

SECTION VII
ECONOMIC EVALUATION
OF
SLUDGE DEWATERING TECHNIQUES

SECTION VII

ECONOMIC EVALUATION OF SLUDGE DEWATERING TECHNIQUES

A. General

The total cost of dewatering and disposing of sludge from the Carl A. White Reclamation Plant will ultimately be comprised of the following basic cost segments:

1. Sludge Dewatering Installation and Operational Costs
2. Transportation Costs of Dewatered Sludge
3. Land Disposal Costs

Higher percentage solids contents achieved in the first step (sludge dewatering) results in lower transportation and disposal costs to the extent that the composite ranking of a more expensive type of dewatering equipment, which produces a higher solids concentration, can be substantially improved. Refer to Table vii-1.

It is because of the substantial impact of the percentage solids attainable on total costs, that sludge transportation and ultimate disposal costs had to be addressed comparatively in this report. The ultimate land disposal site selection and cost remains the subject of another report.

To make a valid comparison the operative Pellegrine Construction landfill site, twenty (20) miles from the Carl A. White plant, was used. A meeting between Mr. Pellegrine and L. Robert Kimball representatives, on November 14, 1979, yielded a contemporary verbal quotation of \$1.50 per cubic yard for disposal. See Page X-2 for relative influence of disposal costs.

In order to place a viable cost on the transportation of the dewatered sludge from the Creekside, PA plant site to the Pellegrine landfill site, a rate of \$2.8514 per ton was utilized. This is the 20 mile one-way haul rate quoted in a January 2, 1980 telephone estimate from Merlo Trucking, R.D. 6, Johnstown, PA. This unit cost is considered high, but therefore conservative, because it relates to high waged (unionized) drivers. See Page X-2 for relative influence of transportation costs.

The basic equation used is \$0.41 per ton for the first mile, plus \$0.12 per ton mile after the first payload mile, plus a current 6% fuel surcharge. The equipment quoted is 22 payloadton tri-axle dump trucks. An alternative current quotation is \$30 per hour for truck and driver. Further savings might be realized through competitive bidding for the hauling of the dewatered sludge.

TABLE VII - 1

<u>Equipment Mfr.</u>	<u>Type</u>	<u>First Cost Ranking</u>	<u>Transportation & Disposal Ranking</u>	<u>Composite* Ranking</u>
L-R-S	"Black Box"	6	1	1
Passavant	Belt Filter Press	3	4	2
Passavant	Pressure Filter	2	6	3
Envirex	Belt Filter Press	1	9	4
Envirex	Vacuum Filter	4	10	5
Infilco	Belt Filter Press	5	8	6
Parkson	Belt Filter Press	9	3	7
Euramca	Belt Filter Press	7	2	8
Komline	Belt Filter Press	8	7	9
Ancatec-B	Vacuum Leg	10	5	10
Sharples	Centrifuge	11	11	11
Bird	Centrifuge	**	**	**

* Composite ranking includes 20 yr. annual amortized first costs, shipped, installed and operative plus annual operating and maintenance costs, plus building costs (not separately columnized, but included above), and annual transportation and land disposal costs.

** Bird Centrifuge is not included because of absence of sludge testing. Manufacturer assumed results submitted without testing.

B. Equipment Vendor Cost Data

Ten of the eleven manufacturers contacted at the beginning of this study responded with the data we sought (see Section III. D.). It is worthy of note that all early contacts were made directly with the manufacturers, rather than manufacturers' representatives. The purpose was to avoid any possibility of anyone of these major manufacturers having recently developed an improved type of equipment of which their representatives may not yet have been apprised and/or trained.

The following fourteen pages of "Sludge Dewatering Cost Summation Sheets" present, in a uniform manner, the data submitted by the manufacturers. Each manufacturer was given the opportunity to check our interpretation of his submittals to assure accuracy and avoid misinterpretations.

The uniform comparison of capital, operating and maintenance costs are self explanatory but we felt it important to also determine and compare percentage solids obtainable to credibly determine sludge acceptability (at a landfill site), and trucking and disposal costs or fees because of the varying quantities.

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Creekside, Indiana County, Pennsylvania

SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer Ancatec-Barefoot Corporation
 Basic Type of Equipment Vacuum Leg

CAPITAL COST

Equipment	\$1,858,000.00**
Freight	185,000.00 (assume 10% capital)
Installation	185,800.00 (assume 10% capital)
Start-up Services	incl.
Total Capital Cost:	\$2,048,800.00**
Annual Amortized Cost *:	\$ 195,210.00**

* 7½% (U.S.E.P.A. Basis)

OPERATING & MAINTENANCE COSTS

Operators <u>7920</u> hrs./year x \$7.50/hr.	= \$ 59,400.00
Power <u>4,316,180</u> KWH/yr. x \$0.03/KWH	= 129,485.40**
Chemicals _____ tons/yr. x \$ _____ /ton	= 29,040.00
Maintenance and Repair Allowance	= 206,560.80
Total Annual O & M Cost:	\$ 424,486.20**
Annual Amortized Cost:	\$ 195,210.00**
Total Annual Cost:	\$ 619,696.20**

**See Sheet 2 of 2 for recalculation without the building.

REMARKS:
The expected cake solids, particularly in the high range, are suspect. This is based on a visual observation made when the samples were taken. In most instances, a portion of the loose dewatered sludge was discharged and not accounted for in the solids analysis.

AVERAGE % WT. SOLIDS OBTAINED: 16-58 %

COST/TON OF DRY SOLIDS \$ 89.42 /TON

SPECIFIC EQUIPMENT
One (1) dewatering cone, four (4) sludge conditioning cones, four (4) distribution cones, sixty-four (64) vacuum filtering legs, four (4) collecting conveyors, four (4) vacuum systems, four (4) compressed air systems, four (4) hydraulic systems, one (1) building

SPACE REQUIRED (including maintenance clearances)

Length:	90.0'
Width:	90.0' (no allowances for access)
Height:	70.0'

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SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer Ancatec-Barefoot Corporation
 Basic Type of Equipment Vacuum Leg

CAPITAL COST

Equipment	\$1,467,200.00
Freight	5,000.00 (assumed)
Installation	146,720.00 (assume 10%)
Start-up Services	incl.
Total Capital Cost:	\$1,618,920.00
Annual Amortized Cost *:	\$ 154,251.00

* 7½% (U.S.E.P.A. Basis)

OPERATING & MAINTENANCE COSTS

Operators <u>7920</u> hrs./year x \$7.50/hr.	=	\$ 59,400.00
Power <u>3,175,920</u> KWH/yr. x \$0.03/KWH	=	95,277.60
Chemicals _____ tons/yr. x \$ _____ /ton	=	29,040.00
Maintenance and Repair Allowance	=	206,560.80
Total Annual O & M Cost:		\$ 390,278.40
Annual Amortized Cost:		\$ 154,251.00
Total Annual Cost:		\$ 544,529.40

REMARKS: See Sheet 1 of 2

AVERAGE % WT. SOLIDS OBTAINED: 16-58 %

COST/TON OF DRY SOLIDS \$ 78.58 /TON

SPECIFIC EQUIPMENT
Same as Sheet 1 of 2 less building

SPACE REQUIRED (including maintenance clearances)
Length - 90.0', Width - 90.0', Height - 70.0' (no allowances for access)

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SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer	Envirex
Basic Type of Equipment	Filter Press
CAPITAL COST	
Equipment	\$259,000.00
Freight	incl.
Installation	25,900.00 (10%)
Start-up Services	10,000.00 (est.)
Total Capital Cost:	\$294,900.00
Annual Amortized Cost *:	\$ 28,100.00
* 7½% (U.S.E.P.A. Basis)	

OPERATING & MAINTENANCE COSTS			
Operators	2890	hrs./year	x \$7.50/hr. = \$ 21,675.00
Power	144,700	KWH/yr.	x \$0.03/KWH = 4,341.00
Chemicals		tons/yr.	x \$ /ton = None
Maintenance and Repair Allowance			= 25,900.00
Total Annual O & M Cost:			\$ 51,916.00
Annual Amortized Cost:			\$ 28,100.00
Total Annual Cost:			\$ 80,016.00

REMARKS:
These costs do not reflect the installation of a 45'-0" diameter gravity thickener which they recommend. The existing clarifier should be able to perform this function.

AVERAGE % WT. SOLIDS OBTAINED: 10.0 %

COST/TON OF DRY SOLIDS \$ 11.55 /TON

SPECIFIC EQUIPMENT
Four (4) 1.0 meter belt filter presses with control panel, chemical conditioning reaction drum and wash water pump.

SPACE REQUIRED (including maintenance clearances)
Estimated 360 square feet.

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SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer	Envirex
Basic Type of Equipment	Vacuum Filter
CAPITAL COST	
Equipment	\$494,000.00
Freight	incl.
Installation	50,000.00 (approx. 10%)
Start-up Services	10,000.00
Total Capital Cost:	\$554,000.00
Annual Amortized Cost *:	\$ 52,785.00
* 7½% (U.S.E.P.A. Basis)	

OPERATING & MAINTENANCE COSTS	
Operators <u>1530</u> hrs./year x \$7.50/hr.	= \$ 11,475.00
Power <u>1,918,250</u> KWH/yr. x \$0.03/KWH	= 57,550.00
Chemicals _____ tons/yr. x \$ _____ /ton	= None
Maintenance and Repair Allowance	= 14,820.00
Total Annual O & M Cost:	\$ 83,845.00
Annual Amortized Cost:	\$ 52,785.00
Total Annual Cost:	\$136,630.00

REMARKS:
Capital costs do not reflect installation of a 45.0' diameter gravity thickener they
recommend. The existing clarifiers should be able to perform this function.

AVERAGE % WT. SOLIDS OBTAINED: 10.0 %

COST/TON OF DRY SOLIDS \$ 19.72 /TON

SPECIFIC EQUIPMENT
Two (2) 12.0' diameter x 24.0' long vacuum filters with control panel and wash water pump.

SPACE REQUIRED (including maintenance clearances)
Estimated 360 square feet.

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SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer Basic Type of Equipment CAPITAL COST Equipment Freight Installation Start-up Services Total Capital Cost: Annual Amortized Cost *: * 7½% (U.S.E.P.A. Basis)	Euramca, Inc. Belt Filter Press \$313,000.00 (\$350,000.00) incl. (incl.) 5,000.00 (5,000.00) incl. (incl.) \$318,000.00 (\$355,000.00) \$ 30,300.00 (\$ 33,825.00)
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OPERATING & MAINTENANCE COSTS Operators <u>3960</u> hrs./year x \$7.50/hr. = Power <u>(448,498)</u> KWH/yr. x \$0.03/KWH = Chemicals <u>52.0</u> tons/yr. x \$4000.00/ton = Maintenance and Repair Allowance =	\$ 29,700.00 (\$29,700.00) 8,233.00 (13,395.00) \$208,000.00 (318,000.00) 24,800.00 (26,800.00) \$270,733.00 (\$387,895.00) \$ 30,300.00 (\$33,825.00) \$301,033.00 (\$421,720.00)
Total Annual O & M Cost: Annual Amortized Cost: Total Annual Cost:	\$270,733.00 (\$387,895.00) \$ 30,300.00 (\$33,825.00) \$301,033.00 (\$421,720.00)

REMARKS:
(includes Roediger Quick Lime Stabilization System)
Not used on cost-comparison sheet because this was most costly of three presented
by this manufacturer.

AVERAGE % WT. SOLIDS OBTAINED: 12.0-14.0 % (<20.0)

COST/TON OF DRY SOLIDS \$ 43.44 /TON (60.85)

SPECIFIC EQUIPMENT
Three (3) Model 15.3 Ecopress 1.5 meter belt width, control panels, sludge metering/polymer
metering pumps, polymer preparation system (O.L.S. system)

SPACE REQUIRED (including maintenance clearances)
Length - 14.4', Width - 7.2', Height - 6.5', Weight - 15,400 lb. (ea. unit)
(9.5;54.0;11.0) for QLS System + sub-support system

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SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer Euramca, Inc.
 Basic Type of Equipment Belt Filter Press

CAPITAL COST

Equipment	<u>\$263,000.00 (\$300,000.00)</u>
Freight	<u>incl. (incl.)</u>
Installation	<u>5,000.00 (5,000.00)</u>
Start-up Services	<u>incl. (incl.)</u>
Total Capital Cost:	<u>\$268,000.00 (\$305,000.00)</u>
Annual Amortized Cost *:	<u>\$ 25,535.00 (\$ 29,060.00)</u>

* 7½% (U.S.E.P.A. Basis)

OPERATING & MAINTENANCE COSTS

Operators <u>3960</u> hrs./year x \$7.50/hr.	<u>= \$ 29,700.00 (\$29,700.00)</u>
Power <u>150,480</u> KWH/yr. x \$0.03/KWH	<u>= 4,515.00 (8,268.00)</u>
Chemicals <u>275,616</u> tons/yr. x \$ /ton	<u>= \$208,000.00 (318,000.00)</u>
Maintenance and Repair Allowance	<u>= 19,400.00 (21,400.00)</u>
Total Annual O & M Cost:	<u>\$261,615.00 (\$377,368.00)</u>
Annual Amortized Cost:	<u>\$ 25,535.00 (\$20,060.00)</u>
Total Annual Cost:	<u>\$287,150.00 (\$406,428.00)</u>

REMARKS:

(Includes Roediger Quick Lime Stabilization System)

AVERAGE % WT. SOLIDS OBTAINED: 12.0-14.0 % (<20.0)

COST/TON OF DRY SOLIDS \$ 41.44 /TON (58.65)

SPECIFIC EQUIPMENT

Two (2) Model 20.3 Ecopress 2.0 meter belt width, control panels, sludge metering/polymer metering pumps, polymer metering pumps, polymer preparation system (QLS System)

SPACE REQUIRED (including maintenance clearances)

Length - 14.4', Width - 9.8', Height - 6.8', Weight - 17,000 lb. (ea. unit)
(29.5;42.0;11.0) for QLS System + sub-support system

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SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer	Euramca, Inc.
Basic Type of Equipment	Belt Filter Press
CAPITAL COST	
Equipment	\$303,000.00 (\$340,000.00)
Freight	incl. (incl.)
Installation	5,000.00 (5,000.00)
Start-up Services	incl. (incl.)
Total Capital Cost:	\$308,000.00 (\$345,000.00)
Annual Amortized Cost *:	\$ 29,346.00 (\$32,872.00)
* 7½% (U.S.E.P.A. Basis)	
OPERATING & MAINTENANCE COSTS	
Operators <u>3960</u> hrs./year x \$7.50/hr.	= \$ 29,700.00 (\$29,700.00)
Power <u>159,720</u> KWH/yr. x \$0.03/KWH	= 4,792.00 (7,920.00)
Chemicals <u>(264,000)</u> tons/yr. x \$ /ton	= \$208,000.00 (318,800.00)
Maintenance and Repair Allowance	= 19,700.00 (21,700.00)
Total Annual O & M Cost:	\$262,192.99 (\$377,320.00)
Annual Amortized Cost:	\$ 29,346.00 (\$32,872.00)
Total Annual Cost:	\$291,538.00 (\$410,192.00)

REMARKS:

(includes Roediger Quick Lime Stabilization System)

AVERAGE % WT. SOLIDS OBTAINED: 12.0-14.0 % (<20.0)

COST/TON OF DRY SOLIDS \$ 42.07 /TON (59.19)

SPECIFIC EQUIPMENT

Two (2) Model 25.3 Ecopress 2.5 meter belt width, control panels, sludge metering/polymer metering pumps, polymer preparation system (Q.L.S. System)

SPACE REQUIRED (including maintenance clearances)

Length - 14.4', Width - 11.1', Height - 6.8', Weight - 18,600 lb. (ea. unit)
(29.5;42.0;11.0) for Q.L.S. System + sub-support system

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SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer Passavant Corporation
 Basic Type of Equipment Pressure Filter

CAPITAL COST

Equipment	<u>\$580,000.00</u>
Freight	<u>incl.</u>
Installation	<u>\$100,000.00</u>
Start-up Services	<u>incl.</u>
	<u>\$</u>
Total Capital Cost:	<u>\$680,000.00</u>
Annual Amortized Cost *:	<u>\$ 64,790.00</u>

* 7½% (U.S.E.P.A. Basis)

OPERATING & MAINTENANCE COSTS

Operators <u>1980</u> hrs./year x \$7.50/hr.	<u>= \$ 14,850.00</u>
Power <u>206.580</u> KWH/yr. x \$0.03/KWH	<u>= \$ 6,198.00</u>
Chemicals <u>---</u> tons/yr. x \$ -- /ton	<u>=</u>
Maintenance and Repair Allowance	<u>= \$ 15,000.00</u>
	<u>-----</u>
Total Annual O & M Cost:	<u>\$ 36,048.00</u>
Annual Amortized Cost:	<u>\$ 64,790.00</u>
Total Annual Cost:	<u>\$100,838.00</u>

REMARKS:

AVERAGE % WT. SOLIDS OBTAINED: 12.5 %

COST/TON OF DRY SOLIDS \$ 14.55 /TON

SPECIFIC EQUIPMENT

One (1) Pressure Filter - Model 15 complete with one (1) filtrate weir tank, two (2) filter feed pumps, one (1) fast-fill pump, one (1) air compressor, one (1) lot of automatic valves and semi-automatic master control panel.

SPACE REQUIRED (including maintenance clearances)

Height - 9'.5", Width - 8.0', Length - 50.0', Weight - 280,000 lbs., 140 tons

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SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer Passavant
 Basic Type of Equipment Continuous Belt Vacuum/Pressure Filter Press

CAPITAL COST

Equipment		\$ 215,000.00
Freight		incl
Installation		\$ 32,000.00
Start-up Services		incl
Total Capital Cost:		\$ 247,000.00
Annual Amortized Cost *:		\$ 23,534.00
* 7½% (U.S.E.P.A. Basis)		

OPERATING & MAINTENANCE COSTS

Operators <u>2970</u> hrs./year x \$7.50/hr.	=	\$ 22,275.00
Power <u>149,617</u> KWH/yr. x \$0.03/KWH	=	4,489.00
Chemicals <u>17.33</u> tons/yr. x \$4000.00/ton	=	69,300.00
Maintenance and Repair Allowance	=	4,500.00
Total Annual O & M Cost:		\$ 100,564.00
Annual Amortized Cost:		\$ 23,534.00
Total Annual Cost:		\$ 124,098.00

REMARKS:

Includes power costs for sludge feed pumps. Does not include water requirement.
106 GPM @ 60 PSI

AVERAGE % WT. SOLIDS OBTAINED: 14.0 %

COST/TON OF DRY SOLIDS \$ 17.91 /TON

SPECIFIC EQUIPMENT

Two (2) vac-u-press model no. BFP 2200 each unit complete with control panel, vacuum fan, polymer tank and mixer, static mixer, sludge and polymer feed pumps, eductor and funnel and one auxiliary control panel for both units.

SPACE REQUIRED (including maintenance clearances)

Height - 10'-0"; Length - 24'-0"; Width 20'-0" (Weight 10,800 # Each)

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SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer	Sharples Stoke Div. Pennwalt	
Basic Type of Equipment	Centrifuge	
CAPITAL COST		* See Remarks
Equipment	\$250,000.00	\$250,000.00
Freight	\$ 2,500.00(assume)	\$ 2,500.00
Installation	\$ 25,000.00(assume)	\$ 25,000.00
Start-up Services	incl.	incl.
Total Capital Cost:	\$277,500.00	\$277,500.00
Annual Amortized Cost *:	\$ 26,440.00	\$ 26,440.00

* 7½% (U.S.E.P.A. Basis)

OPERATING & MAINTENANCE COSTS			
Operators <u>495</u>	hrs./year	x \$7.50/hr.	= \$ 3,713.00
Power <u>177,178</u>	KWH/yr.	x \$0.03/KWH	= \$ 5,315.00
Chemicals <u>6.93</u>	tons/yr.	x \$ /ton	= \$ 27,720.00
Maintenance and Repair Allowance			= \$ 2,500.00
Total Annual O & M Cost:			\$ 39,248.00
Annual Amortized Cost:			\$ 26,440.00
Total Annual Cost:			\$ 65,688.00

REMARKS:

* Corrected information in this column - result of personal visit to plant to observe laboratory runs on 3 drums of sludge, various polymer and dosage rates.

AVERAGE % WT. SOLIDS OBTAINED: 18-20 % (assume, to be verified)* 9.5%

COST/TON OF DRY SOLIDS \$ 9.48 /TON *155.55/Ton

SPECIFIC EQUIPMENT

(2) Model PM-30000 backdrive centrifuges of stainless steel and tungsten carbon construction; ploymer feed system is included.

SPACE REQUIRED (including maintenance clearances)

(per unit) Height - 54", Width - 76", Length - 116", Weight - 2500 lbs.

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SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer Bird Machine Company, Inc.
 Basic Type of Equipment Centrifuge

CAPITAL COST

Equipment \$185,000.00
 Freight incl.
 Installation 25,000.00 (assume)
 Start-up Services incl.
Total Capital Cost: \$210,000.00
 Annual Amortized Cost *: \$ 20,010.00
 * 7½% (U.S.E.P.A. Basis)

OPERATING & MAINTENANCE COSTS

Operators 330 hrs./year x \$7.50/hr. = \$ 2,475.00
 Power 265,770 KWH/yr. x \$0.03/KWH = 7,973.00
 Chemicals 3.0 tons/yr. x \$2700.00/ton = 8,100.00
 Maintenance and Repair Allowance = 3,000.00
Total Annual O & M Cost: \$ 21,548.00
Annual Amortized Cost: \$ 20,010.00
Total Annual Cost: \$ 41,558.00

REMARKS:

Chemical cost seems to be low compared to other dewatering systems - \$/ton and also application rate. AFTER TESTING OTHER CENTRIFUGES, AND IN THE ABSENCE OF LAB WORK BY BIRD, THIS DATA IS IGNORED IN THIS REPORT.

AVERAGE % WT. SOLIDS OBTAINED: 20.0 % (to be verified)

COST/TON OF DRY SOLIDS \$ 6.00 /TON

SPECIFIC EQUIPMENT

One (1) HB-3900 centrifuge complete with polymer feed system, etc. A fault panel will have to be installed in the control room if not already there.

SPACE REQUIRED ^{does not include} ~~(including~~ maintenance clearances)
14'-0" long, 4'-0" high, and 8'-0" wide

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SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer Liquid Removal Service, Inc.
 Basic Type of Equipment "Black Box"

CAPITAL COST

Equipment	<u>\$281,280.00</u>
Freight	<u>incl.</u>
Installation	<u>incl.</u>
Start-up Services	<u>30,000.00 (estimate)</u>
	<u>incl.</u>
Total Capital Cost:	<u>\$311,280.00</u>
Annual Amortized Cost *:	<u>\$ 29,660.00</u>

* 7½% (U.S.E.P.A. Basis)

OPERATING & MAINTENANCE COSTS

Operators _____ hrs./year x \$7.50/hr.	= _____
Power _____ KWH/yr. x \$0.03/KWH	= _____
Chemicals _____ tons/yr. x \$ _____ /ton	= _____
Maintenance and Repair Allowance	= _____
	<u>_____</u>
Total Annual O & M Cost:	<u>\$152,931.00 (all inclusive)</u>
Annual Amortized Cost:	<u>\$ 29,660.00</u>
Total Annual Cost:	<u>\$182,591.00</u>

REMARKS:
Black box appears to be nothing more than a belt filter press. Solids content of cake appears high. They supplied the results.

AVERAGE % WT. SOLIDS OBTAINED: 19.5-25.5 % (to be verified)

COST/TON OF DRY SOLIDS \$ 26.35 /TON

SPECIFIC EQUIPMENT
All equipment to attain a 20.0% solids content or better will be provided excluding the cake load-out system

SPACE REQUIRED (including maintenance clearances)
Length - 35'-9", Width - 27'-0", Height - 9'-4" (including clearances)

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SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer Parkson Corporation
 Basic Type of Equipment Belt Filter Press

CAPITAL COST

Equipment	<u>\$258,000.00</u>
Freight	<u>incl.</u>
Installation	<u>\$25,800.00</u>
Start-up Services	<u>incl.</u>
Total Capital Cost:	<u>\$283,800.00</u>
Annual Amortized Cost *:	<u>\$ 27,040.00</u>

* 7½% (U.S.E.P.A. Basis)

OPERATING & MAINTENANCE COSTS

Operators <u>3960</u> hrs./year x \$7.50/hr.	<u>= \$ 29,700.00</u>
Power <u>198,440</u> KWH/yr. x \$0.03/KWH	<u>= \$ 5,953.00</u>
Chemicals <u>69.3</u> tons/yr. x \$3750.00/ton	<u>= \$259,875.00</u>
Maintenance and Repair Allowance	<u>= \$ 12,900.00</u>
Total Annual O & M Cost:	<u>\$308,428.00</u>
Annual Amortized Cost:	<u>\$ 27,040.00</u>
Total Annual Cost:	<u>\$335,468.00</u>

REMARKS:

AVERAGE % WT. SOLIDS OBTAINED: 20-21 % by wt.

COST/TON OF DRY SOLIDS \$ 48.41 /TON

SPECIFIC EQUIPMENT

Two (2) Model MP-80 Magnum Presses each complete with polymer feed system, wash water pump, air compressor and motor control center with automatic controls

SPACE REQUIRED (including maintenance clearances)

(Each Unit) - Height - 7'-6", Width - 9'-1", Length - 14'-10", Weight - 7.8 tons, 15,600 lbs

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Carl A. White Water Reclamation Plant
Creekside, Indiana County, Pennsylvania

SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer	<u>Infilco Degremont, Inc.</u>
Basic Type of Equipment	<u>Filter Press</u>
CAPITAL COST	
Equipment	<u>\$150,000.00</u>
Freight	<u>incl.</u>
Installation	<u>20,000.00 (estimate)</u>
Start-up Services	<u>incl.</u>
Total Capital Cost:	<u>\$170,000.00</u>
Annual Amortized Cost *:	<u>\$ 16,198.00</u>
* 7½% (U.S.E.P.A. Basis)	

OPERATING & MAINTENANCE COSTS	
Operators <u>7920</u> hrs./year x \$7.50/hr.	= <u>\$ 59,400.00</u>
Power <u>29,530</u> KWH/yr. x \$0.03/KWH	= <u>886.00</u>
Chemicals <u>24.6</u> tons/yr. x \$3300.00/ton	= <u>\$ 81,180.00 (estimate)</u>
Maintenance and Repair Allowance	= <u>4,500.00</u>
Total Annual O & M Cost:	<u>\$145,966.00</u>
Annual Amortized Cost:	<u>\$ 16,198.00</u>
Total Annual Cost:	<u>\$162,164.00</u>

REMARKS:
(2) Sludge Feed Pumps - \$10,000 additional
Mono - vari speed type

AVERAGE % WT. SOLIDS OBTAINED: 10.5 %

COST/TON OF DRY SOLIDS \$23.40 /TON

SPECIFIC EQUIPMENT
Two (2) Model F-3 Floc Press incl. control panel, polymer feed system, air compressor and
sludge conveying system

SPACE REQUIRED (including maintenance clearances)
(Both units less clearances) - Height - 12.0', Width - 40.0', Length - 33.0', Weight (both
units) - approx. 15 tons

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Carl A. White Water Reclamation Plant
Creekside, Indiana County, Pennsylvania

SLUDGE DEWATERING COST SUMMATION SHEET

Manufacturer Komline Sanderson Engr. Co.
 Basic Type of Equipment Belt Filter Press

CAPITAL COST

Equipment \$120,000.00
 Freight incl.
 Installation 18,000.00 (15%)
 Start-up Services 2,000.00

Total Capital Cost: \$140,000.00
 Annual Amortized Cost *: \$ 13,340.00
 * 7½% (U.S.E.P.A. Basis)

OPERATING & MAINTENANCE COSTS

Operators 990 hrs./year x \$7.50/hr. = \$ 7,425.00
 Power _____ KWH/yr. x \$0.03/KWH = 2,110.00
 Chemicals 71.73 tons/yr. x \$3622.00/ton = 259,806.00
 Maintenance and Repair Allowance = 6,450.00

Total Annual O & M Cost: \$275,791.00
Annual Amortized Cost: \$ 13,340.00
Total Annual Cost: \$289,131.00

REMARKS:

AVERAGE % WT. SOLIDS OBTAINED: 12-12.5 %

COST/TON OF DRY SOLIDS \$ 41.72 /TON

SPECIFIC EQUIPMENT

One (1) Unitmat System belt press complete with control panel, belt wash and dual polymer feed switch

SPACE REQUIRED (excluding maintenance clearances)

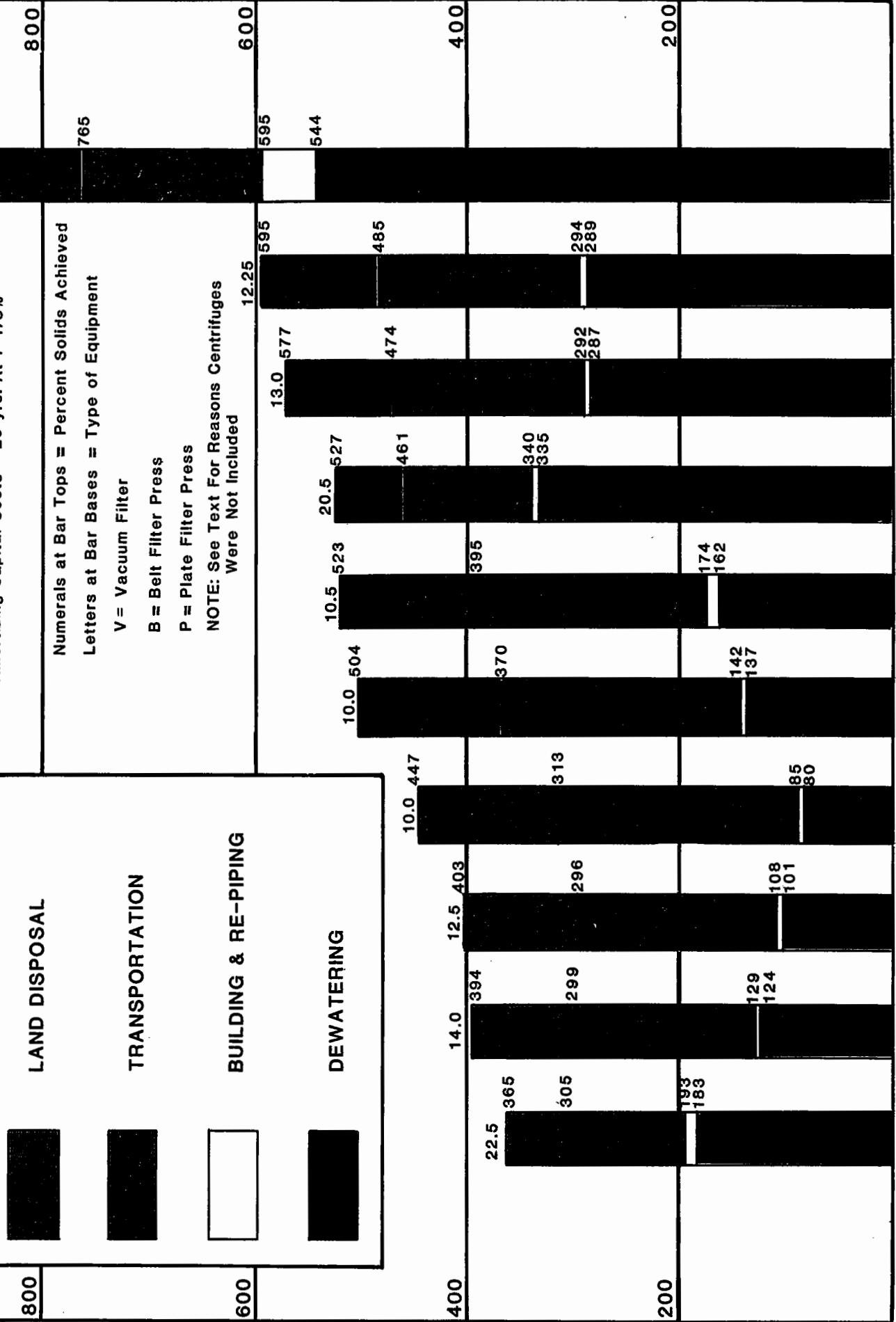
Approx. 123 sq. ft.

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Consulting Engineers & Architects

FIGURE VII - 1

ESTIMATED ANNUAL COST - THOUSANDS OF DOLLARS (1980)

Amortizing Capital Costs - 20 yrs. At 7 1/8%



B L-R-S Passavant B Passavant B Envirex B Envirex V Envirex B Inflico B Inflico B Parkson B Euramca B Komline Barefoot V Barefoot

L. Robert Kimball & Associates
Ebensburg, Pennsylvania

Revised March 5, 1980
Second Revision October 8, 1980

FIGURE VII - 1A

ESTIMATED ANNUAL COST - THOUSANDS OF DOLLARS (1980)

LAND DISPOSAL

EQUIPMENT REPLACEMENT

TRANSPORTATION

OPERATION & MAINTENANCE

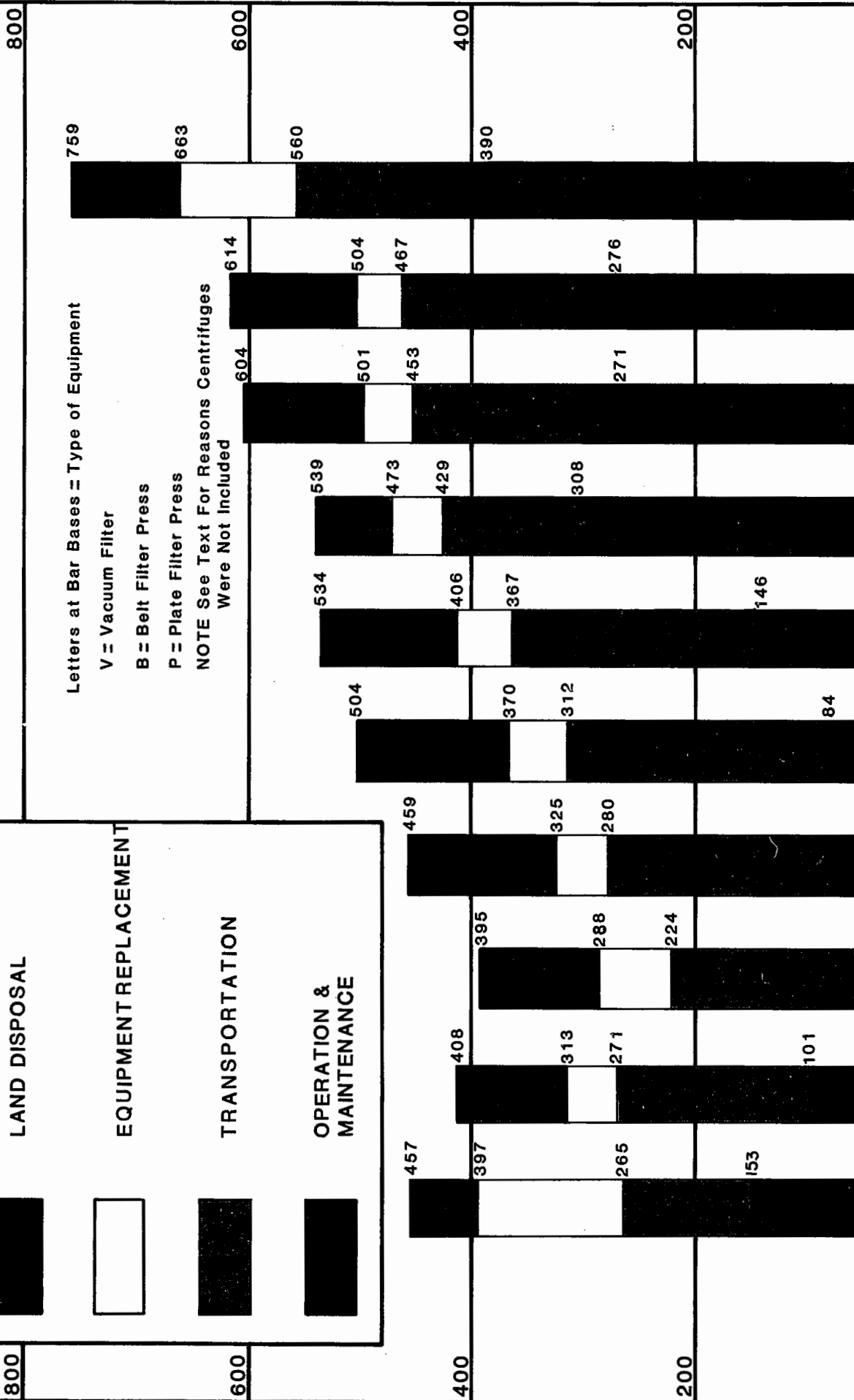
Letters at Bar Bases = Type of Equipment

V = Vacuum Filter

B = Belt Filter Press

P = Plate Filter Press

NOTE See Text For Reasons Centrifuges Were Not Included



B L-R-S Passavant Passavant Envirex Envirex B Envirex V Envirex B Inflico B Parkson B Euramca B Komline Barefoot V
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 Ebensburg, Pennsylvania

Figure VII-2 relates sludge quantities versus percent weight solids.

Similarly area and volume needs for the various equipment units are important in that more compact units may be accommodated within the present structure whereas larger units will require new, separate housing.

In like fashion the weights, and thus unit bearing pressures, are important, so as not to overload the present building floor and pilings or to allow for proper foundations for any new structure.

Figure VII-1, immediately following the "Cost Summation" sheets, graphically compares the total 20 year amortized annual costs of the original equipment as well as its segments basis for dewatering costs, initial structure and piping renovation costs, sludge transportation costs, (1980), and land disposal costs or fees. (1980)

Detailed costs, size, weight, percentage solids, remarks and relative rankings of twelve (12) different assemblies - extracted from the summation sheets and other contacts made as necessary for clarifications are presented in Appendix C "Tabulation of Total Sludge Dewatering and Disposal Costs".

C. Cost Data Evaluation

Referring to Figure VII-1 and Appendix C, the detailed tabulation, a wide range of values can be noted for each and every aspect of the total systems. First costs, labor, power, chemicals, building, transportation and disposal costs all exhibit wide variations.

The elimination of the highest and the lowest total cost systems improves the comparison, but total annual costs following such deletion still range from \$365,000 to \$595,000, or \$1,000 to \$1,630 per day.

It should be noted that although the "dry ton" processing cost, (330 day basis) noted on each cost summation sheet, and also as a line item on the Appendix C tabulation ranges ostentatiously from \$11.55 per ton to \$155.55 per ton of dry weight solids, the true total estimated dewatering, transportation and disposal costs as total dollars per year vary from \$6.11 per ton to \$19.19 per ton. Eliminating high and low, again, yields \$6.63 per ton to \$15.05 per ton:

TABLE VII - 2

<u>Equipment Description</u>	<u>Processing*</u> \$/Dry Ton	<u>Dewatering</u> \$/Ton <u>Processed</u>	<u>Transportation**</u> \$/Ton <u>Processed</u>	<u>Disposal**</u> \$/Ton <u>Processed</u>	<u>Total</u> \$/Ton <u>Processes</u>
L-R-S	\$ 26.35	\$ 4.64	\$ 2.84	\$ 1.52	\$ 9.00
Passavant Filter Press	17.91	2.08	2.86	1.60	6.54
Passavant Filter Press	14.55	1.53	2.85	1.62	6.00
Envirex Filter Press	11.55	1.00	2.85	1.68	5.53
Envirex Vacuum Filter	19.72	1.71	2.85	1.68	6.24
Infilco Filter Press	23.40	2.09	2.86	1.65	6.60
Parkson Filter Press	48.41	7.91	2.86	1.56	12.33
Euramca Filter Press	41.44	4.49	2.85	1.61	9.03
Komline Filter Press	41.72	4.33	2.84	1.64	8.81
Ancatec-B Vacuum Leg	78.58	9.18	2.86	1.61	13.65
Sharples Centrifuge	155.55	11.65	2.85	1.61	16.11

* Based on 330 operative days/year. (For 365 days, add 10.6%).

** Landfill at 20 miles, \$2.85/ton hauling, \$1.50/c.y. dump fee.

The constantly changing raw water quality, and therefore the possible sludge quantities render it difficult to favor either a high first cost-low disposal cost unit versus a low first cost-high transportation cost type of equipment or vice-versa.

Care must be exercised in the interpretation of the data in Table VII-2, above. Although Envirex Filter Presses are seemingly most economical at \$5.53 per ton sludge - 219 tons/day - therefore it would cost \$1,120 per day or about \$445,000 per year. On the otherhand Passavant units should produce only 163 tons/day at a total disposal at cost of \$6.54 per ton or \$1,070 per day or \$390,000/yr.

The best comparison is presented tabularly in Appendix C.

FIGURE VIII - 2

HAUL VOLUME VS. PERCENT SOLIDS

