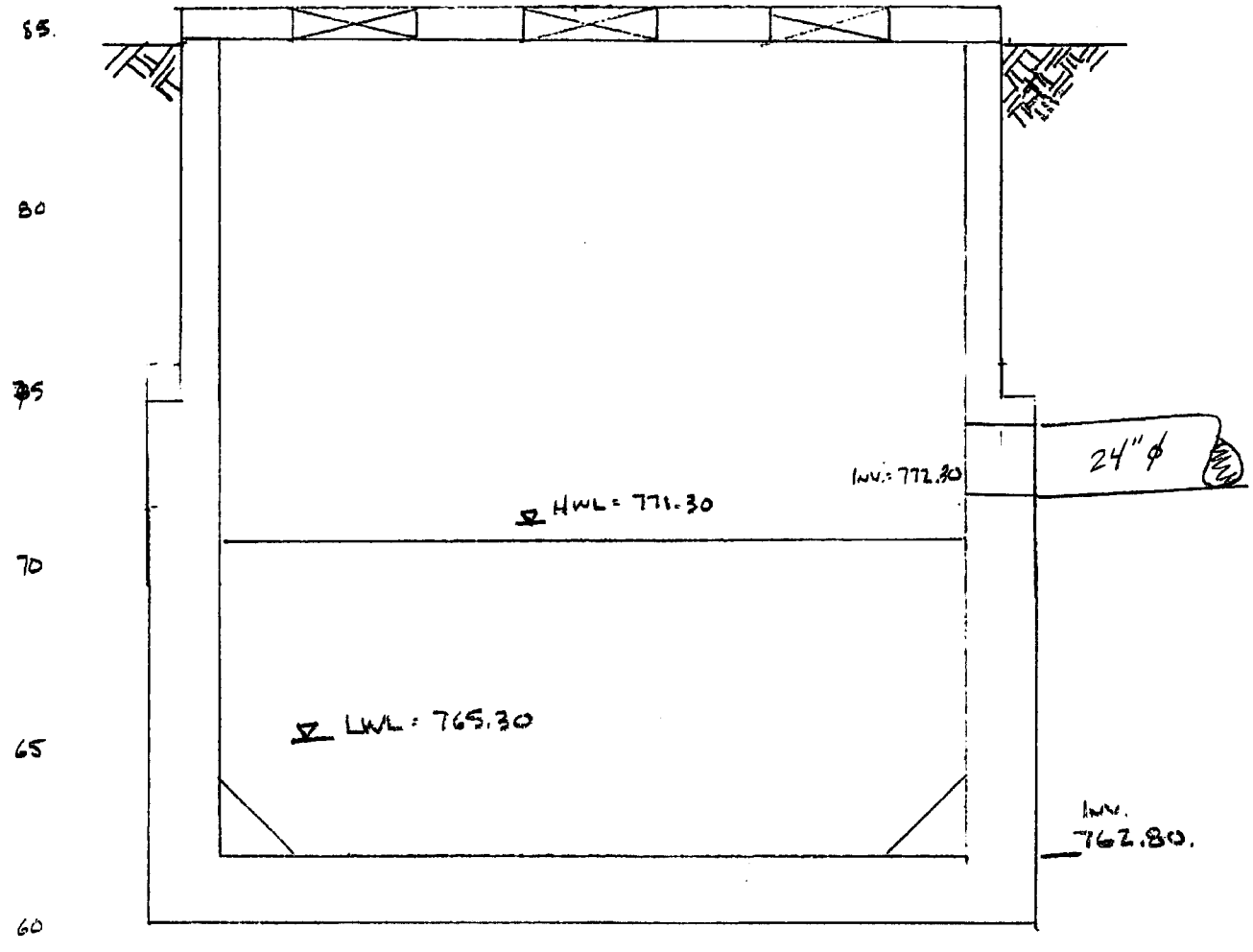
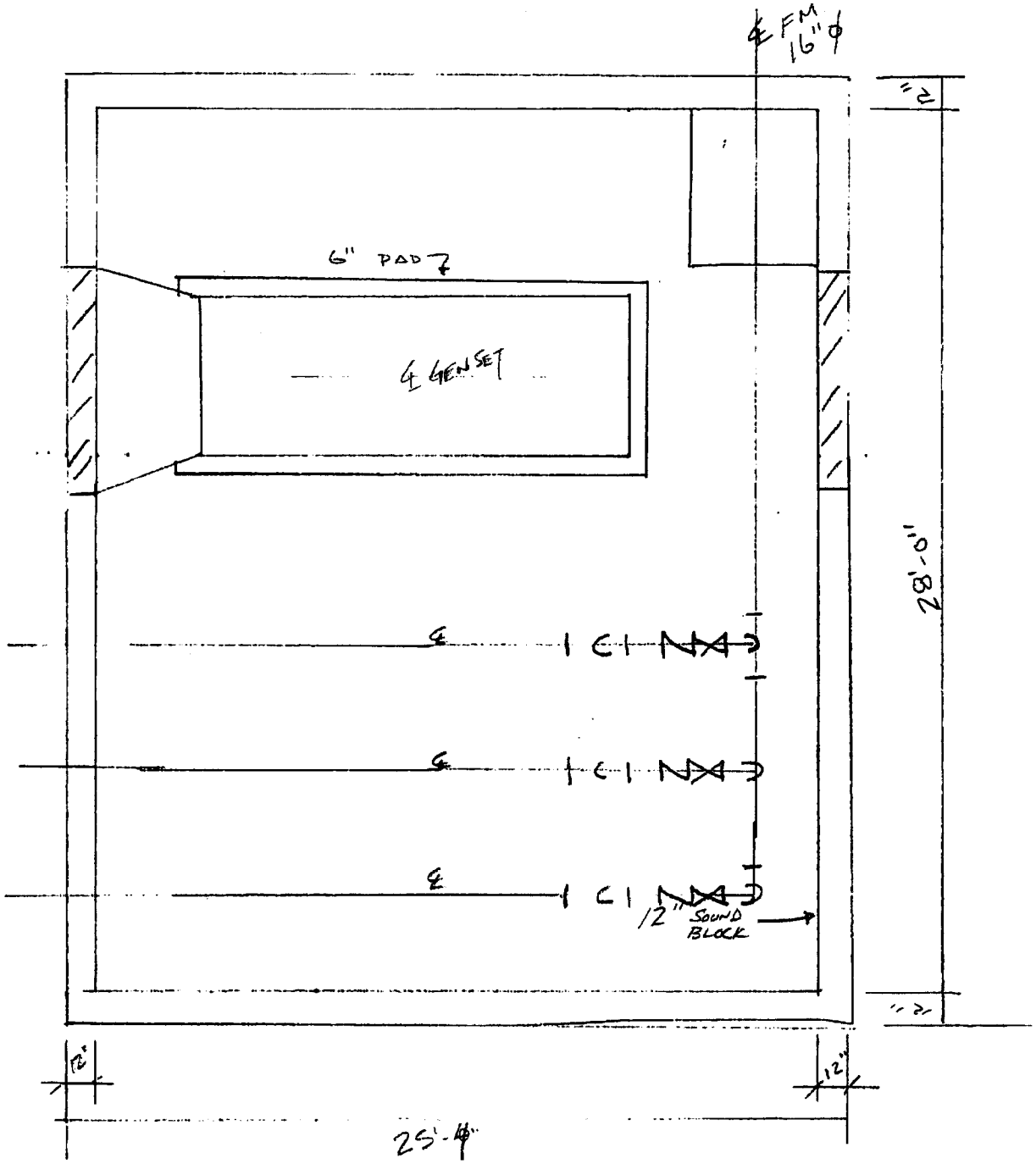
KLH
ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT MACM Act 537 Projects — JOB NO. 220-33
White Oak Long Run PS. — SHEET NO. 3 OF .....
COMPUTED BY KAH. — DATE 12-20-01



KLH
ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT ..... JOB NO. 220-33
..... SHEET NO. 4 OF .....
COMPUTED BY ..... DATE 12-20-07



1 SQ. = 1'-0"

REFER

KLH
ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT Long Run Interceptor JOB NO. 220-87
P.S. SHEET NO. ..... OF .....
COMPUTED BY K&H & RDH DATE 12-12-07

Top of Influent Line: 788.75
Inv. of Influent Line: 776.30

Less to Ops Level 3'-00

773.0

Ops. Level 6

767.0

788.75
-5.00
783.75

790
Static: ~~784~~ - 767 = 17'-0"

Static ~~20~~ 23'

5 MGD - 3472 GPM @ 98.3 → 98.5.

2 Pumps Operating - 1736 → 1,740 GPM.

Need 3 pumps @ 98.5. TDH & 1740 GPM.

Pipe Diameter	Pipe Length	Inlet	Valves	Check Valve	90	45	Side of Tee	Run of Tee	Increaser	Outlet	Equivilent Length
2											0
4											0
6											0
8											0
10											0
12											0
14	6065					31					6592
16	6065					31					6654
18											0
20											0
22											0
24											0
30											0
36											0
42											0
48											0

WOLR

Pump Data Sheet - Yeomans Pump, Aurora, IL

YEOMANS

Company: KLH Engineers, Inc.
Name: Kevin Hoffman
Date: 12/14/2007

Customer:
Project:
Location:
Quote #:
Item ID / Tag #:
Qty. of Pumps:

Vert. Sump

Pump:

Model: 8417-4A

Type: 6000
Synch speed: 1200 rpm

Speed: 1160 rpm
Dia: 16.625 in

Curve ID No.: 40063A

Impeller ID No.: Y-4012D

Specific Speeds:

Ns: 1782
Nss: 5796

Dimensions:

Suction: 8 in
Discharge: 8 in

Pump Limits:

Temperature: 150 °F
Pressure: 90 psi g
Sphere size: 4 in

Power: ---
Eye area: ---

Search Criteria:

Flow: 1740 US gpm

Head: 98.5 ft

Fluid:

Water
SG: 1
Viscosity: 1.105 cP

Temperature: 60 °F
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a

NPSHa: ---

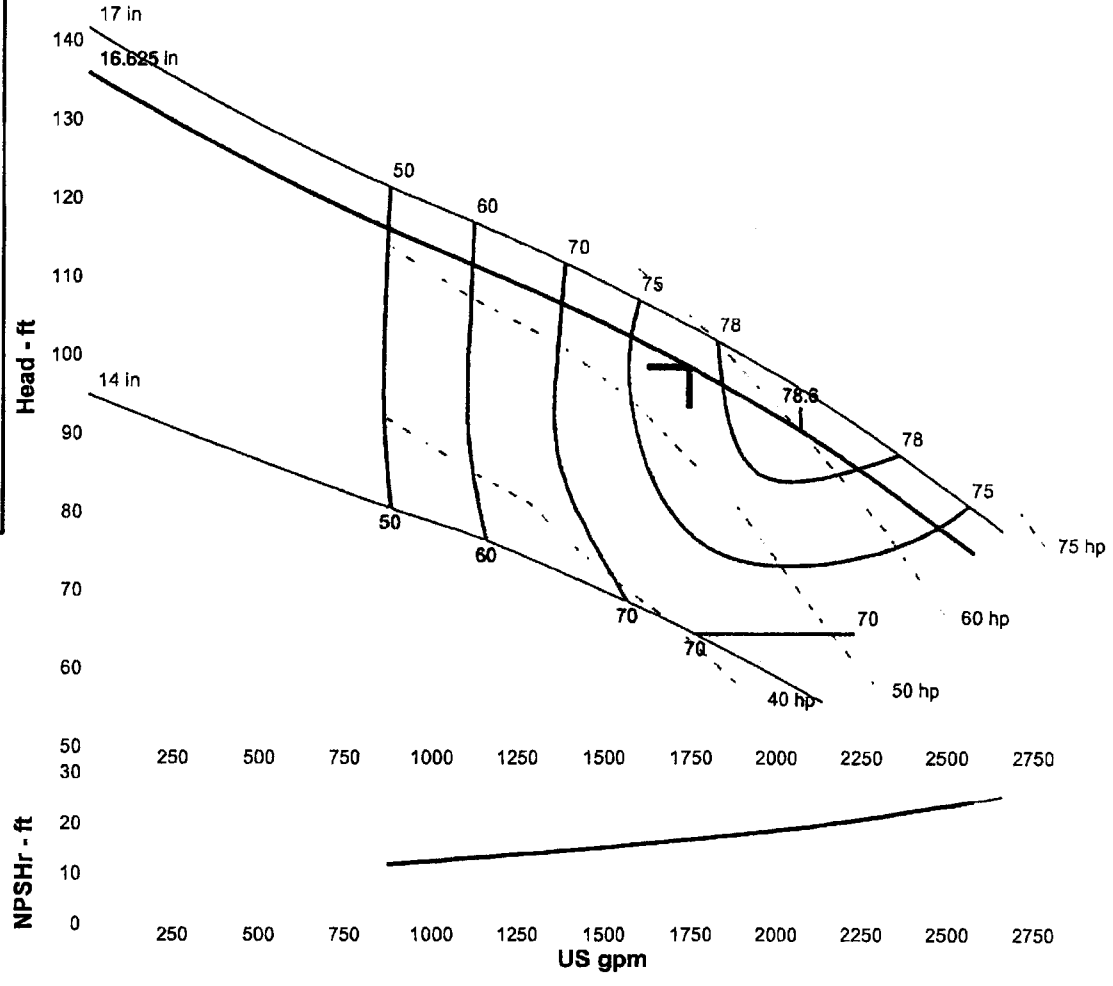
Motor:

Standard: NEMA
Enclosure: TEFC

Size: 75 hp
Speed: 1200
Frame: 405T

Sizing criteria: Max Power on Design Curve

---- Data Point ----	
Flow:	1740 US gpm
Head:	98.5 ft
Eff:	77%
Power:	56.1 hp
NPSHr:	16.9 ft
---- Design Curve ----	
Shutoff head:	136 ft
Shutoff dP:	58.8 psi
flow:	---
:	79% @ 2068 US gpm
NOL power:	66.9 hp @ 2573 US gpm
-- Max Curve --	
Max power:	71.3 hp @ 2657 US gpm



Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
2088	1160	89.9	79	60.3	19.5
1740	1160	98.5	77	56.1	16.9
1392	1160	106	70	53	14.6
1044	1160	113	57	51.9	12.7
696	1160	120	43	50.2	10.8

Selected from catalog: YP_main.60 Vers: 1

Pump Data Sheet - Yeomans Pump, Aurora IL

Company: KLH Engineers, Inc.
Name: Kevin Hoffman
Date: 12/14/2007

Customer:
Project:
Location:
Quote #:
Item ID / Tag #:
Qty. of Pumps:

Pump:

Model: 6153

Type: 9100
Synch speed: 1800 rpm

Curve ID No.: 3603

Specific Speeds:

Dimensions:

Speed: 1750 rpm
Dia: 12.875 in

Impeller ID No.: Y-4739

Ns: ---
Nss: ---

Suction: ---
Discharge: 6 in

Pump Limits:

Temperature: 104 °F
Pressure: 150 psi g
Sphere size: 3 in

Power: ---
Eye area: ---

Search Criteria:

Flow: 1740 US gpm
Head: 98.5 ft

Fluid:

Water
SG: 1
Viscosity: 1.105 cP

NPSHa: ---

Temperature: 60 °F
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a

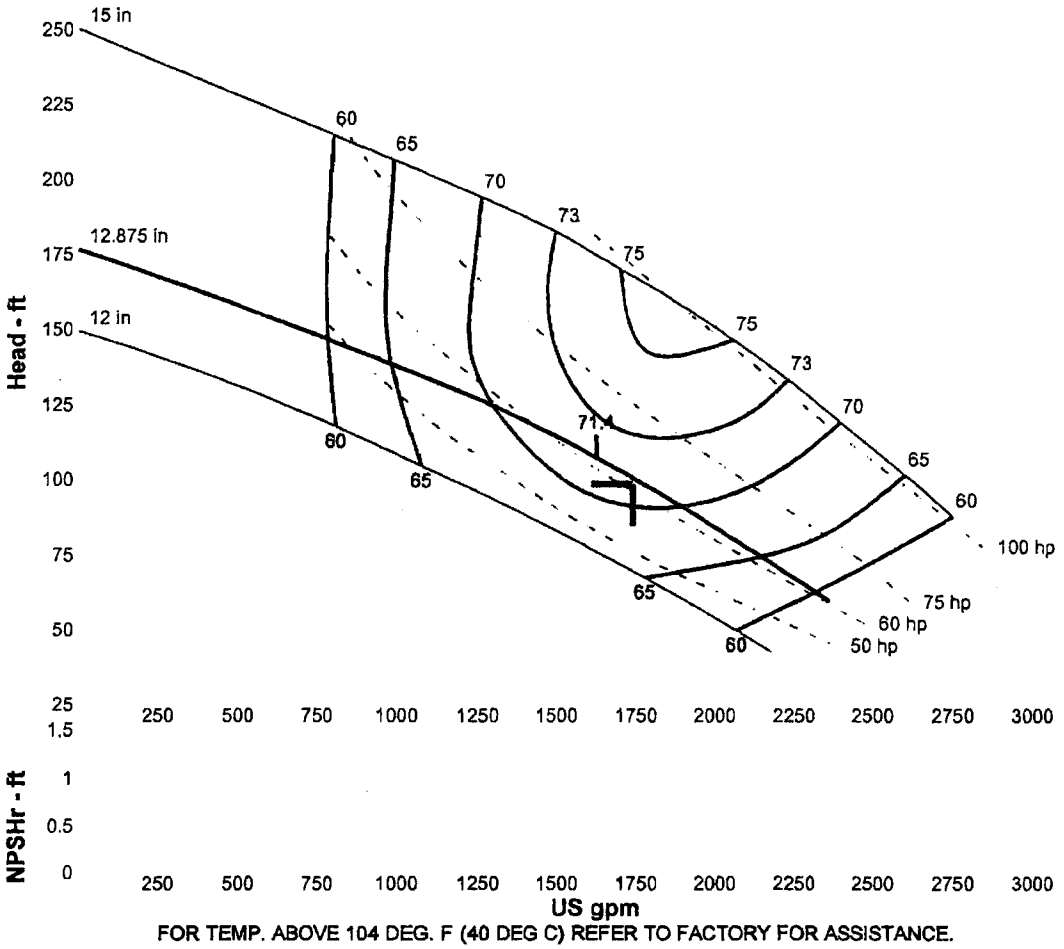
Motor:

Standard: YCC
Enclosure: TENV

Size: 75 hp
Speed: 1800
Frame: 320

Sizing criteria: Max Power on Design Curve

--- Data Point ---	
Flow:	1740 US gpm
Head:	101 ft
Eff:	70.8%
Power:	62 hp
NPSHr:	---
--- Design Curve ---	
Shutoff head:	177 ft
Shutoff dP:	76.5 psi
flow:	---
:	71.4% @ 1626 US gpm
NOL power:	62.3 hp @ 1894 US gpm
-- Max Curve --	
Max power:	103 hp @ 2395 US gpm



FOR TEMP. ABOVE 104 DEG. F (40 DEG C) REFER TO FACTORY FOR ASSISTANCE.

Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
2088	1750	78.4	66.1	62.2	---
1740	1750	101	70.8	62	---
1392	1750	120	70.4	59.4	---
1044	1750	136	66	54	---
696	1750	150	57.9	46.4	---

Selected from catalog: YP_9100.60 Vers: 1

Pump Data Sheet - Fairbanks Morse Pump, 60 Hz

Company: KLH Engineers, Inc.
Name: Kevin Hoffman
Date: 12/14/2007

Fairbanks Morse
Pentair Water

Vert. Shaft

Pump:

Size: 6"5413
Type: 5400-NONCLOG
Synch speed: 1800 rpm
Speed: 1780 rpm
Dia: 11.625 in
Curve: 130604C
Impeller: T6C1C
Specific Speeds:
Ns: 2614
Nss: 7567
Dimensions:
Suction: 6 in
Discharge: 6 in

Pump Limits:

Temperature: 150 °F
Pressure: 85 psi g
Sphere size: 3 in
Power: ---
Eye area: ---

Search Criteria:

Flow: 1740 US gpm
Head: 98.5 ft

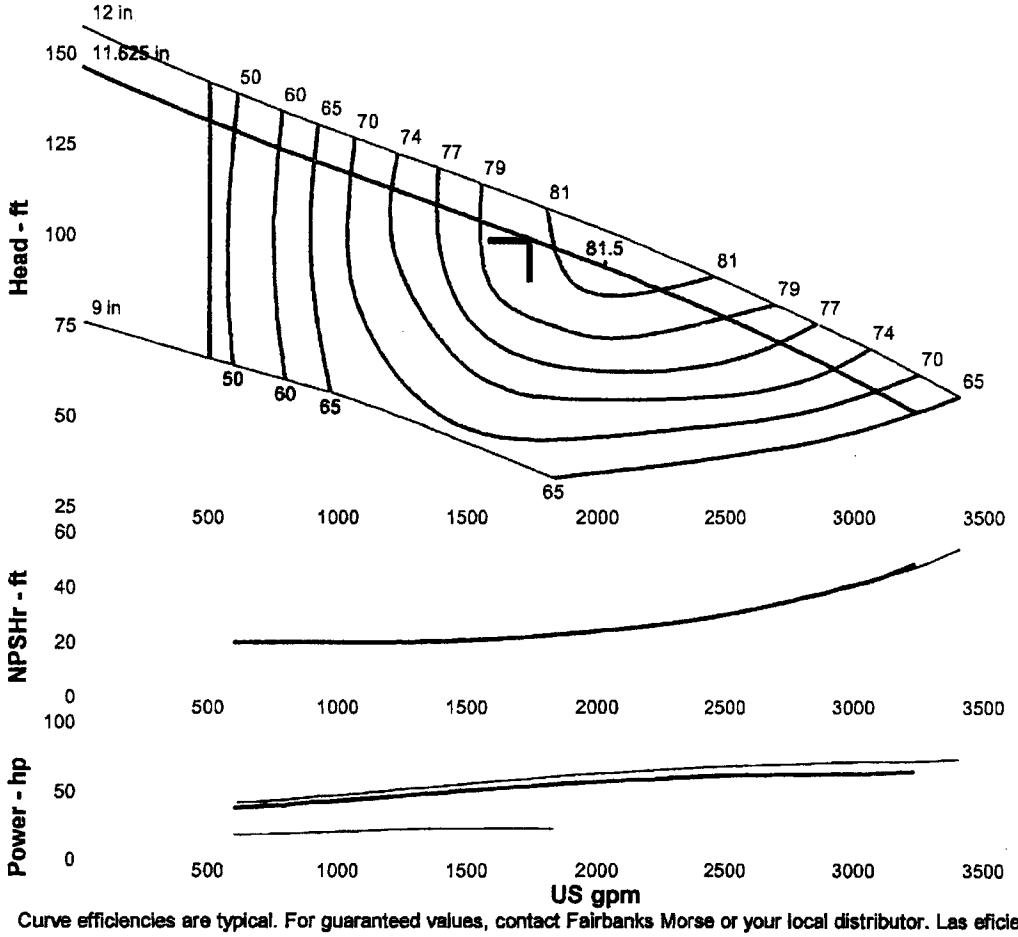
Fluid:

Water
SG: 1
Viscosity: 1.105 cP
Temperature: 60 °F
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a
NPSHa: ---

Motor:

Standard: NEMA
Enclosure: TEFC
Size: 75 hp
Speed: 1800
Frame: 365T
Sizing criteria: Max Power on Design Curve

--- Data Point ---	
Flow:	1740 US gpm
Head:	99 ft
Eff:	80%
Power:	54 hp
NPSHr:	22.2 ft
--- Design Curve ---	
Shutoff head:	146 ft
Shutoff dP:	63.3 psi
flow:	500 US gpm
	81% @ 2029 US gpm
NOL power:	
	64.4 hp @ 3232 US gpm
-- Max Curve --	
Max power:	
	73.3 hp @ 3406 US gpm



Curve efficiencies are typical. For guaranteed values, contact Fairbanks Morse or your local distributor. Las eficiencias en curvas son típicas. Para valores garantizados contacte a Fairbanks Morse o a su distribuidor local.

Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
2088	1780	89.5	81	57.9	25
1740	1780	99	80	54	22.2
1392	1780	108	77	49.2	20.4
1044	1780	117	70	44.1	20
696	1780	126	56	39.5	20

Selected from catalog: Fairbanks Morse Centrifugal.60 Vers: 3

Company: KLH Engineers, Inc.
Name: Kevin Hoffman
Date: 12/14/2007

Fairbanks Morse
Pentair Water

SUBMERSIBLE

Pump:

Size: 6"5433M&W

Type: 5430-SOLIDS HANDLING
Synch speed: 1800 rpm

Speed: 1770 rpm
Dia: 11.6875 in

Curve: 330604C

Impeller: T6C1C

Specific Speeds:

Ns: 2604
Nss: 7480

Dimensions:

Suction: 8 in
Discharge: 6 in

Pump Limits:

Temperature: 104 °F
Pressure: 85 psi g
Sphere size: 3 in

Power: ---
Eye area: ---

Search Criteria:

Flow: 1740 US gpm

Head: 98.5 ft

Fluid:

Water
SG: 1
Viscosity: 1.105 cP

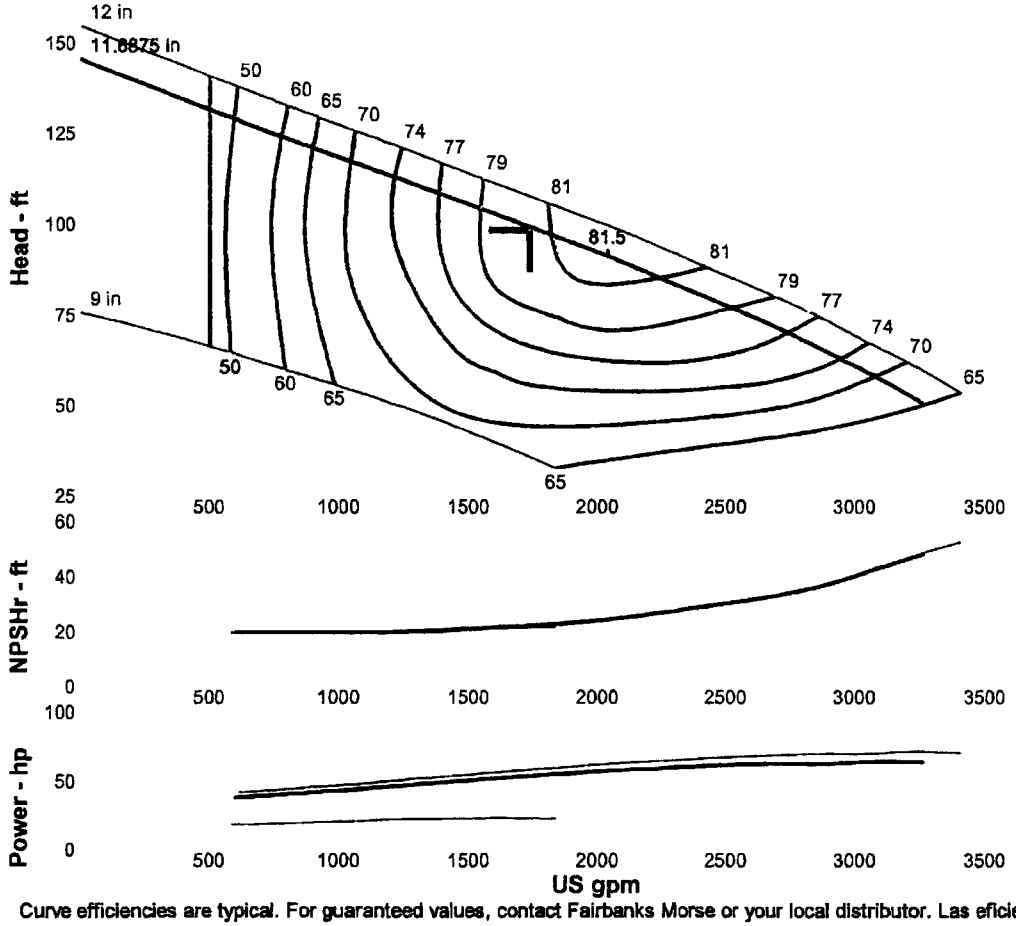
Temperature: 60 °F
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a

NPSHa: ---

Motor:

Consult Fairbanks Morse Pump, 60 Hz to select a motor for this pump.

--- Data Point ---	
Flow:	1740 US gpm
Head:	99.5 ft
Eff:	80%
Power:	54.3 hp
NPSHr:	22.6 ft
--- Design Curve ---	
Shutoff head:	146 ft
Shutoff dP:	63 psi
flow:	500 US gpm
	82% @ 2042 US gpm
NOL power:	
	64.7 hp @ 3080 US gpm
-- Max Curve --	
Max power:	
	71.9 hp @ 3200 US gpm



Curve efficiencies are typical. For guaranteed values, contact Fairbanks Morse or your local distributor. Las eficiencias en curvas son típicas. Para valores garantizados contacte a Fairbanks Morse o a su distribuidor local.

Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
2088	1770	90.1	81	58.3	25.3
1740	1770	99.5	80	54.3	22.6
1392	1770	108	77	49.4	20.8
1044	1770	117	70	44.3	20
696	1770	126	56	39.8	20

Kevin Hoffman

From: Mark Robinson [mrobinson@daman-superiorllc.net]
Sent: Tuesday, December 18, 2007 2:00 PM
To: Kevin Hoffman
Subject: MACM

Kevin,

Various Yeomans selections for White Oak Long Run P.S.

Series 9235 dry-pit submersible M/N 6173SC with 100 hp motor.....$26,968.00 (wt. 3,047#)
Options; SS casing or impeller wear rings.....$575.00 each
Non-witnessed performance test.....$1,118.00

Series 9100 submersible M/N 6173 with 100 hp motor.....$20,339.00 (wt. 2197#)
Options; SS casing or impeller wear rings.....$460.00
Non-witnessed performance test.....$1,143.00

This submersible pump is designed for Class 1 Group C&D (FM labeled.)

4X4 EL rail system; base elbow, sealing flange assy., top guide bracket & intermediate guide bracket....$1,010.00 (wt. 180#) **2" Rails not included.**

Series 6000 dry-pit vertical shaft M/N 6317SC-4A with 100 hp motor.....$25,350.00 (wt. 2,980#)
Options; mechanical seal.....$1,019.00
SS casing or impeller wear rings.....$575.00
Non-witnessed performance test.....$1,131.00

Same pump but with Explosion Proof motor.....$27,273.00 (wt. 3,588#)

16 FT of shafting with hardware for vertical dry-pit.....$4,000.00

Please call should you need additional information or have any questions.

Merry Christmas to you and your family,
Mark

Live Search Maps

MACM: West Shore Pump Station
Side-by-Side Pump Comparison

Required Duty Point 11,810 gpm at 96.5 feet TDH
Required Duty Point per Pump 3,950 gpm at 97.5 feet TDH

Manufacturer (Model)	Flygt	Wilo - EMU	Yeomans Chicago	Yeomans Chicago
Type of Pump	Dry Pit Submersible	Dry Pit Submersible	Dry Pit Submersible	Verticle Shaft
Number of Pumps	4 Total -3 Operating	3 Total - 2 Operating	3 Total - 2 Operating	3 Total - 2 Operating
Model	NT 3306/705	FA 30.93D	No Option Avaialble	10522-6/5
Mfr. Curve No.	63-670		No Option Avaialble	3596
Impeller Type	N- Series	GGG50	No Option Avaialble	Y-4696
No. of Impeller Vanes	3	3	No Option Avaialble	????
Impeller Diameter, in. (mm)	16.9 (430)	16.7	No Option Avaialble	18
Max. Impeller Dia. in. (mm)	16.9 (430)	17.8	No Option Avaialble	22
Percentage of Max Impeller	100.0%	93.8%	No Option Avaialble	81.8%
Nearest Duty Point	3,999 gpm at 98.2 feet TDH	3,950 gpm at 96.5 feet TDH	No Option Avaialble	3,950 gpm at 98.2 feet TDH
Best Efficiency Point	5,575 gpm at 82.9 feet TDH	5,100 gpm at 81 feet TDH	No Option Avaialble	4,150 gpm at 97 feet TDH
Rated Horsepower[2]	150 HP	134 HP	No Option Avaialble	128 HP
Motor Horspower	150 HP	150 HP	>125 HP	150 HP
Pump Speed[2]	1185 rpm	1151 rpm	No Option Avaialble	1200 rpm
Pump Efficiency[2]	67.1%	80.3%	No Option Avaialble	77.0%
NPSHr	15.9	18.5	No Option Avaialble	16.5
Power Requirement	460 Volt, 3 Phase, 60 Hz	460 Volt, 3 Phase, 60 Hz	No Option Avaialble	460 Volt, 3 Phase, 60 Hz
Solids Capability	????	????	No Option Avaialble	5" diameter
Suction	14" diameter	12" diameter	No Option Avaialble	10" diameter
Discharge	12" diameter	12" diameter	No Option Avaialble	10" diameter
Front to Back Dimension (in)	41.375	42.5	No Option Avaialble	41
Base Width (in)	39	27.5625	No Option Avaialble	38
Height - Suction CL to Top (in)	93	82.6875	No Option Avaialble	66.1875
Weight, lb.	3530	2645.5	No Option Avaialble	3590
Estimate Budget Price[3]	$62,383	$48,740	No Option Avaialble	$41,379

1. All series data is total for the pumping system as one entity.
2. At duty point.
3. From manufacturer representative quotes.

Overall Selection:
Yeomans Vert Shaft.

Dry Pit Sub Selection
Wilo EMU.

Client / Job MACM: West Shore Pump Station

Pipe Diameter	24	in			24	20	24 in
Length of Pipe	[redacted]	ft			[redacted]		ft
Friction Factor "C"	130				100	100	100
Pump Suction El.	715	ft		Low	Pump Suction	725	High
Pump Discharge El.	755	ft			Pump Dischar	755	
Static Head	40	ft			Static Head	30	ft
Flow Rate Incremer	500	GPM					
Design Pump rate	17	MGD					
Design Pump rate	11806	GPM					
Velocity	8.37	ft/sec					
V^2/2g	1.09	ft/sec					
Friction Headloss	48.14	ft					
TDH Required	[redacted]	ft					

		24			24			20			24			
Flow Rate GPM	Velocity ft/sec	V^2 2g ft/sec	Friction Headloss Ft	Velocity ft/sec	V^2 2g ft/sec	Friction Headloss Ft	Velocity ft/sec	V^2 2g ft/sec	Friction Headloss Ft	Velocity ft/sec	V^2 2g ft/sec	Friction Headloss Ft	Total Dynamic Headloss Ft
0	0	0	0	0	0	0	0	0	0	0	0	0	40.00
500	0.35	0.00	0.138745248	0.35	0.00	0.003948001	0.51	0.00	0.01917183	0.35	0.00	0	40.16
1000	0.71	0.01	0.500176875	0.71	0.01	0.014232549	1.02	0.02	0.069114481	0.71	0.01	0	40.58
1500	1.06	0.02	1.058991411	1.06	0.02	0.030133636	1.53	0.04	0.146331519	1.06	0.02	0	41.24
2000	1.42	0.03	1.803138559	1.42	0.03	0.051308367	2.04	0.06	0.249157831	1.42	0.03	0	42.10
2500	1.77	0.05	2.724661936	1.77	0.05	0.077530345	2.55	0.10	0.376494006	1.77	0.05	0	43.18
3000	2.13	0.07	3.817665997	2.13	0.07	0.108631812	3.06	0.15	0.527525395	2.13	0.07	0	44.45
3500	2.48	0.10	5.077494839	2.48	0.10	0.144480283	3.57	0.20	0.701608646	2.48	0.10	0	45.92
4000	2.84	0.12	6.500317841	2.84	0.12	0.184966759	4.08	0.26	0.898214444	2.84	0.12	0	47.58
4500	3.19	0.16	8.082891685	3.19	0.16	0.22999895	4.60	0.33	1.116894625	3.19	0.16	0	49.43
5000	3.55	0.20	9.822411322	3.55	0.20	0.279497038	5.11	0.40	1.357261589	3.55	0.20	0	51.46
5500	3.90	0.24	11.71641063	3.90	0.24	0.333390851	5.62	0.49	1.618974566	3.90	0.24	0	53.67
6000	4.26	0.28	13.76269298	4.26	0.28	0.391617883	6.13	0.58	1.901730026	4.26	0.28	0	56.06
6500	4.61	0.33	15.95928088	4.61	0.33	0.454121864	6.64	0.68	2.20525472	4.61	0.33	0	58.62
7000	4.96	0.38	18.30437829	4.96	0.38	0.520851688	7.15	0.79	2.529300468	4.96	0.38	0	61.35
7500	5.32	0.44	20.79634176	5.32	0.44	0.591760591	7.66	0.91	2.873640182	5.32	0.44	0	64.26
8000	5.67	0.50	23.43365785	5.67	0.50	0.666805507	8.17	1.04	3.238064731	5.67	0.50	0	67.34
8500	6.03	0.56	26.2149251	6.03	0.56	0.745946559	8.68	1.17	3.622380464	6.03	0.56	0	70.58
9000	6.38	0.63	29.13883948	6.38	0.63	0.829146639	9.19	1.31	4.02640719	6.38	0.63	0	73.99
9500	6.74	0.70	32.20418245	6.74	0.70	0.916371074	9.70	1.46	4.449976528	6.74	0.70	0	77.57
10000	7.09	0.78	35.40981099	7.09	0.78	1.00758734	10.21	1.62	4.892930538	7.09	0.78	0	81.31
10500	7.45	0.86	38.75464936	7.45	0.86	1.102764826	10.72	1.79	5.355120574	7.45	0.86	0	85.21
11000	7.80	0.94	42.237682	7.80	0.94	1.201874635	11.23	1.96	5.836406305	7.80	0.94	0	89.28
11500	8.16	1.03	45.85794755	8.16	1.03	1.304889411	11.74	2.14	6.336654891	8.16	1.03	0	93.50
11810	8.38	1.09	48.17102852	8.38	1.09	1.370708206	12.06	2.26	6.656276605	8.38	1.09	0	96.20
12000	8.51	1.12	49.61453367	8.51	1.12	1.411783193	12.25	2.33	6.855740265	8.51	1.12	0	97.88
12500	8.86	1.22	53.50657258	8.86	1.22	1.522531288	12.77	2.53	7.393542514	8.86	1.22	0	102.42
13000	9.22	1.32	57.53323712	9.22	1.32	1.63711016	13.28	2.74	7.949947345	9.22	1.32	0	107.12
13500	9.57	1.42	61.69373737	9.57	1.42	1.755497332	13.79	2.95	8.524845605	9.57	1.42	0	111.97
14000	9.93	1.53	65.98731761	9.93	1.53	1.8776713	14.30	3.17	9.118132869	9.93	1.53	0	116.98
14500	10.28	1.64	70.41325367	10.28	1.64	2.003611456	14.81	3.40	9.729709071	10.28	1.64	0	122.15
15000	10.64	1.76	74.97085053	10.64	1.76	2.133298025	15.32	3.64	10.35947817	10.64	1.76	0	127.46
15500	10.99	1.88	79.65944022	10.99	1.88	2.266712	15.83	3.89	11.00734787	10.99	1.88	0	132.93
16000	11.35	2.00	84.4783799	11.35	2.00	2.403835087	16.34	4.15	11.67322935	11.35	2.00	0	138.56
16500	11.70	2.13	89.42705017	11.70	2.13	2.544649663	16.85	4.41	12.357037	11.70	2.13	0	144.33
17000	12.06	2.26	94.50485349	12.06	2.26	2.689138724	17.36	4.68	13.05868828	12.06	2.26	0	150.25
17500	12.41	2.39	99.7112128	12.41	2.39	2.83728585	17.87	4.96	13.77810343	12.41	2.39	0	156.33
18000	12.77	2.53	105.0455703	12.77	2.53	2.989075168	18.38	5.25	14.51520537	12.77	2.53	0	162.55
18500	13.12	2.67	110.507386	13.12	2.67	3.144491316	18.89	5.54	15.26991951	13.12	2.67	0	168.92
19000	13.47	2.82	116.0961373	13.47	2.82	3.303519418	19.40	5.85	16.04217362	13.47	2.82	0	175.44
19500	13.83	2.97	121.8113172	13.83	2.97	3.466145051	19.91	6.16	16.83189764	13.83	2.97	0	182.11
20000	14.18	3.12	127.6524341	14.18	3.12	3.632354225	20.42	6.48	17.63902365	14.18	3.12	0	188.92
20500	14.54	3.28	133.6190106	14.54	3.28	3.802133355	20.94	6.81	18.46348566	14.54	3.28	0	195.88
21000	14.89	3.44	139.7105827	14.89	3.44	3.975469239	21.45	7.14	19.30521958	14.89	3.44	0	202.99
21500	15.25	3.61	145.9266993	15.25	3.61	4.152349044	21.96	7.49	20.16416308	15.25	3.61	0	210.24
22000	15.60	3.78	152.2669218	15.60	3.78	4.332760283	22.47	7.84	21.04025553	15.60	3.78	0	217.64
22500	15.96	3.95	158.7308227	15.96	3.95	4.516690796	22.98	8.20	21.93343788	15.96	3.95	0	225.18
23000	16.31	4.13	165.3179858	16.31	4.13	4.70412874	23.49	8.57	22.84365261	16.31	4.13	0	232.87
23500	16.67	4.31	172.0280054	16.67	4.31	4.895062569	24.00	8.94	23.77084366	16.67	4.31	0	240.69
24000	17.02	4.50	178.8604857	17.02	4.50	5.089481022	24.51	9.33	24.71495634	17.02	4.50	0	248.66
24500	17.38	4.69	185.8150406	17.38	4.69	5.287373112	25.02	9.72	25.6759373	17.38	4.69	0	256.78
25000	17.73	4.88	192.8912932	17.73	4.88	5.488728111	25.53	10.12	26.65373445	17.73	4.88	0	265.03
25500	18.08	5.08	200.088875	18.08	5.08	5.69353554	26.04	10.53	27.64829688	18.08	5.08	0	273.43
26000	18.44	5.28	207.4074263	18.44	5.28	5.901785158	26.55	10.95	28.65957489	18.44	5.28	0	281.97
26500	18.79	5.48	214.8465951	18.79	5.48	6.113466953	27.06	11.37	29.68751984	18.79	5.48	0	290.65
27000	19.15	5.69	222.4060374	19.15	5.69	6.328571131	27.57	11.81	30.73208418	19.15	5.69	0	299.47

Peak Instantaneous Flow	17	MGD	11805.6	gpm

Assume Maximum Detention Time in Wetwell			1	min
Effective Volume of Wet Well	11805.6	gallons		
Effective Volume of Wet Well	1577.23	ft^3		
Number of Sections in Wetwel	2			
Effective Volume per Section	5902.78	gallons		
Effective Volume per Section	788.614	ft^3		

Q	11805.56	
t	2	
V	5902.778	gallons
	788.614	ft^3

Check Detention times at other flows

	Q MGD	Q gpm	t(d) minutes
Low Flow	3.7	2569	2.297
Proposed Average Daily	10.037	6970	0.847

Dimensioning for Total and Effective Volume
Enter Information in shaded areas

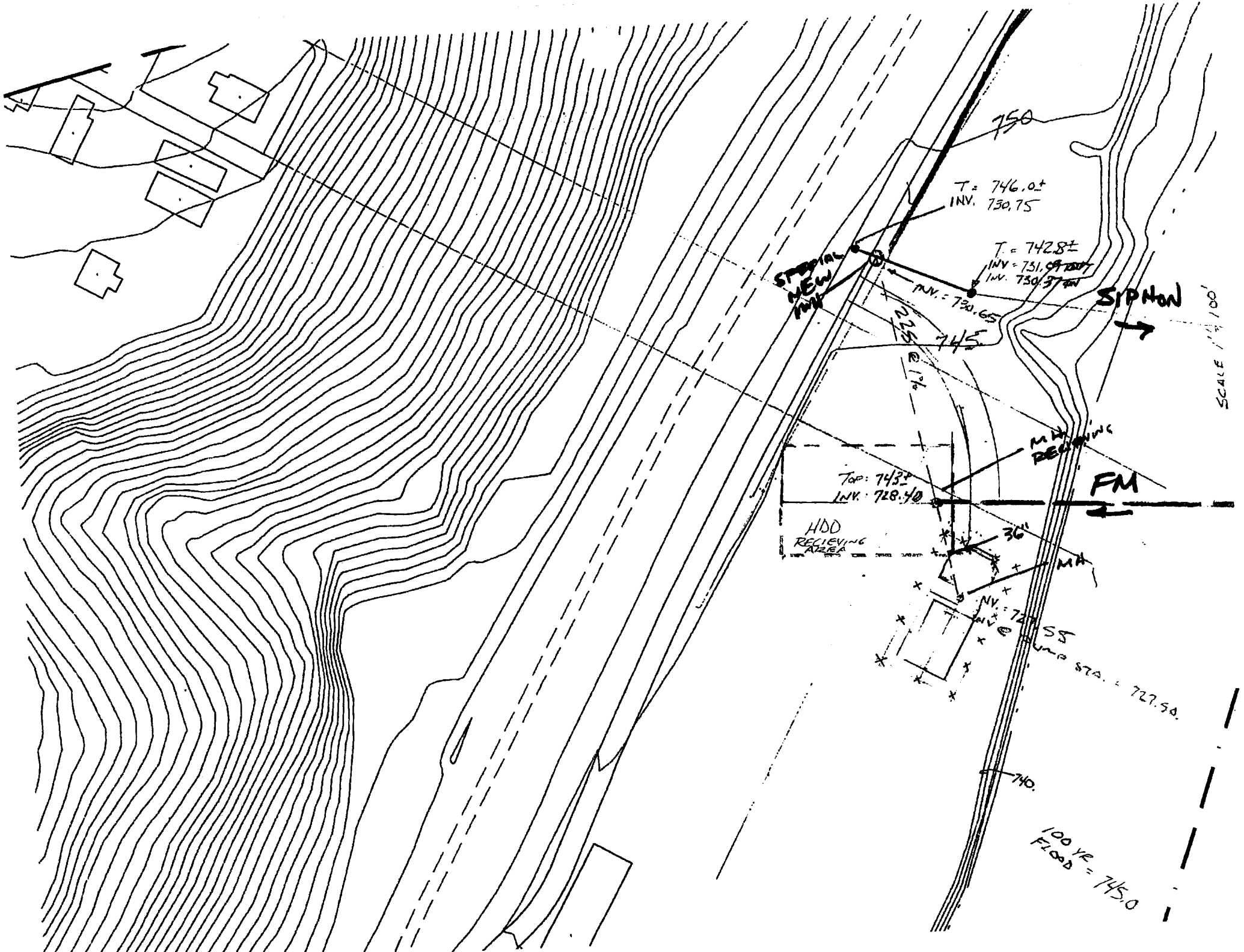
Client MACM
Job West Shore Pump Station

Effective Volume Goal 788.6143 ft^3

Slope 1 2

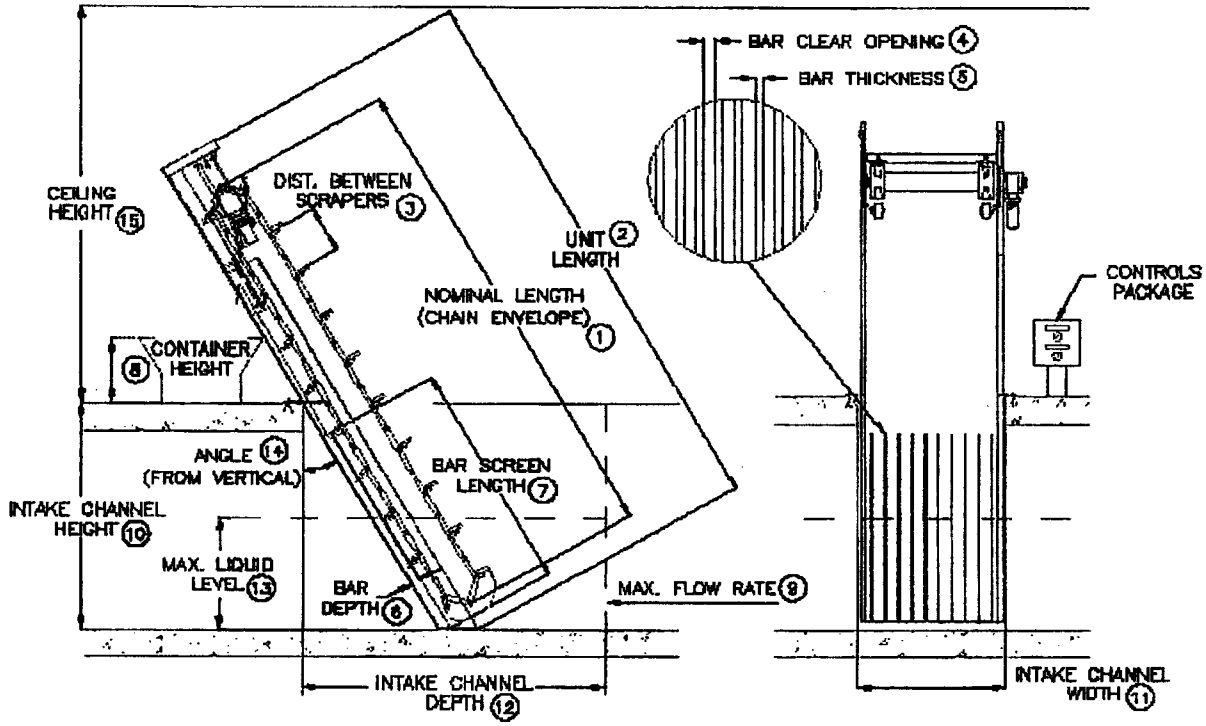
	Depth ft	Frt to Bck Wall ft	Wall to Wal ft	Eff. Vol. ft^3	Total Vol ft^3	Elevation
Base Dim	0	8.00	14.00	Submerge	0.00	719.5
	1	8.00	14.00	Submerge	67.00	720.5
	2	8.00	14.00	Submerge	134.00	721.5
	3	8.00	14.00	Submerge	201.00	722.5
0.5	3.5	8.50	15.00	Submerge	261.63	723
1	4	9.00	16.00	Submerge	332.00	723.5
1.17	4.17	9.17	16.34	Submerge	358.28	723.67
1.5	4.5	10.50	18.00	194.22	474.75	724
2	5	13.00	18.00	311.22	640.00	724.5
2.5	5.5	13.00	18.00	428.22	704.00	725
3	6	13.00	18.00	545.22	768.00	725.5
3.5	6.5	13.00	18.00	662.22	832.00	726
4	7	13.00	18.00	779.22	896.00	726.5
4.5	7.5	13.00	18.00	896.22	960.00	
3.83	8	13.00	18.00	1013.22	1024.00	
4.33	8.5	13.00	18.00	1130.22	1088.00	
4.83	9	13.00	18.00	1247.22	1152.00	
5.33	9.5	13.00	18.00	1364.22	1216.00	
5.83	10	13.00	18.00	2202.46	1280.00	
6.33	10.5	19.33	18.00	2437.9	1942.19	
6.83	11	19.83	18.00	3517.52	2084.17	
7.33	11.5	26.66	18.00	3898.4	2885.81	
7.83	12	27.66	18.00	5246.401	3119.28	
8.33	12.5	34.99	18.00	5799.721	4073.88	
8.83	13	36.49	18.00	7443.101	4412.33	
9.33	13.5	44.32	18.00	8195.861	5533.38	
9.83	14	46.32	18.00	4206.06	5990.32	

Pipe Diameter	Pipe Length	Inlet	Valves	Check Valve	90	45	Side of Tee	Run of Tee	Increaser	Outlet	Equivilent Length
2											0
4											0
6											0
8											0
10											0
12											0
14											0
16											0
18											0
20	30		1	1							176
22											0
24	5505				3.25						5709.75
30											0
36											0
42											0
48											0


750
T = 746.0±
INV. 730.75
T = 742.8±
INV = 731.09 EXIST
INV. 730.37 NEW
STRUCTURE NEW INV
INV. = 730.65
SIPHON
225 @ 1%
745
SCALE 1" = 100'
MH RECEIVING
FM
TOP: 743±
INV. 728.40
HDD RECIEVING AREA
36"
MH
INV. = 727.55
STA. = 727.50
740
100 YR FLOOD = 745.0

February 4, 2008

City of Mckeesport
West Shore Pump Station
Duperon Corporation Budgetary Proposal No. 4156



EQUIPMENT SUMMARY	
Model	Full Penetration, Fine Screen Model
1. Nominal Size	5 ft x 15 ft
2. Unit Length	15 ft
3. Dist. Between Scrapers	2 Link (21 in)
4. Bar Clear Opening	0.50 in
5. Bar Thickness	0.25 in
6. Bar Depth	0.75 in
7. Bar Screen Length	Approx. 5.75 ft
8. Container Height	Estimated 4 ft
9. Max. Flow Rate	17 MGD
10. Intake Channel Height	5 ft
11. Intake Channel Width	5 ft
12. Intake Channel Depth	TBD
13. Max. Liquid Level	TBD
14. Angle (From Vertical)	30 Degrees
15. Ceiling Height	Unknown
Drive Side (L/R)	Unknown
Material of Construction	304 SSTL

ACCESSORIES	
Channel Closeouts	YES
Enclosure/Cover	OPTIONAL
Debris Chute	NO
Controls Package	Range

SCREENINGS	
Gravity Feed or Pumped?	Unknown
Typical Debris?	Unknown

DUPERON corporation

February 4, 2008

City of McKeesport
West Shore Pump Station
Duperon Corporation Proposal No. 4156

FLOW CALCULATIONS

MAX. FLOW 17 MGD per channel							Head Loss		@ 25% Blockage		@ 50% Blockage	
	Slot (in)	Bar (in)	Intake Width (ft)	Req'd. Liquid Level (ft)	Approach Velocity (fps)	Slot Velocity (fps)	(ft)	(in)	(ft)	(in)	(ft)	(in)
	0.50	0.25	5.00	3.50	1.67	2.96	0.14	1.66	0.28	3.40	0.71	8.58

NOTE: These calculations are a rough estimation based upon the information available at this time in order to maintain approximately a 3 fps slot velocity for peak flow. Flow characteristics calculated for clean water and not derated for debris.

NOTE: Duperon strongly recommends a minimum of 1 ft water depth at all times the unit is in operation to get an optimal amount of screening area.

Pump Data Sheet - Yeomans Pump, Aurora, IL

Company: KLH Engineers, Inc.
Name: Kevin Hoffman
Date: 11/7/2007

Customer: MACP
Project: WEST SHORE
Location:
Quote #:
Item ID / Tag #: VERTICAL SHAFT
Qty. of Pumps:

YEOMANS

Pump:

Model: 10522-6 / 5

Type: 6000
Synch speed: 1200 rpm

Speed: 1160 rpm
Dia: 18 in

Curve ID No.: 3596

Impeller ID No.: Y-4696

Specific Speeds:

Ns: 1817
Nss: 8097

Dimensions:

Suction: 10 in
Discharge: 10 in

Pump Limits:

Temperature: 150 °F
Pressure: 105 psi g
Sphere size: 5 in

Power: ---
Eye area: ---

Search Criteria:

Flow: 3950 US gpm

Head: 96.5 ft

Fluid:

Water
SG: 1
Viscosity: 1.105 cP

Temperature: 60 °F
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a

NPSHa: ---

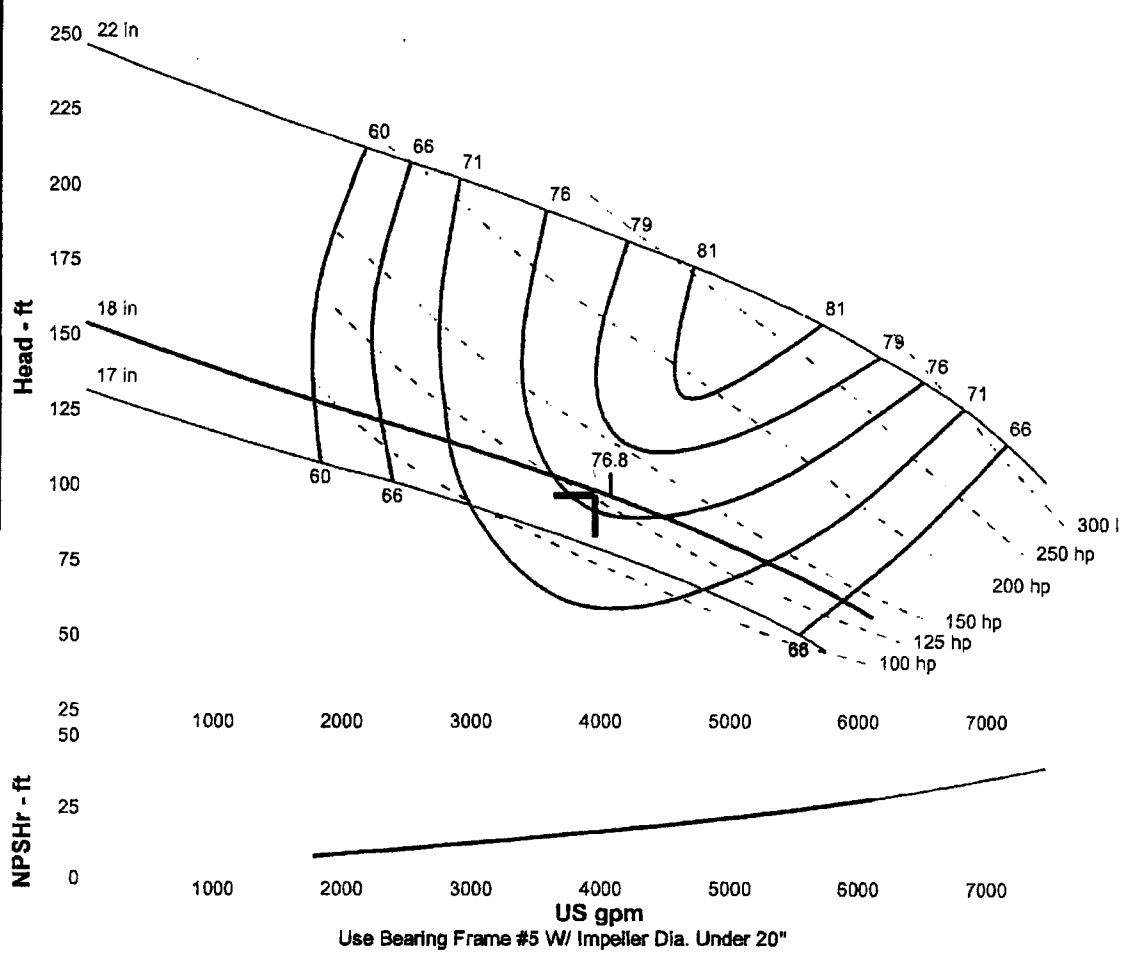
Motor:

Standard: NEMA
Enclosure: TEFC

Size: 150 hp
Speed: 1200
Frame: 447T

Sizing criteria: Max Power on Design Curve

---- Data Point ----	
Flow:	3950 US gpm
Head:	98.2 ft
Eff:	77%
Power:	128 hp
NPSHr:	16.5 ft
---- Design Curve ----	
Shutoff head:	154 ft
Shutoff dP:	66.6 psi
n flow:	---
:	77% @ 4072 US gpm
NOL power:	140 hp @ 5282 US gpm
-- Max Curve --	
Max power:	316 hp @ 7456 US gpm



Use Bearing Frame #5 W/ Impeller Dia. Under 20"

Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
4740	1160	84.6	74	135	20.3
3950	1160	98.2	77	128	16.5
3160	1160	110	73	119	13.1
2370	1160	120	67	108	9.88
1580	1160	131	58	91.6	6.88

Selected from catalog: YP_main.60 Vers: 1

Pump Data Sheet - Yeomans Pump, Aurora, IL

Company: KLH Engineers, Inc.
Name: Kevin Hoffman
Date: 11/7/2007

Customer:
Project:
Location:
Quote #:
Item ID / Tag #:
Qty. of Pumps:

Pump:

Model: 10522-6 / 5

Type: 6000
Synch speed: 1200 rpm

Speed: 1160 rpm
Dia: 18 in

Curve ID No.: 3596

Impeller ID No.: Y-4696

Specific Speeds:

Ns: 1817
Nss: 8097

Dimensions:

Suction: 10 in
Discharge: 10 in

Pump Limits:

Temperature: 150 °F
Pressure: 105 psi g
Sphere size: 5 in

Power: ---
Eye area: ---

Search Criteria:

Flow: 3950 US gpm

Head: 96.5 ft

Fluid:

Water
SG: 1
Viscosity: 1.105 cP

Temperature: 60 °F
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a

NPSHa: ---

Motor:

Standard: NEMA
Enclosure: TEFC

Size: 150 hp
Speed: 1200
Frame: 447T

Sizing criteria: Max Power on Design Curve

--- Data Point ---

Flow:	3950 US gpm
Head:	98.2 ft
Eff:	77%
Power:	128 hp
NPSHr:	16.5 ft

--- Design Curve ---

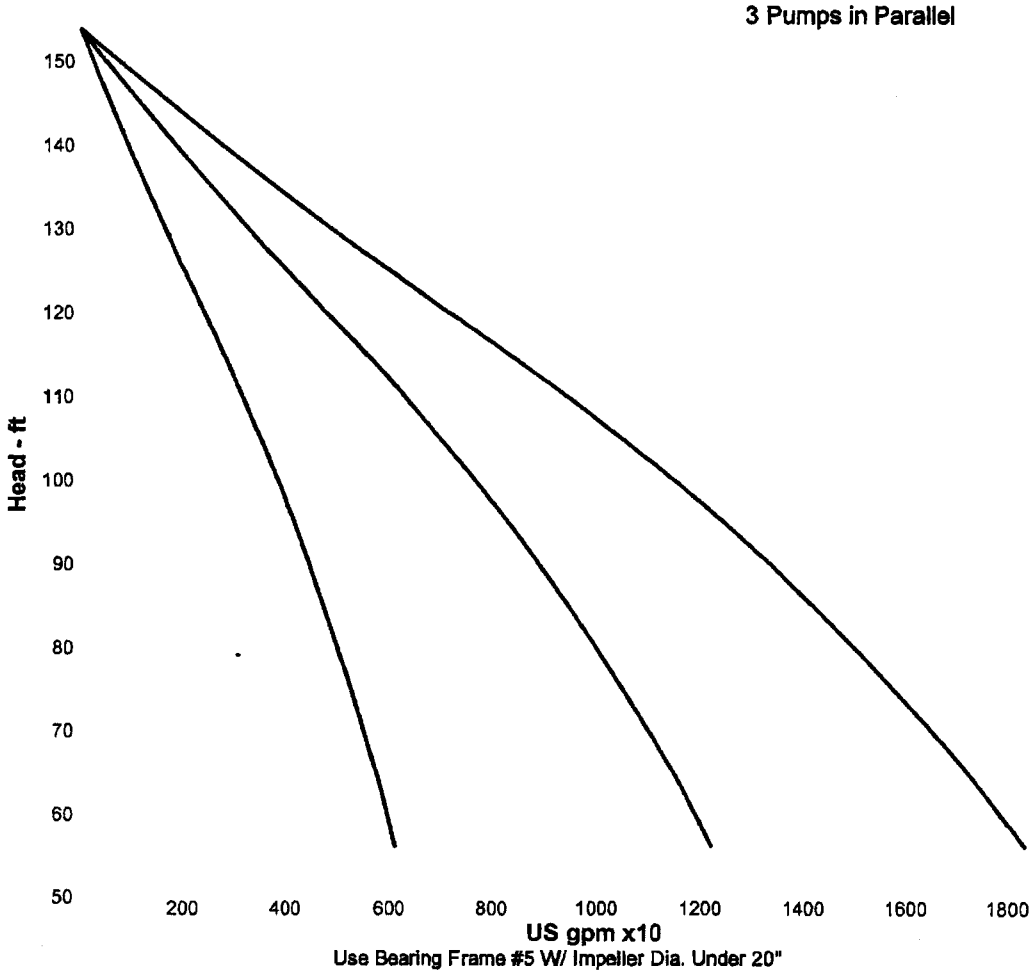
Shutoff head:	154 ft
Shutoff dP:	66.6 psi
'n flow:	---

: 77% @ 4072 US gpm

NOL power:
140 hp @ 5282 US gpm

-- Max Curve --

Max power:
316 hp @ 7456 US gpm



Use Bearing Frame #5 W/ Impeller Dia. Under 20"

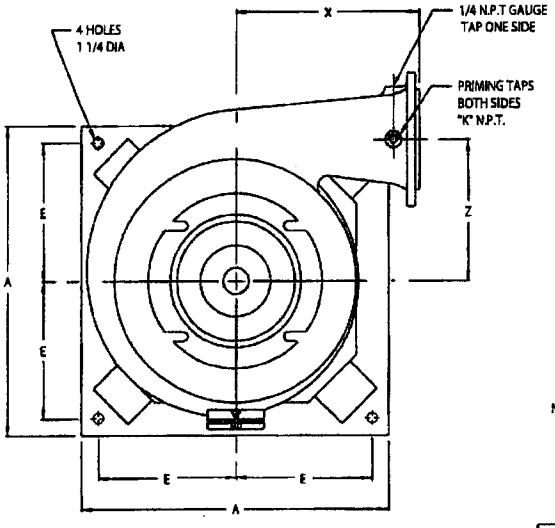
Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
4740	1160	84.6	74	135	20.3
3950	1160	98.2	77	128	16.5
3160	1160	110	73	119	13.1
2370	1160	120	67	108	9.88
1580	1160	131	58	91.6	6.88

Selected from catalog: YP_main.60 Vers: 1

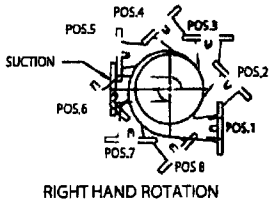
SERIES 6250

VERTICAL LINE-SHAFT SOLIDS-HANDLING PUMPS

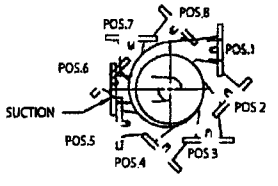


RELATIVE POSITION OF
SUCTION AND DISCHARGE
(AS VIEWED FROM THE MOTOR END)

LEFT HAND ROTATION



RIGHT HAND ROTATION



NOTE: DISCHARGE IN POSITION NO.1
FURNISHED AS STANDARD.
OTHER POSITIONS AVAILABLE
FROM FACTORY WHEN SPECIFIED.

OUTLINE DWG #	102900
S.O.	
JOB:	

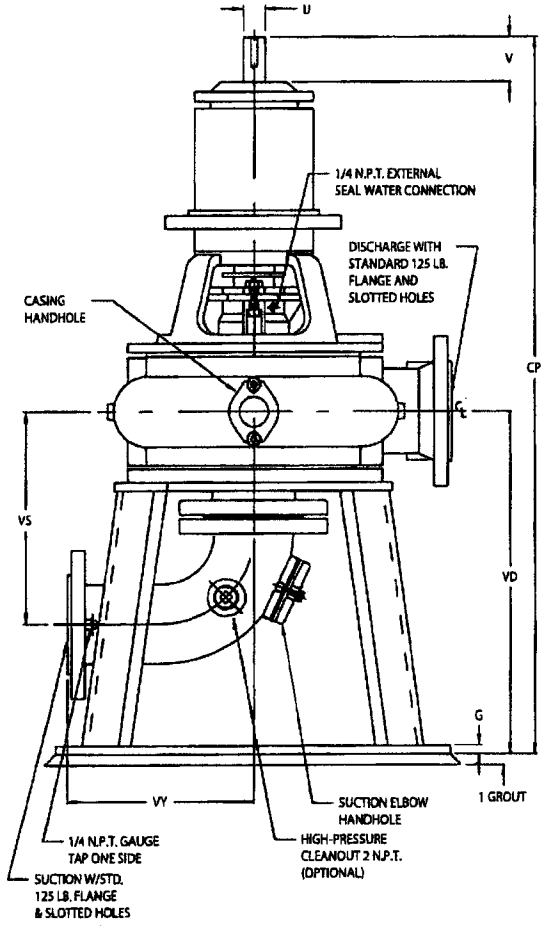
ISSUE	REVISION	DATE

LIST OF EQUIPMENT FURNISHED:

___ Model _____ Pump
Rated for _____ GPM at _____ Ft.TDH.
___ _____ HP, _____ RPM, _____ Volts
___ Phase, _____ Hz Vertical C-Face
Motor in _____ NEMA
enclosure complete with pedestal
___ ROTATION _____ POSITION # _____
___ ROTATION _____ POSITION # _____

OPTIONAL ACCESSORIES:

- ☐ Anchor Bolts
- ☐ Mechanical Seal
- ☐ Bronze or S.S. Impeller
- ☐ Bronze or S.S. Wear Rings
- ☐ 416 S.S. Pump Shaft
- ☐ Safety Guard



NOTES: 1. ALL DIMENSIONS ARE IN INCHES.
2. WEIGHT IS IN POUNDS.

TABLE OF DIMENSIONS

✓	PUMP MODEL	DIS	SUC	A	E	G	K	X	Z	CP	U	KEY	V	VD	VS	VY	WEIGHT
	4317-4A/4BHT	4	8	30	13 3/4	5/8	1/2	13	10 3/4	61 7/8	2 3/8	5/8x5/8x3	4 1/4	27	13 1/8	14	1175
	4317-4A/4BHT																
	6315-4A/4BHT	6	6	24	10 3/4	1/2		16	11	60				26	16 7/8	14	1160
	6315-4A/4BHT		8														
	6317-4A/4BHT	6	8	30	13 3/4	5/8		17	11 3/4	62 1/4				28 3/16	17 1/2	15	1325
	6317-4A/4BHT		10												18 1/2	16	
	8317-4A/4BHT	8	8	30	13 3/4	5/8		17	11 3/4	62 1/4				28 3/16	17 1/2	15	1325
	8317-4A/4BHT		10												18 1/2	16	
	8417-4A	8	8	30	13 3/4	5/8		18	13	63 1/8				28 3/4	18	15	1520
	8417-4A		10												19	16	
	8515-4A	8	8	30	13 3/4	5/8		16 1/2	11 9/16	63 1/8				28 3/4	18	15	1420
	8515-4A		10												19	16	
	8518-4A/4B	8	8	30	13 3/4	5/8		18	13	63 1/8				28 3/4	18	15	1520
	8518-4A/4B		10												19	16	
	10522-4B	10	10	38	16 1/2	1		22	17	75 3/8				39 7/8	21 15/16	18	3500
	10522-4B		12												22 15/16	20	
	10522-5/6	10	10	38	16 1/2	1		22	17	84	2 7/8	3/4x3/4x5	6 1/4	39 7/8	21 15/16	18	3590
	10522-5/6		12												22 15/16	20	
	12515-4A	12	12	38	16 1/2	1		15 1/8	12	69				33 1/2	22	20	1760
	12622-4B	12	12	38	16 1/2	1		24	18	76 1/8	2 3/8	5/8x5/8x3	4 1/4	40 5/8	25 1/16	20	4500
	12622-4B		14													22	
	12622-5/6	12	12	38	16 1/2	1		24	18	84 3/4	2 7/8	3/4x3/4x5	6 1/4	40 5/8	25 1/16	20	4600
	12622-5/6		14													22	
	12624-4B	12	12	38	16 1/2	1		24	18	76 1/8	2 3/8	5/8x5/8x3	4 1/4	40 5/8	25 1/16	20	4520
	12624-4B		14													22	
	12624-5/6	12	12	38	16 1/2	1	3/4	24	18	84 3/4	2 7/8	3/4x3/4x5	6 1/4	40 5/8	25 1/16	20	4620
	12624-5/6		14													22	
	14518-4B/4BHT	14	14	38	16 1/2	1		20	18	74	2 3/8	5/8x5/8x3	4 1/4	38 1/16	24 15/16	22	4600
	14518-4B/4BHT		16												25 15/16	15	
	14620-4B	14	14	38	16 1/2	1		20	18	77 1/2	2 1/2	3/4x3/4x3	4 1/4	41 7/8	26 1/16	22	4800
	14620-5									86 1/2	2 1/2	3/4x3/4x5	6 1/2				
	16620-4B	16	14	38	16 1/2	1		22	18	77 1/2	2 1/2	3/4x3/4x3	4 1/4	41 7/8	26 1/16	22	4820
	16620-5									86 1/2	2 1/2		6 1/2				
	16622-5B/6B	16	18	43 1/2	20	1		22	19 1/2	97 1/2	2 1/2		6 1/2	52 1/2	32 1/2	16 1/2	4900
	16624-5B/6B	16	18	43 1/2	20	1		22	19 1/2	97 1/2	2 1/2	3/4x3/4x5	6 1/2	52 5/8	32 1/2	16 1/2	4930
	18530-6B/6BHT	18	20	48	20	1 1/4		27	22	98 1/2	2 1/2		6 1/2	53 1/16	36 1/16	18	5600
	18624-5B/6B	18	20	43 1/2	20	1	1	27	19 1/2	97 1/2	2 1/2		6 1/2	52 5/8	32 1/2	16 1/2	4950
	18622-5B	18	18	43 1/2	20	1		22	19 1/2	100 1/2	2 1/2		6 1/2	54 1/8	33 1/2	16 1/2	4920
	20724-6B	20	20	43 1/2	20	1		22	24	98	2 1/2		6 1/2	52 1/2	42 1/2	18	5700

CHANNEL MOUNTED GUIDE BEARING
-STANDARD-

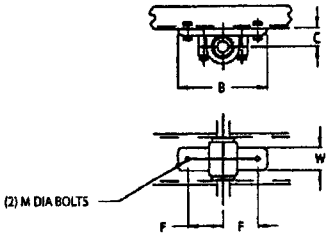
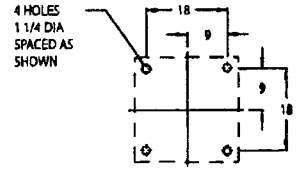


TABLE OF DIMENSIONS

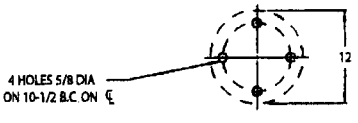
SHAFT SERIES	C	B	W	F	M	VV
27-31,37	1 5/8	6 1/4	1 5/8	2 3/8	1/2	5
41	1 7/8	6 3/4	1 3/4	2 1/2	1/2	5 1/2
48	2 1/8	7 3/4	2 1/8	3	1/2	6 1/8
55-61	2 1/4	8 1/4	2 1/4	3 1/8	5/8	7
71	2 1/2	8 7/8	2 3/8	3 3/8	5/8	7 3/4
81	2 3/4	9 5/8	2 1/2	3 5/8	5/8	7 3/4
88	3 1/2	12	3 1/2	4 1/2	7/8	8 5/8
91	4	14	3 3/8	5 7/16	7/8	9

NOTES:
1) ALL DIMENSIONS ARE IN INCHES.
2) ALTERNATIVE SHAFT SERIES OR TYPES MAY BE REQUIRED DEPENDING ON THE SPECIFIC PUMP MODEL, OPERATING SPEED RANGE AND OTHER FACTORS. PLEASE REFER TO FACTORY FOR SELECTION, SIZING AND DESIGN ASSISTANCE

MOTOR FRAMES
182TC THRU 445TC (FOR FRAMES ABOVE 445TC OR "P" MOUNTING CONSULT FACTORY)



MOTOR FRAMES
143TC THRU 145TC



OUTLINE DWG #	109150
S.O.	
JOB:	

ISSUE	REVISION	DATE

LIST OF EQUIPMENT FURNISHED:

____ ITEM ☐ STANDARD ☐ SPECIAL TUBE _____

(QTY) SHAFTING CONSISTING OF:

1 SECTION "A" SHAFTING WITH SPLINED END

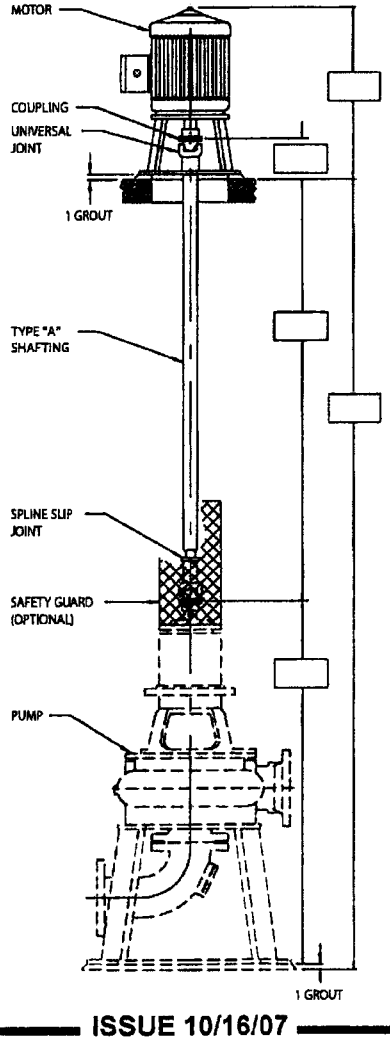
____ SECTION "B" SHAFTING EACH WITH ONE (1) INTERMEDIATE BEARING

____ HP, ____ RPM, ____ VOLTS, ____ PHASE, ____ HZ.
VERTICAL, C-FACE MOTOR IN _____
NEMA ENCLOSURE COMPLETE WITH PEDESTAL
AND COUPLING.

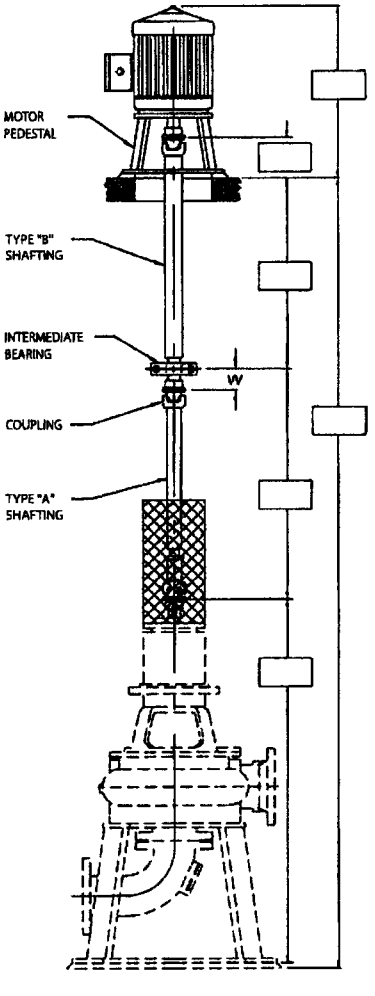
OPTIONAL:

☐ SAFETY GUARD

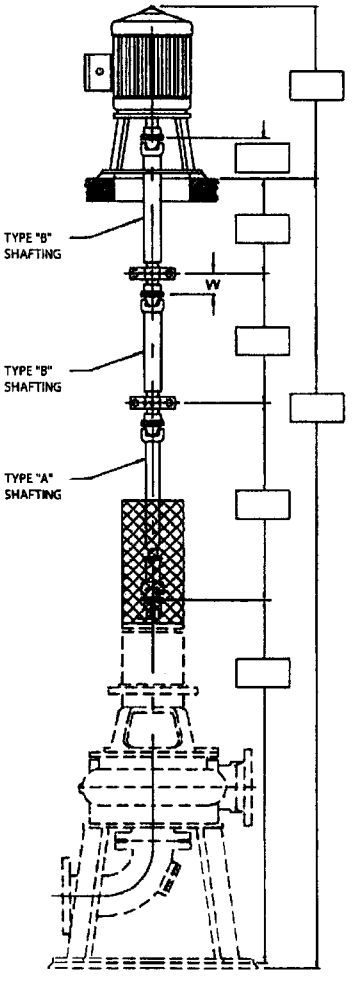
SINGLE
SHAFTING LENGTH



DOUBLE
SHAFTING LENGTH



TRIPLE
SHAFTING LENGTH



Kevin Hoffman

From: Mark Robinson [mrobinson@daman-superiorllc.net]
Sent: Wednesday, November 14, 2007 4:01 PM
To: Kevin Hoffman
Subject: SPAM -MACM
Attachments: mck3.pdf

Kevin,
Pricing for the Vertical Shafted Yeomans pumps and a drawing & curve for the 10522 pump.

West Shore: 10522-6/5 with 150 hp, 1200 rpm, 460/3/60, TEFC motor.....$33,649.00 (wt. 5075#)
Same but with Explosion Proof motor.....$35,037.00 (wt. 5910#)

Adder Options: Mechanical Seal.....$1,159.00
SS Impeller or Case wear ring.....$694.00 Each
Non-Witnessed Performance Test..... $1,877.00

Long Run: 6317LC-4BHT with 200 hp, 1800 rpm, 460/3/60, TEFC motor.....$29,196.00 (wt. 2840#)
Same but with Explosion Proof motor.....$30,048.00 (wt. 3575#)

Adder Options: Same as above.

Note: Adder for flexible shafting for all four pump stations (I assumed a 16 ft. length) and per each pump, including shafting, safety shields and hardware.....$4,000.00 per pump.

Please contact me should you have any questions or require additional information.

Best regards,
Mark

Daman Superior, LLC

PUMP DATA SHEET

Yeomans Pump, Aurora, IL

11/14/07

Selection list: ---

Search Criteria:
Flow: 3950 US gpm
Head: 96.5 ft
Tolerance: --- % of head

Fluid: Water
Temperature: 60 °F
SG: 1
Viscosity: 1.105 cP
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a

NPSHa: --- ft

Advanced Criteria:
Preferred Operating Area: ---
Secondary Operating Point: ---
Max temperature: --- °F
Max suction pressure: --- psi g
Max sphere size: --- in
Max power: --- bhp
Max suction specific speed: --- (Nss)
Min trim: --- % of max diameter
Min head rise: --- % to shutoff

Curve Corrections: none

Catalog: 6000 Dry Pit Solids Handling 60Hz vers 2

Pump: 10522-6 / 5
Type: 6000
Synch speed: 1200 rpm
Speed: 1160 rpm
Dia: 18 in
Curve no.: 3596

Specific Speeds
Ns: 1817 Nss: 8097

Dimensions:
Suction: 10 in Discharge: 10 in

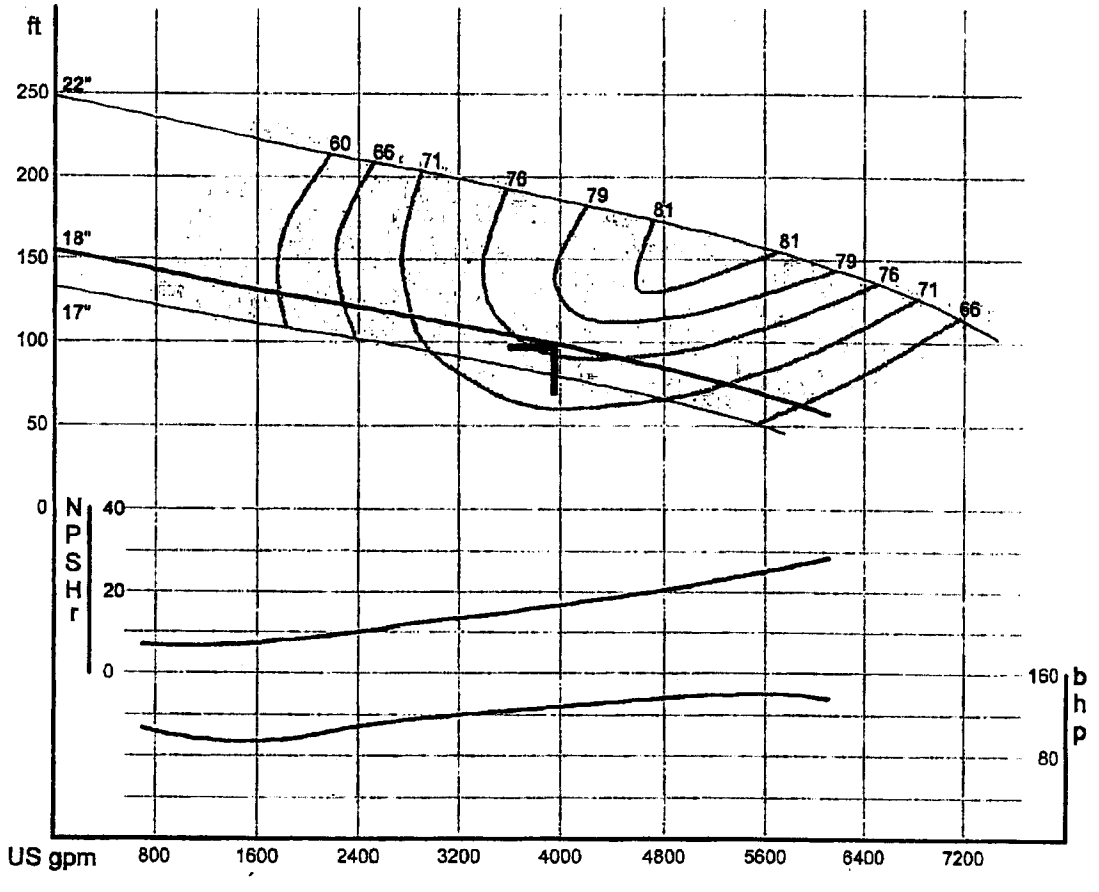
Pump Limits:
Temperature: 150 °F
Pressure: 105 psi g
Sphere size: 5 in
Power: --- bhp

Motor: 150 hp
Speed: 1200
Frame: 447T
Standard: NEMA
Enclosure: TEFC
Sizing criteria: Max Power on Design Curve

--- Data Point ---
Flow: 3950 US gpm
Head: 98.2 ft
Eff: 77%
Power: 127 bhp
NPSHr: 16.5 ft

-- Design Curve --
Shutoff Head: 154 ft
Shutoff dP: 66.6 psi
Min Flow: --- US gpm
BEP: 77% eff
@ 4072 US gpm
NOL Pwr: 139 bhp
@ 5289 US gpm

-- Max Curve --
Max Pwr: 315 bhp
@ 7456 US gpm



Pump note: USE BEARING FRAME #5 W/ IMPELLER DIA. UNDER 20"

PumpfinderPlus vers 7.1

Daman Superior, LLC

PUMP DATA SHEET

Yeomans Pump, Aurora, IL

11/14/07

Selection list: —

Catalog: 6000 Dry Pit Solids Handling 60Hz vers 2

Pump: 10522-6 / 5

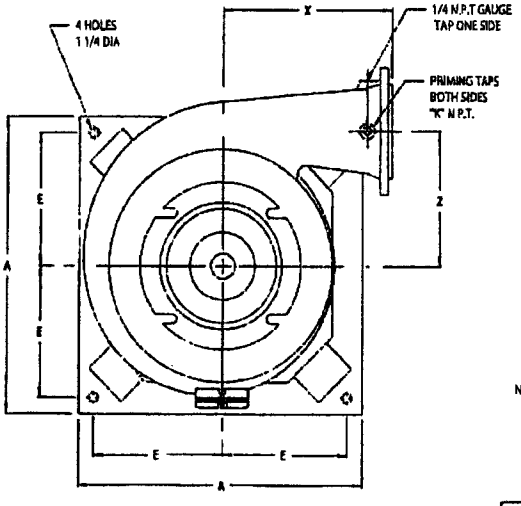
Performance Evaluation:

Flow	Speed	Head	Pump	Power	NPSHr	Motor	Motor	Hrs/yr	Cost
US gpm	rpm	ft	%eff	bhp	ft	%eff	kW		/kWh
4740	1160	84.5	74	135	20.3				
3950	1160	98.2	77	127	16.5				
3160	1160	110	73	119	13.1				
2370	1160	121	67	108	9.87				
1580	1160	131	54	97.4	7.48				

YEOMANS

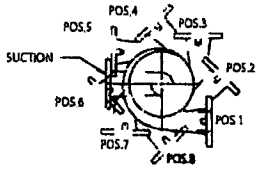
SERIES 6250

VERTICAL LINE-SHAFT SOLIDS-HANDLING PUMPS

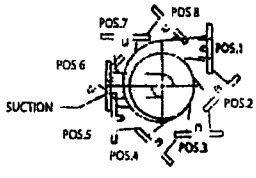


RELATIVE POSITION OF SUCTION AND DISCHARGE (AS VIEWED FROM THE MOTOR END)

LEFT HAND ROTATION



RIGHT HAND ROTATION



NOTE: DISCHARGE IN POSITION NO.1 FURNISHED AS STANDARD. OTHER POSITIONS AVALIABLE FROM FACTORY WHEN SPECIFIED.

OUTLINE DWG #	102900
S.O.	
JOB:	

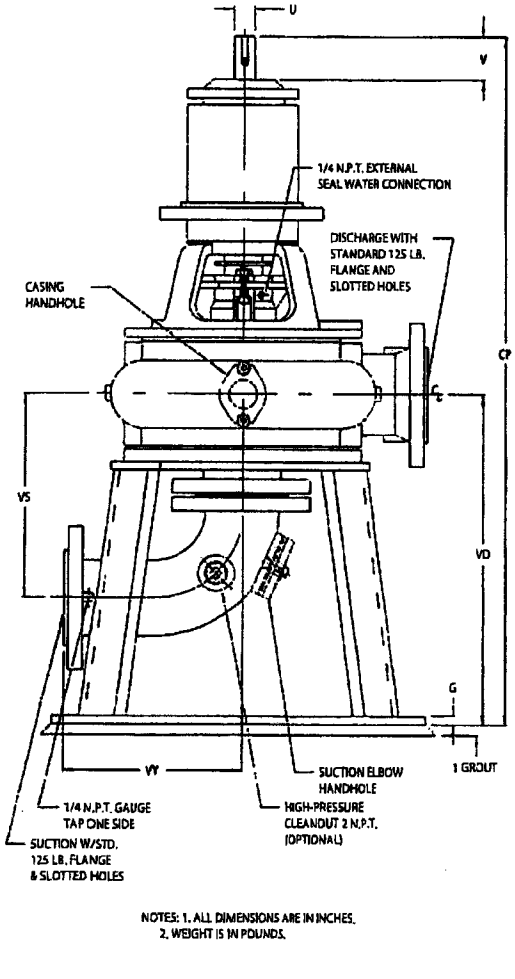
ISSUE	REVISION	DATE

LIST OF EQUIPMENT FURNISHED:

__ Model _____ Pump
Rated for _____ GPM at _____ Ft.TDH.
__ _____ HP, _____ RPM, _____ Volts
__ Phase, __ Hz Vertical C-Face
Motor in _____ NEMA
enclosure complete with pedestal
__ ROTATION _____ POSITION # _____
__ ROTATION _____ POSITION # _____

OPTIONAL ACCESSORIES:

- ☐ Anchor Bolts
- ☐ Mechanical Seal
- ☐ Bronze or S.S. Impeller
- ☐ Bronze or S.S. Wear Rings
- ☐ 416 S.S. Pump Shaft
- ☐ Safety Guard



NOTES: 1. ALL DIMENSIONS ARE IN INCHES.
2. WEIGHT IS IN POUNDS.

TABLE OF DIMENSIONS

✓	PUMP MODEL	DIS	SUC	A	E	G	K	X	Z	CP	U	KEY	V	VD	VS	VY	WEIGHT
	4317-4A/4BHT	4	8	30	13 3/4	5/8	1/2	13	10 3/4	61 7/8	2 3/8	5/8x5/8x3	4 1/4	27	13 1/8	14	1175
	4317-4A/4BHT																
	6315-4A/4BHT	6	6	24	10 3/4	1/2		16	11	60				26	16 7/8	14	1160
	6315-4A/4BHT		8														
✓	6317-4A/4BHT	6	8	30	13 3/4	5/8		17	11 3/4	62 1/4				28 3/16	17 1/2	15	1325
✓	6317-4A/4BHT		10												18 1/2	16	
	8317-4A/4BHT	8	8	30	13 3/4	5/8		17	11 3/4	62 1/4				28 3/16	17 1/2	15	1325
	8317-4A/4BHT		10												18 1/2	16	
	8417-4A	8	8	30	13 3/4	5/8		18	13	63 1/8				28 1/4	18	15	1520
	8417-4A		10												19	16	
	8515-4A	8	8	30	13 3/4	5/8		16 1/2	11 9/16	63 1/8				28 1/4	18	15	1420
	8515-4A		10												19	16	
	8518-4A/4B	8	8	30	13 3/4	5/8		18	13	63 1/8				28 3/4	18	15	1520
	8518-4A/4B		10												19	16	
	10522-4B	10	10	38	16 1/2	1	3/4	22	17	75 3/8				39 2/8	21 1/16	18	3500
	10522-4B		12												22 1/16	20	
✓	10522-5/6	10	10	38	16 1/2	1		22	17	84	2 3/8	1/4x3/4x5	6 1/4	39 7/8	21 1/16	18	3590
✓	10522-5/6		12												22 1/16	20	
	12515-4A	12	12	38	16 1/2	1		15 1/8	12	69	2 3/8	5/8x5/8x3	4 1/4	33 1/2	22	20	1760
	12622-4B	12	12	38	16 1/2	1		24	18	76 1/8				40 5/16	25 1/16	20	4500
	12622-4B		14													22	
	12622-5/6	12	12	38	16 1/2	1		24	18	84 1/4	2 3/8	3/4x3/4x5	6 1/4	40 5/16	25 1/16	20	4600
	12622-5/6		14													22	
	12624-4B	12	12	38	16 1/2	1		24	18	76 1/8	2 3/8	5/8x5/8x3	4 1/4	40 5/16	25 1/16	20	4520
	12624-4B		14													22	
	12624-5/6	12	12	38	16 1/2	1		24	18	84 1/4	2 3/8	3/4x3/4x5	6 1/4	40 5/16	25 1/16	20	4620
	12624-5/6		14													22	
	14518-4B/4BHT	14	14	38	16 1/2	1		20	18	74	2 3/8	5/8x5/8x3	4 1/4	38 1/16	24 5/16	22	4600
	14518-4B/4BHT		16												25 5/16	15	
	14620-4B	14	14	38	16 1/2	1		20	18	77 1/4	2 3/8	5/8x5/8x3	4 1/4	41 7/8	26 1/16	22	4800
	14620-5									86 1/4	2 7/8	3/4x3/4x5	6 1/4				
	16620-4B	16	14	38	16 1/2	1		22	18	77 1/4	2 3/8	5/8x5/8x3	4 1/4	41 7/8	26 1/16	22	4820
	16620-5									86 1/4	2 7/8		6 1/4				
	16622-5B/6B	16	18	43 1/2	20	1		22	19 1/2	97 1/4	2 7/8		6 1/4	52 1/16	32 1/16	16 1/2	4900
	16624-5B/6B	16	18	43 1/2	20	1		22	19 1/2	97 1/4	2 7/8	3/4x3/4x5	6 1/4	52 5/16	32 1/16	16 1/2	4930
	18530-6B/6BHT	18	20	48	20	1 1/2		27	22	98 1/2	2 7/8		6 1/4	53 5/16	36 5/16	18	5600
	18624-5B/6B	18	20	43 1/2	20	1	1	27	19 1/2	97 1/2	2 7/8		6 1/4	52 5/16	32 1/16	16 1/2	4950
	18622-5B	18	18	43 1/2	20	1		22	19 1/2	100 1/4	2 7/8		6 1/4	54 1/16	33 1/16	16 1/2	4920
	20724-6B	20	20	43 1/2	20	1		22	24	98	2 7/8		6 1/4	52 1/16	42 1/16	18	5700

YEOMANS

SERIES 6250

VERTICAL LINE-SHAFT SOLIDS-HANDLING PUMPS

CHANNEL MOUNTED GUIDE BEARING
-STANDARD-

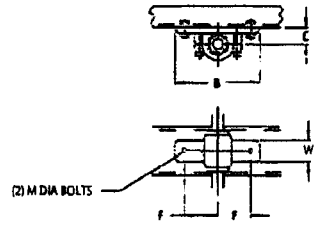
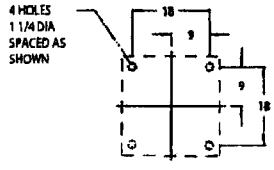


TABLE OF DIMENSIONS

SHAFT SERIES	C	B	W	F	M	VV
27-31, 37	1 5/8	6 1/4	1 5/8	2 3/8	1/2	5
41	1 7/8	6 3/4	1 3/4	2 1/2	1/2	5 1/2
48	2 1/8	7 3/4	2 1/8	3	1/2	6 1/8
55-61	2 1/4	8 1/4	2 1/4	3 1/8	5/8	7
71	2 1/2	8 7/8	2 3/8	3 3/8	5/8	7 3/4
81	2 3/4	9 5/8	2 1/2	3 5/8	5/8	7 3/4
88	3 1/2	12	3 1/2	4 1/2	7/8	8 5/8
91	4	14	3 3/8	5 7/16	7/8	9

NOTE: ALL DIMENSIONS ARE IN INCHES.

MOTOR FRAMES
182TC THRU 445TC (FOR FRAMES ABOVE 445TC OR "P" MOUNTING CONSULT FACTORY)



MOTOR FRAMES
143TC THRU 145TC

OUTLINE DWG #	109150
S.O.	
JOB:	

ISSUE	REVISION	DATE

LIST OF EQUIPMENT FURNISHED:

____ ITEM ☐ STANDARD ☐ SPECIAL TUBE ____

(QTY) SHAFTING CONSISTING OF:

1 SECTION "A" SHAFTING WITH SPLINED END

____ SECTION "B" SHAFTING EACH WITH ONE (1) INTERMEDIATE BEARING

____ HP, ____ RPM, ____ VOLTS, ____ PHASE, ____ HZ.

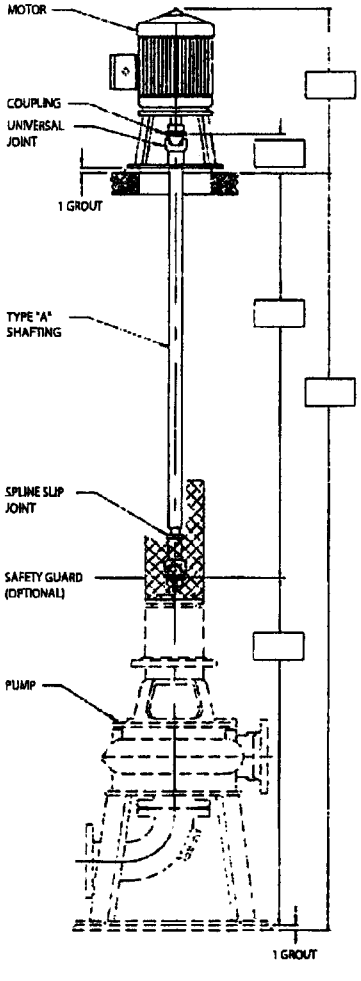
VERTICAL, C-FACE MOTOR IN ____

NEMA ENCLOSURE COMPLETE WITH PEDESTAL AND COUPLING.

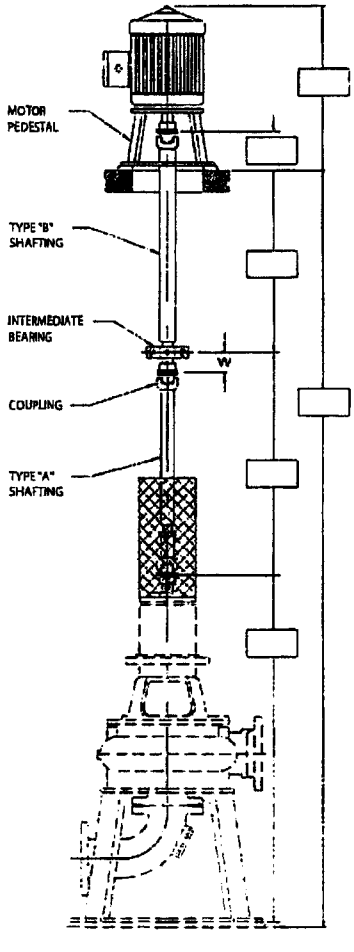
OPTIONAL:

☐ SAFETY GUARD

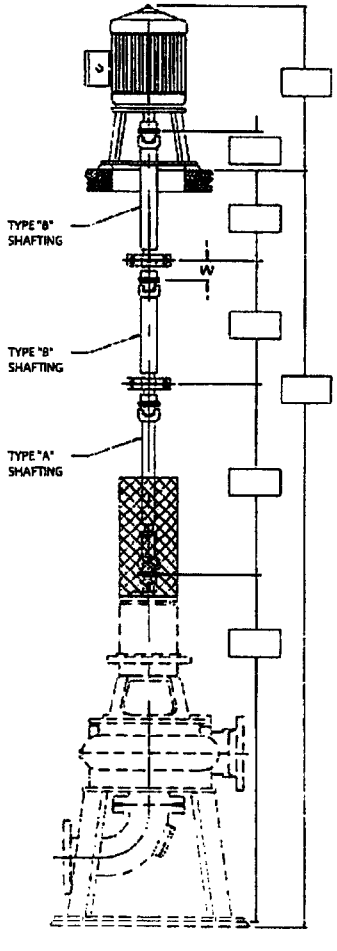
SINGLE SHAFTING LENGTH



DOUBLE SHAFTING LENGTH



TRIPLE SHAFTING LENGTH



APPENDIX D

WWTP CALCULATIONS AND CATALOG CUTS

KLH ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT MACM ACT 537 PROJECTS — JOB NO. 220-33
WWTP EXPANSION DESIGN — SHEET NO. 1 OF
COMPUTED BY KDH — DATE 10-4-07

EXPAND WWTP:

GIVEN:

① EXISTING CAPACITY - HYDRAULIC - 11.5 MGD
ORGANIC - 19,950 #/D (203 mg/L)
TSS - 23,690 #/D (247 mg/L)

② EXISTING LOADINGS* - AVE Q - 11.0 MGD
MAX DAY - 22.0 MGD
MIN DAY - 6.4 MGD

*(DATA FROM 1/07 - 8/07)

ALL LOADS INCLUDE INTERNAL WWTP RECYCLE

BOD AVE DAY - 114 mg/L
BOD MAX MONTH - 176.2 mg/L
BOD MAX DAY - 277 mg/L (7/07)

TSS AVE DAY - 102 mg/L
TSS MAX DAY - 310 mg/L (7/07)
TSS MAX MONTH - 137.5 mg/L

③ PROPOSED WWTP LOADINGS - HYDRAULIC -
AVE DAY Q - 12.0 MGD
MAX DAY - 42.5 MGD. - FROM 537

ORGANIC - 19,950 #/D (200 mg/L)
TSS - 23,690 #/D (237 mg/L)
NH_3-N - 2,302 #/D (23 mg/L)
TN - 3,703 #/D (37 mg/L)

④ EFFLUENT GOALS

BOD - 10 mg/L
TSS - 10 mg/L
TN - 5 mg/L
NH_3-N - 1 mg/L

ASSUMPTIONS

1.) DEFAULT KINETIC VALUES UNLESS OTHERWISE INDICATED
2.) WW TEMP 15° C SUMMER 10°C WINTER

KLH ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT MACM Act 537 Projects JOB NO. 220-33
WWTP Expansion Process Design SHEET NO. 2 OF .....
COMPUTED BY KDH DATE 10-4-07

Split Treatment Scheme:

- All Q through new headworks consisting of screens, grit removal & raw sewage pump station.
- Flow from pumps will be split in a controlled Q-paced splitter box → some percentage (approx ½Q) will be processed by the existing WWTP and the remainder treated by new SBRs.
- All ave day Q up to the peak less capacity of exist CCT will be disinfected by UV and discharged to River.

→ Assume NO BOD or TSS removal in Headworks

- Reference SBR design spreadsheet output for new process calculations
- Reference Flow & Mass Balance sheets for overall design

KLH ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT MACM: WWTP EXPANSION JOB NO. 220-33
BNR TREATMENT BLENDING SHEET NO. 1 OF
COMPUTED BY KDH DATE 10/24/07

GOAL TOTAL N = 5 mg/L

IF WWTP IS SPLIT & SBR FUNCTIONS FOR BNR

THEN SBR MUST ACHIEVE TN OF:

$$(6\ MGD)(7.8) + (6\ MGD)TN_{SBR} = (12\ MGD)(5\ mg/L)$$

$TN = 2.2\ mg/L\ TN_{SBR}$
$TKN = 1.12\ mg/L\ (51\%)$
$NH_3\text{-}N = 0.88\ mg/L\ (40.3\%)$
$NO_x = 1.08\ mg/L\ (49\%)$

THE SBR IS BEING DESIGNED FOR TN = 5 mg/L & NH_3-N = 1 mg/L

★ ∴ SBR WILL NOT OBTAIN LOW ENOUGH CONCENTRATIONS TO BLEND W/ EXISTING WWTP Q TO MEET TN GOAL = 5 mg/L

IF TP = 1 mg/L

$$(6\ MGD)(1.62) + (6\ MGD)(TP_{SBR}) = 12\ MGD\ (1\ mg/L)$$

$TP = 0.38\ mg/L\ TP_{SBR}$

THIS IS PRETTY MUCH IMPOSSIBLE TO ACHIEVE AS TYPICALLY BIO P REMOVAL STOPS AT 1 mg/L.

MUST LEAVE BACK DOOR TO REMOVE PHOSPHORUS !!!

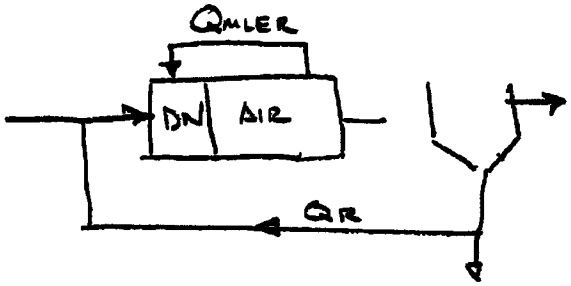
CONSIDER HAVING SBR REACH 1 mg/L & UTILIZE EXISTING BASINS CONVERTING TO 5-STAGE BARDENPHO OR 3-STAGE A²/O PHOREDOX PROCESS

MACM ACTUAL DATA

Date	Flow	Effluent						Influent					
		NH3-N	TKN	Free Org N	Nox	TN	TP	NH3-N	TKN	Free Org N	Nox	TN	TP
9/20/2007		4.76	6.1	1.34	6.34	12.44	1.65						
9/24/2007		4.11	4.7	0.59	2.3	7	<0.1						
10/1/2007		1.14	2.7	1.56	6.28	8.98	2.16						
10/8/2007		2.55	4.5	1.95	0.38	4.88	2.6	11.6	15.2	3.6	0.07	15.27	3.6
10/15/2007		2.86	4.4	1.54	6.23	10.63	1.45	14.1	5.3		0.06		4.4
10/22/2007		4.6	4.7	0.1	2.85	7.55	2.15	15.2	23.7	8.5	0.14	23.84	3.7
Average		3.34	4.52	1.18	4.06	8.58		13.63	14.73	6.05	0.09	19.56	3.90
Percentage		38.9%	52.6%	13.8%	47.4%	100.0%		69.7%	75.3%	30.9%	0.5%	100.0%	
TKN:NH3-N Ratio			1.35						1.08				
Max		4.76	6.10	1.95	6.34	12.44	2.60	11.60	15.20	3.60	0.07	15.27	3.60
Percentage		38.3%	49%	15.7%	51.0%	100.0%		76.0%	99.5%	23.6%	0.5%	100.0%	
TKN:NH3-N Ratio			1.28						1.31				

MACM: BNR FOR EXIST PROCESS

MLE - DN ZONE



Enter following Influent Data		
Flow	8	MGD
BOD	114	mg/L
NH3-N	14	mg/L
TKN:NH3	1.08	Ratio
TKN:NOx	163.6	Ratio
TN:NH3-N	0.69	Ratio
COD:BOD	2	Ratio
Enter the following Effluent		
BOD	15	mg/L
NH3-N	1	mg/L
TN	166.8	#/D
Enter the following Operating Parameters		
MLSS	3500	
Volatile Fraction	0.75	
Is there Primary Clarifiers?	No	
Volume of Aeration	371,420	ft3
TKN	15.12	mg/L
NOx	0.092420538	mg/L
NH3-N	115.092	#/D
TN	2.50	mg/L
Residual NOx	1.50	mg/L
MLVSS	2625	mg/L
Volume in Aeration	2778221.6	gal
Soluble Influent TKN	10.962	mg/L
Remaining to be Nitrifyed	8.46	mg/L
qN	0.028	
MLVSS in DN	20163.73714	#
MLVSS in Aeration	60822.21638	#
Volume DN	921,034	gallons
Detention Time	2.8	hours
Percentage of Volume	33%	
lb. NO3 Equvialent	100.08	#
Effluent COD	1401.12	#
DN BOD Removal	700.56	#
DN BOD Removal	11	mg/L
DN Effluent BOD	104	mg/L
Vol Reqd for BOD Removal	1,840,000.00	gallons
Total Volume Required	2,761,034	gallons
Total Volume Required	369,122	ft3

RATIONALE DESIGN FOR ACTIVATED SLUDGE SYSTEMS

Client MACM
Project Exisitng Unit Process WWTP

Given Information

Max Day Q	8	MGD	Entered Value	
BOD_{in}	6905.5	#/d	BOD influent to aeration basins	
BOD_{in}	104	mg/L	Unit Conversion	Includes 5% load for recycle
BOD_{eff}	15	mg/L	BOD (soluble) effluent from aeration basins	
$NH3\text{-}N_{in}$	522.8	#/d	NH3-N influent to aeration basins	Includes 15% load for recycle
$NH3\text{-}N_{in}$	7.835185185	mg/L	TKN based on 60% as NH3-N	
$NH3\text{-}N_{eff}$	1	mg/L	NH3-N effluent from aeration basins	
TKN_{in}	8.5	mg/L		
MinWW Temp.	50	deg F	Entered Value	
MinWW Temp.	10	deg C	Unit Conversion	
Vant-Hoff Factor	1.135		Temperature Correction Value	
Rxtr DO	3	mg/L	Entered Value for Minimu DO in Rxtr	
pH	7	units	Entered Value	
MLSS	3500	mg/L	Entered Target Value	
f	0.75		Entered Value for Ratio of Active Cells in MLVSS	
MLVSS	*2625*	mg/L	Calculated MLVSS from Volatile Fraction	
μ_m	0.5	d^{-1}	Max. Specific Growth Rate (Typical value unless otherwise noted)	
K_s	1.4	mg/L	Typical value unless otherwise noted	
Y_n	0.2	mg VSS/mg	Synthesis Rate for Nitrifiers (Typical value unless otherwise noted)	
Y	0.5	mg VSS/mg BOD	Synthesis Rate for BOD (Typical value unless otherwise noted)	
k_{dn} @ 15 deg C	0.07	d^{-1}	Endogenous Resp. Rate for Nit @ 15 deg. C (Typical value unless otherwise noted)	
k_{dn}	0.037		Temperature Correction	
$k_{d@}$ 15 deg C	0.08	d^{-1} BOD	Endogenous Resp. Rate for BOD @ 15 deg. C (Typical value unless otherwise noted)	
k_d	0.029		Temperature Correction	
K_n	0.22	mg/L	Calculated nitirification rate constant	
SF	2		Safetey Factor	

Application of Model:

BOD Removed	5904.7	# BOD removed		
NH3-N Removed	456.0	# NH3-N removed		
f_n	0.030			
$\mu'(m)$	0.18	d^-1		
k'	0.9	d^-1		
θ_c^M	6.99	days		
θ_c	13.98	days		
U(NH3-N)	0.54	d^-1		
Predicted N_e	0.33	mg/L		
U	0.2	# BOD removed/# MLVSS * d		
θ (BOD)	0.23	days	5.52	hours
θ(NH3-N)	0.21	days	5.04	hours
Governing θ	**0.23**	**days**	**5.52**	**hours**
Volume Required	**1,840,000**	**gallons**	**245,989**	**ft^3**

Calculated F:M 0.17 d^-1 BOD (mg/L) /[MLVSS (mg/L)*HRT]

MACM WWTP Expansion
Existing Unit Processes
WAS Production Estimate by Aerobic Treatment

Enter design parameters and assumptions in highlighted cells

Influent Conditions (Assuming balanced recycle loads)			
Flow	8 MGD		
Influent Effluent BOD	104 mg/L	7606 lb./day	
Primary Effluent TSS	102 mg/L	6805 lb./day	
VSS fraction of TSS	75%		
Non-Deg fraction of V	20%		
Tank Volume	1,840,000 MG		
Activated Sludge Process			
Actual F:M Ratio	0.17		
Min Required MLSS	59,654.9 #/D	3,887 mg/L	
Volatile Fraction of M	*75%*		
MLVSS	44,741.2 #/D	2,916 mg/L	
Water Temperature	50 deg F	10 deg C	
f(d)	*0.46*		
k(d) (active cell basis)	*0.07*		
Y Yield Constant	*0.55* /d		
Effluent BOD Soluble	7.5 mg/L	497 lb./day	
Effluent TSS	10 mg/L	663 lb./day	
BOD Design Efficienc	92.8%		
TSS Design Efficiency	90.2%		
Substrate Utilization, U	0.16		

Waste Activated Sludge

				VSS	ISS	TSS
Influent Solids, lb./day						
Inert					1701	
Non-Deg VSS				1021		
Synthesized Cells						
Y*BOD(in-out)			3908.08			
f(d)*k(d)*MLVSS			1,440.67			
Deg. Fractic		77%		1569		
Non-Deg Fr		23%	898.8584			
	Organic		69%	620		
New Cells	Inorganic		31%		279	
Total				**3210**	**1980**	**5189**
	Percentage			0.62	0.38	
Effluent Loss				**413**	**255**	**667**
Waste Activated Sludge				**2797**	**1725**	**4522**
	WAS Concentration			10017 mg/L		10000 mg/L
				54,131 gpd		54,223 gpd

MCRT (waste)	13.19 days	
MCRT (check w/ U)	10.33 days	

KLH ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT Act 537 Process WWTP Exp. JOB NO. 220.30
Exist Process BNR Blending SHEET NO. 6 OF
COMPUTED BY KDH DATE 11-28-07

Chemical Dosing of Secondary Tanks for Phosphorus Removal

$$\text{Chem Dose} = CD_t (TP - TP_t) \times (SF)$$

Alum Dose Based on % P Removed

% Remov.	CD_t
< 85	13 mg/L
85 ≤ R ≤ 95	16 mg/L
> 95%	22 mg/L

$$\% \text{ Removed} = \frac{4-1}{4} = 75\% \Rightarrow 13 \text{ mg/L}$$

$$13 \text{ mg/L} (4-1) \times (SF) = 39 \times SF$$

SF → round to nearest 5 mg/L interval

Assume 40 mg/L

Estimate Alum Required

$$\text{Alum} = 40 \text{ mg/L} \times 8 \text{ MGD} \times 8.34 = 2{,}668 \text{ \#/D}$$

Increase in Sludge

$$P_{sludge} = \frac{Q \times CD \times 0.091 \times 4 \times 8.34}{1 \times 10^6}$$

$$P_{sludge} = \frac{8{,}009000 \times 40 \times 0.091 \times 4 \times 8.34}{1 \times 10^6} = 971 \text{ \#/D}$$

$$\forall_{PS} = P_{sludge} \times SVI$$

$$\forall_{PS} = 971 \times 71.2 = 69{,}167 \text{ ft}^3/\text{basin}$$

+ 25% total Vol for Sec Orifices. For Alum Sludge ONLY!!! → Total = 4522 + 971 = 5493 #/D × 71.2 = 391,101

Total Vol = 273,178 ft³ !! Too much Vol.!!

Must have BIO P Removal!

KLH ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT MACM: Act 537 Plan JOB NO. 220-33
WWTP Exp. - Exist BNR SHEET NO. 7 OF .....
COMPUTED BY KDH DATE 12-3-07

- Since Expected Bio P & Chem Precip is not likely to achieve Potential Effluent Limits look at other process to remove P.
- Since all existing Aeration Basins will be utilized to achieve Potential TN limits options are limited.

Options available for "Separate" Stage P removal include the PhoStrip Process & Tertiary Filtration.

First look at PhoStrip.

Existing Original CCT will not be utilized in Treatment Scheme. Can it be used for PhoStrip side stream?

See Table 11-25 from Metcalf & Eddy attached.

The MLE process designed appears to meet the following criteria.

Criteria	Process	Design
F/M	0.1-0.5	0.17
Θ_c	10-30 d	14 days
MLSS	600-5,000 mg/L	3500 mg/L
HRT		
Anaerobic	8-12 hr	?
Aerobic	4-10 hr	5.5 hr
RAS % Inf.	20-50%	?
Internal Recycle % Inf	10-20%	?

Using Internal Recycle as Stripper Underflow & Anaerobic HRT as basis — Is Existing CCT a viable option?

KLH ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT MACM - ACT 537 PROJECTS JOB NO. 220-33
EXIST WWTP BNR BLENDING SHEET NO. 8 OF
COMPUTED BY KDH DATE 12-3-07

INFLUENT Q = 8 MGD.

10% Q = 0.8 MGD

20% Q 1.6 MGD

HRT_{max} = 12 hr

HRT_{min} = 8 hr

$10\%Q\ @\ HRT_{max}$ = 0.8 MGD x 12 hr $\left(\frac{1d}{24hr}\right)$ = 0.4 MGD.

$10\%Q\ @\ HRT_{min}$ = 0.8 MGD x 8 hr $\left(\frac{1d}{24hr}\right)$ = 0.267 MGD.

$20\%Q\ @\ HRT_{max}$ = 1.6 x 12/24 = 0.8 MGD.

$20\%Q\ @\ HRT_{min}$ = 1.6 x 8/24 = 0.534 MGD.

EXIST VOL =
SIDE WATER DEPTH = 6'-0" FT
2 CHANNELS AT 8' WIDE PER PASS X 5 PASSES AT 30'-0"
& 1 PASS AT 23.5' PER CHANNEL

VOL/CHANNEL = 6 X 8 X [(5x30)+ 23.5] = 8328 FT^3

TOTAL VOL = 16,565 FT^3 = 124,600 GAL.

→ JUST SHORT FOR LOW Q & MIN HRT

IF USED COULD PROBABLY EXPECT SOME REMOVAL
BUT STILL NOT ENOUGH ON ITS OWN. COULD
POSSIBLY BE UTILIZED TO OFFSET CHEM ADDITION
IF USE BOTH METHODS...!!!

KLH ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT MACM- Act 537 JOB NO. 220-33
WWTP EXP. - EXIST BNR SHEET NO. 9 OF
COMPUTED BY KDH DATE

POTENTIAL BIO P REMOVAL

$TP_{BE} = TP_i - (Y_{\%BOD_{12}} * TP_{fMLVSS})$

TP_{BE} - TP BIO EFFLUENT

TP_i - TP INFLUENT = 4 mg/L

TP_{fmass} - % TP IN BIOMASS = 0.04 (ASSUMED)

$TP_{BE} = 4 - (0.5 \times (104-15) \times 0.04)$

$TP_{BE} = 2.22$ mg/L

THIS IS SLIGHTLY ABOVE PUBLISHED INFO FOR CONSERVATIVE PHOSTRIP DESIGN (1.5) HOWEVER W/ INSUFFICIENT VOL THIS COULD BE VIABLE → FURTHERMORE THIS REPRESENTS A 45% REMOVAL EXISTING PROCESS REMOVAL IS DOCUMENTED THROUGH SAMPLING AT APPROX ~ 35%

CHEMICAL ADDITION W/ PHOSTRIP

Chem Dose = $CD_c (TP - TP_2) \times SF$

% REMOVED = $\frac{2.2-1}{2.2} = \sim 55\%$ $CD_c = 13$ (SEE pg. 6 OF CALCS)

$13 \times (2.2-1) \times SF = 15.6$ SF

ADD SF TO 20 mg/L FOR NEAREST HIGHER 5 mg/L DOSE.

Alum = 20 mg/L x 8 MGD x 8.34 = 1334 #/D

CUTS ALUM DOSE 1/2 FROM ASSUMPTION NO BIO P OCCURS

P SLUDGE SHOULD BE 1/2 ALSO.
= 485.7 #/D
+4522. #/D BOD SLUDGE.

5007 x 71.2 = 356,459 → STILL HIGH.
WILL HAVE TO WASTE AT RAPID RATE!!

KLH ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT MACM Bld P — JOB NO. —
SHEET NO. 10 OF —
COMPUTED BY KDH — DATE 12-3-07

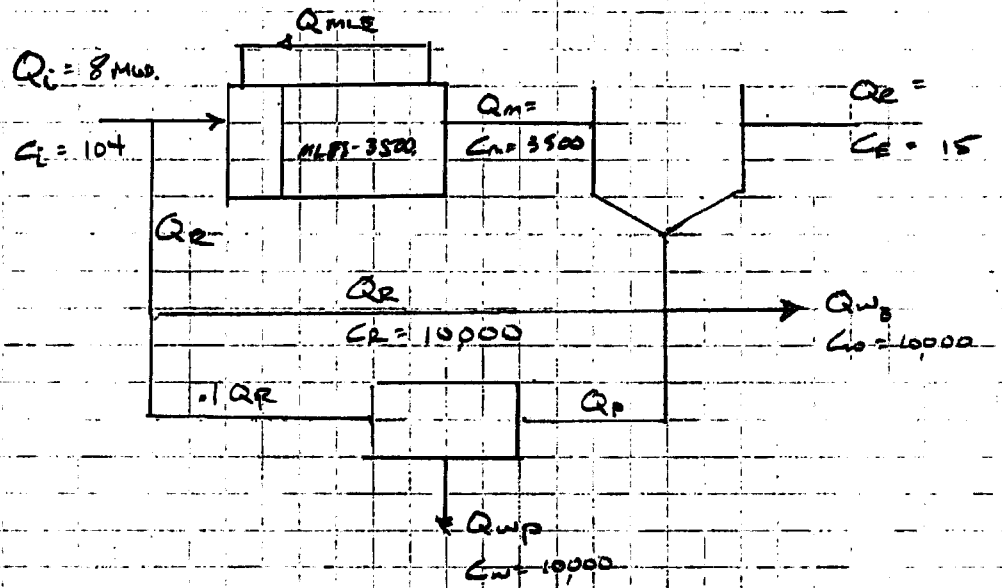
MOVING SLUDGE IN & OUT TO ACCOMODATE STORAGE

~~Vol~~ IN CLARIFIERS WILL BE HIGH → HOWEVER

MLE REQUIRES SLUDGE BE MOVED AT 100-200% $Q_{FORWARD}$

∴ SOLD #/D AT SAY 10,000 mg/L

= 60,071 gpd → 41.7 gpm.



Q_i = 8,000,000 GPD

$Q_E = Q_i - Q_W$

$Q_W = Q_{WB} + Q_{WP}$

Q_{WB} = 54,223 gpd

Q_{WP} = 5,824 gpd

C_E = 15

C_i = 104

$C_W = C_R$ = 10,000

MLSS = 3500

MASS BALANCE ON AERATION BASIN

$Q_i C_i + Q_R C_R = Q_m C_m$

$Q_i C_i + Q_R C_R = Q_i C_m + Q_R C_m$

SOLVE FOR Q_R

$Q_R C_W - Q_R C_m = Q_i C_m - Q_i C_i$

$Q_R(10{,}000) - Q_R(3500) = (8)(3500) - 8(104)$

Q_R = 4.2 MGD

⇒ Q_R/Q_i = 0.53%

$Q_P = 0.1 \times Q_i =$

$0.1 \times 8 =$ 0.8 MGD.

$Q_R + Q_{WP} + Q_{WB} = 4.2 + .054 + .005$

$Q_{TOTAL\ W/R} = 4.23$ MGD = 2944 gpm.

KLH ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT MACM : Act 537 · WWTP JOB NO. 220-33
Exist WWTP BNR SHEET NO. 11 OF
COMPUTED BY KDH DATE 12-3-07

AT THIS RATE 2944 gpm.

t_d SLUDGE = $\frac{60,057 \text{ gal}}{2944 \text{ gpm}}$ = 20 min IN STORAGE.

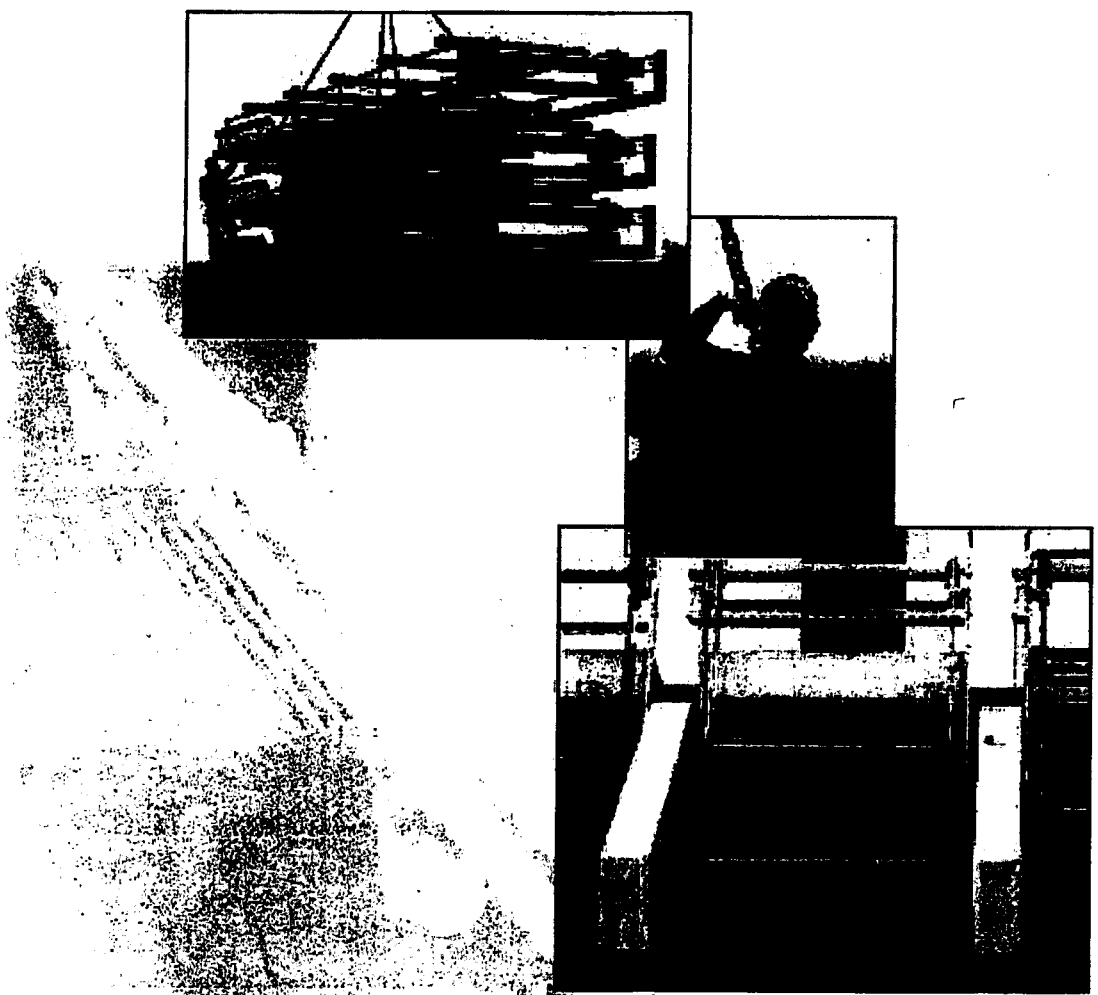
→ AT LOW SVI SHOULD NOT BE STORAGE ISSUE.

∴ BNR FOR TN & TP IS POSSIBLE

DO NOT CONSTRUCT UNTIL ACTUAL PERMIT LIMITS ARE KNOWN ∴

DUPERON
corporation

our solutions are simple



FlexRake™

Trashracks & Trashrakes

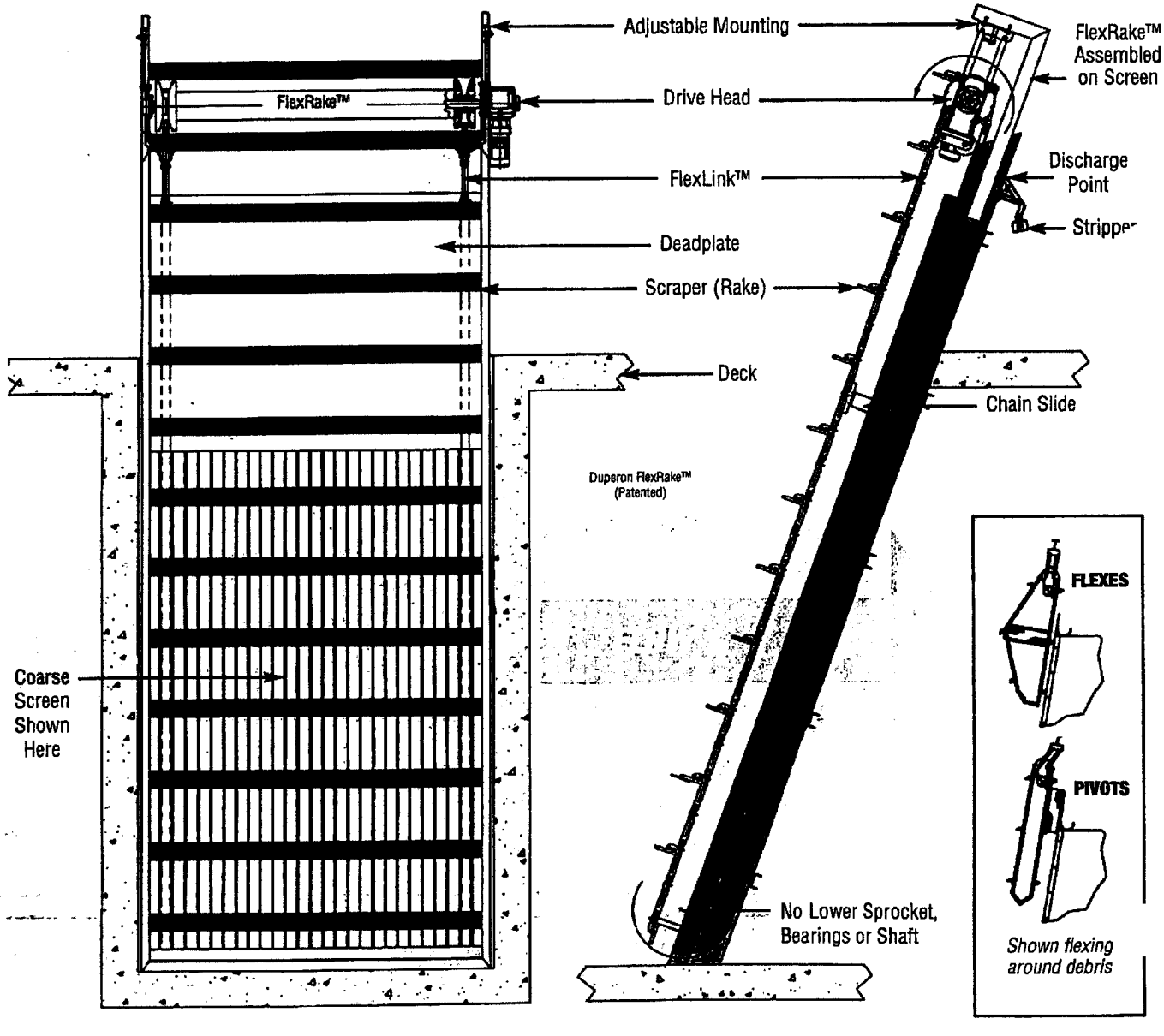
The Duperon FlexRake™

BENEFITS

- Affordable
- Reduces Operating/Maintenance Costs
- Eliminates Underwater Maintenance
- Increases Productivity
- Easily Installed, Available Fully Assembled
- Reduces Risk for Worker Injury
- Easily Adapted to Changing Site and Debris Conditions
- Customized to New and Existing Sites and Barscreens

FEATURES

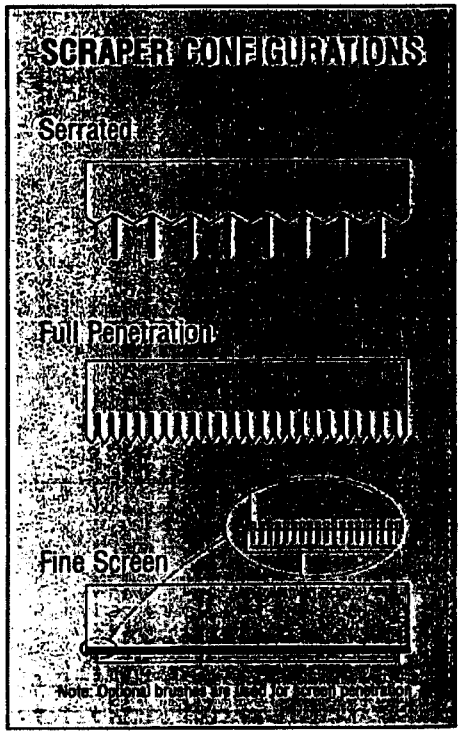
- Simple Mechanical Device
- Automatic, Continuous Cleaning
- Rakes Coarse to Fine Screens
- Energy Efficient
- Lifting Capacity to 1000 lbs
- Multiple Scrapers Rake Entire Screen
- All Non-corrosive Parts Underwater
- No Frame or Underwater Sprockets, Bearings or Shafts
- Flexible for Larger Debris (drums, tires...)



THE FLEXRAKE™ MODELS

Model	STANDARD (Coarse Screen)	FULL PENETRATION	FINE SCREEN	SINGLE STRAND
Applications	Water Treatment, Stormwater Pumpstations, Industrial Intakes, Hydroelectric	Water Treatment, Wastewater, Pulp/Paper Mills, Food Processing, Industrial Intakes or where debris wrapping or accumulation on bar-screens is a problem	Water Treatment, Food Processing, Fish Screening, Industrial Processing	Water Treatment, Wastewater, Food Processing, Fish Screening, Industrial Processing
Screen Size	2 - 12 feet wide Max. 40–50 feet long (without modifications)	1 - 12 feet wide Max. 40–50 feet long (without modifications)	1 - 12 feet wide Max. 40–50 feet long (without modifications)	1-2 feet wide Max. 40–50 feet long (without modifications)
Scraper Configuration (see below)	Serrated	Full penetration	Straight Edge, 45 degree bevel (optional brush)	Straight Edge, 45 degree bevel, or Full Penetration, or Serrated (depending upon bar opening)
Bar Opening	1 - 12 inches	1/4 - 2 inches	.060 – .25 inches (smaller openings available - consult factory)	.060 – 4 inches (smaller openings available - consult factory)
Purchase Options	**For Retrofit with existing barscreens:** • Rake Only • Rake Mounting • Barscreen Accessories: return guides, chain slides, strippers, etc. • Scraper Accessories: brushes, etc. **For new barscreens:** • FlexRake™ fully assembled on barscreen (including accessories) • Just place, anchor and wire.	FlexRake™ fully assembled on barscreen	FlexRake™ fully assembled on barscreen Back cleaning device available	FlexRake™ fully assembled on barscreen

ALL MODELS	
Power Requirements Available	110/230 volt, single phase 230/460 volt, three phase Solar
Installation	Installed, Adapted, Maintained and Removed from the deck in most cases
Controls	Custom and Standard Packages are available.
Drive	Standard is 1/8hp electric integral gearmotor. DC, Explosion Proof and other Special Duty motors are available
Screen Materials	A36 Steel, coated with Duperon Standard Coating or 304 Stainless Steel (other options available).
Screen Orientation	Horizontal to vertical



BUDGET PROPOSAL SUMMARY
PISTA® GRIT REMOVAL

1.0 GENERAL DESCRIPTION

Four Model 12.0A **PISTA®** Grit Chamber mechanisms, each suitable for installation in a concrete structure. Each **PISTA®** shall be complete with the following: drive motor, spur gear final drive head, air bell, propeller, drive tube, top mounted grit pump, grit concentrator, dewatering screw conveyor, and automatic NEMA 4 electrical and vacuum priming controls. Fluidizer vanes and Flow Control Baffles also included.

2.0 PISTA® GRIT REMOVAL EQUIPMENT

The flow in each removal chamber shall travel between the inlet and outlet a minimum of 360 degrees, providing maximum travel of the liquid for effective grit removal. It shall handle all flows equal to or less than a peak flow of 12.0 MGD each.

The *standard* dimensions of the Model 12.0A **PISTA®** are as follows:

Upper Chamber Diameter	12'-0"
Upper Chamber Depth	6'-8"
Lower Chamber Diameter (minimum)	5'-0"
Lower Chamber Depth (minimum)	6'-8"
Inlet & Outlet Channel Widths	3'-0"

3.0 CORROSION PROTECTION

All fabricated steel components shall be commercial blasted and prime coated by the Manufacturer with one 3-mil DFT coat of Tnemec 66-1211 prior to shipment. All motors and gearboxes shall be furnished with the original manufacturer's coating. Final touch up and finish painting is the responsibility of the purchasing contractor.

4.0 ITEMS NOT INCLUDED

- Field assembly/erection or installation
- Interconnecting piping, wiring and conduit
- Field paint, painting, and final surface preparation
- Lubricants
- Anchorage, anchor bolts
- Field testing, if required
- Grouting
- All concrete work

5.0 DELIVERY, TERMS, BUDGET PRICING

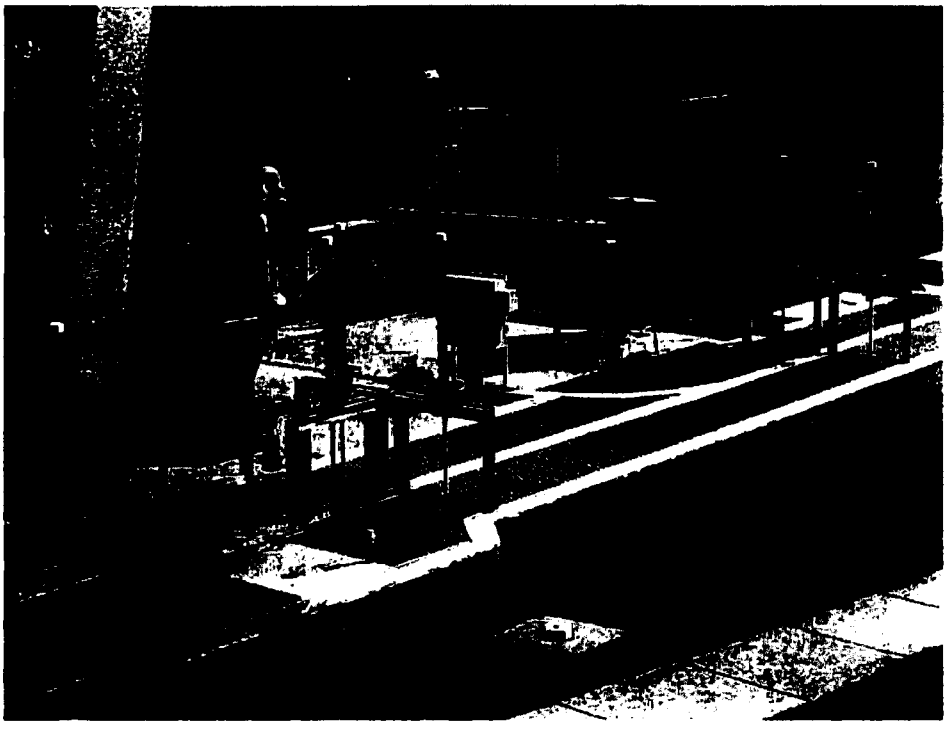
Submittal drawings and other technical engineering details are expected to be complete in 4-6 weeks after receipt of a purchase order. Once Smith & Loveless receives approved drawings, manufacturing would take 12-14 weeks.

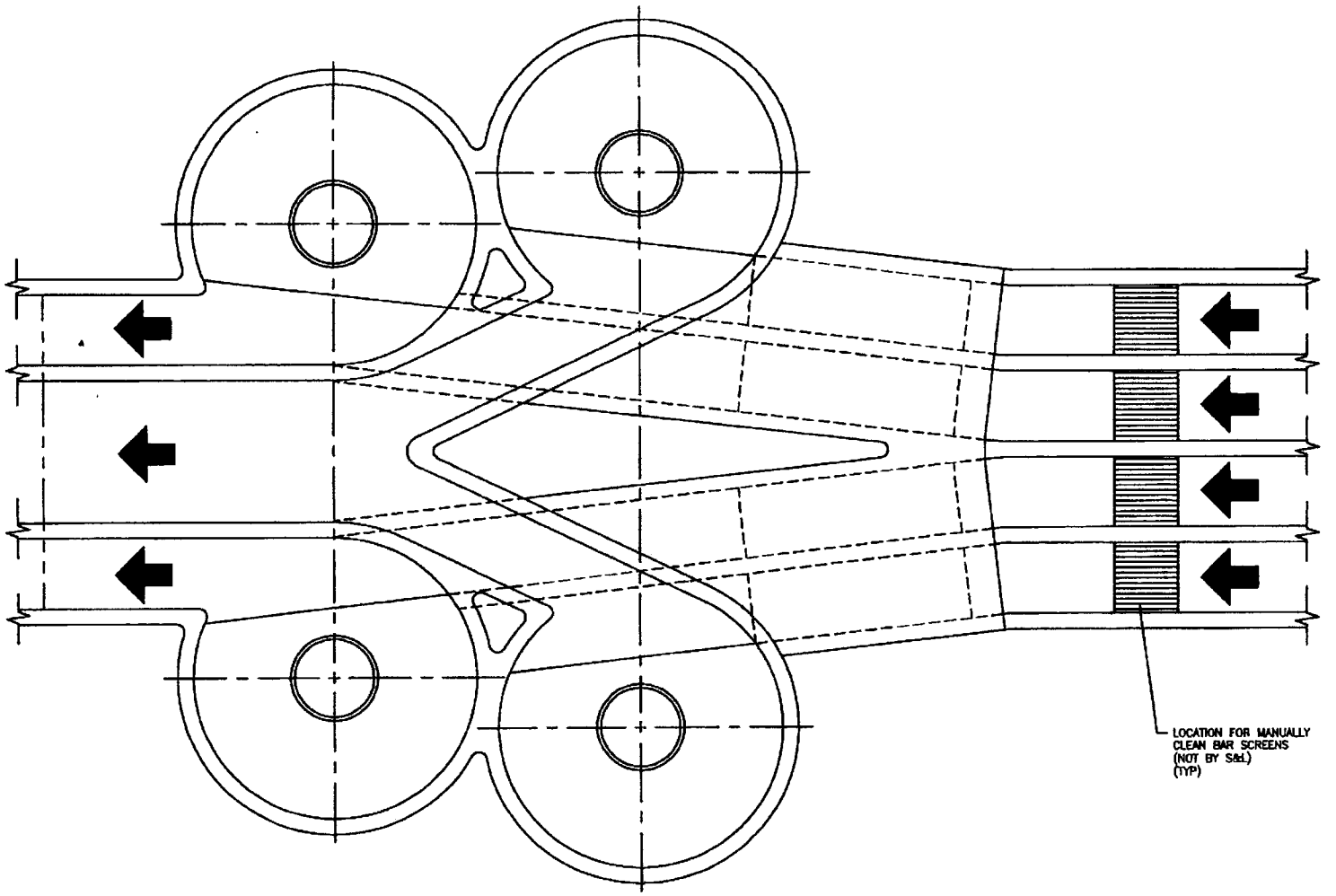
Payment Terms -To be determined

Budget Price List (FOB, Factory) – Offer Valid for 60 days.

Four Model 12.0A for concrete tank	$500,000.00
Freight, startup and training	Included
Turbo Grit Pumps	Included
Grit Concentrators (qty 4)	Included
Dewatering Screw Conveyors (qty 4)	Included
Controls	Included

See a Complete PISTA Grit Removal System Installation Photo below





NOTES:

1. CONSULT FACTORY FOR DIMENSIONS FOR A PARTICULAR MODEL.
2. COPYRIGHT (C) 1998, 2007 SMITH & LOVELESS, INC.

678198/A

				DRAWN BY: R.DIEHM	DATE: 4/28/1998	ALLOWABLE TOLERANCES	FOR	
				CHECKED BY: LRA	DATE: 4/28/1998	FRACTIONS –	PISTA® GRIT REMOVAL SYSTEM MULTIPLE LAYOUT	
				APPROVED BY: SBM	DATE: 5/1998	DECIMALS –		
A	N2007-56	8/2007	JK	SCALE: NTS	CODE:	ANGLES –	SIZE U/M EA	WT.
LET	ECN NO	DATE	BY APP'D				FILE NAME \SALES\67B198A	PLOT SCALE 1=64.000
ORIGINAL ISSUE	N2003-12			© Smith & Loveless, Inc. 1998,2007			SERIAL NO	DWG NO 678198 REV A

THE DESIGN AND DETAIL OF THIS DRAWING IS THE PROPERTY OF SMITH & LOVELESS, INC. AND IS NOT TO BE USED EXCEPT IN CONNECTION WITH OUR WORK. DESIGN AND INVENTION RIGHTS ARE RESERVED. DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

Smith & Loveless, Inc.

SHEET 1 OF 1

PISTA® GRIT REMOVAL SYSTEM W/ CONCRETE TANK MODEL NUMBER	DIA. A	DIM. B	DIM. C	DIM. D	DIM. E	DIA. F	SEE NOTE I. G_1		SEE NOTE I. G_2	DIA. H	DIM. J	*MAX. K	SEE NOTE I. L_1		SEE NOTE I. L_2	H.P. M	DIA. N
1.0	6'-0"	2'-0"	1'-0"	3'-8"	5'-0"	3'-0"	1'-0"		1'-0"	1'-0"	21'-0"	4'-1"	1'-5"		1'-8"	3/4	3'-6"
2.5	7'-0"	2'-6"	1'-3"	3'-8"	5'-0"	3'-0"	1'-3"		1'-0"	1'-0"	22'-0"	4'-1"	1'-11"		2'-2"	3/4	3'-6"
4.0	8'-0"	3'-0"	1'-6"	4'-0"	5'-0"	3'-0"	1'-4"		1'-0"	1'-0"	23'-0"	4'-1"	2'-2"		2'-4"	3/4	3'-6"
7.0	10'-0"	4'-0"	2'-0"	4'-9"	5'-6"	5'-0"	1'-6"		1'-0"	1'-6"	25'-0"	4'-1"	2'-6"		2'-6"	1	5'-6"
12.0	12'-0"	5'-0"	2'-6"	5'-0"	6'-8"	5'-0"	1'-11"		1'-9"	1'-6"	29'-6"	6'-1"	3'-1"		3'-1"	1	5'-6"
20.0	16'-0"	7'-0"	3'-6"	5'-6"	6'-10"	5'-0"	2'-2"		2'-0"	1'-6"	40'-6"	6'-1"	3'-6"		3'-6"	2	5'-6"
30.0	18'-0"	8'-0"	4'-0"	6'-6"	7'-0"	5'-0"	2'-8"		2'-3"	1'-6"	46'-0"	6'-1"	4'-3"		4'-3"	2	5'-6"
50.0	20'-0"	9'-0"	4'-6"	7'-0"	8'-0"	5'-0"	3'-9"		3'-5"	1'-6"	51'-6"	6'-1"	5'-10"		5'-10"	2	5'-6"
70.0	24'-0"	11'-0"	5'-6"	7'-0"	8'-0"	6'-0"	3'-9"		3'-9"	1'-6"	62'-6"	6'-1"	5'-11"		5'-11"	2	6'-6"

PISTA® GRIT REMOVAL SYSTEM W/ CONCRETE TANK MODEL NUMBER	DIM. P	DIM. S
1.0	2'-0"	15'-0"
2.5	2'-6"	15'-0"
4.0	3'-0"	15'-0"
7.0	4'-0"	15'-0"
12.0	5'-0"	17'-6"
20.0	6'-0"	24'-6"
30.0	7'-0"	28'-0"
50.0	9'-0"	31'-6"
70.0	10'-0"	38'-6"

NOTES:

1. Dimensions G and L on Drawings 67D132, 67D135, and 67D138 Change According to the Type of System Required:

   Dim's. G_1 and L_1 are used for the Free Flow Flume.

   Dim's. G_2 and L_2 are used for the Parshall Flume, Size Shown on Drawing 67D130.

* 2. Max. K Dimension is not Applicable for the Turbo Pump Pista®.

67C117

DRAWN	R. DIEHM	2/80
ENGINEERED	E.A.M.	6/80
APPROVED	S.M.	6/80
SCALE	NONE	
PATENT NO.	N80-1	
SHEET NO.	9	

Smith & Loveless, Inc.

PISTA® GRIT REMOVAL SYSTEM WITH CONCRETE TANK DIMENSIONAL CHART

DWG NO. 67C117 REV G

ENGINEERING DATA

Smith & Loveless, Inc.

14040 W. Santa Fe Trail Dr.
Lenexa, Kansas 66215

Water & Wastewater Treatment Systems
Pista® Grit Chamber
Outline Drawings
Page 27
April, 1991

PUMP SELECTION CALCUATION

Client / Job HEADWORKS MACM: [redacted] Pump Station

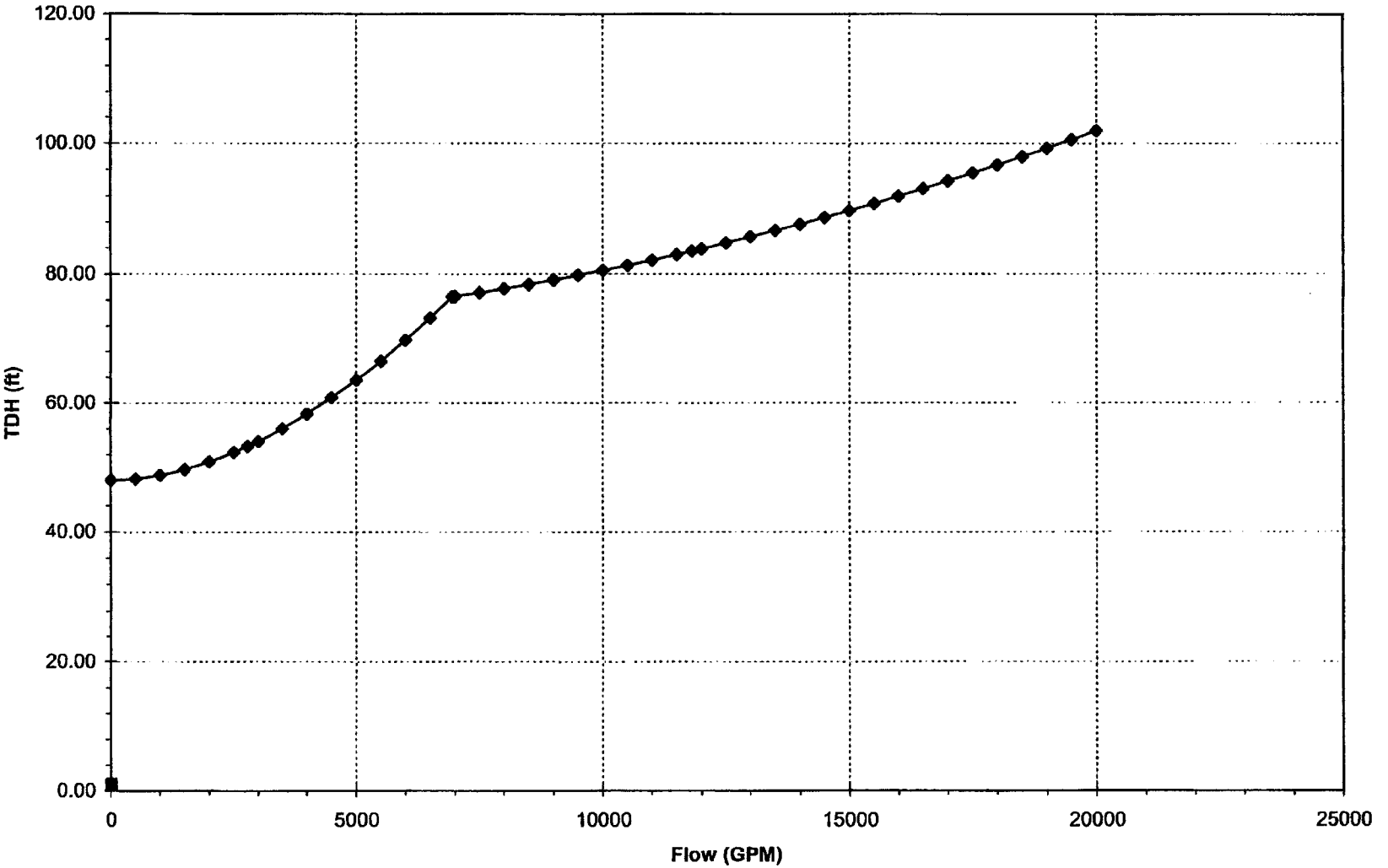
4/4 MGD CAPACITY

	24	18	20	12	
Pipe Diameter	24	18	20	12	in
Length of Pipe	[redacted]	[redacted]			ft
Friction Factor "C"	100	100	100	100	
Pump Suction El.	707	8.8	MGD	8.8	MGD
Pump Discharge El.	755	6111	GPM	6111	GPM
Static Head	48	7.70	ft/sec	17.34	ft/sec
Flow Rate Increme	500	0.92	ft/sec	4.67	ft/sec
		4.22	ft	14.96	ft

	Low	High	
Design Pump rate	8.8	26.4	MGD
Design Pump rate	6111	18333	GPM
Velocity	4.33	13.00	ft/sec
V^2/2g	0.29	2.62	ft/sec
Friction Headloss	3.30	25.17	ft
TDH Required	[redacted]		ft

	24			18			20			12			
Flow Rate GPM	Velocity ft/sec	V^2 2g ft/sec	Friction Headloss Ft	Velocity ft/sec	V^2 2g ft/sec	Friction Headloss Ft	Velocity ft/sec	V^2 2g ft/sec	Friction Headloss Ft	Velocity ft/sec	V^2 2g ft/sec	Friction Headloss Ft	Total Dynamic Headloss Ft
0	0	0	0	0	0	0	0	0	0	0	0	0	48.00
500	0.35	0.00	0.032136725	0.63	0.01	0.041165898	0.51	0.00	0	1.42	0.03	0.145819387	48.22
1000	0.71	0.01	0.115852953	1.26	0.02	0.14840314	1.02	0.02	0	2.84	0.12	0.525679161	48.79
1500	1.06	0.02	0.245287793	1.89	0.06	0.314204151	1.53	0.04	0	4.26	0.28	1.112985715	49.67
2000	1.42	0.03	0.417650109	2.52	0.10	0.534993593	2.04	0.06	0	5.67	0.50	1.895074348	50.85
2500	1.77	0.05	0.631097011	3.15	0.15	0.808410797	2.55	0.10	0	7.09	0.78	2.863583009	52.30
[redacted]													
3000	2.13	0.07	0.884262949	3.78	0.22	1.132706547	3.06	0.15	0	8.51	1.12	4.012315561	54.03
3500	2.48	0.10	1.176069505	4.41	0.30	1.506499429	3.57	0.20	0	9.93	1.53	5.336378711	56.02
4000	2.84	0.12	1.505629415	5.04	0.39	1.928652894	4.08	0.26	0	11.35	2.00	6.83174653	58.27
4500	3.19	0.16	1.87219145	5.67	0.50	2.398204645	4.60	0.33	0	12.77	2.53	8.495010332	60.77
5000	3.55	0.20	2.275105891	6.30	0.62	2.91432242	5.11	0.40	0	14.18	3.12	10.32322205	63.51
5500	3.90	0.24	2.713801527	6.93	0.75	3.476274518	5.62	0.49	0	15.60	3.78	12.31378982	66.50
6000	4.26	0.28	3.187769567	7.56	0.89	4.083409197	6.13	0.58	0	17.02	4.50	14.46440502	69.74
6500	4.61	0.33	3.696551974	8.20	1.04	4.735139729	6.64	0.68	0	18.44	5.28	16.77298933	73.20
[redacted]													
7000	4.96	0.38	4.239732742	8.83	1.21	5.352254451	7.15	0.79	0	19.86	6.12	18.95895621	76.55
7500	5.32	0.44	4.81693121	9.46	1.39	5.352254451	7.66	0.91	0	21.28	7.03	18.95895621	77.13
8000	5.67	0.50	5.427796829	10.09	1.58	5.352254451	8.17	1.04	0	22.69	8.00	18.95895621	77.74
8500	6.03	0.56	6.072004987	10.72	1.78	5.352254451	8.68	1.17	0	24.11	9.03	18.95895621	78.38
9000	6.38	0.63	6.749253641	11.35	2.00	5.352254451	9.19	1.31	0	25.53	10.12	18.95895621	79.06
9500	6.74	0.70	7.459260543	11.98	2.23	5.352254451	9.70	1.46	0	26.95	11.28	18.95895621	79.77
10000	7.09	0.78	8.201760948	12.61	2.47	5.352254451	10.21	1.62	0	28.37	12.50	18.95895621	80.51
10500	7.45	0.86	8.976505685	13.24	2.72	5.352254451	10.72	1.79	0	29.79	13.78	18.95895621	81.29
11000	7.80	0.94	9.783259528	13.87	2.99	5.352254451	11.23	1.96	0	31.20	15.12	18.95895621	82.09
11500	8.16	1.03	10.6217998	14.50	3.26	5.352254451	11.74	2.14	0	32.62	16.53	18.95895621	82.93
11810	8.38	1.09	11.1575648	14.89	3.44	5.352254451	12.06	2.26	0	33.50	17.43	18.95895621	83.47
12000	8.51	1.12	11.49191519	15.13	3.55	5.352254451	12.25	2.33	0	34.04	17.99	18.95895621	83.80
12500	8.86	1.22	12.39340469	15.76	3.86	5.352254451	12.77	2.53	0	35.46	19.52	18.95895621	84.70
13000	9.22	1.32	13.32607671	16.39	4.17	5.352254451	13.28	2.74	0	36.88	21.12	18.95895621	85.64
13500	9.57	1.42	14.28974828	17.02	4.50	5.352254451	13.79	2.95	0	38.30	22.77	18.95895621	86.60
14000	9.93	1.53	15.28424438	17.65	4.84	5.352254451	14.30	3.17	0	39.71	24.49	18.95895621	87.60
14500	10.28	1.64	16.30939725	18.28	5.19	5.352254451	14.81	3.40	0	41.13	26.27	18.95895621	88.62
15000	10.64	1.76	17.36504593	18.91	5.55	5.352254451	15.32	3.64	0	42.55	28.12	18.95895621	89.68
15500	10.99	1.88	18.45103568	19.54	5.93	5.352254451	15.83	3.89	0	43.97	30.02	18.95895621	90.76
16000	11.35	2.00	19.56721761	20.17	6.32	5.352254451	16.34	4.15	0	45.39	31.99	18.95895621	91.88
16500	11.70	2.13	20.71344826	20.80	6.72	5.352254451	16.85	4.41	0	46.81	34.02	18.95895621	93.02
17000	12.06	2.26	21.88958921	21.43	7.13	5.352254451	17.36	4.68	0	48.23	36.11	18.95895621	94.20
17500	12.41	2.39	23.09550682	22.06	7.56	5.352254451	17.87	4.96	0	49.64	38.27	18.95895621	95.41
18000	12.77	2.53	24.33107186	22.69	8.00	5.352254451	18.38	5.25	0	51.06	40.49	18.95895621	96.64
18500	13.12	2.67	25.59615931	23.32	8.45	5.352254451	18.89	5.54	0	52.48	42.77	18.95895621	97.91
19000	13.47	2.82	26.89064806	23.96	8.91	5.352254451	19.40	5.85	0	53.90	45.11	18.95895621	99.20
19500	13.83	2.97	28.21442072	24.59	9.39	5.352254451	19.91	6.16	0	55.32	47.52	18.95895621	100.53
20000	14.18	3.12	29.56736339	25.22	9.87	5.352254451	20.42	6.48	0	56.74	49.98	18.95895621	101.88
20500	14.54	3.28	30.94936551	25.85	10.37	5.352254451	20.94	6.81	0	58.15	52.51	18.95895621	103.26
[redacted]													
21000	14.89	3.44	32.36031961	26.48	10.89	5.352254451	21.45	7.14	0	59.57	55.11	18.95895621	104.67
21500	15.25	3.61	33.80012122	27.11	11.41	5.352254451	21.96	7.49	0	60.99	57.76	18.95895621	106.11
22000	15.60	3.78	35.2686687	27.74	11.95	5.352254451	22.47	7.84	0	62.41	60.48	18.95895621	107.58
22500	15.96	3.95	36.76586308	28.37	12.50	5.352254451	22.98	8.20	0	63.83	63.26	18.95895621	109.08
23000	16.31	4.13	38.29160794	29.00	13.06	5.352254451	23.49	8.57	0	65.25	66.10	18.95895621	110.60
23500	16.67	4.31	39.84580931	29.63	13.63	5.352254451	24.00	8.94	0	66.66	69.01	18.95895621	112.16
24000	17.02	4.50	41.42837552	30.26	14.22	5.352254451	24.51	9.33	0	68.08	71.98	18.95895621	113.74
24500	17.38	4.69	43.03921713	30.89	14.82	5.352254451	25.02	9.72	0	69.50	75.01	18.95895621	115.35
25000	17.73	4.88	44.67824682	31.52	15.43	5.352254451	25.53	10.12	0	70.92	78.10	18.95895621	116.99
25500	18.08	5.08	46.34537929	32.15	16.05	5.352254451	26.04	10.53	0	72.34	81.25	210.2907136	309.99
26000	18.44	5.28	48.04053118	32.78	16.69	5.352254451	26.55	10.95	0	73.76	84.47	217.9824124	319.38
26500	18.79	5.48	49.76362099	33.41	17.33	63.7452687	27.06	11.37	0	75.17	87.75	225.8008787	387.31
27000	19.15	5.69	51.5145690l	34.04	17.99	65.98816521	27.57	11.81	0	76.59	91.09	233.7457307	399.25

MACM: Influent Raw SewagePump Station System Curve



Pump Selctions

Peak Flow 50 MGD

Pump Orientation

	Option 1			Option 2			Option 3			Option 3a		
No. Pumps	3	2 Total		3	2 Total		3	3 Total		3	3 Total	
Flow, MGD	36	14	50	30	20	50	30	30	60	30	30	60
Per Pump Flow, MGD	18	7	50	15	10	50	8.8	8.8	44	8.8	8.8	44
Flow, gpm	12500	4861.11		10416.67	6944.444		6111.111	6111.111		6111.111	6111.111	
Flow, ft3/s	27.85	10.83		23.21	15.47		13.61	13.61		13.61	13.61	
Desired Suction Velocity		3 fps										
Suction Ax, ft2	9.28	3.61		7.74	5.16		4.54	4.54		4.54	4.54	
Diameter, ft	3.44	2.14		3.14	2.56		2.40	2.40		2.40	2.40	
Diameter, in	41.25	25.73		37.66	30.75		28.84	28.84		28.84	28.84	
							Bells			No Bells		
Actual Diameter Used	38.75	25		38.75	32		27.5	27.5		24	24	
If Bell, Nominal Pipe	30	18		30	24		20	20		24	24	
Actual Diameter Used	3.23	2.08		3.23	2.67		2.29	2.29		2.00	2.00	
Actual Suction Ax	8.19	3.41		8.19	5.59		4.12	4.12		3.14	3.14	
Actual Suction Vel.	3.40	3.18		2.63	2.77		3.30	3.30		4.33	4.33	
Velocity In Suction												
Suction Ax	4.91	1.77		4.91	3.14		2.18	2.18		3.14	3.14	
Suction Vel	5.67	6.13		4.73	4.92		6.24	6.24		4.33	4.33	
Check Low Flow Velocities												
No. Pumps	3	2 Total		3	2 Total		3	3 Total		3	3 Total	
Flow, MGD	25.2	9.8		21	14							
Per Pump Flow, MGD	12.6	4.9		10.5	7		4.5	5.5		4.5	5.5	
Flow, gpm	8750	3402.78		7291.667	4861.111		3125	3819.444		3125	3819.444	
Flow, ft3/s	19.49	7.58		16.24	10.83		6.96	8.51		6.96	8.51	
Actual Diameter Used	38.75	25		38.75	32		27.5	27.5		24	24	
If Bell, Nominal Pipe	30	18		30	24		20	20		24	24	
Actual Diameter Used	3.23	2.08		3.23	2.67		2.29	2.29		2.00	2.00	
Actual Suction Ax	8.19	3.41		8.19	5.59		4.12	4.12		3.14	3.14	
Actual Suction Vel.	2.38	2.22		1.98	1.94		1.69	2.06		2.22	2.71	
Velocity in Suction												
Suction Ax	4.91	1.77		4.91	3.14		2.18	2.18		3.14	3.14	
Suction Vel	3.97	4.29		3.31	3.45		3.19	3.90		2.22	2.71	

Selection Option 3
Reasons: Intake velocity at peak near 3 fps, at low >2 fps
Suction Velocities between approx. 4-6 fps low to peak

	D1	D2	
D, ft	2.29	2.29	
Dist From Wall, xD	0.75	1.71875	1.71875
Dist CL to CL, xD	2	3.4375	3.4375
No. Wetwell Sections	2		
No. of Suctions	2	1	
Bottom W of Wet Well	10.3125		
Rounded Bottom W	10		

MACM: Raw Sewage Pump Station at WWTP
Side-by-Side Pump Comparison

Required Duty Point 30555 gpm at 92.5 feet TDH
Required Duty Point per Pump 6111 gpm at 92.5 feet TDH

Manufacturer (Model)	Flygt	Yeomans Chicago
Type of Pump	Dry Pit Submersible	Verticle Shaft
Number of Pumps	4 Total - 3 Operating	4 Total - 3 Operating
Model	NT 3356-735	12624-6
Mfr. Curve No.	63-670	3596
Impeller Type	N Serires	Y-5090
No. of Impeller Vanes	3	????
Impeller Diameter, in. (mm)	17.5 (445)	23.125
Max. Impeller Dia. in. (mm)	17.5 (445)	24
Percentage of Max Impeller	100.0%	96.4%
Nearest Duty Point	6,120 gpm at 93.1 feet TDH	6,111 gpm at 93.5 feet TDH
Best Efficiency Point	7,150 gpm at 84.1 feet TDH	6,550 gpm at 90 feet TDH
Rated Horsepower[2]	215 HP	181 HP
Motor Horspower	250 HP	250 HP
Pump Speed[2]	1185	875
Pump Efficiency[2]	80.2%	80.0%
NPSHr		10.9
Power Requirement	460 Volt, 3 Phase, 60 Hz	460 Volt, 3 Phase, 60 Hz
Solids Capability	????	6" diameter
Suction	14" diameter	12" diameter
Discharge	14" diameter	12" diameter
Front to Back Dimension (in)	42.125	43
Base Width (in)	37.5	38
Height - Suction CL to Top (in)	105.5	69.5
Weight, lb.	4,410	4,620
Estimate Budget Price[3]	$82,560	$49,200

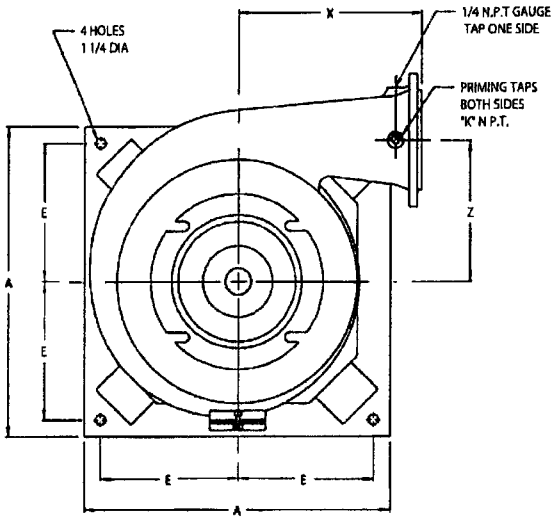
1. All series data is total for the pumping system as one entity.
2. At duty point.
3. From manufacturer representative quotes.

REPLACED EXISTING PUMPS FOR HEAD & Q AT EXIST WWTP PUMP STA.

YEOMANS

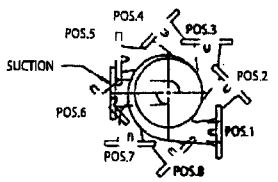
SERIES 6250

VERTICAL LINE-SHAFT SOLIDS-HANDLING PUMPS

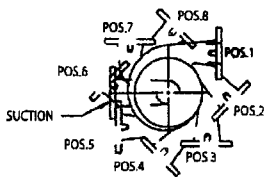


RELATIVE POSITION OF SUCTION AND DISCHARGE (AS VIEWED FROM THE MOTOR END)

LEFT HAND ROTATION



RIGHT HAND ROTATION



NOTE: DISCHARGE IN POSITION NO.1 FURNISHED AS STANDARD. OTHER POSITIONS AVAILABLE FROM FACTORY WHEN SPECIFIED.

OUTLINE DWG #	102900
S.O.	
JOB:	

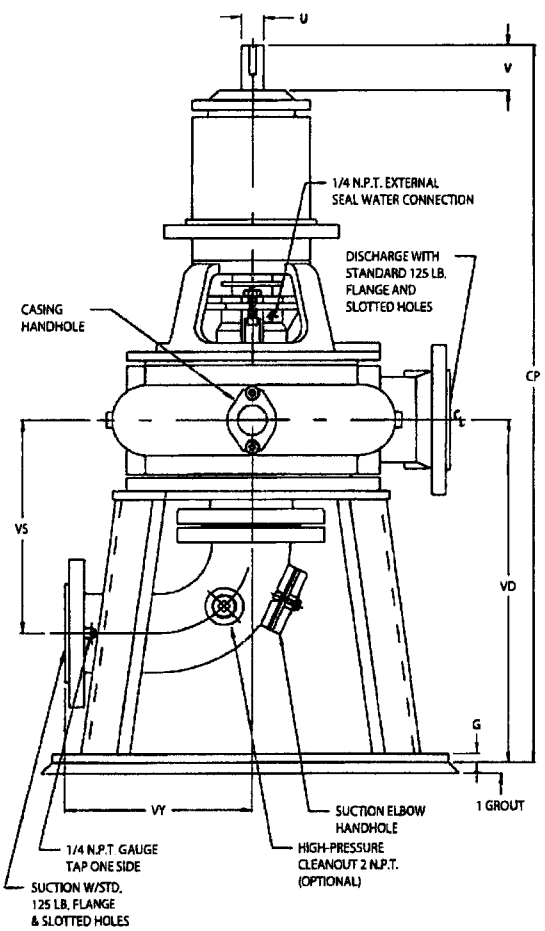
ISSUE	REVISION	DATE

LIST OF EQUIPMENT FURNISHED:

___ Model _____ Pump
Rated for _____ GPM at _____ Ft.TDH.
___ _____ HP, _____ RPM, _____ Volts
___ Phase, ___ Hz Vertical C-Face
Motor in _____ NEMA
enclosure complete with pedestal
___ ROTATION _____ POSITION # _____
___ ROTATION _____ POSITION # _____

OPTIONAL ACCESSORIES:

- ☐ Anchor Bolts
- ☐ Mechanical Seal
- ☐ Bronze or S.S. Impeller
- ☐ Bronze or S.S. Wear Rings
- ☐ 416 S.S. Pump Shaft
- ☐ Safety Guard



NOTES: 1. ALL DIMENSIONS ARE IN INCHES.
2. WEIGHT IS IN POUNDS

TABLE OF DIMENSIONS

√	PUMP MODEL	DIS	SUC	A	E	G	K	X	Z	CP	U	KEY	V	VD	VS	VY	WEIGHT
	4317-4A/4BHT	4	8	30	13 3/4	5/8	1/2	13	10 3/4	61 7/8	2 3/8	5/8x5/8x3	4 1/4	27	13 1/8	14	1175
	4317-4A/4BHT																
	6315-4A/4BHT	6	6	24	10 3/4	1/2		16	11	60				26	16 7/8	14	1160
	6315-4A/4BHT		8														
	6317-4A/4BHT	6	8	30	13 3/4	5/8		17	11 3/4	62 1/4				28 3/16	17 1/2	15	1325
	6317-4A/4BHT		10												18 1/2	16	
	8317-4A/4BHT	8	8	30	13 3/4	5/8		17	11 3/4	62 1/4				28 3/16	17 1/2	15	1325
	8317-4A/4BHT		10												18 1/2	16	
	8417-4A	8	8	30	13 3/4	5/8		18	13	63 1/8				28 3/4	18	15	1520
	8417-4A		10												19	16	
	8515-4A	8	8	30	13 3/4	5/8		16 1/2	11 9/16	63 1/8				28 3/4	18	15	1420
	8515-4A		10												19	16	
	8518-4A/4B	8	8	30	13 3/4	5/8		18	13	63 1/8				28 3/4	18	15	1520
	8518-4A/4B		10												19	16	
	10522-4B	10	10	38	16 1/2	1		22	17	75 3/8				39 7/8	21 15/16	18	3500
	10522-4B		12												22 15/16	20	
	10522-5/6	10	10	38	16 1/2	1		22	17	84	2 7/8	3/4x3/4x5	6 1/4	39 7/8	21 15/16	18	3590
	10522-5/6		12												22 15/16	20	
	12515-4A	12	12	38	16 1/2	1		15 1/2	12	69				33 1/2	22	20	1760
	12622-4B	12	12	38	16 1/2	1		24	18	76 1/8	2 3/8	5/8x5/8x3	4 1/4	40 5/16	25 1/16	20	4500
	12622-4B		14													22	
	12622-5/6	12	12	38	16 1/2	1		24	18	84 3/4	2 7/8	3/4x3/4x5	6 1/4	40 5/16	25 1/16	20	4600
	12622-5/6		14													22	
	12624-4B	12	12	38	16 1/2	1		24	18	76 1/8	2 3/8	5/8x5/8x3	4 1/4	40 5/16	25 1/16	20	4520
	12624-4B		14													22	
	12624-5/6	12	12	38	16 1/2	1	3/4	24	18	84 3/4	2 7/8	3/4x3/4x5	6 1/4	40 5/16	25 1/16	20	4620
	12624-5/6		14													22	
	14518-4B/4BHT	14	14	38	16 1/2	1		20	18	74	2 3/8	5/8x5/8x3	4 1/4	38 1/16	24 7/16	22	4600
	14518-4B/4BHT		16												25 7/16	15	
	14620-4B	14	14	38	16 1/2	1		20	18	77 1/2	2 1/2	5/8x5/8x3	4 1/4	41 7/8	26 1/16	22	4800
	14620-5									86 1/8	2 1/2	3/4x3/4x5	6 1/2				
	16620-4B	16	14	38	16 1/2	1		22	18	77 1/2	2 1/2	5/8x5/8x3	4 1/4	41 7/8	26 1/16	22	4820
	16620-5									86 1/8	2 1/2		6 1/2				
	16622-5B/6B	16	18	43 1/2	20	1		22	19 1/2	97 1/2	2 1/2		6 1/2	52 1/2	32 1/2	16 1/2	4900
	16624-5B/6B	16	18	43 1/2	20	1		22	19 1/2	97 1/2	2 1/2	3/4x3/4x5	6 1/2	52 1/16	32 1/2	16 1/2	4930
	18530-6B/6BHT	18	20	48	20	1 1/2		27	22	98 1/2	2 1/2		6 1/2	53 1/16	36 1/16	18	5600
	18624-5B/6B	18	20	43 1/2	20	1	1	27	19 1/2	97 1/2	2 1/2		6 1/2	52 1/16	32 1/2	16 1/2	4950
	18622-5B	18	18	43 1/2	20	1		22	19 1/2	100 1/2	2 1/2		6 1/2	54 1/8	33 1/2	16 1/2	4920
	20724-6B	20	20	43 1/2	20	1		22	24	98	2 1/2		6 1/2	52 1/2	42 1/2	18	5700

Kevin Hoffman

From: Mark Robinson [mrobinson@daman-superiorllc.net]
Sent: Monday, December 03, 2007 10:56 AM
To: Kevin Hoffman
Subject: MACM

Kevin,

Yeomans pricing, the curve you viewed is accurate. Revised condition of 6111 gpm @ 93' tdh.

12624-6, Series 6250 vertical shafted pump with 250 hp, 900 rpm, 460/3/60, TEFC motor.....$49,200.00

Same pump but with Explosion Proof motor.....$54,120.00

Mark

COST/PUMP = 49,200

20% FOR VFD DUTY = 9,840

PERFORMANCE TEST = 2,158.00

SHAFT = 4,000.00

TOTAL = $65,200

Pump Data Sheet - Yeomans Pump, Aurora, IL

Company: KLH Engineers, Inc.
Name: Kevin Hoffman
Date: 12/3/2007

Customer:
Project:
Location:
Quote #:
Item ID / Tag #:
Qty. of Pumps:

Pump:

Model: 12624-6

Type: 6000
Synch speed: 900 rpm

Speed: 875 rpm
Dia: 23.125 in

Curve ID No.: 40169

Impeller ID No.: Y-5090

Specific Speeds:

Ns: 2192
Nss: 11150

Dimensions:

Suction: 12 in
Discharge: 12 in

Pump Limits:

Temperature: 150 °F
Pressure: ---
Sphere size: 6 in

Power: ---
Eye area: ---

Search Criteria:

Flow: 6111 US gpm

Head: 93 ft

Fluid:

Water
SG: 1
Viscosity: 1.105 cP

Temperature: 60 °F
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a

NPSHa: ---

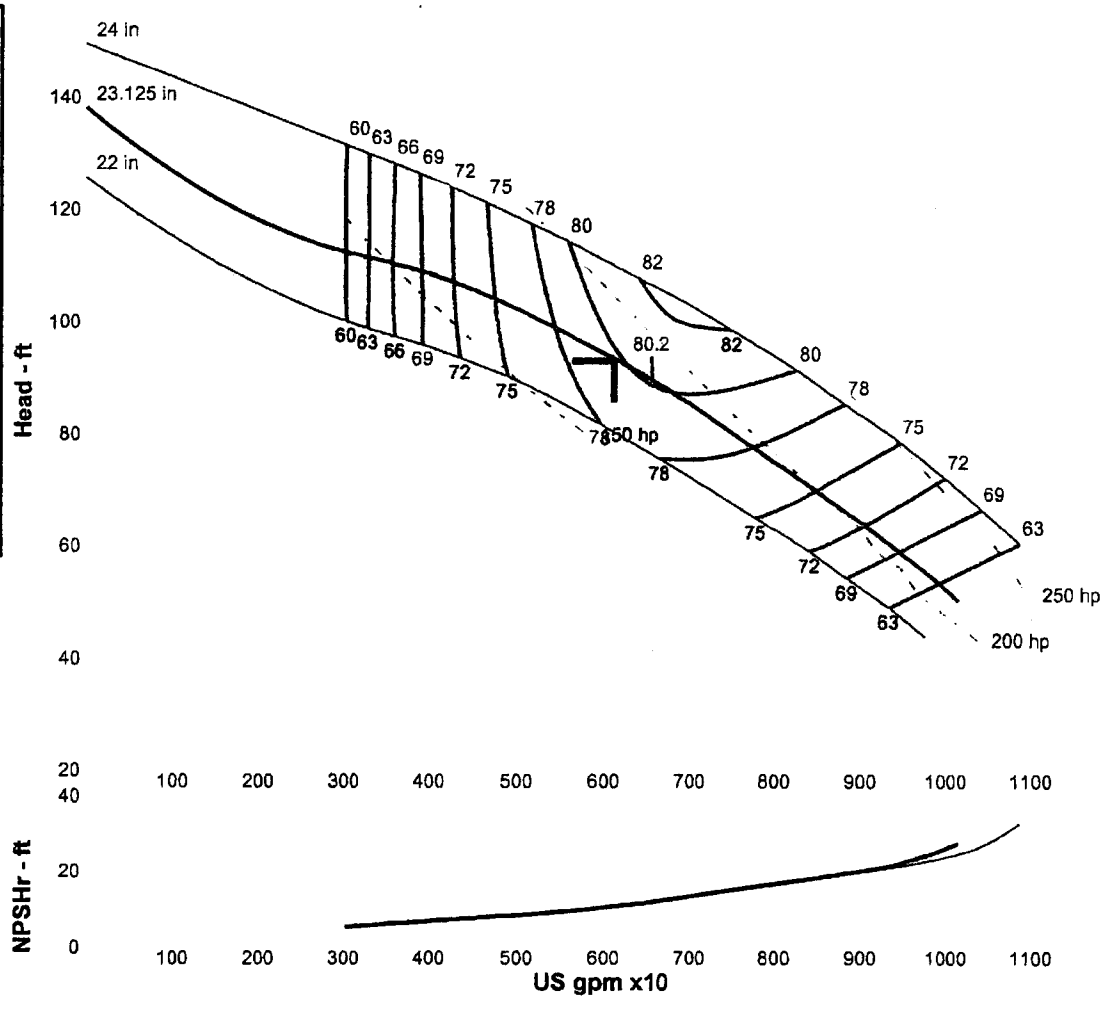
Motor:

Standard: NEMA
Enclosure: TEFC

Size: 250 hp
Speed: 900
Frame: 449T

Sizing criteria: Max Power on Design Curve

--- Data Point ---	
Flow:	6111 US gpm
Head:	93.5 ft
Eff:	80%
Power:	181 hp
NPSHr:	10.9 ft
--- Design Curve ---	
Shutoff head:	138 ft
Shutoff dP:	59.8 psi
Min flow:	---
BEP:	80% @ 6555 US gpm
NOL power:	212 hp @ 9911 US gpm
-- Max Curve --	
Max power:	264 hp @ 10870 US gpm



Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
7333	875	82	79	192	14.6
6111	875	93.5	80	181	10.9
4889	875	103	76	168	8.46
3667	875	110	67	152	6.55
2444	875	117	54	134	4.69

Selected from catalog: YP_main.60 Vers: 1

Pump Data Sheet - Yeomans Pump, Aurora, IL

Company: KLH Engineers, Inc.
Name: Kevin Hoffman
Date: 12/3/2007

Customer:
Project:
Location:
Quote #:
Item ID / Tag #:
Qty. of Pumps:

YEOMANS

Pump:

Model: 12624-6

Type: 6000
Synch speed: 900 rpm

Speed: 875 rpm
Dia: 23.125 in

Curve ID No.: 40169

Impeller ID No.: Y-5090

Specific Speeds:

Ns: 2192
Nss: 11150

Dimensions:

Suction: 12 in
Discharge: 12 in

Pump Limits:

Temperature: 150 °F
Pressure: —
Sphere size: 6 in

Power: ---
Eye area: ---

Search Criteria:

Flow: 6111 US gpm

Head: 93 ft

Fluid:

Water
SG: 1
Viscosity: 1.105 cP

Temperature: 60 °F
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a

NPSHa: ---

Motor:

Standard: NEMA
Enclosure: TEFC

Size: 250 hp
Speed: 900
Frame: 449T

Sizing criteria: Max Power on Design Curve

— Data Point —

Flow:	6111 US gpm
Head:	93.5 ft
Eff:	80%
Power:	181 hp
NPSHr:	10.9 ft

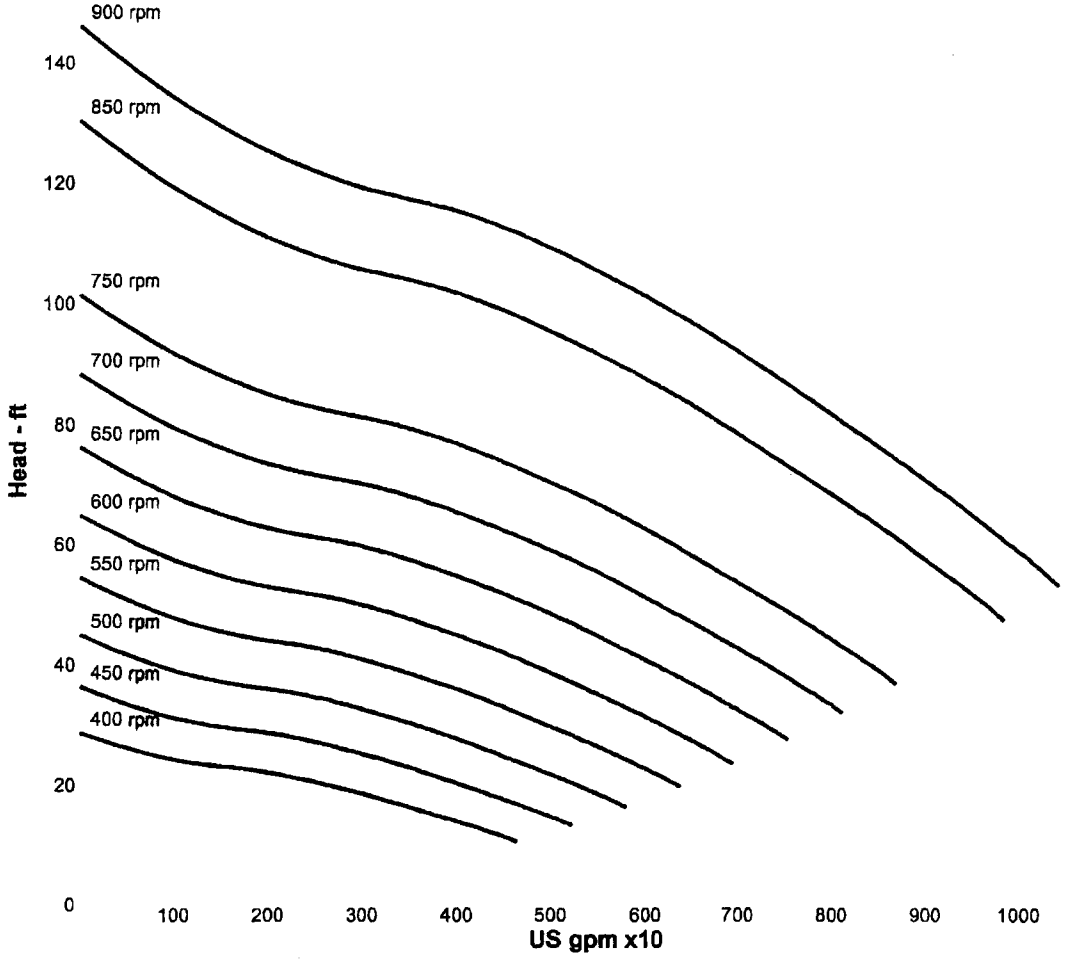
— Design Curve —

Shutoff head:	138 ft
Shutoff dP:	59.8 psi
Min flow:	—
	80% @ 6555 US gpm

NOL power:
212 hp @ 9911 US gpm

— Max Curve —

Max power:
264 hp @ 10870 US gpm



Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
7333	875	82	79	192	14.6
6111	875	93.5	80	181	10.9
4889	875	103	76	168	8.46
3667	875	110	67	152	6.55
2444	875	117	54	134	4.69

Selected from catalog: YP_main.60 Vers: 1

Pump Data Sheet - Yeomans Pump, Aurora, IL

Company: KLH Engineers, Inc.
Name: Kevin Hoffman
Date: 11/28/2007

Customer:
Project:
Location:
Quote #:
Item ID / Tag #:
Qty. of Pumps:

YEOMANS

Pump:

Model: 12624-6

Type: 6000
Synch speed: 900 rpm

Speed: 875 rpm
Dia: 23.125 in

Curve ID No.: 40169

Impeller ID No.: Y-5090

Specific Speeds:

Ns: 2192
Nss: 11150

Dimensions:

Suction: 12 in
Discharge: 12 in

Pump Limits:

Temperature: 150 °F
Pressure: ---
Sphere size: 6 in

Power: ---
Eye area: ---

Search Criteria:

Flow: 6111 US gpm

Head: 92.5 ft

Fluid:

Water
SG: 1
Viscosity: 1.105 cP

Temperature: 60 °F
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a

NPSHa: ---

Motor:

Standard: NEMA
Enclosure: TEFC

Size: 250 hp
Speed: 900
Frame: 449T

Sizing criteria: Max Power on Design Curve

--- Data Point ---

Flow:	6111 US gpm
Head:	93.5 ft
Eff:	80%
Power:	181 hp
NPSHr:	10.9 ft

--- Design Curve ---

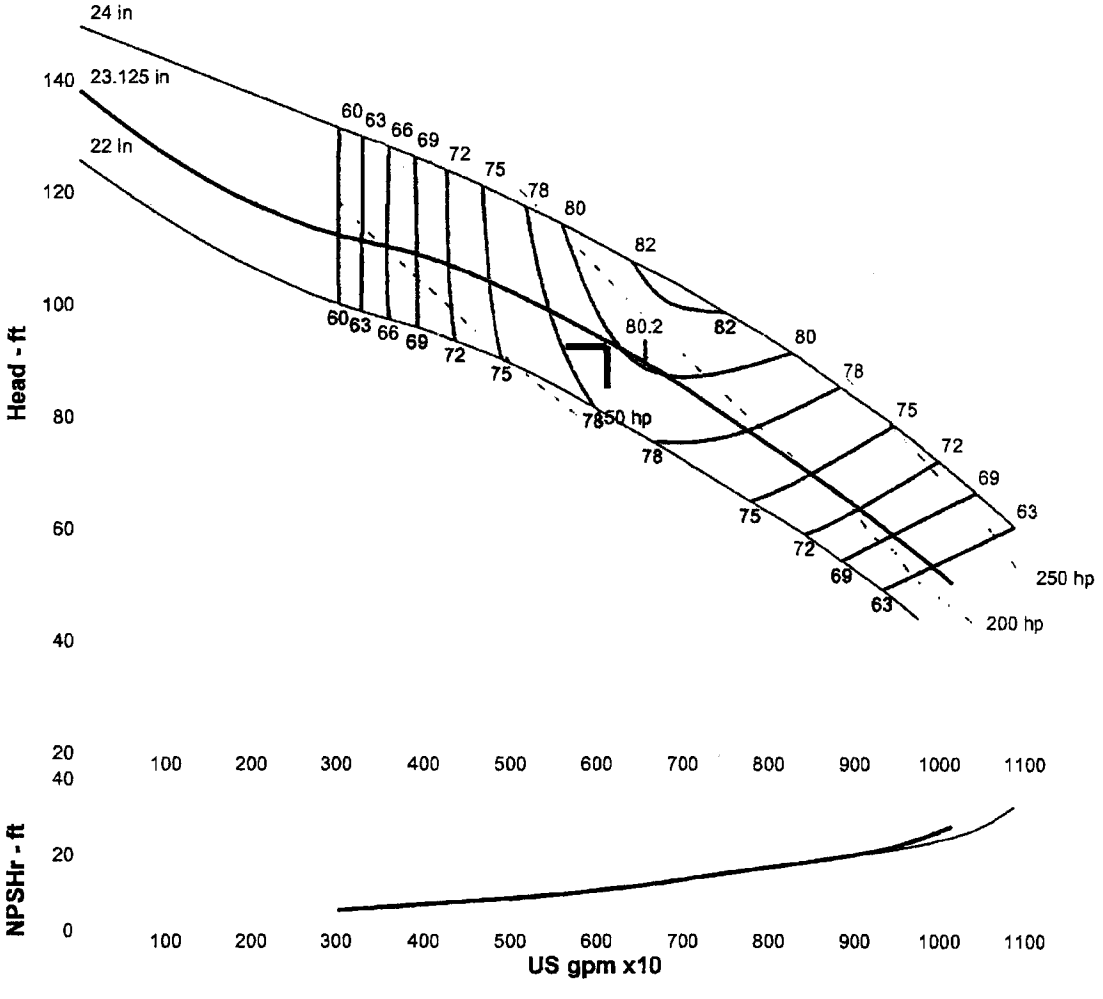
Shutoff head:	138 ft
Shutoff dP:	59.8 psi
Min flow:	---

: 80% @ 6555 US gpm

NOL power:
212 hp @ 9911 US gpm

-- Max Curve --

Max power:
264 hp @ 10870 US gpm



Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
7333	875	82	79	192	14.6
6111	875	93.5	80	181	10.9
4889	875	103	76	168	8.46
3667	875	110	67	152	6.55
2444	875	117	54	134	4.69

Selected from catalog: YP_main.60 Vers: 1

Pump Data Sheet - Yeomans Pump, Aurora, IL

Company: KLH Engineers, Inc.
Name: Kevin Hoffman
Date: 11/28/2007

Customer:
Project:
Location:
Quote #:
Item ID / Tag #:
Qty. of Pumps:

YEOMANS

Pump:

Model: 12624-6

Type: 6000
Synch speed: 900 rpm

Speed: 875 rpm
Dia: 23.125 in

Curve ID No.: 40169

Impeller ID No.: Y-5090

Specific Speeds:

Ns: 2192
Nss: 11150

Dimensions:

Suction: 12 in
Discharge: 12 in

Pump Limits:

Temperature: 150 °F
Pressure: ---
Sphere size: 6 in

Power: ---
Eye area: ---

Search Criteria:

Flow: 6111 US gpm

Head: 92.5 ft

Fluid:

Water
SG: 1
Viscosity: 1.105 cP

Temperature: 60 °F
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a

NPSHa: ---

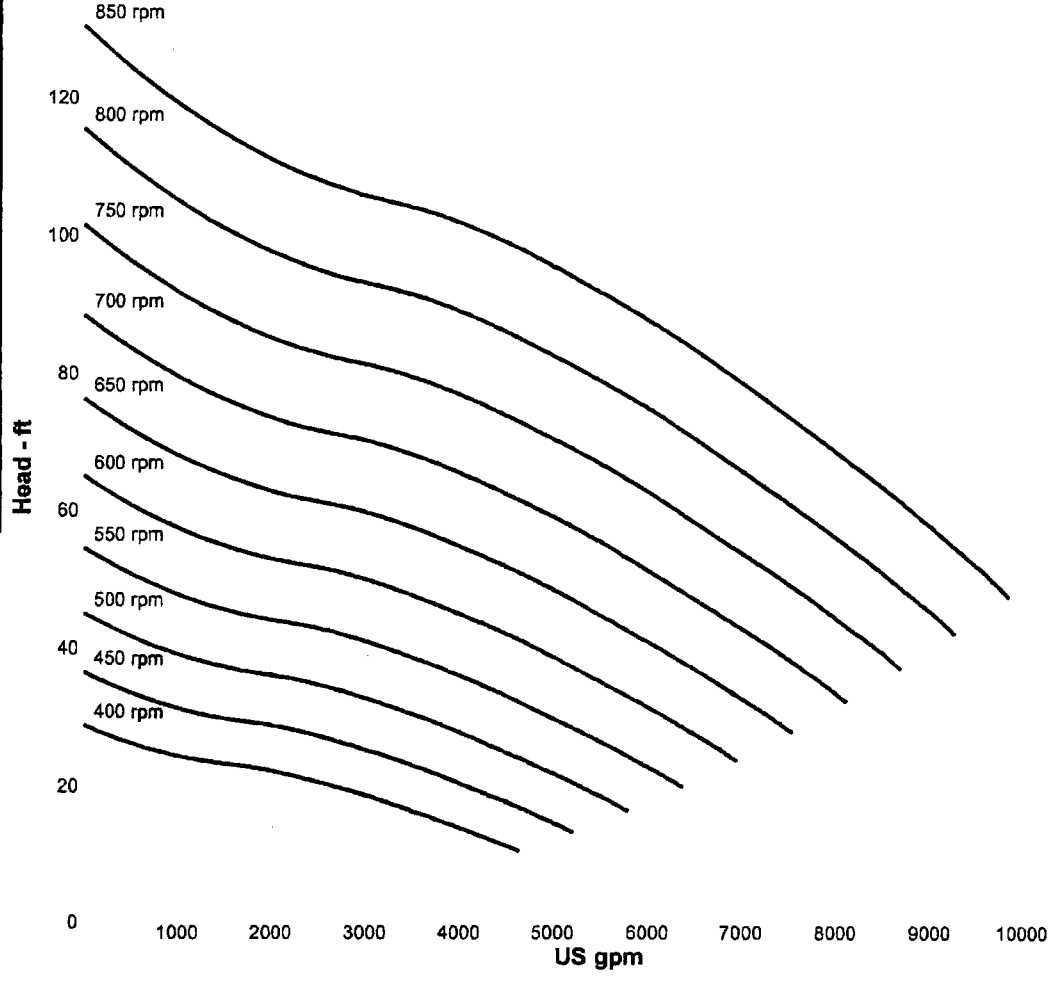
Motor:

Standard: NEMA
Enclosure: TEFC

Size: 250 hp
Speed: 900
Frame: 449T

Sizing criteria: Max Power on Design Curve

--- Data Point ---	
Flow:	6111 US gpm
Head:	93.5 ft
Eff:	80%
Power:	181 hp
NPSHr:	10.9 ft
---- Design Curve ----	
Shutoff head:	138 ft
Shutoff dP:	59.8 psi
Min flow:	---
:	80% @ 6555 US gpm
NOL power:	
	212 hp @ 9911 US gpm
-- Max Curve --	
Max power:	
	264 hp @ 10870 US gpm



Performance Evaluation:

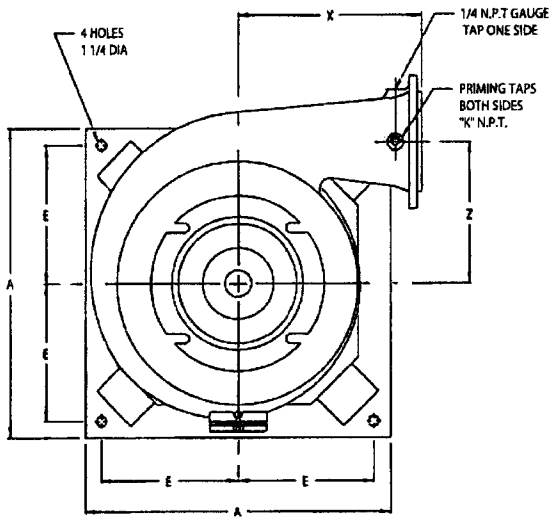
Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
7333	875	82	79	192	14.6
6111	875	93.5	80	181	10.9
4889	875	103	76	168	8.46
3667	875	110	67	152	6.55
2444	875	117	54	134	4.69

Selected from catalog: YP_main.60 Vers: 1

YEOMANS

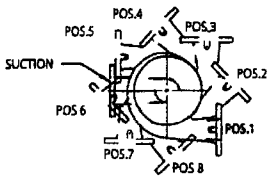
SERIES 6250

VERTICAL LINE-SHAFT SOLIDS-HANDLING PUMPS

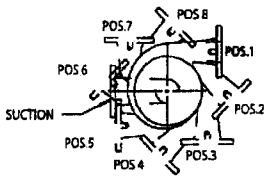


RELATIVE POSITION OF SUCTION AND DISCHARGE (AS VIEWED FROM THE MOTOR END)

LEFT HAND ROTATION



RIGHT HAND ROTATION



NOTE: DISCHARGE IN POSITION NO.1 FURNISHED AS STANDARD. OTHER POSITIONS AVALIABLE FROM FACTORY WHEN SPECIFIED.

OUTLINE DWG #	102900
S.O.	
JOB:	

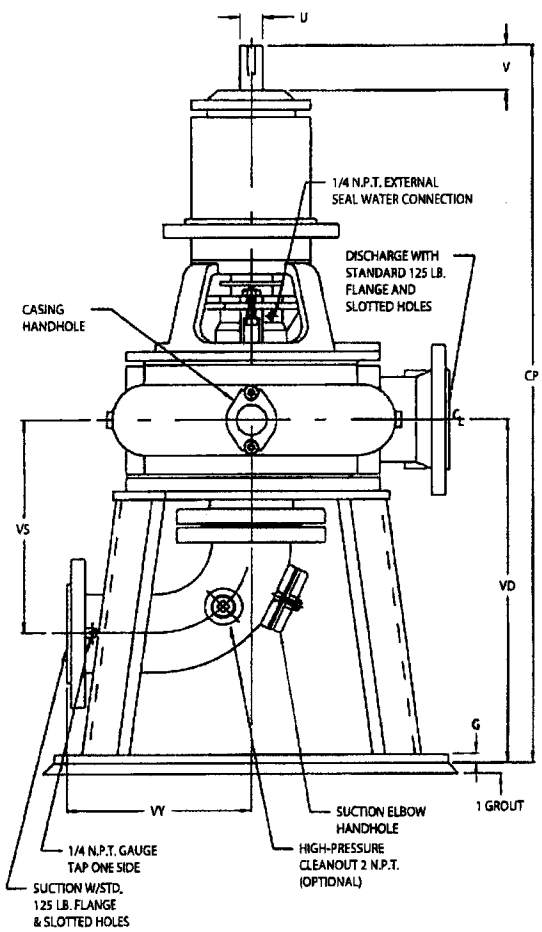
ISSUE	REVISION	DATE

LIST OF EQUIPMENT FURNISHED:

___ Model _____ Pump
Rated for _____ GPM at _____ Ft.TDH.
___ _____ HP, _____ RPM, _____ Volts
____ Phase, _____ Hz Vertical C-Face
Motor in _____ NEMA
enclosure complete with pedestal
___ ROTATION _____ POSITION # _____
___ ROTATION _____ POSITION # _____

OPTIONAL ACCESSORIES:

- ☐ Anchor Bolts
- ☐ Mechanical Seal
- ☐ Bronze or S.S. Impeller
- ☐ Bronze or S.S. Wear Rings
- ☐ 416 S.S. Pump Shaft
- ☐ Safety Guard



NOTES: 1. ALL DIMENSIONS ARE IN INCHES.
2 WEIGHT IS IN POUNDS.

TABLE OF DIMENSIONS

✓	PUMP MODEL	DIS	SUC	A	E	G	K	X	Z	CP	U	KEY	V	VD	VS	VY	WEIGHT
	4317-4A/4BHT	4	8	30	13 3/4	5/8	1/2	13	10 3/4	61 7/8	2 3/8	5/8x5/8x3	4 1/4	27	13 3/8	14	1175
	4317-4A/4BHT																
	6315-4A/4BHT	6	6	24	10 3/4	1/2		16	11	60				26	16 7/8	14	1160
	6315-4A/4BHT		8														
	6317-4A/4BHT	6	8	30	13 3/4	5/8		17	11 3/4	62 1/4				28 3/16	17 1/2	15	1325
	6317-4A/4BHT		10												18 1/2	16	
	8317-4A/4BHT	8	8	30	13 3/4	5/8		17	11 3/4	62 1/4				28 3/16	17 1/2	15	1325
	8317-4A/4BHT		10												18 1/2	16	
	8417-4A	8	8	30	13 3/4	5/8		18	13	63 1/8				28 3/4	18	15	1520
	8417-4A		10												19	16	
	8515-4A	8	8	30	13 3/4	5/8		16 1/2	11 9/16	63 1/8				28 3/4	18	15	1420
	8515-4A		10												19	16	
	8518-4A/4B	8	8	30	13 3/4	5/8		18	13	63 1/8				28 3/4	18	15	1520
	8518-4A/4B		10												19	16	
	10522-4B	10	10	38	16 1/2	1		22	17	75 3/8				39 2/8	21 5/16	18	3500
	10522-4B		12												22 5/16	20	
	10522-5/6	10	10	38	16 1/2	1		22	17	84	2 7/8	3/4x3/4x5	6 1/4	39 7/8	21 5/16	18	3590
	10522-5/6		12												22 5/16	20	
	12515-4A	12	12	38	16 1/2	1		15 1/8	12	69	2 3/8	5/8x5/8x3	4 1/4	33 1/2	22	20	1760
	12622-4B	12	12	38	16 1/2	1		24	18	76 1/8				40 5/16	25 1/16	20	4500
	12622-4B		14													22	
	12622-5/6	12	12	38	16 1/2	1		24	18	84 3/4	2 7/8	3/4x3/4x5	6 1/4	40 5/16	25 1/16	20	4600
	12622-5/6		14													22	
	12624-4B	12	12	38	16 1/2	1	3/4	24	18	76 1/8	2 3/8	5/8x5/8x3	4 1/4	40 5/16	25 1/16	20	4520
	12624-4B		14													22	
	12624-5/6	12	12	38	16 1/2	1		24	18	84 3/4	2 7/8	3/4x3/4x5	6 1/4	40 5/16	25 1/16	20	4620
	12624-5/6		14													22	
	14518-4B/4BHT	14	14	38	16 1/2	1		20	18	74	2 3/8	5/8x5/8x3	4 1/4	38 1/16	24 3/16	22	4600
	14518-4B/4BHT		16												25 3/16	15	
	14620-4B	14	14	38	16 1/2	1		20	18	77 1/2	2 3/8	5/8x5/8x3	4 1/4	41 7/8	26 1/16	22	4800
	14620-5									86 3/8	2 7/8	3/4x3/4x5	6 1/4				
	16620-4B	16	14	38	16 1/2	1		22	18	77 1/2	2 3/8	5/8x5/8x3	4 1/4	41 7/8	26 1/16	22	4820
	16620-5									86 3/8	2 7/8		6 1/4				
	16622-5B/6B	16	18	43 1/2	20	1		22	19 1/2	97 1/2	2 7/8		6 1/4	52 1/2	32 1/2	16 1/2	4900
	16624-5B/6B	16	18	43 1/2	20	1		22	19 1/2	97 1/2	2 7/8		6 1/4	52 1/16	32 1/2	16 1/2	4930
	18530-6B/8BHT	18	20	48	20	1 1/4		27	22	98 1/2	2 7/8	3/4x3/4x5	6 1/4	53 1/16	36 1/16	18	5600
	18624-5B/6B	18	20	43 1/2	20	1	1	27	19 1/2	97 1/2	2 7/8		6 1/4	52 1/16	32 1/2	16 1/2	4950
	18622-5B	18	18	43 1/2	20	1		22	19 1/2	100 3/8	2 7/8		6 1/4	54 1/8	33 1/2	16 1/2	4920
	20724-6B	20	20	43 1/2	20	1		22	24	98	2 7/8		6 1/4	52 1/2	42 1/2	18	5700

PERFORMANCE CURVE

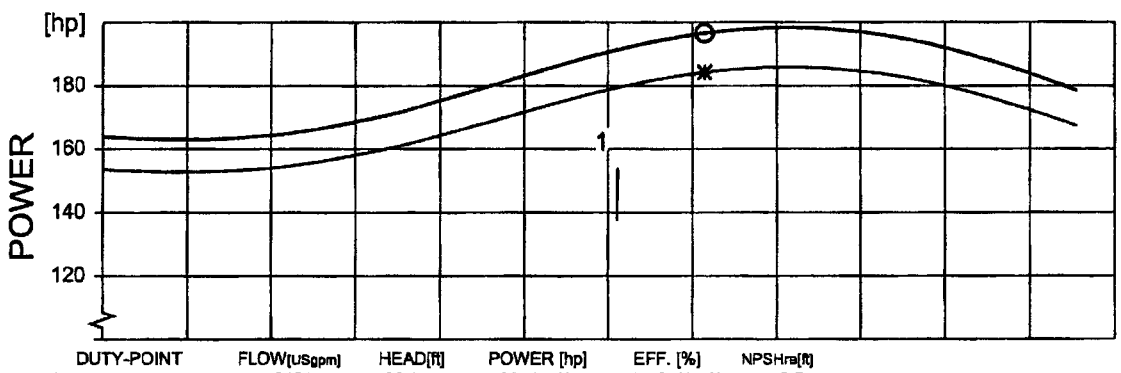
PRODUCT	NT 3356 /735	TYPE	
DATE	2008-03-05	PROJECT	
CURVE NO	63-670	ISSUE	2

	1/1-LOAD	3/4-LOAD	1/2-LOAD
POWER FACTOR	0.83	0.79	0.69
EFFICIENCY	93.5 %	93.5 %	93.0 %
MOTOR DATA	---	---	---

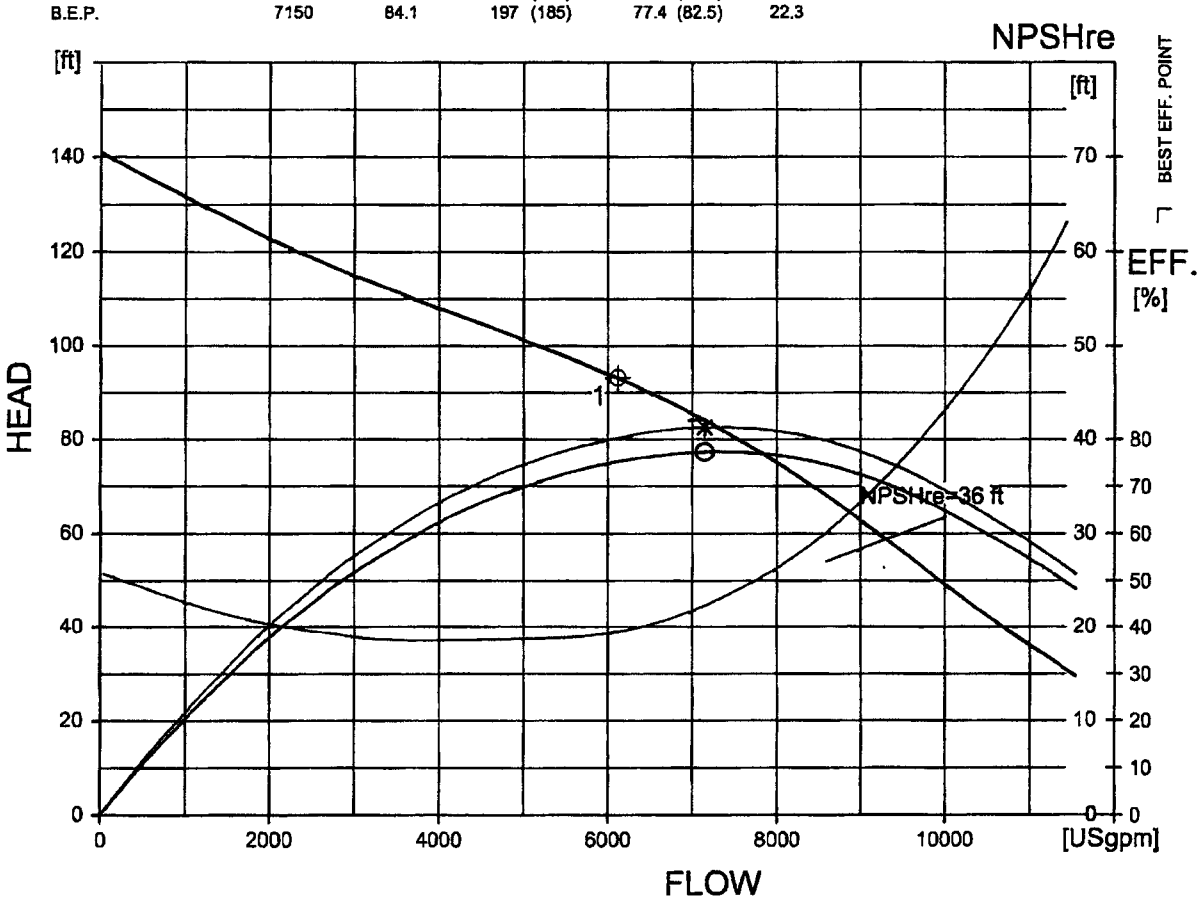
RATED POWER	215	hp
STARTING CURRENT ...	1555	A
RATED CURRENT ...	260	A
RATED SPEED	1185	rpm
TOT.MOM.OF INERTIA ...	3.3	kgm2
NO. OF BLADES	3	

IMPELLER DIAMETER	445 mm		
MOTOR #	43-44-6BC	STATOR	01D
REV	13		
FREQ.	60 Hz	PHASES	3
VOLTAGE	460 V	POLES	6
GEARTYPE	---	RATIO	---

COMMENTS	INLET/OUTLET	IMP. THROUGHLET
	14/ 14 inch	---



DUTY-POINT	FLOW[USgpm]	HEAD[ft]	POWER [hp]	EFF. [%]	NPSHre[ft]
1	6120	93.1	192 (180)	75.2 (80.2)	19.5
B.E.P.	7150	84.1	197 (185)	77.4 (82.5)	22.3



NPSHre = NPSH3% + min. operational margin

Performance with clear water and ambient temp 40 C

HI B Curve

FLYPS3.1.5.8 (20060531)

RAM INDUSTRIAL SERVICES, INC.
Box 478 • 1799 Plank Rd. • Carrolltown, PA 15722-0478
Telephone 814/344-6591 • Fax 814/344-8020

November 16, 2007

KLH Engineering, Inc.
5173 Campbell Run Road
Pittsburgh, PA 15205
Phone# 412-494-0510
Fax# 412-494-0426
Attn: Mr. Kevin Hoffman

Proposal No.: MP1107-1947JF

We are pleased to quote the following equipment MACM Project:

Item 1: ***Raw Sewage Pumps - Duty Point Each Pump: 6,945 GPM @ 105' TDH***

- Six (6) Flygt Submersible Dry Pit Wastewater Pumps, Model CT3312/765, 670 Impeller Code with 475 mm impeller, 3-60-460 Volt, 280 HP Motor. Includes 12" discharge, 40' of power cable, FLS, and prepared for MAS unit. Package complete with 14" X 16" suction elbow and stand. Price includes start up.

Total Price for Pumps: $495,360.00
***Explosion Proof Adder per pump would be $4,532.00 each.**

Terms: Subject to credit approval
F.O.B. Shipping Point
Freight: Prepaid and Allowed
Delivery: 16-18 Weeks after approved submittals
Pricing: Firm for acceptance within thirty days from date of quotation.

Should you require any additional information, or if we may be of further assistance please do not hesitate to contact us.

Sincerely,

Joseph M. Felix, Inside Sales
Mike Presutti, Sales Manager Cell # 412-841-9324
Ram Industrial Services, Inc.

PERFORMANCE CURVE

FLYGT		PRODUCT: NT 3312 /765	TYPE:
DATE: 2007-11-16	PROJECT: MACM - Raw Sewage Pumps	CURVE NO: 63-670	ISSUE: 2

	1/1-LOAD	3/4-LOAD	1/2-LOAD
POWER FACTOR	0.80	0.75	0.63
EFFICIENCY	94.0 %	94.0 %	93.0 %
MOTOR DATA	—	—	—

RATED POWER	280	hp
STARTING CURRENT ...	2230	A
RATED CURRENT ...	345	A
RATED SPEED	1185	rpm
TOT.MOM.OF INERTIA ...	4.5	kgm2
NO. OF BLADES	3	

IMPELLER DIAMETER: 490 mm

MOTOR #	STATOR	REV
43-56-6BC	01D	13

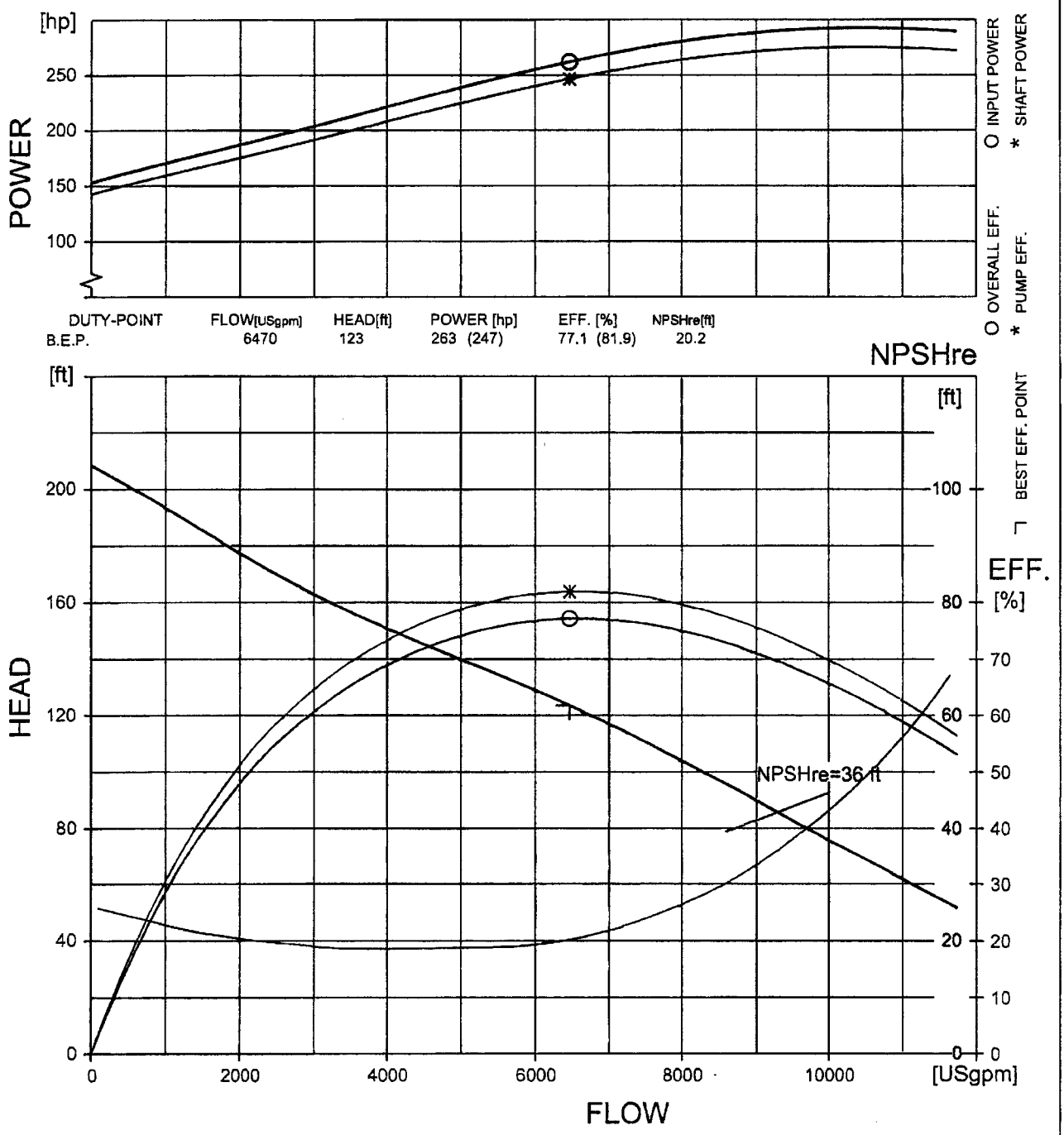
FREQ.	PHASES	VOLTAGE	POLES
60 Hz	3	460 V	6

GEARTYPE: --- RATIO: ---

COMMENTS

INLET/OUTLET: 14/ 12 inch

IMP. THROUGHLET: ---



DUTY-POINT	FLOW[USgpm]	HEAD[ft]	POWER [hp]	EFF. [%]	NPSHre[ft]
B.E.P.	6470	123	263 (247)	77.1 (81.9)	20.2

NPSHre = NPSH3% + min. operational margin

Performance with clear water and ambient temp 40 °C

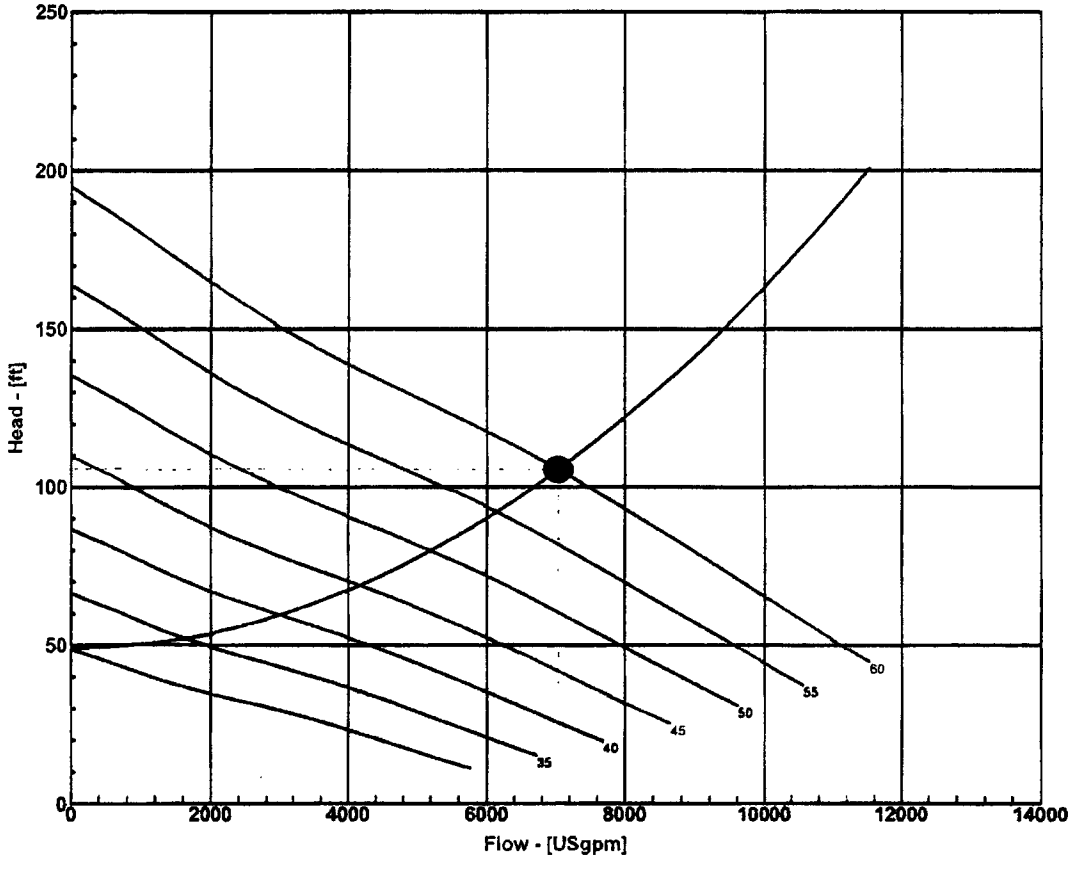
FLYGT HI B Curve

FLYPS3.1.5.9 (20060531)

VFD-Analysis - Performance

Project: MACM - Raw Sewage Pumps

Created by:: JOE



Performance

Pump: N 3312 63-670

PRODUCT DATA

Imp. diam.: 475 mm

Rtd. pwr.: 280 hp

Vanes: 3

Throughlet: 0 inch

Connection: Single

VFD connection: 1-VFD pump

No of pumps: 1

Frequency: 60 Hz

Flow: 7038.7 USgpm

Head: 105.5 ft

Pwr cons.: 188.5 kW

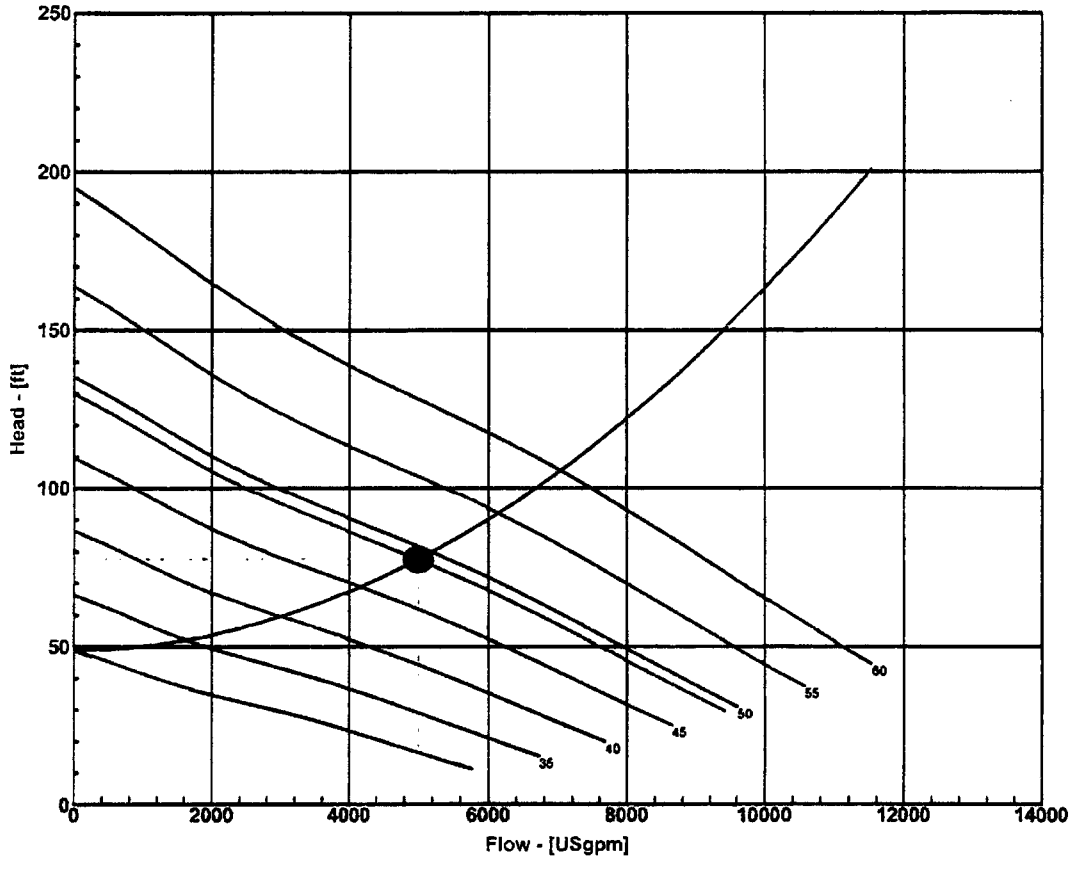
Overall eff: 74.4 %

Spec. energy: 445.4 kWh/Mg

VFD-Analysis - Performance

Project: MACM - Raw Sewage Pumps

Created by:: JOE



Performance

Pump: N 3312 63-670

PRODUCT DATA

Imp. diam.: 475 mm

Rtd. pwr.: 280 hp

Vanes: 3

Throughlet: 0 inch

Connection: Single

VFD connection: 1-VFD pump

No of pumps: 1

Frequency: 49 Hz

Flow: 5001.0 USgpm

Head: 77.5 ft

Pwr cons.: 105.0 kW

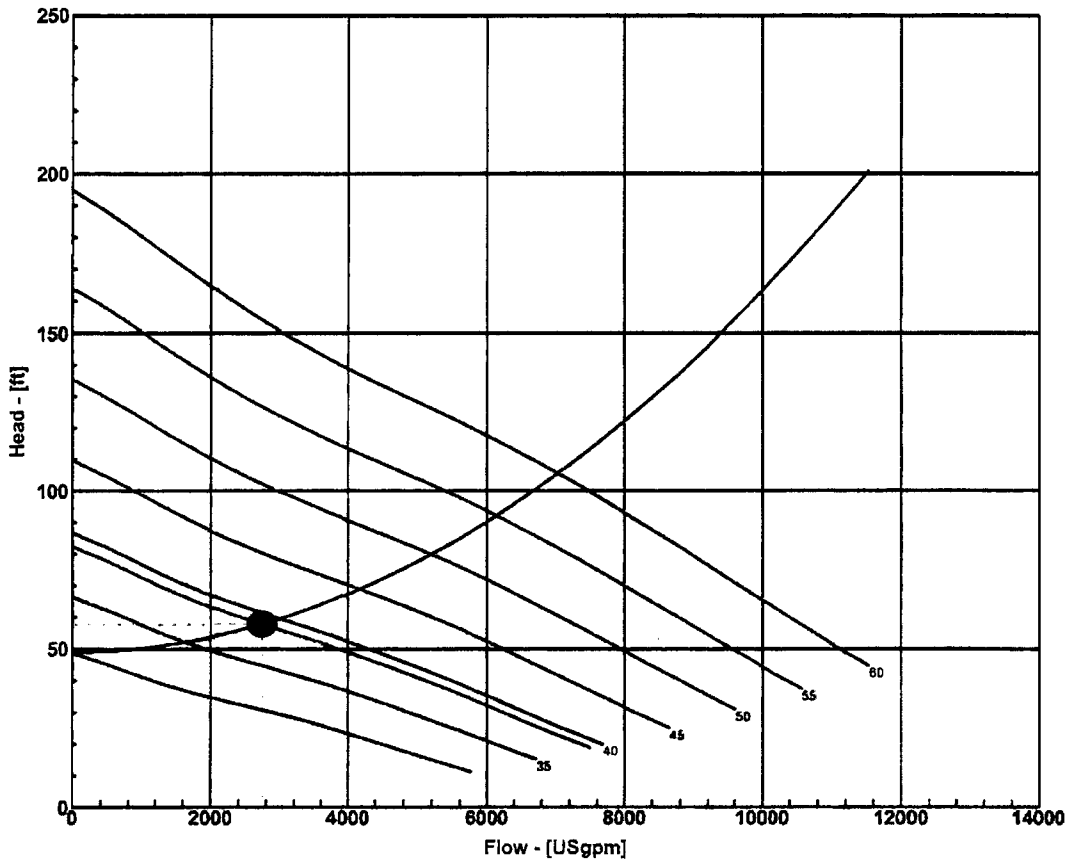
Overall eff: 69.7 %

Spec. energy: 349.3 kWh/Mg

VFD-Analysis - Performance

Project: MACM - Raw Sewage Pumps

Created by:: JOE



Pump: N 3312 63-670

PRODUCT DATA

Imp. diam.: 475 mm

Rtd. pwr.: 280 hp

Vanes: 3

Throughlet: 0 Inch

Connection: Single

VFD connection: 1-VFD pump

No of pumps: 1

Frequency: 39 Hz

Flow: 2748.5 USgpm

Head: 57.6 ft

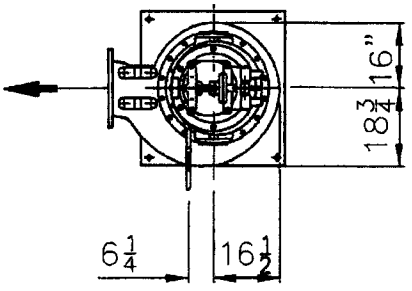
Pwr cons.: 50.6 kW

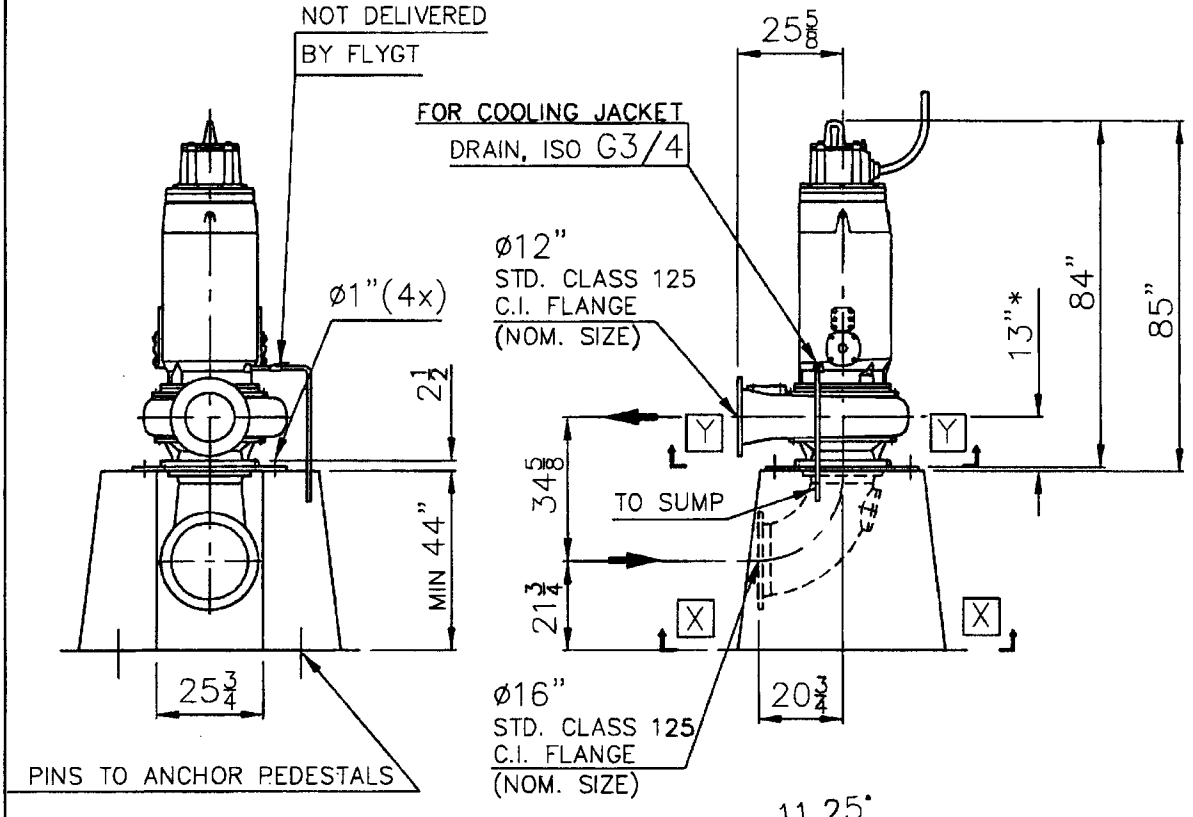
Overall eff: 59.0 %

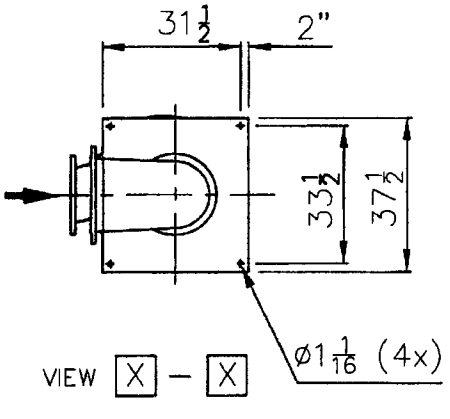
Spec. energy: 306.3 kWh/Mg

NOTE:
PUMP CAN BE ROTATED ABOUT ITS CENTERLINE
TO 16 POSITIONS RELATIVE TO THE INLET ELBOW.
INCREMENTS ARE 22.5°.

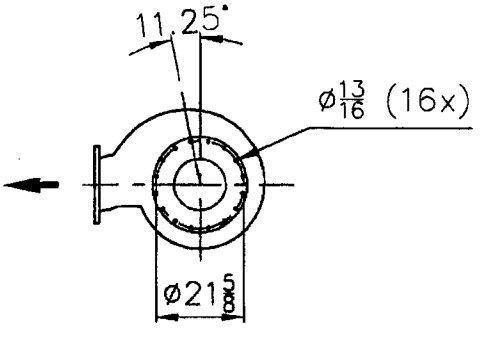
*DIMENSION TO INLET ELBOW FLANGE.







VIEW X – X



VIEW Y – Y

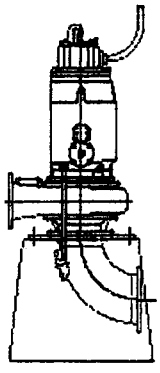
Weight (lbs)		
Pump	Stand	Inlet Elbow
4410	335	445

AUTOCAD DRAWING	Denomination: Dimensional drwg CT,NT 3312 765/775 ø16" / ø12"	Drawn by: KA	Checked by:	Date: 050630
		Scale: 1:40		Reg no: 5399
		6444500		2

FLYGT

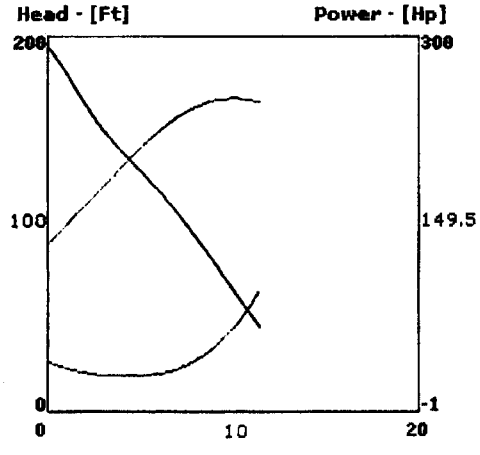
PRODUCT: NT 3312 / 765

Product picture



Curves ⊕ **Enlarge**

Available impeller diam: 475 mm



Pump Data

Curve id: 63-670 Impeller: 670 Poles: 6 - pole Motor: 43-56-6BC Frequency: 60 Hz

Motor Data

Rated output power Hp (kW)	Ø	Nominal voltage (V)	Full load current (A)	Locked rotor current (A)	Locked rotor kVA	Locked rotor code letter kVA/Hp	Poles/rpm
280 (209)	3	460	345	2230	1775	H	6/1185

Pump motor Hp	Efficiency			Power factor		
	100% load	75% load	50% load	100% load	75% load	50% load
280	94	94	93	0.8	0.75	0.63

Cable Data

HP	Cables	Volts	Max. length (Ft)	Cable size/Nominal OD.	Conductors (In one cable)	Type	Part number
280	2	460	420	4 G 70 1.85"-(47mm)	(3) 70 mm² (PWR) (1) 70 mm² (GND)	STD	942067
Pilot cable				S12 X 1.5 30.0 mm (1.18")	(12) 1.5 (CTRL)		94 08 94

Available Outlet and Inlet Sizes

Outlet Drilled Flange	12"
Inlet Drilled Flange	16"

Engineered for life

FLYGT

PERFORMANCE CURVE

PRODUCT	TYPE
NT 3312 /765	

DATE	PROJECT	CURVE NO	ISSUE
2007-11-16	MACM - Raw Sewage Pumps	63-670	2

	1/1-LOAD	3/4-LOAD	1/2-LOAD
POWER FACTOR	0.80	0.75	0.63
EFFICIENCY	94.0 %	94.0 %	93.0 %
MOTOR DATA	---	---	---

RATED POWER	280	hp
STARTING CURRENT ...	2230	A
RATED CURRENT ...	345	A
RATED SPEED	1185	rpm
TOT.MOM.OF INERTIA ...	4.5	kgm2
NO. OF BLADES	3	

IMPELLER DIAMETER: 475 mm

MOTOR #	STATOR	REV
43-56-6BC	01D	13

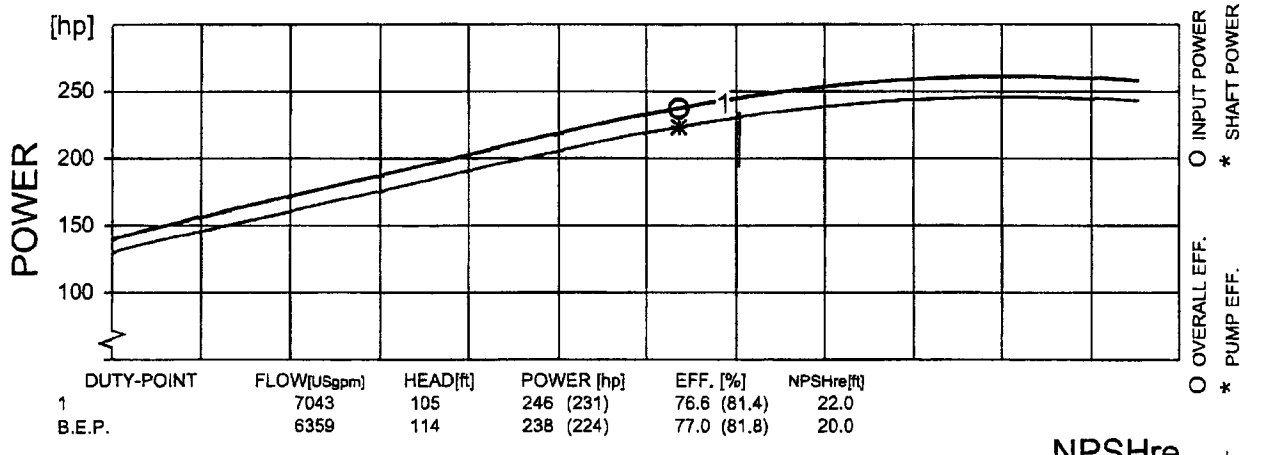
FREQ.	PHASES	VOLTAGE	POLES
60 Hz	3	460 V	6

GEARTYPE	RATIO
---	---

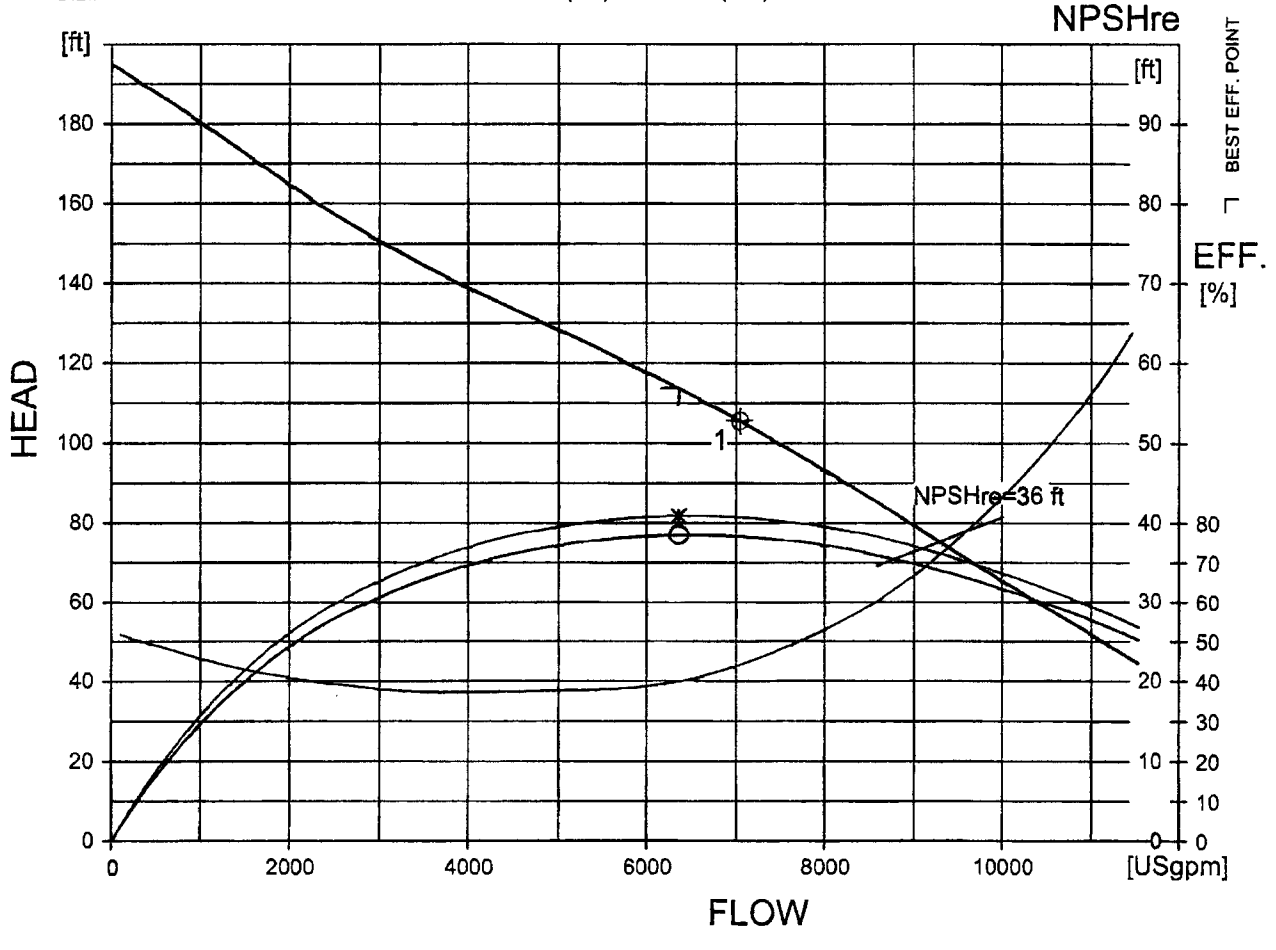
COMMENTS

INLET/OUTLET: 14/ 12 inch

IMP. THROUGHLET: ---



DUTY-POINT	FLOW[USgpm]	HEAD[ft]	POWER [hp]	EFF. [%]	NPSHre[ft]
1	7043	105	246 (231)	76.6 (81.4)	22.0
B.E.P.	6359	114	238 (224)	77.0 (81.8)	20.0



NPSHre = NPSH3% + min. operational margin

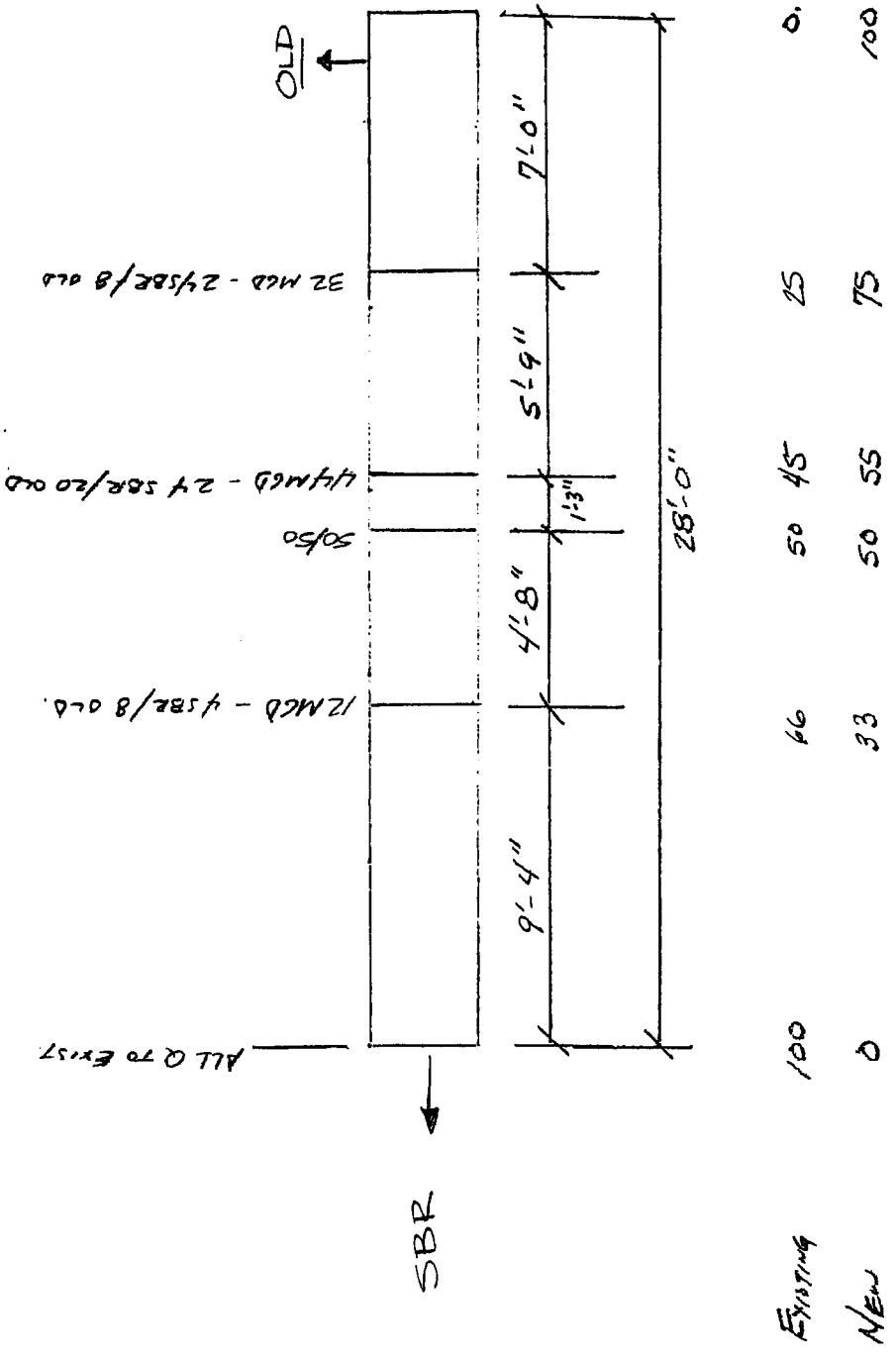
Performance with clear water and ambient temp 40 °C

FLYGT HI B Curve

FLYPS3.1.5.9 (20060531)

KLH
ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT MACM Job No. 220-33
Splitter Box Sheet No. 1 OF 1
COMPUTED BY KDH Date 1-15-08



KLH ENG[illegible]S, INC.
5173 Campbells Run Road
Pittsburgh, PA 15205

SBR Design Sheet (up to 4 Basins)

REQUIRED DATA (Enter requested information in shaded cell.)				*Formula or Reasoning*
Client (Job No.)	MACM			
Design Period	20	Years		Entered Design Period
Low Ave Day	4	MGD		Entered Flow
Ave Day Flow (Q):	6	MGD		Entered Flow
Intermediate Wet Weather Q	12	MGD		Entered Flow
Peak Day Flow (Q):	24.00	MGD		Calculated Peak = Ave Day Q * Peak Factor
Influent Paramters:	mg/L		#/D	
BOD	115		3836.4	Entered Concnetration; Calculated Mass = C(mg/L)*Q(MGD)*8.34
TSS (mg/L)	102		3402.7	Entered Concnetration; Calculated Mass = C(mg/L)*Q(MGD)*8.34
NH3-N (mg/L)	25		1251.0	Entered Concnetration; Calculated Mass = C(mg/L)*Q(MGD)*8.34
Effluent BOD Soluble	15	mg/L		Entered Concnetration
Effluent TSS	15	mg/L		Entered Concnetration
Effluent NH3-N	1	mg/L		Entered Concnetration
No. SBR Tanks	4	Tanks		Entered Number of Tanks
Normal Total Cycle Time	4.8	hours		Entered Time
Normal Q Cylces per Tank	5	Cycles		24 hours per day / Entered cycle time
Normal Decant time	72	minutes		Entered Decant Time
Storm Total Cycle Time	3.6	hours		Entered Time
Storm Q Cycles per Tank	6.666666667	Cycles		Entered Number of Cycles
Storm Decant time	54	minutes		Entered Decant Time
Storm Total Cycle Time	2	hours		Entered Time
Storm Q Cycles per Tank	12	Cycles		Entered Number of Cycles
Extreme Storm Decant time	60	minutes		Entered Decant Time
Physical/Biological Wastewater Characteristics (Assuming balanced recycle loads)				
F:M Ratio	0.035			*Changed value consistent with ABJ NDN Design*
Desired MLSS (mg/L)	4843	mg/L		*Changed value consistent with ABJ NDN Design*
VSS fraction of TSS	75%			Assumed Default Value
Non-Deg fraction of VSS	25%			Assumed Default Value
Water Temperature deg. F; deg. C	50		10	Entered Temperature in deg. F; Conversion from deg. F to Deg. C
f(d)	0.46			Assumed Default Value from published kinetic factors
k(d) (active cell basis)	0.12			Assumed Default Value from published kinetic factors
N(s), Sludge Nitrogen Content	0.09			Assumed Default Value from published kinetic factors
Y, Yield Constant	0.6	/d		Assumed Default Value from published kinetic factors
Desired SVI	150	ml/g		Assumed Default Value
Desired SVI	2.4	fl^3/lb.		Conversion of units

REPRESENTS CONFIRMATION OF ABJ NDN DESIGN FROM T KUNZ - 11-7-07

LOW WATER LEVEL CALCULATION			*Formula or Reasoning*
BOD Loading per Basin	959.1	#/D	Calculated Mass = C(mg/L)*Q(MGD)*8.34
Required MLVSS for BOD Removal	27,402.9	#/D	BOD Loading / F:M Ratio
Required MLSS for BOD Removal	36,537.14	#/D	Required MLVSS / Percent Volatile
Nitrogen Loading	232.69	#/D	Nit(in) -Nit(out) - [(BOD(in)-BOD(out)*Y*N(s)*Q (mgd) * 8.34
Minimum Required MLSS for Nitrification	25,854.00	#/D	Nitrogen Loading * 1e3 /Nitrification Rate * Aeration Time * VSS fraction of TSS
Governing Required MLSS	36,537.14	#/D	Internal Program Check for Recommended Values
Minimum Required MLSS	2,920.63	mg/L	Conversion from #/D to mg/L (divide by Q(MGD)*8.34)
SBR Sludge Volume	65,766.9	ft^3/basin	Governing Required MLSS *SVI
SBR Sludge Volume	491,970.26	gal / basin	Conversion to gallons fom ft^3 (multiply ft^3 by 7.48)

DECANT CALCULATIONS			
Normal SBR Condtions			*Formula or Reasoning*
High Water Volume Normal Conditions	30,080.21	ft^3	Ave Day Flow per Basin * [(hr/cycle)-Decant time(hr)] / [24 * 7.48]
Storm Decant Rate per Tank	4,513.89	GPM	[High Water Volume Normal Conditions * 7.48 / Decant Time] + [Wet Weather Flow per Basin / 1440]
Storm Decant Rate per Tank	6.50	MGD	Conversion from GPM to MGD
Storm SBR Condtions			
High Water Volume Storm Conditions Per Tank	45,120.32	ft^3	Peak Day Flow per Basin * [(hr/cycle)-Decant time(hr)] / [24 * 7.48]
Storm Decant Rate per Tank	8,333.33	GPM	[High Water Volume Storm Conditions * 7.48 / Decant Time] + [Peak Day Flow per Basin / 1440]
Storm Decant Rate per Tank	12.00	MGD	Conversion from GPM to MGD
Extreme Storm SBR Condtions			
Extreme Storm Decant Volume per Tank	33,422.46	ft^3	Peak Day Flow / (Number Tanks * Extreme Storm Cycles per Tank)
Extreme Storm Decant Volume per Tank	8,333.33	GPM	Conversion from gallons to ft^3 (divide gallons by 7.48)
Extreme Storm Decant Rate per Tank	12.00	MGD	Extreme Storm Decant Volume / Extreme Decant Time
Total Decanter Length	45	ft	
Decanters per Basin	2		Conditional Value Based Upon Calculated Decanter Length
Decanter Length (each)	22.5		Total Decanter Length / Decanters per Basin

BASIN SIZING			*Formula or Reasoning*
Basin Working Volume	99,189.32	ft^3	High Water Volume Storm Conditions + SBR Sludge Volume
Top Water Level	15	ft	Assumed Value / Program Default
LWL Buffer Zone	3	ft	Assumed Value / Program Default
Basin Area	8265.78	ft^2	Basin Working Volume / (Top Water Level - Buffer Zone)
Sludge Depth	7.96	ft	SBR Low Water Level Vol. / Basin Area
Low Water Level	10.96	ft	Sludge Depth + LWL Buffer Zone
Decant Depth	4.04	ft	High Water Volume Storm Conditions
High Water Level Check	Continue with Design		Internal Program Check
Length:Width Ratio (to 1)	1.5		Assumed Value
Basin Width	74.0	ft	[Basin Area / L:W Ratio]^(0.5)
Basin Length	111.00	ft	Length:Width Ratio (to 1) * Width
Maximum Average Flow Depth	13.38	ft	Low Water Level Depth + [Flow per Basin * (Cycle Time (min) - Decant Time)] / Basin Area * 7.48 * 1440
Hydraulic Retention Time	0.83	days	Basin Area * Maximum Average Flow Depth * 7.48 / Flow per Basin
Hydraulic Retention Time	19.86	hrs	Hydraulic Retention Time in days * 24 hr/D
MLVSS at Low Water Level	4,847.5	mg/L	Required MLVSS for BOD Removal / (Basin Area * Low Water Level Depth * 62.4/1e6)
MLSS at Low Water Level	6,463.3	mg/L	Required MLVSS for BOD Removal / (Basin Area * High Water Level Depth * 62.4/1e6)
MLVSS at High Water Level	3,540.8	mg/L	Required MLSS for BOD Removal / (Basin Area * Low Water Level Depth * 62.4/1e6)
MLSS at High Water Level	4,721.0	mg/L	Required MLSS for BOD Removal / (Basin Area * High Water Level Depth * 62.4/1e6)

ACTIVATED SLUDGE BIOLOGICAL CALCULATIONS

Waste Sludge Calculation (All values are in #/D unless otherwise noted)

		Volatile SS	Inert SS	Total SS	*Formula or Reasoning*
Influent Suspended Solids, lb./day	3402.7				
Inert Fraction	25%		851		Influent Solids * Inert Fraction
Non-Degradable VSS Fraction	25%	638			Influent Solids * VSS Fraction * Non-Degradable VSS Fraction
Synthesized Cells					
BOD Reduction	2001.60				Yield Coeff. * Influent BOD Mass * Eff. BOD Mass
MLVSS Reduction	1,512.64				Decay fraction * Decay Coeff. * MLVSS Mass
Degradable Synthesized Cell Fraction	77%				Assumed Default Value
Non-Degrad. Synthesized Cell Fraction	23%				Assumed Default Value
Degradable Synthesized Cells		29			[BOD Reduction * Degradable Fraction] - MLVSS Reduction
Non-Degradable Synthesized Cells	460.37				BOD Reduction * Non-Degradable Fraction
Non-Degradable Organic Cell Fraction	75%				Assumed Default Value
Non-Degradable Inorganic Cell Fraction	25%				Assumed Default Value
Non-Degradable Organic Cells		345			Non-Degradable Synthesized Cells * Non-Degradable Organic Cell Fraction
Non-Degradable Inorganic Cells			115		Non-Degradable Synthesized Cells * Non-Degradable inorganic Cell Fraction
Total Waste Sludge in #/D		1012	966	1978	Sum of SS Category
Percentage of Total Sludge		51%	49%		SS Category / Total SS
Effluent Loss in #/D		384	367	751	Calculated Effluent Mass = C(mg/L)*Q(MGD)*8.34 8 Percentage of Total Sludge
Waste Activated Sludge Production		**628**	**599**	**1227**	Total Waste Sludge in #/D -Effluent Loss in #/D

Solids Retention Time	55.43	days	Minimum Required MLSS / Waste Activated Sludge Production
Sludge Wasted per # BOD	1.28		Waste Activated Sludge Production / Influent BOD Mass
Is Sludge Wasted per # BOD > 0.5 ?	Yes, Continue with Design		Internal Program Check for Recommended Values
Waste Sludge Concentration	*8,000*	*mg/L*	Assumed Default Value
Sludge Flow from SBR	18,391.1	gpd	Waste Activated Sludge Production / Waste Sludge Concentration * 8.34 *1e6
Sludge Flow per Tank	3.19	gpm	Sludge Flow / Number of Tanks * 1440 min/d

Will Nit/Denit occur naturally?	Possible		If the Solids Retention Time>15, then natural Nitrification is Possible
Assuming Provisions for Complete			
Nitrification, Minimum Alkalinity Req'd.	278.5	mg/L as CaCO3	60 mg/L CaCO3 + (7.14 * NH-N3 Concnetration)
Potential Denit. Alkalinity Recovery	89.25	mg/L as CaCO3	50% * (7.14 * NH-N3 Concnetration)
Chemical Addition with Denit	189.25	mg/L as CaCO3	Nitrification, Minimum Alkalinity Req'd. - Potential Denit. Alkalinity Recovery
CaCO3 in 50% NaOH Solution	8.20	# CaCO3 / gal NaOH	Chemical Property Default Value
Maximum Chemcial Addition Dosage	1699.53	gpd 50% NaOH	[Nitrification, Minimum Alkalinity Req'd. * 8.34 * Ave Day Q] / CaCO3 in 50% NaOH Solution
Maximum Chemcial Addition Dosage	1.18	gpm 50% NaOH	Conversion from gpd to gpm (by dividing by 1440)
Reduced Chemical Addition Dosage	1154.89	gpd 50% NaOH	[Chemical Addition with Denit. * 8.34 * Ave Day Q] / CaCO3 in 50% NaOH Solution
Reduced Chemical Addition Dosage	0.80	gpm 50% NaOH	Conversion from gpd to gpm (by dividing by 1440)

PROCESS AIR CALCULATIONS

#O2/#BOD	1.1		Assumed Default Value
#O2/#NH4-N	4.6		Assumed Default Value
AOR	9,974.64	#O2/day	(#O2/#BOD * #/D BOD) + (#O2/#NH4-N * #/D NH4-N)
Bubble Diffuser Type (Fine or Coarse)	Fine		Entered Diffuser Type
AOR/SOR	0.33		Conditional Default for Diffuser Type
Assumed OTE	2%	/ ft	Conditional Default for Diffuser Type
SOR	20.99	#O2/min	AOR / (AOR/SOR) * 1440
Diffusers to Floor Distance	1	ft	Entered Distance
Submergence	14.0	ft	High Water Level Depth - Diffuser to Floor Distance
OTE	0.28		Submergence * Assumed OTE
Theoretical 1-SCFM	0.0173	#O2/min	Assumed Default Value
Calculated 1-SCFM	0.0048	#O2/min	OTE * Theoretical 1-SCFM
SCFM Required	4,333.78	scfm	[SOR / Calculated 1-SCFM] + 0.5 scfm
Water Depth Pressure	6.07	psig	Submergence / Specific Gavity of Water
Piping Loss	0.75	psig	Entered Piping Loss
Total Pressure Required	6.82	psig	Water Depth Pressure + Piping Loss
Blower Efficency	70%		Assumed Default Value
Required BHP	162.11	BHP	[(SCFM Required * 0.23) * {(14.7 + Total Pressure)/14.7}^(0.283-1] / Blower Efficiency
Specified Total BHP	170	BHP	Rounded Value
Number of Operating Blowers	3		Entered Number of Operating Blowers
HP Each	60	BHP	Specified Total BHP per Number of Operating Blowers

DESIGN CALCULATIONS
BOD Removal Nitrification and De-Nitrification Process

McKeesport, PA
Sanitaire Project Number 17501-05a

Design Parameters

A. Influent Conditions

Average Dry Weather Flow	4.0 MGD
Peak Dry Weather Flow	6.0 MGD
Peak Wet Weather Flow	24.0 MGD
BOD_5 (20°C)	115 mg/l
Suspended Solids	102 mg/l
TKN	38 mg/l
Phosphorus	5 mg/l
Alkalinity (Minimum Requirement)	185 mg/l
Waste Water Temperature	50 - 68 °F
Ambient Air Temperature	20 - 90 °F
Site Elevation	750 ft

B. Effluent Conditions

BOD_5 (20°C)	15 mg/l
Suspended Solids	15 mg/l
NH_3 -N	1 mg/l
Total Nitrogen	5 mg/l
Total Phosphorous	1 mg/l

C. ICEAS™ Process Design Criteria

F / M	0.035 BOD_5 / MLSS / day
SVI (after 30 minutes settling)	150 ml/g
Number of ICEAS Basins	4
Top Water Level	15 ft

CYCLE	AIR-OFF	AIR-ON	SETTLE	DECANT	TOTAL
Normal	48 min	120 min	48 min	72 min	4.8 hour
Intermediate	36 min	90 min	36 min	54 min	3.6 hour
Storm	0 min	30 min	30 min	60 min	2 hour

BOD Load

$$BOD_L = \frac{Q \times BODin \times 8.34}{1E+06}$$

where BOD_L = BOD Load (lb/day)
Q = Average Dry Weather Flow per basin (gal/day)
BODin = Influent BOD concentration (mg/l)
1.E+06 = conversion (l/mg)
8.34 = conversion (lb/gal)

$$BOD_L = \frac{1{,}000{,}000 \times 115 \times 8.34}{1E+06}$$

BOD_L = 959 lb/day/basin

Mass of Biomass for BOD Removal

$$Mbod = \frac{BODL}{F/M}$$

where Mbod = Mass of Biomass for BOD Removal (lb/day/basin)
F / M = Food to Microorganism ratio (day^{-1})

$$Mbod = \frac{959}{0.035}$$

Mbod = 27,403 lb/basin

Nitrogen Load

$$\Delta N = \frac{[(NH_3in - NH_3out) - ((BODin - BODout) \times Y \times Ns)] \times Q \times 8.34}{1E+06}$$

where
- ΔN = Net Nitrogen Load (lb/day/basin)
- NH_3in = Influent Ammonia Concentration (mg/l)
- NH_3out = Effluent Ammonia required (mg/l)
- BODout = Effluent BOD required (mg/l)
- Y = Sludge Yield (MLSS / BOD removed)
- Ns = Sludge Nitrogen content (N / sludge)

$$\Delta N = \frac{[(38 - 1) - ((115 - 15) \times 0.75 \times 0.07)] \times 1{,}000{,}000 \times 8.34}{1E+06}$$

ΔN = 264.80 lb/day/basin

Mass of Biomass Required for Nitrification

$$Mnit = \frac{\Delta N \times 10^3}{K \times Ta \times 0.7}$$

where
- Mnit = Mass of Biomass for Nitrification (lb/day/basin)
- 10^3 = conversion (mg/g)
- K = Nitrification Rate (mg NH_3 -N/g MLVSS/hr)
- Ta = Time of Aeration (hr/day)
- 0.7 = Fraction of MLSS which is volatile

$$Mnit = \frac{264.80 \times 10^3}{1.5 \times 10 \times 0.7}$$

Mnit = 25,219 lb/day/basin

Design Mass of Biomass

The Design Mass of Biomass is the larger of the BOD Removal Mass and the Nitrification Mass:

Mbod = 27,403 lb/day/basin

Mnit = 25,219 lb/day/basin

Mbio = 27,403 lb/day/basin

Volume of Biomass

Vbio = Mbio x SVI

where Vbio = Volume of Biomass (ft^3/basin)
Mbio = Mass of Biomass (lb/day/basin)
SVI = Sludge Volume Index (ft^3/lb)

Vbio = 27,403 x 2.4

Vbio = 65,767 ft^3/basin

Maximum Volume Above Bottom Water Level

Peak Dry Weather Flow:

$$Vbwld = \frac{PDWF \times (NCT - NDT)}{24 \times 7.48}$$

where
- Vbwld = Maximum Volume Above BWL at Peak Dry Weather Flow (ft^3/basin)
- PDWF = Peak Dry Weather Flow (gal/day)
- NCT = Normal Cycle Time (hr/cycle)
- NDT = Decant Time (hr/cycle)
- 7.48 = conversion (gal/ft^3)

$$Vbwld = \frac{1{,}200{,}000 \times (4.80 - 1.2)}{24 \times 7.48}$$

Vbwld =	30,080 ft^3/basin

Peak Wet Weather Flow:

$$Vbwls = \frac{PWWF \times (SCT - SDT)}{24 \times 7.48}$$

where
- Vbwls = Maximum Volume Above BWL at Peak Wet Weather (Storm) Flow (ft^3/basin)
- PWWF = Peak Wet Weather Flow (gal/day)
- SCT = Storm Cycle Time (hr/cycle)
- SDT = Storm Decant Time (hr/cycle)
- 7.48 = conversion (gal/ft^3)

$$Vbwls = \frac{6{,}000{,}000 \times (2.0 - 1)}{24 \times 7.48}$$

Vbwls =	33,422 ft^3/basin

MVAB =	33,422 ft^3/basin

Decant Rates

Peak Dry Weather Flow:

$$NDR = \frac{MVAB \times 7.48}{NDT} + \frac{PDWF}{1{,}440}$$

where NDR = Normal Decant Rate (gal/min)
NDT = Normal Decant Time (min/cycle)

$$NDR = \frac{33{,}422 \times 7.48}{60} + \frac{1{,}200{,}000}{1{,}440}$$

NDR = 4,514 gal/min

Peak Wet Weather Flow:

$$PDR = \frac{MVAB \times 7.48}{SDT} + \frac{PWWF}{1{,}440}$$

where PDR = Peak Decant Rate (gal/min)
SDT = Storm Decant Time (min/cycle)

$$PDR = \frac{33{,}422 \times 7.48}{60} + \frac{6{,}000{,}000}{1{,}440}$$

PDR = 8,333 gal/min

Decanter Sizing

Average Dry Weather Flow:

$$DLa = \frac{NDR}{\text{Weir Loading Rate} \times 7.48}$$

where DLa = Decanter Length for Average Dry Weather Flow (ft)
20 = Weir Loading Rate (ft^3/min/ft of decanter weir)

$$DLa = \frac{4{,}514}{20 \times 7.48}$$

DLa =	30.17 ft

Peak Wet Weather Flow:

$$DLp = \frac{PDR}{\text{Weir Loading Rate} \times 7.48}$$

where DLp = Decanter Length for Peak Wet Weather (Storm) Flow (ft)
25 = Weir Loading Rate (ft^3/min/ft of decanter weir)

$$DLp = \frac{8{,}333}{25 \times 7.48}$$

DLp =	44.56 ft

Design Decanter Length =	60.0 ft

Basin Working Volume

$$BWV = MVAB + Vbio + Vc$$

where MVAB = Maximum Volume Above BWL (ft^3/basin)
Vbio = Volume of Biomass (ft^3/basin)
Vc = Volume of chemical sludge due to Phosphorus removal (ft^3/basin [See end of calculation]).
Please refer to phosphorus removal calculation.

$$BWV = 33{,}422 + 65{,}767 + 146$$

BWV = 99,335 ft^3

Basin Area

$$BA = \frac{BWV}{TWL - BZ}$$

where BA = Basin Area (ft^2)
TWL = Top Water Level (ft)
BZ = Buffer Zone (ft) - Safety Factor

$$BA = \frac{99{,}335}{15.0 - 3.0}$$

BA = 8,278 ft^2

Sludge Depth

$$SD = \frac{Vbio}{BA}$$

where SD = Sludge Depth (ft)

$$SD = \frac{65{,}767}{8{,}278}$$

SD = 7.94 ft

Decanter Draw Down

$$DD = \frac{MVAB}{BA}$$

where DD = Draw Down (ft)
MVAB = Maximum Volume Above BWL (ft^3)

$$DD = \frac{33{,}422}{8{,}278}$$

DD =	4.04 ft

Bottom Water Level

$$BWL = SD + BZ + \frac{Vc}{BA}$$

where BWL = Bottom Water Level (ft)

$$BWL = 7.94 + 3.00 + \frac{145.72}{8{,}278}$$

BWL =	10.96 ft

Top Water Level

$$TWL = BWL + DD$$

where TWL = Top Water Level (ft)

$$TWL = 10.96 + 4.04$$

TWL =	15.00 ft

Hydraulic Retention Time

$$HRT = \frac{BA \times MAFD \times 7.48}{Q}$$

where HRT = Hydraulic Retention Time (days)
BA = Basin Area (ft^2)
MAFD = Maximum Average Flow Depth (ft)

$$MAFD = \frac{Q \times ((CT \times 60) - DT)}{BA \times 60 \times 24 \times 7.48} + BWL$$

$$MAFD = \frac{1{,}000{,}000 \times ((4.8 \times 60) - 72)}{8{,}278 \times 60 \times 24 \times 7.48} + 10.96$$

$$MAFD = 13.38$$

$$HRT = \frac{8{,}278 \times 13.38 \times 7.48}{1{,}000{,}000}$$

HRT =	0.83 days

MLSS Concentration at Bottom Water Level

$$MLSS = \frac{Mbio \times 1E{+}06}{BWL \times (BA - CA) \times 62.42}$$

where MLSS = Mixed Liquor Suspended Solids concentration at Bottom Water Level (mg/l)
Mbio = Mass of Biomass (lb/basin)
62.42 / 1E+06 = conversion (lb/mg x l/ft^3)
CA = Area Increment due to chemical sludge (ft^2/basin)

$$MLSS = \frac{27{,}403 \times 1E{+}06}{10.96 \times (8278 - 9.71) \times 62.42}$$

MLSS =	4,843 mg/l

Mass of Sludge Produced

$$\Delta M = \frac{Q \times (BODin - BODout) \times Yobs \times 8.34}{1E+06}$$

where ΔM = Mass of Sludge Produced (lb/day/basin)
Yobs = Observed Sludge Yield (MLSS / BODremoved)

$$\Delta M = \frac{1{,}000{,}000 \times (115 - 15) \times 0.75 \times 8.34}{1E+06}$$

ΔM =	626 lb/day/basin

Volume of Sludge Produced

$$Vws = \frac{\Delta M}{SFws \times 8.34} + \frac{CSludge}{SFws \times 8.34}$$

where Vws = Volume of Waste Sludge (gal/day/basin)
SFws = Solids Fraction in Waste Sludge
8.34 = density (lb/gal)
CSludge = Mass of chemical sludge produced (lb/day/basin) Please refer to phosphorus removal calculation.

$$Vws = \frac{626 + 60.72}{0.0085 \times 8.34}$$

Vws =	9,680 gal/day/basin

Mean Cell Residence Time

$$MCRT = \frac{Mbio}{\Delta M + ((Q - Vws) \times Ssout \times 8.34 / 1E+06)}$$

where Mbio = Mass of Biomass (lb/basin)
Ssout = Suspended Solids in Effluent (mg/l)
8.34E-06 = conversion (lb/mg x l/gal)

$$MCRT = \frac{27{,}403}{626 + ((1{,}000{,}000 - 9{,}680) \times 15 \times 8.34 / 1E+06)}$$

MCRT =	36.57 days

Waste Sludge Pump Capacity

$$WSP = \frac{Vws \times CT}{24 \times SPT}$$

where WSP = Waste Sludge Pump Capacity(gal/min)
SPT = Sludge Pumping Time (min/cycle)

$$WSP = \frac{9{,}680 \times 4.8}{24 \times 20}$$

WSP =	97 gal/min

Biological Phosphorus Removal

$$TPb = TPi - [(Yobs \times BODr) \times TPps]$$

where
TPb = Concentration of the Total Phosphorus in the Effluent after biological removal, mg/l
TPi = Concentration of the Total Phosphorus in the Influent, mg/l
Yobs = Observed Yield Factor, (lb of MLSS/lb of BOD Removed)
BODr = Biochemical Oxygen Demand Removed, mg/l
TPps = Percent of Total Phosphorus in Biomass

$$TPb = 5.0 - [(0.75 \times 100) \times 0.04]$$

TPb =	2.0 mg/l

Chemical Dosing

$$CD = CDt \times (TPb - TETP) \times (1 + SF)$$

where
CDt= Theoretical Chemical Dosage (mg/l)
SF= Safety Factor for Chemical Dosing (%)
TETP= Required Phosphorus concentration in effluent (mg/l)

Alum Dosage Based on percentage removal (PR) of Phosphorus:

PR	CDt
PR < 85	13 mg/l
85 ≤ PR ≤ 95	16 mg/l
PR > 95	22 mg/l

$$PR = \left[\frac{(TPb - TETP)}{TPe} \right] \times 100$$

$$PR = \left[\frac{(2.0 - 1.0)}{2.0} \right] \times 100$$

PR= 50%

CDt= 13 mg/l

CD= 13 x(2.0 - 1.0 x #########

...Rounded to the Nearest 5 mg/l

CD =	20 mg/l

Mass of Chemical Sludge

$$CSludge = \frac{Q \times CD \times 0.091 \times 4 \times 8.34}{1E+06}$$

where CSludge= Mass of Chemical Sludge Produced per basin (lb/day/basin)
0.091= Fraction of Alum reacting with Phosphorus
4= Mass of Precipitate formed per Mass of Alum

$$CSludge = \frac{1{,}000{,}000 \times 20 \times 0.091 \times 4 \times 8.34}{1E+06}$$

CSludge =	60.7 lb/day

Volume of Chemical Sludge

$$Vcs = CSludge \times SVI$$

where Vcs Volume of Chemical Sludge (ft^3/basin)
CSludge = Mass of Chemical Sludge (lb/day/basin)
SVI = Sludge Volume Index (ft^3/lb)

$$Vcs = 61 \times 2.4$$

Vcs =	146 ft^3/basin

AIR CALCULATIONS

BOD Removal Nitrification and Denitrification Process

McKeesport, PA

ABJ Project Number 17501-05a

$$AOR1 = A \times \frac{Q \times BODin}{1E+06} \times 8.34$$

where AOR1 = Actual Oxygen Required for BOD oxidation (lb/day/basin)
A = O_2 / BOD
Q = average flow (gal/day/basin)
BODin = influent BOD received (mg/l)
1E+06 = conversion (g x mg)
8.34 = conversion (lb x gal)

$$A = AT - DNC$$

where AT = Total O2/BOD required for carbonaceous treatment
DNC = Denitrification Credit (O2/BOD)

$$AT = 1.20 \quad O2/BOD$$

Denitrification Credit

$$DNC = \frac{2.9 \times DN \times \Delta N}{BOD_L}$$

where DNC = Dentirification credit (O2/BOD)
DN = Fraction of nitrate denitrified
ΔN = Net Nitrogen Load (lb/day/basin)
BOD_L = BOD Load (lb/day/basin)

$$\Delta N = \frac{[(NH_3in - NH_3out) - ((BODin - BODout) \times Yobs \times Ns)] \times Q \times 8.34}{1E+06}$$

where NH3in = influent ammonia concentration (mg/l)
NH3out = effluent ammonia required (mg/l)
Yobs = Observed sludge Yield (MLSS / BOD removed)
Ns = Sludge Nitrogen content (N / sludge)
BODout = effluent BOD (mg/l)

$$\Delta N = \frac{[(38 - 1) - ((115 - 15) \times 0.75 \times 0.07)] \times 1{,}000{,}000 \times 8.34}{1E+06}$$

ΔN =	264.80 lb/day/basin

$$DNC = \frac{2.9 \times 0.9 \times 264.80}{959.1}$$

DNC = 0.00 O2/BOD **No denitrification credit taken.**

A = AT - DNC

A = 1.20 - 0.00

A =	1.20 O2/BOD

$$AOR1 = 1.2 \times \left[\frac{1{,}000{,}000 \times 115 \times 8.34}{1E+06}\right]$$

AOR1 =	1,151 lb/day/basin

AOR2 = 4.6 x ΔN

where AOR2 = Actual Oxygen Requirement for NH3 oxidation (lb/day/basin)

AOR2 = 4.6 x 264.80

AOR2 =	1,218 lb/day/basin

AOR = AOR1 + AOR2

AOR = 1,151 + 1,218

AOR =	2,369 lb/day/basin

$$SOR = \frac{AOR}{AOR/SOR}$$

$$AOR/SOR = \frac{alpha \times theta^{(Tsite-20)} \times (beta \times C^{*}sat20 \times Psite/Pstd * CsurfT/Csurf_{20} - D.O.)}{C^{*}sat20}$$

where

alpha	=	alpha factor
theta	=	temperature coefficient
Tsite	=	water temperature (°C)
beta	=	beta factor
Psite	=	Site Atmospheric Pressure
Pstd	=	standard atmospheric pressure (1 atm)
$C^{*}sat20$	=	dissolved oxygen solubility at standard conditions (mg/l)
CsurfT	=	dissolved oxygen solubility at site water temperature (mg/l)
$Csurf_{20}$	=	dissolved oxygen solubility at 20°C (mg/l)
D.O.	=	residual dissolved oxygen concentration (mg/l)

$$AOR/SOR = \frac{0.65 \times 1.024^{(20-20)} \times (0.95 \times 10.15 \times 14.34/14.7 \times 9.07/9.07 - 2.0)}{10.15}$$

AOR/SOR=	0.4744

$$SOR = \frac{2,369}{0.4744}$$

SOR =	4,994 lb/day/basin

Aeration Depth

Average Aeration Depth:

$$AADad = \frac{ADWF \times [(NCT \times 60) - (NDT + NST)]}{2 \times 1440 \times 7.48 \times BA} + BWL$$

where
- MADpd = Maximum Aeration Depth at Average Dry Weather Flow (ft)
- ADWF = Average Dry Weather Flow (gpd/basin)
- NCT = Normal Cycle Time (hr)
- NDT = Normal Decant Time (min)
- NST = Normal Settling Time (min)
- BA = Basin Area (ft^2)
- 1440 = conversion (min/day)
- 7.48 = conversion (gal/ft^3)

$$MADad = \frac{1{,}000{,}000 \times [(4.8 \times 60) - (48 + 72)]}{2 \times 1440 \times 7.48 \times 8{,}278} + 10.96$$

AADad =	11.90 ft

Maximum Aeration Depth:

$$MADpw = \frac{PWWF \times [(SCT \times 60) - (SDT + SST)]}{1440 \times 7.48 \times BA} + BWL$$

where
- MADpw = Maximum Aeration Depth at Peak Wet Weather Flow (ft)
- PWWF = Peak Wet Weather Flow (gpd/basin)
- SCT = Storm Cycle Time (hr)
- SDT = Storm Decant Time (min)
- SST = Storm Settling Time (min)

$$MADpw = \frac{6{,}000{,}000 \times [(2 \times 60) - (30 + 60)]}{1440 \times 7.48 \times 8{,}278} + 10.96$$

MADpw =	12.98 ft

MAD =	13.79 ft

Air Flow Requirement

$$\text{Process Air} = \frac{\text{SOR} \times 10{,}000}{\text{rho} \times \text{SOTE} \times \text{TA} \times \text{Opw} \times 60}$$

where Process Air = Process air flow requirement (SCFM)
rho = air density (lb/ft³)
SOTE = Standard Oxygen Transfer Efficiency @ Submergence of 10.9 ft
TA = Time of Aeration (hr/day)
Opw = fraction of Oxygen in air by Weight
10,000 = conversion (100% * 100%)
60 = Conversion (min/hr)

$$\text{Process Air} = \frac{4{,}994 \times 10{,}000}{0.075 \times 23.2\% \times 10 \times 23.2\% \times 60}$$

Process Air=	2,066 SCFM

Mixing Air = 0.125 x BA

where Mixing Air = Mixing air flow requirement (standard SCFM)
0.125 scfm/ft² = recommended air flow per unit area of basin

Mixing Air = 0.125 x 8,278

Mixing Air =	1,035 SCFM

Blower Unit Capacity

The Blower Unit Capacity (BUC) is the larger of the process air requirement and the mixing air requirement:

Process Air = 2,066 SCFM

Mixing Air = 1,035 SCFM

Use 2 blowers per basin...

BUC =	1,033 SCFM

Blower Pressure

PSIG = (MAD x 0.432) + HL

where PSIG = blower pressure (PSIG)
0.432 = water density (PSI/ft)
HL = Head Loss safety factor (PSIG)

PSIG = (13.79 x 0.432) + 1

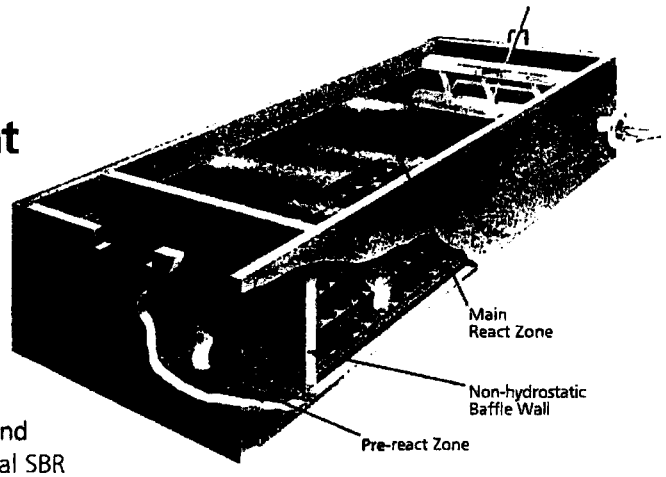
Rounded to the next tenth of a psig...

PSIG =	7.00 PSIG

ICEAS®
Advanced SBR Technology

ABJ®

Cost-Effective Wastewater Treatment



Sanitaire has provided the wastewater treatment industry with innovative and cost-effective treatment technologies for over 35 years. This tradition continues with the ABJ Intermittent Cycle Extended Aeration (ICEAS) process, which is an advance sequencing batch reactor (SBR) technology for municipal and industrial wastewater treatment.

The conventional SBR, a variant of the activated sludge process, operates on the fill and draw principle. Fill, react, settle, decant and idle phases occur sequentially on a cyclic basis. In the conventional SBR configuration, flow is diverted from the basin during settling and decanting and requires two or more basins or an influent equalization tank to receive flow when settling and decanting. Sanitaire can provide a conventional SBR but recommends the superior flexibility of the ICEAS design, which does not require any flow diversion.

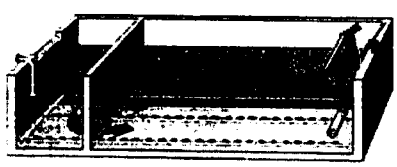
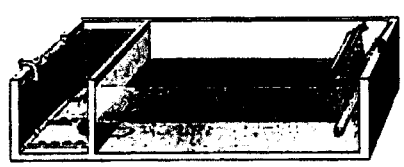
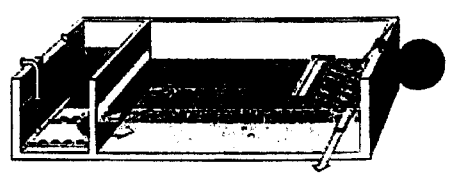
The ICEAS Process

The advanced ABJ ICEAS process is a fully automated and simple to operate biological treatment system that:

- Operates as a time-based control system allowing continuous inflow of wastewater during all phases of the cycle.
- Responds to flow and load variations.
- Can achieve processes of biological oxidation, nitrification, denitrification, phosphorus removal and liquid/solids separation continuously in a single basin.
- Easily expands and produces a high quality effluent.
- Provides two treatment zones (pre-react and main-react) separated by a non-hydrostatic baffle wall.
- Utilizes the pre-react zone as a biological selector for enhancing the growth of desirable organisms.
- Offers flexibility for meeting specific application needs with custom engineered process cycles.

The ICEAS Cycle

React – Periods of aeration and/or mixing are applied to achieve the desired biological treatment.
Settle – Aeration and/or mixing are discontinued allowing solids to settle to the bottom of the basin leaving a layer of clear, treated water at the top.
Decant – The clear, treated water is removed by an automated, time-controlled decant mechanism.

ICEAS Features

Continuous Inflow

- Provides equal loading and flow to all basins, simplifying operation and process control.
- Can be designed to accommodate up to six times average daily flow.
- Results in smaller basin size and less equipment, reducing construction and O&M costs.
- Eliminates primary and secondary clarifiers and return sludge pumps.
- Enables single-basin operation for maintenance and low flow conditions.

Decanter Design

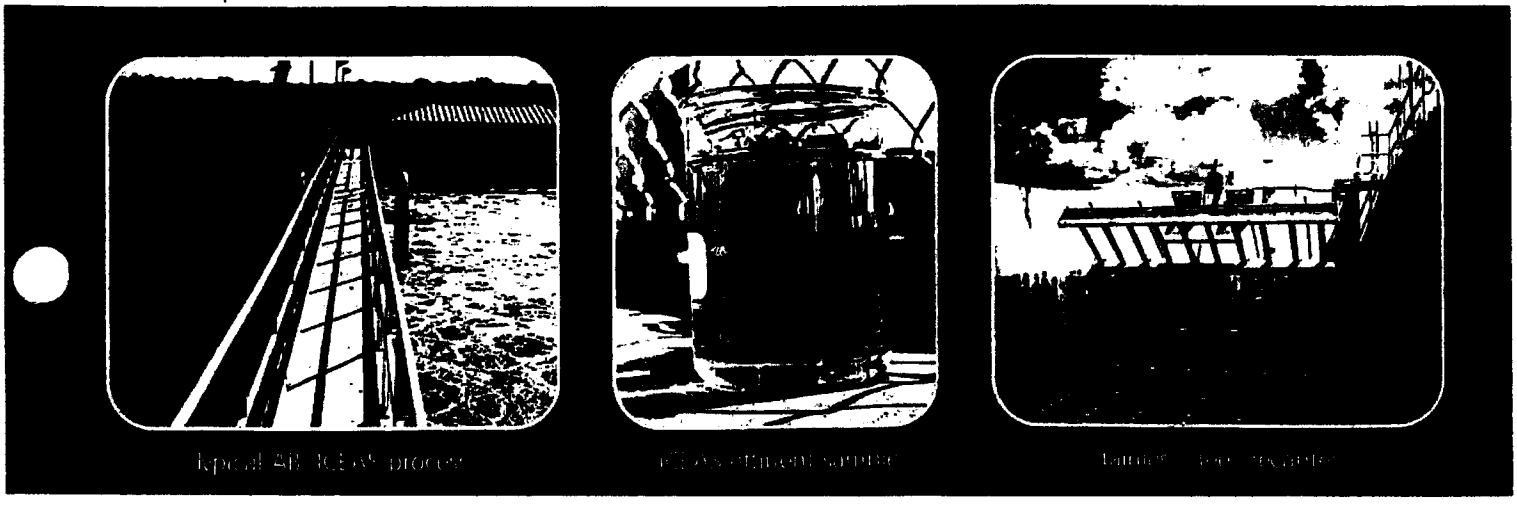
- High quality workmanship and advanced engineering provide a long-lasting decanter.
- Rugged, corrosion resistant stainless steel construction.
- Decants from the top down withdrawing only the uppermost clear water from the basin preventing disruption of the settling solids.
- Uses a proprietary scum exclusion float to prevent the carryover of floating material with the treated effluent.
- Flow over the decanter weir is visible from the basin walkway providing a check of effluent quality.
- Actuator operates via a VFD providing a constant rate of effluent discharge to downstream facilities.
- Parked above top water level during react and settling phases serving as an emergency overflow device in the event of extreme storm conditions or power failure.
- Actuator drive mounted outside of basin at walkway level for easy maintenance.

Energy Efficient Aeration Systems

- State-of-the-art aeration systems have been applied worldwide in activated sludge and biological nutrient removal applications. SANITAIRE diffusers provide high oxygen transfer efficiency, require minimal maintenance and are time proven for their durability in wastewater treatment processes.
- Fine Bubble Membrane aeration systems include advanced membrane material specifically engineered for domestic and industrial applications providing resistance to material property changes. The time-proven piping system accommodates thermal expansion and contraction and prevents air leakage, pipe separation and distributor rollover.
- Coarse Bubble aeration systems provide efficient wide band aeration and mixing with minimal maintenance. Stainless steel material provides corrosion resistance and structural integrity and is fully passivated after fabrication. (Available in fixed header and removable header options).

Municipal and Industrial Wastewater Treatment

The ABJ ICEAS process provides high quality effluent for both municipal and industrial wastewater treatment facilities. Typical industrial applications include waste from meat processing, beverage, pharmaceutical, food processing, pulp and paper and chemical plants.



ICEAS-NDN PROCESS: BIOLOGICAL NUTRIENT REMOVAL (BNR)

Designed for the Removal of:

- BOD
- TSS
- Ammonia
- Total Nitrogen
- Total Phosphorous

Typically Used for:

- Municipal Wastewater
- Industrial Wastewater

Biological nutrient removal is accomplished in the ICEAS-NDN process by incorporating alternating phases of oxic-anoxic/anaerobic (air on-air off) conditions in the cycle as shown in Figure 13. The ICEAS basin is sized to ensure complete nitrification, denitrification and to maximize the total biological phosphorus removal.

Typical normal and storm cycles using 2 basins for the ICEAS-NDN process are shown in Figure 14 and 15. The aerobic phases promote BOD removal, nitrification and phosphorus uptake. The anoxic/anaerobic (air off) phases promote denitrification and phosphorus release. Nitrification rates and sludge age requirements for the nitrification process are calculated based on the temperature range and pH of the influent wastewater.

The degree of denitrification and phosphorus removal achieved by the ICEAS-NDN process is dependant on the influent BOD/TN and BOD/TP ratios. The typical blower control for the ICEAS-NDN process involves a D.O. control system with blower output control.

Figure 13

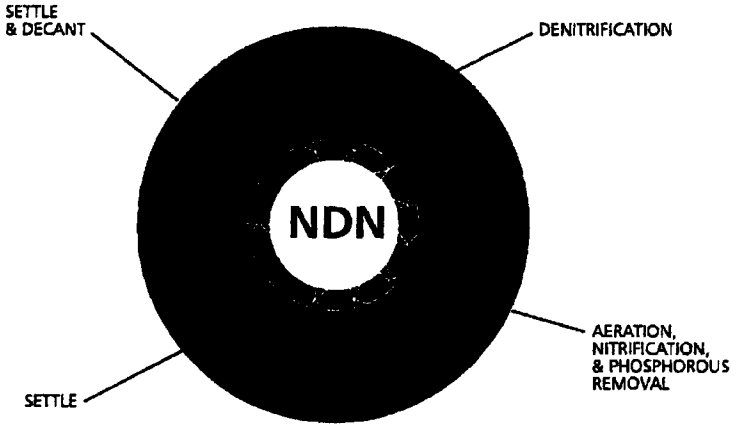


Figure 14

Normal Cycle Operational Sequence of ICEAS-NDN Process

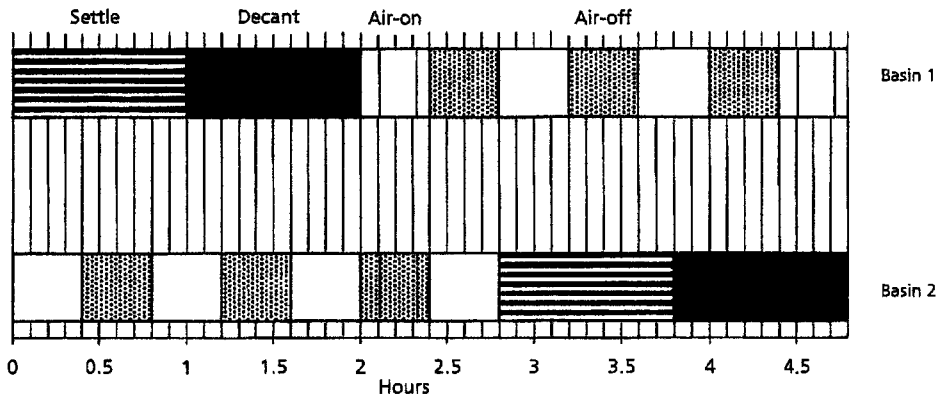
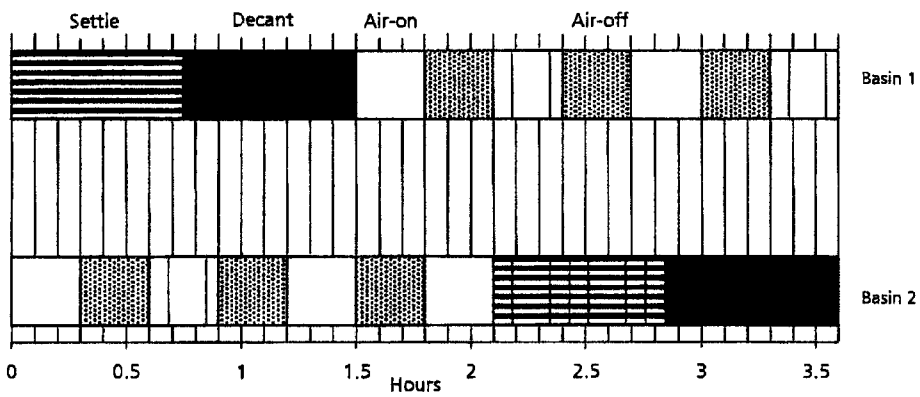


Figure 15

Storm Cycle Operational Sequence of the ICEAS-NDN Process



The cycle charts for the ICEAS-NDN process operating in normal and storm cycles using four basins are shown in Figures 16 and 17.

Figure 16

Normal Cycle Operational Sequence for the ICEAS-NDN Process

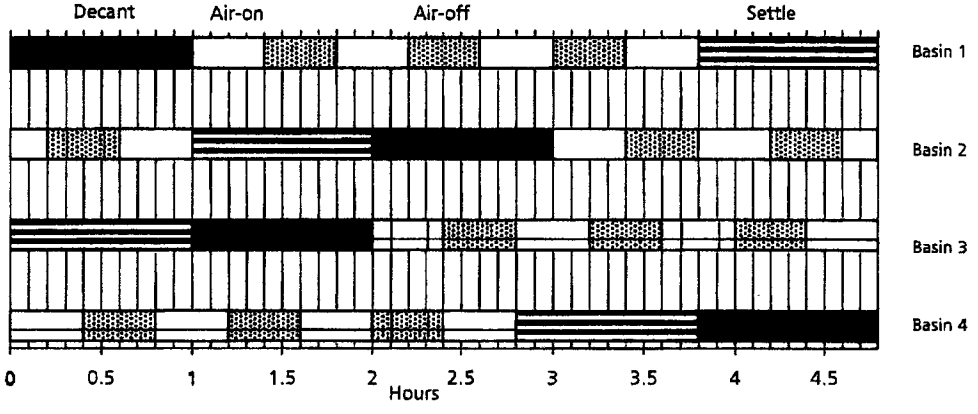
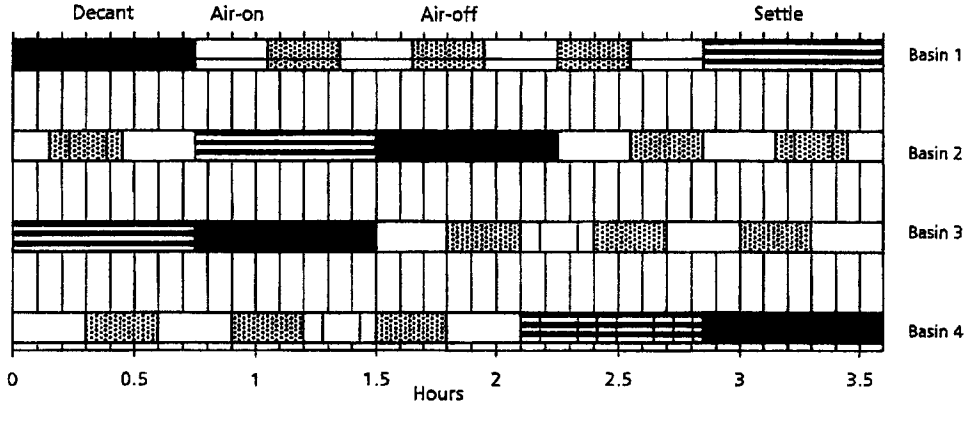


Figure 17

Storm Cycle Operational Sequence of the ICEAS-NDN Process



SIEMENS

SCOPE OF SUPPLY **Ultraviolet "UV" Disinfection**	**November 16, 2007** **Proposal # 2772001**

PROJECT NAME: McKeesport, OH WWTP

RECOMMENDED SYSTEM: HE-40-A300-AW-6 Train # 2 (24 MGD)

ORIENTATION: Vertical

LAMP TECHNOLOGY: Low-pressure high intensity "AMALGAM"

AUTHORIZED REPRESENTATIVE:

Rick Bible
BissNuss, Inc.
2600 Boyce Plaza Rd.
Pittsburgh, PA 15241
(412) 221-1200

DESIGN OVERVIEW- Train # 2- 24 MGD:

Water type	Wastewater
Flow rate (Peak)	24 MGD
Flow rate (Average)	7.5 MGD
Flow rate (Minimum)	SBR Decant
Transmission @ 254 nm	65% (assumed)
Total suspended solids TSS	<10 mg/liter (design)
Biological oxygen demand	<10 mg/liter (design)
Temperature	50 F
Influent (per 100 ml sample)	N/A
Discharge permit	200/100 ml (summer)
Discharge permit	2000/100 ml (winter)
UV Dosage	>30,000

System type	Vertical Open Channel
UV monitoring system	Yes
Lamp type	High intensity
Module material	Stainless Steel
Electrical enclosure	NEMA 4x
Running time meter	Yes
Individual lamp indicators	Yes
Flow pacing	~~No~~
Auto quartz cleaning system	Yes
Power Distribution Center	Remote NEMA 4x
Level Control	Finger Weir
Redundancy	TBD

Ric & Adam Conf. Call 12/13/07

YES

- Least Expensive Easiest to Op Biggest Footprint
- Note is static

40 Lamps/Mod.
~~40~~/Mod.

- 4-20 mA from Decanter

Adam - 201-760-0364

OVERVIEW

The vertical design will allow for energy and lamp conservation by flow pacing. A flow signal will be used to turn modules on and off. This provides the most economical way to control the system.

This UV disinfection system is designed to provide maximum dosage using low-pressure high intensity "AMALGAM" output technology at peak flow at end of lamp life. System has been designed based on calculations as outlined in the EPA design manual.

System is to be installed in pre-poured concrete channels. All supports will be provided. Anchorages will be provided by others and should be stainless steel.

SCOPE

TYPE	Vertical
CHANNEL TYPE	Poured Concrete
NUMBER CHANNELS	1
MODULES PER CHANNEL	6
LAMPS PER MODULE	40
TOTAL LAMPS PER CHANNEL	240
TOTAL LAMPS PER PROJECT	240
LEVEL CONTROL	Fixed Finger Weir

Modules will hold lamps in a vertical position in a channel. An automatic air driven cleaning system will be provided. This will lower maintenance costs as well as improve system performance. System requires an air compressor. Compressor will be rated at 60 to 90 psi. If plant air exists, then it can be incorporated.

The Modules will be connected to a Power Distribution Center (PDC) through watertight cables. The plant electrician will bring protected power to the PDC.

Each module will contain and display through a window kit located in the top of the module: the UV monitoring system, L.E.D. lamp on/off indicators, elapsed running time meter, on/off switch, electronic ballasts and other electrical controls.

All materials exposed to the effluent will be stainless steel and quartz. All other materials exposed to UV light will be stainless steel, GE type 214 quartz, Teflon, Viton, EPDM and EPR.

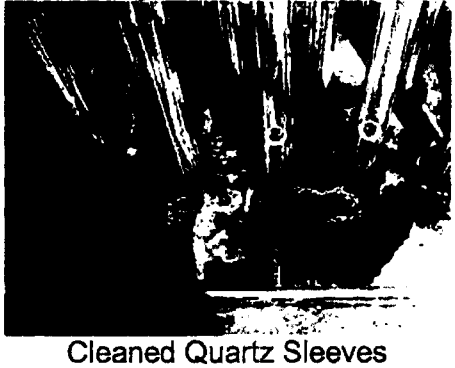
MAINTENANCE

In order to insure proper disinfection, the system needs to be maintained. Each UV system has lamps that are protected by quartz sleeves. Since the lamps produce heat and since the effluent has solids, the quartz sleeves can become fouled. This necessitates a cleaning regime that will be determined by plant operating conditions.

Automatic Cleaning

To automate the cleaning process, an air driven cleaning system has been incorporated. The system is operated using plant compressed air or via a dedicated air compressor. An air-driven piston will push the quartz wiping system over the arc length of the UV lamp. The cleaning system is comprised of a stainless steel fitting housing an EPDM ring. The "quick-stroke" approach prevents build-up and also prevents dragging of material over the sleeve.

Dirty Quartz Sleeves



Cleaned Quartz Sleeves

ELECTRICAL PER MODULE

Power consumption per system:	14 kW
Voltage:	230 volt single phase
Hertz:	50/60
Amp draw:	70

SYSTEM CONTROLS AND DISPLAYS

UV monitors:	One (1) per module
Lamp indicators:	Forty (40) per module
Running time meter:	One (1) per module
Flow pacing system	One (1) per module
Main PLC:	Allen Bradley Micrologix 1100

UV LAMPS

Lamp watts:	320
UV watts @ 254 nm:	110
Quantity per module:	40
Lamp spacing:	4.0"
Lamp life:	12,000 hours
Lamp treatment:	Internal coating
Arrangement:	Staggered

QUARTZ SLEEVES

Material:	Pure fused quartz
Seals:	Viton
Transmission:	94%
Type:	GE TYPE 214
Style:	Open on one end

SPARE PARTS

While the system has been designed to be maintained on a regular schedule and undergo component replacement on a yearly basis, Siemens recommends having spare parts on site for unforeseen occurrences.

10 %	UV Lamps	(16)
10 set	Quartz sleeves	(10)
10 set	O-rings	(10)
10 set	Wiper rings	(10)

WARRANTY

All metal and structural components will be guaranteed for a period of five (5) years. All electrical components will be guaranteed for a period of one (1) year. Lamps have a pro-rated warranty of one (1) year.

ESTIMATED SHIPMENT

Submittals	6-8 weeks after order
Equipment Delivery	12-14 weeks after approval

DELIVERABLES:

Six (6)	UV Modules (240 total lamps)
Six (6)	Bracketing systems
Six (6)	Automatic cleaning systems
Six (6)	Ultraviolet monitoring systems
One (1)	Power Distribution Center
One (1)	System Control Center (Allen Bradley PLC)
One (1)	Air compressor
One (1)	Wireway
One (1)	Weir sized for peak of 24 MGD
One (1)	Set of spare parts
One (1)	Hoist
One (1)	Crating
One (1)	Shipping
One (1)	Start up

PRICING

Total Price, FOB Shipping Points.....**$ 370,000**

Siemens Water Technologies

John Rutledge
Technical Sales Manager- UV

[redacted]

SIEMENS WATER TECHNOLOGIES HYDRAULIC ANALYSIS

MCKEESPORT, PA WWTP

SYSTEM: VE-40-A300-3X2-AW

VE-40-A300-3X2-AW	Open Channel Vertical System
Peak Flow Rate:	24 MGD
Number of Channels:	1
Number of Modules per channel	6

1a) Determine open area of the channel:

Channel dims:
Width = 90.0"
Depth = 60.5"

Open area of channel: 90.0 in X 60.5 in = **5445 in^2**

1b) Determine area of UV equipment:

Area of support legs = 1.5 in X 60.5 in X 6 = **544.5 in^2** ✓
Area of wiper blades = .50 in 25.25 X 6 = **75.0 in^2** 75.75
Area of wiper rods = 20 X .5 X 6 = **60 in^2** ✓
Area of air cylinder = 2 in by 24.0 in X 3 = **144 in^2** ✓
Area of quartz sleeves = .985 X 21 X 60.5 = **1245 in^2** 1251.5

1c) Determine net open channel flow area:

75.75 1251.5 2075.25
544 in^2 + ~~75.0~~ + 60.0 in^2 + 144.0 in^2 + ~~1245~~ in^2 = ~~2068~~ **in^2**

5445 in^2 – ~~2068~~ in^2 = ~~3377~~ in^2 /1550 m^2/in^2 = 2.1 **m^2**
2075.25 = 3369.75 → 3369 in^2 = 23.4 SFT.

2) Determine the maximum velocity in the channel at 24.0 MGD

$$V_{channel} = \frac{\text{(Q) Total Flow Rate}}{\text{(\# of channels)}\ (A_{channel})(1000L/m^3)(\ 60s/min)}.$$

$$V_{channel} = \frac{63{,}083\ \text{l/min}}{(2.1)(1000L/m^3)(\ 60s/min)}.$$

$V_{channel} =$ **.500 m/s**

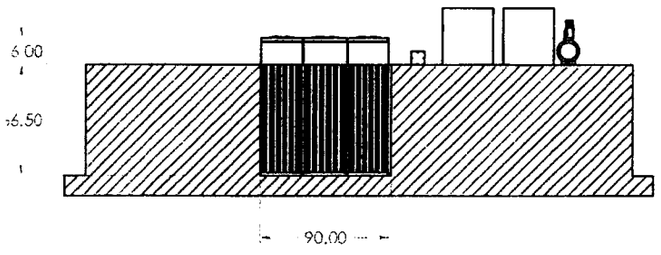
3) Determine the headloss in the channel for 24 MGD:

$$H_{channel} = \frac{1.8\ V^2}{2\ g}$$

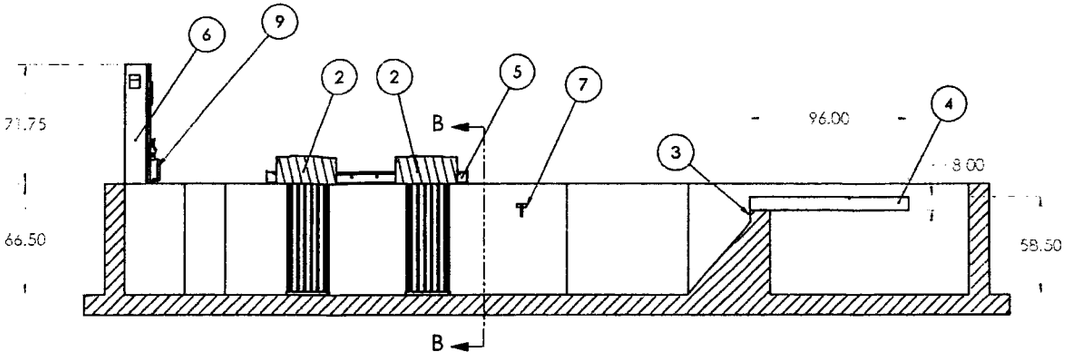
$$H_{channel} = \frac{1.8\ (.500^2\ (1000mm/m)}{2(9.81)}\ X\ 2\ (\#\ \text{modules}) = 45.87\ \text{mm}$$

$H_{channel} =$ = 45.87 mm = 1.8 **in total headloss at 24 MGD**

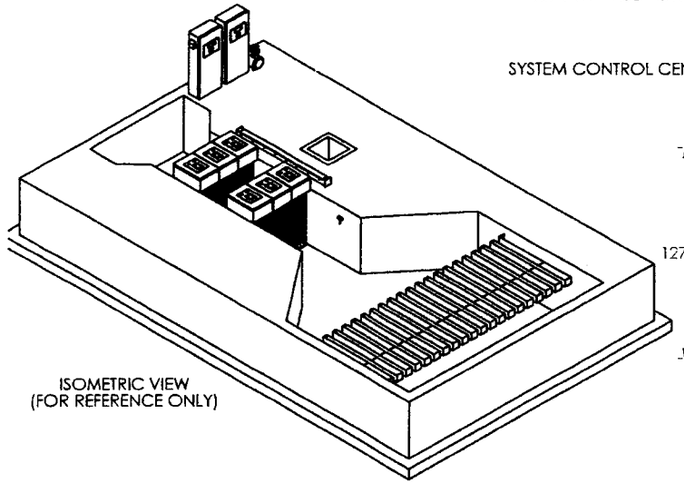
Prepared by Joseph Yelpo
Dec. 11, 2007



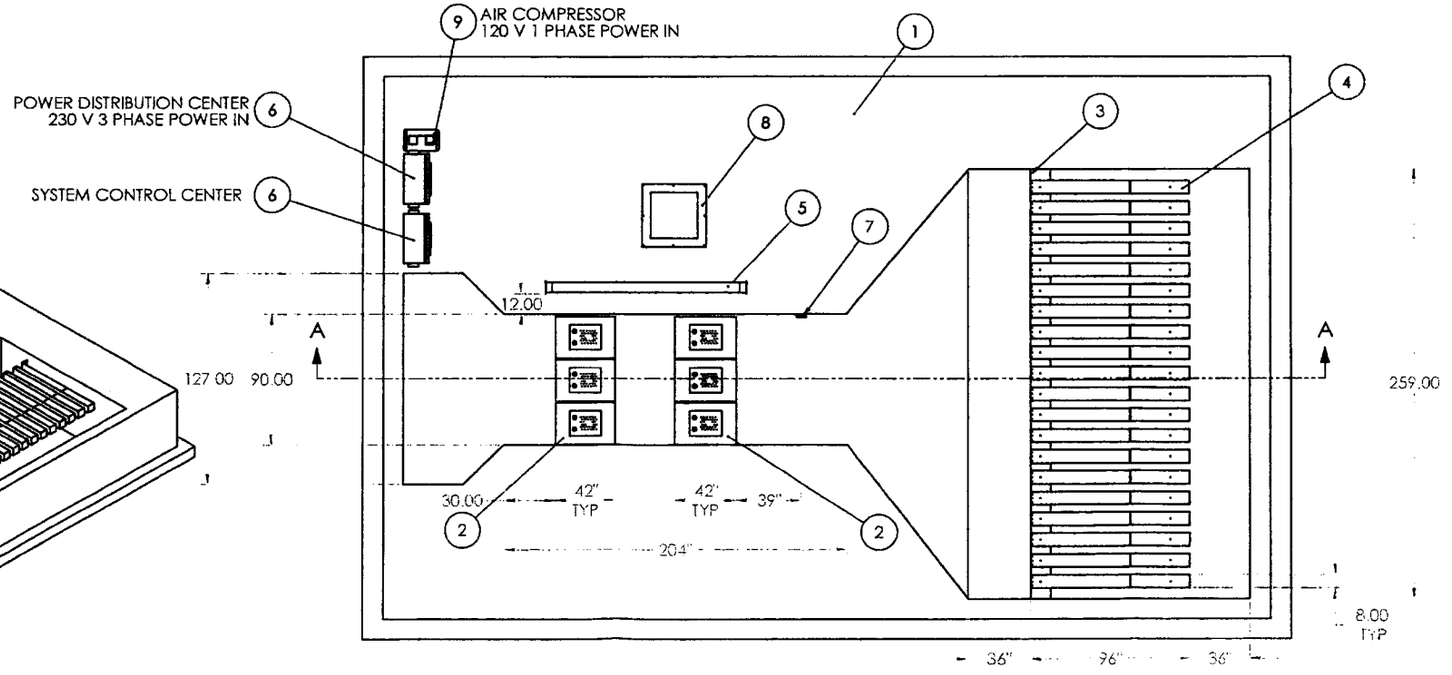
SECTION B-B
SCALE 1 : 40



SECTION A-A
SCALE 1 : 40



ISOMETRIC VIEW
(FOR REFERENCE ONLY)



ITEM NO.	PART NUMBER	QTY.
1	CHANNEL - UV EQUIPMENT	1
2	LAVA 40000 EQUIPMENT	6
3	WEIR DAM PLATE	1
4	FINGER WEIR	20
5	WIRING TROUGH	1
6	ENCLOSURE	2
7	V LEVEL WATER SENSOR	1
8	ANING TANK	1
9	R550	1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF COATINGS
TOLERANCES ON ALL SURFACES
1-PLACE DECIMALS ± .030
2-PLACE DECIMALS ± .015
3-PLACE DECIMALS ± .005
FRACTIONS ± 1/8"
ANGLES ± -
DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ANSI Y14.5M

DESIGNER	S. MARTIN	DATE 12/25/07
CHECKER		DATE
ENGINEER		DATE
MANAGER		DATE

TITLE: BARRIER - VE-40-A300-3X2-AW: UV EQUIPMENT DETAIL

CLIENT:

SIEMENS Water Technologies
Allendale New Jersey
201-760-0364

KLH
ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT MACM Act 537 Project JOB NO. 220-38
MWTP Expansion: Aerobic Digesters SHEET NO. 1 OF .....
COMPUTED BY KDH DATE 11-28-07

GOALS: 1) DESIGN AEROBIC DIGESTERS FOR MACM MWTP
2) DETERMINE IF PRIMARY CLARIFIERS HAS SUFFICIENT $\forall$ OL FOR THIS CAPACITY. IF NOT, IF BASIN DEPTH IS INCREASED CAN BASINS FUNCTION AS DIGESTERS

GIVEN:

SLUDGE FLOW FROM EXISTING PROCESS: 4522 #/D = 54,200 @ 1% (10,000 mg/L)
SLUDGE FLOW FROM SBR PROCESS: 1227 #/D = 18,391 @ 0.8% (8000 mg/L)

TOTAL WASTE TO DIGESTER
#/D = 5750 #/D
GPD = 72,600 gpd = 9705 cf/D
CONCENTRATION = 9,500 mg/L (0.95%)
TEMP = 10° C MIN = 50°F

GOAL TO THICKEN TO 1.8% BY VOLATILE SOLIDS REDUCTION
ACHIEVE 40% VOLATILE SOLIDS REDUCTION
3425 #/D OR 60% WAS IS VOLATICE MATTER

$$\forall = \frac{Q_i (X_i + Y S_i)}{X (k_d P_v + 1/SRT)}$$

WHERE Q_i: SLUDGE FLOW CF/D
X_i = 9,500 mg/L
X = 18,000 mg/L
Y = 0 } B/C NO PRIMARY SLUDGE
S_i = 0 }
k_d 0.02 - SEE FIG 3.1 FROM WEF MOP FD-9 1985
P_v = 0.6 - % VOLATICE
SRT: 48.0 DAYS - REF FIG. 3.2 WEFMOP FD-9 1985
WHERE 40% VSRED. = 480 RT.°C

$$\forall_{OL} = \frac{9,705 (9500 + 0)}{18000 (0.02 \times 0.6) + (1/48)} = 156,002 \text{ FT}^3$$
$$= 1,166,980 \text{ GAL}$$

$$HRT = \frac{1,166,980 \text{ GAL}}{72,600 \text{ GPD}} = 16 \text{ DAYS}$$ ✓ w/ TYP DESIGN VALUES 12-18 DAYS

PRIMARY CLARIFIER & FLOC TANK VOL.

PRIMARY CLARIFIERS:	125 x 29 x 9.5* x 4	= 137,750
FLOCCULATION TANKS:	28 x 29 x 11.33* x 4	= 36,800
		174,550 FT³

* SWD.

$\forall_{PC/FT} > \forall_{DIGRED'D}$

→ AVE DEPTH = $\frac{156,002}{174,550} \times 9.5 = 8.5$ FT

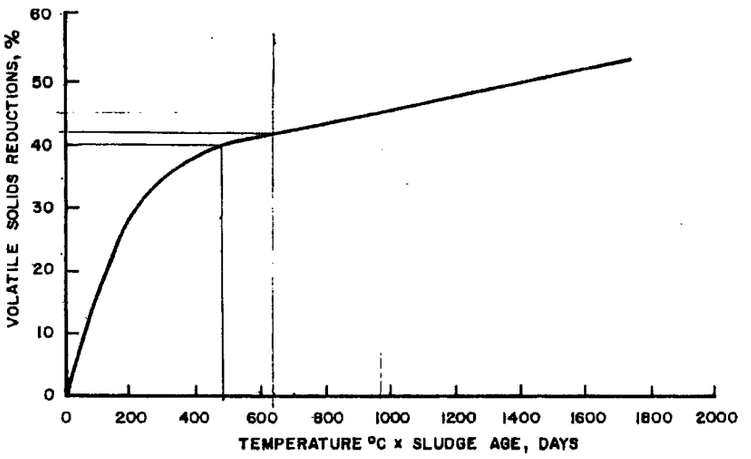


FIGURE 3.2. Volatile solids reduction as a function of digester liquid temperature and digester sludge age.

The data presented in Figure 3.2 can be used to compute a required sludge age given a desired level of volatile suspended solids reduction and an assumed operating temperature. The required digester volume is then determined by:

$$V = \frac{Q_t(X_t + YS_t)}{X(K_d P_v + 1/SRT)} \tag{8}$$

where

th[illegible] deterioration in the aerobic digestion process at high[illegible]
[illegible]es has been attributed to the theory th[illegible] classical biological kinetics do not apply at temperatures in excess of 35 to 40°C.

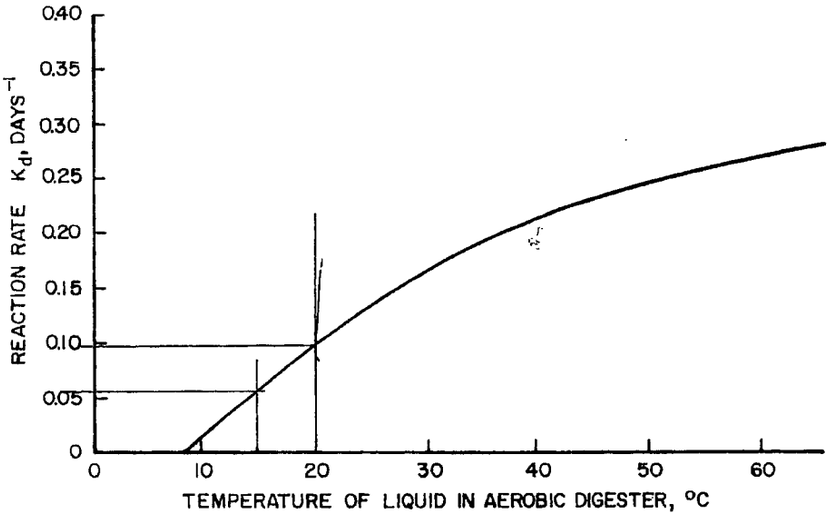


FIGURE 3.1. Reaction rate K_d versus aerobic digester liquid temperatures.

KLH
ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT MACM: Act 537 Projects JOB NO. 220-38
WWTP Expansion: Aerobic Digesters SHEET NO. 4 OF
COMPUTED BY KDH DATE 11-28-07

AIR REQUIREMENTS.

TOTAL MASS WASTED: 5,750 #/D

TO ACHIEVE 40% VS REDUCTION IN WINTER (10°C ASSUMED TEMP)
SRT-TEMP = 480 ⇒ SRT = 48 DAYS SEE FIG 3.2 MOPG

IN SUMMER - ASSUME T = 20°C AT 480 DAYS
TEMP SRT = 960 = VS % REDUCTION OF 45 %

TOTAL MASS VSS = 2797 + 628. = 3425 #/D.

MASS REDUCTION
WINTER = 3425 x 0.4 = 1370 #/D
SUMMER = 3425 x 0.45 = 1541.25 #/D.

O_2 REQUIRED.

WINTER 1370 x 2.3 = 3151 # O_2 /D.
SUMMER 1541.25 x 2.3 = 3545 # O_2/D ← GOVERNS.

AIR REQUIRED.

$$\frac{3545\ \#O_2/D}{(0.075)(0.232)} = 203,735\ FT^3/D.$$

ASSUME 10% OTE.

$$\frac{203,735}{(0.1)(1440)} = 1415\ CFM$$

CHECK FOR MIXING:

1415 CFM ÷ 156,000 FT^3 = 9.07 CFM/1000 CFT

DEP REQUIRES MIN 30 CFM/1000 CF.
∴ MIXING DEFICIENT.

SO DESIGN AIR FOR MIXING

17455 x 30 CFM = 5,236.5 CFM

KLH
ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT MACM · Act 537 - WWTP Expansion JOB NO. 220-33
Aerobic Digesters SHEET NO. 5 OF
COMPUTED BY KDH DATE 12-4-07

CHECK #/D FOR CHEMICAL PRECIP SLUDGE ASSOCIATED
. W/ PHOSPHORUS REMOVAL.

#/D WASTED = 5007 + 1227 = 6234
GPD = 78682 = 10520 CF/D.
CONCENTRATION = 9500 mg/L
TEMP = 10° C

$$\# = \frac{10{,}520\,(9500+0)}{18{,}000\,(6.02)(.6)+(1/48)} = 169{,}103.\ FT^3$$

$\#_{PC/FT} > V_{DIGREQ.}$ ✓ O.K.

KLH
ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205

SUBJECT MACM ACT 537 - WWTP EXPANSION — JOB NO. 220-33
AEROBIC DIGESTERS - AIR — SHEET NO. 6 OF
COMPUTED BY KDH — DATE 12-17-07

NEED 5,236.5 CFM FOR MIXING

MAX DEPTH - 11.33 FT

ASSUME LOSSES THRU:
DIFFUSERS - 1.5 FT
LATERALS - 0.5 FT.
2 FT.

STATIC 11.33 FT

SUBTOTAL - 13.33 FT = 5.77 psig

PIPING LOSSES

	CFM	LOSS
MAIN - 16" GALV.	5240	0.052 /100 FT.
10"	2620	0.18 /100 FT
8"	2620	0.52 / 100 FT
6"	2620	2.3 /100 FT

MAIN

16" → 216 x 0.052/100 = 0.11 FT
10" → 60' X 0.18/100 = 0.11 FT. } > 0.22 FT. = 0.1 psig.

16" - 70 IN YD. + 20 IN BLD + 3-90°

5.8
+ 1 psig OVERPRESSURE
6.8

ASSUME 2 UNITS @ 8psig
5240

Friction Loss Chart

This chart may be used to compute friction losses in a piping system. For example, determine the friction loss incurred when 70 CFM flows through a 2" pipe, 50' long.

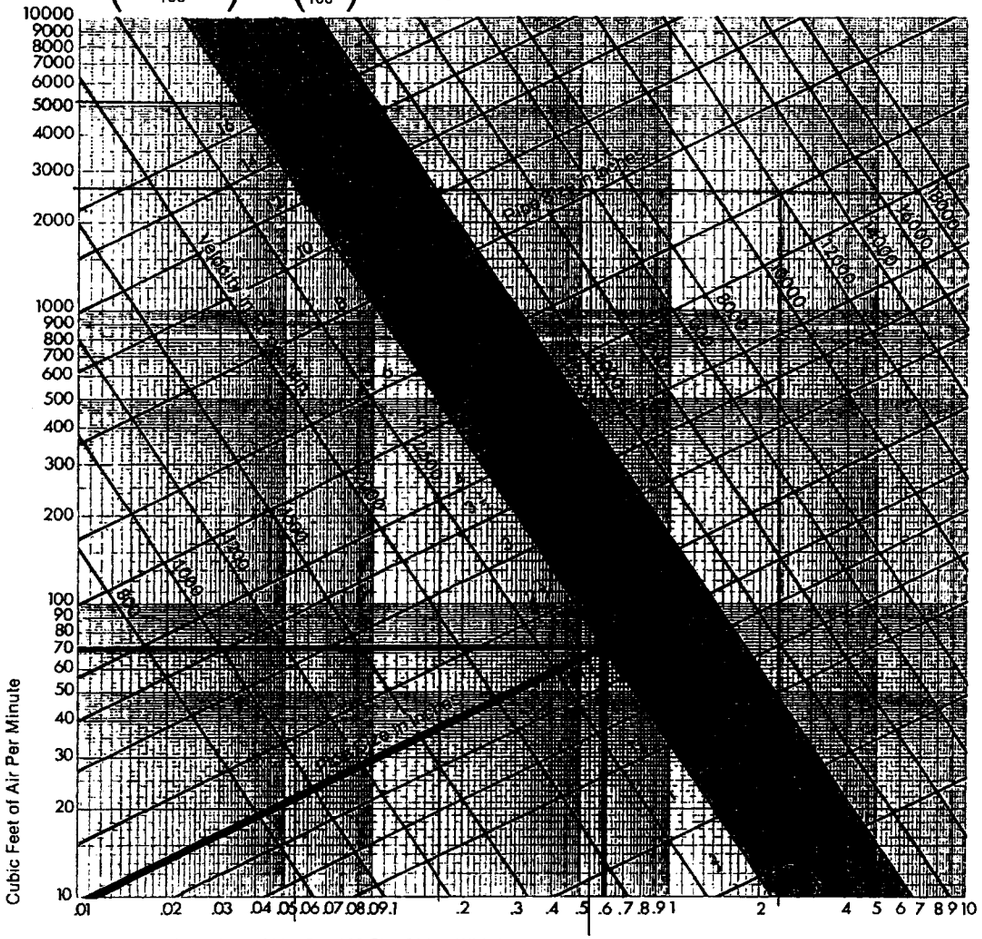
Step 1: Intersect 70 CFM and the sloping line for 2" pipe as shown.

Step 2: Drop a vertical from this point of intersection and read the loss/100' of line, in this case, .60Hg/100'.

Step 3: Multiply the loss/100' of line by the length of run/100'. The loss for 50', then, is

$$.60\left(\frac{\text{length of run}}{100'}\right) = .60\left(\frac{50'}{100'}\right) = 0.30'' \text{ Hg.}$$

Also: Velocity in the line may be read from the negatively sloping lines on the graph. Here, to get 70 CFM through a 2" line, the air must travel at a velocity of approximately 3000 FPM.



Friction Loss in Inches of Hg. Per 100 Ft. of Line With Inlet Air at 70° F. and 14.7 P.S.I.A

Environmental Dynamics Inc.
5601 Paris Road Columbia, MO 65202-9399
TELEPHONE (573) 474-9456 FAX (573) 474-6988

January 7, 2008

Mr. Dennis Telleck
Learco Equipment Co.
1373 McLaughlin Run Road
Pittsburg, PA 15241

RE: MACM WWTP - McKeesport, PA
Aerobic Digester Basins upgrade
EDI FlexAir™ and MaxAir™ Aeration-Mixing System

Dear Dennis:

Environmental Dynamics Inc. (EDI) appreciates receiving the design request for the upgrade of eight digesters at the MACM WWTP, located in McKeesport, PA. EDI has a tremendous amount of experience in the aeration field and I think you will find the proposed system to be economically feasible and attractive in your application. A preliminary process review and aeration system design has been prepared for your review.

Process Review:
EDI understands that at this facility, there are 4 pre-aeration basins and 4 primary clarifiers to be converted into aerobic digesters. EDI is proposing two options using flexible membrane and PVC wide band coarse bubble diffusers for this project. This equipment will result in excellent process performance, adequately sized aeration capacity, superior mixing, and optimized power consumption.

Each pre-aeration basin has dimensions of 28 feet x 29 feet x 11.33 feet SWD and each clarifier has dimensions of 125 feet x 29 feet x 9.5 feet SWD.

The following design option was provided:

Airflow = 5,240 scfm (8 basins)

Traditional aerobic digester mixing parameters require the aeration system to be capable of producing 30 SCFM per 1000 cubic feet of basin volume with the largest blower out of service. This design parameter closely follows the "Ten State Standards" which were written around coarse bubble diffusers when the tanks were basically in the 8-10 ft SWD range. However, based upon almost 20 years of experience, EDI has determined that using flexible membrane diffusers at an airflow rate of 0.25 scfm per square foot of floor area will provide proper mixing conditions with sludge suspended solids content less than 3.5% and with the diffusers in a grid configuration.

EDI has analyzed the oxygen requirements of the system to provide adequate MLVSS reduction. The airflow required for VSS reduction is less than the required mixing airflows. EDI recommends supplying a maximum of 30 scfm per 1000 cubic feet of basin volume to provide a

completely mixed environment at peak conditions, this meets the given airflow of 5,240 scfm, distributed with 1,104 scfm going to the pre-aeration basins and 4,132 scfm to the clarifiers.

It is also proposed that the average design condition and recommended operating condition be based upon 0.25 scfm per square foot for the flexible membrane system, this corresponds to an airflow of 812 scfm for the pre-aeration basins and 3,625 scfm for the clarifiers.

Diffuser Selection and System Design:

EDI recommends the FlexAir™ Magnum diffuser for the digester basin. This diffuser offers high oxygen transfer capabilities with the added advantage of maximum fouling or clogging resistance for minimum maintenance. We have extensive field experience with these diffusers and have numerous field installations demonstrating the excellent mechanical and process performance capabilities of the diffusers. We have also presented a design using the EDI MaxAir™ coarse bubble diffusers for the proposed digester

The FlexAir and MaxAir diffusers offered on this project employ several unique features that offer a high degree of mechanical integrity for the Client and ease of installation for the Contractor. Specifically, the following features are provided:

- Employs standard PVC piping for ease of handling and installation. Piping components are provided with flanged joints at all field connections. Piping sections are prefabricated at the factory and are shipped in maximum allowable lengths. Prefabricated header sections include factory drilled diffuser outlet ports.

- Provision of PVC piping and patented Spectrum™ diffuser mounting system provides a high degree of mechanical integrity. The mounting system offered will withstand 4,800 in-lbs of applied load with no mechanical failure. This mechanical integrity is superior to all competing tube and disc mounting systems offered in the industry.

- Factory assembled diffuser assemblies are provided with diffuser units and Spectrum mounting bracket. The only installation required is to clamp the assembly on the air header piping.

- The physical size of the FlexAir and MaxAir diffuser assembly and the high degree of preassembly provided minimizes the installation requirements for these systems.

The airflow and corresponding number of diffusers per basin, are shown below, also a generic layout for each option is attached.

DIFFUSER SYSTEM OPTION	DIGESTER BASIN					
	PRE-AERATION (28' x29' x11.33')			CLARIFIER (125' x29' x9.5')		
	AIRFLOW (SCFM)	# OF DIFFUSERS	AIR PER DIFFUSER (SCFM)	AIRFLOW (SCFM)	# OF DIFFUSERS	AIR PER DIFFUSER (SCFM)
Flex Air - Magnum 84P (flexible membrane)	peak: 276 ave: 203	24 units (12 assemblies)	peak: 11.5 ave: 8.46	peak: 1033 ave: 907	100 units (50 assemblies)	peak: 10.33 ave: 9.07
PVC MaxAir Simplex	276	18 units	15.33	1033	72 units	15.33

The FlexAir™ Model 84P diffuser assembly employs two Magnum tubes per assembly mounted in a duplex arrangement with the patented Spectrum™ Saddle Mount Assembly. Please note that using the Magnum Diffuser system, the airflow per tube for peak can be reduced to the average use, this will allow considerable energy cost savings.

The PVC MaxAir™ Simplex diffuser employs one MaxAir™ tube, mounted with the patented Spectrum™ Saddle Mount Assembly. Details and specifications of all diffusers are enclosed for your reference.

Budget Costs:
The budget cost for this application is $98,150 USD for the FlexAir™ option and $ 102,990 USD for the MaxAir™ system, total for the 8 basins. These prices include all in-basin aeration components starting at the top of the stainless steel drop pipe. An allocation for freight and field service is also included in these prices.

Mr. Telleck, thank you for your interest in our products. Please contact EDI for any additional information regarding our products or the design developed for this application.

Sincerely,

Carolina Ausmus
Application Engineer

Attachments:
System and Diffuser Details

5601 Paris Road
Columbia, MO 65202
Phone: 573-474-9456
Fax: 573-474-6988

Preliminary Project Drawing

Requested by : Sales
Title: McKeesport, PA (digester upgrade)
Requested Due Date: ____

Submitted Date: January 7, 2008
Submitted by: Carolina Ausmus
Project Number: (if applicable) N/A

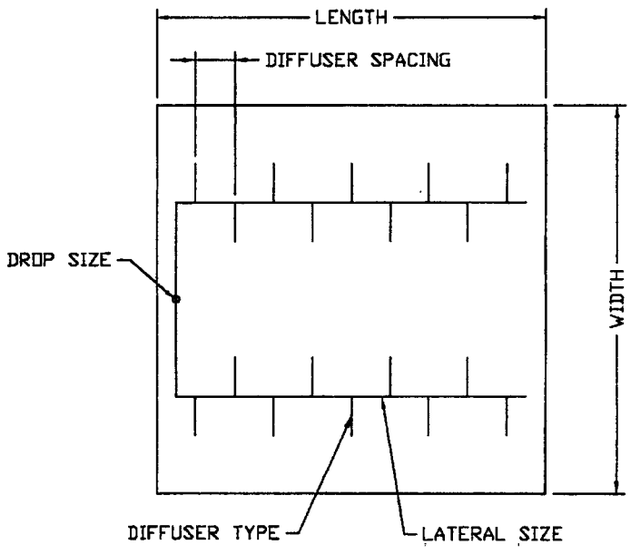
Drawing Type:
☐ Mktg. ☐ Lab ☒ Proposal ☐ Submittal ☐ Final Con. ☐ Fabrication ☐ R&D ☐ Re-Work ☐ Revision ☐ Production ☐ Misc.

Technical Reference:

Diffuser Type: PVC MaxAir Simplex Diffuser Assembly
Number of Diffusers: 18
Submergence Depth: 10.33
Liquid Depth: 11.33

Basin Length: 28 **Basin Width:** 29
Basin Diameter: ____ **No. of Basins:** 4
Diffuser Spacing: 3.11 **Drop Size:** 4
No. of Laterals: 2 **Lateral Size:** 4

Special Comments: ____



Disclaimer: Generic Image Only – Final Proposal/Submittal Drawing(s) may differ from generic sales image.

5601 Paris Road
Columbia, MO 65202
Phone: 573-474-9456
Fax: 573-474-6988

Preliminary Project Drawing

Requested by : Sales
Title: McKeesport, PA (digester upgrade)
Requested Due Date: ____

Submitted Date: January 7, 2008
Submitted by: Carolina Ausmus
Project Number: (if applicable) N/A

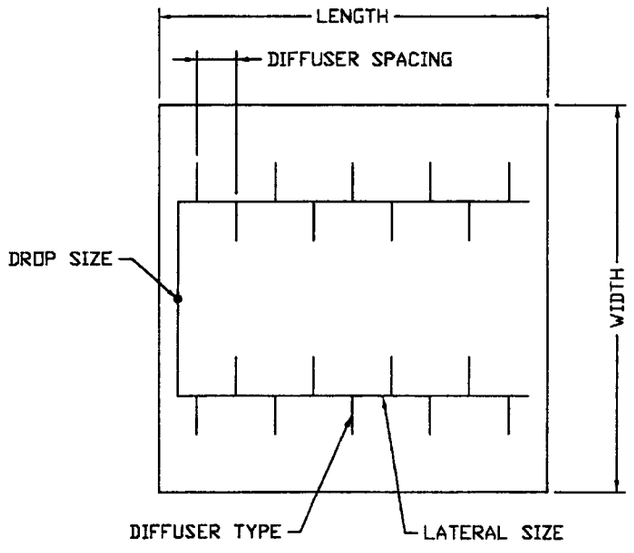
Drawing Type:
☐ Mktg. ☐ Lab ☒ Proposal ☐ Submittal ☐ Final Con. ☐ Fabrication ☐ R&D ☐ Re-Work ☐ Revision ☐ Production ☐ Misc.

Technical Reference:

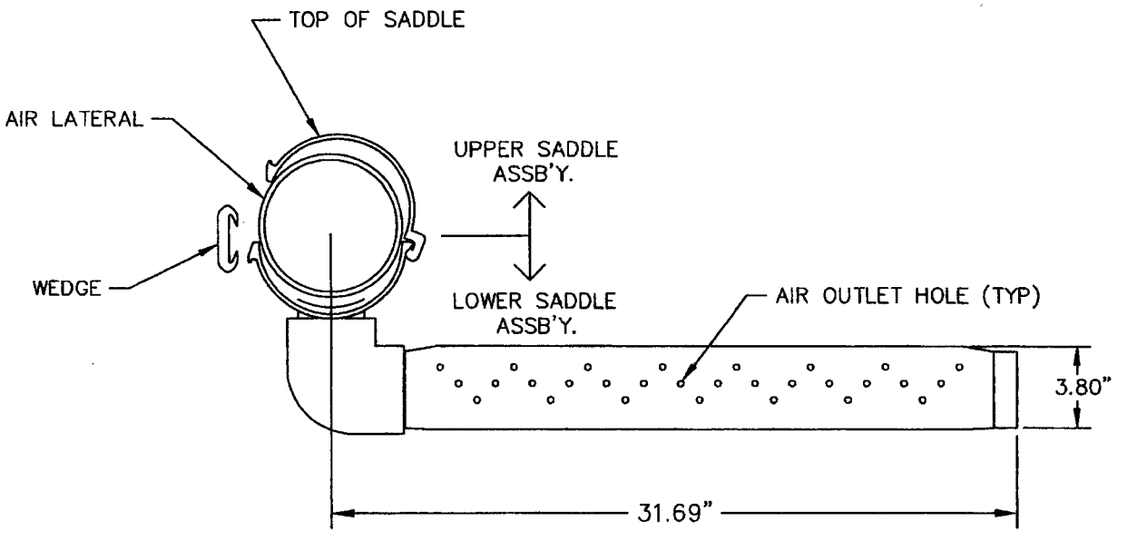
Diffuser Type: PVC MaxAir Simplex Diffuser Assembly
Number of Diffusers: 72
Submergence Depth: 8.5
Liquid Depth: 9.5

Basin Length: 125 **Basin Width:** 29
Basin Diameter: ____ **No. of Basins:** 4
Diffuser Spacing: 3.47 **Drop Size:** 8
No. of Laterals: 2 **Lateral Size:** 6

Special Comments: ____



Disclaimer: Generic Image Only – Final Proposal/Submittal Drawing(s) may differ from generic sales image.



NOTES:
BOTTOM SADDLE ASSEMBLY FACTORY ASSEMBLED AND CONTAINS:
- BOTTOM OF SPECTRUM™ SADDLE
- O-RING SEAL
- HEAVY WALL PVC BODY
- THREADED ENDCAP

MAXAIR SIMPLEX DIFFUSER ASSEMBLY		ENG. BY:	DWG. BY: TEM
TYPICAL INSTALLATION DETAIL		REV	DATE
DATE: 9-7-95	SCALE: N.T.S.	DWG NO:	7764

ENVIRONMENTAL DYNAMICS INC.
5601 PARIS ROAD
COLUMBIA, MISSOURI 65202
PHONE: 573-474-9456
FAX: 573-474-6988
WWW.WASTEWATER.COM

5601 Paris Road
Columbia, MO 65202
Phone: 573-474-9456
Fax: 573-474-6988

Preliminary Project Drawing

Requested by : Sales
Title: McKeesport, PA (digester upgrade)
Requested Due Date: ____

Submitted Date: January 7, 2008
Submitted by: Carolina Ausmus
Project Number: (if applicable) N/A

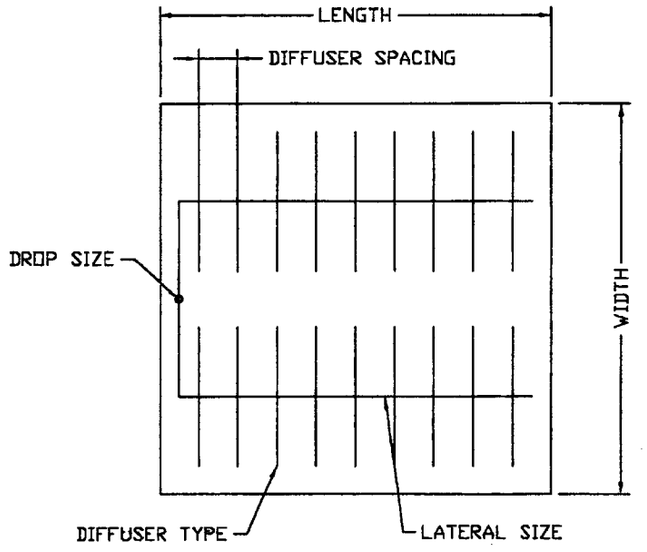
Drawing Type:
☐ Mktg. ☐ Lab ☒ Proposal ☐ Submittal ☐ Final Con. ☐ Fabrication ☐ R&D ☐ Re-Work ☐ Revision ☐ Production ☐ Misc.

Technical Reference:

Diffuser Type: FlexAir® 84P Magnum Assembly
Number of Diffusers: 24
Submergence Depth: 10.33
Liquid Depth: 11.33

Basin Length: 28 **Basin Width:** 29
Basin Diameter: ____ **No. of Basins:** 4
Diffuser Spacing: 4.67 **Drop Size:** 4
No. of Laterals: 2 **Lateral Size:** 4

Special Comments: ____



Disclaimer: Generic Image Only – Final Proposal/Submittal Drawing(s) may differ from generic sales image.

5601 Paris Road
Columbia, MO 65202
Phone: 573-474-9456
Fax: 573-474-6988

Preliminary Project Drawing

Requested by : Sales
Title: McKeesport, PA (digester upgrade)
Requested Due Date: ____

Submitted Date: January 7, 2008
Submitted by: Carolina Ausmus
Project Number: (if applicable) N/A

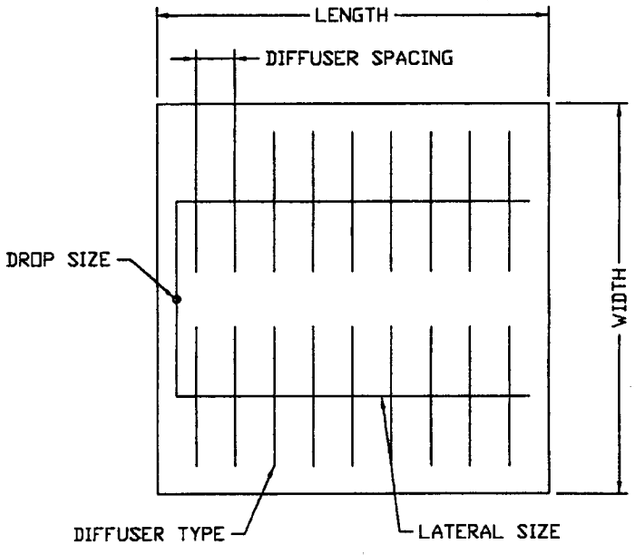
Drawing Type:
☐ Mktg. ☐ Lab ☒ Proposal ☐ Submittal ☐ Final Con. ☐ Fabrication ☐ R&D ☐ Re-Work ☐ Revision ☐ Production ☐ Misc.

Technical Reference:

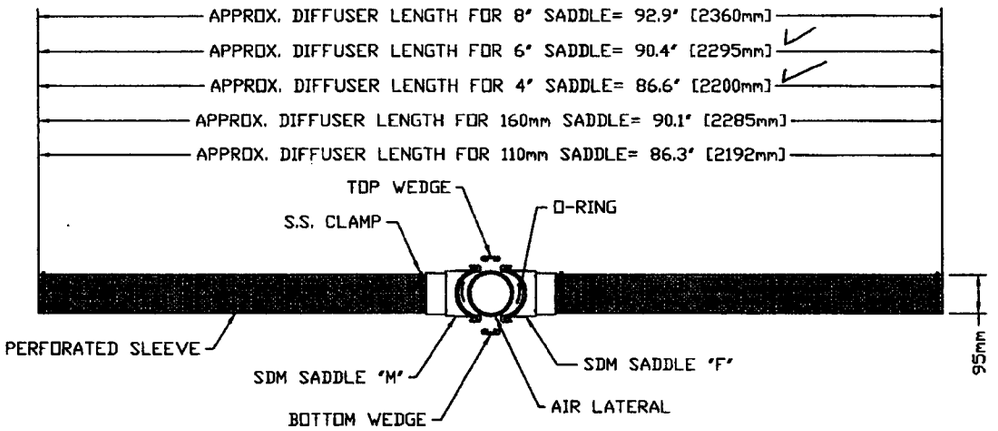
Diffuser Type: FlexAir® 84P Magnum Assembly
Number of Diffusers: 100
Submergence Depth: 8.5
Liquid Depth: 9.5

Basin Length: 125
Basin Width: 29
Basin Diameter: ____
No. of Basins: 4
Diffuser Spacing: 5
Drop Size: 8
No. of Laterals: 2
Lateral Size: 6

Special Comments: ____



Disclaimer: Generic Image Only – Final Proposal/Submittal Drawing(s) may differ from generic sales image.



NOTES:

A ACTIVE PERFORATED AREA= 732IN² (0.47m²)
NORMAL AIRFLOW RANGE= 6-40 scfm (10-68nm³/h)
PEAK AIRFLOW CAPACITY+ 68 scfm (116nm³/h)

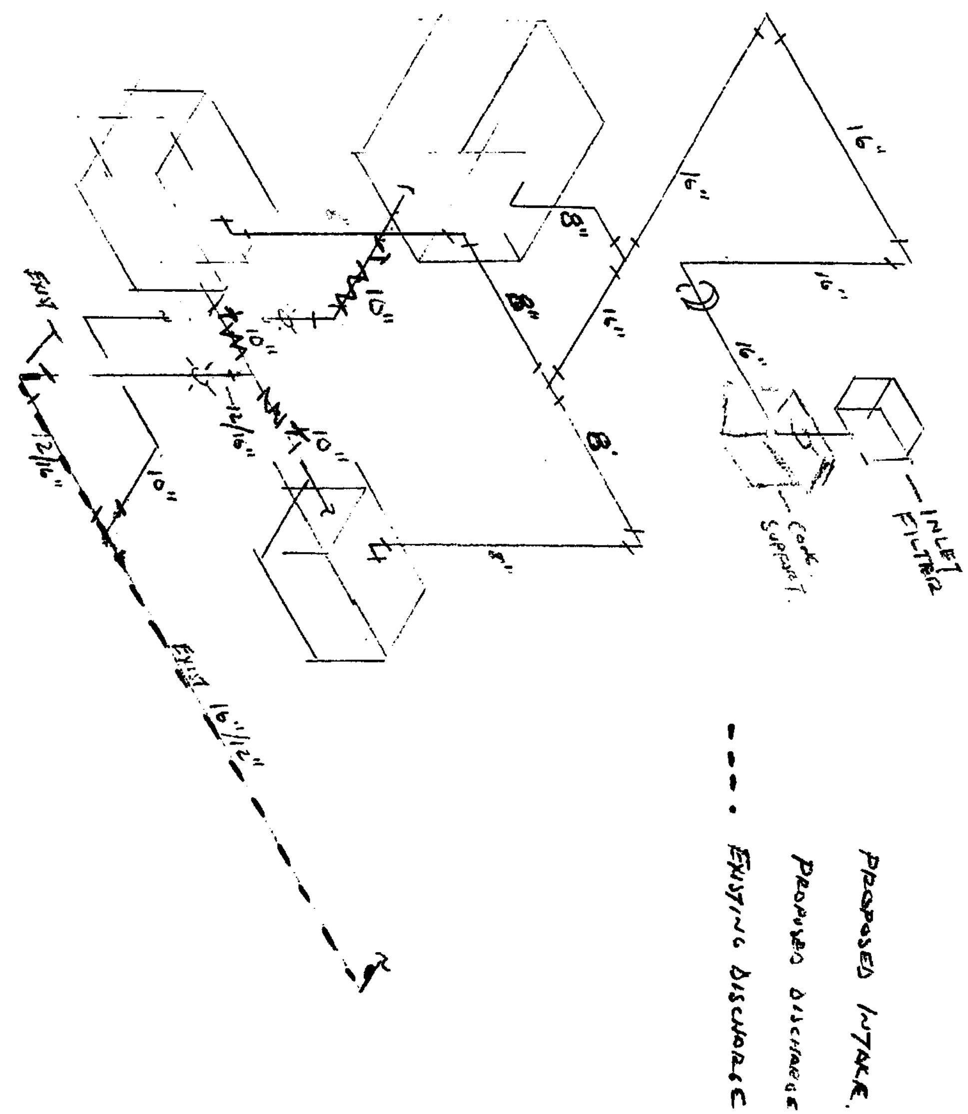
ENVIRONMENTAL DYNAMICS INC.
5601 PARIS ROAD
COLUMBIA, MISSOURI 65202
PHONE: 573-474-9456
FAX: 573-474-8988
WWW.WASTEWATER.COM

FLEXAIR MAGNUM 84P DIFFUSER ASSEMBLY
WITH SPECTRUM SDM CENTERLINE SADDLE
SALES DRAWING

DRAWN BY: M. BROOKS	CHECKED:		ENG: B. FROEBEL
DATE: 06/24/04	REV LEVEL: A		REV DATE: 03/17/06
SCALE: N.T.S.	PAGE NO. 1 OF 1		DRAWING NO. 21375

KLH
Engineers, Inc.
5173 Campbells Run Road
Pittsburgh, PA 15205

Subject: MACM. Act 537 Projects: WWTP Exp. Digester Blower Rms. Job No. 230-33
Sheet No. 1 of
Computed By: KDH Date: 1-16-07



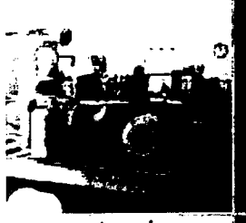
The Original Manufacturer

UNIVERSAL

The Universal *Difference*

The Right People

In the last 25 years we've learned that selling blower packages involves more than a firm handshake and a trusting smile. Effectively sell custom engineered products requires people who understand the process from start to finish. That's why our sales team is comprised of people who are highly technical and have a firm grasp of the engineering, manufacturing and service aspects of the business.



Engineered Around You

We pride ourselves on engineering the right blower system for each customer. Doing so requires that we maintain our own CAD-based engineering department with multiple engineers on staff dedicated to blower system design. Our team of professionals evaluates each job on an individual basis so you're never forced to settle for anything less than the best.

Manufactured to Fit

Universal Blower Pac believes that the only way to guarantee quality is to establish complete control of product creation. That is why, in addition to engineering, we also manufacture all of our blower packages. This allows sales, engineering, and manufacturing to work together in meeting your expectations.

Service that Keeps You Running

Down-time can put your commitments in jeopardy. Universal Blower Pac understands the implications that go along with service issues, which is why we employ service technicians with decades of experience in solving problems of application installation, maintenance, etc. You can count on us, before, during and after the sale.

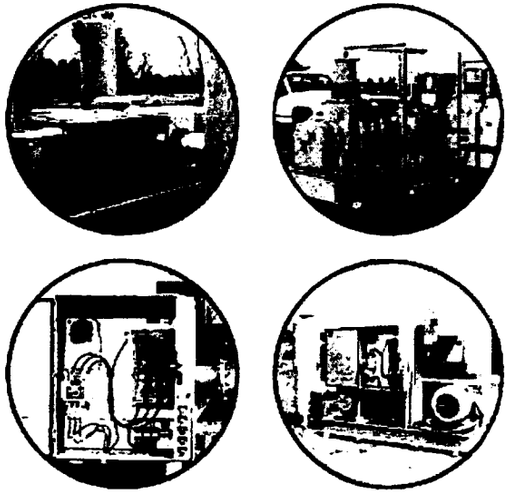
Warranties for your Piece of Mind

As with any capitol investment, you want to be sure the product you buy is going to last. We supply a one point warranty and service to solve all possible problems and issues. In addition, we maintain authorized reps for local service. Extended warranties are available for properly designed and maintained packages at little extra cost. You'll rest easy knowing the blower package you purchased will be around for the long haul.

Diverse Products *for a* Changing Market

At Universal Blower Pac we know in order to serve our clients we must remain flexible. For each application our blower packages must adapt to fit unique needs. That's why we've developed products to address the varying needs of the customers we serve. From affordable, compact units to the most powerful package, we will work to find the solution that best fits your goals.

- **Highly custom packages** meeting detailed specifications to **pre-engineered units** that will have you up and running in no time.
- **Innovative designs** for competitive pricing due to mass production and cost control, with in-house manufacturing.
- Specialized packages designed to serve specific industries.
- **Acoustical solutions** with dependable results offering variable performance levels and pricing depending on customer requirements.
- **Electrical interface control systems** – from simple monitoring to complex feedback variable frequency drives with programmable controls.



Talk to us and learn what it means to be "*taken care of*"

From inception, we'll work together to define your needs. Then, we'll custom design and manufacture a blower package that fits you.

Universal Blower Pac - *The Original Manufacturer*

440 Park 32 West Drive | Noblesville, IN 46062-9252 | PH 317-773-7256 | FX 317-776-5086
website: www.universalblowerpac.com | email: sales@universalblowerpac.com

UNIVERSAL BLOWER PAC, INC
The Original Manufacturer

January 10, 2008

Project: MACM

Customer: BissNuss, Inc.

Option 1: Two UBP Aerobic Digester Blower Packages

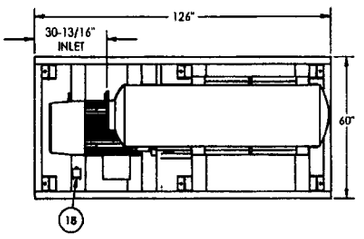
Notes:

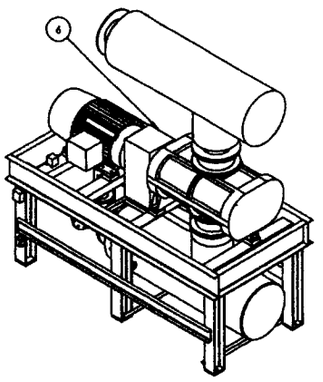
- This proposal is for two Universal Blower Pac packages utilizing 11CDL31 Cycloblowers and 300 HP NEMA frame motors.
- The attached drawing is from a similar project. This configuration can be modified to meet dimensional constraints or other customer needs.
- This blower uses a helical screw to move air versus a standard straight-lobed impeller. It gradually releases air through its discharge port resulting in a balanced compression cycle with little noise and pulsation. Its volumetric efficiency is also much better than a straight lobed machine at high pressure resulting in significant power savings.
- The blower and motor will be connected through use of a drive coupling. This eliminates lateral loading on the blower and motor shafts that shortens bearing life. It also eliminates v-belt maintenance and the 3-5% power transfer losses normally incurred with a v-belt drive.
- The unit's speed and flow are controlled with a variable frequency drive. We can achieve turndown to around 2000 SCFM.
- The unit will operate without an enclosure at an estimated noise level of 91 dBA at 1m in a free field. A partial Acousti-Pac enclosure will lower the noise level to 81 dBA.
- Specifications and CAD drawings are available.

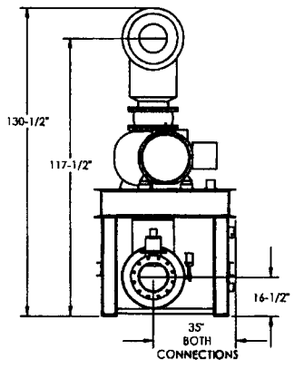
440 Park 32 West Drive | Noblesville, IN 46062-9252 | PH 317-773-7256 | FX 317-776-5086
website: www.universalblowerpac.com email: aplacek@universalblowerpac.com

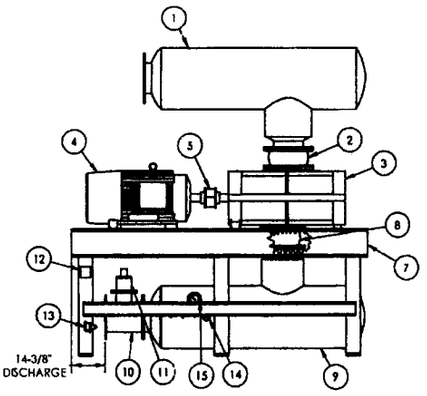
ITEM NO.	I NUMBER	DESCRIPTION	QTY.
1	[illegible] +2	Grade L inlet Silencer w/ oversized 14" flanges	1
2	14" 8 F-F	14" Single arch flex join!	1
3	11CDL27	CYCLOBLOWER	1
4	ECP440BT-4	250 HP, PE, 1EFC, 1800 RPM Motor w/ NC T-slats and 120V space heaters	1
5	10901	Steelflex T10 Drive coupling	1
6	CG070736	Coupling guard	1
7	B070738	A700 Blower / Motor base w/ motor rails	1
8	12" 8 F-F	12" flanged flex joint, 8" F-F w/ acoustical wrap	1
9	DRS-12	Grade L Discharge Silencer w/ lagging	1
10	12"	12" Pipe Spool	1
11	8"	Weighted Pressure Relief Valve	1
12	ESS-E238C	NEMA 4 remote temperature switch w/ 1/2" x 4" Stainless steel thermowell	1
13	J6-222	J6-222, 0-20 PSI Pressure Switch	1
14	T30025-B10	3", 50-400 F Temperature gauge w/ stainless steel thermowell	1
15	P5081G	4-1/2", Pressure Gauge Assembly	1
16	J6-136	J6-136, 0-50" wc Vacuum Switch	1
17	2030-LT	4-1/2", 0-30 WC, Vacuum gauge w/ bracket	1
18	PMC-BETA 440	Electronic Vibration Switch	1
19	E070736	ENCLOSURE W/ FAN	1

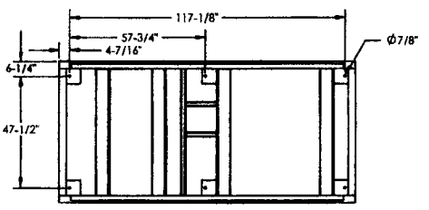
REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	DRAWING CREATED	10/26/2007	JH











PACKAGE PERFORMANCE:

DESIGN PRESSURE: 10 PSIG
DESIGN AIRFLOW: 4250 ICFM
BLOWER SPEED: 1796 RPM
PRV SET POINT: 11 PSIG
PRESS. SW. SET POINT: 11 PSIG
TEMP. SW. SET POINT: 350 'F
VAC. SW. SET POINT: 20 " WC
APPROX. WEIGHT: 10346 LBS

NOTE:

1. INSTALL AND OPERATE ACCORDING TO O&M MANUAL.
2. SOME ITEMS, USUALLY SILENCERS, MAY BE DISASSEMBLED FOR SHIPMENT. REASSEMBLY MAY BE REQUIRED.

UNIVERSAL

TITLE: 11CDL27 / 250 HP / A700

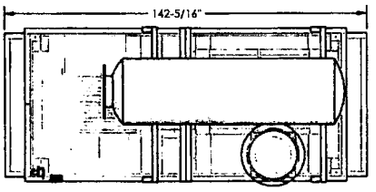
SIZE C | DWG NO 07073B

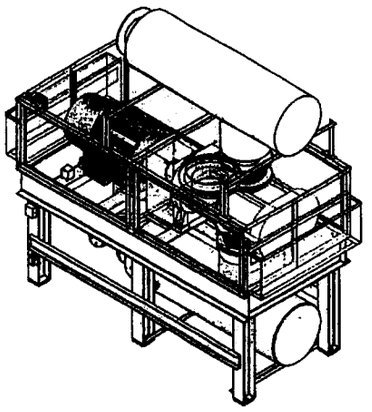
SCALE: 1:24 | WEIGHT: | SHEET 1 OF 2

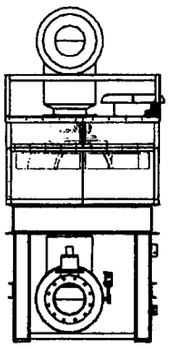
REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
-	-	See Sheet1	-	-

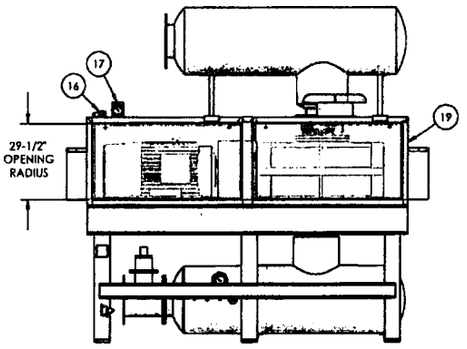
SPECIFICATIONS:

1. Material of Construction: 1/8" Aluminum
2. Enclosure and Vent Box lined w/ 2" Acoustical Foam
3. Qty (4) hinged, flip-down doors (2 per side)
4. Qty (8) 1/2 turn compression latches (2 per door)
5. Qty(1) Exhaust Fan (4.3 Amps @ 1/60/120)
6. Suitable for Outdoor Use









NOTE:

1. INSTALL AND OPERATE ACCORDING TO O&M MANUAL.
2. SOME ITEMS, USUALLY SILENCERS, MAY BE DISASSEMBLED FOR SHIPMENT. REASSEMBLY MAY BE REQUIRED.

UNIVERSAL

TITLE: 11CDL27 / 250 HP / A700

SIZE C | DWG. NO 07073B

SCALE: 1:26 | WEIGHT: | SHEET 2 OF 2

CycloBlower Pressure Model 11CDL31

Price:

Click to enter price

Project Specifications

Corrected Values	Original Units		English Units		Metric Units	
Barometer	500	ALTI-FT	14.426	PSIA	0.995	bar a
Elevation	500	ALTI-FT	500	ALTI-FT	152	alti-m
Inlet Pressure	0	In HGV	0	PSIG	0	bar g
Inlet Temp.	100	°F	100	°F	38	°C
Inlet Flow	5240	SCFM	5967.84	ICFM	10139	m³/h
Dis. Flow	4534	CFM	4534	CFM	7703	m³/h
Dis. Pressure	8	PSIG	8	PSIG	0.552	bar g
Rel. Humidity	90	%	90	%	90	%
Delta Pressure	8	PSI	8	PSI	0.552	bar

Measured Values	Plot Units		English Units		Metric Units	
Blower Speed	2055	RPM	2055	RPM	2055	RPM
% of Max Speed	93	%	93	%	93	%
Blower Power**	263	HP	263	HP	196.1	kw
Efficiency	67.1	%	67.1	%	67.1	%
Discharge Temp.	201	°F	201	°F	94	°C
Estimated Noise	91	db	91	db	91	db

**Drive losses not included

Physical:

Weight 3560 lbs.
Main Diameter 18.111 in.

Performance:

Max Delta P 20.1 PSI
Min Delta P 0 PSI
Max Temp 350 °F
Max speed 2200 rpm
Min speed 0 rpm
Max Case Pressure 35 PSIG

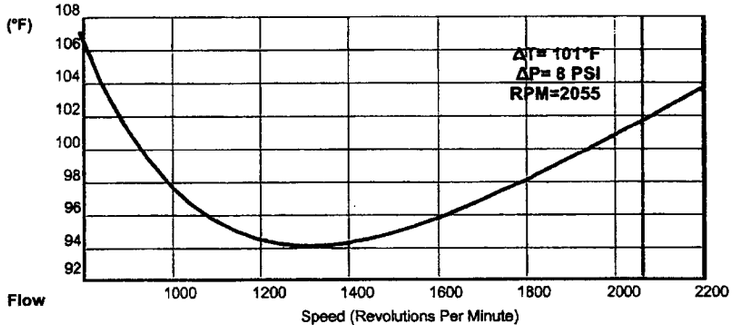
Gas Parameters	English Units		Metric Units	
Molecular Weight	28.32	lbm/lbmol	28.32	kg/kgmol
R Value	54.57	ft.lbf/lbm.R	0.3	kJ/kg.K
Density	0.068	lbm/ft³	1.089	kg/m³
Sp. Heat @ Const. P	0.25	BTU/lbm.R	1.04	kJ/kg.K
Ratio of Sp. Heats	1.39		1.39	
Saturated Vapor Pres.	0.9487	PSIA	0.065	bar a
Partial Pres. of Gas	13.5726	PSIA	0.936	bar a
Partial Pres. of Vapor	0.8538	PSIA	0.0585	bar a
Reference Pressure	14.696	PSIA	0.995	bar a
Reference Temperature	68	°F	0	°C
Reference Rel. Humid.	36	%	0	%

Gas mix: % by volume

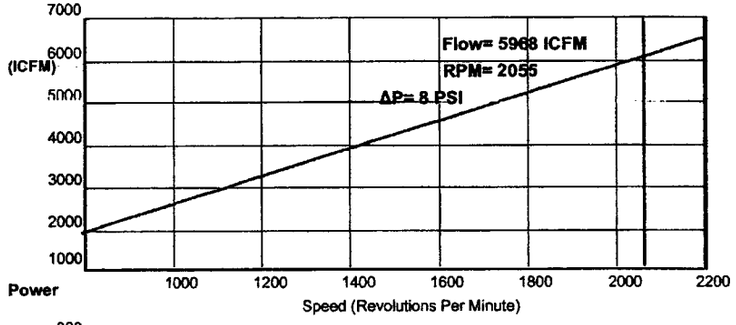
Air 100 %

Performance Information - Cyclo Blower Pressure Model 11CDL31

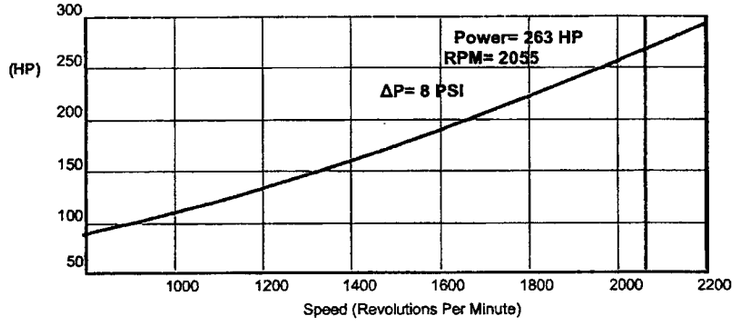
Temperature Rise



Flow



Power



UNIVERSAL BLOWER PAC, INC
The Original Manufacturer

January 10, 2008

Project: MACM

Customer: BissNuss, Inc.

Option 2: Three UBP Aerobic Digester Blower Packages

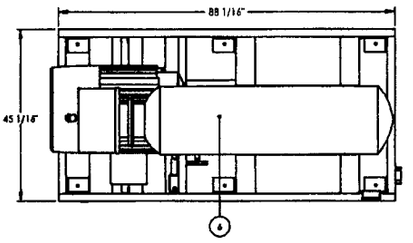
Notes:

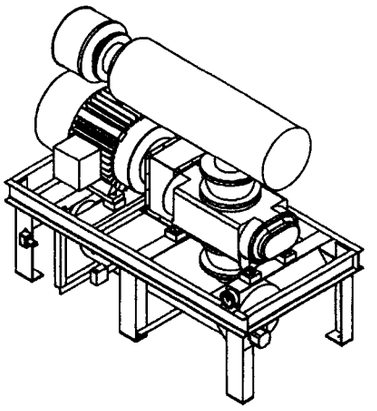
- This proposal is for three Universal Blower Pac packages utilizing 624 HF blowers and 150 HP NEMA frame motors.
- The attached drawing is from a similar project. This configuration can be modified to meet dimensional constraints or other customer needs.
- This blower uses a twisted helical lobe to move air versus a standard straight-lobed impeller. It gradually releases air through its discharge port resulting in a balanced compression cycle with little noise and pulsation.
- The blower and motor will be connected through use of a drive coupling. This eliminates lateral loading on the blower and motor shafts that shortens bearing life. It also eliminates v-belt maintenance and the 3-5% power transfer losses normally incurred with a v-belt drive.
- The unit's speed and flow are controlled with a variable frequency drive. We can achieve turndown to around 500 SCFM.
- The unit will operate without an enclosure at an estimated noise level of 97 dBA at 1m in a free field. A partial Acousti-Pac enclosure will lower the noise level to 87 dBA. An Attenu-Pac full enclosure will lower the noise level to 77 dBA.
- Specifications and CAD drawings are available.

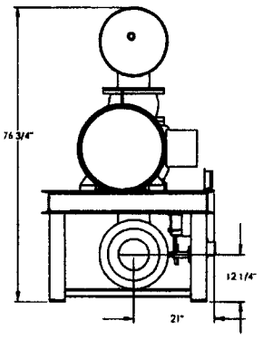
440 Park 32 West Drive | Noblesville, IN 46062-9252 | PH 317-773-7256 | FX 317-776-5086
website: www.universalblowerpac.com email: aplacek@universalblowerpac.com

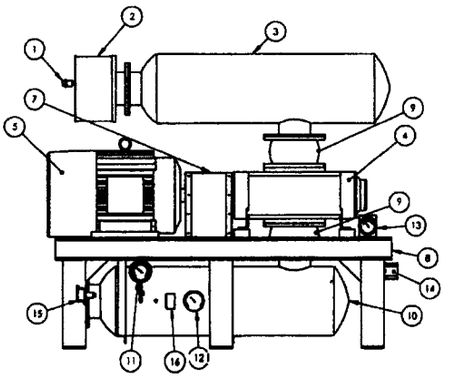
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1		Filter restriction indicator	1
2	EMO-8	Inlet filter w/ paper element	1
3	DRSLP-8	Grade L Inlet Silencer	1
4	6024	M-D Pneumatics Equalizer 6024 (left shaft, bottom discharge)	1
5	ECP44107-4	125 HP, 1800RPM, PE, TEFC, 3/60/460, 444T Motor w/ Thermostats	1
6	0.375 x 2	Drive coupling	1
7	Coupling Guard 06123A	Coupling Guard	1
8	806123	A500 Blower / Motor base w/ motor rails	1
9	10" 8 F-F	10" flanged flex joint, 8" F-F	2
10	DRSLP-8	Grade L Discharge Silencer	1
11	P50BTG	4-1/2", Pressure Gauge Assembly	1
12	T50025	5" Bimetal rear mount thermometer	1
13	2000_gauge_assem	4", 0-20 "WC, Vacuum gauge w/ bracket	1
14	1950	Differential Pressure Switch	1
15	J6-222	J6-222, 0-20 PSI Pressure Switch	1
16	5100	NEMA 4X Adjustable Temperature switch	1
17	ED6123A	ATTENU-PAC FULL ENCLOSURE W/ FAN	1

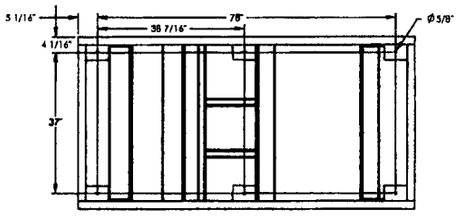
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	DRAWING CREATED	12/4/06	JH
	B	FILTER/SILENCER COMBO REPLACED W/ FULL SILENCER AND FILTER	4/27/07	JH











Package Performance

Design Pressure: 9 PSIG
Design Airflow: 1650 SCFM
Blower Speed: 2139 RPM
PRV Set Point: 10 PSIG
Vacuum Sw. Set Pt: 15 "WC
Pressure Sw. Set Pt: 10 PSIG
Temperature Sw. Set Pt: 300 'F
Approx. Package Wt: 4200 LBS
Approx. Enclosure Wt: 650 LBS

NOTE:

1. INSTALL AND OPERATE ACCORDING TO O&M MANUAL.
2. SOME ITEMS, USUALLY SILENCERS, MAY BE DISASSEMBLED FOR SHIPMENT. REASSEMBLY MAY BE REQUIRED.

UNIVERSAL

TITLE: 6024 / 125 HP / A500

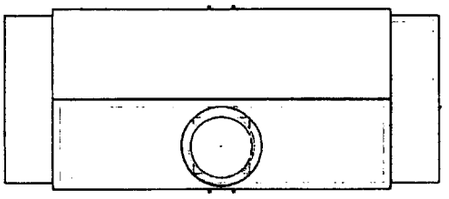
SIZE C | DWG. NO. 06123A

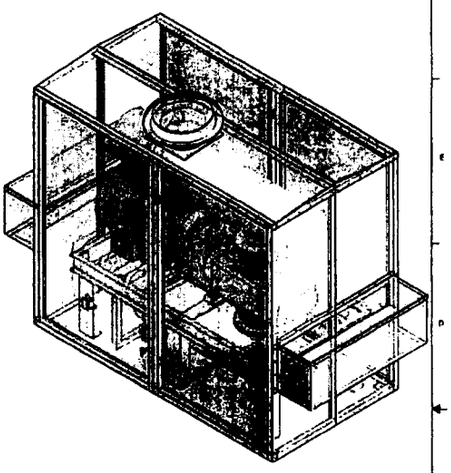
SCALE: 1:16 | WEIGHT: | SHEET 1 OF 2

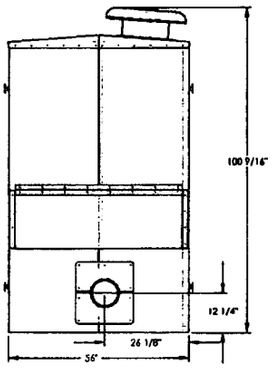
Specifications:

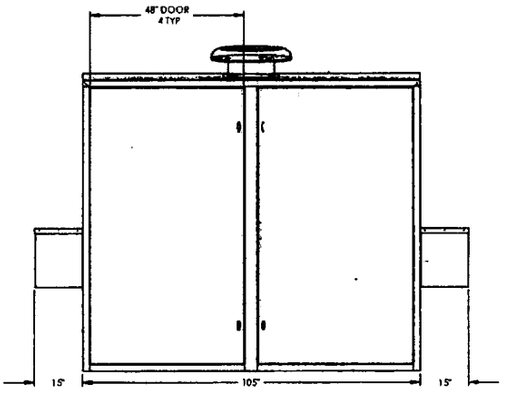
1. Material of construction: 1/8" Aluminum
2. Enclosure and vent boxes lined w/ 2" acoustical foam
3. Qty (4) hinged doors (2 front, 2 back)
4. Qty (8) 1/2 turn compression latches (2 per door)
5. Qty (1) Exhaust fan

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
-	-	See Sheet1	-	-









UNIVERSAL

TITLE: 6024 / 125 HP / A500

SIZE C | DWG. NO. 06123A

SCALE: 1:16 | WEIGHT: | SHEET 2 OF 2

HeliFlow HF Series Model 624

Price:

Click to enter price

Project Specifications

Corrected Values	Original Units		English Units		Metric Units	
Barometer	500	ALTI-FT	14.426	PSIA	0.995	bar a
Elevation	500	ALTI-FT	500	ALTI-FT	152	alti-m
Inlet Pressure	0	in HGV	0	PSIG	0	bar g
Inlet Temp.	100	°F	100	°F	38	°C
Inlet Flow	2620	SCFM	2983.92	ICFM	5070	m³/h
Dis. Flow	2316	CFM	2316	CFM	3935	m³/h
Dis. Pressure	8	PSIG	8	PSIG	0.552	bar g
Rel. Humidity	90	%	90	%	90	%
Delta Pressure	8	PSI	8	PSI	0.552	bar

Measured Values	Plot Units		English Units		Metric Units	
Blower Speed	3248	RPM	3248	RPM	3248	RPM
% of Max Speed	98	%	98	%	98	%
Blower Power**	121.4	HP	121.4	HP	90.5	kw
Efficiency	72.7	%	72.7	%	72.7	%
Discharge Temp.	216	°F	216	°F	102	°C
Estimated Noise	97	db	97	db	97	db

**Drive losses not included

Physical:

Weight	N/A lbs.
Gear Diameter	6.5 in.
Case Length	24.00 in.
Port Size	10 in.
WR²	N/A lb-ft²
Configuration	Horizontal

Performance:

Max Delta P	12 PSI
Max Temp	350 °F
Max speed	3300 rpm
Min speed	882 rpm
Max Case Pressure	25 PSIG
Max Delta T	250 °F
Max T	350 °F

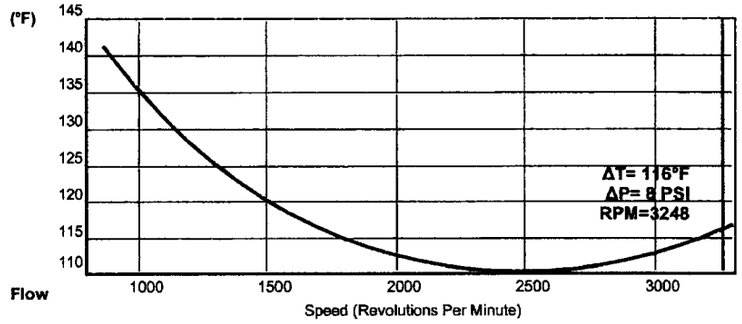
Gas Parameters	English Units		Metric Units	
Molecular Weight	28.32	lbm/lbmol	28.32	kg/kgmol
R Value	54.57	ft.lbf/lbm.R	0.3	kJ/kg.K
Density	0.068	lbm/ft³	1.089	kg/m³
Sp. Heat @ Const. P	0.25	BTU/lbm.R	1.04	kJ/kg.K
Ratio of Sp. Heats	1.39		1.39	
Saturated Vapor Pres.	0.9487	PSIA	0.065	bar a
Partial Pres. of Gas	13.5726	PSIA	0.936	bar a
Partial Pres. of Vapor	0.8538	PSIA	0.0585	bar a
Reference Pressure	14.696	PSIA	0.995	bar a
Reference Temperature	68	°F	0	°C
Reference Rel. Humid.	36	%	0	%

Gas mix: % by volume

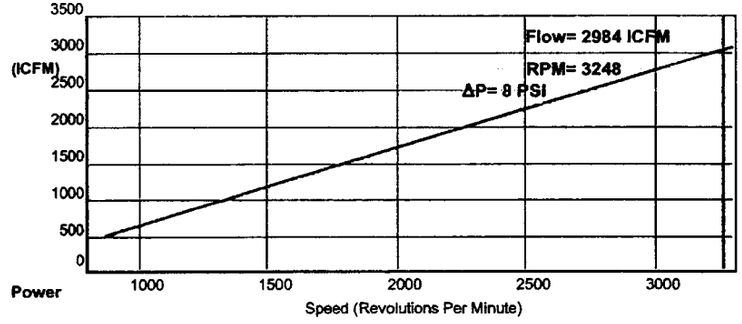
Air 100 %

Performance Information - HeliFlow HF Series Model 624

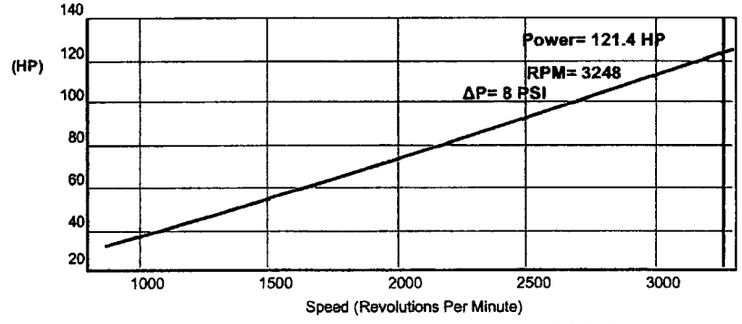
Temperature Rise

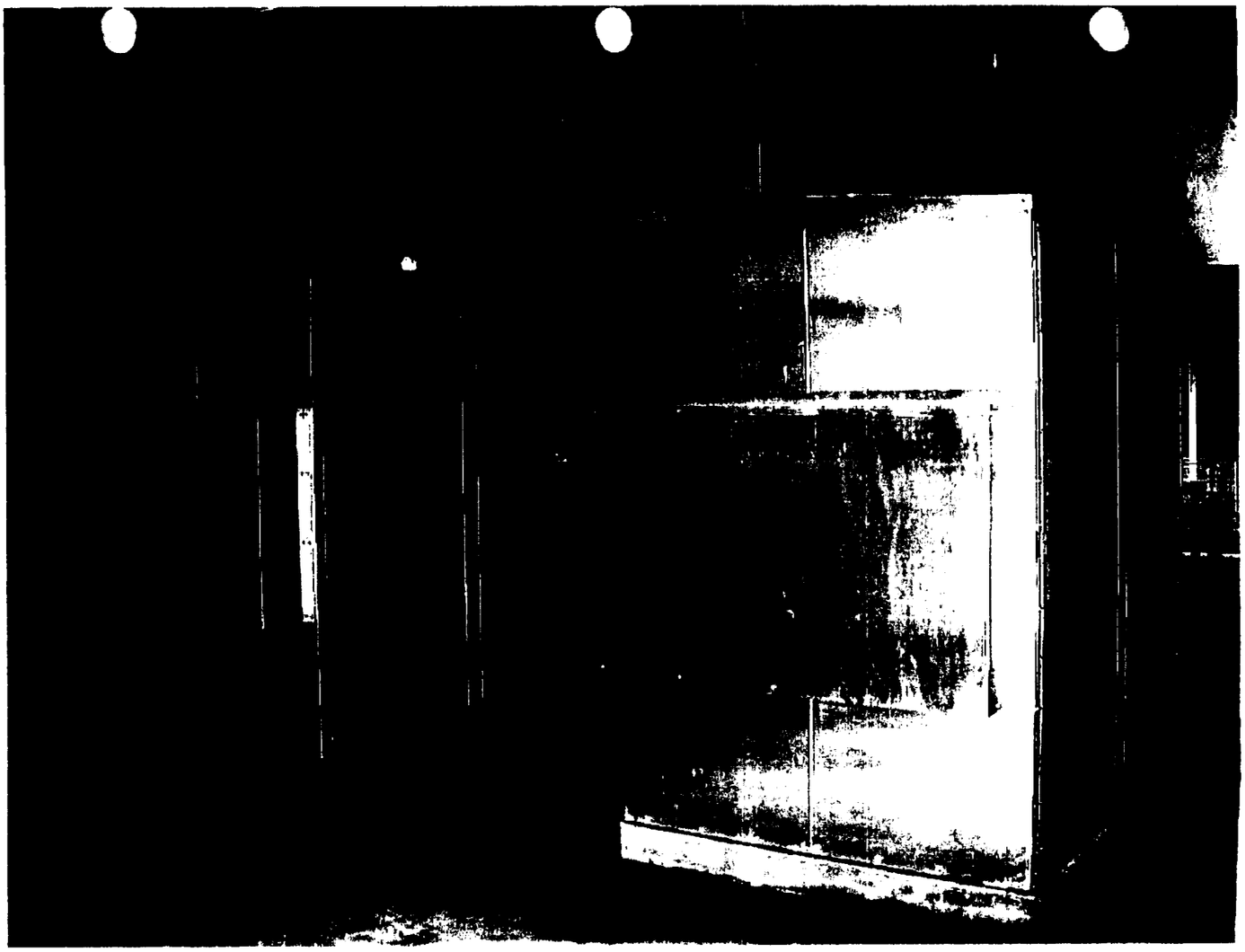


Flow



Power





APPENDIX E

HYDRAULIC PROFILE CALCULATIONS

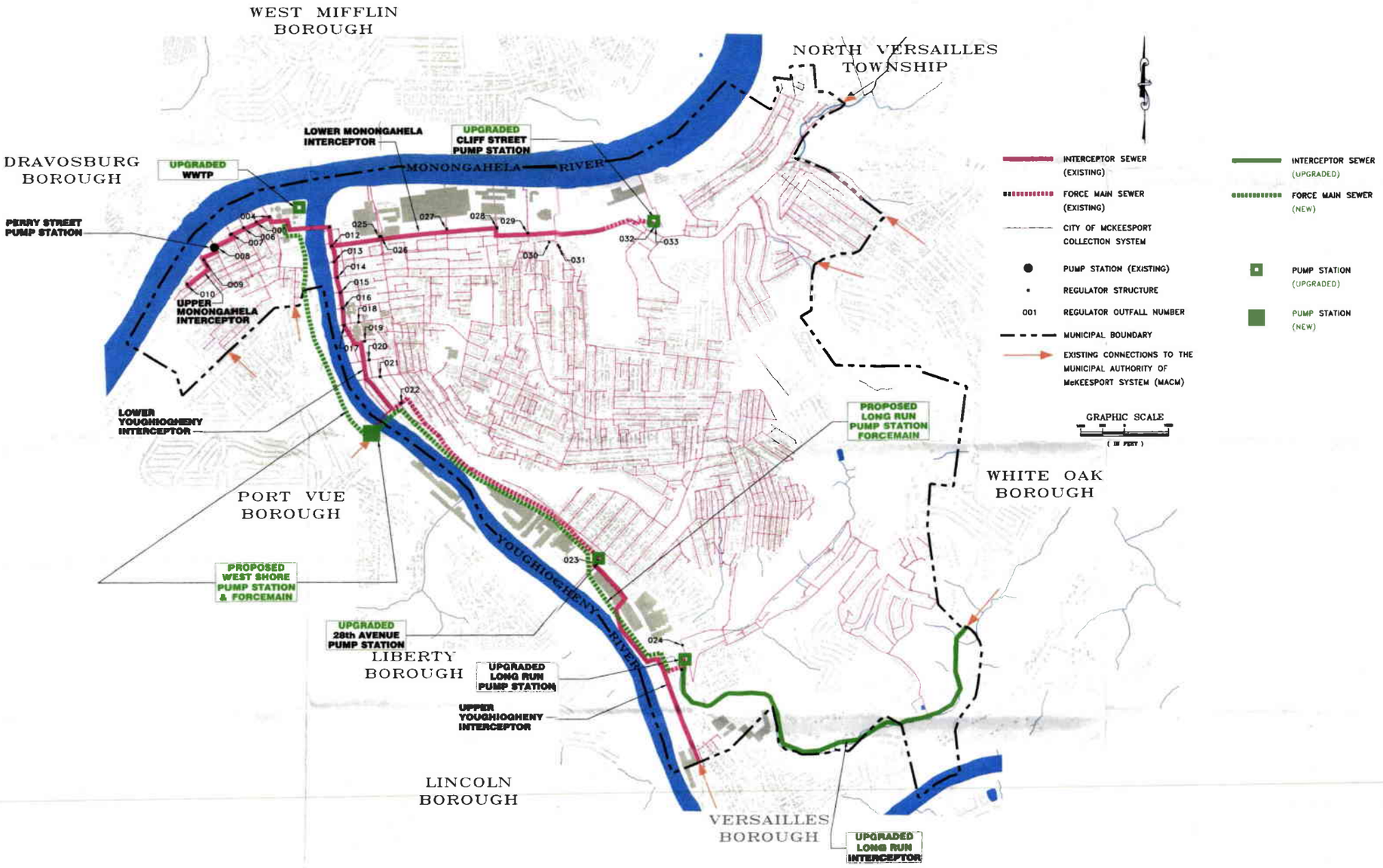
Hydraulic Profile Calculations

To Exisitng WWTP

Description				Loss						Elevation						
	Flow in MGD			4.5	8	12	15.5	20	44	4.5	8	12	15.5	20	44	Top of Wall
	Flow in gpm			3125	5556	8333	10764	13889	30556							
	Flow in cfs			6.96	12.38	18.56	23.98	30.94	68.07							
Starting Elevation	**Normal Pool**									740.34	740.34	740.34	740.34	740.34	740.34	
Invert of Flume				724.45	724.45	724.45	724.45	724.45	724.45							
Submergence at Flood - Static Loss				15.89	15.89	15.89	15.89	15.89	15.89							
Open Channel Loss		Invert Elevation		729	Width		8	feet								
		Depth		11.34	11.34	11.34	11.34	11.34	11.34							
		Wetted Perimeter		30.68	30.68	30.68	30.68	30.68	30.68							
		Area		90.71	90.71	90.71	90.71	90.71	90.71							
		Hydraulic Radius		2.96	2.96	2.96	2.96	2.96	2.96							
		Velocity ft/s		0.06	0.14	0.20	0.26	0.34	0.75							
				4.67E-09	1.48E-08	3.32E-08	5.54E-08	9.22E-08	4.46E-07							
		Length	105	4.9E-07	1.55E-06	3.49E-06	5.82E-06	9.68E-06	4.69E-05							
		Actual Lose		Neglible	Neglible	Neglible	Neglible	Neglible	Neglible							
Water Level in Effluent Flume										740.34	740.34	740.34	740.34	740.34	740.34	
Outfall Pipe			36 inches	8	feet Long											
Exit Loss		K=	1	0.02	0.05	0.11	0.18	0.30	1.44							
Pipe Friction Loss		f =	0.019	0.00	0.00	0.01	0.01	0.02	0.07							
Orifice		Cv	0.82	Area	7.07	ft^2										
				0.02	0.07	0.16	0.27	0.44	N/A							
Total Loss				0.04	0.12	0.27	0.45	0.75								
Effluent Manhole										740.38	740.46	740.61	740.79	741.09	741.09	
Outfall Pipe			36 inches	9	feet Long											
Exit Loss		K=	1	0.02	0.05	0.11	0.18	0.30	N/A							
Pipe Friction Loss		f =	0.0155	0.00	0.00	0.00	0.01	0.01								
Orifice		Cv	0.82	Area	7.07	ft^2										
				0.02	0.07	0.16	0.27	0.44	N/A							
Total Loss				0.04	0.12	0.27	0.45	0.75								
Chlorine Contact Effluent Box										740.41	740.58	740.88	741.24	741.85	741.85	
Actual Static Drop over weir				-2.59	-2.59	-2.59	-2.59	-2.59								
Effluent Weir	No. Wiers		2	7.83	feet Long								Exisiting Weir Elevation		737.75	743.50
CCT Water Elevation		Weir Loss		0.28	0.36	0.50	0.60	0.71	1.19	740.41	740.58	740.88	741.24	741.85	741.85	
Open Channel Loss		Invert Elevation		729.75	Width		7.83	feet								
		Depth		10.66	10.83	11.13	11.49	12.10	N/A							
		Wetted Perimeter		28.16	29.49	30.09	30.82	32.02								
		Area		83.50	84.80	87.16	90.00	94.72								
		Hydraulic Radius		2.86	2.88	2.90	2.92	2.96								
		Velocity ft/s		0.04	0.07	0.11	0.13	0.16								
				1.47E-09	4.45E-09	9.22E-09	1.4E-08	2E-08								
		Length	44.5	6.56E-08	1.98E-07	4.1E-07	6.22E-07	8.89E-07								
		Actual Loss		Neglible	Neglible	Neglible	Neglible	Neglible								
CCT Water Elevation										740.41	740.58	740.88	741.24	741.85	741.85	
Open Channel Loss		Invert Elevation		735.5	Width		4	feet								
		Depth		4.91	5.08	5.38	5.74	6.35	N/A							
		Wetted Perimeter		13.83	14.16	14.76	15.49	16.69								
		Area		19.66	20.32	21.53	22.98	25.39								
		Hydraulic Radius		1.42	1.44	1.46	1.48	1.52								
		Velocity ft/s		0.35	0.61	0.86	1.04	1.22								
				2.88E-07	8.24E-07	1.56E-06	2.15E-06	2.65E-06								
		Length	29	8.34E-06	2.39E-05	4.53E-05	6.23E-05	7.69E-05								
		Actual Loss		Neglible	Neglible	Neglible	Neglible	Neglible								
Clarifier No. 1 Effluent Flume										740.41	740.58	740.88	741.24	741.85	741.85	743.50
			36 inches	261	feet Long											
Exit Loss		K=	1	0.02	0.05	0.11	0.18	0.30	1.44							
Pipe Friction Loss		f =	0.0155	0.02	0.06	0.14	0.24	0.40	1.94							
Orifice		Cv	0.82	Area	7.07	ft^2										
				0.02	0.07	0.16	0.27	0.44	N/A							
Total Loss				0.06	0.18	0.41	0.69	1.14								
Clarifier No. 2 Effluent Flume										740.47	740.76	741.29	741.93	742.99	742.99	744.75
Calculated Recommended Static over weir				0.04	0.06	0.08	0.09	0.11	N/A							
Actual Static Drop over weir				-0.54	-0.83	-1.36	-2.00	-3.06								
Effluent Weir	No. Wiers		2	301	feet Long								Exisiting Weir Elevation		739.93	744.75
Clarifier No. 2 Water Elevation		Weir Loss		0.02	0.03	0.04	0.05	0.05	0.09	740.47	740.76	741.29	741.93	742.99	742.99	
Outfall Pipe			36 inches	339	feet Long											
Exit Loss		K=	1	0.00	0.01	0.03	0.04	0.07	N/A							
Pipe Friction Loss		f =	0.0155	0.01	0.02	0.05	0.08	0.13								
Orifice		Cv	0.82	Area	7.07	ft^2										
				0.01	0.02	0.04	0.07	0.11	N/A							
Total Loss				0.02	0.05	0.11	0.19	0.32								
Aeration Basin Effluent Box										740.49	740.81	741.41	742.12	743.30	743.30	
Calculated Recommended Static over weir				0.09	0.14	0.18	0.21	0.25	N/A							
Actual Static Drop over weir				1.97	1.65	1.05	0.34	-0.84								
Aeration Basin Effluent Weir		No. Wiers	4	52	feet Long								Exisiting Weir Elevation		742.46	746.80
				0.05	0.07	0.09	0.11	0.13	0.21	742.51	742.53	742.55	742.57	743.30	743.30	

To New WWTP

Description				Loss						Elevation					
	Flow in MGD			4.5	7.5	12	15.5	24	44	4.5	7.5	12	15.5	24	44
	Flow in gpm			3125	5208	8333	10764	16667	30556						
	Flow in cfs			6.96	11.60	18.56	23.98	37.13	68.07						
Starting Elevation	**Normal Pool**									740.34	740.34	740.34	740.34	740.34	740.34
Invert of Flume				724.45	724.45	724.45	724.45	724.45	724.45						
Submergence at Flood - Static Loss				15.89	15.89	15.89	15.89	15.89	15.89						
Open Channel Loss		Invert Elevation	729	Width		8	feet								
		Depth		11.34	11.34	11.34	11.34	11.34	11.34						
		Wetted Perimeter		30.68	30.68	30.68	30.68	30.68	30.68						
		Area		90.71	90.71	90.71	90.71	90.71	90.71						
		Hydraulic Radius		2.96	2.96	2.96	2.96	2.96	2.96						
		Velocity ft/s		0.08	0.13	0.20	0.26	0.41	0.75						
				4.67E-09	1.3E-08	3.32E-08	5.54E-08	1.33E-07	4.46E-07						
		Length	105	4.9E-07	1.36E-06	3.49E-06	5.82E-06	1.39E-05	4.69E-05						
		Actual Loss		Neglible	Neglible	Neglible	Neglible	Neglible	Neglible						
Water Level in Effluent Flume										740.34	740.34	740.34	740.34	740.34	740.34
Calculated Recommended Static over weir				0.24	0.33	0.45	0.54	0.72	N/A						
Actual Static Drop over weir				0.72	0.72	0.72	0.72	0.72							
Effluent Weir	No. Wiers		1	51.63	feet Long						Proposed Weir Elevation					741.06
UV Channel Downstream Elevation		Weir Loss		0.12	0.17	0.23	0.27	0.38	N/A	741.18	741.22	741.28	741.33	741.42	
		Invert Elevation		729.75	Width		5		feet						
Open Channel Loss				Neglible	Neglible	Neglible	Neglible	Neglible	Neglible						
Actual Loss thru Uv	Area (ft^2)		23.4	Velocity	0.2975	0.495833	0.793333	1.024722	1.586667	2.908889					
Loss		No. Module in Pass	2		0.004948	0.013743	0.035183	0.058699	0.14073						
UV Channel Upstream/Stilling Well Elevation										741.18	741.24	741.32	741.39	741.56	
Pipe Loss			36	inches	1167	feet Long									
Exit Loss		K=	1		0.02	0.04	0.11	0.18	0.43	N/A					
Pipe Friction Loss		f =	0.015		0.09	0.24	0.62	1.04	2.50						
Orifice		Cv	0.82	Area		7.908578	ft^2								
				0.02	0.06	0.16	0.27	0.64	N/A						
Total Loss				0.13	0.35	0.89	1.49	3.57							
SBR Effluent Box										741.31	741.59	742.21	742.87	745.12	
SBR Decanter Loss								1.50							
SBR Low Water Level														746.62	
SBR High Water Level								5.00						751.62	
SBR Splitter Box															
Pipe Loss			24	inches	151	feet Long									
Exit Loss		K=	1		0.00	0.01	0.03	0.06	0.14	N/A					
Pipe Friction Loss		f =	0.015		0.01	0.01	0.04	0.06	0.15						
Orifice		Cv	0.82	Area		3.14159	ft^2								
				0.01	0.02	0.05	0.08	0.20	N/A						
Total Loss				0.02	0.05	0.12	0.20	0.49							
Effluent SBR Splitter Box Level										751.84	751.87	751.75	751.63	752.11	
Calculated Recommended Static over weir				0.44	0.62	0.85	1.01	1.35	N/A						
Actual Static Drop over weir				1.81	1.78	1.78	1.62	1.33							
Splitter Box Weir	No. Wiers		4	5	feet Long						Proposed Weir Elevation					753.45
		Weir Loss		0.22	0.31	0.43	0.51	0.68	N/A	753.67	753.78	753.88	753.96	754.13	
Flow Control Box															
Pipe Loss			16	inches	226	feet Long									
Exit Loss		K=	1		0.24	0.67				N/A					
Pipe Friction Loss		f =	0.015		0.54	1.51									
Orifice		Cv	0.82	Area		1.767144	ft^2								
				0.02	0.06	0.16	0.27	0.64	N/A						
Pipe Loss			30	inches	226	feet Long									
Exit Loss		K=	1				0.22	0.37	0.89	N/A					
Pipe Friction Loss		f =	0.015				0.30	0.50	1.20						
Orifice		Cv	0.82	Area		4.908734	ft^2								
							0.02	0.03	0.08	N/A					
Total Loss				0.81	2.24	0.70	1.17	2.81			756.36	756.55			
Influent Flow Control Box Level										754.93	756.36	757.25	757.72	759.36	759.36
Calculated Recommended Static over weir				0.34	0.48	0.65	0.77	1.03	1.55						
Actual Static Drop over weir				5.82	4.39	3.50	3.03	1.39	1.39						
			1	30	feet Long						Proposed Weir Elevation					760.75
		Weir Loss		0.17	0.24	0.33	0.39	0.52	0.77	760.92	760.99	761.08	761.14	761.27	761.52
Pipe Loss			42	inches	250	feet Long									
Exit Loss		K=	1		0.01	0.02	0.05	0.09	0.21	0.71					
Pipe Friction Loss		f =	0.015		0.01	0.02	0.06	0.09	0.22	0.74					
Orifice		Cv	0.82	Area		10.08472	ft^2								
				0.00	0.00	0.00	0.01	0.02	0.07						
Total Loss				0.02	0.04	0.11	0.19	0.45	1.51						
										760.94	761.03	761.19	761.32	761.72	763.04



REPRINTED FROM THE MUNICIPAL AUTHORITY OF THE CITY OF McKEESPORT ACT 537 SEWAGE FACILITES PLAN (NOVEMBER 2006)

Revisions	Date	Revisions General Revisions	Date 6/06

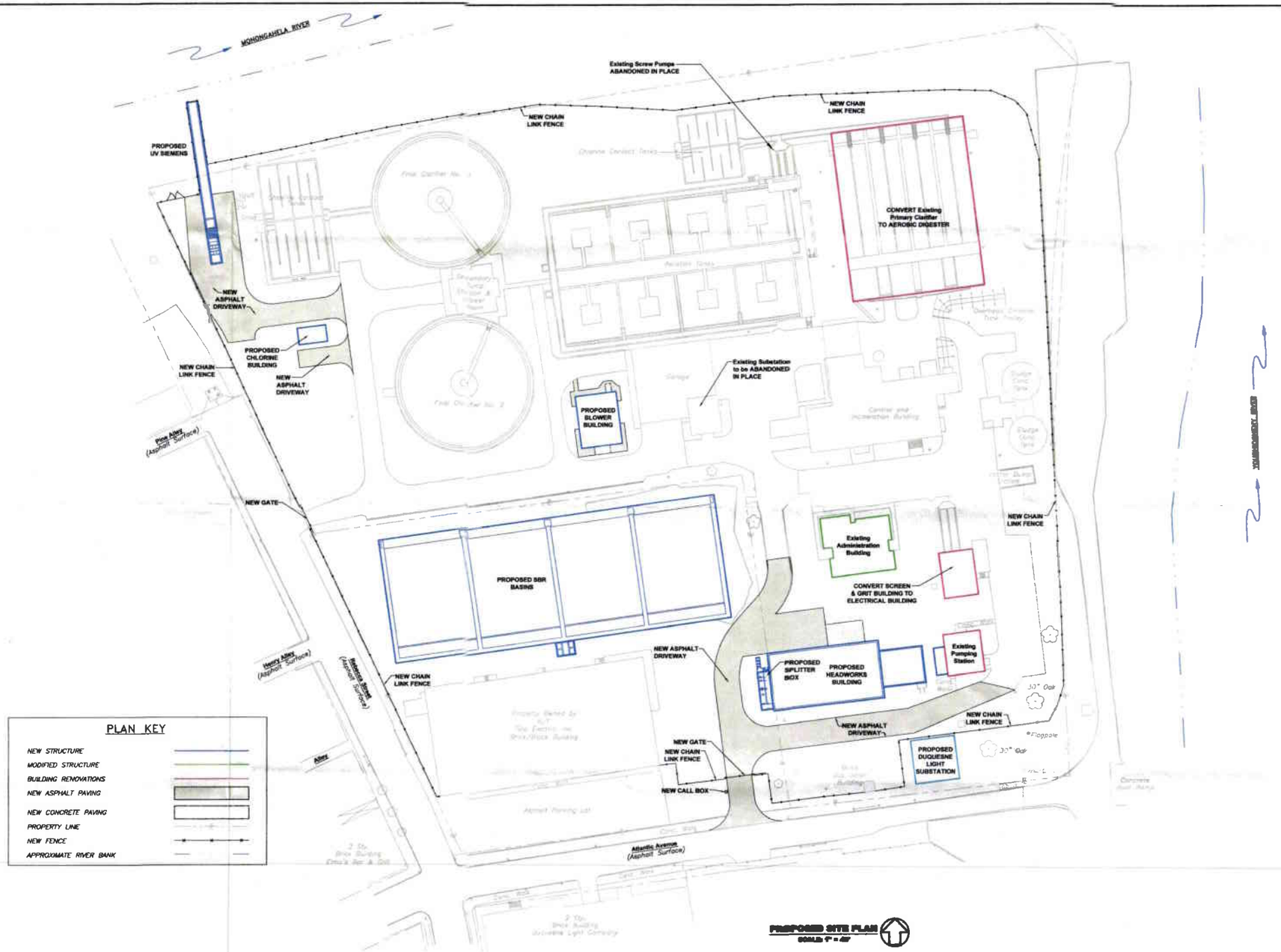
KLH ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205
PHONE: 412-922-3015
FAX: 412-922-0238
INFO@KLHENGINEERS.COM

MUNICIPAL AUTHORITY OF THE CITY OF MCKEESPORT
ALLEGHENY COUNTY, PENNSYLVANIA
ACT 537 SEWAGE FACILITIES PLAN
PROPOSED ALTERNATES 2 & 3

Scale:	As Shown
Date:	JAN. 2008
Drawn By:	WWM
Checked By:	K.H.
Approved By:	K.H.

Sheet No. 1 OF 6

Plate No. 6-3



Revisions	Date

KLH ENGINEERS, INC.
5173 CAMPBELLS RUN ROAD
PITTSBURGH, PA 15205
PHONE 412-494-4490
FAX 412-494-0486
info@klhengineers.com

MUNICIPAL AUTHORITY OF THE CITY OF MCKEESPORT
ALLEGHENY COUNTY, PENNSYLVANIA
WASTEWATER TREATMENT PLANT
PROPOSED PROPERTY AND SITE PLAN

Scale:	As Shown
Date:	March 2008
Drawn By:	DMB
Checked By:	KSH
Approved By:	BHG

Sheet No.
6 OF 6

Plate No.
4-4