

Engineering Report

For

**Sloan Estates
Wastewater Treatment
And
Dispersal System**

**05-52007
569**

February 25, 2005

Prepared by

Rural Engineering Services, Inc.

Prepared for

The Barber Group



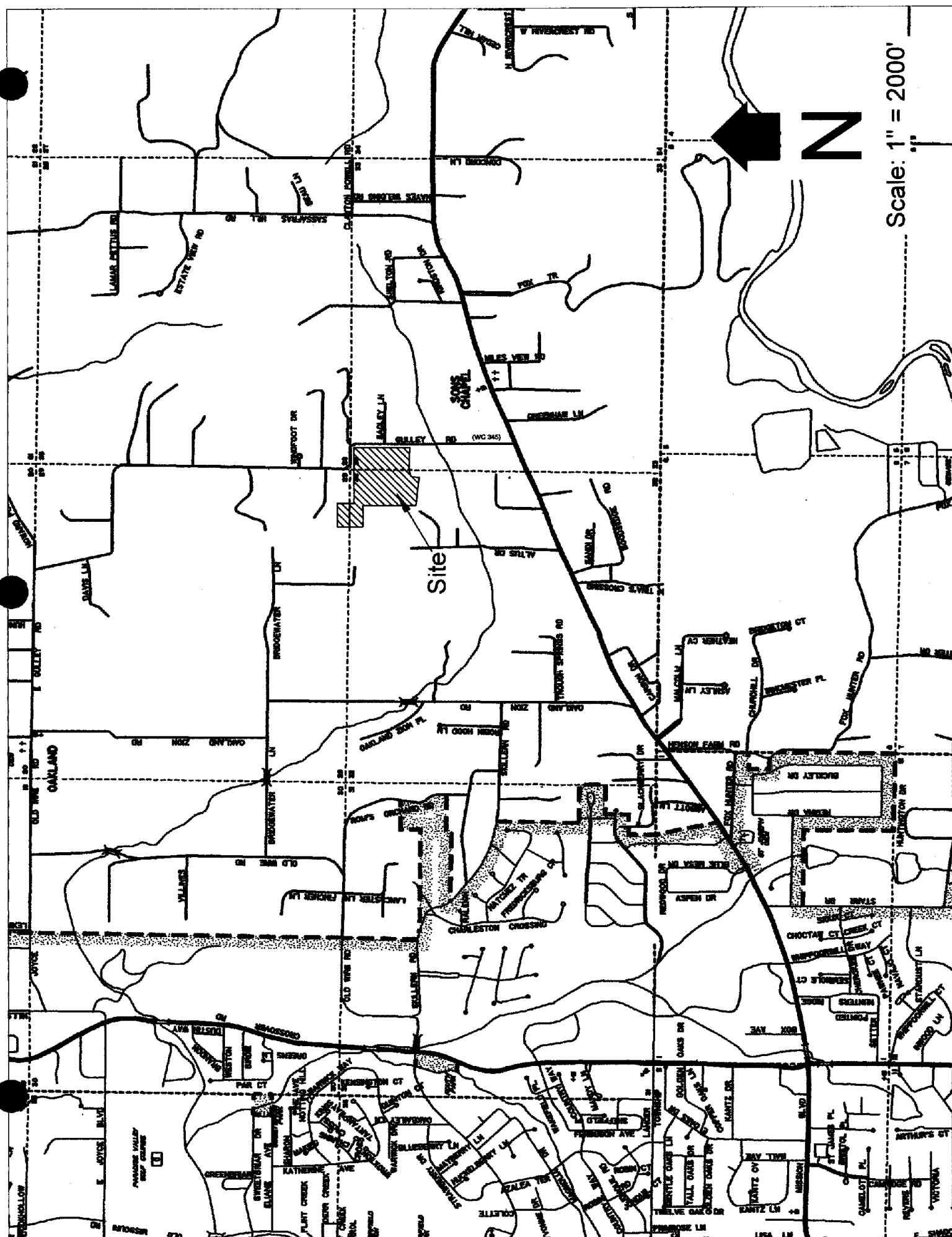
0 0.3 0.6 0.9 1.2 1.5 km
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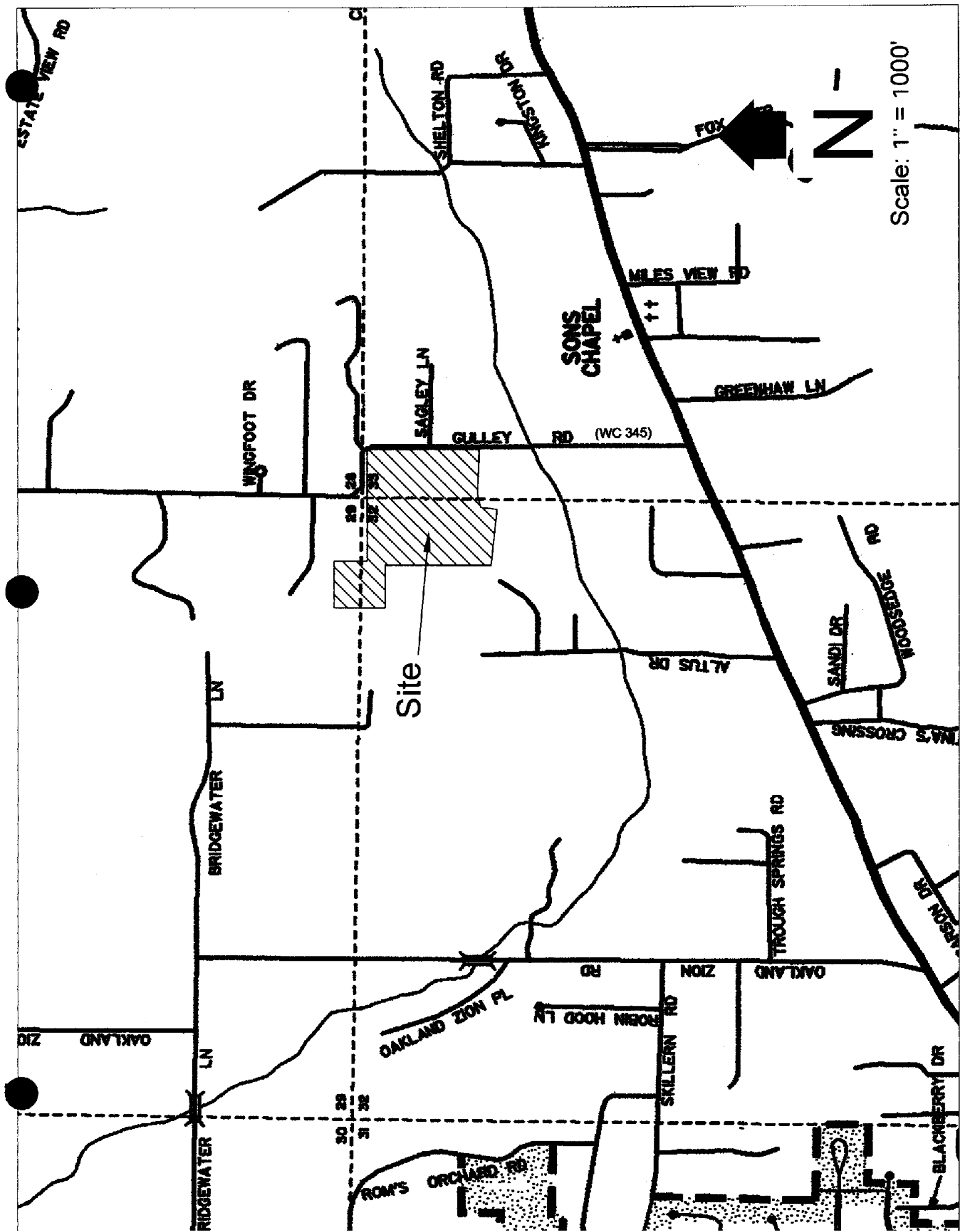
Map center is 36° 06' 25"N, 94° 05' 18"W (WGS84/NAD83)

Elkins quadrangle

Projection is UTM Zone 15 NAD83 Datum

M=2.927
G=-0.641





Scale: 1" = 1000'



Project Description:

The project is proposed as 61 residences developed over an approximately 32 acre site east of Fayetteville, AR. The residences will be served by public water provided by the City of Fayetteville, AR. The project plan has been developed with coordination with Mr. Trevor Bowman and MR. Art Scott of PDC, Inc. Cave Springs, AR.

The wastewater collection system will consist of a septic tank effluent pumping (STEP) collection sewer, with 1250 gallon interceptor tanks located at each home. The effluent turbine pumps in the STEP tanks will pump to a 2" SDR 21 PVC effluent sewer. The wastewater treatment system will consist of a single large equalization and recirculation tank baffled at 2/3 volume followed by a package trickling filter system with sludge collection and recycle to the primary tanks. The wastewater dispersal system will consist of a dosing tank to provide storage prior to dosing the treated wastewater into subsurface drip irrigation located on the property.

Design Basis:

The wastewater flow estimates were based upon 260 gallons per day per home. For the 61 homes ultimately planned for this development, the total average daily flow is estimated at 15,860 gallons per day.

The treatment technology is a fixed-film, or attached growth process which can typically provide treatment when the system is hydraulically and organically under loaded.

The drip irrigation system is sized by using the soil loading rates provided by Sheri Herron, Arkansas Professional Soil Classifier #53

Treatment System Components:

The treatment system consists of a single large settling tank, with the tank sized for 8,000 gallons nominal capacity. The tank is followed by two model 36/24 BioClere® treatment unit. The treatment unit has synthetic (plastic) media for a fixed film process, and is constructed with an integral clarifier under the media for sludge (biomass) collection and recycle. The biomass is recirculated to the primary settling tank by pumps within the BioClere unit that are provided as an integral part of the BioClere package. The treatment units are followed by a 4000 gallon dosing tank with 4 turbine pumps (2 duplex pump packages) sized to dose the treated wastewater to subsurface drip irrigation tubing. The wastewater will be dispersed into the soil for final dispersal.

Equalization/Recirculation Tank

The equalization/recirculation tank is sized as recommended by AquaPoint, Inc. for approximately 8 hours of wastewater flow. The tank will be a fiberglass tank

manufactured under IAPMO standards and tested prior to installation. The tank is baffled at 2/3 volume and the sludge recycle from the BioClere® unit will be pumped to the inlet end of the tank. Ballast for the tank will be constructed as concrete dead men holding the tanks against buoyant forces by the use of straps over the tanks and onto the dead men. The tank is to be manufactured by Xerxes Corporation of Minneapolis, MN

Treatment Unit

The treatment unit will be a package trickling filter system known as BioClere, manufactured by AquaPoint, Inc. of New Bedford, MA. The treatment unit was sized by AquaPoint, Inc. to treat a total of 17,000 gallons per day. The treatment system plans have been reviewed by an AquaPoint engineer to ensure that the design complies with the manufacturer's application requirements.

Dosing Tank and Pumps

The dosing tank is sized for 4000 gallons or approximately 4 hours of the total daily flow. Pumps from the dosing tank were sized by determining the flow required to dose the largest zones. Two cases were examined – the zone with the highest static head requirement and the zone with the highest friction head requirement. The pumps were sized to provide flow and head to meet both situations. The pump sizing is shown in Appendix B, and is based upon the irrigation tubing manufacturer's suggested sizing criteria. Pumps will be duplexed, and each set of zones will be served by a duplex pump package in the dosing tank. Pumps are Zoeller model 5031-0007, 2/4 HP, 7-Stage, 230VAC single phase pumps capable of approximately 15.2 gpm at 126 feet of head. The pumps, floats, junction boxes, and pump vaults are to be as manufactured by the Zoeller Company, Louisville, KY.

Each duplex pump system will be followed by a turbine flow meter capable of measuring and recording (totalizing) flows of approximately 15 gpm.

Drip Irrigation System

Area requirements for the drip zones were determined by having the soil mapped by Sheri Herron, Arkansas Professional Soil Classifier # 53. After detailed design calculations and area sizing was performed, it was determined that the original area planned for drip irrigation would not provide enough irrigation area for 175% of the total daily flow. The soil loading rates are provided in Appendix A of this report. An average loading rate of 0.39 was used to determine the drip system layout and sizing.

The drip irrigation system is planned as zones of subsurface tubing manufactured by GeoFlow, Inc. of Sausalito, CA. Drip tubing will be Wasteflow, drip irrigation tubing with pressure compensated emitters spaced 24 inches on center. Tubing will be placed as nearly on contour as possible with no more than one foot of elevation difference between the beginning and the end of each run. The laterals are sized for 3-inch PVC in order to minimize friction head loss. Each zone will be served by a supply lateral and a return

lateral having sufficient diameters to provide the pressure and flows for dosing and flushing based upon the manufacturer's sizing guidelines and software. The Geoflow sizing charts and calculations are included as Appendix B of this report.

The drip irrigation system includes a head control box (Geoflow, Inc.) to screen (filter) the treated wastewater to a minimum of 100 microns. The head control box includes the screen filter, solenoids to provide a field flush and a screen filter flush, and piping, wiring, and fittings required to complete the head control box in its enclosure.

The drip irrigation system will also include mechanical zone valves to allow the pumps to supply treated wastewater to each of the zones based upon timed dosing.

The drip irrigation sizing calculations using the GeoFlow® sizing spreadsheet are provided as Appendix B of this report.

Electrical/Electronic Controls

The BioClere wastewater treatment unit will include the electrical controls in a minimum of a NEMA 3R enclosure. The controls for the BioClere units will only control the functions of the BioClere unit.

The controls for the dosing tank, drip irrigation head control box, and displays for the flow meters will be enclosed in a separate enclosure meeting the minimum requirements of NEMA 3R. The controls for the dosing pumps will be set up to be programmable to provide scheduled doses ranging from 3 minutes to 60 minutes in a continuous range, and on a schedule ranging from every 15 minutes up to every 4 hours within a continuously selectable range.

The control panel enclosure will also include elapsed time meters and cycle counters for each pump. The panel will also include a display to show the total flow through each of the flow meters.

Sloan Estates

Pressure Sewer Calculations

[illegible]

$Q = (0.5 n) + 20$
Q in gpm

$H_f = S * \text{pipe length}$

$$S = \left[\frac{Q}{0.285C(D)^{2.63}} \right]^{1.852}$$

C = 130

D = 2"

Q in gpm

S in ft/ft

Longest Run is Line 2 + Line 3 + Line 9 + Line 11 = 1930 ft.

Cumulative $H_f = 60.6$ ft

$H_{\text{static}} = 1523 - 1498 = 25$ ft

TDH = 85.6 ft

Largest H_{static} run is from Lot 1 to Treatment Plant

= 1523 - 1463 = 60 ft.

Cumulative $H_f = \text{Line 5} + \text{Line 6} + \text{Line 8} + \text{Line 9} + \text{Line 11}$

= 3.8 + 9.2 + 15.2 + 6.9 + 21.2 = 56.3

TDH = 116.3 ft.

Use a pump capable of 116.3 ft TDH

Zoeller Model 5030 - 0005 ½ Hp, 6-Stage 115VAC 12.0 Amps Capable of 10.5 gpm at 116 ft TDH

Appendix A

Soil Evaluation Report

Soil Analysis for Drip Irrigation Sewage Disposal **Sloan Estates Subdivision - Washington County, Arkansas**

The soils at this site are dominantly FaC2 Fayetteville fine sandy loam. They have a fine sandy loam surface and a sandy clay loam subsurface. Loading rates are based on ADH Drip Irrigation Guidelines.

PIT # 1
 BSWT 22 inches (chroma >3)
 DEPTH > 50 inches
 LOADING RATE 0.451 gpd/sq.ft.
 COMMENTS:

PIT # 2
 BSWT 29 inches (chroma 3)
 MSWT 38 inches (chroma 2)
 AMSWT 35 inches
 DEPTH > 50 inches
 LOADING RATE 0.239 gpd/sq.ft.
 COMMENTS:

PIT # 3
 BSWT 22 inches (chroma 3)
 MSWT 34 inches (chroma 2)
 AMSWT 30 inches
 DEPTH > 50 inches
 LOADING RATE 0.205 gpd/sq.ft.
 COMMENTS:

PIT # 4
 BSWT 17 inches (chroma >3)
 MSWT 20 inches (chroma 2)
 AMSWT 19 inches
 DEPTH > 50 inches
 LOADING RATE 0.13 gpd/sq.ft.
 COMMENTS:

PIT # 5
 BSWT 21 inches (FeMn)
 MSWT 32 inches (chroma 2)
 AMSWT 28 inches
 DEPTH > 50 inches
 LOADING RATE 0.191 gpd/sq.ft.
 COMMENTS:

PIT # 6
 BSWT 19 inches (chroma >3)
 MSWT 25 inches (chroma 2)
 AMSWT 23 inches
 DEPTH > 50 inches
 LOADING RATE 0.157 gpd/sq.ft.
 COMMENTS: EB Transitional horizon

PIT # 7
 BSWT 25 inches (chroma >3)
 MSWT 27 inches (chroma 2)
 AMSWT 26 inches
 DEPTH > 50 inches
 LOADING RATE 0.178 gpd/sq.ft.
 COMMENTS:

PIT # 8
 BSWT at surface
 DEPTH > 50 inches
 LOADING RATE n/a gpd/sq.ft.
 COMMENTS:

PIT # 9
 BSWT 28 inches (chroma >3)
 DEPTH > 50 inches
 LOADING RATE 0.574 gpd/sq.ft.
 COMMENTS:

PIT # 10
 BSWT 23 inches (chroma >3)
 DEPTH > 45 inches
 LOADING RATE 0.472 gpd/sq.ft.
 COMMENTS:

PIT # 11
 BSWT 22 inches (FeMn)
 DEPTH > 50 inches
 LOADING RATE 0.451 gpd/sq.ft.
 COMMENTS:

PIT # 12
 BSWT 22 inches (chroma 3)
 MSWT 30 inches (chroma 2)
 AMSWT 27 inches
 DEPTH > 50 inches
 LOADING RATE 0.185 gpd/sq.ft.
 COMMENTS:

PIT # 13
 BSWT 23 inches (chroma 3)
 MSWT 33 inches (chroma 2)
 AMSWT 30 inches
 DEPTH > 50 inches
 LOADING RATE 0.205 gpd/sq.ft.
 COMMENTS:

Soil Analysis for Drip Irrigation Sewage Disposal
Sloan Estates Subdivision - Washington County, Arkansas

PIT # 14
 BSWT 21 inches (chroma >3)
 MSWT 27 inches (chroma 2)
 AMSWT 25 inches
 DEPTH > 50 inches
 LOADING RATE 0.171 gpd/sq.ft.

COMMENTS:

PIT # 15
 BSWT 25 inches (chroma >3)
 MSWT 30 inches (chroma 2)
 AMSWT 28 inches
 DEPTH > 50 inches
 LOADING RATE 0.191 gpd/sq.ft.

COMMENTS:

PIT # 16
 BSWT 20 inches (chroma >3)
 MSWT 28 inches (chroma 2)
 AMSWT 25 inches
 DEPTH > 50 inches
 LOADING RATE 0.171 gpd/sq.ft.

COMMENTS: irregular boundary

PIT # 17
 BSWT 15 inches (chroma >3)
 MSWT 20 inches (chroma 2)
 AMSWT 18 inches
 DEPTH > 50 inches
 LOADING RATE 0.123 gpd/sq.ft.

COMMENTS:

PIT # 18
 BSWT 19 inches (chroma >3)
 MSWT 22 inches (chroma 2)
 AMSWT 21 inches
 DEPTH > 50 inches
 LOADING RATE 0.144 gpd/sq.ft.

COMMENTS:

PIT # 19
 BSWT 14 inches (chroma >3)
 MSWT 21 inches (chroma 2)
 AMSWT 19 inches
 DEPTH > 50 inches
 LOADING RATE 0.13 gpd/sq.ft.

COMMENTS: irregular boundary

PIT # 20
 BSWT 18 inches (chroma = 3)
 DEPTH > 50 inches
 LOADING RATE 0.369 gpd/sq.ft.

COMMENTS: weathering sandstone causing discoloration



Appendix B

Drip Field Pump Sizing

GEOFLOW Spreadsheets

Geoflow Subsurface Dripline Dispersal: Field Calculation

Job Description:	Sloan Estates
Contact:	Art Scott
Prepared by:	Mark Gross
Date:	2/2/2005

Please fill in the shaded areas and drop down menus below:

Note. This worksheet can be found in Geoflow's Design and Installation Manual

		Dispersal Field as Single Zone	Dispersal Field as Multiple Zones	
Number of Zones		1	6	zone(s)
A)	Quantity of effluent to be disposed per day	16,120	2,687	gallons / day
B)	Hydraulic loading rate	0.39	0.39	gallons / sq.ft. / day
C)	Determine total area required	41,333	6,889	square ft.
D)	Choose spacing between WASTEFLOW lines	2	2	ft.
D)	Choose spacing between WASTEFLOW emitters	2 ft. ▼	2	ft.
E)	Total linear ft.	20,667	3,444	each
F)	Total number of emitters	10,333	1,722	each
G)	Select Wasteflow dripline	Wasteflow PC - 1/2gph ▼	Wasteflow PC 1/2 gph	dripline
H)	Pressure at the beginning of the dripfield	20 psi ▼	20	psi
I)	Feet of Head at the beginning of the dripfield	46.2	46.2	ft.
J)	What is the flow rate per emitter in gph?	0.53	0.53	gallons per hour
K)	Total flow for the area (gph)	5,477	913	gallons per hour
	Total flow for the area (gpm)	91.28	15.21	gallons per minute
L)	Select pipe diameters for manifolds and submains	3	1.25	inch
M)	Select Vortex Filter (item no.)	AP4E-2F-4 (2in./4holes)	AP4E-1F (1in.)	
N)	Maximum length of each WASTEFLOW line. For additional technical flow, pressure and flushing data please refer to Geoflow's Design Manual and WASTEFLOW hydraulics worksheet.	424	424	ft.

Check below to choose quantity and length of daily doses

Dosing			
Number of doses per day/zone:	12	12	
Pump run time per dose/zone (minutes):	14.72	14.72	minutes
Pump run time per day/zone (hours):	2.94	2.94	hours / day
Pump run time per day/all zones (hours):	2.94	17.66	hours

Geoflow Subsurface Dispersal: Pump Size Calculation

Job Description:	Sloan Estates
Contact:	Art Scott
Prepared by:	Mark Gross
Date:	2/2/2005

Please fill in the shaded areas below:

Information automatically inserted is from the multiple zone column in 'Worksheet 1-Field Design'.

Note. This worksheet can be found in Geoflow's Design and Installation Manual

O)	Minimum pump capacity	15.21 gpm	
P)	Header pipe size	1.25 inch	
Q)	Pressure loss in 100 ft. of pipe	2.27 psi	
R)	Friction head in 100 ft. of pipe	5.24 ft.	
S)	Static head		
	i) Height from pump to tank outlet	6 ft.	
	ii) Elevation increase or decrease	10 ft.	
T)	Total static head	16 ft.	
U)	Friction head		
	i) Equivalent length of fittings	0 ft.	
	ii) Distance from pump to field	600 ft.	
	iii) Total equivalent length of pipe	600 ft.	
	iv) Total effective feet	31.4622 ft.	
	v) Head required at dripfield	46.2 ft.	
	vi) Headloss through filter or Headwork	25.41 ft.	11 psi
	vii) Head loss through zone valves	6.93 ft.	3 psi
V)	Total friction Head	110.0022	
W)	Total dynamic head	126.00 ft.	
X)	Minimum pump capacity	15.21 gpm	
Y)	Choose the pump	***	

*** Note a few States + counties require additional flow for flushing. Please check your local re

If you need assistance designing for this additional flow, please

- See Geoflow flushing worksheet or
- Contact Geoflow at 800-828-3388.

From: [Vickerson, Casey](#)
To: [Deardoff, Amy](#)
Subject: FW: Sloan Estates 4837-WR-2
Date: Monday, October 28, 2013 11:22:44 AM
Attachments: [52007 Sloan Estates Report-p0001 - p0015.tif](#)

4837-WR-2, thanks!

From: Kathy Bartlett [<mailto:kathy@aquatechsys.com>]
Sent: Monday, October 28, 2013 11:20 AM
To: Vickerson, Casey
Subject: RE: Sloan Estates 4837-WR-2

I did receive the attached from Craig Corder at ADH. Looking at this further I see that there are the field calculations that the engineer Mark Gross did and originally submitted with the project. Look at pages 14 and 15. Hopefully this will be of some help.

Kathy Bartlett

From: Vickerson, Casey [<mailto:Vickerson@adeq.state.ar.us>]
Sent: Thursday, October 10, 2013 4:14 PM
To: Kathy Bartlett
Subject: RE: Sloan Estates 4837-WR-2

Thanks. If you don't luck out with that, I'll just use a range of the loading rates in the permit so they're all considered, I suppose.

From: Kathy Bartlett [<mailto:kathy@aquatechsys.com>]
Sent: Thursday, October 10, 2013 4:01 PM
To: Vickerson, Casey
Subject: RE: Sloan Estates 4837-WR-2

Hello Casey

I have attempted on several occasions to have the original soil classifier contact me so I can see if she has any plans identifying the pits locations so I can determine which loading rate corresponds with which zone in the drip field. She has yet to contact me back. I reviewed everything that AR Department of Health had on file for this permit as well and there was nothing of use in this regards. If we are stuck at this point what is the ADERQ's suggestion. This is an existing operational drip field so we cannot have pits redug to try to piece together what is missing from the original engineering and calculations.

I will go down to the county planning office and request the files from the projects initial planning and development to see if I can obtain any further information that way as well, I'll let you know what I find.

Regards
Kathy Bartlett

From: Vickerson, Casey [<mailto:Vickerson@adeq.state.ar.us>]
Sent: Monday, September 09, 2013 4:30 PM
To: Kathy Bartlett
Subject: RE: Sloan Estates 4837-WR-2

Great, thanks!

From: Kathy Bartlett [<mailto:kathy@aquatechsys.com>]
Sent: Monday, September 09, 2013 4:25 PM
To: Vickerson, Casey
Subject: RE: Sloan Estates 4837-WR-2

I believe there are actual 58 buildable lots, because some of them are unbuildable. I will double check and confirm. I have spoken to the POA about the financial assurance requirement. They have spoken to their bank already and are prepared to submit an LOC once the budget is approved

Kathy

From: Vickerson, Casey [<mailto:Vickerson@adeq.state.ar.us>]
Sent: Monday, September 09, 2013 3:55 PM
To: Kathy Bartlett
Subject: RE: Sloan Estates 4837-WR-2

Thanks. Am I correct in seeing per the maps that the facility has 62 lots?

Also, each permit for a nonmunicipal domestic sewage treatment system is required to submit a financial assurance mechanism that covers the estimated costs of operating and maintaining the system for a minimum period of five (5) years. I received the cost estimate in the application, but per Arkansas Code Annotated § 8-4-203:

The applicant's financial ability to operate and maintain the nonmunicipal domestic sewage treatment works for a period of five (5) years shall be demonstrated to the department by:

- (A) Obtaining insurance that specifically covers operation and maintenance costs;
- (B) Obtaining a letter of credit;
- (C) Obtaining a surety bond;
- (D) Obtaining a trust fund or an escrow account; or
- (E) Using a combination of insurance, letter of credit, surety bond, trust fund, or escrow account.

I appreciate your help,
Casey

From: Kathy Bartlett [<mailto:kathy@aquatechsys.com>]
Sent: Monday, September 09, 2013 3:44 PM
To: Vickerson, Casey
Subject: RE: Sloan Estates 4837-WR-2

Casey

I have a call into the original soil classifier and the engineer who did the original design to get further information. I am awaiting their response and will advise you as soon as I have further information.

Regards
Kathy Bartlett

From: Vickerson, Casey [<mailto:Vickerson@adeq.state.ar.us>]
Sent: Monday, September 09, 2013 11:29 AM
To: Kathy Bartlett
Subject: RE: Sloan Estates 4837-WR-2

Kathy,

I'm beginning the drafting process for the referenced permit and wonder if you could tell me the loading rates for each drip zone? I found a soil analysis that gives this information for 20 pits, but it does not specify how the pits correspond to the 6 zones these were taken in. Clarification would be much appreciated.

Also, this facility does not have a reserve drip field, correct?

Thanks,
Casey

From: Kathy Bartlett [<mailto:kathy@aquatechsys.com>]
Sent: Thursday, September 05, 2013 2:46 PM
To: Vickerson, Casey
Subject: Sloan Estates 4837-WR-2

Casey

Attached is the permit transfer form for the referenced facility.

Kathy Bartlett
Greenfield Capital Development
479-527-9880