

Soils Report for Proposed Septic System



Agri-Waste Technology, Inc.

5400 Etta Burke Court
Raleigh, North Carolina 27606
Phone: (919) 859-0669
Fax: (919) 233-1970
Email: awt@agriwaste.com

COPY



Soil Suitability for Sewage Treatment and Disposal Systems

CRC Health Carolina House
176 Lassiter Homestead Road
Durham, NC 27707

Prepared for: Mr. Eric Westrom, CRC Health Carolina House

XCOPY: Mr. Duane K. Stewart, Duane K. Stewart & Associates

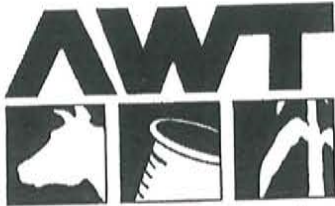
Prepared By: Jeff Vaughan, Ph.D., L.S.S.
Senior Agronomist/Soil Scientist

Enrique Cachafeiro
Soils/GIS Specialist

Chris McGee
Assistant Agronomist/Soil Scientist

Sloan Griffin
Soils Technician

Report Date: June 25, 2007



Agri-Waste Technology, Inc.

5400 Etta Burke Court
Raleigh, North Carolina 27606
Phone: (919) 859-0669
Fax: (919) 233-1970
Email: awt@agriwaste.com

Soil Suitability for Sewage Treatment and Disposal Systems
CRC Health Carolina House
176 Lassiter Homestead Road, Durham, NC 27707

PREPARED FOR: Mr. Eric Westrom, CRC Health Carolina House
XCOPY: Mr. Duane K. Stewart, Duane K. Stewart & Associates
PREPARED BY: Jeff Vaughan
Enrique Cachafeiro
Christopher McGee
Sloan Griffin
DATE: June 25, 2007

Soil suitability for domestic sewage treatment and disposal systems was evaluated on 3/9/07, 4/17/07, 4/27/07, 5/1/07, and 6/1/07 for the property located at 176 Lassiter Homestead Road, Durham, NC (Chatham County). Jeff Vaughan, Enrique Cachafeiro, Chris McGee, and Sloan Griffin of Agri-Waste Technology, Inc. (AWT) conducted the soil evaluation, Ksat tests, and system layout. Mr. Thomas Boyce of Chatham County Health Department (CCHD) met with Jeff Vaughan at the site on 4/17/07.

It is our recommendation and understanding that a subsurface drip with pre-treatment septic system is planned for this site to replace the current surface spray application system and accommodate the addition of beds and personnel to the residential care facility on the property. Therefore, a permit application for this type of system was submitted to CCHD on 4/2/07. The aerial maps in Attachment 1 detail the locations of the soil borings, wells, soil types, topography, property lines, saturated hydraulic conductivity (Ksat) test locations, and the proposed boundary of the useable soil areas.

The predominant soil type on this property is Creedmoor sandy loam (map symbols CrB and CrC). The majority of soil borings on the site exhibited provisionally suitable soil depths of 12 – 17 inches. A detailed profile description of the soil on the property is shown in Attachment 2. A written description of a typical profile is below. The soil analysis results for each horizon are in Attachment 3.

- A— 0 to 6 inches, brown (10YR 5/3) sandy loam; granular structure; very friable; non-sticky, non-plastic; very strongly acid; clear smooth boundary.
CEC = 2.9 meq/100cm³
- Bt1— 6 to 14 inches, brownish yellow (10YR 6/8) sandy clay loam; weak sub-angular blocky structure; friable; slightly-sticky, slightly-plastic; very strongly acid; gradual smooth boundary.
CEC = 3.8 meq/100cm³
- Btg2—14 to 30 inches, brownish yellow (10YR 6/8) clay; many distinct medium yellowish red (5YR 5/8) and gray (10YR 6/1) mottles; massive structure; extremely firm; very sticky, very plastic; very strongly acid; gradual smooth boundary.
CEC = 7.7 meq/100cm³
- Btg3—30 to 50 inches, gray (10YR 6/1) clay; many distinct medium yellowish red (5YR 5/8) mottles; massive structure; extremely firm; very sticky, very plastic; very strongly acid; clear smooth boundary.
CEC = 10.7 meq/100cm³
- Cg— 50+ inches, light gray (10YR 7/1) silt loam; few distinct medium yellowish red (5YR 5/8) mottles; single grain structure; friable; slightly-sticky, slightly-plastic; very strongly acid.
CEC = 13.5 meq/100cm³

A total of four saturated hydraulic conductivity (Ksat) tests were conducted within the proposed drainfield locations on April 27, 2007. The purpose of these tests was to determine permeability at 6 inches and 12 inches within the soil profile and, thus, assign a loading rate for the proposed subsurface drip with pre-treatment septic system. All tests were performed with a Guelph Permeameter and the results are detailed in Table 1 below.

Table 1. Saturated Hydraulic Conductivity (Ksat) Data.

Test	Soil Depth ---inches---	Permeability ---GPD/ft ² ---
1	6	5.82
	12	0.06
2	6	3.59
	12	0.22
3	6	0.33
	12	0.96
4	6	0.36
	12	0.24
Geometric Mean		
	6	1.25
	12	0.23

The most restrictive soil horizon at this site is the Btg1 horizon. The Btg1 horizon has a clay texture, placing it into the Type IV soil grouping. The loading rate range for a subsurface drip with pre-treatment in a Type IV soil is 0.05 - 0.15 GPD/ft². The Ksat test data is substantial higher than this loading rate range, so a loading rate of 0.15 GPD/ft² is proposed for this system.

The approximate land area required for an irrigation system is calculated based on the size of the proposed facility and the loading rate of the soil. The residential care facility on this site is planned to house up to 28 residents and 21 employees, which equates to a design flow of 2940 GPD. Table 2 below presents the area of usable soil required for a daily flow of 2940 GPD based on a loading rate of 0.15 GPD/ft². The actual computations are in a spreadsheet in Attachment 4.

Table 2. Estimated Wastewater Daily Flow Limits on this Property.

Available Area for Wastewater Treatment (ft ²)	Daily Flow (gal/day)
58,800	2940

Forty-six drainfield lines were laid out within provisionally suitable soil areas on the property. Drainfield lines were laid out on 10 foot centers as shown on the layout map in Attachment 2. The drainfield line lengths, flag colors, and elevations are shown in Table 3 below. Only a portion of the drainfield lines laid out in the field will be required for the proposed septic system (9,800 feet each for the initial and repair systems).

Table 3. Septic System Layout Information.

Line Number	Flag Color	Line Length	Line Number	Flag Color	Line Length
		--feet--			--feet--
1	Blue	117	14b	Red	40
2	Red	121	15b	Blue	36
3	Orange	118	16b	Pink	41
4	Pink	115	17b	Orange	41
5	Blue	109	18b	Red	37
6	Red	65	19b	Blue	40
7	Orange	44	20b	Pink	36
8	Pink	125	21b	Orange	33
9	Orange	135	22b	Red	35
10	Red	133	23b	Blue	28
11	Blue	152	24b	Pink	33
12	Pink	166	A	Red	47
13	Orange	174	B	White	56
14	Red	169	C	Pink	79
15	Blue	149	D	Purple	92
16	Pink	140	E	Blue	99
17	Orange	126	F	Orange	98
18	Red	125	G	Yellow	85
19	Blue	126	H	Red	84
20	Pink	122	I	White	85
21	Orange	176	J	Pink	97
22	Red	195	K	Purple	112
23	Blue	137	L	Blue	107
24	Pink	109	M	Orange	111
25	Pink	76	N	Yellow	103
1b	Orange	38	O	Blue	23
2b	Red	31	P	Red	127
3b	Blue	27	Q	White	72
4b	Pink	31	R	Pink	96
5b	Orange	32	S	Purple	83
6b	Red	33	T	Blue	83
7b	Blue	32	U	Orange	53
8b	Pink	23	V	Yellow	51
9b	Orange	23	W	Red	13
10b	Red	28			
11b	Blue	27			
12b	Pink	33			
13b	Orange	30			
Total⁽¹⁾	---	---	---	---	27,340

(1) Line laid out multiplied by 5 because layout on 10' centers but system lines on 2' centers.

We recommend the installation of a subsurface drip with pre-treatment septic system on this site based on the site evaluation and the collected site data. The recommended loading rate for this system is 0.15 GPD/ft² and a design flow of 2940 GPD to serve 28 residents and 21 personnel/employees. We appreciate the opportunity to assist you in this matter. Please contact us with any questions, concerns, or comments.

crchealth

**ATTACHMENT 1: Property Maps Detailing Soil Suitability
for Septic Systems, Soil Types, Ksat Test
Locations, and System Layout**



5400 Etta Burke Court
 Raleigh, NC 27605
 Phone: (919) 859-0569
 (919) 233-1970

CRC Property
 Chatham Co., NC



Soils Map

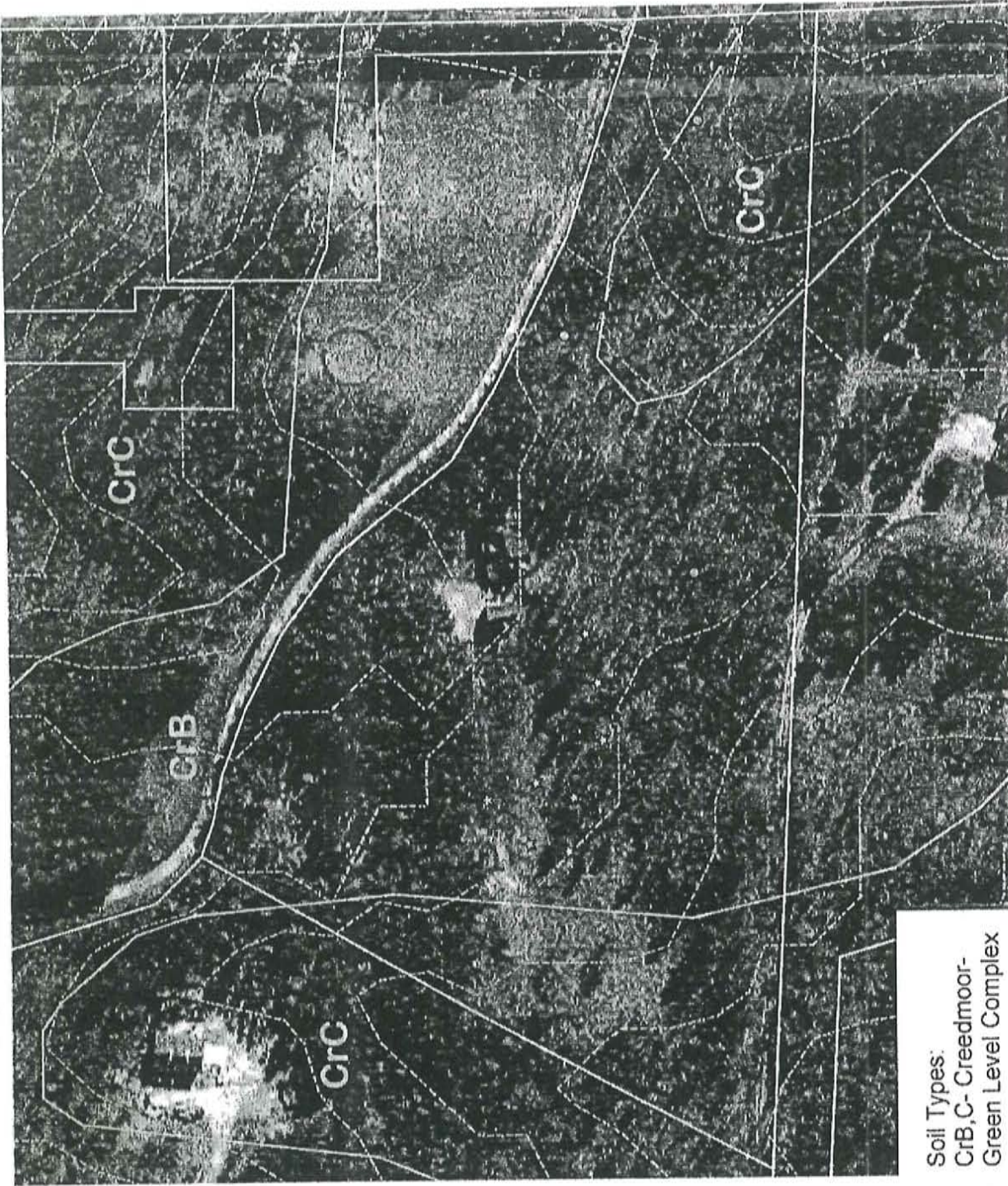
Legend

SI Contours

Depth of Prov Suitable Soil

- <12"
- 12" - 17"
- 18" - 23"
- Well
- ☆ Sprinkler Hood
- ▭ Parcels
- Soil Types

Drawn By:
 Enrique Cachafeiro
 Reviewed By:
 Jeff Vaughan
 Date:
 06/15/2007



Soil Types:
 CrB, C- Creedmoor-
 Green Level Complex



AMT
 Land Development Division
 Agriwaste-Technology, Inc.
 5400 Etta Burrie Court
 Raleigh, NC 27606
 Phone: (919) 859-0689
 (919) 233-1970

CRC Property
 Chatham Co., NC

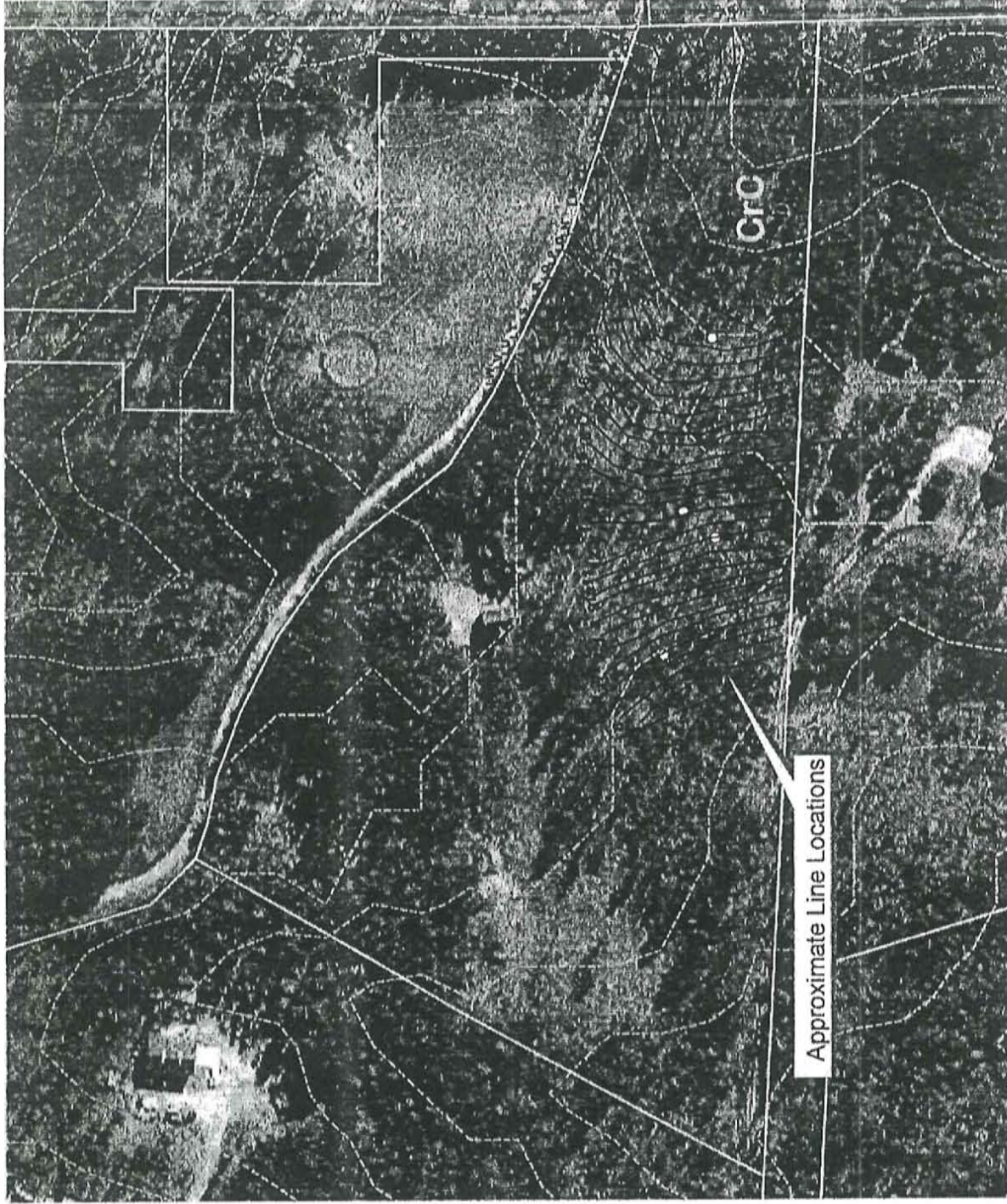


Layout &
 KSAT Map

Legend

- Sft Contours
- KSAT Tests
- Parcels

Drawn By:
 Enrique Cachateiro
 Reviewed By:
 Jeff Vaughan
 Date:
 06/15/2007



**ATTACHMENT 2: Typical Profile Description of
Provisionally Suitable Soil**

.1940 Landscape Pos/Slope %	-	Profile LTAR	-
.1942 Wetness Condition	-	System Type	-
.1943/.1956 Saprolite	-		
.1944 Restrictive Horizon	-		
.1948 Profile Classification	-		

Comments:

EVALUATED BY: Jeff Vaughan, Enrique Cachafeiro, Chris McGee, and Sloan Griffin
 COMMENTS: _____

LEGEND OF ABBREVIATIONS FOR SITE EVALUATION FORM

<u>LANDSCAPE POSITION</u>	<u>TEXTURE GROUP</u>	<u>TEXTURE CLASS</u>	<u>.1955 LTAR</u> (gal/day/sqft)
CC - Concave Slope	I	S - Sand	1.2 - .08
CV - Convex Slope		LS - Loamy Sand	
DS - Debris Slump			
D - Depression	II	SL - Sandy Loam	0.8 - 0.6
DW - Drainage Way		L - Loam	
FP - Flood Plain			
FS - Foot Slope	III	SCL - Sandy Clay Loam	0.6 - 0.3
H - Head Slope		CL - Clay Loam	
I - Interflueve		SiL - Silt Loam	
L - Linear Slope		Si - Silt	
N - Nose Slope		SiCL - Silt Clay Loam	
P - Pocosin			
R - Ridge	IV	SC - Sandy Clay	0.4 - 0.1
S - Shoulder		C - Clay	
T - Terrace		SiC - Silty Clay	
		O - Organic	
<u>STRUCTURE</u>	<u>MOIST CONSISTENCE</u>	<u>MOTTLES</u>	<u>WET CONSISTENCE</u>
G - Single Grain	Vfr - Very Friable	1 - Few	NS - Non Sticky
M - Massive	Fr - Friable	2 - Common	SS - Slightly Sticky
CR - Crumb	Fi - Firm	3 - Many	S - Sticky
GR - Granular	Vfi - Very Firm		VS - Very Sticky
SBK - Subgranular Blocky	Efi - Extremely Firm	F - Faint	
ABK - Angular Blocky		D - Distinct	NP - Non Plastic
PL - Platy		P - Prominent	SP - Slightly Plastic
PR - Prismatic			P - Plastic
		f - Fine	VP - Very Plastic
		m - Medium	
		c - Coarse	

ATTACHMENT 3: Soil Analysis Results



Soil Test Report

Grower: Westrom, Eric
 176 Lassifer Homestead Rd
 Chapel Hill, NC 27514

Farm: Chatham County

Copies To: Vaughan, Jeff
 Vaughan, Jeff
 c/o Agri-Waste Technology, Inc.
 5400 Elta Burke Court
 Raleigh, NC 27606

4/18/2007 SERVING N.C. RESIDENTS FOR OVER 60 YEARS

Agronomist Comments

Field Information		Applied Lime		Recommendations	
Sample No.	Last Crop	Mo	Yr	T/A	Crop or Year
CHA	A Horizon				
		1T	80-120	60-80	40-60
		0	80-120	60-80	40-60

Test Results

Soil Class	HM%	W/V	CEC	BS%	Ac	pH	P-I	K-I	Ca%	Mg%	Zn-I	Zn-AI	Cu-I	S-I	SS-I	NO ₃ -N	NH ₄ -N	Na
MIN	0.6	1.26	2.9	21.0	2.3	4.7	3	14	11.0	6.0	11	11	16	37				0.1

Field Information

Applied Lime		Recommendations			
Sample No.	Last Crop	Mo	Yr	T/A	Crop or Year
CHBT1	Bt1 Horizon				
		1.3T	80-120	70-90	40-60
		0	80-120	70-90	40-60

Test Results

Soil Class	HM%	W/V	CEC	BS%	Ac	pH	P-I	K-I	Ca%	Mg%	Zn-I	Zn-AI	Cu-I	S-I	SS-I	NO ₃ -N	NH ₄ -N	Na
MIN	0.51	1.29	3.8	26.0	2.8	4.6	0	12	12.0	12.0	10	10	23	49				0.1

Field Information

Applied Lime		Recommendations			
Sample No.	Last Crop	Mo	Yr	T/A	Crop or Year
CHBT2	Btg2 Horizon				
		2.7T	80-120	70-90	30-50
		0	80-120	70-90	30-50

Test Results

Soil Class	HM%	W/V	CEC	BS%	Ac	pH	P-I	K-I	Ca%	Mg%	Zn-I	Zn-AI	Cu-I	S-I	SS-I	NO ₃ -N	NH ₄ -N	Na
MIN	0.27	1.20	7.7	27.0	5.6	4.5	0	18	13.0	14.0	7	7	26	55				0.1

Field Information

Applied Lime		Recommendations			
Sample No.	Last Crop	Mo	Yr	T/A	Crop or Year
CHBT3	Btg3 Horizon				
		3.1T	80-120	70-90	0-20
		0	80-120	70-90	0-20

Test Results

Soil Class	HM%	W/V	CEC	BS%	Ac	pH	P-I	K-I	Ca%	Mg%	Zn-I	Zn-AI	Cu-I	S-I	SS-I	NO ₃ -N	NH ₄ -N	Na
MIN	0.09	0.96	10.7	31.0	7.4	4.7	0	33	7.0	22.0	81	81	66	53				0.3

Field Information Applied Lime Recommendations

Sample No.	Last Crop	Mo	Yr	T/A	Crop or Year	Lime	N	P2O5	K2O	Mg	S	Ca	Zn	B	Mn	See Note	
CHCG	Cg Horizon				1st Crop: Hardwood,M 2nd Crop: Hardwood,M	3-4T 0	80-120 80-120	70-90 70-90	20-40 20-40	0 0	15-20 15-20	\$ \$	\$ \$				11 11

Test Results

Soil Class	HM%	W/V	CEC	BS%	AC	PH	P-I	K-I	Ca%	Mg%	Mn-I	Mn-AI(1)	Mn-AI(2)	Zn-I	Zn-AI	Ca-I	S-I	SS-I	NO3-N	NH4-N	Na
MIN	0.0	1.02	13.5	28.0	9.7	4.9	0	25	8.0	20.0	9			17	17	25	12				0.6

**ATTACHMENT 4: Septic System Area Computation
Spreadsheets**

Subsurface Drip (w/ Pre-Treatment) Septic System Area Computation

Created by: JV
Created on: 6/20/2001
Updated on: 6/25/2007

Client Name:	CRC Health
Design Flow (gal/day):	2940 (28 residents and 21 employees)
LTAR (gal/day/ft ²):	0.15
Trench Bottom Area (ft ²):	19600 (Design flow/LTAR)
On-center distance between trenches (ft):	2
Trench Bottom Length (ft):	9800
Minimum Field Area Required (ft ²):	19600 (Trench Bottom Length*Trench on-center distance)
Total Field Area Required (ft ²) ⁽¹⁾ :	49000 (Minimum field area*2.5)
Total Field Area Required (ft ²) ⁽¹⁾ :	58800 (Minimum field area*3)

(1) Provides for reserve area and soil irregularity, 2.5 to 3 is multiplier.



