

**TALKING ROCK RANCH
PHASE 2 & 3
SEWER COLLECTION SYSTEM
DESIGN REPORT**

Prepared for:

Talking Rock Land, L.L.C.
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Job # 01377

Prepared by:

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May 2002

TABLE OF CONTENTS

Report cover.....	1
Table of Contents.....	2
Introduction.....	3
Objective.....	3,4
System Analysis.....	4
Conclusion.....	4,5

Appendix A

Site map

Appendix B

Spreadsheets detailing results of analysis

Appendix C

Drawing sheets 1 and 2 showing site.
Zones
Number of pumps
Length of segments
Size of low pressure sewer lines



1. Introduction

General Description

Talking Rock Ranch Subdivision consists of residential and recreational facilities. This planned area development (PAD) was approved by the Yavapai County Board of Supervisors on October 6, 1999 and Amended on May 8, 2000.

The entire subdivision encompasses more than 2000 acres of undeveloped and newly developed land that slopes towards Inscription Canyon. The site is divided by Williamson Valley Road. The site consists of forested areas with, sometimes, extreme slopes. Phases 2 and 3 are located in the Southeastern portion of this subdivision off Talking Rock Ranch Road. See Appendix A for an area site map.

This report examines the design of the sewer system for Phases 2, 3 and future Phases 5 and 6, adjacent to Phase 3 of the Talking Rock Ranch Subdivision. The project site is located in portions of Sections 15 and 22, Township 16 North, Range 3 West, Gila and Salt River and Meridian, Yavapai County, Arizona. The project is generally located in the Southern portion of Williamson Valley and straddles Williamson Valley Road.

2. Objective

This report will address the combined gravity and low pressure sewer system design for Talking Rock Ranch Subdivision within Phases 2 and 3. As with Phase 1 all lots lower in elevation than the sewer line will be served by a homeowner installed and operated grinder pump station. These individual pump stations are also the pressure source for the low pressure sewers.

Phase 1 of Talking Rock Ranch consists of a low pressure sewer system that discharges to a gravity sewer system. The gravity sewer in Phase 1 then discharges into a Homeowner's Association operated and maintained duplex pump station. This pump station is designed to pump sewage from Phase 1 and future Phases east of Williamson Valley Road to an existing treatment plant located at the south end of the Talking Rock Ranch property. Piping for Phase 1 has been sized to service the future Phases of Talking Rock Ranch. Phases 2 and 3 will connect to the existing Phase 1 sewer system.

Phase 2 proposes to extend the 8" gravity sewer line from Double Adobe Road along the length of Three Forks Road to a high point just East of Centennial Drive. This 8" line will be stubbed out just beyond the Phase line for future use. Soza Mesa Lane and Centennial Drive South of Three Forks Road will be served by 8" gravity lines. All other sewer lines within this Phase are proposed as pressure sewers and will connect to the 8" gravity sewer line in Three Forks Road.

Phase 3 proposes to be served entirely by a low pressure sewer system. Sewage will be pumped from each individual home through a low pressure sewer system to a high point on Double Adobe Road at the south end of this Phase. At this point the system becomes gravity and connects to Phase 2, then to Phase 1. The low pressure sewer line at the North end of Double Adobe Road will be stubbed out just beyond the Phase line for future use. See Appendix C for Phase 2 and 3 Sewer Collection System layouts.

This entire system is designed to service Phases 2, 3 and future Phases 5 and 6.

3. System Analysis

The sewer collection system for Phases 2, 3 and future Phases 5 and 6, adjacent to Phase 3 is more than adequately designed to provide sewer service for each lot within these areas. The low pressure sewer piping analysis was performed using computer design software developed by Environment One Corporation of Niskayuna, New York, that calculates velocity and friction losses for specific pumps in simultaneous operation. The design is based on the Hazen-Williams formula for determining pipe sizes that result in minimum flow velocities of 3.0 feet per second or higher, as required by ADEQ. Pipe sizes are based on the inside diameter and the "C" factor selected for the pipe type selected. The roughness coefficient, "C", for SDR11 is 145. The analysis is based on a design flow of 235 gallons/dwelling/day and SDR11 polyethylene pipe. Phases 2 and 3 and future Phases 5 and 6, adjacent to Phase 3 include a total of 169 Environment One GP 2010-60 pump stations. The highest total dynamic head (TDH) encountered is 104.83 feet in zone 33 (Phase 3), which is below the "not recommended to exceed" pressure of 60 psi or 138 feet of TDH per Environment One. The highest total retention time within the system is 3.22 hours. Flushing connections will be located at the terminal end of each main, intersections, changes in pipe diameter and at any sharp changes in direction. Air release valves will be placed at high points in the system. The flattest section of 8" diameter gravity sewer

line within Phase 2 can handle the flows of this Phase as well as multiple lots within future Phases.

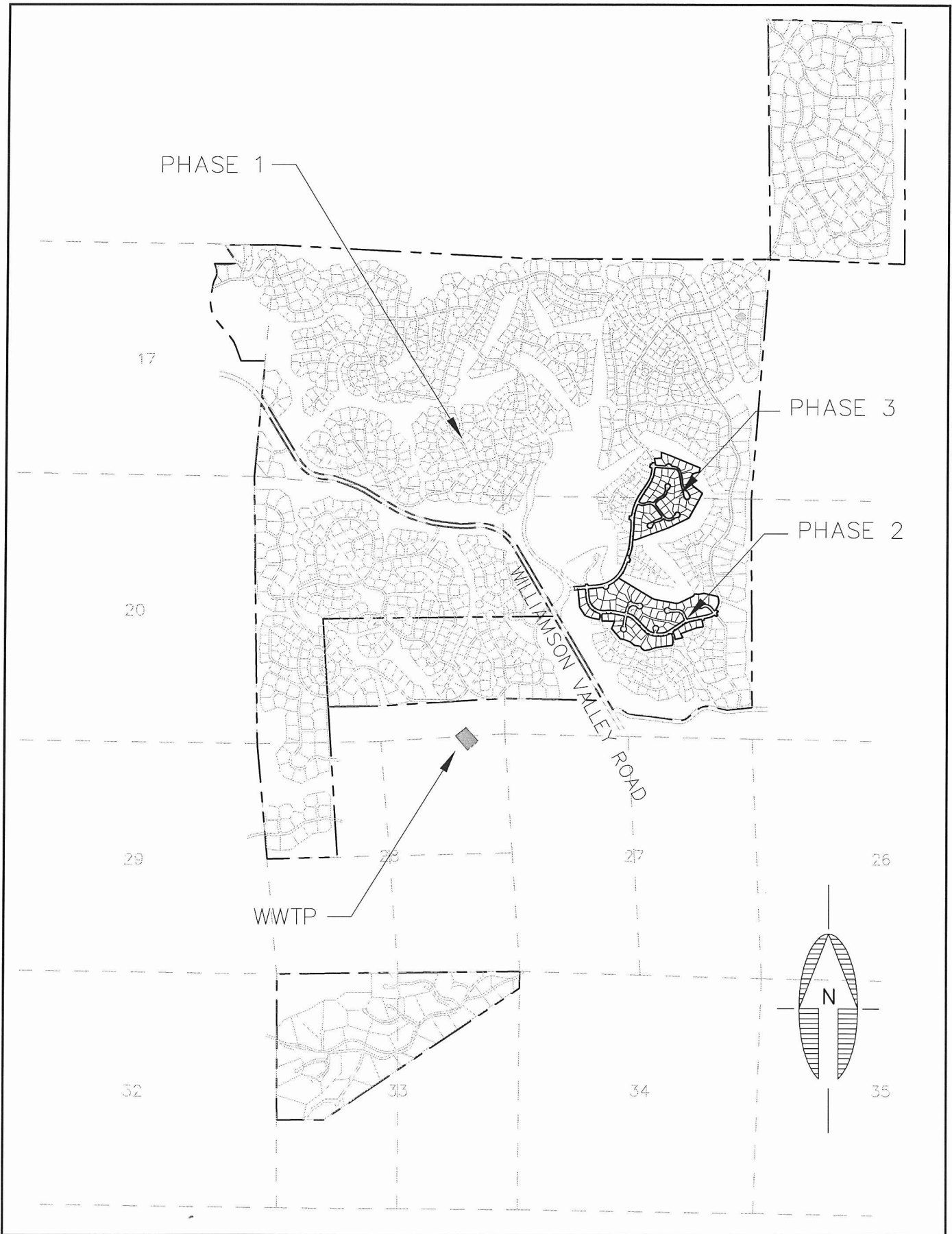
4. Conclusion

The combination gravity and low pressure sewer system chosen for the project is the preferred system based on the mountainous terrain the system covers. An all gravity system would not be practical due to the extreme depths at the highest points that would be required to drain the lowest points.

This system will serve 169 single family lots with low pressure sewer and 33 single family lots with gravity sewer.

APPENDIX A
SITE MAP

P:\2001\01377\dwg\01377 SITE MAP.dwg, 11/05/2002 09:13:37 AM



SHEPARD - WESNITZER, INC. CIVIL ENGINEERING AND SURVEYING 115 E. GOODWIN ST., SUITE G PRESCOTT, AZ 86303 (928) 541-0443	JOB NO:	01377	TALKING ROCK RANCH	YAVAPAI COUNTY ARIZONA	SHEET 1 OF 1
	DATE:	NOV 2001			
	SCALE:	1"=3000'	APPENDIX A SITE MAP		
	DRAWN:	BBH			
	DESIGN:	BBH			
CHECKED:	DMB				

APPENDIX B

LOW PRESSURE SEWER ANALYSIS

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Talking Rock Ranch - Phase 2

November 5, 2002

Prepared By:
B. HUZAR

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)
his spreadsheet was calculated using pipe diameters for: SDR11 HDPE																	
1.00	2.00	3	3	235.00	11.00	2	22.00	1.50	3.72	125.00	3.75	4.69	14.27	5,080.00	5,056.00	24.00	38.27
2.00	2.00	1	4	235.00	11.00	3	33.00	2.00	3.57	357.00	2.68	9.58	9.58	5,080.00	5,070.00	10.00	19.58
3.00	4.00	3	3	235.00	11.00	2	22.00	1.50	3.72	66.00	3.75	2.48	29.95	5,057.00	5,022.00	35.00	64.95
4.00	4.00	8	11	235.00	11.00	4	44.00	2.00	4.76	601.00	4.57	27.47	27.47	5,057.00	5,034.00	23.00	50.47
5.00	5.00	3	3	235.00	11.00	2	22.00	1.50	3.72	245.00	3.75	9.20	9.20	5,050.00	5,026.00	24.00	33.20
6.00	7.00	3	3	235.00	11.00	2	22.00	1.50	3.72	69.00	3.75	2.59	27.45	5,028.00	5,016.00	12.00	39.45
7.00	7.00	8	11	235.00	11.00	4	44.00	2.00	4.76	544.00	4.57	24.86	24.86	5,028.00	5,003.00	25.00	49.86
8.00	9.00	3	3	235.00	11.00	2	22.00	1.50	3.72	98.00	3.75	3.68	13.47	5,028.00	4,999.00	29.00	42.47
9.00	9.00	4	7	235.00	11.00	3	33.00	2.00	3.57	365.00	2.68	9.79	9.79	5,028.00	5,005.00	23.00	32.79

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME (HR)
Talking Rock Ranch - Phase 2

November 5, 2002

Prepared By:
B. HUZA

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: SDR11HDPE										
1.00	2.00	3	1.50	9.85	125.00	12.32	705	57.24	0.42	1.82
2.00	2.00	4	2.00	15.40	357.00	54.99	940	17.09	1.40	1.40
3.00	4.00	3	1.50	9.85	66.00	6.50	705	108.41	0.22	1.08
4.00	4.00	11	2.00	15.40	601.00	92.57	2,585	27.92	0.86	0.86
5.00	5.00	3	1.50	9.85	245.00	24.14	705	29.21	0.82	0.82
6.00	7.00	3	1.50	9.85	69.00	6.80	705	103.70	0.23	1.01
7.00	7.00	11	2.00	15.40	544.00	83.79	2,585	30.85	0.78	0.78
8.00	9.00	3	1.50	9.85	98.00	9.66	705	73.01	0.33	1.15
9.00	9.00	7	2.00	15.40	365.00	56.22	1,645	29.26	0.82	0.82

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Talking Rock Ranch - Phase 3

November 5, 2002

Prepared By:
B. HUAZ

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)
his spreadsheet was calculated using pipe diameters for: SDR11HDPE																	
1.00	2.00	3	3	235.00	11.00	2	22.00	1.50	3.72	129.00	3.75	4.84	89.01	5,021.00	5,020.00	1.00	90.01
2.00	3.00	6	9	235.00	11.00	3	33.00	2.00	3.57	338.00	2.68	9.07	84.16	5,018.00	5,011.00	7.00	91.16
3.00	4.00	7	16	235.00	11.00	4	44.00	2.50	3.25	413.00	1.80	7.45	75.10	5,012.00	5,004.00	8.00	83.10
4.00	5.00	7	23	235.00	11.00	5	55.00	2.50	4.06	551.00	2.73	15.03	67.64	5,012.00	4,996.00	16.00	83.64
5.00	14.00	3	49	235.00	11.00	6	66.00	3.00	3.29	928.00	1.47	13.61	52.62	5,012.00	4,999.00	13.00	65.62
x	6.00	7.00	3	235.00	11.00	2	22.00	1.50	3.72	72.00	3.75	2.70	65.08	5,022.00	5,018.00	4.00	69.08
y	7.00	10.00	5	235.00	11.00	3	33.00	2.00	3.57	401.00	2.68	10.76	62.37	5,020.00	5,012.00	8.00	70.37
8.00	9.00	3	3	235.00	11.00	2	22.00	1.50	3.72	137.00	3.75	5.14	64.51	5,012.00	5,001.00	11.00	75.51
9.00	10.00	5	8	235.00	11.00	3	33.00	2.00	3.57	289.00	2.68	7.75	59.37	5,012.00	5,003.00	9.00	68.37
x	10.00	13.00	2	235.00	11.00	4	44.00	2.50	3.25	372.00	1.80	6.71	51.61	5,012.00	5,006.00	6.00	57.61
11.00	12.00	3	3	235.00	11.00	2	22.00	1.50	3.72	136.00	3.75	5.11	59.81	5,012.00	5,004.00	8.00	67.81
12.00	13.00	7	10	235.00	11.00	4	44.00	2.50	3.25	543.00	1.80	9.80	54.70	5,012.00	5,001.00	11.00	65.70
x	13.00	14.00	3	235.00	11.00	6	66.00	3.00	3.29	402.00	1.47	5.89	44.90	5,012.00	4,999.00	13.00	57.90
14.00	15.00	1	81	235.00	11.00	8	88.00	3.00	4.38	370.00	2.50	9.24	39.01	5,012.00	4,999.00	13.00	52.01
15.00	15.00	6	133	235.00	11.00	9	99.00	3.00	4.93	958.00	3.11	29.77	29.77	5,012.00	4,993.00	19.00	48.77
16.00	17.00	3	3	235.00	11.00	2	22.00	1.50	3.72	58.00	3.75	2.18	70.83	5,012.00	4,978.00	34.00	104.83
17.00	20.00	7	10	235.00	11.00	4	44.00	2.50	3.25	311.00	1.80	5.61	68.65	5,012.00	4,978.00	34.00	102.65
18.00	19.00	3	3	235.00	11.00	2	22.00	1.50	3.72	83.00	3.75	3.12	71.97	5,012.00	4,988.00	24.00	95.97
19.00	20.00	7	10	235.00	11.00	4	44.00	2.50	3.25	322.00	1.80	5.81	68.85	5,012.00	4,984.00	28.00	96.85
20.00	23.00	0	20	235.00	11.00	5	55.00	2.50	4.06	230.00	2.73	6.27	63.04	5,012.00	5,012.00	0.00	63.04
21.00	22.00	3	3	235.00	11.00	2	22.00	1.50	3.72	45.00	3.75	1.69	67.70	5,012.00	4,980.00	32.00	99.70
22.00	23.00	7	10	235.00	11.00	4	44.00	2.50	3.25	512.00	1.80	9.24	66.01	5,012.00	4,978.00	34.00	100.01
23.00	26.00	0	30	235.00	11.00	5	55.00	2.50	4.06	107.00	2.73	2.92	56.77	5,012.00	5,012.00	0.00	56.77
24.00	25.00	3	3	235.00	11.00	2	22.00	1.50	3.72	88.00	3.75	3.30	59.76	5,012.00	4,987.00	25.00	84.76
25.00	26.00	2	5	235.00	11.00	6	66.00	2.50	4.87	97.00	2.68	2.60	56.45	5,012.00	4,984.00	28.00	84.45
26.00	31.00	0	35	235.00	11.00	3	33.00	2.00	3.57	409.00	3.82	15.64	53.85	5,012.00	5,012.00	0.00	53.85
27.00	28.00	3	3	235.00	11.00	2	22.00	1.50	3.72	99.00	3.75	3.72	48.29	5,012.00	4,990.00	22.00	70.29
28.00	31.00	2	5	235.00	11.00	3	33.00	2.00	3.57	237.00	2.68	6.36	44.57	5,012.00	4,989.00	23.00	67.57
29.00	30.00	3	3	235.00	11.00	2	22.00	1.50	3.72	66.00	3.75	2.48	47.75	5,012.00	4,990.00	22.00	69.75
30.00	31.00	3	6	235.00	11.00	3	33.00	2.00	3.57	263.00	2.68	7.06	45.27	5,012.00	4,990.00	22.00	67.27
31.00	15.00	0	46	235.00	11.00	6	66.00	2.50	4.87	221.00	3.82	8.45	38.21	5,012.00	5,012.00	0.00	38.21
32.00	33.00	3	3	235.00	11.00	2	22.00	1.50	3.72	76.00	3.75	2.85	79.49	5,012.00	4,994.00	18.00	97.49
33.00	34.00	3	6	235.00	11.00	3	33.00	2.00	3.57	159.00	2.68	4.27	76.63	5,012.00	4,990.00	22.00	98.63
34.00	37.00	7	13	235.00	11.00	4	44.00	2.50	3.25	351.00	1.80	6.33	72.37	5,012.00	4,988.00	24.00	96.37
35.00	36.00	3	3	235.00	11.00	2	22.00	1.50	3.72	117.00	3.75	4.39	75.44	5,012.00	4,994.00	18.00	93.44
36.00	37.00	3	6	235.00	11.00	3	33.00	2.00	3.57	187.00	2.68	5.02	71.05	5,012.00	4,991.00	21.00	92.05
37.00	40.00	0	19	235.00	11.00	5	55.00	2.50	4.06	311.00	2.73	8.48	66.04	5,012.00	5,012.00	0.00	66.04

Page 1 Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One.

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS
Talking Rock Ranch - Phase 3

November 5, 2002

Prepared By:
B. HUZA

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)
his spreadsheet was calculated using pipe diameters for: SDR11 HDPE																	
38.00	39.00	3	3	235.00	11.00	2	22.00	1.50	3.72	57.00	3.75	2.14	61.44	5,012.00	4,991.00	21.00	82.44
39.00	40.00	1	4	235.00	11.00	3	33.00	2.00	3.57	65.00	2.68	1.74	59.30	5,012.00	4,996.00	16.00	75.30
40.00	5.00	0	23	235.00	11.00	5	55.00	2.50	4.06	181.00	2.73	4.94	57.55	5,012.00	5,012.00	0.00	57.55

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME (HR)

Talking Rock Ranch - Phase 3

November 5, 2002

Prepared By:
B. HUIZA

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: SDR11 HDPE										
1.00	2.00	3	1.50	9.85	129.00	12.71	705	55.47	0.43	3.22
2.00	3.00	9	2.00	15.40	338.00	52.06	2,115	40.62	0.59	2.79
3.00	4.00	16	2.50	22.57	413.00	93.21	3,760	40.34	0.59	2.20
4.00	5.00	23	2.50	22.57	551.00	124.36	5,405	43.46	0.55	1.60
5.00	14.00	49	3.00	33.47	928.00	310.57	11,515	37.08	0.65	1.05
6.00	7.00	3	1.50	9.85	72.00	7.09	705	99.38	0.24	2.35
7.00	10.00	8	2.00	15.40	401.00	61.77	1,880	30.44	0.79	2.11
8.00	9.00	3	1.50	9.85	137.00	13.50	705	52.23	0.46	2.35
9.00	10.00	8	2.00	15.40	289.00	44.51	1,880	42.23	0.57	1.89
10.00	13.00	18	2.50	22.57	372.00	83.96	4,230	50.38	0.48	1.32
11.00	12.00	3	1.50	9.85	136.00	13.40	705	52.61	0.46	2.55
12.00	13.00	10	2.50	22.57	543.00	122.56	2,350	19.17	1.25	2.10
13.00	14.00	31	3.00	33.47	402.00	134.53	7,285	54.15	0.44	0.85
14.00	15.00	81	3.00	33.47	370.00	123.82	19,035	153.73	0.16	0.40
15.00	15.00	133	3.00	33.47	958.00	320.61	31,255	97.49	0.25	0.25
16.00	17.00	3	1.50	9.85	58.00	5.71	705	123.37	0.19	1.88
17.00	20.00	10	2.50	22.57	311.00	70.19	2,350	33.48	0.72	1.69
18.00	19.00	3	1.50	9.85	83.00	8.18	705	86.21	0.28	1.99
19.00	20.00	10	2.50	22.57	322.00	72.68	2,350	32.34	0.74	1.72
20.00	23.00	20	2.50	22.57	230.00	51.91	4,700	90.54	0.27	0.97
21.00	22.00	3	1.50	9.85	45.00	4.43	705	159.01	0.15	2.04
22.00	23.00	10	2.50	22.57	512.00	115.56	2,350	20.34	1.18	1.89
23.00	26.00	30	2.50	22.57	107.00	24.15	7,050	291.93	0.08	0.71
24.00	25.00	3	1.50	9.85	88.00	8.67	705	81.31	0.30	1.23
25.00	26.00	5	2.00	15.40	97.00	14.94	1,175	78.64	0.31	0.93
26.00	31.00	35	2.50	22.57	409.00	92.31	8,225	89.10	0.27	0.63
27.00	28.00	3	1.50	9.85	99.00	9.75	705	72.28	0.33	1.43
28.00	31.00	5	2.00	15.40	237.00	36.51	1,175	32.19	0.75	1.10
29.00	30.00	3	1.50	9.85	66.00	6.50	705	108.41	0.22	1.27
30.00	31.00	6	2.00	15.40	263.00	40.51	1,410	34.81	0.69	1.05
31.00	15.00	46	2.50	22.57	221.00	49.88	10,810	216.72	0.11	0.36
32.00	33.00	3	1.50	9.85	76.00	7.49	705	94.15	0.25	2.90
33.00	34.00	6	2.00	15.40	159.00	24.49	1,410	57.57	0.42	2.65
34.00	37.00	13	2.50	22.57	351.00	79.22	3,055	38.56	0.62	2.23
35.00	36.00	3	1.50	9.85	117.00	11.53	705	61.16	0.39	2.49
36.00	37.00	6	2.00	15.40	187.00	28.80	1,410	48.95	0.49	2.10
37.00	40.00	19	2.50	22.57	311.00	70.19	4,465	63.61	0.38	1.61
38.00	39.00	3	1.50	9.85	57.00	5.62	705	125.53	0.19	1.68
39.00	40.00	4	2.00	15.40	65.00	10.01	940	93.89	0.26	1.49

Page 1 Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME (HR)
Talking Rock Ranch - Phase 3

November 5, 2002

Prepared By:
B. HUZA

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)
40.00	5.00	23	2.50	22.57	181.00	40.85	5,405	132.31	0.18	1.23
his spreadsheet was calculated using pipe diameters for: SDR11 HDPE										

APPENDIX C

SEWER COLLECTION SYSTEM