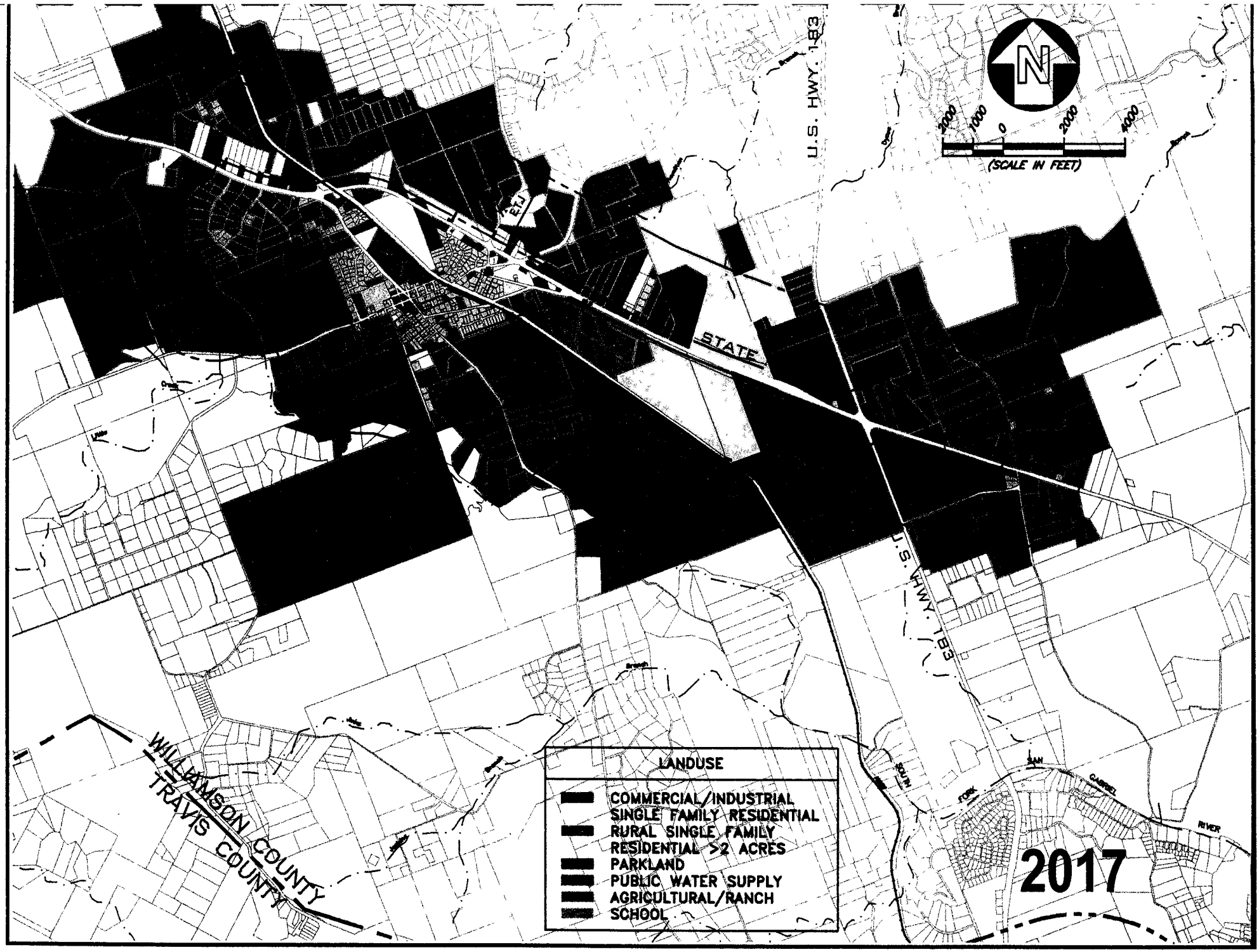
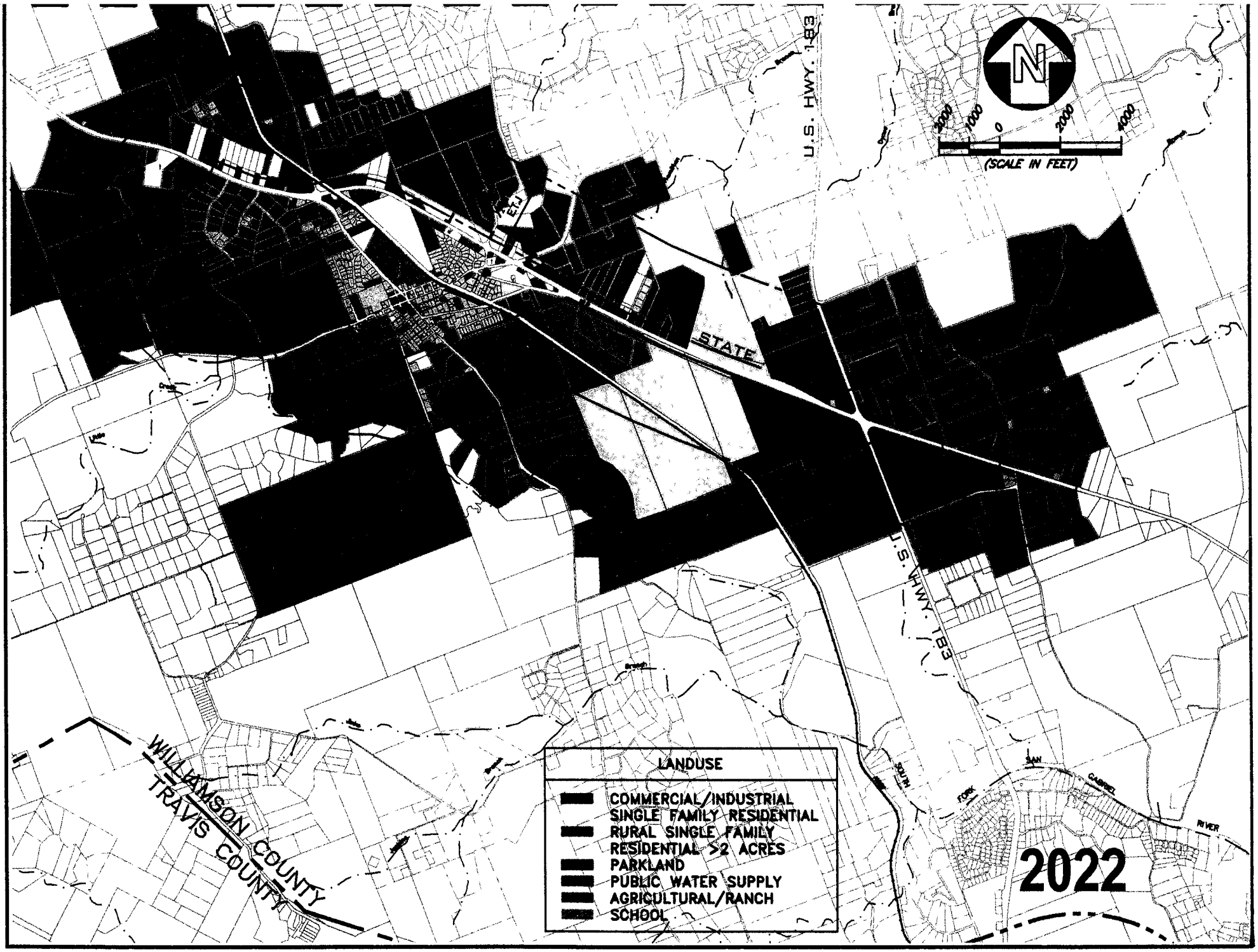

N
2000
1000
0
2000
4000
(SCALE IN FEET)
U.S. HWY. 183
STATE
U.S. HWY. 183
ETJ
WILLIAMSON COUNTY
TRAVIS COUNTY
LANDUSE
COMMERCIAL/INDUSTRIAL
SINGLE FAMILY RESIDENTIAL
RURAL SINGLE FAMILY RESIDENTIAL >2 ACRES
PARKLAND
PUBLIC WATER SUPPLY
AGRICULTURAL/RANCH
SCHOOL
SOUTH
SAN
GABRIEL
FORK
RIVER
2017


N
3000
1000
0
2000
4000
(SCALE IN FEET)
U.S. HWY. 183
ETJ
STATE
U.S. HWY. 183
WILLIAMSON COUNTY
TRAVIS COUNTY
SOUTH
SAN
GABRIEL
FORK
RIVER
LANDUSE
COMMERCIAL/INDUSTRIAL
SINGLE FAMILY RESIDENTIAL
RURAL SINGLE FAMILY
RESIDENTIAL >2 ACRES
PARKLAND
PUBLIC WATER SUPPLY
AGRICULTURAL/RANCH
SCHOOL
2022

APPENDIX 2

GRAVITY COLLECTION SYSTEM LAYOUT / PRELIMINARY PLAN & PROFILE DRAWINGS

APPENDIX 3

LOW PRESSURE SEWER SYSTEM

July 11, 2002

David Allen
Baker-Aicklen & Associates, Inc.
405 Brushy Creek Rd.
Cedar Park, TX 78613

Dear David,

This design analysis examines the use of a low pressure sewer system using Environment One grinder pumps for Liberty Hill. The low pressure sewer approach provides not only a technical solution, but also an economic advantage to be realized with low up front costs.

System Analysis

Using the drawings and data you supplied, I ran the enclosed preliminary pressure sewer pipe sizing and branch analysis. This was run through our computer design program that employs our latest Flow Velocity and Friction Head Loss vs. Pumps in Simultaneous Operation Spreadsheet.

The design criteria for the software calculation program is based on the *Hazen-Williams* formulas for determining pipe sizes (calculations for Cross Sectional Area, Velocity and Friction Loss) to create flow velocities of 2.00 fps or higher. At these velocities scouring is assured. Pipe sizes are based on the ID of the pipe type selected. A "C" factor of 150, SDR 21 PVC pipe, and daily flow per home of 200 gpd are used in this analysis.

There are 156 simplex grinder pump stations in this analysis, 1 duplex station (for the rest home), and a conventional pump station for the school. Two sets of hydraulic data are included, indicating the system characteristics when the school pump station is "on" and when it is "off". The highest Total Dynamic Head generated in the system is 133 feet. This is below our continuous-run rating of 138 feet. Flow velocity, when the school pump station is off, is low in zones 1 and 12, but is not a problem provided that it runs regularly. During vacation periods when this station is inactive, it is recommended that zones 1 and 12 are periodically flushed.

General recommendations for valve placement are as follows: flushing connections at 1,500' to 2,000' intervals and at branch ends and junctions; isolation valves at all branch junctions; and air release valves at peaks of 25 feet or more and/or at intervals of 2,000 to 2,500 feet.

Quantities of grinder pumps, pipe, and appurtenances are indicated on the cost page. Costs of these items and their installation are best obtained from sources in your region.

I am looking forward to working with you on this and future projects. If you any questions or require additional information please call me at extension 3022.

Sincerely,

Bruce Richardson
LPS System Designer

Environment One Corporation

Pressure Sewer Preliminary Cost and Design Analysis For Liberty Hill, TX

Prepared For:
Baker-Aicklen & Assiciates, Inc. - Cedar Creek Office
405 Brushy Creek Rd.
Cedar Park TX 78613
Tel: 512 260-3700
Fax: 512 260-3701
Prepared By: Bruce Richardson
July 11, 2002

July 11, 2002

Budgetary Low Pressure Sewer System Costs

Liberty Hill, TX

	Quantity	Description	Unit Cost	Sub Total
Pumps	156	2010-61	$0.00	$0.00
	1	2015-97	$0.00	$0.00
	157	Pump/Panel Installation	$0.00	$0.00
	7,850	1.25" Pipe Laterals	$0.00	$0.00
	157	Lateral Kits	$0.00	$0.00
				$0.00
Piping	5,019	1.50" Pipe	$0.00	$0.00
	7,906	2.00" Pipe	$0.00	$0.00
	1,220	3.00" Pipe	$0.00	$0.00
	5,607	4.00" Pipe	$0.00	$0.00
				$0.00

Total Per Home	**$0.00**	**Total Without Other >>>>>>>>>>>>>>>>**	**$0.00**
Grand Total Per Home	**$0.00**	**Total Including Other >>>>>>>>>>>>>>>>**	**$0.00**

Note: The System Costs above are based on piping sized for, and Grinder Pumps manufactured by Environment One Corporation.

Prepared By:
Bruce Richardson

Liberty Hill, TX
(pump station on)

July 11, 2002

Zone Number	Pumps to Zone	Number of Cores in Zone	Accum Cores in Zone	Gal/Day per Core	Max Flow per Core	Max Sim Ops	Max Flow (GPM)	Pipe Size (Inches)	Max Velocity (FPS)	Length of Main this Zone	Friction Loss Factor (ft/100ft)	Friction Loss this Zone	Accumulated Friction Loss (Feet)	Max Main Elevation	Minimum Pump Elevation	Static Head (Feet)	Total Dynamic Head (ft)
is spreadsheet was calculated using pipe diameters for: SDR21PVC													Friction loss calculations were based on a Constant for inside roughness = 150				
1.00	6.00	3	3	200.00	11.00	2	67.00	3.00	2.73	550.00	0.87	4.78	75.36	1,025.00	1,000.00	25.00	100.36
PS	1.00		GPD:	20000.00		GPM:	45.00	Type:	ctfgl		Desc:	School Pump Station					
2.00	6.00	3	3	200.00	11.00	2	22.00	1.50	3.04	382.00	2.15	8.22	78.80	1,025.00	1,000.00	25.00	103.80
3.00	4.00	3	3	200.00	11.00	2	22.00	1.50	3.04	365.00	2.15	7.85	94.24	1,025.00	1,000.00	25.00	119.24
4.00	5.00	6	9	200.00	11.00	3	33.00	2.00	2.92	573.00	1.54	8.84	86.39	1,025.00	1,000.00	25.00	111.39
5.00	6.00	3	12	200.00	11.00	4	44.00	2.00	3.89	265.00	2.63	6.97	77.54	1,025.00	1,000.00	25.00	102.54
6.00	12.00	1	19	200.00	11.00	5	100.00	3.00	4.07	340.00	1.83	6.21	70.58	1,025.00	1,000.00	25.00	95.58
7.00	8.00	3	3	200.00	11.00	2	22.00	1.50	3.04	200.00	2.15	4.30	78.60	1,025.00	1,000.00	25.00	103.60
8.00	12.00	4	7	200.00	11.00	3	33.00	2.00	2.92	643.00	1.54	9.92	74.29	1,025.00	1,000.00	25.00	99.29
9.00	10.00	3	3	200.00	11.00	2	22.00	1.50	3.04	286.00	2.15	6.15	92.02	1,025.00	1,000.00	25.00	117.02
10.00	11.00	6	9	200.00	11.00	3	33.00	2.00	2.92	521.00	1.54	8.04	85.87	1,025.00	1,000.00	25.00	110.87
11.00	12.00	6	15	200.00	11.00	4	44.00	2.00	3.89	512.00	2.63	13.46	77.83	1,025.00	1,000.00	25.00	102.83
12.00	20.00	5	46	200.00	11.00	6	111.00	4.00	2.73	269.00	0.65	1.75	64.37	1,025.00	1,000.00	25.00	89.37
13.00	14.00	3	3	200.00	11.00	2	22.00	1.50	3.04	208.00	2.15	4.48	76.74	1,025.00	1,000.00	25.00	101.74
14.00	16.00	2	5	200.00	11.00	3	33.00	2.00	2.92	121.00	1.54	1.87	72.26	1,025.00	1,000.00	25.00	97.26
15.00	16.00	2	2	200.00	11.00	2	22.00	1.50	3.04	243.00	2.15	5.23	75.63	1,025.00	1,000.00	25.00	100.63
16.00	20.00	1	8	200.00	11.00	3	33.00	2.00	2.92	504.00	1.54	7.78	70.40	1,025.00	1,000.00	25.00	95.40
17.00	18.00	3	3	200.00	11.00	2	22.00	1.50	3.04	330.00	2.15	7.10	86.30	1,025.00	1,000.00	25.00	111.30
18.00	19.00	6	9	200.00	11.00	3	33.00	2.00	2.92	512.00	1.54	7.90	79.20	1,025.00	1,000.00	25.00	104.20
19.00	20.00	5	14	200.00	11.00	4	44.00	2.00	3.89	330.00	2.63	8.67	71.30	1,025.00	1,000.00	25.00	96.30
20.00	26.00	9	77	200.00	11.00	7	122.00	4.00	3.01	280.00	0.78	2.17	62.62	1,025.00	1,000.00	25.00	87.62
21.00	22.00	3	3	200.00	11.00	2	22.00	1.50	3.04	313.00	2.15	6.73	73.20	1,025.00	1,000.00	25.00	98.20
22.00	26.00	2	5	200.00	11.00	3	33.00	2.00	2.92	390.00	1.54	6.02	66.47	1,025.00	1,000.00	25.00	91.47
23.00	24.00	3	3	200.00	11.00	2	22.00	1.50	3.04	234.00	2.15	5.03	79.46	1,025.00	1,000.00	25.00	104.46
24.00	25.00	6	9	200.00	11.00	3	33.00	2.00	2.92	565.00	1.54	8.72	74.43	1,025.00	1,000.00	25.00	99.43
25.00	26.00	2	11	200.00	11.00	4	44.00	2.00	3.89	200.00	2.63	5.26	65.71	1,025.00	1,000.00	25.00	90.71
26.00	42.00	3	96	200.00	11.00	8	133.00	4.00	3.28	217.00	0.91	1.97	60.45	1,025.00	1,000.00	25.00	85.45
27.00	29.00	3	3	200.00	11.00	2	22.00	1.50	3.04	340.00	2.15	7.32	76.03	1,025.00	1,000.00	25.00	101.03
28.00	29.00	2	2	200.00	11.00	2	22.00	1.50	3.04	234.00	2.15	5.03	73.75	1,025.00	1,000.00	25.00	98.75
29.00	32.00	3	8	200.00	11.00	3	33.00	2.00	2.92	217.00	1.54	3.35	68.72	1,025.00	1,000.00	25.00	93.72
30.00	31.00	3	3	200.00	11.00	2	22.00	1.50	3.04	373.00	2.15	8.03	80.23	1,025.00	1,000.00	25.00	105.23
31.00	32.00	1	4	200.00	11.00	3	33.00	2.00	2.92	443.00	1.54	6.84	72.20	1,025.00	1,000.00	25.00	97.20
32.00	39.00	2	14	200.00	11.00	4	44.00	2.00	3.89	156.00	2.63	4.10	65.37	1,025.00	1,000.00	25.00	90.37
33.00	35.00	3	3	200.00	11.00	2	22.00	1.50	3.04	521.00	2.15	11.21	107.90	1,025.00	1,000.00	25.00	132.90
34.00	35.00	2	2	200.00	11.00	2	22.00	1.50	3.04	217.00	2.15	4.67	101.36	1,025.00	1,000.00	25.00	126.36
35.00	38.00	6	11	200.00	11.00	4	44.00	2.00	3.89	625.00	2.63	16.43	96.69	1,025.00	1,000.00	25.00	121.69
36.00	37.00	3	3	200.00	11.00	2	22.00	1.50	3.04	113.00	2.15	2.43	85.90	1,025.00	1,000.00	25.00	110.90

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One.

Prepared By:
Bruce Richardson

Liberty Hill, TX
(pump station on)

July 11, 2002

Zone Number	Pumps to Zone	Number of Cores in Zone	Accum Cores in Zone	Gal/Day per Core	Max Flow per Core	Max Sim Ops	Max Flow (GPM)	Pipe Size (Inches)	Max Velocity (FPS)	Length of Main this Zone	Friction Loss Factor (ft/100ft)	Friction Loss this Zone	Accumulated Friction Loss (Feet)	Max Main Elevation	Minimum Pump Elevation	Static Head (Feet)	Total Dynamic Head (ft)
iis spreadsheet was calculated using pipe diameters for: SDR21PVC													Friction loss calculations were based on a Constant for inside roughness ‹ 150				
37.00	38.00	5	8	200.00	11.00	3	33.00	2.00	2.92	208.00	1.54	3.21	83.47	1,025.00	1,000.00	25.00	108.47
38.00	39.00	4	23	200.00	11.00	5	55.00	2.00	4.86	478.00	3.97	19.00	80.26	1,025.00	1,000.00	25.00	105.26
39.00	42.00	3	40	200.00	11.00	6	66.00	3.00	2.69	330.00	0.85	2.79	61.27	1,025.00	1,000.00	25.00	86.27
40.00	41.00	3	3	200.00	11.00	2	22.00	1.50	3.04	347.00	2.15	7.47	75.86	1,025.00	1,000.00	25.00	100.86
41.00	42.00	4	7	200.00	11.00	3	33.00	2.00	2.92	643.00	1.54	9.92	68.40	1,025.00	1,000.00	25.00	93.40
42.00	44.00	10	153	200.00	11.00	10	155.00	4.00	3.82	947.00	1.21	11.44	58.48	1,025.00	1,000.00	25.00	83.48
43.00	44.00	3	3	200.00	11.00	2	22.00	1.50	3.04	313.00	2.15	6.73	53.77	1,025.00	1,000.00	25.00	78.77
44.00	44.00	1	157	200.00	11.00	10	155.00	4.00	3.82	3,894.00	1.21	47.04	47.04	1,025.00	1,000.00	25.00	72.04

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One.

Prepared By:
Bruce Richardson

Liberty Hill, TX
(pump station on)

July 11, 2002

Zone Number	Pumps to Zone	Accumulated Total of Cores this Zone	Existing Pipe Size	Gallons per 100 Lineal Feet	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
his spreadsheet was calculated using pipe diameters for: SDR21PVC										
1.00	6.00	3	3.00	40.90	550.00	224.93	20,600	91.58	0.26	2.30
2.00	6.00	3	1.50	12.07	382.00	46.11	600	13.01	1.84	3.89
3.00	4.00	3	1.50	12.07	365.00	44.06	600	13.62	1.76	5.74
4.00	5.00	9	2.00	18.84	573.00	107.97	1,800	16.67	1.44	3.98
5.00	6.00	12	2.00	18.84	265.00	49.93	2,400	48.07	0.50	2.54
6.00	12.00	19	3.00	40.90	340.00	139.05	23,800	171.17	0.14	2.04
7.00	8.00	3	1.50	12.07	200.00	24.14	600	24.85	0.97	4.94
8.00	12.00	7	2.00	18.84	643.00	121.16	1,400	11.56	2.08	3.98
9.00	10.00	3	1.50	12.07	286.00	34.52	600	17.38	1.38	5.36
10.00	11.00	9	2.00	18.84	521.00	98.17	1,800	18.34	1.31	3.98
11.00	12.00	15	2.00	18.84	512.00	96.47	3,000	31.10	0.77	2.67
12.00	20.00	46	4.00	67.65	269.00	181.98	29,200	160.46	0.15	1.90
13.00	14.00	3	1.50	12.07	208.00	25.11	600	23.90	1.00	4.73
14.00	16.00	5	2.00	18.84	121.00	22.80	1,000	43.86	0.55	3.72
15.00	16.00	2	1.50	12.07	243.00	29.33	400	13.64	1.76	4.94
16.00	20.00	8	2.00	18.84	504.00	94.96	1,600	16.85	1.42	3.18
17.00	18.00	3	1.50	12.07	330.00	39.83	600	15.06	1.59	5.16
18.00	19.00	9	2.00	18.84	512.00	96.47	1,800	18.66	1.29	3.57
19.00	20.00	14	2.00	18.84	330.00	62.18	2,800	45.03	0.53	2.29
20.00	26.00	77	4.00	67.65	280.00	189.42	35,400	186.88	0.13	1.75
21.00	22.00	3	1.50	12.07	313.00	37.78	600	15.88	1.51	4.90
22.00	26.00	5	2.00	18.84	390.00	73.48	1,000	13.61	1.76	3.39
23.00	24.00	3	1.50	12.07	234.00	28.24	600	21.24	1.13	4.58
24.00	25.00	9	2.00	18.84	565.00	106.46	1,800	16.91	1.42	3.45
25.00	26.00	11	2.00	18.84	200.00	37.68	2,200	58.38	0.41	2.03
26.00	42.00	96	4.00	67.65	217.00	146.80	39,200	267.02	0.09	1.62
27.00	29.00	3	1.50	12.07	340.00	41.04	600	14.62	1.64	4.45
28.00	29.00	2	1.50	12.07	234.00	28.24	400	14.16	1.69	4.50
29.00	32.00	8	2.00	18.84	217.00	40.89	1,600	39.13	0.61	2.80
30.00	31.00	3	1.50	12.07	373.00	45.02	600	13.33	1.80	6.50
31.00	32.00	4	2.00	18.84	443.00	83.47	800	9.58	2.50	4.69
32.00	39.00	14	2.00	18.84	156.00	29.39	2,800	95.26	0.25	2.19
33.00	35.00	3	1.50	12.07	521.00	62.89	600	9.54	2.52	6.21
34.00	35.00	2	1.50	12.07	217.00	26.19	400	15.27	1.57	5.26
35.00	38.00	11	2.00	18.84	625.00	117.76	2,200	18.68	1.28	3.69
36.00	37.00	3	1.50	12.07	113.00	13.64	600	43.99	0.55	3.54
37.00	38.00	8	2.00	18.84	208.00	39.19	1,600	40.82	0.59	3.00
38.00	39.00	23	2.00	18.84	478.00	90.07	4,600	51.07	0.47	2.41
39.00	42.00	40	3.00	40.90	330.00	134.96	8,000	59.28	0.40	1.94

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One

Zone Number	Pumps to Zone	Accumulated Total of Cores this Zone	Existing Pipe Size	Gallons per 100 Lineal Feet	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
his spreadsheet was calculated using pipe diameters for: SDR21PVC										
40.00	41.00	3	1.50	12.07	347.00	41.88	600	14.33	1.68	5.29
41.00	42.00	7	2.00	18.84	643.00	121.16	1,400	11.56	2.08	3.61
42.00	44.00	153	4.00	67.65	947.00	640.66	50,600	78.98	0.30	1.53
43.00	44.00	3	1.50	12.07	313.00	37.78	600	15.88	1.51	2.74
44.00	44.00	157	4.00	67.65	3,894.00	2,634.33	51,400	19.51	1.23	1.23

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One

Prepared By:
Bruce Richardson

Liberty Hill, TX
(pump station off)

July 11, 2002

Zone Number	Pumps to Zone	Number of Cores in Zone	Accum Cores in Zone	Gal/Day per Core	Max Flow per Core	Max Sim Ops	Max Flow (GPM)	Pipe Size (Inches)	Max Velocity (FPS)	Length of Main this Zone	Friction Loss Factor (ft/100ft)	Friction Loss this Zone	Accumulated Friction Loss (Feet)	Max Main Elevation	Minimum Pump Elevation	Static Head (Feet)	Total Dynamic Head (ft)
is spreadsheet was calculated using pipe diameters for: SDR21PVC													Friction loss calculations were based on a Constant for inside roughness = 150				
1.00	6.00	3	3	200.00	11.00	2	22.00	3.00	0.90	550.00	0.11	0.61	36.16	1,025.00	1,000.00	25.00	61.16
PS	1.00		GPD: 20000.00			GPM: 45.00		Type:	ctfgl		Desc: School Pump Station						
2.00	6.00	3	3	200.00	11.00	2	22.00	1.50	3.04	382.00	2.15	8.22	43.77	1,025.00	1,000.00	25.00	68.77
3.00	4.00	3	3	200.00	11.00	2	22.00	1.50	3.04	365.00	2.15	7.85	59.21	1,025.00	1,000.00	25.00	84.21
4.00	5.00	6	9	200.00	11.00	3	33.00	2.00	2.92	573.00	1.54	8.84	51.36	1,025.00	1,000.00	25.00	76.36
5.00	6.00	3	12	200.00	11.00	4	44.00	2.00	3.89	265.00	2.63	6.97	42.51	1,025.00	1,000.00	25.00	67.51
6.00	12.00	1	19	200.00	11.00	5	55.00	3.00	2.24	340.00	0.60	2.05	35.55	1,025.00	1,000.00	25.00	60.55
7.00	8.00	3	3	200.00	11.00	2	22.00	1.50	3.04	200.00	2.15	4.30	47.72	1,025.00	1,000.00	25.00	72.72
8.00	12.00	4	7	200.00	11.00	3	33.00	2.00	2.92	643.00	1.54	9.92	43.42	1,025.00	1,000.00	25.00	68.42
9.00	10.00	3	3	200.00	11.00	2	22.00	1.50	3.04	286.00	2.15	6.15	61.15	1,025.00	1,000.00	25.00	86.15
10.00	11.00	6	9	200.00	11.00	3	33.00	2.00	2.92	521.00	1.54	8.04	55.00	1,025.00	1,000.00	25.00	80.00
11.00	12.00	6	15	200.00	11.00	4	44.00	2.00	3.89	512.00	2.63	13.46	46.96	1,025.00	1,000.00	25.00	71.96
12.00	20.00	5	46	200.00	11.00	6	66.00	4.00	1.63	269.00	0.25	0.67	33.50	1,025.00	1,000.00	25.00	58.50
13.00	14.00	3	3	200.00	11.00	2	22.00	1.50	3.04	208.00	2.15	4.48	46.95	1,025.00	1,000.00	25.00	71.95
14.00	16.00	2	5	200.00	11.00	3	33.00	2.00	2.92	121.00	1.54	1.87	42.47	1,025.00	1,000.00	25.00	67.47
15.00	16.00	2	2	200.00	11.00	2	22.00	1.50	3.04	243.00	2.15	5.23	45.83	1,025.00	1,000.00	25.00	70.83
16.00	20.00	1	8	200.00	11.00	3	33.00	2.00	2.92	504.00	1.54	7.78	40.61	1,025.00	1,000.00	25.00	65.61
17.00	18.00	3	3	200.00	11.00	2	22.00	1.50	3.04	330.00	2.15	7.10	56.50	1,025.00	1,000.00	25.00	81.50
18.00	19.00	6	9	200.00	11.00	3	33.00	2.00	2.92	512.00	1.54	7.90	49.40	1,025.00	1,000.00	25.00	74.40
19.00	20.00	5	14	200.00	11.00	4	44.00	2.00	3.89	330.00	2.63	8.67	41.50	1,025.00	1,000.00	25.00	66.50
20.00	26.00	9	77	200.00	11.00	7	77.00	4.00	1.90	280.00	0.33	0.93	32.83	1,025.00	1,000.00	25.00	57.83
21.00	22.00	3	3	200.00	11.00	2	22.00	1.50	3.04	313.00	2.15	6.73	44.66	1,025.00	1,000.00	25.00	69.66
22.00	26.00	2	5	200.00	11.00	3	33.00	2.00	2.92	390.00	1.54	6.02	37.92	1,025.00	1,000.00	25.00	62.92
23.00	24.00	3	3	200.00	11.00	2	22.00	1.50	3.04	234.00	2.15	5.03	50.91	1,025.00	1,000.00	25.00	75.91
24.00	25.00	6	9	200.00	11.00	3	33.00	2.00	2.92	565.00	1.54	8.72	45.88	1,025.00	1,000.00	25.00	70.88
25.00	26.00	2	11	200.00	11.00	4	44.00	2.00	3.89	200.00	2.63	5.26	37.16	1,025.00	1,000.00	25.00	62.16
26.00	42.00	3	96	200.00	11.00	8	88.00	4.00	2.17	217.00	0.42	0.92	31.90	1,025.00	1,000.00	25.00	56.90
27.00	29.00	3	3	200.00	11.00	2	22.00	1.50	3.04	340.00	2.15	7.32	48.54	1,025.00	1,000.00	25.00	73.54
28.00	29.00	2	2	200.00	11.00	2	22.00	1.50	3.04	234.00	2.15	5.03	46.26	1,025.00	1,000.00	25.00	71.26
29.00	32.00	3	8	200.00	11.00	3	33.00	2.00	2.92	217.00	1.54	3.35	41.22	1,025.00	1,000.00	25.00	66.22
30.00	31.00	3	3	200.00	11.00	2	22.00	1.50	3.04	373.00	2.15	8.03	52.74	1,025.00	1,000.00	25.00	77.74
31.00	32.00	1	4	200.00	11.00	3	33.00	2.00	2.92	443.00	1.54	6.84	44.71	1,025.00	1,000.00	25.00	69.71
32.00	39.00	2	14	200.00	11.00	4	44.00	2.00	3.89	156.00	2.63	4.10	37.88	1,025.00	1,000.00	25.00	62.88
33.00	35.00	3	3	200.00	11.00	2	22.00	1.50	3.04	521.00	2.15	11.21	80.41	1,025.00	1,000.00	25.00	105.41
34.00	35.00	2	2	200.00	11.00	2	22.00	1.50	3.04	217.00	2.15	4.67	73.87	1,025.00	1,000.00	25.00	98.87
35.00	38.00	6	11	200.00	11.00	4	44.00	2.00	3.89	625.00	2.63	16.43	69.20	1,025.00	1,000.00	25.00	94.20
36.00	37.00	3	3	200.00	11.00	2	22.00	1.50	3.04	113.00	2.15	2.43	58.41	1,025.00	1,000.00	25.00	83.41

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One.

Prepared By:
Bruce Richardson

Liberty Hill, TX
(pump station off)

July 11, 2002

Zone Number	Pumps to Zone	Number of Cores in Zone	Accum Cores in Zone	Gal/Day per Core	Max Flow per Core	Max Sim Ops	Max Flow (GPM)	Pipe Size (Inches)	Max Velocity (FPS)	Length of Main this Zone	Friction Loss Factor (ft/100ft)	Friction Loss this Zone	Accumulated Friction Loss (Feet)	Max Main Elevation	Minimum Pump Elevation	Static Head (Feet)	Total Dynamic Head (ft)
iis spreadsheet was calculated using pipe diameters for: SDR21PVC													Friction loss calculations were based on a Constant for inside roughness = 150				
37.00	38.00	5	8	200.00	11.00	3	33.00	2.00	2.92	208.00	1.54	3.21	55.98	1,025.00	1,000.00	25.00	80.98
38.00	39.00	4	23	200.00	11.00	5	55.00	2.00	4.86	478.00	3.97	19.00	52.77	1,025.00	1,000.00	25.00	77.77
39.00	42.00	3	40	200.00	11.00	6	66.00	3.00	2.69	330.00	0.85	2.79	33.77	1,025.00	1,000.00	25.00	58.77
40.00	41.00	3	3	200.00	11.00	2	22.00	1.50	3.04	347.00	2.15	7.47	48.37	1,025.00	1,000.00	25.00	73.37
41.00	42.00	4	7	200.00	11.00	3	33.00	2.00	2.92	643.00	1.54	9.92	40.91	1,025.00	1,000.00	25.00	65.91
42.00	44.00	10	153	200.00	11.00	10	110.00	4.00	2.71	947.00	0.64	6.06	30.98	1,025.00	1,000.00	25.00	55.98
43.00	44.00	3	3	200.00	11.00	2	22.00	1.50	3.04	313.00	2.15	6.73	31.66	1,025.00	1,000.00	25.00	56.66
44.00	44.00	1	157	200.00	11.00	10	110.00	4.00	2.71	3,894.00	0.64	24.92	24.92	1,025.00	1,000.00	25.00	49.92

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One.

Prepared By:
Bruce Richardson

Liberty Hill, TX
(pump station off)

July 11, 2002

Zone Number	Pumps to Zone	Accumulated Total of Cores this Zone	Existing Pipe Size	Gallons per 100 Lineal Feet	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
his spreadsheet was calculated using pipe diameters for: SDR21PVC										
1.00	6.00	3	3.00	40.90	550.00	224.93	600	2.67	9.00	13.34
2.00	6.00	3	1.50	12.07	382.00	46.11	600	13.01	1.84	6.19
3.00	4.00	3	1.50	12.07	365.00	44.06	600	13.62	1.76	8.05
4.00	5.00	9	2.00	18.84	573.00	107.97	1,800	16.67	1.44	6.29
5.00	6.00	12	2.00	18.84	265.00	49.93	2,400	48.07	0.50	4.85
6.00	12.00	19	3.00	40.90	340.00	139.05	3,800	27.33	0.88	4.35
7.00	8.00	3	1.50	12.07	200.00	24.14	600	24.85	0.97	6.51
8.00	12.00	7	2.00	18.84	643.00	121.16	1,400	11.56	2.08	5.55
9.00	10.00	3	1.50	12.07	286.00	34.52	600	17.38	1.38	6.93
10.00	11.00	9	2.00	18.84	521.00	98.17	1,800	18.34	1.31	5.55
11.00	12.00	15	2.00	18.84	512.00	96.47	3,000	31.10	0.77	4.24
12.00	20.00	46	4.00	67.65	269.00	181.98	9,200	50.55	0.47	3.47
13.00	14.00	3	1.50	12.07	208.00	25.11	600	23.90	1.00	5.97
14.00	16.00	5	2.00	18.84	121.00	22.80	1,000	43.86	0.55	4.97
15.00	16.00	2	1.50	12.07	243.00	29.33	400	13.64	1.76	6.18
16.00	20.00	8	2.00	18.84	504.00	94.96	1,600	16.85	1.42	4.42
17.00	18.00	3	1.50	12.07	330.00	39.83	600	15.06	1.59	6.41
18.00	19.00	9	2.00	18.84	512.00	96.47	1,800	18.66	1.29	4.81
19.00	20.00	14	2.00	18.84	330.00	62.18	2,800	45.03	0.53	3.53
20.00	26.00	77	4.00	67.65	280.00	189.42	15,400	81.30	0.30	2.99
21.00	22.00	3	1.50	12.07	313.00	37.78	600	15.88	1.51	5.97
22.00	26.00	5	2.00	18.84	390.00	73.48	1,000	13.61	1.76	4.46
23.00	24.00	3	1.50	12.07	234.00	28.24	600	21.24	1.13	5.66
24.00	25.00	9	2.00	18.84	565.00	106.46	1,800	16.91	1.42	4.53
25.00	26.00	11	2.00	18.84	200.00	37.68	2,200	58.38	0.41	3.11
26.00	42.00	96	4.00	67.65	217.00	146.80	19,200	130.79	0.18	2.70
27.00	29.00	3	1.50	12.07	340.00	41.04	600	14.62	1.64	5.43
28.00	29.00	2	1.50	12.07	234.00	28.24	400	14.16	1.69	5.48
29.00	32.00	8	2.00	18.84	217.00	40.89	1,600	39.13	0.61	3.79
30.00	31.00	3	1.50	12.07	373.00	45.02	600	13.33	1.80	7.48
31.00	32.00	4	2.00	18.84	443.00	83.47	800	9.58	2.50	5.68
32.00	39.00	14	2.00	18.84	156.00	29.39	2,800	95.26	0.25	3.17
33.00	35.00	3	1.50	12.07	521.00	62.89	600	9.54	2.52	7.19
34.00	35.00	2	1.50	12.07	217.00	26.19	400	15.27	1.57	6.25
35.00	38.00	11	2.00	18.84	625.00	117.76	2,200	18.68	1.28	4.68
36.00	37.00	3	1.50	12.07	113.00	13.64	600	43.99	0.55	4.52
37.00	38.00	8	2.00	18.84	208.00	39.19	1,600	40.82	0.59	3.98
38.00	39.00	23	2.00	18.84	478.00	90.07	4,600	51.07	0.47	3.39
39.00	42.00	40	3.00	40.90	330.00	134.96	8,000	59.28	0.40	2.92

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One

APPENDIX 4

COLLECTION SYSTEM
OPINION OF PROBABLE COSTS

ALTERNATIVE 1
GRAVITY COLLECTION SYSTEM W/ LIBERTY HILL LIFT STATION

Item	Description	Unit	Quantity	Unit Price	Amount
Gravity Collection System					
1	Mobilization @ 5%	LS	1	41600	**$41,600**
2	8-inch SDR 35 Sewer Line 0-8 ft	LF	4582	25	**$114,550**
3	8-inch SDR 35 Sewer Line 8-10 ft	LF	4415	27	**$119,205**
4	8-inch SDR 35 Sewer Line 10-12 ft	LF	4052	30	**$121,560**
5	8-inch SDR 35 Sewer Line 12-14 ft	LF	1619	37	**$59,903**
6	8-inch SDR 35 Sewer Line 14-16 ft	LF	540	45	**$24,300**
7	Manholes	EA	53	3000	**$159,000**
8	6-inch SDR 35 Service	EA	162	1000	**$162,000**
9	Decommission Septic Tank	Ea	162	200	**$32,400**
10	Erosion Sedimentation Controls	LS	1	39000	**$39,000**
11	Trench Protection	LF	15208	2	**$30,416**
12	Traffic Control	LS	1	15000	**$15,000**
	Construction Total Gravity Collection System				**$918,934**

LIFT STATION AND FORCE MAIN

1	Wet Well Excavation	LS	1	2000	**$2,500**
2	Wet Well	Ea	1.00	10000	**$10,000**
3	Duplex Lift Station 200 gpm @ 102 ft TDH	LS	1	50000	**$50,000**
4	Electrical and Controls	LS	1	25000	**$25,000**
5	12" Bore and Encasement	LF	250	250	**$62,500**
6	Force Main - 6" PVC	LF	12000	12	**$144,000**
	Construction Total Wastewater Lift Station and Force Main				**$294,000**
	Subtotal				**$1,212,900**
	Contingencies @ 20 %				**$242,600**
	Construction Total				**$1,455,500**
	Engineering & Surveying @ 15 %				**$218,325**
	TOTAL				**$1,673,825**

HIGH SCHOOL LIFT STATION AND FORCE MAIN

1	Wet Well Excavation	LS	1	2000	**$2,000**
2	Wet Well	Ea	1.00	7500	**$7,500**
3	Duplex Lift Station 60 gpm @ 74 ft TDH)	LS	1	25000	**$25,000**
4	Electrical and Controls	LS	1	17000	**$17,000**
5	Force Main - 3" PVC	LF	1600	8	**$12,800**
	Construction Total Wastewater Lift Station and Force Main				**$64,300**
	Subtotal				**$64,300**
	Contingencies @ 20 %				**$12,900**
	Construction Total				**$77,200**
	Engineering & Surveying @ 20 %				**$15,440**
	TOTAL				**$92,640**

ALTERNATIVE 1
GRAVITY COLLECTION SYSTEM W/ LIBERTY HILL LIFT STATION
Yearly Operation and Maintenance Costs

	Description	Unit	Quantity	Unit Price	Cost
1	Gravity Collection System	mile	2.88	2000	$5,761
2	Lift Station and Force Main				
	Electrical	KWhr	9812	0.08	$785
	Labor (assumed to be 15 % electrical costs)				$118
	Total Annual Cost				$6,663

ALTERNATIVE 1
GRAVITY COLLECTION SYSTEM W/ LIBERTY HILL LIFT STATION

Description	West of CR 279			East of CR 279			Total		
	Cost*	Services	Cost/Service**	Cost*	Services	Cost/Service**	Cost*	Services	Cost/Service**
Line A	$151,496	18	$8,400	$251,551	43	$5,900	$403,048	61	$6,607
Line B	$72,234	13	$5,600	$101,770	19	$5,400	$174,004	32	$5,438
Line C	$66,934	10	$6,700				$66,934	10	$6,693
Line D	$102,293	10	$10,200	$56,238	10	$5,600	$158,531	20	$7,927
Line E	$99,932	9	$11,100	$90,071	15	$6,000	$190,003	24	$7,917
Line G	$79,746	9	$8,900	$25,594	6	$4,300	$105,340	15	$7,023
Subtotal	$572,635	69	$8,483	$525,223	93	$5,440	$1,097,858	162	$6,777
LIFT STATION & FORCE MAIN							$352,800	162	$2,178
TOTAL							$1,450,658		$8,955

* - Costs include 20 % Contingency, Costs do not include Engineering
** - Gravity Line Only

ALTERNATIVE 1
GRAVITY COLLECTION SYSTEM LINE A

Item	Description	Unit	Quantity	Unit Price	Amount
	West of CR 279				
1	Insurance, Bonds, Move In @ 5 %	LS	1	5600	$5,600
2	8-inch SDR 35 Sewer Line 0-8 ft	LF	280	25	$7,000
3	8-inch SDR 35 Sewer Line 8-10 ft	LF	240	27	$6,480
4	8-inch SDR 35 Sewer Line 10-12 ft	LF	1104	29	$32,016
5	8-inch SDR 35 Sewer Line 12-14 ft	LF	337	37	$12,469
6	8-inch SDR 35 Sewer Line 14-16 ft	LF	280	45	$12,600
7	Manholes	EA	7	3000	$21,000
8	6-inch SDR 35 Service	EA	18	1000	$18,000
9	Decommission Septic Tank	Ea	18	200	$3,600
10	Erosion Sedimentation Controls	LS	1	3000	$3,000
11	Trench Protection	LF	2241	2	$4,482
	Subtotal Line A West of 279				$126,247
	Contingencies @ 20 Percent				$25,249
	Subtotal Line A West of 279				$151,496
	East of CR 279				
1	Insurance, Bonds, Move In @ 5 %	LS	1	5100	$5,100
2	8-inch SDR 35 Sewer Line 0-8 ft	LF	0	25	$0
3	8-inch SDR 35 Sewer Line 8-10 ft	LF	349	27	$9,423
4	8-inch SDR 35 Sewer Line 10-12 ft	LF	605	29	$17,545
5	8-inch SDR 35 Sewer Line 12-14 ft	LF	374	37	$13,838
6	8-inch SDR 35 Sewer Line 14-16 ft	LF	0	45	$0
7	Manholes	EA	5	3000	$15,000
8	6-inch SDR 35 Service	EA	16	1000	$16,000
9	Decommission Septic Tank	Ea	16	200	$3,200
10	Erosion Sedimentation Controls	LS	1	3000	$3,000
11	Trench Protection	LF	1328	2	$2,656
12	Traffic Control	LS	1	1	$2,500
	Subtotal Line A West of 279				$88,262
	Contingencies @ 20 Percent				$17,652
	Subtotal Line A East of 279				$105,914
	East of CR279 Lines A-1 thru A-5				
1	Insurance, Bonds, Move In @ 5 %	LS	1	5400	$5,400
2	8-inch SDR 35 Sewer Line 0-8 ft	LF	545	25	$13,625
3	8-inch SDR 35 Sewer Line 8-10 ft	LF	709	27	$19,143
4	8-inch SDR 35 Sewer Line 10-12 ft	LF	576	29	$16,704
5	8-inch SDR 35 Sewer Line 12-14 ft	LF	88	37	$3,256
6	8-inch SDR 35 Sewer Line 14-16 ft	LF	0	45	$0
7	Manholes	EA	8	3000	$24,000
8	6-inch SDR 35 Service	EA	27	1000	$27,000
9	Decommission Septic Tank	Ea	27	200	$5,400
10	Erosion Sedimentation Controls	LS	1	3000	$3,000
11	Trench Protection	LF	1918	2	$3,836
	Subtotal Line A Sublines East of 279				$121,364
	Contingencies @ 20 Percent				$24,273
	Total Branch Lines A				$145,637
	Total Line A				$403,048

ALTERNATIVE 1
GRAVITY COLLECTION SYSTEM LINE B

Item	Description	Unit	Quantity	Unit Price	Amount
	West of CR 279				
1	Insurance, Bonds, Move In @ 5 %	LS	1	2600	$2,600
2	8-inch SDR 35 Sewer Line 0-8 ft	LF	0	25	$0
3	8-inch SDR 35 Sewer Line 8-10 ft	LF	435	27	$11,745
4	8-inch SDR 35 Sewer Line 10-12 ft	LF	480	29	$13,920
5	8-inch SDR 35 Sewer Line 12-14 ft	LF	0	37	$0
6	8-inch SDR 35 Sewer Line 14-16 ft	LF	0	45	$0
7	Manholes	EA	2	3000	$6,000
8	6-inch SDR 35 Service	EA	13	1000	$13,000
9	Decommission Septic Tank	Ea	13	200	$2,600
10	Erosion Sedimentation Controls	LS	2	3000	$6,000
11	Trench Protection	LF	915	2	$1,830
12	Traffic Control	LS	1	1	$2,500
	Subtotal Line B West of 279				$60,195
	Contingencies @ 20 Percent				$12,039
	Subtotal Line B West of 279				$72,234
	East of CR 279				
1	Insurance, Bonds, Move In @ 5 %	LS	1	3900	$3,900
2	8-inch SDR 35 Sewer Line 0-8 ft	LF	789	25	$19,725
3	8-inch SDR 35 Sewer Line 8-10 ft	LF	545	27	$14,715
4	8-inch SDR 35 Sewer Line 10-12 ft	LF	0	29	$0
5	8-inch SDR 35 Sewer Line 12-14 ft	LF	0	37	$0
6	8-inch SDR 35 Sewer Line 14-16 ft	LF	0	45	$0
7	Manholes	EA	6	3000	$18,000
8	6-inch SDR 35 Service	EA	19	1000	$19,000
9	Decommission Septic Tank	Ea	19	200	$3,800
10	Erosion Sedimentation Controls	LS	1	3000	$3,000
11	Trench Protection	LF	1334	2	$2,668
	Subtotal Line B East of 279				$84,808
	Contingencies @ 20 Percent				$16,962
	Subotal Line B East of 279				$101,770
	Total Line B				$174,004

ALTERNATIVE 1
GRAVITY COLLECTION SYSTEM LINE C

Item	Description	Unit	Quantity	Unit Price	Amount
	West of CR 279				
1	Insurance, Bonds, Move In @ 5 %	LS	1	2300	$2,300
2	8-inch SDR 35 Sewer Line 0-8 ft	LF	114	25	$2,850
3	8-inch SDR 35 Sewer Line 8-10 ft	LF	200	27	$5,400
4	8-inch SDR 35 Sewer Line 10-12 ft	LF	580	29	$16,820
5	8-inch SDR 35 Sewer Line 12-14 ft	LF	80	37	$2,960
6	8-inch SDR 35 Sewer Line 14-16 ft	LF	0	45	$0
7	Manholes	EA	2	3000	$6,000
8	6-inch SDR 35 Service	EA	10	1000	$10,000
9	Decommission Septic Tank	Ea	10	200	$2,000
10	Erosion Sedimentation Controls	LS	1	3000	$3,000
11	Trench Protection	LF	974	2	$1,948
12	Traffic Control	LS	1	1	$2,500
	Subtotal Line C West of 279				$55,778
	Contingencies @ 20 Percent				$11,156
	Total Line C West of 279				$66,934

ALTERNATIVE 1
GRAVITY COLLECTION SYSTEM LINE D

Item	Description	Unit	Quantity	Unit Price	Amount
	West of CR 279				
1	Insurance, Bonds, Move In @ 5 %	LS	1	3700	$3,700
2	8-inch SDR 35 Sewer Line 0-8 ft	LF	380	25	$9,500
3	8-inch SDR 35 Sewer Line 8-10 ft	LF	356	27	$9,612
4	8-inch SDR 35 Sewer Line 10-12 ft	LF	440	29	$12,760
5	8-inch SDR 35 Sewer Line 12-14 ft	LF	380	37	$14,060
6	8-inch SDR 35 Sewer Line 14-16 ft	LF	0	45	$0
7	Manholes	EA	5	3000	$15,000
8	6-inch SDR 35 Service	EA	10	1000	$10,000
9	Decommission Septic Tank	Ea	10	200	$2,000
10	Erosion Sedimentation Controls	LS	1	3000	$3,000
11	Trench Protection	LF	1556	2	$3,112
12	Traffic Control	LS	1	1	$2,500
	Subtotal Line D West of 279				$85,244
	Contingencies @ 20 Percent				$17,049
	Subtotal Line D West of 279				$102,293
	East of CR 279				
1	Insurance, Bonds, Move In @ 5 %	LS	1	2100	$2,100
2	8-inch SDR 35 Sewer Line 0-8 ft	LF	159	25	$3,975
3	8-inch SDR 35 Sewer Line 8-10 ft	LF	568	27	$15,336
4	8-inch SDR 35 Sewer Line 10-12 ft	LF	0	29	$0
5	8-inch SDR 35 Sewer Line 12-14 ft	LF	0	37	$0
6	8-inch SDR 35 Sewer Line 14-16 ft	LF	0	45	$0
7	Manholes	EA	3	3000	$9,000
8	6-inch SDR 35 Service	EA	10	1000	$10,000
9	Decommission Septic Tank	Ea	10	200	$2,000
10	Erosion Sedimentation Controls	LS	1	3000	$3,000
11	Trench Protection	LF	727	2	$1,454
	Subtotal Line D East of 279				$46,865
	Contingencies @ 20 Percent				$9,373
	Total Line D East of 279				$56,238
	Total Line D				$158,531

ALTERNATIVE 1
GRAVITY COLLECTION SYSTEM LINE E

Item	Description	Unit	Quantity	Unit Price	Amount
	West of CR 279				
1	Insurance, Bonds, Move In @ 5 %	LS	1	3800	3800
2	8-inch SDR 35 Sewer Line 0-8 ft	LF	800	25	$20,000
3	8-inch SDR 35 Sewer Line 8-10 ft	LF	813	27	$21,951
4	8-inch SDR 35 Sewer Line 10-12 ft	LF	0	29	$0
5	8-inch SDR 35 Sewer Line 12-14 ft	LF	0	37	$0
6	8-inch SDR 35 Sewer Line 14-16 ft	LF	0	45	$0
7	Manholes	EA	6	3000	$18,000
8	6-inch SDR 35 Service	EA	9	1000	$9,000
9	Decommission Septic Tank	Ea	9	200	$1,800
10	Erosion Sedimentation Controls	LS	1	3000	$3,000
11	Trench Protection	LF	1613	2	$3,226
12	Traffic Control	LS	1	1	$2,500
	Subtotal Line E West of 279				83277
	Contingencies @ 20 Percent				$16,655
	Subtotal Line E West of 279				99932.4
	East of CR 279				
1	Insurance, Bonds, Move In @ 5 %	LS	1	3200	$3,200
2	8-inch SDR 35 Sewer Line 0-8 ft	LF	466	25	$11,650
3	8-inch SDR 35 Sewer Line 8-10 ft	LF	60	27	$1,620
4	8-inch SDR 35 Sewer Line 10-12 ft	LF	167	29	$4,843
5	8-inch SDR 35 Sewer Line 12-14 ft	LF	260	37	$9,620
6	8-inch SDR 35 Sewer Line 14-16 ft	LF	260	45	$11,700
7	Manholes	EA	3	3000	$9,000
8	6-inch SDR 35 Service	EA	15	1000	$15,000
9	Decommission Septic Tank	Ea	15	200	$3,000
10	Erosion Sedimentation Controls	LS	1	3000	$3,000
11	Trench Protection	LF	1213	2	$2,426
	Subtotal Line E East of 279				75059
	Contingencies @ 20 Percent				$15,012
	Total Line E East of 279				$90,071
	Total Line E				$190,003

ALTERNATIVE 1
GRAVITY COLLECTION SYSTEM LINE G

Item	Description	Unit	Quantity	Unit Price	Amount
	West of CR 279				
1	Insurance, Bonds, Move In @ 5 %	LS	1	2900	$2,900
2	8-inch SDR 35 Sewer Line 0-8 ft	LF	785	25	$19,625
3	8-inch SDR 35 Sewer Line 8-10 ft	LF	140	27	$3,780
4	8-inch SDR 35 Sewer Line 10-12 ft	LF	100	29	$2,900
5	8-inch SDR 35 Sewer Line 12-14 ft	LF	100	37	$3,700
6	8-inch SDR 35 Sewer Line 14-16 ft	LF	0	45	$0
7	Manholes	EA	5	3000	$15,000
8	6-inch SDR 35 Service	EA	9	1000	$9,000
9	Decommission Septic Tank	Ea	9	200	$1,800
10	Erosion Sedimentation Controls	LS	1	3000	$3,000
11	Trench Protection	LF	1125	2	$2,250
12	Traffic Control	LS	1	1	$2,500
	Subtotal Line G West of 279				$66,455
	Contingencies @ 20 Percent				$13,291
	Subtotal Line E W of 279				$79,746
	East of CR 279				
1	Insurance, Bonds, Move In @ 5 %	LS	1	1000	$1,000
2	8-inch SDR 35 Sewer Line 0-8 ft	LF	264	25	$6,600
3	8-inch SDR 35 Sewer Line 8-10 ft	LF	0	27	$0
4	8-inch SDR 35 Sewer Line 10-12 ft	LF	0	29	$0
5	8-inch SDR 35 Sewer Line 12-14 ft	LF	0	37	$0
6	8-inch SDR 35 Sewer Line 14-16 ft	LF	0	45	$0
7	Manholes	EA	1	3000	$3,000
8	6-inch SDR 35 Service	EA	6	1000	$6,000
9	Decommission Septic Tank	Ea	6	200	$1,200
10	Erosion Sedimentation Controls	LS	1	3000	$3,000
11	Trench Protection	LF	264	2	$528
	Subtotal Line G East of 279				$21,328
	Contingencies @ 20 Percent				$4,266
	Total Line G East of 279				$25,594
	Total Line G				$105,340

ALTERNATIVE 1
HIGH SCHOOL LIFT STATION PRELIMINARY DESIGN

1 Wet Well Minimum Working Volume

Volume = Q*T/4

Where: Q= Pump Flow = 40 gpm

T=Minimum Cycle Time = 10 min

Working Volume = 100 gallons

24
43

2 Working Level

Assume 8 ft diameter wet well

Excavation = 35

Working Level= 0.3 ft

3 Depth

Assume 12 ft depth

Concrete

Walls =	10.28
Foundation =	5.70
Total	16.00

4 Static Head

Floor Elevation	983	ft msl
Elevation @ SH 29 WWTP	1025	ft msl

Static Head = 42 ft

5 Friction Head = Hf=.2083*(100/C)^1.85*Q^1.85/Di^4.86

C=	120	
Q=	60	gpm
Di=	3	in
Hf=	1.39	ft/100 ft
Velocity	2.72	fps

Force Main Length= 1600 ft

Hf= 22 ft

6 Minor Losses

Allow 7 ft minor losses

7 Total Head = 71 ft TDH

8 Required Power = Q*TDH**GAMMA/550/E= 3 hp Drawn

2.0 KW

ALTERNATIVE 2
LOW PRESSURE SEWER SYSTEM AND FORCE MAIN FROM HIGH SCHOOL

Item	Description	Unit	Quantity	Unit Price	Amount
Low Pressure Sewer System					
1	2.0-inch SDR 21 Pressure Pipe	LF	5019	6	**$30,114**
2	3.0-inch SDR 21 Pressure Pipe	LF	7906	8	**$63,248**
3	4.0-inch SDR 21 Pressure Pipe	LF	1220	10	**$12,200**
4	6.0-inch SDR 21 Pressure Pipe	LF	5607	12	**$67,284**
5	Gator Grinder Pump	Ea	161	1900	**$305,900**
6	45 GPM Elementary/Middle School	Ea	1	32500	**$32,500**
7	1-1/2" Pipe lateral Services	LF	7850	3	**$23,550**
8	Lateral Shut Off Valves and Appurtenances	Ea	163	200	**$32,600**
9	Flush Valves and Appurtenances	LF	19752	2.5	**$49,380**
10	Septic Tank Decommissioning	Ea	161	200	**$32,200**
11	Erosion Sedimentation Controls	LS	1	20000	**$20,000**
12	Trench Protection	LF	0		**$0**
13	Traffic Control	LS	1	10000	**$10,000**
	Construction Total Low Pressure Sewer System				**$678,976**
LIFT STATION AND FORCE MAIN					
1	Wet Well Excavation	LS	1	2500	**$2,500**
2	Wet Well	Ea	1.00	10000	**$10,000**
3	Duplex Lift Station 200 gpm @ 62 ft TDH	LS	1	50000	**$50,000**
4	Electrical and Controls	LS	1	25000	**$25,000**
5	12" Bore and Encasement	LF	250	250	**$62,500**
6	Force Main - 6" PVC	LF	7040	12	**$84,480**
	Construction Total Wastewater Lift Station and Force Main				**$234,480**
	Subtotal				**$913,500**
	Contingencies @ 20 %				**$182,700**
	Construction Total				**$1,096,200**
	Engineering & Surveying @ 15 %				**$164,430**
	TOTAL				**$1,260,630**

ALTERNATIVE 2

LOW PRESSURE SEWER SYSTEM AND FORCE MAIN FROM HIGH SCHOOL

LIFT STATION DESIGN

1 Wet Well Minimum Working Volume

Volume = Q*T/4

Where: Q= Pump Flow = 200 gpm

T=Minimum Cycle Time = 10 min

Working Volume = 500 gallons

24.1

42.8

2 Working Level

Assume 6 ft diameter wet well

Excavation = 19

Working Level= 2.4 ft

3 Depth

Assume 10 ft depth

Concrete

4 Static Elevation

Walls = 6.63

Floor Elevation 995 ft msl

Foundation = 4.19

Elevation @ SH 29 WWTP 1025 ft msl

Total 11.00

Static Head = 30 ft

5 Friction Head = Hf=.2083*(100/C)^1.85*Q^1.85/Di^4.86

C= 120

Q= 200 gpm

Di= 6 in

Hf= 0.44 ft/100 ft

Velocity 2.27 fps

Force Main Length= 7040 ft

Hf= 31 ft

Allow 7 ft minor losses

Total Head = 68 ft TDH

6 Required Power = Q*TDH**GAMMA/550/E= 6 hp Drawn

4.7 KW

7 Total Operating Hours @ ADF = 32 gpm 6551 KWhr

ALTERNATIVE 2

LOW PRESSURE SEWER SYSTEM AND FORCE MAIN FROM HIGH SCHOOL

Yearly Operation and Maintenance Costs

	Description	Unit	Quantity	Unit Price	Cost
1	Grinder Pumps	Ea	162.00	52	$8,424
2	Lift Station and Force Main				
	Electrical	KWhr	6651	0.08	$532
	Labor (assumed to be 15 % electrical costs)				$80
	Total Annual Cost				$9,036

APPENDIX 5

PRELIMINARY DESIGN SUMMARIES
CONCEPTUAL LEVEL SITE PLANS

LIBERTY HILL REGIONAL WASTEWATER STUDY
300,000 GPD Oxidation Ditch
Opinion of Probable Costs

Item	Description	No. Units	Units	Unit Cost	Total Cost
WW-1	Bonds and Insurance	1	LS	$52,000	$52,000
WW-2	Mobilization	1	LS	$50,000	$50,000
WW-3	Site Work and Excavation	1	LS	$120,000	$120,000
WW-4	Lift Station	1	LS	$115,000	$115,000
WW-5	Oxidation Ditch	1	LS	$210,000	$210,000
WW-6	Clarifier	1	LS	$260,000	$260,000
WW-7	Brush or Disk Aerators	1	LS	$44,000	$44,000
WW-8	Return Sludge Pumps	1	LS	$90,000	$90,000
WW-9	Filter Equipment	1	LS	$120,000	$120,000
WW-10	Ultraviolet Disinfection	1	LS	$42,000	$42,000
WW-11	Sludge Holding Tank	1	LS	$35,000	$35,000
WW-12	Yard Piping	1	LS	$80,000	$80,000
WW-13	Electrical	1	LS	$175,000	$175,000
WW-14	Phos. Removal Pumps, Pipe, & Storage	1	LS	$25,000	$25,000
WW-15	Storage Building	1	LS	$10,000	$10,000
WW-16	Chain Link Fence	1	LS	$18,000	$18,000
WW-17	Start up	1	LS	$6,000	$6,000
	Subtotal				$1,452,000
	Contingencies @ 20 %				$290,400
	Total Construction Cost				$1,742,400
	Engineering & Surveying @ 15 %				$261,360
	Total Cost				$2,003,760

50 gpd

LIBERTY HILL REGIONAL WASTEWATER STUDY
300,000 GPD Extended Aeration Treatment Plant Construction Costs
Opinion of Probable Costs

Item	Description	No. Units	Units	Unit Cost	Total Cost
WW-1	Bonds and Insurance	1	LS	$52,000	$52,000
WW-2	Mobilization	1	LS	$50,000	$50,000
WW-3	Site Work and Excavation	1	LS	$63,000	$63,000
WW-4	Lift Station (Concrete)	1	LS	$60,000	$60,000
WW-5	WWTP Foundation (Concrete)	1	LS	$125,000	$125,000
WW-6	Filter (Concrete)	1	LS	$21,000	$21,000
WW-7	Blower Building (Concrete)	1	LS	$15,000	$15,000
WW-8	WWTP	1	LS	$425,000	$425,000
WW-9	Clarifier Equipment	1	LS	$45,000	$45,000
WW-10	Filter Equipment	1	LS	$120,000	$120,000
WW-11	Blower Equipment	1	LS	$75,000	$75,000
WW-12	Lift Station Equipment	1	LS	$69,000	$69,000
WW-13	Ultraviolet Disinfection	1	LS	$42,000	$42,000
WW-14	Yard Piping	1	LS	$80,000	$80,000
WW-15	Electrical	1	LS	$175,000	$175,000
WW-16	Phos. Removal Pumps, Pipe, & Storage	1	LS	$25,000	$25,000
WW-17	Storage Building	1	LS	$10,000	$10,000
WW-18	Chain Link Fence	1	LS	$10,000	$10,000
WW-19	Start up	1	LS	$6,000	$6,000
	Subtotal				$1,468,000
	Contingencies @ 20 %				$293,600
	Total Construction Cost				$1,761,600
	Engineering & Surveying @ 15 %				$264,240
	Total Cost				$2,025,840

** - Costs were exprapolated from a similar facility constructed in 1995 and ajdusted to todays dollars with the ENR Construction Cost Index

LIBERTY HILL REGIONAL WASTEWATER STUDY

Phase 1 Design Calculations

Average Dry Flow	250,000			
Wet Weather Maximum 30 Day (gpd)	300,000			
Peaking Factor	1.99	Peak Factor = [(18+(0.0206*F)^.5/(4+(0.0206*F)^.5)]		
Peak Flow (gpd)	1,248,260	Includes 750 gpd/acre I&I		
Overall Peak Factor	4.2			
Influent BOD5				
Average Day	200	mg/l	417	lb/day
Maximum Month	250	mg/l	521	lb/day
Influent TSS				
Average Day	200	mg/l	417	lb/day
Maximum Month	250	mg/l	521	lb/day
Influent Ammonia				
Average Day	15	mg/l		
Maximum Month	20	mg/l		
Influent Phosphorus				
Average Day	7	mg/l	15	lb/day
Maximum Month	10	mg/l	21	lb/day

Design Criteria - Extended Aeration/Oxidation Ditch

Aeration Basin Organic Load	15	lb BOD5/Day/1000 Cuft
Aeration System Design		
Extended Aeration	2850	SCF/lb BOD 5
Oxidation Ditch	2.2	lb O2/lb BOD5
Clarification		
Max. Surface Loading @ Peak Flow	1000	gpd/ft^2
Min. Detention Time @ Peak Flow	1.8	hrs
Max. Surface Loading @ Design Flow	500	gpd/ft^2
Min. Detention Time @ Design Flow	3.6	hrs
Filtration		
@ Design Flow	4	gpm/ft @ Design Flow
@ Peak Flow	8	gpm/ft @ Peak Flow (one unit out of service)
Chlorine Contact Basin	20	min HRT @ Peak Flow

Design

Sizing Calculations

Aeration Basin

Basin Volume Extended Air	**27800**	cubic feet		207944	gallons
Oxidation Ditch	**27852**	cubic feet		208333	gallons
Aeration					
Extended Aeration	1032	scfm	1153	lb O2/day	
Oxidation Ditch	1147	lb O2/day			

LIBERTY HILL REGIONAL WASTEWATER STUDY

Phase 1 Design Calculations

Clarification

Required Surface Area @ Peak Flow	**1248**	**ft^2**
Required Surface Area @ Avg. Flow	600	ft^2
Required Volume @ Peak Flow	**93620**	**gal**
Required Volume @ Avg. Flow	37500	gal
Required SWD @ Peak Flow	10	ft
Required SWD @ Avg. Flow	8	ft

Filtration

Reqd. Area @ Design Flow	52	ft^2
Reqd. Area @ Peak Flow	108	ft^2
Provide 4 Filters @	**26**	**ft^2 Ea**

Chlorine Contact Tank

Required Volume =		**17337**	**gal**	
Required Dosage @	10 mg/L	**25**	**lb/day**	
Dosage Rate @	1.00%	**300**	**gal/day**	
Provide 15 days storage		**4500**	**gallons**	Use 5000 gallons

Ferric Chloride Feed ——

		1.8	lb Fe per lb P	
Dosage =		**26**	lb/day	
FeSO4 Required @ 0.5 #/gal FeCl3		**53**	gpd	
Provide 30 days storage		**1576**	gallons	**Use 1600** gallons

Dimensioning Calculations

Aeration Basin Extended Air Concentric Tanks

Volume =		**27800**	cu ft
Use 10 SWD depth			
Surface Area =		**2780**	ft^2
Required Total Surface Area =		**4717**	ft^2 (AB + Sludge Holding Tank+Clarifier)
Goal Seek Incremental Diameter =	28.7	4717	ft
Overal Diameter =		**69**	ft

Aeration Basin Oxidation Ditch

Volume =		27852	cu ft
Use 6 SWD ft			
Assume Side Slope =	1		
Assume Bottom Width =	10 ft		
Assume End Radius =	20 ft		
Goal Seek Tot. Length	317 ft	27852	cu ft
Overall St Channel		159	ft Note: Two channels provided.
End To End Length		231	ft

LIBERTY HILL REGIONAL WASTEWATER STUDY

Phase 1 Design Calculations

Clarifier								
Required Area =			1248	ft^2				
Diameter =			40	ft^2	Use		**40**	ft
Area =			1257	ft^2				
Filtration								
Required Area =			108	ft^2				
Provide	4	filters	36	ft^2 ea				
Dimensions =			6.0 x 6.0	ft				
Chlorine Contact Chamber								
Required Volume =			17337	gallons				
Surface Area @	6	ft SWD	386	ft^2				
Overall L:W	3							
Length =			11.3	ft				
Width=			3.8	ft	Use	11.0	x 4.0	Channel
Overall Width =			8.8	ft				
Sludge Holding Tank								
Provide	10	days holding						
Sludge Production =			0.8	lb/lb BODr				
			297	lb Solids/day				
Clarifier Underflow	0.70%		5089	gal/day				
Tank Volume =			50893	gal/day				
SWD =	10	ft						
Required Surface Area =			680	ft^2				
Oxidation Ditch Need External Tank								
Diameter =			29	ft				

APPENDIX 6

PRELIMINARY PLAN & PROFILE DRAWINGS / OPINION OF PROBABLE COSTS EFFLUENT LINE

LIBERTY HILL REGIONAL WASTEWATER STUDY

GRAVITY EFFLUENT LINE

Item	Description	Unit	Quantity	Unit Price	Amount
1	Insurance, Bonds, Move In @ 5 %	LS	1	24000	$24,000
2	18-inch F 679, T-1 Wall Sewer Line 0-8 ft	LF	4325	40	$173,000
3	18-inch F 679, T-1 Wall Sewer Line 8-10 ft	LF	1460	43	$62,780
4	18-inch F 679, T-1 Wall Sewer Line 10-12 ft	LF	1040	46	$47,840
5	18-inch F 679, T-1 Wall Sewer Line 12-14 ft	LF	760	50	$38,000
6	18-inch F 679, T-1 Wall Sewer Line 14-16 ft	LF	200	54	$10,800
7	18-inch F 679, T-1 Wall Sewer Line 16-18 ft	LF	240	60	$14,400
8	28-inch Bore and Encasement	LF	120	350	$42,000
9	Manholes	EA	21	3000	$63,000
10	Outfall Structure South Fork San Gabriel	EA	1	12000	$12,000
11	Erosion Sedimentation Controls	LS	1	10000	$10,000
12	Trench Protection	LF	8025	2	$16,050
	Subtotal				$513,870
	Contingencies @ 20 Percent				$102,774
	Construction Total				**$616,644**
	Engineering and Surveying @ 15 %				$92,497
	TOTAL				**$709,141**

PRESSURE EFFLUENT LINE

Item	Description	Unit	Quantity	Unit Price	Amount
1	Insurance, Bonds, Move In @ 5 %	LS	1	20000	$20,000
2	16-inch Class 100	LF	8025	35	$280,875
3	28-inch Bore and Encasement	LF	120	350	$42,000
4	Appurtenances	LS	1	8500	$8,500
5	Outfall Structure South Fork San Gabriel	Ea	1	12000	$12,000
6	Erosion Sedimentation Controls	LS	1	8000	$8,000
7	Trench Protection	LF	8025	2	$16,050
	Subtotal				$387,425
	Contingencies @ 20 Percent				$77,485
	Construction Total				**$464,910**
	Engineering and Surveying @ 15 %				$69,737
	TOTAL				**$534,647**