solution fed		0,0133	MGD(US)
Operation labor required		5700	pers-hrs/yr
Costs			
Construction and equipment cost	$2,450,000		$
Operational labor cost	$45,600		$/yr
Material and supply cost	$49,100		$/yr
Amortization cost	$124,000		$/yr

Afluente Canoas (MM)

User Input Data

Description	Value	Units
Average Flow	365	MGD(US)
Minimum Flow	320	MGD(US)
Maximum Flow	730	MGD(US)
Suspended Solids	226	mg/L
% Volatile Solids	75	%
BOD	271	mg/L
Soluble BOD	80	mg/L
COD	550	mg/L
Soluble COD	350	mg/L
TKN	70,4	mgN/L
Soluble TKN	35,2	mgN/L
Ammonia	26	mgN/L
Total Phosphorus	9,7	mgP/L
pH	7,3	
Cations	160	mg/L
Anions	160	mg/L
Settleable Solids	50	mL/L
Oil and Grease	100	mg/L
Nitrite	0	mgN/L
Nitrate	0	mgN/L
Non-Degradable Fraction of VSS	40	%
Average Summer	68	deg F
Average Winter	60,8	deg F

Tratamiento Preliminar

User Input Data

Screening

Description	Value	Units
Cleaning Method	Mechanically Cleane	
Mechanically Cleaned Depth	9,84	ft
Manually Cleaned Depth	2	ft
Width	0,25	in
Space	0,235	in
Slope	15	degrees
Shape Factor	1,8	
Approach	1,31	ft/s
Max	3	ft/s
Ave	1,31	ft/s

Grit Removal

Description	Value	Units
Particle Size	0,00786	in
Specific Gravity	2	
Type of Grit Removal	Aerated	
Number of Units	1	

Design By	Depth		
Depth		14,8	ft
Width		65,6	ft
Current Allowance		1,7	
Manning Coefficient		0,035	
Volume of Grit		40	cuft grit/MGal(US)
Detention Time		10	min
Air Supply per Unit Length of Tank		3	scfm/ft
Surface Velocity		1,5	ft/s
Tank Floor Velocity		1	ft/s
Capital Cost		40	years

Cost Override

Description	**Value**	**Units**
Override Construction Cost	FALSE	
	$0.00	$
Override Annual Operational Cost	FALSE	
	$0.00	$
Override Annual Maintenance Cost	FALSE	
	$0.00	$
Override Annual Materials Cost	FALSE	
	$0.00	$
Override Annual Chemical Cost	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization Cost	FALSE	
	$0.00	$

Design Output Data

Description	**Value**	**Units**
Mechanically Cleaned Bar Screen		
Design Information		
Bar size	0,25	in
Bar spacing	0,235	in
Slope of bars from horizontal	15	degrees
Head loss through screen	2,6965E+308	ft
Approach velocity	1,31	ft/s
Average flow through velocity (screen)	1,31	ft/s
Maximum flow through velocity (screen)	3	ft/s
Screen channel width	46,4	ft
Average channel depth	9,84	ft
Aerated Grit Chamber		
Design Information		
Maximum flow	751	MGD(US)
Average flow	387	MGD(US)
Minimum flow	342	MGD(US)
Temperature	60,8	deg F
Maximum flow through velocity (grit chamber)	0,362	ft/s
Average flow through velocity (grit chamber)	0,186	ft/s
Size of smallest particle 100% removed	0,00786	in
Specific gravity of particle	2	
Number of units	1	
Maximum flow/unit	751	MGD(US)
Width of channel	217	ft
Depth of channel	14,8	ft

Length of channel		217	ft
Settling velocity of particle		0,0513	ft/s
Hydraulic retention time		10	min
Volume of grit		0,116	MGD(US)
Air supply		3	cfm
Costs			
Construction and equipment cost	$13,400,000		$
Operational labor cost	$376,000		$/yr
Maintenance labor cost	$130,000		$/yr
Material and supply cost	$334,000		$/yr
Energy cost	$50,600		$/yr
Amortization cost	$675,000		$/yr

Coagulacion y Floculacion

User Input Data

Chemical Phosphorus Removal

Description	**Value**	**Units**
Metal Precipitant	Equivalent Iron	
Effluent Phosphorus	5	mg/L
Override Design	TRUE	
Chemical Dosage	5	mg/L

Cost Override

Description	**Value**	**Units**
Override Construction Cost	FALSE	
	$0.00	$
Override Annual Operational Cost	FALSE	
	$0.00	$
Override Annual Maintenance Cost	FALSE	
	$0.00	$
Override Annual Materials Cost	FALSE	
	$0.00	$
Override Annual Chemical Cost	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization Cost	FALSE	
	$0.00	$

Design Output Data

Description	**Value**	**Units**
Chemical Phosphorus Removal		
Design Information		
Chemical used	Equivalent Iron	
Chemical dosage	5	mg/L
Mass of chemical per year	2690000	kg/yr
Chemical sludge production	30,5	mg/L
Organic sludge production	2,81	mg/L
Costs		
Chemical cost	$4,680,000	$/yr

Espasamiento pro gravedad

User Input Data

Gravity Thickening

Description	**Value**	**Units**
Underflow Concentration	5	%

Depth		14	ft
Based On	Mass Loading		
Mass Loading		24	lb/(sqft·d)
Settling Velocity		0,000694	ft/s
Initial Height		4	ft
Intercept		3	ft
Override Design	TRUE		
Surface Area per Thickener		4500	sqft
Number of Units		7	
Override Database Costs	FALSE		
Standard 90 ft Diameter Thickener	$145,000.00		$
Thickener		20	years
Structural		40	years

Cost Override

Description	**Value**	**Units**
Override Construction Cost	TRUE	
	$10,000,000.00	$
Override Annual Operational Cost	FALSE	
	$0.00	$
Override Annual Maintenance Cost	FALSE	
	$0.00	$
Override Annual Materials Cost	FALSE	
	$0.00	$
Override Annual Chemical Cost	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization Cost	FALSE	
	$0.00	$

Design Output Data

Description	**Value**	**Units**
Gravity Thickening		
Design Information		
Initial concentration	1	%
Thickened concentration	5	%
Mass loading	24	lb/(sqft·d)
Hydraulic loading	769	gal(US)/(sqft·d)
Hydraulic retention time	3,27	hr
Number of tanks	7	
Tank volume	441000	cuft
Depth	14	ft
Surface area per tank	4500	sqft
Tank diameter	76	ft
Quantities		
Amount of sludge generated	2020000	lb/d
Volume of thickened sludge	4,15	MGD(US)
Operation labor required	19200	pers-hrs/yr
Maintenance labor required	7700	pers-hrs/yr
Electrical energy required	85500	kWh/yr
Volume of earthwork required	401000	cuft
Slab thickness	11,4	in
Volume of slab concrete required	35100	cuft
Wall thickness	14	in
Volume of wall concrete required	31100	cuft

Costs		
Operational labor cost	$154,000	$/yr
Maintenance labor cost	$66,400	$/yr
Material and supply cost	$23,500	$/yr
Energy cost	$17,100	$/yr
Amortization cost	$148,000	$/yr

Sedimentación Primaria

User Input Data

Primary Clarification

Description	Value	Units
Design Basis	Peak Flow	
Surface Overflow Rate	2400	gal(US)/(sqft·d)
Sidewater Depth	16	ft
Specific Gravity	1,05	
Underflow Concentration	1	%
Weir Overflow Rate	15000	gal(US)/(ft·d)
Type of Clarifier	Circular	
Suspended Solids	58	%
BOD	32	%
COD	40	%
TKN	5	%
Phosphorus	5	%
Override Design	TRUE	
Length-Rectangular Only	0	ft
Width-Rectangular Only	0	ft
Diameter-Circular Only	165	ft
Excavation Depth	4	ft
Number of Tanks per Battery	4	
Number of Batteries	4	
Override Database Costs	FALSE	
Standard 20 X 120 ft Rectangular Clarifier Mecl	$119,000.00	$
Standard 90 ft Diameter Circular Mechanism	$97,600.00	$
Standard 3000 gpm Pump and Driver Unit	$19,500.00	$
Mechanical	20	years
Structural	40	years
Pump	25	years

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$36,000,000.00	$
Override Annual Operational Cost	FALSE	
	$0.00	$
Override Annual Maintenance Cost	FALSE	
	$0.00	$
Override Annual Materials Cost	FALSE	
	$0.00	$
Override Annual Chemical Cost	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization Cost	FALSE	
	$0.00	$

Design Output Data

Description	Value		Units
Primary Clarification			
Design Information			
Surface area		342000	sqft
Surface area per circular clarifier		21400	sqft
Diameter of each circular clarifier		165	ft
Number of clarifiers per battery		4	
Number of batteries		4	
Solids loading rate		3,57	lb/(sqft·d)
Hydraulic retention time		2,53	hr
Weir length		50300	ft
Volume of sludge generated		8,63	MGD(US)
Surface overflow rate		2200	gal(US)/(sqft·d)
Quantities			
Operation labor required		8580	pers-hrs/yr
Maintenance labor required		4860	pers-hrs/yr
Electrical energy required		63700	kWh/yr
Volume of earthwork required		5580000	cuft
Slab thickness		11,9	in
Volume of slab concrete required		374000	cuft
Wall thickness		15	in
Volume of wall concrete required		183000	cuft
Costs			
Operational labor cost	$68,700		$/yr
Maintenance labor cost	$41,900		$/yr
Material and supply cost	$141,000		$/yr
Energy cost	$12,700		$/yr
Amortization cost	$802,000		$/yr
Notes			
Effluent soluble TKN adjusted to satisfy user-specified TKN removal.			
Waste Sludge Pumping			
Design Information			
Average daily pumping rate		8,63	MGD(US)
Total pumping capacity		8,63	MGD(US)
Design capacity per pump		4,32	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		8,63	MGD(US)
Quantities			
Operation labor required		606	pers-hrs/yr
Maintenance labor required		514	pers-hrs/yr
Electrical energy required		288000	kWh/yr
Volume of earthwork required		2960	cuft
Area of pump building		370	sqft
Costs			
Operational labor cost	$4,850		$/yr
Maintenance labor cost	$4,430		$/yr
Material and supply cost	$1,110		$/yr
Energy cost	$57,600		$/yr
Amortization cost	$10,400		$/yr

Digestion Anaerobica

User Input Data

Anaerobic Digestion

Description	Value		Units
Specific Gravity		1,05	

Percent Volatile Solids Destroyed		50	%
Concentration in Digester		3,4	%
Minimum Detention Time in Primary Digester		15	d
Location	Warm-Winter > 10 D		
Raw Wastewater		60,8	deg F
Digester		104	deg F
Fraction of Influent Flow Returned as Supernan		2	%
Suspended Solids		6250	mg/L
BOD		1000	mg/L
COD		2150	mg/L
TKN		950	mgN/L
Ammonia		650	mg/L
Override Design	TRUE		
Diameter		90	ft
Sidewater Depth		75	ft
Number of Primary Digester Tanks		14	
Number of Secondary Digester Tanks		0	
Number of Batteries		1	
Override Database Costs	FALSE		
Standard 70 ft Diameter Floating Cover	$444,000.00		$
Standard 60 ft Diameter Gas Circulation Unit	$131,000.00		$
Standard 1 Million Btu/Hr Heating Unit	$55,300.00		$
Standard 2 in Diameter Gas Safety Equipment	$43,400.00		$
Standard Size Sludge Pump 8gpm At 70 ft of H	$5,960.00		$
Natural Gas Per 1000 cuft	$21.10		$
Floating Cover		20	years
Gas Circulation Unit		20	years
Heating Unit		20	years
Gas Safety Equipment		20	years
Sludge Pump		25	years
Structural		40	years

Cost Override

Description	**Value**	**Units**
Override Construction Cost	TRUE	
	$149,000,000.00	$
Override Annual Operational Cost	TRUE	
	$398,000.00	$
Override Annual Maintenance Cost	TRUE	
	$237,000.00	$
Override Annual Materials Cost	TRUE	
	$322,000.00	$
Override Annual Chemical Cost	TRUE	
	$0.00	$
Override Annual Energy Cost	TRUE	
	$846,000.00	$
Override Annual Amortization Cost	FALSE	
	$0.00	$

Design Output Data

Description	**Value**	**Units**
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digester	3,4	%
Detention time	15	d

Digester depth		75	ft
Digester diameter		90	ft
Effective digester volume		7010000	cuft
Number of digesters per battery		14	
Number of primary digesters per battery		14	
Number of secondary digesters per battery		0	
Number of batteries		1	
Gas produced		92,5	MGD(US)
Heat required		76200000	BTU/hr
Digester gas required		31,7	MGD(US)
Total natural gas required		0	MGD(US)
Quantities			
Operation labor required		85800	pers-hrs/yr
Maintenance labor required		47800	pers-hrs/yr
Electrical energy required		7140000	kWh/yr
Volume of earthwork required		3130000	cuft
Slab thickness		22,3	in
Volume of slab concrete required		175000	cuft
Wall thickness		45	in
Volume of wall concrete required		1240000	cuft
Sidewater depth		75	ft
Surface area/floor of 2-story control bldg		14100	sqft
Piping size		10	in
Length of total piping system		6200	ft
Number of 90 degree elbows		182	
Number of tees		357	
Number of plug valves		259	
Total dry solids treated		1820000	lb/d
Costs			
Amortization cost	$4,100,000		$/yr
Notes			
Mass balance based on user input			

BAF

User Input Data

User Wastewater Process

Description	**Value**	**Units**
Suspended Solids	95	% Reduction
Volatile Solids	90	% Reduction
BOD	90	% Reduction
Soluble BOD	90	% Reduction
COD	90	% Reduction
Soluble COD	90	% Reduction
TKN	50	% Reduction
Soluble TKN	50	% Reduction
Ammonia	50	% Reduction
Total Phosphorus	5	% Reduction
pH	7	
Cations	0	% Reduction
Anions	0	% Reduction
Settleable Solids	90	% Reduction
Oil and Grease	0	% Reduction
Nitrite	0	% Reduction
Nitrate	0	% Reduction
Average Summer	68	deg F
Average Winter	60,8	deg F

Flow Generated	15,6	MGD(US)
Suspended Solids	1	%

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$640,000,000.00	$
Override Annual Operational Cost	TRUE	
	$520,000.00	$
Override Annual Maintenance Cost	TRUE	
	$520,000.00	$
Override Annual Materials Cost	TRUE	
	$1,500,000.00	$
Override Annual Chemical Cost	TRUE	
	$0.00	$
Override Annual Energy Cost	TRUE	
	$23,000,000.00	$
Override Annual Amortization Cost	TRUE	
	$10,000,000.00	$

Design Output Data

Description	Value	Units
User Specified Wastewater Process Design Information		
No Design Data		

Deshidratación por centrifugas

User Input Data

Centrifugation

Description	Value	Units
Cake Solids Content	28	%
Solids Capture	90	%
Power Requirement	1	HP/gpm(US)
Daily Operating Time	8	hr/d
Weekly Operating Time	7	d/wk
Number of Units	5	
Excess Capacity Factor	1,25	
Chemical Dose	1	% dry wt
Override Database Costs	FALSE	
Standard 50 hp Centrifuge	$271,000.00	$
Centrifuge	15	years
Structural	40	years

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$50,000,000.00	$
Override Annual Operational Cost	TRUE	
	$438,000.00	$
Override Annual Maintenance Cost	TRUE	
	$547,000.00	$
Override Annual Materials Cost	TRUE	
	$0.00	$
Override Annual Chemical Cost	TRUE	
	$5,420,000.00	$
Override Annual Energy Cost	TRUE	

	$3,640,000.00	$
Override Annual Amortization Cost	FALSE	
	$0.00	$

Design Output Data

Description	Value	Units
Centrifugation		
Design Information		
Total power required	8690	HP
Power required per unit	197	HP
Excess capacity factor	1,25	
Number of units	44	
Chemical dose	1	% dry wt
Chemicals required	29800	lb/d
Sludge flow	10	MGD(US)
Initial solid conc	3,4	%
Operational hours per day	8	hr
Operational days per week	7	d
Quantities		
Number of centrifuges	44	
Power required per unit	197	HP
Area of building	11700	sqft
Dry solids produced	946000	lb/d
Operation labor required	138000	pers-hrs/yr
Maintenance labor required	22000	pers-hrs/yr
Electrical energy required	9820000	kWh/yr
Costs		
Amortization cost	$6,150,000	$/yr
Polymer Feed System		
Quantities		
Polymer dosage	9930	lb/d
Liquid chemical solution fed	0,476	MGD(US)
O&M labor required	57600	pers-hrs/yr
Dry material handling and mixing labor required	3730	pers-hrs/yr
Total operation labor required	61300	pers-hrs/yr

Generacion con motores de combustion biogas

User Input Data

User Specified Sludge Process

Description	Value	Units
Volume Reduction	0	%
Percent Volatile Solids Destroyed	0	%

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$37,500,000.00	$
Override Annual Operational Cost	TRUE	
	$1,240,000.00	$
Override Annual Maintenance Cost	TRUE	
	$1,240,000.00	$
Override Annual Materials Cost	TRUE	
	$833,000.00	$
Override Annual Chemical Cost	TRUE	
	$0.00	$
Override Annual Energy Cost	TRUE	

	$-11,100,000.00		$
Override Annual Amortization Cost	TRUE		
	$1,800,000.00		$

Design Output Data

Description	Value	Units

Filtro Desnitrificador

User Input Data

Denitrification - Attached Growth

Description	Value		Units
Allowable Effluent Nitrate		5	mg/L
Alkalinity Production		3	mg/L
Methanol Requirement		3	lb/lb NO3
Specific Surface Area of Media		41	1/ft
Application Rate		1080	gal(US)/(sqft·d)
Backwash Rate		17300	gal(US)/(sqft·d)
Minimum Media Depth		12	ft
Override Database Costs	FALSE		
Media per cuft	$5.09		$
1 Cross-Sectional sqft of Distribution System ar	$121.00		$
Standard 3000gpm Pump and Driver Unit	$19,500.00		$
1 lb of Methanol	$0.84		$
Distribution System		25	years
Pump		25	years
Structural		40	years

Cost Override

Description	Value		Units
Override Construction Cost	FALSE		
	$0.00		$
Override Annual Operational Cost	FALSE		
	$0.00		$
Override Annual Maintenance Cost	FALSE		
	$0.00		$
Override Annual Materials Cost	FALSE		
	$0.00		$
Override Annual Chemical Cost	TRUE		
	$12,300,000.00		$
Override Annual Energy Cost	FALSE		
	$0.00		$
Override Annual Amortization Cost	FALSE		
	$0.00		$

Design Output Data

Description	Value		Units
Attached Growth Denitrification			
Design Information			
Surface removal rate		0,0061	lb/(sqft·d)
Total media surface area		-4900000	sqft
Total volume of media needed		-110000	cuft
Total column area		338000	sqft
Actual media volume		4050000	cuft
Hydraulic retention time		120	min
Daily methanol required		0	lb/d
Total backwash required		4860	MGD(US)

Costs			
Construction and equipment cost	$96,000,000		$
Operational labor cost	$248,000		$/yr
Maintenance labor cost	$424,000		$/yr
Material and supply cost	$480,000		$/yr
Energy cost	$7,740,000		$/yr
Amortization cost	$5,560,000		$/yr
Notes			
This unit is not needed. The influent nitrate is less than the allowable effluent nitrate.			
Internal Recycle Pumping			
Design Information			
Average daily pumping rate		365	MGD(US)
Total pumping capacity		730	MGD(US)
Design capacity per pump		26,1	MGD(US)
Number of pumps		5	
Number of batteries		7	
Firm pumping capacity		365	MGD(US)
Quantities			
Operation labor required		8340	pers-hrs/yr
Maintenance labor required		5520	pers-hrs/yr
Electrical energy required		12000000	kWh/yr
Volume of earthwork required		126000	cuft
Area of pump building		15800	sqft
Costs			
Construction and equipment cost	$9,890,000		$
Operational labor cost	$66,700		$/yr
Maintenance labor cost	$47,600		$/yr
Material and supply cost	$69,200		$/yr
Energy cost	$2,410,000		$/yr
Amortization cost	$645,000		$/yr
Wash Water Pumping			
Design Information			
Average daily pumping rate		38	MGD(US)
Total pumping capacity		38	MGD(US)
Design capacity per pump		19	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		38	MGD(US)
Quantities			
Operation labor required		946	pers-hrs/yr
Maintenance labor required		897	pers-hrs/yr
Electrical energy required		1730	kWh/yr
Volume of earthwork required		7600	cuft
Area of pump building		950	sqft
Costs			
Construction and equipment cost	$588,000		$
Operational labor cost	$7,570		$/yr
Maintenance labor cost	$7,730		$/yr
Material and supply cost	$4,120		$/yr
Energy cost	$346		$/yr
Amortization cost	$38,400		$/yr

Disposicion Final - Costo No Incluido

User Input Data

Hauling and Land Filling

Description	**Value**	**Units**

Distance to Disposal Site	15,5	miles
Daily Operation	8	hr
Loading Time per Vehicle	0,75	hr
Hauling Time per Trip	1	hr
Disposal Cost Based On	Sludge Disposal per	
Override Database Costs	TRUE	
Standard 22 cuyd Vehicle	$314,000.00	$
Annual Charge of Land Fill	$43,100.00	$
Sludge Disposal per cuyd	$23.60	$
Sludge Disposal per ton	$28.00	$
Vehicle	15	years
Structural	40	years

Cost Override

Description	**Value**	**Units**
Override Construction Cost	FALSE	
	$0.00	$
Override Annual Operational Cost	FALSE	
	$0.00	$
Override Annual Maintenance Cost	FALSE	
	$0.00	$
Override Annual Materials Cost	FALSE	
	$0.00	$
Override Annual Chemical Cost	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization Cost	TRUE	
	$0.00	$

Design Output Data

Description	**Value**	**Units**
Sludge Hauling and Land Filling Design Information		
Volume of sludge hauled	0,364	MGD(US)
Truck capacity	810	cuft
Round trip time to disposal site	1	hr
Truck loading time	0,75	hr
Operational hours per day	8	hr
Number of trucks required	14	
Distance to disposal site	15,5	miles
Quantities		
Total sludge volume hauled	0,364	MGD(US)
Maximum anticipated landfill downtime	30	d
Anticipated sludge storage height	8	ft
Sludge storage shed area	183000	sqft
Width of sludge storage shed slab	302	ft
Length of sludge storage shed slab	605	ft
Volume of earthwork required	463000	cuft
Volume of slab concrete required	187000	cuft
Surface area of canopy roof	183000	sqft
Round trip haul distance	31,1	miles
Round trips per day per truck	5	
Distance traveled per year per truck	38800	miles
Sludge hauled	3190000	lb/d
Operation labor required	43900	pers-hrs/yr

LandFilling cost	$15,500,000	$/yr

Desinfeccion por cloro

User Input Data

Chlorination

Description	Value	Units
Contact Time At Peak Flow	30	min
Chlorine Dose	10	mg/L
Influent Coliform Count	10000000	/100mL
Override Design	FALSE	
Volume of Tank	2030000	cuft
Override Database Costs	FALSE	
1 Ton of Chlorine	$1,610.00	$
Standard 2000 lb/d Chlorinator	$37,900.00	$
Chlorinator	15	years
Structural	40	years

Cost Override

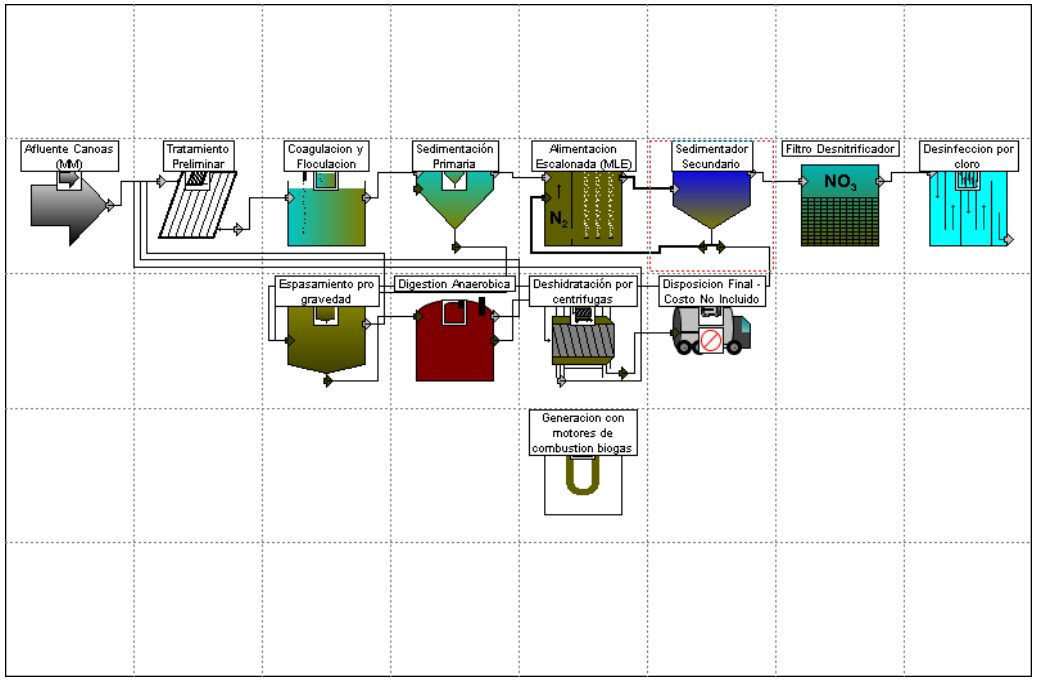
Description	Value	Units
Override Construction Cost	FALSE	
	$0.00	$
Override Annual Operational Cost	FALSE	
	$0.00	$
Override Annual Maintenance Cost	FALSE	
	$0.00	$
Override Annual Materials Cost	FALSE	
	$0.00	$
Override Annual Chemical Cost	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization Cost	FALSE	
	$0.00	$

Design Output Data

Description	Value	Units
Chlorination		
Design Information		
Volume of tank	2030000	cuft
Average chlorine required	30400	lb/d
Peak chlorine required	60900	lb/d
Influent coliform count	10000000	/100mL
Effluent coliform count	29,2	/100mL
Quantities		
Operational labor required	9790	pers-hrs/yr
Maintenance labor required	11800	pers-hrs/yr
Electrical energy required	269000	kWh/yr
Volume of earthwork required	731000	cuft
Volume of slab concrete required	204000	cuft
Volume of wall concrete required	167000	cuft
Number of chlorinators and evaporators	4	
Chlorination building area	1440	sqft
Number of chlorine cylinders	457	
Area of chlorine storage building	64000	sqft
Costs		
Construction and equipment cost	$10,300,000	$

Operational labor cost	$78,300	$/yr
Maintenance labor cost	$102,000	$/yr
Material and supply cost	$140,000	$/yr
Chemical cost	$8,940,000	$/yr
Energy cost	$53,700	$/yr
Amortization cost	$656,000	$/yr

FIII-Alt 1- Alim Esc+FDNs



Summary

Equipment Database

Sept 2007,(USA Avg)

Layout Summary

Present Worth	Project	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
$3,010,000,000	$1,650,000,000	$3,700,000	$3,080,000	$4,030,000	$28,400,000	$38,000,000	$35,600,000

Process Summary

Process	Construction	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
Tratamiento Preliminar	$13,200,000	$367,000	$127,000	$331,000	$0	$50,000	$669,000
Coagulacion y Floculacion	$0	$0	$0	$0	$4,550,000	$0	$0
Sedimentación Primaria	$36,000,000	$73,200	$46,100	$142,000	$0	$60,600	$811,000
Alimentacion Escalonada (MLE	$179,000,000	$233,000	$184,000	$1,340,000	$0	$23,100,000	$11,400,000
Sedimentador Secundario	$61,000,000	$114,000	$71,200	$301,000	$0	$59,700	$1,800,000
Filtro Desnitrificador	$107,000,000	$323,000	$480,000	$555,000	$9,490,000	$10,200,000	$6,260,000
Desinfeccion por cloro	$10,300,000	$78,300	$102,000	$140,000	$8,940,000	$53,700	$656,000
Espasamiento pro gravedad	$10,000,000	$95,800	$44,800	$23,500	$0	$11,900	$148,000
Digestion Anaerobica	$149,000,000	$398,000	$237,000	$322,000	$0	$846,000	$3,880,000
Deshidratación por centrifugas	$50,000,000	$438,000	$547,000	$0	$5,420,000	$3,640,000	$4,020,000
Generacion con motores de co	$37,500,000	$1,240,000	$1,240,000	$833,000	$0	$0	$1,800,000
Blower System	$79,200,000	$0	$0	$0	$0	$0	$4,000,000
Iron Feed System	$2,360,000	$44,800	$0	$47,100	$0	$0	$119,000
Other Costs	$912,000,000	$293,000	$0	$0	$0	$0	$0

Summary of Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	210	acre
Administration labor hours	35400	hr/yr
Laboratory labor hours	14500	hr/yr
Costs		
DIRECT COSTS		
Mobilization	$14,500,000	$
Site preparation	$12,500,000	$
Site electrical	$48,400,000	$
Yard piping	$29,600,000	$
Instrumentation and control	$30,300,000	$
Lab and administration building	$23,100,000	$
Unit process construction costs	$734,000,000	$
Profit	$134,000,000	$
Total construction costs	$1,030,000,000	$
INDIRECT COSTS		
Miscellaneous cost	$216,000,000	$
Legal cost	$20,500,000	$
Engineering design fee	$154,000,000	$
Inspection cost	$20,500,000	$
Contingency	$103,000,000	$
Technical	$20,500,000	$
Total indirect costs	$534,000,000	$
MISC		
Cost of land	$0	$
Interest during construction	$85,600,000	$
LABOR COSTS		
Administration labor cost	$177,000	$/yr
Laboratory labor cost	$116,000	$/yr
Unit process operation labor co	$3,400,000	$/yr
Unit process maintenance labo	$3,080,000	$/yr
Total labor costs	$6,780,000	$/yr
PROJECT SUMMARY		
Present worth	$3,010,000,000	$
Total project cost	$1,650,000,000	$
Total operation labor cost	$3,700,000	$/yr
Total maintenance labor cost	$3,080,000	$/yr
Total material cost	$4,030,000	$/yr
Total chemical cost	$28,400,000	$/yr
Total energy cost	$38,000,000	$/yr
Total amortization cost	$35,600,000	$/yr

Summary of Air Supply System

Description	Value	Units
Blower System for Entire Plant		
Design Information		
Minimum air flow capacity	242000	scfm

Safety factor		2	
Requested air flow capacity		483000	scfm
Total capacity of blowers		483000	scfm
Number of blowers in use		5	
Total number of blowers		6	
Capacity of individual blowers		96700	scfm
Estimated cost of an installed l	$11,900,000		$
Blower building area		3650	sqft
Costs			
Construction and equipment cc	$79,200,000		$
Amortization cost	$4,000,000		$/yr
Notes			
Energy costs are shown at the individual unit processes that require air			

Summary of Chemical Feed System for Iron

Description	Value		Units
Iron Salt Solution Feed System			
Quantities			
Ferric chloride dosage rate		45800	lb/d
Iron salt dosage rate as equiva		15700	lb/d
Liquid chemical solution fed		0,0129	MGD(US)
Operation labor required		5600	pers-hrs/yr
Costs			
Construction and equipment cc	$2,360,000		$
Operational labor cost	$44,800		$/yr
Material and supply cost	$47,100		$/yr
Amortization cost	$119,000		$/yr

Afluente Canoas (MM)

User Input Data

Description	Value		Units
Average Flow		365	MGD(US)
Minimum Flow		320	MGD(US)
Maximum Flow		730	MGD(US)
Suspended Solids		226	mg/L
% Volatile Solids		75	%
BOD		271	mg/L
Soluble BOD		80	mg/L
COD		550	mg/L
Soluble COD		350	mg/L
TKN		70,4	mgN/L
Soluble TKN		35,2	mgN/L
Ammonia		26	mgN/L
Total Phosphorus		9,7	mgP/L
pH		7,3	
Cations		160	mg/L
Anions		160	mg/L
Settleable Solids		50	mL/L
Oil and Grease		100	mg/L
Nitrite		0	mgN/L
Nitrate		0	mgN/L
Non-Degradable Fraction of VS		40	%
Average Summer		68	deg F
Average Winter		60,8	deg F

Tratamiento Preliminar

User Input Data

Screening

Description	Value	Units
Cleaning Method	Mechanically Cleane	
Mechanically Cleaned Depth	9,84	ft
Manually Cleaned Depth	2	ft
Width	0,25	in
Space	0,235	in
Slope	15	degrees
Shape Factor	1,8	
Approach	1,31	ft/s
Max	3	ft/s
Ave	1,31	ft/s

Grit Removal

Description	Value	Units
Particle Size	0,00786	in
Specific Gravity	2	
Type of Grit Removal	Aerated	
Number of Units	1	
Design By	Depth	
Depth	14,8	ft
Width	65,6	ft
Current Allowance	1,7	
Manning Coefficient	0,035	
Volume of Grit	40	cuft grit/MGal(US)
Detention Time	10	min
Air Supply per Unit Length of T	3	scfm/ft
Surface Velocity	1,5	ft/s
Tank Floor Velocity	1	ft/s
Capital Cost	40	years

Cost Override

Description	Value	Units
Override Construction Cost	FALSE	
	$0.00	$
Override Annual Operational C	FALSE	
	$0.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	
	$0.00	$
Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization (	FALSE	
	$0.00	$

Design Output Data

Description	Value	Units
Mechanically Cleaned Bar Screen		
Design Information		
Bar size	0,25	in
Bar spacing	0,235	in
Slope of bars from horizontal	15	degrees

Head loss through screen		2,6965E+308	ft
Approach velocity		1,31	ft/s
Average flow through velocity (		1,31	ft/s
Maximum flow through velocity		3	ft/s
Screen channel width		45,1	ft
Average channel depth		9,84	ft
Aerated Grit Chamber			
Design Information			
Maximum flow		740	MGD(US)
Average flow		376	MGD(US)
Minimum flow		331	MGD(US)
Temperature		60,8	deg F
Maximum flow through velocity		0,359	ft/s
Average flow through velocity (		0,182	ft/s
Size of smallest particle 100%		0,00786	in
Specific gravity of particle		2	
Number of units		1	
Maximum flow/unit		740	MGD(US)
Width of channel		216	ft
Depth of channel		14,8	ft
Length of channel		216	ft
Settling velocity of particle		0,0513	ft/s
Hydraulic retention time		10	min
Volume of grit		0,113	MGD(US)
Air supply		3	cfm
Costs			
Construction and equipment cc	$13,200,000		$
Operational labor cost	$367,000		$/yr
Maintenance labor cost	$127,000		$/yr
Material and supply cost	$331,000		$/yr
Energy cost	$50,000		$/yr
Amortization cost	$669,000		$/yr

Coagulacion y Floculacion

User Input Data

Chemical Phosphorus Removal

Description	**Value**		**Units**
Metal Precipitant	Equivalent Iron		
Effluent Phosphorus		5	mg/L
Override Design	TRUE		
Chemical Dosage		5	mg/L

Cost Override

Description	**Value**		**Units**
Override Construction Cost	FALSE		
	$0.00		$
Override Annual Operational C	FALSE		
	$0.00		$
Override Annual Maintenance	FALSE		
	$0.00		$
Override Annual Materials Cos	FALSE		
	$0.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$
Override Annual Energy Cost	FALSE		
	$0.00		$

Override Annual Amortization (	FALSE	
	$0.00	$

Design Output Data

Description	Value	Units
Chemical Phosphorus Removal		
Design Information		
Chemical used	Equivalent Iron	
Chemical dosage	5	mg/L
Mass of chemical per year	2610000	kg/yr
Chemical sludge production	31,1	mg/L
Organic sludge production	2,8	mg/L
Costs		
Chemical cost	$4,550,000	$/yr

Espasamiento pro gravedad

User Input Data

Gravity Thickening

Description	Value	Units
Underflow Concentration	5	%
Depth	14	ft
Based On	Mass Loading	
Mass Loading	24	lb/(sqft·d)
Settling Velocity	0,000694	ft/s
Initial Height	4	ft
Intercept	3	ft
Override Design	TRUE	
Surface Area per Thickener	4500	sqft
Number of Units	7	
Override Database Costs	FALSE	
Standard 90 ft Diameter Thick	$145,000.00	$
Thickener	20	years
Structural	40	years

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$10,000,000.00	$
Override Annual Operational C	FALSE	
	$0.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	
	$0.00	$
Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization (	FALSE	
	$0.00	$

Design Output Data

Description	Value	Units
Gravity Thickening		
Design Information		
Initial concentration	1	%

Thickened concentration		5	%
Mass loading		24	lb/(sqft·d)
Hydraulic loading		416	gal(US)/(sqft·d)
Hydraulic retention time		6,03	hr
Number of tanks		7	
Tank volume		441000	cuft
Depth		14	ft
Surface area per tank		4500	sqft
Tank diameter		76	ft
Quantities			
Amount of sludge generated		1090000	lb/d
Volume of thickened sludge		2,25	MGD(US)
Operation labor required		12000	pers-hrs/yr
Maintenance labor required		5200	pers-hrs/yr
Electrical energy required		59700	kWh/yr
Volume of earthwork required		401000	cuft
Slab thickness		11,4	in
Volume of slab concrete requir		35100	cuft
Wall thickness		14	in
Volume of wall concrete requir		31100	cuft
Costs			
Operational labor cost	$95,800		$/yr
Maintenance labor cost	$44,800		$/yr
Material and supply cost	$23,500		$/yr
Energy cost	$11,900		$/yr
Amortization cost	$148,000		$/yr

Sedimentación Primaria

User Input Data

Primary Clarification

Description	**Value**		**Units**
Design Basis	Peak Flow		
Surface Overflow Rate		2400	gal(US)/(sqft·d)
Sidewater Depth		16	ft
Specific Gravity		1,05	
Underflow Concentration		1	%
Weir Overflow Rate		15000	gal(US)/(ft·d)
Type of Clarifier	Circular		
Suspended Solids		58	%
BOD		32	%
COD		40	%
TKN		5	%
Phosphorus		5	%
Override Design	TRUE		
Length-Rectangular Only		0	ft
Width-Rectangular Only		0	ft
Diameter-Circular Only		165	ft
Excavation Depth		4	ft
Number of Tanks per Battery		4	
Number of Batteries		4	
Override Database Costs	FALSE		
Standard 20 X 120 ft Rectangu	$119,000.00		$
Standard 90 ft Diameter Circul	$97,600.00		$
Standard 3000 gpm Pump and	$19,500.00		$
Mechanical		20	years
Structural		40	years

Pump	25	years

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$36,000,000.00	$
Override Annual Operational C	FALSE	
	$0.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	
	$0.00	$
Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization (	FALSE	
	$0.00	$

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	342000	sqft
Surface area per circular clarifi	21400	sqft
Diameter of each circular clarif	165	ft
Number of clarifiers per battery	4	
Number of batteries	4	
Solids loading rate	2,97	lb/(sqft·d)
Hydraulic retention time	2,6	hr
Weir length	49600	ft
Volume of sludge generated	7,17	MGD(US)
Surface overflow rate	2170	gal(US)/(sqft·d)
Quantities		
Operation labor required	8580	pers-hrs/yr
Maintenance labor required	4860	pers-hrs/yr
Electrical energy required	63700	kWh/yr
Volume of earthwork required	5580000	cuft
Slab thickness	11,9	in
Volume of slab concrete requir	374000	cuft
Wall thickness	15	in
Volume of wall concrete requir	183000	cuft
Costs		
Operational labor cost	$68,700	$/yr
Maintenance labor cost	$41,900	$/yr
Material and supply cost	$141,000	$/yr
Energy cost	$12,700	$/yr
Amortization cost	$802,000	$/yr
Notes		
Effluent soluble TKN adjusted to satisfy user-specified TKN removal.		
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	7,17	MGD(US)
Total pumping capacity	7,17	MGD(US)
Design capacity per pump	3,59	MGD(US)
Number of pumps	3	

Number of batteries		1	
Firm pumping capacity		7,17	MGD(US)
Quantities			
Operation labor required		570	pers-hrs/yr
Maintenance labor required		484	pers-hrs/yr
Electrical energy required		239000	kWh/yr
Volume of earthwork required		2730	cuft
Area of pump building		341	sqft
Costs			
Operational labor cost	$4,560		$/yr
Maintenance labor cost	$4,170		$/yr
Material and supply cost	$1,030		$/yr
Energy cost	$47,800		$/yr
Amortization cost	$9,580		$/yr

Digestion Anaerobica

User Input Data

Anaerobic Digestion

Description	**Value**		**Units**
Specific Gravity		1,05	
Percent Volatile Solids Destroy		50	%
Concentration in Digester		3,4	%
Minimum Detention Time in Pri		15	d
Location	Warm-Winter > 10 D		
Raw Wastewater		60,8	deg F
Digester		104	deg F
Fraction of Influent Flow Returi		2	%
Suspended Solids		6250	mg/L
BOD		1000	mg/L
COD		2150	mg/L
TKN		950	mgN/L
Ammonia		650	mg/L
Override Design	TRUE		
Diameter		90	ft
Sidewater Depth		75	ft
Number of Primary Digester Ta		14	
Number of Secondary Digester		0	
Number of Batteries		1	
Override Database Costs	FALSE		
Standard 70 ft Diameter Floatir	$444,000.00		$
Standard 60 ft Diameter Gas C	$131,000.00		$
Standard 1 Million Btu/Hr Heat	$55,300.00		$
Standard 2 in Diameter Gas Sa	$43,400.00		$
Standard Size Sludge Pump 8(	$5,960.00		$
Natural Gas Per 1000 cuft	$21.10		$
Floating Cover		20	years
Gas Circulation Unit		20	years
Heating Unit		20	years
Gas Safety Equipment		20	years
Sludge Pump		25	years
Structural		40	years

Cost Override

Description	**Value**	**Units**
Override Construction Cost	TRUE	
	$149,000,000.00	$

Override Annual Operational C	TRUE	
	$398,000.00	$
Override Annual Maintenance	TRUE	
	$237,000.00	$
Override Annual Materials Cos	TRUE	
	$322,000.00	$
Override Annual Chemical Cos	TRUE	
	$0.00	$
Override Annual Energy Cost	TRUE	
	$846,000.00	$
Override Annual Amortization (	FALSE	
	$0.00	$

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	50	%
Solids concentration in digeste	3,4	%
Detention time	15	d
Digester depth	75	ft
Digester diameter	90	ft
Effective digester volume	7010000	cuft
Number of digesters per batter	14	
Number of primary digesters p	14	
Number of secondary digesters	0	
Number of batteries	1	
Gas produced	37,7	MGD(US)
Heat required	46300000	BTU/hr
Digester gas required	19,2	MGD(US)
Total natural gas required	0	MGD(US)
Quantities		
Operation labor required	51300	pers-hrs/yr
Maintenance labor required	29200	pers-hrs/yr
Electrical energy required	4370000	kWh/yr
Volume of earthwork required	3130000	cuft
Slab thickness	22,3	in
Volume of slab concrete requir	175000	cuft
Wall thickness	45	in
Volume of wall concrete requir	1240000	cuft
Sidewater depth	75	ft
Surface area/floor of 2-story cc	14100	sqft
Piping size	10	in
Length of total piping system	6200	ft
Number of 90 degree elbows	182	
Number of tees	357	
Number of plug valves	259	
Total dry solids treated	985000	lb/d
Costs		
Amortization cost	$3,880,000	$/yr
Notes		
Mass balance based on user input		

Alimentacion Escalonada (MLE)

User Input Data

Predenitrification

Description	Value	Units
Aeration Type	Diffused Aeration	
Effluent Nitrate	20	mgN/L
Design Basis	Specify Design SRT	
Design SRT	7	d
Safety Factor for Calculated SI	1,5	
Maximum Heterotrophic Specif	6	1/d
Heterotrophic Decay Rate	0,24	1/d
Maximum Autotrophic Specific	0,5	1/d
Autotrophic Decay Rate	0,04	1/d
Biomass Yield	0,5	
Readily Biodegradable Substra	30	%
Suspended Solids	3200	mg/L
Bubble Size	Fine Bubble	
Alpha Factor for Oxygen Trans	0,5	
Beta Factor for Oxygen Satura	0,95	
Coarse Bubble Minimum Air Fl	19,8	scfm/1000 cuft
Fine Bubble Minimum Air Flow	0,12	scfm/ft2
Standard Oxygen Transfer Effi	20	%
Override Design	TRUE	
Aerobic Volume	15100000	cuft
Anoxic Volume	5610000	cuft
Tank Width	22	ft
Tank Depth	16,4	ft
Pipe Gallery Width	55,6	ft
Excavation Depth	4,27	ft
Number of Tanks	7	
Number of Batteries	22	
Required Air Flow - Diffused A	16	scfm/1000 cuft
Required Horsepower - Mecha	0	HP
Number of Mixers per Anoxic T	3	
Override Database Costs	FALSE	
Slow Speed 20 hp Aerator	$21,700.00	$
Standard 2 scfm Fine Bubble D	$54.20	$
Standard 12 scfm Coarse Bubl	$32.50	$
Standard 550 scfm Swing Arm	$15,200.00	$
5 hp Vertical Turbine Mixer	$9,700.00	$
Standard 3000 gpm Pump and	$19,500.00	$
Mechanical Aerator	20	years
Fine Bubble Diffuser	10	years
Coarse Bubble Diffuser	20	years
Swing Arm Diffuser	20	years
Turbine Mixer	20	years
Pump	25	years
Structural	40	years

Cost Override

Description	Value	Units
Override Construction Cost	FALSE	
	$0.00	$
Override Annual Operational C	FALSE	
	$0.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	
	$0.00	$

Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization (	FALSE	
	$0.00	$

Design Output Data

Description	Value	Units
Pre-Denitrification Activated Sludge		
Design Information		
Design Override Enabled - sizi		
Predenitrification Design		
Design aerobic SRT for nitrifica	7	d
Total reactor SRT	9,6	d
Design SS	3790	mg/L
Calculated VSS	2720	mg/L
Calculated VSS:TSS ratio	0,717	lb VSS/lb SS
Total volume of anoxic reactors	5610000	cuft
Total volume of aerobic reactor	15100000	cuft
Total volume of all reactors	20700000	cuft
Width of parallel train	22	ft
Sidewater depth	16,4	ft
Number of batteries	22	
Number of parallel trains per ba	7	
Number of anoxic cells within c	2	
Number of aerobic cells within	3	
Total number of dividing walls i	616	
Anoxic hydraulic retention time	2,72	hr
Aerobic hydraulic retention time	7,31	hr
Amount of sludge generated	511000	lb/d
Sludge recycle rate	227	MGD(US)
Nitrogen requirement for bioma	11,8	mg/L
Phosphorus requirement for bi	2,37	mg/L
Oxygen requirement to meet av	1160000	lb/d
Air flow required to meet avera	242000	scfm
Design air flow	16	scfm/1000 cuft
Design air flow	40,4	scfm/ft2
Quantities		
Operation labor required	23400	pers-hrs/yr
Maintenance labor required	17200	pers-hrs/yr
Electrical energy required	93200000	kWh/yr
Volume of earthwork required	10400000	cuft
Volume of slab concrete requir	3230000	cuft
Volume of wall concrete requir	2360000	cuft
Handrail length	4400	ft
Number of diffusers per train	785	
Fine bubble diffuser floor cover	5,8	%
Number of swing arm headers	15	
Required mixing power	2770	HP
Total number of mixers	924	
Design mixing power per mixer	5	HP
Mixing power for each unaerate	9	HP
Costs		
Construction and equipment co	$152,000,000	$
Operational labor cost	$187,000	$/yr

Maintenance labor cost	$149,000		$/yr
Material and supply cost	$1,150,000		$/yr
Energy cost	$18,600,000		$/yr
Amortization cost	$9,690,000		$/yr
Notes			
Minimum winter SRT not calculated, design SRT specified by user			
Design is based on user specified design overrides - Performance data is assumed to be correc			
Internal Recycle Pumping			
Design Information			
Average daily pumping rate		2,91	MGD(US)
Total pumping capacity		5,81	MGD(US)
Design capacity per pump		2,91	MGD(US)
Number of pumps		462	
Number of batteries		1	
Firm pumping capacity		2,91	MGD(US)
Quantities			
Operation labor required		505	pers-hrs/yr
Maintenance labor required		422	pers-hrs/yr
Electrical energy required		97200	kWh/yr
Volume of earthwork required		2520	cuft
Area of pump building		315	sqft
Costs			
Construction and equipment cc	$20,600,000		$
Operational labor cost	$4,040		$/yr
Maintenance labor cost	$3,640		$/yr
Material and supply cost	$144,000		$/yr
Energy cost	$2,990,000		$/yr
Amortization cost	$1,350,000		$/yr
Notes			
Pumps are sized based on an individual battery of internal pumps for each train			
Sludge Recycle Pumping			
Design Information			
Average daily pumping rate		227	MGD(US)
Total pumping capacity		453	MGD(US)
Design capacity per pump		28,3	MGD(US)
Number of pumps		5	
Number of batteries		4	
Firm pumping capacity		227	MGD(US)
Quantities			
Operation labor required		5150	pers-hrs/yr
Maintenance labor required		3630	pers-hrs/yr
Electrical energy required		7490000	kWh/yr
Volume of earthwork required		77900	cuft
Area of pump building		9740	sqft
Costs			
Construction and equipment cc	$6,210,000		$
Operational labor cost	$41,200		$/yr
Maintenance labor cost	$31,300		$/yr
Material and supply cost	$43,500		$/yr
Energy cost	$1,500,000		$/yr
Amortization cost	$405,000		$/yr

Deshidratación por centrifugas

User Input Data

Centrifugation

Description	**Value**	**Units**

Cake Solids Content		28	%
Solids Capture		90	%
Power Requirement		1	HP/gpm(US)
Daily Operating Time		8	hr/d
Weekly Operating Time		7	d/wk
Number of Units		5	
Excess Capacity Factor		1,25	
Chemical Dose		1	% dry wt
Override Database Costs	FALSE		
Standard 50 hp Centrifuge	$271,000.00		$
Centrifuge		15	years
Structural		40	years

Cost Override

Description	**Value**		**Units**
Override Construction Cost	TRUE		
	$50,000,000.00		$
Override Annual Operational C	TRUE		
	$438,000.00		$
Override Annual Maintenance	TRUE		
	$547,000.00		$
Override Annual Materials Cos	TRUE		
	$0.00		$
Override Annual Chemical Cos	TRUE		
	$5,420,000.00		$
Override Annual Energy Cost	TRUE		
	$3,640,000.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	**Value**		**Units**
Centrifugation			
Design Information			
Total power required		5670	HP
Power required per unit		196	HP
Excess capacity factor		1,25	
Number of units		29	
Chemical dose		1	% dry wt
Chemicals required		19400	lb/d
Sludge flow		6,53	MGD(US)
Initial solid conc		3,4	%
Operational hours per day		8	hr
Operational days per week		7	d
Quantities			
Number of centrifuges		29	
Power required per unit		196	HP
Area of building		7740	sqft
Dry solids produced		617000	lb/d
Operation labor required		95300	pers-hrs/yr
Maintenance labor required		15300	pers-hrs/yr
Electrical energy required		6620000	kWh/yr
Costs			
Amortization cost	$4,020,000		$/yr
Polymer Feed System			
Quantities			

Polymer dosage	6480	lb/d
Liquid chemical solution fed	0,311	MGD(US)
O&M labor required	43700	pers-hrs/yr
Dry material handling and mixi	3300	pers-hrs/yr
Total operation labor required	47000	pers-hrs/yr

Generacion con motores de combustion biogas

User Input Data

User Specified Sludge Process

Description	Value	Units
Volume Reduction	0	%
Percent Volatile Solids Destroy	0	%

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$37,500,000.00	$
Override Annual Operational C	TRUE	
	$1,240,000.00	$
Override Annual Maintenance	TRUE	
	$1,240,000.00	$
Override Annual Materials Cos	TRUE	
	$833,000.00	$
Override Annual Chemical Cos	TRUE	
	$0.00	$
Override Annual Energy Cost	TRUE	
	$-11,100,000.00	$
Override Annual Amortization (	TRUE	
	$1,800,000.00	$

Design Output Data

Description	Value	Units

Sedimentador Secundario

User Input Data

Secondary Clarifier

Description	Value	Units
Design Basis	Average Flow	
Surface Overflow Rate	500	gal(US)/(sqft·d)
Sidewater Depth	9	ft
Specific Gravity	1,03	
Underflow Concentration	1	%
Weir Overflow Rate - Maximun	15000	gal(US)/(ft·d)
Effluent Suspended Solids	20	mg/L
Type of Clarifier	Circular	
Override Design	FALSE	
Length-Rectangular Only	0	ft
Width-Rectangular Only	0	ft
Diameter-Circular Only	122	ft
Excavation Depth	4	ft
Number of Tanks per Battery	16	
Number of Batteries	4	
Override Database Costs	FALSE	
Rectangular Clarifier Mechanis	$119,000.00	$
Circular Clarifier Mechanism-9	$97,600.00	$
Standard 3000 gpm Pump and	$19,500.00	$

Mechanical	20	years
Structural	40	years
Pump	25	years

Cost Override

Description	Value	Units
Override Construction Cost	TRUE	
	$61,000,000.00	$
Override Annual Operational C	FALSE	
	$0.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	
	$0.00	$
Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization (	FALSE	
	$0.00	$

Design Output Data

Description	Value		Units
Secondary Clarification			
Design Information			
Surface area		742000	sqft
Surface area per circular clarifi		11600	sqft
Diameter of each circular clarif		122	ft
Number of clarifiers per battery		16	
Number of batteries		4	
Solids loading rate		25,5	lb/(sqft·d)
Hydraulic retention time		3,23	hr
Weir length		49100	ft
Volume of wasted sludge		5,95	MGD(US)
Quantities			
Operation labor required		13700	pers-hrs/yr
Maintenance labor required		7790	pers-hrs/yr
Electrical energy required		99900	kWh/yr
Volume of earthwork required		10700000	cuft
Slab thickness		10,1	in
Volume of slab concrete requir		709000	cuft
Wall thickness		11,5	in
Volume of wall concrete requir		256000	cuft
Costs			
Operational labor cost	$109,000		$/yr
Maintenance labor cost	$67,200		$/yr
Material and supply cost	$301,000		$/yr
Energy cost	$20,000		$/yr
Amortization cost	$1,790,000		$/yr
Waste Sludge Pumping			
Design Information			
Average daily pumping rate		5,95	MGD(US)
Total pumping capacity		5,95	MGD(US)
Design capacity per pump		2,97	MGD(US)
Number of pumps		3	
Number of batteries		1	

Firm pumping capacity		5,95	MGD(US)
Quantities			
Operation labor required		553	pers-hrs/yr
Maintenance labor required		469	pers-hrs/yr
Electrical energy required		198000	kWh/yr
Volume of earthwork required		2540	cuft
Area of pump building		317	sqft
Costs			
Operational labor cost	$4,430		$/yr
Maintenance labor cost	$4,040		$/yr
Material and supply cost	$947		$/yr
Energy cost	$39,700		$/yr
Amortization cost	$8,830		$/yr

Disposicion Final - Costo No Incluido

User Input Data

Hauling and Land Filling

Description	**Value**		**Units**
Distance to Disposal Site		15,5	miles
Daily Operation		8	hr
Loading Time per Vehicle		0,75	hr
Hauling Time per Trip		1	hr
Disposal Cost Based On	Sludge Disposal per		
Override Database Costs	TRUE		
Standard 22 cuyd Vehicle	$314,000.00		$
Annual Charge of Land Fill	$43,100.00		$
Sludge Disposal per cuyd	$23.60		$
Sludge Disposal per ton	$28.00		$
Vehicle		15	years
Structural		40	years

Cost Override

Description	**Value**	**Units**
Override Construction Cost	FALSE	
	$0.00	$
Override Annual Operational C	FALSE	
	$0.00	$
Override Annual Maintenance	FALSE	
	$0.00	$
Override Annual Materials Cos	FALSE	
	$0.00	$
Override Annual Chemical Cos	FALSE	
	$0.00	$
Override Annual Energy Cost	FALSE	
	$0.00	$
Override Annual Amortization (	TRUE	
	$0.00	$

Design Output Data

Description	**Value**		**Units**
Sludge Hauling and Land Filling			
Design Information			
Volume of sludge hauled		0,237	MGD(US)
Truck capacity		810	cuft
Round trip time to disposal site		1	hr
Truck loading time		0,75	hr

Operational hours per day		8	hr
Number of trucks required		9	
Distance to disposal site		15,5	miles
Quantities			
Total sludge volume hauled		0,237	MGD(US)
Maximum anticipated landfill d		30	d
Anticipated sludge storage hei		8	ft
Sludge storage shed area		119000	sqft
Width of sludge storage shed s		244	ft
Length of sludge storage shed		488	ft
Volume of earthwork required		303000	cuft
Volume of slab concrete requir		123000	cuft
Surface area of canopy roof		119000	sqft
Round trip haul distance		31,1	miles
Round trips per day per truck		5	
Distance traveled per year per		38800	miles
Sludge hauled		2080000	lb/d
Operation labor required		28600	pers-hrs/yr
LandFilling cost	$10,100,000		$/yr

Filtro Desnitrificador

User Input Data

Denitrification - Attached Growth

Description	Value		Units
Allowable Effluent Nitrate		20	mg/L
Alkalinity Production		3	mg/L
Methanol Requirement		3	lb/lb NO3
Specific Surface Area of Media		41	1/ft
Application Rate		1080	gal(US)/(sqft·d)
Backwash Rate		17300	gal(US)/(sqft·d)
Minimum Media Depth		12	ft
Override Database Costs	FALSE		
Media per cuft	$5.09		$
1 Cross-Sectional sqft of Distri	$121.00		$
Standard 3000gpm Pump and	$19,500.00		$
1 lb of Methanol	$0.84		$
Distribution System		25	years
Pump		25	years
Structural		40	years

Cost Override

Description	Value		Units
Override Construction Cost	FALSE		
	$0.00		$
Override Annual Operational C	FALSE		
	$0.00		$
Override Annual Maintenance	FALSE		
	$0.00		$
Override Annual Materials Cos	FALSE		
	$0.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$
Override Annual Energy Cost	FALSE		
	$0.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	Value		Units
Attached Growth Denitrification			
Design Information			
Surface removal rate		0,0061	lb/(sqft·d)
Total media surface area		0	sqft
Total volume of media needed		0	cuft
Total column area		338000	sqft
Actual media volume		4060000	cuft
Hydraulic retention time		120	min
Daily methanol required		183000	lb/d
Total backwash required		4870	MGD(US)
Costs			
Construction and equipment cc	$96,300,000		$
Operational labor cost	$248,000		$/yr
Maintenance labor cost	$425,000		$/yr
Material and supply cost	$482,000		$/yr
Chemical cost	$9,490,000		$/yr
Energy cost	$7,740,000		$/yr
Amortization cost	$5,580,000		$/yr
Notes			
This unit is not needed. The influent nitrate is less than the allowable effluent nitrate.			
Internal Recycle Pumping			
Design Information			
Average daily pumping rate		365	MGD(US)
Total pumping capacity		730	MGD(US)
Design capacity per pump		26,1	MGD(US)
Number of pumps		5	
Number of batteries		7	
Firm pumping capacity		365	MGD(US)
Quantities			
Operation labor required		8340	pers-hrs/yr
Maintenance labor required		5520	pers-hrs/yr
Electrical energy required		12100000	kWh/yr
Volume of earthwork required		126000	cuft
Area of pump building		15800	sqft
Costs			
Construction and equipment cc	$9,890,000		$
Operational labor cost	$66,800		$/yr
Maintenance labor cost	$47,600		$/yr
Material and supply cost	$69,200		$/yr
Energy cost	$2,410,000		$/yr
Amortization cost	$645,000		$/yr
Wash Water Pumping			
Design Information			
Average daily pumping rate		38	MGD(US)
Total pumping capacity		38	MGD(US)
Design capacity per pump		19	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		38	MGD(US)
Quantities			
Operation labor required		946	pers-hrs/yr
Maintenance labor required		897	pers-hrs/yr
Electrical energy required		1730	kWh/yr

Volume of earthwork required		7600	cuft
Area of pump building		950	sqft
Costs			
Construction and equipment cc	$588,000		$
Operational labor cost	$7,570		$/yr
Maintenance labor cost	$7,740		$/yr
Material and supply cost	$4,120		$/yr
Energy cost	$346		$/yr
Amortization cost	$38,400		$/yr

Desinfeccion por cloro

User Input Data

Chlorination

Description	Value		Units
Contact Time At Peak Flow		30	min
Chlorine Dose		10	mg/L
Influent Coliform Count		10000000	/100mL
Override Design	FALSE		
Volume of Tank		2030000	cuft
Override Database Costs	FALSE		
1 Ton of Chlorine	$1,610.00		$
Standard 2000 lb/d Chlorinator	$37,900.00		$
Chlorinator		15	years
Structural		40	years

Cost Override

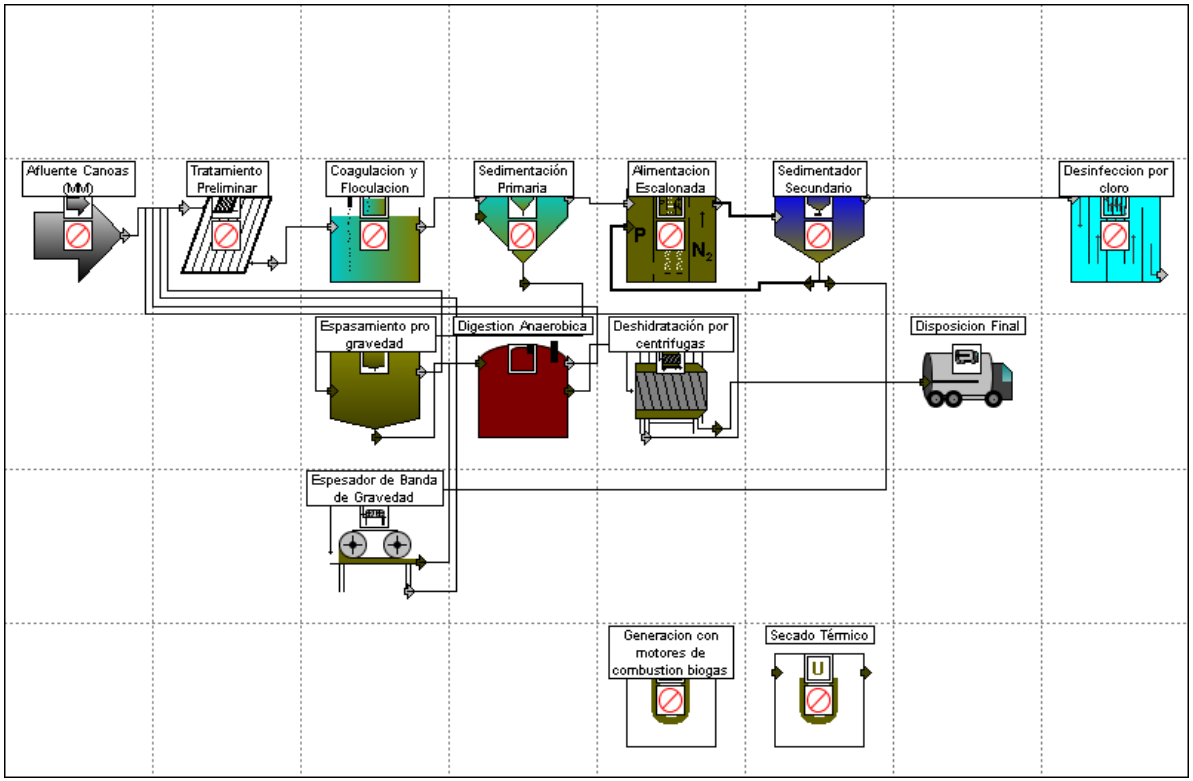
Description	Value		Units
Override Construction Cost	FALSE		
	$0.00		$
Override Annual Operational C	FALSE		
	$0.00		$
Override Annual Maintenance	FALSE		
	$0.00		$
Override Annual Materials Cos	FALSE		
	$0.00		$
Override Annual Chemical Cos	FALSE		
	$0.00		$
Override Annual Energy Cost	FALSE		
	$0.00		$
Override Annual Amortization (	FALSE		
	$0.00		$

Design Output Data

Description	Value		Units
Chlorination			
Design Information			
Volume of tank		2030000	cuft
Average chlorine required		30400	lb/d
Peak chlorine required		60900	lb/d
Influent coliform count		10000000	/100mL
Effluent coliform count		29,2	/100mL
Quantities			
Operational labor required		9790	pers-hrs/yr
Maintenance labor required		11800	pers-hrs/yr
Electrical energy required		269000	kWh/yr
Volume of earthwork required		731000	cuft

Volume of slab concrete requir		204000	cuft
Volume of wall concrete requir		167000	cuft
Number of chlorinators and eva		4	
Chlorination building area		1440	sqft
Number of chlorine cylinders		457	
Area of chlorine storage buildir		64000	sqft
Costs			
Construction and equipment co	$10,300,000		$
Operational labor cost	$78,300		$/yr
Maintenance labor cost	$102,000		$/yr
Material and supply cost	$140,000		$/yr
Chemical cost	$8,940,000		$/yr
Energy cost	$53,700		$/yr
Amortization cost	$656,000		$/yr

FIII/FII-línea de lodos THP



Summary

Equipment Database

Sept 2007,(USA Avg)

Layout Summary

Present Worth	Project	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
$1,140,000,000	$402,000,000	$1,390,000	$915,000	$13,000,000	$6,950,000	$5,250,000	$22,600,000

Process Summary

Process	Construction	Operation (/yr)	Maintenance (/yr)	Material (/yr)	Chemical (/yr)	Energy (/yr)	Amortization (/yr)
Espasamiento pro gravedad	$10.000.000	$58.200	$28.600	$23.500	$0	$8.150	$148.000
Digestion Anaerobica	$149.000.000	$518.000	$308.000	$418.000	$0	$1.100.000	$15.000.000
Deshidratación por centrifugas	$23.000.000	$438.000	$547.000	$0	$5.420.000	$3.640.000	$7.070.000
Disposicion Final	$5.760.000	$254.000	$0	$12.500.000	$0	$0	$422.000
Espesador de Banda de Grave	$30.500.000	$120.000	$31.300	$0	$1.530.000	$494.000	$0
Other Costs	$184.000.000	$0	$0	$0	$0	$0	$0

Summary of Costs for Layout

Description	Value	Units
Other Costs		
Quantities		
Required land	8,57	acre
Administration labor hours	0	hr/yr
Laboratory labor hours	0	hr/yr
Costs		
DIRECT COSTS		
Unit process construction costs	$218,000,000	$
Profit	$32,700,000	$
Total construction costs	$251,000,000	$
INDIRECT COSTS		
Miscellaneous cost	$52,700,000	$
Legal cost	$5,020,000	$
Engineering design fee	$37,700,000	$
Inspection cost	$5,020,000	$
Contingency	$25,100,000	$
Technical	$5,020,000	$
Total indirect costs	$131,000,000	$
MISC		
Cost of land	$0	$
Interest during construction	$20,900,000	$
LABOR COSTS		
Administration labor cost	$0	$/yr
Laboratory labor cost	$0	$/yr
Unit process operation labor co	$1,390,000	$/yr
Unit process maintenance labo	$915,000	$/yr
Total labor costs	$2,300,000	$/yr
PROJECT SUMMARY		
Present worth	$1,140,000,000	$
Total project cost	$402,000,000	$
Total operation labor cost	$1,390,000	$/yr
Total maintenance labor cost	$915,000	$/yr
Total material cost	$13,000,000	$/yr
Total chemical cost	$6,950,000	$/yr
Total energy cost	$5,250,000	$/yr
Total amortization cost	$22,600,000	$/yr

Afluente Canoas (MM)
Tratamiento Preliminar
Design Output Data

Description	Value	Units
Mechanically Cleaned Bar Screen		
Design Information		
Bar size	0,25	in
Bar spacing	0,235	in
Slope of bars from horizontal	15	degrees
Head loss through screen	2,6965E+308	ft
Approach velocity	1,31	ft/s
Average flow through velocity (	1,31	ft/s
Maximum flow through velocity	3	ft/s
Screen channel width	45,3	ft
Average channel depth	9,84	ft
Aerated Grit Chamber		
Design Information		
Maximum flow	742	MGD(US)
Average flow	378	MGD(US)

Minimum flow	333	MGD(US)
Temperature	60,8	deg F
Maximum flow through velocity	0,359	ft/s
Average flow through velocity (	0,183	ft/s
Size of smallest particle 100%	0,00786	in
Specific gravity of particle	2	
Number of units	1	
Maximum flow/unit	742	MGD(US)
Width of channel	216	ft
Depth of channel	14,8	ft
Length of channel	216	ft
Settling velocity of particle	0,0513	ft/s
Hydraulic retention time	10	min
Volume of grit	0,113	MGD(US)
Air supply	3	cfm

Coagulacion y Floculacion

Design Output Data

Description	Value		Units
Chemical Phosphorus Removal			
Design Information			
Chemical used	Equivalent Iron		
Chemical dosage		12	mg/L
Mass of chemical per year		6300000	kg/yr
Chemical sludge production		40	mg/L
Organic sludge production		6,71	mg/L

Espasamiento pro gravedad

Design Output Data

Description	Value		Units
Gravity Thickening			
Design Information			
Initial concentration		1	%
Thickened concentration		5	%
Mass loading		24	lb/(sqft·d)
Hydraulic loading		218	gal(US)/(sqft·d)
Hydraulic retention time		11,5	hr
Number of tanks		7	
Tank volume		441000	cuft
Depth		14	ft
Surface area per tank		4500	sqft
Tank diameter		76	ft
Quantities			
Amount of sludge generated		572000	lb/d
Volume of thickened sludge		1,18	MGD(US)
Operation labor required		7270	pers-hrs/yr
Maintenance labor required		3430	pers-hrs/yr
Electrical energy required		40800	kWh/yr
Volume of earthwork required		401000	cuft
Slab thickness		11,4	in
Volume of slab concrete requir		35100	cuft
Wall thickness		14	in
Volume of wall concrete requir		31100	cuft
Costs			
Operational labor cost	$58,200		$/yr
Maintenance labor cost	$28,600		$/yr
Material and supply cost	$23,500		$/yr
Energy cost	$8,150		$/yr
Amortization cost	$148,000		$/yr

Espesador de Banda de Gravedad

Design Output Data

Description	Value		Units
Gravity Belt Thickener			

Design Information			
Belt filter width		6,56	ft
Number of units		94	
Hydraulic loading per unit per r		0,18	MGD(US)
Hydraulic loading required per		33,8	MGD(US)
Final solids content		6	%
Solids capture fraction		0,985	
Quantities			
Operation labor required		15000	pers-hrs/yr
Maintenance labor required		3750	pers-hrs/yr
Power		2470000	kWh/yr
Polymer required		1850	lb/d
Dry solids produced		463000	lb/d
Belt filter(s)	$25,900,000		$
Building	$1,540,000		$
Installation	$6,490,000		$
Polymer system	$9,600,000		$
Feed pumps	$2,850,000		$
Conveyor system	$6,490,000		$
Costs			
Operational labor cost	$120,000		$/yr
Maintenance labor cost	$31,300		$/yr
Chemical cost	$1,530,000		$/yr
Energy cost	$494,000		$/yr

Sedimentación Primaria

Design Output Data

Description	Value	Units
Primary Clarification		
Design Information		
Surface area	342000	sqft
Surface area per circular clarifi	21400	sqft
Diameter of each circular clarif	165	ft
Number of clarifiers per battery	4	
Number of batteries	4	
Solids loading rate	2,85	lb/(sqft·d)
Hydraulic retention time	2,59	hr
Weir length	49700	ft
Volume of sludge generated	6,86	MGD(US)
Surface overflow rate	2180	gal(US)/(sqft·d)
Quantities		
Operation labor required	8580	pers-hrs/yr
Maintenance labor required	4860	pers-hrs/yr
Electrical energy required	63700	kWh/yr
Volume of earthwork required	5580000	cuft
Slab thickness	11,9	in
Volume of slab concrete requir	374000	cuft
Wall thickness	15	in
Volume of wall concrete requir	183000	cuft
Notes		
Effluent soluble TKN adjusted to satisfy user-specified TKN removal.		
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	6,86	MGD(US)
Total pumping capacity	6,86	MGD(US)
Design capacity per pump	3,43	MGD(US)
Number of pumps	3	
Number of batteries	1	
Firm pumping capacity	6,86	MGD(US)
Quantities		
Operation labor required	564	pers-hrs/yr
Maintenance labor required	479	pers-hrs/yr
Electrical energy required	229000	kWh/yr
Volume of earthwork required	2680	cuft

Area of pump building	335	sqft

Digestion Anaerobica

Design Output Data

Description	Value	Units
Anaerobic Digestion		
Design Information		
Percent VSS destroyed	43	%
Solids concentration in digeste	3,4	%
Detention time	15	d
Digester depth	75	ft
Digester diameter	90	ft
Effective digester volume	7010000	cuft
Number of digesters per batter	14	
Number of primary digesters p	14	
Number of secondary digesters	0	
Number of batteries	1	
Gas produced	29,5	MGD(US)
Heat required	43300000	BTU/hr
Digester gas required	18	MGD(US)
Total natural gas required	0	MGD(US)
Quantities		
Operation labor required	51200	pers-hrs/yr
Maintenance labor required	29100	pers-hrs/yr
Electrical energy required	4360000	kWh/yr
Volume of earthwork required	3130000	cuft
Slab thickness	22,3	in
Volume of slab concrete requir	175000	cuft
Wall thickness	45	in
Volume of wall concrete requir	1240000	cuft
Sidewater depth	75	ft
Surface area/floor of 2-story cc	14100	sqft
Piping size	10	in
Length of total piping system	6200	ft
Number of 90 degree elbows	182	
Number of tees	357	
Number of plug valves	259	
Total dry solids treated	982000	lb/d
Notes		
Mass balance based on user input		

Alimentacion Escalonada

Design Output Data

Description	Value	Units
BNR System for BIO-P and N Removal		
Design Information		
Design Override Enabled - sizi		
5-Stage Biological Phosphorus		
Design aerobic SRT for nitrifica	5	d
Total reactor SRT	10	d
Design SS	2260	mg/L
Calculated VSS	1390	mg/L
Calculated VSS:TSS ratio	0,613	lb VSS/lb SS
Total volume of anaerobic reac	366000	cuft
Total volume of anoxic reactors	16000000	cuft
Total volume of aerobic reacto	16400000	cuft
Total volume of all reactors	32800000	cuft
Width of parallel train	262	ft
Sidewater depth	16,4	ft
Number of batteries	1	
Number of parallel trains per b	24	
Number of anoxic cells within c	3	
Number of aerobic cells within	3	
Anaerobic hydraulic retention t	0,176	hr

Anoxic hydraulic retention time	7,72	hr
Aerobic hydraulic retention tim	7,9	hr
Amount of sludge generated	464000	lb/d
Sludge recycle ratio	51	%
Sludge recycle rate	190	MGD(US)
Nitrogen required for biomass	14,9	mg/L
Phosphorus required for bioma	2,98	mg/L
Oxygen required to meet avera	944000	lb/d
Air flow required to meet avera	277000	scfm
Design air flow	16,9	scfm/1000 cuft
Design air flow	6,65	scfm/ft2
Quantities		
Operation labor required	19800	pers-hrs/yr
Maintenance labor required	14900	pers-hrs/yr
Electrical energy required	81000000	kWh/yr
Volume of earthwork required	14200000	cuft
Volume of slab concrete requir	4250000	cuft
Volume of wall concrete requir	578000	cuft
Handrail length	15400	ft
Number of diffusers per train	5770	
Fine bubble diffuser floor cover	6,12	%
Number of swing arm headers	13	
Required mixing power	8100	HP
Total number of mixers	288	
Required mixing power per mix	28,1	HP
Design mixing power per mixer	5	HP
Mixing power for each unaerat	84,4	HP

Notes

Minimum SRT not calculated, design SRT specified by user

Design is based on user specified design overrides - Performance data is assumed to be correct.

WARNING: Anoxic HRT is out of the normal range, consider changing your design override values

WARNING: Anaerobic HRT is out of the normal range, consider changing your design override values

Required hp per mixer exceeds the maximum allowed of 5 hp/mixer, consider increasing number of mixers per tank

Aerobic-Anoxic internal recycle pumps sized for 4x the influent flow

Internal Recycle Pumping

Design Information

Average daily pumping rate	62,2	MGD(US)
Total pumping capacity	62,2	MGD(US)
Design capacity per pump	20,7	MGD(US)
Number of pumps	96	
Number of batteries	1	
Firm pumping capacity	62,2	MGD(US)
Quantities		
Operation labor required	1450	pers-hrs/yr
Maintenance labor required	1230	pers-hrs/yr
Electrical energy required	2060000	kWh/yr
Volume of earthwork required	11400	cuft
Area of pump building	1430	sqft

Notes

Pumps are sized based on an individual battery of internal pumps for each train

Sludge Recycle Pumping

Design Information

Average daily pumping rate	373	MGD(US)
Total pumping capacity	373	MGD(US)
Design capacity per pump	23,3	MGD(US)
Number of pumps	5	
Number of batteries	4	
Firm pumping capacity	373	MGD(US)
Quantities		
Operation labor required	8530	pers-hrs/yr
Maintenance labor required	5630	pers-hrs/yr
Electrical energy required	12300000	kWh/yr
Volume of earthwork required	65200	cuft
Area of pump building	8160	sqft

Deshidratación por centrifugas

Design Output Data

Description	Value	Units
Centrifugation		
Design Information		
Total power required	6290	HP
Power required per unit	196	HP
Excess capacity factor	1,25	
Number of units	32	
Chemical dose	1	% dry wt
Chemicals required	21600	lb/d
Sludge flow	7,24	MGD(US)
Initial solid conc	3,4	%
Operational hours per day	8	hr
Operational days per week	7	d
Quantities		
Number of centrifuges	32	
Power required per unit	196	HP
Area of building	8550	sqft
Dry solids produced	685000	lb/d
Operation labor required	104000	pers-hrs/yr
Maintenance labor required	16700	pers-hrs/yr
Electrical energy required	7280000	kWh/yr
Polymer Feed System		
Quantities		
Polymer dosage	7190	lb/d
Liquid chemical solution fed	0,345	MGD(US)
O&M labor required	46700	pers-hrs/yr
Dry material handling and mixi	3400	pers-hrs/yr
Total operation labor required	50100	pers-hrs/yr

Generacion con motores de combustion biogas

Design Output Data

Description	Value	Units

Sedimentador Secundario

Design Output Data

Description	Value	Units
Secondary Clarification		
Design Information		
Surface area	509000	sqft
Surface area per circular clarifi	25400	sqft
Diameter of each circular clarif	180	ft
Number of clarifiers per battery	5	
Number of batteries	4	
Solids loading rate	20,9	lb/(sqft·d)
Hydraulic retention time	4,16	hr
Weir length	49200	ft
Volume of wasted sludge	8,06	MGD(US)
Surface overflow rate	733	gal(US)/(sqft·d)
Quantities		
Operation labor required	10900	pers-hrs/yr
Maintenance labor required	6190	pers-hrs/yr
Electrical energy required	80300	kWh/yr
Volume of earthwork required	8660000	cuft
Slab thickness	12,2	in
Volume of slab concrete requir	566000	cuft
Wall thickness	15,5	in
Volume of wall concrete requir	273000	cuft
Waste Sludge Pumping		
Design Information		
Average daily pumping rate	8,06	MGD(US)
Total pumping capacity	8,06	MGD(US)

Design capacity per pump		4,03	MGD(US)
Number of pumps		3	
Number of batteries		1	
Firm pumping capacity		8,06	MGD(US)
Quantities			
Operation labor required		592	pers-hrs/yr
Maintenance labor required		502	pers-hrs/yr
Electrical energy required		269000	kWh/yr
Volume of earthwork required		2870	cuft
Area of pump building		359	sqft

Secado Térmico

Design Output Data

Description	Value	Units

Disposicion Final

Design Output Data

Description	Value		Units
Sludge Hauling and Land Filling			
Design Information			
Volume of sludge hauled		0,263	MGD(US)
Truck capacity		810	cuft
Round trip time to disposal site		1	hr
Truck loading time		0,75	hr
Operational hours per day		8	hr
Number of trucks required		10	
Distance to disposal site		15,5	miles
Quantities			
Total sludge volume hauled		0,263	MGD(US)
Maximum anticipated landfill d		30	d
Anticipated sludge storage hei		8	ft
Sludge storage shed area		132000	sqft
Width of sludge storage shed s		257	ft
Length of sludge storage shed		514	ft
Volume of earthwork required		336000	cuft
Volume of slab concrete requir		136000	cuft
Surface area of canopy roof		132000	sqft
Round trip haul distance		31,1	miles
Round trips per day per truck		5	
Distance traveled per year per		38800	miles
Sludge hauled		2310000	lb/d
Operation labor required		31700	pers-hrs/yr
LandFilling cost	$11,200,000		$/yr
Costs			
Construction and equipment c	$5,760,000		$
Operational labor cost	$254,000		$/yr
Material and supply cost	$12,500,000		$/yr
Amortization cost	$422,000		$/yr

Desinfeccion por cloro

Design Output Data

Description	Value		Units
Chlorination			
Design Information			
Volume of tank		2030000	cuft
Average chlorine required		30400	lb/d
Peak chlorine required		60900	lb/d
Influent coliform count		10000000	/100mL
Effluent coliform count		29,2	/100mL
Quantities			
Operational labor required		9790	pers-hrs/yr
Maintenance labor required		11800	pers-hrs/yr
Electrical energy required		269000	kWh/yr
Volume of earthwork required		731000	cuft

Volume of slab concrete requir	204000	cuft
Volume of wall concrete requir	167000	cuft
Number of chlorinators and eva	4	
Chlorination building area	1440	sqft
Number of chlorine cylinders	457	
Area of chlorine storage buildir	64000	sqft