2020 Facilities Plan Treatment Report

APPENDIX 9D

BIOSOLIDS SCREENING ALTERNATIVES – COST ESTIMATES



BIOSOLIDS ALTERNATIVE EVALUATIONS

COST ESTIMATE SUMMARY

General Description

This alternative involves continuing MMSD's current biosolids program with a few minor improvements. JIWWTP primary sludge is pumped to SSWWTP and is thickened and anaerobically digested along with all SSWWTP primary sludge and some SSWWTP WAS. Most of the SSWWTP WAS and digested sludge are pumped to JIWWTP and thickened with JIWWTP WAS. The JIWWTP thickened sludge, along with some JIWWTP primary sludge, is dewatered and dried to produce Milorganite®, which is distributed and sold as a commercial fertilizer.

A portion of the SSWWTP digested sludge is thickened and dewatered to produce Agri-Life® as a dewatered cake product for land application. The alternative assumes that the existing thickening centrifuges at SSWWTP will be replaced with gravity belt thickeners and that two of the SSWWTP sludge storage tanks are converted to primary digesters, resulting in 8 anaerobic digesters operating at SSWWTP.

In addition, it assumes that the JIWWTP Dewatering & Drying facility will undergo major equipment repair/replacement in 10 years and that the JIWWTP turbine powerhouse will be expanded, with two new turbines replacing the existing two.

The alternative assumes that 85% of MMSD biosolids go to Milorganite® and 15% go to Agri-Life®.

Biosolids Distribution				
	85%	Milorganite®	15%	Dewatered Cake Agri-Life®
	0%	Glass Furnace	0%	Landfill
	0%	Incineration	0%	Land Application

ENR Index = 10000 (assumed Milwaukee 2007)

Summary of Capital Costs			
Estimated Construction Cost Without Contingency or Markup		\$135,840,000	
Contingency	25%	\$33,960,000	
Estimated Construction Cost Without Markup			\$169,800,000
Contractor OH&M/Engineering		30%	\$50,940,000

Total Capital Cost \$220,740,000

Summary of Operation & Maintenance Costs

Total Annual Cost \$47,350,000

Life Cycle Analysis

Interest Rate Per Year 5.125% Number of Years 20 Present Worth Factor 12 331

Present Worth of Total Operation & Maintenance Cost \$583,880,000

Total Present Worth \$805,000,000



TABLE 9D-1 SHEET 1 OF 11 **SCREENING ALTERNATIVE 1A –** MAINTAIN EXISTING MILOGRANITE® AND AGRI-LIFE® PROGRAMS (NEW TURBINES)

2020 TREATMENT REPORT

6/2/07

BIOSOLIDS ALTERNATIVE EVALUATIONS

CAPITAL COST ESTIMATE SUMMARY

Subprojects		Capital Cost (\$)
(list subprojects for which there is a Capital Cost Worksheet)	(link to total costs from Capital Cost Worksheets)	
SWWTP DIGESTER REHABILITATION		\$4,370,00
WWTP TURBINE UPGRADES		\$49,830,00
&D FACILITY CAPITAL UPGRADES IN 10 YEARS		\$50,500,00
ITERPLANT SLUDGE PIPELINE UPGRADES		\$1,380,00
EW LOCOMOTIVE		\$1,290,00
SWWTP GRAVITY BELT THICKENERS		\$2,550,00
EW DEWATERED CAKE STORAGE		\$3,280,00
Subtotal	\$113,200,000	
Subtotal	\$113,200,000	Capital Cost
	Allowance %	(\$)
llowance for Undesigned Details	20%	\$22,640,00
stimate of Construction Cost Without Contingency or Markup		\$135,840,000



TABLE 9D-1 SHEET 2 OF 11

SCREENING ALTERNATIVE 1A –

MAINTAIN EXISTING MILOGRANITE® AND

AGRI-LIFE® PROGRAMS (NEW TURBINES)

BIOSOLIDS ALTERNATIVE EVALUATIONS

SSWWTP DIGESTER REHABILITATION CAPITAL COST

Total Capital	Capital Cost (all divisions, without contingency or markup) =					
DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)		
DIVISION 11: EQUIPMENT						
New Digester Mixing Systems	8	each	\$491,000	\$3,930,000		
New Digester Recirculation Pumps	4	each	\$16,000	\$60,000		
Recirculating Sludge Heat Exchangers	2	each	\$44,000	\$90,000		
Storage Digester Sludge Transfer Pumps	2	each	\$59,000	\$120,000		
Digester Gas Safety Equipment	Ť	allowance	\$171,000	\$170,000		
Division 11 Subtotal	\$4,370,000					

ю	< insert link to		on the Capi	A STATE OF THE PARTY OF THE PAR	Worksheet ADJUSTED			
	Unit Cost	Cost	ENR	Adjustment	UNIT COST	ITEM	MANUFACTURER	COMMENTS
2	(\$)	Year	Index	Factor		, , , , , , , , , , , , , , , , , , ,	MANOPACIONER	- COMMENTO
00	\$453,180	2005	9231	1.08	\$490,933	External Draft Tube Mixers for 110' diameter	Eimco (Energenics) +30% for install	WLM; 4 mixers/tank; Infilco Degremont (IDI) makes cannon bubble mixers x1.05 Mech/Elect/I&C/Civil
0	\$14,333	2005	9231	1.08	\$15,526	Wemco Hidrostal, 10 HP motors, 250 gpm @ 60' TDH	Ley & Associates +30% for install	WLM; thermo digester pumps assumed the same for meso x1.05 Mech/Elect/l&C/Civil
0	\$40,950	2005	9231	1.08	\$44,361	Sludge-Hot Water Systems	Alfa Laval +30% for install	WLM; provide supplemental heating on recirc line x1.05 Mech/Elect/l&C/Civil
0	\$54,600	2005	9231	1.08	\$59,149	Wemco Hidrostal, 30 HP motors, VFD, 1200 gpm @ 60' TDH	Ley & Associates +250% for VFD +30% for install	WLM; x1.05 Mech/Elect/I&C/Civil
10	\$157,500	2005	9231	1.08	\$170,621	TBD	TBD	WLM; x1.05 Mech/Elect/I&C/Civil



TABLE 9D-1 SHEET 3 OF 11 SCREENING ALTERNATIVE 1A -MAINTAIN EXISTING MILOGRANITE® AND AGRI-LIFE® PROGRAMS (NEW TURBINES) 2020 TREATMENT REPORT

BIOSOLIDS ALTERNATIVE EVALUATIONS

JIWWTP TURBINE UPGRADES CAPITAL COST

\$49,830,000 Total Capital Cost (all divisions, without contingency or markup) =

DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 13: SPECIAL CONSTRUCTION				
Powerhouse and Electrical Feed Upgrades	1	each	\$49,832,090	\$49,830,000

Actual	COST ADJUSTMENT			ADJUSTED			
Unit Cost (\$)	Cost Year	ENR Index	Adjustment Factor	UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$46,000,000	2005	9231	1.08	\$49,832,088	turbine and other power supply upgrades		Lou Germanotta estimate

----- insert link to this cost on the Capital Cost Summary Worksheet



TABLE 9D-1 SHEET 4 OF 11 SCREENING ALTERNATIVE 1A -MAINTAIN EXISTING MILOGRANITE® AND AGRI-LIFE® PROGRAMS (NEW TURBINES) 2020 TREATMENT REPORT

BIOSOLIDS ALTERNATIVE EVALUATIONS

D&D FACILITY UPGRADES CAPITOL COST

Total Capital Cost (all divisions, without contingency or markup) = \$50,500,000 **Unit Cost** SUBTOTAL DESCRIPTION Quantity Units (\$) (\$) **DIVISION 13: SPECIAL CONSTRUCTION** Unit Process 24 Upgrade each \$7,938,000 \$7,940,000 \$17,420,000 Unit Process 25 Upgrade each \$17,423,000 Unit Process 27 Upgrade each \$4,582,000 \$4,580,000 \$12,630,000 Unit Process 29 Upgrade each \$12,629,000 Unit Process 30 Upgrade \$1,278,000 \$1,280,000 each Unit Process 31 Upgrade \$747,000 \$750,000 each Unit Process 32 Upgrade each \$2,809,000 \$2,810,000 Miscellaneous Costs (drop chutes, etc.) \$3,093,000 each \$3,090,000 **Division 13 Subtotal** \$50,500,000

Actual	C	OST ADJU	STMENT	ADJUSTED			
Unit Cost	Cost	ENR	Adjustment	UNIT COST			
(\$)	Year	Index	Factor	(\$)	ITEM	MANUFACTURER	COMMENTS
\$7,700,000	2006	9700	1.03	\$7,938,144			NPB
\$16,900,000	2006	9700	1.03	\$17,422,680			NPB
\$4,445,000	2006	9700	1.03	\$4,582,474			NPB
\$12,250,000	2006	9700	1.03	\$12,628,866			NPB
\$1,240,000	2006	9700	1.03	\$1,278,351			NPB
\$725,000	2006	9700	1.03	\$747,423			NPB
\$2,725,000	2006	9700	1.03	\$2,809,278			NPB
\$3,000,000	2006	9700	1.03	\$3,092,784			NPB



TABLE 9D-1 SHEET 5 OF 11

SCREENING ALTERNATIVE 1A –

MAINTAIN EXISTING MILOGRANITE® AND

AGRI-LIFE® PROGRAMS (NEW TURBINES)

2020 TREATMENT REPORT

BIOSOLIDS ALTERNATIVE EVALUATIONS

INTERPLANT SLUDGE PIPELINE UPGRADES CAPITOL COSTS

Total Capital Cost (all divisions, without contingency or markup) = \$1,380,000 **Unit Cost** SUBTOTAL DESCRIPTION Quantity Units (\$) **DIVISION 11: EQUIPMENT** JIWWTP and SSWWTP Pumps \$93,000 \$1,120,000 Division 11 Subtotal \$1,120,000 DIVISION 16: ELECTRICAL Pipeline Cathodic Protection \$258,000 \$260,000 allowance

\$260,000

Division 16 Subtotal

Actual		OST ADJU		ADJUSTED			
Unit Cost (\$)	Cost Year	ENR Index	Adjustment Factor	UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$90,000	2006	9700	1.03	\$92,784	pump, motor, etc. rated for 300 psi +5000 for install	TBD	quote from Mickey at RDM
\$250,000	2006	9700	1.03	\$257,732	TBD	TBD	PWC



TABLE 9D-1 SHEET 6 OF 11

SCREENING ALTERNATIVE 1A –

MAINTAIN EXISTING MILOGRANITE® AND

AGRI-LIFE® PROGRAMS (NEW TURBINES)

BIOSOLIDS ALTERNATIVE EVALUATIONS

NEW LOCOMOTIVE CAPITOL COSTS

\$1,290,000 Total Capital Cost (all divisions, without contingency or markup) =

1	each	\$1,289,000	\$1,290,000
1	al \$1,290,000	1 each	

insert link to this cost on the Capital Cost Summary Worksheet
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Actual	С	OST ADJU	STMENT	ADJUSTED			
Unit Cost (\$)	Cost Year	ENR Index	Adjustment Factor	UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$1,250,000	2006	9700	1.03	\$1,288,660	TBD	TBD	AES



BIOSOLIDS ALTERNATIVE EVALUATIONS

NEW SSWWTP GRAVITY BELT THICKENERS CAPITAL COST

Total Capital Cost	(all divisions,	without contin	gency or markup) =	\$2,550,000
DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 11: EQUIPMENT				
2 meter Gravity Belt Thickener	7	each	\$222,000	\$1,550,000
500 gpm Gravity Belt Thickner Feed Pumps	7	each	\$62,000	\$430,000
Progressing Cavity Gravity Belt Thickner Polymer Feed Pumps	3	each	\$44,000	\$130,000
Progressing Cavity Thickened Sludge Transfer Pumps	6	each	\$74.000	\$440,000
Division 11 Subtotal	\$2,550,000			

Actual Unit Cost	Cost	OST ADJU	Adjustment	ADJUSTED UNIT COST	NAMES OF THE PARTY	2554593025334460203	NACTORNOUS.
(\$)	Year	Index	Factor	(\$)	ITEM	MANUFACTURER	COMMENTS
\$204,750	2005	9231	1.08	\$221,807	Ashbrook Aquabelt (Energenics)	Energenecs	x1.3 installed x1.05 Mech/Elect/I&C/Civil
\$57,330	2005	9231	1.08 1.08 1.08		Wemco Hidrostal 500 gpm at 75' TDH, w/VFDs for adjustable speed. 20 HP motors.	Ley & Associates	Ley & Assoc. quote for 400 gpm at 60', x2 for vfd, x1.4 for large flow/pressure, x1.3 installed x1.05 Mech/Elect/I&C/Civi
\$40,950	2005	9231	1.08		200 gpm@40'TDH, w/VFDs	Moyno or Netszch	x1.3 installed x1.05 Mech/Elect/I&C/Civil
\$68,250	2005	9231	1.08	\$73,936	250 gpm @ 140 TDH	Moyno or Netszch	Ley & Assoc. quote x2 for vld x1.3 installed x1.05 Mech/Elect/I&C/Civil



TABLE 9D-1 SHEET 8 OF 11 SCREENING ALTERNATIVE 1A -MAINTAIN EXISTING MILOGRANITE® AND AGRI-LIFE® PROGRAMS (NEW TURBINES)
2020 TREATMENT REPORT

BIOSOLIDS ALTERNATIVE EVALUATIONS

NEW DEWATERED CAKE STORAGE CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$3,280,000 **Unit Cost** SUBTOTAL DESCRIPTION Quantity Units (\$) (\$) **DIVISION 2: SITEWORK** Additional Covered Cake Storage Area 121,430 sf \$27 \$3,280,000 **Division 2 Subtotal** \$3,280,000

Actual	C	OST ADJU	STMENT	ADJUSTED			
Unit Cost (\$)	Cost Year	Index	Adjustment Factor	UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$25	2005	9231	1.08	\$27	Covered pad, 8 foot concrete push walls, 8 foot open	n wall above, metal building	WLM; for 127 days of stora



TABLE 9D-1 SHEET 9 OF 11 SCREENING ALTERNATIVE 1A -MAINTAIN EXISTING MILOGRANITE® AND **AGRI-LIFE® PROGRAMS (NEW TURBINES)**

BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) =

114,100

\$47,350,000 Total Annual O&M Cost =

Milorganite® Annual Operating & Maintenance Costs

% of biosolids to Milorganite® = 85% annual biosolids (dt/year) = 96,985

and a second factorial			
	Milorganite® A	llocations	Annual Cost
Item/Process	%	\$/dt	\$/yr
JIWWTP Thickening	6.7%	\$26.50	\$2,570,00
JIWWTP Dewatering/Drying	60.9%	\$241.40	\$23,412,00
JIWWTP Chaff Processing	4.8%	\$19.20	\$1,862,00
Milorganite Warehouse/Shipping	5.8%	\$23.00	\$2,231,00
JIWWTP Natural Gas & Electric Purchase	34.5%	\$136.70	\$13,258,00
Biosolids Marketing	17.8%	\$70.70	\$6,857,00
IPS Pipeline Sludge Transfer (includes SS energy)	0.6%	\$2.20	\$213,000
SSWWTP Digester Gas Credit/Replacement	-2.4%	-\$9.60	-\$931,000
SSWWTP Sludge Thickening (energy included)	1.5%	\$6.10	\$592,000
SSWWTP Digestion (energy included)	3.8%	\$14.90	\$1,445,00
Milorganite® Sales Revenue	-34.0%	-\$134.80	-\$13,074,000
SUBTOTAL	100%	\$396	\$38,435,156

Cake Agri-Life® Annual Operating Costs

% of biosolids to cake Agri-Life® = 15% annual biosolids (dt/year) = 17,115

	Agri-Life® All	Annual Cost	
Item/Process	%	\$/dt	\$/yr
SSWWTP Digester Gas Credit/Replacement	-8.0%	-\$41.70	-\$714,000
SSWWTP Sludge Thickening (energy included)	35.6%	\$185.50	\$3,170,000
SSWWTP Digestion (energy included)	7.0%	\$36.40	\$620,000
SSWWTP Dewatering (energy included)	39.4%	\$205.30	\$3,510,000
Transport To Ag/WEPCO	26.0%	\$135.10	\$2,310,000
SUBTOTAL	100%	\$521	\$8,910,069

Glass Furnace Annual Operating Costs

% of biosolids to glass furnace = 0%

	Minergy Allo	cations	Annual Cost
Item/Process	%	\$/dt	S/yr
JIWWTP Thickening	6.1%	\$26.50	\$0
JIWWTP Dewatering/Drying	55.7%	\$241.40	\$0
JIWWTP Electric Purchase	21.6%	\$93.50	\$0
JIWWTP Natural Gas Purchase	0.3%	\$1.10	\$0
IPS Pipeline Sludge Transfer (includes SS energy)	0.6%	\$2.50	\$0
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0
SSWWTP Sludge Thickening (energy included)	1.6%	\$7.00	\$0
SSWWTP Digestion (energy included)	4.0%	\$17.20	\$0
Glass Aggregate Sales Revenue	-0.4%	-\$1.80	\$0
Glass Furnace Annual Operating Costs	10.6%	\$45.80	\$0
SUBTOTAL	100%	\$433	\$0

from Geoff Hurtado's estimate - 2004, Solids Cost 2004 UWSactual XLS, (ENR = 8620) unless otherwise specified

\$42.32 2005 9231

\$45.84

8,295,455

Milorganite® Annual Operating & Maintenance Costs

Total Milorganite® 2004 tons =	56,040					
	Hurtado	2004	Cost	ENR	2020	2004
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost
JIWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49	2,214,536
JIWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41	20,182,520
JIWWTP Chaff Processing	\$928,541	\$16.57	2004	8620	\$19.22	1,606,969
Milorganite® Warehouse/Shipping	\$1,108,821	\$19.79	2004	8620	\$22.95	1,918,969
JIWWTP Natural Gas & Electric Purchase*	\$6,602,327	\$117.81	2004	8620	\$136.68	11,426,243 multiplied by 0.7 to account for new turbine efficiency
Biosolids Marketing		\$60.93	2004	8620	\$70.69	5,909,524 based on tons sold, not tons produced
IPS Pipeline Sludge Transfer	\$104,631	\$1.87	2004	8620	\$2.17	181,078
SSWWTP Digester Gas Credit/Replacement		-\$9.64	2007	10000	-\$9.64	-935,296 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) / prop. biosolids
SSWWTP Sludge Thickening	\$292,305	\$5.22	2004	8620	\$6.05	505,875
SSWWTP Digestion	\$718,116	\$12.81	2004	8620	\$14.87	1,242,799
Milorganite Sales Revenue		-\$116.21	2004	8620	-\$134.81	-11,270,627
						32,982,589

*changes depending on turbine existance at JI Cake Agri-Life® Annual Operating Costs

Canc	AMIL	-LIIC	-	iuai c	Dera	cirica	003t
	That peak	THE PARTY OF	-	Section Water	SCHOOL STATE	245000	

Total cake Agri-Life® 2004 tons =	2168					
	Hurtado		Cost	ENR	2020	2004
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost
SSWWTP Digester Gas Credit/Replacement	ALLEGO TO THE STATE OF THE STAT	-\$41.69	2007	10000	-\$41.69	-713,609 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46	2,736,138
SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39	536,838
SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205.33	3,029,220
Polymer & Lime Filter Cake To Ag/WEPCO		\$116.46	2004	8620	\$135.11	1,993,259 based on tons transported, not tons produced

0 10 employees & 6% of capital costs; from Biosolids Alternative Sizing Worksheets r4.xls by WLM

Glass Furnace Annual Operating Costs

Minergy Process

Total biosolids 2004 =	62,873						
Total Milorganite® 2004 tons =	56,040						
	Hurtado	2004	Cost	ENR	2020	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cos	st .
JIWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49		0
JIWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41		0
JIWWTP Electric Purchase	0442707.53492	\$93.50	2007	10000	\$93.50		0 Energy Evaluation 09.11.06.xls
JIWWTP Natural Gas Purchase		\$1.08	2007	10000	\$1.08		0 from PWC 9/05 meeting notes (Biosolids Evaluation Summary 090105.ppt)
IPS Pipeline Sludge Transfer	\$134,469	\$2.14	2004	8620	\$2.48		0 SS IPS part of cost multiplied by total digested solids/digested solids to milo (in 2004)
SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00		0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$379,562	\$6.04	2004	8620	\$7.00		0
SSWWTP Digestion	\$932,484	\$14.83	2004	8620	\$17.21		0
Minergy Sales Revenue		-\$1.58	2004	8620	-\$1.83		0 \$2/ton finished from PWC 9/05 meeting notes (Biosolids Evaluation Summary 090105.ppt)



TABLE 9D-1 SHEET 10 OF 11 **SCREENING ALTERNATIVE 1A – EXISTING MILORGANITE® AND AGRI-LIFE® PROGRAMS (NEW TURBINES)**

BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) =

Cake Trucking & Landfilling

114,100 Total Annual O&M Cost = \$47,350,000

\$104.70 \$589

Landfill Annual Operating & Maintenance Costs

% of biosolids to landfill = 0%

annual biosolids (dt/year) = 0 Milorganite® Allocations Annual Cost \$/dt JIWWTP Electric Purchase \$57.00 IPS Pipeline Sludge Transfer 0.0% \$0.20 SSWWTP Digester Gas Credit/Replacement 0.0% \$0.00 SSWWTP Sludge Thickening (energy included) 31.5% \$185.50 SSWWTP Dewatering (energy included) 34.8% \$205.30 SSWWTP Digestion (energy included) 6.2% \$36.40

17.8%

100%

Land Application Annual Operating & Maintenance Costs

% of biosolids to land application = 0% annual biosolids (dt/year) = 0

Milorganite® Allocations Annual Cost \$/dt JIWWTP Electric Purchase 9.2% \$57.00 IPS Pipeline Sludge Transfer 0.0% \$0.20 SSWWTP Digester Gas Credit/Replacement 0.0% SSWWTP Sludge Thickening (energy included) 29.8% \$185.50 SSWWTP Dewatering (energy included) 33.0% \$205.30 SSWWTP Digestion (energy included) 5.9% \$36.40 22.1% Polymer & Lime Filter Cake To Ag/WEPCO \$137.30 SUBTOTAL

Incineration Annual Operating & Maintenance Costs

% of biosolids to Milorganite® = 0%

annual biosolids (dt/year) = 0 Annual Cost Milorganite® Allocations S/dt JIWWTP Thickening 23.3% JIWWTP Dewatering JIWWTP Electric Purchase 28.1% \$80.90 IPS Pipeline Sludge Transfer (includes SS energy) \$0 0.5% \$1.40 \$40.50 Incineration Facility Labor 14.1% Incineration Facility Maintenance/Repair/Replace 9.4% \$27.10 Incineration Facility Chemicals and Other Costs 0.8% \$2.40 Ash Transport 0.5% \$1.40 \$0 Ash Landfill 2.9% \$8.40 SSWWTP Digester Gas Credit/Replacement 0.0% \$0.00 SUBTOTAL

from Geoff Hurtado's estimate - 2004, Solids Cost 2004 UWSactual .XLS, (ENR = 8620) unless otherwise specified

2004 Cost

Hurtado

Landfill Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873

Total cake Agri-Life® 2004 tons = 2168

Hurtado

	Hurtado		Cost	ENR	2020	2004
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	n Process Cost
JIWWTP Electrical Purchase		\$57	2007	10000	\$56.97	97 0 Energy Evaluation 09.11.06.xls
IPS Pipeline Sludge Transfer	\$9.352	\$0.15	2004	8620	\$0.17	17 0 JI IPS cost x2 to account for WAS transfer and divided by total 2004 biosolids production
SSWWTP Digester Gas Credit/Replacement		- \$0.00	2007	10000	\$0.00	00 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s') x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46	46 0
SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205.33	33 0
SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39	39 0
Cake Trucking & Landfilling		\$96.61	2005	9231	\$104.66	66 0 Waste Management quote *247/313 (to discount for solids lost in digestion)

Land Application Annual Operating & Maintenance Costs

Total biosolids 2004 = 62.873

Total cake Agri-Life® 2004 tons = 2168

Hurtado

- 11	JIVVVI P Electrical Purchase		201	2007	10000	\$30.97	G Energy Evaluation 09.11.06.xis
ı	IPS Pipeline Sludge Transfer	\$9,352	\$0.15	2004	8620	\$0.17	0 JI IPS cost x2 to account for WAS transfer and divided by total 2004 biosolids production
Ш	SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00	0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
Ш	SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46	0
Ш	SSWWTP Dewatering	\$383.719	\$176.99	2004	8620	\$205.33	0
ı	SSWWTP Digestion	\$68.003	\$31.37	2004	8620	\$36.39	0
Ш	Polymer & Lime Filter Cake To Ag/WEPCO	-	\$118.37	2004	8620	\$137.32	0 from Biosolids Alternative Sizing Worksheets r4 xls by WLM, *247/313 to account for solids lost in digestion

2004

2020

2020

Index Process Cost/ton Process Cost

Cost ENR

Cost ENR

Process Cost/ton Year

Incineration Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873

Total Milorganite® 2004 tons = 56,040

Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost
JIWWTP Thickening	\$1,279,606	\$57.87	2004	8620	\$67.13	0 *313/247 (raw total/digested total) to account for PSD instead of digested sludge, 1.5 because only half of the sludge is currently thickened (AES)
JIWWTP Dewatering	\$2,222,754	\$50.26	2004	8620	\$58.31	0 *BFP number used *313/247 (raw total/digested total) to account for PSD instead of digested sludge per PWC; centrifuges will cost at least as much as BFP
JIWWTP Electrical Purchase		\$81	2007	10000	\$80.93	0 Energy Evaluation 09.11.06.xls
IPS Pipeline Sludge Transfer	\$76,401	\$1.22	2004	8620	\$1.41	0 JI cost removed: SS IPS part of cost multiplied by (solids to digestion-PSD from JI)/digested solids to millo (in 2004)
Incineration Facility Labor		\$34.94	2004	8620	\$40.53	0 43 employes at \$75,000/yr for 92,300 tons/year (Incineration Evaluation.x/s)
Incineration Facility Maintenance/Repair/Replace	6	\$23.34	2004	8620	\$27.07	0 6% of equipment costs which are assumed to be 25% of capital cost (Incineration Evaluation.xls); does not account for operation of centrifuges; per PWC
Incineration Facility Chemicals and Other Costs		\$2.07	2004	8620	\$2.40	0 Incineration Evaluation.xls
Fly Ash Transport	-	\$1.38	2006	9700	\$1.42	0 WM quote for 20YD dump truck, assuming 20 min. for loading *72/313 to account for solids lost in incineration (assuming same loss of solids as with Minergy)
Fly Ash Landfill	3	\$8.17	2006	9700	\$8.42	0 WM quote - \$35/ton landfill, \$0.5/ton taxes *72/313 to account for solids lost in incineration (assuming same loss of solids as with Minergy)
SSWWTP Digester Gas Credit/Replacement	2	\$0.00	2007	10000	\$0.00	0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids



TABLE 9D-1 SHEET 11 OF 11

SCREENING ALTERNATIVE 1A –

EXISTING MILORGANITE® AND AGRI-LIFE®

PROGRAMS (NEW TURBINES)

BIOSOLIDS ALTERNATIVE EVALUATIONS

COST ESTIMATE SUMMARY

General Description

This alternative involves continuing MMSD's current biosolids program with a few minor improvements. JIWWTP primary sludge is pumped to SSWWTP and is thickened and anaerobically digested along with all SSWWTP primary sludge and some SSWWTP WAS. Most of the SSWWTP WAS and digested sludge are pumped to JIWWTP and thickened with JIWWTP WAS. The JIWWTP thickened sludge, along with some JIWWTP primary sludge, is dewatered and dried to produce Milorganite®, which is distributed and sold as a commercial fertilizer.

A portion of the SSWWTP digested sludge is thickened and dewatered to produce Agri-Life® as a dewatered cake product for land application. The alternative assumes that the existing thickening centrifuges at SSWWTP will be replaced with gravity belt thickeners and that two of the SSWWTP sludge storage tanks are converted to primary digesters, resulting in 8 anaerobic digesters operating at SSWWTP.

In addition, it assumes that the JIWWTP Dewatering & Drying facility will undergo major equipment repair/replacement in 10 years and that the JIWWTP turbine powerhouse will be replaced with upgraded electrical service.

The alternative assumes that 85% of MMSD biosolids go to Milorganite® and 15% go to Agri-Life®.

Biosolids Distribution				
	85%	Milorganite®	15%	Dewatered Cake Agri-Life®
	0%	Glass Furnace	0%	Landfill
	0%	Incineration	0%	Land Application

ENR Index = 10000 (assumed Milwaukee 2007)

Summary of Capital Costs			
Estimated Construction Cost Without Contingency or Markup		\$106,730,000	
Contingency	25%	\$26,680,000	
Estimated Construction Cost Without Markup			\$133,410,000
Contractor OH&M/Engineering		30%	\$40,020,000
Total Capital Cost			\$173,430,000

Summary of Operation & Maintenance Costs

Total Annual Cost \$52,350,000

Life Cycle Analysis

 Interest Rate Per Year
 5.125%

 Number of Years
 20

 Present Worth Factor
 12.331

Present Worth of Total Operation & Maintenance Cost \$645,540,000

Total Present Worth \$819,000,000



TABLE 9D-2 SHEET 1 OF 11

SCREENING ALTERNATIVE 1B – MAINTAIN EXISTING MILOGRANITE® AND AGRI-LIFE® PROGRAMS (ABANDON TURBINES)

2020 TREATMENT REPORT

6/2/07

BIOSOLIDS ALTERNATIVE EVALUATIONS

CAPITAL COST ESTIMATE SUMMARY

Subprojects		Capital Cost (\$)
(list subprojects for which there is a Capital Cost Worksheet)		(link to total costs from Capital Cost Worksheets)
SSWWTP DIGESTER REHABILITATION		\$4,370,00
JIWWTP ELECTRICAL UPGRADES		\$25,570,00
D&D FACILITY CAPITAL UPGRADES IN 10 YEARS		\$50,500,00
NTERPLANT SLUDGE PIPELINE UPGRADES		\$1,380,00
NEW LOCOMOTIVE		\$1,290,00
SSWWTP GRAVITY BELT THICKENERS NEW DEWATERED CAKE STORAGE		\$2,550,00 \$3,280,00
Subtotal	\$88,940,000	
	Allowance %	Capital Cost (\$)
Allowance for Undesigned Details	20%	\$17,790,00



TABLE 9D-2 SHEET 2 OF 11

SCREENING ALTERNATIVE 1B —

MAINTAIN EXISTING MILOGRANITE® AND

AGRI-LIFE® PROGRAMS (ABANDON TURBINES)

2020 TREATMENT REPORT

BIOSOLIDS ALTERNATIVE EVALUATIONS

SSWWTP DIGESTER REHABILITATION CAPITAL COST

DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 11: EQUIPMENT				
New Digester Mixing Systems	8	each	\$491,000	\$3,930,000
New Digester Recirculation Pumps	4	each	\$16,000	\$60,000
Recirculating Sludge Heat Exchangers	2	each	\$44,000	\$90,000
Storage Digester Sludge Transfer Pumps	2	each	\$59,000	\$120,000
Digester Gas Safety Equipment	1	allowance	\$171,000	\$170,000
Division 11 Subtotal	\$4,370,000			

< it	nsert link to	this cost on the	Capital Cost	Summary	Worksheet
------	---------------	------------------	--------------	---------	-----------

00	< insert link to	this cost	on the Capi	tal Cost Summary	Worksheet			
Actual		ctual COST ADJUSTMENT ADJUSTED		ADJUSTED				
	Unit Cost	Cost	ENR	Adjustment	UNIT COST			
- 22	(\$)	Year	Index	Factor	(\$)	ITEM	MANUFACTURER	COMMENTS
00	\$453,180	2005	9231	1.08	\$490.933	External Draft Tube Mixers for 110' diameter	Eimco (Energenics) +30% for install	WLM: 4 mixers/tank; Inflico Degremont (IDI) makes cannon bubble mixers x1.05 Mech/Elect/I&C/Civil
00	\$14,333	2005	9231	1.08	\$15,526	Wemco Hidrostal, 10 HP motors, 250 gpm @ 60' TDH	Ley & Associates +30% for install	WLM: thermo digester pumps assumed the same for meso x1.05 Mech/Elect/\&C/Civil
00	\$40,950	2005	9231	1.08	\$44,361	Sludge-Hot Water Systems	Alfa Laval +30% for install	WLM; provide supplemental heating on recirc line x1.05 Mech/Elect/I&C/Civil
00	\$54,600	2005	9231	1.08	\$59,149	Wemco Hidrostal, 30 HP motors, VFD, 1200 gpm @ 60' TDH	Ley & Associates +250% for VFD +30% for install	WLM; x1.05 Mech/Elect/I&C/Civil
00	\$157,500	2005	9231	1,08	\$170,621	TBD	TBD	WLM; x1.05 Mech/Elect/l&C/Civil



TABLE 9D-2 SHEET 3 OF 11 SCREENING ALTERNATIVE 1B -MAINTAIN EXISTING MILOGRANITE® AND AGRI-LIFE® PROGRAMS (ABANDON TURBINES)
2020 TREATMENT REPORT
6/2/07 TR_9B.T002.07.06.02.cdr

BIOSOLIDS ALTERNATIVE EVALUATIONS

JIWWTP ELECTRICAL UPGRADES CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$25,570,000

DESCRIPTION DIVISION 13: SPECIAL CONSTRUCTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
Powerhouse and Electrical Feed Upgrades	1	each	\$25,566,030	\$25,570,000

< insert link t	o this cost	on the Cap	ital Cost Summar	y Worksheet		
Actual	C	OST ADJU	STMENT	ADJUSTED		
Unit Cost	Cost	ENR	Adjustment	UNIT COST		
(\$)	Year	Index	Factor	(\$)	ITEM	MANUFACTU

(\$) Year Index Factor (\$) ITEM MANUFACTURER COMMENTS

\$23,600,000 2005 9231 1.08 \$25,566,028 electrical supply upgrade Lou Germanotta estimate



TABLE 9D-2 SHEET 4 OF 11

SCREENING ALTERNATIVE 1B —

MAINTAIN EXISTING MILOGRANITE® AND

AGRI-LIFE® PROGRAMS (ABANDON TURBINES)

2020 TREATMENT REPORT

BIOSOLIDS ALTERNATIVE EVALUATIONS

D&D FACILITY UPGRADES CAPITOL COST

Total Capital Cost (all divisions, without contingency or markup) = \$50,500,000 **Unit Cost** SUBTOTAL DESCRIPTION Quantity Units (\$) (\$) **DIVISION 13: SPECIAL CONSTRUCTION** Unit Process 24 Upgrade each \$7,938,000 \$7,940,000 Unit Process 25 Upgrade each \$17,423,000 \$17,420,000 Unit Process 27 Upgrade \$4,582,000 \$4,580,000 each Unit Process 29 Upgrade \$12,629,000 \$12,630,000 each Unit Process 30 Upgrade \$1,278,000 \$1,280,000 each Unit Process 31 Upgrade \$747,000 \$750,000 each Unit Process 32 Upgrade \$2,809,000 each \$2,810,000 Miscellaneous Costs (drop chutes, etc.) \$3,093,000 \$3,090,000 each

\$50,500,000

Division 13 Subtotal

---- insert link to this cost on the Capital Cost Summary Worksheet

Actual	C	OST ADJU	STMENT	ADJUSTED			
Unit Cost (\$)	Cost Year	ENR Index	Adjustment Factor	UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$7,700,000	2006	9700	1.03	\$7,938,144			NPB
\$16,900,000	2006	9700	1.03	\$17,422,680			NPB
\$4,445,000	2006	9700	1.03	\$4,582,474			NPB
\$12,250,000	2006	9700	1.03	\$12,628,866			NPB
\$1,240,000	2006	9700	1.03	\$1,278,351			NPB
\$725,000	2006	9700	1.03	\$747,423			NPB
\$2,725,000	2006	9700	1.03	\$2,809,278			NPB
\$3,000,000	2006	9700	1.03	\$3,092,784			NPB



TABLE 9D-2 SHEET 3 OF 11

SCREENING ALTERNATIVE 1B —

MAINTAIN EXISTING MILOGRANITE® AND

AGRI-LIFE® PROGRAMS (ABANDON TURBINES)

2020 TREATMENT REPORT

BIOSOLIDS ALTERNATIVE EVALUATIONS

INTERPLANT SLUDGE PIPELINE UPGRADES CAPITOL COSTS

Total Capital Cost (all divisions, without contingency or markup) = \$1,380,000

DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 11: EQUIPMENT				
JIWWTP and SSWWTP Pumps	12	each	\$93,000	\$1,120,000
Divisi	on 11 Subtotal \$1,120,000			
Pipeline Cathodic Protection	1	allowance	\$258,000	\$260,000
Divisi	on 16 Subtotal \$260,000			

Actual	C	OST ADJU		ADJUSTED			
Unit Cost (\$)	Year_	ENR Index	Adjustment Factor	UNIT COST(\$)	ITEM	MANUFACTURER	COMMENTS
\$90,000	2006	9700	1.03	\$92,784	pump, motor, etc. rated for 300 psi +5000 for install	TBD	quote from Mickey at RDM
\$250,000	2006	9700	1.03	\$257,732	TBD	TBD	PWC

--- insert link to this cost on the Capital Cost Summary Worksheet



TABLE 9D-2 SHEET 6 OF 11

SCREENING ALTERNATIVE 1B —

MAINTAIN EXISTING MILOGRANITE® AND

AGRI-LIFE® PROGRAMS (ABANDON TURBINES)

2020 TREATMENT REPORT

BIOSOLIDS ALTERNATIVE EVALUATIONS

NEW LOCOMOTIVE CAPITOL COSTS

Total Capital Cost (all divisions, without contingency or markup) = \$1,290,000

DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 11: EQUIPMENT				
New Locomotive	1	each	\$1,289,000	\$1,290,000
Division 11 Subtotal	\$1,290,000			



Actual		OST ADJUS	STMENT	ADJUSTED			
Unit Cost	Cost	ENR	Adjustment	UNIT COST			
(\$)	Year	Index	Factor	(\$)	ITEM	MANUFACTURER	COMMENTS
\$1,250,000	2006	9700	1.03	\$1,288,660	TBD	TBD	AES



TABLE 9D-2 SHEET 7 OF 11

SCREENING ALTERNATIVE 1B —

MAINTAIN EXISTING MILOGRANITE® AND

AGRI-LIFE® PROGRAMS (ABANDON TURBINES)

2020 TREATMENT REPORT

2020 TREATMENT REPORT 6/2/07

TR_9B.T002.07.06.02.cdr

BIOSOLIDS ALTERNATIVE EVALUATIONS

NEW SSWWTP GRAVITY BELT THICKENERS CAPITAL COST

Total Capital Co	Total Capital Cost (all divisions, without contingency or markup) =									
DESCRIPTION	Quantity Units		Unit Cost (\$)	SUBTOTAL (\$)						
DIVISION 11: EQUIPMENT										
2 meter Gravity Belt Thickener	7	each	\$222,000	\$1,550,000						
500 gpm Gravity Belt Thickner Feed Pumps	7	each	\$62,000	\$430,000						
Progressing Cavity Gravity Belt Thickner Polymer Feed Pumps	3	each	\$44,000	\$130,000						
Progressing Cavity Thickened Sludge Transfer Pumps	6	each	\$74,000	\$440,000						
Division 11 Subtotal	\$2,550,000									

Jnit Cost Co				ADJUSTED			
The state of the s	Cost	ENR	Adjustment	UNIT COST			
(\$) Ye	Year	Index	Factor	(\$)	ITEM	MANUFACTURER	COMMENTS
\$204,750 20	2005	9231	1.08	\$221,807	Ashbrook Aquabelt (Energenics)	Energenecs	x1.3 installed x1.05 Mech/Elect/I&C/Civil
\$57,330 20	2005	9231	1.08	\$62,106	Wemco Hidrostal 500 gpm at 75' TDH, w/VFDs for adjustable speed. 20 HP motors.	Ley & Associates	Ley & Assoc. quote for 400 gpm at 60', x2 for vfd, x1.4 for large flow/pressure, x1.3 installed x1.05 Mech/Elect/I&C/Civil
	2005	9231	1.08	\$44,361	200 gpm@40'TDH, w/VFDs	Moyno or Netszch	x1.3 installed x1.05 Mech/Elect/I&C/Civil
\$68,250 20	2005	9231	1.08	\$73,936	250 gpm @ 140' TDH	Moyno or Netszch	Ley & Assoc. quote x2 for vfd x1.3 installed x1.05 Mech/Elect/I&C/Civil



TABLE 9D-2 SHEET 8 OF 11 SCREENING ALTERNATIVE 1B -MAINTAIN EXISTING MILOGRANITE® AND AGRI-LIFE® PROGRAMS (ABANDON TURBINES)
2020 TREATMENT REPORT

6/2/07

BIOSOLIDS ALTERNATIVE EVALUATIONS

NEW DEWATERED CAKE STORAGE CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$3,280,000

				AMERICAN SOCIAL SECTION
DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 2: SITEWORK				
Additional Covered Cake Storage Area	121,430	sf	\$27	\$3,280,000
Purity an Italy	40.000.000			
Division 2 Subtotal	\$3,280,000			

Actual Unit Cost		on the Capit COST ADJU: ENR	Charles and the second of the	Worksheet ADJUSTED UNIT COST			
(\$)	Year	Index	Factor	(\$)	ITEM	MANUFACTURER	COMMENTS
\$25	2005	9231	1.08	\$27	Covered pad, 8 foot concrete push walls, 8 foot open	wall above, metal building	WLM; for 127 days of storag
							5



TABLE 9D-2 SHEET 9 OF 11 SCREENING ALTERNATIVE 1B -MAINTAIN EXISTING MILOGRANITE® AND AGRI-LIFE® PROGRAMS (ABANDON TURBINES)
2020 TREATMENT REPORT

BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) =

Total Annual O&M Cost = \$52,350,000

Milorganite® Annual Operating & Maintenance Costs

% of biosolids to Milorganite® = 85%

annual biosolids (dt/year) =	96,985		
	Milorganite® A	Annual Cost	
Item/Process	%	\$/dt	S/yr
JIWWTP Thickening	5.9%	\$26.50	\$2,570,000
JIWWTP Dewatering/Drying	53.9%	\$241.40	\$23,412,000
JIWWTP Chaff Processing	4.3%	\$19.20	\$1,862,000
Milorganite® Warehouse/Shipping	5.1%	\$23.00	\$2,231,000
JIWWTP Natural Gas & Electric Purchase	42.0%	\$188.30	\$18,262,000
Biosolids Marketing	15.8%	\$70.70	\$6,857,000
IPS Pipeline Sludge Transfer (includes SS energy)	0.5%	\$2.20	\$213,000
SSWWTP Digester Gas Credit/Replacement	-2.1%	-\$9,60	-\$931,000
SSWWTP Sludge Thickening (energy included)	1.4%	\$6.10	\$592,000
SSWWTP Digestion (energy included)	3.3%	\$14.90	\$1,445,000
Milorganite® Sales Revenue	-30.1%	-\$134.80	-\$13,074,000
SUBTOTAL	100%	\$448	\$43,439,582

Cake Agri-Life® Annual Operating Costs

% of biosolids to cake Agri-Life® = 15% annual biosolids (dt/year) = 17,115

	Agri-Life® All	locations	Annual Cost		
Item/Process	%	S/dt	\$/yr		
SSWWTP Digester Gas Credit/Replacement	-8.0%	-\$41.70	-\$714,000		
SSWWTP Sludge Thickening (energy included)	35.6%	\$185.50	\$3,170,000		
SSWWTP Digestion (energy included)	7.0%	\$36.40	\$620,000		
SSWWTP Dewatering (energy included)	39.4%	\$205.30	\$3,510,000		
Transport To Ag/WEPCO	26.0%	\$135.10	\$2,310,000		
SUBTOTAL	100%	\$521	\$8,910,069		

Glass Furnace Annual Operating Costs

% of biosolids to glass furnace =	0%		
annual biosolids (dt/year) =	0		
And described and Control of the Con	Minergy Allo	cations	Annual Cost
Item/Process	%	\$/dt	\$/yr
JIWWTP Thickening	6.1%	\$26.50	\$0
JIWWTP Dewatering/Drying	55.7%	\$241.40	\$0
JIWWTP Electric Purchase	21.6%	\$93.50	\$0
JIWWTP Natural Gas Purchase	0.3%	\$1.10	\$0
IPS Pipeline Sludge Transfer (includes SS energy)	0.6%	\$2.50	\$0
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0
SSWWTP Sludge Thickening (energy included)	1.6%	\$7.00	\$0
SSWWTP Digestion (energy included)	4.0%	\$17.20	\$0
Glass Aggregate Sales Revenue	-0.4%	-\$1.80	\$0
Glass Furnace Annual Operating Costs	10.6%	\$45.80	\$0
SUBTOTAL	L 100%	\$433	\$0

from Geoff Hurtado's estimate - 2004, Solids Cost 2004 UWSactual XLS, (ENR = 8620) unless otherwise specified

Milorganite® Annual Operating & Maintenance Costs

Total Milorganite® 2004 tons =	56,040	i.				
	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost
JIWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49	2,214,536
JIWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241,41	20,182,520
JIWWTP Chaff Processing	\$928,541	\$16.57	2004	8620	\$19.22	1,606,969
Milorganite Warehouse/Shipping	\$1,108,821	\$19.79	2004	8620	\$22.95	1,918,969
JIWWTP Natural Gas & Electric Purchase*	14	\$188.32	2007	10000	\$188.32	18,264,536 Energy Evaluation 09.11.06.xls
Biosolids Marketing	I control vol.	\$60.93	2004	8620	\$70.69	5,909,524 based on tons sold, not tons produced
IPS Pipeline Sludge Transfer	\$104,631	\$1.87	2004	8620	\$2.17	181,078
SSWWTP Digester Gas Credit/Replacement		-\$9.64	2007	10000	-\$9.64	-935,296 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$292,305	\$5.22	2004	8620	\$6.05	505,875
SSWWTP Digestion	\$718,116	\$12.81	2004	8620	\$14.87	1,242,799
Milorganite® Sales Revenue		-\$116.21	2004	8620	-\$134.81	-11,270,627
						39,820,882

*changes depending on turbine existance at JI

Cake Agri-Life® Annual Operating Costs

Total cake Agri-Life® 2004 tons =	2168					
900	Hurtado		Cost	ENR	2020 (6/2007)	2004
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost
SSWWTP Digester Gas Credit/Replacement	5.7	-\$41.69	2007	10000	-\$41.69	-713,609 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46	2,736,138
SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39	536,838
SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205.33	3,029,220
Polymer & Lime Filter Cake To Ag/WEPCO	1	\$116.46	2004	8620	\$135.11	1,993,259 based on tons transported, not tons produced

Glass Furnace Annual Operating Costs

Total biosolids 2004 =	62,873					
Total Milorganite® 2004 tons =	56,040					
12-MY VIOLENCE PROPERTY VIOLENCE OF STATE OF STA	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost
JIWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49	0
JIWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41	0
JIWWTP Electric Purchase	and the same	\$93.50	2007	10000	\$93.50	0 Energy Evaluation 09.11.06.xls
JIWWTP Natural Gas Purchase		\$1,08	2007	10000	\$1.08	0 from PWC 9/05 meeting notes (Biosolids Evaluation Summary 090105.ppt)
IPS Pipeline Sludge Transfer	\$134,469	\$2.14	2004	8620	\$2.48	0 SS IPS part of cost multiplied by total digested solids/digested solids to milo (in 2004)
SSWWTP Digester Gas Credit/Replacement	1.0	\$0.00	2007	10000	\$0.00	0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.xls) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$379,562	\$6.04	2004	8620	\$7.00	0
SSWWTP Digestion	\$932,484	\$14.83	2004	8620	\$17.21	0
Minergy Sales Revenue		-\$1.58	2004	8620	-\$1.83	0 \$2/ton finished from PWC 9/05 meeting notes (Biosolids Evaluation Summary 090105.ppt)
Minergy Process		\$42.32	2005	9231	\$45.84	0 10 employees & 6% of capital costs; from Biosolids Alternative Sizing Worksheets r4.xls by WLM



BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) =

Total Annual O&M Cost = \$52,350,000

Landfill Annual Operating & Maintenance Costs

% of biosolids to landfill = 0% annual biosolids (dt/year) = 0

	Milorganite Al	locations	Annual Cost
Item/Process	%	\$/dt	\$/yr
JIWWTP Electric Purchase	9.7%	\$57.00	\$
IPS Pipeline Sludge Transfer	0.0%	\$0.20	\$
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$
SSWWTP Sludge Thickening (energy included)	31.5%	\$185.50	\$
SSWWTP Dewatering (energy included)	34.8%	\$205.30	\$
SSWWTP Digestion (energy included)	6.2%	\$36.40	\$
Cake Trucking & Landfilling	17.8%	\$104.70	\$
SURTOTAL	100%	\$589	

Land Application Annual Operating & Maintenance Costs

% of biosolids to land application = 0% annual biosolids (dt/year) = 0

Annual Cost Item/Process

JIWWTP Electric Purchase
IPS Pipeline Sludge Transfer \$/dt 9.2% \$57.00 0.0% \$0.20 SSWWTP Digester Gas Credit/Replacement SSWWTP Sludge Thickening (energy included) 29.8% \$185.50 SSWWTP Dewatering (energy included) 33.0% \$205.30 SSWWTP Digestion (energy included) 5.9% \$36.40 Polymer & Lime Filter Cake To Ag/WEPCO \$137.30 SUBTOTAL 100% \$622

Incineration Annual Operating & Maintenance Costs

% of biosolids to Milorganite® = 0%

annual biosolids (dt/year) = 0			
	Milorganite@ A	llocations	Annual Cost
Item/Process	%	\$/dt	S/yr
JIWWTP Thickening	23.3%	\$67.10	\$0
JIWWTP Dewatering	20.3%	\$58.30	\$0
JIWWTP Electric Purchase	28.1%	\$80.90	\$0
IPS Pipeline Sludge Transfer (includes SS energy)	0.5%	\$1.40	\$0
Incineration Facility Labor	14.1%	\$40.50	\$0
Incineration Facility Maintenance/Repair/Replace	9.4%	\$27.10	\$0
Incineration Facility Chemicals and Other Costs	0.8%	\$2.40	\$0
Ash Transport	0.5%	\$1.40	\$0
Ash Landfill	2.9%	\$8.40	\$0
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0
SUBTOTAL	100%	\$288	\$0

from Geoff Hurtado's estimate - 2004, Solids Cost 2004 UWSactual XLS, (ENR = 8620) unless otherwise specified

Landfill Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873 Total cake Agri-Life® 2004 tons = 2168

	Hurtado		Cost	ENK	2020 (5/2007)	2004
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	ton Process Cost
JIWWTP Electrical Purchase		\$57	2007	10000	\$56.97	3.97 0 Energy Evaluation 09.11.06.x/s
IPS Pipeline Sludge Transfer	\$9,352	\$0.15	2004	8620	\$0.17	0.17 0 JI IPS cost x2 to account for WAS transfer and divided by total 2004 biosolids production
SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00	0.00 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) / prop. biosolids
SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46	5.46 0
SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205.33	5.33 0
SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39	3.39 0
Cake Trucking & Landfilling		\$96.61	2005	9231	\$104.66	1.66 0 Waste Management quote *247/313 (to discount for solids lost in digestion)

Land Application Annual Operating & Maintenance Costs

Total biosolids 2004 = 62.873 Total cake Agri-Life® 2004 tons = 2168

- 1		Hurtado	2004	Cost	ENK	2020 (6/2007)	2004	
1	Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cos	at the state of th
	JIWWTP Electrical Purchase		\$57	2007	10000	\$56.97		0 Energy Evaluation 09.11.06 xls
	IPS Pipeline Sludge Transfer	\$9,352	\$0.15	2004	8620	\$0.17		0 JLIPS cost x2 to account for WAS transfer and divided by total 2004 biosolids production
	SSWWTP Digester Gas Credit/Replacement	-	\$0.00	2007	10000	\$0.00		0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
	SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46		0
	SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205.33		0
- 1	SSWWTP Digestion	\$68,003	\$31.37	2004	8620	536 39		0

0 from Biosolids Alternative Sizing Worksheets r4.xls by WLM, *247/313 to account for solids lost in digestion

Incineration Annual Operating & Maintenance Costs

Polymer & Lime Filter Cake To Ag/WEPCO

55 040

Total Milorganite® 2004 tons =	56,040						
The state of the s	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost	
JIWWTP Thickening	\$1,279,606	\$57.87	2004	8620	\$67.13	0	*313/247 (raw total/digested total) to account for PSD instead of digested sludge, /.5 because only half of the sludge is currently thickened (AES)
JIWWTP Dewatering	\$2,222,754	\$50.26	2004	8620	\$58.31	0	*BFP number used *313/247 (raw total/digested total) to account for PSD instead of digested sludge per PWC; centrifuges will cost at least as much as BFP
JIWWTP Electrical Purchase		\$81	2007	10000	\$80.93	0 8	Energy Evaluation 09.11.06 xls
IPS Pipeline Sludge Transfer	\$76,401	\$1.22	2004	8620	\$1.41	0.	JI cost removed; SS IPS part of cost multiplied by (solids to digestion-PSD from JI)/digested solids to milo (in 2004)
Incineration Facility Labor		\$34.94	2004	8620	\$40.53	0.4	43 employes at \$75,000/yr for 92,300 tons/year (Incineration Evaluation.xls)
Incineration Facility Maintenance/Repair/Replace		\$23.34	2004	8620	\$27.07	0.6	6% of equipment costs which are assumed to be 25% of capital cost (Incineration Evaluation.xls); does not account for operation of centrifuges; per PWC
Incineration Facility Chemicals and Other Costs		\$2.07	2004	8620	\$2.40	0 /	Incineration Evaluation xis
Fly Ash Transport	-	\$1.38	2006	9700	\$1.42	0 \	WM quote for 20YD dump truck, assuming 20 min. for loading *72/313 to account for solids lost in incineration (assuming same loss of solids as with Minergy)
Fly Ash Landfill	12	\$8.17	2006	9700	\$8.42	0 1	WM quote - \$35/ton landfill, \$0.5/ton taxes *72/313 to account for solids lost in incineration (assuming same loss of solids as with Minergy)
SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00	0 1	value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
ACTION OF THE PROPERTY OF THE						0	



TABLE 9D-2 SHEET 11 OF 11 **SCREENING ALTERNATIVE 1B – MAINTAIN EXISTING MILOGRANITE® AND AGRI-LIFE® PROGRAMS (ABANDON TURBINES)** 2020 TREATMENT REPORT

BIOSOLIDS ALTERNATIVE EVALUATIONS

COST ESTIMATE SUMMARY

General Description

This alternative involves sending JIWWTP primary sludge to SSWWTP, where it is thickened and digested along with SSWWTP primary sludge. SSWWTP WAS and digested sludge are pumped to JIWWTP, where they are thickened along with JIWWTP WAS. The thickened sludges are dewatered and dried at the JIWWTP Dewatering and Drying facility, and the dried solids are sent to the Glass Furnace Facility. Waste heat from the Glass Furnace Facility is used to dry the biosolids.

The alternative includes four new gravity belt thickeners at SSWWTP, and requires two of the existing sludge storage tanks be converted back to primary digesters, for a total of eight primary digesters.

The alternative assumes the JIWWTP Dewatering & Drying facility will undergo a major rehab in 10 years, and that the JIWWTP turbine facility is eliminated with electrical feed upgrades at JIWWTP to provide full redundancy.

The alternative assumes all biosolids are disposed of through the Glass Furnace facility.

Biosolids Distribution				
	0%	Milorganite	0%	Dewatered Cake Agrilife
	100%	Glass Furnace	0%	Landfill

00% Glass Furnace 0% Landfill 0% Incineration 0% Land Application

ENR Index = 10000 (assumed Milwaukee 2007)

Summary of Capital Costs

Estimated Construction Cost Without Contingency or Markup \$153,380,000

Contingency 25% \$38,350,000
Estimated Construction Cost Without Markup

Contractor OH&M/Engineering 30% \$57,520,000

Total Capital Cost \$249,250,000

Summary of Operation & Maintenance Costs

Total Annual Cost \$47,890,000

Life Cycle Analysis

 Interest Rate Per Year
 5.125%

 Number of Years
 20

 Present Worth Factor
 12.331

Present Worth of Total Operation & Maintenance Cost \$590,540,000

Total Present Worth \$840,000,000



TABLE 9D-3 SHEET 1 OF 10
SCREENING ALTERNATIVE 2 –
GLASS FURNACE TECHNOLOGY

\$191,730,000

BIOSOLIDS ALTERNATIVE EVALUATIONS

CAPITAL COST ESTIMATE SUMMARY

Subprojects			Capital Cost (\$)
(list subprojects for which there is a Capital Cost Workshee	t)		(link to total costs from Capital Cost
			Worksheets)
SWWTP DIGESTER REHABILITATION			\$4,370,00
WWTP ELECTRICAL UPGRADES			\$27,740,00
&D FACILITY CAPITAL UPGRADES IN 10 YEARS			\$50,500,00
NTERPLANT SLUDGE PIPELINE UPGRADES			\$1,380,00
LASS FURNACE FACILITY			\$42,260,00
SWWTP GRAVITY BELT THICKENERS			\$1,570,00
Subto	tal	\$127,820,000	
			Capital Cost
		Allowance %	(\$)
lowance for Undesigned Details		20%	\$25,560,00
stimate of Construction Cost Without Contingency or Markup			\$153,380,000



TABLE 9D-3 SHEET 2 OF 10
SCREENING ALTERNATIVE 2 –
GLASS FURNACE TECHNOLOGY

BIOSOLIDS ALTERNATIVE EVALUATIONS

SSWWTP DIGESTER REHABILITATION CAPITAL COST

ζ	insert	link	to	this	cost	on	the	Capital	Cost	Summary	Worksheet

\$14,333 2005 9231 1.08 \$15,526 Wemcc \$40,950 2005 9231 1.08 \$44,361 Sludge		TUFACTURER COMMENTS	
\$453.180 2005 9231 1.08 \$490.933 Externs \$14,333 2005 9231 1.08 \$15,526 Werncc \$40,950 2005 9231 1.08 \$44,361 Sludge	Average data and the Average	UFACTURER COMMENTS	
\$14,333 2005 9231 1.08 \$15,526 Wemcc \$40,950 2005 9231 1.08 \$44,361 Sludge	\$400.033 External Draft Tube Mixers for 110' dia		
\$40,950 2005 9231 1.08 \$44,361 Sludge		0% for install WLM: 4 mixers/tank; Infilico Degremont (IDI) makes cannon bubble mixers x1.05	5 Mech/Elect/I&C/Civil
	\$15,526 Wemco Hidrostal, 10 HP motors, 250 g	for install WLM; thermo digester pumps assumed the same for meso x1.05 Mech/Elect/l&	kC/Civil
\$54,600 2005 9231 1.08 \$59,149 Wemco	\$44,361 Sludge-Hot Water Systems	tall WLM; provide supplemental heating on recirc line x1.05 Mech/Elect/I&C/Civil	
	\$59,149 Wemco Hidrostal, 30 HP motors, VFD,	% for VFD +30% for install WLM; x1.05 Mech/Elect/I&C/Civil	
\$157,500 2005 9231 1.08 \$170,621 TBD	\$170,621 TBD	WLM; x1.05 Mech/Elect/I&C/Civil	
		al +30% for insta	al +30% for install WLM; provide supplemental heating on recirc line x1.05 Mech/Elect/1&C/Civil ws.sociates +250% for VFD +30% for install WLM; x1.05 Mech/Elect/1&C/Civil



BIOSOLIDS ALTERNATIVE EVALUATIONS

JIWWTP ELECTRICAL UPGRADES CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$27,740,000

DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 13: SPECIAL CONSTRUCTION Powerhouse and Electrical Feed Upgrades Electrical Feed to Oxygen Facility	1	each each	\$25,566,030 \$2,167,000	\$25,570,000 \$2,170,000

< insert link to this cost	on the Capital Cost	Summary Worksheet
----------------------------	---------------------	-------------------

Actual	C	OST ADJU	STMENT	ADJUSTED			
Unit Cost (\$)	Year	Index	Adjustment Factor	UNIT COST(\$)	ITEM	MANUFACTURER	COMMENTS
\$23,600,000 \$2,000,000	2005 2005	9231 9231	1.08 1.08	\$25,566,028 \$2,166,613	electrical supply upgrade		Lou Germanotta estimate WLM



BIOSOLIDS ALTERNATIVE EVALUATIONS

D&D FACILITY UPGRADES CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$50,500,000 **Unit Cost** SUBTOTAL DESCRIPTION Quantity Units (\$) (\$) **DIVISION 13: SPECIAL CONSTRUCTION** Unit Process 24 Upgrade each \$7,938,000 \$7,940,000 Unit Process 25 Upgrade each \$17,423,000 \$17,420,000 Unit Process 27 Upgrade each \$4,582,000 \$4,580,000 Unit Process 29 Upgrade \$12,629,000 \$12,630,000 each Unit Process 30 Upgrade \$1,278,000 \$1,280,000 each Unit Process 31 Upgrade \$747,000 \$750,000 each Unit Process 32 Upgrade each \$2,809,000 \$2,810,000 Miscellaneous Costs (drop chutes, etc.) \$3,093,000 \$3,090,000 each **Division 13 Subtotal** \$50,500,000

Actual	C	OST ADJU	STMENT	ADJUSTED			
Unit Cost	Cost	ENR	Adjustment	UNIT COST			
(\$)	Year_	Index	Factor	(\$)	_ITEM_	MANUFACTURER	COMMENTS
\$7,700,000	2006	9700	1.03	\$7,938,144			NPB
\$16,900,000	2006	9700	1.03	\$17,422,680			NPB
\$4,445,000	2006	9700	1.03	\$4,582,474			NPB
\$12,250,000	2006	9700	1.03	\$12,628,866			NPB
\$1,240,000	2006	9700	1.03	\$1,278,351			NPB
\$725,000	2006	9700	1.03	\$747,423			NPB
\$2,725,000	2006	9700	1.03	\$2,809,278			NPB
\$3,000,000	2006	9700	1.03	\$3,092,784			NPB



BIOSOLIDS ALTERNATIVE EVALUATIONS

INTERPLANT SLUDGE PIPELINE UPGRADES CAPITAL COSTS

Total Capital Cost (all divisions, without contingency or markup) = \$1,380,000

Unit Cost SUBTOTAL

DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)	
DIVISION 11: EQUIPMENT					
JIWWTP and SSWWTP Pumps	12	each	\$93,000	\$1,120,000	
Division 11 Subtot	al \$1,120,000				
Pipeline Cathodic Protection	1	allowance	\$258,000	\$260,000	
Division 16 Subto	al \$260,000				

Actual Init Cost (\$)	Cost Year	ENR Index	Adjustment Factor	ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$90,000	2006	9700	1.03	\$92,784	pump, motor, etc. rated for 300 psi +5000 for install	TBD	quote from Mickey at RDN
\$250,000	2006	9700	1.03	\$257,732	ТВО	TBD	PWC



BIOSOLIDS ALTERNATIVE EVALUATIONS

GLASS FURNACE FACILITY CAPITAL COSTS

Total Capital Cost (all divisions, without contingency or markup) = \$42,260,000

	Total Capital Co	st (all divisions	, without contin	igency or markup) =	\$42,260,000
DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)	
DIVISION 11: EQUIPMENT					
Glass Furnace Facility		1	each	\$42,255,000	\$42,260,000
	Division 11 Subtotal	\$42,260,000			

insert	link	to thi	s cost	on the	Canital	Cost S	Summary	Worksheet	

Actual	C	OST ADJU	STMENT	ADJUSTED			
Unit Cost	Cost	ENR	Adjustment	UNIT COST			
(\$)	Year	Index	Factor	(\$)	ITEM	MANUFACTURER	COMMENTS
\$40,987,013	2006	9700	1.03	\$42,254,653	Minergy Glass Pack Process Facility	Minergy (7/12/05 quote)	/1.225 engineering± /1.1 contingency x1.05 Mech/Elect/l&C/Civi



BIOSOLIDS ALTERNATIVE EVALUATIONS

NEW SSWWTP GRAVITY BELT THICKENERS CAPITAL COST

Actual Unit Cost	Cost	OST ADJU	Adjustment	UNIT COST			
(\$)	Year	Index	Factor	(\$)	ITEM	MANUFACTURER	
\$204,750	2005	9231	1.08	\$221,807	Ashbrook Aquabelt (Energenics)	Energenecs	x1.3 installed x1.05 Mech/Elect/I&C/Civil
\$57,330	2005	9231	1.08 1.08 1.08		Wemco Hidrostal 500 gpm at 75° TDH, w/VFDs for adjustable speed. 20 HP motors.	Ley & Associates	Ley & Assoc. quote for 400 gpm at 60', x2 for vfd, x1.4 for large flow/pressure, x1.3 installed x1.05 Mech/Elect/I&C/Civi
\$40,950	2005	9231 9231	1.08		200 gpm@40*TDH, w/VFDs	Moyno or Netszch	x1.3 installed x1.05 Mech/Elect/I&C/Civil
\$68,250	2005	9231	1.08	\$73,936	250 gpm @ 140' TDH	Moyno or Netszch	Ley & Assoc, quote x2 for vld x1.3 installed x1.05 Mech/Elect/I&C/Civil



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BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) =

Total Annual O&M Cost = \$47,890,000

Milorganite® Annual Operating & Maintenance Costs

% of biosolids to Milorganite® = 0%

annual biosolids (dt/year) = 0

	Milorganite® A	llocations	Annual Cost
Item/Process	%	\$/dt	\$/yr
JIWWTP Thickening	6.5%	\$26.50	\$0
JIWWTP Dewatering/Drying	59.5%	\$241.40	\$0
JIWWTP Chaff Processing	4.7%	\$19.20	\$0
Milorganite® Warehouse/Shipping	5.7%	\$23.00	\$0
JIWWTP Natural Gas & Electric Purchase	33.7%	\$136.70	\$0
Biosolids Marketing	17.4%	\$70.70	so
IPS Pipeline Sludge Transfer (includes SS energy)	0.5%	\$2.20	\$0
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0
SSWWTP Sludge Thickening (energy included)	1.5%	\$6.10	SC
SSWWTP Digestion (energy included)	3.7%	\$14.90	\$0
Milorganite® Sales Revenue	-33.2%	-\$134.80	\$0
SUBTOTAL	100%	\$406	\$0

Cake Agri-Life® Annual Operating Costs

% of biosolids to cake Agri-Life® = 0%

difficult biosolido (dibyodi) 9	Agri-Life® All	Agri-Life® Allocations		
Item/Process	%	\$/dt	\$/yr	
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0	
SSWWTP Sludge Thickening (energy included)	33.0%	\$185.50	\$0	
SSWWTP Digestion (energy included)	6.5%	\$36.40	\$0	
SSWWTP Dewatering (energy included)	36.5%	\$205.30	\$0	
Transport To Ag/WEPCO	24.0%	\$135.10	\$0	
SURTOTAL	100%	\$562	SO.	

Glass Furnace Annual Operating Costs

% of biosolids to glass furnace = 100%

annuai biosolias (avyear) =	114,100		
	Minergy Allo	Annual Cost	
Item/Process	%	\$/dt	\$/yr
JIWWTP Thickening	6.3%	\$26.50	\$3,024,000
JIWWTP Dewatering/Drying	57.5%	\$241.40	\$27,544,000
JIWWTP Electric Purchase	22.3%	\$93.50	\$10,668,000
JIWWTP Natural Gas Purchase	0.3%	\$1.10	\$126,000
IPS Pipeline Sludge Transfer (includes SS energy)	0.6%	\$2.50	\$285,000
SSWWTP Digester Gas Credit/Replacement	-3.2%	-\$13.50	-\$1,540,000
SSWWTP Sludge Thickening (energy included)	1.7%	\$7.00	\$799,000
SSWWTP Digestion (energy included)	4.1%	\$17.20	\$1,963,000
Glass Aggregate Sales Revenue	-0.4%	-\$1.80	-\$205,000
Glass Furnace Annual Operating Costs	10.9%	\$45.80	\$5,226,000
SUBTOTAL	100%	\$420	\$47,887,770

from Geoff Hurtado's estimate - 2004, Solids Cost 2004 UWSactual .XLS, (ENR = 8620) unless otherwise specified

\$42.32 2005 9231

Milorganite® Annual Operating & Maintenance Costs

Total Milorganite® 2004 tons =	56,040	Ď.					
	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Co	st .
JIWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49		0
JIWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41		0
JIWWTP Chaff Processing	\$928,541	\$16.57	2004	8620	\$19.22		0
Milorganite® Warehouse/Shipping	\$1,108,821	\$19.79	2004	8620	\$22.95		0
JIWWTP Natural Gas & Electric Purchase*	\$6,602,327	\$117.81	2004	8620	\$136.68		0 multiplied by 0.7 to account for new turbine efficiency
Biosolids Marketing		\$60.93	2004	8620	\$70.69		0 based on tons sold, not tons produced
IPS Pipeline Sludge Transfer	\$104,631	\$1.87	2004	8620	\$2.17		O. C.
SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00		0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$292,305	\$5.22	2004	8620	\$6.05		
SSWWTP Digestion	\$718,116	\$12.81	2004	8620	\$14.87		0
Milorganite® Sales Revenue		-\$116.21	2004	8620	-\$134.81		0

*changes depending on turbine existance at JI

Cake Agri-Life® Annual Operating Costs

Total cake Agri-Life® 2004 tons =	2168						
	Hurtado		Cost	ENR	2020 (6/2007)	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cos	st .
SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00		0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46		0
SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39		0
SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205.33		0
Polymer & Lime Filter Cake To Ag/WEPCO		\$116.46	2004	8620	\$135.11		0 based on tons transported, not tons produced
							0

Glass Furnace	Annual	Operating	Costs
Total biosolids 2004	=		

Minergy Process

- 1	Total Milorganite® 2004 tons =	56,040	Š.				
- 1		Hurtado	2004	Cost	ENR	2020 (6/2007)	2004
	Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost
8	JIWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49	2,605,336
	JIWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41	23,744,141
8	JIWWTP Electric Purchase	5	\$93.50	2007	10000	\$93.50	10,667,998 Energy Evaluation 09.11.06.xls
	JIWWTP Natural Gas Purchase		\$1.08	2007	10000	\$1.08	123,619 from PWC 9/05 meeting notes (Biosolids Evaluation Summary 090105.ppt)
	IPS Pipeline Sludge Transfer	\$134,469	\$2,14	2004	8620	\$2.48	244,030 SS IPS part of cost multiplied by total digested solids/digested solids to milo (in 2004)
¥	SSWWTP Digester Gas Credit/Replacement		-\$13.51	2007	10000	-\$13.51	-1,541,366 value per ton VSS destroyed (from Energy Evaluation 09.11.06 x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
1	SSWWTP Sludge Thickening	\$379,562	\$6.04	2004	8620	\$7.00	688,818
	SSWWTP Digestion	\$932,484	\$14.83	2004	8620	\$17.21	1,692,244
	Mineray Sales Revenue	I THE ROLL OF	-\$1,58	2004	8620	-\$1.83	-180,081 \$2/ton finished from PWC 9/05 meeting notes (Biosolids Evaluation Summary 090105,ppt)

\$45.84 4,828,544 10 employees & 6% of capital costs; from Biosolids Alternative Sizing Worksheets r4.xls by WLM



BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) = 114,100

Total Annual O&M Cost = \$47,890,000

Landfill Annual Operating & Maintenance Costs

% of biosolids to landfill = 0% annual biosolids (dt/year) = 0

	Milorganite® A	llocations	Annual Cost	
Item/Process	%	\$/dt	\$/yr	
JIWWTP Electric Purchase	9.7%	\$57.00	\$0	
IPS Pipeline Sludge Transfer	0.0%	\$0.20	\$0	
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0	
SSWWTP Sludge Thickening (energy included)	31.5%	\$185.50	\$0	
SSWWTP Dewatering (energy included)	34.8%	\$205.30	\$0	
SSWWTP Digestion (energy included)	6.2%	\$36.40	\$0	
Cake Trucking & Landfilling	17.8%	\$104.70	\$0	
SUBTOTAL	100%	\$589	\$0	

Land Application Annual Operating & Maintenance Costs

% of biosolids to land application = 0% annual biosolids (dt/year) = 0

	Milorganite® A	llocations	Annual Cost
Item/Process	%	S/dt	\$/yr
JIWWTP Electric Purchase	9.2%	\$57.00	\$0
IPS Pipeline Sludge Transfer	0.0%	\$0.20	\$0
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0
SSWWTP Sludge Thickening (energy included)	29.8%	\$185.50	\$0
SSWWTP Dewatering (energy included)	33.0%	\$205.30	\$0
SSWWTP Digestion (energy included)	5.9%	\$36.40	\$0
Polymer & Lime Filter Cake To Ag/WEPCO	22.1%	\$137.30	\$0
SUBTOTAL	100%	\$622	\$0

Incineration Annual Operating & Maintenance Costs

% of biosolids to Milorganite® = 0%

annual biosolids (dt/year) = 0			
	Milorganite® A	llocations	Annual Cost
Item/Process	%	\$/dt	\$/yr
JIWWTP Thickening	23.3%	\$67.10	\$0
JIWWTP Dewatering	20.3%	\$58.30	\$0
JIWWTP Electric Purchase	28.1%	\$80.90	\$0
IPS Pipeline Sludge Transfer (includes SS energy)	0.5%	\$1.40	\$0
Incineration Facility Labor	14.1%	\$40.50	\$0
Incineration Facility Maintenance/Repair/Replace	9.4%	\$27.10	\$0
Incineration Facility Chemicals and Other Costs	0.8%	\$2.40	\$0
Ash Transport	0.5%	\$1.40	\$0
Ash Landfill	2.9%	\$8.40	\$0
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0
SUBTOTAL	100%	\$288	\$0

from Geoff Hurtado's estimate - 2004, Solids Cost 2004 UWSactual XLS, (ENR = 8620) unless otherwise specified

Landfill Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873 Total cake Agri-Life® 2004 tons = 2168

	Hurtado		Cost	ENR	2020 (6/2007)	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost	
JIWWTP Electrical Purchase		\$57	2007	10000	\$56.97	0	Energy Evaluation 09.11.05.xls
IPS Pipeline Sludge Transfer	\$9,352	\$0,15	2004	8620	\$0.17	0	JI IPS cost x2 to account for WAS transfer and divided by total 2004 biosolids production
SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00	0	value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46	0	
SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205 33	a	
SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39	0	
Cake Trucking & Landfilling	-	\$96.61	2005	9231	\$104.66	0	Waste Management quote *247/313 (to discount for solids lost in digestion)

Land Application Annual Operating & Maintenance Costs Total biosolids 2004 = 62,873

Total cake Agri-Life® 2004 tons =	2168						
- A	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Co	ost
JIWWTP Electrical Purchase		\$57	2007	10000	\$56.97		0 Energy Evaluation 09.11.06.xls
IPS Pipeline Sludge Transfer	\$9,352	\$0.15	2004	8620	\$0.17		0 JI IPS cost x2 to account for WAS transfer and divided by total 2004 biosolids production
SSWWTP Digester Gas Credit/Replacement	-	\$0.00	2007	10000	\$0.00		0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46		0
SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205.33		0
SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39		o c
Polymer & Lime Filter Cake To Ag/WEPCO		\$118.37	2004	8620	\$137.32		0 from Biosolids Alternative Sizing Worksheets r4.xls by WLM, *247/313 to account for solids lost in digestion

Incineration Annual Operating & Maintenance Costs

momentum Annual Operating whiteh	CHAILCE COST						
Total biosolids 2004 =	62,873						
Total Milorganite® 2004 tons =	56,040						
TOTAL CONTROL OF THE PROPERTY OF THE PARTY OF	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost	
JIWWTP Thickening	\$1,279,606	\$57.87	2004	8620	\$67.13	0 *3	13/247 (raw total/digested total) to account for PSD instead of digested sludge, /.5 because only half of the sludge is currently thickened (AES)
JIWWTP Dewatering	\$2,222,754	\$50.26	2004	8620	\$58.31	0 *B	BPP number used *313/247 (raw total/digested total) to account for PSD instead of digested sludge per PWC; centrifuges will cost at least as much as BFP
JIWWTP Electrical Purchase	Carrier Samuel	\$81	2007	10000	\$80.93	0 En	ergy Evaluation 09.11.06.xls
IPS Pipeline Sludge Transfer	\$76,401	\$1.22	2004	8620	\$1.41	0 JI c	cost removed; SS IPS part of cost multiplied by (solids to digestion-PSD from JI)/digested solids to milo (in 2004)
Incineration Facility Labor	-	\$34.94	2004	8620	\$40.53	0 43	employes at \$75,000/yr for 92,300 tons/year (incineration Evaluation.xis)
Incineration Facility Maintenance/Repair/Replace		\$23.34	2004	8620	\$27.07	0 6%	of equipment costs which are assumed to be 25% of capital cost (incineration Evaluation.xis); does not account for operation of centrifuges; per PWC
Incineration Facility Chemicals and Other Costs	*	\$2.07	2004	8620	\$2.40	O Inc	cineration Evaluation.xls
Fly Ash Transport		\$1.38	2006	9700	\$1.42	0 WN	M quote for 20YD dump truck, assuming 20 min. for loading *72/313 to account for solids lost in incineration (assuming same loss of solids as with Minergy)
Fly Ash Landfill		\$8.17	2006	9700	\$8.42	O WA	M quote - \$35/ton landfill, \$0.5/ton taxes *72/313 to account for solids lost in incineration (assuming same loss of solids as with Minergy)
SSWWTP Digester Gas Credit/Replacement	5	\$0.00	2007	10000	\$0.00	0 val	lue per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids



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BIOSOLIDS ALTERNATIVE EVALUATIONS

COST ESTIMATE SUMMARY

General Description

This alternative involves blending JIWWTP primary sludge and WAS in a JIWWTP E/B Tank and then pumping the blended sludge to SSWWTP via the IPS pipeline. At SSWWTP the JIWWTP blended sludge would be thickened using gravity belt thickeners (GBTs). SSWWTP WAS would also be thickened on GBTs. The thickened sludges, along with SSWWTP primary sludge, would then be anaerobically digested using standard mesophilic anaerobic digestion, to produce a Class B biosolid product. The digested biosolids would be dewatered using recessed plate filter presses, with the dewatered biosolids hauled to landfill.

The alternative assumes that the turbines and all sludge thickening, dewatering and drying processes at JIWWTP would be eliminated. The existing JIWWTP GBTs would be relocated to SSWWTP for use in sludge thickening. The alternative also assumes that the IPS pipeline is in good condition for the planning period, but assumes that the existing JIWWTP IPS pumps will be replaced.

The alternative assumes all biosolids are landfilled.

Biosolids Distribution				
	0%	Milorganite®	0%	Dewatered Cake Agri-Life®
	0%	Glass Furnace	100%	Landfill
	0%	Incineration	0%	Land Application

ENR Index = 10000 (assumed Milwaukee 2007)

				Summary of Capital Costs
		\$83,800,000		Estimated Construction Cost Without Contingency or Markup
		\$20,950,000	25%	Contingency
04,750,000	\$104			Estimated Construction Cost Without Markup
31,430,000	\$31	30%		Contractor OH&M/Engineering
,180,000	\$136,1			Total Capital Cost
,	\$136			Total Capital Cost

Summary of Operation & Maintenance Costs

Total Annual Cost \$62,460,000

Life Cycle Analysis

 Interest Rate Per Year
 5.125%

 Number of Years
 20

 Present Worth Factor
 12.331

Present Worth of Total Operation & Maintenance Cost \$770,210,000

Total Present Worth \$906,000,000



BIOSOLIDS ALTERNATIVE EVALUATIONS

CAPITAL COST ESTIMATE SUMMARY

Subprojects		Capital Cost (\$)
(list subprojects for which there is a Capital Cost Worksheet)		(link to total costs from Capital Cost Worksheets)
IIWWTP ELECTRICAL UPGRADES		\$25,570,00
JIWWTP DEWATERING AND DRYING FACILITY DEMOLITION		\$21,670,00
SSWWTP DIGESTER REHABILITATION		\$7,520,00
SSWWTP THICKENING UPGRADES		\$5,920,00
SSWWTP DEWATERING UPGRADES		\$8,330,00
NTERPLANT SLUDGE PIPELINE UPGRADES		\$820,00
Subtotal	\$69,830,000	
	Allowance %	Capital Cost (\$)
Allowance for Undesigned Details	20%	\$13,970,00
Estimate of Construction Cost Without Contingency or Markup	\$83,800,00	



BIOSOLIDS ALTERNATIVE EVALUATIONS

JIWWTP ELECTRICAL UPGRADES CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$25,570,000

DESCRIPTION DIVISION 13: SPECIAL CONSTRUCTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
Powerhouse and Electrical Feed Upgrades	1	each	\$25,566,030	\$25,570,000

C	incort link	to this cost on	the Canital	Cost Summan	Workshoot

COST ADJUSTMENT			ADJUSTED			
Year	Index	Adjustment Factor	UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
2005	9231	1.08	\$25,566,028	electrical supply upgrade		Lou Germanotta estimate
	Cost Year	Cost ENR Year Index	Cost ENR Adjustment Year Index Factor	Cost ENR Adjustment UNIT COST Year Index Factor (\$)	Cost ENR Adjustment UNIT COST Year Index Factor (\$) ITEM	Cost ENR Adjustment UNIT COST Year Index Factor (\$) ITEM MANUFACTURER



BIOSOLIDS ALTERNATIVE EVALUATIONS

JIWWTP D&D FACILITY DECOMMISSION CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$21,670,000

DESCRIPTION	a	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 13: SPECIAL CONSTRUCTION					
Demolition of D&D Facilities		1	allowance	\$21,666,000	\$21,670,000
Di	ivision 13 Subtotal	\$21,670,000			

Actual	C	OST ADJU	STMENT	ADJUSTED			
Unit Cost (\$)	Year	ENR Index	Adjustment Factor	UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$20,000,000	2005	9231	1.08	\$21,666,125	TBD	TBD	WLM



BIOSOLIDS ALTERNATIVE EVALUATIONS

SSWWTP DIGESTER REHABILITATION CAPITAL COST

\$7,520,000 Total Capital Cost (all divisions, without contingency or markup) = Unit Cost (\$) SUBTOTAL (\$) Quantity Units DIVISION 11: EQUIPMENT 12 each 24 each 6 each 8 each 1 allowance DIVISION 11: EQUIPMENT
New Digester Mixing Systems
New Digester Recirculation Pumps
Recirculating Sludge Heat Exchangers
Storage Digester Sludge Transfer Pumps
Digester Gas Safety Equipment \$491,000 \$16,000 \$44,000 \$59,000 \$518,000 \$5,890,000 \$380,000 \$260,000 \$470,000 \$520,000 Division 11 Subtotal \$7,520,000

ı	<	insert	link	to	this	cost	on	the	Capital	Cost	Summary	Wor	ksh	eet

CC	OST ADJUS	TMENT	ADJUSTED			
Cost	ENR	Adjustment	UNIT COST			
Year	Index	Factor	(\$)	ITEM	MANUFACTURER	COMMENTS
2005	9231	1.08	\$490,933	External Draft Tube Mixers for 110' diameter	Eimco (Energenics) +30% for install	WLM; 4 mixers/tank; Inflico Degremont (IDI) makes cannon bubble mixers x1.05 Mech/Elect/18C/Civil
						WLM; thermo digester pumps assumed the same for meso x1.05 Mech/Elect/I&C/Civil WLM; provide supplemental heating on recirc line x1.05 Mech/Elect/I&C/Civil
			Sec. 20.00 hours			WLM; x1.05 Mech/Elect/l&C/Civil
			A STATE OF THE PARTY OF THE PAR		The state of the s	WLM: x1.3 installed x1.05 Mech/Elect/I&C/Civil
2005	9231	1,00	3517,550	name aresters, FYRVS, moisture removal	TOU	VVLM, X I.3 installed X I.00 Metryzectulocicivii.
	Cost Year	Cost Year Index 2005 9231 2005 9231 2005 9231 2005 9231	Year Index Factor 2005 9231 1.08 2005 9231 1.08 2005 9231 1.08 2005 9231 1.08 2005 9231 1.08	Cost Year ENR Index Adjustment Factor UNIT COST (\$) 2005 9231 1.08 \$490.933 2005 9231 1.08 \$15,526 2005 9231 1.08 \$44,361 2005 9231 1.08 \$59,149	Cost Year ENR Year Index Factor UNIT COST (\$) ITEM	Cost Year ENR Year Index Factor (\$) ITEM MANUFACTURER



BIOSOLIDS ALTERNATIVE EVALUATIONS

SSWWTP THICKENING UPGRADES CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$5,920,000 SUBTOTAL Unit Cost (S) Quantity Units (\$) **DIVISION 11: EQUIPMENT** DIVISION 11: EQUIPMENT

2 meter Gravity Belt Thickner Feed Pumps

Progressing Cavity Belt Thickner Feed Pumps

Progressing Cavity Belt Thickner Polymer Feed Pumps

Progressing Cavity Belt Bulk Polymer Transfer Pumps

Progressing Cavity GBT Bulk Polymer Transfer Pumps

Progressing Cavity GBT Bulk Polymer Mix Pumps

Progressing Cavity Operational Storage Pumps each each each each each each \$2,220,000 \$62,000 \$44,000 \$370,000 \$130,000 \$74,000 \$1,180,000 \$37,000 \$70,000 \$30,000 \$60,000 \$74,000 \$440,000 Division 11 Subtotal \$4,470,000 DIVISION 13: SPECIAL CONSTRUCTION Relocate JIWWTP Gravity Belt Thickeners to SSWWTP Thickening Building Addition \$74,000 \$300,000 7,200 Division 13 Subtotal \$1,450,000

	Actual		ST ADJUS		ADJUSTED			
	Unit Cost (\$)	Cost	Index	Adjustment Factor	UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
-	(3)	Tear	index	ractor	(3)	TI CM	MANOPACTORER	COMMENTS
100	\$204,750	2005	9231	1.08	\$221,807	Ashbrook Aquabelt (Energenics)	Energenecs	WLM; x1.3 installed x1.05 Mech/Elect/I&C/Civil
	\$57,330	2005	9231	1.08	\$62,106	Wemco Hidrostal 500 gpm at 75' TDH, w/VFDs for adjustable speed. 20 HP motors.	Ley & Associates	WLM; Ley & Assoc. quote for 400 gpm at 60', x2 for vfd, x1 4 for large flow/pressure, x1.3 installed x1.05 Mech/Elect/I&C/Civil
	\$40,950	2005	9231	1.08	\$44,361	200 gpm@40'TDH, w/VFDs	Moyno or Netszch	WLM; x1.3 installed x1.05 Mech/Elect/I&C/Civil
	\$68,250	2005	9231	1.08	\$73,936	250 gpm @ 140' TDH	Moyno or Netszch	WLM; Ley & Assoc quote x2 for vfd x1.3 installed x1.05 Mech/Elect/l&C/Civil
	\$34,125	2005	9231	1.08	\$36,968	10 gpm/3 HP, constant speed	Moyno or Netszch	WLM; x1.3 installed x1.05 Mech/Elect/I&C/Civil
	\$27,300	2005	9231	1.08	\$29,574	5 gpm, 2 HP, DC adjustable speed	Moyno or Netszch	WLM; x1.3 installed x1.05 Mech/Elect/I&C/Civil
	\$68,250	2005	9231	1,08	\$73,936	250 gpm @ 140' TDH wVFDs	Moyno or Netszch	WI.M; x2 for VFDs x1.3 installed x1.05 Mech/Elect/I&C/Civil
	\$68,250	2005	9231	1.08	\$73,936	3 meter units		WLM professional judgment; x1.3 installed x1.05 Mech/Elect/I&C/Civil
10000	\$150	2005	9231	1.08	\$162	TBD	TBD	WLM



BIOSOLIDS ALTERNATIVE EVALUATIONS

SSWWTP DEWATERING UPGRADES CAPITAL COST

tity Un 1 allowa cubic y 4,650 cubic y 0,000 8 cubic y 75 cubic y	nce \$108,000 yards \$11 yards \$13	\$8,330,000 SUBTOTAL (\$) \$110,000 \$510,000 \$60,000	Actual Unit Cost (\$) \$100,000 \$10 \$12		n the Capital DST ADJUST ENR Index 9231 9231 9231	Cost Summary W IMENT Adjustment Factor 1.08 1.08 1.08	ADJUSTED UNIT COST (\$)	TBD	MANUFACTURER TBD TBD TBD	COMMENTS WLM WLM WLM
1 allowa 6,500 cubic y 4,650 cubic y	its (\$) nce \$108,000 yards \$11 yards \$13	\$110,000 \$510,000 \$60,000	Unit Cost (\$) \$100,000 \$10 \$12	2005 2005	9231 9231	Adjustment Factor	\$108,331 \$11	TBD TBD	TBD TBD	WLM WLM
1 allowa 6,500 cubic y 4,650 cubic y	nce \$108,000 yards \$11 yards \$13	\$110,000 \$510,000 \$60,000	\$100,000 \$10 \$12	2005 2005	9231 9231	1.08	\$108,331 \$11	TBD TBD	TBD TBD	WLM WLM
6,500 cubic y 4,650 cubic y 0,000	vards \$11 vards \$13	\$510,000 \$60,000	\$10 \$12	2005	9231	1.08	\$11	TBD	TBD	WLM
6,500 cubic y 4,650 cubic y 0,000	vards \$11 vards \$13	\$510,000 \$60,000	\$10 \$12	2005	9231	1.08	\$11	TBD	TBD	WLM
0,000 8 cubic y	vards \$13	\$60,000	\$12 \$500	2005						
8 cubic y										
		\$40,000		2005	9231	1.08	\$542	TBD	TBD	WLM
			\$500	2005	9231	1.08	\$542	TBD	TBD	WLM
0,000										
4 each 3 each 6 each 6 each 3 each 1 each 1 allowal 40 each 2 each	\$7,000 \$22,000 \$118,000 \$126,000 \$518,000 \$99,000 \$111,000 \$148,000 \$3,000 \$162,000	\$30,000 \$70,000 \$710,000 \$760,000 \$1,550,000 \$270,000 \$110,000 \$150,000 \$120,000 \$320,000	\$6,825 \$20,475 \$109,200 \$116,025 \$477,750 \$81,900 \$102,375 \$136,500 \$3,000 \$150,000	2005 2005 2005 2005 2005 2005 2005 2005	9231 9231 9231 9231 9231 9231 9231 9231	1.08 1.08 1.08 1.08 1.08 1.08 1.08 1.08	\$22,181 \$118,297 \$125,691 \$517,550 \$88,723 \$110,903 \$147,871 \$3,250	Axial flow turbine, 2 HP w/SCR DC Adj Speed Drive Axial flow turbine, 10 HP 650 gpm @ 100 psi, 125 HP Piston membrane w/hydraulic oil, linear flow drop from 160->225 psi 151 plates (150 chambers) @ 2k mm x 2k mm; 530 cf @ 225 psig 100 HP 100 gpm @ 1,500 psi, 125 HP TBD 20' L x 7' W x 6' H 50,000 lbs minimum lift capacity	Lightnin Model SX81C2 Lightnin Model SX84C10 Moyno Model 2K335G1 CDQ-DAA (Order No. AS43109-90-4) Abel Model FQQG504-22/75; 22.5" pistons/75 HP/54 strokes/minute Rittershaus&Blecher ID No. 0-24-200-007-00 Moyno Model 4G065G1SSQ match existing two at South Shore TBD match existing at SS match existing at SS	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil WLM
0,000			1							
6.000 sf	\$220	\$3,520,000	\$200	2005	9231	1.08	\$217	TRD	TRD	WLM
				3500			9 65 030			
	.000 sf	NS 1730.	,000 sf \$220 \$3,520,000	,000 sf \$220 \$3,520,000 \$200	,000 sf \$220 \$3,520,000 \$200 2005	,000 sf \$220 \$3,520,000 \$200 2005 9231	,000 sf \$220 \$3,520,000 \$200 2005 9231 1.08	,000 sf \$220 \$3,520,000 \$200 2005 9231 1.08 \$217	,000 sf \$220 \$3,520,000 \$200 2005 9231 1.08 \$217 TBD	000 sf \$220 \$3,520,000 \$200 2005 9231 1.08 \$217 TBD TBD



BIOSOLIDS ALTERNATIVE EVALUATIONS

INTERPLANT SLUDGE PIPELINE UPGRADES CAPITAL COSTS

Total Capital Cost (all divisions, without contingency or markup) = \$820,000 **Unit Cost** SUBTOTAL DESCRIPTION Quantity Units (\$) (\$) **DIVISION 11: EQUIPMENT** JIWWTP and SSWWTP Pumps \$93,000 \$560,000 **Division 11 Subtotal** \$560,000 DIVISION 16: ELECTRICAL Pipeline Cathodic Protection \$258,000 \$260,000 allowance

\$260,000

Division 16 Subtotal

C	OST ADJUS	STMENT	ADJUSTED			
Cost Year	ENR Index	Adjustment Factor	UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
2006	9700	1.03	\$92,784	pump, motor, etc. rated for 300 psi +5000 for install	TBD	quote from Mickey at RDM
2006	9700	1.03	\$257,732	TBD	TBD	PWC
	Cost Year 2006	Cost Year Index 2006 9700	Cost Year Index ENR Adjustment Factor 2006 9700 1.03	Cost Year Index Adjustment Factor (\$) 2006 9700 1.03 \$92,784	Cost Year Index Factor (\$) ITEM 2006 9700 1.03 \$92,784 pump, motor, etc. rated for 300 psi +5000 for install	Cost Year Index Factor (\$) ITEM MANUFACTURER 2006 9700 1.03 \$92,784 pump, motor, etc. rated for 300 psi +5000 for install TBD



BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) =

Total Annual O&M Cost = \$62,460,000

Milorganite® Annual Operating & Maintenance Costs

% of biosolids to Milorganite® = 0%

	Milorganite® A	llocations	Annual Cost
Item/Process	%	\$/dt	\$/yr
JIWWTP Thickening	6.5%	\$26.50	\$0
JIWWTP Dewatering/Drying	59.5%	\$241.40	\$0
JIWWTP Chaff Processing	4.7%	\$19.20	\$0
Milorganite® Warehouse/Shipping	5.7%	\$23.00	\$0
JIWWTP Natural Gas & Electric Purchase	33.7%	\$136.70	\$0
Biosolids Marketing	17.4%	\$70.70	\$0
IPS Pipeline Sludge Transfer (includes SS energy)	0.5%	\$2.20	\$0
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0
SSWWTP Sludge Thickening (energy included)	1.5%	\$6.10	SO
SSWWTP Digestion (energy included)	3.7%	\$14.90	\$0
Milorganite® Sales Revenue	-33.2%	-\$134.80	\$0
SUBTOTAL	100%	\$406	\$0

Cake Agri-Life® Annual Operating Costs

% of biosolids to cake Agri-Life® = 0%

	Agri-Life® All	Annual Cost	
Item/Process	%	\$/dt	\$/yr
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0
SSWWTP Sludge Thickening (energy included)	33.0%	\$185.50	\$0
SSWWTP Digestion (energy included)	6.5%	\$36.40	\$0
SSWWTP Dewatering (energy included)	36.5%	\$205.30	\$0
Transport To Ag/WEPCO	24.0%	\$135.10	\$0
SUBTOTAL	100%	\$562	\$0

Glass Furnace Annual Operating Costs

% of biosolids to glass furnace = 0%

	Minergy Allo	cations	Annual Cost
Item/Process	%	\$/dt	\$/yr
JIWWTP Thickening	6.1%	\$26.50	\$0
JIWWTP Dewatering/Drying	55.7%	\$241.40	\$0
JIWWTP Electric Purchase	21.6%	\$93.50	\$0
JIWWTP Natural Gas Purchase	0.3%	\$1.10	\$0
IPS Pipeline Sludge Transfer (includes SS energy)	0.6%	\$2.50	\$0
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0
SSWWTP Sludge Thickening (energy included)	1.6%	\$7.00	\$0
SSWWTP Digestion (energy included)	4.0%	\$17.20	\$0
Glass Aggregate Sales Revenue	-0.4%	-\$1.80	\$0
Glass Furnace Annual Operating Costs	10.6%	\$45.80	\$0
SUBTOTAL	100%	\$433	\$0

from Geoff Hurtado's estimate - 2004, Solids Cost 2004 UWSactual XLS, (ENR = 8620) unless otherwise specified

Milorganite® Annual Operating & Maintenance Costs

Total Milorganite® 2004 tons =	56,040						
	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cos	st .
JIWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49		0
JIWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41		0
JIWWTP Chaff Processing	\$928,541	\$16.57	2004	8620	\$19.22		0
Milorganite® Warehouse/Shipping	\$1,108,821	\$19.79	2004	8620	\$22.95		0
JIWWTP Natural Gas & Electric Purchase*	\$6,602,327	\$117.81	2004	8620	\$136.68		0 multiplied by 0.7 to account for new turbine efficiency
Biosolids Marketing		\$60.93	2004	8620	\$70.69		0 based on tons sold, not tons produced
IPS Pipeline Sludge Transfer	\$104,631	\$1.87	2004	8620	\$2.17		0
SSWWTP Digester Gas Credit/Replacement	-	\$0.00	2007	10000	\$0.00		0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.xls) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$292,305	\$5.22	2004	8620	\$6.05		
SSWWTP Digestion	\$718,116	\$12.81	2004	8620	\$14.87		0
Milorganite® Sales Revenue		-\$116.21	2004	8620	-\$134.81		0

*changes depending on turbine existance at JI

Cake Agri-Life® Annual Operating Costs

Decree Continue	Cost	ENR	2020 (6/2007)	2004	
Decrees Continue			2020 (0/2007)	2004	
Process Cost/ton	Year	Index F	Process Cost/ton	Process Cost	
\$0.00	2007	10000	\$0.00	(0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
\$159.87	2004	8620	\$185.46	(
\$31.37	2004	8620	\$36.39	30	
\$176.99	2004	8620	\$205.33	(
\$116.46	2004	8620	\$135.11	(Dibased on tons transported, not tons produced
					B TREAM TO SECURE NO BEST FOODS AND TO SECURE AND THE SECURE OF THE SECU
	\$159.87 \$31.37 \$176.99	\$159.87 2004 \$31.37 2004	\$159.87 2004 8620 \$31.37 2004 8620 \$176.99 2004 8620	\$159.87 2004 8620 \$185.46 \$31.37 2004 8620 \$36.39 \$176.99 2004 8620 \$205.33	\$159.87 2004 8620 \$185.46 (\$31.37 2004 8620 \$36.39 (\$176.99 2004 8620 \$205.33 (\$116.46 2004 8620 \$135.11 (\$16.46 2004 8620

Glass Furnace Annual Operating Costs

Total biosolids 2004 =	62,873						
Total Milorganite® 2004 tons =	56,040						
	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost	t t
JIWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49		0
JIWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41		0
JIWWTP Electric Purchase	-	\$93.50	2007	10000	\$93.50	1	0 Energy Evaluation 09.11.06 xls
JIWWTP Natural Gas Purchase		\$1.08	2007	10000	\$1,08		0 from PWC 9/05 meeting notes (Biosolids Evaluation Summary 090105.ppt)
IPS Pipeline Sludge Transfer	\$134,469	\$2,14	2004	8620	\$2.48		0 SS IPS part of cost multiplied by total digested solids/digested solids to milo (in 2004)
SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00		0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.xls) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$379,562	\$6.04	2004	8620	\$7.00	(
SSWWTP Digestion	\$932,484	\$14.83	2004	8620	\$17.21		0
Minergy Sales Revenue	A WILLIAM CO.	-\$1.58	2004	8620	-\$1.83	(\$2/ton finished from PWC 9/05 meeting notes (Biosolids Evaluation Summary 090105.ppt)
Minergy Process	9	\$42.32	2005	9231	\$45.84		0 10 employees & 6% of capital costs; from Biosolids Alternative Sizing Worksheets r4.xls by WLM



BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) =

Total Annual O&M Cost = \$62,460,000

Landfill Annual Operating & Maintenance Costs

% of biosolids to landfill = 100% annual biosolids (dt/year) = 114,100

	Milorganite® A	Annual Cost		
Item/Process	%	\$/dt	S/yr	
JIWWTP Electric Purchase	10.4%	\$57.00	\$6,504,000	
IPS Pipeline Sludge Transfer	0.0%	\$0.20	\$23,000	
SSWWTP Digester Gas Credit/Replacement	-7.6%	-\$41.70	-\$4,758,000	
SSWWTP Sludge Thickening (energy included)	33.9%	\$185.50	\$21,166,000	
SSWWTP Dewatering (energy included)	37.5%	\$205.30	\$23,425,000	
SSWWTP Digestion (energy included)	6.6%	\$36.40	\$4,153,000	
Cake Trucking & Landfilling	19.1%	\$104.70	\$11,946,000	
SURTOTAL	100%	\$547	\$62.458.340	

Land Application Annual Operating & Maintenance Costs

% of biosolids to land application = 0% annual biosolids (dt/year) = 0

	Milorganite® Allocations				
Item/Process	%	\$/dt	S/yr		
JIWWTP Electric Purchase	9.2%	\$57.00	\$0		
IPS Pipeline Sludge Transfer	0.0%	\$0.20	\$0		
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	SO		
SSWWTP Sludge Thickening (energy included)	29.8%	\$185.50	\$0		
SSWWTP Dewatering (energy included)	33.0%	\$205.30	SO		
SSWWTP Digestion (energy included)	5.9%	\$36.40	50		
Polymer & Lime Filter Cake To Ag/WEPCO	22.1%	\$137.30	50		
SUBTOTAL	100%	\$622	50		

Incineration Annual Operating & Maintenance Costs

% of biosolids to milorganite = 0%

annual biosolids (dt/year) = 0			
	Milorganite® A	llocations	Annual Cost
Item/Process	%	\$/dt	S/yr
JIWWTP Thickening	23.3%	\$67.10	SC
JIWWTP Dewatering	20.3%	\$58.30	SC
JIWWTP Electric Purchase	28.1%	\$80.90	SC
IPS Pipeline Sludge Transfer (includes SS energy)	0.5%	\$1.40	SC
Incineration Facility Labor	14.1%	\$40.50	SC
Incineration Facility Maintenance/Repair/Replace	9.4%	\$27.10	SC
Incineration Facility Chemicals and Other Costs	0.8%	\$2.40	SO
Ash Transport	0.5%	\$1.40	\$0
Ash Landfill	2.9%	\$8.40	SO
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	SC
SUBTOTAL	100%	\$288	SO

from Geoff Hurtado's estimate - 2004, Solids Cost 2004 UWSactual XLS, (ENR = 8620) unless otherwise specified

Landfill Annual Operating & Maintenance Costs

Total biosolids 2004 = 62.873 Total cake Agri-Life® 2004 tons = 2168

Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost
JIWWTP Electrical Purchase		\$57	2007	10000	\$56.97	6,500,314 Energy Evaluation 09.11.06.xls
IPS Pipeline Sludge Transfer	\$9,352	\$0.15	2004	8620	\$0.17	16,972 JI IPS cost x2 to account for WAS transfer and divided by total 2004 biosolids production
SSWWTP Digester Gas Credit/Replacement		-\$41.69	2007	10000	-\$41.69	-4,757,396 value per ton VSS destroyed (from Energy Evaluation 09.11.06.xls) x (prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) / prop. biosolids
SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46	18,240,919
SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205.33	20,194,800
SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39	3,578,921
Cake Trucking & Landfilling	14-100-1000-1	\$96.61	2005	9231	\$104.66	11,023,668 Waste Management quote *247/313 (to discount for solids lost in digestion)
Proposition Confidence and Confedence and Confedenc						54,798,198

6.500.314

Land Application Annual Operating & Maintenance Costs Total biosolids 2004 = 62,873

2168					
Hurtado	2004	Cost	ENR	2020 (6/2007)	2004
2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost
	\$57	2007	10000	\$56.97	6,500,314 Energy Evaluation 09.11.06.x/s
\$9,352	\$0.15	2004	8620	\$0.17	0 JI IPS cost x2 to account for WAS transfer and divided by total 2004 biosolids production
	\$0.00	2007	10000	\$0.00	0 value per ton VSS destroyed (from Energy Evaluation 09.11.06 xls) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)) x dig. volume reduction (Hurtado) /prop. biosolids
\$346,593	\$159.87	2004	8620	\$185.46	0
\$383,719	\$176.99	2004	8620	\$205.33	0
\$68,003	\$31.37	2004	8620	\$36.39	0
-	\$118.37	2004	8620	\$137.32	0 from Biosolids Alternative Sizing Worksheets r4.xls by WLM, "247/313 to account for solids lost in digestion
	######################################	2004 Cost Process Cost/ton \$57 \$9,352 \$0.15 - \$0.00 \$346,593 \$159.87 \$383,719 \$176.99 \$68,003 \$31.37	Hurlado 2004 Cost 2004 Cost Year 2007 S9.352 \$0.15 2004 \$383,719 \$176.99 2004 \$68,003 \$31.37 2004	Hurtado 2004 Cost ENR 2004 Cost Process Cost/ton Year Index - \$57 2007 10000 \$9.352 \$0.15 2004 8620 \$346,593 \$159.87 2004 8620 \$383,719 \$176.99 2004 8620 \$68,003 \$31.37 2004 8620	Hurtado 2004 Cost ENR 2020 (6/2007) 2004 Cost Process Cost/ton Year Index Process Cost/ton \$57 2007 10000 \$56.97 \$9.352 \$0.15 2004 8620 \$0.17 \$0.00 2007 10000 \$0.00 \$346.593 \$159.87 2004 8620 \$185.46 \$383.719 \$176.99 2004 8620 \$205.33 \$68,003 \$31.37 2004 8620 \$36.39

Cost ENR 2020 (6/2007)

Incineration Annual Operating & Maintenance Costs Total biosolids 2004 =

Total Milorganite® 2004 tons =	56,040					
Part County Assumed Street Proceedings County Street Street	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	on Process Cost
JIWWTP Thickening	\$1,279,606	\$57.87	2004	8620	\$67.13	.13 0 *313/247 (raw total/digested total) to account for PSD instead of digested sludge, /.5 because only half of the sludge is currently thickened (AES)
JIWWTP Dewatering	\$2,222,754	\$50.26	2004	8620	\$58.31	.31 0 *BFP number used *313/247 (raw total/digested total) to account for PSD instead of digested sludge per PWC; centrifuges will cost at least as much as BFP
JIWWTP Electrical Purchase		\$81	2007	10000	\$80.93	93 0 Energy Evaluation 09.11.06 x/s
IPS Pipeline Sludge Transfer	\$76,401	\$1.22	2004	8620	\$1.41	41 0 JI cost removed; SS IPS part of cost multiplied by (solids to digestion-PSD from JI)/digested solids to mile (in 2004)
Incineration Facility Labor		\$34.94	2004	8620	\$40.53	53 0 43 employes at \$75,000/yr for 92,300 tons/year (Incineration Evaluation.x/s)
Incineration Facility Maintenance/Repair/Replace		\$23.34	2004	8620	\$27.07	.07 0 6% of equipment costs which are assumed to be 25% of capital cost (Incineration Evaluation.xis); does not account for operation of centrifuges; per PWC
Incineration Facility Chemicals and Other Costs	-	\$2.07	2004	8620	\$2.40	40 0 Incineration Evaluation.xls
Fly Ash Transport	-	\$1.38	2006	9700	\$1.42	42 0 WM quote for 20YD dump truck, assuming 20 min. for loading *72/313 to account for solids lost in incineration (assuming same loss of solids as with Minergy)
Fly Ash Landfill		\$8.17	2006	9700	\$8.42	42 0 VM quote - \$35/ton landfill, \$0.5/ton taxes *72/313 to account for solids lost in incineration (assuming same loss of solids as with Minergy)
SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00	00 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids



BIOSOLIDS ALTERNATIVE EVALUATIONS

COST ESTIMATE SUMMARY

General Description

This alternative involves blending JIWWTP primary sludge and WAS in a JIWWTP E/B Tank and then pumping the blended sludge to SSWWTP via the IPS pipeline. At SSWWTP the JIWWTP blended sludge would be thickened using gravity belt thickeners (GBTs). SSWWTP WAS would also be thickened on GBTs. The thickened sludges, along with SSWWTP primary sludge, would then be anaerobically digested using temperature phased digestion, to produce a Class A biosolid product. The digested biosolids would be dewatered using recessed plate filter presses, with the dewatered biosolids stored in a covered, open air building, prior to land application.

The alternative assumes that the turbines and all sludge thickening, dewatering and drying processes at JIWWTP would be eliminated. The existing JIWWTP GBTs would be relocated to SSWWTP for use in sludge thickening. The alternative also assumes that the IPS pipeline is in good condition for the planning period, but assumes that the existing JIWWTP IPS pumps will be replaced.

Biosolids D	istribution
-------------	-------------

0% 0% 0%

Milorganite® Glass Furnace Incineration

0% 0% Landfill 100%

Dewatered Cake Agri-Life®

Land Application

\$171,780,000

30%

ENR Index = 10000 (assumed Milwaukee 2007)

Summary of Capital Costs

Estimated Construction Cost Without Contingency or Markup

25% \$42,950,000

Contingency

Estimated Construction Cost Without Markup

\$214,730,000

Contractor OH&M/Engineering

Total Capital Cost

Summary of Operation & Maintenance Costs

Total Annual Cost \$66,180,000

Life Cycle Analysis

Interest Rate Per Year 5.125% Number of Years 20 Present Worth Factor 12.331

Present Worth of Total Operation & Maintenance Cost

\$816,080,000

\$64,420,000

\$279,150,000

Total Present Worth \$1,095,000,000



TABLE 9D-5 SHEET 1 OF 11 SCREENING ALTERNATIVE 4 -LAND APPLICATION

BIOSOLIDS ALTERNATIVE EVALUATIONS

CAPITAL COST ESTIMATE SUMMARY

Subprojects	Capital Cost (\$)		
(list subprojects for which there is a Capital Cost Worksheet)	(link to total costs from Capital Cost Worksheets)		
IWWTP ELECTRICAL UPGRADES		\$25,570,000	
IWWTP DEWATERING AND DRYING FACILITY DEMOLITION		\$21,670,000	
SSWWTP DIGESTER REHABILITATION		\$10,180,000	
SSWWTP THICKENING UPGRADES		\$6,210,000	
SWWTP DEWATERING UPGRADES		\$8,840,00	
SSWWTP STORAGE NTERPLANT SLUDGE PIPELINE UPGRADES		\$69,860,00 \$820,00	
Subtotal	\$143,150,000		
	Allowance %	Capital Cost (\$)	
Allowance for Undesigned Details	20%	\$28,630,000	
Estimate of Construction Cost Without Contingency or Markup	\$171,780,000		



TABLE 9D-5 SHEET 2 OF 11

SCREENING ALTERNATIVE 4 –

LAND APPLICATION

BIOSOLIDS ALTERNATIVE EVALUATIONS

JIWWTP ELECTRICAL UPGRADES CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$25,570,000

DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 13: SPECIAL CONSTRUCTION				
Powerhouse and Electrical Feed Upgrades	1	each	\$25,566,030	\$25,570,000

C	incort link	to this cost on	the Canital	Cost Summan	Workshoot

Actual	C	OST ADJU	STMENT	ADJUSTED			
Unit Cost (\$)	Cost Year	Index	Adjustment Factor	UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$23,600,000	2005	9231	1.08	\$25,566,028	electrical supply upgrade		Lou Germanotta estimate



BIOSOLIDS ALTERNATIVE EVALUATIONS

JIWWTP D&D FACILITY DECOMMISSION CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$21,670,000

DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 13: SPECIAL CONSTRUCTION				
Demolition of D&D Facilities	1	allowance	\$21,666,000	\$21,670,000
Division 13 Sub	ototal \$21,670,000			

 insert	link	to	this	cost	on	the	Capital	Cost	Summary	Worksheet	

Actual Unit Cost (\$)	Cost Year	OST ADJU: ENR Index	STMENT Adjustment Factor	ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$20,000,000	2005	9231	1.08	\$21,666,125	TBD	TBD	WLM



BIOSOLIDS ALTERNATIVE EVALUATIONS

SSWWTP DIGESTER REHABILITATION CAPITAL COST

Total Capital C	ost (all divisions	, without conting	gency or markup) =	\$10,180,000	The state of the s			ost Summary Wo				
			Unit Cost	SUBTOTAL	Actual		OST ADJUST	MENT	ADJUSTED			
DESCRIPTION	Quantity	Units	(\$)	(\$)	Unit Cost (\$)	Year Year	Index	Factor	UNIT COST	ІТЕМ	MANUFACTURER	COMMENTS
DIVISION 11: EQUIPMENT												
New Digester Mixing Systems	2	each	\$491,000	\$980,000	\$453,180	2005	9231	1.08	\$490,933	External Draft Tube Mixers for 110' diameter	Eimco (Energenics) +30% for install	WLM; 4 mixers/tank; Infilco Degremont (IDI) makes cannon bubble mixers x1.05 Mech/Elect/I&C/Civ
New Digester Mixing Systems	. 4	each	\$491,000	\$1,960,000	\$453,180	2005	9231	1.08	\$490,933	Cannon Bubble or External Draft Tube; 125' diameter x 38' SWD	Cannon: Infilco Degremont (IDI)/Draft tubes: Eimco (Energenics)	WLM; x1.3 installed, x1.05 Mech/Elect/I&C/Civil
New Digester Recirculation Pumps	12	each	\$16,000	\$190,000	\$14,333	2005	9231	1.08	\$15,526	Wemco Hidrostal, 10 HP motors, 250 gpm @ 60' TDH	Ley & Associates +30% for install	WLM; thermo digester pumps assumed the same for meso x1.05 Mech/Elect/I&C/Civil
Thermophilic Digester Gas Handling Equipment	1	allowance	\$518,000	\$520,000	\$477,750	2005	9231	1.08	\$517,550	flame aresters, PVRVs, moisture removal	TBD	WLM; x1.3 installed, x1.05 Mech/Elect/I&C/Civil
Hot/Cold Water Reservoirs	2	each	\$12,000	\$20,000	\$10,920	2005	9231	1.08	\$11,830	5,000 gallons each	TBD	WLM; x1.3 installed, x1.05 Mech/Elect/I&C/Civil
Thermophilic Digester Mixing Systems	6	each	\$491,000	\$2,950,000	\$453,180	2005	9231	1.08	\$490,933	Cannon Bubble or External Draft Tube; 90' diameter x 40' SWD	Cannon: Infilco Degremont (IDI)/Draft tubes: Eimco (Energenics)	WLM; x1.3 installed, x1.05 Mech/Elect/I&C/Civil
Thermo/Raw Sludge Heat Interchangers	6	each	\$207,000	\$1,240,000	\$191,100	2005	9231	1.08	\$207,020	Sludge-Water-Sludge Systems, Tube in shell	Soltech	WLM; x1.3 installed, x1.05 Mech/Elect/I&C/Civil
Thermo Sludge Heat Exchangers	6	each	\$44,000	\$260,000	\$40,950	2005	9231	1.08	\$44,361	Sludge-Hot Water Systems; Spiral	Alfa Laval; Provide Supplemental Heating on Recirc Lines	WLM; x1.3 installed, x1.05 Mech/Elect/I&C/Civil
Thermo Sludge Recirculation Pumps	12	each	\$16,000	\$190,000	\$14,333	2005	9231	1.08	\$15,526	250 gpm at 60' TDH, 10 HP motors	Wemco Hidrostal	WLM; x1.3 installed, x1.05 Mech/Elect/I&C/Civil
Thermo Sludge Transfer Pumps	8	each	\$58,000	\$460,000	\$53,576	2005	9231	1.08	\$58,039	1,200 gpm at 60' TDH, VFDs, 30 HP motor	Wemco Hidrostal	WLM; x2.5 for VFD x1.3 installed, x1.05 Mech/Elect/l&C/Civil
Division 11 Subtotal	\$8,770,000				V2.5 EP ZEIVE							
DIVISION 13: SPECIAL CONSTRUCTION												
Thermophilic Digester Control Building	8,800	sf	\$160	\$1,410,000	\$150	2005	9231	1.08	\$162	TBD	TBD	WLM
Division 13 Subtotal	\$1,410,000											



BIOSOLIDS ALTERNATIVE EVALUATIONS

SSWWTP THICKENING UPGRADES CAPITAL COST

					Actual	C	OST ADJU		ADJUSTED			
DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)	Unit Cost (\$)	Cost	ENR Index	Adjustment Factor	UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
DIVISION 11: EQUIPMENT		12			3: 0.00				0			
meter Gravity Belt Thickener	10	each	\$222,000	\$2,220,000	\$204,750	2005	9231	1.08	\$221,807	Ashbrook Aquabelt (Energenics)	Energenecs	WLM; x1.3 installed x1.05 Mech/Elect/I&C/Civil
00 gpm Gravity Belt Thickner Feed Pumps	6	each	\$62,000	\$370,000	\$57,330	2005	9231	1.08	\$62,106	Wemco Hidrostal 500 gpm at 75' TDH, w/VFDs for adjustable speed. 20 HP motors.	Ley & Associates	WLM; Ley & Assoc. quote for 400 gpm at 60', x2 for vfd, x1.4 for large flow/pressure, x1.3 installed x1.05 Mech/Elect/I&C/Civ
rogressing Cavity Gravity Belt Thickner Polymer Feed Pumps	3	each	\$44,000	\$130,000	\$40,950	2005 2005	9231 9231	1.08	\$44,361	200 gpm@40'TDH, w/VFDs	Moyno or Netszch	WLM; x1.3 installed x1.05 Mech/Elect/I&C/Civil
rogressing Cavity Thickened Sludge Transfer Pumps	16	each	\$74,000	\$1,180,000	\$68,250	2005	9231	1.08	\$73,936	250 gpm @ 140° TDH	Moyno or Netszch	WLM; Ley & Assoc. quote x2 for vfd x1.3 installed x1.05 Mech/Elect/l&C/Civil
rogressing Cavity GBT Bulk Polymer Transfer Pumps	2	each	\$37,000	\$70,000	\$34,125	2005	9231	1.08	\$36,968	10 gpm/3 HP, constant speed	Moyno or Netszch	WLM; x1.3 installed x1.05 Mech/Elect/I&C/Civil
rogressing Cavity GBT Bulk Polymer Mix Pumps	2	each	\$30,000	\$60,000	\$27,300	2005	9231	1.08	\$29,574	5 gpm, 2 HP, DC adjustable speed	Moyno or Netszch	WLM; x1.3 installed x1.05 Mech/Elect/I&C/Civil
Progressing Cavity Operational Storage Pumps	6	each	\$74,000	\$440,000	\$68,250	2005	9231	1.08	\$73,936	250 gpm @ 140' TDH w/VFDs	Moyno or Netszch	WLM; x2 for VFDs x1.3 installed x1.05 Mech/Elect/I&C/Civil
Division 11 Subtota	\$4,470,000											
DIVISION 13: SPECIAL CONSTRUCTION												
Relocate JIWWTP Gravity Belt Thickeners to SSWWTP	4	each	\$74,000	\$300,000	\$68,250	2005	9231 9231	1.08		3 meter units		WLM professional judgment; x1.3 installed x1.05 Mech/Elect/l&C/Civil
hickening Building Addition	7,200	sf	\$200	\$1,440,000	\$150	2005	9231	1.08	\$162	TBD	TBD	WLM
Division 13 Subtots												



BIOSOLIDS ALTERNATIVE EVALUATIONS

SSWWTP DEWATERING UPGRADES	CAPITAL	COST
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Total Capital	Cost (all division	s, without contin	gency or markup) =	\$8,840,000	Actual		COST ADJUST		ADJUSTED			
DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)	Unit Cost (\$)	Cost	ENR	Adjustment Factor	UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
DIVISION 2: SITEWORK	S C: 32-15		e 11.5 % b		3 31 3		32	3-42			# E	2. 2.
Dewatering	1	allowance	\$108,000	\$110,000	\$100,000	2005	9231	1.08	\$108,331	TBD	TBD	WLM
Excavation	46,500	cubic yards	\$11	\$510,000	\$10	2005	9231	1.08	\$11	TBD	TBD	WLM
Structural Fill	4,650	cubic yards	\$13	\$60,000	\$12	2005	9231	1.08	\$13	TBD	TBD	WLM
Division 2 Subtotal	\$680,000											
DIVISION 3: CONCRETE												
Sludge Reaction Tank	8	cubic yards	\$540	\$0	\$500	2005	9231	1.08	\$542	TBD	TBD	WLM
Sludge Holding Tank	75		\$540	\$40,000	\$500	2005	9231	1.08	\$542		TBD	WLM
Division 3 Subtotal	\$40,000	-										
DIVISION 11: EQUIPMENT												
Sludge Reaction Tank Mixers	4	each	\$7,000	\$30,000	\$6,825	2005	9231	1.08	\$7 394	Axial flow turbine, 2 HP w/SCR DC Adj Speed Drive	Lightnin Model SX81C2	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
Sludge Holding Tank Mixers Progressing Cavity Sludge Transfer Pumps Recessed Plate Filter Press Feed Pumps Recessed Plate Filter Presses Progressing Cavity Recessed Plate Press Polymer Feed Pumps Piston Recessed Plate Filter Press Wash Pumps Recessed Plate Appurtenances Roll-off Sludge Containers Straddle Carriers for Sludge Containers	3 6 6 3 3 1 1 1 100 4	each each each each each each each	\$22,000 \$118,000 \$126,000 \$518,000 \$89,000 \$111,000 \$148,000 \$3,000	\$70,000 \$710,000 \$760,000 \$1,550,000 \$270,000 \$110,000 \$150,000 \$300,000 \$650,000	\$20,475 \$109,200 \$116,025 \$477,750 \$81,900 \$102,375 \$136,500 \$3,000 \$150,000	2005 2005 2005 2005 2005 2005 2005 2005	9231 9231 9231 9231 9231 9231 9231 9231	1.08 1.08 1.08 1.08 1.08 1.08 1.08 1.08	\$22,181 \$118,297 \$125,691 \$517,550 \$88,723 \$110,903 \$147,871 \$3,250	Axial flow turbine, 10 HP 650 gpm @ 100 psi, 125 HP Piston membrane w/hydraulic oil; linear flow drop from 160->225 psi 151 plates (150 chambers) @ 2k mm x 2k mm; 530 cf @ 225 psig	Lightnin Model SX84C10 Moyno Model 2K335G1 CDQ-DAA (Order No: AS43109-90-4) Abel Model FQQG504-22/75; 22.5" pistons/75 HP/54 strokes/minute Rittershaus&Blecher ID No: 0-24-200-007-00 Moyno Model 4G065G1SSQ match existing two at South Shore TBD match existing at SS match existing at SS	WLM; x1.3 installed x1.05Mech/Elect/l&C/Civi WLM WLM
20 0000000 2000000												
Division 11 Subtotal	\$4,600,000											
DIVISION 13: SPECIAL CONSTRUCTION												
Dewatering Building Addition	16,000	sf	\$220	\$3,520,000	\$200	2005	9231	1,08	\$217	TBD	TBD	VVLM
Division 13 Subtotal	\$3,520,000	1										



BIOSOLIDS ALTERNATIVE EVALUATIONS

SSWWTP STORAGE FACILITY CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$69,860,000

DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 11: EQUIPMENT				
Front End Loaders for Material Handling	2	each	\$155,000	\$310,000
Division 11 Subtotal DIVISION 13: SPECIAL CONSTRUCTION	\$310,000			
Dewatered Cake Storage Building Land for Storage Building and Associated Facilities	609,840	sf allowance	\$27 \$53,082,000	\$16,470,000 \$53,080,000
Division 13 Subtotal	\$69,550,000			

The second second second second			ital Cost Summa				
Actual Unit Cost (\$)	Cost Year	ENR Index	STMENT Adjustment Factor	ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$150,000	2006	9700	1.03	\$154,639	3-5 yard buckets	Caterpillar website literature	WLM
\$25 \$49,000,000	2005 2005	9231 9231	1.08 1.08	\$27 \$53,082,006	TBD TBD	TBD TBD	WLM WLM/PWC



BIOSOLIDS ALTERNATIVE EVALUATIONS

INTERPLANT SLUDGE PIPELINE UPGRADES CAPITAL COSTS

Total Capital Cost (all divisions, without contingency or markup) = \$820,000 **Unit Cost** SUBTOTAL DESCRIPTION Quantity Units (\$) **DIVISION 11: EQUIPMENT** JIWWTP and SSWWTP Pumps \$93,000 \$560,000 **Division 11 Subtotal** \$560,000 DIVISION 16: ELECTRICAL Pipeline Cathodic Protection \$258,000 \$260,000 allowance **Division 16 Subtotal** \$260,000

Actual	C	COST ADJU	STMENT	ADJUSTED			
Unit Cost (\$)	Cost Year	ENR Index	Adjustment Factor	UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$90,000	2006	9700	1.03	\$92,784	pump, motor, etc. rated for 300 psi +5000 for install	TBD	quote from Mickey at RDN
\$250,000	2006	9700	1.03	\$257,732	TBD	TBD	PWC



BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) =

Total Annual O&M Cost = \$34,700,000

Milorganite® Annual Operating & Maintenance Costs

% of biosolids to Milorganite® = 0% annual biosolids (dt/year) = 0

70-1007/19 (00-00-00-00-00-00-00-00-00-00-00-00-00-	Milorganite® A	llocations	Annual Cost
Item/Process	%	\$/dt	\$/yr
JIWWTP Thickening	6.5%	\$26.50	\$1
JIWWTP Dewatering/Drying	59.5%	\$241.40	S
JIWWTP Chaff Processing	4.7%	\$19.20	S
Milorganite® Warehouse/Shipping	5.7%	\$23.00	Ş
JIWWTP Natural Gas & Electric Purchase	33.7%	\$136.70	S
Biosolids Marketing	17.4%	\$70.70	Si
IPS Pipeline Sludge Transfer (includes SS energy)	0.5%	\$2.20	S
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	S
SSWWTP Sludge Thickening (energy included)	1.5%	\$6.10	S
SSWWTP Digestion (energy included)	3.7%	\$14.90	S
Milorganite® Sales Revenue	-33.2%	-\$134.80	\$
SUBTOTAL	100%	\$406	S

Cake Agrilife Annual Operating Costs

70 U	DIOSOROS	to cake A	Au-rues	-	U
	annual	biosolids	(dt/year)	=	0

arrida biosolius (biyebi) – V	Agri-Life® Alle	ocations	Annual Cost	
Item/Process	%	\$/dt	\$/yr	
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0	
SSWWTP Sludge Thickening (energy included)	33.0%	\$185.50	\$0	
SSWWTP Digestion (energy included)	6.5%	\$36.40	\$0 \$0	
SSWWTP Dewatering (energy included)	36.5%	\$205.30		
Transport To Ag/WEPCO	24.0%	\$135.10	\$0	
SUBTOTAL	100%	\$562	so	

Glass Furnace Annual Operating Costs

% Of	biosolids	to glass	furnace =	09
	annual h	insolids (dt/vear) =	0

	Minergy Allo	cations	Annual Cost
Item/Process	%	\$/dt	\$/yr
JIWWTP Thickening	6.1%	\$26.50	\$0
JIWWTP Dewatering/Drying	55.7%	\$241.40	\$0
JIWWTP Electric Purchase	21.6%	\$93.50	\$0
JIWWTP Natural Gas Purchase	0.3%	\$1.10	\$0
IPS Pipeline Sludge Transfer (includes SS energy)	0.6%	\$2.50	\$0
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0
SSWWTP Sludge Thickening (energy included)	1.6%	\$7.00	\$0
SSWWTP Digestion (energy included)	4.0%	\$17.20	\$0
Glass Aggregate Sales Revenue	-0.4%	-\$1.80	\$0
Glass Furnace Annual Operating Costs	10.6%	\$45.80	\$0
SUBTOTAL	100%	\$433	\$0

from Geoff Hurtado's estimate - 2004, Solids Cost 2004 UWSactual XLS, (ENR = 8620) unless otherwise specified

56,040

Milorganite® Annual Operating & Maintenance Costs

	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cos	t t
JIWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49		0
JIWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41		0
JIWWTP Chaff Processing	\$928,541	\$16.57	2004	8620	\$19.22		0
Milorganite® Warehouse/Shipping	\$1,108,821	\$19.79	2004	8620	\$22.95		0
JIWWTP Natural Gas & Electric Purchase*	\$6,602,327	\$117.81	2004	8620	\$136.68		0 multiplied by 0.7 to account for new turbine efficiency
Biosolids Marketing		\$60.93	2004	8620	\$70.69		0 based on tons sold, not tons produced
IPS Pipeline Sludge Transfer	\$104,631	\$1.87	2004	8620	\$2.17		
SSWWTP Digester Gas Credit/Replacement	0.0000000000000000000000000000000000000	\$0.00	2007	10000	\$0.00		0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) / prop. biosolids
SSWWTP Sludge Thickening	\$292,305	\$5.22	2004	8620	\$6.05		
SSWWTP Digestion	\$718,116	\$12.81	2004	8620	\$14.87		0
Milorganite® Sales Revenue		-\$116.21	2004	8620	-\$134.81		0

*changes depending on turbine existance at JI

Total Milorganite® 2004 tons =

Cake Agri-Life® Annual Operating Costs

Total cake Agri-Life® 2004 tons =	2168						
The same of the sa	Hurtado		Cost	ENR	2020 (6/2007)	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cos	st .
SSWWTP Digester Gas Credit/Replacement	-	\$0.00	2007	10000	\$0.00		0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46		0
SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39		0
SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205.33		0
Polymer & Lime Filter Cake To Ag/WEPCO	· Managaritaning	\$116.46	2004	8620	\$135.11		0 based on tons transported, not tons produced
							0

Glass Furnace Annual Operating Cos	G	lass	Furnace	Annual	Operating	Cost
------------------------------------	---	------	----------------	--------	-----------	------

Glass Furnace Annual Operating Co	sts						
Total biosolids 2004 =	62,873	3					
Total Milorganite® 2004 tons =	56,040)					
	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cos	st
JIWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49		0
JIWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41		0
JIWWTP Electric Purchase		\$93.50	2007	10000	\$93.50		0 Energy Evaluation 09.11.06.xls
JIWWTP Natural Gas Purchase		\$1.08	2007	10000	\$1.08		0 from PWC 9/05 meeting notes (Biosolids Evaluation Summary 090105 ppt)
IPS Pipeline Sludge Transfer	\$134,469	\$2,14	2004	8620	\$2.48		0 SS IPS part of cost multiplied by total digested solids/digested solids to milo (in 2004)
SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00		0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$379,562	\$6.04	2004	8620	\$7.00		0
SSWWTP Digestion	\$932,484	\$14.83	2004	8620	\$17.21		0
Minergy Sales Revenue	1 WILL BOOK 1	-\$1.58	2004	8620	-\$1.83		0 \$2/ton finished from PWC 9/05 meeting notes (Biosolids Evaluation Summary 090105.ppt)
Minergy Process	9	\$42.32	2005	9231	\$45.84		0 10 employees & 6% of capital costs; from Biosolids Alternative Sizing Worksheets 14.xls by WLM



6/2/07

BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) =

Total Annual O&M Cost = \$62,460,000

Landfill Annual Operating & Maintenance Costs

% of biosolids to landfill = 100% annual biosolids (dt/year) = 114,100

	Milorganite® A	Annual Cost		
Item/Process	%	\$/dt	S/yr	
JIWWTP Electric Purchase	10.4%	\$57.00	\$6,504,000	
IPS Pipeline Sludge Transfer	0.0%	\$0.20	\$23,000	
SSWWTP Digester Gas Credit/Replacement	-7.6%	-\$41.70	-\$4,758,000	
SSWWTP Sludge Thickening (energy included)	33.9%	\$185.50	\$21,166,000	
SSWWTP Dewatering (energy included)	37.5%	\$205.30	\$23,425,000	
SSWWTP Digestion (energy included)	6.6%	\$36.40	\$4,153,000	
Cake Trucking & Landfilling	19.1%	\$104.70	\$11,946,000	
SUBTOTAL	100%	\$547	\$62,458,340	

Land Application Annual Operating & Maintenance Costs

% of biosolids to land application = 0% annual biosolids (dt/year) = 0

	Milorganite® A	llocations	Annual Cost	
Item/Process	%	\$/dt	S/yr	
JIWWTP Electric Purchase	9.2%	\$57.00	\$0	
IPS Pipeline Sludge Transfer	0.0%	\$0.20	SO	
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	SO	
SSWWTP Sludge Thickening (energy included)	29.8%	\$185.50	\$0	
SSWWTP Dewatering (energy included)	33.0%	\$205.30	SO	
SSWWTP Digestion (energy included)	5.9%	\$36.40	S0	
Polymer & Lime Filter Cake To Ag/WEPCO	22.1%	\$137.30	S0	
SUBTOTAL	100%	\$622	\$0	

Incineration Annual Operating & Maintenance Costs

% of biosolids to milorganite = 0%

annual biosolids (dt/year) = 0			
	Milorganite® A	llocations	Annual Cost
Item/Process	%	\$/dt	S/yr
JIWWTP Thickening	23.3%	\$67.10	SI
JIWWTP Dewatering	20.3%	\$58.30	S
JIWWTP Electric Purchase	28.1%	\$80.90	Si
IPS Pipeline Sludge Transfer (includes SS energy)	0.5%	\$1.40	SI
Incineration Facility Labor	14.1%	\$40.50	S
Incineration Facility Maintenance/Repair/Replace	9.4%	\$27.10	S
Incineration Facility Chemicals and Other Costs	0.8%	\$2.40	S
Ash Transport	0.5%	\$1.40	Si
Ash Landfill	2.9%	\$8.40	S
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	S
SUBTOTAL	100%	\$288	S

from Geoff Hurtado's estimate - 2004, Solids Cost 2004 UWSactual XLS, (ENR = 8620) unless otherwise specified

Landfill Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873

Total cake Agri-Life® 2004 tons = 2168

Hutlado

JIWWTP Electrical Purchase		\$57	2007	10000	\$56.97	6,500,314 Energy Evaluation 09.11.06.xls
IPS Pipeline Sludge Transfer	\$9,352	\$0.15	2004	8620	\$0.17	16,972 JI IPS cost x2 to account for WAS transfer and divided by total 2004 biosolids production
SSWWTP Digester Gas Credit/Replacement		-\$41.69	2007	10000	-\$41.69	-4,757,396 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) / prop. biosolids
SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46	18,240,919
SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205.33	20,194,800
SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39	3,578,921
Calca Tarakina 8 Landfillian		600.04	2005	0224	6104.66	11 000 CC0 Marts Massacranet quate 1247/240 (to discount for called last in direction)

54,798,198

6,500,314

Land Application Annual Operating & Maintenance Costs Total biosolids 2004 = 62,873

	Total cake agrilife 2004 tons =	2168					
		Hurtado	2004	Cost	ENR	2020 (6/2007)	2004
	Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost
	JIWWTP Electrical Purchase		\$57	2007	10000	\$56.97	6,500,314 Energy Evaluation 09.11.06.x/s
	IPS Pipeline Sludge Transfer	\$9,352	\$0.15	2004	8620	\$0.17	0 JI IPS cost x2 to account for WAS transfer and divided by total 2004 biosolids production
	SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00	0 value per ton VSS destroyed (from Energy Evaluation 09.11.06 xls) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
	SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46	0
	SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205.33	0
	SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39	0
	Polymer & Lime Filter Cake To Ag/WEPCO		\$118.37	2004	8620	\$137.32	0 from Biosolids Alternative Sizing Worksheets r4.x/s by WLM, *247/313 to account for solids lost in digestion
ш							

Cost ENR 2020 (6/2007) 2004

2004 Cost Process Cost/ton Year Index Process Cost/ton Process Cost

Incineration Annual Operating & Maintenance Costs Total biosolids 2004 = 62,873

Total Milorganite® 2004 tons =	56,040					
A DEL DENO ASSELLO MARINE PRODUCE NO DESCRIPTO DE LA CONTRACTION DEL CONTRACTION DE LA CONTRACTION DE	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	n Process Cost
JIWWTP Thickening	\$1,279,606	\$57.87	2004	8620	\$67.13	13 0 *313/247 (raw total/digested total) to account for PSD instead of digested sludge, /.5 because only half of the sludge is currently thickened (AES)
JIWWTP Dewatering	\$2,222,754	\$50.26	2004	8620	\$58.31	0 *BFP number used *313/247 (raw total/digested total) to account for PSD instead of digested sludge per PWC; centrifuges will cost at least as much as BFP
JIWWTP Electrical Purchase		\$81	2007	10000	\$80.93	93 0 Energy Evaluation 09.11.06.xls
IPS Pipeline Sludge Transfer	\$76,401	\$1.22	2004	8620	\$1.41	41 0 JI cost removed; SS IPS part of cost multiplied by (solids to digestion-PSD from JI)/digested solids to milo (in 2004)
Incineration Facility Labor		\$34.94	2004	8620	\$40.53	53 0 43 employes at \$75,000/yr for 92,300 tons/year (Incineration Evaluation.x/s)
Incineration Facility Maintenance/Repair/Replace		\$23.34	2004	8620	\$27.07	07 0 6% of equipment costs which are assumed to be 25% of capital cost (Incineration Evaluation.xls); does not account for operation of centrifuges; per PWC
Incineration Facility Chemicals and Other Costs		\$2.07	2004	8620	\$2.40	40 0 Incineration Evaluation.xls
Fly Ash Transport	-	\$1.38	2006	9700	\$1.42	42 0 WM quote for 20YD dump truck, assuming 20 min. for loading *72/313 to account for solids lost in incineration (assuming same loss of solids as with Minergy)
Fly Ash Landfill		\$8.17	2006	9700	\$8.42	42 0 VM quote - \$35/ton landfill, \$0.5/ton taxes *72/313 to account for solids lost in incineration (assuming same loss of solids as with Minergy)
SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00	00 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
						0



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6/2/07

BIOSOLIDS ALTERNATIVE EVALUATIONS

COST ESTIMATE SUMMARY

General Description

This alternative involves pumping SSWWTP WAS and PSD to JIWWTP, where they are thickened along with JIWWTP WAS and PSD. The thickened sludges are sent to high solids centrifuges for dewatering before entering the Incinerator Facility where they maintain self-combustion. The existing belt filter presses do not thicken the solids enough to maintain self combustion, and thus they will be abandoned.

The alternative includes four new gravity belt thickeners at JIWWTP. The JIWWTP dewatering and drying facility and SSWWTP thickening and digestion facilities will be abandoned.

The alternative assumes the JIWWTP turbine facility is eliminated with electrical feed upgrades at JIWWTP to provide full redundancy.

Biosol	ide	Die	tribe	tion
DIUSUI	IUS.	DIS	пири	шоп

0% 0% 100% Milorganite® Glass Furnace Incineration 0% 0% 0%

25%

Dewatered Cake Agri-Life®

Landfill

Land Application

ENR Index = 10000 (assumed Milwaukee 2007)

Summary of Capital Costs

Estimated Construction Cost Without Contingency or Markup

\$299,980,000

Contingency

Estimated Construction Cost Without Markup

\$75,000,000

30% \$112,490,000

Total Capital Cost

Contractor OH&M/Engineering

\$487,470,000

Summary of Operation & Maintenance Costs

Total Annual Cost

\$34,700,000

Life Cycle Analysis

Interest Rate Per Year Number of Years 5.125% 20

Present Worth Factor

12.331

Present Worth of Total Operation & Maintenance Cost

\$427,890,000

\$374,980,000

Total Present Worth

\$915,000,000



BIOSOLIDS ALTERNATIVE EVALUATIONS

CAPITAL COST ESTIMATE SUMMARY

Subprojects		Capital Cost (\$)
(list subprojects for which there is a Capital Cost Worksheet)		(link to total costs from Capital Cost Worksheets)
WWTP ELECTRICAL UPGRADES		\$25,570,000
WWTP INCINERATION FACILITY		\$216,600,00
WWTP THICKENING UPGRADES		\$1,570,00
NTERPLANT SLUDGE PIPELINE UPGRADES SWWTP DIGESTING FACILITIES DEMOLITION		\$820,000 5,420,000
Subtotal	\$249,980,000	
	Allowance %	Capital Cost (\$)
Havenes for Underwood Details	200/	¢50,000,00
llowance for Undesigned Details	20%	\$50,000,00



BIOSOLIDS ALTERNATIVE EVALUATIONS

JIWWTP ELECTRICAL UPGRADES CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$25,570,000

DESCRIPTION

Quantity

Units

SUBTOTAL

(\$)

DIVISION 13: SPECIAL CONSTRUCTION

Powerhouse and Electrical Feed Upgrades

1 each \$25,566,030 \$25,570,000

MENTS
ta estimate



BIOSOLIDS ALTERNATIVE EVALUATIONS

JIWWTP INCINERATION FACILITY CAPITAL COST

	Total Capital Co	Total Capital Cost (all divisions, without contingency or markup) =						
DESCRIPTION		Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)			
DIVISION 13: SPECIAL CONSTRUCTION								
Incineration Facility		313	d. tons/day	\$692,000	\$216,600,000			
Div	rision 13 Subtotal	\$216,600,000						

Actual Unit Cost (\$)	Cost Year	ENR Index	TMENT Adjustment Factor	ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$596,230	2004	8620	1.16	\$691,682	similar to Metro Plant in St. Paul, MN		scaled from Minnesota plant costs (\$201 million in 6/03 to 11/04 by AES; 398 tpd to 247 tpd) x1.05 Mech/Elect/I&C/Civil



BIOSOLIDS ALTERNATIVE EVALUATIONS

JIWWTP THICKENING UPGRADES CAPITAL COST

DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 11: EQUIPMENT				
2 meter Gravity Belt Thickener	4	each	\$222,000	\$890,000
500 gpm Gravity Belt Thickner Feed Pumps	4	each	\$62,000	\$250,000
Progressing Cavity Gravity Belt Thickner Polymer Feed Pumps	3	each	\$44,000	\$130,000
Progressing Cavity Thickened Sludge Transfer Pumps	4	each	\$74,000	\$300,000
Division 11 Subtotal	\$1,570,000			

Actual	COLS MI	OST ADJU		ADJUSTED			
Unit Cost	Cost	ENR	Adjustment	UNIT COST	ITEM	MANUEACTURER	COMMENTS
(9)) Cal	IIIGEX	- ractor		SII LIII	MANOFACTORER	COMMENTO
\$204,750	2005	9231	1.08	\$221,807	Ashbrook Aquabelt (Energenics)	Energenecs	x1.3 installed x1.05 Mech/Elect/I&C/Civil
\$57,330	2005	9231	1.08	\$62,106	Wemco Hidrostal 500 gpm at 75' TDH, w/VFDs for ad	Ley & Associates	Ley & Assoc. quote for 400 gpm at 60', x2 for vfd, x1.4 for large flow/pressure, x1.3 installed x1.05 Mech/Elect/l&C/Civil
\$40,950	2005	9231	1.08	\$44,361	200 gpm@40'TDH, w/VFDs	Moyno or Netszch	x1.3 installed x1.05 Mech/Elect/I&C/Civil
\$68,250	2005	9231	1.08	\$73,936	250 gpm @ 140' TDH	Moyno or Netszch	Ley & Assoc. quote x2 for vfd x1.3 installed x1.05 Mech/Elect/I&C/Civil
	\$204,750 \$57,330 \$40,950	\$204,750 2005 \$57,330 2005 \$40,950 2005	\$204,750 2005 9231 \$57,330 2005 9231 \$40,950 2005 9231	\$204,750 2005 9231 1.08 \$57,330 2005 9231 1.08 \$40,950 2005 9231 1.08	(\$) Year Index Factor (\$) \$204,750 2005 9231 1.08 \$221,807 \$57,330 2005 9231 1.08 \$62,106 \$40,950 2005 9231 1.08 \$44,361	(\$) Year Index Factor (\$) ITEM \$204,750 2005 9231 1.08 \$221,807 Ashbrook Aquabelt (Energenics) \$57,330 2005 9231 1.08 \$62,106 Wemco Hidrostal 500 gpm at 75' TDH, w/VFDs for acceptable with the property of the	(\$) Year Index Factor (\$) ITEM MANUFACTURER \$204,750 2005 9231 1.08 \$221,807 Ashbrook Aquabelt (Energenics) Energenecs \$57,330 2005 9231 1.08 \$62,106 Wemco Hidrostal 500 gpm at 75' TDH, w/VFDs for ad Ley & Associates \$40,950 2005 9231 1.08 \$44,361 200 gpm@40'TDH, w/VFDs Moyno or Netszch



BIOSOLIDS ALTERNATIVE EVALUATIONS

INTERPLANT SLUDGE PIPELINE UPGRADES CAPITOL COSTS

Total Capital Cost (all divisions, without contingency or markup) = \$820,000 <---- insert link to this cost on the Capital Cost Summary Worksheet

ш					
	Actual	C	ADJUSTE		
Ш	Unit Cost	Cost	ENR	Adjustment	UNIT COST

						Actual	C	OST ADJU	STMENT	ADJUSTED			
DESCRIPTION	-207	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)	Unit Cost (\$)	Cost Year	ENR Index	Adjustment Factor	UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
DIVISION 11: EQUIPMENT													
JIWWTP and SSWWTP Pumps		6	each	\$93,000	\$560,000	\$90,000	2006	9700	1.03	\$92,784	pump, motor, etc. rated for 300 psi +5000 for install	TBD	quote from Mickey at RDM
	Division 11 Subtotal	\$560,000											
DIVISION 16: ELECTRICAL					-								
Pipeline Cathodic Protection		3	allowance	\$258,000	\$260,000	\$250,000	2006	9700	1.03	\$257,732	TBD	TBD	PWC
	Division 16 Subtotal	\$260,000											



BIOSOLIDS ALTERNATIVE EVALUATIONS

SSWWTP DIGESTER DEMOLITION CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$5,420,000

DESCRIPTION Quantity Units Unit Cost (\$)

DIVISION 13: SPECIAL CONSTRUCTION

Demolition of Digesting Facilities 1 allowance \$5,417,000 \$5,420,000

\$5,420,000

Division 13 Subtotal

				v Worksheet

Actual Unit Cost	Cost	OST ADJUS	STMENT Adjustment	ADJUSTED UNIT COST			
(\$)	Year_	Index	Factor	(\$)	ITEM	MANUFACTURER	COMMENTS
\$5,000,000	2005	9231	1.08	\$5,416,531	TBD	TBD	PWC



BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) =

Total Annual O&M Cost = \$34,700,000

Milorganite® Annual Operating & Maintenance Costs

% of biosolids to Milorganite® = 0% annual biosolids (dt/year) = 0

	Milorganite® A	llocations	Annual Cost
Item/Process	%	S/dt	\$/yr
JIWWTP Thickening	6.5%	\$26.50	\$0
JIWWTP Dewatering/Drying	59.5%	\$241.40	\$0
JIWWTP Chaff Processing	4.7%	\$19.20	\$0
Milorganite® Warehouse/Shipping	5.7%	\$23.00	\$0
JIWWTP Natural Gas & Electric Purchase	33.7%	\$136.70	\$0
Biosolids Marketing	17.4%	\$70.70	\$0
IPS Pipeline Sludge Transfer (includes SS energy)	0.5%	\$2.20	\$0
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0
SSWWTP Sludge Thickening (energy included)	1.5%	\$6.10	SO
SSWWTP Digestion (energy included)	3.7%	\$14.90	\$0
Milorganite® Sales Revenue	-33.2%	-\$134.80	\$0
SUBTOTAL	100%	\$406	\$0

Cake Agrilife Annual Operating Costs

% of biosolids to cake Agri-Life® = 0% annual biosolids (dt/year) = 0

Agri-Life® Allocations Annual Cost Item/Process
SSWWTP Digester Gas Credit/Replacement \$/dt \$/yr 0.0% \$0.00 \$0 SSWWTP Sludge Thickening (energy included) SSWWTP Digestion (energy included) SSWWTP Dewatering (energy included) \$0 \$0 \$0 33.0% \$185.50 6.5% \$36.40 36.5% \$205.30 \$0 \$0 Transport To Ag/WEPCO 24.0% \$135.10 SUBTOTAL 100% \$562

Glass Furnace Annual Operating Costs

% of biosolids to glass furnace = 0%

	Minergy Allo	cations	Annual Cost
Item/Process	%	\$/dt	\$/yr
JIWWTP Thickening	6.1%	\$26.50	\$0
JIWWTP Dewatering/Drying	55.7%	\$241.40	\$0
JIWWTP Electric Purchase	21.6%	\$93.50	\$0
JIWWTP Natural Gas Purchase	0.3%	\$1.10	\$0
IPS Pipeline Sludge Transfer (includes SS energy)	0.6%	\$2.50	\$0
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	\$0
SSWWTP Sludge Thickening (energy included)	1.6%	\$7.00	\$0
SSWWTP Digestion (energy included)	4.0%	\$17.20	\$0
Glass Aggregate Sales Revenue	-0.4%	-\$1.80	\$0
Glass Furnace Annual Operating Costs	10.6%	\$45.80	\$0
SUBTOTAL	100%	\$433	\$0

from Geoff Hurtado's estimate - 2004, Solids Cost 2004 UWSactual .XLS, (ENR = 8620) unless otherwise specified

Milorganite® Annual Operating & Maintenance Costs

Total Milorganite® 2004 tons =	56,040						
	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cos	st .
JIWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49		0
JIWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41		0
JIWWTP Chaff Processing	\$928,541	\$16.57	2004	8620	\$19.22		0
Milorganite® Warehouse/Shipping	\$1,108,821	\$19.79	2004	8620	\$22.95		0
JIWWTP Natural Gas & Electric Purchase*	\$6,602,327	\$117.81	2004	8620	\$136.68		0 multiplied by 0.7 to account for new turbine efficiency
Biosolids Marketing		\$60.93	2004	8620	\$70.69		0 based on tons sold, not tons produced
IPS Pipeline Sludge Transfer	\$104,631	\$1.87	2004	8620	\$2.17		0
SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00		0 value per ton VSS destroyed (from Energy Evaluation 09.11.06 xls) x (prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) / prop. biosolids
SSWWTP Sludge Thickening	\$292,305	\$5.22	2004	8620	\$6.05		
SSWWTP Digestion	\$718,116	\$12.81	2004	8620	\$14.87		0
Milorganite® Sales Revenue		-\$116.21	2004	8620	-\$134.81		0

*changes depending on turbine existance at JI

Cake Agri-Life® Annual Operating Costs

Total cake Agri-Life® 2004 tons =	2168						
	Hurtado		Cost	ENR	2020 (6/2007)	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cos	t control of the cont
SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00		0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46	1	0
SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39	9	0
SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205.33		0
Polymer & Lime Filter Cake To Ag/WEPCO	O SALIZATED TO SE	\$116.46	2004	8620	\$135.11	1	0 based on tons transported, not tons produced
						9	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

Glass Fur	rnace Annua	I Operating	Costs
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Glass Furnace Annual Operating Co	sts						
Total biosolids 2004 =	62,873						
Total Milorganite® 2004 tons =	56,040)					
	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004	
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cos	st
JIWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49		0
JIWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41		0
JIWWTP Electric Purchase		\$93.50	2007	10000	\$93.50		0 Energy Evaluation 09.11.06.xls
JIWWTP Natural Gas Purchase		\$1.08	2007	10000	\$1.08		0 from PWC 9/05 meeting notes (Biosolids Evaluation Summary 090105.ppt)
IPS Pipeline Sludge Transfer	\$134,469	\$2,14	2004	8620	\$2.48		0 SS IPS part of cost multiplied by total digested solids/digested solids to milo (in 2004)
SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00		0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.xls) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$379,562	\$6.04	2004	8620	\$7.00		0
SSWWTP Digestion	\$932,484	\$14.83	2004	8620	\$17.21		0
Minergy Sales Revenue	A WILL HOUSE	-\$1.58	2004	8620	-\$1.83		\$2/ton finished from PWC 9/05 meeting notes (Biosolids Evaluation Summary 090105.ppt)
Minergy Process	9	\$42.32	2005	9231	\$45.84		0 10 employees & 6% of capital costs; from Biosolids Alternative Sizing Worksheets r4.xls by WLM
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BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) =

Total Annual O&M Cost = \$34,700,000

Landfill Annual Operating & Maintenance Costs

% of biosolids to landfill = 0% annual biosolids (dt/year) = 0

	Milorganite® A	llocations	Annual Cost
Item/Process	%	\$/dt	S/yr
JIWWTP Electric Purchase	9.7%	\$57.00	SC
IPS Pipeline Sludge Transfer	0.0%	\$0.20	SC
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	SC
SSWWTP Sludge Thickening (energy included)	31.5%	\$185.50	SC
SSWWTP Dewatering (energy included)	34.8%	\$205.30	SC
SSWWTP Digestion (energy included)	6.2%	\$36.40	SC
Cake Trucking & Landfilling	17.8%	\$104.70	SC
SUBTOTAL	100%	\$580	50

Land Application Annual Operating & Maintenance Costs

% of biosolids to land application = 0% annual biosolids (dt/year) = 0

	Milorganite® A	llocations	Annual Cost	
Item/Process	%	\$/dt	S/yr	
JIWWTP Electric Purchase	9.2%	\$57.00	SC	
IPS Pipeline Sludge Transfer	0.0%	\$0.20	SO	
SSWWTP Digester Gas Credit/Replacement	0.0%	\$0.00	SO	
SSWWTP Sludge Thickening (energy included)	29.8%	\$185.50	SO	
SSWWTP Dewatering (energy included)	33.0%	\$205.30	SO	
SSWWTP Digestion (energy included)	5.9%	\$36.40	50	
Polymer & Lime Filter Cake To Ag/WEPCO	22.1%	\$137.30	SO	
SUBTOTAL	100%	\$622	SO	

Incineration Annual Operating & Maintenance Costs % of biosolids to Milorganite® = 100%

annual biosolids (dt/year) = 114,100 Milorganite® Allocations Annual Cost \$/dt S/vr JIWWTP Thickening 22.1% \$7,656,000 JIWWTP Dewatering 19.2% \$6,652,000 JIWWTP Electric Purchase 26.6% \$80.90 \$9,231,000 IPS Pipeline Sludge Transfer (includes SS energy) \$160,000 0.5% \$1.40 \$4,621,000 Incineration Facility Labor 13.3% \$40.50 Incineration Facility Maintenance/Repair/Replace 8.9% \$27.10 \$3,092,000 Incineration Facility Chemicals and Other Costs \$2.40 \$274,000 Ash Transport 0.5% \$1.40 \$160,000

SUBTOTAL

2.8%

5.5%

\$8.40

\$16.60

\$958,000

\$1,894,000

\$34,698,000

from Geoff Hurtado's estimate - 2004, Solids Cost 2004 UWSactual XLS, (ENR = 8620) unless otherwise specified

Landfill Annual Operating & Maintenance Costs

Total biosolids 2004 = 62.873 Total cake Agri-Life® 2004 tons = 2168

100000000000000000000000000000000000000	Hurtado		Cost	ENR	2020 (6/2007)	2004
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	n Process Cost
JIWWTP Electrical Purchase		\$57	2007	10000	\$56.97	97 0 Energy Evaluation 09.11.06.xls
IPS Pipeline Sludge Transfer	\$9,352	\$0.15	2004	8620	\$0.17	.17 0 JI IPS cost x2 to account for WAS transfer and divided by total 2004 biosolids production
SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00	00 value per ton VSS destroyed (from Energy Evaluation 09.11.06 xls) x (prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids x % to digestion (Hurtado) - 2004 solids to digestion (H
SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46	46 0
SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205.33	33 0
SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39	39 0
Cake Trucking & Landfilling	-	\$96.61	2005	9231	\$104.66	66 0 Waste Management quote *247/313 (to discount for solids lost in digestion)
						50M

Land Application Annual Operating & Maintenance Costs Total biosolids 2004 = 62,873

	Total cake Agri-Life® 2004 tons =	2168						
		Hurtado	2004	Cost	ENR	2020 (6/2007)	2004	
ı	Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Co	st .
ı	JIWWTP Electrical Purchase		\$57	2007	10000	\$56.97		0 Energy Evaluation 09.11.06.xls
	IPS Pipeline Sludge Transfer	\$9,352	\$0.15	2004	8620	\$0.17		0 JI IPS cost x2 to account for WAS transfer and divided by total 2004 biosolids production
	SSWWTP Digester Gas Credit/Replacement		\$0.00	2007	10000	\$0.00		0 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
	SSWWTP Sludge Thickening	\$346,593	\$159.87	2004	8620	\$185.46		0
ı	SSWWTP Dewatering	\$383,719	\$176.99	2004	8620	\$205.33		0
	SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39		0
	Polymer & Lime Filter Cake To Ag/WEPCO	*	\$118.37	2004	8620	\$137.32		0 from Biosolids Alternative Sizing Workshoots r4.xls by WLM, "247/313 to account for solids lost in digestion
								0

Incineration Annual Operating & Maintenance Costs Total biosolids 2004 =

Total Milorganite® 2004 tons =	56,040					
TO DELIGH MALLOS SER PROPERTY AS PASSION PROCESS STORY SPANSOR SH	Hurtado	2004	Cost	ENR	2020 (6/2007)	2004
Process	2004 Cost	Process Cost/ton	Year	Index	Process Cost/ton	Process Cost
JIWWTP Thickening	\$1,279,606	\$57.87	2004	8620	\$67.13	6,602,998 *313/247 (raw total/digested total) to account for PSD instead of digested sludge, /.5 because only half of the sludge is currently thickened (AES)
JIWWTP Dewatering	\$2,222,754	\$50.26	2004	8620	\$58.31	5,734,906 *BFP number used *313/247 (raw total/digested total) to account for PSD instead of digested studge per PWC; centrifuges will cost at least as much as BFP
JIWWTP Electrical Purchase		\$81	2007	10000	\$80.93	9,234,136 Energy Evaluation 09.11.06.xls
IPS Pipeline Sludge Transfer	\$76,401	\$1.22	2004	8620	\$1.41	138,650 JI cost removed; SS IPS part of cost multiplied by (solids to digestion-PSD from JI)/digested solids to millo (in 2004)
Incineration Facility Labor	,	\$34.94	2004	8620	\$40.53	3,986,701 43 employes at \$75,000/yr for 92,300 tons/year (Incineration Evaluation.x/s)
Incineration Facility Maintenance/Repair/Replace		\$23.34	2004	8620	\$27.07	2,662,614 6% of equipment costs which are assumed to be 25% of capital cost (Incineration Evaluation.xis); does not account for operation of centrifuges; per PWC
Incineration Facility Chemicals and Other Costs	-	\$2.07	2004	8620	\$2.40	235,630 Incineration Evaluation.xls
Fly Ash Transport	*	\$1.38	2006	9700	\$1.42	157,480 WM quote for 20YD dump truck, assuming 20 min. for loading *72/313 to account for solids lost in incineration (assuming same loss of solids as with Minergy)
Fly Ash Landfill		\$8.17	2006	9700	\$8.42	931,756 WM quote - \$35/ton landfill, \$0.5/ton taxes *72/313 to account for solids lost in incineration (assuming same loss of solids as with Minergy)
SSWWTP Digester Gas Credit/Replacement	-	\$16.58	2007	10000	\$16.58	1,891,781 value per ton VSS destroyed (from Energy Evaluation 09.11.06.x/s) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids



Ash Landfill

SSWWTP Digester Gas Credit/Replacement