

SUPPORTING CALCULATIONS

SUB-HEADINGS:

RUN-OFF CALCULATIONS

DITCH DESIGN 1-11

CULVERT DESIGN

ROCK DAM DESIGN

RUN OFF CALCULATIONS

DITCH 1

SECTION Q4 SCS METHOD

$$TA = 167636 \text{ ft}^2 = 3.85 \text{ AC}$$

$$\text{GRADING} = 0.74 \text{ AC} + 12973 \text{ ft}^2 = 1.04 \text{ AC}$$

$$\text{FIELD} = 3.85 - 1.04 = 2.81 \text{ AC}$$

$$L = 666' + 273' = 939'$$

$$\text{CHANNEL } 320 + 273 = 593'$$

$$\Delta eL = 311.5 - 273.5 = 38'$$

$$S = 38/939 = 4\%$$

$$\text{CN WEIGHTED } \frac{1.04}{3.85} \times 89 = 24.04 \text{ GRADED}$$

$$\frac{2.83}{3.85} \times 71 = 52.19 \text{ FILED}$$

$$3 \text{ (a) RAIN} = 5.6''_{10, 24 \text{ hr}} \quad \text{CN}_w = 76.23 \rightarrow \underline{76}$$

$$(b) \text{ DEPTH} \quad 75 \quad 76 \quad 80$$

$$5.0 \quad 2.45 \quad 2.89$$

$$5.6 \quad 2.948 \quad \underline{X} \quad 3.424$$

$$6.0 \quad 3.28 \quad 3.78$$

$$(c) L = 209(a)^{0.6} \quad X = 3.04'' \text{ DEEP}$$

$$a = 12.23 \text{ EQUIV ACRES}$$

$$(d) \text{ FIG 3-08 p } 3\% \text{ LS } < 8\% @ \text{ CN} = 76 \rightarrow 14 \text{ CFS/IN}$$

$$4. Q_1 = 14 \text{ CFS/IN} \times 3.04'' = 42.56 \text{ CFS}$$

$$Q_2 = 42.56 \times \frac{3.85}{12.23} = 13.4 \text{ CFS}$$

$$5. Q_3 \text{ No imperv}$$

$$\% \text{ CHANN MOD} = 593/939 = 63\% \rightarrow 1.7$$

$$Q_3 = 13.4 \times 1.7 = 22.8 \text{ CFS}$$

$$6 \text{ SLOPE FACTOR} = 1.0$$

$$Q_4 = (1) \times 22.8 = 22.8 \text{ DESIGN}$$

NO PONDING.

D1

SECTION Q4 RATIONAL Check

$$Q = CIA$$

$$A = 3.85AC$$

$$C = 0.6$$

$$L @ \Delta PL = 38'$$

$$L = 939'$$

$$t_c = 6.1 \text{ MIN}$$

I CURVE 8.03(e) \rightarrow 8"

$$Q = (.6)(8) 3.85$$

$$Q = 18.48 \text{ CFS VS } 22.8 \text{ CFS SCS METHOD}$$

\approx CLOSE BIG SITE.

DITCH 1

SECTION Q3

$$TA = 120261 \text{ \#}' = 2.76 \text{ AC}$$

$$\text{GRADING AREA} = 21505 \text{ \#}' + 1060.4 = 0.74 \text{ AC}$$

$$\text{FIELD } 2.76 - 0.74 = 2.02 \text{ AC}$$

$$L = 565 + 101 = 666' ; \text{ CHANN} = 219 + 101 = 320'$$

$$\Delta L = 311.5 - 279 = 32.5'$$

$$S = 32.5 / 666 = 4.9\% \approx 5\%$$

$$\text{CN WEIGHTS } \frac{0.74}{2.76} \times 89 = 23.9 \text{ GRADED}$$

$$\frac{2.02}{2.76} \times 71 = 52.0 \text{ FIELD}$$

$$\text{CN} = \frac{75.9}{2.76} \approx \underline{\underline{76}}$$

3(a) $R = 5.6''$

(b) DEPTH

	75	76	80
5.0	2.45		2.89
5.6	2.948	X	3.424
6.0	3.28		3.78

(c) $L = 209 \text{ (a)}^{0.6}$

$X = 3.04$ "DEEP"

$a = 6.9$ EQUIV ACRES

(d) FIG 3.08 (P) $3\% < S < 8\% \rightarrow 8.5 \text{ cfs/in}$

4. $Q_1 = 8.5 \text{ cfs/in} \times 3.04 = 25.84 \text{ cfs}$

$$Q_2 = 25.84 \times \frac{2.76}{6.9} = 10.34 \text{ cfs}$$

5. No IMPERV

$$\% \text{ CHANNEL MOD} = \frac{320 \text{ DITCH}}{666 \text{ TOTAL}} = 48\% \rightarrow 1.34$$

$$Q_3 = 10.34 \times 1.34 = 13.86 \text{ cfs}$$

6. SLOPE ADJ $\rightarrow 1.04$

$$Q_4 = 13.86 \times 1.04 = 14.4 \text{ cfs}$$

No PONDING

$$\text{DESIGN} = 14.4 \text{ cfs.}$$

DITCH 1
SECTION Q2

$$TA = 82667 \text{ ft}^2 = 1.9 \text{ AC}$$

$$\text{GRADING AREA} = 21585 \text{ ft}^2 = 0.5 \text{ AC}$$

$$\text{FIELD} = 1.4 \text{ AC}$$

$$L = 565' \quad (219' \text{ IN CHANNEL})$$

$$\Delta eL = 311.5 - 283 = 28.50$$

$$S = \frac{28.5}{565} = 5\%$$

$$\text{CN WEIGHTED } \frac{.5}{1.9} \times 89 = 2.36 \quad \text{GRADING}$$

$$\frac{1.4}{1.9} \times 71 = \frac{52.32}{1.9} \quad \text{FIELD}$$

$$54.68 \sim \underline{\underline{55}} \text{ CN}$$

3(a) $R = 5.6''$

(b) CHART STOPS @ 60

$$5.0 \quad 1.30$$

$$5.6 \quad X$$

$$6.0 \quad 1.92$$

$$\frac{.6}{1} = \frac{X}{.62} = .372$$

$$1.3 + .37 = \underline{\underline{1.67}}$$

(c) $L = 209(a)^{.6}$

$$a = 5.25 \text{ EQUIV ACRE}$$

d FIG 3.08(p) 3% < S < 8% → 6 CFS/IN

4. $Q_1 = 6 \text{ CFS/IN} \times 1.67 = 10.02 \text{ CFS}$

$$Q_2 = 10.02 \times \frac{1.9}{5.25} = 3.63 \text{ CFS}$$

5 NO IMPETRV

$$\text{MOD CHANNEL \%} = \frac{219}{565} = 39\%$$

FACTOR 1.3

$$Q_3 = 3.63 \times 1.3 = \underline{\underline{4.72}} \text{ CFS}$$

6. Slope ADJ 1.04

$$Q_4 = 4.72 \text{ CFS} \times 1.04 = \underline{\underline{4.9 \text{ CFS DESIGN}}}$$

SECTION Q1 DITCH #1



TA = 24,491 #' = 0.56 AC

L = 332

$\Delta el = 311.5 - 295.5 = 16$

S = $\frac{16}{332} = 4.8\%$

CN WEIGHTED GRADED = 8585 #' = 0.2 AC

FIELD = 0.56 - 0.2 = 0.36

GRADE $\frac{.2}{.56} \times 89 = 31.8$

FIELD $\frac{.36}{.56} \times 71 = 45.64$
CN $\frac{77.44}{77.44} = 78$

3(a) R = 5.6"

(b) D = 75 78 80

5.0 2.45 2.89

5.6" 2.948 X 3.424

6.0 3.28 3.78

X = 3.23"

(c) L = 209 (a)^{.6}

a = 2.16 EQUIV ACRES

d FIG 3.08p 3% LS < 8% → 4.1 CFS/IN

4. Q₁ = 4.1 CFS/IN x 3.23" = 13.24 CFS

Q₂ = 13.24 x $\frac{0.56}{2.16} = 3.43$ CFS

5. No imperv

CHANNEL MOD % $\frac{143' \text{ IN CHANN}}{332} = 43\%$

1.25 FACTOR

Q₃ = 3.43 x 1.25 = 4.29

6 SLOPE ADJ 1.04

4.29 x 1.04 = 4.46 CFS

NOT PRACTICAL
SO RUN RATIONAL
FOR SMALL #' &
MODS.

DITCH 1 SECTION Q₁ RATIONAL

RATIONAL -

$$C = .6$$

$$A = .56 AC$$

$$t_c = 2.1 \text{ MIN}$$

$$I = 7.5$$

$$Q = CIA = (.6)(.56) 7.5 = \underline{\underline{2.52}} \text{ CFF. } \underline{\underline{VS}} \text{ 4.5}$$

DITCH 2

$$TA = 180088 \text{ ft}^2 = 4.13 \text{ AC.}$$

$$GRADING = 4.13 - 2.74 = 1.39 \text{ AC}$$

$$FIELD = 119556 \text{ ft}^2 = 2.74 \text{ AC}$$

$$L = 1174'$$

$$\Delta el = 323 - 273.5 = 49.5'$$

$$S = \frac{49.5}{1174} = 4.2\%$$

$$CN \text{ WEIGHTED } \frac{1.39}{4.13} \times 89 = 29.95 \text{ GRADING}$$

$$\frac{2.74}{4.13} \times 71 = \underline{47.10} \text{ FIELD}$$

3(a) RAIN = 5.6"

$$CN_w = \underline{\underline{77}}$$

(b) Depth	7.5	7.7	8.0
	5.0	2.45	2.89
	5.6	2.948	<u>3.424</u>
	6.0	3.28	3.78

$$X = 3.14" \text{ DEEP}$$

(c) $L = 209(a)^{.6}$

$$a = 17.8 \text{ AC EQUIV}$$

(d) FIG 3.08 (p) $3\% < S < 8\% \rightarrow 17.5 \text{ CFS/IN}$

4. $Q_1 = 17.5 \text{ CFS/IN} \times 3.14" = 54.95 \text{ CFS}$

$$Q_2 = 54.95 \times \frac{4.13}{17.8} = 12.75 \text{ CFS}$$

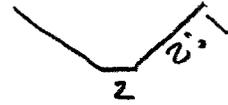
5. No IMPERV
No CHANNEL MOD

$$Q_3 = Q_2 = 12.75$$

6. Slope 4% = 1.0

$$Q_4 = 12.75 \times 1 = 12.75 \text{ CFS DESIGN}$$

DITCH 3W



$$TA = 2228 \text{ ft}^2 = 0.05 \text{ AC}$$

CN = 89 ALL GRADING

$$L = 88'$$

$$\Delta e_L = 309.5 - 306 = 3.5'$$

$$S = \frac{3.5}{88} = 4\%$$

3(a) $R = 5.6$

(b) $D = 4.36''$

c $L = 209 (a)^{1.48}$

$$a = 0.24 \text{ EQUIV AC}$$

(d) FIG 3.08(p) 3% LS 2.1 CFS/INCH

4 $Q_1 = 2.1 \times 4.36 = 9.16 \text{ CFS}$

$$Q_2 = 9.16 \times \frac{0.05}{0.24} = 1.91 \text{ CFS}$$

5. No IMPERV

100% CHANNEL MOD $\rightarrow 1.65$

$$1.91 \text{ CFS} \times 1.65 = 3.15$$

6 slope ADJ 4% = 1.0

DESIGN 3.15 CFS

DITCH 3 S



$$TA = 5693 \text{ ft}^2 = 0.13 \text{ AC}$$

$$CN = 89 \text{ ALL GRADING}$$

$$L = 183'$$

$$\Delta EL = 309.5 - 306 = 3.5'$$

$$S = 3.5/183 = 1.9\% \approx 2\%$$

$$3(a) R = 5.6$$

$$(b) D = 4.36'' @ 89 CN \text{ \& } 5.6'' \text{ SEE PREV. CALC.}$$

$$(c) L = 209 (a)^{0.6}$$

$$Q = 0.8 \text{ EQUIV ACRES}$$

$$(d) \text{ FIG 3.08 (c) } S < 3\% \text{ \& } 89 CN \rightarrow 1.9 \text{ CFS/IN}$$

$$4. Q_1 = 1.9 \text{ CFS/IN} \times 4.36'' = 8.28 \text{ CFS}$$

$$Q_2 = 8.28 \times \frac{0.13}{0.8} = 1.35 \text{ CFS}$$

5. NO IMPERV

$$100\% \text{ CHANNEL MOD} \rightarrow 1.65 @ CN=89$$

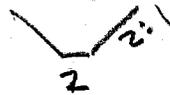
$$1.35 \text{ CFS} \times 1.65 = 2.22 \text{ CFS}$$

6. SLOPE ADJ	1.5	1.13	$\frac{.5}{1.5} = \frac{X}{1.2}$	$X = 0.07$
	2.0	X		
	3.0	0.93	$1.13 - 0.07 = 1.06$	

$$2.22 \text{ CFS} \times 1.06 = 2.36 \text{ CFS}$$

DESIGN 2.36 CFS

DITCH #4



$$TA = 9595 \text{ ft}^2 \rightarrow 0.22 \text{ AC}$$

CN = 89 ALL GRADING

$$L = 260'$$

$$\Delta EL = 309.5 - 307 = 2.5'$$

$$S = \frac{2.5}{260} \rightarrow 0.96\%$$

3(a) $R = 5.6''$

(b) $D = 4.36''$

(c) $L = 209(a)$

$$a = 1.44 \text{ EQUIV AC}$$

(d) FIG 3.08(0) $< 3\% \rightarrow 2.9 \text{ CFS/IN}$

4. $Q_1 = 2.9 \text{ CFS/IN} \times 4.36'' = 12.64 \text{ CFS}$

$$Q_2 = 12.64 \times \frac{.22}{1.44} = 1.9 \text{ CFS}$$

5. IMPETRV N/A

MOD CHANNEL 100% 1.65

$$1.9 \text{ CFS} \times 1.65 = 3.2 \text{ CFS}$$

6. SLOPE ADJ 1.0 NO CHANGE

$$\text{DESIGN} = 3.2 \text{ CFS}$$

DITCH #5

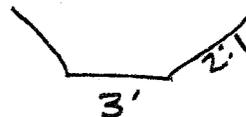
$$TA = 10,384 \text{ ft}^2 = 0.24 \text{ AC}$$

CN = 89 ALL GRADED

$$L = 357'$$

$$\Delta EL = 315.5 - 307 = 8.50$$

$$S = \frac{8.5}{357} = 2.4\%$$



3(a) $R = 5.6$

(b) Depth = 4.36 FOR 5.6" @ CN = 89

(c) $L = 209(a)'$

$a = 2.44$ AC EQUIV.

(d) FIG 308(b) $< 3\% \frac{1}{2} A_{EQ} = 2.44$

$= 3.5$ CFS/INCH

4.0 $Q_1 = 3.5 \text{ CFS/INCH} \times 4.36 = 15.26 \text{ CFS}$

$Q_2 = 15.26 \times \frac{0.24}{2.44} = 1.5 \text{ CFS}$

5.a IMPERVIOUS = N/A

MOD CHANNEL = 100% 1.65 FOR CN = 89

$1.5 \times 1.65 = 2.48$

6. SLOPE ADJ 1.01 CALC PREV 9W

$2.48 \times 1.01 = 2.5$

DESIGN 2.5 CFS

DITCH #6 (+5+4)

$TA_6 = 34738 \# \rightarrow 0.8 \text{ AC}$
 $GRADING = 5439 \# = 0.12 \text{ AC}$
 $EXIST \text{ FIELD} = 0.8 - 0.12 = 0.68 \text{ AC}$
 $L = 355'$
 $\Delta eL = 323 - 306.25 = 16.75'$
 $S = 16.75 / 355 = 4.7\%$



WEIGHTED CN $\frac{0.12}{0.8} \times 89 = 13.35$
 $\frac{.68}{0.8} \times 71 = 60.35$

$73.7 \approx \underline{74} = \text{CN}$

3(a) $R = 5.6''$

(b) $D = 2.86''$ PREV CALC DITCH 9W

(c) $L = 209 (a)^{.6}$

$a = 2.42$ EQUIV ACRES

(d) FIG 308(p) $3\% < S < 5\% \rightarrow 4.3 \text{ CFS/IN}$

4 $Q_1 = 4.3 \times 2.86'' = 12.3 \text{ CFS}$

$Q_2 = 12.3 \times \frac{0.8}{2.42} = 4.06 \text{ CFS}$

5 IMPERV = 0 N/A

CHANNEL MOD N/A

6 SLOPE ADJ $4\% \quad 1.0 \quad \frac{.7}{1} = \frac{x}{.04}$

4.7

5 $1.04 \quad \text{ADJ} = 1.028$

$4.06 \times 1.028 = 4.2 \text{ CFS}$

DESIGN 4.2 CFS Ditch 6 CONTRIB

3.2

4 "

2.5

5 "

9.9 CFS @ DESIGN POINT.

DITCH 7N (7S SIM)



$$TA = 12723 \text{ ft} \rightarrow 0.29 \text{ AC}$$

CN = 89 ALL NEW GRADED

$$L = 276'$$

$$\Delta EL = 326 - 315.0 = 11$$

$$S = \frac{11}{276} = 4\%$$

3(a) \rightarrow 5.6" RAINFALL

3(b) \rightarrow 4.36" DEPTH USING 5.6" & CN = 89

$$A(a) \quad L = 209 (a)'$$

$$aL = 1.59 \text{ AC EQUIV.}$$

$$\text{FIG 803 (p)} \rightarrow 3.0 \text{ CFS/INCH}$$

$$Q_1 = 3.0 \times 4.36" = 13.08 \text{ CFS}$$

$$Q_2 = 13.08 \times \frac{0.29}{1.59} = 2.39 \text{ CFS}$$

5 IMPERVIOUS N/A

MOD CHANNEL 100% @ CN = 89

$$2.39 \times 1.65 = 3.94 \text{ CFS}$$

6. SLOPE ADJ = 1.0 @ 4%

NO PONDING

$$\text{DESIGN} = 3.9 \text{ CFS}$$

Ditch 8

$$TA = 192,336 \text{ ft} \rightarrow 4.42 \text{ AC}$$

$$L = 633'$$

$$\Delta c = 315.5 - 311 = 4.5'$$

$$S' = \frac{4.5}{633} = .007 \%$$

FIELDS = 2.77 AC, CN = 71 - CULTIVATED

NOW GRADED 89, $4.42 - 2.77 = 1.65 \text{ AC}$

② CN 89

$$\frac{1.65}{4.42} \times 89 = \underline{33.2}$$

$$\frac{2.77}{4.42} \times 71 = \underline{44.5} \quad \Sigma = \underline{78}$$

③ Q_{10,24}

5.6" RAINFALL

78 80

5

2.45

2.89

5.6

2.948

3.23

3.424

6.0

3.28

3.78

④ (a) L = 209(a)^{6.6}

$$a = 6.34 \text{ AC}$$

803(b) 6 CFS/m

$$(b) Q_1 = 6 \text{ CFS/m} \times 3.23'' = 19.38$$

$$(c) Q_2 = 19.38 \times \frac{4.42}{6.34} = 13.51$$

⑤ IMPERVIOUS N/A

Hyd Mod Length 100% → OFF CHART USE CN = 95

$$13.51 \times 1.25 = 16.89$$

⑥ SLOPE → (.9) = 16.89 × (.9) = 15.2 CFS

⑦ PONDING N/A

DESIGN = 15.2 CFS. AGREES ≈ RATIONALE @ 16.6



DITCH # 8 RATIONAL

①
② - A = 4.42 AC

FIELD 2.77 AC. C = .5

GRADED NEW = 1.65 AC C = .6

$$\frac{2.77}{4.42} \times .5 = .31$$

$$\frac{1.65}{4.42} \times .6 = .22$$

.54 WEIGHTED AVG "C"

③ $T_c \Delta E = 4.5'$

$T_c = 8 \text{ MIN}$

$I = 7$

$Q = CIA$

$(.54)(7)4.42 = 16.62 \text{ CFS}$

DITCH 9 W

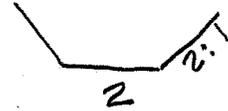
TA = 860134' → 2.52 AC

GRADE 168564' → 0.39 AC

L = 773'

ΔEL = 330 - 311 = 19'

S = $\frac{19}{773} = 2.4\%$



GRADE $\frac{0.39 \text{ AC}}{2.52} \times 89 = 13.8$

FIELD $\frac{2.52 - 139}{2.52} \times 71 = \underline{60.01}$

CN WTD = 73.8 ~> 74

③ Q_{10,24} = 5.6 RAINFALL

	70	74	75
5	2.04		2.45
5.6	2.5	<u>2.86</u>	2.948
6.0	2.80	DEPTH	3.28

④ (a) L = 209 (a)'6

a = 8.84 EQUIV AC

803 (p) FOR <3% → 7 CFS/IN

(b) Q₁ = 7 × 2.86" = 20.02

Q₂ = 20.02 × $\frac{2.52}{8.84} = 5.71 \text{ CFS}$

⑤ IMPERVIOUS NA

MOD CHANNEL 0%

⑥ SLOPE ADJ 8.03 (d)

1.5	1.13
2.4	x
3.0	0.93

$\frac{.9}{1.5} = \frac{x}{.2} \quad x = .12$

1.13 - .12 = 1.01

Q₆ = 5.71 × 1.01 = 5.8 CFS DESIGN

DITCH 9E

$$TA = 28605\phi \rightarrow 0.66 AC$$

100% GRADING CN = 89

$$L = 437$$

$$\Delta EL = 330 - 313 = 17'$$

$$S = \frac{17}{437} = 3.9\%$$



3a

5.6" RAINFALL

3b

	85	89	90	
5	3.37		3.88	} DEPTH
5.6	3.934	<u>4.36"</u>	4.462	
6.0	4.31		4.85	

4 a

$$L = 209 (a)^L$$

$$a = 3.42 AC \text{ EQUIV}$$

FIG 803(p) \rightarrow 6.1 CFS/IN PEAK RATE @ EQUIV AREA

$$Q_1 = 6.1 \text{ CFS/IN} \times 4.36" = 26.6$$

$$Q_2 = 26.6 \times \frac{0.66 AC}{3.42} = 5.13 \text{ CFS}$$

5. IMPERV N/A

MOD CHAN 100% 1.7 FACTOR

$$5.13 \times 1.7 = \underline{8.7}$$

6 SLOPE ADJ 1.0

7 NO PONDING

$$DESIGN = 8.7 \text{ CFS}$$

DITCH 10

$$TA = 133254 \phi' = 3.06 AC$$

CN = 89 ALL GRADING

$$L = 1142' \text{ ALL IN CHANNEL}$$

$$\Delta EL = 315.5 - 305 = 10.5$$

$$S = 10.5/1142 = .9\%$$

3(a) RAIN = 5.6"

(b) DEPTH	85	89	90
	5.0	3.37	3.88
	5.6	3.934	4.462
	6.0	4.31	4.85

X

$$X = 4.36''$$

$$(c) L = 209 (A)^{.6}$$

$$Q = 16.95 \text{ EQUIV } A_c$$

(d) FIG 3.08 (e) $S < 3\% \rightarrow 15.5 \text{ CFS/IN}$

$$A. Q_1 = 15.5 \text{ CFS/IN} \times 4.36'' = 67.58 \text{ CFS}$$

$$Q_2 = 67.58 \times \frac{3.06}{16.95} = 12.20 \text{ CFS}$$

5. NO IMPETRV

CHANNEL MOD: 100% IN CHANNEL 1.45

$$Q_3 = 12.20 \times 1.45 = 17.69 \text{ CFS}$$

$$6. \text{ SLOPE ADJ} = \begin{array}{l} .7 = 0.90 \\ .9 = X = 1.97 \\ 1.0 = 1.0 \end{array} \quad \frac{.7}{.3} = \frac{X}{.1}$$

$$Q_4 = 17.69 \times .97$$

$$Q_4 = 17.1 \text{ CFS}$$

NO PONDING

$$\text{DESIGN} = 17.1 \text{ CFS}$$

DITCH 11

$$TA = 234878 \text{ ft}^2 = 5.39 \text{ AC}$$

CN = 89 ALL GRADED

$$L = 918' ; 341' \text{ IN CHANNEL}$$

$$\Delta_{EL} = 315.5 - 305 = 10.5'$$

$$S = \frac{10.5}{918} = 1.2\%$$

3(a) RAIN = 5.6"

(b) DEPTH	85	89	90
	5.0	3.37	3.88
	5.6	3.934	X
	6.0	4.31	4.85

$$X = 4.36''$$

(c) $L = 201(a)^L$

$$a = 11.78 \text{ EQUIV ACRES}$$

(d) FIG 3.08 (e) $S < 3\%$, CN = 89 \rightarrow 11.5 CFS/IN

4. $Q_1 = 11.5 \times 4.36 = 50.14$

$$Q_2 = 50.14 \times \frac{5.39}{11.78} = 22.94 \text{ CFS}$$

5.

$$\text{IMPERVIOUS AREA} = 3344 \text{ ft}^2 = \frac{.077 \text{ AC}}{5.39} = 1.4\%$$

$$Q_3 = 22.94 \times 1.001 = 22.96$$

$$\text{CHANNEL MOD } \% = \frac{341}{918} = 37.1\% \quad 1.15$$

$$Q_3 = 22.96 \times 1.15 = 26.4 \text{ CFS}$$

6. SLOPE ADJ

	1.0	1.0	
	1.2	X	
Q_4	1.5	1.13	$X = \frac{.12}{.5} = .13$

$$Q_4 = 26.4 \times 1.05 = \underline{\underline{27.72}} \text{ CFS DESIGN}$$

DITCH DESIGN

DITCH 1 DESIGN LOWER SECTION Q4 to Q3

Q4 DESIGN POINT

(a) $Q = 22.8$ CFS

(b) SECTION CHANNEL SLOPE Q4 to Q3

$$\frac{278 - 243.5}{273} = 12.6\% \approx 13\%$$

(c) $k = .24$ CLAY MATL SEE GEOLOGIST REPORT
 OUR CONSTRUCTION PLAN STIPULATES RIP-RAP
 PROTECTION FOR LOWER REACHES OF
 DITCH 1.

CLASSIFY AS STEEP GRADIENT $10\% < S \approx 13\%$

I. $B = 4'$ WIDE, 2:1 SLOPE (CHART 8.05H)

FIG 8.05(K) USE $n = .15$ $d_N = .65 = d$

$$d = \frac{A_3}{A_2} \frac{d_N}{\frac{d/b}{2:1}}$$

$\frac{d}{b}$	$\frac{d}{b}$	$\frac{d}{b}$	$\frac{d}{b}$
$.1$	$.16$	$.16$	$.16$
1.083	1.083	1.083	1.083
X	X	X	X
1.12	1.12	1.12	1.12
1.142	1.142	1.142	1.142

$$d = (1.12)(.65) = .73$$

$$d_{50} = \frac{d}{d_N} d_{50c} = \frac{.73}{.65} (1.75)$$

$$d_{50} = .84' \quad \text{use } d_{50} = 12''$$

$$\text{MAX STONE SIZE} = 1.5 \times d_{50} = (1.5 \times 1.0) = 1.8''$$

THR RIPRAP BELOW FINISH SLOPE

$$1.5 \times d_{\text{MAX}} = 1.5 \times 18 = 27''$$

DITCH 1 DESIGN SECTION Q₃ to Q₂

$$Q_3 = 14.4 \text{ CFS}$$

$$\text{SLOPE} = \frac{283 - 278}{101'} = 5\% = .05\%$$

S < 10% CLASS AS MODERATE SLOPE

$$b = 4'$$

$$z = 2$$

1. TRY $d_{50} = 6''$ @ $d = 1'$

$$n = .069 \quad 8.05f$$

$$T_d = 2 \text{ PSF}$$

2. FIG 8.05d

$$Q_N = 14.4 \times .069 = .99 \text{ USE } 1.0$$

$$\frac{d}{B} = .20 \quad B = 4' \text{ BOTTOM}$$

$$d = (.2)(4) = 0.8'$$

3. CALC SHR STRESS

$$\gamma = y d s$$

$$= (62.4 \text{ #/ft}^3)(0.8')(0.05)$$

$$= 2.49 > 2.0 \text{ NG USE } d_{50} = 12''$$

@ $d_{50} = 9''$

$$n = .074$$

$$T_d = 3.0 \text{ PSF}$$

$$Q_N = 14.4(.074) = 1.08$$

FIG 8.05d $\frac{d}{B} = .22$

$$d = (.22)(4) = .88$$

$$\gamma = y d s$$

$$= (62.4 \text{ #/ft}^3)(.88)(.05)$$

$$= 2.75 < 3 \quad \underline{\underline{\text{OK}}}$$

$$d_{\text{MAX}} = 1.5(d_{50}) = 1.5(9'') = 13.5''$$

$$\text{THK RIPRAP} = 13.5 \times 1.5 = 21'' \text{ DEEP}$$

Ditch 1, SECTION Q3-Q2 CONTD

CHK SIDE SLOPE RIP RAP.

1. FIG 8.05(g) $\phi = 41^\circ$

$$2:1 \text{ SLOPE} = 26.6^\circ < 41^\circ \underline{\underline{\text{OK}}}$$

SOIL CLAY OK.

2. FIG 8.05(h) $K_1 =$

$$\frac{B}{d} = \frac{4}{(88)} = 5.54$$

$$K_1 = 0.78$$

3. FIG 8.05(i)

$$K_2 = 1.72$$

4.

$$\begin{aligned} d_{50} \text{ SIDES} &= \frac{K_1}{K_2} d_{50} \text{ BOTTOM} \quad d_{50} = 9'' \\ &= \frac{.78}{1.72} (9) \\ &= 9.75'' \end{aligned}$$

USE $d_{50} = 10''$ SIDES & BOTTOM.

$$d_{\text{MAX}} = 10 \times 1.5 = 15''$$

$$d_{\text{THK}} = 15 \times 1.5 = \underline{\underline{22.5 \text{ THK}}}$$

SIDES & BOTT @ 23''

DITCH I DESIGN SECTION Q₂ to Q₁

$$Q_2 = 4.9 \text{ CFS}$$

$$\text{SLOPE} = \frac{295.5 - 283}{219} = 5.7\% = .06\% < 10\%$$

MILD SLOPE

$$B = 4''$$

$$Z = 2$$

I TRY $d_{50} = 6'' @ d = .75$

$$n = .069$$

$$t_d = 2 \text{ psf}$$

2. FIG 8.05d

$$Q_N = 4.9 \times .069 = 0.34$$

$$\frac{d}{B} = .095 ; d = (.095)(4) = .38'$$

3. CALC $\gamma = \gamma d s$

$$= (62.4)(0.38)(0.6)$$

$$= 1.42 < 2 \quad \underline{\underline{\text{OK}}}$$

use $d_{50} = 6''$

SIDE SLOPE

1. SAME

2. $B/d = 4/.38 = 10.53 \text{ USE } 10$

$$K_1 = .78$$

3. SAME @ .72

4. $\frac{K_1}{K_2} d_{50 \text{ BOTT}} = d_{50 \text{ SIDES}}$

$$\frac{.78}{.72} (6'') = 6.5''$$

SET $d_{50} = 9$ FOR SIDE & BOTT

$$d_{\text{MAX}} = 9 \times 1.5 = 13.5$$

DITCH 1 DESIGN SECTION Q₁ TO UPPER END

Q = 2.52

S = .06'/1

Z = 2

B = 3

CHK BARE EARTH n = 0.02

SOLVE MANNING

d = .155, V = 4.9, Q = 2.53

V > V_p SO MUST LINE

BERMUDA V_p = 5.5 CURVE "D"

TRIAL d = .5, R = .382

8.05 (c) (5.5)(.382) = 2.10

n = 0.45, V = 4.27 Q = 8.54 >> Q_R

TRIAL d = .3, R = .249

V_R = (5.5)(.249) = 1.37

n = 0.49, V = 2.946, Q = 3.18 > Q_R

TRIAL d = .25, R = .212

V_R = (5.5)(.212) = 1.17

n = 0.56, V = 2.32, Q = 2.03 < Q_R

BETWN .25 & .3

d = .27 R = .227

V_R = (5.5)(.227) = 1.25

8.05 (c) n = .0.53

V = 2.54 Q = 2.45 < Q_{NG}

d = .28 V_R = (5.5)(.234) = 1.29

n = 0.53

V = 2.62 Q = 2.61 OK

V < V_p

DITCH 1 (CONT'D)

RETARDANCE CURVE B

SET $D = .75$ $R = .531$

TRY $V = 1$; $VR = .531$

3.05 (c) $n = .23$

$V = 1.04$, $Q = 3.51$, $N = .23$ LOWER V

TRY $V = .8$, $VR = (.8)(.531) = .425$

(c) $n = .27$

$V = .887$, $Q = 2.99$, $N = .27$ LOWER V

TRY $V = .7$ $VR = (.7)(.531) = .372$

(c) $n = .29$

$V = .825$ $Q = 2.79$

TRY $V = .85$ $VR = (.85)(.531) = .45$

(c) $n = .28$

$V_{CALC} = .855$, $Q = 2.89 < Q_{REQ}$ OK

$V < V_p$; Q OK

LINING $n = .066$ $d < 1.5$

$d = .312$, $A = 1.126$, $R = .256$

$V = 2.23$ FPS $< V_p$

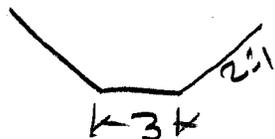
$Q = 2.52$

$\tau_{ACTUAL} = 1.16$

$\tau_{ALL} = 1.55$

$1.16 < 1.55$ OK

CURLEX I

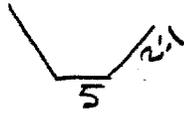


BETZMUDA GRASS
CURLEX I

DITCH 2

$$Q = 12.75 \text{ cfs}$$

$$S = .042\% < 10\%$$



$$Z = 2$$

$$B = 5'$$

BARE EARTH

$$A = bd + Zd^2$$

$$d = 1.5$$

$$(5)(\text{depth}) + 2(\text{depth})^2 = 3.0$$

$$P = b + 2d\sqrt{Z^2 + 1}$$

$$= 5 + 2(\text{depth})\sqrt{5} = 7.236$$

$$R = A/P = .415$$

@ $n = .02$ USING MANNING @ $n = .02$, SOLVE

$$V = 6.72, Q = 12.75, d = 0.3345', R = .292$$

V EXCEEDS 2.0 SO TEMP LINING REQD &

TRY BERMUDA GRASS

GRASS CURVE D & $V_{\text{allow}} = 5.5 \text{ FPS}$

$$d = .334 \quad VR = (5.5)(R) = (5.5)(.292) = 1.606$$

$$\text{FIG 8.05c} \quad n = 0.048 \quad V = 2.8, Q = 5.3 \text{ NG}$$

$$d = .6 \quad VR = (5.5)(.484) = 2.66, n = 0.041$$

$$\underline{d = .53, R = .436, V = 4.08, Q = 13.1 \text{ OK}}$$

$$V < V_p \quad Q > Q_{\text{REQD}} \text{ OK}$$

RETARDANCE CURVE B WITH ACTUAL VEL

$$d = 1.0 \quad V_t = 3 \quad A = 7.0, R = .739$$

$$VR = (3)(.739) = 2.22$$

$$8.05c) \quad n = .092$$

$$V_{\text{calc}} = 2.713, Q = 18.99$$

$$d = 1.0 \quad V_{t_2} = 2.7; \quad VR = (2.7)(.739) = 2.0$$

$$(c) \quad n = .1$$

$$V_{\text{calc}} = 2.5, Q = 17.4$$

USE V

OUT

DITCH 2 CONTD

$V_{t3} = 1.5 ; V_R = (1.5)(.739) = 1.69$

(c) $n = .12$

$V = 2.08 \quad Q = 14.56$

Try $V = 1.0 \quad V_R = (1)(.739) = .739$

$n = .119$

$V = 1.31 \quad Q = 9.2 \text{ NG}$

<u>V</u>	<u>n</u>	<u>V_{calc}</u>	<u>Q</u>
2.7	.1	2.5	17.4
1.5	.145 ²⁵	1.721	12.05
1.7	.14	1.78	12.48
> 1.8	.135	1.85	12.94
1.4			

$V < V_p \quad \& \quad Q \approx Q_R \quad \underline{OK}$

LINING $n = .066$

$d' = .666 > .55 \quad n @ .066 \text{ OK}$

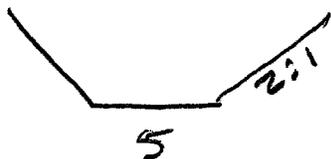
$A = 4.22$

$R = 1.529$

$V = 3.025 < 5.15 V_p \text{ OK}$

$Q = 12.75 \text{ OK}$

$T_{actual} = 1.75 < 2.0 \text{ CURLEX II}$



BETZMUDA GRASS
CURLEX II

DITCH #6 DESIGN

$Q = 9.9 \text{ cfs}$

$S = .05 \text{ \%/}$

$Z = 2$

$B = 4$ - TO SLOW VEL & FITS INTO EXISTING TOPO

CHECK BAIRE EARTH @ $n = .02$

SOLVE MANNING @ $n = .02$

$d = .313 \quad V = 6.6 > 2.0$ NEED LINER

TRY BERMUDA GRASS CURVE "D"

@ $V_p = 5.5 \text{ FPS}$

$D = .49, A = 2.44 \text{ \text{'}}^2, R = .394,$

$V = 4.07 \quad Q = 9.9$

$V < V_p, Q = Q_{10}$ GOOD OK!

CHK HI RETARDANCE CURVE "B"

TRY $D = 1.0 \quad A = 6.0 \quad R = .708$

V_t	$V \times R$	n (8.05 (c))	V_{calc}	Q_{calc}
2	1.416	.12	2.21	13.24
2.1	1.487	.115	2.18	13.08

CONVERGES

$V < V_p, Q > Q_{10}$ OK

CURLOX LINER

$n = .066 \quad d < 1.5 \quad d = 1.5 \rightarrow Q = 6.86 < Q_{10}$

$n = .035 \quad .5 < d < 2.0$

$d = .43', A = 2.09, R = .353$

$V = 4.75 \quad Q = 9.93$

$Y_{ACTUAL} = 1.34'$

$Y_{ALLOWABLE} = 1.55$ Curlox Type I



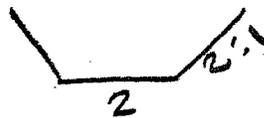
BERMUDA GRASS
CURLOX TYPE I

DITCH 3-7 & 9 DESIGN

		Q	S	B	Z	
DITCH	3W	3.15	.04	2	2	SEE 9E
	3S	2.36	.02	2	2	9E
	3SW	7.62	.04	2	2	9E
DITCH	4	3.2	.009	2	2	9E
DITCH	5	2.5	.03	2	2	9E
DITCH	6	9.9	.05	2	2	9E
DITCH	7N	3.9	.04	2	2	9E
	7S	3.9	.04	2	2	9E
DITCH	8	15.2	.01	3	2	*CONTROL B=3
DITCH	9E	8.7	.04	2	2	CONTROL B=2
	9W	5.8	.03	2	2	SEE 9E

DESIGN DITCH 9E TO INCLUDE AS SHOWN ABOVE

$Q = 8.7$
 $S = .04 \frac{1}{2}$
 $Z = 2'$
 $B = 2'$



BARE EARTH @ $n = .02$ SOLVE MANNING

$d = .438$; $A = 1.26$, $R = .318$, $V = 6.945 \text{ FPS}$ $Q = 8.75$

$V \gg V_p$ DIRT @ 2.0 FPS LINING REQ'D

TRY BERMUDA GRASS

Curve "D" d	R	n	NG	Q
$d = .68'$	$R = .453$	$n = .042$	NG	$Q = 9.7$
$= .6$		$n = .045$	NG	$Q = 7.2$
$= .65$		$n = .044$		$Q = 8.3$
$d = .66$		$n = .044$		$Q = 8.62$
$> d = .67$		$n = .043$		$Q = 9$

$V = 4.06$, $Q = 9$ OK

CHECK CURVE B RETARDED FLOW

SET D=1 RUN TRIALS FOR VEL

D=1.0, A=4.0, R=.618 FIG 8.05(C) USED

V_t	V_R	n	V_{CALC}	Q_{CALC}
2	1.24	.14	1.544	6.18 < C
3	1.85	.11	1.968	7.86
3.5	2.16	.095	2.276	9.10

$V=2.18 @ Q=8.74$

8.74

SOLVE $V=2.188, Q=8.75, n=0.0988$

$V < V_R = 5.5$

$Q \geq Q_{REQ'D} \quad \underline{OK}$

LINING IS REQ'D SEE CALC

$n = .066 @ d < 1.5 \rightarrow d = .816$

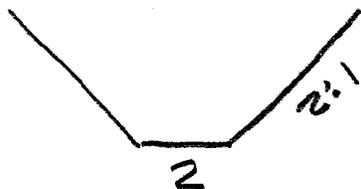
$n = .035 @ .5 < d < 2.0 \rightarrow d = .589$ CONTROLS

so $d = .589, V = 4.652$ FPS; $Q = 8.71$

$T_{ACTUAL} = 1.47$

$T_d = 1.5$ FOR CURLEX I

$1.47 < 1.5$ USE CURLEX I



BERMUDA GRASS
CURLEX I

DITCH #8 DESIGN

$$Q = 15.2 \text{ CFS}$$

$$S = .01 \frac{1}{1}$$

$$Z = 2$$

$$B = 3$$

BARE EARTH CHK $n = .02$

SOLVE MANNING SPREAD SHEET

$$d = .718, A = 3.786, R = .513$$

$$V = 4.77 > 2.1 \text{ SO LINING REQ}$$

$$Q = 15.2$$

TRY BERMUDA GRASS CURVE "D" $n = .045$

$$d = .718, V_p = 5.5 \text{ FPS @ } d = .718$$

$$V_R = (5.5)(.513) = 2.8$$

$$8.05(c) \quad n = .045$$

$$Q = 6.76 \text{ NG}$$

$$d = 1.0, R = .669$$

$$V_R = (5.5)(.669) = 3.68$$

$$n = .038$$

1. $Q = 15.0 < 15.2$ DEEPER REQ'D

$$d = 1.01, R = .675$$

$$V_R = (5.5)(.675) = 3.7$$

$$8.05(c) \quad n = .038$$

$$Q = 15.29 \text{ OK}$$

$$V = 3.01 < V_p \text{ OK}$$

Check RETARDANCE CURVE "B"

$$D = 1.5'$$



DITCH 8 - CHK RETARDANCE CURVE B

$Q_{10} = 15.2$

Tried $D=1, 1.5, 2.0$

$D=2.0, A=14.0; R=1.172$

Vt	VR	n	V _{calc}	Q _{calc}
3	3.516	.071	2.33	32.66
2.5	2.93	.081	2.04	28.63
2.1	2.461	.088	1.882	
2.07	2.426	<u>.087</u>	1.94	26.65

$\left[\begin{array}{l} \leftarrow \approx 2 \\ \leftarrow \end{array} \right.$
 \leftarrow
 $\rightarrow \approx 2$

$Q = AV \frac{15.2}{14.0} = 1.09$

.18	1.09	1.278	0.13	1.27	17.8
.18	1.2	1.41	0.12	1.38	19.32
.13	1.05	1.23	0.14	1.18	16.56

CONVERGENT @ $n \approx .14$

$V = 1.05, Q = 16 > Q_{10}$

$V < V_p$ OK

TEMP LINING

$n = .066, d < .5, d_{calc} > .5$ USE $n = .035$

$n = .035, .5 < d < 2.0$

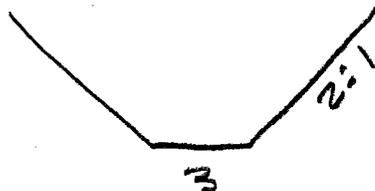
$d = .965', A = 4.757, R = 0.65$

$V = 3.195, Q = 15.2 \geq Q_{10}$ OK

$V < V_p$ OK

$\gamma_{ACTUAL} = 0.6022$

$\gamma_{ALLOW} = 1.55$ OK CURLEX I



BERMUDA GRASS
CURLEX TYPE I

DITCH 10 DESIGN

$Q = 17.11 \text{ CFS}$

$S = .01 \text{ } \frac{1}{1}$

$Z = 2$

$B = 2' \text{ @ HEAD ; } 5' \text{ @ SOUTH}$

HEAD DRAINS DIKE SLOPE ONLY $Q \gg 17.11$

ACTUAL $Q_{\text{west}} < 3 \text{ CFS}$ SO USE DESIGN

FOR $Q \text{ @ } Q = 8.7 \text{ CFS @ } S = 0.4 \text{ } \frac{1}{1}$ - CONSERVATIVE

$B = 5' \text{ SOUTH DITCH}$

CHK BARE EARTH @ $n = .02$

SOLVE MANNING @ $n = .02$

$d = 0.602', A = 3.735, R = 486$

$V = 4.6 \text{ FPS } \gg 2.0 \text{ SO LINER REQD}$

$Q = 17.19 > 17.11$

TRY BERMUDA GRASS CURVE "D"

$D = 1.0 \quad V_p = 5.5 \quad V_R = 5.15 \quad 8.05c \quad n = 0.36$

$Q = 27.17$

$D = .8 \quad V_R = 4.42 \quad n = 0.38$

$Q = 17.88$

$D = .78 \quad 4.34 \quad n = 0.37$

$V = 3.432 < V_p @ 5.5 \quad \text{OK}$

$Q = 17.59 > Q_{10} \quad \text{OK}$

CHK RETARDANCE CURVE B

TRY $D = 1.5, A = 12, R = 1.236$

$\Delta = .03$	V_E	V_R	n	V_{CALC}	Q_{CALC}
	2	2.47	.087	1.97	23.67
	1.9	2.35	.10	1.72	20.59
	<u>1.8</u>	2.25	.093	<u>1.84</u>	22.14

CONVERGES

$V = 1.8, Q = 22.14 > Q_{10} \quad \text{OK}$

DITCH 10

DESIGN TEMP LINING

$$n = .066 \quad d < 1.5 \quad @ d = 1.5 \quad Q = 4.67 \text{ NG}$$

$$n = 0.35 \quad 1.5 < d < 2.0$$

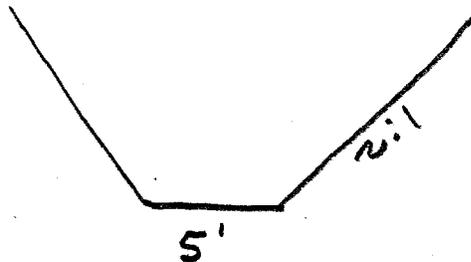
SOLVE MANNING @ .035

$$d = 1.75, \quad A = 4.875, \quad R = 1.767$$

$$V = 3.57 \quad Q = 17.4 > Q_{10} \text{ OK}$$

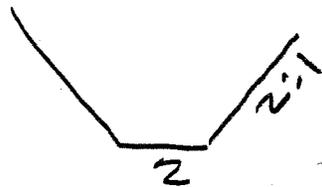
$$T_{ACTUAL} = 0.47$$

$$T_{ALLOW} = 1.55 \quad \text{CURLEX TYPE I}$$



BERMUDA GRASS
CURLEX TYPE I

W SOUTH DITCH



BERMUDA GRASS
CURLEX TYPE I

WEST DITCH

DITCH 11 DESIGN

$$Q = 27.72$$

$$S = 0.12'/1$$

$$Z = 2$$

$$B = 5'$$

CHECK BARE EARTH @ $n = 0.02$.

SOLVE MANNING @ $n = 0.02$

$$d = 0.75', \quad A = 4.875, \quad R = 0.584$$

$$V = 5.7 > V_p \text{ SO LINER REQUIRED}$$

$$Q = 27.78 \text{ OK}$$

TRY BERMUDA GRASS CURVE "D" $V_p = 5.5$

$$D = 0.965 \quad V_p = 5.5 \quad V_R = 5.028 \quad 8.05(c) \quad n = 0.37$$

$$V_{calc} = 4.16 \quad ; \quad Q_{calc} = 27.79 \text{ OK}$$

$$V < V_p \text{ OK } V_p = 5.5$$

OK FOR BERMUDA GRASS

CHECK RETARDANCE CURVE "B"

$$\text{TRY } D = 2.0 \quad ; \quad A = 18 \quad ; \quad R = 1.507$$

V_t	V_R	$n (8.05(c))$	V_{calc}	Q_{calc}
2	3.014	0.078	2.75	49.51
2.2	3.315	.073	2.9	52
<u>1.8</u>	2.713	.082	<u>1.82</u>	<u>32.73</u>

CONVERGES

$$V = 1.82, < V_p = 5.5$$

$$Q >> Q_{10}$$

OK

DESIGN TEMP LINING

$n = 0.66$ $d < 1.5'$ $Q = 5.12$ so $d > 1.5$ use $n = 0.3$

$n = 0.33$ $1.5 < d < 2.0$

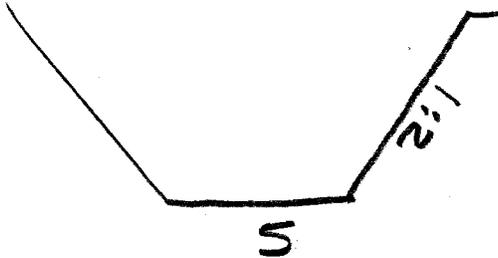
MANNING @ 0.35

$d = .935$, $A = 6.423$, $R = .894$

$V = 4.33$, $Q = 27.8$

$\gamma_{ACTUAL} = .70$

$\gamma_{ALLOW} = 1.5$ use CURLEY I



BERMUDA GRASS
CURLEY TYPE I

CULVERT DESIGN

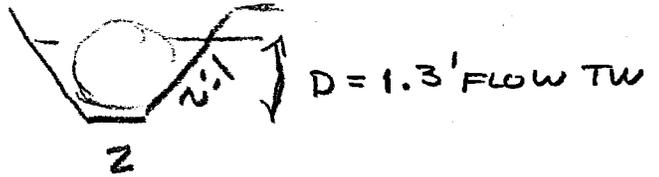
DITCH FROM FES TO ROAD

$$Q = 21 \text{ CFS}$$

$$S = .01 \%$$

$$Z = 2$$

$$B = 2'$$



CHK TEMP LINING FIRST

$$n = .066 \text{ } d < 1.5$$

$$n = .035 \text{ } .5 < d < 2. \leftarrow$$

$$d = 1.3' < 24" \phi \text{ SO TW LESS THAN TOP PIA}$$

$$V = 3.8 \quad Q = 21.2$$

$$\gamma = 0.808 < T_{all} 1.5$$

BERMUDA GRASS CURVE "D" $V_p = 5.5$

$$V_p = 5.5; \text{ } 8.05 (C) \quad n = .037 \quad V_R = 4.34$$

$$D = 1.35 \quad A = 634, R = .789 \quad V = 3.44 \quad Q = 21.8 \text{ } \circ$$

$$V < V_{p \text{ or } R}$$

RETARDANCE CHECK CURVE "B"

$$D = 1.5, A = 7.5; R = .861$$

V_t	V_R	n	V_{calc}	Q_{calc}
3	2.584	.086	1.568	11.76
4	3.445	.074	1.823	13.67
5	4.306	.066	2.04	15.33

$$D = 1.75$$

3	2.939	.08	1.837	17.68
4	3.918	.068	2.161	20.80
5	4.898	.061	2.409	23.19

$$T_{ay} \text{ Acta } \quad Q/A = 21/9.625 = 2.18 \leftarrow$$

$$n = .067, V = 2.18, Q = 21.11 \text{ } \text{OK}$$

$$V < V_p$$

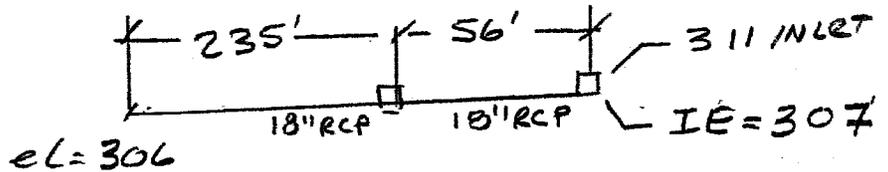
FARM ROAD CULVERT

$$Q = Q_{\text{8 DITCH}} + Q_{\text{9 W DITCH}} \quad (Q_{10} \text{ SINCE FARM})$$

$$= 15.2 \text{ CFS} + 5.8 \text{ CFS}$$

$$= 21.0 \text{ CFS}$$

Length =



$$L = 291$$

$$S = \frac{308.75 - 306}{291} = .009971 \rightarrow 0.9971\%$$

$$\text{HW ALLOW} = 313 - 308.75 = 4.25'$$

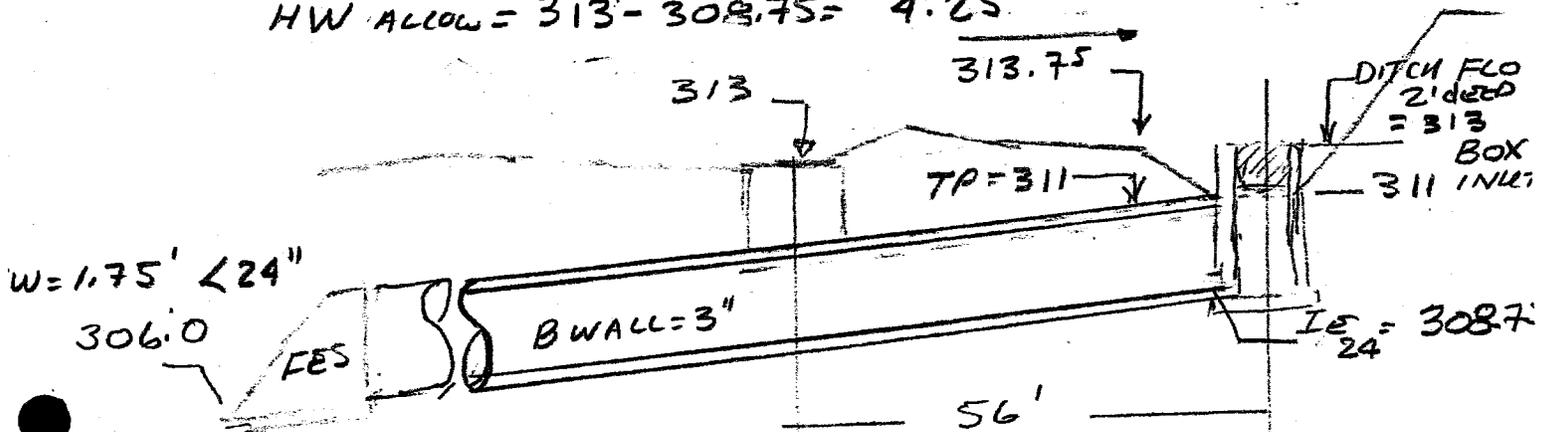


FIG 33 24" CHK INLET CONTROL

FIG 33

$$\frac{\text{HW}}{D} = 1.58$$

$$\text{HW} = 1.58 \times 2 = \underline{3.16}$$

LESS THAN ALLOW OK

FIG 33 21" INLET CONTROL " $\frac{\text{HW}}{D} = 2.4$

$$\text{HW} = 2.4 \times 1.75 \phi = \underline{4.2} \approx 4.25 \text{ O.K.}$$

USE 21" ϕ IF INLET CONTROLS

24" CHK OUTLET CONTROL

TABLE 12 ENTRANCE LOSS COEFFE $K_e = .5 \text{ SQ}$

FIG 38 $H = 3.6$

DUE TO OUTLET SLOPE: $TW < \text{TOP OF CULV}$

$$h_o = \frac{d_c + D}{2} \quad d_c \text{ (FIG 38)} = 1.7$$

$$h_o = \frac{1.7 + 2.0}{2} = 1.85 \text{ OR } TW = 1.75 \text{ USE } 1.85$$

$$HW = 3.6 + 1.85 - 2.74 = 2.71$$

$$HW_{OUT} = 2.71 < HW_{IN} = 3.16 \quad \text{INLET CONTROL}$$

21" CNK OUTLET CONTROL

$$K_c = 5$$

$$\text{FIG 38 } H = 6.7'$$

NO DISCONTINUOUS 21"

USE 24" RCP CULVERT T&G CL B.

OUTLET VEL FIG 4

$$\text{FULL FLOW } Q = 24 \text{ CFS, } V = 8 \text{ FPS FULL}$$

$$\frac{Q}{Q_F} = \frac{21}{24_{\text{FULL}}} = 0.875$$

USE FIG 20

$$1.13 = \frac{V_{10}}{V_{\text{FULL}}}$$

$$\text{So } V_{10} = 8 \times 1.13 = 9.0 \text{ FPS}$$

USE 24" T&G CLASS B @ HW = 3.16 INLET

$$V_{\text{OUTLET}} = 9 \text{ FPS}$$

OUTLET PROTECTION @ CULVERT

$$Q = 21 \text{ CFS}$$

$$\text{PIPE } \phi = 24''$$

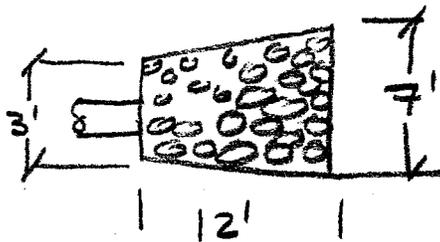
$$TW = 1.75'$$

$TW > D/2$ SO MAXIMUM CONDITION

FIG 8.06 b

$$L_a = 12'$$

VOULTR PIPE = 9.0 FPS USE 10 CURVE



$$d_{50} = 9''$$

ROCK DAM DESIGN

ROCK DAM #1 $Q_1 + Q_2 = 35.55 \text{ CFS}$
 $TA_1 + TA_2 = 7.98 \text{ AC}$

REQD VOL = $1800 \times 7.98 = 14,364 \text{ FT}^3 \text{ OK}$
EFFICIENCY = $.01 \text{ SEC AC} \times 35.55 \text{ CFS} \times 43560$
 $= 15486 \text{ FT}^3$
=

$90' - 5 - (276 - 275)4 = 81' \text{ INSIDE @ CRIT FLOW}$
 $140 - 2\frac{1}{2}' - 1 \times 2 = 135.5$
 $135.5 \times 81 = 10,976 < 15486 \text{ FT}^3$

Need to keep Dims @ 90×140 so use
Temp 12" HIGH ROCK BREAKER IN INLET
CHANNEL OF DITCH 1 & 2 TO REDUCE
VELOCITY.

ROCK DAM STRUCTURE #2

DITCH #3SW + #3S + #3W

$$\Sigma Q = 7.62 \text{ CFS}$$

$$\Sigma TA = 0.43 \text{ AC}$$

$$\text{REQD VOL} = 1800 \times .43 \text{ AC} = 774 \text{ ft}^3$$

$$\text{PERFECT EFFICIENCY} = .01 \text{ \#} \times 43560 \times 7.62 \text{ CFS}$$

$$= 3320 \text{ \#}^1$$

$$\approx 58' \text{ SQ}$$

$$60' + 5 + 4(2) = 74'$$

$$\text{BOTT} = 303.0$$

ROCK DAM STRUCTURE #3

$$\text{DITCH} \approx 4 + \#5 + \#6$$

$$\text{TA} = .22 + .24 + .8 = 1.26 \text{ AC}$$

$$Q = 3.2 + 2.5 + 4.2 = 9.9 \text{ CFS}$$

$$\text{REDD VOL} = 1800 \times 1.26 \text{ AC} = 2268.0 \text{ FT}^3$$

$$\begin{aligned} \text{PERFECT EFFICIENCY @ } .61 \times 9.9 \times 43560 &= 4,313 \text{ FT}^3 \\ &= 66' \text{ SQ} \end{aligned}$$

MUST USE 90' NS SO USE 48" EW

$$90 + 5 + 4 \approx 100' \text{ } \Phi\text{-}\Phi \text{ N-S}$$

$$48 + 2.5 + 2 \approx 54 \text{ } \Phi\text{-}\Phi \text{ EW}$$

FINANCIAL RESPONSIBILITY / OWNERSHIP FORM
SEDIMENTATION POLLUTION CONTROL ACT

No person may initiate a land-disturbing activity on one or more acres as covered by the Act before this form and an acceptable erosion and sedimentation control plan have been completed and approved by the Land Quality Section, NC Department of Environment, and Natural Resources. (Please type or print and, if question is not applicable, place N/ A in the blank).

Part A.

1. Project Name Novozymes North America Inc. - Source Separated Solid Waste Composting Facility
2. Location of land-disturbing activity: County Franklin
City or Township Franklinton, and Highway/Street Hwy 56 & Old Smith Farm Rd.
3. Approximate date land-disturbing activity will be commenced: May 12, 2003
4. Purpose of development (residential, commercial, industrial, etc.): Commercial
5. Total acreage disturbed or uncovered (including off-site borrow and waste areas):
15 acres

Amount of fee enclosed \$ 750.00
6. Has an erosion and sedimentation control plan been filed? Yes _____ No X
7. Enclosed X
8. Person to contact should sediment control issues arise during land-disturbing activity.
Name Paul Rehder Telephone 919-494-3370
9. Landowner(s) of Record (Use blank page to list additional owners):
Novozymes North America, Inc.
Name(s)

<u>PO Box 576</u> Current Mailing Address	<u>77 Perry Chapel Church Rd.</u> Current Street Address
<u>Franklinton</u> <u>NC</u> <u>27525</u> City State Zip	<u>Franklinton</u> <u>NC</u> <u>27525</u> City State Zip
10. Recorded in Deed Book No. 766 Page No. 210

Part B.

Person(s) or firm(s) who are financially responsible for this land-disturbing activity (Use a blank page to list additional persons or firms):

Novozymes North America, Inc.
Name of Person(s) or Firm(s)

PO Box 576
Current Mailing Address

Franklinton NC 27525
City State Zip

Telephone 919-494-3370

77 Perry Chapel Church Rd.
Current Street Address

Franklinton NC 27525
City State Zip

Telephone 919-494-3370

2. (a) If the Financially Responsible Party is not a resident of North Carolina give name and street address of a North Carolina Agent.

_____			_____		
Name					
_____			_____		
Mailing Address			Street Address		
_____	_____	_____	_____	_____	_____
City	State	Zip	City	State	Zip
_____			_____		
Telephone			Telephone		

(b) If the Financially Responsible Party is a Partnership or other person engaging in business under an assumed name, attach a copy of the certificate of assumed name. If the Financially Responsible Party is a Corporation give name and street address of the Registered Agent.

Mark Paige - Vice President of Tech.Ops.
Name of Registered Agent

Novozymes North America, Inc.

PO Box 576
Mailing Address

77 Perry Chapel Church Rd
Street Address

Franklinton NC 27525
City State Zip

Franklinton NC 27525
City State Zip

Telephone 919-494-3000

Telephone _____

The above information is true and correct to the best of my knowledge and belief and was provided by me under oath. (This form must be signed by the financially responsible person if an individual or his attorney-in-fact or if not an individual by an officer, director, partner, or registered agent with authority to execute instruments for the financially responsible person). I agree to provide corrected information should there be any change in the information provided herein.

Mark R. Paige
Type or print name
Mark R. Paige
Signature

VP, Technical Operations
Title or Authority
3/28/03
Date

I, Olivia K. Madlin, a Notary Public of the County of Franklin

State of North Carolina, hereby certify that Mark Paige appeared personally before me this day and being duly sworn acknowledged that the above form was executed by him.

Witness my hand and notarial seal, this 28th day of March, 2003

Seal

Olivia K. Madlin
Notary

My commission expires 10-23-05

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT,
AND NATURAL RESOURCES
LAND QUALITY SECTION

EROSION AND SEDIMENTATION CONTROL PLAN CHECKLIST

The following items shall be incorporated with respect to specific site conditions, in an erosion and sedimentation control plan

LOCATION INFORMATION

Project location
Roads, street
North arrow
Scale
Adjoining lakes, streams or other
major drainage ways

Design calculations cross-sections and method of stabilization of existing and planned channels (include temporary linings)
Design calculations and construction details of energy dissipators below culvert and storm sewer outlets (for rip-rap aprons, include stone sizes (diameters and apron dimensions)
Soil information below culvert storm outlets
Design calculations and construction details to control ground-water, i.e., seeps, high water table, etc.
Names of receiving watercourse or name of municipal operator (only where storm water discharges are to occur)

GENERAL SITE FEATURES

_____ North arrow
_____ Scale
_____ Property line
_____ Legend
_____ Existing contours
_____ Proposed contours
_____ Limit and acreage of disturbed area
_____ Planned and existing building locations and elevations
_____ Planned and existing road locations and elevations
_____ Lot and/or building numbers
_____ Land use of surrounding areas
_____ Rock outcrops
_____ Seeps or springs
_____ Wetland limits
_____ Easements
_____ Streams, lakes, ponds, drainage ways, dams
_____ Boundaries of the total tract
_____ If the same person conducts the land-disturbing activity and any related borrow or waste activity, the related borrow or waste activity shall constitute part of the land-disturbing activity unless the borrow or waste activity is regulated under the Mining Act of 1971, or is a landfill regulated by the Division of Solid Waste Management. If the land-disturbing activity and any related borrow or waste activity are not conducted by the same person, they shall be considered separate land-disturbing activities
_____ Stockpiled topsoil or subsoil location
_____ Street profiles

EROSION CONTROL MEASURES

_____ Legend
_____ Location of temporary and permanent measures
_____ Construction drawings and details for temporary and permanent measures
_____ Design calculations for sediment basin and other measures
_____ Maintenance requirements during construction
_____ Person responsible for maintenance during construction
_____ Maintenance requirements and responsible person(s) of permanent measures

VEGETATIVE STABILIZATION

_____ Areas and acreage to be vegetatively stabilized
_____ Planned vegetation with details of plants, seed, mulch and fertilizer
_____ Specifications for permanent and temporary vegetation
_____ Method of soil preparation

NOTE: Should include provision for ground cover on exposed slopes within 30 working days following completion of any phase of grading, permanent ground cover for all disturbed areas within 30 working days or 120 calendar days (whichever is shorter) following completion of construction or development.

OTHER REQUIREMENTS

Narrative describing construction sequence (as needed)
Narrative describing the nature and purpose of the construction activity
Completed Financial Responsibility/Ownership Form (to be signed by person financially responsible for project)
Bid specifications regarding erosion control
Construction sequence related to sedimentation and erosion control (include installation of critical measures prior to initiation of the land-disturbing activity and removal of measures after areas they serve have been permanently stabilized)

SITE DRAINAGE FEATURES

_____ Existing and planned drainage patterns (include off-site areas that drain through project)
_____ Size of Areas to be disturbed (Acreage)
_____ Size and location of culverts and sewers
_____ Soils information (type, special characteristics)
_____ Design calculations for peak discharges of runoff (including the construction phase and final runoff coefficients of the site)
_____ Design calculations and construction details for culverts and storm sewers

APPENDIX

December 31, 2001

Soils Report
Proposed Compost Site
Novozymes North America, Inc.
Franklin County, NC

Summary

This report summarizes the results of a soils investigation of a proposed large Type 3 composting site owned by Novozymes NA, Inc. in Franklin County, North Carolina. The soils were investigated according to requirements of the North Carolina Solid Waste Rules (15A NCAC 13B). More specifically, this investigation was conducted to meet requirements outlined in section .1405 (4)(B) of the rules.

Results indicate that there are 3 predominant soil units at the site. The Helena series is located in the concave head of a drain on the west side of the site. The Vance and Wedowec series occupy the ridge tops and slopes. All 3 units have dense argillic horizons. There is noticeable compaction across the site in the upper argillic and overlying Ap horizon in the Vance and Wedowec units.

These soils should be adequate for the proposed compost pad if the sandy Ap horizons are removed and the argillic horizons compacted prior to placement of the proposed crush and run pad.

The depth to the seasonal high water table is >12 feet. Long-term monitoring of nearby groundwater monitoring wells indicates that the depth to groundwater is 15 to 25 feet. This site meets the minimum requirement for vertical separation between the pad and indicators of seasonal high water table.

Site Description

The proposed composting pad site is located south of Hwy 56 approximately 6 miles east of Franklinton, North Carolina (Figure 1). The site is located on an upland agricultural field within the Cedar Creek watershed of the Tar River. The site is located on a broad ridge that slopes down to the north, south and east toward tributaries to Cedar Creek. The Franklin County soil survey shows that the site is predominantly Wedowec series. Associated soil series in this setting include Cecil, Appling, Vance, and Helena.

Field Investigations

Three representative pits were excavated to a depth of 5-6 feet. Pit 1 was located on the ridge top at the south end of the proposed compost pad area. Pit 2 was located in the head of a drainage on the west side of the site. Pit 3 was located on the north end of the site on the ridge top. Soil horizons were identified and described for each pit (Appendix A). Soil samples were collected from each horizon to a depth of 6 feet and analyzed for typical soil parameters (Appendix B). Soil map units were defined from features

expressed in the soil pits, and selected criteria were used to map soil units across the site. Approximately 75 soil borings were made to delineate the soil map units.

RESULTS

Soil Units

There were 3 distinct soil series identified and mapped (Figure 2). The Vance series was identified in Pit 3 at the north end of the site on the highest part of the ridge top. The Helena series was identified in Pit 2 and occupies the slopes and bottom of the drainage in the western portion of the site. Helena was differentiated from the Vance based on higher moisture content in the subsoil of Helena. The Wedowee unit was identified in pit 1 and was mapped in the remainder of the site. The Wedowee was distinguished from the Vance and Helena based on predominantly red to strong brown (5YR to 10 YR) subsoil colors compared to predominantly strong brown to yellow brown color (10YR to 2.5Y) in the subsoil for Vance and Helena. The boundaries between Helena and Vance and Helena and Wedowee were abrupt (less than 50 feet). Boundaries between Wedowee and Vance were broader (typically 50-100 feet).

Seasonal High Water Table

The depth to the seasonal high water table is >12 feet in the 3 soil pits. Nearby groundwater monitoring wells indicate that the depth to groundwater is 15 to 25 feet.

Low chroma redox depletion features and redox concentrations were observed in pit 2 (Helena unit) beginning at 36" in the BC horizon. These indicators reflect higher seasonal soil moisture content and slower permeability. Once the compacted compost pad is constructed, infiltration of rainwater will be greatly reduced, and it is unlikely that these conditions will persist.

For the pad area, the sandy textured upper horizons will be removed down to the clayey Bt horizons. In the Helena unit, the sandy upper horizons will be removed and filled with approximately 24" of compacted clay and 12" of compacted crush and run. This will result in a minimum separation of 48" between the pad surface and the low chroma redox depletion features.



Appendix 1. Soil Pit Profile Descriptions

Pit #1

Location: Novozymes North America, Inc. Farm 3, Field G3

Landscape position: Broad ridgetop

Slope: 1-3%

Horizon	Depth (inches)	Description
Ap	0-7	Dark brown to brown (10YR 4/3) sandy loam. Weak, fine subangular blocky structure. Nonsticky, non plastic, very friable. Abrupt, wavy boundary. Many fine and medium roots.
Bt1	9-14	Yellowish red (5YR 5/6) clay with few, fine, distinct red (2.5YR 4/8) redox concentrations and common, coarse, distinct brown to dark brown (10YR 4/3) depletions. Moderate, very coarse prismatic structure breaking into weak coarse subangular blocky structure. Common 10YR 4/3 coatings on ped faces extending greater than 10 cm into underlying horizons. Thick continuous clay films on ped faces. Many, continuous clay films within peds. Slightly sticky, slightly plastic, firm. Common fine and few medium roots.
Bt2	14-21	Yellowish red (5YR 5/6) clay with common coarse, distinct red (2.5 YR 4/8) redox concentrations. Weak to moderate, very coarse to medium prismatic structure breaking into coarse subangular blocky structure. Thick continuous brown (7.5 YR 4/3) clay films on ped faces extending > 10 cm into adjacent horizons. Slightly sticky to sticky, plastic, firm to very firm. Few fine roots.
Bt3	21-38	Yellowish red (5YR 5.6) clay loam with few medium faint red (2.5YR 5/8) redox concentrations. Common red (2.5 YR 5/8) grain coatings. Very coarse, moderate prismatic structure breaking into medium to coarse, moderate subangular blocky structure. Slightly sticky, slightly plastic to plastic, firm. Few fine roots. Gradual boundary.
CB	38-50	Yellowish red (5YR 5/8) clay loam with common medium distinct red (2.5 YR 4/8) redox concentrations. Weak medium subangular blocky structure. Slightly sticky, plastic, friable. Common areas of relict rock foliation with common K feldspar and quartz grains.
C1	50-62	Yellowish red (5YR 5/8) clay loam with few medium distinct red (2.5YR 4.8) redox concentrations. Weak medium subangular blocky structure.

Slightly sticky, plastic, friable. Relict rock foliation. Few thin continuous clay films in localized areas.

C2 62+ Gneissic granitic saprolite. Clay loam texture.

Pit #2

Location: Novozymes North America, Inc. Farm 3, Field G3

Landscape position: Head of concave depression below ridgetop.

Slope: 1-3%

Horizon	Depth	Description
Ap1	0-5	Dark brown (7.5 YR 3/2) sandy clay loam. Weak, medium subangular blocky structure. Nonsticky, slightly plastic to nonplastic, very friable. Many fine and common medium roots.
Ap2	5-11	Dark brown (10YR 3/3) sandy clay loam. Weak subangular blocky to massive structure. Compacted. Slightly sticky, plastic, friable to firm. Common fine roots.
Bt1	11-20	Dark yellowish brown (10YR 4/4 to 4/6) clay to clay loam. Weak, coarse subangular blocky structure. Slightly sticky, plastic, friable to firm. Few fine roots.
Bt2	20-36	Yellowish brown (10YR 5/6) clay. Weak, coarse subangular structure. Slightly sticky to sticky, plastic, friable to firm.
BC	36-51	Yellowish brown (10YR 5/6) clay with common, fine to medium, distinct grayish brown (2.5Y 5/2) redox depletions and few fine distinct yellowish red (5YR 5/6) redox concentrations. Weak subangular blocky to massive. Very sticky, plastic, firm.
C	51-60+	Light yellowish brown (2.5Y 6/4) clay to silty clay. Few, coarse, distinct strong brown (7.5YR 5/8) redox concentrations. Massive. Slightly sticky, slightly plastic to plastic, friable.

The Bt1 and Bt2 horizons were noticeably moister than overlying horizons.

Pit # 3

Location: Novozymes North America, Inc. Farm 3, Field G3

Landscape position: Broad ridgetop

Slope: 1-3%

Horizon	Depth (in)	Description
Ap1	0-5	Brown (10YR 4/3) sandy clay loam. Weak medium subangular blocky structure. Slightly sticky, slightly plastic, very friable. Abrupt lower boundary. Many fine and common medium roots.
Ap2	5-10	Olive brown (2.5Y 4/3) sandy clay loam. Massive, compacted. Slightly sticky, slightly plastic, firm. Clear lower boundary.
Bt1	10-15	Light olive brown (2.5Y 5/4) clay. Weak medium subangular blocky to massive structure. Common, thin clay coatings on grain surfaces. Few discontinuous clay films. Sticky, plastic, firm. Clear lower boundary.
Bt2	15-23	Light olive brown (2.5Y 5/6) clay. Common, fine to medium, distinct red (2.5YR 5/8) redox concentrations. Weak subangular structure. Common discontinuous clay films. Sticky, plastic to very plastic, firm.
Bt3	23-33	Light olive brown (2.5Y 5/6) clay. Many, fine to medium distinct red (2.5Y 5/8) redox concentrations. Weak prismatic breaking into moderate subangular blocky structure. Many thick, olive brown (2.5Y 4/4) continuous clay films on ped faces. Clay coatings commonly extend > 10 cm. Sticky to very sticky, very plastic, firm.
Bt4	33-46	Light olive brown (2.5Y 5/6) clay with broad inclusions of red (2.5YR 5/8) redox concentrations sandy clay loam to clay loam. Few medium to coarse faint light yellowish brown (2.5Y 6/4) redox depletions. Many fine to medium very distinct red (2.5YR 5/8) redox concentrations. Moderate prismatic structure breaking into moderate subangular blocky structure. Common thick continuous clay coatings on ped faces extending > 10 cm. Many thin (2mm) clay layers interbedded with coarser feldspar and quartz grains. Sticky, plastic, firm.
C	46-70+	Strong brown (7.5YR 5/6) clay loam to sandy clay loam. Massive. Slightly sticky, slightly plastic, friable. Relict rock foliation and common feldspar, quartz, and mica. Granitic, gneissic saprolite.

Appendix B. Soil Test Results

Sample #	Horizon	Depth (inches)	pH	CEC	OM %	P ppm	K ppm	Mg ppm	Ca ppm	Na ppm	Na %	B ppm	Cl ppm	Sol. salts mmhos/cm	Nitrate ppm	S ppm	Zn ppm	Fe ppm	Cu index	Mn index
Pit 1 (Widowee)																				
P1-AP	Ap	0-8	7.7	7.0	1.8	17.5	756.5	48	822.5	173	7.0	5	140	0.31	21	17	16	97	0.3	19
P1-BT1	Bt1	9-14	7.4	6.4	1.5	17.5	1099.5	89	455	123	8.3	4.5	82	0.24	8	16	2	25	0.3	12
P1-BT2	Bt2	14-21	7.4	7.5	2	17.5	1357.5	107	489.5	143	8.3	5.2	69	0.25	3	21	2	49	0.3	10
P1-BT3	Bt3	21-38	7.3	5.3	0.4	0.5	724.5	110.5	345.5	183	15.0	0.1	75	0.27	2	30	1	9	0.4	13
P1-BC	BC	38-50	6.3	6.5	0.5	0.5	172.5	95.5	320	148	9.8	0.2	77	0.19	2	47	1	7	1.0	27
P1-C1	C1	50-62	4.5	5.8	0.8	0.5	208	95.5	266	162	12.2	0.1	87	0.20	2	60	1	8	2.0	52
P1-C2	C2	62-52	4.5	5.2	0.5	0.5	174.5	83.5	221	135	11.7	0.1	55	0.16	2	53	1	6	2.0	52
Pit 2 (Helena)																				
P2-AP1	Ap1	0-5	7.4	7.1	1.8	119.5	742.5	367.5	857	119	6.7	4.6	92	0.26	7	17	13	52	0.1	22
P2-AP2	Ap2	5-11	7.4	5.0	0.7	87	620.5	56.5	520.5	77	6.7	2.3	75	0.14	5	15	7	39	0.1	29
P2-BT1	Bt1	11-20	7.4	3.8	0.5	88.5	582.5	48.5	289	80	9	2.6	51	0.14	2	15	3	27	0.4	26
P2-BT2	Bt2	20-36	7.2	3.9	0.3	0.5	601	57	271.5	75	8.4	2.7	46	0.14	3	18	1	20	0.4	16
P2-BC	BC	36-51	5.2	4.0	0.5	0.5	365.5	129	326.5	100	10.8	0.1	44	0.17	6	66	1	20	1.6	42
P2-C	C	51-60	4.5	7.3	1.1	0.5	57.5	91	453.5	121	7.2	0.1	49	0.15	18	22	1	15	2.0	51
Pit 3 (Vance)																				
P3-AP1	Ap1	0-5	6.9	7.2	1.6	83.5	651.5	62.5	693.5	105	6.4	4.0	66	0.33	5	17	14	58	0.3	26
P3-AP2	Ap2	5-10	7.2	3.5	0.1	55	344.5	39.5	388.5	42	5.2	1.1	43	0.1	5	14	6	47	0.2	25
P3-BT1	Bt1	10-18	7.2	3.1	0.6	51	419.5	30	273	44	5.1	1.6	45	0.07	3	13	2	27	0.3	18
P3-BT2	Bt2	18-23	7.2	5.1	0.6	2	824.5	68.5	370	69	5.8	2.6	38	0.08	3	18	1	20	0.4	14
P3-BT3	Bt3	23-33	7.1	4.4	1.2	0.5	605.5	111.5	372	76	7.5	0.1	47	0.17	3	34	1	18	1.1	26
P3-BT4	Bt4	33-48	5.8	4.2	0.5	1	458	114	331	87	9.1	0.2	44	0.1	2	42	1	13	1.2	34
P3-C	C	48-70	4.5	3.0	0.1	0.5	35	48.5	151	79	5.5	0.1	55	0.08	2	42	1	10	2.0	32

FINANCIAL RESPONSIBILITY / OWNERSHIP FORM
SEDIMENTATION POLLUTION CONTROL ACT

No person may initiate a land-disturbing activity on one or more acres as covered by the Act before this form and an acceptable erosion and sedimentation control plan have been completed and approved by the Land Quality Section, NC Department of Environment, and Natural Resources. (Please type or print and, if question is not applicable, place N/ A in the blank).

Part A.

1. Project Name Novozymes North America Inc. - Source Separated Solid Waste Composting Facility
2. Location of land-disturbing activity: County Franklin
City or Township Franklinton, and Highway/Street Hwy 56 & Old Smith Farm Rd.
3. Approximate date land-disturbing activity will be commenced: May 12, 2003
4. Purpose of development (residential, commercial, industrial, etc.): Commercial
5. Total acreage disturbed or uncovered (including off-site borrow and waste areas):
15 acres

Amount of fee enclosed \$ 750.00

6. Has an erosion and sedimentation control plan been filed? Yes _____ No X
7. Enclosed X
8. Person to contact should sediment control issues arise during land-disturbing activity.
Name Paul Rehder Telephone 919-494-3370
9. Landowner(s) of Record (Use blank page to list additional owners):

Novozymes North America, Inc.

Name(s)

PO Box 576
Current Mailing Address

77 Perry Chapel Church Rd.
Current Street Address

Franklinton NC 27525
City State Zip

Franklinton NC 27525
City State Zip

10. Recorded in Deed Book No. 766 Page No. 210

Part B.

Person(s) or firm(s) who are financially responsible for this land-disturbing activity (Use a blank page to list additional persons or firms):

Novozymes North America, Inc.

Name of Person(s) or Firm(s)

PO Box 576
Current Mailing Address

77 Perry Chapel Church Rd.
Current Street Address

Franklinton NC 27525
City State Zip

Franklinton NC 27525
City State Zip

Telephone 919-494-3370

Telephone 919-494-3370

2. (a) If the Financially Responsible Party is not a resident of North Carolina give name and street address of a North Carolina Agent.

Name _____			_____		
Mailing Address _____			Street Address _____		
City _____	State _____	Zip _____	City _____	State _____	Zip _____
Telephone _____			Telephone _____		

(b) If the Financially Responsible Party is a Partnership or other person engaging in business under an assumed name, attach a copy of the certificate of assumed name. If the Financially Responsible Party is a Corporation give name and street address of the Registered Agent.

Mark Paige – Vice President of Tech.Ops.
Name of Registered Agent

Novozymes North America, Inc.

PO Box 576
Mailing Address

77 Perry Chapel Church Rd
Street Address

Franklinton NC 27525
City State Zip

Franklinton NC 27525
City State Zip

Telephone 919-494-3000

Telephone _____

The above information is true and correct to the best of my knowledge and belief and was provided by me under oath. (This form must be signed by the financially responsible person if an individual or his attorney-in-fact or if not an individual by an officer, director, partner, or registered agent with authority to execute instruments for the financially responsible person). I agree to provide corrected information should there be any change in the information provided herein.

Mark R. Paige
Type or print name
Mark R. Paige
Signature

VP, Technical Operations
Title or Authority
3/28/03
Date

I, Alisa K. Medlen, a Notary Public of the County of Franklin

State of North Carolina, hereby certify that Mark Paige appeared personally before me this day and being duly sworn acknowledged that the above form was executed by him.

Witness my hand and notarial seal, this 28th day of March, 2003

Seal

Alisa K. Medlen
Notary

My commission expires 10-23-05

77 PERRY CHAPEL CHURCH RD.
 P.O. BOX 576
 FRANKLINTON, NC 27525-0576
 TEL. 919-494-3000



N.C.D.E.N.R.
 1628 Mail Service Center
 Raleigh NC 27699-1628

Page 1 of 1
 Date 04/01/2003
 Document 3600002575
 Check # 012507

VOUCHER	INVOICE	GROSS AMOUNT	DISCOUNT	NET AMOUNT
1500002903	PAYREQ032703	750.00	0.00	750.00
Sum Total:		750.00	0.00	750.00

DETACH AND RETAIN THIS STUB FOR YOUR RECORDS

CHECK # 012507

NOVOZYMES NORTH AMERICA, INC.
 77 PERRY CHAPEL CHURCH RD.
 P.O. BOX 576
 FRANKLINTON, NC 27525-0576
 TEL. 919-494-3000

No. 012507

*****750.00* USD
 AMOUNT

PAY TO THE
 ORDER OF

N.C.D.E.N.R.
 1628 Mail Service Center
 Raleigh NC 27699-1628

04/01/2003

NOT VALID AFTER 90 DAYS

SEVEN HUNDRED FIFTY and 00/100

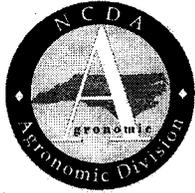
AT BANK ONE WARE, A SUBSIDIARY OF CITICORP
 ONE PLYMOUTH WAY NEWCASTLE, DE 19750

Brentley J. Cole
 Cashier

⑈012507⑈ ⑆031100209⑆

39111306⑈

Laboratory Data



Waste Analysis Report

Grower: Akkadia Consulting
2004 Rivera Ct.
Raleigh, NC 27604

Copies To: County Extension Director
USDA-NRCS-Wake

11/14/00

Farm:

Wake County

Sample Info.		Laboratory Results (parts per million unless otherwise noted)																			
		N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C						
Sample ID:		Total	17561	4141	2575	45074	1417	1258	398	30.0	22.1	9.35	142	1475	135093						
AKKSBM		IN-N	942																		
Waste Code:		-NH4	112																		
IOL		-NO3	830																		
Description:		OR-N	16619																		
Indust.-Other (Lime Stab)		Urea	92.5																		
				Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)					
				1304	5.25	0.00	0.00				10.13	158	7.69	23.17	6.25	62.20					
Recommendations:		Nutrients Available for First Crop											Other Elements		lbs/ton (wet basis)						
Application Method		N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast		3.3	2.6	1.2	12.5	0.39	0.35	0.11	0.01	0.01	T	0.04		0.55	0.60	T	0.00	0.00			
Soil Incorp		4.1	3.3	1.3	15.7	0.49	0.44	0.14	0.01	0.01	T	0.05		0.62	0.60	T	0.00	0.00			
Neutralizing value is very low. The waste product cannot be economically used as a liming material. Application rates should be based on crop nutrient requirement.																					

SAMPLE ID – AKKSBM – NOVOZYMES LIME TREATED SPENT BIO MASS



Waste Analysis Report

Grower: **Akkadia Consulting**
 2004 Rivera Ct.
 Raleigh, NC 27604

Copies To: County Extension Director
 USDA-NRCS-Wake

2/19/01

Farm: Wake County

Sample Info.		Laboratory Results (parts per million unless otherwise noted)																		
Sample ID:		N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C					
AKKWAS	Total	69772	10065	13022	16963	1412	4804	169	28.7	40.3	22.0	158		3255	334387					
	IN-N	500																		
	-NH4	482																		
	-NO3	18.3																		
	OR-N	69272																		
	Urea	51.9																		
			Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)					
			2004	5.85	0.00	0.00				6.51	176	4.79	12.53							
Recommendations:		Nutrients Available for First Crop										Other Elements								
Application Method	N	P ₂ O ₅	K ₂ O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	7.0	3.5	3.1	2.6	0.21	0.72	0.03	T	0.01	T	0.02		0.65	0.50	T	0.00	0.00			
Soil Incorp	8.7	4.3	3.5	3.2	0.27	0.90	0.03	0.01	0.01	T	0.03		0.73	0.50	T	0.00	0.00			

SAMPLE ID – AKKWAS – NOVOZYMES WASTE ACTIVATED SLUDGE

Grower: **Akkadia Consulting**
 2004 Rivera Ct.
 Raleigh, NC 27604

Copies To: County Extension Director
 USDA-NRCS-Wake



Waste Analysis Report

Farm:

Wake County

2/7/01

Sample Info.		Laboratory Results (parts per million unless otherwise noted)																			
Sample ID:		N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C						
AKKHSD		Total 29440	649	1260	1287	423	309	54.8	66.7	26.9	37.3	3.67		694	504483						
Waste Code:		IN-N 260																			
IOO		-NH4 210																			
Description:		-NO3 49.4																			
Indust-Other		OR-N 29181	Na 591	Ni 0.65	Cd 0.39	Pb 0.00	Al	Se	Li	pH 5.53	SS 64	C:N 17.14	DM% 48.06	CCE%	ALE(tons)						
Urea 4570																					
Recommendations:		Nutrients Available for First Crop											Other Elements				lbs/ton (wet basis)				
Application Method		N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast		14.1	0.86	1.2	0.74	0.24	0.18	0.03	0.04	0.02	0.02	T		0.53	0.57	T	T	0.00			
Soil Incorp		11.3	1.1	1.3	0.93	0.30	0.22	0.04	0.05	0.02	0.03	T		0.60	0.57	T	T	0.00			

SAMPLE ID – AKKHSD = FURNITURE SAW DUST



Waste Analysis Report

Grower: Akkadia Consulting
2004 Rivera Ct.
Raleigh, NC 27604

Copies To: County Extension Director
USDA-NRCS-Wake

11/30/00

Farm:

Wake County

Sample Info.		Laboratory Results (parts per million unless otherwise noted)																			
Sample ID:		N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C						
JOYPL1	Total	37308	1481	1798	31695	1240	1028	1764	142	46.7	34.6	10.9		1347	479749						
	IN -N	560																			
Waste Code:	-NH4	314																			
NBS	-NO3	246																			
Description:	OR-N	36748																			
Non-Composted Bark/Sawd	Urea	13723																			
			Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)						
			1293	8.66	0.92	0.00				5.91	42	12.86	91.78								
Recommendations:		Nutrients Available for First Crop											Other Elements								
Application Method		N	P ₂ O ₅	K ₂ O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast		13.8	1.9	3.2	17.5	0.68	0.57	0.97	0.08	0.03	0.02	0.01		2.0	2.4	0.02	T	0.00			
Soil Incorp		27.8	3.1	3.6	29.1	1.1	0.94	1.6	0.13	0.04	0.03	0.01		2.2	2.4	0.02	T	0.00			

Sample Info.		Laboratory Results (parts per million unless otherwise noted)																			
Sample ID:		N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C						
JOYPL3	Total	26424	397	1041	6226	502	340	280	101	19.8	16.3	6.50		1057	493459						
	IN -N	573																			
Waste Code:	-NH4	440																			
NBS	-NO3	133																			
Description:	OR-N	25851																			
Non-Composted Bark/Sawd	Urea	10336																			
			Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)						
			956	4.09	0.91	0.00				5.35	23	18.67	91.92								
Recommendations:		Nutrients Available for First Crop											Other Elements								
Application Method		N	P ₂ O ₅	K ₂ O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast		9.8	0.50	1.8	3.4	0.28	0.19	0.15	0.06	0.01	0.01	T		1.6	1.8	0.01	T	0.00			
Soil Incorp		19.8	0.83	2.1	5.7	0.46	0.31	0.26	0.09	0.02	0.02	0.01		1.8	1.8	0.01	T	0.00			

SAMPLE ID'S - JOYPL1 & JOYPL2 = WOOD WASTE

Sample Info.		Laboratory Results (parts per million unless otherwise noted)													
Sample ID:	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C	
CR0001	Total 21841	4777	10734	9443	3078	1451	213	199	138	31.0	17.3		7417	473065	
Waste Code:	IN-N 1213														
NBS	-NH4 1183														
Description:	OR-N 20628														
Non-Composted Bark/Sawd.	Urea 1493														
		Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)	
		3801	5.85	0.66	0.00				6.53	270	21.66	77.94			

Recommendations:		Nutrients Available for First Crop											Other Elements							
Application Method	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	6.9	5.1	16.1	4.4	1.4	0.68	0.10	0.09	0.06	0.01	0.01		9.3	5.9	0.01	T	0.00			
Soil Incorp	14.3	8.5	18.1	7.4	2.4	1.1	0.17	0.16	0.11	0.02	0.01		10.4	5.9	0.01	T	0.00			

Sample Info.		Laboratory Results (parts per million unless otherwise noted)													
Sample ID:	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C	
KATESV	Total 4874	476	1683	6891	662	298	250	270	27.8	5.49	7.85		534	501818	
Waste Code:	IN-N 344														
NBS	-NH4 139														
Description:	OR-N 4530														
Non-Composted Bark/Sawd.	Urea 959														
		Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)	
		327	4.10	0.86	7.22				5.43	21	102.96	66.07			

Recommendations:		Nutrients Available for First Crop											Other Elements							
Application Method	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	1.3	0.43	2.1	2.7	0.26	0.12	0.10	0.11	0.01	T	T		0.56	0.43	0.01	T	0.01			
Soil Incorp	2.7	0.72	2.4	4.6	0.44	0.20	0.16	0.18	0.02	T	0.01		0.63	0.43	0.01	T	0.01			

Sample Info.		Laboratory Results (parts per million unless otherwise noted)													
Sample ID:	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C	
CRANFO	Total 20989	713	1674	5276	704	371	277	122	29.8	7.78	9.56		960	501719	
Waste Code:	IN-N 503														
NBS	-NH4 456														
Description:	OR-N 20485														
Non-Composted Bark/Sawd.	Urea 6254														
		Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)	
		964	4.08	0.79	0.00				5.47	21	23.90	82.20			

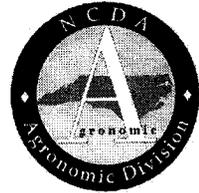
Recommendations:		Nutrients Available for First Crop											Other Elements							
Application Method	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	6.9	0.81	2.6	2.6	0.35	0.18	0.14	0.06	0.01	T	T		1.3	1.6	0.01	T	0.00			
Soil Incorp	14.1	1.3	3.0	4.3	0.58	0.31	0.23	0.10	0.02	0.01	0.01		1.4	1.6	0.01	T	0.00			

SAMPLE ID - CR0001 = ANIMAL BEDDING
SAMPLE ID'S - KATESV & CRANFO = WOOD WASTE

Sample Info.	Laboratory Results (parts per million unless otherwise noted)													
Sample ID:	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C
CONTSY	Total 2776	248	725	1664	327	292	204	101	20.5	6.32	9.66		343	519433
Waste Code:	IN-N 59.2													
NBS	-NH4 55.6													
Description:	-NO3 3.68	Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)
Non-Composted Bark/Sawd.	OR-N 2717	3547	2.97	3.41	0.00				6.36	45	187.12	87.20		
	Urea 486													

Recommendations:	Nutrients Available for First Crop											Other Elements		lbs/ton (wet basis)						
Application Method	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	0.97	0.30	1.2	0.87	0.17	0.15	0.11	0.05	0.01	T	0.01		0.48	6.2	0.01	0.01	0.00			
Soil Incorp	2.0	0.49	1.4	1.5	0.29	0.25	0.18	0.09	0.02	0.01	0.01		0.54	6.2	0.01	0.01	0.00			

SAMPLE ID - CONTSY = WOOD WASTE



Waste Analysis Report

Grower: Akkadia Consulting
2004 Rivera Ct.
Raleigh, NC 27604

Copies To:

Farm:

Wake County

11/9/01

Sample Info		Laboratory Results (parts per million unless otherwise noted)																		
Sample ID:		N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C					
YW115	Total	14559	1693	5096	12492	1874	800	818	310	78.6	17.6	23.8		874	452661					
	IN -N	281																		
Waste Code:	-NH4	253																		
NCW	-NO3	28.1																		
Description:	OR-N	14278																		
Non-Composted - Other	Urea	36.2																		
			Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)					
			675	1.75	0.00	1.64				6.05	72	31.09	53.39							
Recommendations:		Nutrients Available for First Crop										lbs/ton (wet basis)		Other Elements				lbs/ton (wet basis)		
Application Method	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	3.1	1.7	5.2	5.3	0.80	0.34	0.35	0.13	0.03	0.01	0.01		0.75	0.72	T	0.00	T			
Soil Incorp	6.3	2.5	5.9	8.0	1.2	0.51	0.52	0.20	0.05	0.01	0.02		0.84	0.72	T	0.00	T			

Sample Info		Laboratory Results (parts per million unless otherwise noted)																		
Sample ID:		N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C					
YW115	Total	14874	2135	1987	21864	1138	893	1929	238	48.3	12.6	30.0		1345	164264					
	IN -N	791																		
Waste Code:	-NH4	134																		
NCW	-NO3	657																		
Description:	OR-N	14083																		
Non-Composted - Other	Urea	348																		
			Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)					
			1552	1.92	0.00	1.91				7.24	112	11.04	70.58							
Recommendations:		Nutrients Available for First Crop										lbs/ton (wet basis)		Other Elements				lbs/ton (wet basis)		
Application Method	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	4.3	2.8	2.7	12.4	0.64	0.50	1.1	0.13	0.03	0.01	0.02		1.5	2.2	T	0.00	T			
Soil Incorp	8.8	4.1	3.0	18.5	0.96	0.76	1.6	0.20	0.04	0.01	0.03		1.7	2.2	T	0.00	T			

SAMPLE ID - YW115 = YARD WASTE

Grower: Akkadia Consulting
2004 Rivera Ct.
Raleigh, NC 27604

Copies To:



Waste Analysis Report

Farm:

Wake County

3/12/02

Sample Info.		Laboratory Results (parts per million unless otherwise noted)																		
Sample ID:		N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C					
W1	Total	9114	1316	620	2499	368	3147	146491	953	80.0	99.6	290		734	205308					
	IN-N	877																		
	-NH4	877																		
	-NO3	0.00																		
	OR-N	8237																		
	Urea	13.8																		
			Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)					
			471	7.81	24.5	0.00				4.84	67	22.53	75.64							
Recommendations:		Nutrients Available for First Crop											Other Elements							
Application Method	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	4.1	2.7	0.90	2.3	0.33	2.9	133.0	0.86	0.07	0.09	0.26		0.67	0.71	0.01	0.04	0.00			
Soil Incorp	6.0	3.4	1.0	2.8	0.42	3.6	166.2	1.1	0.09	0.11	0.33		0.83	0.71	0.01	0.04	0.00			
Sample Info.		Laboratory Results (parts per million unless otherwise noted)																		
Sample ID:		N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C					
W2	Total	7944	1011	336	2259	276	2660	140030	856	67.3	78.9	259		664	183904					
	IN-N	956																		
	-NH4	956																		
	-NO3	0.00																		
	OR-N	6988																		
	Urea	13.8																		
			Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)					
			382	5.30	20.7	0.00				5.12	52	23.15	38.54							
Recommendations:		Nutrients Available for First Crop											Other Elements							
Application Method	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	1.8	1.1	0.25	1.0	0.13	1.2	64.8	0.40	0.03	0.04	0.12		0.31	0.29	T	0.02	0.00			
Soil Incorp	2.7	1.3	0.28	1.3	0.16	1.5	81.0	0.49	0.04	0.05	0.15		0.38	0.29	T	0.02	0.00			

SAMPLE ID - W1 & W2 = IRON SULFATE DRINKING WATER RESIDUALS

Sample Info.

Sample ID:

C1

Waste Code:

MWO

Description:

Municipal (Other)

Laboratory Results (parts per million unless otherwise noted)

	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C
Total	13157	1242	461	2857	1848	5899	14841	1405	20.8	44.7	23.9		616	301489
IN -N	613													
-NH4	613													
-NO3	0.00													
OR-N	12544													
Urea	3.85													
		Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)
		566	11.3	0.00	8.16				6.47	78	22.91	37.60		

Recommendations:

Application Method

Broadcast

Soil Incorp

Nutrients Available for First Crop

lbs/ton (wet basis)

Other Elements

lbs/ton (wet basis)

	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	3.0	1.3	0.33	1.3	0.83	2.7	6.7	0.63	0.01	0.02	0.01		0.28	0.43	0.01	0.00	0.01			
Soil Incorp	4.1	1.6	0.37	1.6	1.0	3.3	8.4	0.79	0.01	0.03	0.01		0.35	0.43	0.01	0.00	0.01			

SAMPLE ID - C1 = ALUM DRINKING WATER RESIDUALS

Sample Info.		Laboratory Results (parts per million unless otherwise noted)													
Sample ID:	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C	
W608	Total	14281	1577	1885	20800	1055	738	2066	189	36.8	7.92	20.0		223418	
Waste Code:	IN - N														
NCW	-NH4														
Description:	-NO3	Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)	
Non-Composted - Other	OR-N	1241	5.01	0.56	0.00				7.69	175	15.64	46.52			
	Urea														

Recommendations:		Nutrients Available for First Crop										Other Elements								
		lbs/ton (wet basis)										lbs/ton (wet basis)								
Application Method	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	2.7	1.3	1.7	7.7	0.39	0.27	0.77	0.07	0.01	T	0.01			1.2	T	T	0.00			
Soil Incorp	5.3	2.0	1.9	11.6	0.59	0.41	1.2	0.11	0.02	T	0.01			1.2	T	T	0.00			

Sample Info.		Laboratory Results (parts per million unless otherwise noted)													
Sample ID:	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C	
WAS608	Total	20797	2819	3595	11116	1144	956	854	176	38.4	8.93	25.8		356075	
Waste Code:	IN - N														
NCW	-NH4														
Description:	-NO3	Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)	
Non-Composted - Other	OR-N	808	4.94	0.50	0.00				6.72	109	17.12	49.67			
	Urea														

Recommendations:		Nutrients Available for First Crop										Other Elements								
		lbs/ton (wet basis)										lbs/ton (wet basis)								
Application Method	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	4.1	2.6	3.4	4.4	0.45	0.38	0.34	0.07	0.02	T	0.01			0.80	T	T	0.00			
Soil Incorp	8.3	3.9	3.9	6.6	0.68	0.57	0.51	0.10	0.02	0.01	0.02			0.80	T	T	0.00			

Sample Info.		Laboratory Results (parts per million unless otherwise noted)													
Sample ID:	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C	
RALFE	Total	9407	1022	207	2800	393	1138	135732	3638	87.9	26.8	267		130533	
Waste Code:	IN - N														
NCW	-NH4														
Description:	-NO3	Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)	
Non-Composted - Other	OR-N	439	18.4	33.9	0.00				5.87	66	13.88	21.46			
	Urea														

Recommendations:		Nutrients Available for First Crop										Other Elements								
		lbs/ton (wet basis)										lbs/ton (wet basis)								
Application Method	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	0.81	0.40	0.09	0.48	0.07	0.20	23.3	0.62	0.02	T	0.05			0.19	0.01	0.01	0.00			
Soil Incorp	1.6	0.60	0.10	0.72	0.10	0.29	35.0	0.94	0.02	0.01	0.07			0.19	0.01	0.01	0.00			

SAMPLE ID – RALFE = IRON SULFATE DRINK WATER RESIDUALS



Waste Analysis Report

Grower: Akkadia Consulting
2004 Rivera Ct.
Raleigh, NC 27604

Copies To:

Farm:

Wake County

2/5/02

Sample Info.	Laboratory Results (parts per million unless otherwise noted)														
	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C	
Sample ID: SBM125	Total	15905	2260	2338	30379	1407	1253	2493	256	56.0	13.0	27.8	1787	166478	
Waste Code: FCW	IN-N	1393													
	-NH4	364													
Description: Composted Waste - Other	-NO3	1029													
	OR-N	14512													
Recommendations:	Urea	341													
			Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)
			1673	2.60	0.03	2.16				8.63	98	10.47	71.18		

Application Method	Nutrients Available for First Crop										Other Elements									
	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	9.8	4.4	3.2	26.0	1.2	1.1	2.1	0.22	0.05	0.01	0.02		2.0	2.4	T	T	T			
Soil Incorpor	12.2	5.5	3.6	32.4	1.5	1.3	2.7	0.27	0.06	0.01	0.03		2.3	2.4	T	T	T			

Nitrogen is very high in relation to carbon (Low C:N Ratio). If the waste product is to be used as a raw material in composting, blend it with another material with a high C:N ratio. The C:N ratio should be 20-30 for ideal composting conditions.

Compost pH is well above the desired range for plant production. If the compost will be used as a landscape or potting soil, blend it with other materials or add elemental sulfur to decrease pH to the desired range. As a general rule, add 0.25 lb. elemental sulfur per cu. yd. of compost to lower pH 0.5-1.0 unit. Take a follow-up soil sample to determine if pH is within the desired range.

Soluble salt level is high. The roots of plants growing directly in the compost may be damaged particularly under dry soil conditions. The compost should be blended at least 50:50 with another material of lower salt level. High soluble salts likely indicate high nutrient availability. Take a matching soil sample to further evaluate pH and nutrient availability.

Sample Info.	Laboratory Results (parts per million unless otherwise noted)														
	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C	
Sample ID: WAS125	Total	17625	2683	1941	11146	1022	1218	2571	226	49.0	12.0	26.4	275	275401	
Waste Code: FCW	IN-N	900													
	-NH4	380													
Description: Composted Waste - Other	-NO3	520													
	OR-N	16725													
Recommendations:	Urea	118													
			Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	CCE%	ALE(tons)
			417	2.99	0.21	4.19				5.75	54	15.63	37.89		

Application Method	Nutrients Available for First Crop										Other Elements									
	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	5.6	2.8	1.4	5.1	0.46	0.55	1.2	0.10	0.02	0.01	0.01		0.17	0.32	T	T	T			
Soil Incorpor	7.0	3.5	1.6	6.3	0.58	0.69	1.5	0.13	0.03	0.01	0.01		0.19	0.32	T	T	T			

SAMPLE ID – SBM125 = FINISH SPENT BIO MASS COMPOST DEMO PROJECT
SAMPLE ID – WAS125 = FINISH WASTE ACTIVATED SLUDGE COMPOST DEMO PROJECT

SOIL CONTROL LAB

42 HANGAR WAY

Account No.:
153840 1 2197
MAY-01-1 25

Novoxymes NA
Mike Lynos
PO Box 567
Franklinton NC 27525-0576

DATE RECEIVED: 10May01
SAMPLE ID: Feedstock Mix
SAMPLE ID. No.: 1 153840
Metals & Coliform Bacteria

Method (metals): EPA 3050B / EPA 6010
Method (metals): TMECC 04.12-B / 04.14-A
Method (Fecal Coliform): Standard Methods 9221E

Arsenic (As):	Less than	1 mg/kg dw
Cadmium (Cd):	Less than	1 mg/kg dw
Chromium (Cr):		92 mg/kg dw
Copper (Cu):		2 mg/kg dw
Lead (Pb):	Less than	1 mg/kg dw
Mercury (Hg):	Less than	1 mg/kg dw
Molybdenum (Mo):	Less than	1 mg/kg dw
Nickel (Ni):	Less than	1 mg/kg dw
Selenium (Se):	Less than	1 mg/kg dw
Zinc (Zn):		-2 mg/kg dw

Pollutant Loading Rate:
Multiply mg/kg dry weight values times 0.038514 to give you kilograms pollutant per 100
metric ton compost as-received based on a moisture content of 57.5 percent.

Fecal Coliform bacteria: Less than 5 MPN per gram Dry Weight

SOIL CONTROL LAB

42 HANGAR WAY

Account No.:
 153840 1 2197
 MAY-01-1 25

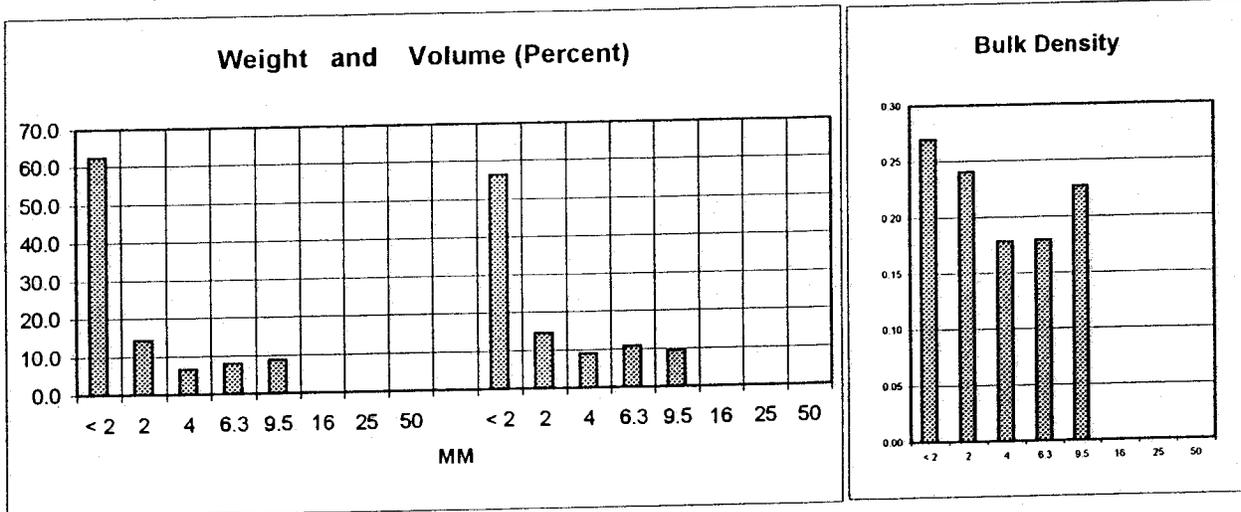
Novoxymes NA
 Mike Lynos
 PO Box 567
 Franklinton NC 27525-0576

DATE RECEIVED: 10May01
 SAMPLE ID: Feedstock Mix
 SAMPLE ID. No.: 1 153840

Size & Volume Distribution, Bulk Density and Inerts

Method: TMECC 02.02-B	Weight percent	Volume percent	Bulk Density g/cc
MM			
> 50 > 2.0	0.0	0.0	0.00
25 to 50 1.0 to 2.0	0.0	0.0	0.00
16 to 25 0.64 to 1.0	0.0	0.0	0.00
9.5 to 16 0.38 to 0.64	8.7	9.4	0.23
6.3 to 9.5 0.25 to 0.38	8.0	10.8	0.18
4.0 to 6.3 0.16 to 0.25	6.5	8.9	0.18
2.0 to 4.0 0.08 to 0.16	14.4	14.6	0.24
< 2.0 < 0.08	62.4	56.3	0.27
Total	100.0	100.0	

Bulk density = < 0.35 Light materials; 0.35 to 0.60 Mid Weight materials; > 0.60 Heavy Materials



Percent Glass, Plastic, Metal and Sharps.
 Glass 0 Plastic 0 Metal 0 Sharps 0

Method: 02-02-C
 0 Sharps 0

Handwritten signature

SOIL CONTROL LAB

42 HANGAR WAY

Account No.:
153840 1 2197
MAY-01-1 25

Novoxymes NA
Mike Lynos
PO Box 567
Franklinton NC 27525-0576

DATE RECEIVED: 10May01
SAMPLE ID: Feedstock Mix
SAMPLE ID. No.: 1 153840

Agricultural Related Constituents

Nutrients-Primary + Secondary

	WET Basis	DRY Basis	TMECC Method	INTERPRETATION for COMPOST: Nutrients (N+P2O5+K2O)
Total Nitrogen:	% 0.66	1.6	4.02-D	2.0 low nutrient content
Ammonia (NH4-N):	mg/kg 898	2116	4.02-C	AgIndex (Nutrients/Na+Cl)
Nitrate (NO3-N):	mg/kg 31	74	4.02-B	> 10 High nutrient ratio
Organic Nitrogen (Org.-N):	% 0.57	1.3	Calc.	Lime Content (lbs. per ton)
Phosphorus (as P2O5):	% 0.007	0.015	Calc.	3 Low lime content
Phosphorus (P):	mg/kg 29	68	4.03-A	C/N Ratio
Potassium (as K2O):	% 0.17	0.41	Calc.	26 Indicates immature
Potassium (K):	mg/kg 1433	3375	4.04-A	Ammonia/Nitrate ratio
Calcium (Ca):	% 0.73	1.7	4.05	29 Indicates immature
Magnesium (Mg):	% 0.06	0.15	4.05	Ammonia nitrogen
Sulfate (SO4):	mg/kg 425	1000	4.12-D/IC	2116 Indicates immature

Nutrients - Trace elements

Copper (Cu):	mg/kg 1	2	4.05-Cu	pH value
Zinc (Zn):	mg/kg -1	-2	4.05-Zn	7.65 Indicates mature
Iron (Fe):	mg/kg 102	241	4.05-Fe	Ash to Organic Matter ratio
Manganese (Mn):	mg/kg 1	3	4.05-Mn	0.60 Average ash content
Boron (B):	mg/kg 8	18	4.05-B	Organic Fraction (per 100 g Ash) 166

Salts, pH, Bulk Density, Carbonates

Sodium (Na):	% 0.077	0.18	4.05-Na	16.7 May restrict use
Chloride (Cl):	% 0.065	0.15	04.05/IC	Soluble Nutrients & Salts (EC5 dw)
pH Value:	units 7.65	NA	04.11-A	8.86 High salts
Electrical Conductivity (EC5 dw):	mmhos/c 3.76	8.86	04.08-A	Biological Activity
Bulk Density :	lb/cu ft 43	18	SCL	(mg CO2-C/gOM/day)
Carbonates :	as CaCO3 1.3	3.0	04.08-A	Respiration Rate
Organic Matter:	% 26.5	62.4	05.07-A	0.2 Low for all uses
Organic Carbon:	% 17.2	40.6	4.01	Biological Available Carbon
Ash:	% 15.9	37.6	3.02	20.4 High-for mulch
Moisture:	% 57.5	0.0	3.09	

NOTE: Wet Basis values based on a moisture content 57.5 percent.

To Calculate: WetBasis = (Dry Basis) X ((100-%Moisture)/100)

To Calculate: lb/cu yd = % WetBasis X 18 X (2700)/(100-%moisture)

To Calculate: lb/cu yd = mg/kg WetBasis X 18 X (0.27)/(100-%moisture)

SOIL CONTROL LAB

42 HANGAR WAY

Account No.:
153840 1 2197
MAY-01-1 25

Novoxymes NA
Mike Lynos
PO Box 567
Franklinton NC 27525-0576

DATE RECEIVED: 10May01
SAMPLE ID: Feedstock Mix
SAMPLE ID. No.: 1 153840

Germination and Growth (cucumber seed) TMECC Method: 05.05-A

Emergence (relative to control) 45 %
Relative Seedling Vigor 5 %

Test Conditions:

Positive Control: Sunland Garden Products (Watsonville, CA) potting mix
Negative Control: Grace Vermiculite

Interpretation:

This test uses a salt tolerant plant (cucumber) grown in a high concentration of test compost (50:50 v/v mix). Compost that contain organic acids, un-ionized ammonia, herbicides, some diseases, anaerobic conditions, high salts and other phytotoxic constituents can effect cucumber germination and vigor. Compost that show phytotoxic effects under test conditions may not show toxic effect when used in actual field conditions. Conditions of high salts, acid or alkali pH and ammonia toxicity can be corrected with added dilution or adjustments resulting from mixing with receiving soil. Compost showing phytotoxic effects should be used with caution.

Carbon Dioxide Evolution Rate	Respiration Rate	Biological Available Carbon (carbon made the limiting factor)
Test Conditions:		
Pre-incubated:	3 day-20 deg.C	3 day-36 deg. C
Incubation:	36 deg.C	36 deg.C
Moisture adjusted:	saturated	saturated
pH	Not adjusted	6.5 to 7.5
Porosity	Not provided	#20 quartz sand
Nutrients	Not provided	NPK+trace
TMECC Method	05.08-B	05.08-F
RESULTS:		
mg CO ₂ -C/g OM/day	0.2 avg. 4 reps.	20.4 avg. 5 reps.
mg CO ₂ -C/g OC/day	0.4 avg. 4 reps.	31.4 avg. 5 reps.
mg CO ₂ -C/g TS/day	0.1 avg. 4 reps.	12.7 avg. 5 reps.
TMECC Method 05.08-B		TMECC Method 05.08-F

INTERPRETATION:	mg CO ₂ -C/g OM/day	8 to 15	Moderately Unstable
< 2	Very stable	15 to 40	Un-Stable
2 to 8	Stable	> 40	Very Un-Stable

RESPIRATION RATE

Optimizing moisture with pre-incubation to simulate maximum biological activity in a source pile.

BIOLOGICAL AVAILABLE CARBON

Optimizing all conditions (except carbon) makes rate of degradation limited by the available carbon in the compost. Purpose is to simulate condition of end use in an agriculture environment where nutrients, porosity, pH adj. and moisture are provided from the grower or receiving soil when optimizing conditions for plant growth.

Mike Lynos

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE

Account No.: 156279-2-2197
Group: Aug-3-01 6

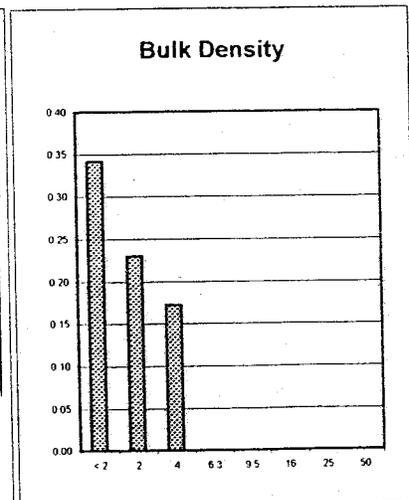
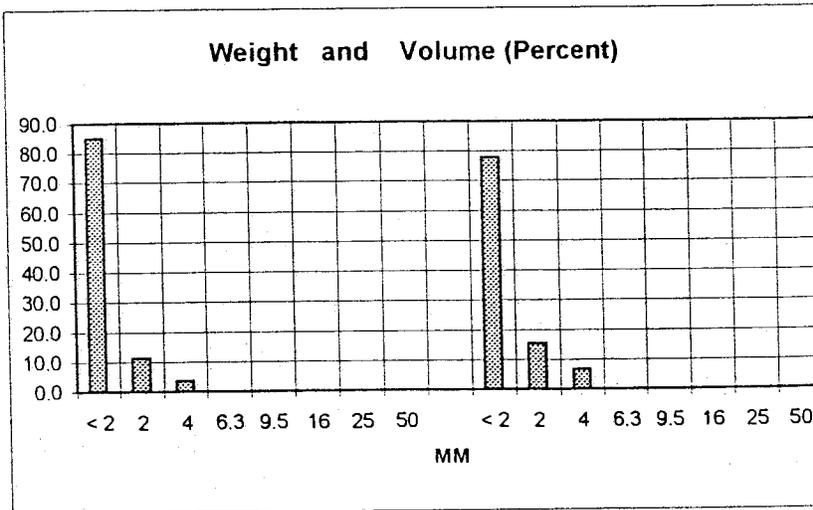
Randy Green
Novozymes
PO Box 576
Franklinton, NC 27525

DATE RECEIVED: 14Aug.01
SAMPLE ID: Compost Finished TW
SAMPLE ID. No.: 2 156279

Size & Volume Distribution, Bulk Density and Inerts

Method: TMECC 02.02-B	Weight percent	Volume percent	Bulk Density g/cc
MM Inches			
> 50 > 2.0	0.0	0.0	0.00
25 to 50 1.0 to 2.0	0.0	0.0	0.00
16 to 25 0.64 to 1.0	0.0	0.0	0.00
9.5 to 16 0.38 to 0.64	0.0	0.0	0.00
6.3 to 9.5 0.25 to 0.38	0.0	0.0	0.00
4.0 to 6.3 0.16 to 0.25	3.7	6.8	0.17
2.0 to 4.0 0.08 to 0.16	11.2	15.3	0.23
< 2.0 < 0.08	85.0	78.0	0.34
Total	100.0	100.0	

Bulk density = < 0.35 Light materials; 0.35 to 0.60 Mid Weight materials; > 0.60 Heavy Materials



Percent Glass, Plastic, Metal and Sharps.

Glass < 1 Plastic < 1 Metal < 1 Sharps < 1

PAGE 1

Method: 02-02-C

Analyst: Frank Shields

Frank Shields

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE

Account No.:
156279 2 2197
Group: Aug-3-01 6

Randy Green
Novozymes
PO Box 576
Franklinton, NC 27525-0576

DATE RECEIVED: 14Aug.01
SAMPLE ID: Compost Finished TW
SAMPLE ID. No.: 2 156279

Germination and Growth (cucumber seed) TMECC Method: 05.05-A

Emergence (relative to control) 100 %
Relative Seedling Vigor 100 %

Test Conditions:

Positive Control: Sunland Garden Products (Watsonville, CA) potting mix
Negative Control: Grace Vermiculite

Interpretation:

This test uses a salt tolerant plant (cucumber) grown in a high concentration of test compost (50:50 v/v mix). Compost that contain organic acids, un-ionized ammonia, herbicides, some diseases, anaerobic conditions, high salts and other phytotoxic constituents can effect cucumber germination and vigor. Compost that show phytotoxic effects under test conditions may not show toxic effect when used in actual field conditions. Conditions of high salts, acid or alkali pH and ammonia toxicity can be corrected with added dilution or adjustments resulting from mixing with receiving soil. Compost showing phytotoxic effects should be used with caution.

Carbon Dioxide Evolution Rate	Respiration Rate	Biological Available Carbon
Test Conditions:	(as received)	(carbon made the limiting factor)
Pre-incubated:	3 day-20 deg.C	3 day-36 deg. C
Incubation:	36 deg.C	36 deg.C
Moisture adjusted:	saturated	saturated
pH	Not adjusted	6.5 to 7.5
Porosity	Not provided	#20 quartz sand
Nutrients	Not provided	NPK+trace
TMECC Method	05.08-B	05.08-F
RESULTS:		
mg CO ₂ -C/g OM/day	0.7 avg. 4 days	9 avg. 5 reps.
mg CO ₂ -C/g OC/day	1.3 avg. 4 days	18 avg. 5 reps.
mg CO ₂ -C/g TS/day	0.3 avg. 4 days	3.9 avg. 5 reps.
TMECC Method 05.08-B		TMECC Method 05.08-F

INTERPRETATION: mg CO ₂ -C/g OM/day	8 to 15	Moderately Unstable
< 2 Very stable	15 to 40	Un-Stable
2 to 8 Stable	> 40	Very Un-Stable

RESPIRATION RATE

Analyst: Frank Shields *Frank Shields*

Optimizing moisture with pre-incubation to simulate maximum biological activity in a source pile.

BIOLOGICAL AVAILABLE CARBON

Optimizing all conditions (except carbon) makes rate of degradation limited by the available carbon in the compost. Purpose is to simulate condition of end use in an agriculture environment where nutrients, porosity,

pH adj. and moisture are provided from the grower or receiving soil when optimizing conditions for plant growth.

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE

Account No.:
156279 - 2 - 2197
Aug-3-01 6

Randy Green
Novozymes
PO Box 576
Franklinton, NC 27525-0576

DATE RECEIVED: 14Aug.01
SAMPLE ID: Compost Finished TW
SAMPLE ID. No.: 2 156279

		WET Basis	DRY Basis	TMECC Method
Nutrients-Primary + Secondary				
Total Nitrogen:	%	1.0	1.5	4.02-D
Ammonia (NH4-N):	mg/kg	347	558	4.02-C
Nitrate (NO3-N):	mg/kg	262	420	4.02-B
Organic Nitrogen (Org.-N):	%	0.90	1.4	Calc.
Phosphorus (as P2O5):	%	0.50	0.80	Calc.
Phosphorus (P):	mg/kg	2191	3519	4.03-A
Potassium (as K2O):	%	0.26	0.42	Calc.
Potassium (K):	mg/kg	2189	3516	4.04-A
Calcium (Ca):	%	1.7	2.8	4.05
Magnesium (Mg):	%	0.13	0.21	4.05
Sulfate (SO4):	mg/kg	809	1300	4.12-D/IC
Nutrients - Trace elements				
Copper (Cu):	mg/kg	15	25	4.05-Cu
Zinc (Zn):	mg/kg	49	79	4.05-Zn
Iron (Fe):	mg/kg	5818	9348	4.05-Fe
Manganese (Mn):	mg/kg	167	268	4.05-Mn
Boron (B):	mg/kg	92	148	4.05-B
Salts, pH, Bulk Density, Carbonates				
Sodium (Na):	%	0.17	0.27	4.05-Na
Chloride (Cl):	%	0.10	0.17	04.05/IC
pH Value:	units	8.21	NA	04.11-A
Electrical Conductivity (EC5 dw):	mmhos/c	2.32	3.73	04.08-A
Bulk Density :	lb/cu ft	33	20	SCL
Carbonates :	as CaCO3 lb/ton	4	7	04.08-A
Organic Matter:	%	25.8	41.5	05.07-A
Organic Carbon:	%	13.6	21.8	4.01
Ash:	%	36.4	58.5	3.02
C/N Ratio	ratio	14.2	14.2	calc.
Moisture:	%	37.8	0.0	3.09

NOTE: Wet Basis values based on a moisture content 37.8 percent. Analyst: Frank Shields

To Calculate: WetBasis = (Dry Basis) X ((100-%Moisture)/100)

To Calculate: lb/cu yd = % WetBasis X 20.44 X (27)/(100-%moisture)

PAGE 3

To Calculate: lb/cu yd = mg/kg WetBasis X 20.44 X (0.0027)/(100-%moisture)

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE

Account No.:
156279-2-2197
Group: Aug-3-01 6

Randy Green
Novozymes
PO Box 576
Franklinton, NC 27525-0576

DATE RECEIVED: 14Aug.01
SAMPLE ID: Compost Finished TW
SAMPLE ID. No.: 2 156279

Metals & Coliform Bacteria

Method (metals): EPA 3050B / EPA 6010
Method (metals): TMECC 04.12-B / 04.14-A
Method (Mercury Hg) TMECC 04.06 / EPA 7471
Method (Fecal Coliform): Standard Methods 9221E

		Units	MDL	% Recover	Date Tested
Arsenic (As):		1 mg/kg dw	1 mg/kg	80	27-Aug-2001
Cadmium (Cd):	Less than	1 mg/kg dw	1 mg/kg	106	27-Aug-2001
Chromium (Cr):		10 mg/kg dw	1 mg/kg	109	27-Aug-2001
Copper (Cu):		25 mg/kg dw	1 mg/kg	116	27-Aug-2001
Lead (Pb):		6 mg/kg dw	1 mg/kg	101	27-Aug-2001
Mercury (Hg):	Less than	1 mg/kg dw	0.1 mg/kg	86	27-Aug-2001
Molybdenum (Mo):		2 mg/kg dw	1 mg/kg	98	27-Aug-2001
Nickel (Ni):		7 mg/kg dw	1 mg/kg	109	27-Aug-2001
Selenium (Se):	Less than	1 mg/kg dw	1 mg/kg	96	27-Aug-2001
Zinc (Zn):		79 mg/kg dw	1 mg/kg	98	27-Aug-2001
Total Solids (tmecc 03.09)		62.2 Percent	0.05%		24 Aug. 01

Fecal Coliform < 2 MPN/g dry weight 24 Aug. 01

Pollutant Loading Rate:

Multiply mg/kg dry weight values times 0.0565 to give you kilograms pollutant per 100 metric ton compost as-received based on a moisture content of 37.76 percent.

Analyst: Frank Shields

PAGE 4

Frank Shields

Account No.:
156279 - 2 - 2197
Batch No. Aug-3-01 6

Date Received
Sample i.d.
Sample I.d. No.

14Aug.01
Compost Finished TW
2 156279

INTERPRETATION:

Page one of two

Nutrients (N+P2O5+K2O)

2.8 Average nutrient content

This is the sum of the primary nutrients Nitrogen, Phosphorus and Potassium. Reported units are consistent with units on fertilizer formulations. A sum greater than five indicates a compost with a high nutrient content and best used when intended to supply nutrients to a receiving soil. A value below two indicates a low nutrient content and best used where soil structure needs improving and nutrients can be added from another source. Most compost fall within the range between two and five.

AgIndex (Nutrients/Na+Cl)

10 High nutrient ratio

Repeated use of a compost with a low AgIndex (below 2) result in sodium and/or chloride becoming the limiting factor governing application rates (ie. sodium and/or chloride become toxic before nutrients become optimum). May be used on well drained soils with salt tolerant plants. Additional nutrients from another source may be needed. An AgIndex above 10 result in a build-up of nutrients to optimum for plant growth without a concern of a toxic build-up of sodium and/or chloride from the compost. Good for increasing nutrients on all soils. Most compost fall in the range between 2 and 10 and concentrations of both nutrients and sodium plus chloride in the receiving soil should be considered when determining application rates. AgIndex is a product of feedstock quality. Feedstock from dairy manure, ocean fish waste, un-washed kelp, industrial wastes, cheese & pickel waste, salt tolerant plants, can produce a finished compost with a low AgIndex.

Lime Content (lbs. per ton)

7 Low lime content

Compost produced from chicken manure (layers), ash materials, and lime products can result in a finished compost high in carbonates. An excellent product when used on a receiving soil where an addition of lime is recommended from a soil analysis, but caution should be used when applying to a soil wanting a lower pH.

C/N Ratio

14.2 Indicates mature

A C/N ratio below 13 indicates Mature and above 15 indicates Immature. But there are many exceptions. Example; large (> 6.3mm) woodchips is slow to breakdown and can result in a Stable product based on Biological Available Carbon (BAC) yet the C/N ratio value is high. Some organic feedstock like bark and redwood are resistant to degradation result in a Stable compost with a high C/N ratio. And some mixes with chicken manure and green grasses can start below 15 and are very un-Stable.

AmmoniaN/NitrateN ratio

1 mature

Ammonia N ppm
558 immature

Nitrate N ppm
420 mature

pH value
8.21 immature

Typically ammonia is in excess with the break-down of organic materials resulting in a increase in pH. This combination result in a loss of volatile ammonia (it smells). Once the toxic ammonia has gone off and the pH drops the microbes convert ammonia to nitrates. A low ammonia + high nitrate indicates Mature. Exceptions are many. A compost with a low pH value (< 7) will retain ammonia and a compost with high lime content can lose ammonia before the organic fraction become stable.

Account No.:
156279 - 2 - 2197
Batch No. Aug-3-01 6

Date Received
Sample i.d.
Sample I.d. No.

14Aug.01
Compost Finished TW
2 156279

INTERPRETATION:

Page two of two

Ash to Organic Matter ratio

1.41 Average ash content

High Ash content indicates possible 1) excess mineralization (old compost) 2) contamination with dirt base material during turning 3) poor quality feedstock or 4) soil or mineral products added. Finding the source and reducing Ash is often the fastest means of increasing nutrient quality of a compost.

Organic Fraction (grams OM per 100 g Ash)

71

Compost operations on a solid base and where there are no more additions of materials once the operation starts can use Ash as a constant value to aid in graphing loss of organic matter, nitrogen conversion, moisture and leaching if tested weekly during composting. A good aid in solving problems with poorly formulated feedstock.

Particle Size % > 6.3 MM (0.5")

0.0 Suitable for all uses

Large particles may restrict use for greenhouses, golf courses, seedlings etc. where a fine size distribution is required. Can still be used for field soils, shrub mixes and mulches.

Soluble Nutrients & Salts (EC5 dw - umhos/cm)

3.73 Average salts

Salts refers to all soluble ions including nutrients and sodium and chloride. High salts + high AgIndex indicates a compost high in readily available nutrients. Application rate should be limited to obtaining optimum nutrients. High Salts and low AgIndex indicates a compost low in nutrients and high concentrations of sodium and/or chloride limiting application rate to toxicity of sodium and/or chloride. Low salts indicates more compost can be applied before salt toxicity and nutrients are not readily available but in a slo-release form.

Respiration Rate

0.7 Low for all uses mg CO₂-C/g OM/day

Biological Available Carbon

9 Moderate-selected use mg CO₂-C/g OM/day

The Respiration Rate (RR) and Biological Available Carbon (BAC) measure the rate CO₂ is released under the same moisture and temperature conditions. Additionally for the BAC test porosity, nutrients, pH and microbes are adjusted for optimum. If both RR and BAC results are about the same indicates the compost conditions are optimum. If the BAC results are higher than RR indicates a compost pile activity limited by one or more of the conditions corrected in the BAC test. A Stable RR and BAC test indicates a Stable product. A Stable RR but un-Stable BAC test indicates an un-Stable product for the purpose of use in agriculture and caution required when used in greenhouses, lawns, golf courses and other high end uses.

Particle Size Distribution

Each size fraction is measured on both a weight and volume basis. Bulk density is calculated from from these two values. Aids in decisions to screen or not and size screen to use. Calculates the weight, volume and make-up of the fraction to be removed. Removing large mineral material greatly improves compost quality. Aids in locating source of un-wanted stone materials and making decisions if removed material should be added into a new pile (woody) or landfilled (stony).

Site Plans

Geomembrane
Liner Details

IAGI HDPE Geomembrane Installation Specification

Prepared by

**INTERNATIONAL ASSOCIATION OF GEOSYNTHETIC INSTALLERS
HDPE GEOMEMBRANE INSTALLATION SPECIFICATION**

International Association of Geo-synthetic Installers

P.O. Box 18012

St. Paul, MN 55118 USA

Telephone: 651-554-1895

Fax: 651-450-6167

Email: iag@iagi.org

Revision by R. W. Gregg, May 21, 2004

PART 1 - GENERAL

1.01 Summary

A. This specification includes furnishing and installing HDPE geo-membranes with a formulated sheet density of 0.940 g/cm or greater. Geo-membranes with both smooth and textured surfaces are included.

1.02 References

A. American Society for Testing and Materials (ASTM):

1. D 638, Standard Test Method for Tensile Properties of Plastics.
2. D 751, Standard Test Methods for Coated Fabrics.
3. D 792, Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
4. D 1004, Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
5. D 1204, Standard Test Method for Linear Dimensional Changes of Non Rigid Thermoplastic Sheeting or Film at Elevated Temperature.
6. D 1238, Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
7. D 1505, Standard Test Method for Density of Plastics by Density-Gradient Technique.
8. D 1603, Standard Test Method for Carbon Black in Olefin Plastics.
9. D 3895, Test Method for Oxidative Induction Time of Polyolefins by Thermal Analysis.
10. D 4218, Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
11. D 4437, Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geo-membranes.
12. D 4833, Test Method for Index Puncture Resistance of Geo-textiles, Geo-membranes and Related Products.
13. D 5199, Standard Test Method for Measuring Nominal Thickness of Smooth Geo-membranes.
14. D 5397, Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefins using Notched Constant Tensile Load Test.
15. D 5596, Standard Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds.

16. D 5641, Standard Practice for Geo-membrane Seam Evaluation by Vacuum Chamber.
17. D 5721, Practice for Air-Oven Aging of Polyolefin Geo-membranes.
18. D 5820, Test Method for Air Testing.
19. D 5885, Test Method for Oxidative Induction Time of Polyolefin Geo-synthetics by High Pressure Differential Scanning Calorimetry.
20. D 5994, Standard Test Method for Measuring Nominal Thickness of Textured Geo-membranes
21. D 6365, Standard Practice for the Nondestructive Testing of Geo-membrane Seams using The Spark Test

B. Geo-synthetic Research Institute (GRI):

1. GRI GM 6, Pressurized Air Channel Test for Dual Seamed Geo-membranes
2. GRI GM 9, Cold Weather Seaming of Geo-membranes
3. GRI GM 10, Specification for Stress Crack Resistance of HDPE Geo-membrane Sheet
4. GRI GM 13, Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geo-membranes
5. GRI GM 14, Test Frequencies for Destructive Seam Testing

1.03 Submittals

A. Submit under provisions of Section 01300, Submittals.

B. Submit the following to the Engineer or Owner, for review and approval, 3 weeks prior to shipment of the Geo-membrane:

1. Documentation of manufacturer's qualifications as specified in subsection 1.04A of this Section.
2. Manufacturer's Quality Control program manual or descriptive documentation.
3. A material properties sheet, including at a minimum all properties specified in GRI GM 13, including test methods used.
4. Sample of the material.
5. Documentation of Installer's qualifications, as specified below and in subsection 1.04B of this Section.
 - a. Submit a list of at least ten completed facilities. For each installation, provide: name and type of facility; its location; the date of installation; name and telephone number of contact at the facility; type and thickness of geo-membrane and; surface area of the installed geo-membrane.
 - b. Submit resumes or qualifications of the Installation Supervisor, Master Seamer and Technicians to be assigned to this project.
 - c. Quality Control Program.
6. Example Material Warranty and Liner Installation Warranty complying with subsections 1.07 and 1.08 of this Section.
7. Resin Supplier's name, resin production plant identification, resin brand name and number, production date of the resin, resin Manufacturer's quality control certificates, and certification that the properties of the resin meet the requirements for the project.

C. Shop Drawings

1. Submit copies of shop drawings for engineer's approval within a reasonable time so as not to delay the start of geo-membrane installation. Shop drawings shall show the proposed panel layout identifying seams and details. Seams should generally follow the direction of the slope. Butt seams or roll-end seams should not occur on a slope unless approved by the Owner's Representative. Butt seams on a slope, if allowed, should be staggered.

2. Placement of geo-membrane will not be allowed to proceed until Owner's Representative has received and approved the shop drawings.

D. Additional Submittals (In-Progress and at Completion)

1. Manufacturer's warranty (refer to subsection 1.07).
2. Geo-membrane installation warranty (refer to subsection 1.08).
3. Daily written acceptance of subgrade surface (refer to subsection 3.01.C).
4. Low-temperature seaming procedures if applicable (refer to subsection 3.03.A).
5. Prequalification test seam samples (refer to subsection 3.05.A.6).
6. Field seam non-destructive test results (refer to subsection 3.05.B.1).
7. Field seam destructive test results (refer to subsection 3.05.C.6).
8. Daily field installation reports (refer to subsection 3.05.G).
9. Installation record drawing, as discussed in subsection 3.05.

1.04 Quality Control

A. Manufacturer's Qualifications: The manufacturer of geo-membrane of the type specified or similar product shall have at least five years experience in the manufacture of such geo-membrane. In addition, the geo-membrane manufacturer shall have manufactured at least 1,000,000 M² (10,000,000 FT²) of the specified type of geo-membrane or similar product during the last five years.

B. Installer's Qualifications

1. The Geo-membrane Installer shall be the Manufacturer, approved Manufacturer's Installer or a contractor approved by the Owner's Representative to install the geo-membrane.
2. The Geo-membrane Installer shall have at least three years experience in the installation of the specified geo-membrane or similar. The Geo-membrane Installer shall have installed at least 10 projects involving a total of 500,000 sq. meters (5,000,000 sf) of the specified type of geo-membrane or similar during the last three years.
3. Installation shall be performed under the direction of a field Installation Supervisor who shall be responsible throughout the geo-membrane installation, for geo-membrane panel layout, seaming, patching, testing, repairs, and all other activities of the Geo-membrane Installer. The Field Installation Supervisor shall have installed or supervised the installation and seaming of a minimum of 10 projects involving a total of 500,000 sq. meters (5,000,000 sf) of geo-membrane of the type specified or similar product. Field Installation Supervisor shall not be changed after work is begun unless approved by Owner.
4. Seaming shall be performed under the direction of a Master Seamer (who may also be the Field Installation Supervisor or Crew Foreman) who has seamed a minimum of 300,000 sq. meters (3,000,000 sf) of geo-membrane of the type specified or similar product, using the same type of seaming apparatus to be used in the current project. The Field Installation Supervisor and/or Master Seamer shall be present whenever seaming is performed.
5. All seaming, patching, other welding operations, and testing shall be performed by qualified technicians employed by the Geo-membrane Installer.

1.05 Delivery, Storage and Handling

A. Each roll of geo-membrane delivered to the site shall be labeled by the manufacturer. The label shall be firmly affixed and shall clearly state the manufacturer's name, product identification, material thickness, roll number, roll dimensions and roll weight.

- B. Geo-membrane shall be protected from mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions.
- C. Rolls shall be stored away from high traffic areas. Continuously and uniformly support rolls on a smooth, level prepared surface.
- D. Rolls shall not be stacked more than three high.

1.06 Project Conditions

- A. Geo-membrane should not be installed in the presence of standing water, while precipitation is occurring, during excessive winds, or when material temperatures are outside the limits specified in Section 3.03.

1.07 Material Warranty

As required by specification, or as required in GRI GM 13 (Attachment A)

1.08 Geo-membrane Installation Warranty

- A. The Geo-membrane Installer shall guarantee the geo-membrane installation against defects in the installation and workmanship for 1 year commencing with the date of final acceptance.

1.09 Geo-membrane Pre-Construction Meeting

- A. A Geo-membrane Pre-Construction Meeting shall be held at the site prior to installation of the geo-membrane. At a minimum, the meeting shall be attended by the Geo-membrane Installer, Owner, Owner's representative (Engineer and/or CQA Firm), and the Earthwork Contractor.

- B. Topics for this meeting shall include:

1. Responsibilities of each party.
2. Lines of authority and communication. Resolution of any project document ambiguity.
3. Methods for documenting, reporting and distributing documents and reports.
4. Procedures for packaging and storing archive samples.
5. Review of time schedule for all installation and testing.
6. Review of panel layout and numbering systems for panels and seams including details for marking on geo-membrane.
7. Procedures and responsibilities for preparation and submission of as-built panel and seam drawings.
8. Temperature and weather limitations. Installation procedures for adverse weather conditions. Defining acceptable subgrade, geo-membrane, or ambient moisture and temperature conditions for working during liner installation.
9. Subgrade conditions, dewatering responsibilities and subgrade maintenance plan.
10. Deployment techniques including allowable subgrade for the geo-membrane.
11. Plan for controlling expansion/contraction and wrinkling of the geo-membrane.
12. Covering of the geo-membrane and cover soil placement.
13. Measurement and payment schedules.
14. Health and safety.

- C. The meeting shall be documented by a person designated at the beginning of the meeting and minutes shall be transmitted to all parties.

PART 2 - PRODUCTS

2.01 Source Quality Control

A. Manufacturing Quality Control

1. The test methods and frequencies used by the manufacturer for quality control/quality assurance of the above geo-membrane prior to delivery, shall be in accordance with GRI GM 13, or modified as required for project specific conditions.
2. The manufacturer's geo-membrane quality control certifications, including results of quality control testing of the products, as specified in subsection 2.01.A.3 of this Section, must be supplied to the Owner's Representative to verify that the materials supplied for the project are in compliance with all product and or project specifications in this Section. The certification shall be signed by a responsible party employed by the manufacturer, such as the QA/QC Manager, Production Manager, or Technical Services Manager. Certifications shall include lot and roll numbers and corresponding shipping information.
3. The Manufacturer will provide Certification that the geo-membrane and welding rod supplied for the project have the same base resin and material properties.

2.02 Geo-membrane

- A. The geo-membrane shall consist of new, first quality products designed and manufactured specifically for the purpose of this work which shall have been satisfactorily demonstrated by prior testing to be suitable and durable for such purposes. The geo-membrane rolls shall be seamless, high density polyethylene (HDPE- Density $>0.94\text{g/cm}$) containing no plasticizers, fillers or extenders and shall be free of holes, blisters or contaminants, and leak free verified by 100% in line spark or equivalent testing. The geo-membrane shall be supplied as a continuous sheet with no factory seams in rolls. The geo-membrane will meet the property requirements as shown in Table A. (GRI GM 13)
- B. Material conformance testing by the Owner's Representative, if required, will be conducted in accordance with the project specifications.
- C. The geo-membrane seams shall meet the property requirements as shown in Table 2, (Attachment B) or as required by project specifications

PART 3 - EXECUTION

3.01 Subgrade Preparation

- A. The subgrade shall be prepared in accordance with the project specifications. The geo-membrane subgrade shall be uniform and free of all sharp or angular objects that may damage the geo-membrane prior to installation of the geo-membrane.
- B. The Geo-membrane Installer and Owner's Representative shall inspect the surface to be covered with the geo-membrane on each day's operations prior to placement of geo-membrane to verify suitability.
- C. The Geo-membrane Installer and Owner's Representative shall provide daily written acceptance for the surface to be covered by the geo-membrane in that day's operations. The surface shall be maintained in a manner, during geo-membrane installation, to ensure subgrade suitability.
- D. All subgrade damaged by construction equipment and deemed unsuitable for geo-membrane deployment shall be repaired prior to placement of the geo-membrane. All repairs shall be approved by the Owner's Representative and the Geo-membrane Installer. This damage, repair, and the responsibilities of the contractor and Geo-membrane Installer shall be defined in the preconstruction meeting.
- E. Owner shall be responsible for compaction tests per project specifications.

F. After subgrade has been jointly inspected by Owner's representative and Installer and accepted by Installer, Installer shall be responsible for damage and repair to subgrade caused by Installer's personnel.

G. After acceptance by Installer, water accumulation by rainfall or due to any actions or inactions of the Installer shall be the responsibility of the Installer. Delays caused by such events shall not be the basis for any claims by the Installer. This includes any costs associated with demobilization/remobilization due to weather or Installer actions/inactions.

3.02 Geo-membrane Placement

A. No geo-membrane shall be deployed until the applicable certifications and quality control certificates listed in subsection 1.03 of this Section are submitted to and approved by the Owner's Representative. Should geo-membrane material be deployed prior to approval by the Owner's Representative it will be at the sole risk of the Geo-membrane Installer and/or Contractor. If the material does not meet project specifications it shall be removed from the work area at no cost to the owner.

B. The geo-membrane shall be installed to the limits shown on the project drawings and essentially as shown on approved panel layout drawings.

C. No geo-membrane material shall be unrolled and deployed if the material temperatures are lower than 0 degrees C (32 degrees F) unless otherwise approved by the Owner's Representative. The specified minimum temperature for material deployment may be adjusted by the Owner's Representative based on recommendations by the manufacturer. Temperature limitations should be defined in the preconstruction meeting. Typically, only the quantity of geo-membrane that will be anchored and seamed together in one day should be deployed.

D. No vehicular traffic shall travel on the geo-membrane other than an approved low ground pressure All Terrain Vehicle or equivalent.

E. Sand bags or equivalent ballast shall be used as necessary to temporarily hold the geo-membrane material in position under the foreseeable and reasonably - expected wind conditions. Sand bag material shall be sufficiently close-knit to prevent soil fines from working through the bags and discharging on the geo-membrane.

F. Geo-membrane placement shall not be done if moisture prevents proper subgrade preparation, panel placement, or panel seaming. Moisture limitations should be defined in the preconstruction meeting.

G. Damaged panels or portions of the damaged panels which have been rejected shall be marked and their removal from the work area recorded.

H. The geo-membrane shall not be allowed to "bridge over" voids or low areas in the subgrade. In these areas, the geo-membrane shall be to allow the geo-membrane to rest in intimate contact with the subgrade.

I. Wrinkles caused by panel placement or thermal expansion should be minimized in accordance with section 1.09 B11.

J. Considerations on Site Geometry: In general, seams shall be oriented parallel to the line of the maximum slope. In corners and odd shaped geometric locations, the total length of field seams shall be minimized. Seams shall not be located at low points in the subgrade unless geometry requires seaming at such locations and if approved by the Owner's Representative.

K. Overlapping: The panels shall be overlapped prior to seaming to whatever extent is necessary to effect a good weld and allow for proper testing. In no case shall this overlap be less than 75mm (3 in.) or in accordance with manufacturer's recommendations, whichever is greater.

3.03 Seaming Procedures

- A. Cold weather installations should follow guidelines as outlined in GRI GM9.
- B. No geo-membrane material shall be seamed when liner temperatures are less than 0 degrees C (32 degrees F) unless the following conditions are complied with:
1. Seaming of the geo-membrane at material temperatures below 0 degrees C (32 degrees F) is allowed if the Geo-membrane Installer can demonstrate to the Owner's Representative, using pre-qualification test seams, that field seams comply with the project specifications, the safety of the crew is ensured, and geo-membrane material can be fabricated (i.e. pipeboots, penetrations, repairs. etc.) at sub-freezing temperatures.
 2. The Geo-membrane Installer shall submit to the Owner's Representative for approval, detailed procedures for seaming at low temperatures, possibly including the following:
 - a. Preheating of the geo-membrane
 - b. The provision of a tent or other device if necessary to prevent heat losses during seaming and rapid heat losses subsequent to seaming.
 - c. Number of test welds to determine appropriate seaming parameters
- C. No geo-membrane material shall be seamed when the sheet temperature is above 75 degrees C (170 degrees F) as measured by an infrared thermometer or surface thermocouple unless otherwise approved by the Owner's Representative. This approval will be based on recommendations by the manufacturer and on a field demonstration by the Geo-membrane Installer using prequalification test seams to demonstrate that seams comply with the specification. Surface temperature measurement is the responsibility of the Installer, using a calibrated meter, traceable to NIST standards.
- D. Seaming shall primarily be performed using automatic fusion welding equipment and techniques. Extrusion welding shall be used where fusion welding is not possible such as at pipe penetrations, patches, repairs and short (less than a roll width) runs of seams.
- E. Fishmouths or excessive wrinkles at the seam overlaps, shall be minimized and when necessary cut along the ridge of the wrinkles back into the panel so as to effect a flat overlap. The cut shall be terminated with a keyhole cut (nominal 10 mm (1/2 in) diameter hole) so as to minimize crack/tear propagation. The overlay shall subsequently be seamed. The key hole cut shall be patched with an oval or round patch of the same base geo-membrane material extending a minimum of 150 mm (6 in.) beyond the cut in all directions.

3.04 Pipe and Structure Penetration Sealing System

- A. Provide penetration sealing system as shown in the Project Drawings.
- B. Penetrations shall be constructed from the base geo-membrane material, flat stock, prefabricated boots and accessories as shown on the Project Drawings. The pre-fabricated or field fabricated assembly shall be field welded to the geo-membrane as shown on the Project Drawings so as to prevent leakage. This assembly shall be tested as outlined in section 3.05.B. Alternatively, where field non destructive testing can not be performed, attachments will be field spark tested by standard holiday leak detectors in accordance with ASTM 6365 Spark testing should be done in areas where both air pressure testing and vacuum testing are not possible.
1. Equipment for Spark testing shall be comprised of but not limited to: A hand held holiday spark tester and conductive wand that generates a high voltage.
 2. The testing activities shall be performed by the Geo-membrane Installer by placing an electrically conductive tape or wire beneath the seam prior to welding. A trial seam containing a non welded segment shall be subject to a calibration test to ensure that such a defect (non welded segment) will be identified under the planned machine settings

and procedures. Upon completion of the weld, enable the spark tester and hold approximately 25mm (1 in) above the weld moving slowly over the entire length of the weld in accordance with ASTM 6365. If there is no spark the weld is considered to be leak free.

3. A spark indicates a hole in the seam. The faulty area shall be located, repaired and retested by the Geo-membrane Installer.
4. Care should be taken if flammable gases are present in the area to be tested.
5. Owner's representative shall be given adequate notice of tests and given the opportunity to witness all tests.

3.05 Field Quality Control

The Owner's Representative shall be notified prior to all pre qualification and production welding and testing, or as agreed upon in the pre construction meeting.

A. Prequalification Test Seams

1. Test seams shall prepared and tested by the Geo-membrane Installer to verify that seaming parameters (speed, temperature and pressure of welding equipment) are adequate.
2. Test seams shall be made by each welding technician and tested in accordance with ASTM D 4437 at the beginning of each seaming period. Test seaming shall be performed under the same conditions and with the same equipment and operator combination as production seaming. The test seam shall be approximately 3.3 meters (10 feet) long for fusion welding and 1 meter (3 feet) long for extrusion welding with the seam centered lengthwise. At a minimum, tests seams should be made by each technician 1 time every 4-6 hours; additional tests may be required with changes in environmental conditions.
3. Two 25 mm (1 in) wide specimens shall be die-cut by the Geo-membrane Installer from each end of the test seam. These specimens shall be tested by the Geo-membrane Installer using a field tensiometer testing both tracks for peel strength and also for shear strength. Each specimen shall fail in the parent material and not in the weld, "Film Tear Bond"(F.T.D. failure). Seam separation equal to or greater than 10% of the track width shall be considered a failing test.
4. The minimum acceptable seam strength values to be obtained for all specimens tested are listed in Subsection 3.05.C.4 of this Section. All four specimens shall pass for the test seam to be a passing seam.
5. If a test seam fails, an additional test seam shall be immediately conducted. If the additional test seam fails, the seaming apparatus shall be rejected and not used for production seaming until the deficiencies are corrected and a successful test seam can be produced.
6. A sample from each test seam shall be labeled. The label shall indicate the date, geo-membrane temperature, number of the seaming unit, technician performing the test seam and pass or fail description. The sample shall then be given to the Owner's Representative for archiving.

B. Field Seam Non-destructive Testing

1. All field seams shall be non-destructively tested by the Geo-membrane Installer over the full seam length before the seams are covered. Each seam shall be numbered or otherwise designated. The location, date, test unit, name of tester and outcome of all non-destructive testing shall be recorded and submitted to the Owner's Representative.
2. Testing should be done as the seaming work progresses, not at the completion of all

field seaming, unless agreed to in advance by the Owner's Representative. All defects found during testing shall be numbered and marked immediately after detection. All defects found should be repaired, retested and remarked to indicate acceptable completion of the repair.

3. Non-destructive testing shall be performed using vacuum box, air pressure or spark testing equipment.

4. Non-destructive tests shall be performed by experienced technicians familiar with the specified test methods. The Geo-membrane Installer shall demonstrate to the Owner's Representative all test methods to verify the test procedures are valid.

5. Extrusion seams shall be vacuum box tested by the Geo-membrane Installer in accordance with ASTM D 4437 and ASTM D 5641 with the following equipment and procedures:

a. Equipment for testing extrusion seams shall be comprised of but not limited to: a vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft rubber gasket attached to the base, port hole or valve assembly and a vacuum gauge; a vacuum pump assembly equipped with a pressure controller and pipe connections; a rubber pressure/vacuum hose with fittings and connections; a plastic bucket; wide paint brush or mop; and a soapy solution.

b. The vacuum pump shall be charged and the tank pressure adjusted to approximately 35 kPa (5 psig).

c. The Geo-membrane Installer shall create a leak tight seal between the gasket and geomembrane interface by wetting a strip of geo-membrane approximately 0.3m (12 in) by 1.2m (48 in) (length and width of box) with a soapy solution, placing the box over the wetted area, and then compressing the box against the geo-membrane. The Geo-membrane Installer shall then close the bleed valve, open the vacuum valve, maintain initial pressure of approximately 35 kPa (5 psig) for approximately 5 seconds. The geo-membrane should be continuously examined through the viewing window for the presence of soap bubbles, indicating a leak. If no bubbles appear after 5 seconds, the area shall be considered leak free. The box shall be depressurized and moved over the next adjoining area with an appropriate overlap and the process repeated.

d. All areas where soap bubbles appear shall be marked, repaired and then retested.

e. At locations where seams cannot be non destructively tested, such as pipe penetrations, alternate nondestructive spark testing (as outlined in section 3.04.B) or equivalent should be substituted.

f. All seams that are vacuum tested shall be marked with the date tested, the name of the technician performing the test and the results of the test.

6. Double Fusion seams with an enclosed channel shall be air pressure tested by the Geo-membrane Installer in accordance with ASTM D 5820 and ASTM D 4437 and the following equipment and procedures:

a. Equipment for testing double fusion seams shall be comprised of but not limited to: an air pump equipped with a pressure gauge capable of generating and sustaining a pressure of 210 kPa (30 psig), mounted on a cushion to protect the geo-membrane; and a manometer equipped with a sharp hollow needle or other approved pressure feed device.

b. The Testing activities shall be performed by the Geo-membrane Installer. Both ends of the seam to be tested shall be sealed and a needle or other approved pressure feed device inserted into the tunnel created by the double wedge fusion weld. The air

pump shall be adjusted to a pressure of 210 kPa (30 psig), and the valve closed. Allow 2 minutes for the injected air to come to equilibrium in the channel, and sustain pressure for 5 minutes. If pressure loss does not exceed 28 kPa (4 psig) after this five minute period the seam shall be considered leak tight. Release pressure from the opposite end verifying pressure drop on needle to ensure testing of the entire seam. The needle or other approved pressure feed device shall be removed and the feed hole sealed.

c. If loss of pressure exceeds 28 kPa (4 psig) during the testing period or pressure does not stabilize, the faulty area shall be located, repaired and retested by the Geo-membrane Installer.

d. Results of the pressure testing shall be recorded on the liner at the seam tested and on a pressure testing record.

C. Destructive Field Seam Testing

1. One destructive test sample per 150 linear m (500 linear ft) seam length or another predetermined length in accordance with GRI GM 14 shall be taken by the Geo-membrane Installer from a location specified by the Owner's Representative. The Geo-membrane Installer shall not be informed in advance of the sample location. In order to obtain test results prior to completion of geomembrane installation, samples shall be cut by the Geo-membrane Installer as directed by the Owner's Representative as seaming progresses.

2. All field samples shall be marked with their sample number and seam number. The sample number, date, time, location, and seam number shall be recorded. The Geo-membrane Installer shall repair all holes in the geo-membrane resulting from obtaining the seam samples. All patches shall be vacuum box tested or spark tested. If a patch cannot be permanently installed over the test location the same day of sample collection, a temporary patch shall be tack welded or hot air welded over the opening until a permanent patch can be affixed.

3. The destructive sample size shall be 300 mm (12 in) wide by 1 m (36 in) long with the seam centered lengthwise. The sample shall be cut into three equal sections and distributed as follows: one section given to the Owner's Representative as an archive sample; one section given to the Owner's Representative for laboratory testing as specified in paragraph 5 below; and one section retained by the Geo-membrane Installer for field testing as specified in paragraph 4 below.

4. For field testing, the Geo-membrane Installer shall cut 10 identical 25 mm (1 in) wide replicate specimens from his sample. The Geo-membrane Installer shall test five specimens for seam shear strength and five for peel strength. Peel tests will be performed on both inside and outside weld tracks. To be acceptable, 4 of 5 test specimens must pass the stated criteria in section 2.02 with less than 10% separation. If 4 of 5 specimens pass, the sample qualifies for testing by the testing laboratory if required.

5. If independent seam testing is required by the specifications it shall be conducted in accordance with ASTM 5820 or ASTM D4437 or GRI GM 6.

6. Reports of the results of examinations and testing shall be prepared and submitted to the Owner's Representative.

7. For field seams, if a laboratory test fails, that shall be considered as an indicator of the possible inadequacy of the entire seamed length corresponding to the test sample. Additional destructive test portions shall then be taken by the Geo-membrane Installer at locations indicated by the Engineer, typically 3 m (10 ft) on either side of the failed

sample and laboratory seam tests shall be performed. Passing tests shall be an indicator of adequate seams. Failing tests shall be an indicator of non-adequate seams and all seams represented by the destructive test location shall be repaired with a cap-strip extrusion welded to all sides of the capped area. All cap-strip seams shall be nondestructively vacuum box tested until adequacy of the seams is achieved. Cap strip seams exceeding 50 M in length (150 FT) shall be destructively tested.

D. Identification of Defects

1. Panels and seams shall be inspected by the Installer and Owner's Representative during and after panel deployment to identify all defects, including holes, blisters, undispersed raw materials and signs of contamination by foreign matter.

E. Evaluation of Defects: Each suspect location on the liner (both in geo-membrane seam and non-seam areas) shall be non-destructively tested using one of the methods described in Section 3.05.B. Each location which fails non-destructive testing shall be marked, numbered, measured and posted on the daily "installation" drawings and subsequently repaired.

1. If a destructive sample fails the field or laboratory test, the Geo-membrane Installer shall repair the seam between the two nearest passed locations on both sides of the failed destructive sample location.

2. Defective seams, tears or holes shall be repaired by reseaming or applying a extrusion welded cap strip.

3. Reseaming may consist of either:

a. Removing the defective weld area and rewelding the parent material using the original welding equipment; or

b. Reseaming by extrusion welding along the overlap at the outside seam edge left by the fusion welding process.

4. Blisters, larger holes, and contamination by foreign matter shall be repaired by patches and/or extrusion weld beads as required. Each patch shall extend a minimum of 150 mm (6 in) beyond all edges of the defects.

5. All repairs shall be measured, located and recorded.

F. Verification of Repairs on Seams: Each repair shall be non-destructively tested using either vacuum box or spark testing methods. Tests which pass the non-destructive test shall be taken as an indication of a successful repair. Failed tests shall be reseamed and retested until a passing test results. The number, date, location, technician and test outcome of each patch shall be recorded.

G. Daily Field Installation Reports: At the beginning of each day's work, the Installer shall provide the Engineer with daily reports for all work accomplished on the previous work day. Reports shall include the following:

1. Total amount and location of geo-membrane placed;

2. Total length and location of seams completed, name of technicians doing seaming and welding unit numbers;

3. Drawings of the previous day's installed geo-membrane showing panel numbers, seam numbers and locations of non-destructive and destructive testing;

4. Results of pre-qualification test seams;

5. Results of non-destructive testing; and

6. Results of vacuum testing of repairs.

H. Destructive test results shall be reported prior to covering of liner or within 48 hours.

3.06 Liner Acceptance

- A. Geo-membrane liner will be accepted by the Owner's Representative when:
1. The entire installation is finished or an agreed upon subsection of the installation is finished.
 2. All Installer's QC documentation is completed and submitted to the owner
 3. Verification of the adequacy of all field seams and repairs and associated geo-membrane testing is complete.

3.07 Anchor Trench

- A. Construct as specified on the project drawings.

3.08 Disposal of Scrap Materials

- A. On completion of installation, the Geo-membrane Installer shall dispose of all trash and scrap material in a location approved by the Owner, remove equipment used in connection with the work herein, and shall leave the premises in a neat acceptable manner. No scrap material shall be allowed to remain on the geo-membrane surface.

PART 4 - MEASUREMENT AND PAYMENT

As per project specifications.

PART 5 - GRI GM13 SPECIFICATION

"This section shall include GRI GM13 manufacturer's specification or a revision of GRI GM13 specific to the unique project requirements and/or standards, as determined by the owner or owners agent."

See Attachment A below.



adopted - June 17, 1997

GRI Standard GM13

Standard Specification for

"Test Properties, Testing Frequency and Recommended Warrant for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes"

1. Scope

1.1 This specification covers high density polyethylene (HDPE) geomembranes with a formulated sheet density of 0.940 g/ml, or greater, in the thickness range of 0.75 mm (30 mils) to 3.0 mm (120 mils). Both smooth and textured geomembrane surfaces are included.

1.2 This specification sets forth a set of minimum physical, mechanical and chemical properties that must be met, or exceeded by the geomembrane being manufactured. In a few cases a range is specified.

1.3 In the context of quality systems and management, this specification represents manufacturing quality control (MQC).

Note 1: Manufacturing quality control represents those actions taken by a manufacturer to ensure that the product represents the stated objective and properties set forth in this specification.

1.4 This standard specification is intended to ensure good quality and performance of HDPE geomembranes in general applications, but may not be adequate for the complete specification of a specific situation. Additional tests, or more restrictive values for the tests indicated, may be necessary under conditions of a particular application.

1.5 This specification also presents a recommended warrant which is focused on the geomembrane material itself.

1.6 The recommended warrant attached to this specification does not cover installation considerations which is independent of the manufacturing of the geomembrane.

Note 2: For information on installation techniques, users of this standard are referred to the geosynthetics literature, which is abundant on the subject.

2. Referenced Documents

2.1 ASTM Standards

D 638 Test Method for Tensile Properties of Plastics
D 792 Specific Gravity (Relative Density) and Density of Plastics by Displacement
D 1004 Test Method for Initial Tear Resistance of Plastics Film and Sheeting
D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
D 1603 Test Method for Carbon Black in Olefin Plastics
D 3895 Test Method for Oxidative Induction Time of Polyolefins by Thermal Analysis
D 4218 Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
D 4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
D 5199 Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
D 5397 Procedure to Perform a Single Point Notched Constant Tensile Load - Appendix (SP-NCTL) Test
D 5596 Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
D 5721 Practice for Air-Oven Aging of Polyolefin Geomembranes
D 5885 Test method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry
D 5994 Test Method for Measuring the Core Thickness of Textured Geomembranes

2.2 GRI Standards

GM10 Specification for the Stress Crack Resistance of Geomembrane Sheet
GM 11 Accelerated Weathering of Geomembranes using a Fluorescent UVA-Condensation Exposure Device
GM 12 Measurement of the Asperity Height of Textured Geomembranes Using a Depth Gage

2.3 U. S. Environmental Protection Agency Technical Guidance Document "Quality Control Assurance and Quality Control for Waste Containment Facilities," EPA/600/R-93/182, September 1993, 305 pgs.

3. Definitions

Manufacturing Quality Control (MQC) - A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications.
ref. EPA/600/R-93/182

Manufacturing Quality Assurance (MQA) - A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract specifications for the project.
ref. EPA/600/R-93/182

Formulation, n - The mixture of a unique combination of ingredients identified by type, properties and quantity. For HDPE geomembranes a formulation is defined as the exact percentages and types of resin(s), additives and carbon black.

4. Material Classification and Formulation

4.1 This specification covers high density polyethylene geomembranes with a formulated sheet density of 0.940 g/ml, or higher.

4.2 The resin from which the geomembrane is made will generally be in the density range of 0.932g/ml or higher, and have a melt index value per ASTM D1238 of less than 1.0 g/10 min.

4.3 The resin shall be virgin material with no more than 10% rework. If rework is used, it must be of the same formulation as the parent material.

4.4 No post consumer resin (PCR) of any type shall be added to the formulation.

5. Physical, Mechanical and Chemical Property Requirements

5.1 The geomembrane shall conform to the test property requirements prescribed in Tables 1 and 2. Table 1 is for smooth HDPE geomembranes and Table 2 is for single and double sided textured HDPE geomembranes. Each of the tables are given in English and SI (metric) units. The conversion from English to SI (metric) is soft.

Note 3: There are several tests often included in other HDPE specifications which are omitted from this standard because they are outdated, irrelevant or generate

information that is not necessary to evaluate on a routine MQC basis. The following tests have been purposely omitted:

- Volatile Loss
- Dimensional Stability
- Coeff. of Linear Expansion
- Resistance to Soil Burial
- Low Temperature Impact
- ESCR Test (D 1693)
- Wide Width Tensile
- Water Vapor Transmission
- Water Absorption
- Ozone Resistance
- Modulus of Elasticity
- Hydrostatic Resistance
- Tensile Impact
- Field Seam Strength
- Multi-Axial Burst
- Various Toxicity Tests

Note 4: There are several tests which are included in this standard (that are not customarily required in other HDPE specifications) because they are relevant and important in the context of current manufacturing processes. The following tests have been purposely added:

- Oxidative Induction Time
- Oven Aging
- Ultraviolet Resistance
- Asperity Height of Textured Sheet

Note 5: There are other tests in this standard, focused on a particular property, which are updated to current standards. The following are in this category:

- Thickness of Textured Sheet
- Puncture Resistance
- Stress Crack Resistance
- Carbon Black Dispersion

Note 6: There are several GRI tests currently included in this standard. Since these topics are not covered in ASTM standards, this is necessary. They are the following:

- UV Fluorescent Light Exposure
- Asperity Height Measurement

5.2 The properties of the HDPE geomembrane shall be tested at the minimum frequency shown in Tables 1 and 2. If the specific manufacturer's quality control guide is more stringent and is certified accordingly, it must be followed in like manner.

Note 7: This specification is focused on manufacturing quality control (MQC). Conformance testing and manufacturing quality assurance (MQA) testing are at the discretion of the purchaser and/or quality assurance engineer, respectively.

6. Workmanship and Appearance

6.1 Smooth geomembrane shall have good appearance qualities. It shall be free from such defects that would affect the specified properties of the geomembrane.

6.2 Textured geomembrane shall generally have uniform texturing appearance. It shall be free from agglomerated texturing material and such defects that would affect the specified properties of the geomembrane.

6.3 General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.

7. MQC Sampling

7.1 Sampling shall be in accordance with the specific test methods listed in Tables 1 and 2. If no sampling protocol is stipulated in the particular test method, then test specimens shall be taken evenly spaced across the entire roll width.

7.2 The number of tests shall be in accordance with the appropriate test methods listed in Tables 1 and 2.

7.3 The average of the test results should be calculated per the particular standard cited and compared to the minimum value listed in these tables, hence the values listed are the minimum average values and are designated as "min. ave."

8. MQC Retest and Rejection

8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer's quality manual.

9. Packaging and Marketing

9.1 The geomembrane shall be rolled onto a substantial core or core segments and held firm by dedicated straps/slings, or other suitable means. The rolls must be adequate for safe transportation to the point of delivery, unless otherwise specified in the contract or order.

10. Certification

10.1 Upon request of the purchaser in the contract or order, a manufacturer's certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished at the time of shipment.

11. Warranty

11.1 Upon request of the purchaser in the contract or order, a manufacturer's warrant of the quality of the material shall be furnished at the completion of the terms of the contract.

11.2 A recommended warrant for smooth and textured HDPE geomembranes manufactured and tested in accordance with this specification is given in Appendix A.

11.3 The warrant in Appendix A is for the geomembrane itself. It does not cover subgrade preparation, installation, seaming, or backfilling. These are separate operations that are often beyond the control, or sphere of influence, of the geomembrane manufacturer.

Note 8: If a warrant is required for installation, it is to be developed between the installation contractor and the party requesting such a document.

Table 1(a) - High Density Polyethylene (HDPE) Geomembrane - Smooth
ENGLISH UNITS

Test	Property				Test	Test	
Value					Testing	Method	
					Frequency		
mils	50 mils	60 mils	80 mils	100 mils	120 mils	30 mils	40
Thickness, (min. ave.)					D 5199	(minimum)	nom.
nom.	nom.	nom.	nom.	nom.	per roll	(mil)	nom.
(mil)	(mil)	(mil)	(mil)	(mil)	(mil)		
lowest individual of 10 values						-10%	-10%
-10%	-10%	-10%	-10%	-10%			
Density (min.)					D 1505/	0.940	
0.940	0.940	0.940	0.940	0.940	0.940	200,000 lb	
					D792	g/cc	g/cc
g/cc	g/cc	g/cc	g/cc	g/cc			
Tensile Properties (1) (min. ave.)					D 638		
20,000 lb					Type IV		
yield stress						63	84
105	126	168	210	252			
lb/in.	lb/in.	lb/in.	lb/in.	lb/in.	lb/in.	lb/in.	
break stress						114	152
190	228	304	380	456			
lb/in.	lb/in.	lb/in.	lb/in.	lb/in.	lb/in.	lb/in.	
yield elongation						12%	12%
12%	12%	12%	12%	12%			
break elongation						700%	700%
700%	700%	700%	700%	700%			
Tear Resistance (min. ave.)					D 1004	21 lb	28
lb	35 lb	42 lb	56 lb	70 lb	84 lb	45,000 lb	
Puncture Resistance (min. ave.)					D 4833	54 lb	72
lb	90 lb	108 lb	144 lb	180 lb	216 lb	45,000 lb	

Stress Crack Resistance (2)					D 5397	200 hr.	200
hr.	200 hr.	200 hr.	200 hr.	200 hr.	200 hr.	per GRI-GM10	
					(App.)		
Carbon Black Content (range)					D 1603	2.0 -	2.0
-	2.0 -	2.0 -	2.0 -	2.0 -	2.0 -	20,000 lb	
					(3)	3.0%	3.0%
3.0%	3.0%	3.0%	3.0%	3.0%			
Carbon Black Dispersion					D 5596	note (4)	note
(4)	note (4)	note	note (4)	note (4)	note (4)	45,000 lb	
(4)							
Oxidative Induction Time (OIT) (min. ave.)							
200,000 lb							
(5)							
(a) Standard OIT					D 3895	100 min.	100
min.	100 min.	100 min.	100 min.	100 min.	100 min.		
		- or -					
(b) High Pressure OIT					D 5885	400 min.	400
min.	400 min.	400 min.	400 min.	400 min.	400 min.		
Oven Aging at 85deg.C (5), (6)					D 5721		
(a) Standard OIT (min. ave.) - % retained					D 3895	55%	55%
55%	55%	55%	55%	55%		per each	
after 90 days							
		- or -					
formulation							
(b) High Pressure OIT (min. ave.) - %					D 5885	80%	80%
80%	80%	80%	80%	80%			
retained after 90 days							
UV Resistance (7)					GM 11		
(a) Standard OIT (min. ave.)					D 3890	N.R. (8)	N.R.
(8)	N.R. (8)	N.R. (8)	N.R. (8)	N.R. (8)	N.R. (8)	per each	
		- or -					
formulation							
(b) High Pressure OIT (min. ave.) - %					D 5885	60%	60%
60%	60%	60%	60%	60%			
retained after 1600 hrs (9)							

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction

Yield elongation is calculated using a gage length of 33 mm
 Break elongation is calculated using a gage length of 50 mm

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(3) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.

(4) Carbon black dispersion for 10 different views:

- minimum 8 of 10 in Categories 1 or 2
- all 10 in Categories 1, 2, or 3

(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(7) The condition of the test should be 20 hr. UV cycle at 75deg.C followed by 4 hr. condensation at 60deg.C.

(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Table 1(b) - High Density Polyethylene (HDPE) Geomembrane - Smooth

SI (METRIC) UNITS								
Test	Property					Test		
						Testing		
Value						Method		
						Frequency	0.75 mm	1.00
mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm	(minimum)		
Thickness, (min. ave.)						D 5199	nom.	
nom.	nom.	nom.	nom.	nom.	nom.		per roll	
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(mm)	
lowest individual of 10 values							-10%	-
10%	-10%	-10%	-10%	-10%	-10%	-10%		
Density (min.)						D 1505/	0.940	
0.940	0.940	0.940	0.940	0.940	0.940	D792	90,000 kg	
g/ml	g/ml	g/ml	g/ml	g/ml	g/ml	g/ml	g/ml	
Tensile Properties (1) (min. ave.)						D 638		
9,000 kg						Type IV		
yield stress							11 kN/m	15
kN/m	18 kN/m	22 kN/m	29 kN/m	37 kN/m	44 kN/m		20 kN/m	27
break stress								
kN/m	33 kN/m	40 kN/m	53 kN/m	67 kN/m	80 kN/m			
yield elongation							12%	
12%	12%	12%	12%	12%	12%			
break elongation							700%	
700%	700%	700%	700%	700%	700%			
Tear Resistance (min. ave.)						D 1004	93 N	125
N	156 N	187 N	249 N	311 N	374 N		20,000 kg	
Puncture Resistance (min. ave.)						D 4833	240 N	320
N	400 N	480 N	640 N	800 N	960 N		20,000 kg	
Stress Crack Resistance (2)						D 5397	200 hr.	200
hr.	200 hr.	200 hr.	200 hr.	200 hr.	200 hr.	(App.)	per GRI-GM10	
Carbon Black Content (range)						D 1603	2.0 -	2.0
-	2.0 -	2.0 -	2.0 -	2.0 -	2.0 -		9,000 kg	

3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	(3)	3.0%
Carbon Black Dispersion						D 5596	note (4) note
(4)	note (4)	note	note (4)	note (4)	note (4)		20,000 kg

(4)
Oxidative Induction Time (OIT) (min. ave.)
90,000 kg

(5)						D 3895	100 min.	100
(a) Standard OIT								
min.	100 min.	100	100 min.	100 min.	100 min.			

min.

- or -

(b) High Pressure OIT						D 5885	400 min.	400
min.	400 min.	400	400 min.	400 min.	400 min.			

min.

Oven Aging at 85deg.C (5), (6)
per each

(a) Standard OIT (min. ave.) - % retained						D 3895	55%
55%	55%	55%	55%	55%		55%	formulation
after 90 days							

- or -

(b) High Pressure OIT (min. ave.) - %						D 5885	80%
80%	80%	80%	80%	80%		80%	
retained after 90 days							

UV Resistance (7)
per each

(a) Standard OIT (min. ave.)						D 3890	N.R. (8)	N.R.
(8)	N.R. (8)	N.R.	N.R. (8)	N.R. (8)	N.R. (8)		formulation	

(8)

- or -

(b) High Pressure OIT (min. ave.) - %						D 5885	60%
60%	60%	60%	60%	60%		60%	
retained after 1600 hrs (9)							

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction

Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(3) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.

(4) Carbon black dispersion for 10 different views:

- minimum 8 of 10 in Categories 1 or 2
- all 10 in Categories 1, 2, or 3

(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(7) The condition of the test should be 20 hr. UV cycle at 75deg.C followed by 4 hr. condensation at 60deg.C.

(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Table 2(a) - High Density Polyethylene (HDPE) Geomembrane - Textured

ENGLISH UNITS									
Test	Property					Test Testing Method			
Value						Frequency	30 mils	40	
mils	50 mils	60 mils	80 mils	100 mils	120 mils	D 5994	(minimum)	nom.	nom.
Thickness (min. ave.)						per roll			
nom.	nom.	nom.	nom.	nom.			(-5%)	(-	
5%)	(-5%)	(-5%)	(-5%)	(-5%)	(-5%)	(-5%)			
lowest individual for 8 out of 10 values							-10%	-10%	
-10%	-10%	-10%	-10%	-10%	-10%				
lowest individual for any of the 10 values							-15%	-15%	
-15%	-15%	-15%	-15%	-15%	-15%				
Asperity Height (min. ave.)						GM 12	7 mil	7	
mil	7 mil	7 mil	7 mil	7 mil	7 mil	7 mil	per roll		
Density (min. ave.)						D 1505/	0.940		
0.940	0.940	0.940	0.940	0.940	0.940	0.940	200,000 lb		
						D792	g/cc	g/cc	
Tensile Properties (min. ave.) (1)						D 638			
20,000 lb						Type IV			
yield stress							63	84	
105	126	168	210	252					
lb/in.	lb/in.	lb/in.	lb/in.	lb/in.	lb/in.	lb/in.	lb/in.		
break stress							45	60	
75	90	120	150	180					
lb/in.	lb/in.	lb/in.	lb/in.	lb/in.	lb/in.	lb/in.	lb/in.		
yield elongation							12%	12%	
12%	12%	12%	12%	12%	12%				
break elongation							100%	100%	
100%	100%	100%	100%	100%	100%				

Tear Resistance (min. ave.)					D 1004	21 lb	28
lb	35 lb	42 lb	56 lb	70 lb	84 lb	45,000 lb	
Puncture Resistance (min. ave.)					D 4833	45 lb	60
lb	75 lb	90 lb	120 lb	150 lb	180 lb	45,000 lb	
Stress Crack Resistance (2)					D 5397	200 hr.	200
hr.	200 hr.	200 hr.	200 hr.	200 hr.	200 hr.	per GRI-GM 10	
					(App.)		
Carbon Black Content (range)					D 1603	2.0 -	2.0
-	2.0 -	2.0 -	2.0 -	2.0 -	2.0 -	20,000 lb	
					(3)	3.0%	3.0%
3.0%	3.0%	3.0%	3.0%	3.0%			
Carbon Black Dispersion					D 5596	note (4)	note
(4) note (4)	note(4)	note(4)	note(4)	note(4)	note (4)	45,000 lb	
Oxidative Induction Time (OIT) (min. ave.)							
200,000 lb							
(5)							
(a) Standard OIT					D 3895	100 min.	100
min.	100 min.	100 min.	100 min.	100 min.	100 min.		
					- or -		
(b) High Pressure OIT					D 5885	400 min.	400
min.	400 min.	400 min.	400 min.	400 min.	400 min.		
Oven Aging at 85deg.C (5), (6)					D 5721		
per each							
(a) Standard OIT (min. ave.) - % retained					D 3895	55%	55%
55%	55%	55%	55%	55%	formulation		
after 90 days							
					- or -		
(b) High Pressure OIT (min. ave.) - %					D 5885	80%	80%
80%	80%	80%	80%	80%			
retained after 90 days							
UV Resistance (7)					GM11		
per each							
(a) Standard OIT					D 3895	N.R. (8)	N.R.
(8) N.R. (8)	N.R. (8)	N.R. (8)	N.R. (8)	N.R. (8)	N.R. (8)	formulation	
					- or -		
(b) High Pressure OIT (min. ave.) - %					D 5885	60%	60%
60%	60%	60%	60%	60%			
retained after 1600 hrs (9)							

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction

Yield elongation is calculated using a gage length of 33 mm

Break elongation is calculated using a gage length of 50 mm

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(3) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.

(4) Carbon black dispersion for 10 different views:

- minimum 8 of 10 in Categories 1 or 2
- all 10 in Categories 1, 2, or 3

(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(7) The condition of the test should be 20 hr. UV cycle at 75deg.C followed by 4 hr. condensation at 60deg.C.

(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Table 2(b) - High Density Polyethylene (HDPE) Geomembrane - Textured

SI (METRIC) UNITS								
Test	Property					Test		
						Testing Method		
Value						Frequency		
mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm		0.75 mm	1.00
Thickness (min. ave.)					D 5994		(minimum)	
nom.	nom.	nom.	nom.	nom.		per roll	nom.	nom.
							(-5%)	(-
5%)	(-5%)	(-5%)	(-5%)	(-5%)	(-5%)			
lowest individual for 8 out of 10 values							-10%	-10%
-10%	-10%	-10%	-10%	-10%	-10%			
lowest individual for any of the 10							-15%	-15%
-15%	-15%	-15%	-15%	-15%	-15%			
values								
Asperity Height (min. ave.)						GM 12	0.18 mm	0.18
mm	0.18 mm	0.18 mm	0.18 mm	0.18 mm	0.18 mm		per roll	
Density (min. ave.)						D 1505/	0.940	
0.940	0.940	0.940	0.940	0.940	0.940	D792	90,000 kg	
							g/ml	g/ml
g/ml	g/ml	g/ml	g/ml	g/ml	g/ml			
Tensile Properties (min. ave.) (1)						D 638		
9,000 kg								
						Type IV		
yield stress							11 kN/m	15
kN/m	18 kN/m	22 kN/m	29 kN/m	37 kN/m	44 kN/m			
break stress							8 kN/m	11
kN/m	13 kN/m	16 kN/m	21 kN/m	26 kN/m	32 kN/m			
yield elongation							12%	12%
12%	12%	12%	12%	12%	12%			
break elongation							100%	100%
100%	100%	100%	100%	100%	100%			
Tear Resistance (min. ave.)						D 1004	93 N	125
N	156 N	187 N	249 N	311 N	374 N		20,000 kg	
Puncture Resistance (min. ave.)						D 4833	200 N	267
N	334 N	400 N	534 N	667 N	801 N		20,000 kg	

Stress Crack Resistance (2)	D 5397	200 hr.	200
hr. 200 hr. 200 hr. 200 hr. 200 hr.	200 hr.	per GRI GM10	
	(App.)		
Carbon Black Content (range)	D 1603	2.0 -	2.0
- 2.0 - 2.0 - 2.0 - 2.0 -	2.0 -	9,000 kg	
	(3)	3.0%	3.0%
3.0% 3.0% 3.0% 3.0% 3.0%	D 5596	note (4)	note
Carbon Black Dispersion	note (4)	20,000 kg	
(4) note (4) note(4) note(4) note(4)			
Oxidative Induction Time (OIT) (min. ave.)			
290,000 kg			
(5)			
(a) Standard OIT	D 3895	100 min.	100
min. 100 min. 100 min. 100 min. 100 min.	100 min.		
	- or -		
(b) High Pressure OIT	D 5885	400 min.	400
min. 400 min. 400 min. 400 min. 400 min.	400 min.		
Oven Aging at 85deg.C (5), (6)	D 5721		
per each			
(a) Standard OIT (min. ave.) - % retained	D 3895	55%	55%
55% 55% 55% 55% 55%	formulation		
after 90 days			
	- or -		
(b) High Pressure OIT (min. ave.) - %	D 5885	80%	80%
80% 80% 80% 80% 80%			
retained after 90 days			
UV Resistance (7)	GM11		
per each			
(a) Standard OIT	D 3895	N.R. (8)	N.R.
(8) N.R. (8) N.R. (8) N.R. (8) N.R. (8)	N.R. (8)	formulation	
	- or -		
(b) High Pressure OIT (min. ave.) - %	D 5885	60%	60%
60% 60% 60% 60% 60%			
retained after 1600 hrs (9)			

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction

Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(3) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.

(4) Carbon black dispersion for 10 different views:

- minimum 8 of 10 in Categories 1 or 2
- all 10 in Categories 1, 2, or 3

(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(7) The condition of the test should be 20 hr. UV cycle at 75deg.C followed by 4 hr. condensation at 60deg.C.

(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Appendix "A"

Typical HDPE Geomembrane Warranty

**Reviewed by: Donald J. Weiss, Esq.
General Council for GSI**

ABC GEOMEMBRANE COMPANY LIMITED WARRANTY

Warranty No:
Project No:
Effective Date:

PURCHASER NAME:
ADDRESS:
CITY, STATE, ZIP, COUNTRY:

PROJECT NAME:
ADDRESS/LOCATION:
CITY, STATE, ZIP, COUNTRY:
GEOMEMBRANE TYPE/DESCRIPTION:

ABC Geomembrane Company warrants each ABC geomembrane to be free from manufacturing defects (as defined by the contract's material specifications) and to be able to withstand normal weathering for a period of 5 years from the above effective date for normal use in approved applications.

This Limited Warranty does not include damages or defects in the ABC geomembrane resulting from acts of God, casualty or catastrophe including but not limited to: earthquakes, floods, piercing hail, tornadoes or force majeure. The term "normal use" as used herein does not include, among other things, the exposure of ABC geomembranes to harmful chemicals, abuse of ABC geomembranes by machinery, equipment or people; improper site preparation or covering materials, excessive pressures or stresses from any

source or improper application or installation. ABC geomembrane material warranty is intended for commercial use only and is not in effect for the consumer as defined in the Magnuson Moss Warranty or any similar federal, state, or local statutes. The parties expressly agree that the sale hereunder is for commercial or industrial use only.

Should defects or premature loss of use within the scope of the above Limited Warranty occur, ABC Geomembrane Company will, at its option, repair or replace the ABC geomembrane on a pro-rata basis at the then current price in such manner as to charge the Purchaser/User only for that portion of the warranted life which has elapsed since purchase of the material. ABC Geomembrane Company will have the right to inspect and determine the cause of any alleged defect in the ABC geomembrane and to take appropriate steps to repair or replace the ABC geomembrane if a defect exists which is covered under this warranty. This Limited Warranty extends only to ABC's geomembrane, and does not extend to the installation service of ABC Geomembrane Company or third parties.

Any claim for any alleged breach of this warranty must be made in writing, by certified mail, to the President of ABC Geomembrane within ten (10) days of becoming aware of the alleged defect. Should the required notice not be given, the defect and all warranties are waived by the Purchaser, and Purchaser shall not have any rights under this warranty. ABC Geomembrane Company shall not be obligated to perform repairs or replacements under this warranty unless and until the area to be repaired or replaced is clean, dry, and unencumbered. This includes, but is not limited to, the area made available for repair and/or replacement of ABC geomembrane to be free from all water, dirt, sludge, residuals and liquids of any kind. If after inspection it is determined that there is no claim under this Limited Warranty, Purchaser shall reimburse ABC Geomembrane Company for its costs associated with the site inspection.

In the event the exclusive remedy provided herein fails in its essential purpose, and in that event only, the Purchaser shall be entitled to a return of the purchase price for so much of the material as ABC Geomembrane Company determines to have violated the warranty provided herein. ABC Geomembrane Company shall not be liable for direct, indirect, special, consequential or incidental damages resulting from a breach of this warranty including, but not limited to, damages for loss of production, lost profits, personal injury or property damage. ABC Geomembrane Company shall not be obligated to reimburse Purchaser for any repairs, replacement, modifications or alterations made by Purchaser unless ABC Geomembrane Company specifically authorized, in writing, said repairs, replacements, modifications or alteration in advance of them having been made. ABC Geomembrane Company's liability under this warranty shall in no event exceed the replacement cost of the material sold to the Purchaser for the particular installation in which it failed.

ABC Geomembrane Company neither assumes nor authorizes any person other than the undersigned of ABC Geomembrane Company to assume for it any other or additional liability in connection with the ABC geomembrane made on the basis of the Limited Warranty. The Limited Warranty on the ABC geomembrane herein is given in lieu of all other possible material warranties, either expressed or implied, and by accepting delivery

of the material, Purchaser waives all other possible warranties, except those specifically given.

Limited Warranty is extended to the purchaser/owner and is non-transferable and non-assignable; i.e., there are no third-party beneficiaries to this warranty.

Purchaser acknowledges by acceptance that the Limited Warranty given herein is accepted in preference to any and other possible materials warranties.

ABC GEOMEMBRANE COMPANY MAKES NO WARRANTY OF ANY KIND OTHER THAN THAT GIVEN ABOVE AND HEREBY DISCLAIMS ALL WARRANTIES, BOTH EXPRESSED OR IMPLIED, OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THIS IS THE ONLY WARRANTY THAT APPLIES TO THE MATERIALS REFERRED TO HEREIN AND ABC DISCLAIMS ANY LIABILITY FOR ANY WARRANTIES GIVEN BY ANY OTHER PERSON OR ENTITY, EITHER WRITTEN OR ORAL.

ABC GEOMEMBRANE COMPANY'S WARRANTY BECOMES AN OBLIGATION OF ABC GEOMEMBRANE COMPANY TO PERFORM UNDER THE WARRANTY ONLY UPON RECEIPT OF FINAL PAYMENT.

I hereby state that I have read and understand the above and foregoing

DATE:

Limited Warranty and agree to such by signing hereunder.

PURCHASER NAME:

SIGNATURE:

TITLE:

ABC GEOMEMBRANE COMPANY:

President or Authorized Representative

Sworn before me this ----- day of ----- 199-

Appendix

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary
William L. Meyer, Director



March 29, 2001

Mr. Steve Stadleman
Manager of Environmental Operations
Novozymes North America, Inc.
PO Box 576
77 Perry Chapel Church Road
Franklinton, North Carolina 27525-0576

Dear Mr. Stadleman:

The Division of Waste Management, Solid Waste Section, has reviewed your request for approval of a Solid Waste Pilot Composting Permit off NC 56 near Perry Chapel Road in Franklin County. Your request is considered approved in accordance with the N.C. Solid Waste Management Rules, 15A NCAC 13B .1409 and subject to the following conditions:

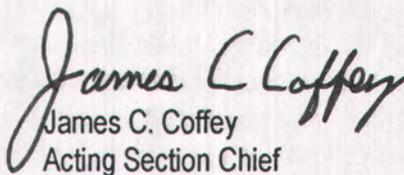
- (1) The approval period is from receipt of this letter to March 31, 2002. If an extension is needed it must be requested by March 1, 2002 with a justification for the extension.
- (2) Composting at this site shall be limited to the materials specified in the application and shall meet all the required setbacks in Section .1404 of the NC Solid Waste Compost Rules.
- (3) The site shall be prepared to control run-off and run-on. Best management practices shall be utilized for this purpose. All run-off from the site and any leachate generated shall be managed to prevent any impact to ground or surface waters.
- (4) This approval is subject to immediate revocation if activities on site result in a direct or potential threat to the public health or the environment or if significant odor problems are created. The Division of Waste Management reserves the right to apply any other requirements of 15A NCAC 13B Section .1400 as the Division deems necessary during the above approval period.
- (5) Operation of the facility and compost monitoring activities will be in accordance with the approved application and Section .1406 of the Solid Waste Management Rules. Records of temperatures shall be maintained to show pathogen reduction and vector attraction reduction requirements have been met and shall be available to representatives of the Section upon request.

1646 Mail Service Center, Raleigh, North Carolina 27699-1646
Phone: 919-733-4996 \ FAX: 919-715-3605 \ Internet: www.enr.state.nc.us

- (6) Compost testing, frequency of testing, and reporting of test results shall be in accordance with the approved application and Section .1408 of the Solid Waste Management Rules. Classification and distribution of compost shall be in accordance with Section .1407 of the Solid Waste Management Rules.
- (7) **All compost shall be tested and approved by the Solid Waste Section prior to removal from the facility for any use.**
- (8) Within 30 days of completion of the pilot project, or by May 1, 2002, which ever occurs first, submit two copies of the final report to the Solid Waste Section. The report shall include the information specified in the approved application.
- (9) Any changes or additions to this facility, subsequent to receipt of this letter shall be approved prior to the start of construction.
- (10) This approval is not transferable.
- (11) Mr. Ben Barnes, Regional Waste Management Specialist, will be responsible for oversight and inspection of the facility and related activities. Mr. Barnes can be contacted at (919) 571-4700.
- (12) **A pre-operation inspection of the facility shall occur prior to the start of composting. Ted Lyon shall be contacted to schedule the meeting.**

If you have questions concerning this approval please contact Ted Lyon, Composting and Land Application Branch Supervisor at (919) 733-0692, extension 253.

Sincerely,


James C. Coffey
Acting Section Chief

cc: Ben Barnes, Waste Management Specialist, Raleigh Regional Office

North Carolina
Department of Environment and Natural Resources

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary
Dexter R. Matthews, Interim Director



April 16, 2002

Mr. Steve Stadleman
Manager of Environmental Operations
Novozymes North America, Inc.
PO Box 576
77 Perry Chapel Church Road
Franklinton, North Carolina 27525-0576

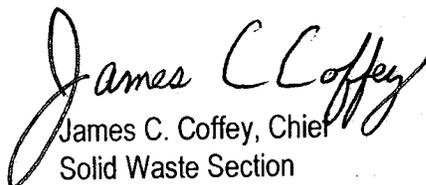
Dear Mr. Stadleman:

The Division of Waste Management, Solid Waste Section, has reviewed your request to extend your Solid Waste Pilot Composting Permit off NC 56 near Perry Chapel Road in Franklin County. Your request is considered approved in accordance with the N.C. Solid Waste Management Rules, 15A NCAC 13B .1409 and subject to the following conditions:

1. All original permit conditions remain in effect.
2. The demonstration approval shall expire April 1, 2003 and all operations shall cease after that date unless a permit to operate a solid waste management facility has been obtained.
3. Any final product produced to-date shall be tested for pathogens, metals, and foreign matter in accordance with the Solid Waste Compost Rules.
4. Should you choose to apply for a permit to operate this facility the application should be submitted at least 90 days prior to this approval expiring.

If you have questions concerning this approval please contact Ted Lyon, Composting and Land Application Branch Supervisor at (919) 733-0692, extension 253.

Sincerely,


James C. Coffey, Chief
Solid Waste Section

cc: Ben Barnes, Waste Management Specialist, Raleigh Regional Office

h:\clalcompost\demolapproval\35-franklin\Novo-03-01 reissue

North Carolina
Department of Environment and Natural Resources



Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary
Dexter R. Matthews, Director

March 21, 2003

Steve
Mr. Lee Yarborough
Novozymes, NA, Inc.
P.O. Box 576
Franklinton, North Carolina 27525-0576

Re: Yard Waste Notification - YWN-35-002 - Novozymes, NA, Inc. - Old Smith Farm Road - Franklin County

Dear Mr. Yarborough:

The Solid Waste Section has received your yard waste facility notification form. As long as your facility only processes and stores less than 6,000 cubic yards of the following materials on a quarterly basis, you can continue to operate by notifying the Section on an annual basis. If your composting activities grow in size to more than 6,000 cubic yards quarterly, please contact the Solid Waste Section for assistance in obtaining a permit.

Facilities operating under notification shall only receive:

- a. Untreated and unpainted wood waste.
- b. "Silviculture Waste" as defined in 15A NCAC 13B.0101(62); waste materials produced from the care and cultivation of forest trees, including bark and woodchips.
- c. "Yard Waste" as defined in 15A NCAC 13B .0101(65); yard trash and land clearing debris to include stumps, limbs, leaves, grass, and untreated wood.

Facilities operating under notification are required to operate in accordance with 15 NCAC 13B .1406 and .1404(a)(1)-(9).

If you have questions or if we can be of any other assistance, please do not hesitate to contact the Regional Waste Management Specialist, Ben Barnes, at 919-571-4700.

Sincerely,

Ted Lyon
Ted Lyon, Supervisor
Composting & Land Application Branch

cc: Ben Barnes, Waste Management Specialist, Raleigh Regional Office
Mark Fry, Eastern District Supervisor, Fayetteville Regional Office
Central File, Solid Waste Section

h:\cl\Compost\Yard Waste\Notifications\35-frank\NovozymesNA_03-03

North Carolina
Department of Environment and Natural Resources

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary
Dexter R. Matthews, Director



November 10, 2003

Mr. Frank Franciosi
Compost Department Manager
Novozymes North America, Inc.
PO Box 576
77 Perry Chapel Church Road
Franklinton, North Carolina 27525-0576

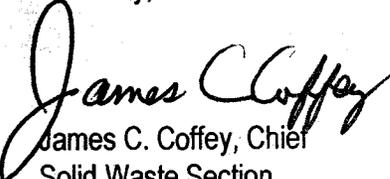
Dear Mr. Franciosi:

The Division of Waste Management, Solid Waste Section, has reviewed your request to extend your Solid Waste Pilot Composting Permit off NC 56 near Perry Chapel Road in Franklin County. Your request is considered approved in accordance with the N.C. Solid Waste Management Rules, 15A NCAC 13B .1409 and subject to the following conditions:

1. All original permit conditions remain in effect.
2. The demonstration approval shall expire April 1, 2004 and all operations shall cease after that date unless a permit to operate a solid waste management facility has been obtained.
3. Any final product produced to-date shall be tested for pathogens, metals, and foreign matter in accordance with the Solid Waste Compost Rules.
4. Should you choose to apply for a permit to operate this facility the application should be submitted at least 90 days prior to this approval expiring.

If you have questions concerning this approval please contact Ted Lyon, Composting and Land Application Branch Supervisor at (919) 733-0692, extension 253.

Sincerely,


James C. Coffey, Chief
Solid Waste Section

cc: Ben Barnes, Waste Management Specialist, Raleigh Regional Office

h:\cia\compost\demolapproval\35-franklin\Novo-ext_11-03



December 21, 2007

MR. THOMAS NAGY, PRESIDENT
NOVOZYMES NORTH AMERICA, INC.
POST OFFICE BOX 576
FRANKLINTON, NORTH CAROLINA 27575



Subject: Permit No. WQ0003487
Novozymes North America, Inc.
Novozymes Residuals Distribution and Land
Application Program
Distribution of Residual Solids (503 Exempt)
Franklin County

Dear Mr. Nagy:

In accordance with your permit renewal request received February 3, 2005, we are forwarding herewith Permit No. WQ0003487, dated December 21, 2007, to Novozymes North America, Inc. for the continued operation of the subject distribution and land application of residuals solids program.

This permit shall be effective from the date of issuance until November 30, 2012, shall void Permit No. WQ0003487 issued July 16, 2004, and shall be subject to the conditions and limitations as specified therein. Please pay particular attention to the monitoring requirements in this permit. Failure to establish an adequate system for collecting and maintaining the required operational information will result in future compliance problems.

The Novozymes North America, Inc. residuals covered by this permit are unique in the low pollutant concentrations and presumed absence of pathogens. However, please note that the residuals disposed of may not meet all the necessary requirements for "Class A residuals" and shall not be referred to as "Class A" residuals. The application for renewal of this permit received on February 3, 2005 was not received six months prior to the expiration date of April 30, 2005. Please pay particular attention to permit condition I.3 which requires the Permittee to request renewal of this permit no later than six months prior to the expiration of this permit.

This permit is being issued to approve the continued operation of the residuals distribution/land application program for another five-year cycle. Please note that on September 1, 2006 State Administrative Code 15A NCAC Subchapter 02T – Waste not Discharged to Surface Water was adopted. This permit incorporates the requirement of these rules. Remember to **take the time to review this permit thoroughly**, as some of the conditions contained therein may have been added, changed, or deleted from those in previously issued permits. Please pay particular attention to the monthly residuals monitoring requirement of Permit Condition IV.2 which is required to verify compliance with the Ceiling and Monthly Average Concentrations of residuals required by Permit Condition II.3.

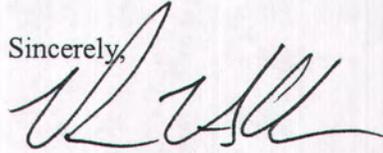


For this permit "bulk residuals" shall mean residuals that are transported and not sold or given away in a bag, bucket, bin, box, carton, vehicle, trailer, tanker, or an open or closed receptacle with a load capacity of 1.102 short tons or one metric ton or less.

If any parts, requirements, or limitations contained in this permit are unacceptable, you have the right to request an adjudicatory hearing upon written request within thirty (30) days following receipt of this permit. This request must be in the form of a written petition, conforming to Chapter 150B of the North Carolina General Statutes, and filed with the Office of Administrative Hearings, 6714 Mail Service Center, Raleigh, NC 27699-6714. Unless such demands are made this permit shall be final and binding.

If you need additional information concerning this matter, please contact Duane Leith at (919) 715-6186 or duane.leith@ncmail.net.

Sincerely,



Coleen H. Sullins

cc: Franklin County Health Department
Raleigh Regional Office, Aquifer Protection Section
Paul Crissman, Chief, Solid Waste Section
Technical Assistance and Certification Unit
APS Central Files
LAU Files

NORTH CAROLINA
ENVIRONMENTAL MANAGEMENT COMMISSION
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
RALEIGH
PERMIT FOR THE DISTRIBUTION OF RESIDUALS (503 EXEMPT)

In accordance with the provisions of Article 21 of Chapter 143, General Statutes of North Carolina as amended, and other applicable Laws, Rules, and Regulations

PERMISSION IS HEREBY GRANTED TO

Novozymes North America, Inc.
Franklin County

FOR THE

continued operation of an industrial spent biomass process residuals program and industrial wastewater residuals program for the distribution and land application of industrial process residuals for Novozymes North America, Inc. consisting of a residuals dewatering system designed to achieve a solids content of approximately 10 percent in the cake stream at a feed rate of approximately 100 gallons per minute and consisting of a sludge feed pump, a decanter centrifuge, a cake pump and system components to discharge dried cake into roll-off containers, and

continued operation of a 1.645 million gallon concrete storage tank and loading bay for the storage and loading of lime-stabilized process waste residuals consisting of one, 1.645 million gallon open top pretensioned concrete tank with a high water alarm, one, 900 GPM submersible residual loading pump, three, 30 hp submersible mixers, the upgrade of an existing sump pump to 300 GPM, a 20 foot by 70 foot concrete loading bay with spillage collection, and all other necessary pumps, valves, and appurtenances for proper operation, and

continued operation of the distribution of process residuals consisting of the distribution of approximately 41,000 dry tons per year of residuals from the sources listed in Condition II. 2., including the spent biomass generated under Permit No. WQ0002806; the

continued operation of a spent biomass storage facilities consisting of one, 292,300 gallon tank, two, 72,000 gallon SBM storage tanks, two, 700,000 gallon SBM storage tanks each with three, 20 HP mixers, two, 150 GPM spent biomass transfer pumps; the

continued operation of a lime stabilization facility consisting of two, 22,000 gallon sludge buffer tank, a 17,400 gallon lime silo, a 1,000 gallon reactor tank with a 2 HP mixer, a 7.5 HP sludge pump, a 2,321 cubic foot lime storage tank with a 60 cubic foot per hour volumetric feeder, a 5,000 gallon mixing tank; and the

continued operation of a residuals marketing and distribution center for spent biomass consisting of a 600 GPM loading pump, a truck loading station, and all other necessary pumps, valves, and appurtenances, with no discharge of wastes to the surface waters, pursuant to the permit renewal application package received on February 3, 2005 and in conformity with the project plan, specifications, and other supporting data subsequently filed and approved by the Department of Environment and Natural Resources and considered a part of this permit.

This permit shall be effective from the date of issuance until November 30, 2012, shall void Permit No. WQ0003487 issued July 16, 2004, and shall be subject to the following specified conditions and limitations:

I. SCHEDULES [please review the entire permit for reporting, monitoring, and other on-going activities]

1. No later than September 1, 2011 the Permittee shall be able to demonstrate compliance with Class A pathogen requirements and site restrictions of 15A NCAC 02T .1106 (b)(2) & (3) as stipulated in Permit Condition II.4. Pathogen requirements of 15A NCAC 02T .1106 (a), & (b)(2) shall to be met upon issuance of this permit.
2. No later than September 1, 2011 the Permittee shall be able to demonstrate compliance with vector attraction reduction requirements of 15A NCAC 02T .1107 (a) as stipulated in Permit Condition II.4.
3. No later than six months prior to the expiration of this permit, the Permittee shall request renewal of this permit on official Division forms. Upon receipt of the request, the Division will review the adequacy of the facilities described therein, and if warranted, will extend the permit for such period of time and under such conditions and limitations as it may deem appropriate. Please note that Rule 15A NCAC 02T .0105(d) requires an updated site map to be submitted with the permit renewal application

II. PERFORMANCE STANDARDS

1. The issuance of this permit shall not relieve the Permittee of the responsibility for damages to surface waters or groundwater resulting from the operation of this residuals distribution and land application program.
2. No residuals other than the following are hereby approved for distribution in accordance with this permit:

Source	Permit County	Volume Number	(Dry Tons/Year)
Novozymes North America Inc.	Franklin	WQ0003487	41,000*
Novozymes North America Inc.	Franklin	WQ0002806	*

* Combined

3. The pollutant concentrations in any residuals that are distributed or land applied to any land application site shall not shall not exceed the following **Ceiling and Monthly Average Concentrations** (i.e., dry weight basis)

Parameter	Monthly Average Concentration (mg/kg)	Ceiling Concentration (mg/kg)
Arsenic	41	75
Cadmium	39	85
Copper	1,500	4,300
Lead	300	840
Mercury	17	57
Molybdenum	n/a	75
Nickel	420	420
Selenium	100	100
Zinc	2,800	7,500

4. When residuals are distributed or land applied under the conditions of this permit, the pathogen requirements and site restrictions in 15A NCAC 02T .1106 (a) and (b), and one vector attraction reduction requirements in 15A NCAC 02T .1107 (a) shall be met. Additionally, an evaluation shall be performed that demonstrates the residuals' ability to comply with this requirement. Upon request, a copy of this evaluation, including all test results and calculations, shall be submitted. Only residuals that are identified as being exempt from this condition shall not be required to comply with the specified pathogen reduction and vector attraction reduction requirements.

5. For residuals treatment and storage facilities, the following minimum setbacks shall be maintained, except where the entities currently exist within the minimum setback or are beyond the control of the facility (all distances are in feet) :
 - i. Any habitable residence or place of public assembly under separate ownership: 100
 - ii. Any property line: 50
 - iii. Any private or public water supply source: 100
 - iv. Surface waters: 50
 - v. Any well with exception of monitoring wells: 100

6. When land applying residuals to any land application site, the following setbacks shall be maintained (all distances in feet):

Description of Setback	Setback by type of application		
	Surface Application by Vehicle	Surface Application by Irrigation	Injection / Incorporation
i. Habitable residence or place of public assembly under separate ownership or not to be maintained as part of the project site	400	400	200
ii. Habitable residence or places of public assembly owned by the permittee, the owner of the land, or the lessee/operator of the land to be maintained as part of the project site	0	200	0
iii. Property lines	50	150	50
iv. Public right of way	50	50	50
v. Private or public water supply	100	100	100
vi. Surface Waters (streams – intermittent and perennial, perennial waterbodies, and wetlands)	100	100	50
vii. Surface water diversions (ephemeral streams, waterways, ditches)	25	100	25
viii. Groundwater lowering ditches (where the bottom of the ditch intersects the SHWT)	25	100	25
ix. Subsurface groundwater lowering system	0	100	0
x. Wells with exception to monitoring wells	100	100	100
xi. Bedrock outcrops	25	25	25
xii. Top of slope of embankments or cuts of two feet or more in vertical height	15	15	15
xiii. Building foundations or basements	0	15	0
xiv. Waterlines	0	10	0
xv. Swimming pools	100	100	100
xvi. Nitrification fields	0	20	0

7. Specific residuals land application area boundaries shall be clearly marked on each land application site prior to and during a bulk residuals land application event.
8. Bulk residuals and other sources of Plant Available Nitrogen (PAN) shall be land applied to all land application sites at or below agronomic rates. Appropriate agronomic rates shall be calculated using expected nitrogen requirements based on the Realistic Yield Expectations (RYE) for each approved land application site. Realistic Yield Expectations for crop types and specific fields or soils types shall be determined by using any of the following methods:
- North Carolina Historical Data for specific crop and soil types as provided by North Carolina State University Department of Soil Science. The Department webpage is located at: <http://www.soil.ncsu.edu/nmp/ncnmwg/yields/>
 - Site Specific Historical Data for crop types on specific fields or soil types by calculating the mean of the best three yields of the last five consecutive crop harvests for each field.
 - If the RYE cannot be determined using methods 8(a) or (b) above, RYE can be established from specially developed soil interpretation records for Nutrient Management Planning, Farm Service Agency Records, university trials, or inference from crop performance on soil with very similar physical and chemical features.

- d. Realistic Yields Expectations and acceptable nitrogen application rates that use the above methodology are required parts of many agricultural planning documents. The Permittee may use the RYE and appropriate agronomic rates reported in any of the following documents:
- i. **Crop management plan** as outlined by the local Cooperative Extension Office, the North Carolina Department of Agriculture and Consumer Services, the Natural Resource Conservation Service, or other agronomist.
 - ii. **Waste Utilization Plan** as outlined by Senate Bill 1217 Interagency Group- Guidance Document: Chapter 1. Guidance for the completion of the plan can be found at: http://www.enr.state.nc.us/DSWC/pages/guidance_docs.html.
 - iii. **Certified Nutrient Management Plan** as outlined by Natural Resources Conservation Services (NRCS). These plans must meet the USDA-NRCS 590 Nutrient Management Standards, which are available at: <ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/590.pdf>
- e. For any crop type for which the RYE and appropriate nitrogen application rate cannot be determined, the Permittee shall contact the Division to determine necessary action.
9. If the land application sites are to be overseeded (e.g., bermuda grass in the summer and rye grass in the winter with BOTH crops to receive residuals), then the second crop shall receive an application of PAN at a rate of no greater than 50 pounds per acre per year. This practice shall be allowed as long as the second crop is to be harvested. If the second crop is to be planted for erosion control only and is to be tilled into the soil, then no residuals shall be land applied to these sites because the PAN will essentially be returned to the soil.
- Prior to application of PAN to permitted sites at rates exceeding the agronomic rate, the Permittee must submit and receive approval by the Division.
10. Should the residuals generated contain a high salt content (i.e., high sodium adsorption ratio (SAR) of ten (10) or higher), the Permittee shall obtain and implement recommendations from the local Cooperative Extension Office, the Department of Agriculture and Consumer Services, the Natural Resource Conservation Service, a North Carolina-licensed Soil Scientist, or other agronomist regarding sodium application rate, soil amendments (e.g., gypsum, etc.) or other ameliorative mechanism for maintaining the integrity of the site in terms of suitability for land application of residuals and maintaining conditions conducive to crop growth. The Permittee shall maintain written records of each monitoring event that includes details of the sites covered and rate of soil amendment application.
11. The COMPLIANCE BOUNDARY for residuals land application programs is specified by regulations in 15A NCAC 2L (i.e., "Groundwater Classifications and Standards"). The Compliance Boundary for each land application site is established at either 250 feet from the residuals land application area or 50 feet within the property boundary, whichever is closest to the residuals land application area. Per 15A NCAC 2T .0105(h), upon the request by the Permittee the Compliance Boundary may be located closer to the waste disposal area (provided the groundwater standards can be met at the newly established Compliance Boundary). Any approved relocation of the COMPLIANCE BOUNDARY will be noted in this permit. An exceedance of Groundwater Standards at or beyond the Compliance Boundary is subject to remediation action according to 15A NCAC 2L .0106(d)(2) as well as enforcement actions in accordance with North Carolina General Statute 143-215.6A through 143-215.6C.

12. The REVIEW BOUNDARY shall be established around each land application site midway between the Compliance Boundary and the perimeter of the residuals land application area. Any exceedance of Groundwater Quality Standards at the Review Boundary shall require action in accordance with 15A NCAC 2L .0106 (d)(1).
13. All land application of bulk residuals shall be conducted by Novozymes North America, Inc. employees or personnel contracted for this purpose by Novozymes North America, Inc. and supervised by the ORC or backup ORC as specified by permit condition III.3.
14. The bulk residuals shall be transported to the application sites by truck and shall be applied to the fields by a manure spreader appropriate for the liquid, solid or semi-solid residuals.
15. Diversion or bypassing of the untreated residuals or leachate from the residual treatment facilities is prohibited.
16. Residuals shall not be stored nor land applied in areas of intense public use, such as schools, playgrounds, etc.
17. No residuals shall be land applied in WS-1 watersheds.

III. OPERATION AND MAINTENANCE REQUIREMENTS

1. The residuals management program shall be effectively maintained and operated at all times as a non-discharge system to prevent the discharge of any wastes resulting from the operation of this program. The Permittee shall maintain an Operation and Maintenance Plan pursuant to 15A NCAC 02T .1110 including operational functions, maintenance schedules, safety measures, and a spill response plan.
2. In the event that the residuals management program is not operated satisfactorily, including the creation of nuisance conditions, the Permittee shall cease land applying residuals to the site, contact the Aquifer Protection Section of the appropriate Division of Water Quality's (Division) regional office, and take any immediate corrective actions as may be required by the Division.
3. Upon classification of the residuals management program by the Water Pollution Control System Operators Certification Commission (WPCSOCC), the Permittee shall designate a certified land application/residuals operator to be in responsible charge (ORC) of the program. The operator shall hold a certificate of the type classification assigned to the program by the WPCSOCC. The Permittee shall also designate a certified back-up operator of the appropriate type to comply with the conditions of 15A NCAC 8G .0201.
4. This permit shall become voidable if the soils of the land application sites fail to assimilate the bulk residuals or the application causes contravention of surface water or groundwater standards and may be rescinded unless the land application sites are maintained and operated in a manner that will protect the assigned water quality standards of the surface waters and groundwater.
5. A copy of this permit shall be maintained in all manned equipment at the land application sites when residuals are being land applied during the life of this permit. A spill prevention and control plan shall be maintained in all residuals transport and application vehicles.
6. Adequate provisions shall be taken to prevent wind erosion and surface runoff from conveying residuals from the land application sites onto adjacent properties or into any surface waters.

7. Adequate procedures shall be provided to prevent surface runoff from carrying any land applied or stored residuals into any surface waters.
8. All residuals shall be adequately stored to prevent leachate runoff until treated. The finished product may be placed on a concrete pad, placed under shelter or covered until such time as it is distributed to the buyer. If an alternate storage site is to be used, approval must be obtained from the Division. The finished product residuals may not be stored greater than sixty days.
9. Bulk residuals shall not be applied to the land under the following conditions:
 - a. If the residuals are likely to adversely affect a threatened or endangered species listed under section 4 of the Endangered Species or its designated critical habitat;
 - b. If the application causes prolonged nuisance conditions;
 - c. If the land fails to assimilate the bulk residuals or the application causes the contravention of surface water or groundwater standards;
 - d. If the land is flooded, frozen, or snow-covered or is otherwise in a condition such that runoff of the residuals would occur;
 - e. Within the 100-year flood elevation unless the bulk residuals are injected or incorporated within a 24-hour period following the residuals land application event;
 - f. During a measurable precipitation event (i.e., $>.01$ " per hour) or within 24 hours following a rainfall event of 0.5 inches or greater in a 24-hour period. Any emergency residuals land application measures shall first be approved in writing by the Division;
 - g. If the slope for land is greater than 10 percent when bulk liquid residuals are surface applied, and if the slope of the land is greater than 18 percent with bulk liquid residuals are injected or incorporated;
 - h. If the pH is not maintained in the soil, residuals, and lime mixture, greater than 6.0, on land application sites onto which residuals are applied. Residuals may be applied to the sites provided that sufficient amounts of lime is also applied to achieve a final pH of the soil mixture of at least 6.0, or if an agronomist provides information indicating that the pH of the soil, residuals, and lime mixture is suited for the specified crop type.
 - i. If the land does not have an established vegetative cover in accordance with the crop management plan outlined by the local Cooperative Extension Office, the Department of Agriculture and Consumer Services, the Natural Resource Conservation Service, or other agronomist unless the bulk residuals are incorporated within a 24-hour period following the residuals land application event or injected;
 - j. If the vertical separation of the seasonal high water table and the depth of residuals application is less than one foot;
 - k. If the vertical separation of the depth to bedrock and the depth of residuals application is less than one foot;
10. This permit shall become voidable unless the agreements between the Permittee and the landowners and lessees or operators of any land application sites not owned by the Permittee are in full force and effect. These agreements shall be considered expired concurrent with the expiration date of the permit and shall be renewed at the same time the permit is renewed.

11. Upon entering an agreement with landowners to apply residuals to a land application site, the Permittee shall require of the landowner or lessee/operator a statement detailing the volume of nutrient sources (waste residuals, manufactured fertilizers, manures, or other animal waste products) other than the residuals to be applied by the Permittee, that have been applied to the land, and a copy of the most recent Nutrient Management Plan (NMP), if available, for the fields within the agreement. **For the purpose of this permit condition, a Crop Management Plan (CMP), Waste Utilization Plan (WUP) or Certified Nutrient Management Plan (CNMP) shall also be considered a Nutrient Management Plan.**

The NMPs must be provided only for those operations where a NMP (also CMP, WUP, or CNMP) is required by the US Department of Agriculture – National Resources Conservation Service (NRCS) or other State Agencies. The Permittee shall rely on the provided information to calculate appropriate reductions in allowable nutrient loading rates. If the calculation shows that the agronomic rates (including PAN) have already been met or exceeded on a field, no additional residuals shall be land applied to that field.

IV. MONITORING AND REPORTING REQUIREMENTS

1. Any monitoring (i.e., including groundwater, surface water, residuals, soil, or plant tissue analyses) deemed necessary by the Division to ensure protection of the environment shall be established, and an acceptable sampling and reporting schedule shall be followed.
2. An analysis shall be conducted on the residuals monthly. The sampling conducted for this monitoring shall be conducted on the residuals at the point they are ready for land application or distribution. The results shall be maintained on file by the Permittee for a minimum of five years. The analysis shall include, but shall not necessarily be limited to, the following parameters:

Aluminum	Magnesium	pH
Ammonia-Nitrogen	Mercury	Plant Available Nitrogen (by calculation)
Arsenic	Molybdenum	Selenium
Cadmium	Nickel	Sodium
Calcium	Nitrate-Nitrite Nitrogen	% Total Solids
Copper	Phosphorus	TKN
Lead	Potassium	Zinc
Sodium Adsorption Ratio (SAR)		

If the residuals are not generated in sufficient quantity to require a distribution or land application event monthly, no sampling is required during the period of inactivity. The Permittee shall submit an annual report, as required in condition IV. 10., even in the event that no land application events occur during a month or an entire year. The annual report shall include an explanation for missing sampling data.

3. The residuals shall be monitored for compliance with Condition II. 4 at least once per month following the initiation of monitoring specified in Permit Conditions I.1 and I.2. The sampling conducted for this monitoring shall be conducted on the residuals at the point they are ready for land application or distribution. The data to verify pathogen and vector attraction reduction of the residuals shall be maintained on file by the Permittee for a minimum of five years. The required data shall be specific to the stabilization process utilized, but also shall be sufficient to demonstrate clear compliance with the Class A pathogen requirements and site restrictions in 15A NCAC 02T .1106 (a) and (b), and one vector attraction reduction requirements in 15A NCAC 02T .1107 (a) shall be met. In addition, the Environmental Protection Agency (EPA) certification statements concerning compliance with pathogen reduction requirements, vector attraction reduction requirements, and management practices shall be completed monthly by the proper authority or authorities, if more than one is involved (i.e., either the person who prepares the residuals, the person who derives the material, or the person who applies the residuals). Only residuals that are identified as being exempt from Condition II. 4. shall not be required to comply with this monitoring requirement.
4. Laboratory analyses of parameters as required by Condition IV. 1., Condition IV. 2., Condition IV. 3., and Condition IV. 4., shall be performed/gathered on the residuals as they are to be distributed or land applied.
5. Laboratory analyses of parameters as required by Condition IV. 1., Condition IV. 2., Condition IV. 3., and Condition IV. 4. shall be in accordance with 15A NCAC 02B .0505.
6. Proper records shall be maintained by the Permittee tracking all bulk residuals land application events. These records shall include, but are not necessarily limited to, the following information:
 - a. Source of residuals;
 - b. Date of land application;
 - c. Location of land application;
 - d. Method of land application;
 - e. Weather conditions (i.e., sunny, cloudy, raining, etc.);
 - f. Predominant Soil Mapping Unit (i.e., CbB2);
 - g. Soil conditions (i.e., dry, wet, frozen, etc.);
 - h. Type of crop or crops to be grown on field;
 - i. Nitrogen Application Rate based on RYEs.
 - j. Volume of residuals land applied in gallons per acre, cubic yard per acre , dry tons per acre, wet ton per acre , or kilograms per hectare;
 - k. Volume of animal waste or other nutrient source applied in gallons per acre, dry ton per acre, or kilograms per hectare (if applicable);
 - l. Volume of soil amendments (i.e., lime, gypsum, etc.) applied in gallons per acre, dry ton per acre, wet tons per acre, or kilograms per hectare (if applicable); and
 - m. Annual and cumulative totals of dry tons per acre of residuals as well as animal waste and other sources of nutrients (i.e., if applicable), annual and cumulative pounds per acre of each heavy metal (i.e., shall include, but shall not be limited to, arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc), annual pounds per acre of PAN, and annual pounds per acre of phosphorus applied to each field.
7. All records required as part of this permit shall be retained a minimum of five years.

8. Three copies of an annual report shall be submitted on or before March 1st. The annual report shall meet the requirements described in the Instructions For Residuals Application Annual Reporting Forms. The most recent instructions for reporting and annual report forms are available on the Land Application Unit website at <http://h2o.enr.state.nc.us/lau/compliance.html>, or can be obtained by contacting the Land Application Unit directly. The annual report shall be submitted to the following address:

NCDENR-DWQ
Information Processing Unit
1617 Mail Service Center
Raleigh, North Carolina 27699-1617

9. **Noncompliance Notification**

The Permittee shall report by telephone to the Raleigh Regional Office, telephone number (919) 791-4200, as soon as possible, but in no case more than 24 hours or on the next working day following the occurrence or first knowledge of the occurrence of any of the following:

- a. Any occurrence with the distribution program which results in the land application of significant amounts of wastes which are abnormal in quantity or characteristic.
- b. Any failure of the distribution program resulting in a release of material to receiving waters.
- c. Any time that self-monitoring information indicates that the facility has gone out of compliance with the conditions and limitations of this permit or the parameters on which the system was designed.
- d. Any process unit failure, due to known or unknown reasons, that render the facility incapable of adequate residual treatment.
- e. Any spillage or discharge from a vehicle or piping system during transportation of residuals.

For any emergency that requires immediate reporting (e.g., discharges to surface waters, imminent failure of a storage structure, etc.) outside normal business hours must be reported to the Division's Emergency Response personnel at telephone number (800) 662-7956, (800) 858-0368, or (919) 733-3300. Persons reporting such occurrences by telephone shall also file a written report in letter form within five (5) days following first knowledge of the occurrence. This report must outline the actions taken or proposed to be taken to ensure that the problem does not recur.

V. **INSPECTIONS**

1. Adequate inspection and maintenance shall be provided by the Permittee to ensure proper operation of the subject facilities.
2. The Permittee or his designee shall inspect the residuals storage, transport, and application facilities, at least once per month, to prevent malfunctions and deterioration, operator errors, and discharges that may cause or lead to the release of wastes to the environment, a threat to human health, or a nuisance. The Permittee shall maintain an inspection log or summary including at least the date and time of inspection, observations made, and any maintenance, repairs, or corrective actions taken by the Permittee. This log of inspections shall be maintained by the Permittee for a period of five years from the date of the inspection and shall be made available to the Division or other permitting authority, upon request.

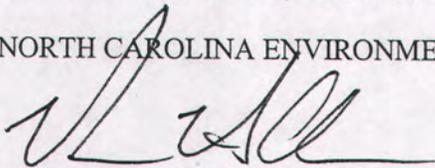
3. Any duly authorized officer, employee, or representative of the Division may, upon presentation of credentials, enter and inspect any property, premises, or place on or related to the land application sites or facilities at any reasonable time for the purpose of determining compliance with this permit; may inspect or copy any records that must be kept under the terms and conditions of this permit; and may obtain samples of groundwater, surface water, or leachate.

VI. GENERAL CONDITIONS

1. This permit shall become voidable unless the activities of the residuals management program are carried out in accordance with the conditions of this permit, the supporting materials, and in the manner approved by the Division.
2. This permit shall be effective only with respect to the nature and volume of residuals described in the application and other supporting data.
3. Failure to abide by the conditions and limitations contained in this permit may subject the Permittee to an enforcement action by the Division in accordance with North Carolina General Statutes §143-215.6A through §143-215.6C.
4. The annual administering and compliance fee shall be paid by the Permittee within 30 days after being billed by the Division. Failure to pay the fee accordingly may cause the Division to initiate action to revoke this permit, as specified by 15 NCAC 2T .0105 (e).
5. The issuance of this permit does not exempt the Permittee from complying with any and all statutes, rules, regulations, or ordinances, which may be imposed by other government agencies (local, state, and federal) that have jurisdiction. Of particular concern to the Division are applicable river buffer rules in 15A NCAC 02B .0200, erosion and sedimentation control requirements in 15A NCAC Chapter 4 and under the Division's General Permit NCG010000, and any requirements pertaining to wetlands under 15A NCAC 02B .0200 and 02H .0500.
6. This permit may be modified, revoked, and/or reissued to incorporate any conditions, limitations and monitoring requirements the Division deems necessary in order to protect the environment and public health adequately.
7. This permit shall not be automatically transferable. In the event that there is a desire for the class A residuals management program to change ownership or to change the name of the Permittee, a formal permit request shall be submitted to the Division documentation from the parties involved and other supporting materials as may be appropriate. The approval of this request shall be considered on its merits and may or may not be approved.

Permit issued this the 21st day of December, 2007.

NORTH CAROLINA ENVIRONMENTAL MANAGEMENT COMMISSION



*Coleen H. Sullins, Director
Division of Water Quality
By Authority of the Environmental Management Commission

Permit Number WQ0003487



VIEW MAPS GET DATA MY TOPOZONE WEB SERVICES ABOUT US HELP!

Download every USGS Topo Map & Aerial Photograph available here \$9.95

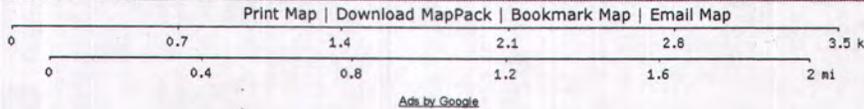
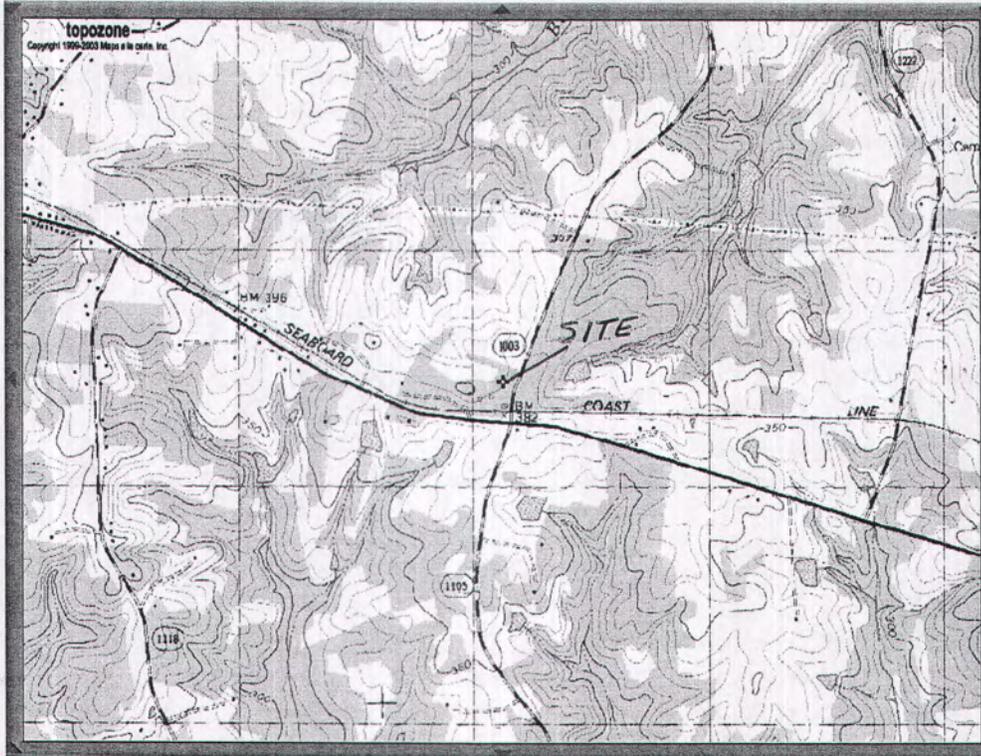
- Map and Photo Info
Download Topo Images
Download Photo Images
USGS Topo Maps
1:24K/25K Topo Maps
1:100K Topo Maps
1:250K Topo Maps
Automatic selection

- TopoZone Pro Layers
Shaded Relief
Street Maps
Aerial Photos
Black and White
Color Infrared
Map Size
Small
Medium
Large
View Scale
1:50,000

- Coordinate Format
D/M/S
Map Datum
NAD83/WGS84
Show target



USGS Franklinton (NC) Topo Map
TopoZone Pro: View Aerial Photos, Download Unlimited Topos
36° 05' 44"N, 78° 24' 37"W (NAD83/WGS84)
Aerial Images Free Aerial Maps GPS Maps Satellite Pictures Land Maps Aerial Maps



MAG
M=-9.045
G=1.527
What's this?

Create 3D With A Camera

PhotoModeler software for modeling and measuring from photos

www.photomodeler.com

Advertise on this site

TopoZone.com © 1999-2007 Demand Media, Inc. - All rights reserved.
Use of this site is governed by our Conditions and Terms of Use. We care about your privacy - please read our Privacy Statement.
demand MEDIA Sports

Ads by Google

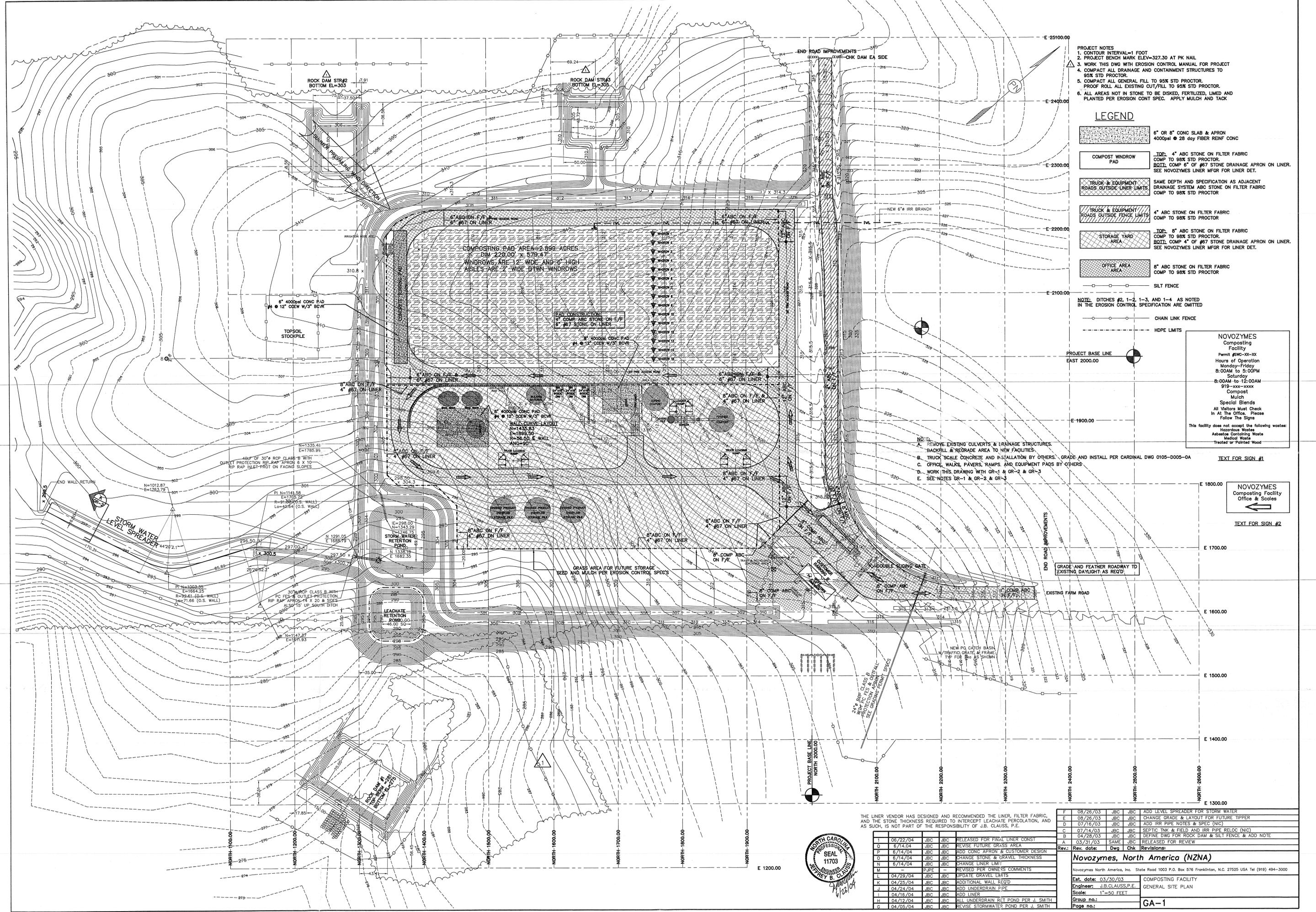
Cary/Raleigh/Ch...
School info, Relo...
Homes/Land Provi...
Triange Native
www.teamchance.com

Real Estate Aucti...
Free Online Biddi...
Homes Across U.S...
Investment Oppor...
www.WilliamsAuction.o

Commercial Real...
Find Providers of...
Commercial Real...
Listings on Busine...
www.business.com

ColdwellBanker...
Commercial
Full service comm...
brokerage Leasing...
Property Manager
www.cbnetn.com

Jacksonville NC...
Coastal North Car...
Real Estate Curre...
Listings For Sale
christnaptz.direchome



- PROJECT NOTES**
1. CONTOUR INTERVAL=1 FOOT
 2. PROJECT BENCH MARK ELEV=327.30 AT PK NAIL
 3. WORK THIS DWG WITH EROSION CONTROL MANUAL FOR PROJECT
 4. COMPACT ALL DRAINAGE AND CONTAINMENT STRUCTURES TO 95% STD PROCTOR.
 5. COMPACT ALL GENERAL FILL TO 95% STD PROCTOR. PROOF ROLL ALL EXISTING CUT/FILL TO 95% STD PROCTOR.
 6. ALL AREAS NOT IN STONE TO BE DISKED, FERTILIZED, LIMED AND PLANTED PER EROSION CONT SPEC. APPLY MULCH AND TACK

LEGEND

- 6" OR 8" CONC SLAB & APRON
4000psi @ 28 day FIBER REINF CONC
- COMPOST WINDROW PAD**
TOP: 4" ABC STONE ON FILTER FABRIC
COMP TO 98% STD PROCTOR.
BOTT: COMP 6" OF #87 STONE DRAINAGE APRON ON LINER.
SEE NOVOZYMES LINER MFGR FOR LINER DET.
- TRUCK & EQUIPMENT ROADS OUTSIDE LINER LIMITS**
SAME DEPTH AND SPECIFICATION AS ADJACENT DRAINAGE SYSTEM ABC STONE ON FILTER FABRIC COMP TO 98% STD PROCTOR
- TRUCK & EQUIPMENT ROADS OUTSIDE FENCE LIMITS**
4" ABC STONE ON FILTER FABRIC
COMP TO 98% STD PROCTOR
- STORAGE YARD AREA**
TOP: 8" ABC STONE ON FILTER FABRIC
COMP TO 98% STD PROCTOR.
BOTT: COMP 4" OF #87 STONE DRAINAGE APRON ON LINER.
SEE NOVOZYMES LINER MFGR FOR LINER DET.
- OFFICE AREA**
8" ABC STONE ON FILTER FABRIC
COMP TO 98% STD PROCTOR
- SILT FENCE
- CHAIN LINK FENCE
- HDPE LIMITS

NOTE: DITCHES #2, 1-2, 1-3, AND 1-4 AS NOTED IN THE EROSION CONTROL SPECIFICATION ARE OMITTED

NOVOZYMES
Composting Facility
Permit #6W-XX-XX
Hours of Operation
Monday-Friday
8:00AM to 5:00PM
Saturday
8:00AM to 12:00AM
9:19-xxx-xxxx
Compost
Mulch
Special Blends
All Visitors Must Check In At The Office, Please Follow The Signs
This facility does not accept the following wastes:
Hazardous Wastes
Asbestos Containing Waste
Medical Waste
Treated or Painted Wood

TEXT FOR SIGN #1

NOVOZYMES
Composting Facility
Composting & Scales
TEXT FOR SIGN #2

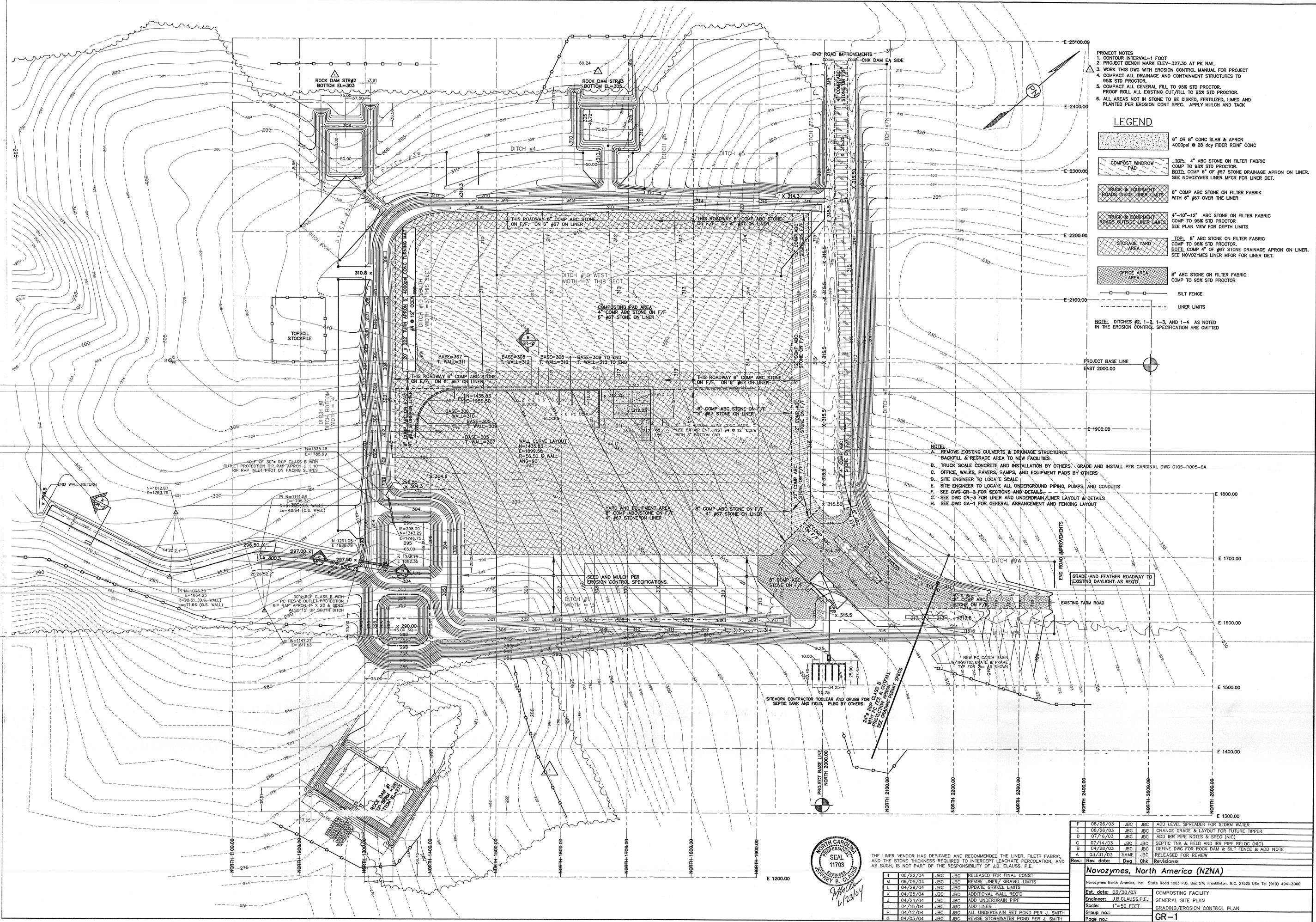
- NOTES**
- REMOVE EXISTING CULVERTS & DRAINAGE STRUCTURES. BACKFILL & REGRADE AREA TO NEW FACILITIES.
 - TRUCK SCALE CONCRETE AND INSTALLATION BY OTHERS. GRADE AND INSTALL PER CARDINAL DWG 0105-0005-0A
 - OFFICE, WALKS, PAVES, RAMPS AND EQUIPMENT PADS BY OTHERS
 - WORK THIS DRAWING WITH GR-1 & GR-2 & GR-3
 - SEE NOTES GR-1 & GR-2 & GR-3



THE LINER VENDOR HAS DESIGNED AND RECOMMENDED THE LINER, FILTER FABRIC, AND THE STONE THICKNESS REQUIRED TO INTERCEPT LEACHATE PERCOLATION, AND AS SUCH, IS NOT PART OF THE RESPONSIBILITY OF J.B. CLAUS, P.E.

Rev.	Rev. date	Dwg	Chk	Revisions
F	08/26/03	JBC	JBC	ADD LEVEL SPREADER FOR STORM WATER
E	08/26/03	JBC	JBC	CHANGE GRADE & LAYOUT FOR FUTURE TIPPER
D	07/15/03	JBC	JBC	ADD IRR PIPE NOTES & SPEC (NIC)
C	07/14/03	JBC	JBC	SEPTIC TANK & FIELD AND IRR PIPE RELOC (NIC)
B	04/28/03	JBC	JBC	DEFINE DWS FOR ROCK DAM & SILT FENCE & ADD NOTE
A	03/31/03	SAME	JBC	RELEASED FOR REVIEW

Novozymes, North America (NZNA)
Novozymes North America, Inc. State Road 1003 P.O. Box 576 Franklin, N.C. 27525 USA Tel (919) 494-3000
Est. date: 03/30/03
Engineer: J.B. CLAUS, P.E.
Scale: 1"=50 FEET
Group no.: GA-1
Page no.: 1



- PROJECT NOTES**
1. CONTOUR INTERVAL=1 FOOT
 2. PROJECT BENCH MARK ELEV=327.30 AT PK NAIL
 3. WORK THIS DWG WITH EROSION CONTROL MANUAL FOR PROJECT
 4. COMPACT ALL DRAINAGE AND CONTAINMENT STRUCTURES TO 95% STD PROCTOR.
 5. COMPACT ALL GENERAL FILL TO 95% STD PROCTOR. PROOF ROLL ALL EXISTING CUT/FILL TO 95% STD PROCTOR.
 6. ALL AREAS NOT IN STONE TO BE DISKED, FERTILIZED, LIMED AND PLANTED PER EROSION CONT SPEC. APPLY MULCH AND TACK

LEGEND

- 6" OR 8" CONC SLAB & APRON
4000psi @ 28 day FIBER REINF CONC
- COMPOST WINDOW PAD
TOP: 4" ABC STONE ON FILTER FABRIC
COMP TO 98% STD PROCTOR.
BOTT: COMP 6" OF #67 STONE DRAINAGE APRON ON LINER.
SEE NOVOTYMES LINER MFGR FOR LINER DET.
- TRUCK & EQUIPMENT ROADS (INSIDE LINER LIMITS)
6" COMP ABC STONE ON FILTER FABRIK
WITH 6" #67 OVER THE LINER
- TRUCK & EQUIPMENT ROADS (OUTSIDE LINER LIMITS)
4"-10"-12" ABC STONE ON FILTER FABRIC
COMP TO 95% STD PROCTOR
SEE PLAN VIEW FOR DEPTH LIMITS
- STORAGE YARD AREA
TOP: 8" ABC STONE ON FILTER FABRIC
COMP TO 98% STD PROCTOR.
BOTT: COMP 4" OF #67 STONE DRAINAGE APRON ON LINER.
SEE NOVOTYMES LINER MFGR FOR LINER DET.
- OFFICE AREA
8" ABC STONE ON FILTER FABRIC
COMP TO 95% STD PROCTOR
- SILT FENCE
- LINER LIMITS

NOTE: DITCHES #2, 1-2, 1-3, AND 1-4 AS NOTED IN THE EROSION CONTROL SPECIFICATION ARE OMITTED

PROJECT BASE LINE
EAST 2000.00

- NOTE:**
- REMOVE EXISTING CULVERTS & DRAINAGE STRUCTURES. BACKFILL & REGRADE AREA TO NEW FACILITIES
 - TRUCK SCALE CONCRETE AND INSTALLATION BY OTHERS. GRADE AND INSTALL PER CARDINAL DWG 0105-0005-0A
 - OFFICE, WALKS, PAVERS, RAMPS, AND EQUIPMENT PADS BY OTHERS
 - SITE ENGINEER TO LOCATE SCALE
 - SITE ENGINEER TO LOCATE ALL UNDERGROUND PIPING, PUMPS, AND CONDUITS
 - SEE DWG GR-2 FOR SECTIONS AND DETAILS
 - SEE DWG GR-3 FOR LINER AND UNDERDRAIN/LINER LAYOUT & DETAILS
 - SEE DWG GA-1 FOR GENERAL ARRANGEMENT AND FENCING LAYOUT

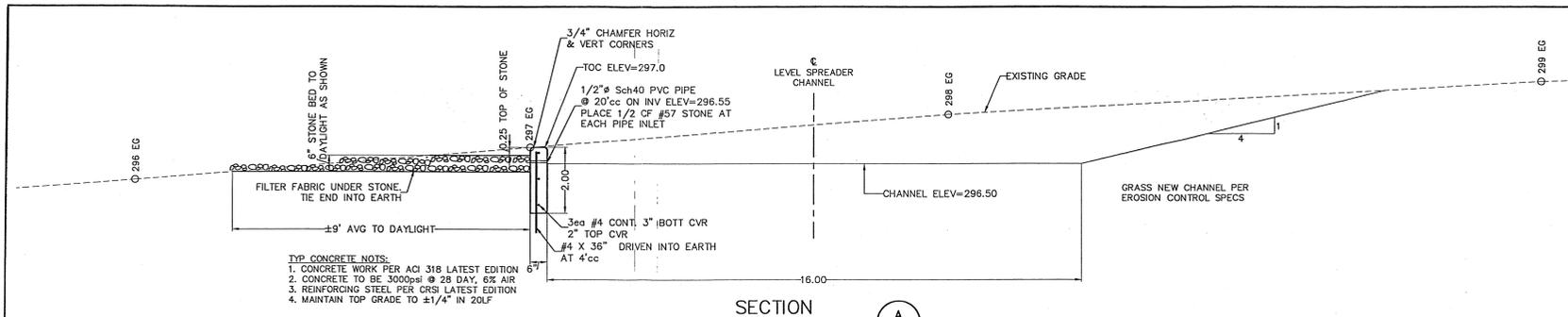


THE LINER VENDOR HAS DESIGNED AND RECOMMENDED THE LINER, FILETR FABRIC, AND THE STONE THICKNESS REQUIRED TO INTERCEPT LEACHATE PERCOLATION, AND AS SUCH, IS NOT PART OF THE RESPONSIBILITY OF J.B. CLAUSSE, P.E.

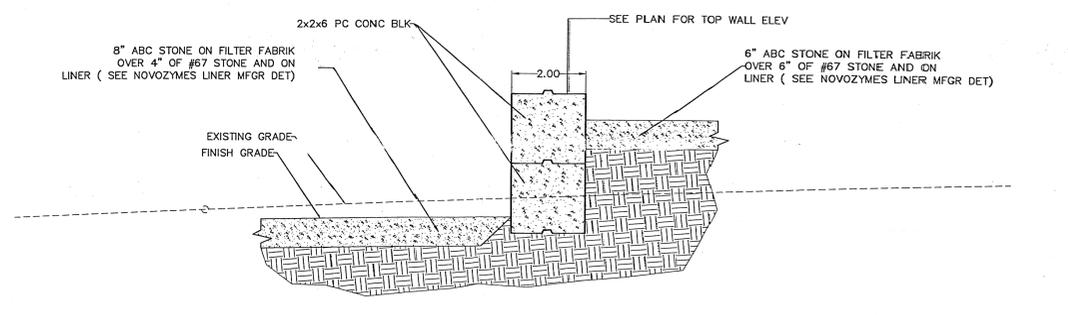
Rev.	Rev. date:	Dwg	Chk	Revisions:
1	06/22/04	JBC	JBC	RELEASED FOR FINAL CONST
M	06/05/04	JBC	JBC	REVISE LINER/ GRAVEL LIMITS
D	04/29/04	JBC	JBC	UPDATE GRAVEL LIMITS
K	04/25/04	JBC	JBC	ADDITIONAL WALL REQ'D
J	04/24/04	JBC	JBC	ADD UNDERDRAIN PIPE
I	04/16/04	JBC	JBC	ADD LINER
H	04/12/04	JBC	JBC	ALL UNDERDRAIN RET POND PER J. SMITH
G	04/05/04	JBC	JBC	REVISE STORMWATER POND PER J. SMITH

F	08/26/03	JBC	JBC	ADD LEVEL SPREADER FOR STORM WATER
E	08/26/03	JBC	JBC	CHANGE GRADE & LAYOUT FOR FUTURE TIPPER
D	07/16/03	JBC	JBC	ADD IRR PIPE NOTES & SPEC (NIC)
C	07/14/03	JBC	JBC	SEPTIC TANK & FIELD AND IRR PIPE RELOC (NIC)
B	04/28/03	JBC	JBC	DEFINE DWG FOR ROCK DAM & SILT FENCE & ADD NOTE
A	03/31/03	SAME	JBC	RELEASED FOR REVIEW

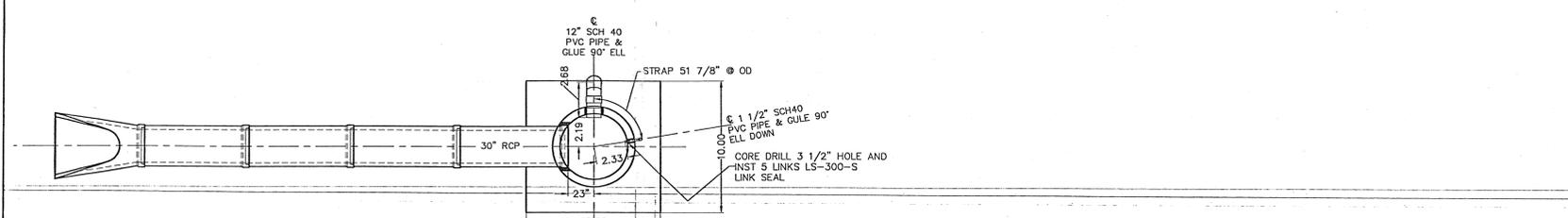
Novozymes, North America (NZNA)
 Novozymes North America, Inc. State Road 1003 P.O. Box 576 Franklinton, N.C. 27525 USA Tel (919) 494-3000
 Est. date: 03/30/03
 Engineer: J.B. CLAUSSE, P.E.
 Scale: 1"=50 FEET
 Group no.:
 Page no.: **GR-1**



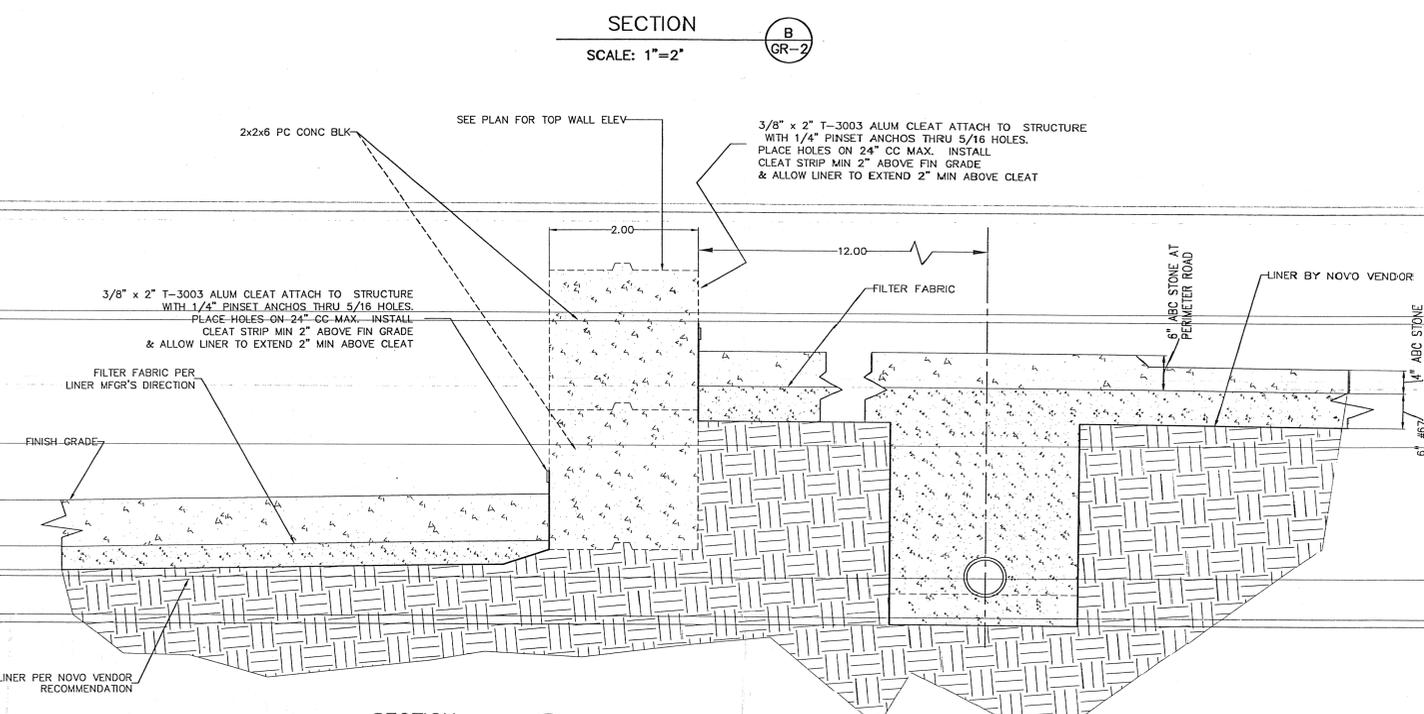
SECTION A
SCALE: 1"=2'



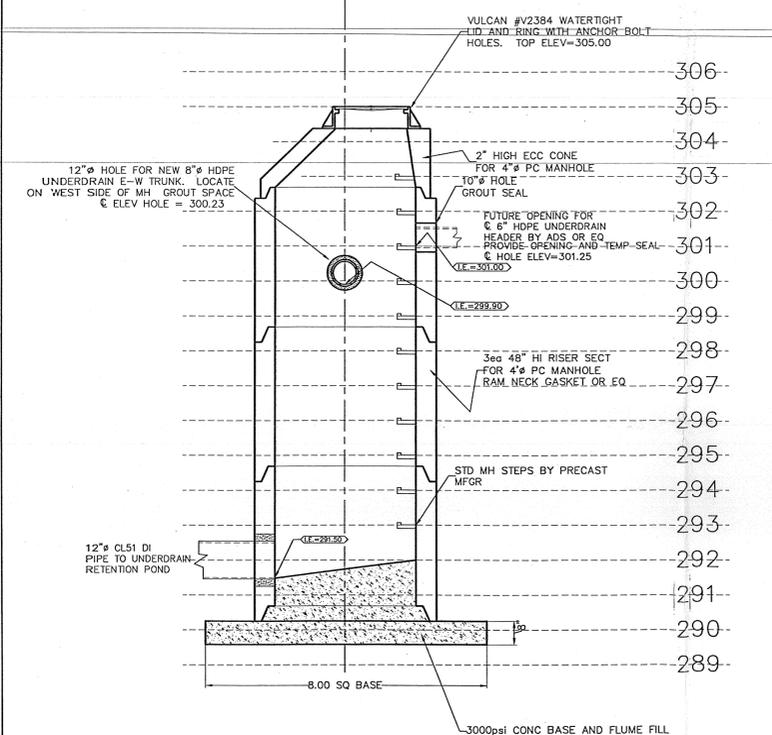
SECTION B
SCALE: 1"=2'



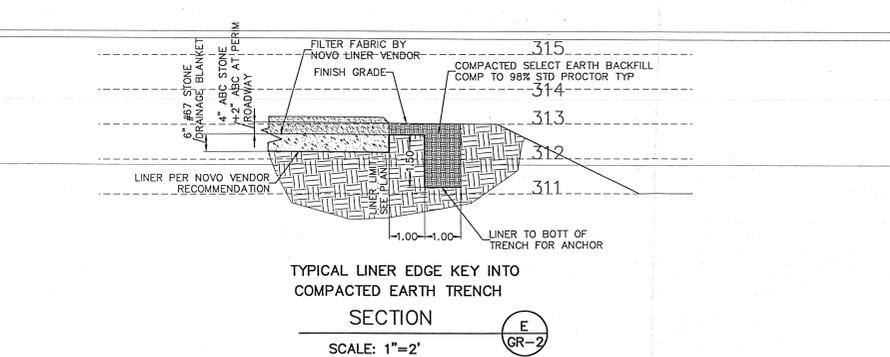
SECTION C
SCALE: 1"=5'



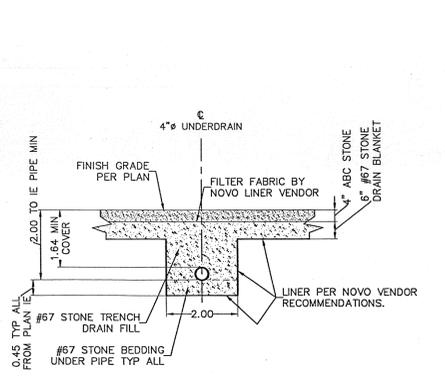
SECTION B1
SCALE: 1"=1'
LINER ATTACHMENT AT STRUCTURES



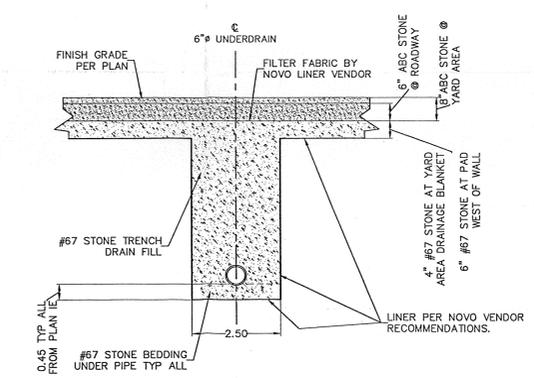
DETAIL 1
MANHOLE
SCALE: 1"=2'



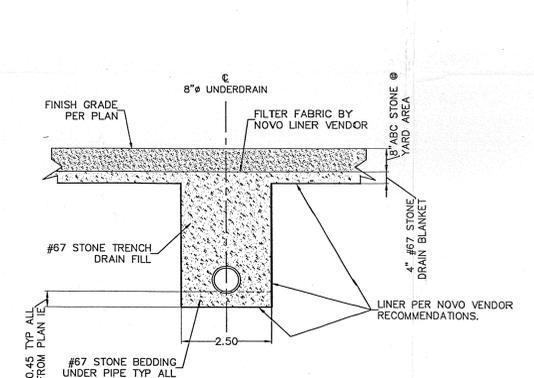
TYPICAL LINER EDGE KEY INTO
COMPACTED EARTH TRENCH
SECTION E
SCALE: 1"=2'



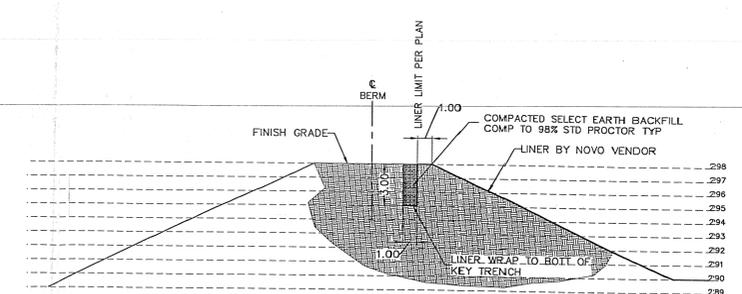
UNDERDRAIN TRENCH SECTIONS
FOR SHALLOWEST 4" Ø BRANCH PIPE
SECTION D
SCALE: 1"=2'



UNDERDRAIN TRENCH SECTIONS
FOR TYPICAL 6" Ø TRUNK PIPE
SECTION D
SCALE: 1"=2'



UNDERDRAIN TRENCH SECTIONS
FOR TYPICAL 8" Ø TRUNK PIPE
SECTION D
SCALE: 1"=2'



LINER ANCHOR KEY
AT LEACHATE RETENTION POND
SECTION F
SCALE: 1"=5'



THE LINER VENDOR HAS DESIGNED AND RECOMMENDED THE LINER, FILTER FABRIC, AND THE STONE THICKNESS REQUIRED TO INTERCEPT LEACHATE PERCOLATION, AND AS SUCH, IS NOT PART OF THE RESPONSIBILITY OF J.B. CLAUS, P.E.

Rev.	Date	By	Check	Revisions
1	06/22/04	JBC	JBC	RELEASED FOR FINAL CONSTRUCTION
A	08/27/03	SAME	JBC	RELEASED FOR BID

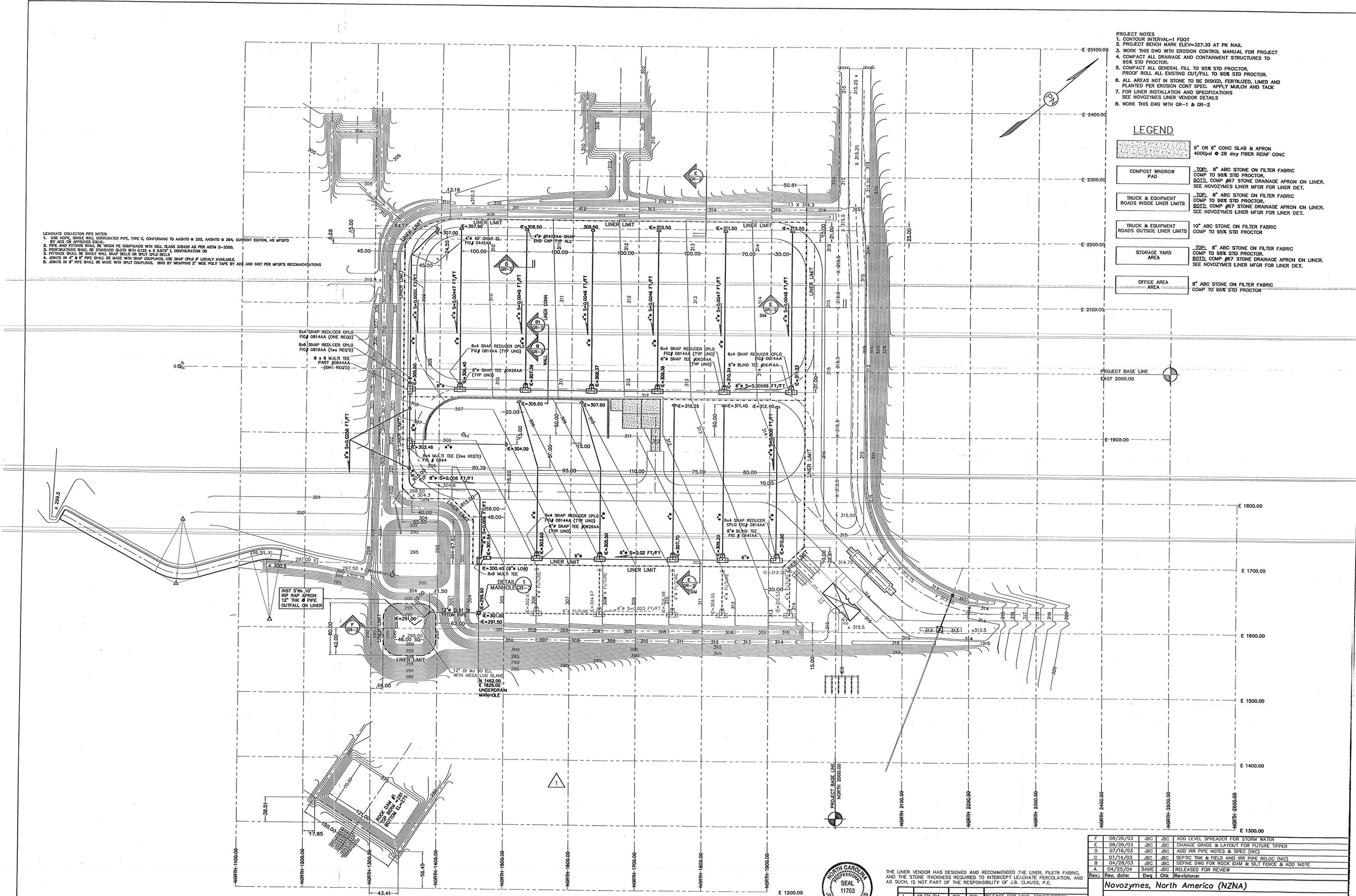
Novozymes, North America (NZNA)
 Novozymes North America, Inc. State Road 1003 P.O. Box 576 Franklinton, N.C. 27525 USA Tel (919) 496-3000
 Est. date: 08/27/03
 Engineer: J.B. CLAUS, P.E.
 Scale: AS NOTED
 Group no.:
 Page no.:
 COMPOSTING FACILITY
 GENERAL SITEWORK
 GRADING/EROSION CONTROL SECTIONS & DETAILS
 GR-2

LEACHATE COLLECTION PIPE NOTES:
 1. USE HDPE, SINGLE WALL CORRUGATED PIPE, TYPE C, CONFORMING TO AASHTO M 252, AASHTO M 294, CURRENT EDITION, AS MFG'D BY ABE OR APPROVED EQUAL.
 2. PIPE AND FITTINGS SHALL BE WRN PE COMPOUNDS WITH CELL CLASS 335420 AS PER ASTM D-3350.
 3. PERFORATIONS SHALL BE STANDARD SLOTS WITH 0.125" X 0.875" I CONFIGURATION CD.
 4. FITTINGS SHALL BE SINGLE WALL SNAP BELLS OR SPLIT CD BELLS.
 5. JOINTS IN 6" & 8" PIPE SHALL BE MADE WITH SNAP COUPLINGS, USE SNAP CPLG IF LOCALLY AVAILABLE.
 6. JOINTS IN 4" PIPE SHALL BE MADE WITH SPLIT COUPLINGS. END BY WRAPPING 2" WIDE POLY TAPE BY ABE AND INST PER MFG'S RECOMMENDATIONS.

- PROJECT NOTES
 1. CONTOUR INTERVAL=1 FOOT
 2. PROJECT BENCH MARK ELEV=327.30 AT PK NAIL
 3. WORK THIS DWG WITH EROSION CONTROL MANUAL FOR PROJECT
 4. COMPACT ALL DRAINAGE AND CONTAINMENT STRUCTURES TO 95% STD PROCTOR.
 5. COMPACT ALL GENERAL FILL TO 95% STD PROCTOR. PROOF ROLL ALL EXISTING CUT/FILL TO 95% STD PROCTOR.
 6. ALL AREAS NOT IN STONE TO BE DISKED, FERTILIZED, LIMED AND PLANTED PER EROSION CONT SPEC. APPLY MULCH AND TACK
 7. FOR LINER INSTALLATION AND SPECIFICATIONS SEE NOVOZYMES LINER VENDOR DETAILS
 8. WORK THIS DWG WITH GR-1 & GR-2

LEGEND

- 6" OR 8" CONC SLAB & APRON
4000psi @ 28 day FIBER REINF CONC
- COMPOST WINDROW PAD
TOP: 8" ABC STONE ON FILTER FABRIC
COMP TO 95% STD PROCTOR.
BOT: COMP #87 STONE DRAINAGE APRON ON LINER.
SEE NOVOZYMES LINER MFR FOR LINER DET.
- TRUCK & EQUIPMENT ROADS INSIDE LINER LIMITS
TOP: 8" ABC STONE ON FILTER FABRIC
COMP TO 95% STD PROCTOR.
BOT: COMP #87 STONE DRAINAGE APRON ON LINER.
SEE NOVOZYMES LINER MFR FOR LINER DET.
- TRUCK & EQUIPMENT ROADS OUTSIDE LINER LIMITS
TOP: 8" ABC STONE ON FILTER FABRIC
COMP TO 95% STD PROCTOR
- STORAGE YARD AREA
TOP: 8" ABC STONE ON FILTER FABRIC
COMP TO 95% STD PROCTOR.
BOT: COMP #87 STONE DRAINAGE APRON ON LINER.
SEE NOVOZYMES LINER MFR FOR LINER DET.
- OFFICE AREA AREA
8" ABC STONE ON FILTER FABRIC
COMP TO 95% STD PROCTOR



INST 5'x6' 10\"/>
 RIP RAP APRON
 12\"/>
 THK PIPE
 OUTFALL ON LINER

12\"/>
 DI MJ
 LUG GLAND
 N 1452.00
 E 1628.00
 UNDERDRAIN
 MANHOLE



THE LINER VENDOR HAS DESIGNED AND RECOMMENDED THE LINER, FILTER FABRIC, AND THE STONE THICKNESS REQUIRED TO INTERCEPT LEACHATE PERCOLATION, AND AS SUCH, IS NOT PART OF THE RESPONSIBILITY OF J.B. CLAUS, P.E.

L	06/21/04	JBC	JBC	RELEASE FOR FINAL CONSTRUCTION
L	06/05/04	JBC	JBC	CHANGE LINER
K	04/29/04	JBC	JBC	ADDITIONAL WALL REQ'D
J	04/24/04	JBC	JBC	ADD UNDERDRAIN PIPE
H	04/16/04	JBC	JBC	ADD LINER
I	04/12/04	JBC	JBC	ADD UNDERDRAIN RET POND PER J. SMITH
G	04/05/04	JBC	JBC	REVISE STORMWATER POND PER J. SMITH

F	08/26/03	JBC	JBC	ADD LEVEL SPREADER FOR STORM WATER
E	08/26/03	JBC	JBC	CHANGE GRADE & LAYOUT FOR FUTURE TIPPER
D	07/16/03	JBC	JBC	ADD IRR PIPE NOTES & SPEC (NIC)
C	07/14/03	JBC	JBC	SEPTIC TANK & FIELD AND IRR PIPE RELOC (NIC)
B	04/28/03	JBC	JBC	DEFINE DWG FOR ROCK DAM & SILT FENCE & ADD NOTE
A	04/25/04	SAME	JBC	RELEASED FOR REVIEW
Rev:	Rev. date:	Dwg	Chk	Revisons:

Novozymes, North America (NZNA)
 Novozymes North America, Inc. State Road 1003 P.O. Box 576 Franklinton, N.C. 27525 USA Tel (919) 494-3000

Est. date:	03/30/03	COMPOSTING FACILITY
Engineer:	J.B. CLAUS, P.E.	LINER AND UNDERDRAIN SYSTEM
Scale:	1"=50 FEET	PLANS AND DETAILS
Group no.:		GR-3
Page no.:		



GEDAR CREEK

WETLANDS

MONITORING WELLS

COMPOST

POLE BARN

IRRIGATION STORAGE

BARN

TRM

OLD SMITH FARM RD

HWY 56

SR 3003

SR 3002

SR 3001

NOVOZYMES NA INC

TO FRANKLINTON

TO LOUISBURG

NOVOZYMES COMPOSTING	
AERIAL MAP LEGEND	
SCALE: 1 inch = 300 feet	
ZONING - HEAVY INDUSTRIAL	ORANGE
STREAMS	BLUE
WETLANDS	BLUE
COMPOST FACILITY	GREEN
1/4 MILE RADIUS	RED
MONITORING WELLS	MW
UTILITIES	YELLOW

SOURCES: WEYERHAUSER 1994 TIMBER SURVEY
FRANKLIN COUNTY, NC SPATIAL DATA EXPLORER 2002

54-198

W 78 24.1 NCINV-94

N 36 05.1

WEYERHAUSER

3-6-94