

APPENDIX 9D

BIOSOLIDS SCREENING ALTERNATIVES – COST ESTIMATES

**Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING**

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

Milwaukee Metropolitan Sewerage District 2020 FACILITIES PLANNING				
BIOSOLIDS ALTERNATIVE EVALUATIONS				
SSWWTP DIGESTER REHABILITATION CAPITAL COST				
Total Capital Cost (all divisions, without contingency or markup) =				\$4,370,000
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			

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Actual Unit Cost (\$)	Cost Year	COST ADJUSTMENT ENR Index	Adjustment Factor	ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$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
\$14,333	2005	9231	1.08	\$15,526	Wemco Hidrostat, 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
\$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
\$54,600	2005	9231	1.08	\$59,149	Wemco Hidrostat, 30 HP motors, VFD, 1200 gpm @ 60' TDH	Ley & Associates +250% for VFD +30% for install	WLM; x1.05 Mech/Elect/I&C/Civil
\$157,500	2005	9231	1.08	\$170,621	TBD	TBD	WLM; x1.05 Mech/Elect/I&C/Civil

BIOSOLIDS ALTERNATIVE EVALUATIONS

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

DIVISION 13: SPECIAL CONSTRUCTION

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Actual Unit Cost (\$)	COST ADJUSTMENT			ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
Year	Cost	ENR Index	Adjustment Factor				



Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING
BIOSOLIDS ALTERNATIVE EVALUATIONS

D&D FACILITY UPGRADES CAPITOL COST

Total Capital Cost (all divisions, without contingency or markup) = \$50,500,000

DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 13: SPECIAL CONSTRUCTION				
Unit Process 24 Upgrade	1	each	\$7,938,000	\$7,940,000
Unit Process 25 Upgrade	1	each	\$17,423,000	\$17,420,000
Unit Process 27 Upgrade	1	each	\$4,582,000	\$4,580,000
Unit Process 29 Upgrade	1	each	\$12,629,000	\$12,630,000
Unit Process 30 Upgrade	1	each	\$1,278,000	\$1,280,000
Unit Process 31 Upgrade	1	each	\$747,000	\$750,000
Unit Process 32 Upgrade	1	each	\$2,809,000	\$2,810,000
Miscellaneous Costs (drop chutes, etc.)	1	each	\$3,093,000	\$3,090,000
Division 13 Subtotal	\$50,500,000			

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Actual Unit Cost (\$)	Cost Year	COST ADJUSTMENT ENR Index	Adjustment Factor	ADJUSTED 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

BIOSOLIDS ALTERNATIVE EVALUATIONS

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

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Actual Unit Cost (\$)	COST ADJUSTMENT			ADJUSTED UNIT COST (\$)
	Cost Year	ENR Index	Adjustment Factor	



BIOSOLIDS ALTERNATIVE EVALUATIONS

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

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BIOSOLIDS ALTERNATIVE EVALUATIONS

Total Capital Cost (all divisions, without contingency or markup) = \$2,550,000

Division 11 Subtotal \$2,550,000

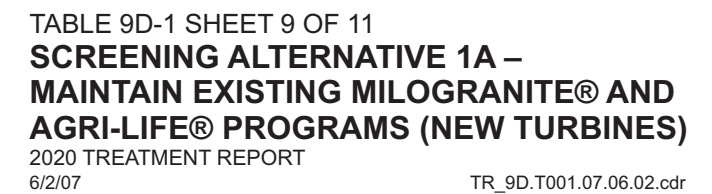
Actual Unit Cost (\$)	COST ADJUSTMENT			ADJUSTED UNIT COST (\$)
	Cost Year	ENR Index	Adjustment Factor	

Ashbrook Aquabell (Energenics)
Wemco Hidrostral 500 gpm at 75' TDH, w/VFDs for adjustable speed. 20 HP motors.
200 gpm@40'TDH, w/VFDs
250 gpm @ 140' TDH



[illegible]

Actual Unit Cost (\$)	COST ADJUSTMENT Cost Year	ENR Index	Adjustment Factor	ADJUSTED UNIT COST (\$)	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 storage



Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING

BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) = 114,100
Total Annual O&M Cost = \$47,350,000

Milorganite® Annual Operating & Maintenance Costs

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

Item/Process	Milorganite® Allocations		Annual Cost \$/yr
	%	\$/dt	
JIWWTP Thickening	6.7%	\$26.50	\$2,570,000
JIWWTP Dewatering/Drying	60.9%	\$241.40	\$23,412,000
JIWWTP Chaff Processing	4.8%	\$19.20	\$1,862,000
Milorganite Warehouse/Shipping	5.8%	\$23.00	\$2,231,000
JIWWTP Natural Gas & Electric Purchase	34.5%	\$136.70	\$13,258,000
Biosolids Marketing	17.8%	\$70.70	\$6,857,000
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	\$1,445,000
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

Item/Process	Agri-Life® Allocations		Annual Cost \$/yr
	%	\$/dt	
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

Item/Process	Minergy Allocations		Annual Cost \$/yr
	%	\$/dt	
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

Process	Hurtado		2004 Process Cost/ton	Cost Year	ENR Index	2020 Process Cost/ton	2004 Process Cost	
	2004 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.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	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 existence at JI

Cake Agri-Life® Annual Operating Costs

Total cake Agri-Life® 2004 tons = 2168

Process	Hurtado		2004 Process Cost/ton	Cost Year	ENR Index	2020 Process Cost/ton	2004 Process Cost	
	2004 Cost							
SSWWTP Digester Gas Credit/Replacement	-		-\$41.69	2007	10000	-\$41.69	-713,609	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	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
							8,295,455	

Glass Furnace Annual Operating Costs

Total biosolids 2004 = 62,873

Total Milorganite® 2004 tons = 56,040

Process	Hurtado		2004 Process Cost/ton	Cost Year	ENR Index	2020 Process Cost/ton	2004 Process Cost	
	2004 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	-		\$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	-		-\$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
							0	

2020 FACILITIES PLANNING

BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) = 114,100
Total Annual O&M Cost = \$47,350,000

Landfill Annual Operating & Maintenance Costs

% of biosolids to landfill = 0%

annual biosolids (dt/year) = 0

Item/Process	Milorganite® Allocations		Annual Cost \$/yr
	%	\$/dt	
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

Item/Process	Milorganite® Allocations		Annual Cost \$/yr
	%	\$/dt	
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

Item/Process	Milorganite® Allocations		Annual Cost \$/yr
	%	\$/dt	
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

Process	Hurtado		Cost Year	ENR Index	2020 Process Cost/ton	2004 Process Cost	
	2004 Cost	Process Cost/ton					
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.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	
Cake Trucking & Landfilling	-	\$96.61	2005	9231	\$104.66	0	Waste Management quote *247/313 (to discount for solids lost in digestion)
						0	

Land Application Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873

Total cake Agri-Life® 2004 tons = 2188

Process	Hurtado		Cost Year	ENR Index	2020 Process Cost/ton	2004 Process Cost	
	2004 Cost	Process Cost/ton					
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.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.xls by WLM, *247/313 to account for solids lost in digestion
						0	

Incineration Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873

Total Milorganite® 2004 tons = 56,040

Process	Hurtado		Cost Year	ENR Index	2020 Process Cost/ton	2004 Process Cost	
	2004 Cost	Process Cost/ton					
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	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	43 employees 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% 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	-	\$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	-	\$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
						0	

Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING

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COST ESTIMATE SUMMARY

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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**

Milwaukee Metropolitan Sewerage District 2020 FACILITIES PLANNING				
BIOSOLIDS ALTERNATIVE EVALUATIONS				
SSWWTP DIGESTER REHABILITATION CAPITAL COST				
Total Capital Cost (all divisions, without contingency or markup) =				\$4,370,000
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			

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

Actual Unit Cost (\$)	Cost Year	COST ADJUSTMENT ENR Index	Adjustment Factor	ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$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
\$14,333	2005	9231	1.08	\$15,526	Wemco Hidrostat, 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
\$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
\$54,600	2005	9231	1.08	\$59,149	Wemco Hidrostat, 30 HP motors, VFD, 1200 gpm @ 60' TDH	Ley & Associates +250% for VFD +30% for install	WLM; x1.05 Mech/Elect/I&C/Civil
\$157,500	2005	9231	1.08	\$170,621	TBD	TBD	WLM; x1.05 Mech/Elect/I&C/Civil

BIOSOLIDS ALTERNATIVE EVALUATIONS

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

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

Actual Unit Cost (\$)	COST ADJUSTMENT			ADJUSTED UNIT COST (\$)
	Cost Year	ENR Index	Adjustment Factor	



Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING
BIOSOLIDS ALTERNATIVE EVALUATIONS

D&D FACILITY UPGRADES CAPITOL COST

Total Capital Cost (all divisions, without contingency or markup) = \$50,500,000

DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 13: SPECIAL CONSTRUCTION				
Unit Process 24 Upgrade	1	each	\$7,938,000	\$7,940,000
Unit Process 25 Upgrade	1	each	\$17,423,000	\$17,420,000
Unit Process 27 Upgrade	1	each	\$4,582,000	\$4,580,000
Unit Process 29 Upgrade	1	each	\$12,629,000	\$12,630,000
Unit Process 30 Upgrade	1	each	\$1,278,000	\$1,280,000
Unit Process 31 Upgrade	1	each	\$747,000	\$750,000
Unit Process 32 Upgrade	1	each	\$2,809,000	\$2,810,000
Miscellaneous Costs (drop chutes, etc.)	1	each	\$3,093,000	\$3,090,000
Division 13 Subtotal	\$50,500,000			

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

Actual Unit Cost (\$)	Cost Year	COST ADJUSTMENT ENR Index	Adjustment Factor	ADJUSTED 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

BIOSOLIDS ALTERNATIVE EVALUATIONS

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

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



BIOSOLIDS ALTERNATIVE EVALUATIONS

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

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Actual Unit Cost (\$)	COST ADJUSTMENT		ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
Cost Year	ENR Index	Adjustment Factor				



BIOSOLIDS ALTERNATIVE EVALUATIONS

Total Capital Cost (all divisions, without contingency or markup) = \$2,550,000

DIVISION 11: EQUIPMENT					
2 meter Gravity Belt Thickener	7	each	\$222,000	\$1,550,000	
500 gpm Gravity Belt Thickener Feed Pumps	7	each	\$62,000	\$430,000	
Progressing Cavity Gravity Belt Thickener Polymer Feed Pumps	3	each	\$44,000	\$130,000	
Progressing Cavity Thickened Sludge Transfer Pumps	6	each	\$74,000	\$440,000	

\$2,550,000

Actual	COST ADJUSTMENT	ADJUSTED
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\$204,750	2005	9231	1.08	\$221,807	Ashbrook Aquabelt (Energenics)	Energenics	x1.3 installed x1.05 Mech/Elect/I&C/Civil
\$57,330	2005	9231	1.08	\$62,106	Wemco Hidrostral 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
\$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



BIOSOLIDS ALTERNATIVE EVALUATIONS

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

DIVISION 2: SITEWORK

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

\$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 storage
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Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING

BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) = 114,100
Total Annual O&M Cost = \$52,350,000

Milorganite® Annual Operating & Maintenance Costs

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

Item/Process	Milorganite® Allocations		Annual Cost \$/yr
	%	\$/dt	
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

Item/Process	Agri-Life® Allocations		Annual Cost \$/yr
	%	\$/dt	
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

Item/Process	Minergy Allocations		Annual Cost \$/yr
	%	\$/dt	
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					
Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 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	1,806,969
Milorganite Warehouse/Shipping	\$1,108,821	\$19.79	2004	8620	\$22.95	1,918,969
JIWWTP Natural Gas & Electric Purchase*	-	\$188.32	2007	10000	\$188.32	18,264,536 Energy Evaluation 09.11.06.xls
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.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	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 existence at JI

Cake Agri-Life® Annual Operating Costs

Total cake Agri-Life® 2004 tons =	2168					
Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
SSWWTP Digester Gas Credit/Replacement	-	-\$41.69	2007	10000	-\$41.69	-713,609 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	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
						8,295,455

Glass Furnace Annual Operating Costs

Total biosolids 2004 =	62,873					
Total Milorganite® 2004 tons =	56,040					
Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 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	-	\$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	-	-\$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
						0

Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING

BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) =	114,100
Total Annual O&M Cost =	\$52,350,000

Landfill Annual Operating & Maintenance Costs

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

Item/Process	Milorganite® Allocations		Annual Cost \$/yr
	%	\$/dt	
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

Item/Process	Milorganite® Allocations		Annual Cost \$/yr
	%	\$/dt	
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

Item/Process	Milorganite® Allocations		Annual Cost \$/yr
	%	\$/dt	
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 = 2188

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
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 WIAS 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	\$348,593	\$159.87	2004	8620	\$185.46	0
SSWWTP Dewatering	\$383,719	\$175.99	2004	8620	\$205.33	0
SSWWTP Digestion	\$68,003	\$31.37	2004	8620	\$36.39	0
Cake Trucking & Landfilling	-	\$86.61	2005	9231	\$104.66	0 Waste Management quote *247/313 (to discount for solids lost in digestion)
						0

Land Application Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873
Total cake Agri-Life® 2004 tons = 2188

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
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 WIAS 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	\$348,593	\$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.xls by WLM, *247/313 to account for solids lost in digestion
						0

Incineration Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873
Total Milorganite® 2004 tons = 56,040

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 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 milo (in 2004)
Incineration Facility Labor	-	\$34.94	2004	8620	\$40.53	0 43 employees 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% 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	-	\$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	-	\$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
						0

Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING

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
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			\$191,730,000
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**

Milwaukee Metropolitan Sewerage District 2020 FACILITIES PLANNING				
BIOSOLIDS ALTERNATIVE EVALUATIONS				
SSWWTP DIGESTER REHABILITATION CAPITAL COST				
Total Capital Cost (all divisions, without contingency or markup) =				\$4,370,000
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			

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

Actual Unit Cost (\$)	Cost Year	COST ADJUSTMENT ENR Index	Adjustment Factor	ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$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
\$14,333	2005	9231	1.08	\$15,526	Wemco Hidrostat, 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
\$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
\$54,600	2005	9231	1.08	\$59,149	Wemco Hidrostat, 30 HP motors, VFD, 1200 gpm @ 60' TDH	Ley & Associates +250% for VFD +30% for install	WLM; x1.05 Mech/Elect/I&C/Civil
\$157,500	2005	9231	1.08	\$170,621	TBD	TBD	WLM; x1.05 Mech/Elect/I&C/Civil

BIOSOLIDS ALTERNATIVE EVALUATIONS

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

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

Actual Unit Cost (\$)	COST ADJUSTMENT			ADJUSTED UNIT COST (\$)
	Cost Year	ENR Index	Adjustment Factor	



Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING
BIOSOLIDS ALTERNATIVE EVALUATIONS

D&D FACILITY UPGRADES CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$50,500,000

DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 13: SPECIAL CONSTRUCTION				
Unit Process 24 Upgrade	1	each	\$7,938,000	\$7,940,000
Unit Process 25 Upgrade	1	each	\$17,423,000	\$17,420,000
Unit Process 27 Upgrade	1	each	\$4,582,000	\$4,580,000
Unit Process 29 Upgrade	1	each	\$12,629,000	\$12,630,000
Unit Process 30 Upgrade	1	each	\$1,278,000	\$1,280,000
Unit Process 31 Upgrade	1	each	\$747,000	\$750,000
Unit Process 32 Upgrade	1	each	\$2,809,000	\$2,810,000
Miscellaneous Costs (drop chutes, etc.)	1	each	\$3,093,000	\$3,090,000
Division 13 Subtotal	\$50,500,000			

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

Actual Unit Cost (\$)	Cost Year	COST ADJUSTMENT ENR Index	Adjustment Factor	ADJUSTED 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

BIOSOLIDS ALTERNATIVE EVALUATIONS

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

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Actual Unit Cost (\$)	COST ADJUSTMENT			ADJUSTED UNIT COST (\$)
	Cost Year	ENR Index	Adjustment Factor	



BIOSOLIDS ALTERNATIVE EVALUATIONS

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

DIVISION 11: EQUIPMENT

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

\$40,987,013

2006

9700

1.03

\$42,254,653

ITEM

MANUFACTURER

COMMENTS

Minergy Glass Pack Process Facility

Minergy (7/12/05 quote)

/1.225 engineering&pm /1.1 contingency x1.05 Mech/Elect/I&C/Civil



Milwaukee Metropolitan Sewerage District 2020 FACILITIES PLANNING BIOSOLIDS ALTERNATIVE EVALUATIONS				
NEW SSWWTP GRAVITY BELT THICKENERS CAPITAL COST				
Total Capital Cost (all divisions, without contingency or markup) =				\$1,570,000
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			

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

Actual Unit Cost (\$)	Cost Year	COST ADJUSTMENT ENR Index	Adjustment Factor	ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$204,750	2005	9231	1.08	\$221,807	Ashbrook Aquabelt (Energenics)	Energenics	x1.3 installed x1.05 Mech/Elect/I&C/Civil
\$57,330	2005	9231	1.08	\$62,106	Wemco Hidrostral 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
\$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

Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING
BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) = 114,100
Total Annual O&M Cost = \$47,890,000

Milorganite® Annual Operating & Maintenance Costs

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

Item/Process	Milorganite® Allocations %	\$/dt	Annual Cost \$/yr
JWWTP Thickening	6.5%	\$26.50	\$0
JWWTP Dewatering/Drying	59.5%	\$241.40	\$0
JWWTP Chaff Processing	4.7%	\$19.20	\$0
Milorganite® Warehouse/Shipping	5.7%	\$23.00	\$0
JWWTP 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	\$0
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%
annual biosolids (dt/year) = 0

Item/Process	Agri-Life® Allocations %	\$/dt	Annual Cost \$/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 = 100%
annual biosolids (dt/year) = 114,100

Item/Process	Minergy Allocations %	\$/dt	Annual Cost \$/yr
JWWTP Thickening	6.3%	\$26.50	\$3,024,000
JWWTP Dewatering/Drying	57.5%	\$241.40	\$27,544,000
JWWTP Electric Purchase	22.3%	\$93.50	\$10,668,000
JWWTP 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

Milorganite® Annual Operating & Maintenance Costs

Total Milorganite® 2004 tons = 56,040

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
JWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49	0
JWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41	0
JWWTP Chaff Processing	\$928,541	\$16.57	2004	8620	\$19.22	0
Milorganite® Warehouse/Shipping	\$1,108,821	\$19.79	2004	8620	\$22.95	0
JWWTP 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	0
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 existence at JI

Cake Agri-Life® Annual Operating Costs

Total cake Agri-Life® 2004 tons = 2168

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
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 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

Glass Furnace Annual Operating Costs

Total biosolids 2004 = 62,873

Total Milorganite® 2004 tons = 56,040

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
JWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49	2,605,336
JWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41	23,744,141
JWWTP Electric Purchase	-	\$93.50	2007	10000	\$93.50	10,667,998 Energy Evaluation 09.11.06.xls
JWWTP 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	-1,541,365 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	688,818
SSWWTP Digestion	\$932,484	\$14.83	2004	8620	\$17.21	1,692,244
Minergy Sales Revenue	-	-\$1.58	2004	8620	-\$1.83	-180,081 \$2/ton finished from PWC 9/05 meeting notes (Biosolids Evaluation Summary 090105.ppt)
Minergy Process	-	\$42.32	2005	9231	\$45.84	4,828,544 10 employees & 6% of capital costs; from Biosolids Alternative Sizing Worksheets r4.xls by WLM
						42,873,283

Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING

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

Item/Process	Milorganite® %	Allocations \$/dt	Annual Cost \$/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

Item/Process	Milorganite® %	Allocations \$/dt	Annual Cost \$/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

Item/Process	Milorganite® %	Allocations \$/dt	Annual Cost \$/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

Process	Hurtado 2004 Cost	Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
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.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
Cake Trucking & Landfilling	-	\$96.61	2005	9231	\$104.66	0 Waste Management quote *247/313 (to discount for solids lost in digestion)
						0

Land Application Annual Operating & Maintenance Costs

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

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
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.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.xls by WLM, *247/313 to account for solids lost in digestion
						0

Incineration Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873
Total Milorganite® 2004 tons = 56,040

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 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 milo (in 2004)
Incineration Facility Labor	-	\$34.94	2004	8620	\$40.53	0 43 employees 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% 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 VM 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	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	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
						0

Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING

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

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

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

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

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

Actual Unit Cost (\$)	COST ADJUSTMENT			ADJUSTED UNIT COST (\$)
	Cost Year	ENR Index	Adjustment Factor	



BIOSOLIDS ALTERNATIVE EVALUATIONS

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 Subtotal	\$21,670,000			

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



Milwaukee Metropolitan Sewerage District				
2020 FACILITIES PLANNING				
BIOSOLIDS ALTERNATIVE EVALUATIONS				
SSWWTP DIGESTER REHABILITATION CAPITAL COST				
Total Capital Cost (all divisions, without contingency or markup) =				\$7,520,000
DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 11: EQUIPMENT				
New Digester Mixing Systems	12	each	\$491,000	\$5,890,000
New Digester Recirculation Pumps	24	each	\$16,000	\$380,000
Recirculating Sludge Heat Exchangers	6	each	\$44,000	\$260,000
Storage Digester Sludge Transfer Pumps	8	each	\$59,000	\$470,000
Digester Gas Safety Equipment	1	allowance	\$518,000	\$520,000
Division 11 Subtotal	\$7,520,000			

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

Actual Unit Cost (\$)	Cost Year	COST ADJUSTMENT ENR Index	Adjustment Factor	ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$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
\$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
\$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
\$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
\$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

Milwaukee Metropolitan Sewerage District 2020 FACILITIES PLANNING				
BIOSOLIDS ALTERNATIVE EVALUATIONS				
SSWWTP THICKENING UPGRADES CAPITAL COST				
Total Capital Cost (all divisions, without contingency or markup) =				\$5,920,000
DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 11: EQUIPMENT				
2 meter Gravity Belt Thickener	10	each	\$222,000	\$2,220,000
500 gpm Gravity Belt Thickener Feed Pumps	6	each	\$62,000	\$370,000
Progressing Cavity Gravity Belt Thickener Polymer Feed Pumps	3	each	\$44,000	\$130,000
Progressing Cavity Thickened Sludge Transfer Pumps	16	each	\$74,000	\$1,180,000
Progressing Cavity GBT Bulk Polymer Transfer Pumps	2	each	\$37,000	\$70,000
Progressing Cavity GBT Bulk Polymer Mix Pumps	2	each	\$30,000	\$60,000
Progressing Cavity Operational Storage Pumps	6	each	\$74,000	\$440,000
Division 11 Subtotal	\$4,470,000			
DIVISION 13: SPECIAL CONSTRUCTION				
Relocate JWWTP Gravity Belt Thickeners to SSWWTP	4	each	\$74,000	\$300,000
Thickening Building Addition	7,200	sf	\$160	\$1,150,000
Division 13 Subtotal	\$1,450,000			

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

Actual Unit Cost (\$)	Cost Year	COST ADJUSTMENT ENR Index	Adjustment Factor	ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$204,750	2005	9231	1.08	\$221,807	Ashbrook Aquabelt (Energenics)	Energenics	WLM; x1.3 installed x1.05 Mech/Elect/I&C/Civil
\$57,330	2005	9231	1.08	\$62,106	Wemco Hidrostat 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/I&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 w/VFDs	Moyno or Netszch	WLM; 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
\$150	2005	9231	1.08	\$162	TBD	TBD	WLM

BIOSOLIDS ALTERNATIVE EVALUATIONS

Total Capital Cost (all divisions, without contingency or markup) = \$8,330,000

DIVISION 2: SITEWORK				
Dewatering	1	allowance	\$108,000	\$110,000
Excavation	46,500	cubic yards	\$11	\$510,000
Structural Fill	4,650	cubic yards	\$13	\$60,000

Division 2 Subtotal \$680,000

DIVISION 3: CONCRETE

Sludge Reaction Tank	8	cubic yards	\$540	\$0
Sludge Holding Tank	75	cubic yards	\$540	\$40,000

Division 3 Subtotal \$40,000

DIVISION 11: EQUIPMENT

Sludge Reaction Tank Mixers	4	each	\$7,000	\$30,000
Sludge Holding Tank Mixers	3	each	\$22,000	\$70,000
Progressing Cavity Sludge Transfer Pumps	6	each	\$118,000	\$710,000
Recessed Plate Filter Press Feed Pumps	6	each	\$126,000	\$760,000
Recessed Plate Filter Presses	3	each	\$518,000	\$1,550,000
Progressing Cavity Recessed Plate Press Polymer Feed Pumps	3	each	\$89,000	\$270,000
Piston Recessed Plate Filter Press Wash Pumps	1	each	\$111,000	\$110,000
Recessed Plate Appurtenances	1	allowance	\$148,000	\$150,000
Roll-off Sludge Containers	40	each	\$3,000	\$120,000
Straddle Carriers for Sludge Containers	2	each	\$162,000	\$320,000

Division 11 Subtotal \$4,090,000

DIVISION 13: SPECIAL CONSTRUCTION

Dewatering Building Addition	16,000	sf	\$220	\$3,520,000
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Division 13 Subtotal \$3,520,000

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Actual Unit Cost (\$)	COST ADJUSTMENT			ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
	Cost Year	ENR Index	Adjustment Factor				
\$100,000	2005	9231	1.08	\$108,331	TBD	TBD	WLM
\$10	2005	9231	1.08	\$11	TBD	TBD	WLM
\$12	2005	9231	1.08	\$13	TBD	TBD	WLM

\$500	2005	9231	1.08	\$542	TBD	TBD	WLM
\$500	2005	9231	1.08	\$542	TBD	TBD	WLM

\$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
\$20,475	2005	9231	1.08	\$22,181	Axial flow turbine, 10 HP	Lightnin Model SX84C10	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
\$109,200	2005	9231	1.08	\$118,297	650 gpm @ 100 psi, 125 HP	Moyno Model 2K335G1 CDQ-DAA (Order No. AS43109-90-4)	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
\$116,025	2005	9231	1.08	\$125,691	Piston membrane w/hydraulic oil; linear flow drop from 160->225 psi	Abel Model FQQG504-22/75; 22.5" pistons/75 HP/54 strokes/minute	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
\$477,750	2005	9231	1.08	\$157,550	151 plates (150 chambers) @ 2k mm x 2k mm, 530 cf @ 225 psig	Rittershaus&Blecher ID No. 0-24-200-007-00	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
\$81,900	2005	9231	1.08	\$88,723	100 HP	Moyno Model 4G065G1SSQ	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
\$102,375	2005	9231	1.08	\$110,903	100 gpm @ 1,500 psi, 125 HP	match existing two at South Shore	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
\$136,500	2005	9231	1.08	\$147,871	TBD	TBD	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
\$3,000	2005	9231	1.08	\$3,250	20' L x 7' W x 6' H	match existing at SS	WLM
\$150,000	2005	9231	1.08	\$162,496	50,000 lbs minimum lift capacity	match existing at SS	WLM

\$200	2005	9231	1.08	\$217	TBD	TBD	WLM
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BIOSOLIDS ALTERNATIVE EVALUATIONS

Total Capital Cost (all divisions, without contingency or markup) = \$820,000

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Actual Unit Cost (\$)	COST ADJUSTMENT			ADJUSTED UNIT COST (\$)
	Cost Year	ENR Index	Adjustment Factor	



Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING
BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) = 114,100
Total Annual O&M Cost = \$62,460,000

Milorganite® Annual Operating & Maintenance Costs

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

Item/Process	Milorganite® Allocations		Annual Cost	
	%	\$/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	\$0	
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%
annual biosolids (dt/year) = 0

Item/Process	Agri-Life® Allocations		Annual Cost	
	%	\$/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%
annual biosolids (dt/year) = 0

Item/Process	Minergy Allocations		Annual Cost	
	%	\$/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

Process	Hurtado		2004	Cost	ENR	2020 (6/2007)		2004
	2004 Cost	Process Cost/ton				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 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	0	
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 existence at JI

Cake Agri-Life® Annual Operating Costs

Total cake Agri-Life® 2004 tons = 2168

Process	Hurtado		2004	Cost	ENR	2020 (6/2007)		2004
	2004 Cost	Process Cost/ton				Process Cost/ton	Process Cost	
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 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

Glass Furnace Annual Operating Costs

Total biosolids 2004 = 62,873

Total Milorganite® 2004 tons = 56,040

Process	Hurtado		2004	Cost	ENR	2020 (6/2007)		2004
	2004 Cost	Process Cost/ton				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	-	\$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	-	-\$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

Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING

BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) = 114,100
Total Annual O&M Cost = \$62,460,000

Landfill Annual Operating & Maintenance Costs

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

Item/Process	Milorganite® %	Allocations \$/dt	Annual Cost \$/yr
JWWTP 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

Item/Process	Milorganite® %	Allocations \$/dt	Annual Cost \$/yr
JWWTP 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

Item/Process	Milorganite® %	Allocations \$/dt	Annual Cost \$/yr
JWWTP Thickening	23.3%	\$67.10	\$0
JWWTP Dewatering	20.3%	\$58.30	\$0
JWWTP 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

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
JWWTP 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	\$363,719	\$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	-	\$96.61	2005	9231	\$104.66	11,023,668 Waste Management quote *247/313 (to discount for solids lost in digestion)
						54,786,198

Land Application Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873
Total cake agnlife 2004 tons = 2168

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
JWWTP 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	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	\$363,719	\$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.xls by WLM, *247/313 to account for solids lost in digestion
						6,500,314

Incineration Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873
Total Milorganite® 2004 tons = 56,040

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
JWWTP Thickening	\$1,279,608	\$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)
JWWTP 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
JWWTP 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 milo (in 2004)
Incineration Facility Labor	-	\$34.94	2004	8620	\$40.53	0 43 employees 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% 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	-	\$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	-	\$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
						0

Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING

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 Distribution

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

ENR Index = 10000 (assumed Milwaukee 2007)

Summary of Capital Costs

Estimated Construction Cost Without Contingency or Markup		\$171,780,000	
Contingency	25%	\$42,950,000	
Estimated Construction Cost Without Markup			\$214,730,000
Contractor OH&M/Engineering	30%		\$64,420,000
Total Capital Cost			\$279,150,000

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

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

BIOSOLIDS ALTERNATIVE EVALUATIONS

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

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

Actual Unit Cost (\$)	COST ADJUSTMENT			ADJUSTED UNIT COST (\$)
	Cost Year	ENR Index	Adjustment Factor	



BIOSOLIDS ALTERNATIVE EVALUATIONS

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

[illegible]

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

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



Milwaukee Metropolitan Sewerage District 2020 FACILITIES PLANNING BIOSOLIDS ALTERNATIVE EVALUATIONS				
SSWWTP DIGESTER REHABILITATION CAPITAL COST				
Total Capital Cost (all divisions, without contingency or markup) =				\$10,180,000
DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 11: EQUIPMENT				
New Digester Mixing Systems	2	each	\$491,000	\$980,000
New Digester Mixing Systems	4	each	\$491,000	\$1,960,000
New Digester Recirculation Pumps	12	each	\$16,000	\$190,000
Thermophilic Digester Gas Handling Equipment	1	allowance	\$518,000	\$520,000
Hot/Cold Water Reservoirs	2	each	\$12,000	\$20,000
Thermophilic Digester Mixing Systems	6	each	\$491,000	\$2,950,000
Thermo/Raw Sludge Heat Interchangers	6	each	\$207,000	\$1,240,000
Thermo Sludge Heat Exchangers	6	each	\$44,000	\$260,000
Thermo Sludge Recirculation Pumps	12	each	\$16,000	\$190,000
Thermo Sludge Transfer Pumps	8	each	\$58,000	\$460,000
Division 11 Subtotal	\$8,770,000			
DIVISION 13: SPECIAL CONSTRUCTION				
Thermophilic Digester Control Building	8,800	sf	\$160	\$1,410,000
Division 13 Subtotal	\$1,410,000			

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

Actual Unit Cost (\$)	Cost Year	COST ADJUSTMENT ENR Index	Adjustment Factor	ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$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
\$453,180	2005	9231	1.08	\$490,933	Cannon Bubble or External Draft Tube; 125' diameter x 38' SWD	Cannon: Inflico Degremont (IDI)/Draft tubes: Eimco (Energenics)	WLM; x1.3 installed, x1.05 Mech/Elect/I&C/Civil
\$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
\$477,750	2005	9231	1.08	\$517,550	flame arresters, PVRVs, moisture removal	TBD	WLM; x1.3 installed, x1.05 Mech/Elect/I&C/Civil
\$10,920	2005	9231	1.08	\$11,830	5,000 gallons each	TBD	WLM; x1.3 installed, x1.05 Mech/Elect/I&C/Civil
\$453,180	2005	9231	1.08	\$490,933	Cannon Bubble or External Draft Tube; 90' diameter x 40' SWD	Cannon: Inflico Degremont (IDI)/Draft tubes: Eimco (Energenics)	WLM; x1.3 installed, x1.05 Mech/Elect/I&C/Civil
\$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
\$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
\$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
\$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/I&C/Civil
\$150	2005	9231	1.08	\$162	TBD	TBD	WLM

Milwaukee Metropolitan Sewerage District				
2020 FACILITIES PLANNING				
BIOSOLIDS ALTERNATIVE EVALUATIONS				
SSWWTP THICKENING UPGRADES CAPITAL COST				
Total Capital Cost (all divisions, without contingency or markup) =				\$6,210,000
DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 11: EQUIPMENT				
2 meter Gravity Belt Thickener	10	each	\$222,000	\$2,220,000
500 gpm Gravity Belt Thickner Feed Pumps	6	each	\$62,000	\$370,000
Progressing Cavity Gravity Belt Thickner Polymer Feed Pumps	3	each	\$44,000	\$130,000
Progressing Cavity Thickened Sludge Transfer Pumps	16	each	\$74,000	\$1,180,000
Progressing Cavity GBT Bulk Polymer Transfer Pumps	2	each	\$37,000	\$70,000
Progressing Cavity GBT Bulk Polymer Mix Pumps	2	each	\$30,000	\$60,000
Progressing Cavity Operational Storage Pumps	6	each	\$74,000	\$440,000
Division 11 Subtotal	\$4,470,000			
DIVISION 13: SPECIAL CONSTRUCTION				
Relocate JIWWTP Gravity Belt Thickeners to SSWWTP	4	each	\$74,000	\$300,000
Thickening Building Addition	7,200	sf	\$200	\$1,440,000
Division 13 Subtotal	\$1,740,000			

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

Actual Unit Cost (\$)	Cost Year	ENR Index	Adjustment Factor	ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$204,750	2005	9231	1.08	\$221,807	Ashbrook Aquabelt (Energenics)	Energenics	WLM; x1.3 installed x1.05 Mech/Elect/I&C/Civil
\$57,330	2005	9231	1.08	\$62,106	Wemco Hidrostral 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/I&C/Civil
\$34,125	2005	9231	1.08	\$36,968	10 gpmv3 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 w/VFDs	Moyno or Netszch	WLM; 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
\$150	2005	9231	1.08	\$162	TBD	TBD	WLM

Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING
BIOSOLIDS ALTERNATIVE EVALUATIONS

SSWWTP DEWATERING UPGRADES CAPITAL COST

Total Capital Cost (all divisions, without contingency or markup) = \$8,840,000

DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 2: SITEWORK				
Dewatering	1	allowance	\$108,000	\$110,000
Excavation	46,500	cubic yards	\$11	\$510,000
Structural Fill	4,650	cubic yards	\$13	\$60,000
Division 2 Subtotal	\$680,000			
DIVISION 3: CONCRETE				
Sludge Reaction Tank	8	cubic yards	\$540	\$0
Sludge Holding Tank	75	cubic yards	\$540	\$40,000
Division 3 Subtotal	\$40,000			
DIVISION 11: EQUIPMENT				
Sludge Reaction Tank Mixers	4	each	\$7,000	\$30,000
Sludge Holding Tank Mixers	3	each	\$22,000	\$70,000
Progressing Cavity Sludge Transfer Pumps	6	each	\$118,000	\$710,000
Recessed Plate Filter Press Feed Pumps	6	each	\$126,000	\$760,000
Recessed Plate Filter Presses	3	each	\$518,000	\$1,550,000
Progressing Cavity Recessed Plate Press Polymer Feed Pumps	3	each	\$89,000	\$270,000
Piston Recessed Plate Filter Press Wash Pumps	1	each	\$111,000	\$110,000
Recessed Plate Appurtenances	1	allowance	\$148,000	\$150,000
Roll-off Sludge Containers	100	each	\$3,000	\$300,000
Straddle Carriers for Sludge Containers	4	each	\$162,000	\$650,000
Division 11 Subtotal	\$4,600,000			
DIVISION 13: SPECIAL CONSTRUCTION				
Dewatering Building Addition	16,000	sf	\$220	\$3,520,000
Division 13 Subtotal	\$3,520,000			

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Actual Unit Cost (\$)	Cost Year	COST ADJUSTMENT ENR Index	Adjustment Factor	ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
\$100,000	2005	9231	1.08	\$108,331	TBD	TBD	WLM
\$10	2005	9231	1.08	\$11	TBD	TBD	WLM
\$12	2005	9231	1.08	\$13	TBD	TBD	WLM
\$500	2005	9231	1.08	\$542	TBD	TBD	WLM
\$500	2005	9231	1.08	\$542	TBD	TBD	WLM
\$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
\$20,475	2005	9231	1.08	\$22,181	Axial flow turbine, 10 HP	Lightnin Model SX84C10	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
\$109,200	2005	9231	1.08	\$118,297	650 gpm @ 100 psi, 125 HP	Moyno Model 2K335G1 CDQ-DAA (Order No. AS43109-90-4)	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
\$116,025	2005	9231	1.08	\$125,691	Piston membrane w/hydraulic oil; linear flow drop from 160->225 psi	Abel Model FQQG504-22/75; 22.5" pistons/75 HP/54 strokes/minute	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
\$477,750	2005	9231	1.08	\$517,550	151 plates (150 chambers) @ 2k mm x 2k mm; 530 cf @ 225 psig	Rittershaus&Blecher ID No. 0-24-200-007-00	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
\$81,900	2005	9231	1.08	\$88,723	100 HP	Moyno Model 4G065G1SSQ	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
\$102,375	2005	9231	1.08	\$110,903	100 gpm @ 1,500 psi, 125 HP	match existing two at South Shore	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
\$136,500	2005	9231	1.08	\$147,871	TBD	TBD	WLM; x1.3 installed x1.05Mech/Elect/I&C/Civil
\$3,000	2005	9231	1.08	\$3,250	20' L x 7' W x 6' H	match existing at SS	WLM
\$150,000	2005	9231	1.08	\$162,496	50,000 lbs minimum lift capacity	match existing at SS	WLM
\$200	2005	9231	1.08	\$217	TBD	TBD	WLM

BIOSOLIDS ALTERNATIVE EVALUATIONS

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

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BIOSOLIDS ALTERNATIVE EVALUATIONS

Total Capital Cost (all divisions, without contingency or markup) = \$820,000

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Actual Unit Cost (\$)	COST ADJUSTMENT			ADJUSTED UNIT COST (\$)
	Cost Year	ENR Index	Adjustment Factor	



Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING
BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) = 114,100
Total Annual O&M Cost = \$34,700,000

Milorganite® Annual Operating & Maintenance Costs

% of biosolids to Milorganite® = 0%			
annual biosolids (dt/year) = 0			
Item/Process	Milorganite® Allocations %	\$/dt	Annual Cost \$/yr
JWWWTP Thickening	6.5%	\$26.50	\$0
JWWWTP Dewatering/Drying	59.5%	\$241.40	\$0
JWWWTP Chaff Processing	4.7%	\$19.20	\$0
Milorganite® Warehouse/Shipping	5.7%	\$23.00	\$0
JWWWTP 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	\$0
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			
Item/Process	Agri-Life® Allocations %	\$/dt	Annual Cost \$/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%			
annual biosolids (dt/year) = 0			
Item/Process	Minergy Allocations %	\$/dt	Annual Cost \$/yr
JWWWTP Thickening	6.1%	\$26.50	\$0
JWWWTP Dewatering/Drying	55.7%	\$241.40	\$0
JWWWTP Electric Purchase	21.6%	\$93.50	\$0
JWWWTP 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					
Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost	
JWWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49	0	
JWWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41	0	
JWWWTP Chaff Processing	\$928,541	\$16.57	2004	8620	\$19.22	0	
Milorganite® Warehouse/Shipping	\$1,108,821	\$19.79	2004	8620	\$22.95	0	
JWWWTP 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	0	
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 existence at JI

Cake Agri-Life® Annual Operating Costs

Total cake Agri-Life® 2004 tons =		2168					
Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost	
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 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

Glass Furnace Annual Operating Costs

Total biosolids 2004 =		62,873					
Total Milorganite® 2004 tons =		56,040					
Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost	
JWWWTP Thickening	\$1,279,606	\$22.83	2004	8620	\$26.49	0	
JWWWTP Dewatering/Drying	\$11,661,890	\$208.10	2004	8620	\$241.41	0	
JWWWTP Electric Purchase	-	\$93.50	2007	10000	\$93.50	0	Energy Evaluation 09.11.06.xls
JWWWTP 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	-	-\$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

Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING

BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) = 114,100
Total Annual O&M Cost = \$62,460,000

Landfill Annual Operating & Maintenance Costs

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

Item/Process	Milorganite® %	Allocations \$/dt	Annual Cost \$/yr
JWWTP 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

Item/Process	Milorganite® %	Allocations \$/dt	Annual Cost \$/yr
JWWTP 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

Item/Process	Milorganite® %	Allocations \$/dt	Annual Cost \$/yr
JWWTP Thickening	23.3%	\$67.10	\$0
JWWTP Dewatering	20.3%	\$58.30	\$0
JWWTP 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 UW/Sactual .XLS, (ENR = 8620) unless otherwise specified

Landfill Annual Operating & Maintenance Costs

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

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
JWWTP Electrical Purchase	-	\$57	2007	10000	\$56.97	6,500,314 <i>Energy Evaluation 09.11.06.xls</i>
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 <i>Energy Evaluation 09.11.06.xls</i>) 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	\$363,719	\$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	-	\$96.61	2005	9231	\$104.66	11,023,668 Waste Management quote *247/313 (to discount for solids lost in digestion)
						54,786,198

Land Application Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873
Total cake agriLife 2004 tons = 2168

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
JWWTP Electrical Purchase	-	\$57	2007	10000	\$56.97	6,500,314 <i>Energy Evaluation 09.11.06.xls</i>
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 <i>Energy Evaluation 09.11.06.xls</i>) 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	\$363,719	\$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 <i>Biosolids Alternative Sizing Worksheets r4.xls</i> by WLM, *247/313 to account for solids lost in digestion
						6,500,314

Incineration Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873
Total Milorganite® 2004 tons = 56,040

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
JWWTP Thickening	\$1,279,608	\$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)
JWWTP 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
JWWTP Electrical Purchase	-	\$81	2007	10000	\$80.93	0 <i>Energy Evaluation 09.11.06.xls</i>
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 43 employees at \$75,000/yr for 92,300 tons/year (<i>Incineration Evaluation.xls</i>)
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 (<i>Incineration Evaluation.xls</i>); does not account for operation of centrifuges; per PWC
Incineration Facility Chemicals and Other Costs	-	\$2.07	2004	8620	\$2.40	0 <i>Incineration Evaluation.xls</i>
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	-	\$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	-	\$0.00	2007	10000	\$0.00	0 value per ton VSS destroyed (from <i>Energy Evaluation 09.11.06.xls</i>) x [prop. Biosolids x % to digestion (Hurtado)] - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
						0

Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING

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.

Biosolids Distribution

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

ENR Index = 10000 (assumed Milwaukee 2007)

Summary of Capital Costs

Estimated Construction Cost Without Contingency or Markup		\$299,980,000	
Contingency	25%	\$75,000,000	
Estimated Construction Cost Without Markup			\$374,980,000
Contractor OH&M/Engineering	30%		\$112,490,000
Total Capital Cost			\$487,470,000

Summary of Operation & Maintenance Costs

Total Annual Cost	\$34,700,000	
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		\$427,890,000

Total Present Worth **\$915,000,000**

BIOSOLIDS ALTERNATIVE EVALUATIONS

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

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

Actual Unit Cost (\$)	COST ADJUSTMENT		ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
	Cost Year	ENR Index				
\$23,600,000	2005	9231	1.08	\$25,566,028	electrical supply upgrade	Lou Germanotta estimate



BIOSOLIDS ALTERNATIVE EVALUATIONS

216,496,329

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Actual Unit Cost (\$)	COST ADJUSTMENT		ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
	Cost Year	ENR Index				
\$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

Total Capital Cost (all divisions, without contingency or markup) = \$1,570,000

Division 11 Subtotal \$1,570,000

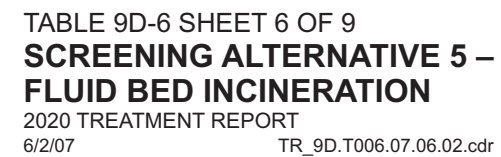
Actual Unit Cost (\$)	COST ADJUSTMENT			ADJUSTED UNIT COST (\$)
	Cost Year	ENR Index	Adjustment Factor	

Ashbrook Aquabelt (Energenics)
Wemco Hidrostral 500 gpm at 75' TDH, w/VFDs for ac
200 gpm@40'TDH, w/VFDs
250 gpm @ 140' TDH



Milwaukee Metropolitan Sewerage District 2020 FACILITIES PLANNING BIOSOLIDS ALTERNATIVE EVALUATIONS				
INTERPLANT SLUDGE PIPELINE UPGRADES CAPITOL COSTS				
Total Capital Cost (all divisions, without contingency or markup) =			\$820,000	
DESCRIPTION	Quantity	Units	Unit Cost (\$)	SUBTOTAL (\$)
DIVISION 11: EQUIPMENT				
JIWWTP and SSWWTP Pumps	6	each	\$93,000	\$560,000
Division 11 Subtotal		\$560,000		
DIVISION 16: ELECTRICAL				
Pipeline Cathodic Protection	1	allowance	\$258,000	\$260,000
Division 16 Subtotal		\$260,000		

Actual Unit Cost (\$)	COST ADJUSTMENT			ADJUSTED UNIT COST (\$)	ITEM	MANUFACTURER	COMMENTS
	Cost Year	ENR Index	Adjustment Factor				
\$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



BIOSOLIDS ALTERNATIVE EVALUATIONS

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

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

[illegible]

Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING
BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) = 114,100
Total Annual O&M Cost = \$34,700,000

Milorganite® Annual Operating & Maintenance Costs

% of biosolids to Milorganite® = 0%			
annual biosolids (dt/year) = 0			
Item/Process	Milorganite® Allocations %	\$/dt	Annual Cost \$/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	\$0
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			
Item/Process	Agri-Life® Allocations %	\$/dt	Annual Cost \$/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%			
annual biosolids (dt/year) = 0			
Item/Process	Minergy Allocations %	\$/dt	Annual Cost \$/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	
Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year ENR Index 2020 (6/2007) Process Cost/ton 2004 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 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 0
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 existence at JI

Cake Agri-Life® Annual Operating Costs

Total cake Agri-Life® 2004 tons =		2168	
Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year ENR Index 2020 (6/2007) Process Cost/ton 2004 Process Cost
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 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

Glass Furnace Annual Operating Costs

Total biosolids 2004 =		62,873	
Total Milorganite® 2004 tons =		56,040	
Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year ENR Index 2020 (6/2007) Process Cost/ton 2004 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	-	\$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	-	-\$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

Milwaukee Metropolitan Sewerage District
2020 FACILITIES PLANNING

BIOSOLIDS ALTERNATIVE EVALUATIONS

O&M COST ESTIMATE

Total 2020 MMSD Biosolids Production (dt/yr) = 114,100
Total Annual O&M Cost = \$34,700,000

Landfill Annual Operating & Maintenance Costs

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

Item/Process	Milorganite® %	Allocations \$/dt	Annual Cost \$/yr
JWWTP 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

Item/Process	Milorganite® %	Allocations \$/dt	Annual Cost \$/yr
JWWTP 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® = 100%
annual biosolids (dt/year) = 114,100

Item/Process	Milorganite® %	Allocations \$/dt	Annual Cost \$/yr
JWWTP Thickening	22.1%	\$67.10	\$7,656,000
JWWTP Dewatering	19.2%	\$58.30	\$6,652,000
JWWTP Electric Purchase	26.6%	\$80.90	\$9,231,000
IPS Pipeline Sludge Transfer (includes SS energy)	0.5%	\$1.40	\$160,000
Incineration Facility Labor	13.3%	\$40.50	\$4,621,000
Incineration Facility Maintenance/Repair/Replace	8.9%	\$27.10	\$3,092,000
Incineration Facility Chemicals and Other Costs	0.8%	\$2.40	\$274,000
Ash Transport	0.5%	\$1.40	\$160,000
Ash Landfill	2.8%	\$8.40	\$958,000
SSWWTP Digester Gas Credit/Replacement	5.5%	\$16.60	\$1,894,000
SUBTOTAL	100%	\$304	\$34,698,000

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

Landfill Annual Operating & Maintenance Costs

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

Process	Hurtado 2004 Cost	Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
JWWTP 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.xls) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
SSWWTP Sludge Thickening	\$348,593	\$159.87	2004	8620	\$185.46	0
SSWWTP Dewatering	\$363,719	\$176.99	2004	8620	\$205.33	0
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)
						0

Land Application Annual Operating & Maintenance Costs

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

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
JWWTP 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.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	\$363,719	\$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.xls by WLM, *247/313 to account for solids lost in digestion
						0

Incineration Annual Operating & Maintenance Costs

Total biosolids 2004 = 62,873
Total Milorganite® 2004 tons = 56,040

Process	Hurtado 2004 Cost	2004 Process Cost/ton	Cost Year	ENR Index	2020 (6/2007) Process Cost/ton	2004 Process Cost
JWWTP Thickening	\$1,279,608	\$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)
JWWTP 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 sludge per PWC; centrifuges will cost at least as much as BFP
JWWTP 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 milo (in 2004)
Incineration Facility Labor	-	\$34.94	2004	8620	\$40.53	3,986,701 43 employees at \$75,000/yr for 92,300 tons/year (Incineration Evaluation.xls)
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.xls); 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.xls) x [prop. Biosolids x % to digestion (Hurtado) - 2004 solids to digestion (Hurtado)] x dig. volume reduction (Hurtado) /prop. biosolids
						31,576,652