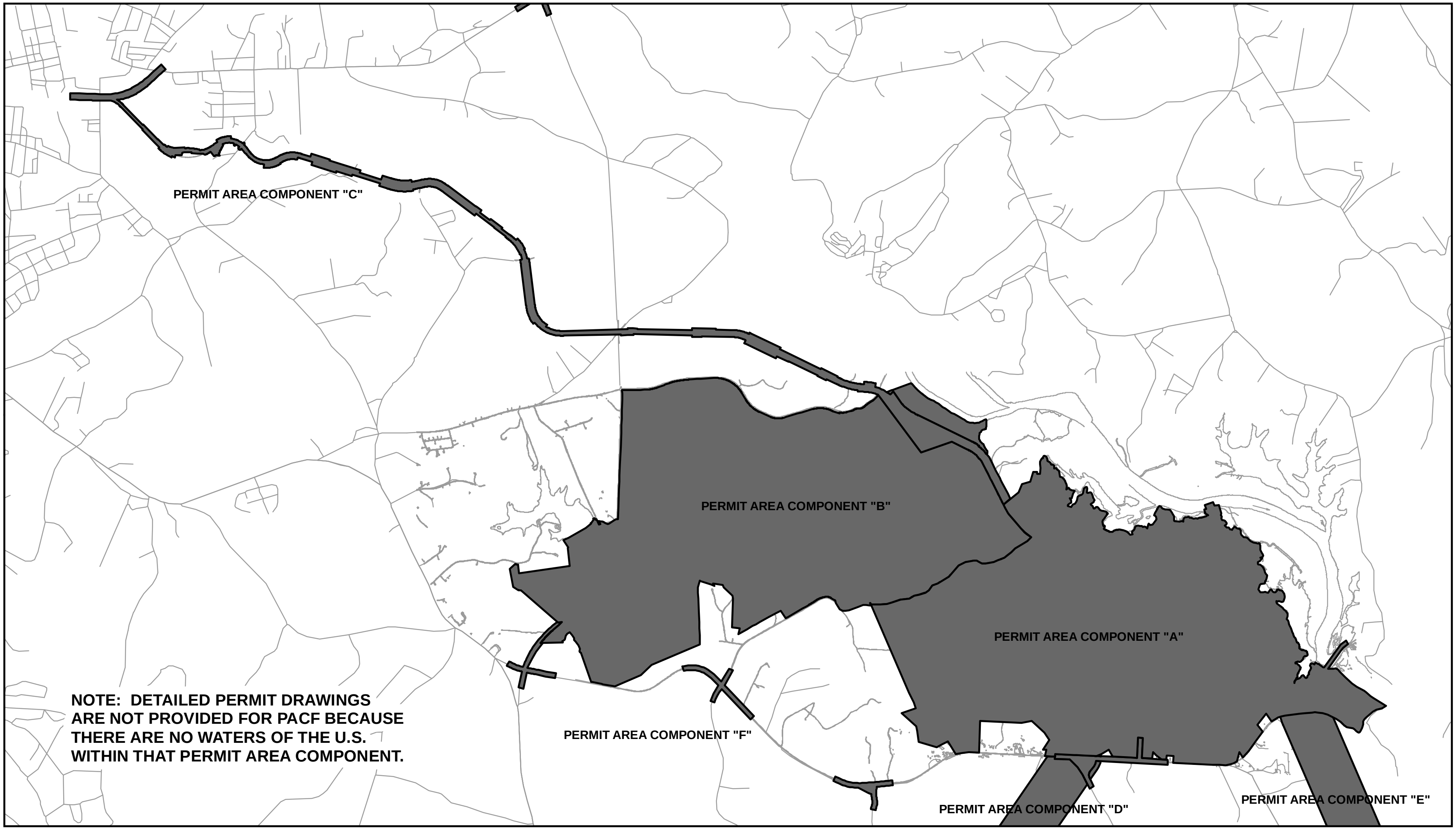


Revisions:

Applicant: Duke Energy

0 2,500 5,000 Feet

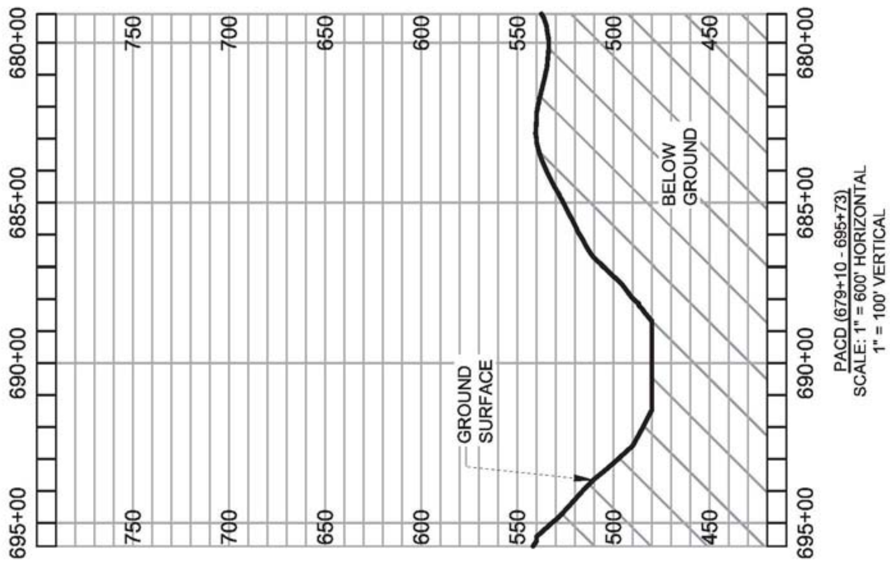
N

Project: William States Lee III Nuclear Station

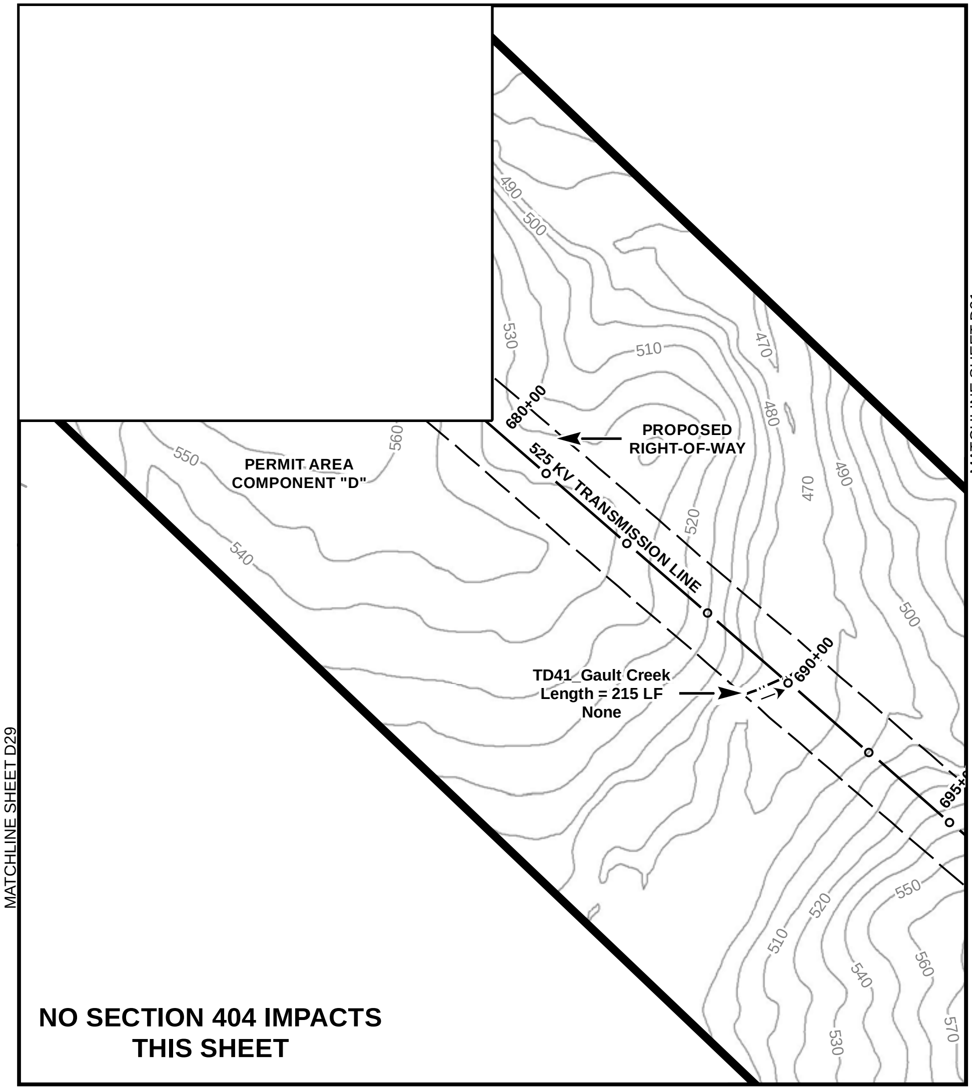
CHEROKEE COUNTY, SOUTH CAROLINA

Title: KEY MAP

Drawn By: Atkins	Scale: As Shown	KEY MAP
Job No. 100008697	Date: 11/9/2011	



MATCHLINE SHEET D29



NO SECTION 404 IMPACTS THIS SHEET

MATCHLINE SHEET D31

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	215
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy

Revisions:

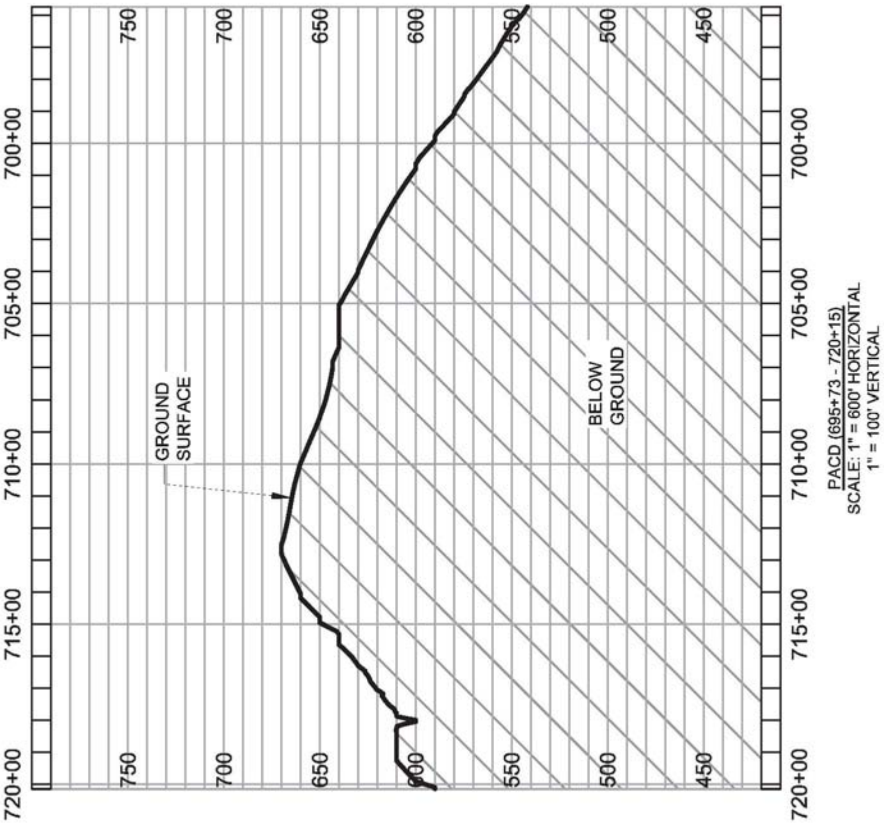
0 250 500 Feet
N

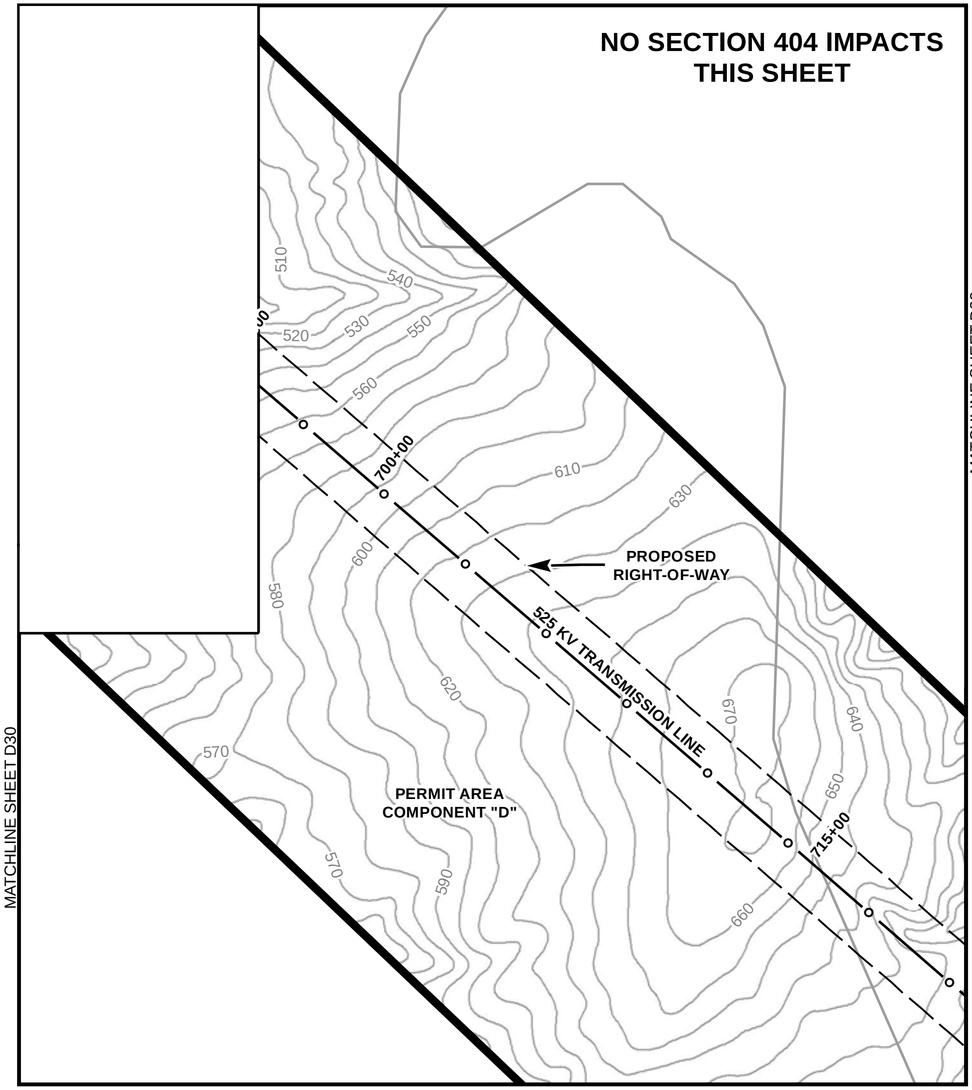
Project: William States Lee III Nuclear Station
CHEROKEE COUNTY, SOUTH CAROLINA

Title: PERMIT AREA COMPONENT "D"
OFFSITE TRANSMISSION LINE
(WEST CORRIDOR)

Drawn By: Atkins	Scale: As Shown	SHEET D30
Job No. 100008697	Date: 11/9/2011	

MATCHLINE SHEET D30





MATCHLINE SHEET D30

MATCHLINE SHEET D32

MATCHLINE SHEET D32

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	---
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy

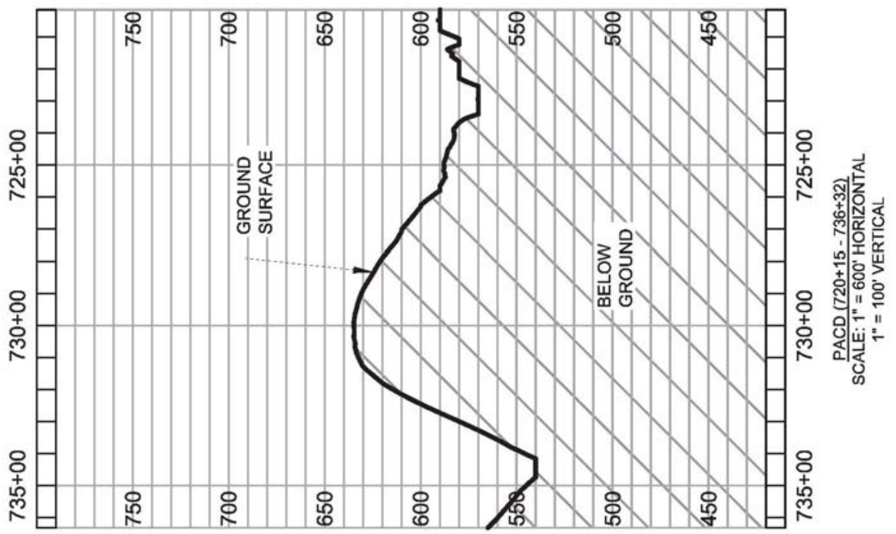
Revisions:

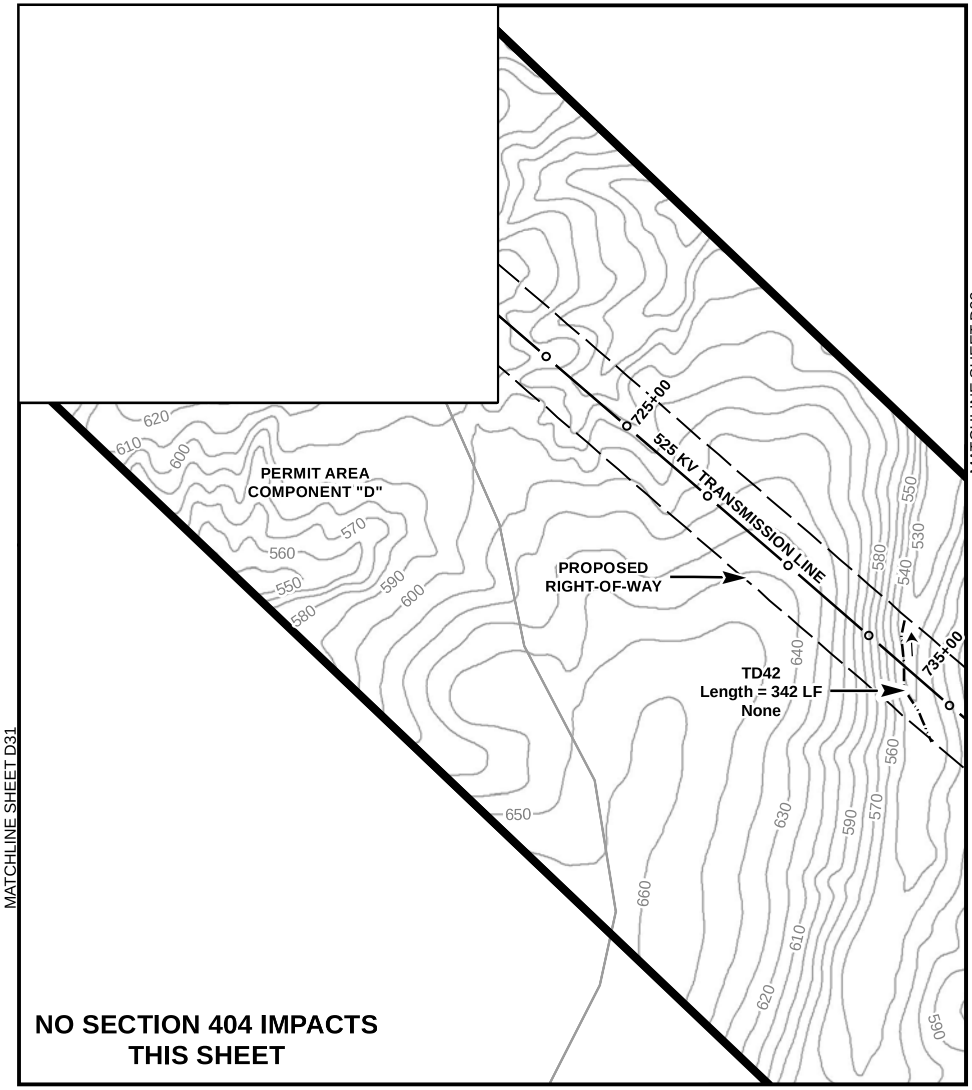
0 250 500 Feet

N

Project:	William States Lee III Nuclear Station CHEROKEE COUNTY, SOUTH CAROLINA
Title:	PERMIT AREA COMPONENT "D" OFFSITE TRANSMISSION LINE (WEST CORRIDOR)
Drawn By: Atkins	Scale: As Shown
Job No. 100008697	Date: 11/9/2011
SHEET	D31

MATCHLINE SHEET D31





MATCHLINE SHEET D31

MATCHLINE SHEET D33

MATCHLINE SHEET D33

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	342
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy®

Revisions:

0 250 500 Feet

N

Project:

William States Lee III Nuclear Station

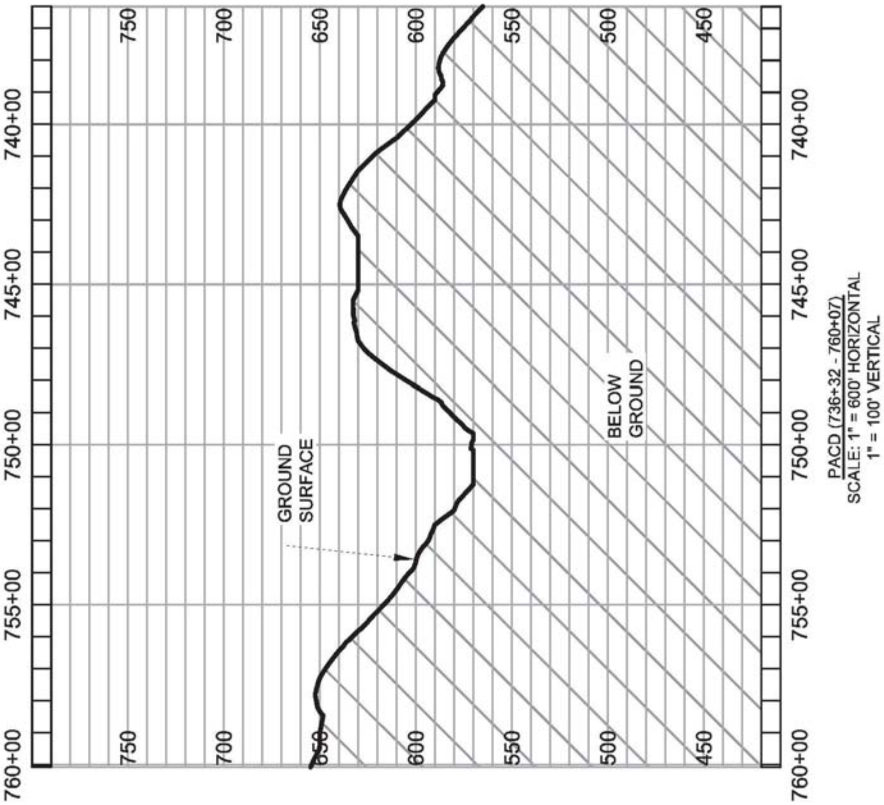
CHEROKEE COUNTY, SOUTH CAROLINA

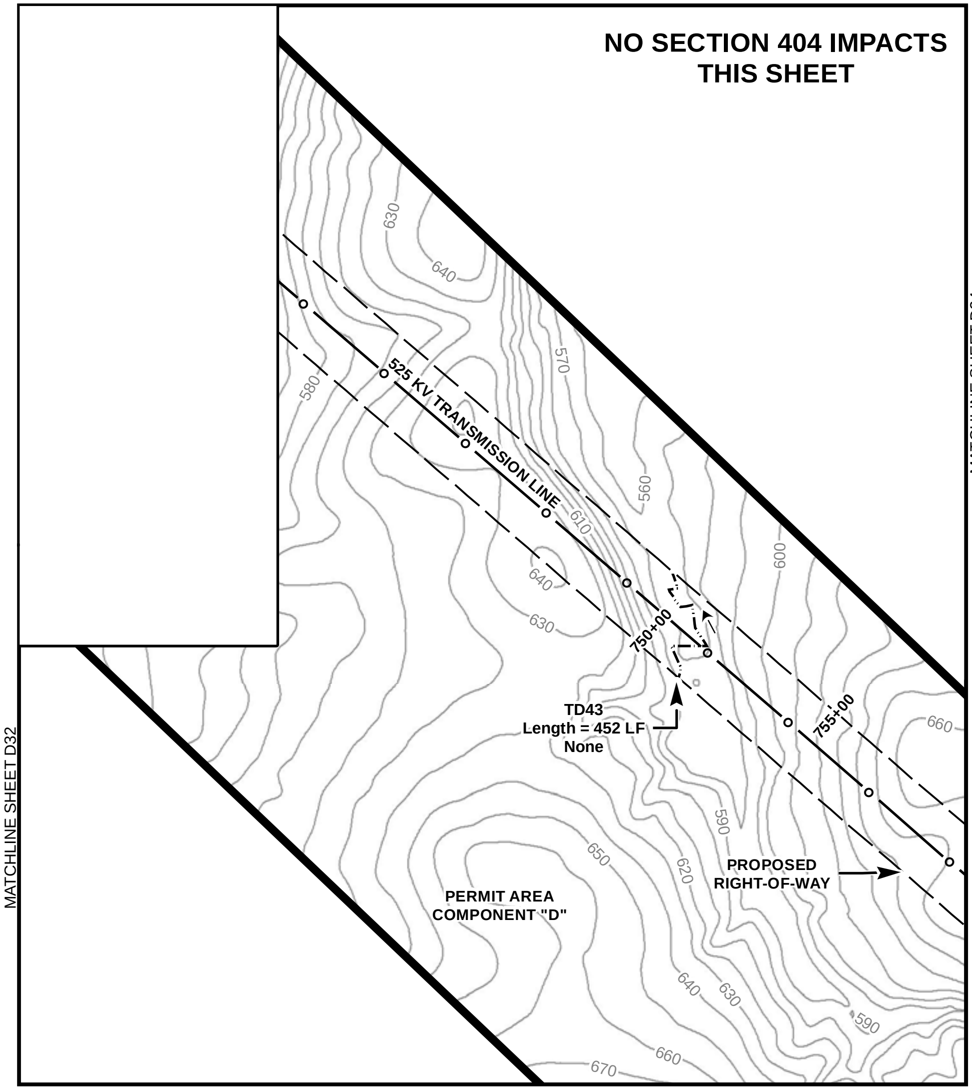
Title:

PERMIT AREA COMPONENT "D"
OFFSITE TRANSMISSION LINE
(WEST CORRIDOR)

Drawn By: Atkins	Scale: As Shown	SHEET D32
Job No. 100008697	Date: 11/9/2011	

MATCHLINE SHEET D32





MATCHLINE SHEET D34

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	452
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy

Revisions:

0 250 500 Feet

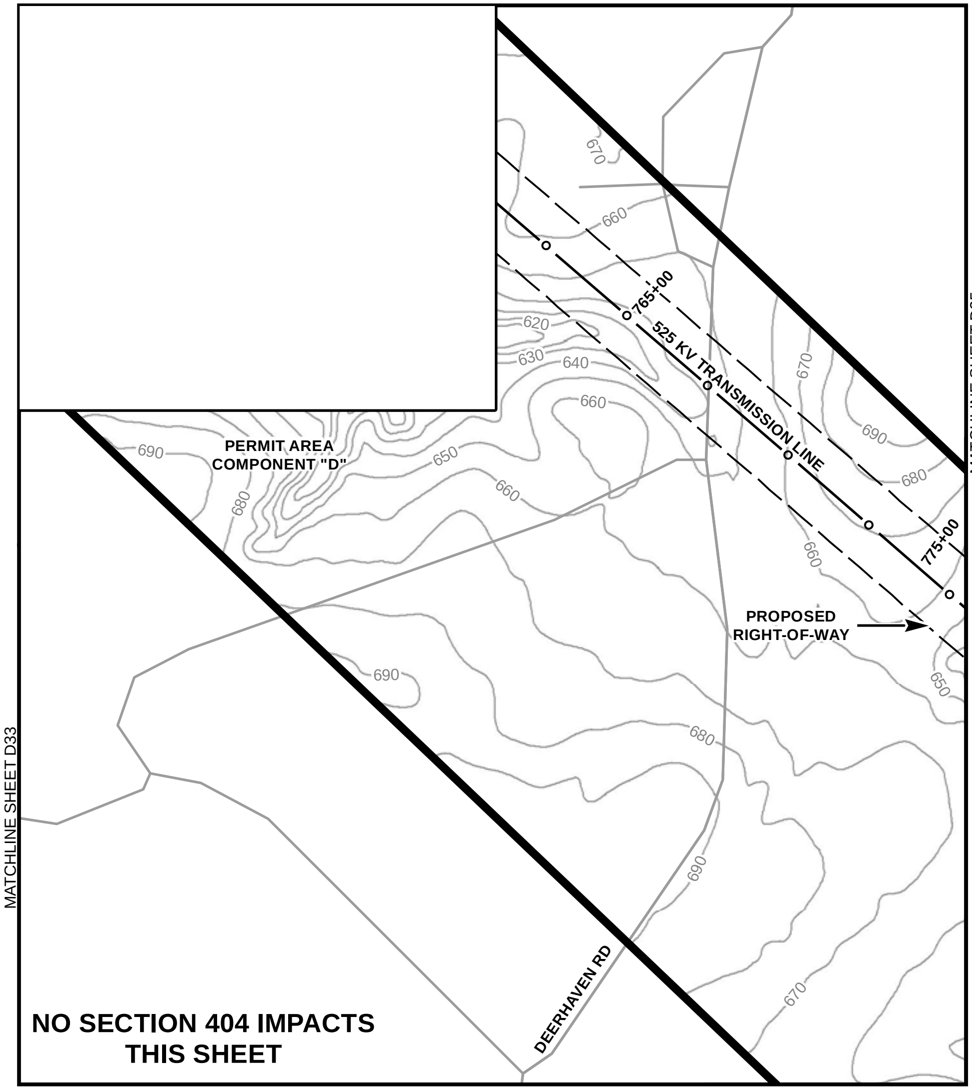
N

Project: William States Lee III Nuclear Station
CHEROKEE COUNTY, SOUTH CAROLINA

Title: PERMIT AREA COMPONENT "D"
OFFSITE TRANSMISSION LINE
(WEST CORRIDOR)

Drawn By: Atkins
Scale: As Shown
Job No. 100008697
Date: 11/9/2011
SHEET D33

MATCHLINE SHEET D33



NO SECTION 404 IMPACTS THIS SHEET

MATCHLINE SHEET D35

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	---
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy®

Revisions:

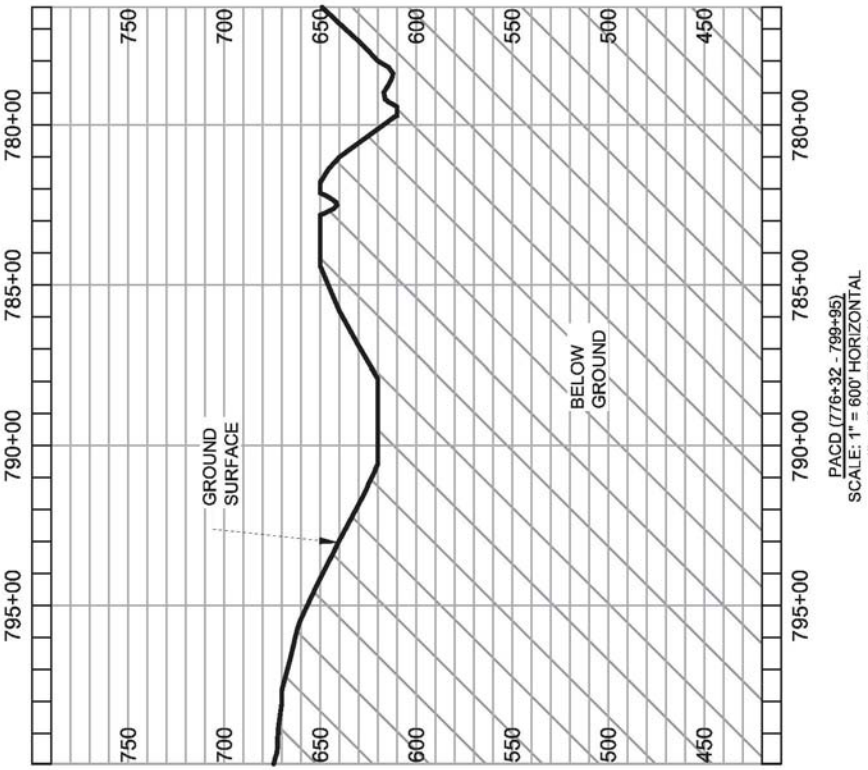
0 250 500
Feet

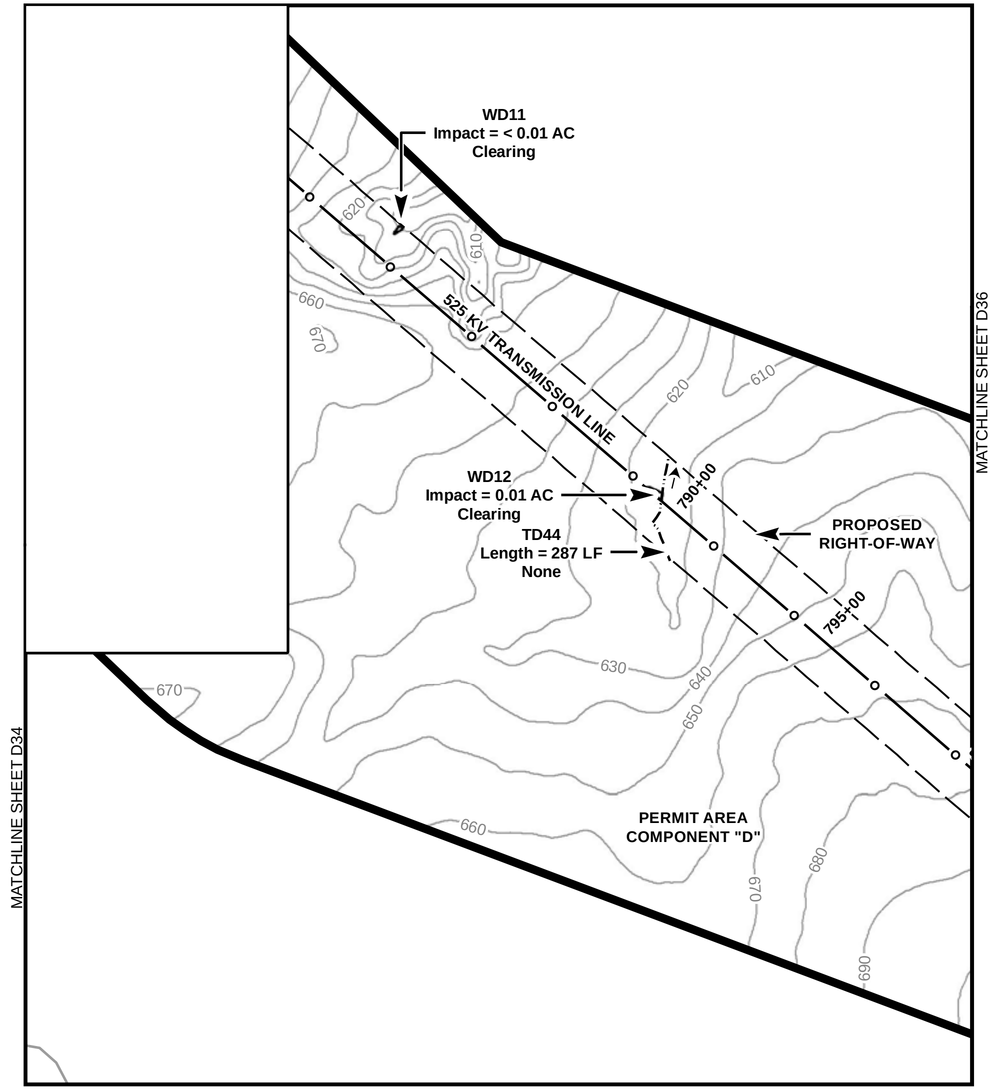
N

Project:
William States Lee III Nuclear Station
CHEROKEE COUNTY, SOUTH CAROLINA

Title:
PERMIT AREA COMPONENT "D"
OFFSITE TRANSMISSION LINE
(WEST CORRIDOR)

Drawn By: Atkins	Scale: As Shown	SHEET D34
Job No. 100008697	Date: 11/9/2011	





Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	287
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	0.01
	Impact (AC)	0.01
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy®

Revisions:

0 250 500 Feet

N

Project:

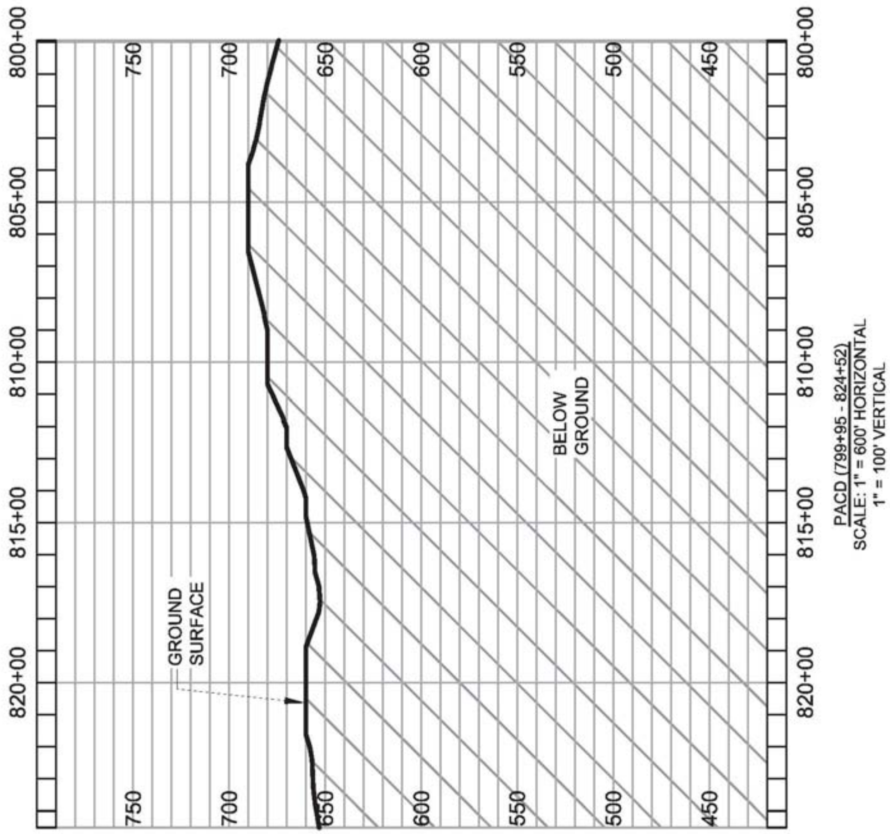
William States Lee III Nuclear Station

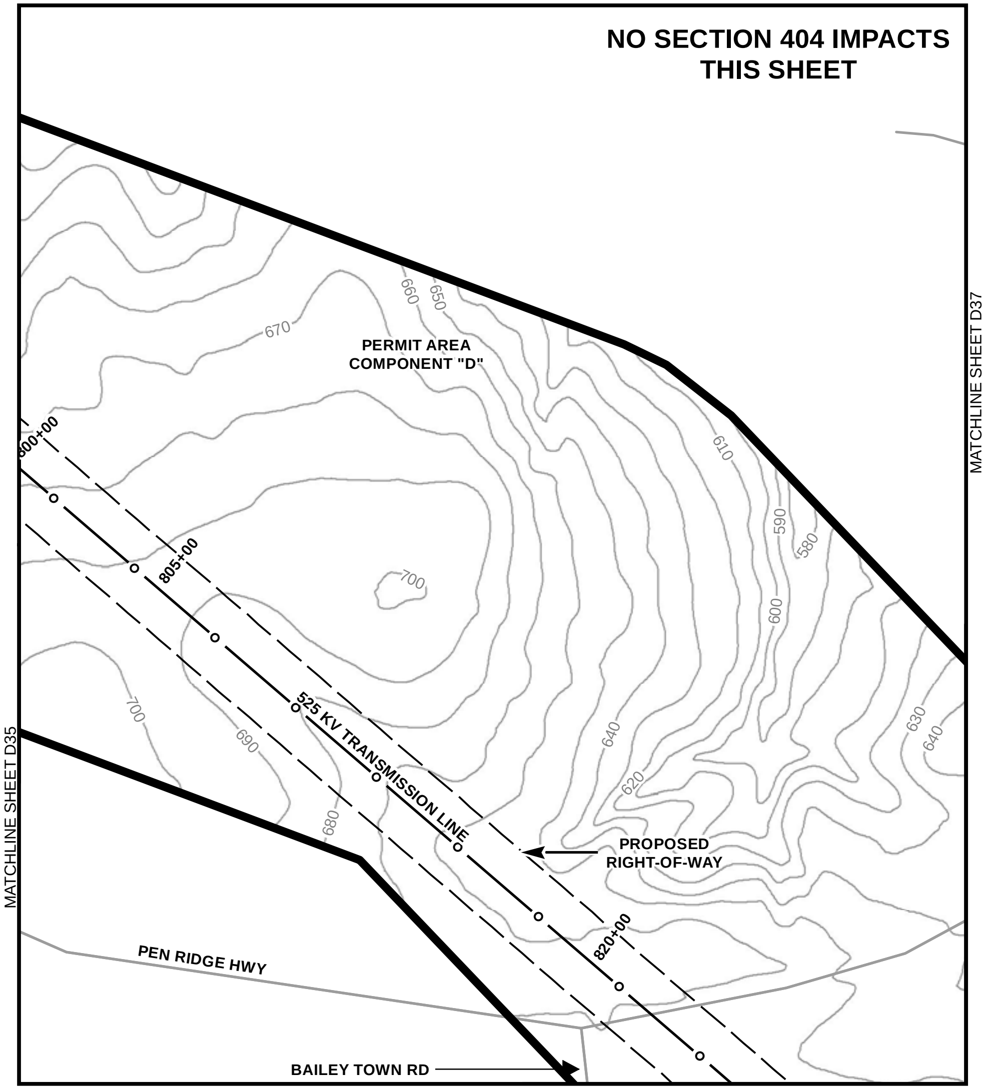
CHEROKEE COUNTY, SOUTH CAROLINA

Title:

PERMIT AREA COMPONENT "D"
OFFSITE TRANSMISSION LINE
(WEST CORRIDOR)

Drawn By: Atkins	Scale: As Shown	SHEET D35
Job No. 100008697	Date: 11/9/2011	





Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	---
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy

Revisions:

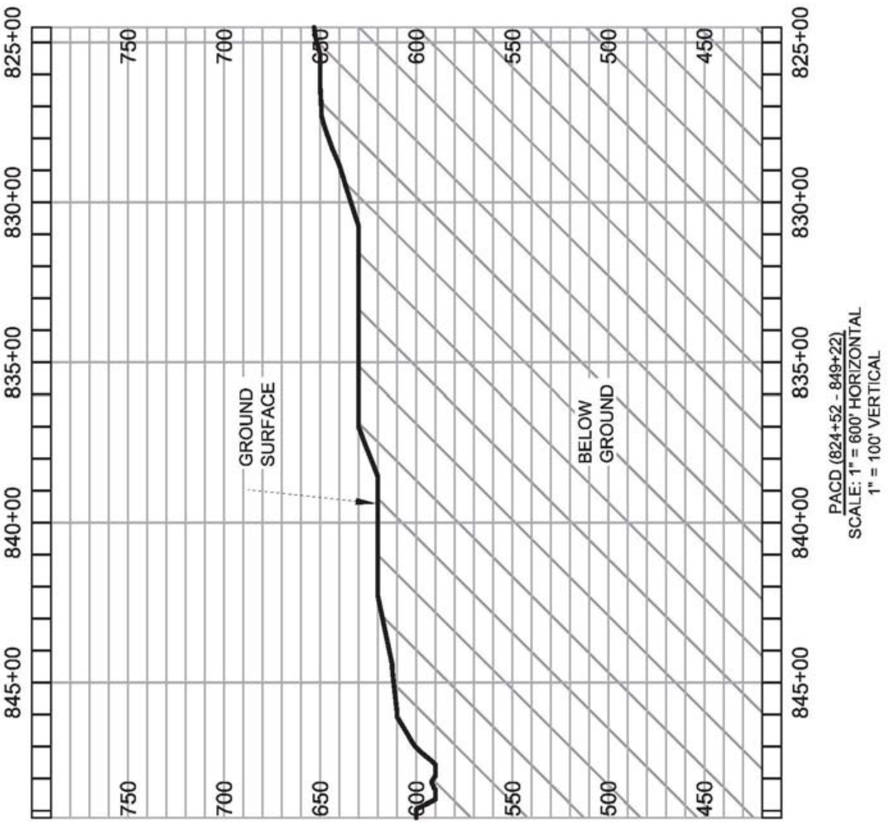
0 250 500 Feet

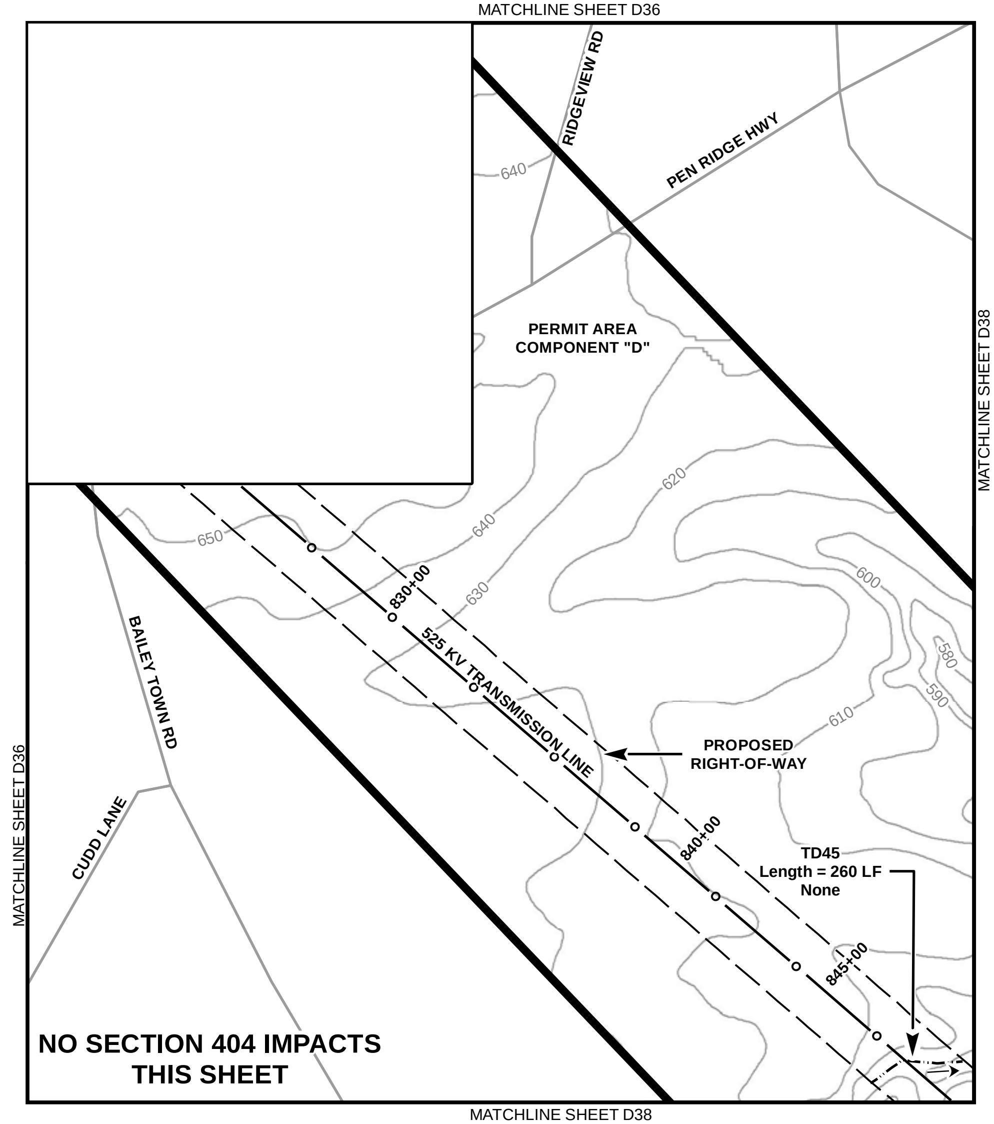
N

Project: William States Lee III Nuclear Station
CHEROKEE COUNTY, SOUTH CAROLINA

Title: PERMIT AREA COMPONENT "D"
OFFSITE TRANSMISSION LINE
(WEST CORRIDOR)

Drawn By: Atkins	Scale: As Shown	SHEET D36
Job No. 100008697	Date: 11/9/2011	





Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	260
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy®

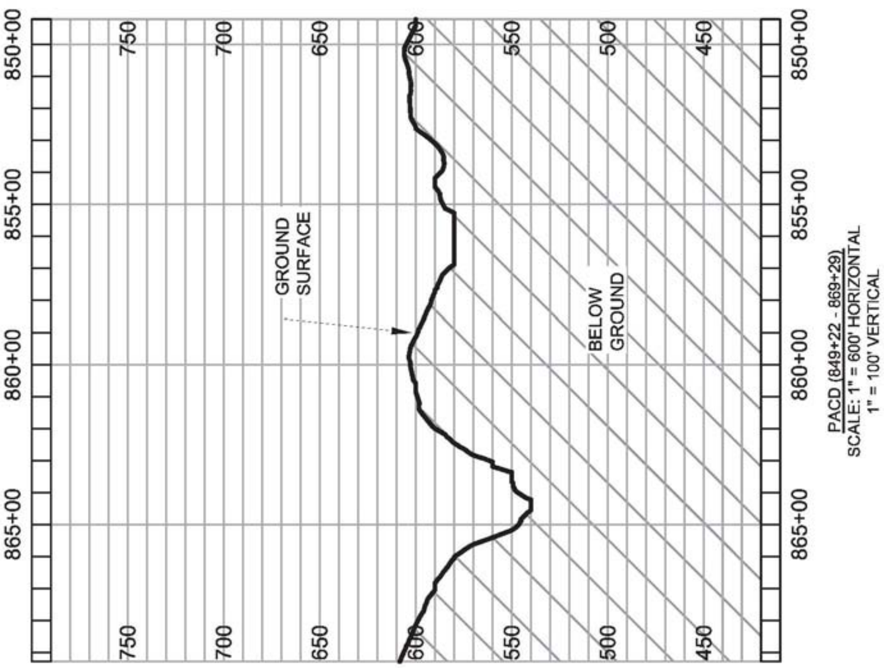
Revisions:

0 250 500 Feet

N

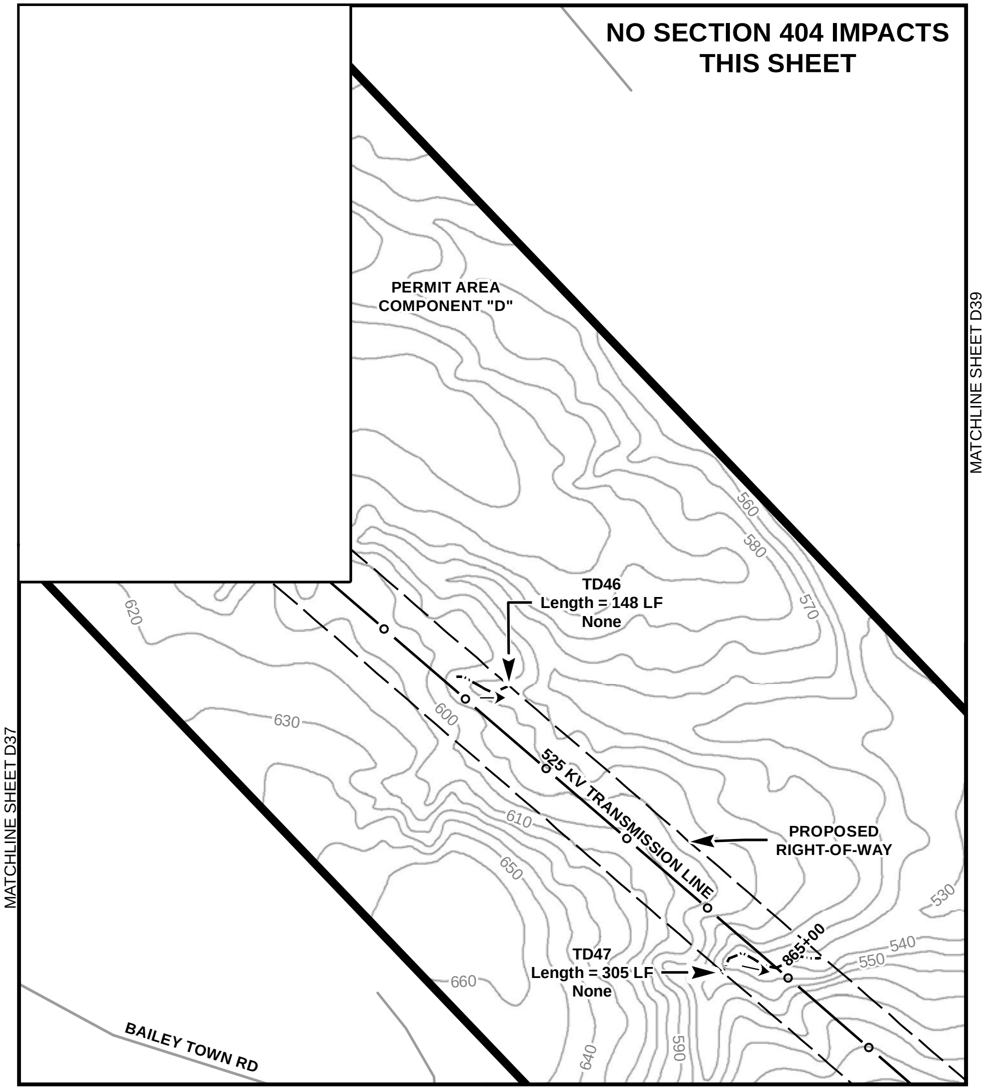
Project: William States Lee III Nuclear Station CHEROKEE COUNTY, SOUTH CAROLINA	
Title: PERMIT AREA COMPONENT "D" OFFSITE TRANSMISSION LINE (WEST CORRIDOR)	
Drawn By: Atkins	Scale: As Shown
Job No. 100008697	Date: 11/9/2011

SHEET D37



MATCHLINE SHEET D37

NO SECTION 404 IMPACTS THIS SHEET



MATCHLINE SHEET D39

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	453
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy®

Revisions:

0 250 500 Feet

N

Project:

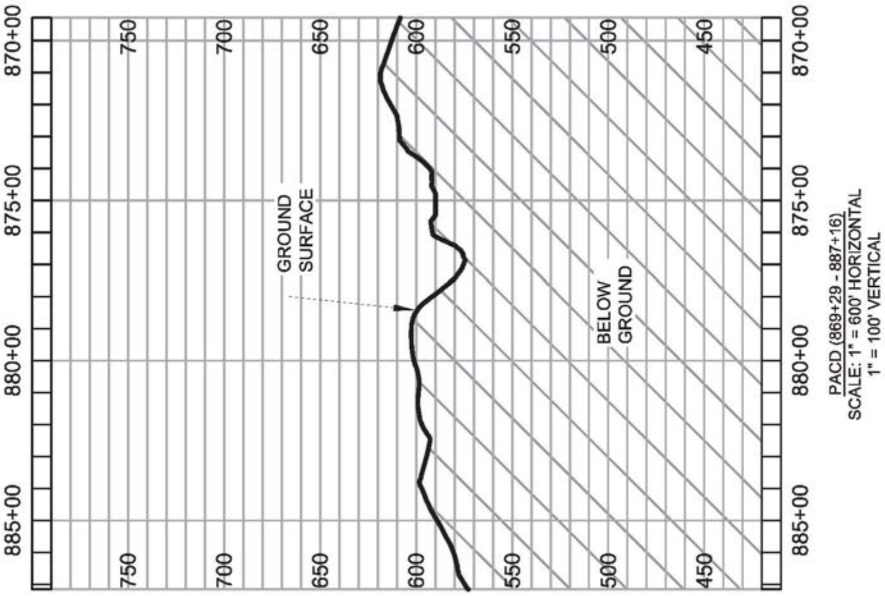
William States Lee III Nuclear Station

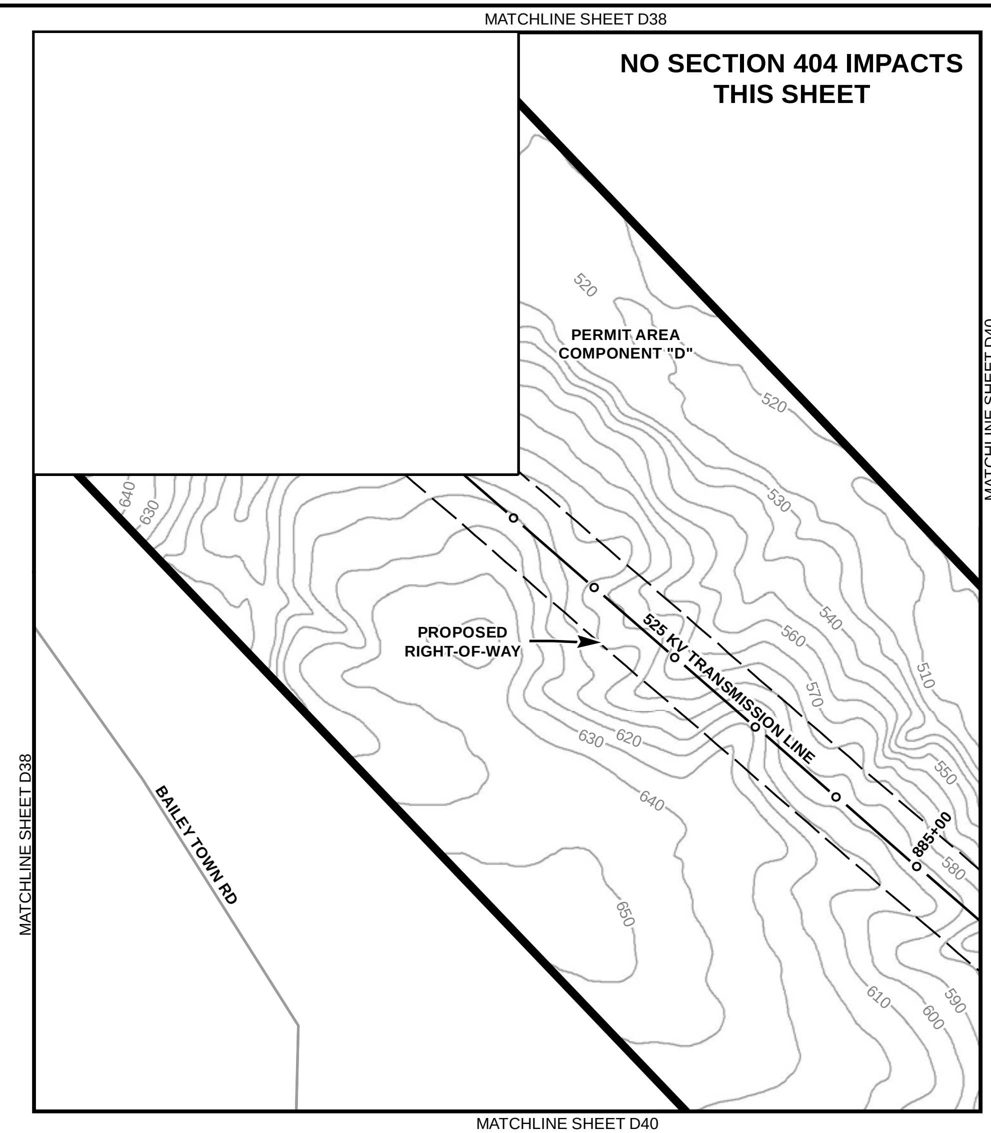
CHEROKEE COUNTY, SOUTH CAROLINA

Title:

PERMIT AREA COMPONENT "D"
OFFSITE TRANSMISSION LINE
(WEST CORRIDOR)

Drawn By: Atkins	Scale: As Shown	SHEET D38
Job No. 100008697	Date: 11/9/2011	





Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	---
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy

Revisions:

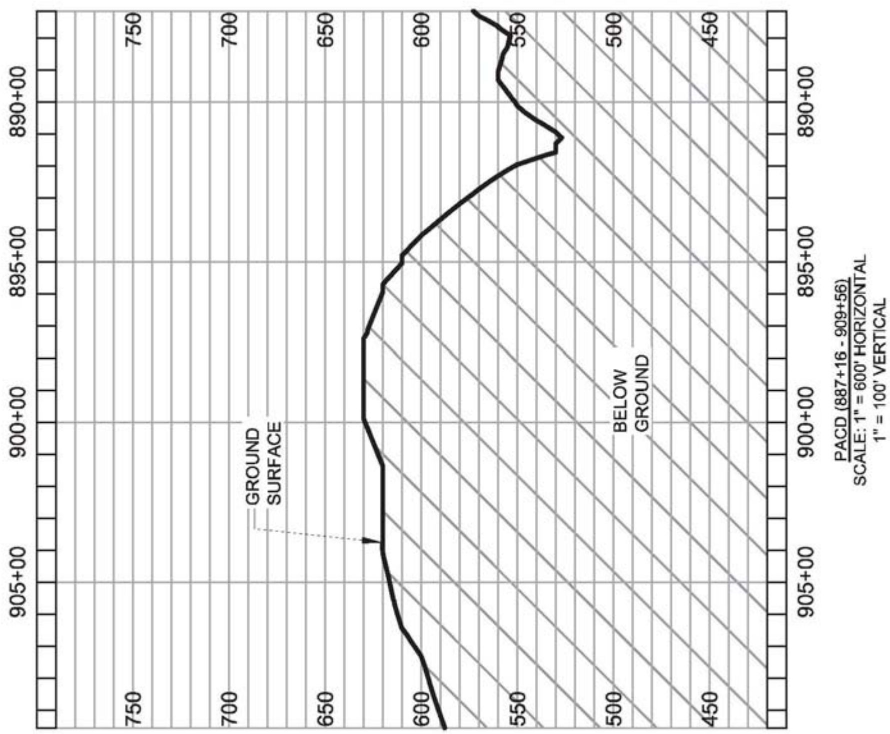
0 250 500 Feet

N

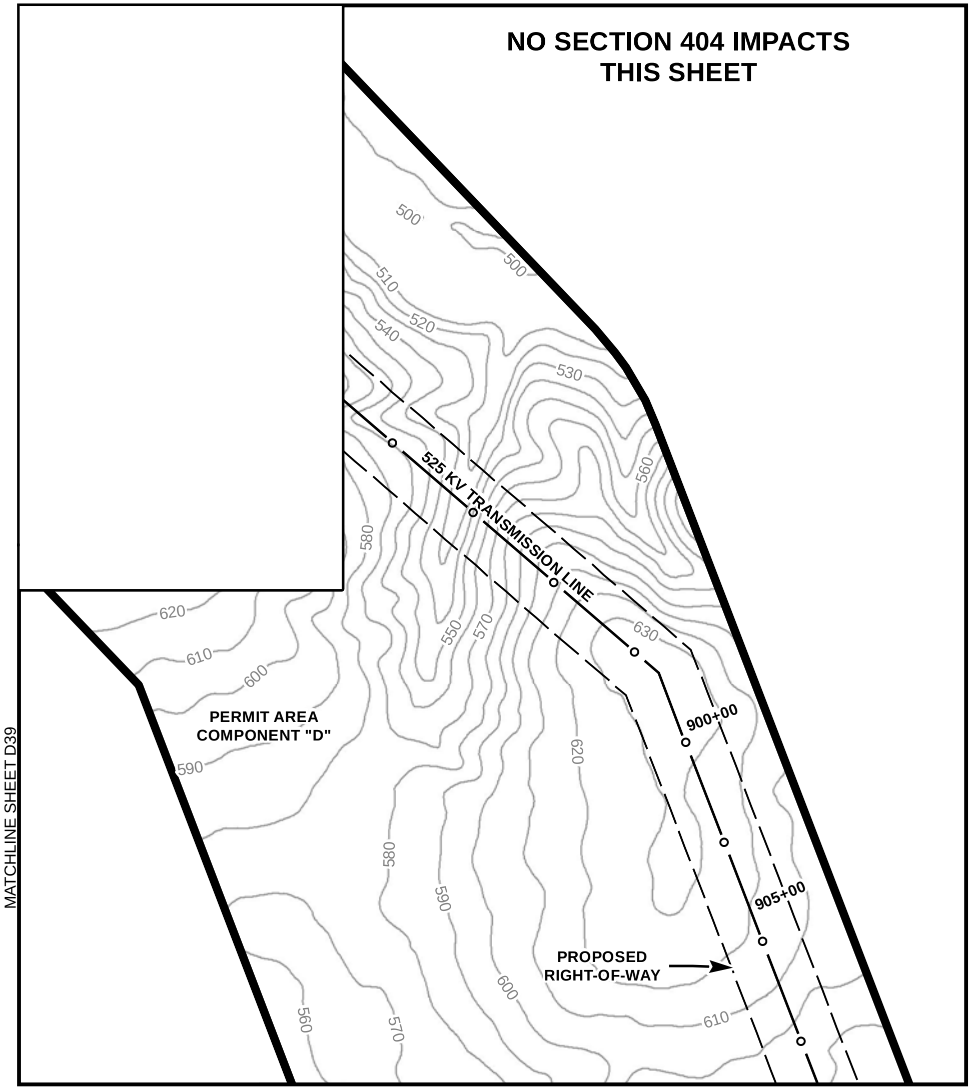
Project: William States Lee III Nuclear Station
CHEROKEE COUNTY, SOUTH CAROLINA

Title: PERMIT AREA COMPONENT "D"
OFFSITE TRANSMISSION LINE
(WEST CORRIDOR)

Drawn By:	Scale:	SHEET
Atkins	As Shown	D39
Job No.: 100008697	Date: 11/9/2011	



MATCHLINE SHEET D39



MATCHLINE SHEET D41

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	---
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy

Revisions:

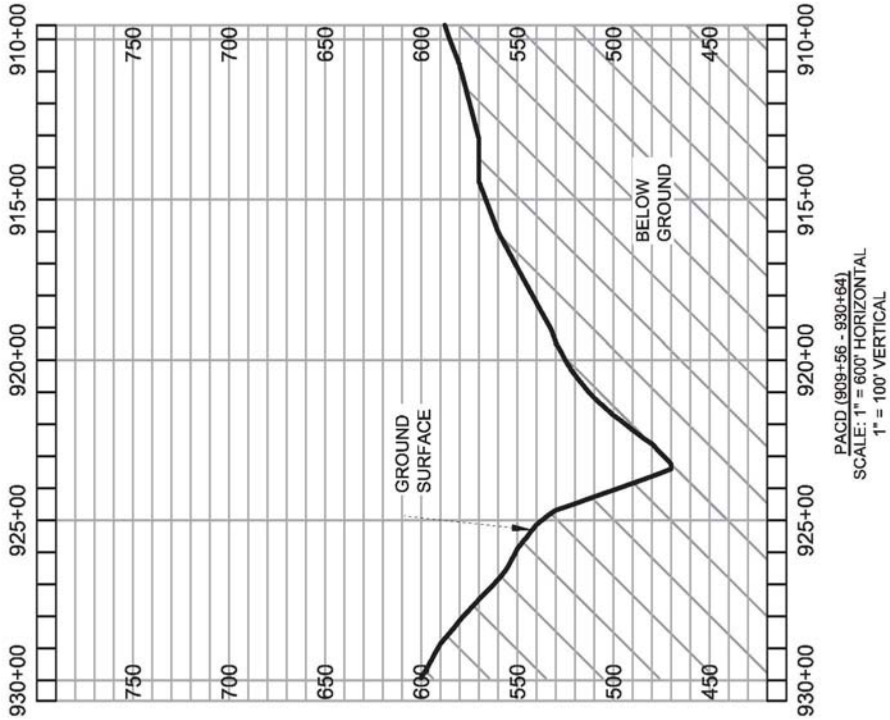
0 250 500 Feet

N

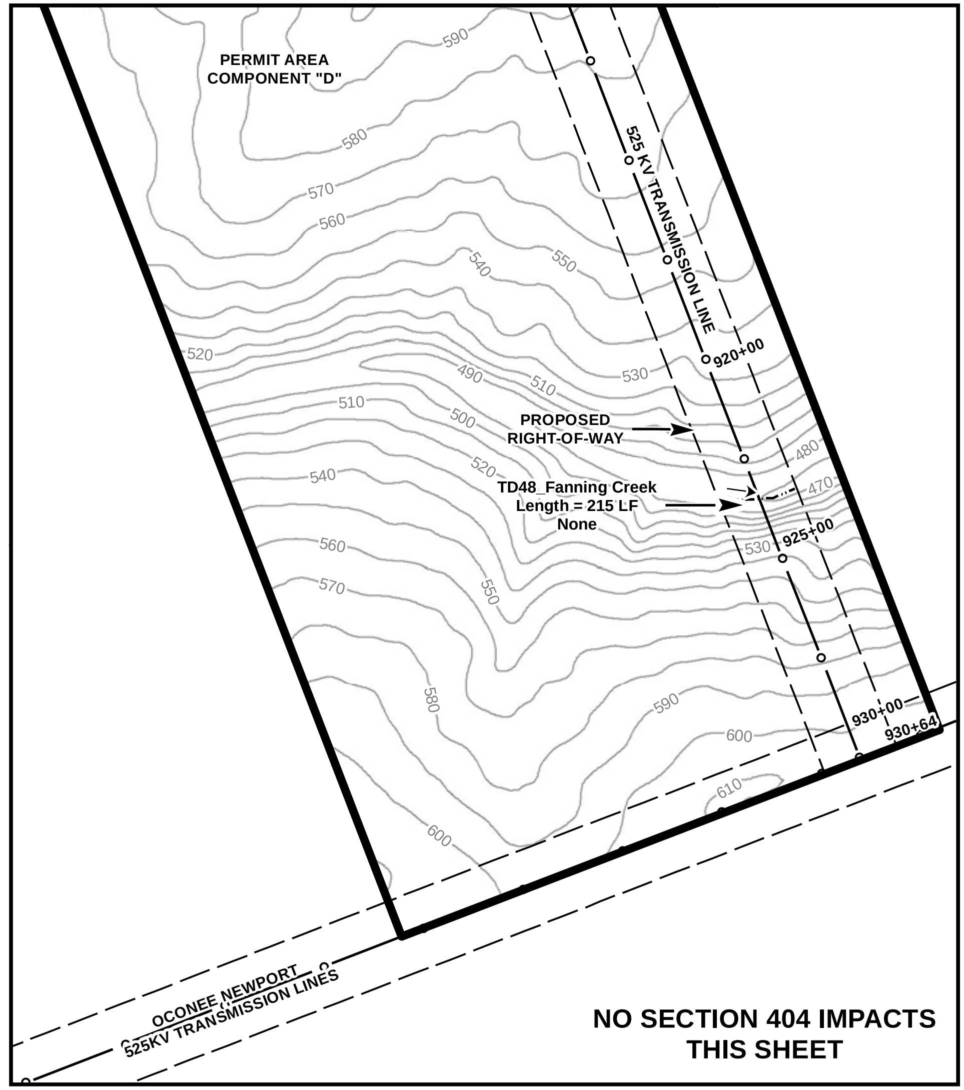
Project: William States Lee III Nuclear Station
CHEROKEE COUNTY, SOUTH CAROLINA

Title: PERMIT AREA COMPONENT "D"
OFFSITE TRANSMISSION LINE
(WEST CORRIDOR)

Drawn By: Atkins	Scale: As Shown	SHEET D40
Job No. 100008697	Date: 11/9/2011	



MATCHLINE SHEET D40



Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	215
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy

Revisions:

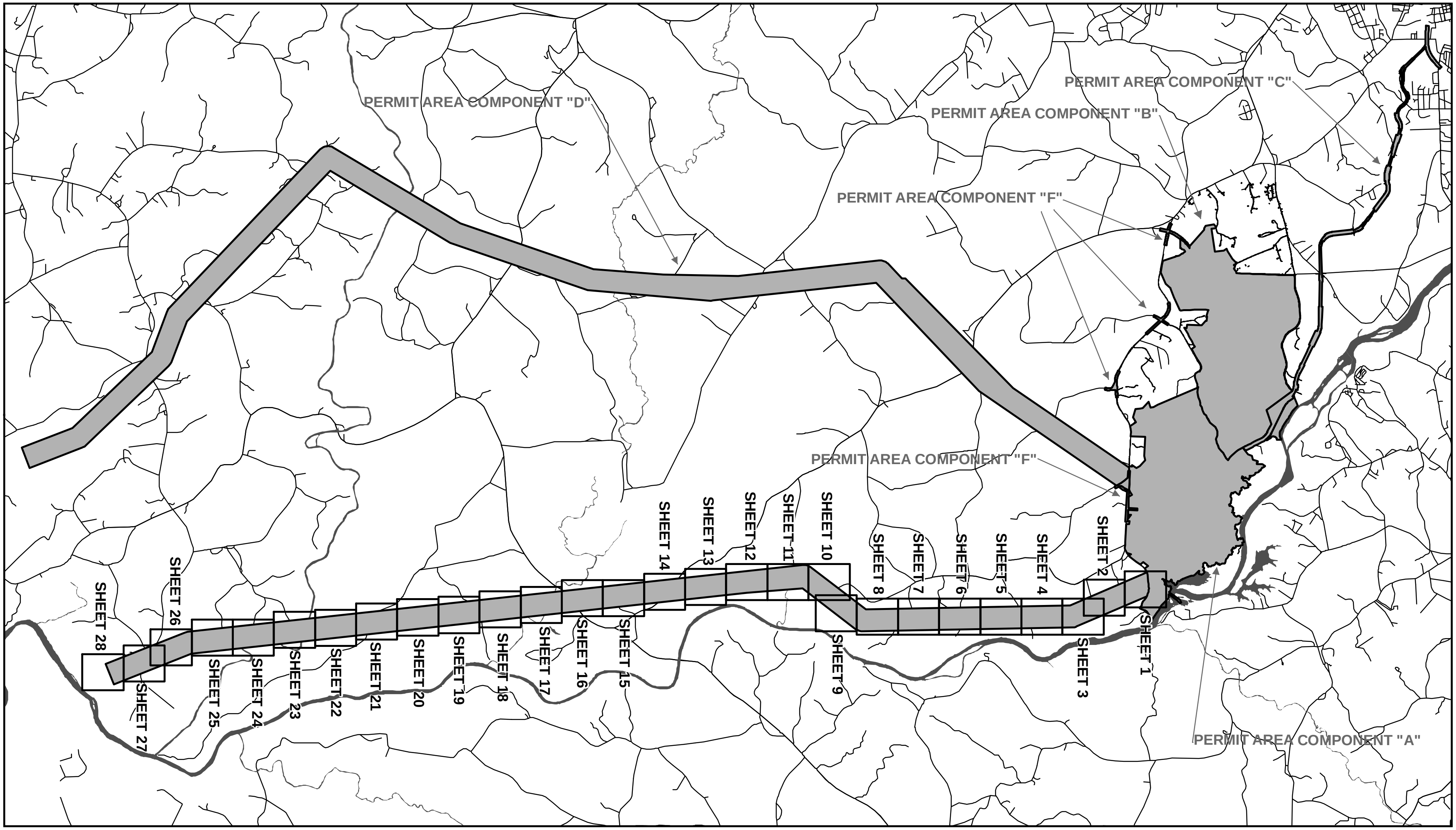
0 250 500 Feet

N

Project: William States Lee III Nuclear Station
CHEROKEE COUNTY, SOUTH CAROLINA

Title: PERMIT AREA COMPONENT "D"
OFFSITE TRANSMISSION LINE
(WEST CORRIDOR)

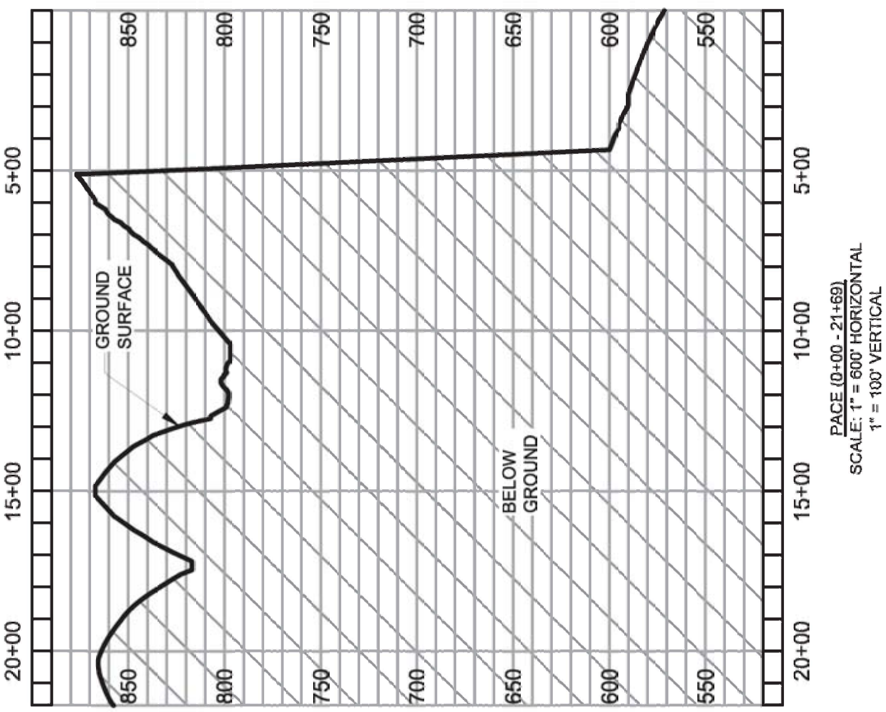
Drawn By: Atkins	Scale: As Shown	SHEET D41
Job No. 100008697	Date: 11/9/2011	

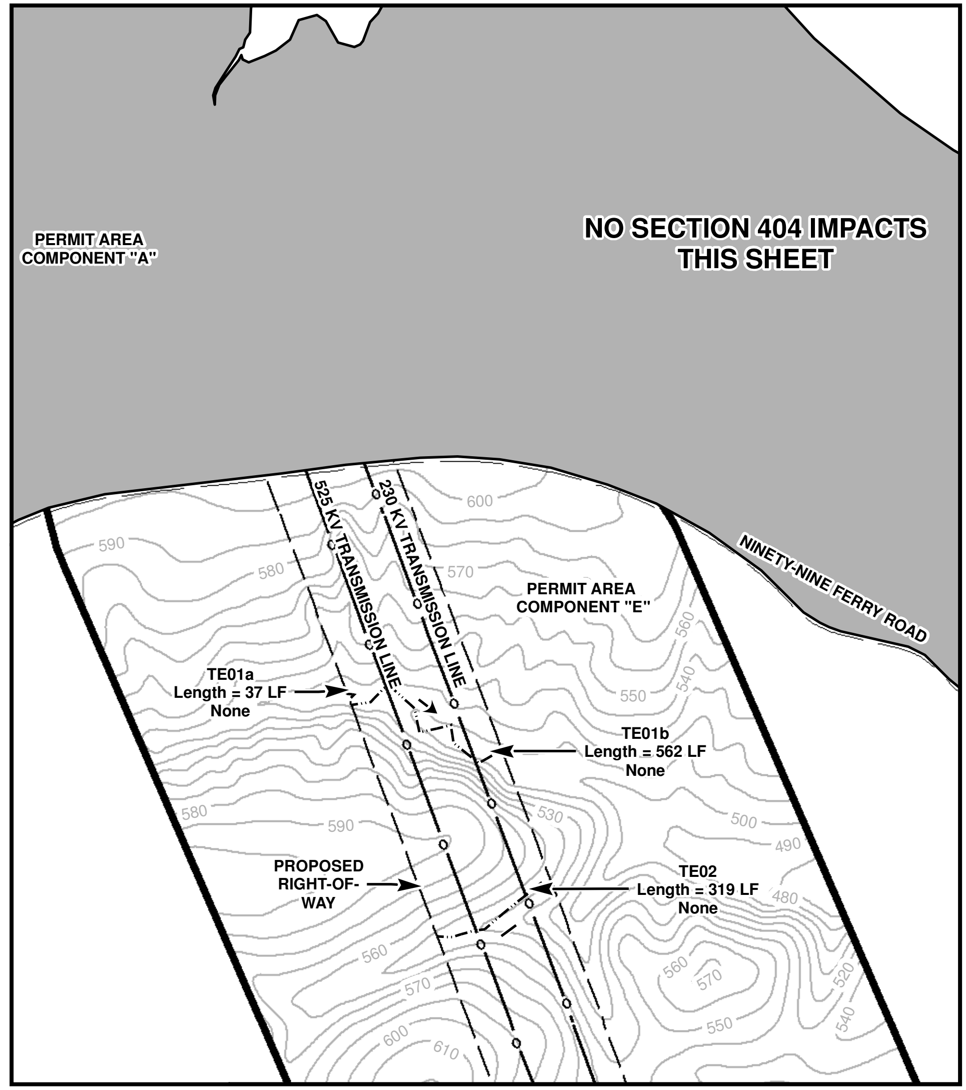


Revisions:		Applicant:		Project:
		Duke Energy®	N 0 1 2 Miles	William States Lee III Nuclear Station CHEROKEE COUNTY, SOUTH CAROLINA

Title: PERMIT AREA COMPONENT "E" INDEX
OFFSITE TRANSMISSION LINE
(EAST CORRIDOR)

Drawn By: Atkins	Scale: As Shown	FIGURE E
Job No. 100008697	Date: 11/9/2011	





MATCHLINE SHEET E2

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	918
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy

Revisions:

0 250 500 Feet

N

Project:

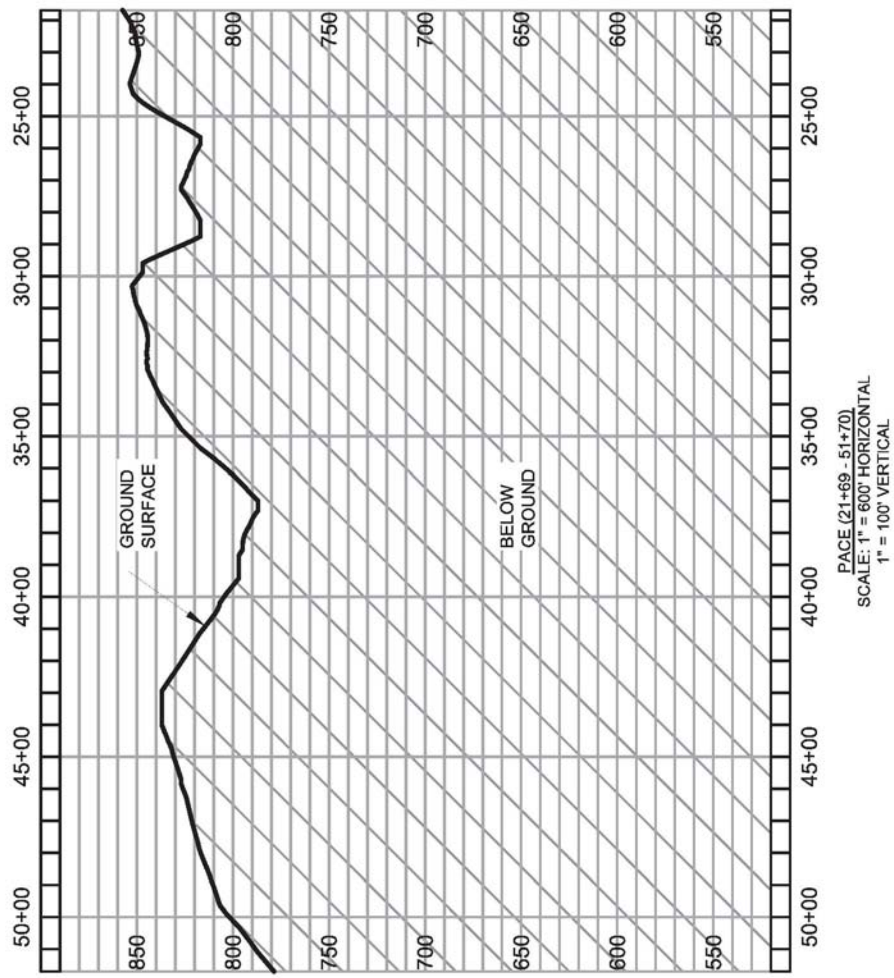
William States Lee III Nuclear Station

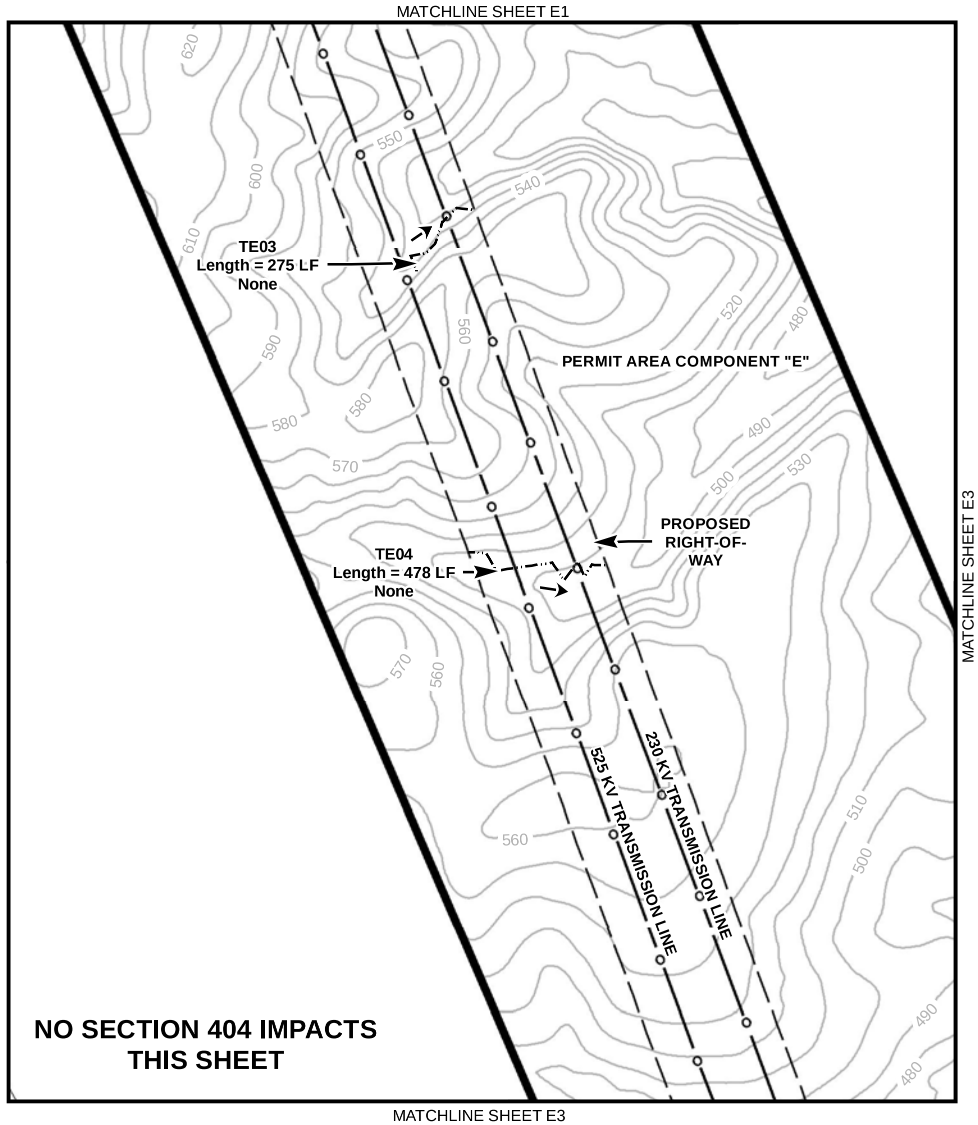
CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title:

PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E1
Job No. 100008697	Date: 11/9/2011	





Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	753
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy

Revisions:

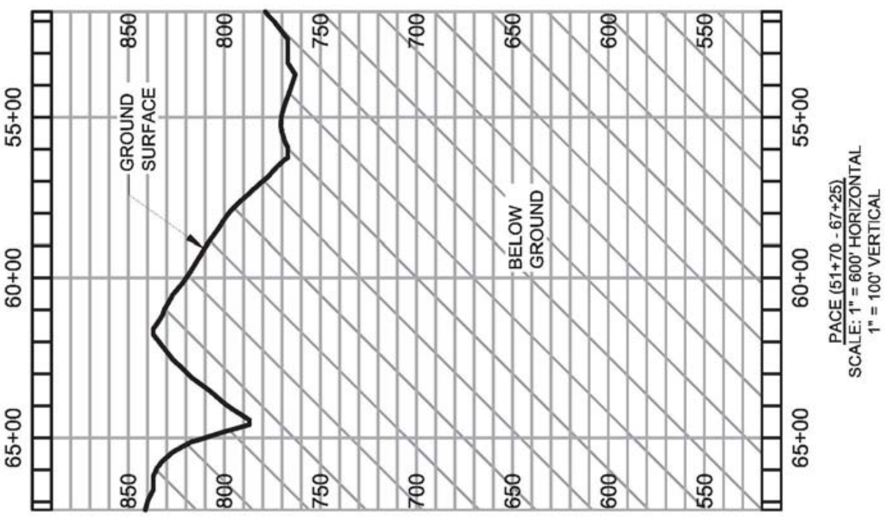
0 250 500 Feet

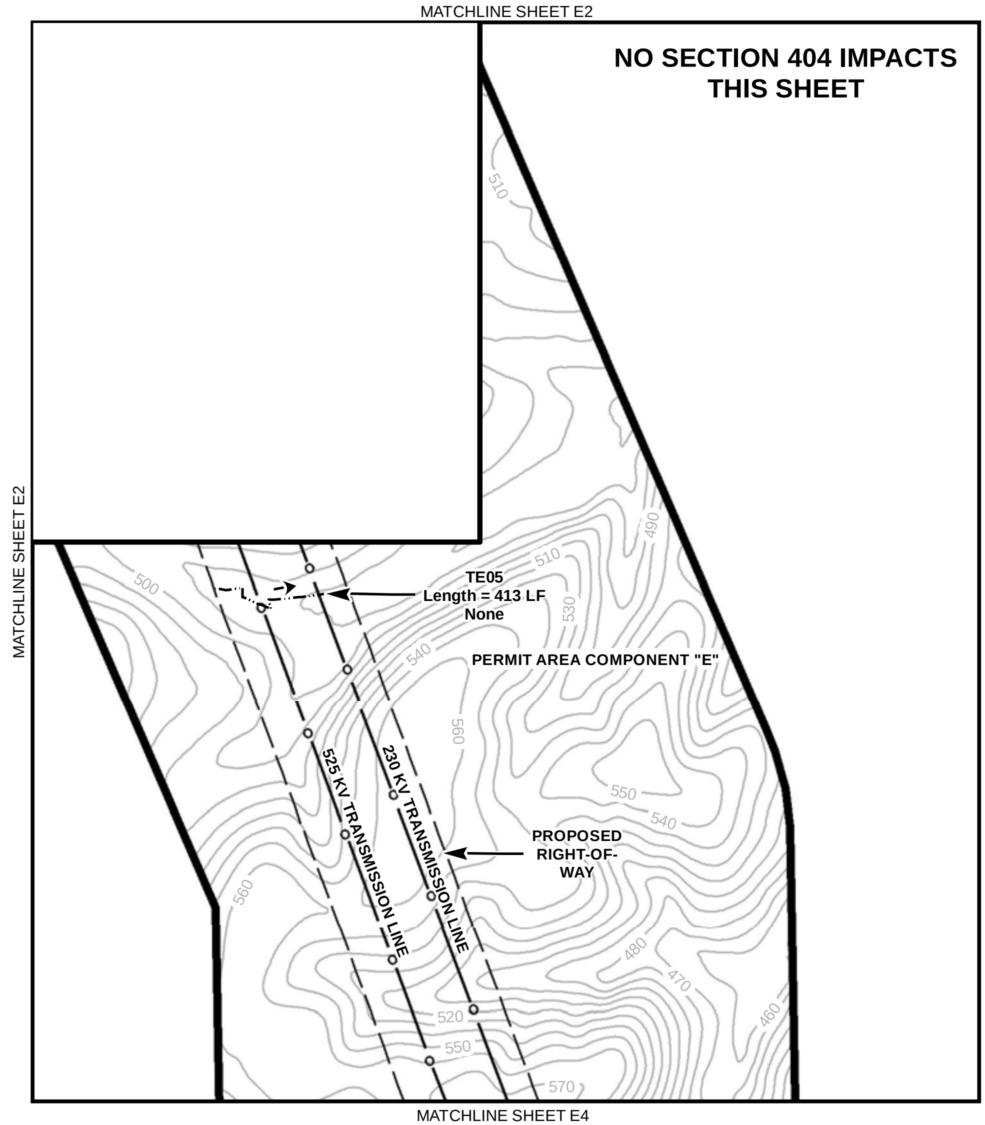
N

Project:
William States Lee III Nuclear Station
CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title:
PERMIT AREA COMPONENT "E" LEE SITE
OFFSITE TRANSMISSION LINES

Drawn By: Atkins
Scale: As Shown
Job No. 100008697
Date: 11/9/2011
SHEET E2





Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	413
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy

Revisions:

0 250 500 Feet

N

Project:

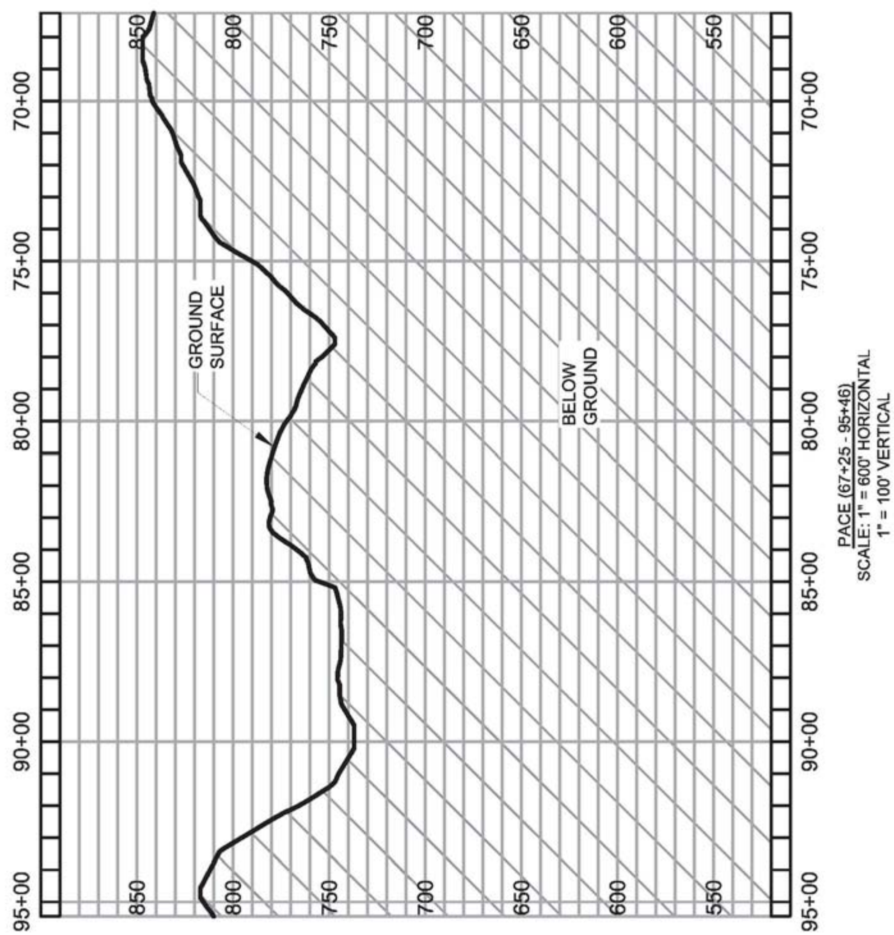
William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

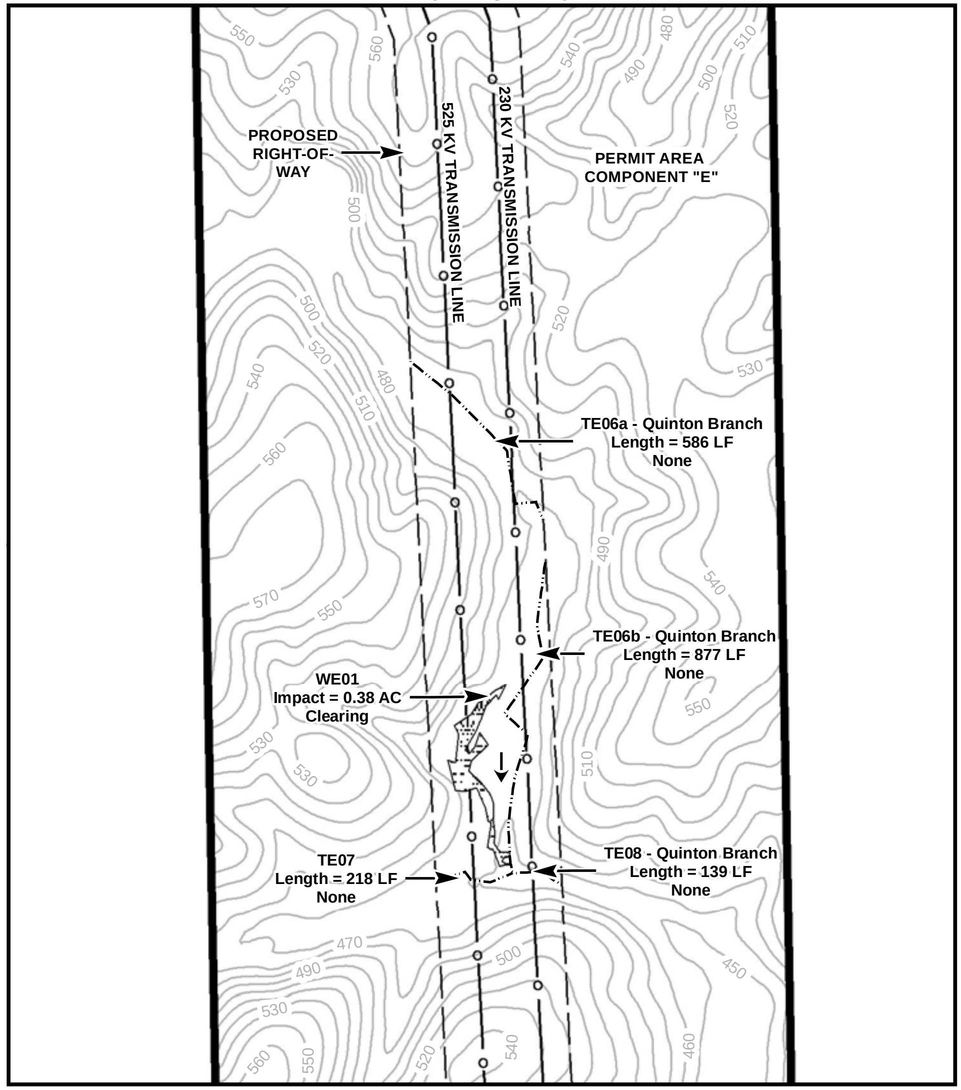
Title:

PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E3
Job No. 100008697	Date: 11/9/2011	



MATCHLINE SHEET E3



MATCHLINE SHEET E5

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	1820
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	0.38
	Impact (AC)	0.38
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy

Revisions:

0 250 500 Feet

N

Project:

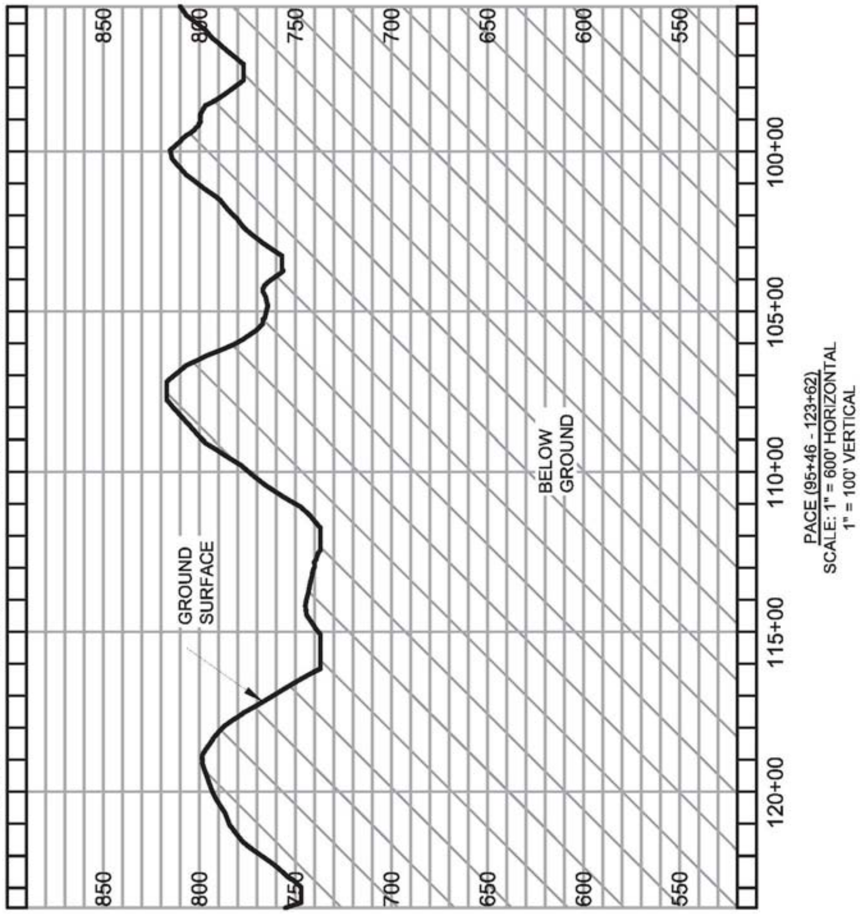
William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

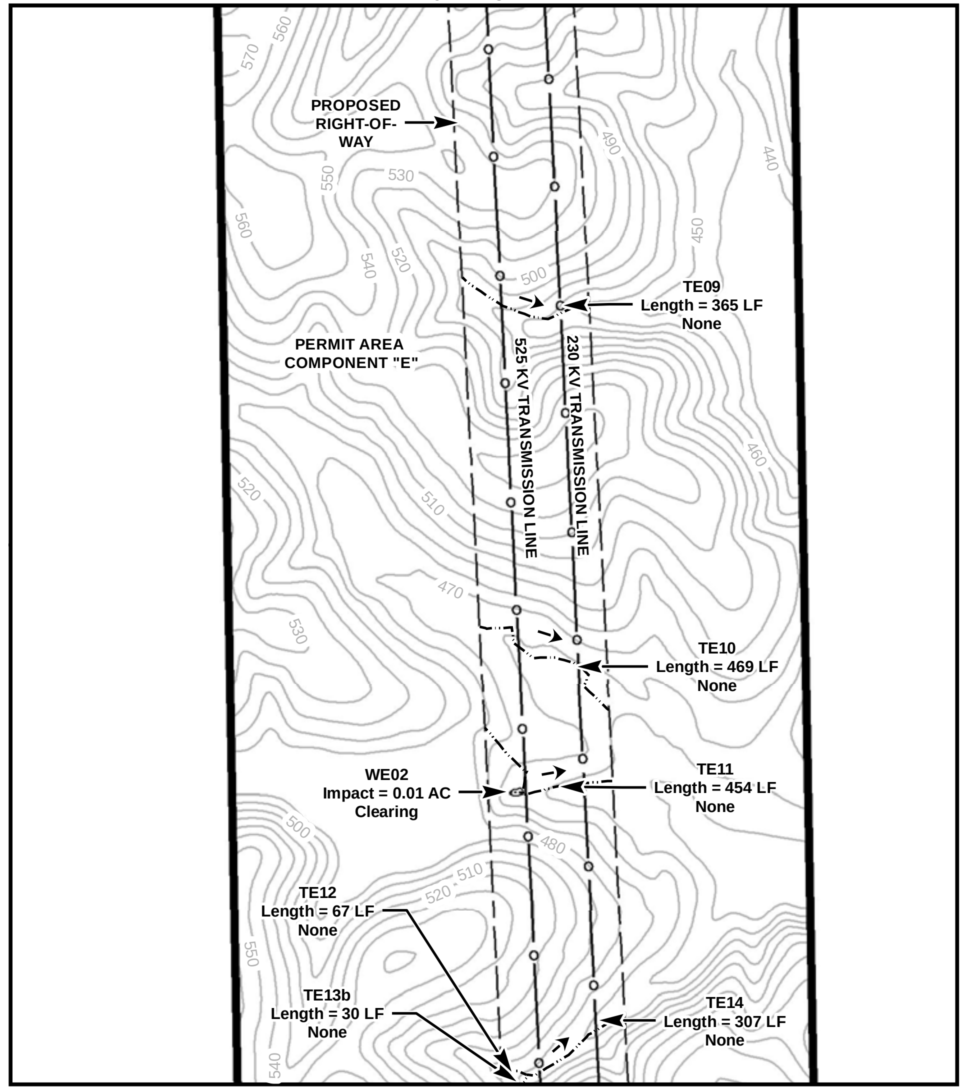
Title:

PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By:	Scale:	SHEET
Atkins	As Shown	E4
Job No.: 100008697	Date: 11/9/2011	



MATCHLINE SHEET E4



MATCHLINE SHEET E6

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	1692
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	0.01
	Impact (AC)	0.01
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy

Revisions:

0 250 500 Feet

N

Project:

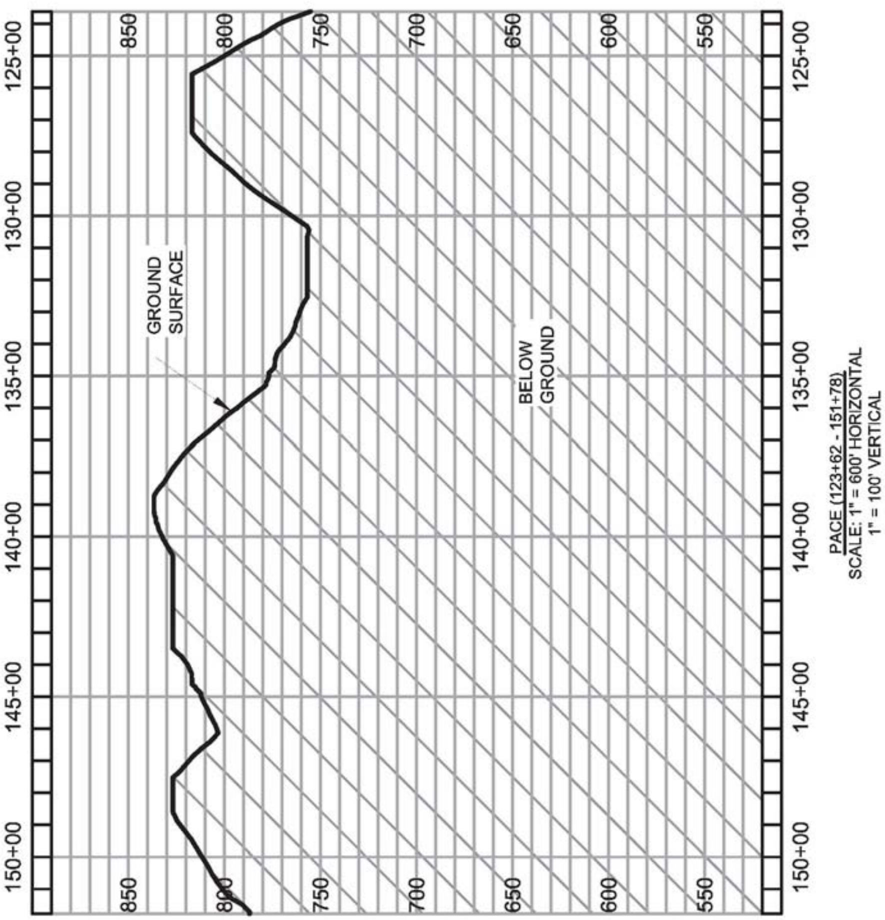
William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title:

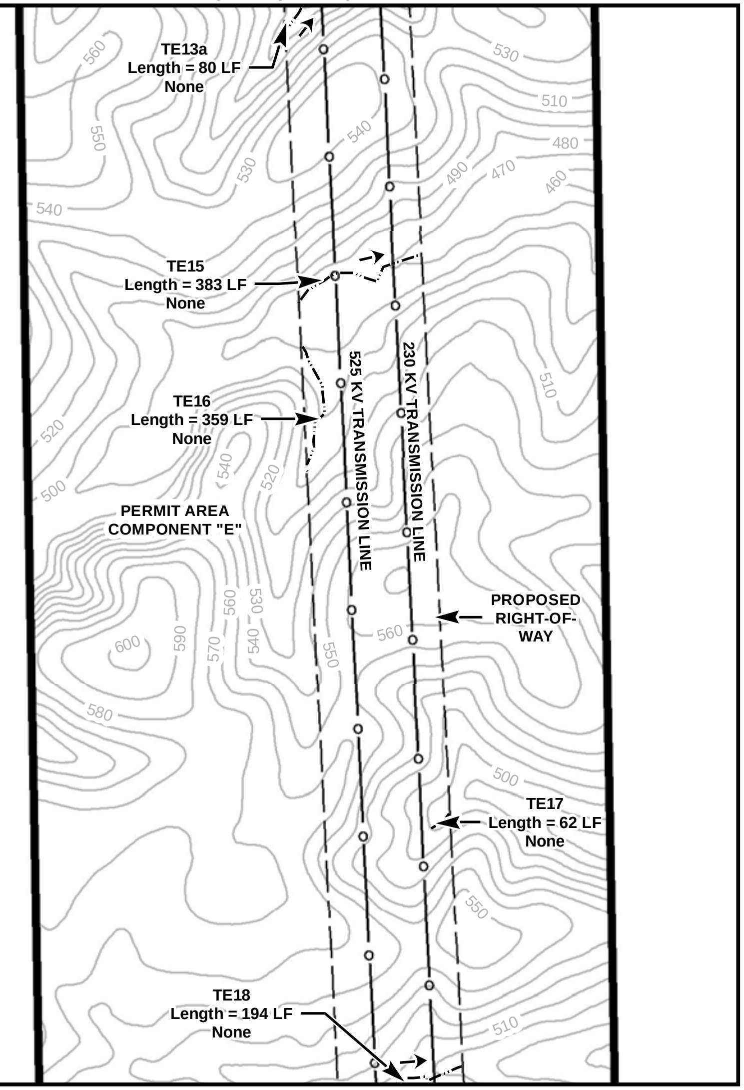
PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E5
Job No. 100008697	Date: 11/9/2011	



MATCHLINE SHEET E5

NO SECTION 404 IMPACTS THIS SHEET



MATCHLINE SHEET E7

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	1078
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy®

Revisions:

0 250 500 Feet

N

Project:

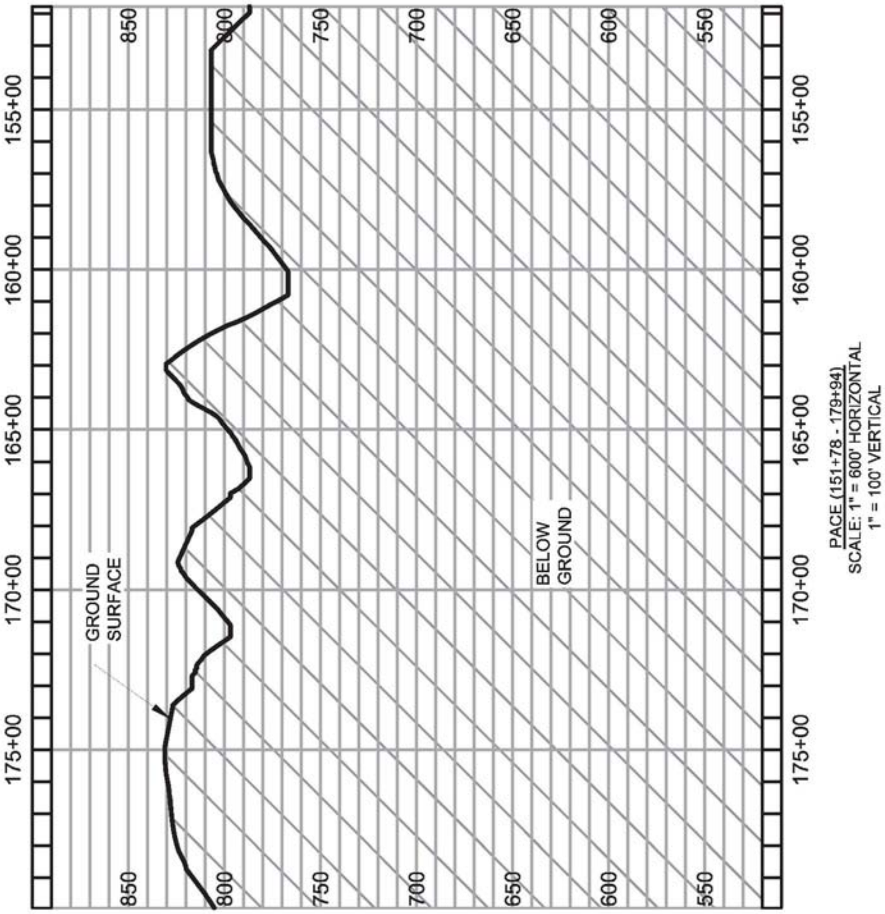
William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title:

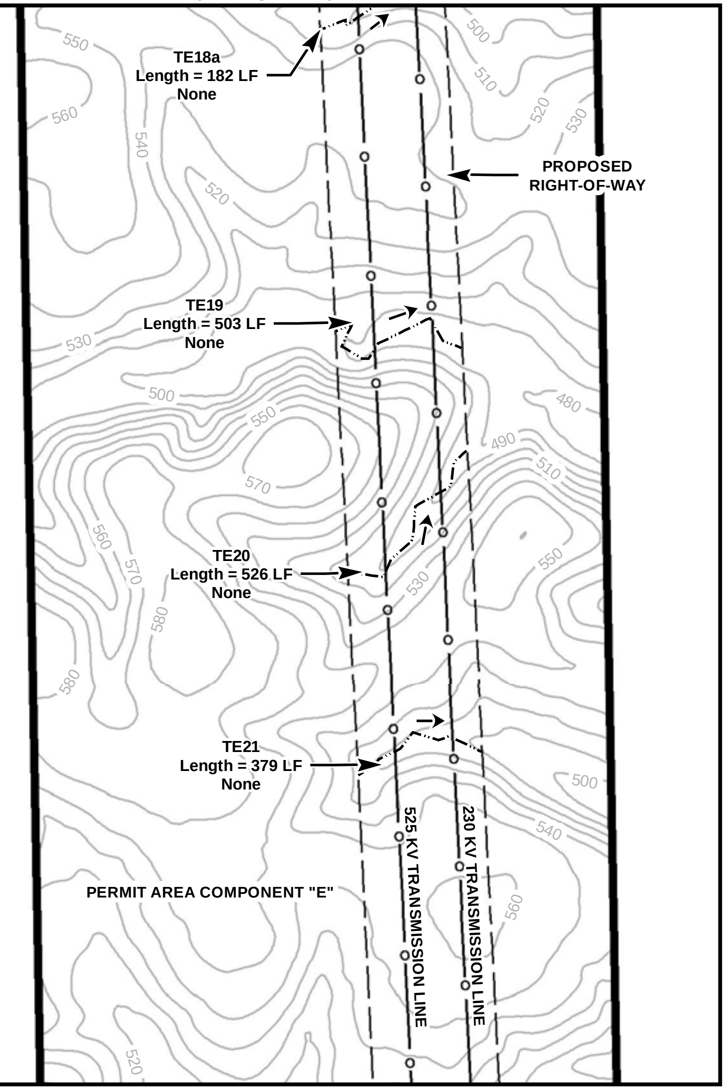
PERMIT AREA COMPONENT "E" LEE SITE
OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E6
Job No. 100008697	Date: 11/9/2011	



MATCHLINE SHEET E6

NO SECTION 404 IMPACTS THIS SHEET



MATCHLINE SHEET E8

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	1590
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy

Revisions:

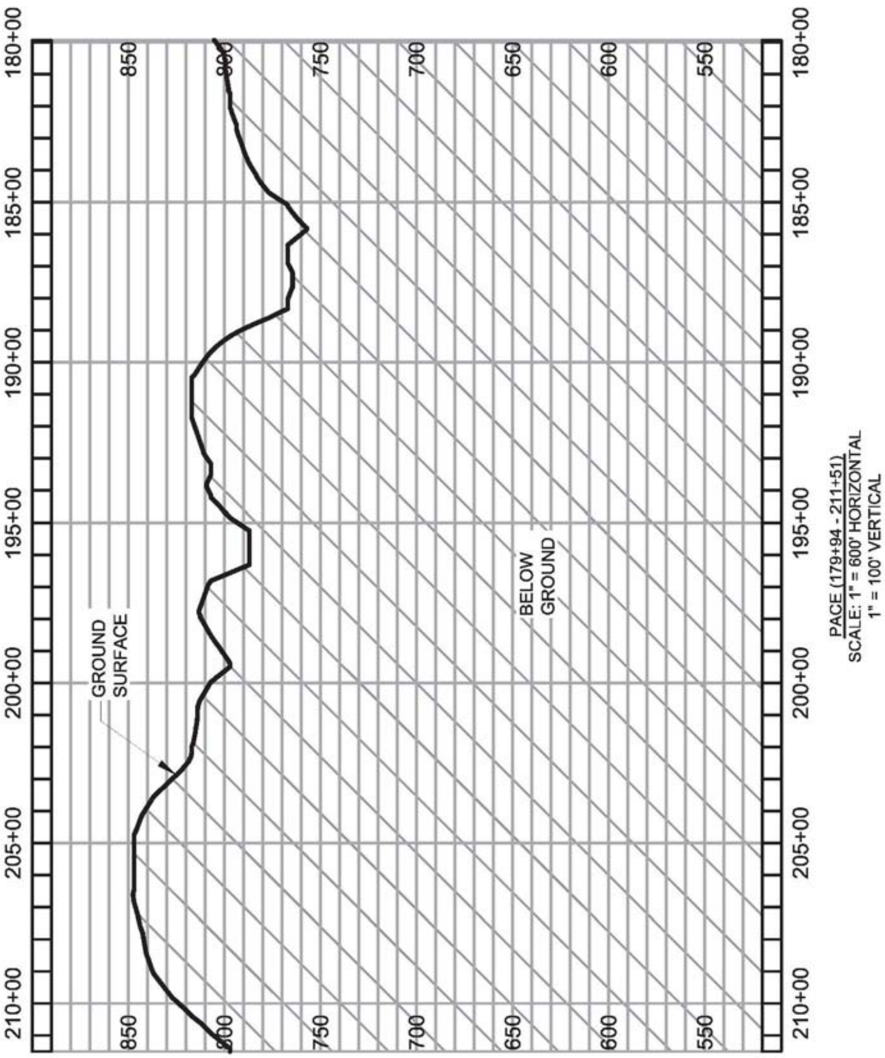
0 250 500 Feet

N

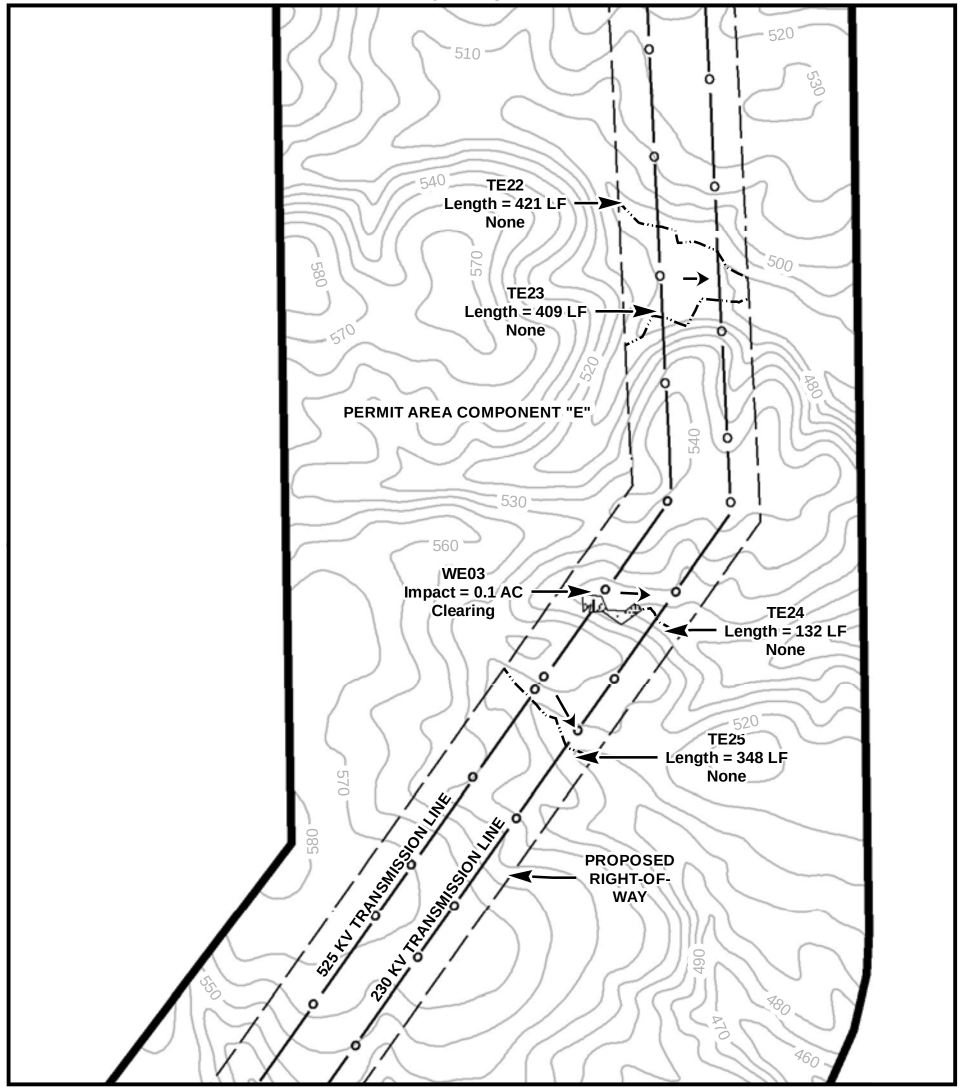
Project: William States Lee III Nuclear Station
CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title: PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E7
Job No. 100008697	Date: 11/9/2011	



MATCHLINE SHEET E7



MATCHLINE SHEET E9

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	1310
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	0.10
	Impact (AC)	0.10
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy

Revisions:

0 250 500 Feet

N

Project:

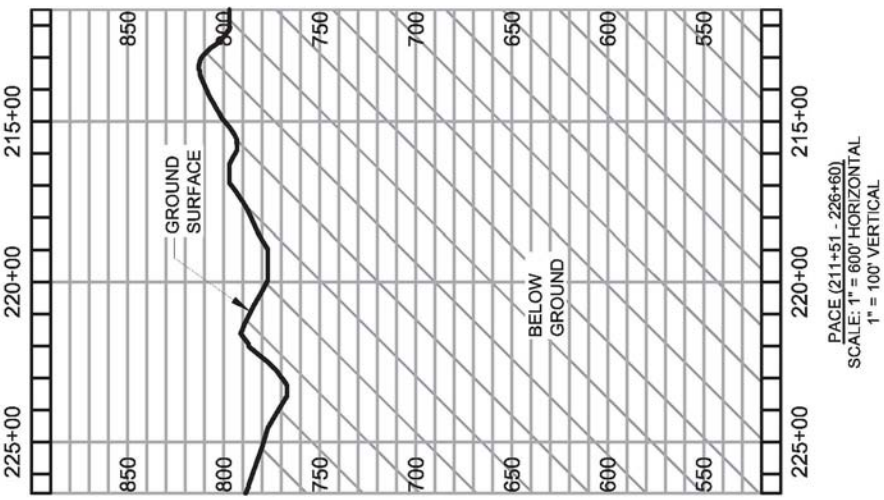
William States Lee III Nuclear Station

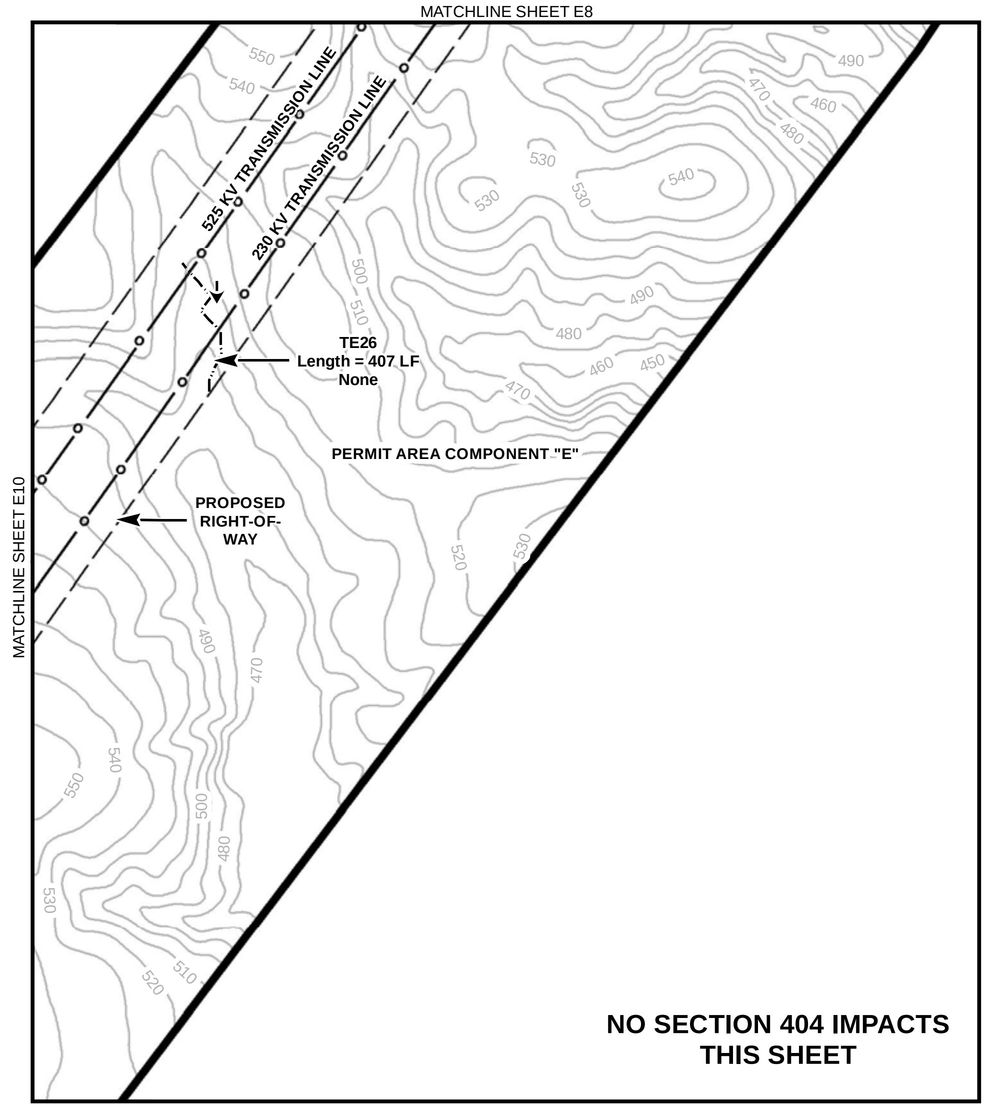
CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title:

PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E8
Job No. 100008697	Date: 11/9/2011	





Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	407
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy

Revisions:

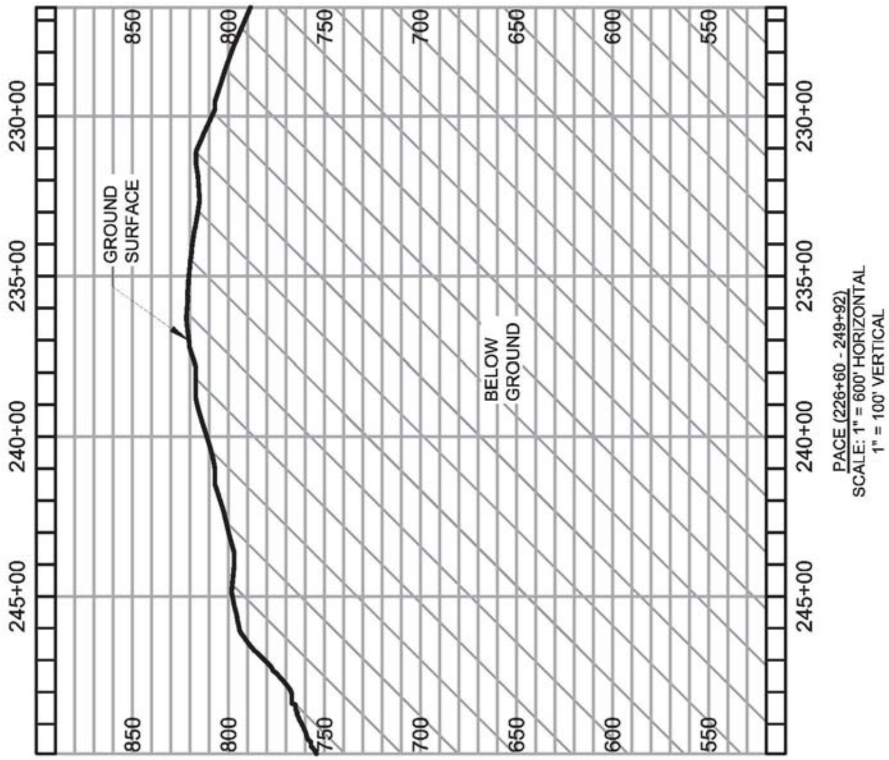
0 250 500 Feet

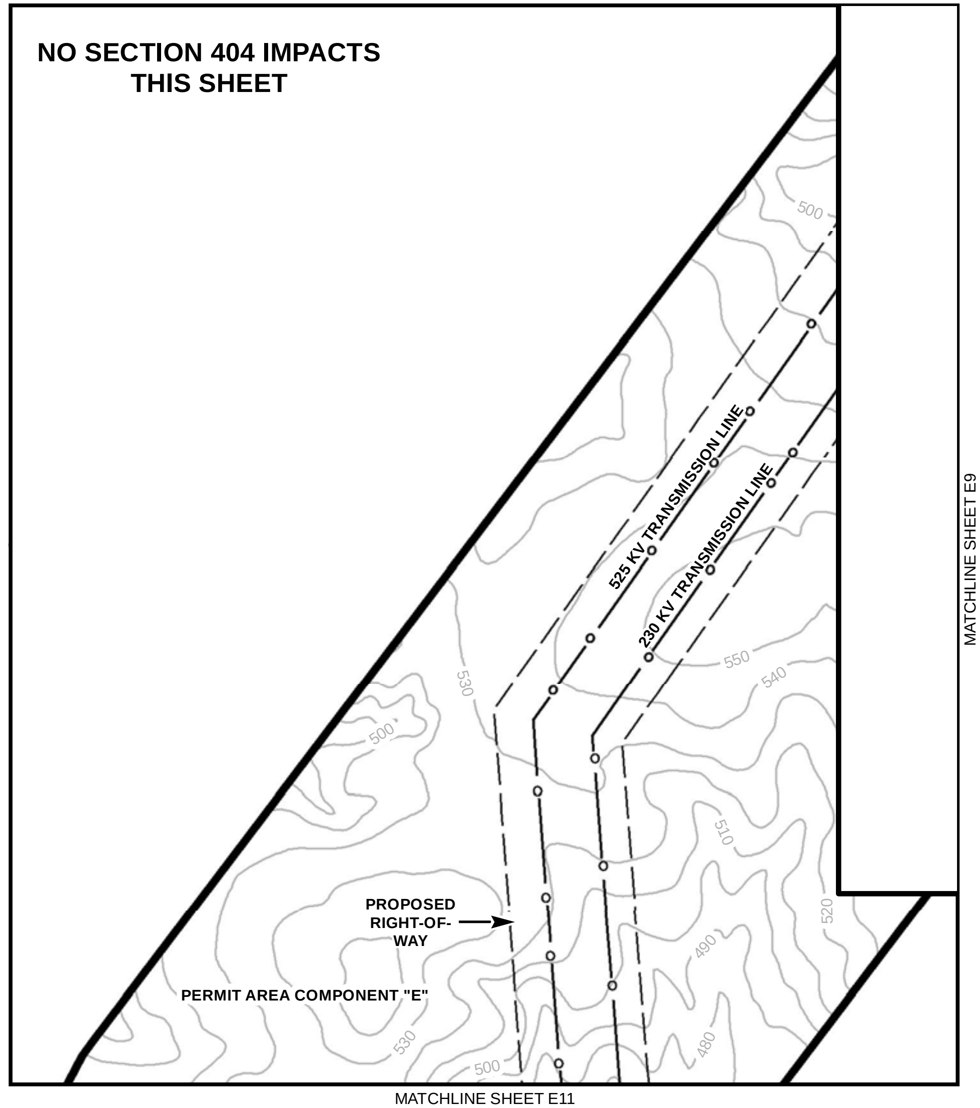
N

Project: William States Lee III Nuclear Station
CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title: PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins
Scale: As Shown
Job No. 100008697
Date: 11/9/2011
SHEET E9





Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	---
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy

Revisions:

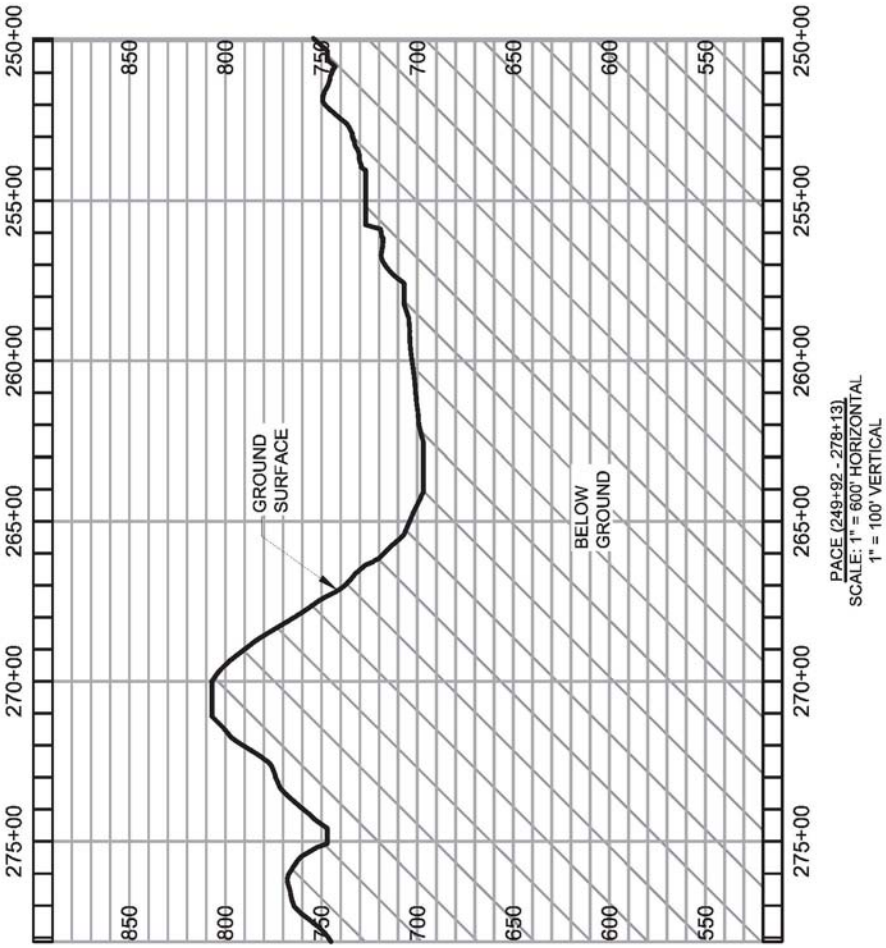
0 250 500 Feet

N

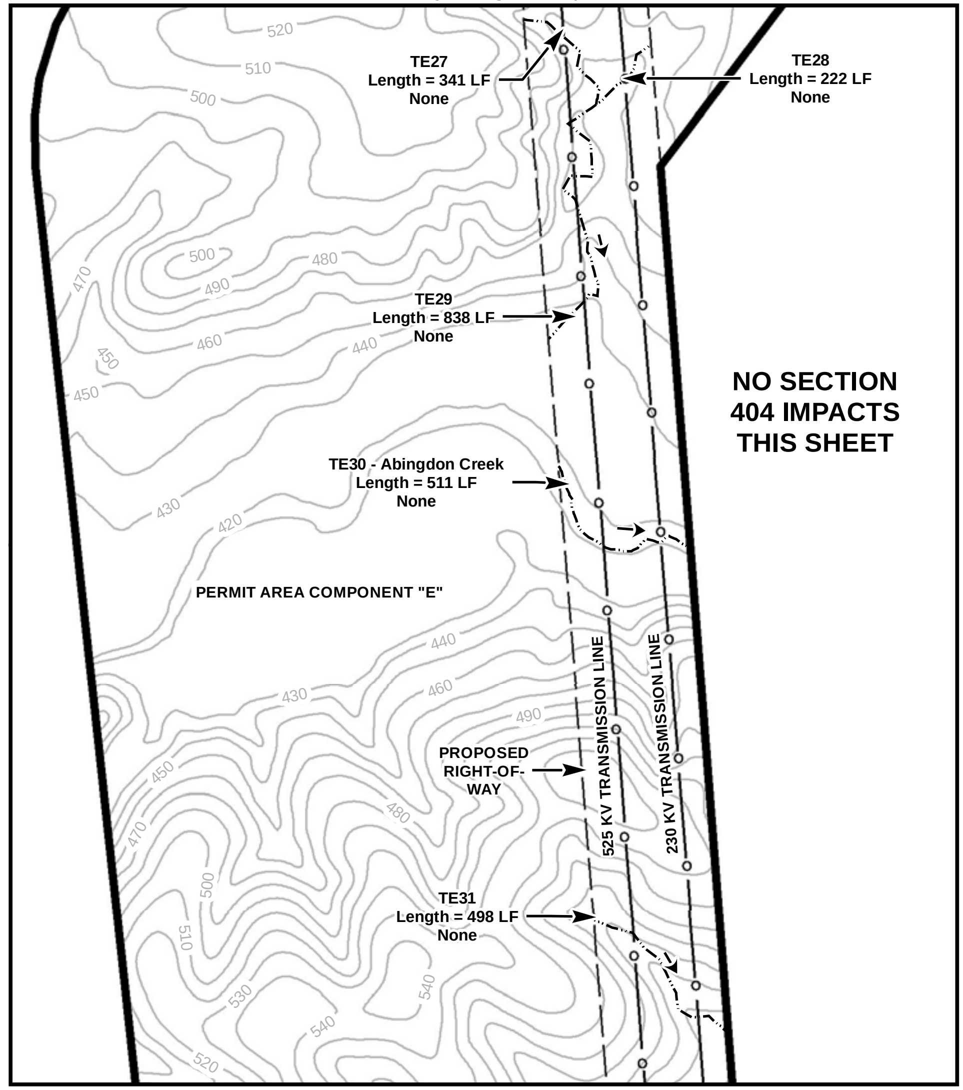
Project: William States Lee III Nuclear Station
CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title: PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E10
Job No. 100008697	Date: 11/9/2011	



MATCHLINE SHEET E10



MATCHLINE SHEET E12

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	2410
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

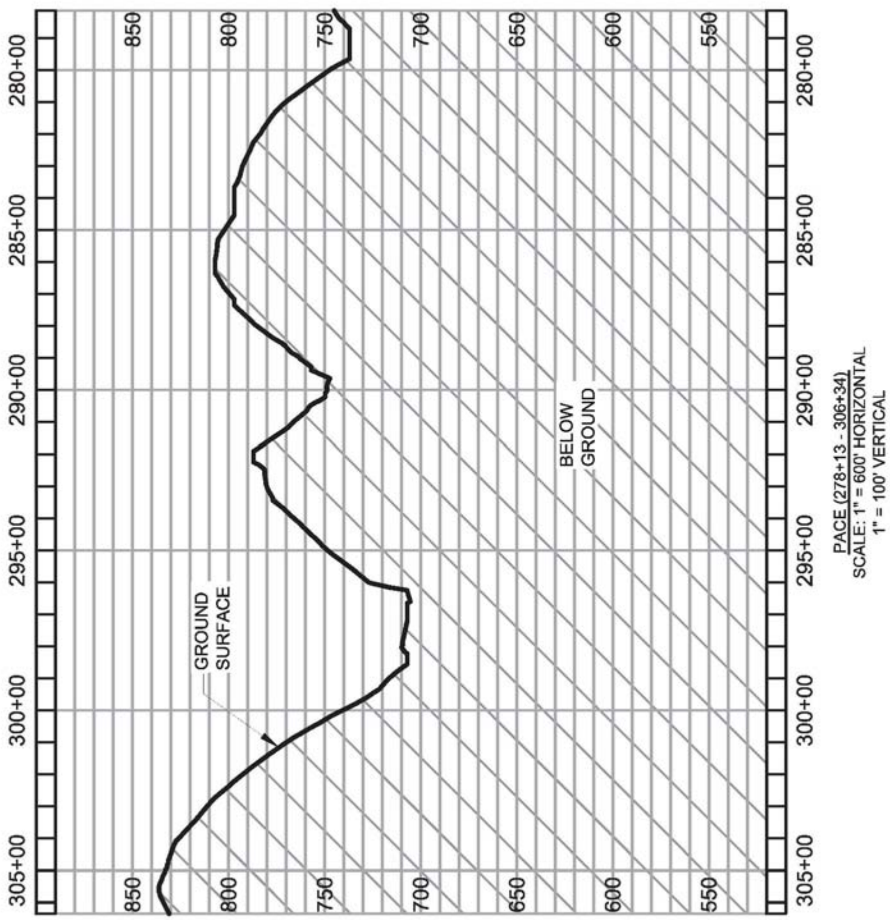
Duke Energy®

Revisions:

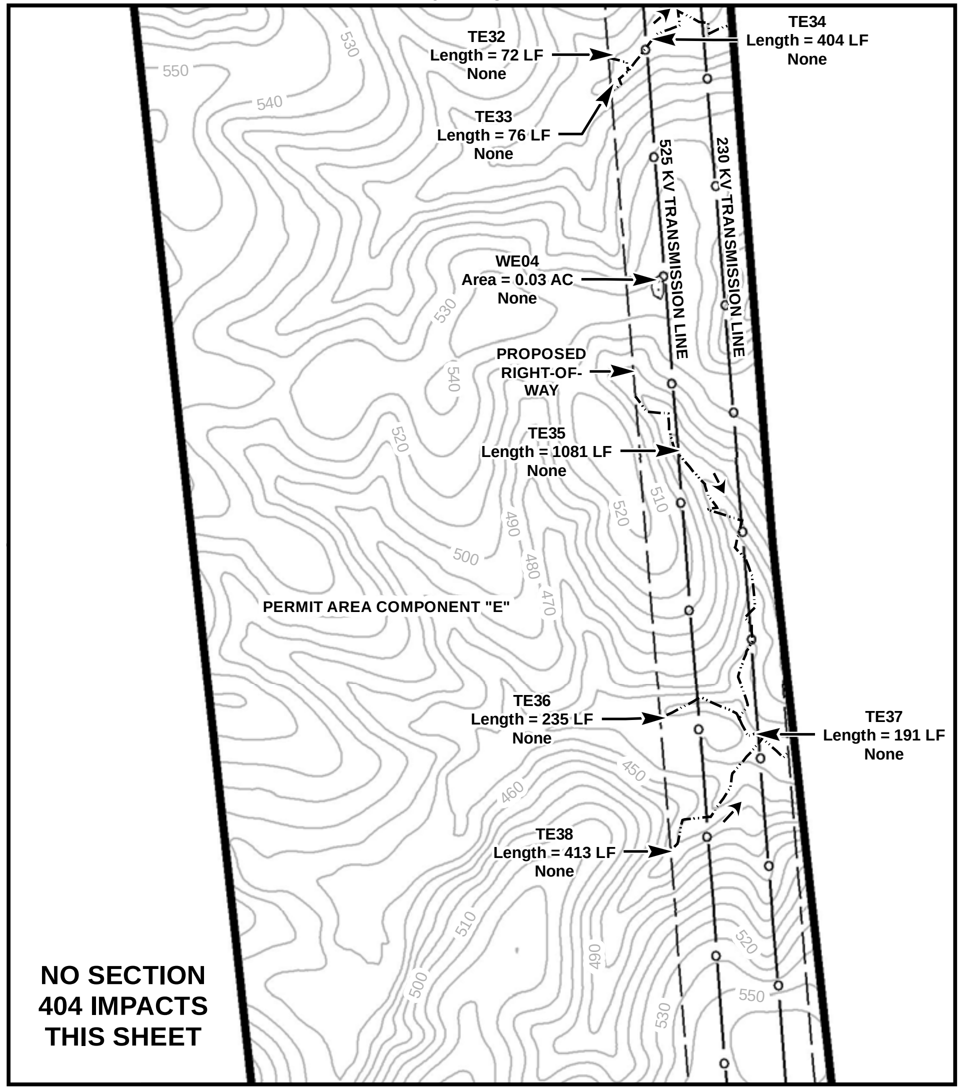
0 250 500 Feet

N

Project:	William States Lee III Nuclear Station CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA
Title:	PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES
Drawn By: Atkins	Scale: As Shown
Job No. 100008697	Date: 11/9/2011
SHEET	E11



MATCHLINE SHEET E11



MATCHLINE SHEET E13

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	2472
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	0.03
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy

Revisions:

0 250 500 Feet

N

Project:

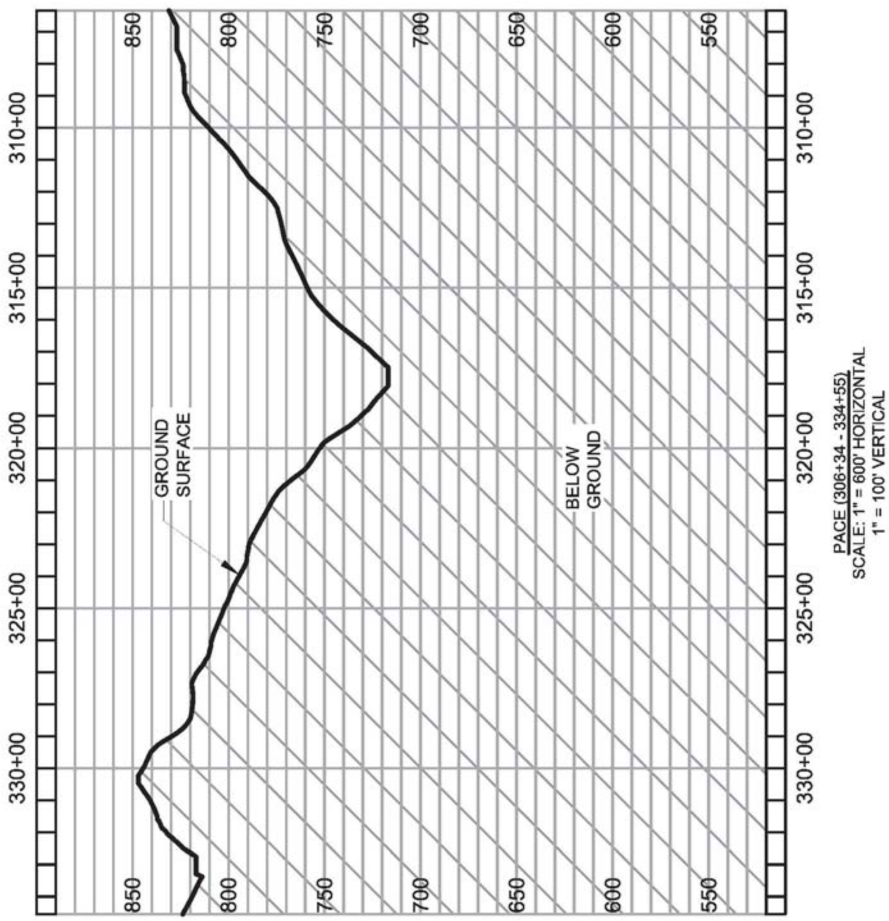
William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

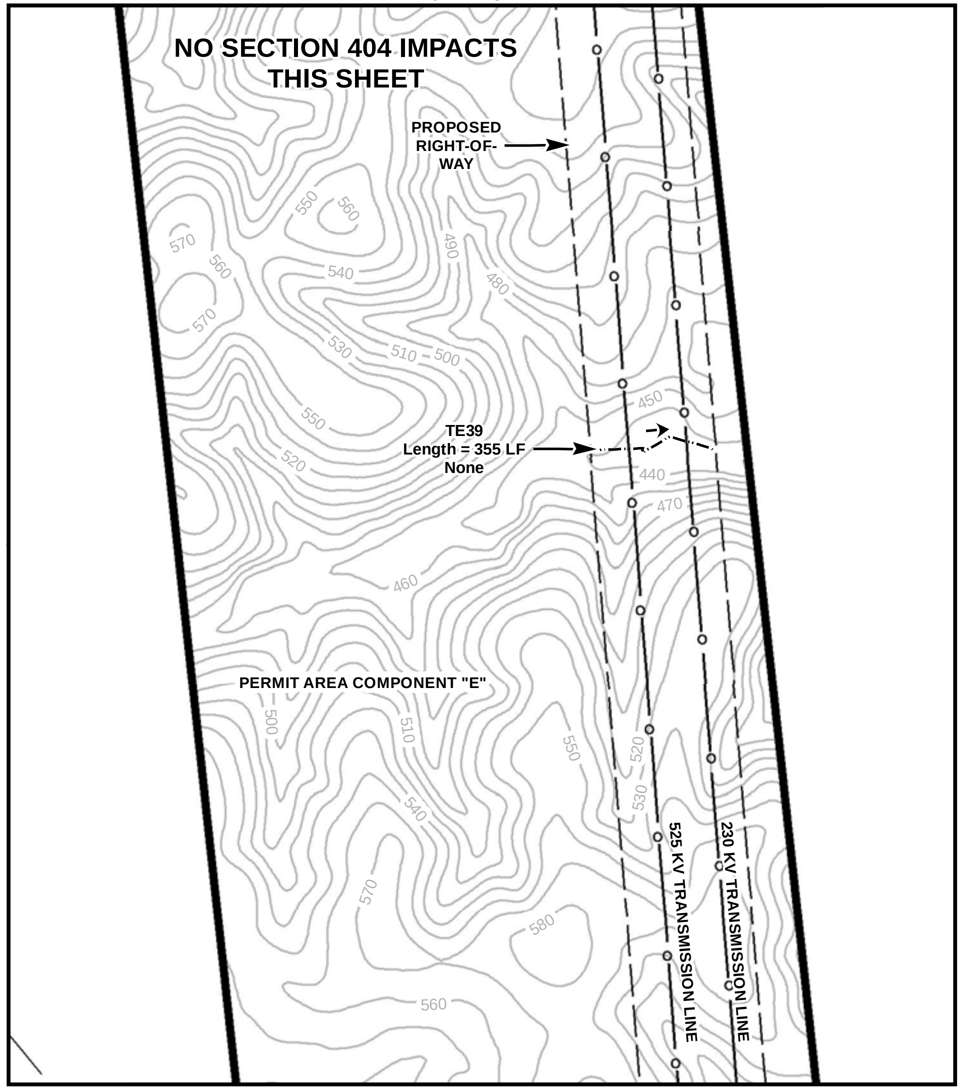
Title:

PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E12
Job No. 100008697	Date: 11/9/2011	



MATCHLINE SHEET E12



MATCHLINE SHEET E14

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	355
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy®

Revisions:

0 250 500 Feet

N

Project:

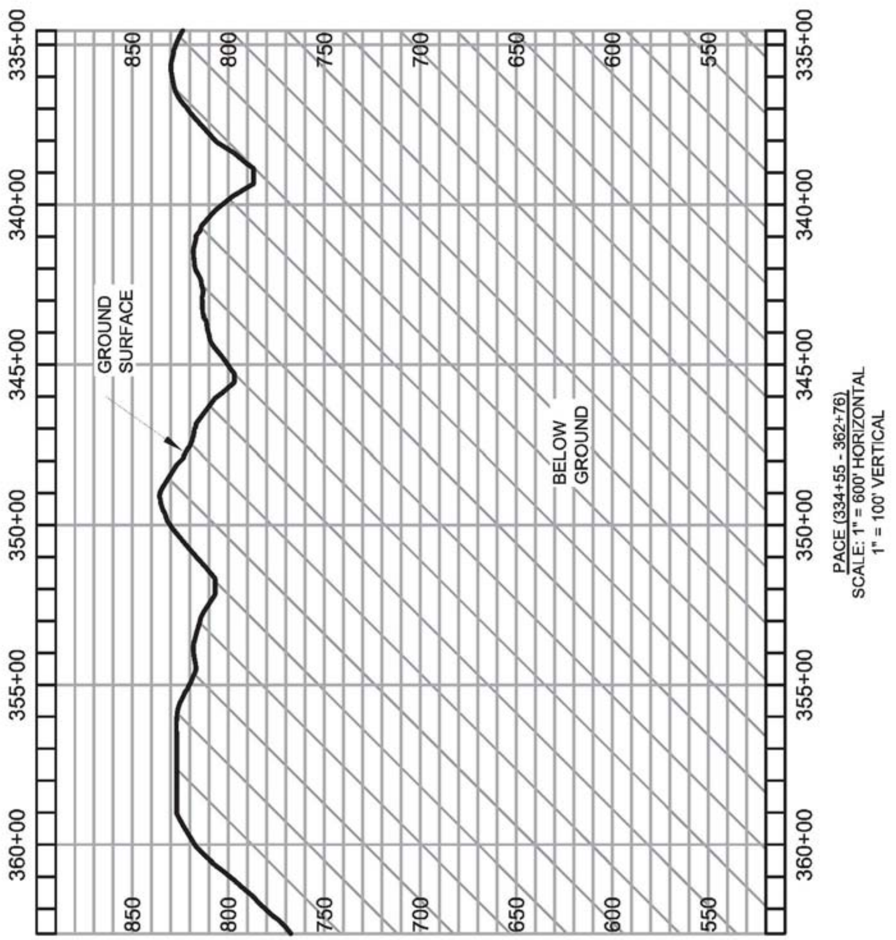
William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

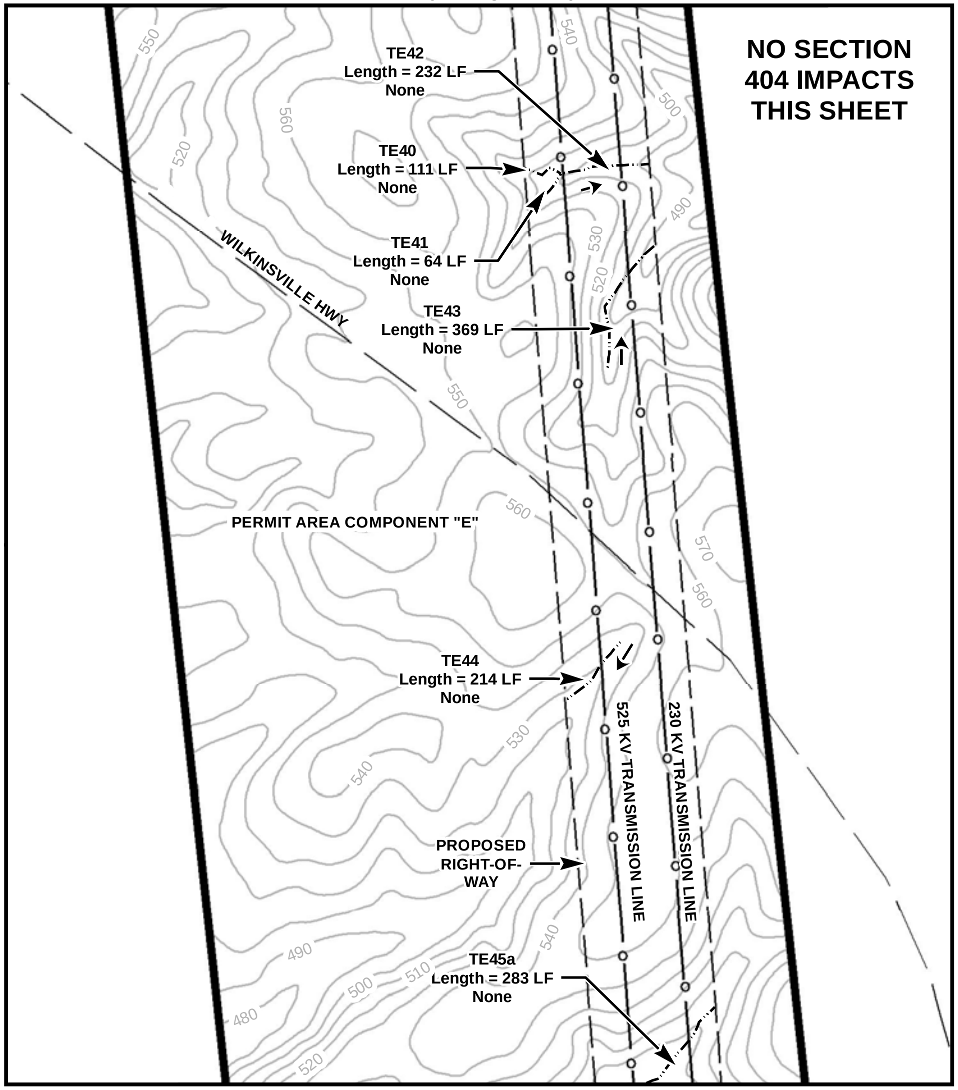
Title:

PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET
Job No. 100008697	Date: 11/9/2011	E13



MATCHLINE SHEET E13



MATCHLINE SHEET E15

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	1273
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy®

Revisions:

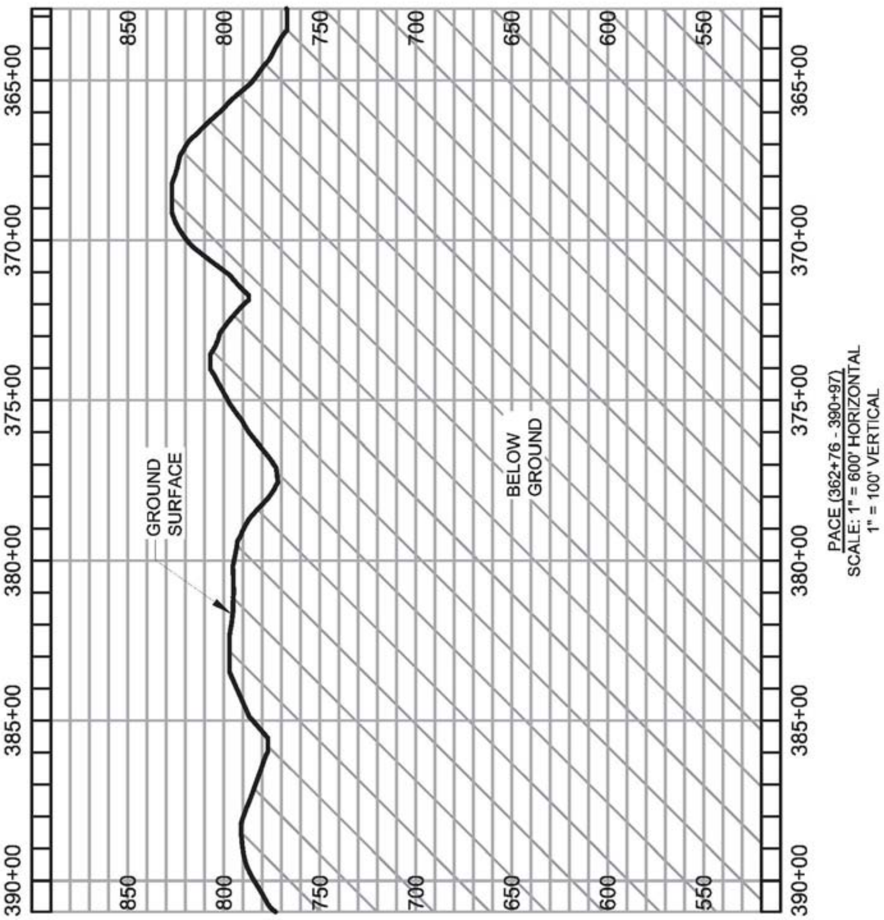
0 250 500 Feet

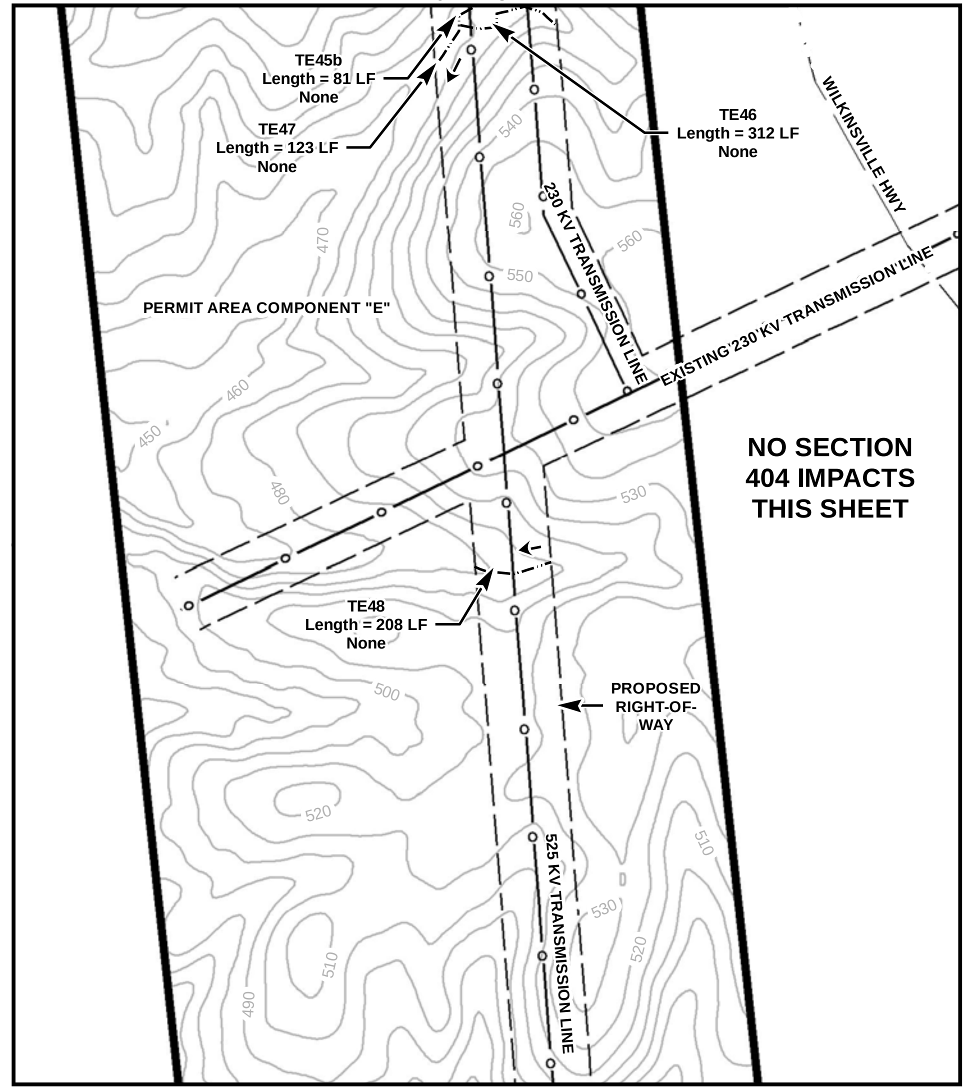
N

Project:
William States Lee III Nuclear Station
CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title:
PERMIT AREA COMPONENT "E" LEE SITE
OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E14
Job No. 100008697	Date: 11/9/2011	





Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	724
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy

Revisions:

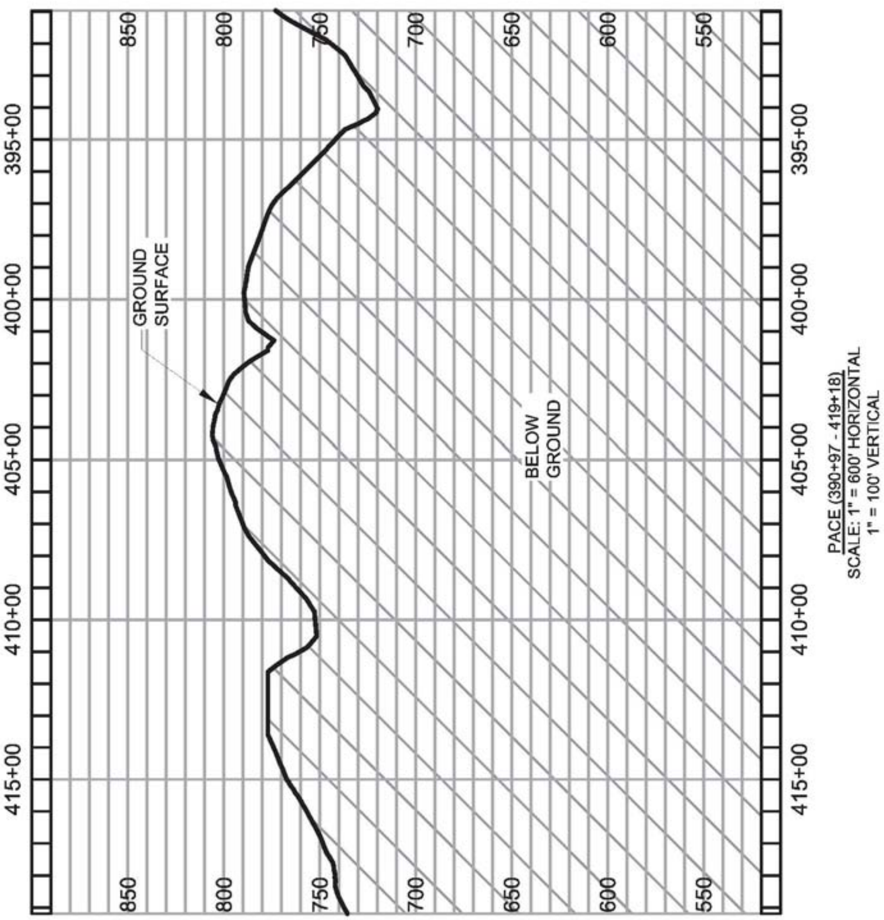
0 250 500 Feet

N

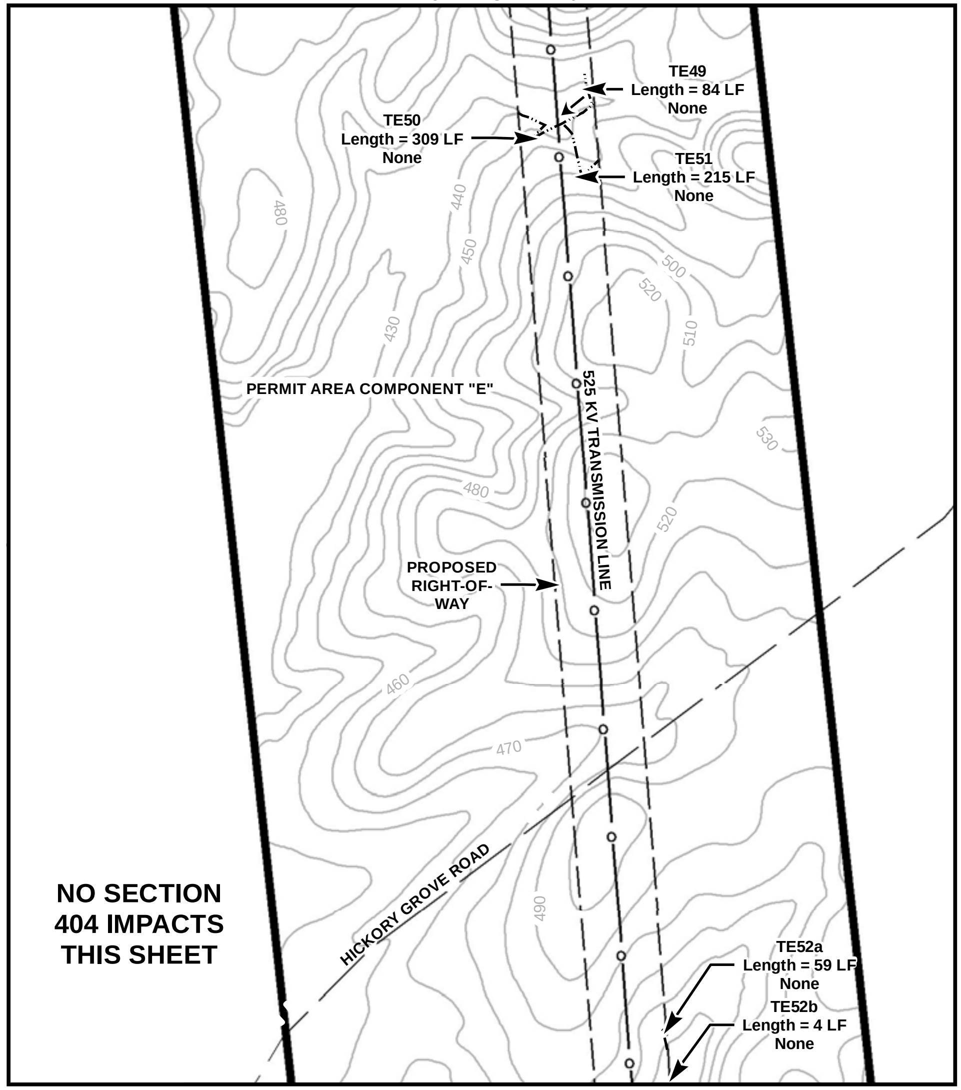
Project:
William States Lee III Nuclear Station
CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title:
PERMIT AREA COMPONENT "E" LEE SITE
OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E15
Job No. 100008697	Date: 11/9/2011	



MATCHLINE SHEET E15



MATCHLINE SHEET E17

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	671
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy®

Revisions:

0 250 500 Feet

N

Project:

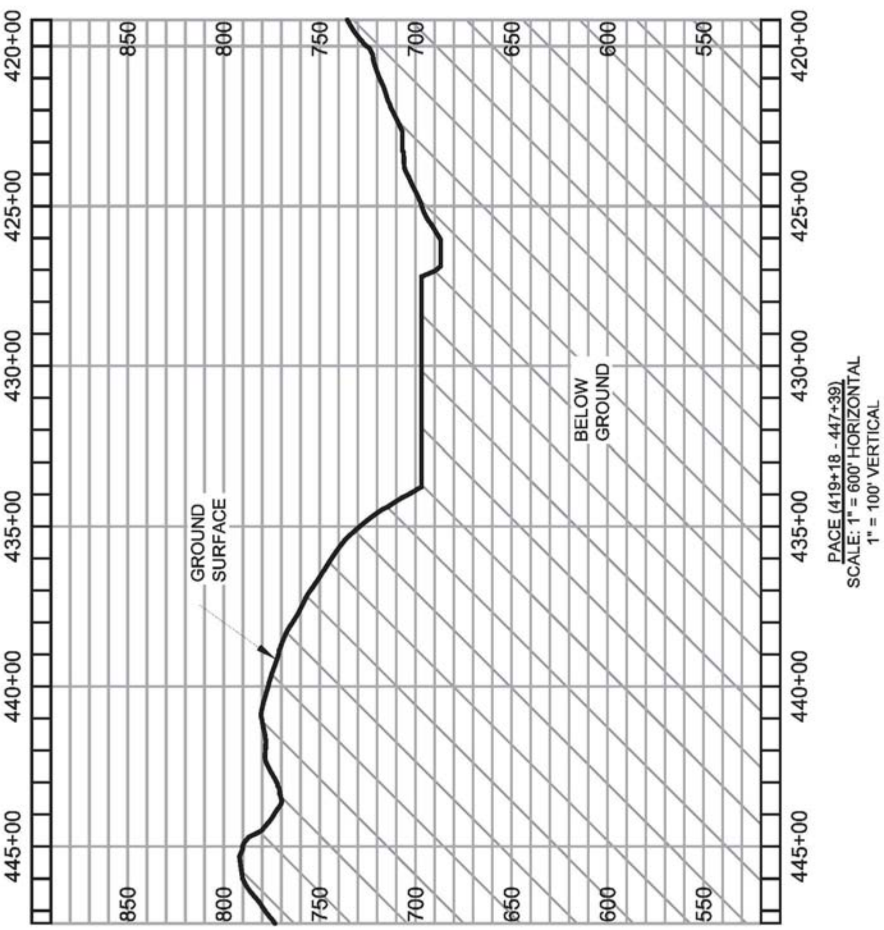
William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

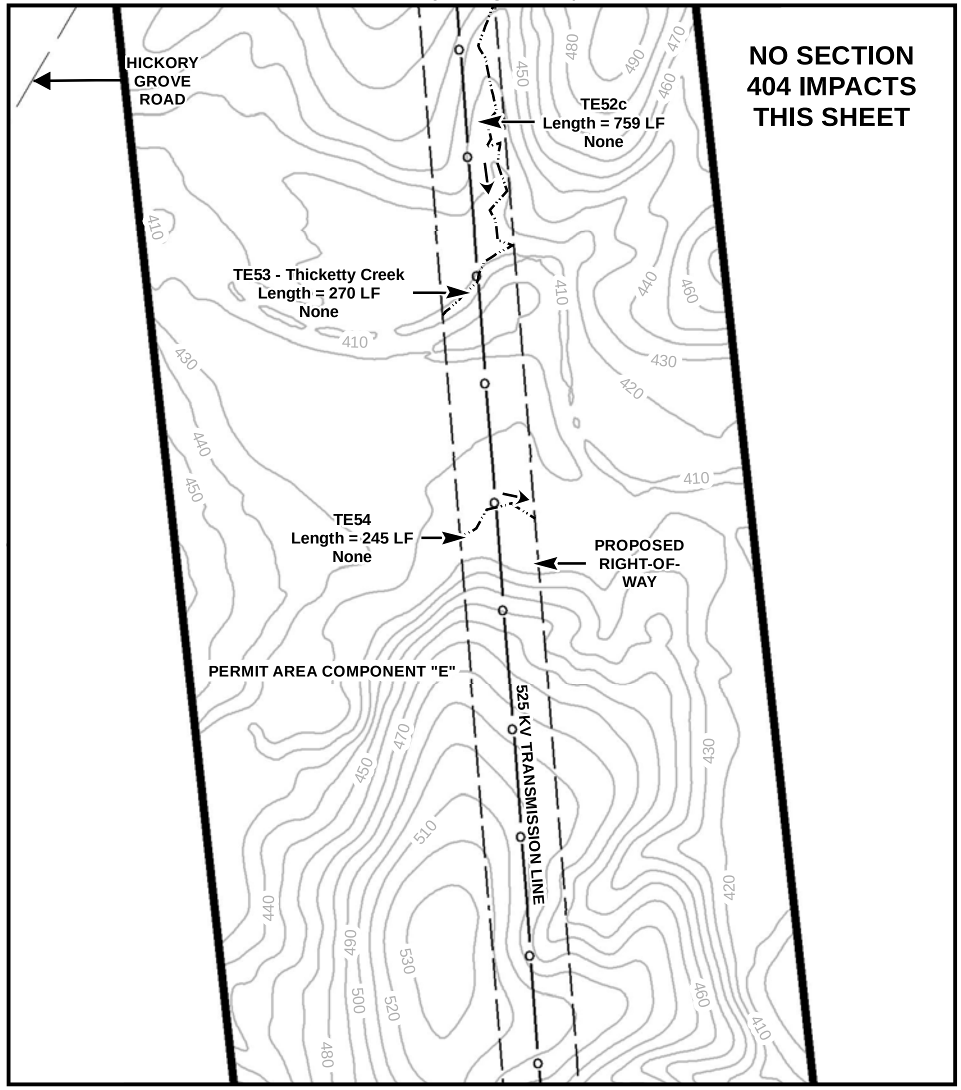
Title:

PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E16
Job No. 100008697	Date: 11/9/2011	



MATCHLINE SHEET E16



MATCHLINE SHEET E18

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	1274
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy

Revisions:

0 250 500 Feet

N

Project:

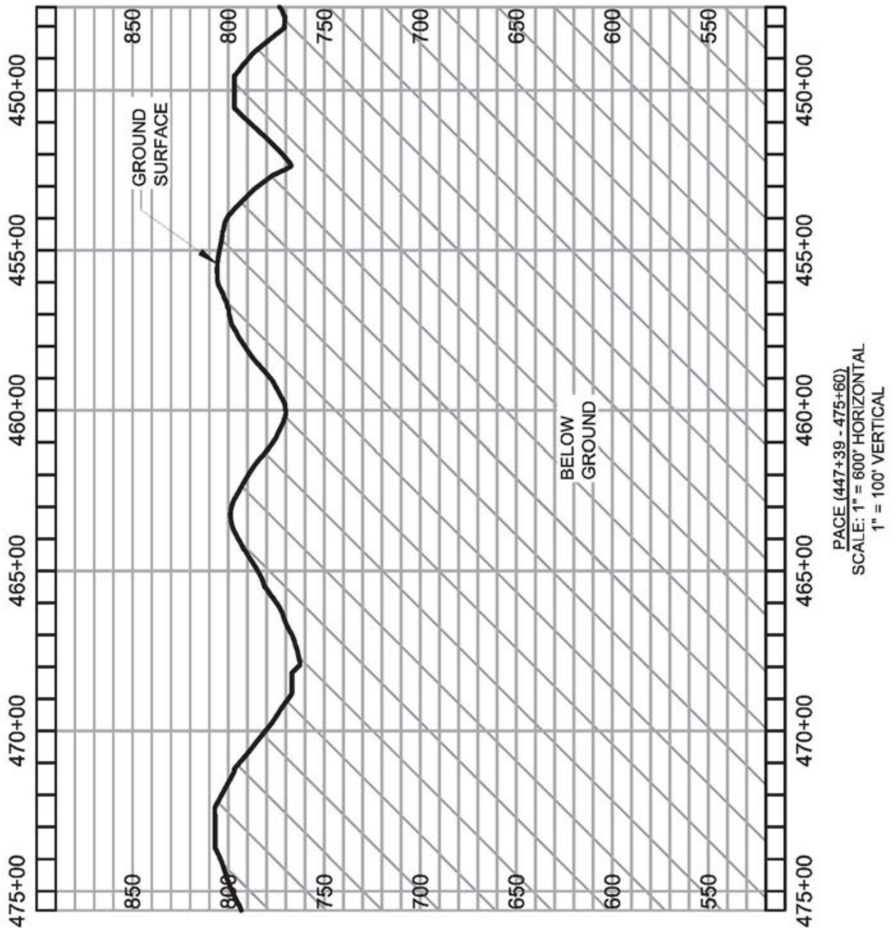
William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

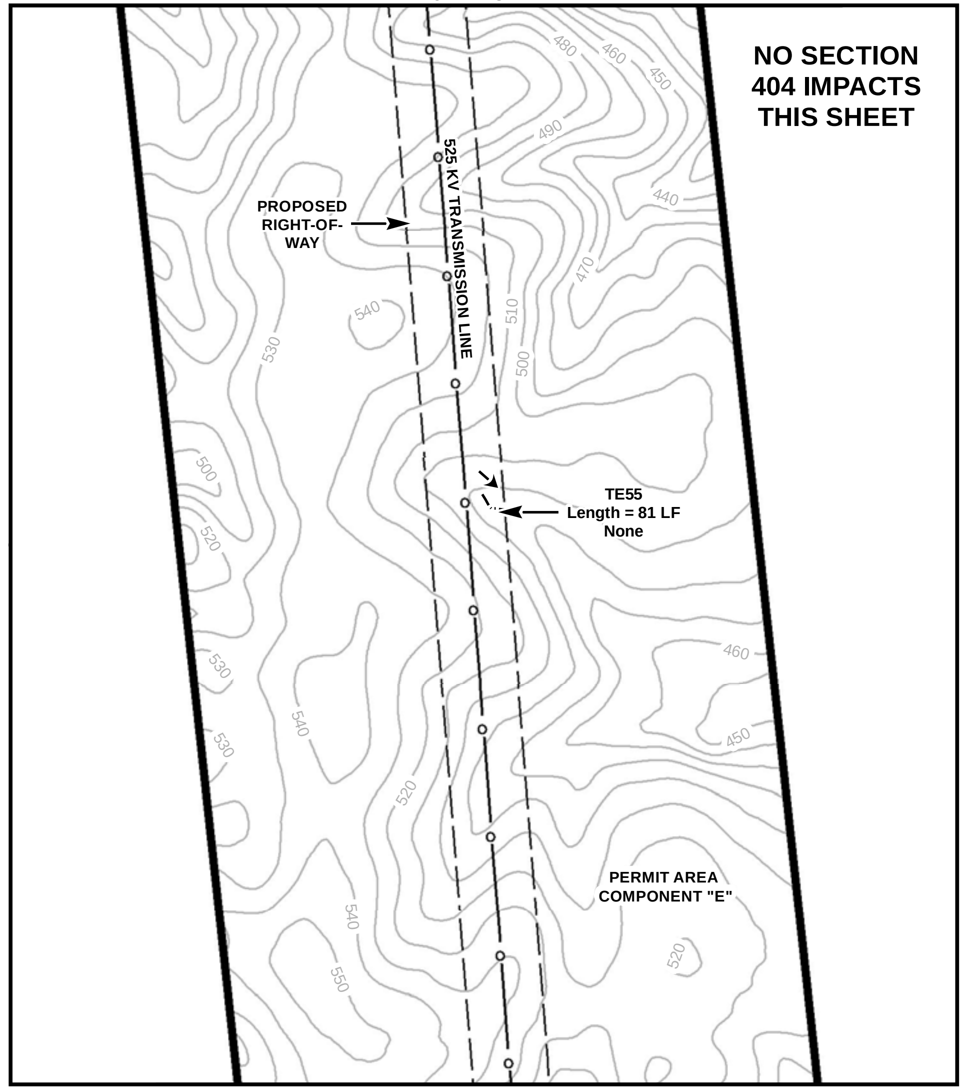
Title:

PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E17
Job No. 100008697	Date: 11/9/2011	



MATCHLINE SHEET E17



MATCHLINE SHEET E19

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	81
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy

Revisions:

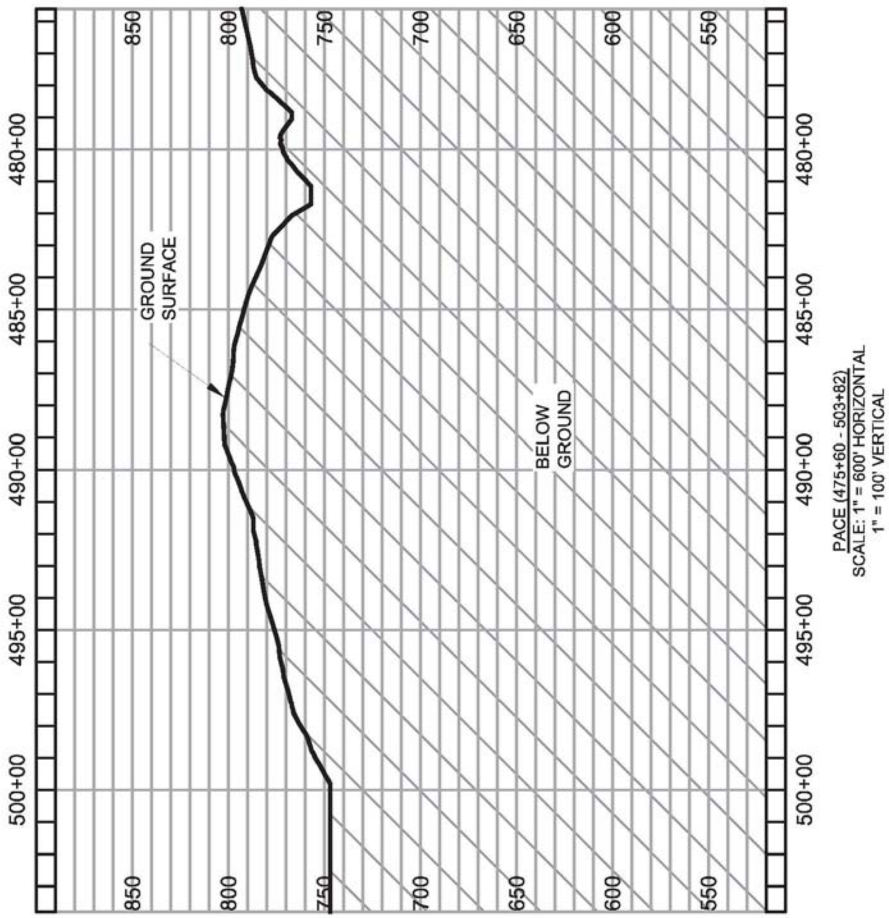
0 250 500 Feet

N

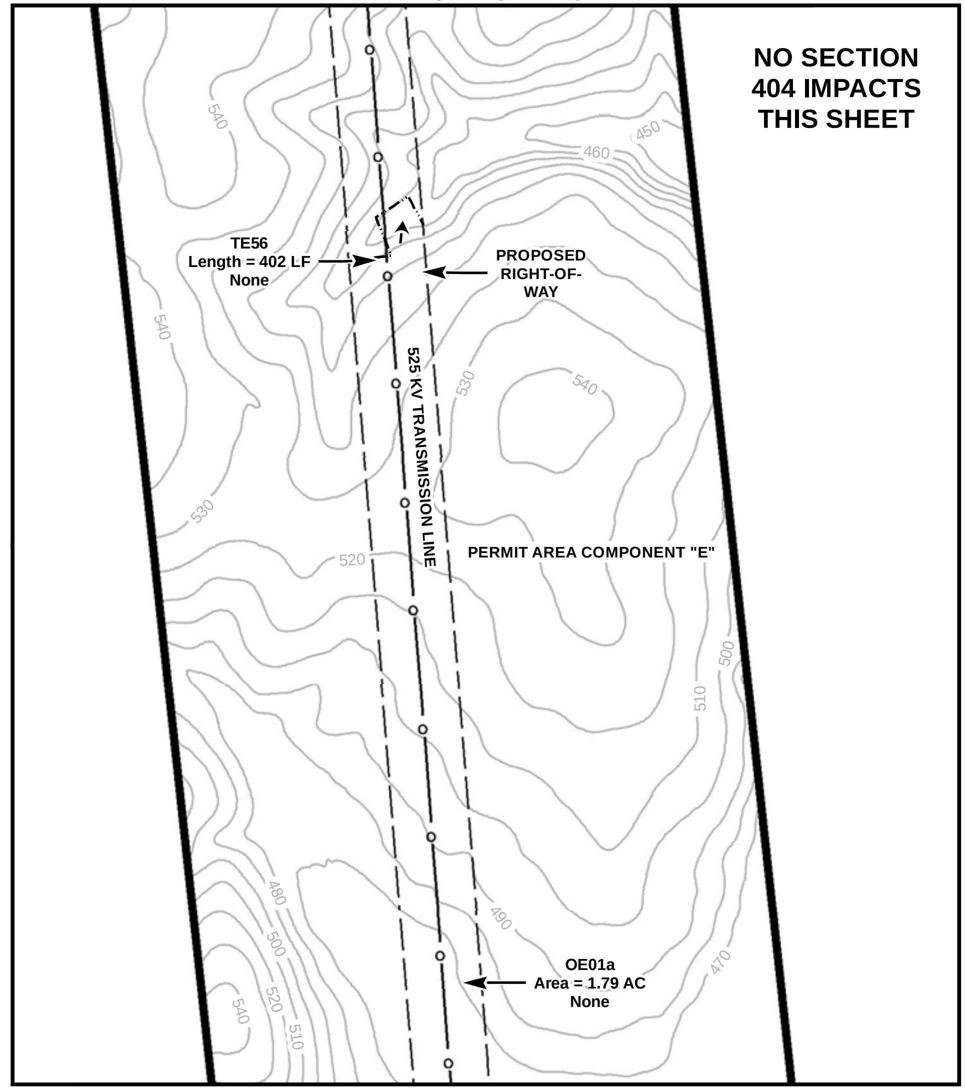
Project: William States Lee III Nuclear Station
CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title: PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E18
Job No. 100008697	Date: 11/9/2011	



MATCHLINE SHEET E18



MATCHLINE SHEET E20

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	402
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	1.79
	Impact (AC)	---

Applicant:

Duke Energy®

Revisions:

0 250 500 Feet

N

Project:

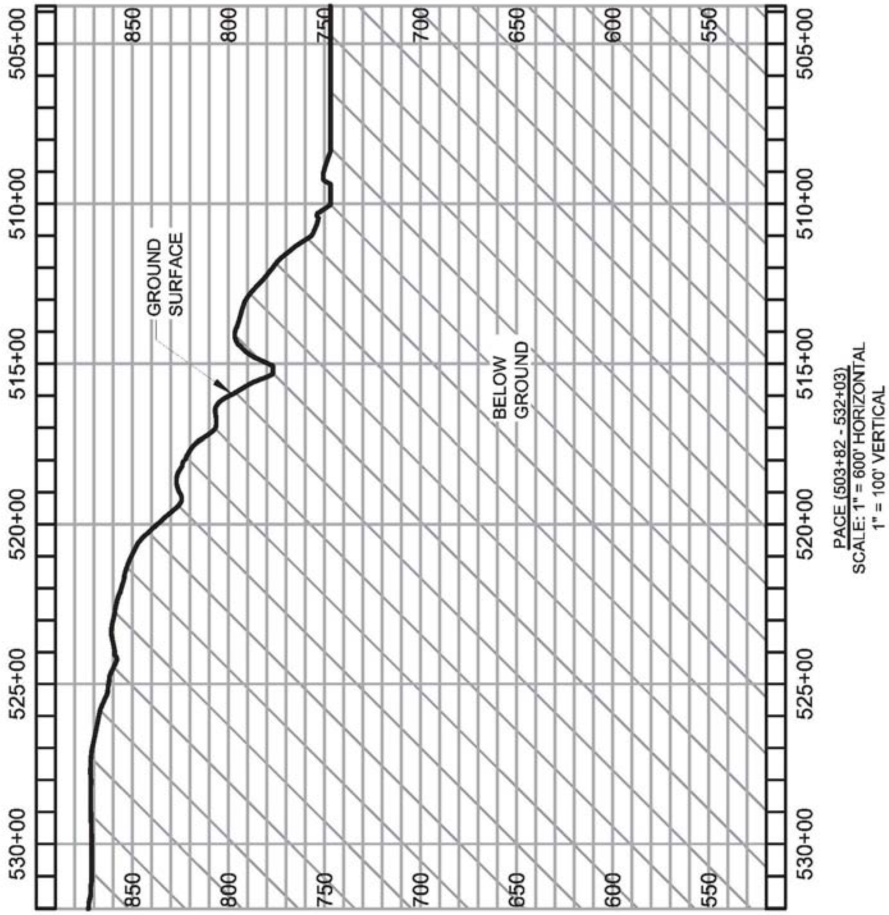
William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

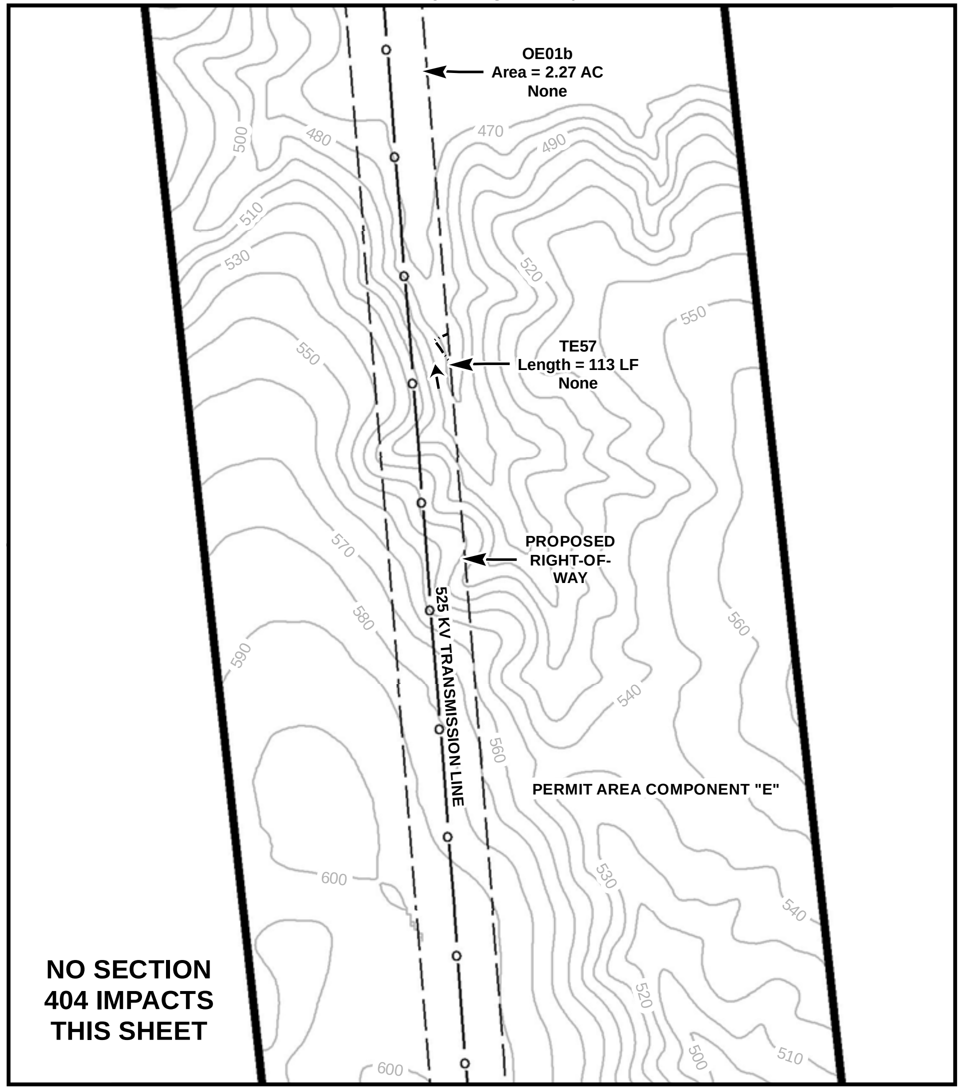
Title:

PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E19
Job No. 100008697	Date: 11/9/2011	



MATCHLINE SHEET E19



MATCHLINE SHEET E21

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	113
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	2.27
	Impact (AC)	---

Applicant:

Duke Energy

Revisions:

0 250 500 Feet

N

Project:

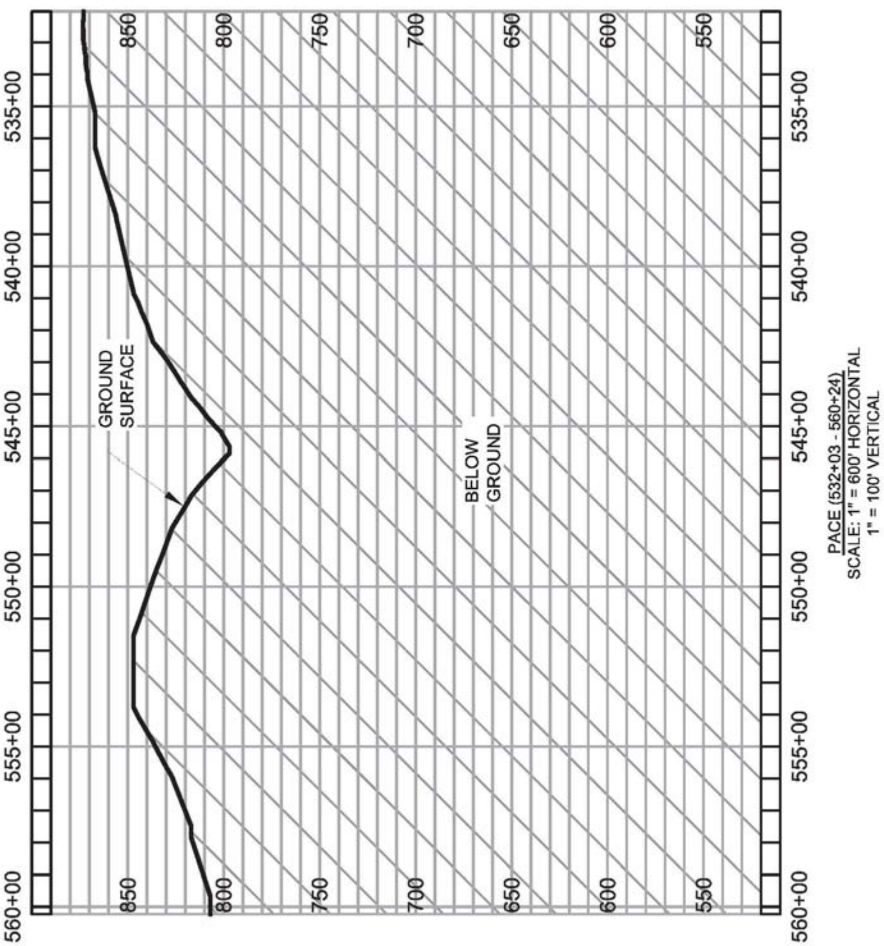
William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

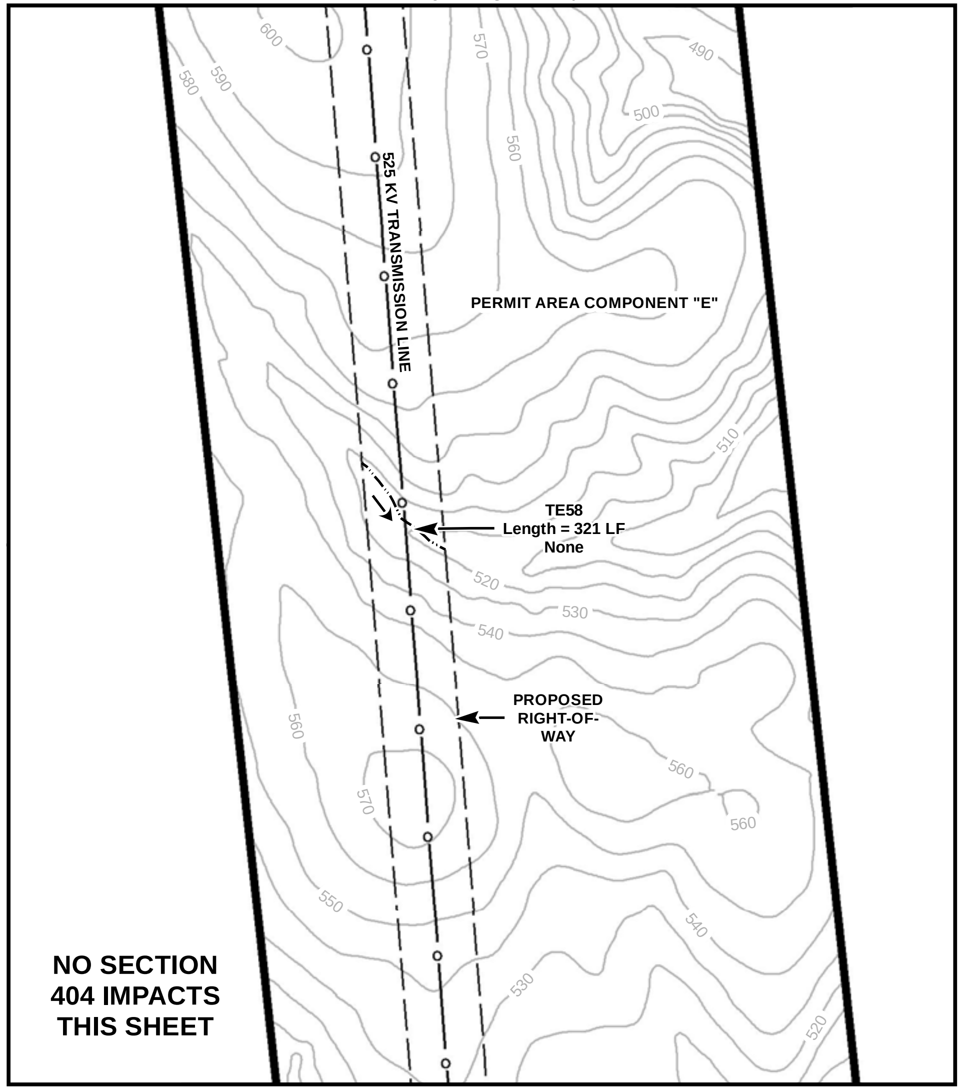
Title:

PERMIT AREA COMPONENT "E" LEE SITE
OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET
Job No. 100008697	Date: 11/9/2011	E20



MATCHLINE SHEET E20



MATCHLINE SHEET E22

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	321
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Revisions:

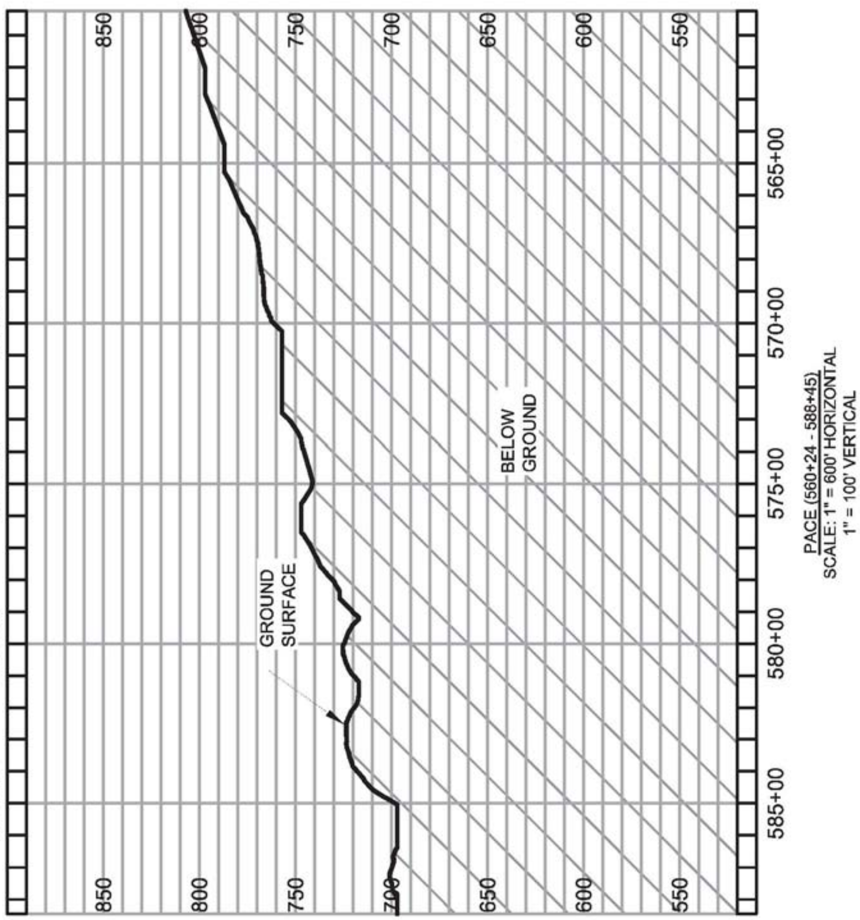
0 250 500 Feet

N

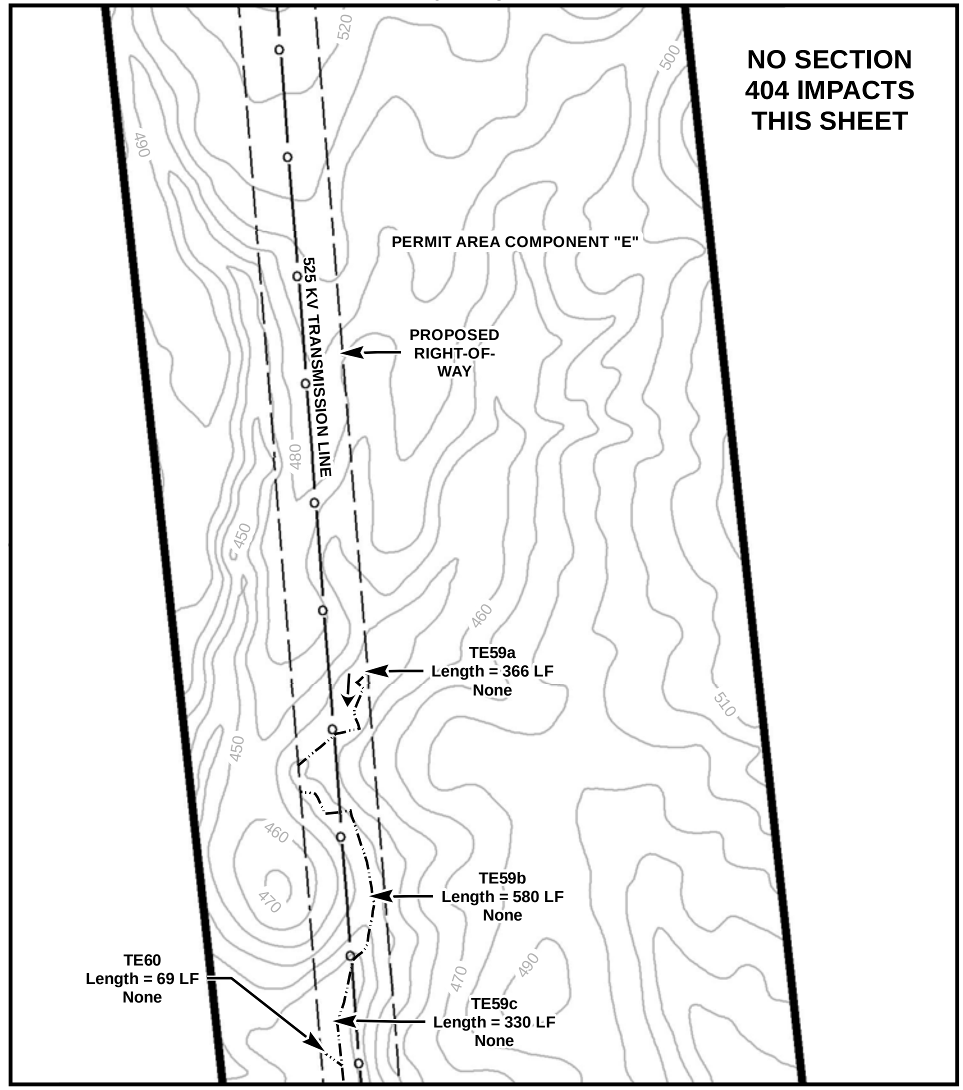
Project:
William States Lee III Nuclear Station
CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title:
PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins
Scale: As Shown
SHEET E21
Job No. 100008697
Date: 11/9/2011



MATCHLINE SHEET E21



MATCHLINE SHEET E23

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	1345
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy®

Revisions:

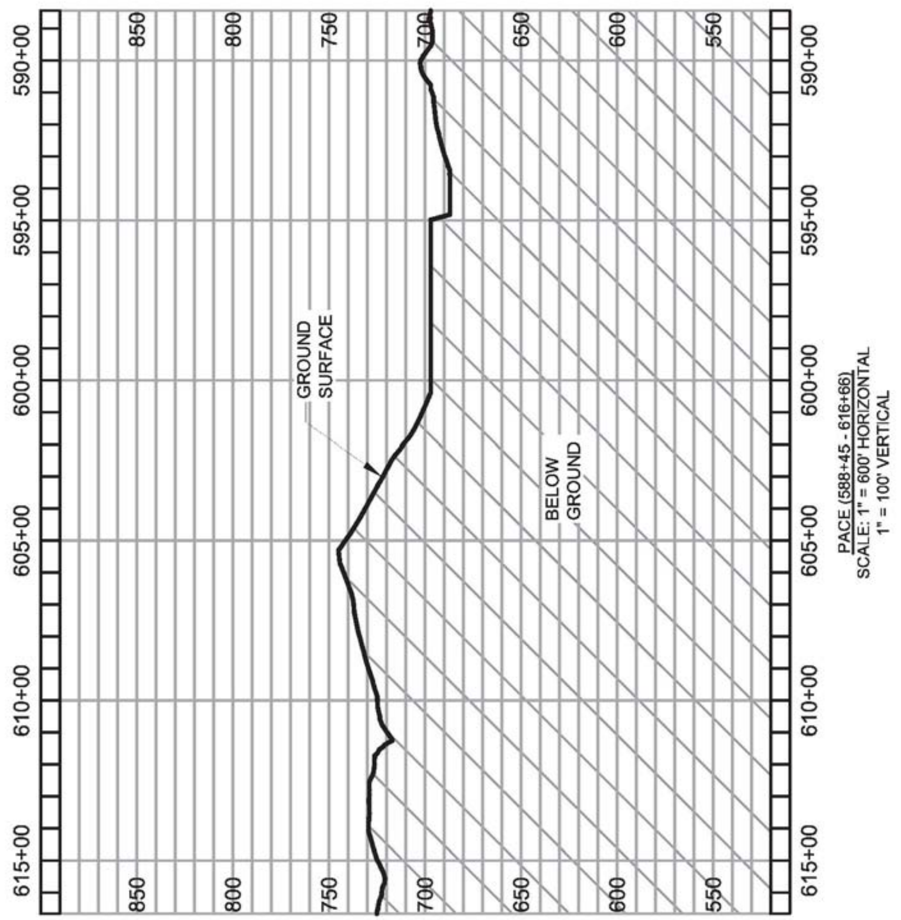
0 250 500 Feet

N

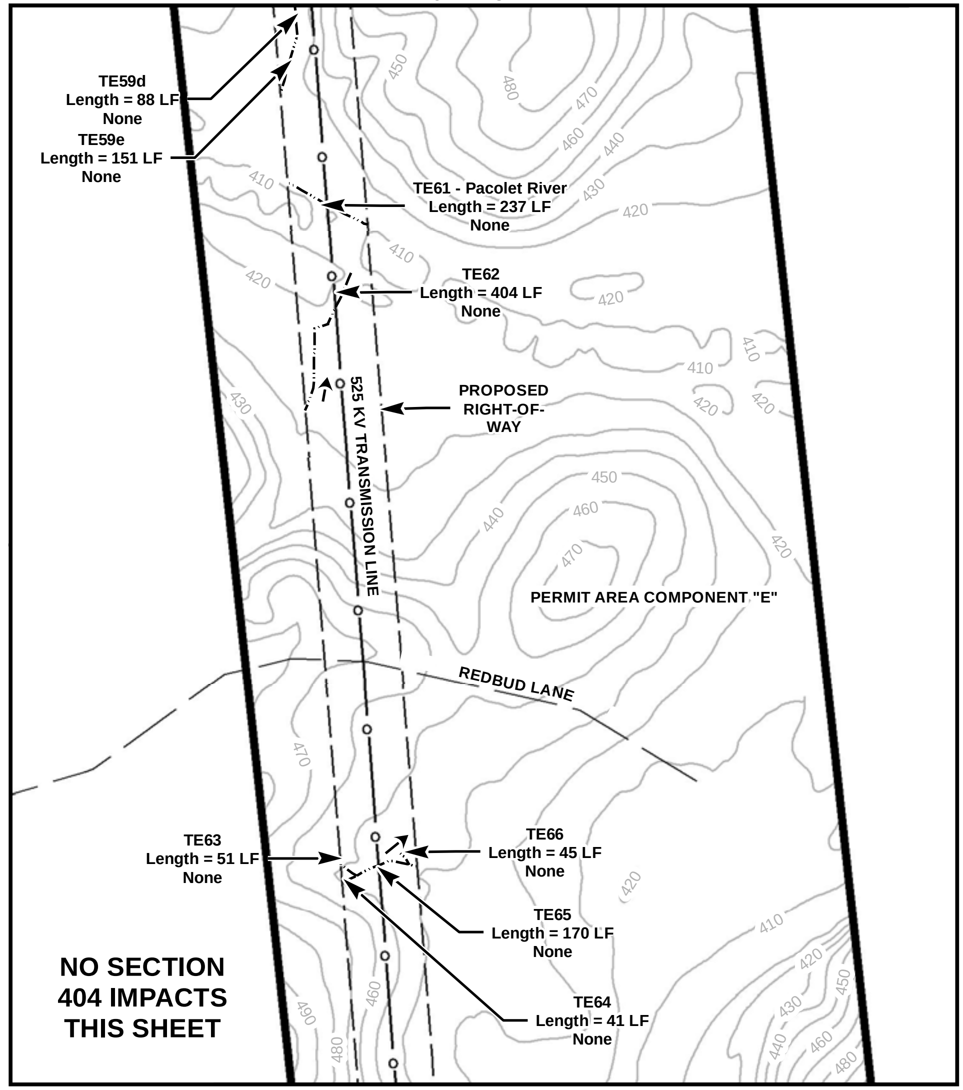
Project:
William States Lee III Nuclear Station
CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title:
PERMIT AREA COMPONENT "E" LEE SITE
OFFSITE TRANSMISSION LINES

Drawn By: Atkins
Scale: As Shown
Job No. 100008697
Date: 11/9/2011
SHEET E22



MATCHLINE SHEET E22



MATCHLINE SHEET E24

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	1187
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy

Revisions:

0 250 500 Feet

N

Project:

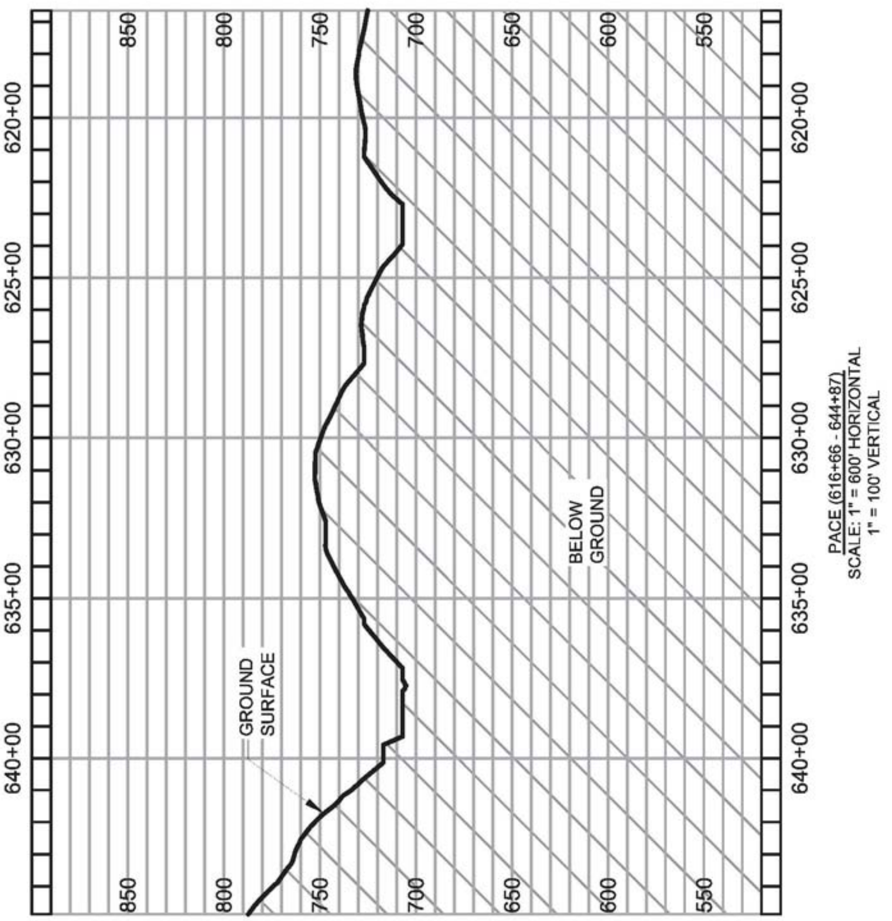
William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

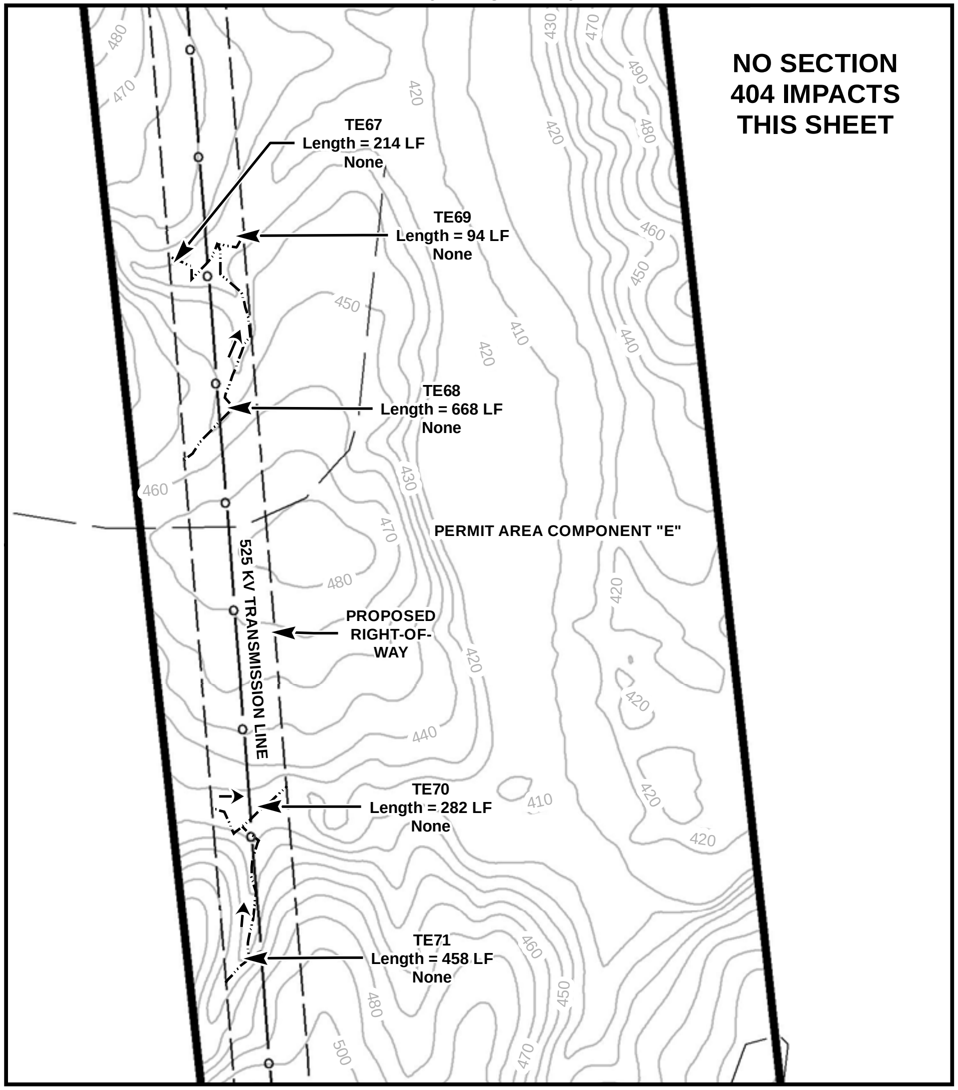
Title:

PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET
Job No. 100008697	Date: 11/9/2011	E23



MATCHLINE SHEET E23



MATCHLINE SHEET E25

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	1716
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy

Revisions:

0 250 500 Feet

N

Project:

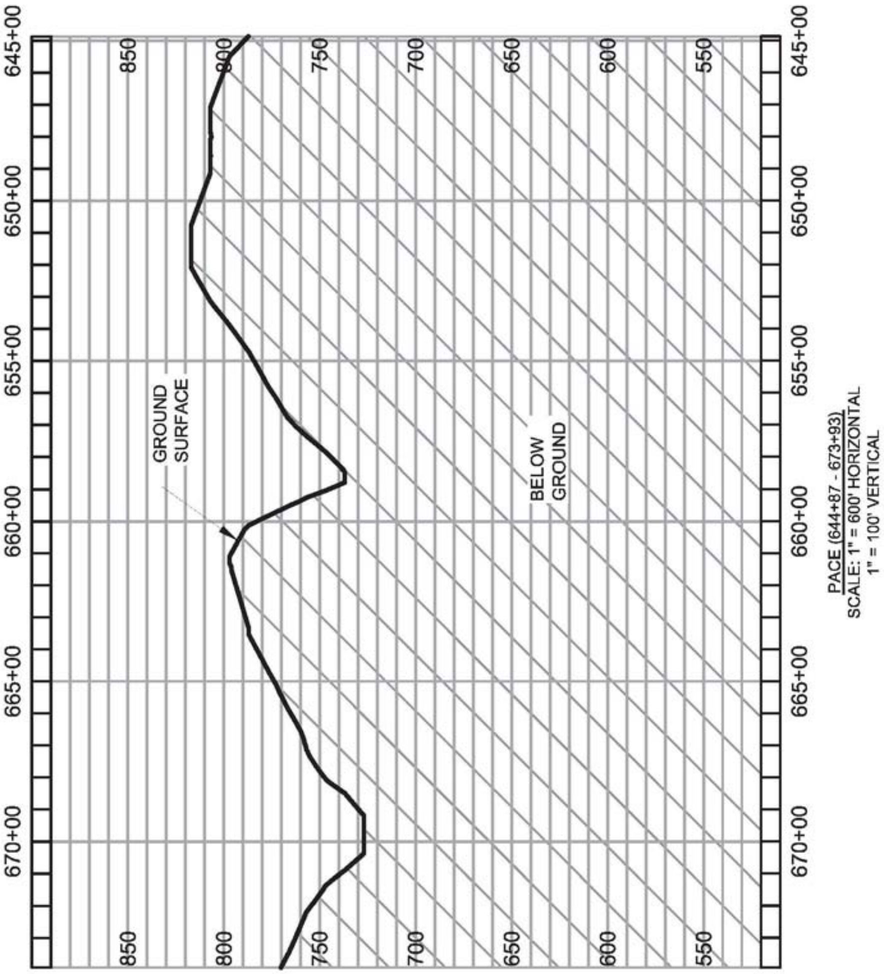
William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

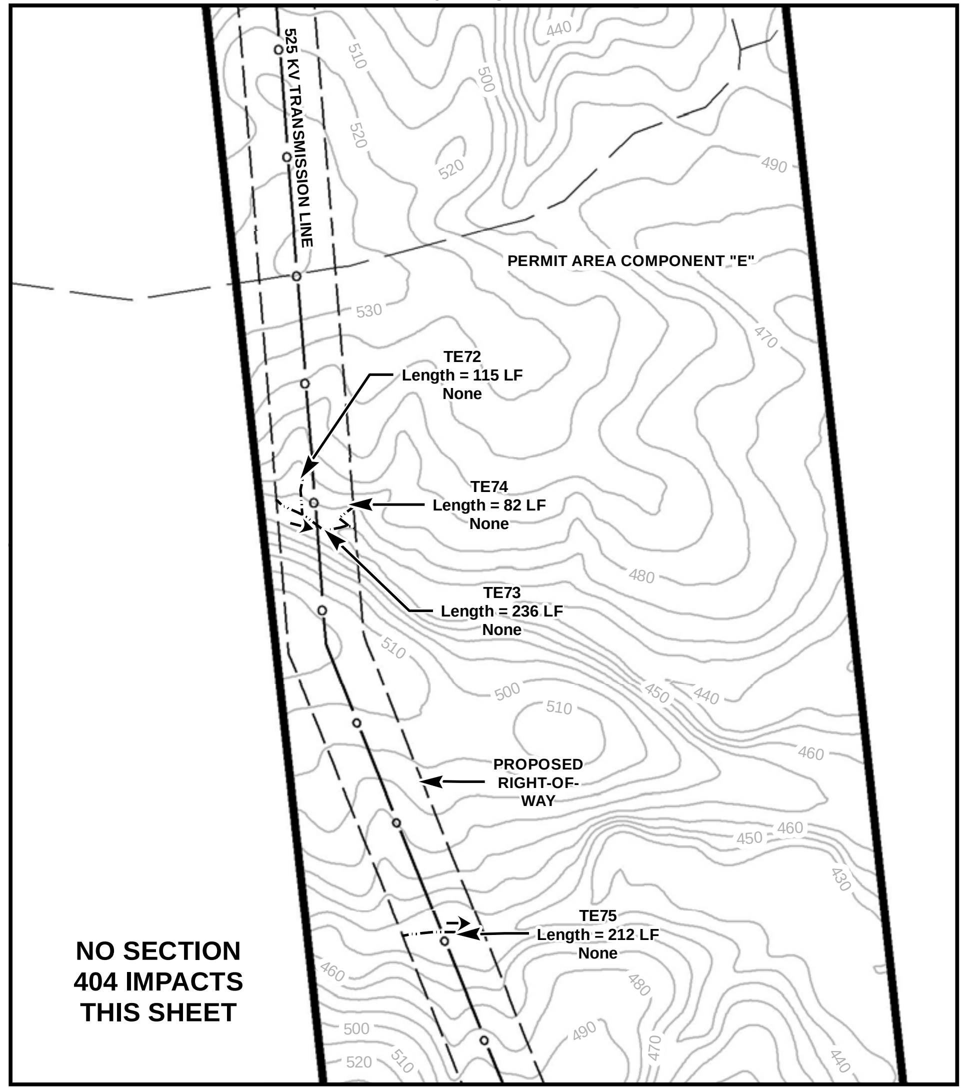
Title:

PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET
Job No. 100008697	Date: 11/9/2011	E24



MATCHLINE SHEET E24



MATCHLINE SHEET E26

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	645
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant:

Duke Energy®

Revisions:

0 250 500 Feet

N

Project:

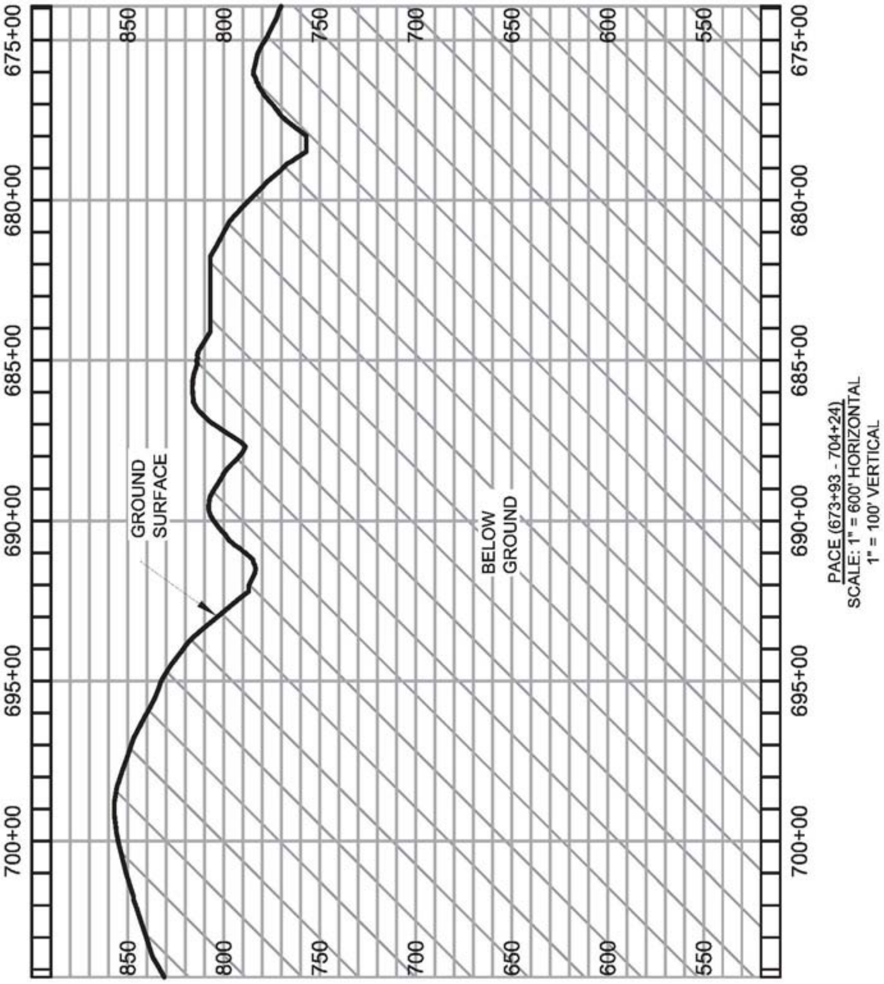
William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

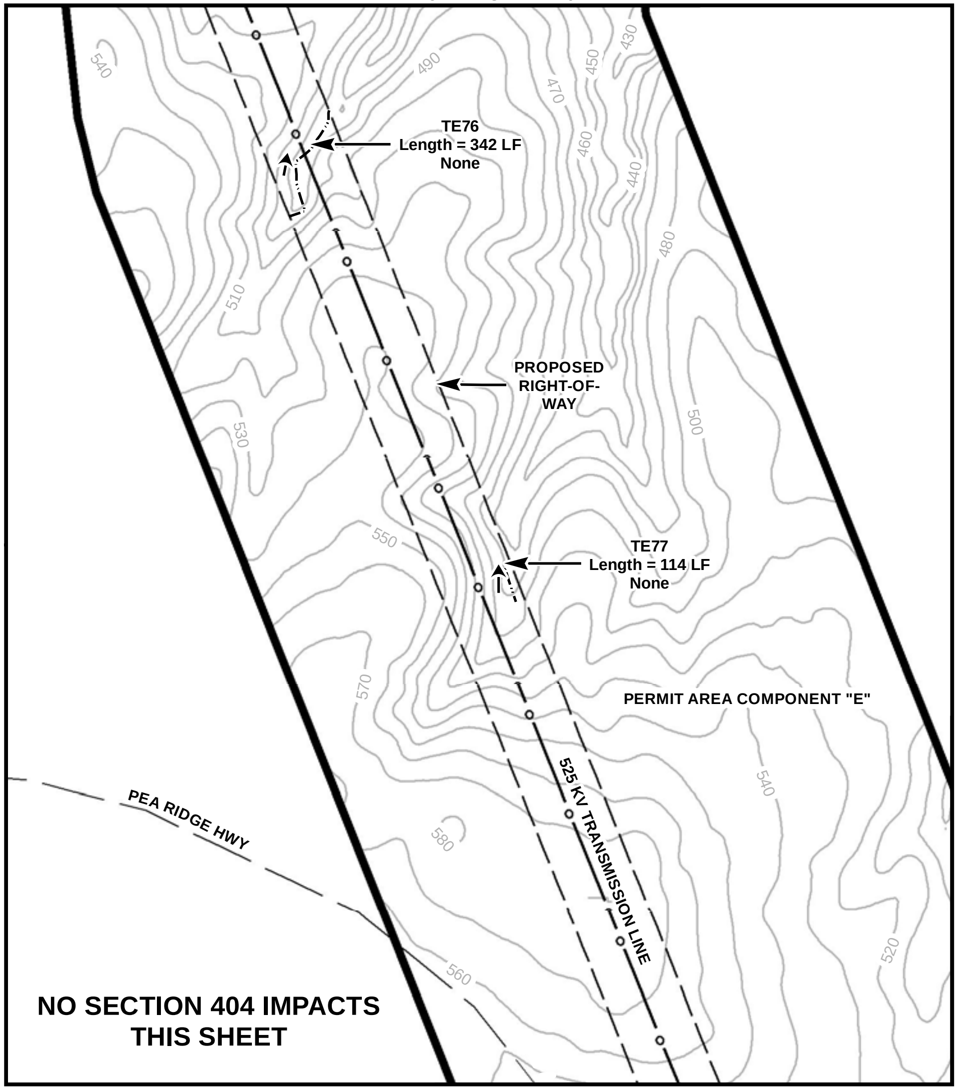
Title:

PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET
Job No. 100008697	Date: 11/9/2011	E25



MATCHLINE SHEET E25



MATCHLINE SHEET E27

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	456
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy®

Revisions:

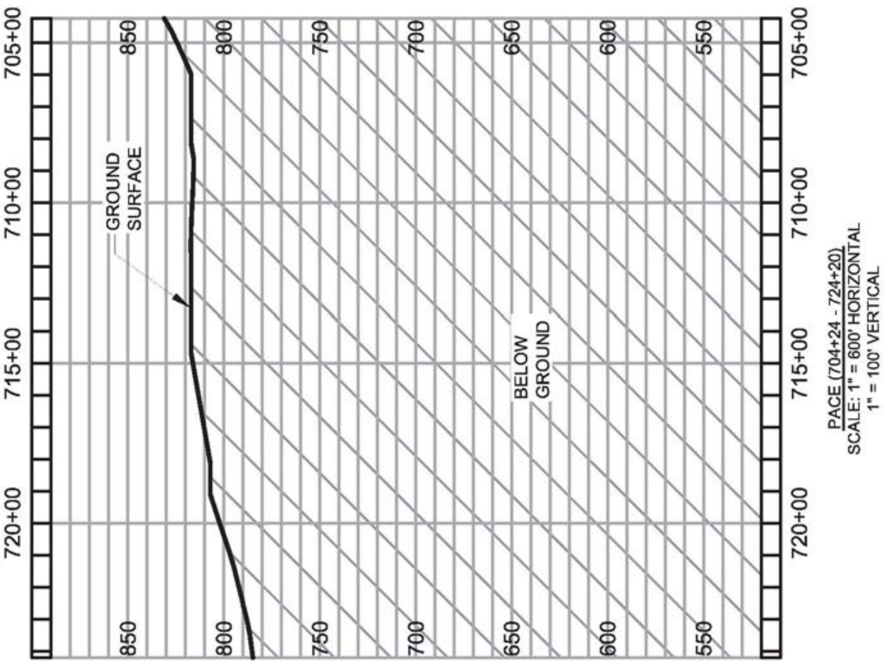
0 250 500 Feet

N

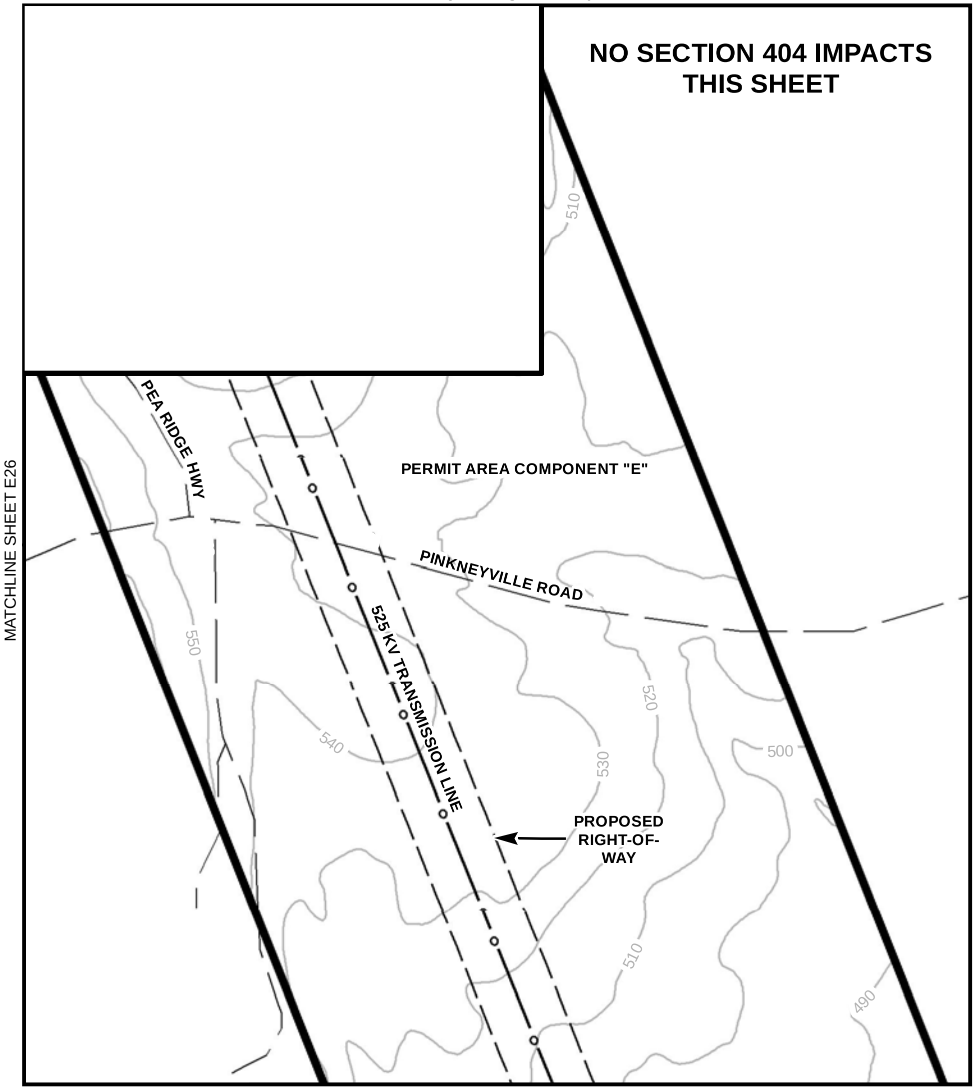
Project: William States Lee III Nuclear Station
CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title: PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E26
Job No. 100008697	Date: 11/9/2011	



MATCHLINE SHEET E26



MATCHLINE SHEET E28

Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	---
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy®

Revisions:

0 250 500 Feet

N

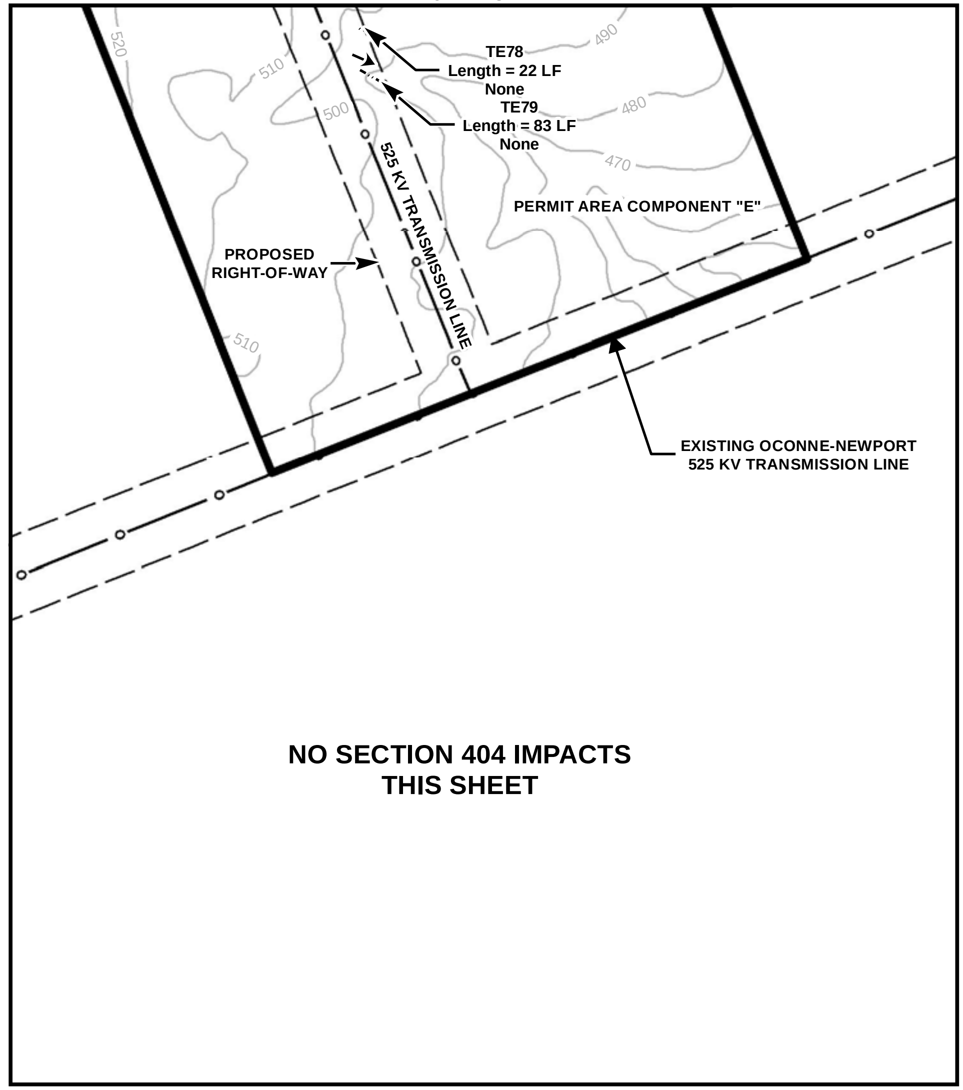
Project: William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title: PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E27
Job No. 100008697	Date: 11/9/2011	

MATCHLINE SHEET E27



Summary of Jurisdictional Features and Impacts on this Sheet		
Tributary	Total Length (LF)	105
	Impact (LF)	---
Vegetated Wetland	Total Area (AC)	---
	Impact (AC)	---
Jurisdictional Open Water	Total Area (AC)	---
	Impact (AC)	---

Applicant: Duke Energy

Revisions:

0 250 500 Feet

N

Project:

William States Lee III Nuclear Station

CHEROKEE AND UNION COUNTIES, SOUTH CAROLINA

Title:

PERMIT AREA COMPONENT "E" LEE SITE OFFSITE TRANSMISSION LINES

Drawn By: Atkins	Scale: As Shown	SHEET E28
Job No. 100008697	Date: 11/9/2011	

Appendix II.B

Plan View Details and Cross Sections

Contents

Page

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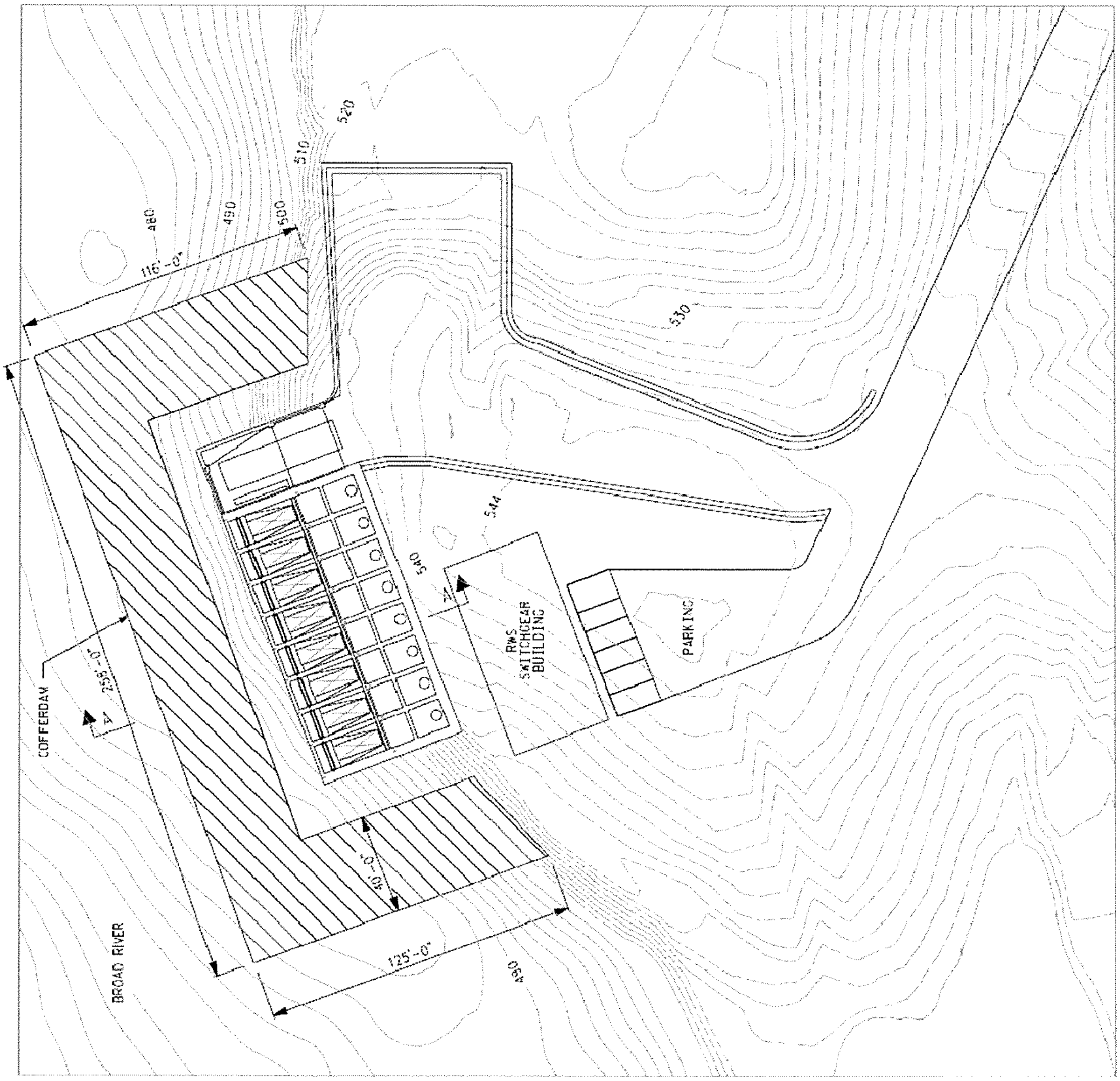
PERMIT AREA COMPONENT A

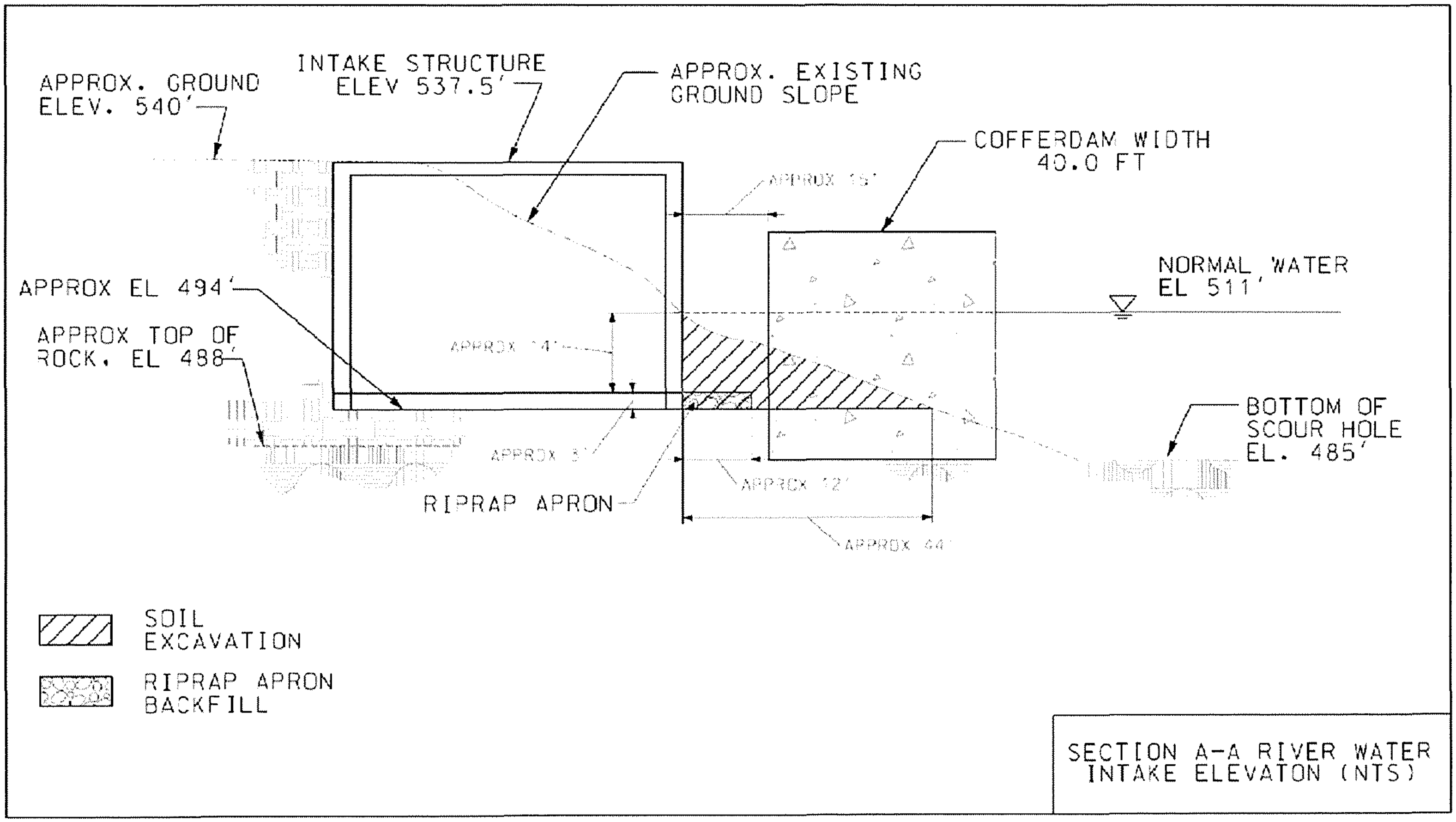
RIVER INTAKE STRUCTURE

PLAN VIEW DETAILS AND CROSS SECTIONS

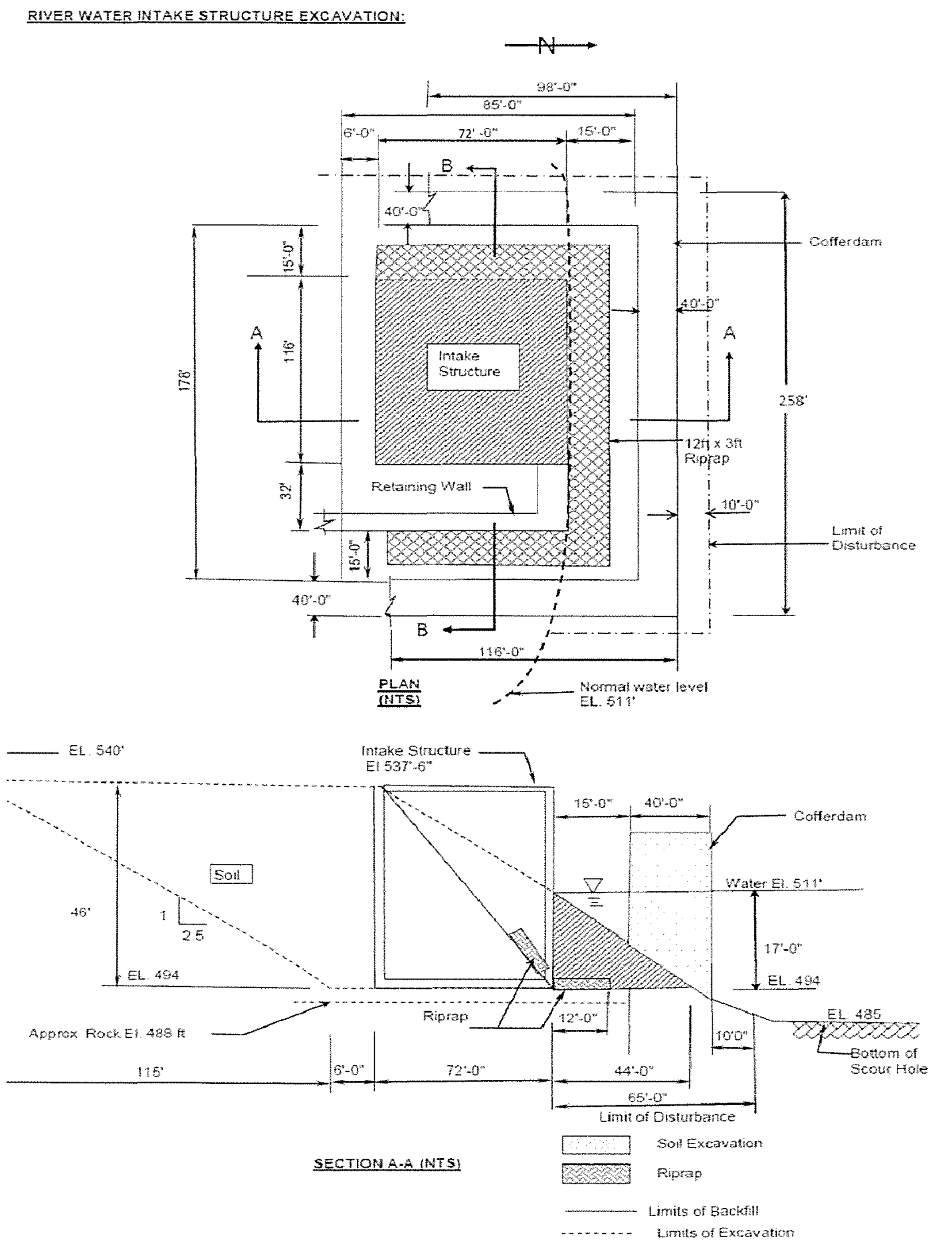


River Water Intake Structure

Limits of Excavation of River Water Intake Structure



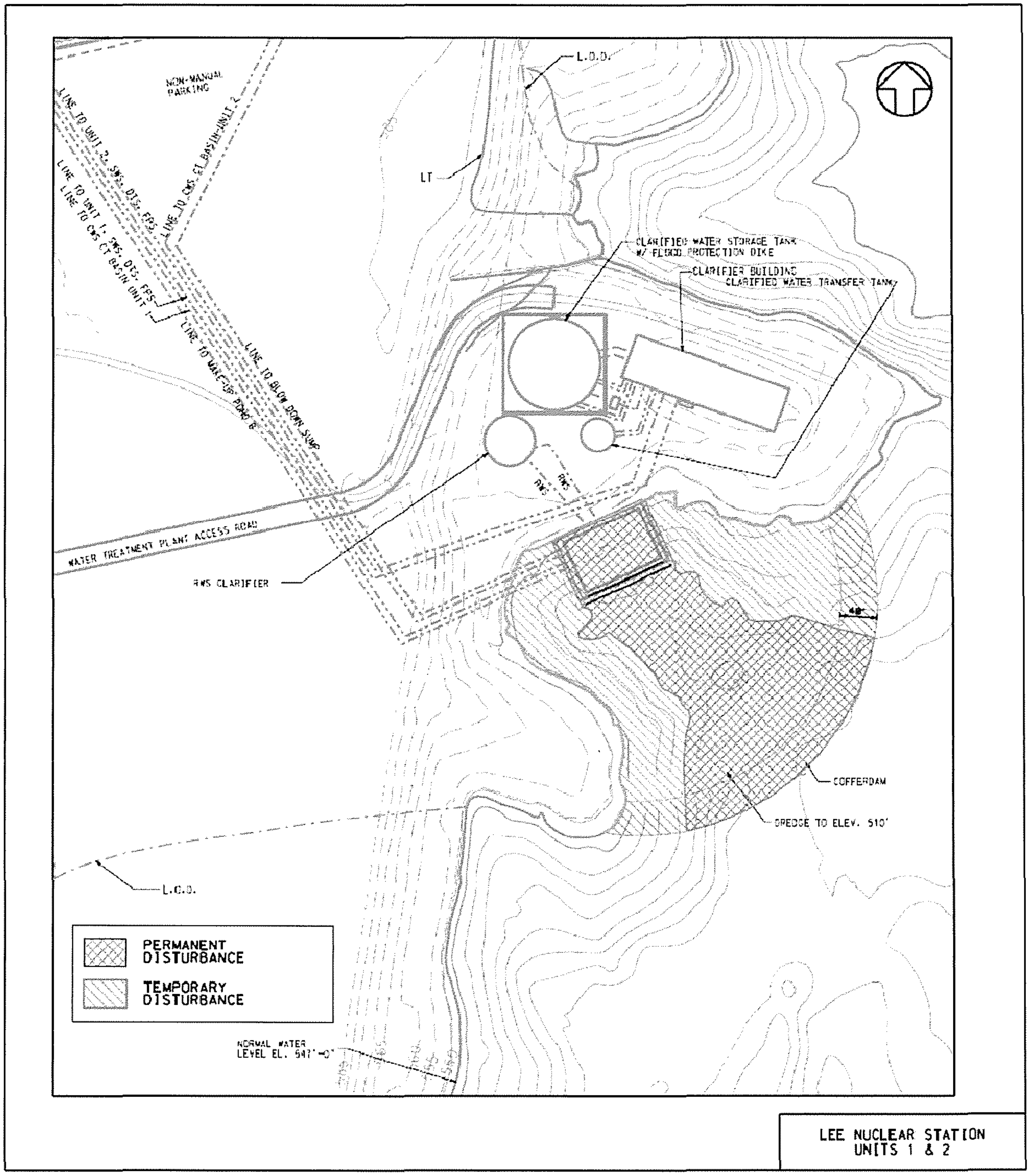
River Water Intake Structure



PERMIT AREA COMPONENT A

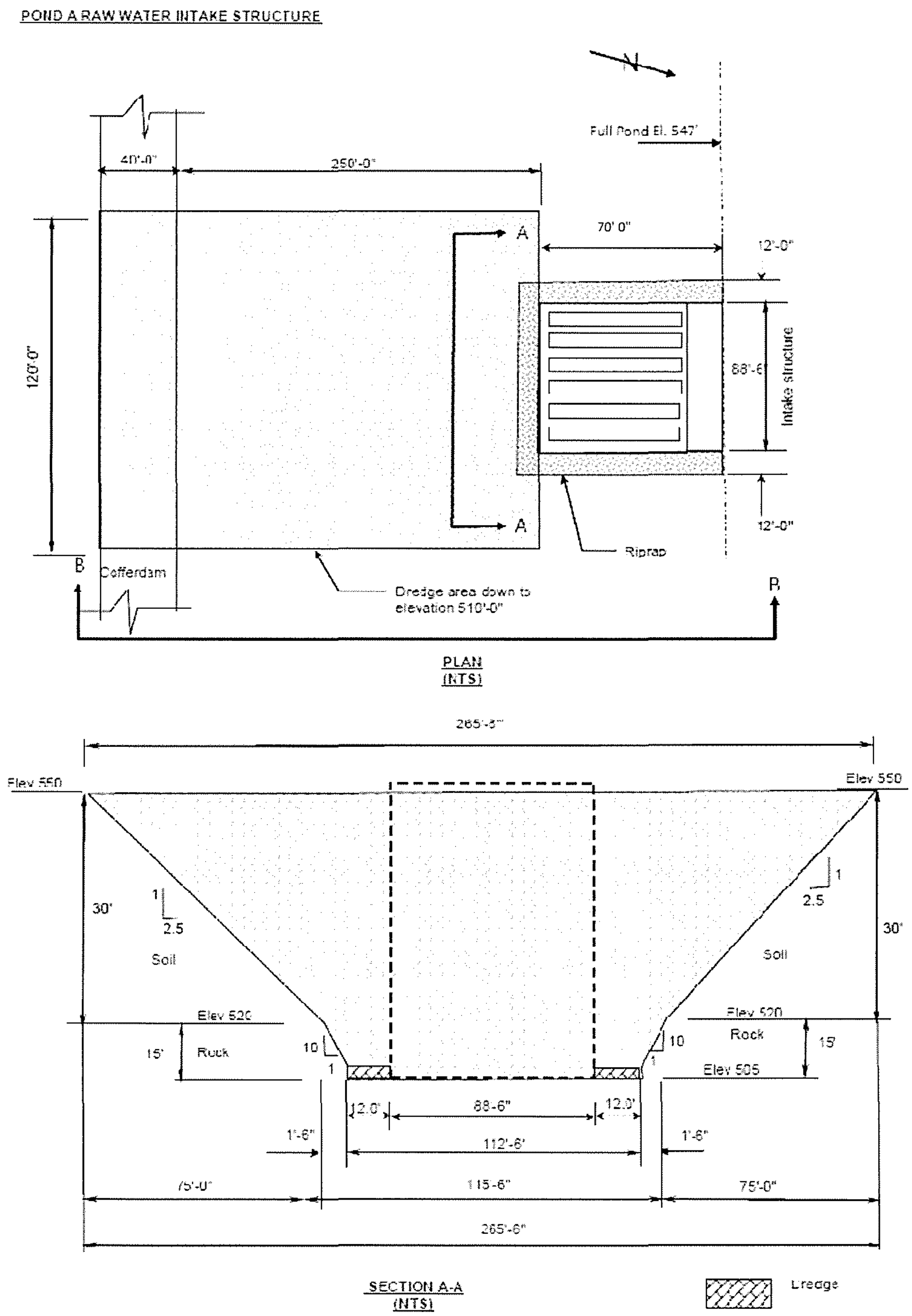
SEDIMENTATION POND A INTAKE STRUCTURE

PLAN VIEW DETAILS AND CROSS SECTIONS

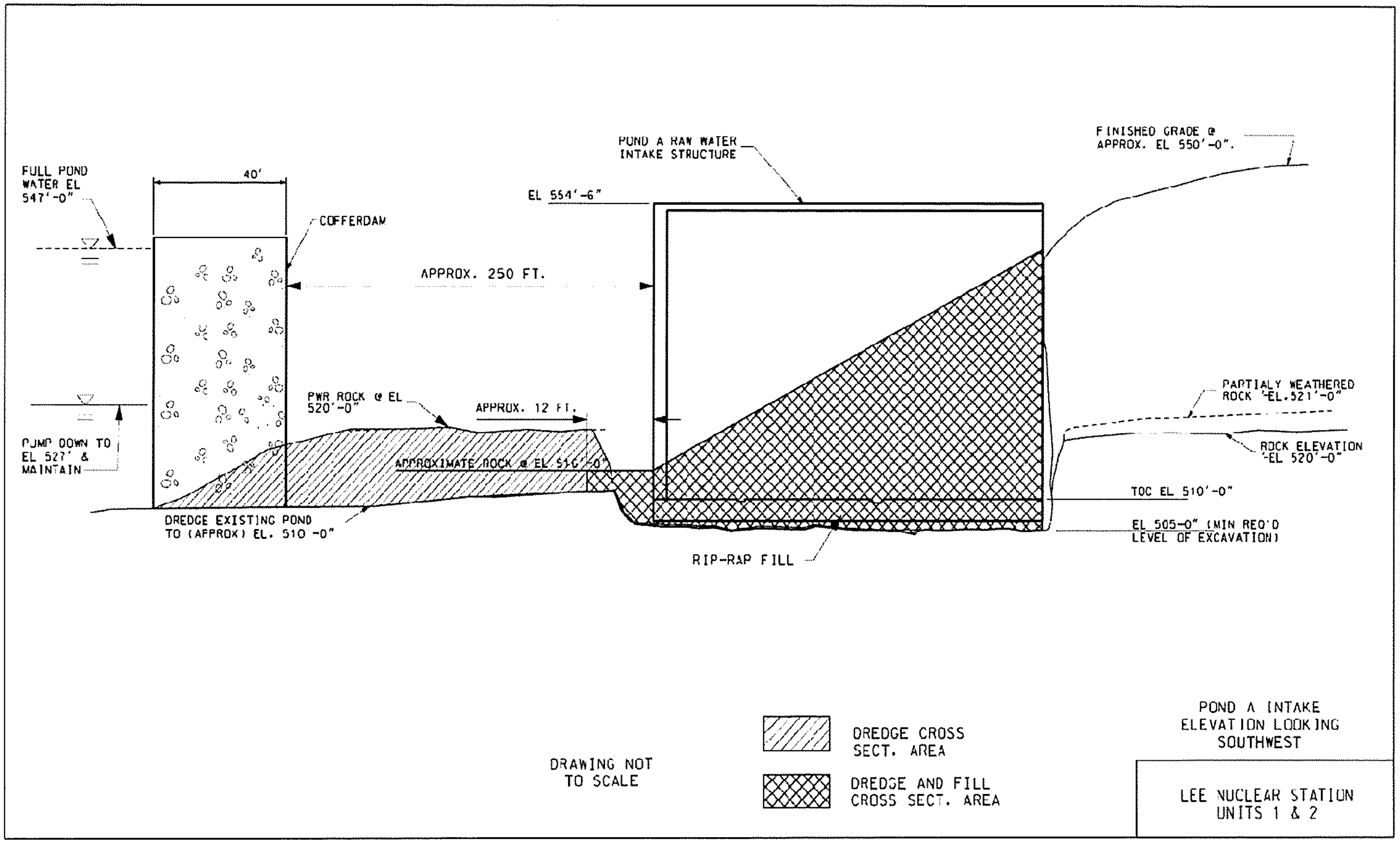


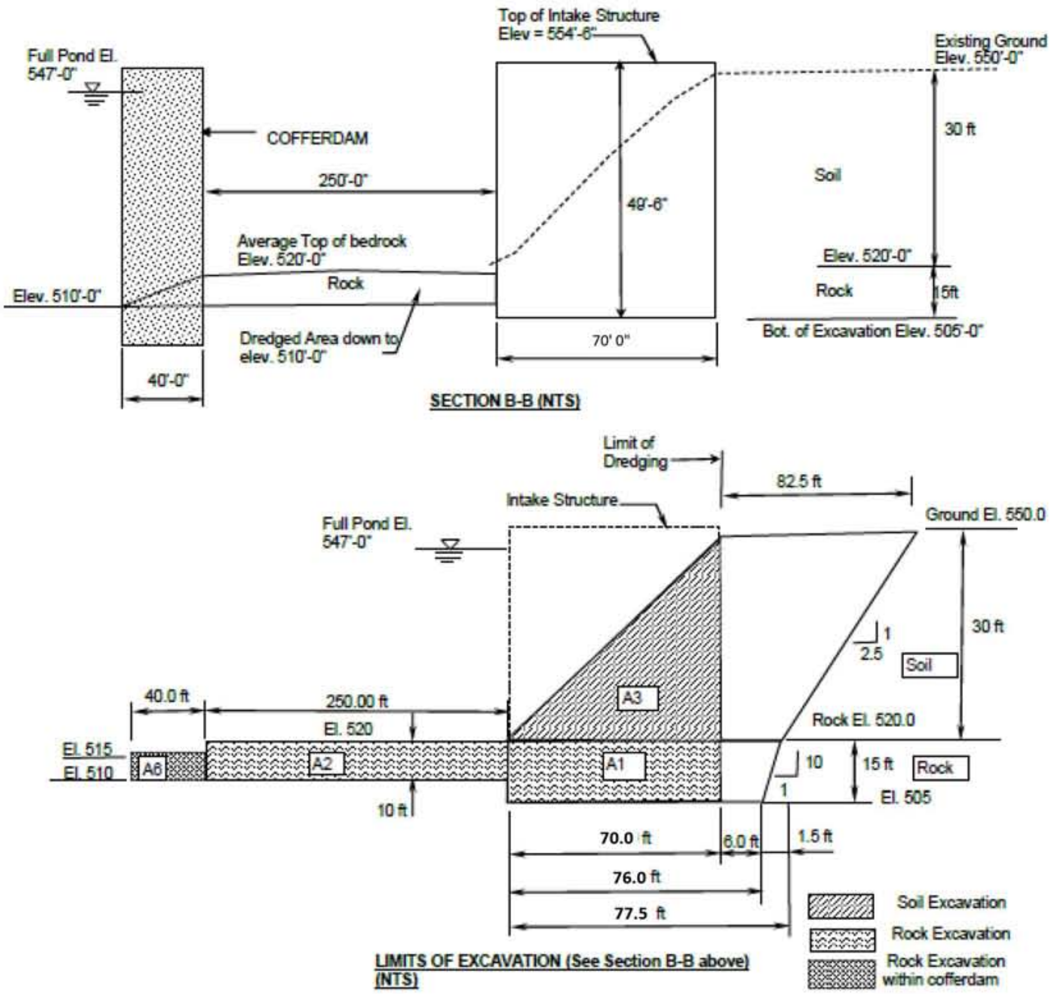
Pond A Raw Water Intake Structure Location Plan

Pond A Intake Structure



Limits of Excavation of Pond A Raw Water Intake Structure



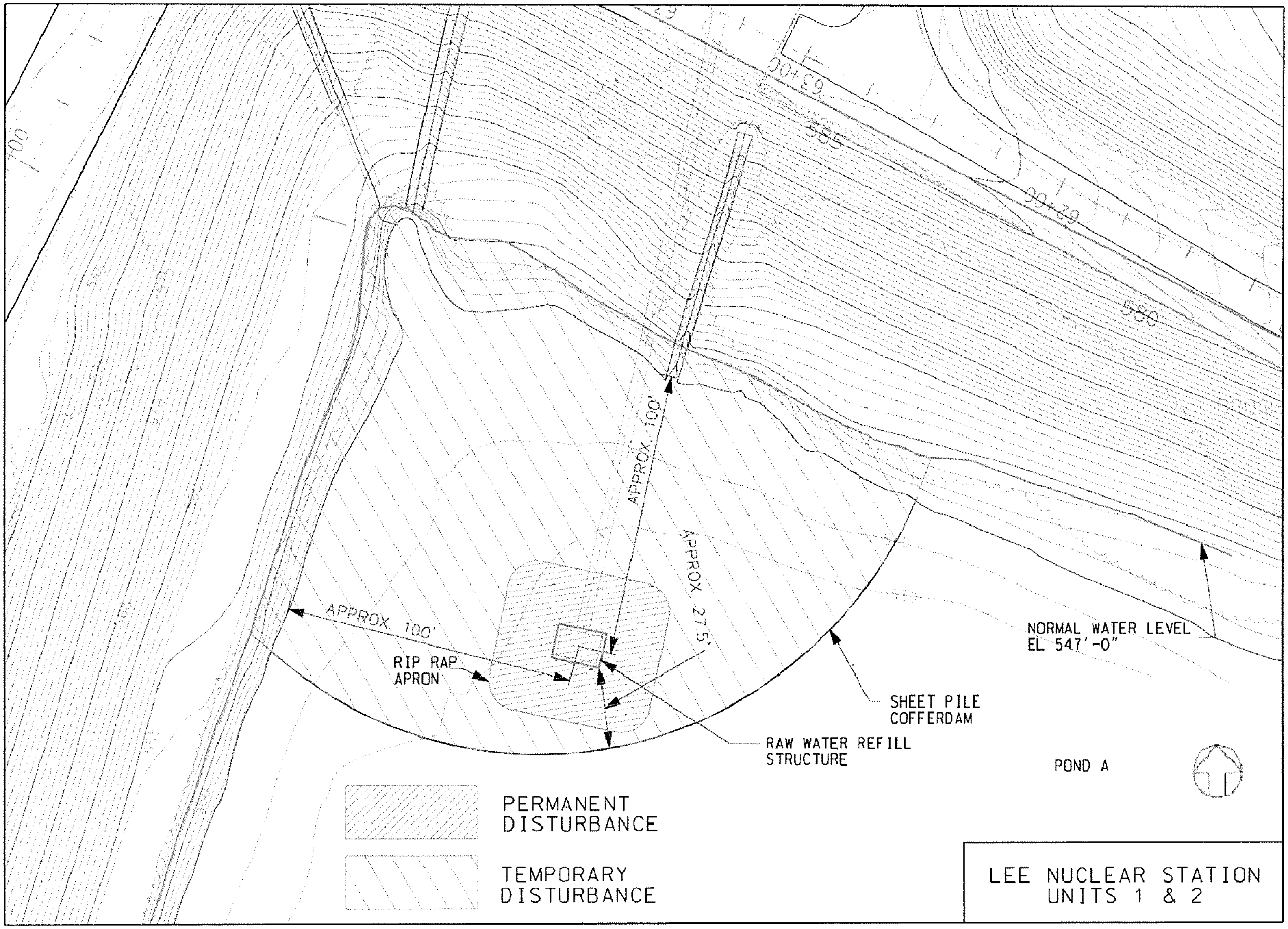

Top of Intake Structure
Elev = 554'-6"
Full Pond El.
547'-0"
Existing Ground
Elev. 550'-0"
COFFERDAM
30 ft
Soil
250'-0"
49'-6"
Average Top of bedrock
Elev. 520'-0"
Elev. 520'-0"
Elev. 510'-0"
Rock
Rock
15ft
Dredged Area down to
elev. 510'-0"
70' 0"
Bot. of Excavation Elev. 505'-0"
40'-0"
SECTION B-B (NTS)
Limit of
Dredging
82.5 ft
Intake Structure
Ground El. 550.0
Full Pond El.
547'-0"
30 ft
1
2.5
Soil
40.0 ft
250.00 ft
A3
Rock El. 520.0
El. 520
El. 515
El. 510
A6
A2
A1
10
1
15 ft
Rock
El. 505
10 ft
70.0 ft
6.0 ft
1.5 ft
76.0 ft
77.5 ft
Soil Excavation
Rock Excavation
Rock Excavation
within cofferdam
LIMITS OF EXCAVATION (See Section B-B above)
(NTS)

PERMIT AREA COMPONENT A

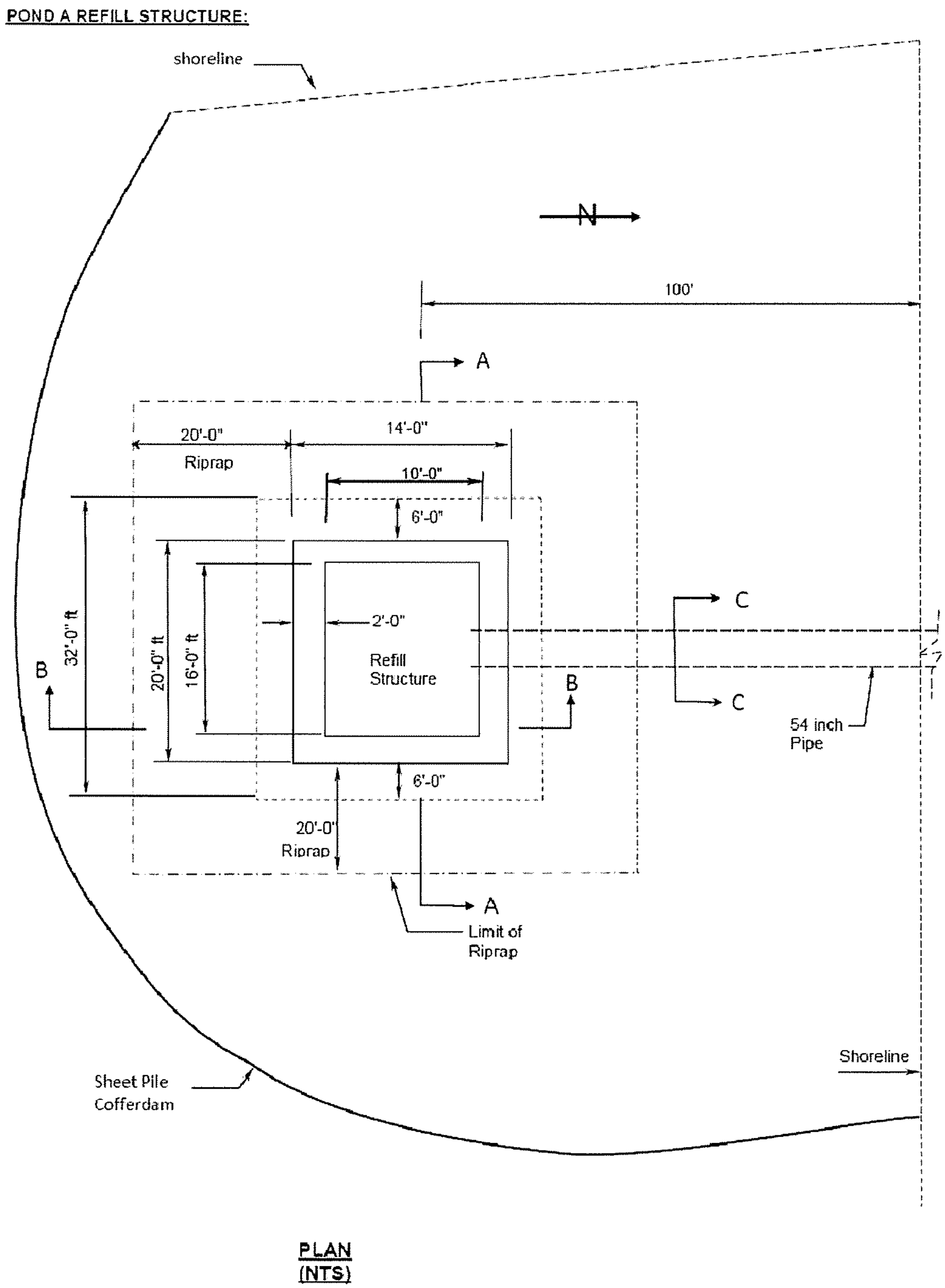
SEDIMENTATION POND A REFILL STRUCTURE

PLAN VIEW DETAILS AND CROSS SECTIONS

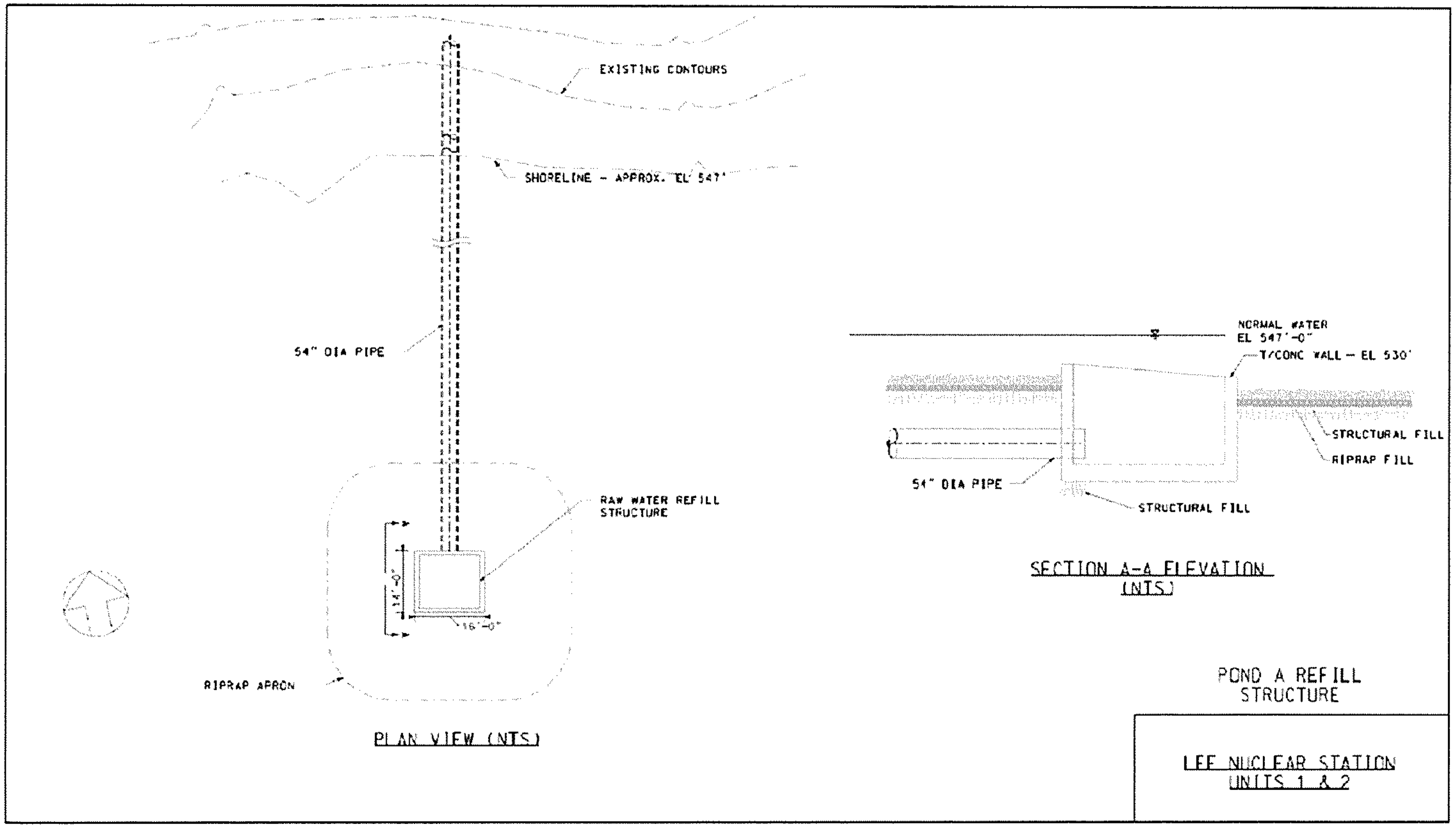
Pond A Raw Water Refill Structure Location Plan



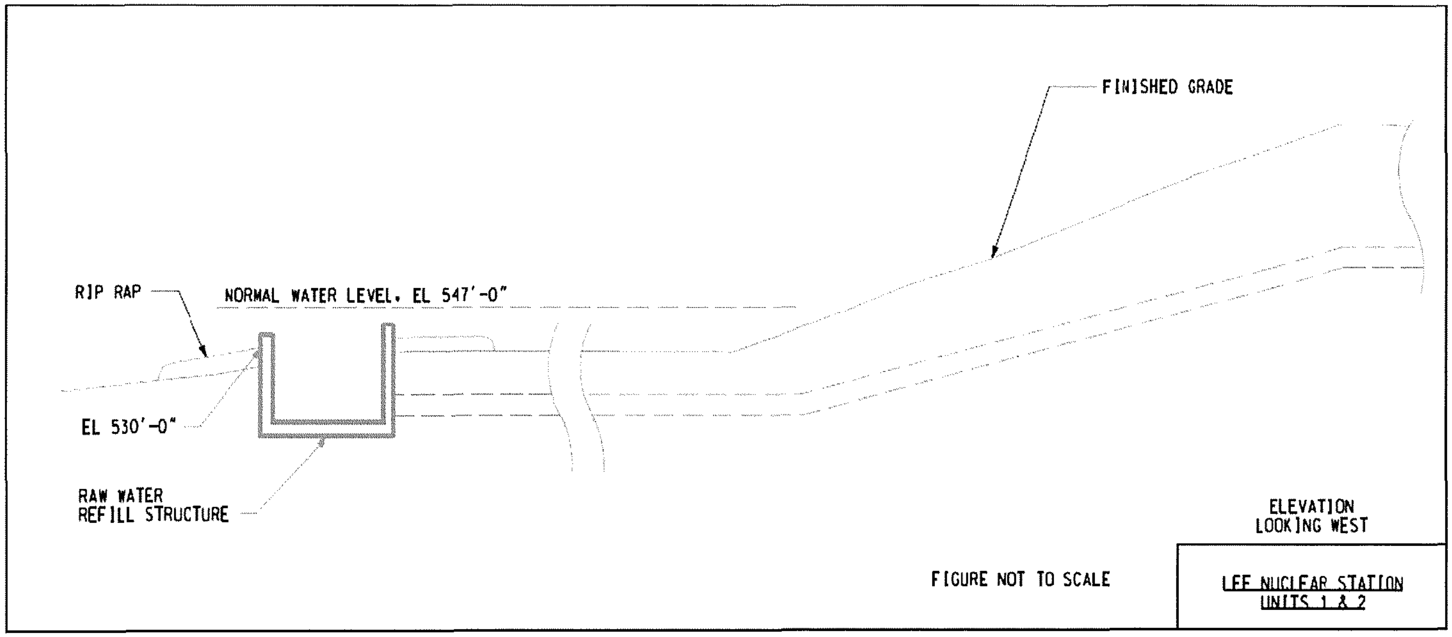
Pond A Raw Water Refill Structure



Pond A Raw Water Refill Structure Plan and Section



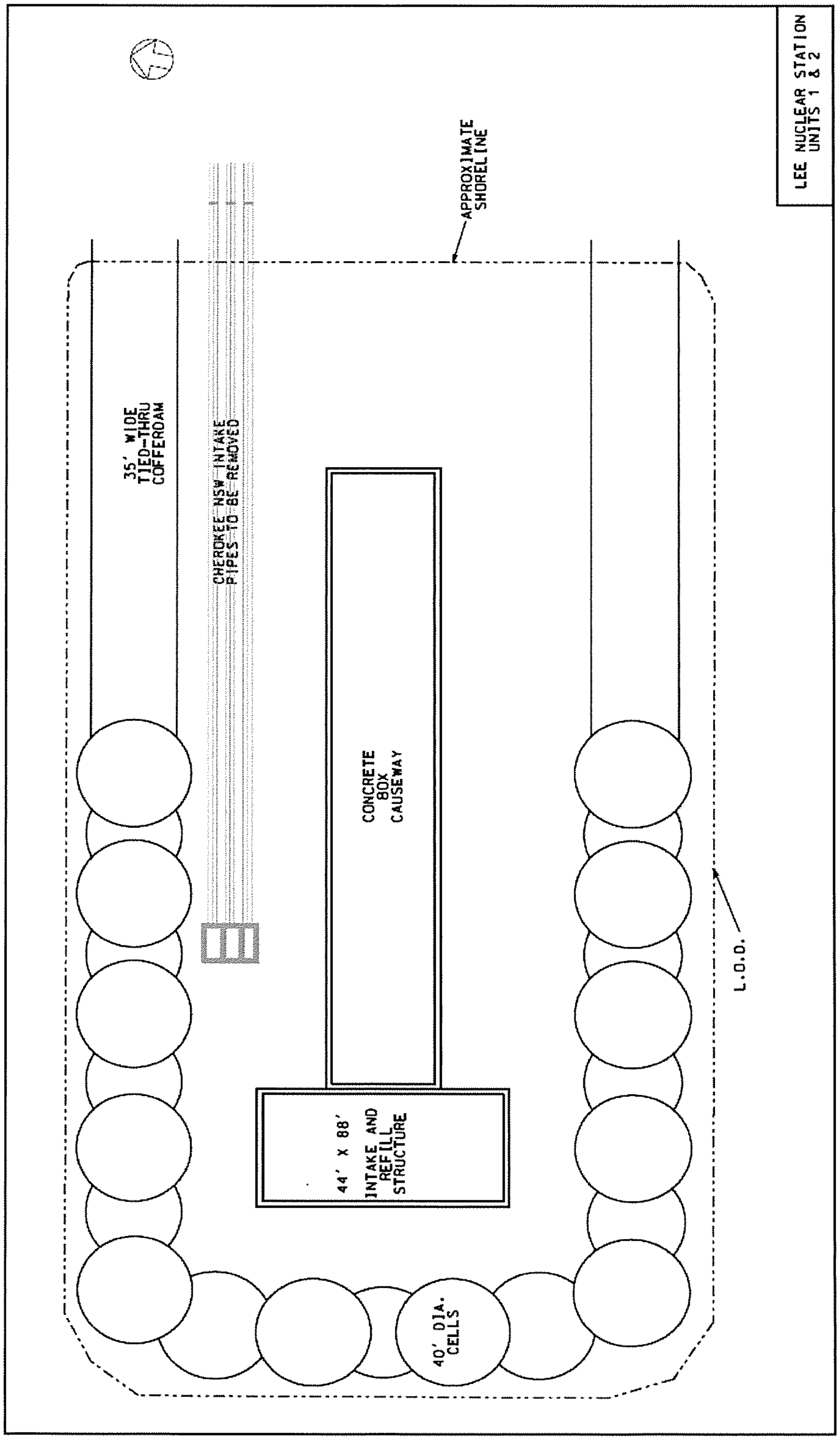
Profile of Pond A Raw Water Refill Structure



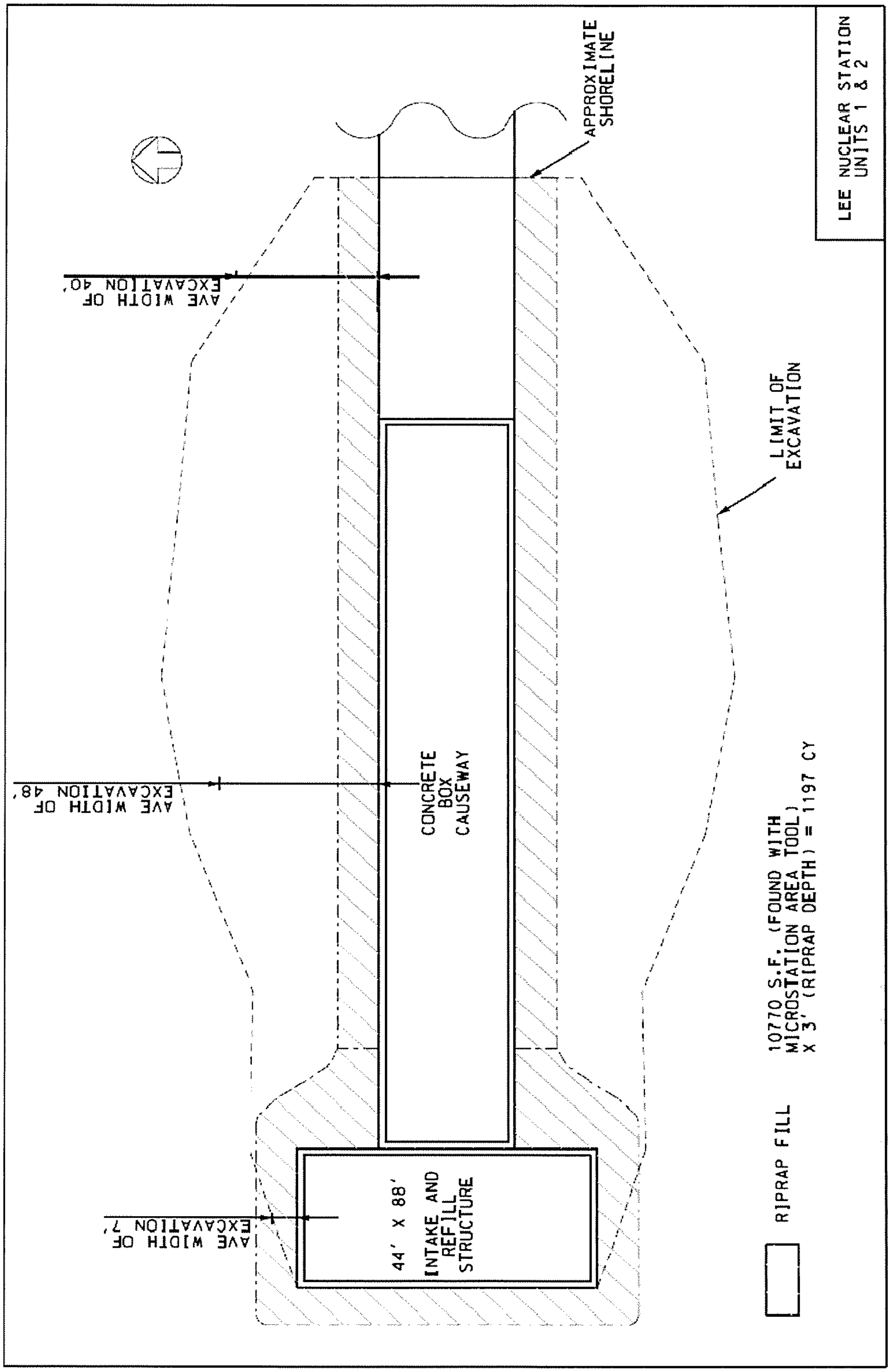
PERMIT AREA COMPONENT A

DROUGHT CONTINGENCY POND B INTAKE/REFILL STRUCTURE

PLAN VIEW DETAILS AND CROSS SECTIONS

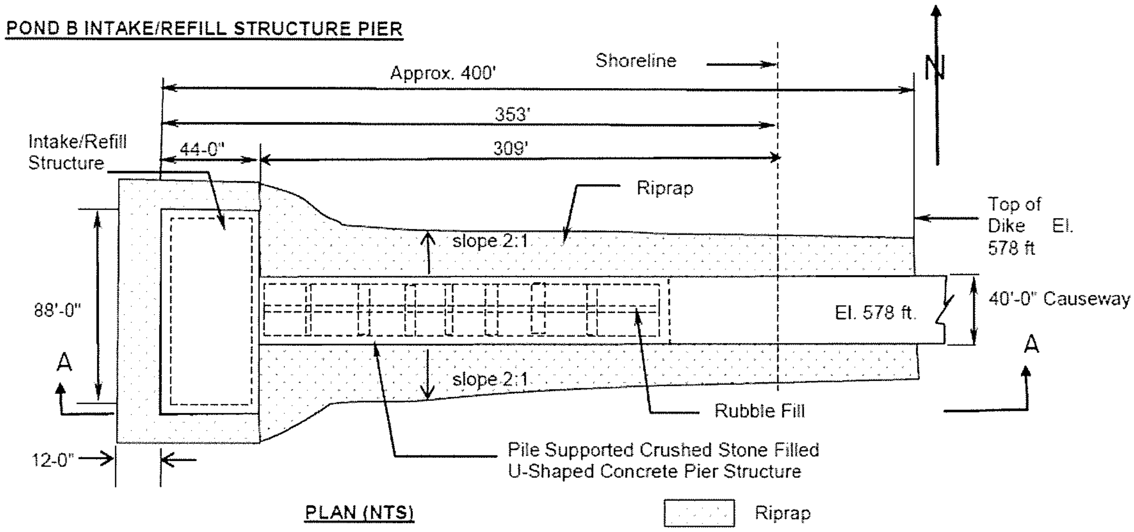


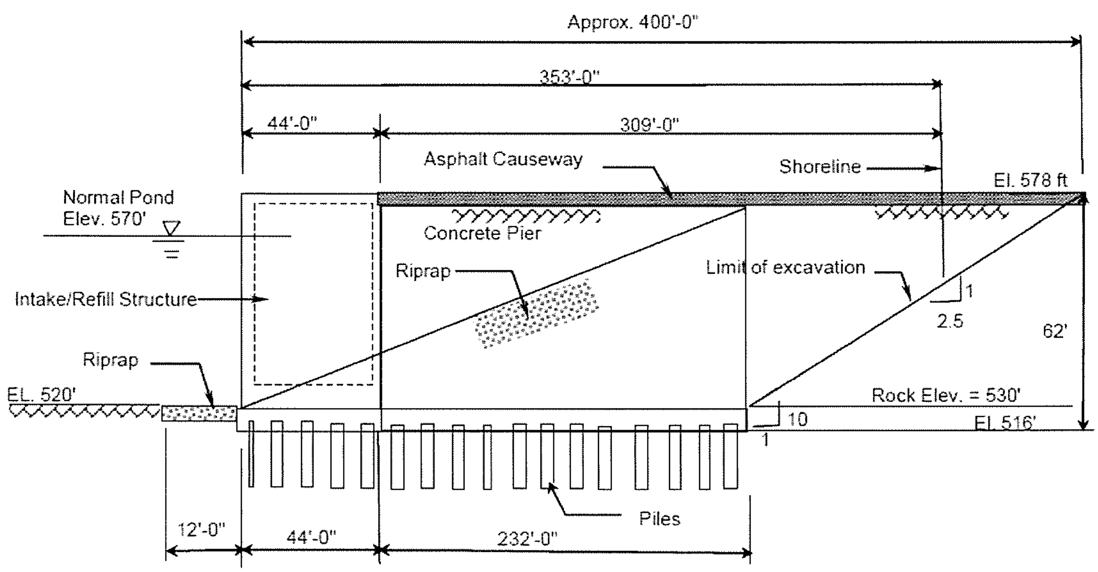
Pond B Intake/Refill Structure Pier Plan



Pond B Intake/Refill Structure Limits of Permanent Disturbance

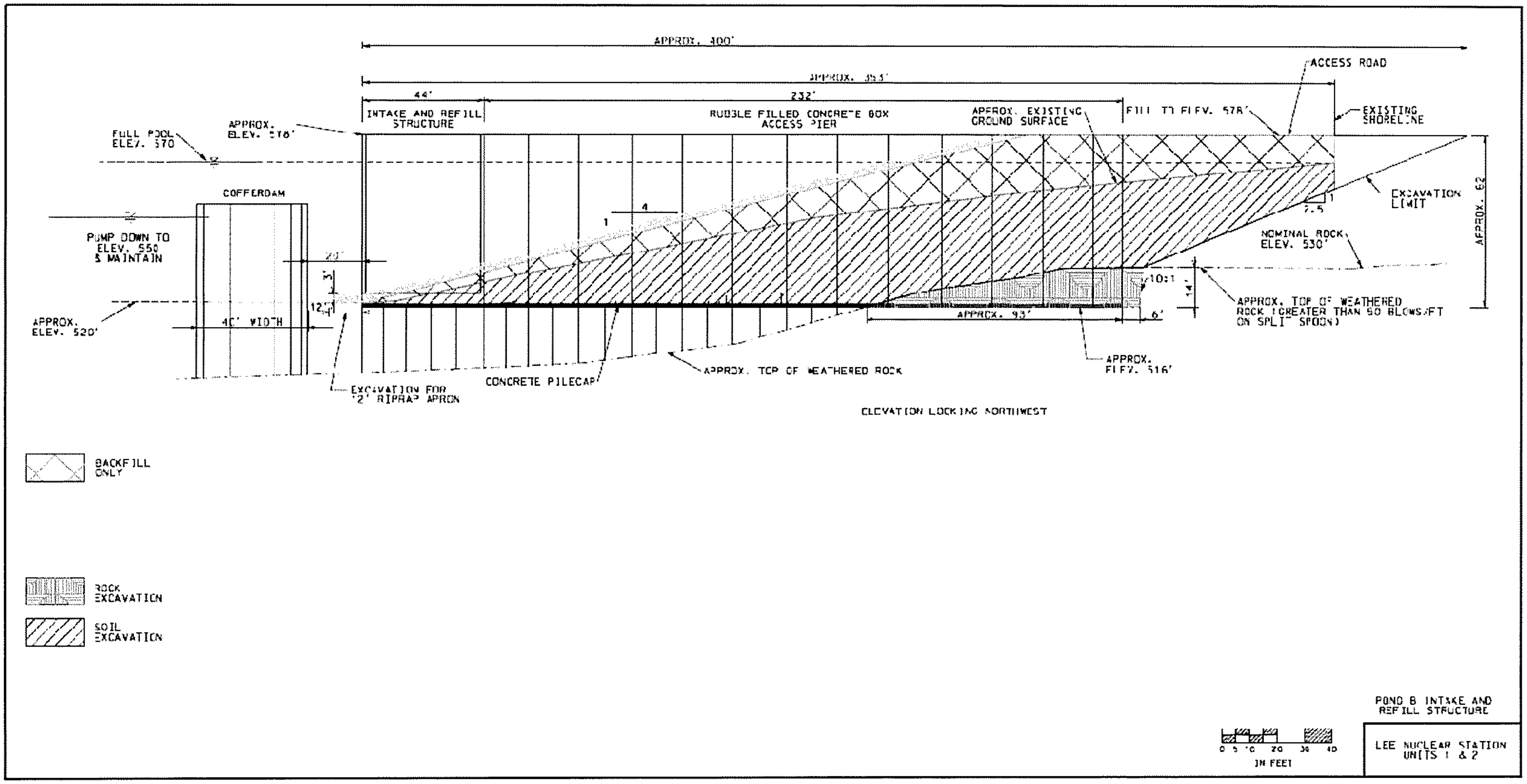
Pond B Intake/Refill Structure





SECTION A-A
(NTS)

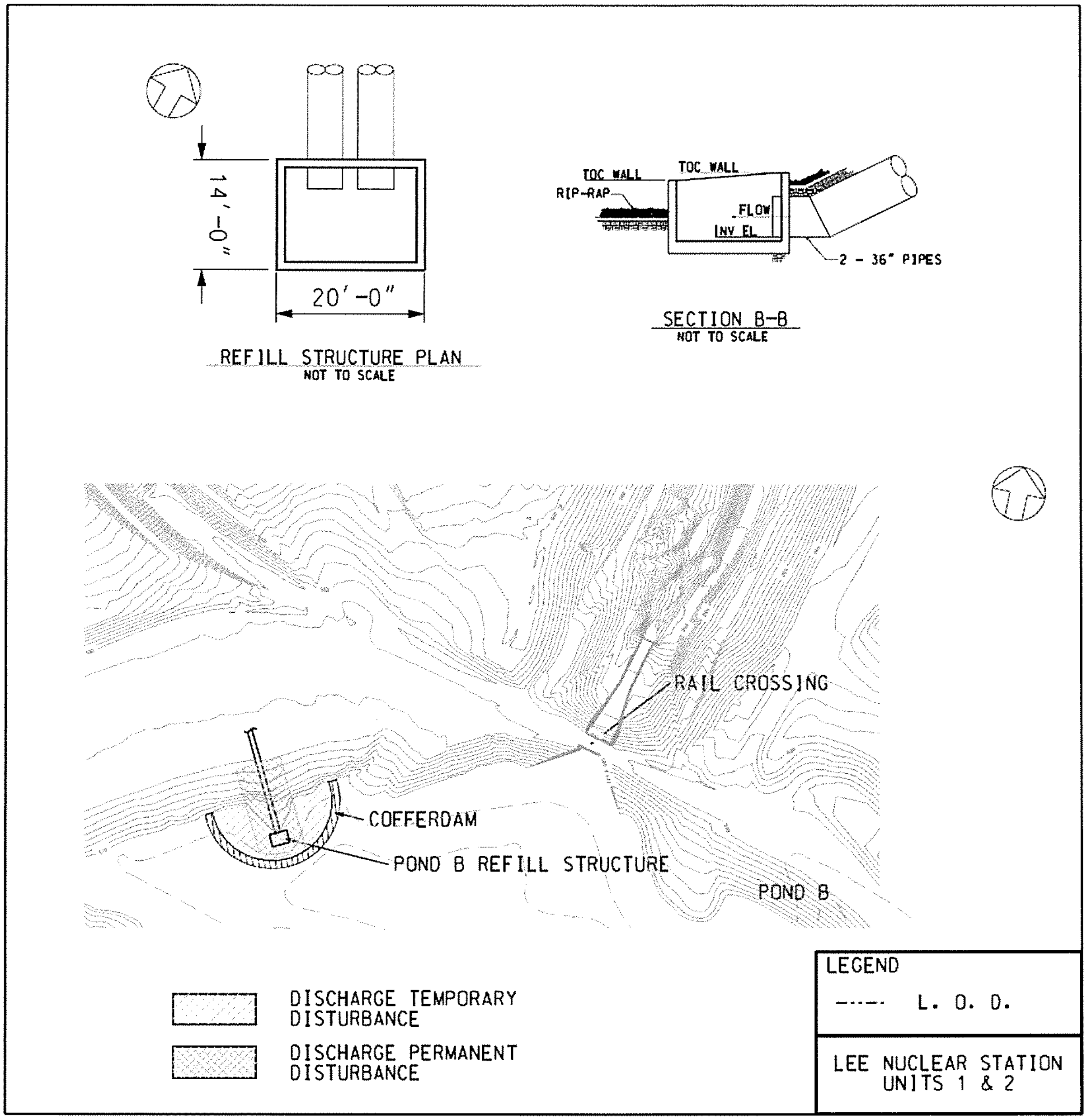
Limits of Excavation of Pond B Intake/Refill Structure



PERMIT AREA COMPONENT A

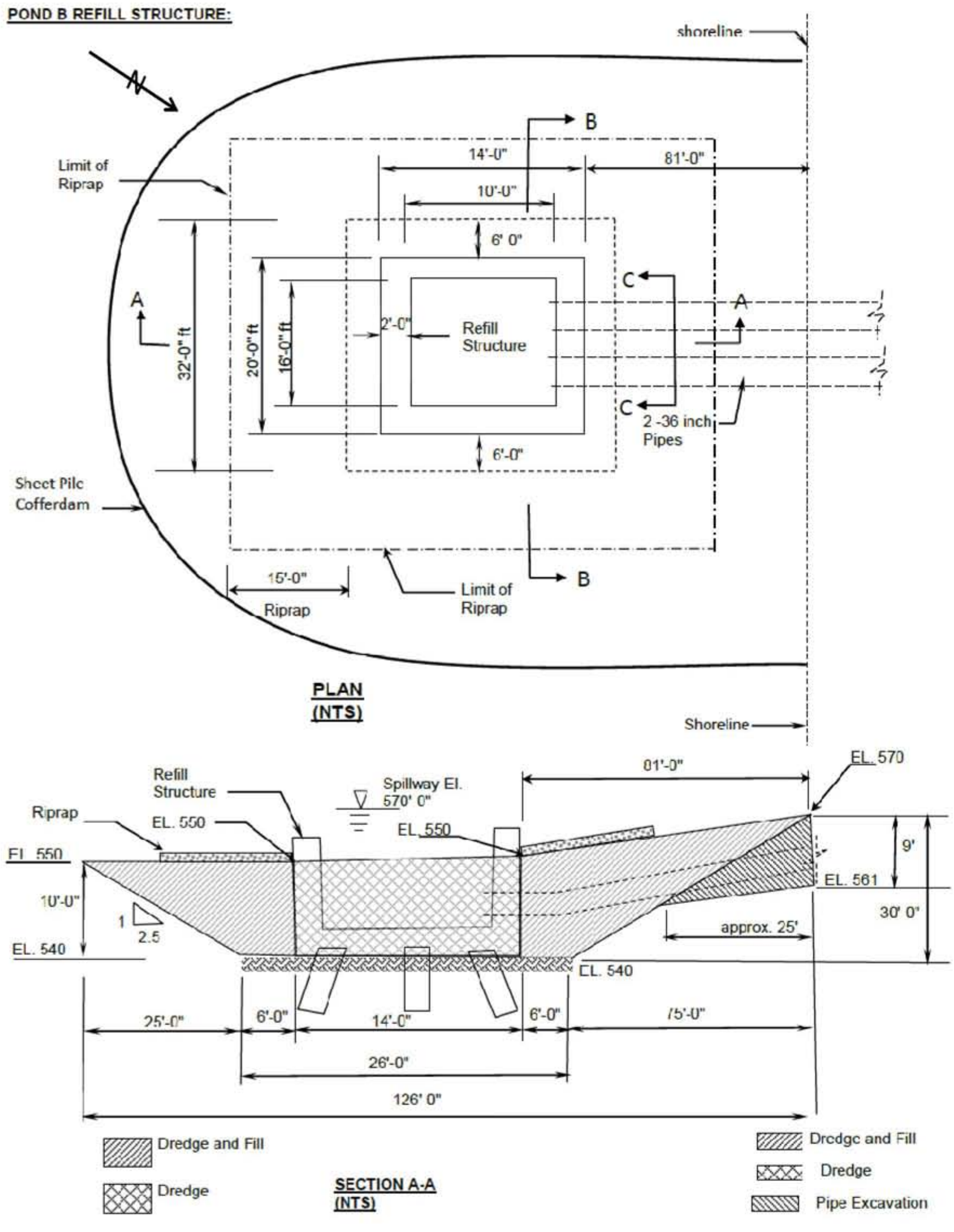
DROUGHT CONTINGENCY POND B REFILL STRUCTURE

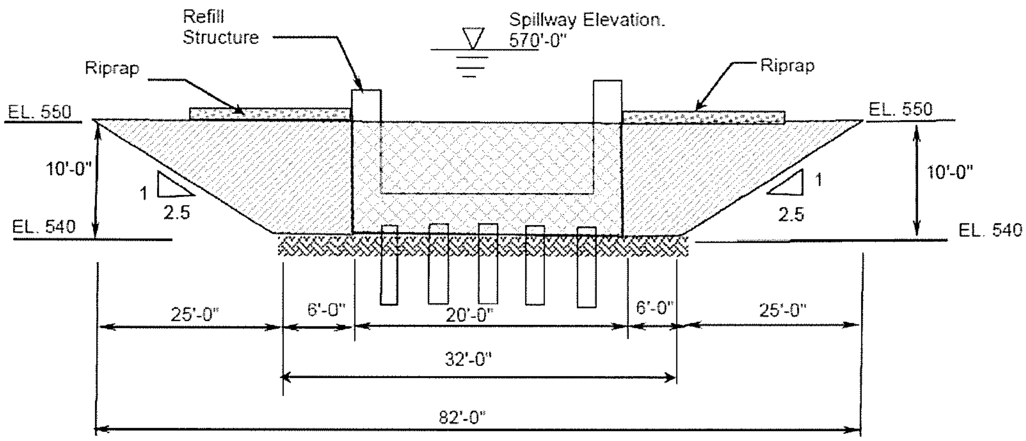
PLAN VIEW DETAILS AND CROSS SECTIONS



Pond B Refill Structure Location Plan

Pond B Refill Structure

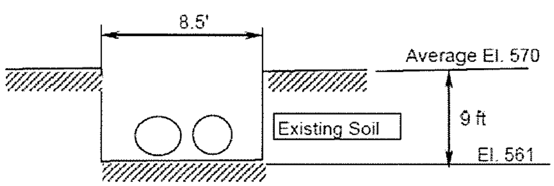




SECTION B-B
(NTS)

Dredge and Fill

Dredge

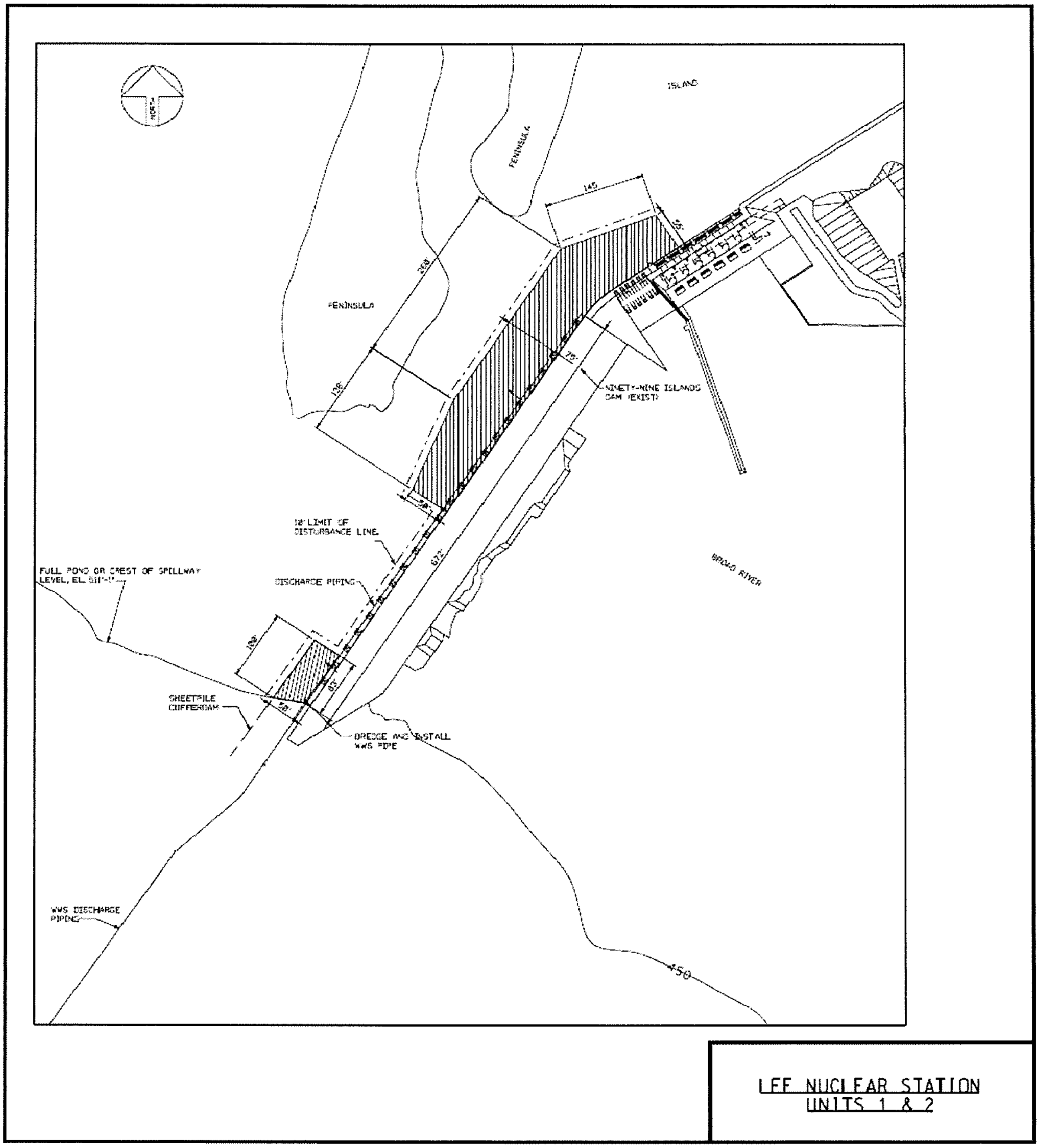


SECTION C-C
REFILL PIPE EXCAVATION
(NTS)

PERMIT AREA COMPONENT A

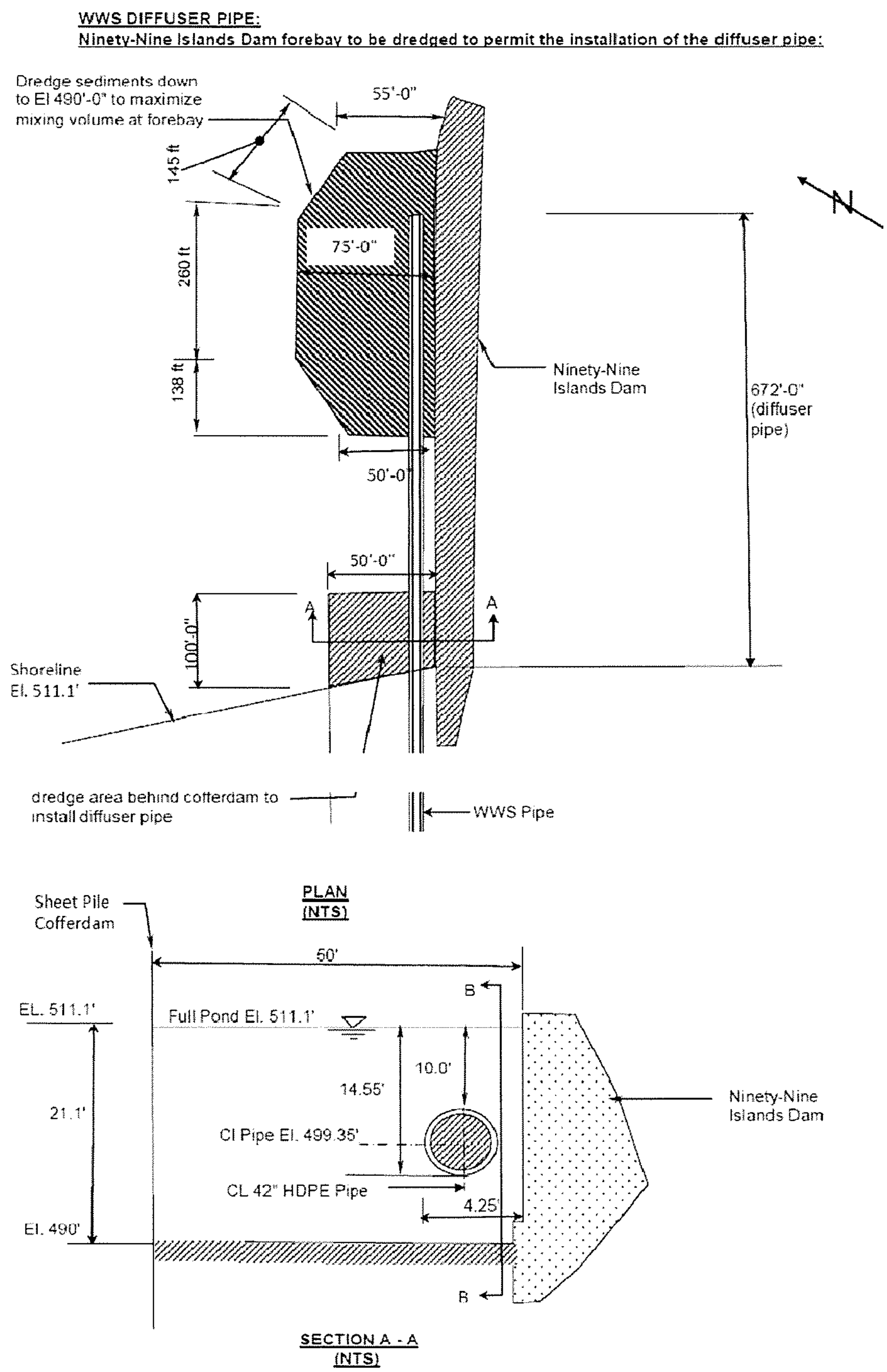
DISCHARGE DIFFUSER PIPE

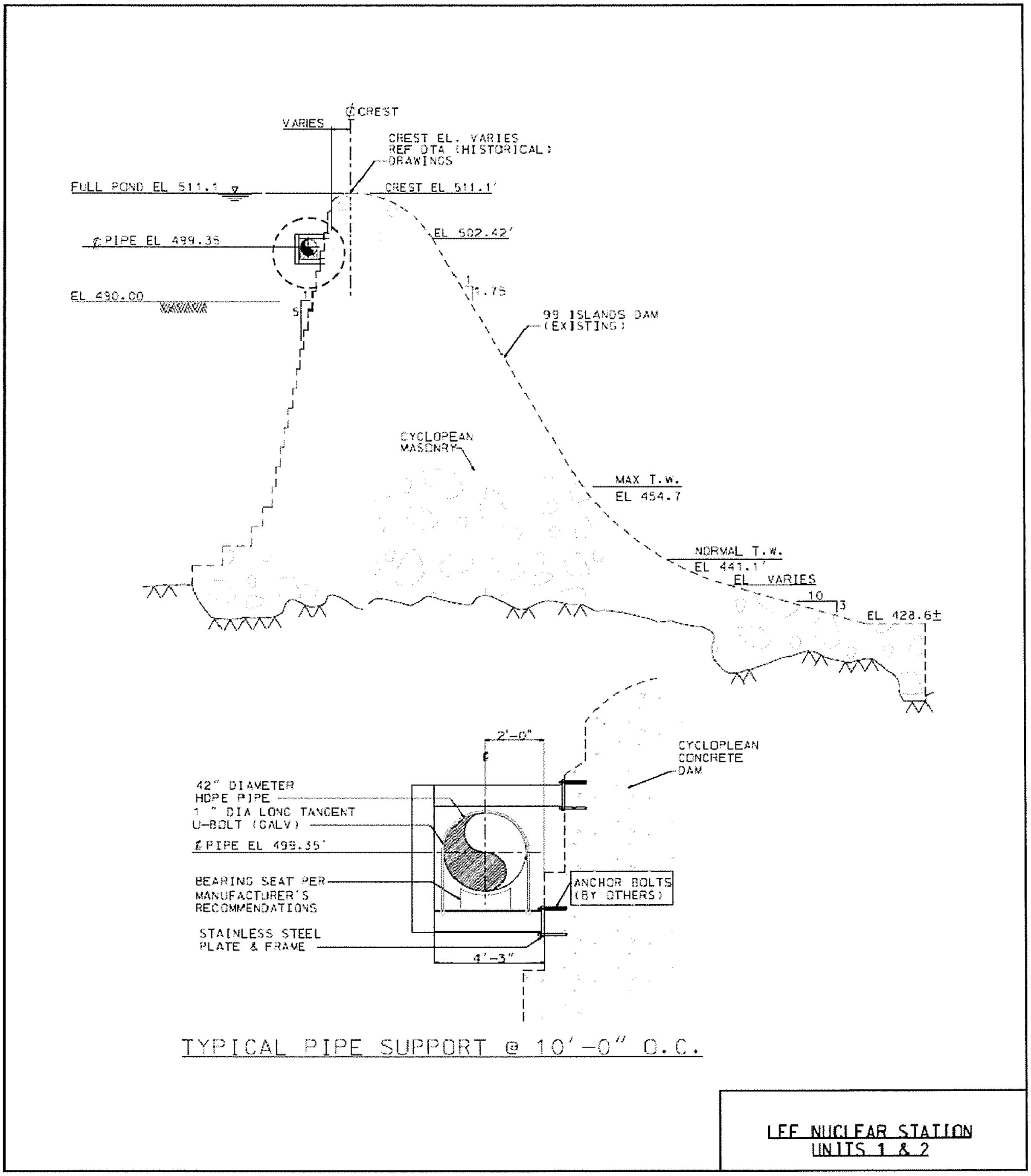
PLAN VIEW DETAILS AND CROSS SECTIONS



Waste Water System Discharge Diffuser Pipe Location Plan

Waste Water System Diffuser Pipe



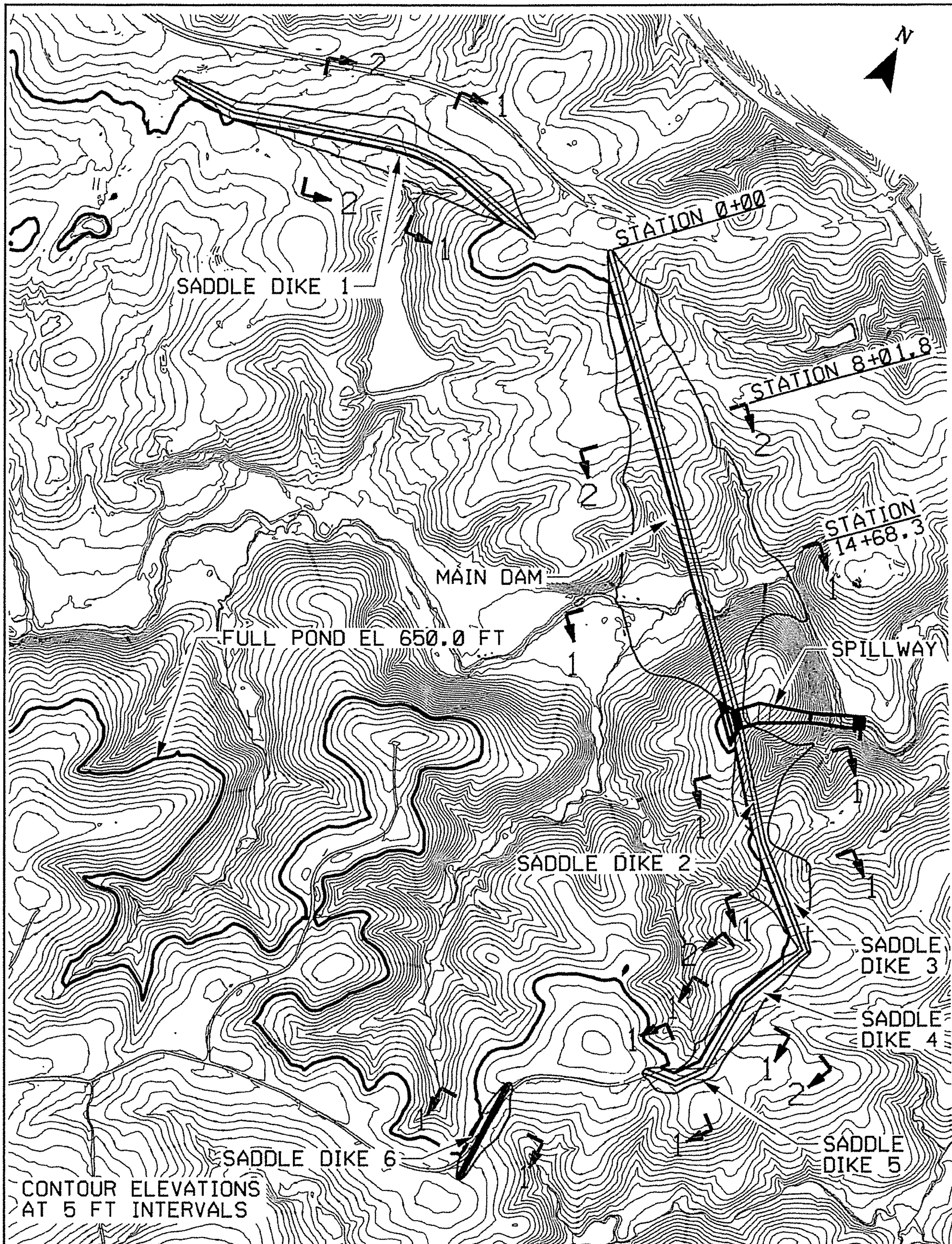


Waste Water System Discharge Diffuser Pipe Support Details

PERMIT AREA COMPONENT B

DROUGHT CONTINGENCY POND C MAIN DAM, SADDLE DIKES, SPILLWAY, AND LONDON CREEK CHANNEL IMPROVEMENTS

CONCEPTUAL DESIGN PLAN VIEW DETAILS AND CROSS SECTIONS



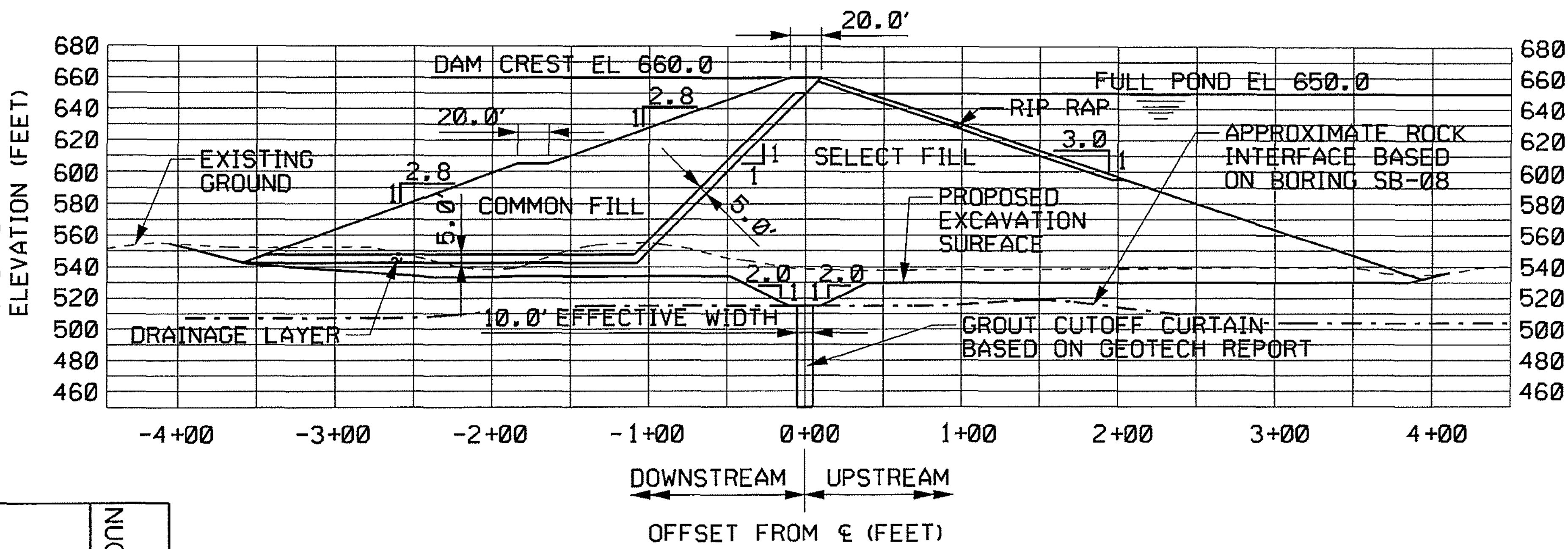
PLAN

SCALE: 1" = 600'

600 300 0 600 1200FT

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

POND C
PLAN

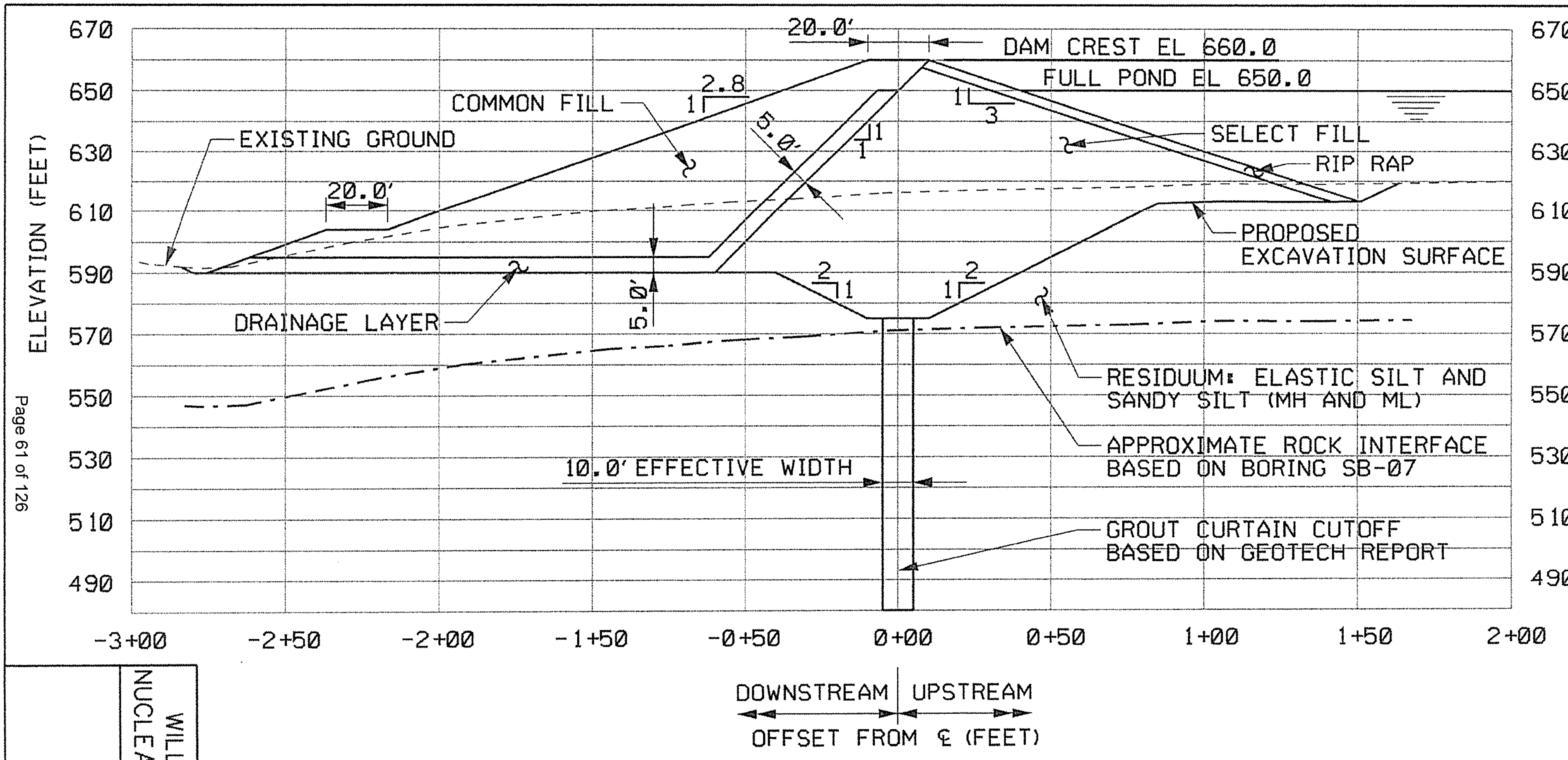


SECTION 1-1

SCALE: 1" = 100'

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

MAKE-UP POND C
MAIN DAM
SECTION



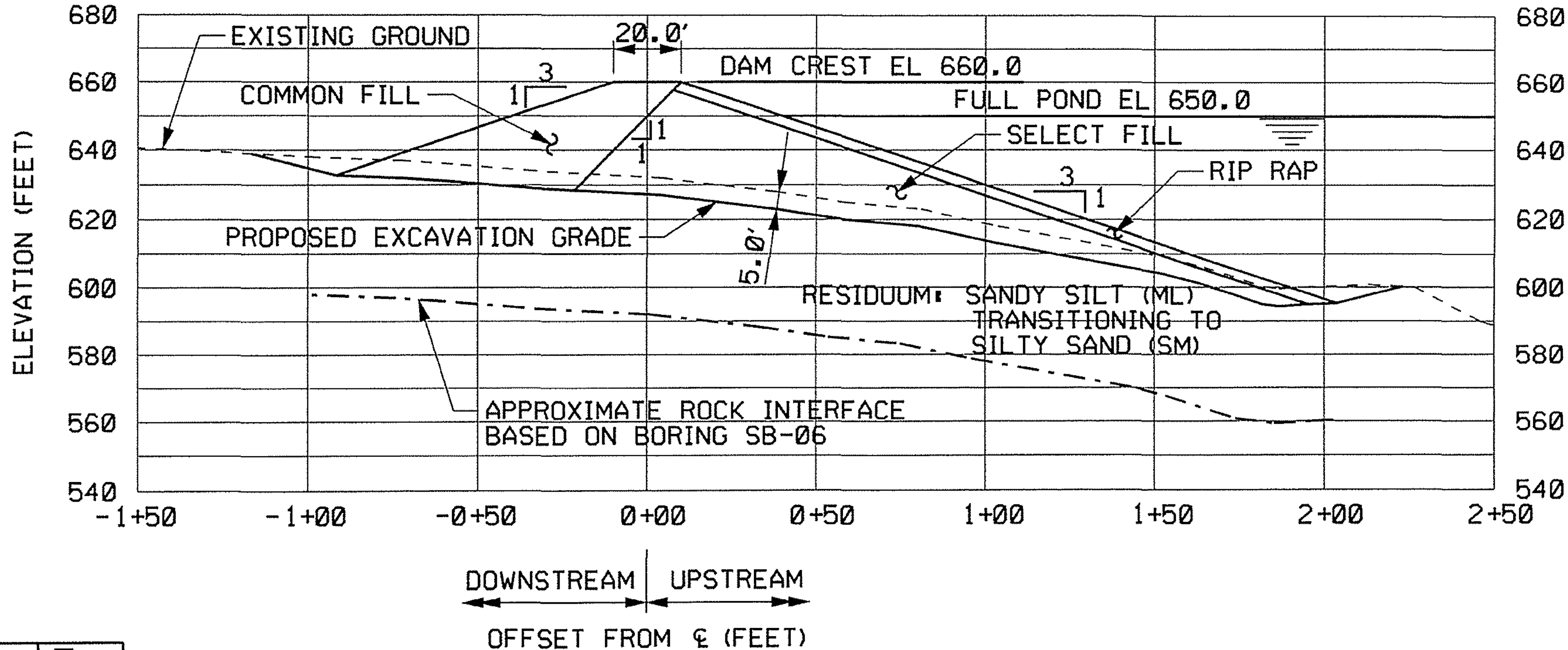
Page 61 of 126

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

POND C
MAIN DAM
SECTION

SECTION 2-2

SCALE: 1" =50'

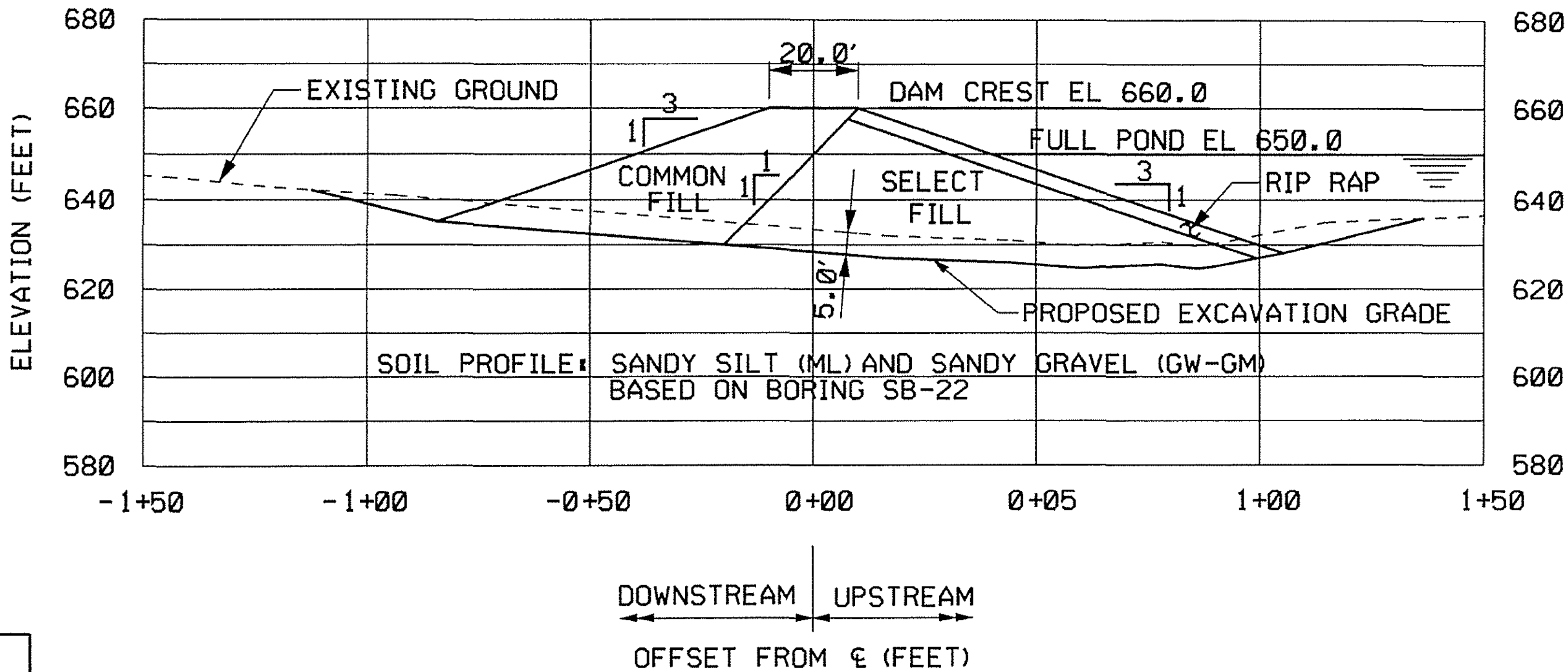


SECTION 1-1

SCALE: 1 " = 50'

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

POND C
SADDLE DIKE 1
SECTION

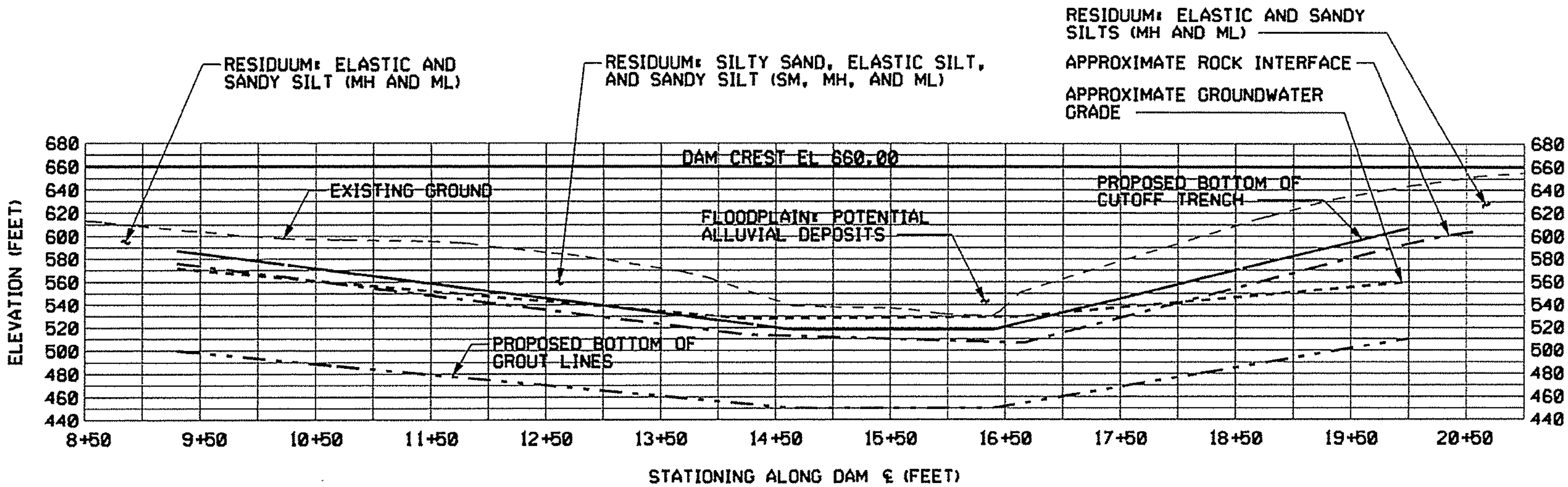


SECTION 2-2

SCALE: 1 " = 40'

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

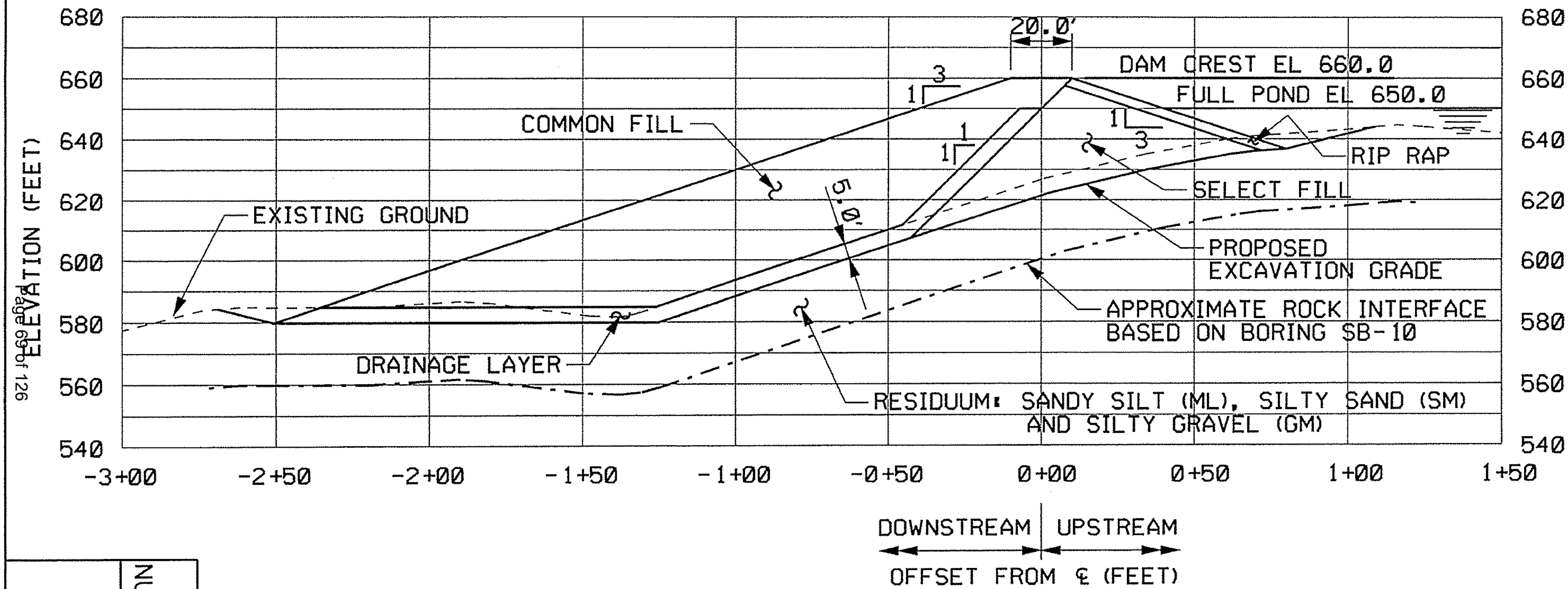
POND C
SADDLE DIKE 1
SECTION



PROFILE (LOOKING DOWNSTREAM)

SCALE: 1" = 100'

LEE NUCLEAR STATION MAKE-UP POND C
POND C MAIN DAM PROFILE

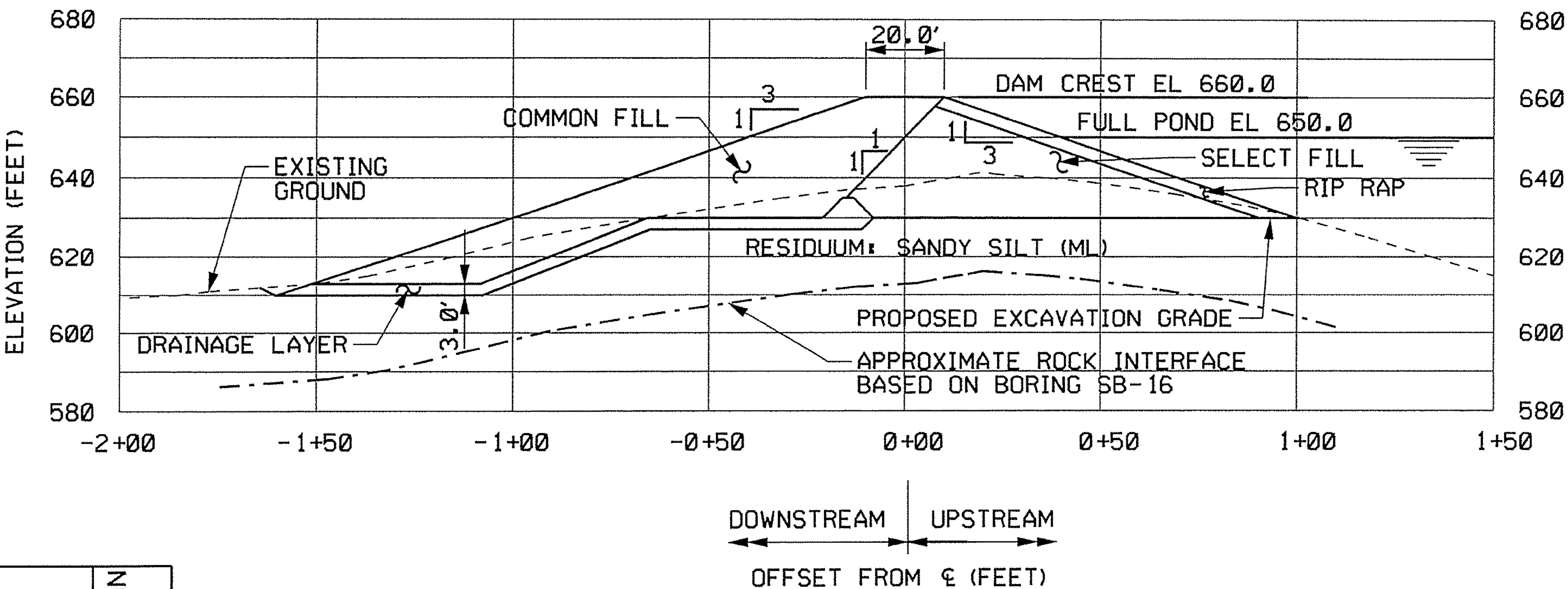


SECTION 1-1

SCALE: 1" = 50'

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

POND C
SADDLE DIKE 2
SECTION

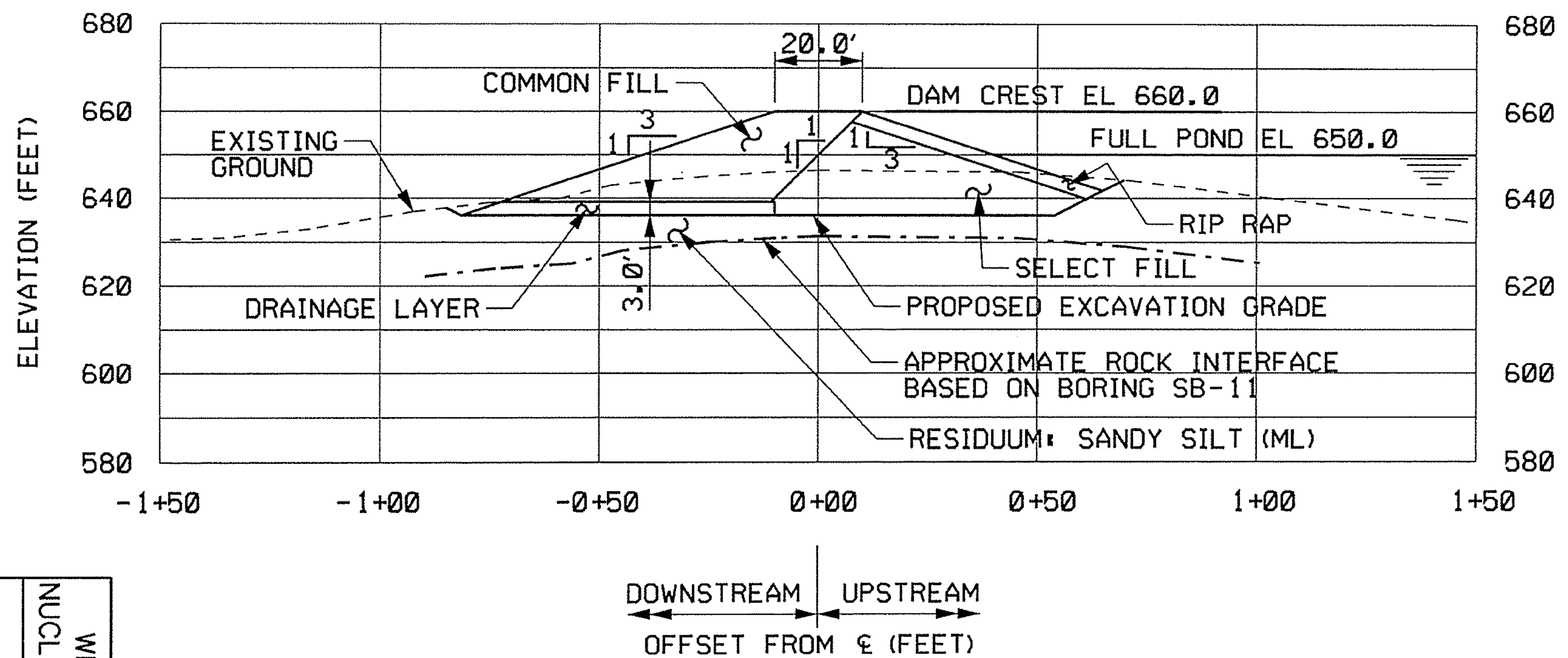


SECTION 1-1

SCALE: 1" = 40'

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

POND C
SADDLE DIKE 3
SECTION

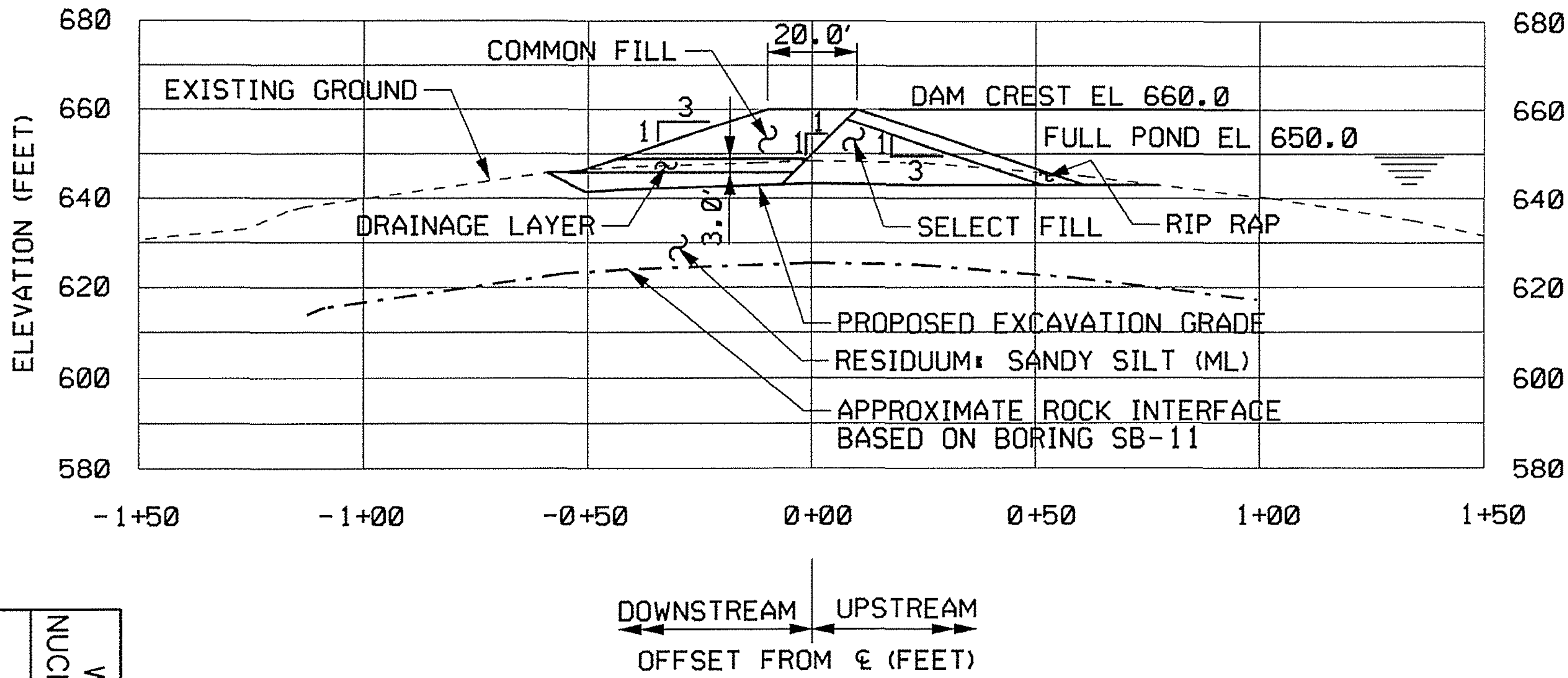


SECTION 1-1

SCALE: 1" = 40'

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

POND C
SADDLE DIKE 4
SECTION

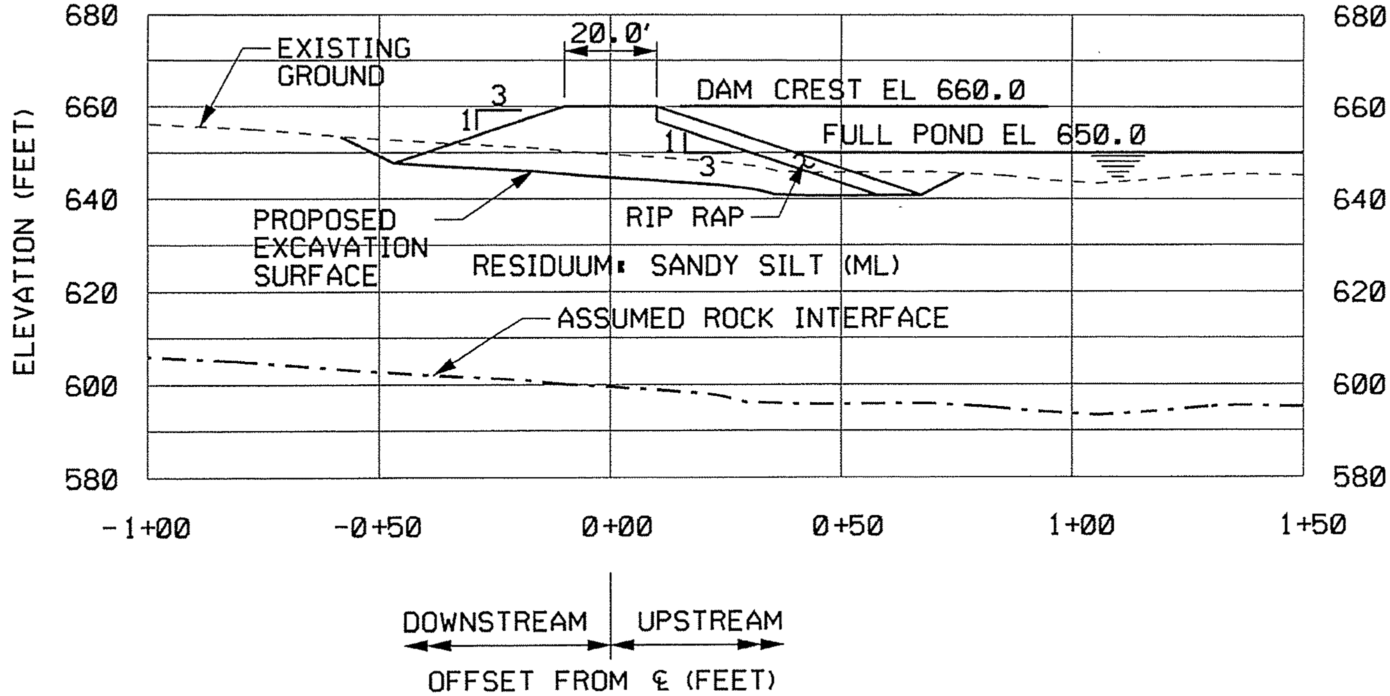


SECTION 2-2

SCALE: 1" = 40'

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

POND C
SADDLE DIKE 4
SECTION

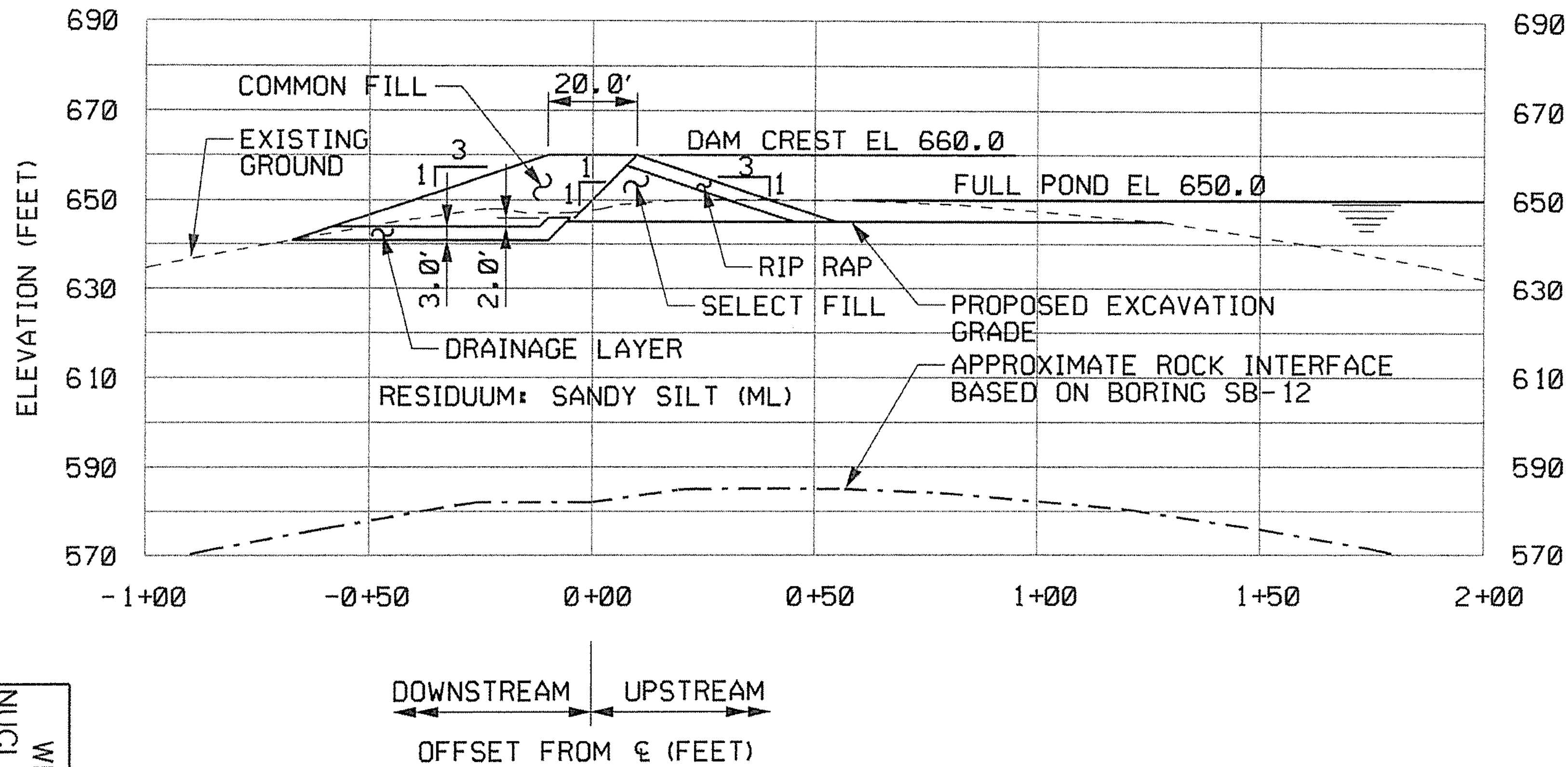


SECTION 1-1

SCALE: 1" = 40'

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

POND C
SADDLE DIKE 5
SECTION

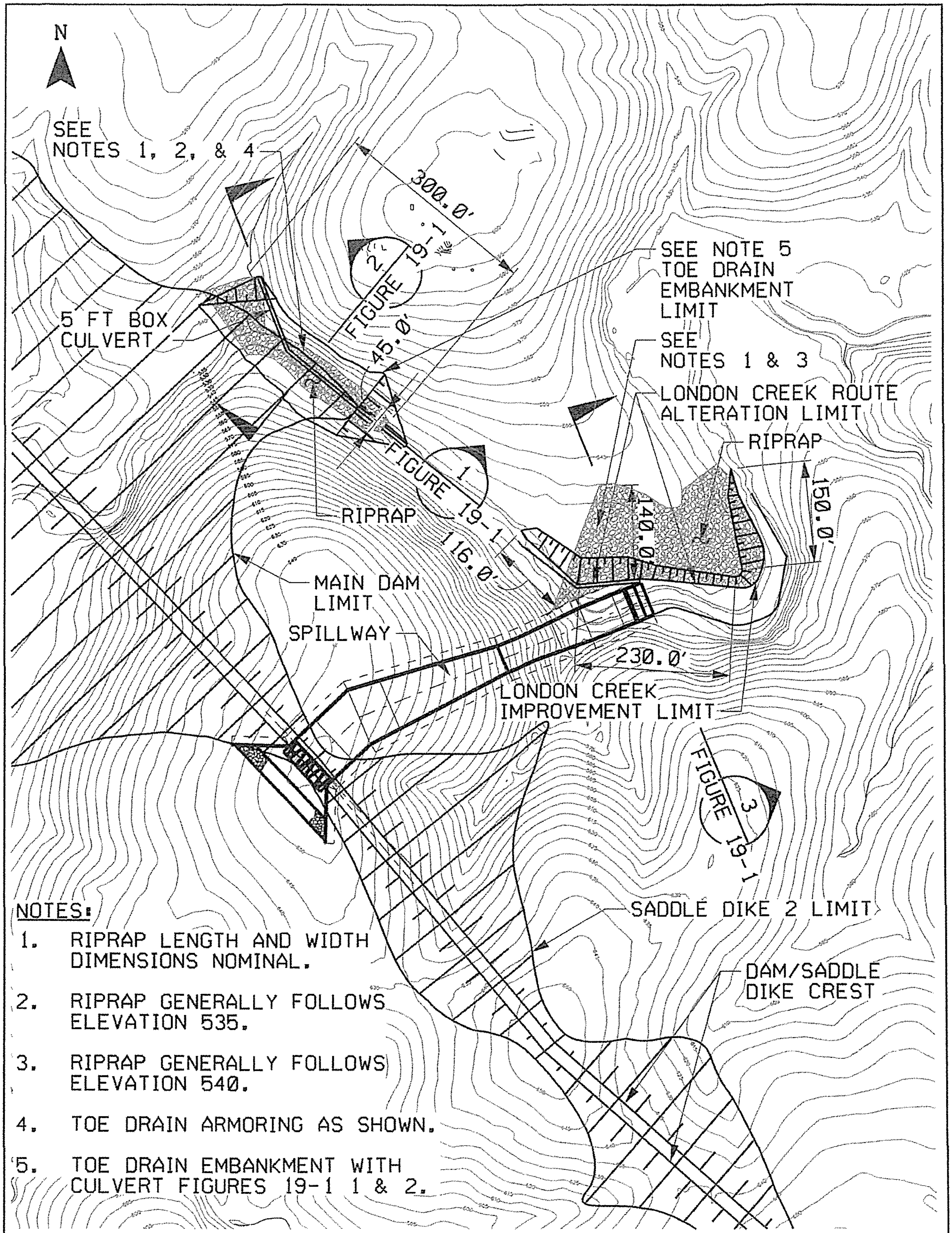


SECTION 1-1

SCALE: 1" = 40'

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

POND C
SADDLE DIKE 6
SECTION



NOTES:

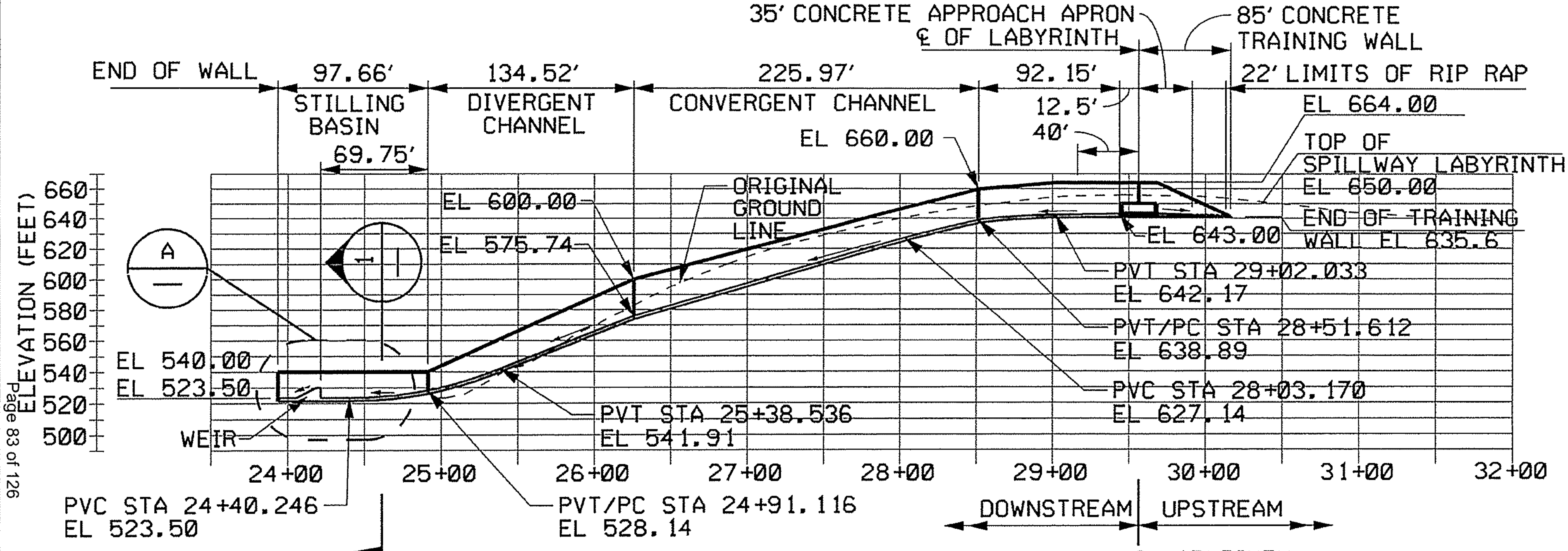
1. RIPRAP LENGTH AND WIDTH DIMENSIONS NOMINAL.
2. RIPRAP GENERALLY FOLLOWS ELEVATION 535.
3. RIPRAP GENERALLY FOLLOWS ELEVATION 540.
4. TOE DRAIN ARMORING AS SHOWN.
5. TOE DRAIN EMBANKMENT WITH CULVERT FIGURES 19-1 1 & 2.

PLAN

SCALE: 1" = 200'

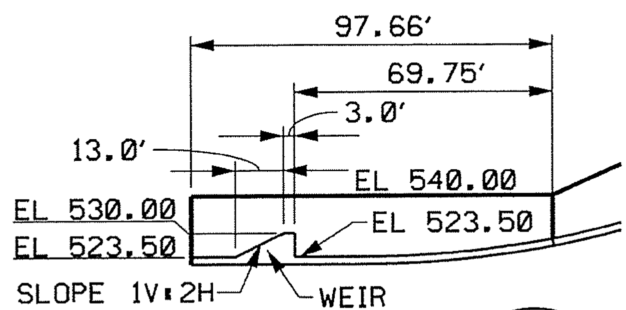
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

POND C - SPILLWAY
RIPRAP
PLAN



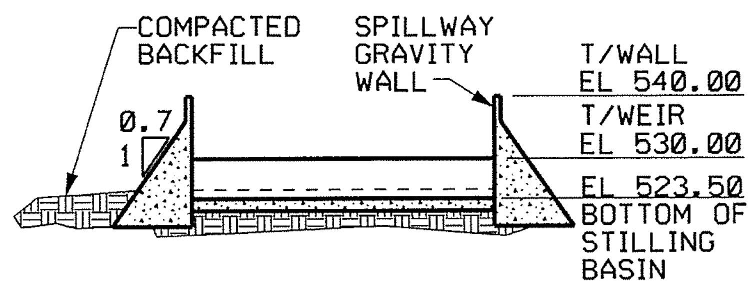
SPILLWAY PROFILE

SCALE: 1" = 100'



DETAIL A

SCALE: 1" = 50'

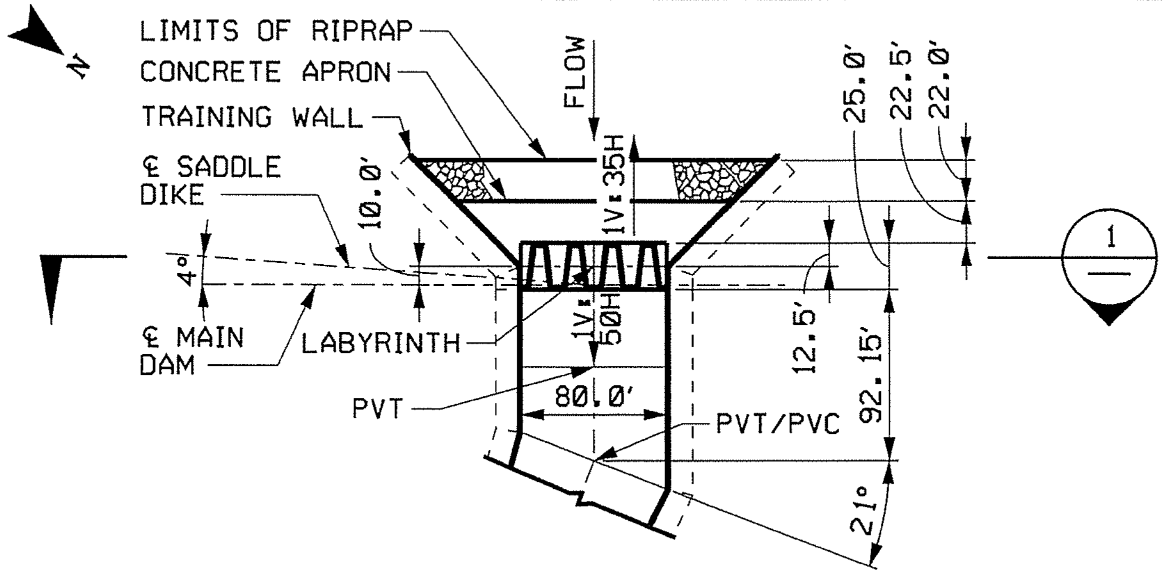


SECTION 1

SCALE: 1" = 30'

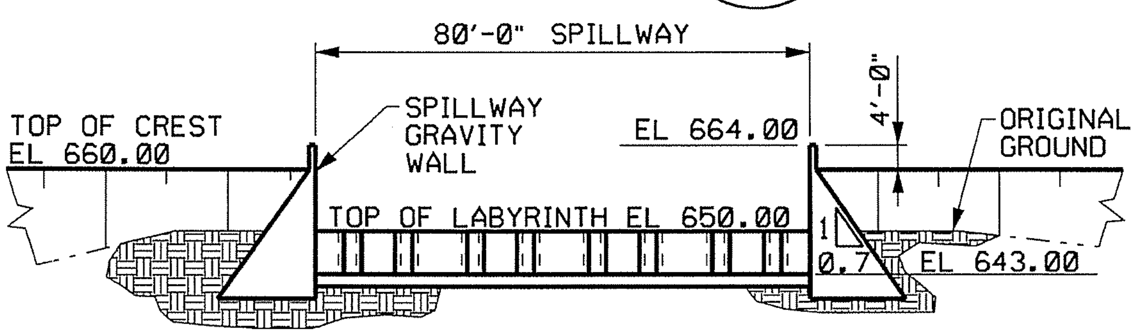
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

POND C - SPILLWAY
CONCRETE
PROFILE



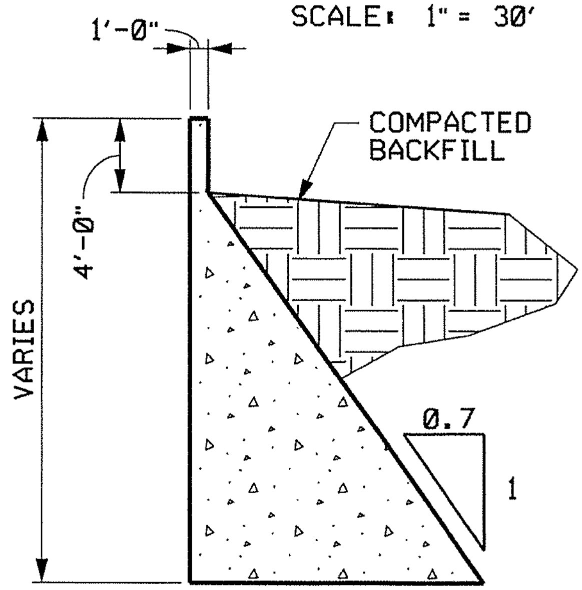
DETAIL A

SCALE: 1" = 100'



SECTION 1

SCALE: 1" = 30'

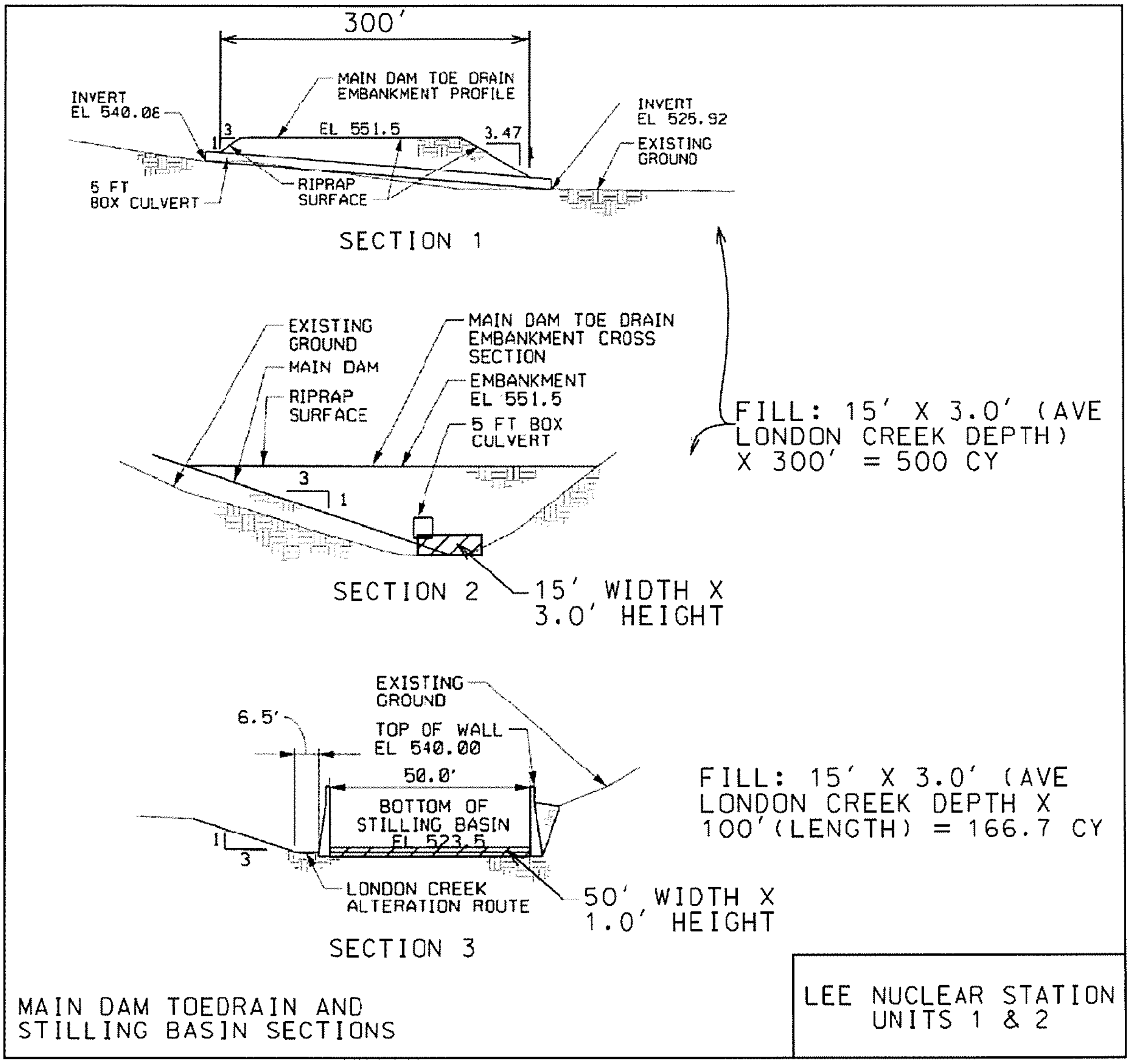


TYPICAL WALL SECTION

SCALE: 1" = 10'

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

POND C - SPILLWAY
CONCRETE
SECTIONS



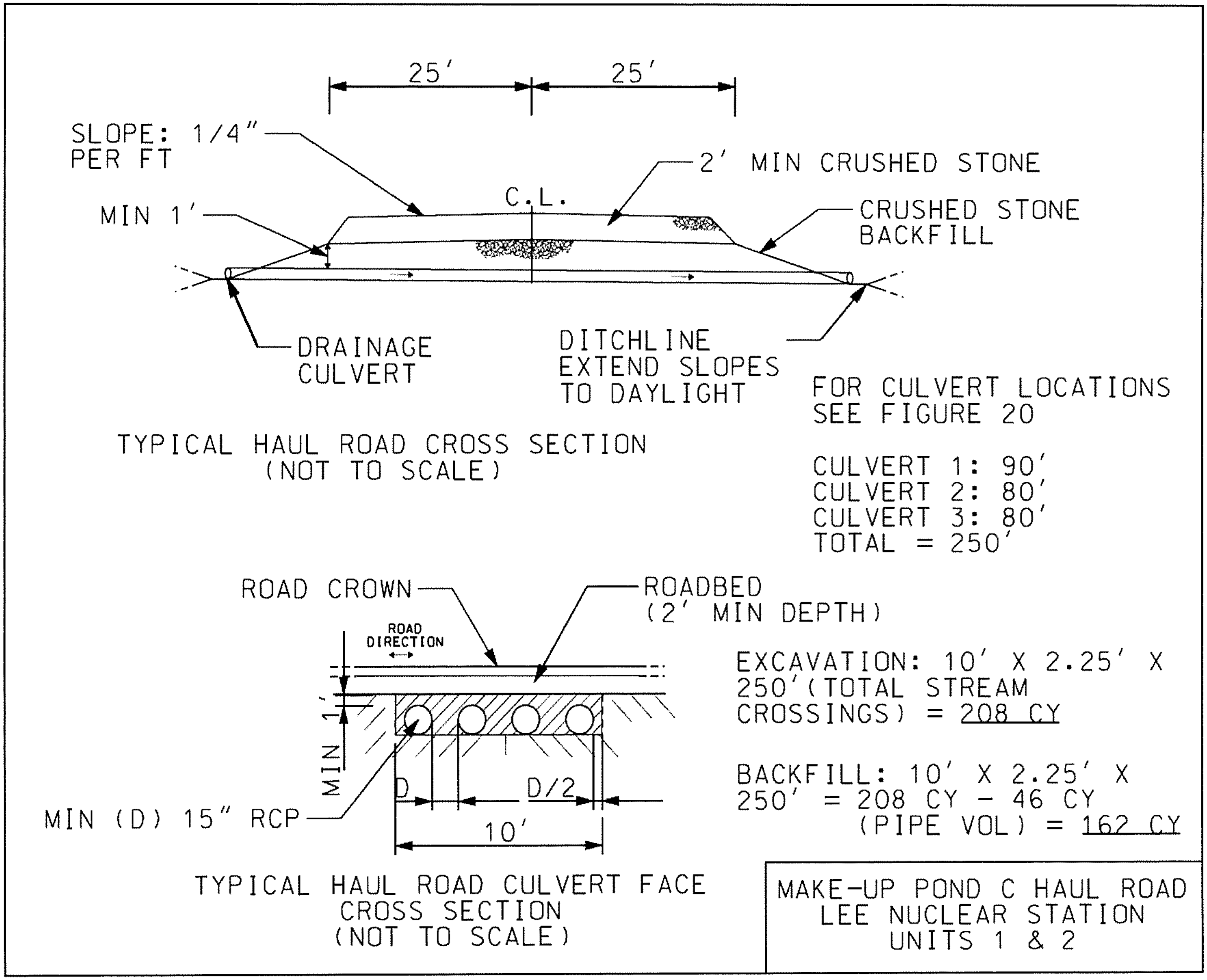
Pond C Main Dam Spillway, Stilling Basin and Toe Culvert Sections

PERMIT AREA COMPONENT B

DROUGHT CONTINGENCY POND C: TEMPORARY HAUL ROAD

CROSS SECTIONS

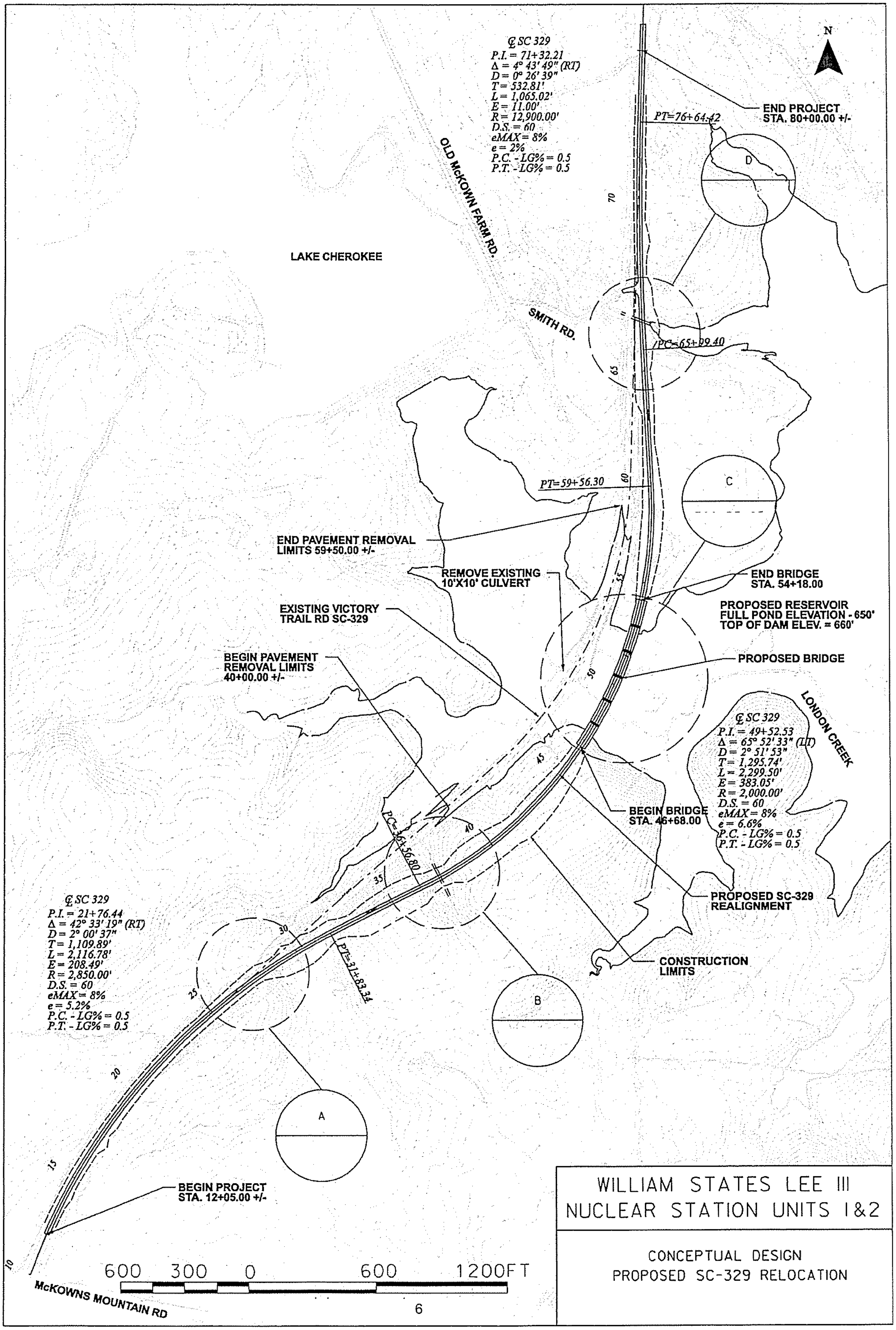
Pond C Haul Road Culverts

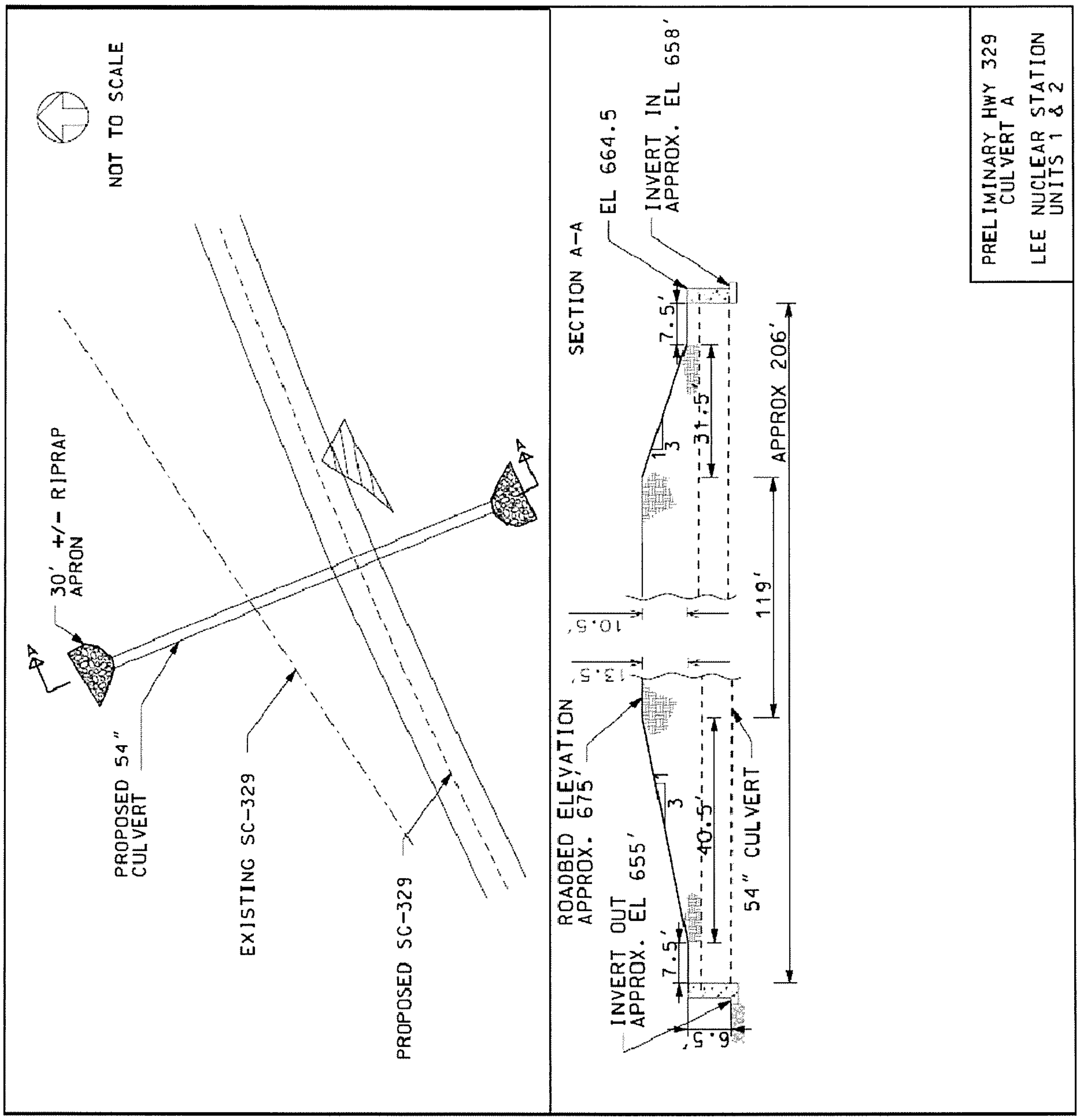


PERMIT AREA COMPONENT B

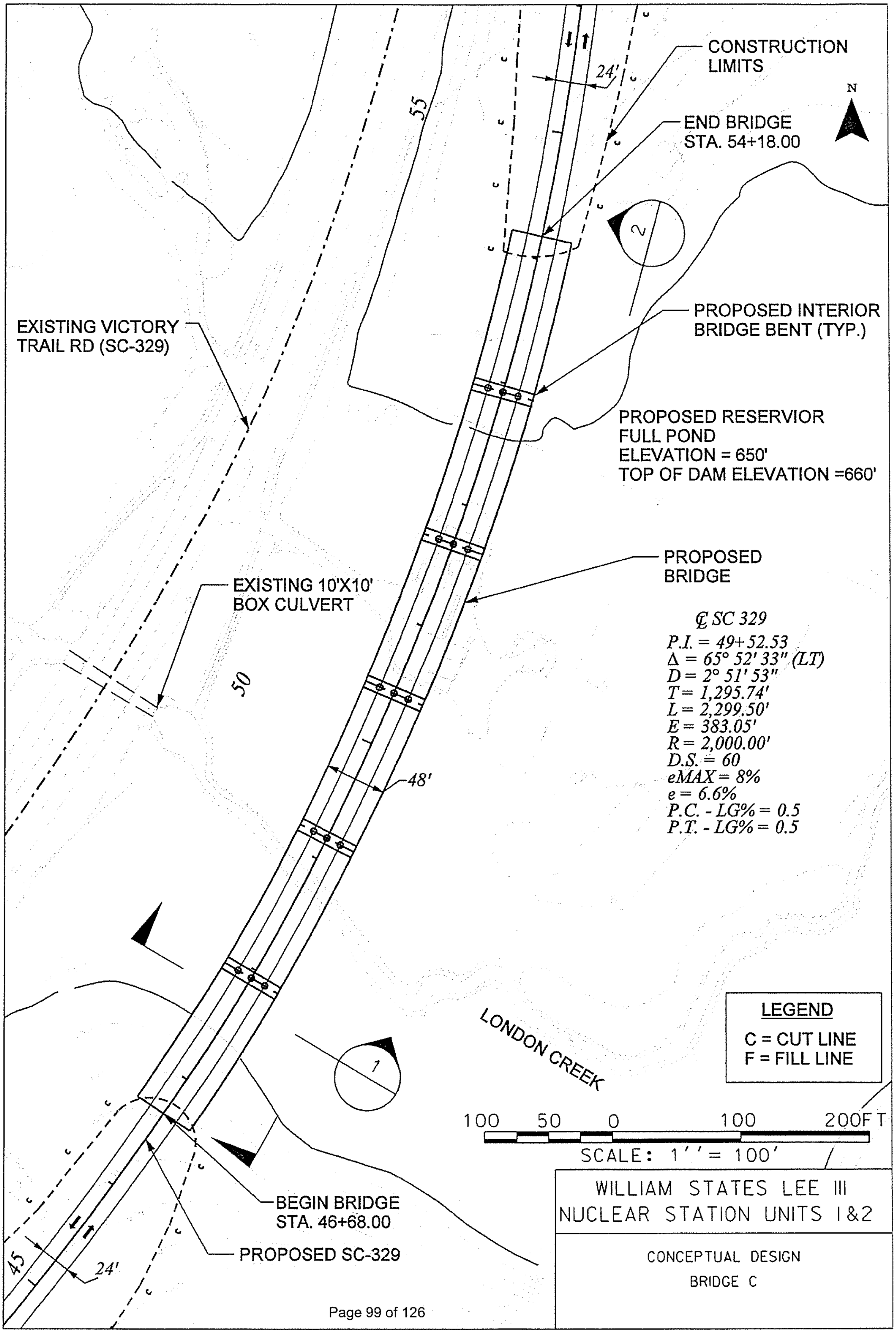
SC 329 REALIGNMENT

CONCEPTUAL DESIGN PLAN VIEW DETAILS AND CROSS SECTIONS


N
℄ SC 329
P.I. = 71+32.21
Δ = 4° 43' 49" (RT)
D = 0° 26' 39"
T = 532.81'
L = 1,065.02'
E = 11.00'
R = 12,900.00'
D.S. = 60
eMAX = 8%
e = 2%
P.C. - LG% = 0.5
P.T. - LG% = 0.5
END PROJECT
STA. 80+00.00 +/-
PT=76+64.42
D
OLD McKOWN FARM RD.
LAKE CHEROKEE
SMITH RD.
PC=65+99.40
PT=59+56.30
C
END PAVEMENT REMOVAL
LIMITS 59+50.00 +/-
REMOVE EXISTING
10'X10' CULVERT
END BRIDGE
STA. 54+18.00
EXISTING VICTORY
TRAIL RD SC-329
PROPOSED RESERVOIR
FULL POND ELEVATION - 650'
TOP OF DAM ELEV. = 660'
BEGIN PAVEMENT
REMOVAL LIMITS
40+00.00 +/-
PROPOSED BRIDGE
LONDON CREEK
℄ SC 329
P.I. = 49+52.53
Δ = 65° 52' 33" (LT)
D = 2° 51' 53"
T = 1,295.74'
L = 2,299.50'
E = 383.05'
R = 2,000.00'
D.S. = 60
eMAX = 8%
e = 6.6%
P.C. - LG% = 0.5
P.T. - LG% = 0.5
PC=36+56.80
BEGIN BRIDGE
STA. 46+68.00
PROPOSED SC-329
REALIGNMENT
℄ SC 329
P.I. = 21+76.44
Δ = 42° 33' 19" (RT)
D = 2° 00' 37"
T = 1,109.89'
L = 2,116.78'
E = 208.49'
R = 2,850.00'
D.S. = 60
eMAX = 8%
e = 5.2%
P.C. - LG% = 0.5
P.T. - LG% = 0.5
PT=31+83.34
CONSTRUCTION
LIMITS
B
A
BEGIN PROJECT
STA. 12+05.00 +/-
600 300 0 600 1200FT
McKOWNS MOUNTAIN RD
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2
CONCEPTUAL DESIGN
PROPOSED SC-329 RELOCATION

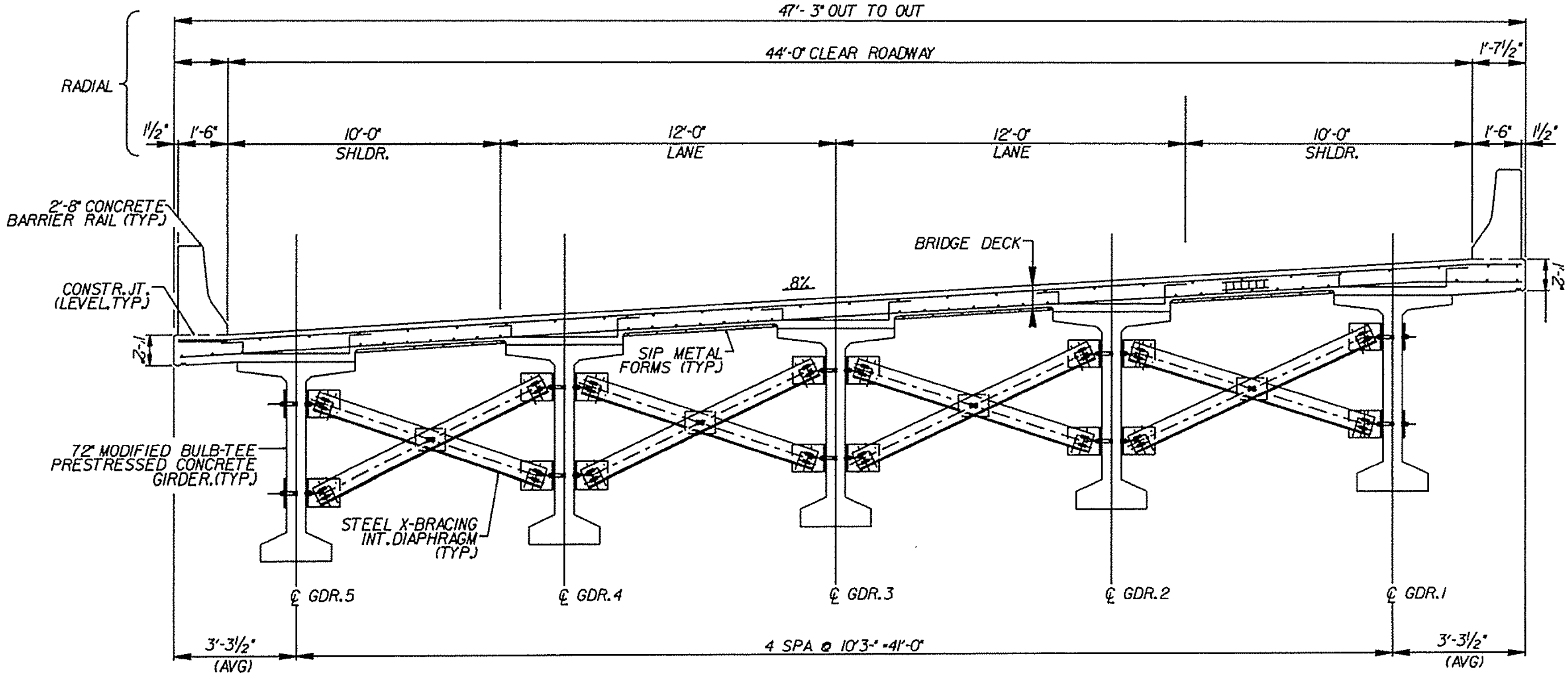


Pond C Highway 329 Culvert A Plan and Section



WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

CONCEPTUAL DESIGN
BRIDGE C

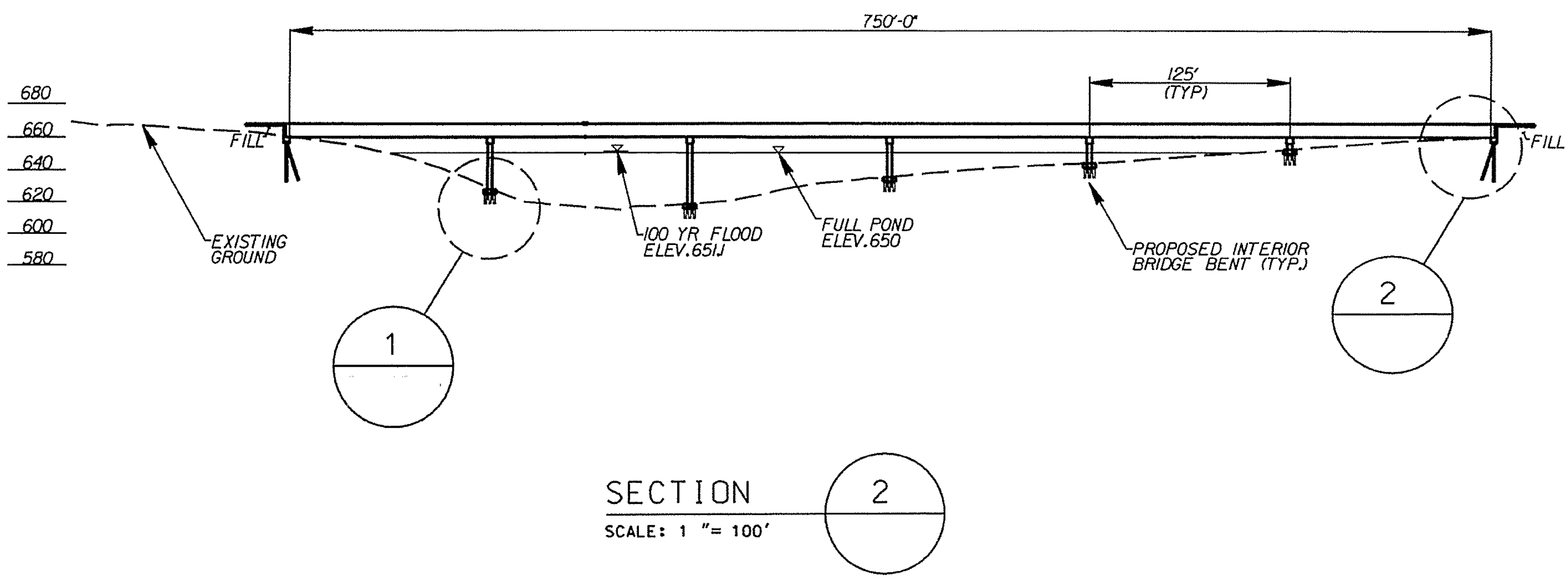


SECTION 1

SCALE: NTS

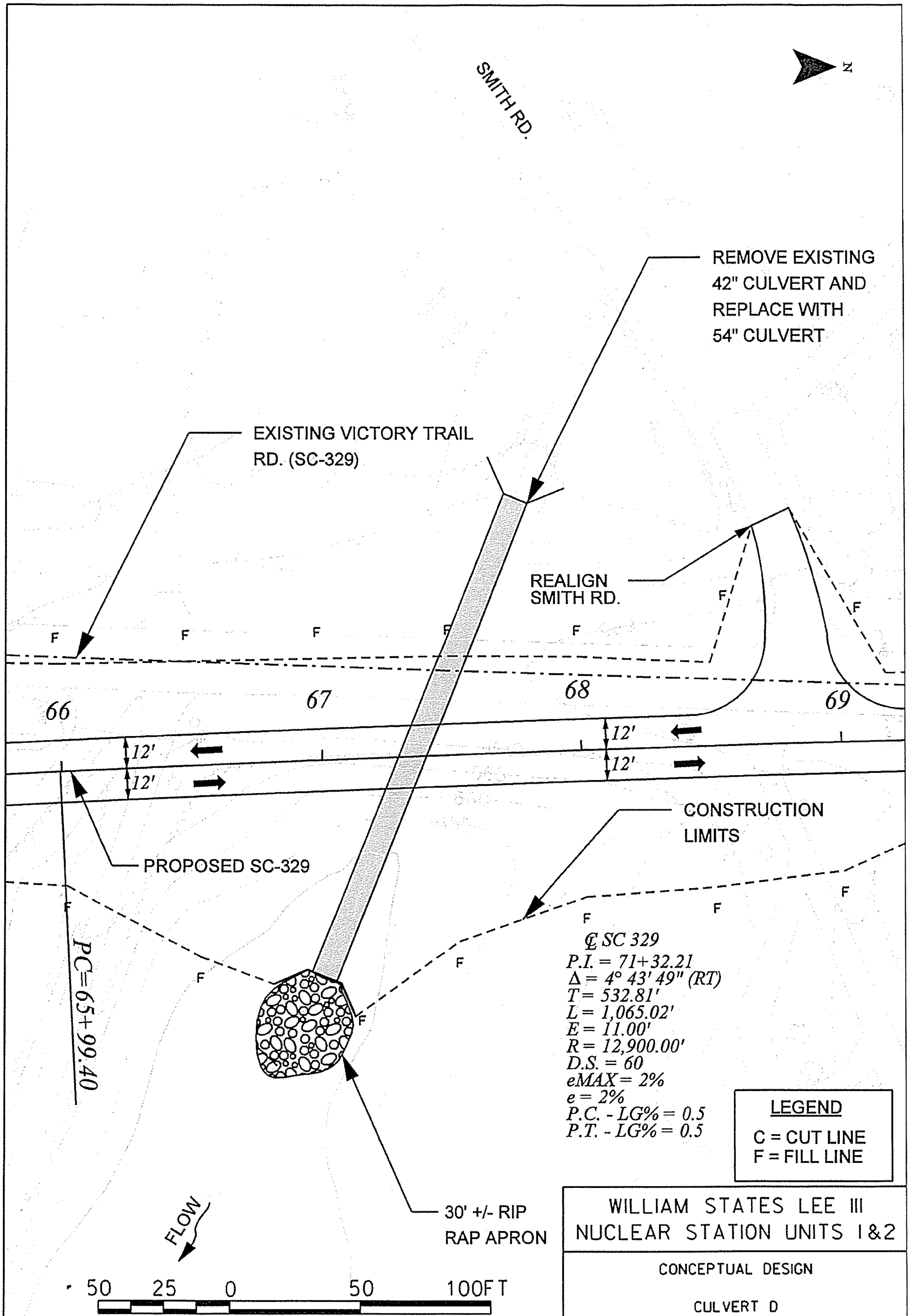
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

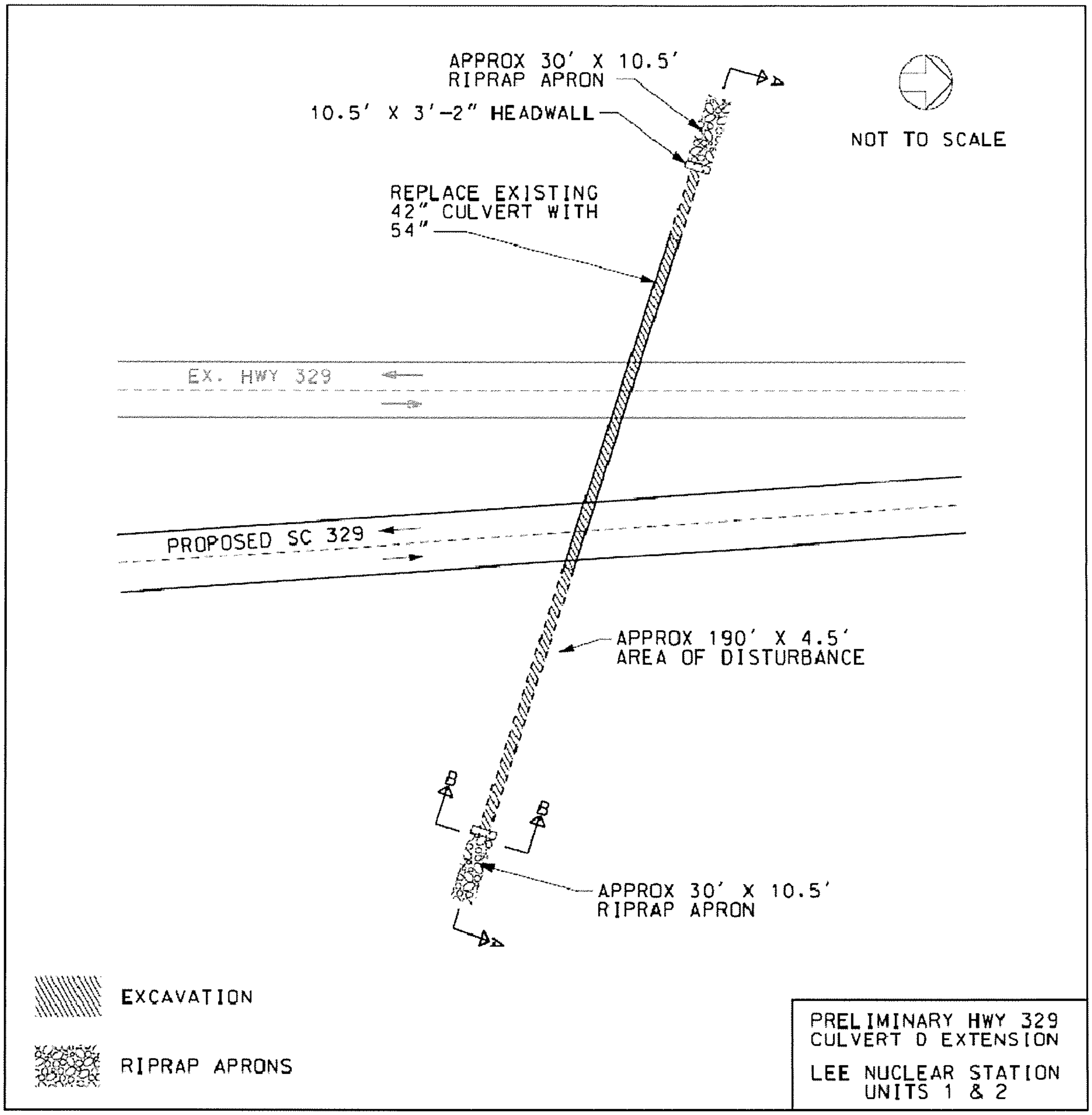
CONCEPTUAL DESIGN
PROPOSED SC-329 BRIDGE SECTION



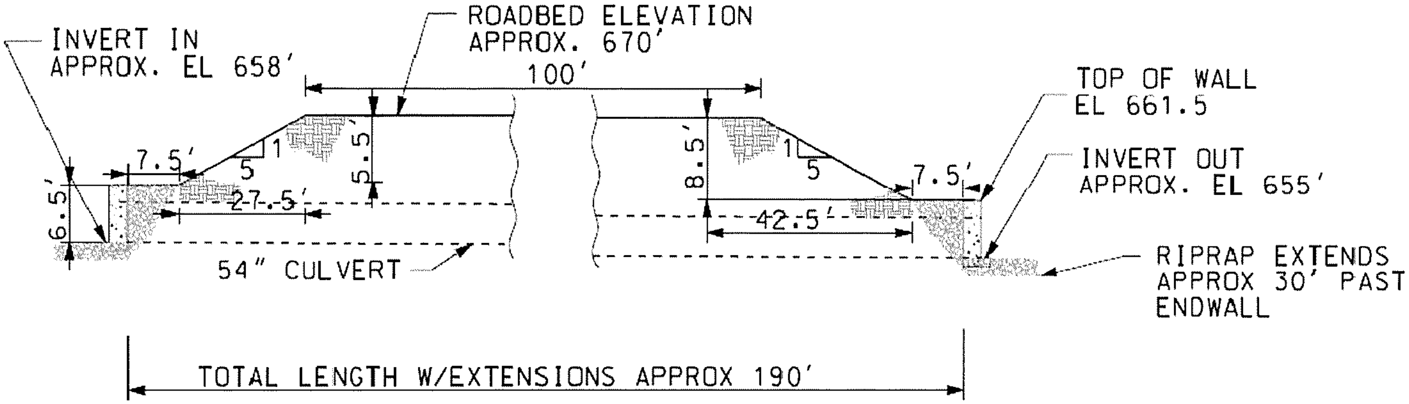
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

CONCEPTUAL DESIGN
PROPOSED SC-329 BRIDGE ELEVATION

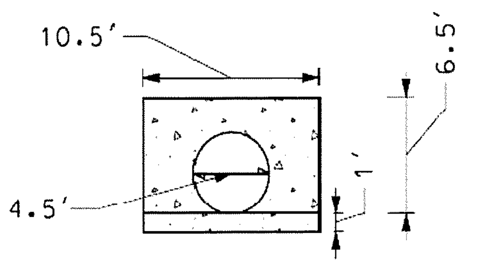

SMITH RD.
N
REMOVE EXISTING 42" CULVERT AND REPLACE WITH 54" CULVERT
EXISTING VICTORY TRAIL RD. (SC-329)
REALIGN SMITH RD.
66
67
68
69
12'
12'
12'
12'
F
C
PROPOSED SC-329
CONSTRUCTION LIMITS
PC=65+99.40
℄ SC 329
P.I. = 71+32.21
Δ = 4° 43' 49" (RT)
T = 532.81'
L = 1,065.02'
E = 11.00'
R = 12,900.00'
D.S. = 60
eMAX = 2%
e = 2%
P.C. - LG% = 0.5
P.T. - LG% = 0.5
LEGEND
C = CUT LINE
F = FILL LINE
30' +/- RIP RAP APRON
FLOW
50 25 0 50 100FT
WILLIAM STATES LEE III NUCLEAR STATION UNITS 1&2
CONCEPTUAL DESIGN
CULVERT D



Pond C Highway 329 Culvert D Plan



CROSS SECTION VIEW A-A



ELEVATION VIEW B-B

ALL ELEVATIONS AND DIMENSIONS
SHOWN ARE PRELIMINARY

ALL ELEVATIONS SHALL BE
CONFIRMED AT FINAL DESIGN

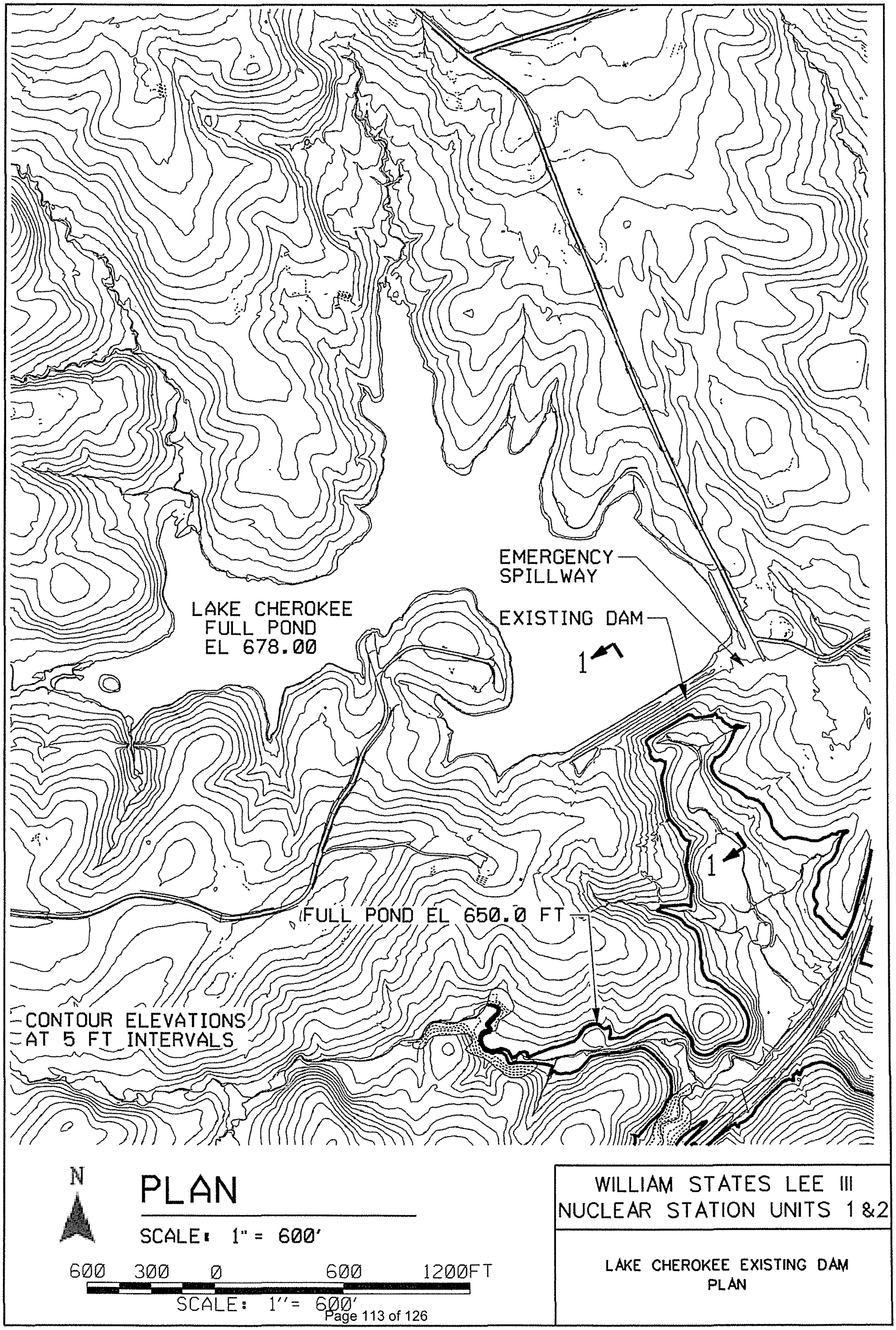
PRELIMINARY HWY 329
CULVERT D EXTENSION

LEE NUCLEAR STATION
UNITS 1 & 2

PERMIT AREA COMPONENT B

LAKE CHEROKEE DAM IMPROVEMENTS

CONCEPTUAL DESIGN PLAN VIEW DETAILS AND CROSS SECTIONS

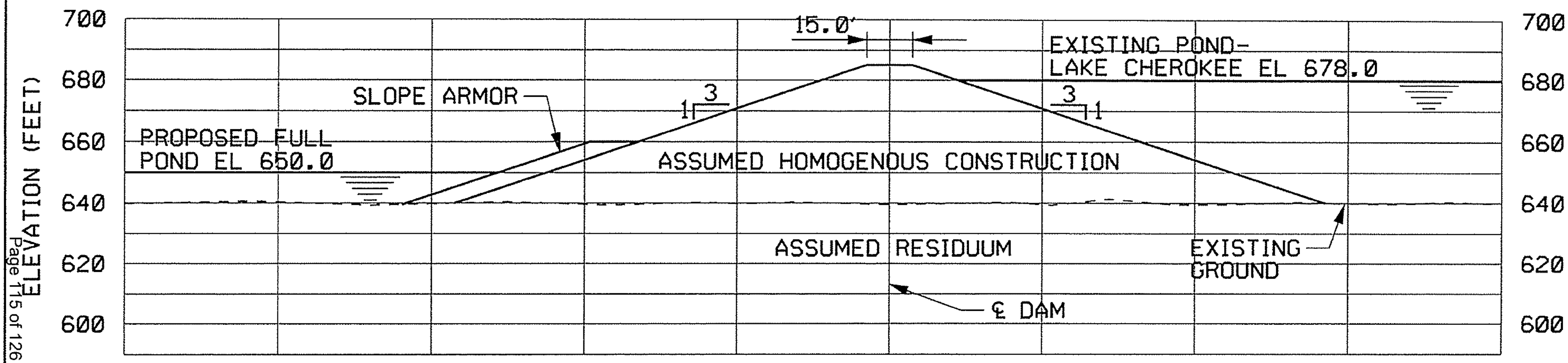


PLAN

SCALE: 1" = 600'

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

LAKE CHEROKEE EXISTING DAM
PLAN



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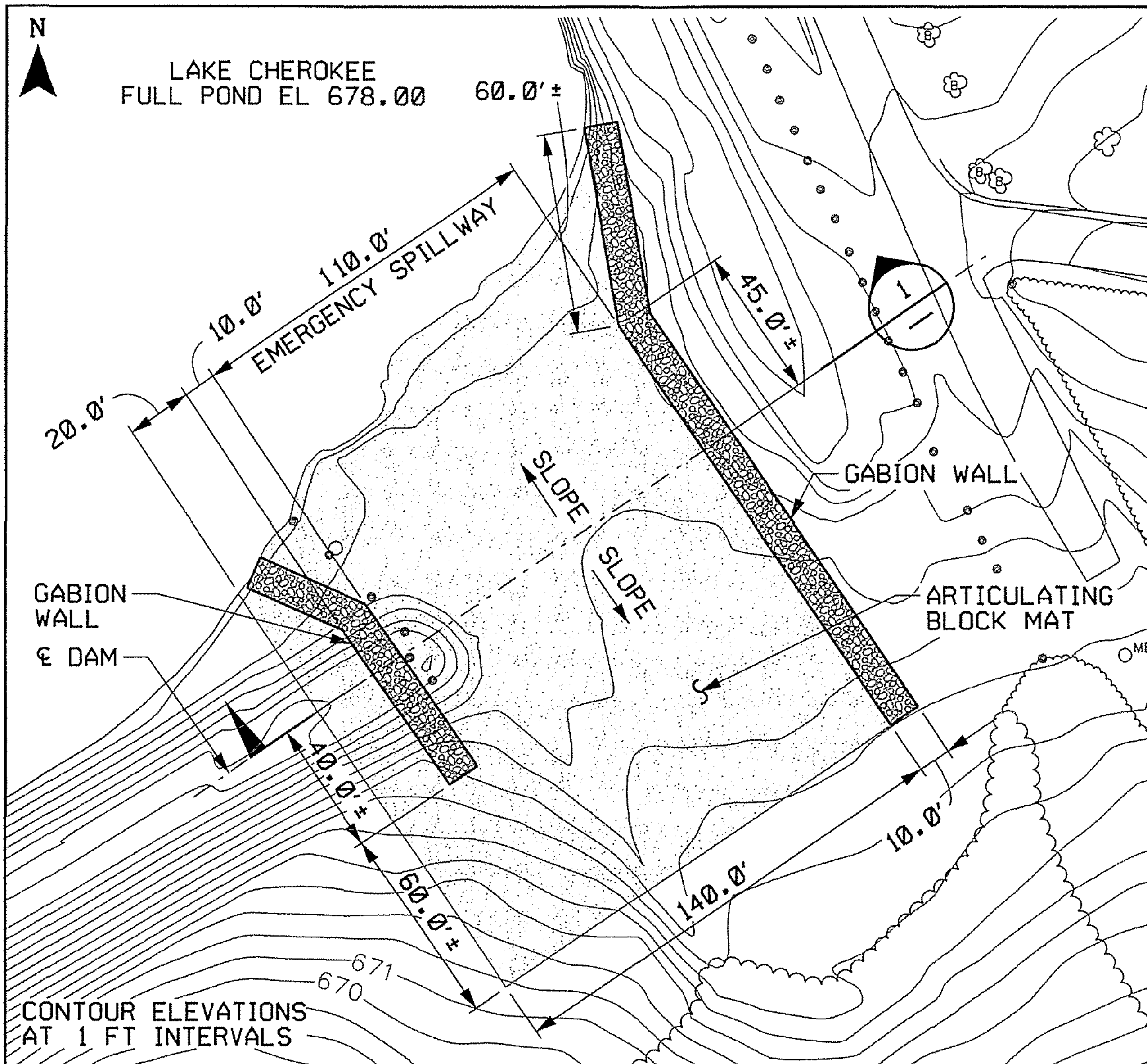
SECTION 1

SCALE: 1" = 50"

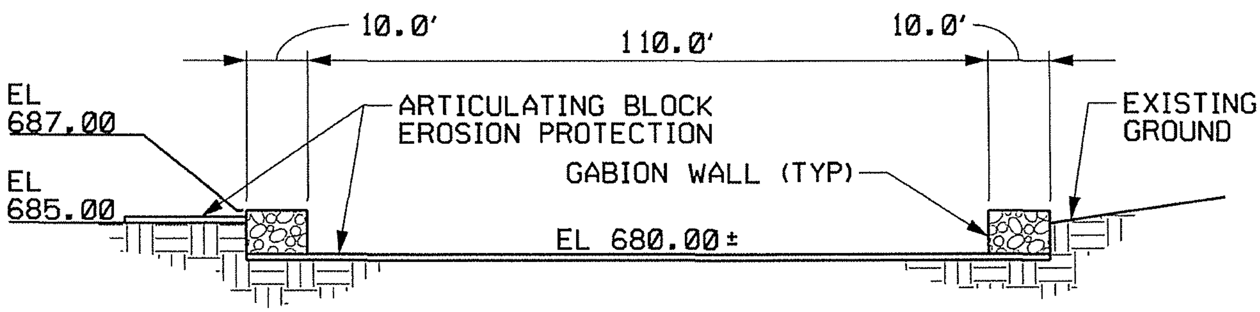
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

LAKE CHEROKEE EXISTING DAM
SECTION



PLAN

SCALE: 1" = 50'



SECTION 1

SCALE: 1" = 30'

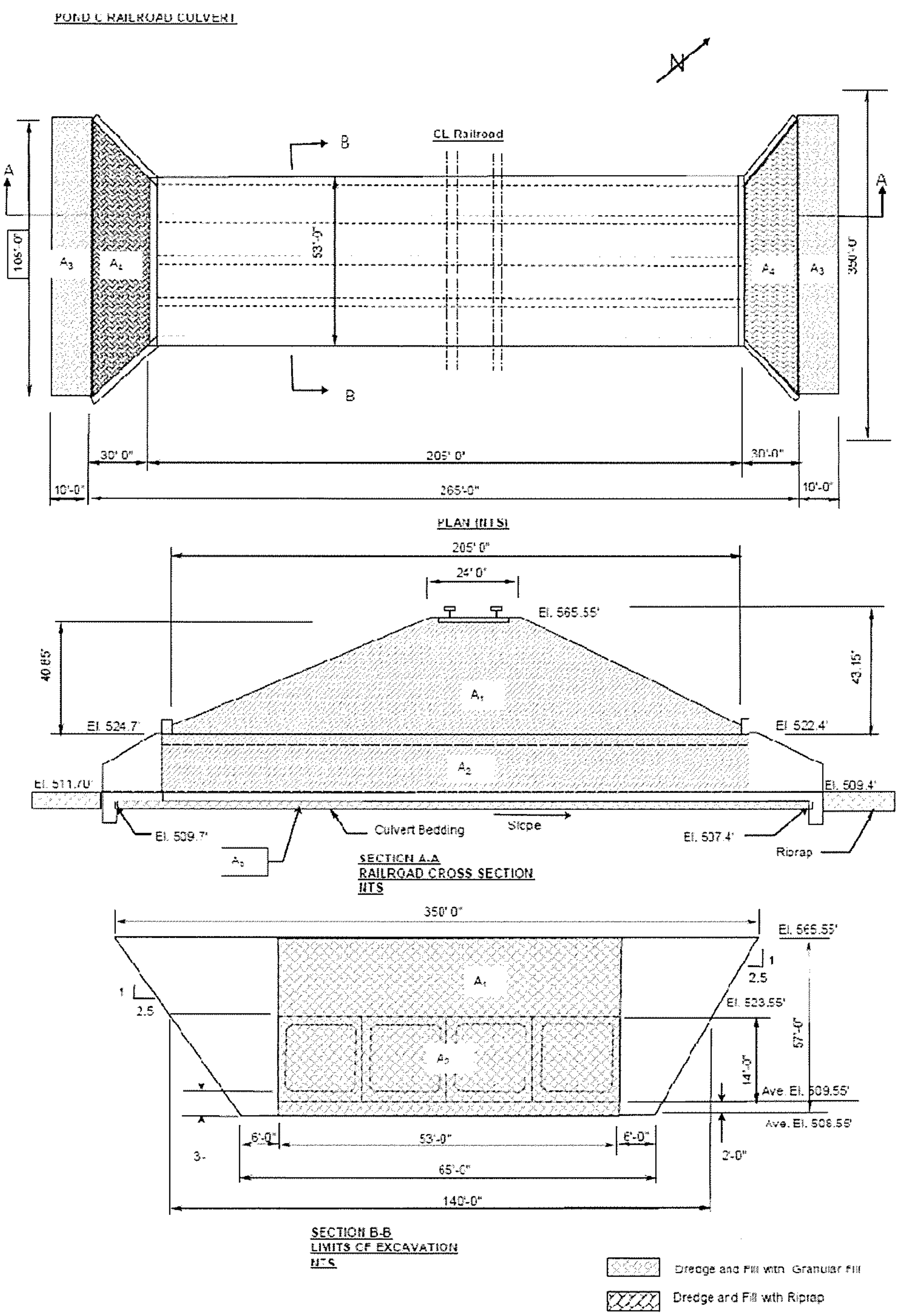
WILLIAM STATES LEE III NUCLEAR STATION UNITS 1&2
LAKE CHEROKEE EXISTING DAM EMERGENCY SPILLWAY PLAN

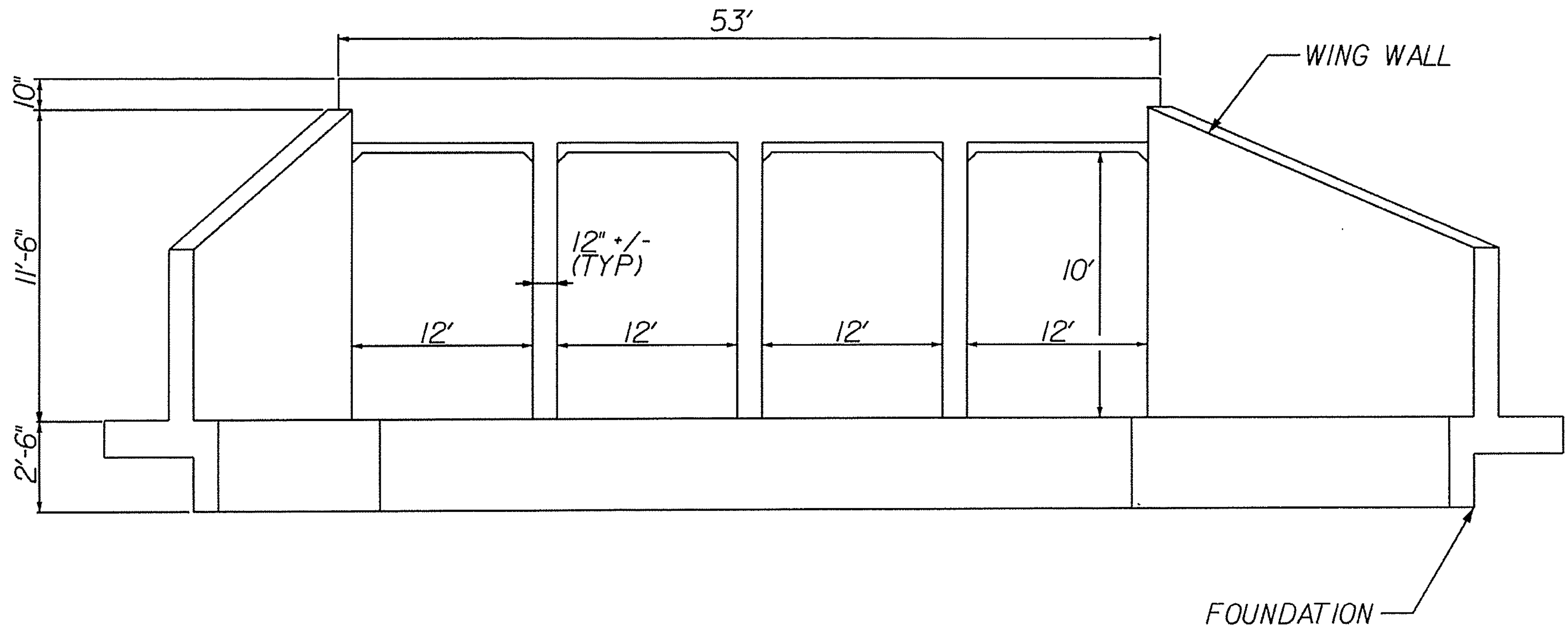
PERMIT AREA COMPONENT C

LONDON CREEK CULVERT REPLACEMENT

CONCEPTUAL DESIGN PLAN VIEW DETAILS AND CROSS SECTIONS

London Creek Railroad Culvert

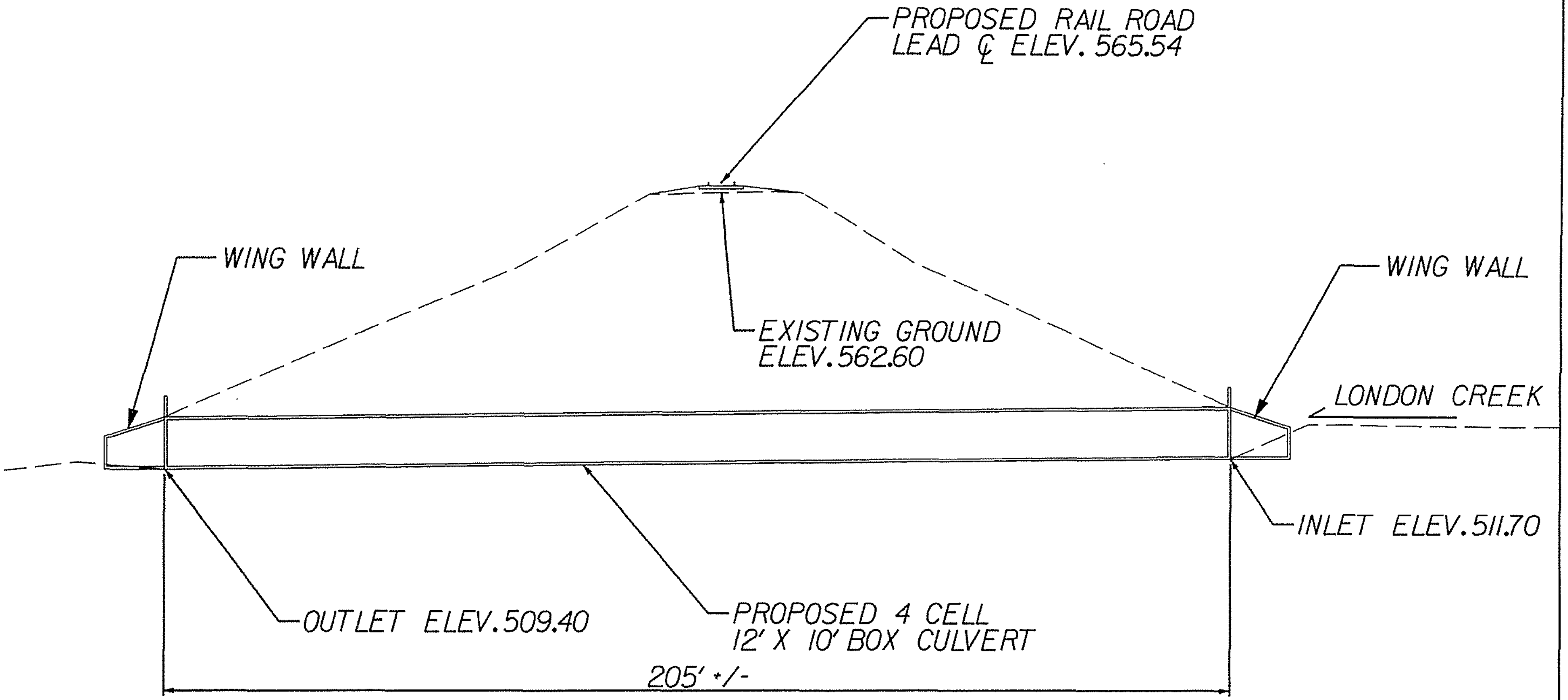




SECTION 1
SCALE: NTS

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1&2

CONCEPTUAL DESIGN
CULVERT E
BOX CULVERT END ELEVATION



CULVERT SECTION 2

SCALE: NTS

WILLIAM STATES LEE III NUCLEAR STATION UNITS 1&2
CONCEPTUAL DESIGN CULVERT E BOX CULVERT PROFILE

PART III
WILLIAM STATES LEE III NUCLEAR STATION
CONCEPTUAL MITIGATION PLAN

Prepared for:

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November 2011

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Acronyms and Abbreviations

C.F.R.	*Code of Federal Regulations*
EPA	U.S. Environmental Protection Agency
GIS	Geographic Information System
IRT	Interagency Review Team
kV	kilovolt
NCWAM	North Carolina Wetland Assessment Method
NMFS	National Marine Fisheries Service
NRC	Nuclear Regulatory Commission
NUREG-1555	NRC Environmental Standard Review Plans for Environmental Reviews for Nuclear Power Plants
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SHPO	State Historical Preservation Officer
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

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1.0 MITIGATION

This section summarizes the conceptual mitigation plan for the Lee Nuclear Station, including the regulatory framework and the process used to calculate the required mitigation credits. This section with its associated appendices also provides information about the specific components of the proposed mitigation. These components will provide the necessary restoration, enhancement, and preservation mitigation credits to offset the unavoidable impacts from the proposed construction of the Lee Nuclear Station.

The 2008 Federal mitigation rule (Mitigation Rule) (U.S. Army Corps of Engineers [USACE] and U.S. Environmental Protection Agency [EPA] 2008) provides flexibility in defining the watershed for compensatory mitigation purposes and allows several contiguous 8-digit Hydrologic Unit Code watersheds to comprise an appropriate service area. As described in more detail in Section 1.2.1, project impacts occur in the Upper and Lower Broad watersheds within South Carolina and have effects in the downstream portions of the Broad River. Because 1) 60 percent of the Upper Broad River watershed is in North Carolina, 2) stakeholders and South Carolina regulatory authorities will not accept mitigation outside of South Carolina, and 3) there are no landscape-level mitigation opportunities within the South Carolina portion of the Upper Broad watershed, it is not practicable to provide mitigation within the Upper Broad watershed, which will appropriately and effectively compensate for project impacts (in particular stream impacts, as discussed in Volume I, Part II, Section 7.0). Duke Energy viewed this challenge as an opportunity to develop a meaningful mitigation plan that implements the hierarchy prescribed in 33 C.F.R. § 332.3(b)(2) through (6), and to provide significant regional benefits to the Broad River. The conceptual mitigation plan includes the purchase of bank credits as well as permittee-responsible mitigation using a watershed approach. This approach was used to look for large mitigation opportunities that would create benefits within entire catchments of the Broad River watershed. Through a proposed public/ private partnership with the U.S. Forest Service (USFS), Duke Energy proposes the restoration and enhancement of a series of adjacent streams within the Lower Broad River watershed at Sumter National Forest as the keystone component of this conceptual mitigation plan. The proposed restoration and enhancement of these streams would provide an opportunity to address degraded aquatic stream functions in the Broad River watershed through a landscape-level project. Degradation of the streams proposed for mitigation was the result of historical agricultural practices. The selection of these sites also assists the USFS in meeting watershed needs identified in its Forest Management Plan by restoring the functions of aquatic resources within national forests for public benefit.

In addition to the opportunities at Sumter National Forest, Duke Energy has identified a large permittee-responsible site to address additional mitigation needs (including preservation and buffer enhancement opportunities). This permittee-responsible site (Turkey Creek tract) is located near the Lee Nuclear Station, and offers a balanced opportunity for mitigation that is substantial enough to provide regional benefits.

1.1 OBJECTIVES

As prescribed in § 332.4(b)(1) of the Mitigation Rule (USACE 2008), Duke Energy provides details regarding avoidance and minimization measures to limit direct impacts to waters of the U.S. in Volume I, Part II, Sections 3.0 and 4.0. However, quantified impacts to waters of the U.S. are unavoidable after full incorporation of avoidance and minimization measures, as described in detail in Volume I, Part II, Section 7.0. In overview, the mitigation package for the Lee Nuclear Station project will consist of a combination of mitigation bank credit purchases and permittee-responsible mitigation including restoration, enhancement, and preservation. Duke Energy plans to develop and implement mitigation based upon an integrated watershed approach to identify large-scale mitigation in a regionally important context in accordance with the Mitigation Rule (USACE 2008) and USACE Charleston District guidelines (USACE 2010). Mitigation will be coordinated with USACE in consultation with the South Carolina Department of Health and Environmental Control (SCDHEC) and South Carolina Department of Natural Resources (SCDNR).

1.1.1 Determination of Required Mitigation Credits

The USACE Charleston District published draft “Guidelines for Preparing a Compensatory Mitigation Plan,” last revised on June 24, 2011 (USACE Charleston District Guidelines) (USACE 2010). The USACE Charleston District Guidelines were used to calculate the amount of credits necessary to provide compensatory mitigation for impacts from the construction of the Lee Nuclear Station and the proposed drought contingency pond. Appendix A provides the calculation of the required mitigation credits. Note that while linear systems are referred to as “tributaries” throughout most of this application, these systems will be referred to as “streams” for the remainder of this section in order to be consistent with the USACE Charleston District Guidelines.

The USACE Charleston District Guidelines provide separate processes for calculating the required mitigation credits for wetlands (including open-water habitats) and streams. Functional assessments were conducted in the field to determine the existing conditions of wetlands and streams for use in the calculation of mitigation credits. These functional assessments are provided in Appendix B.

As required in 33 C.F.R. § 332.3(f)(1) and 40 C.F.R. § 230.93(f)(1), the compensatory mitigation will be sufficient to replace the lost aquatic functions due to permitted unavoidable impacts. Overall, the number of required mitigation credits is compared with the proposed mitigation credits, in order to ensure that the proposed mitigation credits are equal to or greater than the required mitigation credits. A summary table of the required mitigation credits for the Lee Nuclear Station is provided in Table 1-1. The total mitigation requirement for Lee Nuclear Station is 54 wetland credits, 273 open-water credits, and 483,583 stream credits. The USACE Charleston District Guidelines state that at least 50 percent of the mitigation credits generated by a proposed mitigation plan should be the result of restoration or enhancement activities. Proposed impacts from the Lee Nuclear Station project result in a restoration/enhancement credit need of at least 27 wetland credits and 241,792 stream credits. As discussed in the following sections, Duke Energy plans to meet the restoration/ enhancement requirement through a combination of bank credit purchases and permittee-responsible mitigation. Duke Energy plans to meet the remaining mitigation needs through preservation and buffer enhancement using a combination of bank credit purchases and permittee-responsible mitigation.

1.1.2 Mitigation Hierarchy

The Mitigation Rule and USACE Charleston District Guidelines provide a recommended hierarchy for compensatory mitigation. The hierarchy includes 1) mitigation banks, 2) in-lieu fee program credits, and/or 3) permittee-responsible mitigation. These are explained in more detail in the following subsections (extracted from USACE Charleston District Guidelines).

1.1.2.1 Mitigation Banks

Mitigation banks are commercial entities controlling sites (or suites of sites) where resources (e.g., wetlands, streams) are restored, established, enhanced, and/or preserved for the purpose of providing mitigation to offset project-related impacts. Mitigation banks sell credits to permittees, and the responsibility for mitigation success remains with the bank sponsor. The operation/use of a mitigation bank is administered by a mitigation banking instrument.

Duke Energy plans to purchase mitigation bank credits as part of the proposed compensatory mitigation. Details regarding available bank credits and how Duke Energy plans to use credits from mitigation banks in their mitigation plan are discussed in Section 1.2.2.

1.1.2.2 In-Lieu Fee

In-lieu fee programs involve restoration, enhancement, establishment, and/or preservation of aquatic resources through funds paid to a governmental or non-profit entity to satisfy mitigation requirements for project impacts. In-lieu fee programs sell credits to permittees, and the responsibility for mitigation success remains with the program sponsor. The operation/use of an in-lieu fee program is administered by an in-lieu fee program instrument.

There are no applicable in-lieu fee programs in the mitigation search area; therefore, in-lieu fee programs will not be part of Duke Energy’s proposed compensatory mitigation.

1.1.2.3 Permittee-Responsible Mitigation

Permittee-responsible mitigation is an activity undertaken by the permittee to restore, establish, enhance, or preserve aquatic resources to provide compensatory mitigation to offset project impacts. Under permittee-responsible mitigation, the responsibility for implementing mitigation remains with the permittee. Details of the mitigation are outlined in a permittee-responsible mitigation plan. Three types of permittee-responsible mitigation (listed in order of preference per the Mitigation Rule) could be used to provide compensatory mitigation: (a) watershed approach; (b) on-site and in-kind; and (c) off-site and/or out-of-kind.

Duke Energy proposes to perform permittee-responsible mitigation using a watershed approach. The permittee-responsible mitigation watershed approach is discussed in detail in Section 1.2.3.

1.2 LEE NUCLEAR STATION CONCEPTUAL MITIGATION PLAN

The compensatory mitigation plan for the Lee Nuclear Station project has been developed in accordance with the Mitigation Rule and the USACE Charleston District Guidelines. This plan provides mitigation to offset unavoidable impacts to aquatic resources through restoration/ enhancement and preservation, resulting in no net loss of aquatic resource functions and services. This mitigation plan follows the mitigation hierarchy recommended in the rule and guidance documents, including purchase of mitigation bank credits and permittee-responsible mitigation using a watershed approach. The watershed approach uses a regionally significant context, and involves rigorous scientific and technical analyses. This approach provides overall benefits greater than the purchase of bank credits alone. This mitigation plan was developed to restore/enhance and preserve aquatic resources on a scale commensurate with the project impacts. The selection of these sites also assists the USFS in meeting watershed needs identified in its Forest Management Plan to restore the functions of aquatic resources (e.g., stabilizing stream bank erosion and improvement of habitat for fish and macro-benthic communities) within national forests for public benefit.

1.2.1 Mitigation Search Area

Acceptable mitigation methods are identified in the Mitigation Rule and the USACE Charleston District Guidelines. Both of these documents indicate that the desired goal is for mitigation to occur in the same watershed where impacts occur. This is not always possible but is considered the starting point for mitigation planning. As discussed in Volume I, Part II, Section 2.0, the proposed project occurs within the Upper and Lower Broad River watersheds. However, approximately 60 percent of the Upper Broad River watershed is located within North Carolina (Figure 1-1). Given that the project site and associated impacts occur solely within South Carolina, and that coordination with the South Carolina state agencies and other stakeholders indicates that mitigation must occur within South Carolina, Duke Energy proposes to conduct mitigation activities wholly within the state of South Carolina. Because 1) impacts occur in both the Upper and Lower Broad River watersheds in South Carolina; 2) there are not landscape level mitigation opportunities within the Upper Broad River watershed within South Carolina; and 3) the two watersheds are inextricably linked via the Broad River itself, the primary mitigation search area for this project was defined as both the Upper and Lower Broad River watersheds combined, referred to hereafter as the "Broad River watershed." The secondary mitigation search area includes the Tyger River (Hydrologic Unit Code 03050107) and Enoree River (Hydrologic Unit Code 03050108) watersheds, which drain into the Lower Broad River watershed. The tertiary mitigation search area includes the Lower Catawba (Hydrologic Unit Code 03050103), Wateree (Hydrologic Unit Code 03050104), and Saluda (Hydrologic Unit Code 03050109) River watersheds, which, along with the Broad River, are all interrelated parts of the Upper Santee River Basin.

1.2.2 Mitigation Banks

Four existing mitigation banks having service areas[1] that include the primary mitigation search area (the Broad River watershed) were identified. Preliminary data and information pertaining to mitigation banks including wetland and stream credits were obtained by reviewing mitigation bank websites and conducting phone interviews with mitigation bank representatives. In late 2010, the Regulatory In-lieu Fee and Bank Information Tracking System website, which is maintained by the USACE Charleston District, was activated. Duke Energy has queried this system on multiple occasions and conferred with USACE Charleston District staff regarding database updates.

1.2.2.1 Wetlands

The Lee Nuclear Station project will need an estimated 54 wetland credits, including an estimated 27 restoration/enhancement credits. The Grove Creek Mitigation Bank (the Lower Broad River watershed is in the bank's secondary service area and the Upper Broad River watershed is in its tertiary service area) is the only existing mitigation bank associated with the primary mitigation search areas that currently offers wetland mitigation credits (Table 1-2). A review of the Charleston District Regulatory In-lieu Fee and Bank Information Tracking System website on September 23, 2011, indicated that the Grove Creek Mitigation Bank had 3 freshwater wetland restoration/ enhancement credits, 9 buffer enhancement credits, and 12 preservation credits. The Grove Creek Mitigation Bank also has the potential to generate an additional 21 freshwater wetland restoration/enhancement credits through future actions and subsequent credit releases (Table 1-3). Overall, Duke Energy plans to utilize an appreciable number of wetland mitigation bank credits in satisfying mitigation needs.

1.2.2.2 Streams

The Lee Nuclear Station will require an estimated 483,583 stream credits, including 241,792 restoration/enhancement credits. Four existing mitigation banks that meet the service area/search area criteria have available stream credits: Sandy Fork Mitigation Bank, Grove Creek Mitigation Bank, Taylors Creek Mitigation Bank, and Turners Branch Mitigation Bank. The Sandy Fork Mitigation Bank lists the Lower Broad River watershed as its primary service area and the Upper Broad River watershed as its secondary service area. Grove Creek, Taylors Creek, and Turners

[1] A mitigation bank's service area(s) refers to the locations where credit purchases from the mitigation bank may be used to satisfy compensatory mitigation needs.

Branch Mitigation Banks include the Lower Broad River watershed in their secondary service areas and the Upper Broad River watershed in their tertiary service areas (Table 1-2).

According to the Regulatory In-lieu fee and Bank Information Tracking System website on September 23, 2011, approximately 24,000 stream restoration/enhancement and 47,000 preservation credits were currently available from these four mitigation banks (Table 1-2). Each of these four mitigation banks has indicated plans for future credit releases pending the successful completion of scheduled actions regarding bank development and administration. Collectively, these four existing mitigation banks have the potential to generate an additional 155,000 stream restoration/enhancement credits (Table 1-3). In addition, three proposed mitigation banks having service areas that include the Lower Broad River watershed (one of these proposed mitigation banks also identifies the Upper Broad River watershed as its primary service area) are undergoing reviews by the Interagency Review Team (the IRT is composed of the USACE, EPA, U.S. Fish and Wildlife Service [USFWS], National Marine Fisheries Service [NMFS], State Historical Preservation Officer [SHPO], SCDHEC, SCDNR). Overall, Duke Energy plans to utilize an appreciable number of available stream mitigation bank credits in satisfying mitigation needs.

Duke Energy also recognizes that some credits comprising the referenced inventory could be partially "diluted" as it relates to service area tiers and the location of stream impacts associated with the Lee Nuclear Station project. Information concerning potential dilution factors is bank-specific and if appropriate, is detailed in the mitigation banking instrument. The applicant has filed a Freedom of Information Act request with the USACE Charleston District for the purpose of obtaining each bank's mitigation banking instrument in order to refine credit estimates (if necessary) based on individual dilution factors potentially assigned to each mitigation bank.

1.2.3 Permittee-Responsible Mitigation Component

As stated in 33 C.F.R. § 332.3(b)(4), "where permitted impacts are not in the service area of an approved mitigation bank or in-lieu fee program that has the appropriate number and resource type of credits available, permittee-responsible mitigation is the only option. Where practicable and likely to be successful and sustainable, the resource type and location for the required permittee-responsible compensatory mitigation should be determined using the principles of a watershed approach as outlined in paragraph (c) of this section." Since the required number and resource type of wetland and stream credits are not available from approved mitigation banks or in-lieu fee programs, Duke Energy is proposing to use a watershed approach to provide permittee-responsible mitigation. The watershed approach includes consideration of landscape scale, historic and potential aquatic resource conditions, past and projected aquatic resource impacts in the watershed, and terrestrial connections between aquatic resources when determining mitigation requirements. Specific details on the permittee-responsible mitigation sites are discussed in Appendix C and Appendix D.

1.2.3.1 Existing Watershed Conditions and Functional Impairments

As explained in Volume I, Part II, Section 2.0, the proposed Lee Nuclear Station and associated project areas are within the Upper and Lower Broad River watersheds (Hydrologic Unit Codes 03050105 and 03050106). Volume I, Part II, Section 8.2 describes general characteristics of the watersheds including size and estimated aquatic resources. Although a watershed management plan prescribing aquatic function restoration has not been developed for either of these watersheds, several sources are available that provide information on the watershed conditions and needs. These sources include:

- Watershed Quality Assessment: Broad River Basin (SCDHEC 2007)
- An Assessment of the Upper Broad Subbasin (NRCS 2010a)
- An Assessment of the Lower Broad Subbasin (NRCS 2010b)
- Broad Scenic River Management Plan (Broad River Scenic Advisory Council 2003)
- South Carolina State Water Assessment (SCDNR 2009)
- South Carolina Comprehensive Wildlife Conservation Strategy 2005-2010 (SCDNR 2005)
- U.S. Forest Service Revised Land and Resource Management Plan (USDA 2004)

The Broad River watershed, including the Broad, Enoree and Tyger River watersheds, contains 17.5 percent of the South Carolina population and is the most populated watershed in the state (SCDNR 2009). Urbanization has been most prevalent along the I-26 and I-85 corridors and remains a concern within the watershed (NRCS 2010a). This watershed is approximately 63 percent forested (including wetlands), 24 percent agricultural land, and 10 percent urban land. The remaining areas of the watershed include water, scrub/shrub, and barren landcover types.

Surface water development has been extensive in the Broad River watershed. Most of this development has been for the production of hydroelectric power, although several large reservoirs have been built to provide municipal water supplies (SCDNR 2009). As discussed in Volume I, Part II, Section 8.2.1, hundreds of small dams have also been constructed on many tributaries that drain to the Broad River in both North and South Carolina. These impoundments have been constructed for reservoirs, recreation, flood control, stormwater, and irrigation.

Water quality in the Broad River watershed is relatively good; however, some waterbodies do not fully support aquatic life. Functional impairments to aquatic life include poor macroinvertebrate communities, sedimentation, low dissolved oxygen levels, and pH excursions (NRCS 2010a, NRCS 2010b, SCDNR 2009). One of the primary pollutants associated with Piedmont streams is sediment. Between 80 and 90 percent of the soils in the Broad River watershed are considered highly erodible or potentially highly erodible soils (NRCS 2010a, NRCS 2010b). “Legacy sediments” emanating from eroded cropland dominate stream channel geomorphology and associated floodplains in this part of South Carolina. This condition is not new to Piedmont streams as they continue to recover from agricultural practices originating in the 1800s. Many streams in this ecoregion are deeply entrenched (typically 5 to 10 feet below the current floodplain elevation) and are hydrologically disconnected from their floodplains. The entrenchment fosters a condition where large stream flows remain captured within the channel during storm events, which results in increased velocities and high shear stress on stream banks. This often leads to down cutting of the channel and bank cutting/sloughing, resulting in highly turbid water during storm events. As a consequence, the water quality of most Piedmont streams is in a relatively constant state of flux. These streams will continue to erode stream banks and associated floodplains, perpetuating local and downstream sedimentation issues for decades into the future. This sedimentation also affects the substrate within the stream bed, often smothering habitat such as pools, cobble, and gravel. This leads to significant decreases in aquatic biota such as benthic macroinvertebrates and many fish communities.

Another consequence of the incised streams and the disconnection with their floodplains is the alteration of hydrology for streamside wetlands. Since stream flows remain within the channel during storm events, appropriate hydrology is not reaching wetland areas which would have historically occurred along the stream. This has resulted in wetlands with altered hydrology throughout the region.

The functional impairment of “legacy sediments” and stream instability is widespread throughout the Broad River watershed. Therefore, a focus on addressing this functional impairment is likely to result in opportunities for aquatic resource function restoration on a landscape scale and involve a suite of aquatic resource functions.

Other resources in need of protection within the Broad River watershed include rare, threatened, and endangered species; streams and wetlands that are not currently experiencing the sediment impairments described above; large areas of wildlife habitat; and mixed-hardwood forest (NRCS 2010a, NRCS 2010b). Rare, threatened, and endangered species found within the Upper and Lower Broad River watersheds are listed within the NRCS watershed assessments for the watersheds and the South Carolina Comprehensive Wildlife Conservation Strategy (NRCS 2010a, NRCS 2010b, SCDNR 2005). Additionally, a regionally important recreational smallmouth bass fishery exists within the Broad River. Restoration, enhancement, and preservation of high-quality wetland and stream habitat will help to protect all of these resources.

1.2.3.2 Wetlands

Required wetland compensatory mitigation credits that cannot be met through mitigation bank credit purchases will be provided through permittee-responsible mitigation projects using a watershed approach. The projects will involve the preservation of high quality wetlands as well as wetland establishment, restoration, and/or enhancement at the Turkey Creek Tract in Chester and York counties, located within the Lower Broad River watershed. The total number of compensatory wetland mitigation credits generated by establishment, restoration, and/or enhancement activities, including mitigation bank credit purchases and the permittee-responsible mitigation component, will meet the total wetland compensatory mitigation credits needed for the Lee Nuclear Station project.

1.2.3.3 Open Water

Required open-water compensatory mitigation credits will be met through the creation of drought contingency Pond C. The total number of compensatory open-water mitigation credits generated by the onsite and in-kind creation of Pond C will meet or exceed the total open-water compensatory mitigation credits needed for the Lee Nuclear Station project.

1.2.3.4 Streams

The Lee Nuclear Station mitigation search for potential permittee-responsible mitigation sites has been multifaceted and focused within the Upper and Lower Broad River watersheds. Screening criteria were developed to provide a framework for and evaluation of potential sites in the context of the watershed approach. These criteria included factors as discussed in the 33 C.F.R. § 332.3(d)(1) and additional criteria developed for this site selection process, and include:

- Hydrological conditions, soil characteristics, and other physical and chemical characteristics
- Watershed-scale features, such as aquatic habitat diversity, habitat connectivity, and other landscape scale functions
- Size and location of the compensatory mitigation site relative to hydrologic sources and other ecological features
- Compatibility with adjacent land uses and watershed management plans
- Reasonably foreseeable ecological effects of the compensatory mitigation project
- Other relevant factors including, but not limited to, habitat status and trends, local or regional goals for the restoration or protection of particular habitat types or functions
- Appropriate and practical mitigation based on existing design methodology, logistics, and cost
- Public benefit opportunity (e.g., helping to meet resource agency goals, providing for increased public use/benefit of the resource)

Due to the number of credits needed and the complexity of finding acceptable permittee-responsible mitigation sites, multiple options for identifying potential opportunities were reviewed, and are described below. Potential sites have been assessed by various means including desktop analyses using publically available natural resource data and, in many cases, field reconnaissance surveys by experienced biologists.

Potential projects suggested by resource agencies and non-governmental organizations familiar with the resource needs and water quality conditions of this region of South Carolina were considered. Many of these tracts did not meet the screening criteria and were not considered further.

To assist in identifying potential mitigation opportunities, a targeted site search methodology was developed using a Geographic Information System (GIS). The primary variables used in this geospatial computer model were: a) relative degree of stream disturbance, b) presence of degraded stream reaches, c) relative condition of riparian areas, d) land-use category, e) percent impervious cover within the watershed, and f) percent coverage comprising erodible soils within the watershed. The targeted site search resulted in a ranking of watersheds in a series of scaled steps, from 8-digit hydrologic units, to 12-digit hydrologic units, to individualized catchments for each stream within the National Hydrology Dataset. Parcel data were acquired where practicable and potential sites were considered. The targeted site search assisted in narrowing the universe of possibilities for potential mitigation sites to a few promising candidates that were investigated further.

As suggested by USACE, Duke Energy began discussing the potential for restoration/enhancement opportunities in the Sumter National Forest with USFS (Figure 1-2). The Enoree District of the Sumter National Forest is located predominantly in the Lower Broad River, Tyger, and Enoree watersheds, and has been involved in stream restoration/enhancement projects for the past several years. In its recently updated Forest Management Plan, USFS has also identified watershed restoration as an objective for several watersheds within the Lower Broad River watershed (USDA 2004). These watersheds are located within Chester County in what is known as the Woods Ferry area of the Sumter National Forest. Streams within this area exhibit degraded stream function associated with sedimentation and stream instability that are inherent in many streams within the Broad River watershed. The Woods Ferry Area met the screening criteria described above (discussed in more detail in Appendix C), and was therefore selected as a permittee-responsible mitigation site. The selection of these sites assists the USFS in meeting watershed needs identified in its Forest Management Plan and in restoring the function of aquatic resources (e.g., stabilizing stream bank erosion and improvement of habitat for fish and macro-benthic communities) within national forests for public benefit. The conceptual mitigation plan for the restoration and enhancement of streams within the Sumter National Forest is provided in Appendix C.

A second site, the Turkey Creek Tract (Figure 1-2) meets the relevant screening criteria (discussed in more detail in Appendix D), and is therefore also being proposed as a permittee-responsible mitigation site. Mitigation of the stream and floodplain and associated natural resource assets will benefit Turkey Creek and ultimately the Broad River. The conceptual mitigation plan for mitigation within the Turkey Creek Tract is provided in Appendix D.

1.3 SUMMARY

Planning and construction of the Lee Nuclear Station project will seek to avoid and minimize impacts to natural resources including wetlands and streams. Unavoidable impacts are projected to total 5.43 acres of wetlands and 67,285 linear feet of streams and 29.63 acres of open water. A total of 54 wetland credits, 483,583 stream credits, and 273 open-water credits are proposed to provide compensatory mitigation for unavoidable impacts. Under the 2010 USACE Charleston District Guidelines, restoration and enhancement mitigation must provide at least 50 percent of the total mitigation credits. Duke Energy plans to mitigate for impacts to wetlands and streams by a combination of credits purchased from mitigation banks and permittee-responsible mitigation using a watershed approach. Duke Energy intends to provide compensatory mitigation for unavoidable impacts to open water through the onsite and in-kind creation of drought contingency Pond C. Duke's mitigation plan complies with the 2008 Mitigation Rule and the 2010 USACE Charleston District Guidelines.

The mitigation search area consists of the Upper and Lower Broad watersheds within South Carolina. Within this area, the Grove Creek mitigation bank currently has 12 wetland restoration and enhancement credits and 12 wetland preservation credits available, or 45 percent of the total needed. The Sandy Fork, Grove Creek, Taylors Creek, and Turners Branch mitigation banks currently have approximately 24,000 stream restoration and enhancement credits and 47,000 stream preservation credits available, or 15 percent of the need. Additional mitigation bank credits will be available in future releases (21 unreleased wetland restoration and enhancement credits; 155,000 unreleased stream restoration and enhancement credits). Duke Energy plans to purchase an appreciable number of available wetland and stream mitigation bank credits in satisfying mitigation needs.

The remaining mitigation needs will be met through permittee-responsible sites using a watershed approach. Permittee-responsible sites proposed for mitigation include the Woods Ferry area of the Sumter National Forest, and the Turkey Creek Tract. The combination of mitigation at Sumter National Forest and Turkey Creek provides a holistic mitigation approach for watershed-scale features, including extension of upland/riparian habitat connectivity and protecting water quality in the Broad River watershed.

Table 1-1
Summary of Proposed Mitigation Credits Needed
for the Lee Nuclear Station Project

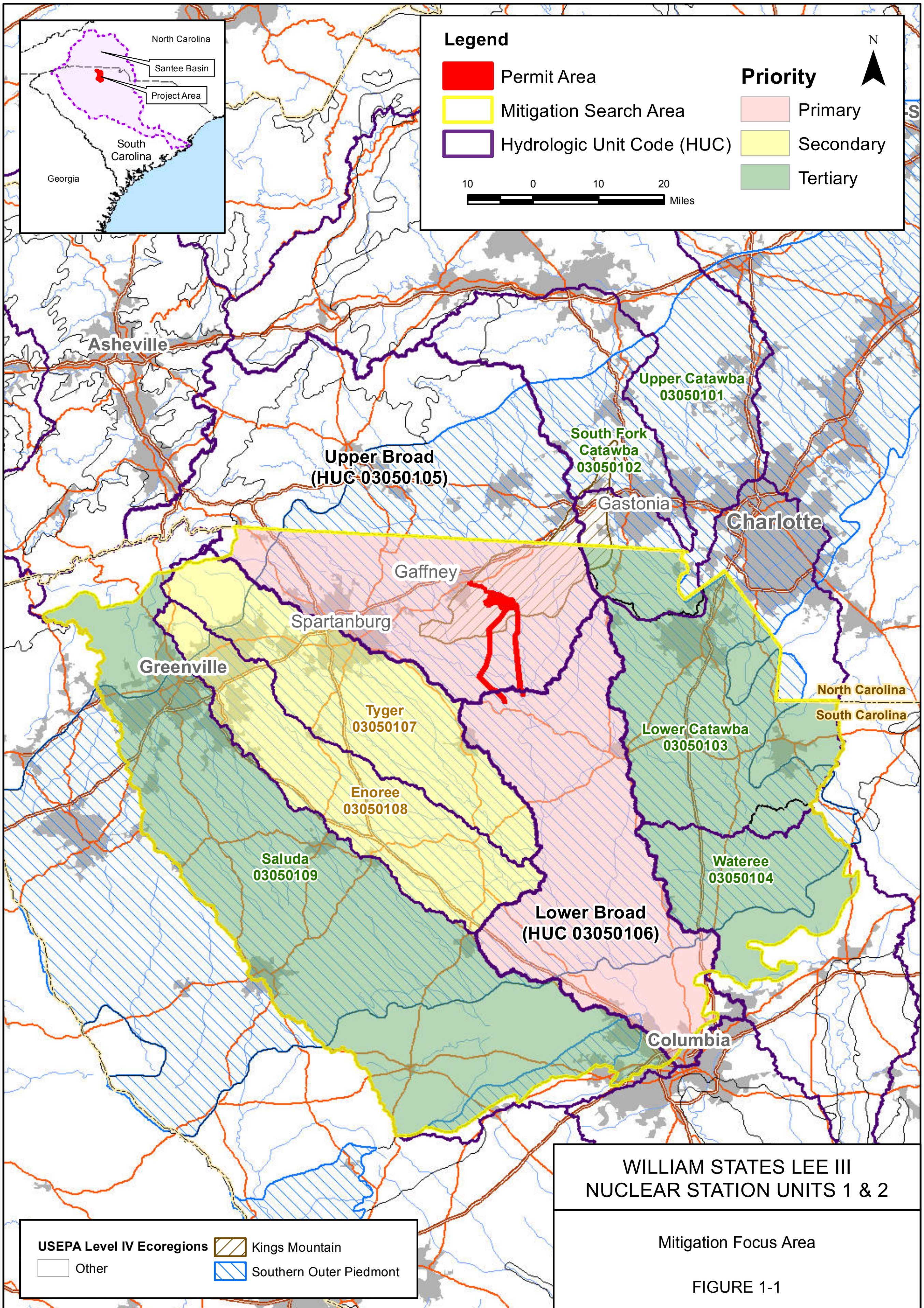
Permit Area Component (PAC)	Wetlands		Open Waters		Streams	
	Impact (ac)	Credits	Impact (ac)	Credits	Impact (lf)	Credits
PAC A	0.21	1.60	12.05	110.86	0	0
PAC B	3.65	37.36	17.58	161.73	65,977	474,561
PAC C	0.42	4.12	0	0	1,308	9,022
PAC D	0.66	6.43	0	0	0	0
PAC E	0.49	4.90	0	0	0	0
PAC F	0	0	0	0	0	0
Total	5.43	54.41	29.63	272.59	67,285	483,583

Table 1-2
Currently Available Wetland and Stream Credits (restore, enhance, preserve)
from Existing Mitigation Banks

Mitigation Bank	Mitigation Bank Service Areas	Wetland Restoration & Enhancement Credits Currently Available	Wetland Preservation Credits Currently Available	Stream Restoration Credits Currently Available	Stream Enhancement Credits Currently Available	Total Stream Restoration & Enhancement Credits Currently Available	Stream Preservation Credits Currently Available
Sandy Fork	Primary: Lower Broad Secondary: Upper Broad	Not Applicable	Not Applicable	3,370	517	3,887	0
Grove Creek	Secondary: Lower Broad Tertiary: Upper Broad	12	12	11,337	Not Applicable	11,337	31,625
Taylors Creek	Secondary: Lower Broad Tertiary: Upper Broad	Not Applicable	Not Applicable	5,393	Not Applicable	5,393	12,718
Turners Branch	Secondary: Lower Broad Tertiary: Upper Broad	Not Applicable	Not Applicable	3,035	Not Applicable	3,035	2,594
Total		12	12	23,135	517	23,652	46,937

Table 1-3
Unreleased (future/potential) Wetland and Stream Credits (restore, enhance)
from Existing Mitigation Banks

Mitigation Bank	Mitigation Bank Service Areas	Unreleased Wetland Restoration & Enhancement Credits	Unreleased Stream Restoration Credits	Unreleased Stream Enhancement Credits	Total Unreleased Stream Restoration & Enhancement Credits
Sandy Fork	Primary: Lower Broad Secondary: Upper Broad	Not Applicable	26,514	9,166	35,680
Grove Creek	Secondary: Lower Broad Tertiary: Upper Broad	21	24,948	Not Applicable	24,948
Taylors Creek	Secondary: Lower Broad Tertiary: Upper Broad	Not Applicable	40,064	Not Applicable	40,064
Turners Branch	Secondary: Lower Broad Tertiary: Upper Broad	Not Applicable	54,539	Not Applicable	54,539
Total		21	146,065	9,166	155,231


North Carolina
Santee Basin
Project Area
South Carolina
Georgia
Legend
Permit Area
Mitigation Search Area
Hydrologic Unit Code (HUC)
Priority
Primary
Secondary
Tertiary
N
10 0 10 20
Miles
Asheville
Upper Catawba 03050101
South Fork Catawba 03050102
Upper Broad (HUC 03050105)
Gastonia
Charlotte
Gaffney
Spartanburg
Greenville
North Carolina
South Carolina
Tyger 03050107
Lower Catawba 03050103
Enoree 03050108
Saluda 03050109
Wateree 03050104
Lower Broad (HUC 03050106)
Columbia
USEPA Level IV Ecoregions
Other
Kings Mountain
Southern Outer Piedmont
WILLIAM STATES LEE III NUCLEAR STATION UNITS 1 & 2
Mitigation Focus Area
FIGURE 1-1

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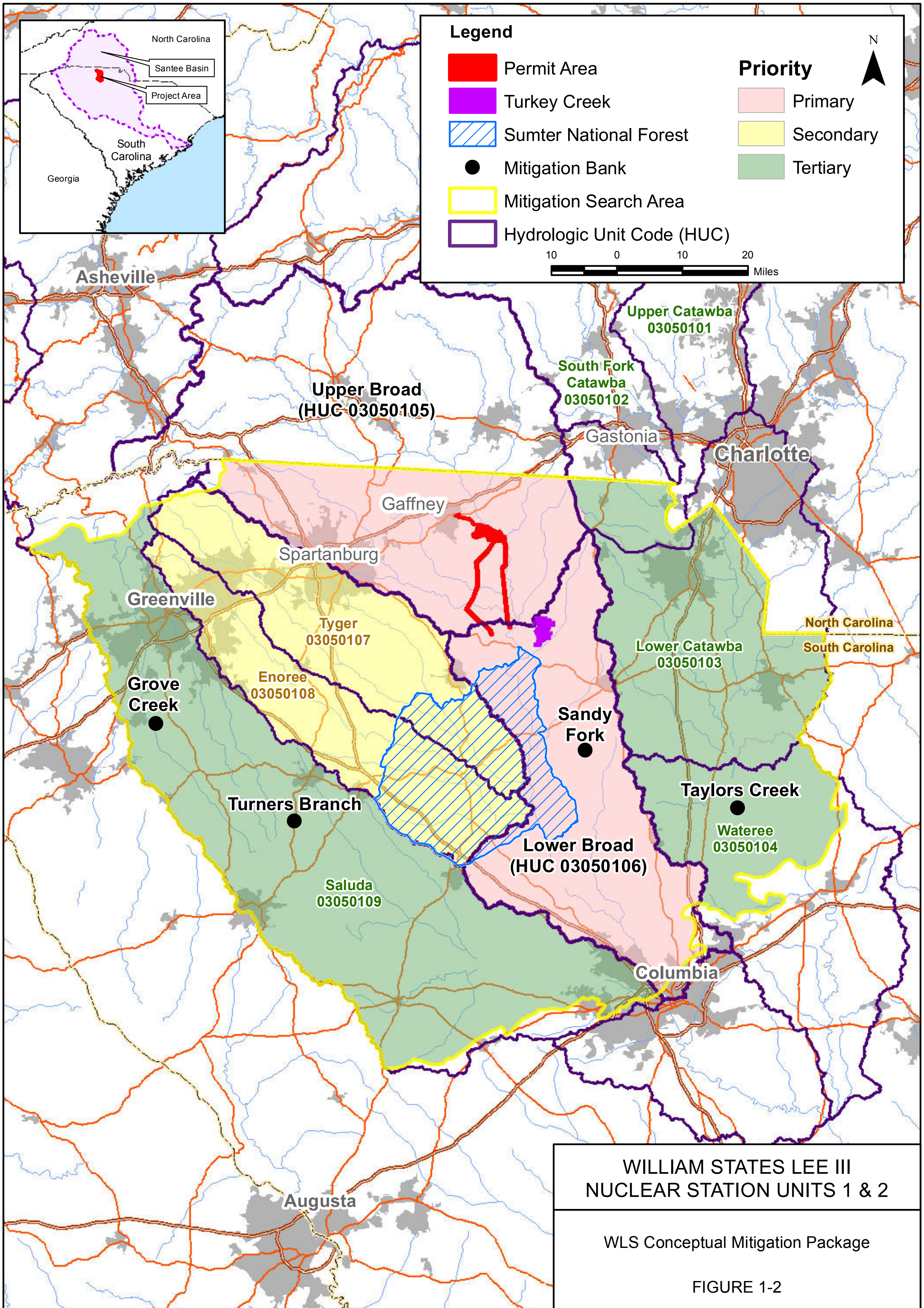
Legend
Permit Area
Turkey Creek
Sumter National Forest
Mitigation Bank
Mitigation Search Area
Hydrologic Unit Code (HUC)
Priority
Primary
Secondary
Tertiary
N
10 0 10 20
Miles
North Carolina
Santee Basin
Project Area
South Carolina
Georgia
Asheville
Upper Broad
(HUC 03050105)
Upper Catawba
03050101
South Fork
Catawba
03050102
Gastonia
Charlotte
Gaffney
Spartanburg
Greenville
Tyger
03050107
Enoree
03050108
North Carolina
South Carolina
Lower Catawba
03050103
Grove
Creek
Sandy
Fork
Taylors Creek
Wateree
03050104
Turners Branch
Lower Broad
(HUC 03050106)
Saluda
03050109
Columbia
Augusta
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
WLS Conceptual Mitigation Package
FIGURE 1-2

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Appendix III.A

Required Mitigation Credit Calculation for the Lee Nuclear Station Project

Contents

Tables

1.0 BACKGROUND

The U.S. Army Corps of Engineers (USACE), Charleston District, has published draft "Guidelines for Preparing a Compensatory Mitigation Plan," last revised on June 24, 2011 (Charleston District Guidelines) (USACE 2010). The 2010 Charleston District Guidelines replaced the "Standard Operating Procedure (SOP) for Compensatory Mitigation" published in 2002 (USACE 2002). While linear systems are referred to as "tributaries" throughout most of this document, these systems will be referred to as "streams" for the remainder of this section to be consistent with the Charleston District Guidelines. These guidelines were used to calculate the amount of wetland, stream, and open water credits necessary to provide compensatory mitigation for impacts associated with the construction of the Lee Nuclear Station and the proposed drought contingency pond.

The Charleston District Guidelines provide a detailed process for itemizing and calculating the required mitigation credits related to project impacts. There are separate processes for wetlands (including open water habitats) and streams. Overall, the number of required mitigation credits will be compared against the proposed mitigation credits, to ensure that the proposed mitigation credits are equal to or greater than the required mitigation credits. The required mitigation credits are calculated by multiplying the length of stream or area of wetland at each impact by an "R-Factor." The "R-Factor" is a modifying variable calculated by evaluating six "Adverse Impact Factors" that are described in greater detail in the following subsections.

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2.0 ADVERSE IMPACT FACTORS

The Adverse Impact Factors considered by the Charleston District Guidelines include the type of wetland or stream impacted (lost type and stream type, respectively), relative regulatory importance (priority category), pre-impact functional condition (existing condition), impact duration (duration), the type of impact (dominant impact), and the cumulative impact of the project as a whole (cumulative impact). The Adverse Impact Factors for wetlands and open waters are provided in Table A-1, and the Adverse Impact Factors for stream impacts are provided in Table A-2. The individual Adverse Impact Factors values vary per factor, with an overall range of 0.05 to 3.0 (Tables A-1 and A-2, USACE 2010). For each mitigation calculation, the various Adverse Impact Factor values are recorded for each impact, and then the sum of the Adverse Impact Factors (known as the R-Factor) is multiplied by the area (acres) of wetland or open water or length (linear feet) of streams of the associated impact. Required mitigation credits are calculated for each impacted wetland/open water area or stream reach, and the individual credit requirements are then summed to determine the overall required mitigation credits for the project.

2.1 WETLANDS AND OPEN WATER

2.1.1 Lost Type

The lost type describes the regulated wetland or open water type associated with the impact. There are three lost types. The lost types are based on the suite of functions that are performed, and are generally grouped by wetland or open water type. The values for the three types are 3.0, 2.0, and 0.2 (USACE 2010).

Type A (3.0)	Type B (2.0)	Type C (0.2)
• Tidal vegetated systems • Riverine systems including headwaters and riparian zones • Intertidal flats • Shallow subtidal bottoms • Bottomland hardwoods	• Seeps and bogs • Savannahs and flatwoods • Depressions • Pocosins and bays	• Man-made lakes and ponds • Vegetated lake littoral • Impoundments • Shallow cove areas

The determination of the wetland or open water types was performed within the permit area during wetland functional assessment activities (see Appendix III.B). Wetland types were subsequently matched to the appropriate lost type according to the Charleston District Guidelines. According to Attachment A.1, 4.51 acres of proposed wetland impact (83 percent) are grouped into the A Type, while 0.24 acres (4 percent) of proposed impacts are in the B Type, and 0.68 acre

(13 percent) of proposed impacts are in the C Type. All 29.63 acres (100 percent) of proposed impacts to open waters are in the C Type.

2.1.2 Priority Category

Priority category recognizes the importance of aquatic resources that provide valuable functions and services on a watershed scale, that occupy important positions in the landscape, or that are considered important because of their rarity. There are three priority categories: primary, secondary, and tertiary. The Adverse Impact Factor values for these categories are 2.0 for primary, 1.5 for secondary, and 0.5 for tertiary. There is a specific list of resource types provided in the Charleston District Guidelines that includes such items as tidal waters, Outstanding Resource Waters, and 303(d) listed waters, as well as certain rare communities (USACE 2010). According to the Charleston District Guidelines, adverse impacts to primary priority areas should be avoided and minimized to the maximum extent practicable. All wetlands and open waters within the permit area have been ranked in the tertiary category (USACE 2010). Attachment A.1 provides the priority categories for wetlands and open water within the permit area.

2.1.3 Existing Condition

Existing condition describes the pre-impact functional condition of each wetland and open water area. The existing condition Adverse Impact Factor is intended to be used as a conditional measure of disturbance relative to the ability of the wetland and open water area to perform its physical, chemical, and biological functions. This Adverse Impact Factor evaluates site disturbances relative to the existing functional state of the wetland area.

The Charleston District Guidelines (USACE 2010) describes four possible existing conditions for wetlands. The four existing conditions include fully functional, partially impaired, impaired, and very impaired. These existing conditions are defined in the Charleston District Guidelines as follows:

- **Fully functional:** the typical suite of functions normally attributed to the aquatic resource type are considered to be functioning naturally. Existing disturbances do not substantially alter important functions. Examples include: pristine (undisturbed) wetlands, aquatic resources with nonfunctional ditches or old logging ruts with no effective drainage, or minor selective cutting.
- **Partially impaired:** site disturbances have resulted in partial or full loss of one or more functions typically attributed to the aquatic resource type but functional recovery is expected to occur through natural processes. Examples include: clear-cut wetlands, aquatic areas with ditches that impair but do not eliminate wetland hydrology, or temporarily cleared utility corridors.
- **Impaired:** site disturbances have resulted in the loss of one or more functions typically attributed to the aquatic resource type and functional recovery is unlikely to occur

through natural processes. Restoration activities are required to facilitate recovery. Examples include: areas that have been impacted by surface drainage and converted to pine monoculture or agriculture, areas that are severely fragmented, or wetlands within maintained utility corridors.

- **Very impaired:** site disturbances have resulted in the loss of most functions typically attributed to the aquatic resource type and functional recovery would require a significant restoration effort. Examples include: filled areas, excavated areas, or effectively drained wetlands (hydrology removed or significantly altered).

The Charleston District Guidelines do not provide a field-based methodology for evaluating wetland areas in a repeatable or consistent fashion. Following consultation with the USACE Charleston District, Duke Energy has chosen to apply the North Carolina Wetland Assessment Method (NCWAM) to develop the functional assessment scores within the permit area. The NCWAM was developed as an accurate, consistent, rapid, observational, and scientifically based field method to determine the level of function of a wetland relative to reference condition (where appropriate) for each of 16 general wetland types. The ecoregions and wetland types that occur within the Lee Nuclear Station permit area occur in both North and South Carolina; therefore, the use of NCWAM for these assessments is reasonable and appropriate.

The procedures provided in the NCWAM User Manual (ver. 4.1, Wetland Functional Assessment Team 2010) were used to identify the wetland type, establish the wetland assessment areas, and perform wetland assessments on each of the wetland evaluation areas with proposed quantified impacts. Once the NCWAM Sub-Function rating outcomes had been determined, they were converted into the four possible existing conditions scores using Table A-3. This conversion between the NCWAM Sub-Function ratings and the existing condition categories in the Charleston District Guidelines was based upon the observed loss or partial loss of functions apparent from the NCWAM assessment and the definition of each existing condition category. Wetland areas found to be fully functional under the Charleston District Guidelines had at least medium NCWAM functional assessment scores for the hydrology, water quality, and habitat Sub-Functions (no low scores were recorded). Wetland areas found to be very impaired had at least two low NCWAM functional assessment scores with one medium score, or three low scores for the three Sub-Functions.

Attachment A.1 provides the existing condition scores for wetlands within the permit area. Overall, 2.66 acres of proposed wetland impact (47 percent) were found to be fully functional, while 1.42 acres (26 percent) were partially impaired, 0.91 acres (17 percent) were impaired, and 0.44 acres (8 percent) were very impaired.

For open water, the Charleston District Guidelines (USACE 2010) uses the same four possible options for the Existing Condition Adverse Impact Factor (Fully Functional, Partially Impaired, Impaired, and Very Impaired). In-lieu of performing a functional assessment, open-water areas present within the permit area were considered to be fully functional for the Existing Condition

Adverse Impact Factor and for the calculation of open-water mitigation credits. The proposed mitigation for open-water impacts is the creation of drought contingency Pond C.

2.1.4 Duration of Impact

Duration is a measure of the overall length of time the adverse impacts are expected to last. For wetlands and open waters, there are five duration categories that range from less than one year to more than 10 years with values ranging from 0.2 to 2.0, respectively (USACE 2010). Most of the wetland and open-water impacts proposed for the Lee Nuclear Station are permanent impacts and would persist for over 10 years. Attachment A.1 provides the duration values for wetlands and open waters within the permit area.

2.1.5 Dominant Impact

The Charleston District Guidelines identify six dominant impacts for wetlands. Dominant impact values range between 0.2 (shade) to 3.0 (fill) (USACE 2010). The most frequently occurring dominant impact factor within the permit area will be impoundment (2.5). Overall, the dominant impact values vary substantially between the different types of impacts. Attachment A.1 provides the dominant impact values for wetlands and open waters within the permit area. Dominant impacts for wetlands are described below.

- **Clear**: to remove vegetation without disturbing the existing topography of the soils.
- **Drain**: ditching, channelization, or excavation that results in the removal of water from an aquatic area causing the area, or a portion of the aquatic area, to change over time to a non-aquatic area or a different type of aquatic area.
- **Dredge**: dig, gather, pull out, or excavate from waters of the United States.
- **Fill**: depositing material used for the primary purpose of replacing an aquatic resource with dry land or changing the bottom elevation of a water body or wetland.
- **Impound/Flood**: collect or confine the flow of a riverine system by means of a dike, embankment, or other man made barrier. Impoundments may result in the formation of ponds, lakes, reservoirs, detention basins, etc., or they may limit the reach of high waters, such as levees or flood dikes.
- **Shade**: shelter or screen by intercepting radiated light or heat. Examples of projects causing shading impacts include bridges, piers, and buildings on pilings (USACE 2010).

The dominant impacts for open waters include drain, dredge, and fill.

2.1.6 Cumulative Impact

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. For wetlands, the total acreage of permanent and temporary impacts are added together to determine the option of the cumulative impact factor for a proposed project.

Once determined for a project, the sum is used to calculate the required mitigation credits for each adverse impact. Five cumulative impact categories comprise this Adverse Impact Factor and they range in size from <0.25 acre (0.1) to ≥10.0 acres (2.0) (USACE 2010). Since the proposed construction of the Lee Nuclear Station is proposed to impact 5.43 acres of wetlands and 29.63 acres of open waters, cumulative impact values of 1.0 for wetlands and 2.0 for open waters were utilized. Attachment A.1 provides the cumulative impact values for wetlands and open waters within the permit area.

2.2 STREAMS

2.2.1 Stream Type

The stream type Adverse Impact Factor describes the regulated stream type associated with the impact. There are three possible stream types, based upon the stream classification terminology used in the USACE Jurisdictional Determination Form Instructional Guidebook (USACE and USEPA 2007). The three types are based upon the hydrologic regime of each relevant stream reach, with distinct separations being made between seasonal/intermittent streams, headwater perennial streams, and the remaining continuum of larger perennial streams within a watershed (Table A-2). The lowest value is 0.1, which is assigned to non-relatively permanent waters, which includes jurisdictional ephemeral and non-seasonal intermittent streams. The middle value is 0.4, which is assigned to larger order (greater than second-order) perennial relatively permanent waters. The highest value is 0.8, which is assigned to seasonally intermittent and perennial streams of less than second stream order (first- and second-order relatively permanent waters). Thus this stream type ranking places the highest value on first- and second-order relatively permanent waters (USACE 2010).

There are 195 stream reaches with proposed impacts (Attachment A.2). Of the 67,276 linear feet of proposed impact, 24,353 linear feet (36 percent) are classified as larger order relatively permanent waters, with 42,923 linear feet (64 percent) classified as first- and second-order relatively permanent waters. There were no streams classified as non-relatively permanent waters.

2.2.2 Priority Category

Priority category recognizes the importance of aquatic resources that provide valuable functions and services on a watershed scale, that occupy important positions in the landscape, or that are considered important because of their rarity (see Section 2.1.2). All streams within the permit area have been ranked as tertiary (Duke Energy 2009). Attachment A.2 provides the stream priority categories within the permit area.

2.2.3 Existing Condition

Similar to wetlands and open waters, a field-based functional assessment was performed. The functional assessment scores were converted into the existing condition Adverse Impact Factor value for each stream reach assessed. The Charleston District Guidelines (USACE 2010) describes four possible values for stream existing conditions: fully functional, partially impaired, impaired, and very impaired. The existing condition is determined for streams following a procedure and an associated worksheet provided in the Charleston District Guidelines. Once the stream functional assessment scores were determined, each score was converted to the appropriate value for existing condition based on the following table in the Charleston District Guidelines.

If the score is:	The value is:	And the existing condition is:
16 to 20	1.5	Fully Functional
11 to 15	0.75	Partially Impaired
6 to 10	0.50	Impaired
Less than 6	0.10	Very Impaired

Attachment A.2 provides the existing condition values for each stream reach. Overall, 38,944 linear feet of proposed impact (58 percent) were found to be fully functional, while 22,234 linear feet (33 percent) were partially impaired, and 6,098 linear feet (9 percent) were impaired. Based upon the procedures within the Charleston District Guidelines, there were no reaches determined to be very impaired.

2.2.4 Duration of Impact

As described in Section 2.1.4, duration is a measure of the overall length of time the adverse impacts are expected to last. Streams have three duration categories. Temporary impacts (0.05) are those that occur for a period of one year of less and restoration will occur following termination of permitted activities. Recurrent impacts (0.1) occur repeatedly over a short time period and permanent project impacts (0.3) will occur for longer than 1 year (USACE 2010). Most of the stream impacts proposed for the permit area are permanent impacts. Attachment A.2 provides the individual duration values for streams within the permit area.

2.2.5 Dominant Impact

The Charleston District Guidelines identify nine dominant impacts for streams. Stream dominant impact values range between 0.05 (shade/clear) to 2.5 (fill) (USACE 2010). The most frequently occurring dominant impact factor within the permit area will be impoundment (2.0). Overall, the dominant impact values vary substantially for the different types of impacts (Table A-2).

Attachment A.2 provides dominant impact values for streams within the permit area. Dominant impacts for streams are described below.

- **Armor**: riprap, bulkhead or other rigid methods to contain stream channels
- **Clear**: activities, such as clearing streambank vegetation without disturbing the existing topography or soil stratigraphy
- **Culvert**: routing a stream through enclosed structures for a distance of less than 100 feet
- **Detention/Weir**: structures placed in streams to slow or divert water when bankfull stage is reached
- **Fill**: permanent placement of fill material in a stream channel
- **Impound/Flood**: convert a flowing system to a still water system such as a reservoir, pond, or lake
- **Morphologic Change**: intentionally alter the established or natural dimension, pattern, or profile of a stream
- **Pipe**: routing a stream through enclosed structures for a distance of greater than 100 feet
- **Shading**: intercepting or blocking sunlight. Examples of projects causing shading impacts include bridges, piers, and buildings constructed on pilings at such elevation that vegetation will be impacted
- **Utility Crossing**: open-cut construction or other pipeline/utility installation methods that require streambed disturbance and reestablishment of pre-project contours after installation

2.2.6 Cumulative Impact

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Once determined for a project, the value is used in the required mitigation credit calculation for each individual impact. Cumulative impacts for streams are based on proposed linear feet of impact. Projects that result in impacts to < 6,000 linear feet of stream are assigned cumulative impact factor between 0.1 and 1.5 while those having stream impacts >6,000 feet are assigned a cumulative impact factor of 3.0 (USACE 2010). Given the length of proposed stream impacts by the project, a cumulative impact value of 3.0 was calculated. Attachment A.2 provides cumulative impact values for streams within the permit area.

Table A-1
Adverse Impact Factors for Wetlands and Open Waters

REQUIRED WETLAND MITIGATION CREDIT TABLE						
FACTORS	OPTIONS					
Lost Type	Type C 0.2	Type B 2.0	Type A 3.0			
Priority Category	Tertiary 0.5	Secondary 1.5	Primary 2.0			
Existing Condition	Very Impaired 0.1	Impaired 1.0	Partially Impaired 2.0	Fully Functional 2.5		
Duration	0.1 year 0.2	1 to 3 years 0.5	3 to 5 years 1.0	5 to 10 years 1.5	Over 10 years 2.0	
Dominant Impact	Shade 0.2	Clear 1.0	Drain 2.0	Dredge 2.5	Impound/Flood 2.5	Fill 3.0
Cumulative Impact	<0.25 Acre 0.1	0.25–0.99 Acres 0.2	1.0–2.99 Acres 0.5	3.0–9.99 Acres 1.0	≥10.0 Acres 2.0	

Note: The cumulative impact factor for the overall project should be included in the sum of factors for each impacted area on the Required Wetland Mitigation Credit Worksheet.

Source: Charleston District Guidelines (USACE 2010)

Table A-2
Adverse Impact Factors for Streams

<table>
<tr><th colspan="37">ADVERSE IMPACT FACTORS FOR LINEAR SYSTEMS</th></tr>
<tr><th>FACTORS</th><th colspan="36">OPTIONS</th></tr>
<tr><td>Stream Type[1]</td><td colspan="12">Non-RPW
0.1</td><td colspan="12">1st and 2nd Order RPWs
0.8</td><td colspan="12">All Other Streams
0.4</td></tr>
<tr><td>Priority Category</td><td colspan="12">Tertiary
0.1</td><td colspan="12">Secondary
0.4</td><td colspan="12">Primary
0.6</td></tr>
<tr><td>Existing Condition</td><td colspan="9">Very Impaired
0.1</td><td colspan="9">Impaired
0.5</td><td colspan="9">Partially Impaired
0.75</td><td colspan="9">Fully Functional
1.5</td></tr>
<tr><td>Duration</td><td colspan="12">Temporary
0.05</td><td colspan="12">Recurrent
0.1</td><td colspan="12">Permanent
0.3</td></tr>
<tr><td>Dominant Impact</td><td colspan="4">Shade/ Clear
0.05</td><td colspan="4">Utility Crossing
0.15</td><td colspan="4">Culvert
0.3</td><td colspan="4">Armor
0.5</td><td colspan="4">Detention/ Weir
0.75</td><td colspan="4">Morpho-logic
1.5</td><td colspan="4">Impound/ Flood
2.0</td><td colspan="4">Pipe
2.2</td><td colspan="4">Fill
2.5</td></tr>
<tr><td>Cumulative Impact (LF)</td><td colspan="6"><50 feet
0.1</td><td colspan="6">51–300 feet
0.10</td><td colspan="6">301–500 feet
0.20</td><td colspan="6">501–999 feet
0.40</td><td colspan="6">1,000–6,000 feet
1.5</td><td colspan="6">>6,000 feet
3.0</td></tr>
</table>

[1] Stream type does not include man-made linear features. These features will be evaluated on a case-by-case basis.

Note: The cumulative impact factor for the overall project should be included in the sum of factors for each impacted area on the Required Wetland Stream Credit Worksheet.

Source: Charleston District Guidelines (USACE 2010)

Table A-3
Conversion of NCWAM Sub-Function Ratings to Charleston District Guidelines Existing Condition
(for Existing Condition descriptions, see Table B-1 in Appendix III-B)

NCWAM Sub-Function Ratings			Charleston District Guidelines Existing Condition
Hydrology	Water Quality	Habitat	
High	High	High	Fully Functional
Medium	High	High	
High	High	Medium	
High	Medium	High	
Low	High	High	Partially Impaired
Medium	High	Medium	
Low	High	Medium	
High	High	Low	
Medium	High	Low	
Medium	Medium	High	
Low	Medium	High	
High	Medium	Medium	
Medium	Medium	Medium	
High	Medium	Low	
High	Low	High	
Medium	Low	High	
High	Low	Medium	
Low	High	Low	Impaired
Low	Medium	Medium	
Medium	Medium	Low	
Low	Low	High	
Medium	Low	Medium	
High	Low	Low	
Low	Medium	Low	Very Impaired
Low	Low	Medium	
Medium	Low	Low	
Low	Low	Low	

3.0 LEE NUCLEAR STATION REQUIRED MITIGATION CREDITS

In order to determine the required mitigation credits necessary for the Lee Nuclear Station project, the individual Adverse Impact Factor values were summed to generate the R-Factor for each wetland area (including open waters) and stream reach. Once the R-Factor was calculated, it was multiplied by the area (for wetlands and open water) or length (for streams) of the associated impact, and individual required mitigation credits were determined. The detailed Adverse Impact Factor Scores, R-Factor, and required mitigation credits are provided in Attachment A.1 for wetlands and in Attachment A.2 for streams. A summary of the required mitigation credits for the Lee Nuclear Station project is provided in Table A-4. The total mitigation requirement for Lee Nuclear Station project is 54 wetland credits, 273 open-water credits, and 483,583 stream credits.

Table A-4
Summary of Proposed Mitigation Credit need
for the Lee Nuclear Station Permit Area

Permit Area Component	Wetlands		Open Water		Streams	
	Impact (lf)	Credits	Impact (ac)	Credits	Impact (ac)	Credits
PAC A	0.21	1.60	12.05	110.86	0	0
PAC B	3.65	37.36	17.58	161.73	65,977	474,561
PAC C	0.42	4.12	0	0	1,308	9,022
PAC D	0.66	6.43	0	0	0	0
PAC E	0.49	4.90	0	0	0	0
PAC F	0	0	0	0	0	0
Total	**5.43**	**54.41**	**29.63**	**272.59**	**67,285**	**483,583**

4.0 REFERENCES

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———. 2010. Guidelines for Preparing a Compensatory Mitigation Plan. Working Draft. Last Revised October 7, 2010.

U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (USEPA). 2007. U.S. Army Corps of Engineers Jurisdictional Determination Form Instructional Guidebook. May 30, 2007.

Wetland Functional Assessment Team. 2010. N.C. Wetland Assessment Method (NC WAM) User Manual. v4.1. October 2010.

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Attachment A.1

Required Wetland and Open Water Mitigation Credits for Lee Nuclear Station Project

Required Wetland and Open Water Mitigation Credits for Lee Nuclear Station

Tuesday, November 08, 2011

10:01:20 PM

Impact Number	Drawing Number	Impact Type	Functional Assessment	Lost Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Acres	Credit
OA01-POND B	A14	Temp_Filling	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.12	1.1
OA01-POND B	A14	Filling	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.52	4.78
OA01-POND B	A20	Filling	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.51	4.69
OA01-POND B	A14	Temp_Filling	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.18	1.66
OA01-POND B	A14	Dredging	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.16	1.47
OA01-POND B	A14	Dredging	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	1.85	17.02
OA01-POND B	A13	Temp_Draining	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.13	1.2
OA01-POND B	A20	Temp_Filling	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.08	0.74
OA01-POND B	A13	Temp_Filling	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.08	0.74
OA01-POND B	A13	Filling	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.06	0.55
OA01-POND B	A14	Filling	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0	0
OA01-POND B	A20	Temp_Filling	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.05	0.46
OA01-POND B	A20	Temp_Draining	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.02	0.18
OA01-POND B	A14	Filling	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.02	0.18
OA01-POND B	A14	Dredging	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.03	0.28
OA01-POND B	A14	Temp_Draining	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.03	0.28
OA01-POND B	A20	Filling	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.02	0.18
OA01-POND B	A14	Temp_Draining	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.04	0.37
OA01-POND B	A14	Dredging	OA01-POND B	0.2	0.5	2.5	2	2	2	9.2	0.05	0.46
OA06	A24	Filling	OA06	0.2	0.5	2.5	2	2	2	9.2	0.06	0.55
OA06	A24	Dredging	OA06	0.2	0.5	2.5	2	2	2	9.2	0.48	4.42
OA07-POND A	A27	Dredging	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	0.56	5.15

Impact Number	Drawing Number	Impact Type	Functional Assessment	Lost Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Acres	Credit
OA07-POND A	A33	Dredging	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	0.6	5.52
OA07-POND A	A32	Dredging	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	0.45	4.14
OA07-POND A	A27	Temp_Draining	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	0.64	5.89
OA07-POND A	A27	Dredging	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	0.81	7.45
OA07-POND A	A26	Temp_Draining	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	0.48	4.42
OA07-POND A	A33	Dredging	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	0.52	4.78
OA07-POND A	A27	Temp_Draining	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	0.44	4.05
OA07-POND A	A27	Temp_Filling	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	0.13	1.2
OA07-POND A	A27	Filling	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	0.22	2.02
OA07-POND A	A27	Dredging	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	1.05	9.66
OA07-POND A	A26	Dredging	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	0.08	0.74
OA07-POND A	A27	Temp_Filling	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	0.07	0.64
OA07-POND A	A26	Filling	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	0.07	0.64
OA07-POND A	A27	Dredging	OA07-POND A	0.2	0.5	2.5	2	2	2	9.2	0.25	2.3
OA10	A36	Temp_Draining	OA10	0.2	0.5	2.5	2	2	2	9.2	0.15	1.38
OA10	A33	Dredging	OA10	0.2	0.5	2.5	2	2	2	9.2	0.1	0.92
OA10	A33	Temp_Filling	OA10	0.2	0.5	2.5	2	2	2	9.2	0.04	0.37
OA10	A36	Dredging	OA10	0.2	0.5	2.5	2	2	2	9.2	0.9	8.28
OB01	B04	Draining/Excavation	OB01	0.2	0.5	2.5	2	2	2	9.2	0.56	5.15
OB02	B11	Draining/Excavation	OB02	0.2	0.5	2.5	2	2	2	9.2	1.68	15.46
OB03	B11	Draining/Excavation	OB03	0.2	0.5	2.5	2	2	2	9.2	0.65	5.98
OB04	B11	Draining/Excavation	OB04	0.2	0.5	2.5	2	2	2	9.2	6.21	57.13
OB05	B11	Draining/Excavation	OB05	0.2	0.5	2.5	2	2	2	9.2	0.7	6.44
OB06	B12	Draining/Excavation	OB06	0.2	0.5	2.5	2	2	2	9.2	1.82	16.74
OB07	B14	Draining/Excavation	OB07	0.2	0.5	2.5	2	2	2	9.2	0.86	7.91

Impact Number	Drawing Number	Impact Type	Functional Assessment	Lost Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Acres	Credit
OB08	B20	Flooding	OB08	0.2	0.5	2.5	2	2	2	9.2	0.03	0.28
OB09a	B23	Draining/Excavation	OB09a	0.2	0.5	2.5	2	2	2	9.2	0.34	3.13
OB09b	B22	Draining/Excavation	OB09b	0.2	0.5	2.5	2	2	2	9.2	0.24	2.21
OB12a	B24	Draining/Excavation	OB12a	0.2	0.5	2.5	2	2	2	9.2	0.32	2.94
OB12b	B25	Draining/Excavation	OB12b	0.2	0.5	2.5	2	2	2	9.2	2.36	21.71
OB13a	B05	Draining/Excavation	OB13a	0.2	0.5	2.5	2	2	2	9.2	1.58	14.54
OB13b	B12	Draining/Excavation	OB13b	0.2	0.5	2.5	2	2	2	9.2	0.21	1.93
OB14b	B06	Filling	OB14b	0.2	0.5	2.5	2	2	2	9.2	0.01	0.09
OB14c	B07	Filling	OB14c	0.2	0.5	2.5	2	2	2	9.2	0.01	0.09
OB14e	B07	Filling	OB14e	0.2	0.5	2.5	2	2	2	9.2	0	0
										Total	29.63	272.59
WA18b	A28	Landclearing	WA18b	3	0.5	0.1	2	1	1	7.6	0.21	1.6
WB01	B03	Filling	WB01	3	0.5	2.5	2	3	1	12	0.01	0.12
WB04b	B06	Landclearing	WB04b	2	0.5	2.5	2	1	1	9	0	0
WB05a	B06	Flooding	WB05a	3	0.5	2.5	2	2.5	1	11.5	0	0
WB05b	B06	Landclearing	WB05b	3	0.5	2.5	2	2.5	1	11.5	0	0
WB06	B06	Flooding	WB06	3	0.5	2.5	2	2.5	1	11.5	0.01	0.12
WB07	B06	Flooding	WB07	3	0.5	2.5	2	2.5	1	11.5	0.02	0.23
WB08	B06	Flooding	WB08	3	0.5	2.5	2	2.5	1	11.5	0.12	1.38
WB09	B06	Flooding	WB09	3	0.5	2.5	2	2.5	1	11.5	0.03	0.34
WB10	B07	Flooding	WB10	3	0.5	2.5	2	2.5	1	11.5	0.02	0.23
WB11	B07	Flooding	WB11	3	0.5	1	2	2.5	1	10	0.86	8.6
WB12	B08	Flooding	WB12	3	0.5	2.5	2	2.5	1	11.5	0.16	1.84
WB13	B08	Flooding	WB13	3	0.5	2.5	2	2.5	1	11.5	0.02	0.23

Impact Number	Drawing Number	Impact Type	Functional Assessment	Lost Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Acres	Credit
WB14	B08	Flooding	WB14	2	0.5	2.5	2	2.5	1	10.5	0.01	0.1
WB15	B09	Flooding	WB15	3	0.5	2.5	2	2.5	1	11.5	0	0
WB16	B09	Flooding	WB16	2	0.5	2.5	2	2.5	1	10.5	0.03	0.32
WB23a	B11	Filling	WB23a	2	0.5	2.5	2	3	1	11	0.14	1.54
WB23b	B11	Filling	WB23b	0.2	0.5	2	2	3	1	8.7	0.06	0.52
WB24	B11	Flooding	WB24	3	0.5	2	2	2.5	1	11	0.16	1.76
WB25a	B12	Flooding	WB25a	3	0.5	2	2	2.5	1	11	0.19	2.09
WB25b	B19	Flooding	WB25b	3	0.5	2	2	2.5	1	11	0.04	0.44
WB26	B12	Filling	WB26	0.2	0.5	1	2	3	1	7.7	0.04	0.31
WB27a	B13	Filling	WB27a	2	0.5	2.5	2	2.5	1	10.5	0	0
WB27b	B13	Flooding	WB27b	2	0.5	2.5	2	2.5	1	10.5	0.02	0.21
WB27c	B13	Filling	WB27c	2	0.5	2.5	2	2.5	1	10.5	0	0
WB28	B13	Flooding	WB28	3	0.5	2.5	2	2.5	1	11.5	0.06	0.69
WB29	B14	Flooding	WB29	3	0.5	2.5	2	2.5	1	11.5	0.01	0.12
WB31	B16	Flooding	WB31	3	0.5	2.5	2	2.5	1	11.5	0.01	0.12
WB32	B16	Flooding	WB32	2	0.5	2.5	2	2.5	1	10.5	0.01	0.1
WB33a	B20	Flooding	WB33a	3	0.5	0.1	2	2	1	8.6	0.11	0.95
WB33b	B20	Flooding	WB33b	3	0.5	0.1	2	2	1	8.6	0.01	0.09
WB34	B20	Flooding	WB34	3	0.5	2	2	2.5	1	11	0.01	0.11
WB35a	B20	Flooding	WB35a	3	0.5	0.1	2	2.5	1	9.1	0.11	1
WB35b	B21	Flooding	WB35b	3	0.5	0.1	2	2.5	1	9.1	0	0
WB36	B21	Flooding	WB36	3	0.5	2.5	2	2.5	1	11.5	0.01	0.12
WB37	B21	Flooding	WB37	3	0.5	2.5	2	2.5	1	11.5	0.05	0.58
WB38	B21	Flooding	WB38	3	0.5	2.5	2	2.5	1	11.5	0.02	0.23
WB39a	B21	Flooding	WB39a	3	0.5	2	2	2.5	1	11	0.03	0.33

Impact Number	Drawing Number	Impact Type	Functional Assessment	Lost Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Acres	Credit
WB39b	B22	Flooding	WB39b	3	0.5	2	2	2.5	1	11	0.08	0.88
WB40	B22	Flooding	WB40	3	0.5	2.5	2	2.5	1	11.5	0.07	0.8
WB41	B22	Flooding	WB41	3	0.5	2	2	2.5	1	11	0.02	0.22
WB42	B22	Flooding	WB42	3	0.5	2.5	2	2.5	1	11.5	0.04	0.46
WB43	B22	Flooding	WB43	3	0.5	2.5	2	2.5	1	11.5	0.03	0.34
WB44a	B22	Temporary Filling	WB44a	3	0.5	2.5	0.2	3	1	10.2	0.04	0.41
WB49a	B25	Flooding	WB49a	0.2	0.2	2.5	2	2.5	1	8.4	0.12	1.01
WB49b	B25	Flooding	WB49b	3	0.5	2.5	2	2.5	1	11.5	0.13	1.5
WB50	B25	Flooding	WB50	3	0.5	1	2	2.5	1	10	0.01	0.1
WB51	B25	Flooding	WB51	0.2	0.5	2.5	2	2.5	1	8.7	0.46	4
WB52	B25	Flooding	WB52	2	0.5	2.5	2	2.5	1	10.5	0.01	0.1
WB53	B25	Filling	WB53	3	0.5	2	2	3	1	11.5	0.04	0.46
WB54	B25	Flooding	WB54	3	0.5	0.1	2	2.5	1	9.1	0	0
WB55a	B26	Flooding	WB55a	3	0.5	2	2	2.5	1	11	0	0
WB55b	B27	Flooding	WB55b	3	0.5	2	2	2.5	1	11	0.02	0.22
WB56	B27	Flooding	WB56	2	0.5	2.5	2	2.5	1	10.5	0.01	0.1
WB57	B27	Flooding	WB57	3	0.5	2.5	2	2.5	1	11.5	0.08	0.92
WB58b	B27	Filling	WB58b	2	0.5	2.5	2	3	1	11	0	0
WB72	B30	Temporary Flooding	WB72	3	0.5	2	0.2	2.5	1	9.2	0.1	0.92
WB76	B31	Flooding	WB76	2	0.5	2.5	2	2.5	1	10.5	0.01	0.1
WC07a	C17	Temporary Flooding	WC07a	3	0.5	2	0.2	2.5	1	9.2	0.05	0.46
WC07b	C17	Temporary Filling	WC07b	3	0.5	2	0.2	2.5	1	9.2	0.02	0.18
WC07c	C17	Filling	WC07c	3	0.5	2	2	3	1	11.5	0.02	0.23
WC07d	C18	Temporary Flooding	WC07d	3	0.5	2	0.2	2.5	1	9.2	0.2	1.84
WC07e	C18	Temporary Filling	WC07e	3	0.5	2	0.2	2.5	1	9.2	0.04	0.37

Impact Number	Drawing Number	Impact Type	Functional Assessment	Lost Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Acres	Credit
WC07f	C18	Filling	WC07f	3	0.5	2	2	3	1	11.5	0.09	1.04
WD01	D04	Clearing	WD01	3	0.05	2.5	2	1	1	9.55	0.11	1.05
WD05	D13	Clearing	WD05	3	0.5	2.5	2	1	1	10	0.13	1.3
WD06a	D14	Clearing	WD06a	3	0.5	2.5	2	1	1	10	0.15	1.5
WD06b	D14	Clearing	WD06b	3	0.5	2.5	2	1	1	10	0	0
WD06c	D15	Clearing	WD06c	3	0.5	2.5	2	1	1	10	0.01	0.1
WD08	D21	Clearing	WD08	3	0.5	2	2	1	1	9.5	0.09	0.86
WD09	D22	Clearing	WD09	3	0.5	2	2	1	1	9.5	0.16	1.52
WD11	D35	Clearing	WD11	3	0.5	2.5	2	1	1	10	0	0
WD12	D35	Clearing	WD12	3	0.5	2.5	2	1	1	10	0.01	0.1
WE01	E04	Clearing	WE01	3	0.5	2.5	2	1	1	10	0.38	3.8
WE02	E05	Clearing	WE02	3	0.5	2.5	2	1	1	10	0.01	0.1
WE03	E08	Clearing	WE03	3	0.5	2.5	2	1	1	10	0.1	1
										Total	5.43	54.41

Attachment A.2

Required Stream Mitigation Credits for Lee Nuclear Station Project

Required Stream Mitigation Credits for Lee Nuclear Station

Tuesday, November 08, 2011

11:39:44 PM

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB03b	B02	2	Perennial	B-S03	Landclearing	0.8	0.1	1.5	0.3	0.05	3	5.75	57	325
TB03c	B02	2	Perennial	B-S03	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	892	6872
TB03c	B08	2	Perennial	B-S03	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	639	4924
TB04b	B03	2	Perennial	B-S08	Landclearing	0.8	0.1	0.75	0.3	0.05	3	5	50	252
TB04c	B03	2	Perennial	B-S08	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	7	47
TB04d	B02	3	Perennial	B-S08a	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	48	336
TB04e	B02	2	Perennial	B-S08b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	239	1840
TB04f	B08	2	Perennial	B-S08b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	1056	8133
TB06a	B03	2	Perennial	B-S06	Piping	0.8	0.1	1.5	0.3	2.2	3	7.9	177	1400
TB09c	B06	1	Perennial	B-S23	Landclearing	0.8	0.1	0.75	0.3	0.05	3	5	40	198
TB101a	B07	1	Seasonal RPW	B-S101	Filling	0.8	0.1	1.5	0.3	2.5	3	8.2	59	484

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB101b	B07	1	Seasonal RPW	B-S101	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	65	504
TB102a	B07	1	Seasonal RPW	B-S100	Filling	0.8	0.1	1.5	0.3	2.5	3	8.2	159	1302
TB102b	B07	1	Seasonal RPW	B-S100	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	78	602
TB103	B08	1	Seasonal RPW	B-S103	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	476	3663
TB104	B08	1	Seasonal RPW	B-S102	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	260	2005
TB12b	B06	2	Seasonal RPW	B-S92	Landclearing	0.8	0.1	0.75	0.3	0.05	3	5	44	220
TB13a	B15	2	Perennial	B-S24c	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	43	297
TB13a	B06	2	Perennial	B-S24	Landclearing	0.8	0.1	0.75	0.3	0.05	3	5	10	52
TB13b	B06	2	Perennial	B-S24	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	387	2686
TB13b	B15	2	Perennial	B-S24c	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	1048	7286
TB13b	B14	2	Perennial	B-S24c	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	25	176
TB13c	B14	2	Perennial	B-S24c	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	803	5578
TB13c	B06	2	Perennial	B-S24a	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	716	5514
TB13d	B06	2	Perennial	B-S24b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	334	2574

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB13e	B07	2	Perennial	B-S24b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	310	2383
TB13f	B07	2	Perennial	B-S24b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	95	731
TB13g	B07	2	Perennial	B-S24b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	6	44
TB13h	B07	2	Perennial	B-S24b	Culvert	0.8	0.1	1.5	0.3	0.3	3	6	4	25
TB13i	B14	2	Perennial	B-S24b	Culvert	0.8	0.1	1.5	0.3	0.3	3	6	9	57
TB13j	B14	2	Perennial	B-S24b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	114	877
TB13k	B07	2	Perennial	B-S24b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	11	84
TB14a	B07	1	Seasonal RPW	B-S25	Piping	0.8	0.1	0.75	0.3	2.2	3	7.15	77	549
TB14b	B07	1	Seasonal RPW	B-S25	Culvert	0.8	0.1	0.5	0.3	0.3	3	5	5	24
TB14c	B07	1	Seasonal RPW	B-S25	Culvert	0.8	0.1	0.5	0.3	0.3	3	5	44	218
TB14d	B07	1	Seasonal RPW	B-S25	Piping	0.8	0.1	0.5	0.3	2.2	3	6.9	93	639
TB14e	B07	1	Seasonal RPW	B-S25	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	1069	7165

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB15a	B07	3	Perennial	B-S12	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	1302	9508
TB15b	B08	3	Perennial	B-S12	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	397	2895
TB16	B07	1	Seasonal RPW	B-S11	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	42	289
TB17a	B08	3	Perennial	B-S09	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	445	3246
TB17b	B08	3	Perennial	B-S09	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	295	2154
TB18aa-London Creek	B30	4	Perennial	B-S13	Filling	0.4	0.1	1.5	0.3	2.5	3	7.8	89	693
TB18ac-London Creek	B30	4	Perennial	B-S13	Armoring	0.4	0.1	1.5	0.3	0.5	3	5.8	378	2191
TB18ad-London Creek	B30	4	Perennial	B-S13	Armoring	0.4	0.1	1.5	0.3	0.5	3	5.8	258	1495
TB18ae-London Creek	B30	4	Perennial	B-S13	Temporary Fill	0.4	0.1	0.75	0.05	2.5	3	6.8	10	69

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB18a-London Creek	B08	4	Perennial	B-S13	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	41	268
TB18b-London Creek	B08	4	Perennial	B-S13a	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	9	59
TB18c-London Creek	B08	4	Perennial	B-S13a	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	293	1920
TB18d-London Creek	B08	4	Perennial	B-S13a	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	646	4229
TB18e-London Creek	B08	4	Perennial	B-S13b	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	375	2458
TB18f-London Creek	B08	4	Perennial	B-S13c	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	508	3330
TB18g-London Creek	B15	3	Perennial	B-S13	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	769	5038
TB18h-London Creek	B15	4	Perennial	B-S13d	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	1095	7175

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB18i-London Creek	B14	4	Perennial	B-S13	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	1724	11291
TB18j-London Creek	B14	4	Perennial	B-S13e	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	1352	8853
TB18k-London Creek	B21	4	Perennial	B-S13e	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	736	4819
TB18l-London Creek	B21	4	Perennial	B-S13e	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	77	504
TB18m-London Creek	B20	4	Perennial	B-S13e	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	163	1066
TB18n-London Creek	B20	4	Perennial	B-S13e	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	231	1515
TB18o-London Creek	B20	4	Perennial	B-S13f	Flooding	0.4	0.1	0.5	0.3	2	3	6.3	580	3657
TB18p-London Creek	B20	4	Perennial	B-S13	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	2131	15553

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB18q-London Creek	B26	4	Perennial	B-S13	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	319	2328
TB18r-London Creek	B20	4	Perennial	B-S13	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	209	1529
TB18s-London Creek	B25	4	Perennial	B-S13	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	1079	7880
TB18t-London Creek	B25	4	Perennial	B-S13	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	594	4337
TB18u-London Creek	B25	4	Perennial	B-S13	Filling	0.4	0.1	1.5	0.3	2.5	3	7.8	98	763
TB18v-London Creek	B25	4	Perennial	B-S13	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	689	5032
TB18w-London Creek	B25	4	Perennial	B-S13g	Filling	0.4	0.1	1.5	0.3	2.5	3	7.8	438	3413
TB18x-London Creek	B25	4	Perennial	B-S13h	Filling	0.4	0.1	1.5	0.3	2.5	3	7.8	385	3004

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB18y-London Creek	B25	4	Perennial	B-S13	Filling	0.4	0.1	1.5	0.3	2.5	3	7.8	78	610
TB18z-London Creek	B30	4	Perennial	B-S13	Filling	0.4	0.1	1.5	0.3	2.5	3	7.8	130	1012
TB19b	B09	2	Perennial	B-S16	Landclearing	0.8	0.1	0.75	0.3	0.05	3	5	54	272
TB19c	B09	2	Perennial	B-S16	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	910	6323
TB19d	B08	2	Perennial	B-S16	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	1273	8844
TB22a	B09	2	Perennial	B-S19	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	562	3768
TB22b	B09	2	Perennial	B-S19a	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	76	531
TB22c	B09	2	Perennial	B-S19	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	335	2577
TB22d	B16	2	Perennial	B-S19b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	951	7321
TB22e	B15	2	Perennial	B-S19b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	160	1231
TB22f	B15	2	Perennial	B-S19b	Culvert	0.8	0.1	1.5	0.3	0.3	3	6	26	158

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB22g	B15	2	Perennial	B-S19b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	78	603
TB22h	B15	2	Perennial	B-S19c	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	183	1411
TB23c	B09	1	Perennial	B-S17a	Landclearing	0.8	0.1	1.5	0.3	0.05	3	5.75	192	1104
TB23d	B09	1	Perennial	B-S17a	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	311	2397
TB23e	B09	1	Perennial	B-S17	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	293	2039
TB24c	B09	1	Perennial	B-S18	Landclearing	0.8	0.1	0.75	0.3	0.05	3	5	67	335
TB24d	B09	1	Perennial	B-S18	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	179	1247
TB25a	B11	1	Perennial	B-S47a	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	235	1632
TB25b	B11	1	Perennial	B-S47b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	24	182
TB25c	B12	1	Perennial	B-S47b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	316	2434
TB25d	B19	1	Perennial	B-S47b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	7	53
TB25e	B12	1	Perennial	B-S47b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	100	767

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB25f	B19	1	Perennial	B-S47b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	50	384
TB25g	B12	1	Perennial	B-S47b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	25	190
TB25h	B19	1	Perennial	B-S47b	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	331	2545
TB26a	B12	1	Seasonal RPW	B-S44a	Filling	0.8	0.1	0.5	0.3	2.5	3	7.2	301	2167
TB26b	B12	1	Seasonal RPW	B-S44b	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	205	1375
TB27c	B12	2	Perennial	B-S41	Landclearing	0.8	0.1	0.75	0.3	0.05	3	5	54	272
TB27d	B12	2	Perennial	B-S41	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	8	54
TB28	B12	1	Seasonal RPW	B-S42	Landclearing	0.8	0.1	0.75	0.3	0.05	3	5	31	154
TB29a	B12	2	Perennial	B-S43	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	925	7123
TB29a	B12	2	Perennial	B-S43	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	0	1
TB29a	B12	2	Perennial	B-S43	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	325	2499
TB29b	B13	2	Perennial	B-S43	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	440	3390

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB29c	B13	2	Perennial	B-S43	Filling	0.8	0.1	1.5	0.3	2.5	3	8.2	95	781
TB29d	B13	2	Perennial	B-S43	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	114	879
TB29e	B13	2	Perennial	B-S43	Culvert	0.8	0.1	0.75	0.3	0.3	3	5.25	28	149
TB29f	B13	2	Perennial	B-S43b	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	703	4886
TB29g	B13	2	Perennial	B-S43b	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	325	2259
TB29h	B13	2	Perennial	B-S43c	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	557	4287
TB29h	B14	2	Perennial	B-S43	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	480	3216
TB29h	B21	2	Perennial	B-S43	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	177	1189
TB29i	B14	2	Perennial	B-S43c	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	317	2315
TB30a	B12	1	Seasonal RPW	B-S45	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	64	448
TB30b	B12	1	Seasonal RPW	B-S45	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	264	1833
TB31	B13	1	Seasonal RPW	B-S46	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	61	408
TB32a	B14	1	Seasonal RPW	B-S25b	Morphologic	0.8	0.1	0.75	0.3	1.5	3	6.45	267	1721

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB32b	B14	1	Seasonal RPW	B-S25b	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	351	2440
TB33a	B15	1	Perennial	B-S26	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	315	2186
TB33b	B14	1	Perennial	B-S26	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	264	1838
TB34b	B23	1	Perennial	B-S34	Landclearing	0.4	0.1	1.5	0.3	0.05	3	5.35	118	633
TB34c	B23	3	Perennial	B-S34d	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	466	3401
TB34d	B22	3	Perennial	B-S34d	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	52	383
TB34e	B22	3	Perennial	B-S34d	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	2009	14666
TB34f	B22	3	Perennial	B-S34b	Flooding	0.4	0.1	0.5	0.3	2	3	6.3	350	2206
TB34g	B22	3	Perennial	B-S34a	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	175	1279
TB34h	B21	3	Perennial	B-S34	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	1349	9851
TB34i	B14	3	Perennial	B-S34a	Flooding	0.4	0.1	1.5	0.3	2	3	7.3	144	1054

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB34j	B14	3	Perennial	B-S34e	Flooding	0.4	0.1	0.75	0.3	2	3	6.55	151	992
TB35a	B15	2	Perennial	B-S22	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	201	1396
TB35b	B15	2	Perennial	B-S22a	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	713	5491
TB35c	B15	2	Perennial	B-S22a	Landclearing	0.8	0.1	1.5	0.3	0.05	3	5.75	52	296
TB38	B19	1	Seasonal RPW	B-S48	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	104	697
TB39a	B19	2	Perennial	B-S49a	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	479	3331
TB39b	B19	2	Perennial	B-S49a	Culvert	0.8	0.1	0.75	0.3	0.3	3	5.25	28	148
TB39c	B20	2	Perennial	B-S49a	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	1002	6962
TB39c	B19	2	Perennial	B-S49a	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	823	5721
TB39d	B20	2	Perennial	B-S49b	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	262	1759
TB39e	B20	2	Perennial	B-S49b	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	68	455
TB40a	B19	1	Seasonal RPW	B-S50	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	49	337

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB40b	B20	1	Seasonal RPW	B-S50	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	125	871
TB41	B20	1	Seasonal RPW	B-S51	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	91	633
TB42	B20	1	Seasonal RPW	B-S52	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	53	357
TB43a	B22	2	Perennial	B-S55	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	264	2034
TB43b	B21	2	Perennial	B-S55	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	2296	17676
TB43c	B20	2	Perennial	B-S55	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	638	4914
TB44	B22	1	Seasonal RPW	B-S40	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	274	1839
TB45	B22	1	Seasonal RPW	B-S39	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	651	4361
TB46b	B22	1	Perennial	B-S38	Landclearing	0.8	0.1	1.5	0.3	0.05	3	5.75	49	281
TB46c	B22	1	Perennial	B-S38	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	675	5198
TB48a	B23	2	Perennial	B-S37	Landclearing	0.8	0.1	0.5	0.3	0.05	3	4.75	46	218
TB48b	B23	2	Perennial	B-S37	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	192	1288

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB48c	B22	2	Perennial	B-S37	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	21	142
TB49	B22	1	Perennial	B-S54	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	66	457
TB50d	B22	1	Perennial	B-S53	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	158	1061
TB51b	B23	1	Seasonal RPW	B-S36	Landclearing	0.8	0.1	0.5	0.3	0.05	3	4.75	8	39
TB52b	B23	1	Seasonal RPW	B-S35	Landclearing	0.8	0.1	0.5	0.3	0.05	3	4.75	12	57
TB60a	B24	1	Perennial	B-S61	Filling	0.8	0.1	1.5	0.3	2.5	3	8.2	74	609
TB60b	B24	1	Perennial	B-S61	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	86	663
TB60c	B24	1	Perennial	B-S61	Culvert	0.8	0.1	1.5	0.3	2.5	3	8.2	33	274
TB60d	B24	1	Perennial	B-S61	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	73	559
TB62a	B25	1	Seasonal RPW	B-S70a	Filling	0.8	0.1	0.75	0.3	2.5	3	7.45	313	2333
TB62b	B25	1	Seasonal RPW	B-S70a	Filling	0.8	0.1	0.75	0.3	2.5	3	7.45	45	335

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB62c	B25	1	Seasonal RPW	B-S70b	Filling	0.8	0.1	1.5	0.3	2.5	3	8.2	127	1038
TB63a	B25	1	Perennial	B-S61b	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	269	1866
TB63b	B25	1	Perennial	B-S61b	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	214	1488
TB64	B25	1	Seasonal RPW	B-S60	Flooding	0.8	0.1	0.5	0.3	2	3	6.7	19	127
TB65a	B27	2	Perennial	B-S58	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	357	2751
TB65b	B26	2	Perennial	B-S58	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	2505	19291
TB65c	B25	2	Perennial	B-S58	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	251	1930
TB66a	B26	2	Perennial	B-S64	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	1913	14729
TB66b	B25	2	Perennial	B-S64	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	591	4549
TB66c	B25	2	Perennial	B-S64	Filling	0.8	0.1	1.5	0.3	2.5	3	8.2	250	2048
TB67a	B31	1	Perennial	B-S69	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	600	4618
TB67b	B26	1	Perennial	B-S69	Flooding	0.8	0.1	1.5	0.3	2	3	7.7	545	4196

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB68	B26	1	Perennial	B-S68	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	41	282
TB69	B26	1	Perennial	B-S65	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	28	195
TB70a	B27	1	Perennial	B-S62	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	493	3424
TB70b	B26	1	Perennial	B-S62	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	205	1423
TB71a	B27	1	Perennial	B-S63	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	79	548
TB71b	B26	1	Perennial	B-S63	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	176	1220
TB72	B26	1	Perennial	B-S59	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	334	2320
TB73	B26	1	Seasonal RPW	B-S66	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	5	35
TB74	B27	1	Perennial	B-S57	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	208	1448
TB75	B27	1	Perennial	B-S56	Flooding	0.8	0.1	0.75	0.3	2	3	6.95	405	2812
TB77a	B28	1	Perennial	B-S74b	Filling	0.8	0.1	0.5	0.3	2.5	3	7.2	81	581

Impact Number	Drawing Number	Order	Type	Functional Assessment	Impact Type	Stream Type	Priority	Existing Condition	Duration	Dominant Impact	Cumulative Impact	Sum of R	Length	Credit
TB77b	B27	1	Perennial	B-S74b	Filling	0.8	0.1	0.5	0.3	2.5	3	7.2	216	1558
TB77c	B27	1	Perennial	B-S74a	Filling	0.8	0.1	1.5	0.3	2.5	3	8.2	126	1037
TB83c	B30	1	Seasonal RPW	B-S71	Temporary Flooding	0.8	0.1	1.5	0.05	2	3	7.45	172	1281
TB95a	B04	1	Perennial	B-S96	Filling	0.8	0.1	0.5	0.3	2.5	3	7.2	6	42
TC18a-London Creek	C17	4	Perennial	C-S13	Temporary Flooding	0.4	0.1	1.5	0.05	2	3	7.05	1148	8090
TC18b-London Creek	C17	4	Perennial	C-S13	Temporary Filling	0.4	0.1	1.5	0.05	2.5	3	7.55	15	113
TC18c-London Creek	C17	4	Perennial	C-S13	Filling	0.4	0.1	1.5	0.3	2.2	3	7.5	5	39
TC18d-London Creek	C18	4	Perennial	C-S13	Culvert	0.4	0.1	1.5	0.3	0.3	3	5.6	69	384
TC18e-London Creek	C18	4	Perennial	C-S13	Culvert	0.4	0.1	1.5	0.3	0.3	3	5.6	71	396
												Total	67285	483583

Appendix III.C

Sumter National Forest Component
Conceptual Mitigation Plan

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1.0 PROJECT DESCRIPTION

Duke Energy is proposing to construct the Lee Nuclear Station in the eastern portion of Cherokee County, South Carolina. The proposed project site is adjacent to the Ninety-Nine Islands Reservoir on the Broad River and directly upstream of the Ninety-Nine Islands Dam, approximately eight miles southeast of Gaffney. The project is located within the Upper and Lower Broad River watersheds (United States Geologic Service [USGS] Hydrologic Unit Codes 03050105 and 03050106). A detailed project description for the Lee Nuclear Station can be found in Volume 1, Part II, Section 2.0 of the Permit Application Package.

The total permit area for the Lee Nuclear Station project encompasses approximately 9,900 acres, which is divided into six permit area components that consist of the Lee Nuclear Site, drought contingency pond C and associated features, a railroad corridor, two off-site transmission line corridors, and off-site roads. The Permit Application Package includes an evaluation of the proposed impacts, including the following components:

- Alternatives analysis for the various facets of the project including site selection, supplemental water needs, and off-site transmission lines (Volume 1, Part II, Section 3.0)
- On-site avoidance and minimization (Volume 1, Part II, Section 4.0)
- Quantified Impacts, including impacts to waters of the United States pursuant to Section 404 of the Clean Water Act (Volume 1, Part II, Section 7.0)
- Secondary and Cumulative Effects (Volume 1, Part II, Section 8.0)

Mitigation for the Lee Nuclear Station will involve a combination of mitigation bank credits and permittee-responsible mitigation, including restoration/enhancement and preservation of wetland and stream components. Mitigation opportunities have been sought within the defined mitigation search area following the watershed approach (see Volume 2, Part III, Section 1.0, Conceptual Mitigation Plan). The watershed approach is a strategic site selection process that seeks to maintain and improve water quality and aquatic resources within the Broad River watershed where the proposed project is located. The Woods Ferry study area (hereafter referred to as "Woods Ferry"), located within the Enoree Ranger District of the Sumter National Forest, was identified as a unique opportunity to provide wetland and stream mitigation at a landscape level to compensate for the proposed impacts at the Lee Nuclear Station (Figure C-1).

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2.0 AVAILABLE MITIGATION CREDITS

Four existing mitigation banks having service areas that include the primary mitigation search area (Upper Broad River watershed and Lower Broad River watershed) were identified. These banks and their credit potential are discussed in Volume 2, Part III, Section 1.2.2, Conceptual Mitigation Plan. The Lee Nuclear Station will need an estimated 54 wetland credits (at least 27 of which must be restoration/enhancement), and will need an estimated 483,583 stream credits (approximately 241,792 credits of restoration/enhancement). Overall, Duke Energy plans to utilize an appreciable number of wetland and stream mitigation bank credits in satisfying mitigation needs. It is anticipated at this time that approximately 10 to 20 percent of the mitigation need will be satisfied through mitigation banks.

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3.0 WATERSHED APPROACH

The permittee-responsible mitigation project was developed utilizing a watershed approach to offset losses to aquatic functions commensurate with those from the proposed project. Volume 2, Part III, Section 1.0, Conceptual Mitigation Plan discusses conditions in the Upper and Lower Broad River watersheds, sources of functional impairments, and resources in need of protection. One of the primary sources of watershed functional impairment is the presence of legacy sediments within streams and floodplains. This impairment will be removed when restoration is accomplished, and the suite of functions typical of a fully functioning stream will be reestablished.

As part of the mitigation site search, Duke Energy conferred with the USACE Charleston District and the United States Forest Service (USFS) regarding the potential for mitigation opportunities on the Sumter National Forest. The Enoree District of the Sumter National Forest is located predominantly in the Lower Broad River, Tyger River, and Enoree River watersheds, and has been considered for stream restoration/enhancement projects for the past several years. In its current Forest Management Plan, USFS has identified watershed restoration as an objective for several watersheds within the Lower Broad River watershed (USFS 2004). These watersheds are located within Chester County in what is known as the Woods Ferry area of the Sumter National Forest. Streams within these areas exhibit functional impairments from sedimentation and stream instability that are common to many streams within the upper portion of the Lower Broad River watershed. Proposed restoration and enhancement of these streams would address sources of functional impairment in the Broad River watershed through a landscape-level project that would restore a suite of aquatic, hydrologic and water quality resource functions. The selection of these sites also would assist the USFS in meeting watershed needs identified in its Forest Management Plan by restoring aquatic resources within national forests for public benefit.

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4.0 PROPOSED COMPENSATORY MITIGATION PLAN

4.1 PROJECT GOALS AND OBJECTIVES

Stream restoration activities are proposed in up to six study watersheds wholly or substantially contained within Woods Ferry (Figures C-1 and C-2). Woods Ferry, comprising over 11,600 acres of contiguous forest, is located in Chester County in the northeast corner of the Enoree Ranger District of Sumter National Forest. The six study watersheds include Clarks Creek, Little Turkey Creek, Mountain Creek, McCluney Branch, unnamed tributary to Broad River, and unnamed tributary to Clarks Creek (Figures C-2 and C-3). The proposed stream restoration activities are designed to restore historic stream and floodplain functions that existed prior to land use manipulations. Eroding farm fields and gullies, as well as extensively logged forests, led to excessive floodplain deposition of sediment. More recently, as much of the region reverted back to forest and pasture, streams have incised or cut through the deep layers of floodplain sediment to historic elevations, leaving streams that are entrenched and laterally unstable. The results of the instability include increased sediment loads, degraded water quality, poor in-stream habitat, reduced water storage and base flow release, and diminished water availability for the riparian plant community. Without the proposed restoration work, on-site streams would undoubtedly continue the stream evolutionary processes resulting in additional stream bank erosion, sedimentation, water quality impacts, and habitat degradation.

The primary goals of this stream restoration project are as follows:

1. Reintroduce surface water flood hydrodynamics onto a constructed/modified floodplain by reestablishing characteristic bankfull dimensions and flood frequency.
2. Reestablish the capacity to store and transport watershed flows and sediment loads by restoring stable stream dimension, pattern, and profile.
3. Reduce sediment within on-site and downstream receiving waters through the removal of legacy sediments in the floodplain, stabilization of eroding stream banks, and restoration of a forested riparian buffer.
4. Improve aquatic habitat by reducing sedimentation and enhancing stream bed variability.
5. Restore the historic hydrologic regime (including overbank flooding and access to ground-water elevations) to the restored floodplain plant communities.
6. Expand on and integrate the restoration and enhancement work with the Best Management Practices and Forest Management Goals of the Woods Ferry area (Figure C-3). The aggregated projects would have the potential to provide an estimated 85,388 linear feet of restored streams.

These goals will be achieved by the following:

1. Restoration (Priority 2 approach per Rosgen [1997]) potential of an estimated 85,388 linear feet of stream channels through floodplain excavation and the concomitant restoration of stable channel dimension, pattern, and profile. Natural stream channel design will be implemented within the newly established banks.
2. Reintroduction of surface water flood hydrodynamics onto the constructed floodplain.
3. Restoration of riparian community along streams following the excavation of legacy sediment.
4. Replacement of bridges and culverts at existing USFS road stream crossings to accommodate the larger floodplains.
5. Revegetating of floodplains and upland slopes adjacent to streams.
6. Providing Woods Ferry mitigation areas permanent protection by way of a Conservation Land Use Agreement between the USFS and the USACE, along an estimated 85,388 linear feet of restored stream channels.

These actions would provide an estimated 319,222 potential restoration or enhancement stream credits, per the requirements in the Charleston District USACE Guidelines, dated October 7, 2010 (Charleston District Guidelines) (USACE 2010a).

4.2 SITE SELECTION

The Lee Nuclear Station mitigation search for potential permittee-responsible mitigation sites was multifaceted and focused within the Upper and Lower Broad River watersheds. Screening criteria were developed to provide a framework for and evaluation of potential sites in the context of the watershed approach. These criteria included factors as discussed in 33 CFR 332.3(d)(1) and additional criteria developed for this site selection process, and include:

- Hydrological conditions, soil characteristics, and other physical and chemical characteristics
- Watershed-scale features, such as aquatic habitat diversity, habitat connectivity, and other landscape scale functions
- Size and location of the compensatory mitigation site relative to hydrologic sources and other ecological features
- Compatibility with adjacent land uses and watershed management plans
- Reasonably foreseeable ecological effects of the compensatory mitigation project
- Other relevant factors including, but not limited to, habitat status and trends, local or regional goals for the restoration or protection of particular habitat types or functions
- Appropriate and practical mitigation based on existing design methodology, logistics, and cost
- Public benefit opportunity (e.g., helping to meet resource agency goals; providing for increased public use/benefit of the resource)

A site review of sub-watersheds within the Enoree District of the Sumter National Forest was undertaken to identify stream restoration opportunities. Following the watershed approach all watersheds within the Enoree District Congressional Boundary were evaluated for restoration potential. Substantial Priority 2 stream opportunities (Rosgen 1997) were identified within the Lower Broad River portion of the Enoree District, predominantly in the Woods Ferry area. The site search continued into the Tyger and Enoree watersheds; however, stream restoration opportunities were sporadic or were found to have significant limitations that made these watersheds less desirable for stream restoration. The Woods Ferry area, which is the closest portion of the Enoree District to the Lee Nuclear Station, meets the screening criteria and therefore was selected as a suitable, permittee-responsible stream mitigation opportunity.

4.2.1 Hydrological Conditions, Soil Characteristics, and Other Physical and Chemical Characteristics

Hydrological conditions, soil characteristics, and other physical characteristics of Woods Ferry can be found in Section 4.4.

4.2.2 Watershed-Scale Features, Such as Aquatic Habitat Diversity, Habitat Connectivity, and Other Landscape Scale Functions

Watershed-scale features are discussed in Section 4.4.

4.2.3 Size and Location of the Compensatory Mitigation Site Relative to Hydrologic Sources and Other Ecological Features

The size and location of the compensatory mitigation site relative to hydrologic sources and other ecological features are discussed in Section 4.4.

4.2.4 Compatibility with Adjacent Land Uses and Watershed Management Plans

Woods Ferry is approximately 99 percent forested, which is compatible with surrounding land uses that are approximately 79 percent forested and 10 percent agricultural. Several sources are available that provide information on the watershed condition and needs of the Upper and Lower Broad River watersheds. These sources include:

- Watershed Quality Assessment: Broad River Basin (SCDHEC 2007)
- An Assessment of the Upper Broad Subbasin (NRCS 2010a)
- An Assessment of the Lower Broad Subbasin (NRCS 2010b)
- Broad Scenic River Management Plan (Broad River Scenic Advisory Council 2003)
- South Carolina State Water Assessment (SCDNR 2009)
- South Carolina Comprehensive Wildlife Conservation Strategy 2005–2010 (SCDNR 2005)

- U.S. Forest Service Revised Land and Resource Management Plan (USFS 2004)

The stream restoration proposed for Woods Ferry is compatible with the conservation and restoration goals of these watershed plans.

4.2.5 Reasonably Foreseeable Ecological Effects of the Compensatory Mitigation Project

Wetland and stream mitigation in Woods Ferry are expected to benefit ecologically important aquatic and terrestrial resources by restoring and protecting stream and floodplain function. Ecological goals of the stream restoration project at Woods Ferry are provided in Section 4.1.

4.2.6 Other Relevant Factors

The Woods Ferry area is subject to continuous water quality and aquatic habitat degradation, as described in Section 4.1, and 4.4.2.5, which can be verified by the proposed Mitigation Plan. The Mitigation Plan will also satisfy the USFS's regional mitigation goals established in the Forest Management Plan by restoring the hydrologic and aquatic functions and connectivity of substantial, contiguous area of tributaries benefitting the Broad River.

Site selection criteria also included appropriateness and practicability, as discussed in Section 4.4. Appropriateness was based on the values and functions of the aquatic resources that could be restored. Practicability was based on the availability of the site, and the ability to implement mitigation based on consideration of cost, the state of the practice of stream restoration science, and the logistics for implementation.

4.3 SITE PROTECTION

A Conservation Land Use Agreement is anticipated between the USACE and the USFS to serve as the site protection instrument for the Woods Ferry mitigation area. The Conservation Land Use Agreement will require that the USFS preserve all areas associated with mitigation actions and prohibit all uses of streams and riparian buffers that could materially alter their biological integrity or functional and educational value. The purpose of the Conservation Land Use Agreement is to assure that future use of the mitigation areas will result in the protection, maintenance and enhancement of wetland and stream functions described in the Final Mitigation Plan.

4.4 BASELINE CONDITIONS

4.4.1 Project Site

Project site information for the Lee Nuclear Station can be found as follows:

- On-site aquatic resources (i.e., wetlands, open water, and streams) are discussed in Volume 1, Part II, Section 6.0 of the Permit Application Package and Sections 2.3 and 2.4 of the Environmental Report and Environmental Report Supplement.
- Quantified impacts to jurisdictional systems are discussed in Volume 1, Part II, Section 7.0 of the Permit Application Package.
- Determination of required mitigation credits for the project is discussed in Volume 2, Part III, Section, 1.0, Conceptual Mitigation Plan.
- Credit calculations are provided in Volume 2, Part III Appendix A of the Permit Application Package.

4.4.2 Proposed Mitigation Site

4.4.2.1 Physiography, Topography, and Land Use

Woods Ferry is located along the western-most portion of Chester County, South Carolina, approximately two miles south of Lockhart (Figures C-2 and C-3). Woods Ferry is bounded by the Broad River to the west and Highway SC-49 (Woods Ferry Road) to the east. The potential restoration features of Woods Ferry include streams within the six study watersheds, five of which flow directly to the Broad River including: Clarks Creek, Little Turkey Creek, McCluney Branch, Mountain Creek, and an unnamed tributary to Broad River (Figure C-2). The sixth study watershed, the unnamed tributary to Clarks Creek, joins Clarks Creek less than 200 feet from its confluence with the Broad River. Aerial photography of the various watersheds is provided in Figures C-4-1 through C-4-6.

Woods Ferry is located in the Southern Outer Piedmont ecoregion of the Piedmont Physiographic province (Griffith et al. 2002). The Southern Outer Piedmont ecoregion extends from northern Virginia, across a large swath of the Carolinas and Georgia, and into Alabama. Once largely cultivated or otherwise deforested, much of the region has reverted to pine and hardwood woodlands. Loblolly-shortleaf pine is the major forest type, with lesser coverage in oak-hickory and oak-pine. Approximately 79 percent of the regional watersheds are forested. Less than 1 percent is occupied by residential and commercial land use. Pastures (4 percent), row crops (6 percent) and transitional land use (7 percent) make up most of the remaining area (SCDHEC 2005). Gneiss, schist and granite are the dominant rock types, covered with deep, erosion-prone saprolite and mostly red, clayey subsoils (Griffith et al. 2002, USDA 1982).

The Woods plantation, established in 1817, was located on the Broad River in the area near Woods Ferry boat landing (Figure C-2). During its operation, much of the plantation was heavily logged and farmed for cotton. In 1936, the USFS acquired the land in and around the Woods plantation that currently makes up much of Woods Ferry. This area was incorporated into the Sumter National Forest with the authority granted by the Weeks Act of 1911 (36 Stat. 961) which authorized the United States Department of Agriculture to locate, purchase, and improve denuded and eroding lands in headwaters of navigable streams. At that time the USFS began extensive erosion control and reforestation work. The work continues today, as many of the upland slopes and ridges are maintained in loblolly pine and the riparian areas are returned to a hardwood canopy including, oak (*Quercus* spp.), hickory (*Carya* spp.), red maple (*Acer rubrum*), tulip poplar (*Liriodendron tulipifera*), and sweetgum (*Liquidambar styraciflua*).

The topography of Woods Ferry is rolling to hilly with linear ridges dissected by intermittent drainageways. Streams tend to have high to moderate gradients in high landscape positions, with lower gradients along larger, lower-relief drainages. Stream drainage systems are dendritic and tend to be perpendicular to the structural trend of the rocks across which they flow (Griffith et al. 2002). First-order streams in the Piedmont generally flow on saprolite. Second and higher-order streams generally have cut down through the saprolite into weathered rock and bedrock, with depth of incision into bedrock increasing with stream order (Costa and Cleaves 1984). Elevations within the project vicinity range from a high of approximately 674 feet National Geodetic Vertical Datum along ridge tops to a low of approximately 300 feet NGVD within the floodplain of the Broad River (Figures C-5-1 through C-5-6).

The human impact on Piedmont streams and local streams in particular has been severe and pronounced. With the beginning of widespread forest clearing and poorly managed agriculture practices in the early 1800s, streams and floodplains filled with the eroded sediments and began to aggrade. By the latter half of the 19th century, this aggradation became especially severe in first- and second-order streams, with stream beds rising as much as 12 feet, actually burying bridges and mill dams in some cases (Trimble 1974). Streams that once flowed as small, single-threaded channels with rocky substrates became filled with sediment and subsequently lost their capacity to contain and transport floodwaters downstream.

As a consequence of the decreased upland erosion and decreased sediment load that occurred abruptly in the 1930s, these same streams have incised through the deposited floodplain sediments, commonly referred to as “legacy sediments”. Detrimental effects to water quality and aquatic habitat continue from these legacy sediments, as lower-order streams adjust vertically and laterally through the legacy sediments to reach equilibrium, and consequently depositing sediment and nutrients into and in many cases, overwhelming larger tributaries downstream (Attachment C-3, Photos 1-4).

4.4.2.2 Soils

Most of the soils within the Woods Ferry area have been altered by human activities. The widespread cultivation of crops, cotton in particular, was a basic element of the local economy from the early 1800s through the 1920s. Poor farming practices in combination with moderate slopes and moderately erosive soils resulted in severe erosion problems. Many areas have deep gullies which have resulted in moderate to severe topsoil loss throughout the region. Most Piedmont soils, including those within the watersheds of the restoration sites, have little or no topsoil. Typical farming practices of the era would dictate orienting the crop rows up and down the hill slopes for better drainage (Trimble 1974). Many gullies formed along these rows as drainage furrows turned into ravines. While mostly stabilized, gullies still remain visible on the valley side slopes adjacent to the proposed stream restoration sites (Attachment C-3, Photos 5–8).

Like most of the floodplain valleys in the Piedmont, the site floodplains retain significant amounts of legacy sediment. Based on initial borings using a hand-turned auger and the degree of incision of local streams, the riparian areas are estimated to have between 5 to 10 feet of legacy sediment deposited on top of historic elevations.

Soils within Woods Ferry have been mapped by the Natural Resources Conservation Service (USDA 1982) and are depicted in Figures C-6-1 through C-6-6. Dominant soil associations, or those soil series comprising over 85 percent of the land area, were recorded for each watershed (Table C-1). The dominant soils series for Woods Ferry are described below in descending order by predominance (USDA 1982).

The **Cataula sandy clay loam, 2 to 6 percent slopes (CaB) and 6 to 10 percent slopes, eroded (CcC2)** series consist of deep, well drained soils found on gently inclined, convex slopes of irregularly shaped ridges; and on ridgetops and short side slopes along small drainageways, respectively. These soils have a dense, brittle, restrictive layer in the subsoil. The soil is low in organic content with moderately slow permeability in the upper surface and slow in the dense brittle layers. Available water capacity is medium. The root zone is moderately deep to the dense brittle layer that restricts root and water movement. Erosion is a moderate to severe hazard.

The **Cecil sandy clay loam, 6 to 10 percent slopes, eroded (CnC2)** series consists of deep, well drained soils on gently inclined, convex slopes on medium and broad ridgetops. The soils have moderate permeability and medium available water capacity. The surface layer is thin and erosion is a severe hazard.

The **Chewacla loam (Cw)** series consists of deep, somewhat poorly drained, nearly level soils found along floodplains and perennial streams. These soils are commonly flooded for brief periods from November to April. The soils have moderate permeability and high available water capacity.

The **Iredell fine sandy loam, 1 to 6 percent slopes (IdB)** series consists of deep, moderately well drained, gently sloping soils found on broad ridges. Permeability is slow and available water capacity is medium. The shrink-swell potential is high. Erosion is a moderate hazard.

The **Madison sandy loam, 2 to 6 percent slopes (MaB), 6 to 10 percent slopes, eroded (MdC2) and 10 to 25 percent slopes, eroded (MdE2**) series consist of deep, gently sloping to moderately steep soils found on broad ridges, broad side slopes, and convex side slopes adjacent to drainageways. Permeability is moderate and available water capacity is medium.

The **Pacolet sandy loam, 10 to 25 percent slopes (PaE)** series consists of deep, well drained, strongly sloping to steep, convex slopes adjacent to drainageways. Permeability is moderately rapid to rapid and available water capacity is low. The soil is droughty and wind erosion is a moderate hazard.

The **Wateree-Rion complex, 15 to 40 percent slopes (WaF)** series consists of an intricate mix of small areas of Wateree sandy loam (45 percent), Rion loamy sand (35 percent) and other soil units including Winnesboro. Wilkes and Pacolet soils make up the remainder of the complex. The complex is found on narrow to broad, long, moderately steep to steep, convex side slopes. Permeability is moderate to moderately rapid and available water capacity is low to medium. Erosion is a severe hazard.

The **Wilkes sandy loam, 15 to 40 percent slopes (WkF)** series consists of moderately deep, well drained soils on moderately steep to steep inclines on broad, long, convex side slopes. Permeability is moderately slow and available water capacity is low. The shrink-swell potential is high and the erosion hazard and equipment limitations are moderate.

The **Winnesboro sandy loam, 6 to 10 percent slopes (WnC) and 10 to 25 percent slopes (WnE)** series consists of deep, well drained soils on narrow ridges and convex side slopes adjacent to small streams. Permeability is slow and available water holding capacity is medium. The shrink-swell potential is high and erosion is a severe hazard.

Table C-1
Soil Characteristics for the Dominant Soil Series Within Each Woods Ferry Study Watershed

Soil Series	Taxonomic classification	Slope (percent)	Landscape Position	Depth to root restrictive layer (inches)	Drainage class
McCluney Branch					
Wilkes WkF	Typic Hapludalfs	15 to 40	interfluve	40 to 60	well drained
Winnsboro WnC	Typic Hapludalfs	6 to 10	interfluve	40 to 60	well drained
Winnsboro WnE	Typic Hapludalfs	10 to 25	interfluve	40 to 60	well drained
Chewacla Cw	Fluvaquentic Dystrudepts	0 to 2	floodplain	>60	somewhat poorly drained
Iredell IdB	Vertic Hapludalfs	1 to 6	interfluves	20 to 60	somewhat poorly drained
Little Turkey Creek					
Winnsboro WnE	Typic Hapludalfs	10 to 25	interfluve	40 to 60	well drained
Cataula CaB	Oxyaquic Kanhapludults	2 to 6	interfluve	16 to 40	well drained
Wilkes WkF	Typic Hapludalfs	15 to 40	interfluve	40 to 60	well drained
Madison MdE2	Typic Kanhapludults	10 to 25, eroded	interfluve	40 to 60	well drained
Madison MaB	Typic Kanhapludults	2 to 6	interfluve	40 to 60	well drained
Chewacla Cw	Fluvaquentic Dystrudepts	0 to 2	floodplain	>60	somewhat poorly drained

Table C-1, cont'd

Soil Series	Taxonomic classification	Slope (percent)	Landscape Position	Depth to root restrictive layer (inches)	Drainage class
Clarks Creek					
Winnsboro WnE	Typic Hapludalfs	10 to 25	interfluve	40 to 60	well drained
Wilkes WkF	Typic Hapludalfs	15 to 40	interfluve	40 to 60	well drained
Cataula CcC2	Oxyaquic Kanhapludults	6 to 10, eroded	interfluve	16 to 40	well drained
Madison MdC2	Typic Kanhapludults	6 to 10, eroded	interfluve	40 to 60	well drained
Winnsboro WnC	Typic Hapludalfs	6 to 10	interfluve	40 to 60	well drained
Wateree-Rion WaF	Typic Dystrudepts	15 to 40	interfluve	20 to 40	well drained
Madison MaB	Typic Kanhapludults	2 to 6	interfluve	40 to 60	well drained
Chewacla Cw	Fluvaquentic Dystrudepts	0 to 2	floodplain	>60	somewhat poorly drained
Unnamed Tributary to Clarks Creek					
Wilkes WkF	Typic Hapludalfs	15 to 40	interfluve	40 to 60	well drained
Winnsboro WnC	Typic Hapludalfs	6 to 10	interfluve	40 to 60	well drained
Madison MdC2	Typic Kanhapludults	6 to 10, eroded	interfluve	40 to 60	well drained
Madison MaB	Typic Kanhapludults	2 to 6	interfluve	40 to 60	well drained
Mountain Creek					
Winnsboro WnE	Typic Hapludalfs	10 to 25	interfluve	40 to 60	well drained
Cataula CcC2	Oxyaquic Kanhapludults	6 to 10, eroded	interfluve	16 to 40	well drained
Pacolet PaE	Typic Kanhapludults	10 to 25	interfluve	>60	well drained
Wilkes WkF	Typic Hapludalfs	15 to 40	interfluve	40 to 60	well drained
Unnamed Tributary to Broad River					
Wilkes WkF	Typic Hapludalfs	15 to 40	interfluve	40 to 60	well drained
Cecil CnC2	Typic Kanhapludults	6 to 10, eroded	interfluve	>60	well drained
Cataula CaB	Oxyaquic Kanhapludults	2 to 6	interfluve	16 to 40	well drained

4.4.2.3 Jurisdictional Systems

Site jurisdictional areas in Woods Ferry will include primarily surface waters as bank-to-bank streams but also include areas of vegetated wetlands. A jurisdictional determination (USACE 2008a) will be requested and will be provided in the Final Mitigation Plan.

4.4.2.4 Plant Communities

Distribution and composition of plant communities reflect landscape-level variation in topography, soils, hydrology, and past or present land-use practices. General plant community classifications have been identified within Woods Ferry stream floodplains and adjacent side slopes including small stream forest, mesic mixed hardwood forest, and pine woodland. Plant community classifications are taken from "The Natural Communities of South Carolina" (Nelson 1986). Pine woodland is not a community described by Nelson (1986) but is used to define the area's upland forest community dominated by planted loblolly pine (*Pinus taeda*).

Small stream forest and bottomland hardwood forest persists along primary floodplains, tributaries, and lower slope drainages (Attachment C-3, Photos 9 and 10). Canopy dominance varies with landscape position and is influenced by soil moisture. Trees include sweetgum, tulip poplar, river birch (*Betula nigra*), water oak (*Quercus nigra*), loblolly pine and American beech (*Fagus grandifolia*). The sub-canopy is not dominated by any one or two species. Species present include box-elder (*Acer negundo*), ironwood (*Carpinus caroliniana*), hop hornbeam (*Ostrya virginiana*), and dogwood (*Cornus florida*). In a few locations, groves of pawpaw (*Asimina triloba*) and stands of giant cane (*Arundinaria gigantea*) are present.

Mesic mixed hardwood forest occupies lower slopes and north-facing bluffs (Attachment C-3, Photo 11). Slopes above the floodplains vary between nearly flat to near cliffs. The mesic mixed forests are dominated by several oak and hickory species including white oak (*Quercus alba*), black oak (*Q. velutina*), northern red oak (*Q. rubra*), mockernut hickory (*Carya alba*), and pignut hickory (*C. glabra*). Other canopy species include tulip poplar, red maple, sugar maple (*Acer saccharum),* occasional black walnut (*Juglans nigra*) and scattered American beech. Microhabitat variation is dictated by direction of exposure. North-facing slopes are cooler and wetter, while south- and west-facing slopes are warmer and drier. On northern slopes sub-canopy species includes redbud (*Cercis canadensis*), hop hornbeam, and American basswood (*Tilia heterophylla*). On the drier south- and west-facing slopes the sub-canopy is dominated by flowering dogwood (*Cornus florida*), American holly (*Ilex opaca*), painted buckeye (*Aesculus sylvatica*) and sparkleberry (*Vaccinium arboreum*).

Pine woodland is the predominant upland community type within Woods Ferry, primarily due to USFS management for loblolly pine over the last 70 years. The pine woodland is dominated by loblolly pine, and is maintained as the single dominant tree through programmatic thinning, clearing, and perhaps limited use of prescribed burning. Several other trees are present as seedlings and saplings including dogwood, sweetgum, red maple, sourwood (*Oxydendron arboreum*) and various oaks and hickories.

4.4.2.5 Hydrology

Watershed Description and Site Hydrology Characterization

Woods Ferry is located in the Lower Broad River watershed (USGS Hydrologic Unit 03050106) (Figure C-2). This hydrophysiographic region is characterized by rolling to hilly topography, containing major drainageways that are bordered by relatively steep valley slopes. The Broad River is the primary receiving water in the area with a drainage area of approximately 2800 square miles as it meanders along the western boundary of Woods Ferry. Woods Ferry is part of the Broad River watershed, and is situated in the Fall Zone area.

The Fall Zone runs as a band across the state, dividing the Coastal Plain and Piedmont physiographic provinces. This zone is marked by rapids or bedrock outcrops (shoals) in the associated river channels. These features were historically common along local reaches of the

Broad River. Indeed, mapping of the Broad River published by Robert Mills in 1825 indicates a fall of 13.5 vertical feet at Neal Shoals (Mills 1825). Neal Shoals is located approximately 2 miles south of Woods Ferry boat landing and is currently the location of the Neal Shoals dam and generating plant, creating a 10-mile impoundment area along the Broad River (Figure C-2). Four of the study watersheds including McCluney Creek, Little Turkey Creek, Clarks Creek (Attachment C-3, Photo 12) and unnamed tributary to Clarks Creek flow into the impoundment. Mountain Creek and the unnamed tributary to Broad River flow into a free-flowing portion of the Broad River below the Neal Shoals dam.

Neal Shoals dam was originally constructed solely to generate electricity, but the facility today also functions as a re-regulating plant to alleviate the downstream effects of releases from the Lockhart dam. Depending on upstream release from the Lockhart dam, normal daily fluctuations in water level within the reservoir can vary by 3 to 5 feet (USGS website: http://waterdata.usgs.gov/sc/nwis/rt).

The six study watersheds range in size from 0.3 to 4.4 square miles (see Figures C-5-1 through C-5-6). Valley slopes within the small drainages are typically greater than 2 percent (0.02 rise/run) but usually less than 1 percent (0.01 rise/run) in larger drainages (usually third-order or greater). Drainage areas for study watersheds and valley slopes for main stem streams and tributaries are provided in Table C-2.

In Chester County, precipitation averages approximately 47 inches per year, with more than half of the rainfall occurring between April and September (USDA 1982). Large floods (20- to 100-year return interval) typically correspond to large thunderstorms and tropical events in the region. Thunderstorms occur about 55 days each year, and primarily during the summer months (USDA 1982).

Bedload material supplied by the region consists primarily of silts and sands, and weathered bedrock (very coarse sand and small gravel). Bedrock outcrops are common within incised streams throughout the site watersheds. Suspended sediment loads consist primarily of easily eroded clays and silts, which transport attached nutrients into downstream waters.

According to the Flood Emergency Management Agency (FEMA) flood maps (www.msc.fema.gov), the geographic floodplain along the Broad River and mouth of the tributaries has a Zone A flood zone designation (FEMA Panel ID 45023C00175C). Zone A flood zones are special flood hazard areas and delineate the 100-year floodplain. Limited detailed studies have been completed for the Broad River or any tributary, and consequently no depths or base flood elevations have been established. Based on the latest available flood mapping from FEMA, all proposed stream work will be conducted outside of any mapped floodplains and should not be affected by any FEMA requirements.

Table C-2
Watershed Drainage Areas and Average Valley Slopes

Watershed	Drainage Area (sq. miles)	Average Valley Slope Tributaries (range)	Average Valley Slope Main Channel (range)
Clarks Creek	4.4	0.023 (0.007–0.107)	0.006 (0.003–0.011)
Little Turkey Creek	3.5	0.019 (0.013–0.025)	0.007 (0.004–0.014)
McCluney Branch	0.9	0.024 (0.023–0.025)	0.015 (0.004–0.032)
Mountain Creek	1.7	0.023 (0.016–0.037)	0.007 (0.007–0.008)
Unnamed tributary to Broad River	0.3	0.012 (na)	0.014 (na)
Unnamed tributary to Clarks Creek	1.8	0.022 (0.017–0.027)	0.008 (0.006–0.011)

On-Site Streams

Historic and existing stream geometries were evaluated based on a classification system using stream evolutionary processes and fluvial geomorphic principles (Rosgen 1994). The stream classification system stratifies streams into comparable groups based on pattern, dimension, profile, and substrate characteristics. Primary components of the classification include degree of entrenchment, width-depth ratio, sinuosity, channel slope, and stream substrate composition. The stream classes characterizing reaches within the site include G, F, C, and E. Each stream type is modified by the number 1 though 6 (e.g., E5) denoting a substrate dominated by 1) bedrock, 2) boulders, 3) cobble, 4) gravel, 5) sand, or 6) slit/clay.

Prior Stream Conditions

Prior or historic conditions are analogous to reference conditions. They refer to stable stream geometry prior to the land disturbances begun by early European settlers. The proposed on-site stream restoration will emulate prior conditions. During development of the Final Mitigation Plan, undisturbed “reference streams” will be measured to verify and refine regional curves (Arcadis and SCDOT 2004, Harmon et al. 1999; see Section 4.4.3) and to further derive parameters such as slopes, cross-sectional area, and width-to-depth ratio for stream restoration planning.

Under historic conditions, streams in the region appear to have had characteristics of predominantly C- and B-type streams. C-type streams are slightly entrenched riffle-pool channels exhibiting moderate sinuosity. C-type streams often occur in narrow to wide valleys with well-developed alluvial floodplains (Valley Type VIII) (Rosgen 1994, 1996). C-type streams typically exhibit a sequence of riffles and pools associated with a sinuous flow pattern and are considered very stable.

B-type streams often occur in moderately steep, structurally controlled valleys (less than 4 percent slope) that have gentle side slopes (Valley Type VII) (Rosgen 1996). Locally, B channels typically occur in valley constriction points where bedrock is exposed and provides a natural grade control. B-type streams on bedrock are moderately entrenched channels that are dominated by bed features that produce rapids and infrequent scour holes for pools.

Existing Stream Conditions

Potentially restorable reaches were identified during existing condition surveys to determine their general stability and their potential for restoration. The streams identified for potential restoration are shown in Figure C-7. Scientists performed qualitative and quantitative investigations of the watershed, stream corridor and channel geomorphology. A representative cross-section of the primary channel within each watershed was surveyed and characterized using Rosgen's (1996) stream classification systems. Table C-3 provides a summary of stream geometry, substrate, stability indexes, and classification. Surveyed stream cross-sections and attendant photographs are provided on Figures C-8-1 through C-8-5.

Based on field measurements, four of the six streams, including Clarks Creek, McCluney Branch, Mountain Creek, and the unnamed tributary to Clarks Creek, have been classified as F-type streams. The F stream type describes deeply entrenched, confined streams in low gradient valleys. These streams do not have access to a floodplain and typically have moderate to high sediment supply, depending on stream bank erosion conditions. Erosion rates can be very high due to stream confinement and the consequential reshaping of channel banks and lateral instability [Attachment C-3, Photos 17–20]. McCluney Branch exhibits transitional characteristics that correspond to a C-type channel.

Table C-3
Existing Condition Parameters for Representative Cross Section
Locations Within the Watersheds of Woods Ferry

Parameter	Clarks Creek	Little Turkey Creek	McCluney Branch	Mountain Creek	Unnamed Tributary to Broad River	Unnamed Tributary to Clarks Creek
Drainage Area (sq. mi.)	3.7	2.4	0.7	1.5	0.3	0.6
Cross-sectional Area (A_{bkf}) (sq. ft.)	35.7	26.2	11.8	27.8	6.1	10.1
Bankfull Width (W_{bkf}) (ft)	21.7	16.6	11.6	21.6	8.1	14.7
Bankfull Mean Depth (D_{bkf}) (ft)	1.6	1.6	1.0	1.3	0.8	0.7
Width/Depth Ratio (W/D)	13.2	10.5	11.4	16.7	10.8	21.4
Bankfull Max Depth (D_{mbkf}) (ft)	2.5	1.9	1.6	1.6	1.4	1.0
Width of Flood Prone Area (W_{fpa}) (ft)	30	21	24	27	17	20
Bank Height Ratio (BHR)	4.5	3.2	5.0	6.9	6.6	7.0
Entrenchment Ratio (ER)	1.4	1.3	2.1	1.3	1.2	1.4
Bed Material	sand	sand	gravel	sand	sand	gravel
Rosgen Stream Type	F5	G5	F4-->C4	F5	G5	F4

Little Turkey Creek and the unnamed tributary to Broad River have been classified as G-type streams. G stream types are found in moderately steep, dissected landforms in alluvial valleys. These streams are typically incised deeply along relic channel patterns. Bank erosion and bedload transport rates are high because of low width-to-depth ratios, moderate stream slopes, and high sediment supply from eroding banks.

Vertical Stability and Channel Evolution

The bank height ratio and the entrenchment ratio are important indicators of vertical channel stability. The bank height ratio determines the degree of channel incision (Rosgen 2001). Streams with high bank height ratios generally contribute a disproportionate amount of sediment from stream banks and the channel bed due to high shear stress. All the measured stream channels at Woods Ferry are rated as highly unstable. The entrenchment ratio describes the relationship of the stream to its valley landform features or vertical containment of the stream (Rosgen 1994, 1996). Streams with entrenchment ratios of 1.4 or less are particularly susceptible to erosion during large flood events because flows are transported within the channel rather than on an adjacent floodplain. The relationship of bank height ratio to stability rating is shown in Table C-4. All channels in Woods Ferry exhibited very high bank height ratios indicating very high bank instability. Similarly, most of the streams exhibit an entrenchment ratio of 1.4 or less, an indicator that these streams have incised to the extent that they have abandoned their floodplains (see Table C-3).

Table C-4
Conversion of Bank Height Ratio to Adjective Ratings of Stability
(Rosgen 2001)

Stability Rating	Bank Height Ratio
Stable (low risk of degradation)	1.0–1.05
Moderately Unstable	1.06–1.3
Unstable (high risk of degradation)	1.3–1.5
Highly Unstable	>1.5

Based on the preliminary survey data, the streams within Woods Ferry have been severely impacted by past land use practices and the legacy sediments left behind. The resulting streams have incised down to the historic bed elevations, leaving high banks exposed to increased shear stress and inducing lateral instability (i.e., bank erosion) along miles of floodplain bottoms. Increased shear stress on the banks results in lateral channel adjustments and increases sediment supply within the channel. In addition, these impacts lead to decreases in channel sinuosity, meander-width ratios, and sediment transport capacity (Rosgen 1996). Stream evolutionary models would predict that over time (perhaps millennia) the channels will continue to widen until a new floodplain develops and channel processes reach equilibrium. On-site streams are expected to continue to erode and deposit sediment into receiving waters downstream until a stable stream pattern has been carved from the adjacent floodplain sediments, a process that may take several millennia to complete (Trimble 1974, Jackson et al. 2005). In the meantime, bank erosion will continue and both in-stream and downstream water quality and aquatic habitats will remain degraded. This erosion process is consistent with numerous stream evolutionary scenarios described by Trimble (1974), Schumm et al. (1984), Simon (1994), and Rosgen (1999, 2001). A conceptual stream evolutionary model for impacted stream channels in Woods Ferry area is provided in Figure C-9.

4.4.2.6 Water Quality

Woods Ferry is located within sub-basin 03050106-03 of the Broad River watershed (SCDHEC 2007). This area is part of the USGS Hydrologic Cataloguing Unit 03050106 (see Figure C-1). The Broad River at SC 72/215/121 has been assigned a Freshwaters (Class FW) usage classification. As such, the restoration candidate streams including Clarks Creek, Little Turkey Creek, McCluney Branch, Mountain Creek, unnamed tributary to Clarks Creek and unnamed tributary to Broad River, are also classified as Class FW. Class FW waters are suitable for primary and secondary contact recreation and as a source of drinking water supply, after conventional treatment in accordance with the requirements of SCDHEC. These waters are suitable for fishing, and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. This class is also suitable for industrial and agricultural uses. Clarks Creek is the only candidate stream for which water quality data was collected by SCDHEC, and the stream has been designated nonsupporting of recreational use due to fecal coliform bacteria (SCDHEC 2007). The source of fecal coliform bacteria is most likely from a combination of land application of livestock waste, failing on-site wastewater disposal systems, cattle in streams, and wildlife (SCDHEC 2005). Clarks Creek is not on the 303(d) list for the pollutant because a Total Maximum Daily Load for fecal coliform bacteria has been developed and approved. None of the remaining candidate streams have been assessed for the 303(d) list (SCDHEC 2010).

Restoration goals at Woods Ferry do not specifically address the impairment to Clarks Creek due to fecal coliform bacteria. Impairments to recreational uses are not anticipated to affect the improvements to stream and riparian functions proposed in this restoration plan.

4.4.2.7 Protected Species

Threatened and endangered species are those plants or animals which the Secretary of the Interior classifies as “threatened” or ”endangered”, based on the best available scientific and commercial data. Species with the federal classification of endangered or threatened for such listing are protected under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.).

The USFWS database of rare and endangered species reports two federally listed species for Chester County, South Carolina (database visited on October 8, 2011): an endangered freshwater mussel, the Carolina heelsplitter (*Lasmigona decorata*); and an endangered bird, the red-cockaded woodpecker (*Picoides borealis*). The vascular plant, Georgia aster (*Aster georgianus*) has a Candidate designation. In addition, the bald eagle (*Haliaeetus leucocephalus*) is protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668–668c, as amended). The bald eagle and Carolina heelsplitter are also listed as Endangered by the State of South Carolina.

The South Carolina Heritage Trust Geographic database of rare and endangered species (database visited on July 29, 2011, data last updated April 15, 2010) indicates no occurrences of Carolina heelsplitter, red-cockaded woodpecker, or bald eagle within 2 miles of the project watersheds. Seven occurrences of the Georgia aster occur within a 3-mile radius of Woods Ferry boat landing on the Broad River.

The Carolina heelsplitter requires larger rivers with cool, clean, and well oxygenated water with stable, silt free bottoms, although many specimens have been found in mud, muddy sand or muddy gravel substrates (Keferl 1991, USFWS 2008). The candidate streams are generally highly disturbed second- and third-order channels impacted by overwhelming sediment loads. The present channel condition makes it unlikely that the Carolina heelsplitter occurs in these systems.

Red-cockaded woodpeckers require open pine woodlands and savannahs with large old pines for nesting (cavity trees) and roosting habitat. Cavity trees must be in open stands with little or no hardwood midstory or overstory. Primary nesting and foraging habitat consists of mature to over-mature southern pine forests dominated by loblolly, long-leaf (*Pinus palustris*), slash (*Pinus elliottii*), and pond (*Pinus serotina*) pines (Thompson and Baker 1971). Principal limiting factors for suitable habitat are fire suppression and lack of mature pines (USFWS 2003). A few large, solitary loblolly pines were observed within the stream bottoms throughout Woods Ferry, although these trees were generally located within a dense hardwood overstory not conducive to nesting habitat. Extensive foraging habitat is available within the open, maintained loblolly pine forest within Woods Ferry. No cavity trees were observed.

Habitat for the bald eagle primarily consists of mature forest in proximity to large bodies of open water for foraging. Large, dominant trees are utilized for nesting sites, typically within 1.0 mile of open water. The impoundment behind the Neal Shoals dam on the Broad River and associated floodplain forests may provide foraging and nesting habitat for the bald eagle. Surveys for nesting bald eagles should be performed within the proposed study watersheds. Specifically, surveyed areas would include appropriate habitat located within 1 mile of the Broad River.

Additional investigation will be conducted for these species to determine if suitable habitat exists. A Section 7 Endangered Species Act clearance will be obtained from the USFWS prior to restoration activities.

4.4.2.8 Site Design and Implementation Constraints

The presence of conditions or characteristics that could hinder restoration activities on the site has been evaluated at a preliminary level. A more-detailed evaluation will be undertaken during the final mitigation plan phase of the project. The evaluation will include but not be limited to the presence of hazardous materials, utilities and restrictive easements, rare/threatened/endangered species or critical habitats, cultural resources, and the potential for hydrologic trespass onto adjacent property. Currently, no evidence of natural or man-made conditions has been identified that could potentially impede proposed restoration activities, and the site appears to have suitable conditions for successful restoration.

4.4.3 Reference Sites

A fundamental concept of stream restoration entails the development and application of regional hydraulic geometry curves to stream reconstruction and enhancement activities. The use of regional curves is a quantitative way to predict the relationship between bankfull channel dimensions (e.g., area, width, depth, discharge) to the size of a watershed area. Hydraulic geometry curves for the South Carolina Piedmont were published in 2004 (Arcadis and SCDOT 2004). These curves characterize a limited number of streams (n=10) over a broad range of watershed sizes within the Piedmont physiographic province. Hydraulic geometry curves have also been developed for the Piedmont of North Carolina (Harmon et al. 1999) and will be used in addition to the South Carolina curves for comparative purposes. Small watersheds or deviations in valley slope, land use, landform, or geologic substrate may not be accurately described by the Piedmont curves. Therefore, on-site and off-site reference reaches will be utilized in conjunction with the regional curves for detailed planning and characterization of streams (Attachment C, Photos 13–16).

Reference stream reaches are further utilized to describe the plan view, profile, and cross-sectional attributes of a stable stream channel that is of the same stream type as that proposed for the restoration site. These sites will also provide reference forest community data to supplement species planting lists and those described in the literature with existing on-site descriptions.

4.5 DETERMINATION OF CREDITS

Preliminary potential stream credit determinations for Woods Ferry were generated pursuant to the USACE Charleston District Guidelines (USACE 2010a). The Charleston District Guidelines provide a detailed process for itemizing and calculating the “Proposed Mitigation Credits” related to stream mitigation. The Proposed Mitigation Credits are calculated by multiplying the length of each identified restoration reach by an “R Factor,” which is a modifying variable calculated by evaluating six “Restoration Mitigation Factors” that determine the amount of mitigation credits a site can generate.

The preliminary credits for Woods Ferry streams have been calculated based on a representative sample reach within each of the six streams. During final mitigation plan studies, a reach-by-reach assessment will be made to complete a final credit determination. The mitigation factors used in the preliminary determination of credit were confirmed during an on-site meeting with the USACE. Restorable stream reaches were identified using a desktop survey of existing geographic information, followed by a reconnaissance-level assessment of landscape history, degree of channel incision (bank height ratio), Rosgen stream type (Rosgen 1996), stream evolutionary development, and current stream bank erosion potential. From these site investigations, an estimated 85,388 linear feet of potentially restorable streams were identified within Woods Ferry watersheds (see Figure C-7). Estimated mitigation factors, estimated length of restorable streams, and stream credit are provided in Table C-5. An estimated 319,222 potential stream mitigation credits have been identified within the six Woods Ferry study streams. The worksheets for determining the preliminary estimate of stream credit is provided in Attachment B.

4.6 MITIGATION WORK PLAN

There are a variety of approaches that may be used to restore incised channels. Rosgen (1997) classified restoration approaches for incised streams into four categories called Priority 1 through 4. The restoration concepts described in the four categories of incised channels incorporate the concepts of the site history, channel evolutionary tendencies, and natural channel design. The four Priority categories include returning the stream to its original elevation (Priority 1), excavating or widening the floodplain (i.e., to contain appropriate stream belt width) to construct a new channel at existing bed elevation (Priority 2), and stabilizing in-place through various bank stabilization or vegetation planting techniques (Priority 3 and 4).

Priority 2 stream restoration appears to offer the best solution for restoring the stream impairments typically found within Woods Ferry. Priority 2 restoration would entail the excavation of a functional floodplain relative to the existing channel elevation and at design parameters appropriate for the proposed channel. This approach would convert the existing F and G channels to C, B, and E stream types by establishing a new, stable stream and floodplain without requiring extensive downstream grade controls. The new channel should approximate reference reach conditions including appropriate pattern, dimension and profile. A full application of the hierarchical assessment (Levels I–V) of channel morphology will be implemented during the final mitigation plan development. However, from a project implementation point of view, the primary installation activities designed to restore on-site streams using Priority 2 methodology will include:

1. Apply natural channel design methodologies to stream restoration.
2. Excavate floodplain encompassing the belt width at current stream elevations.
3. Soil scarification and enhancement.

Table C-5
Preliminary Stream Mitigation Credit Estimate for Woods Ferry

Stream Reach	Estimated Restoration Mitigation Factor	Estimated Length of Restorable Streams (linear feet)	Total Estimated Stream Credits
Clarks Creek	4.25	32,987	140,195
Unnamed tributary to Clarks Creek	3.45	14,753	50,898
McCluney Branch	3.45	9,263	31,957
Little Turkey Creek	3.25	11,981	38,941
Mountain Creek	3.45	12,735	44,573
Unnamed tributary to Broad River	3.45	3,669	12,658
		Total Estimated Stream Credits	319,222

4. Plant community restoration.
5. Non-native invasive plant management.

The Priority 2 restoration concept is expected to have the potential to restore an estimated 85,388 linear feet of stream within Woods Ferry. A brief description of the restoration installation activities is provided below.

4.6.1 Stream Restoration

Figure C-10 depicts a typical conversion that would take place with Priority 2 stream restoration, using the typical cross section from Little Turkey Creek (Figure C-8-2). In general, a new floodplain is excavated to a width (i.e., belt width) that is sufficient to encompass the full meander pattern of a stream based on stable channel design criteria. In conjunction with the new floodplain, a new channel will be constructed that will contain bankfull flows. Larger flows would fill the channel and enter the new floodplain. The morphological adjustments in Figure C-10 reflect a conversion from a Rosgen F5 stream type to a Rosgen C3 type. The entrenchment ratio is raised from approximately 1.4 to a minimum of 3.0 in the proposed section. In keeping with regional hydraulic geometry curves, the "bankfull width/bankfull mean depth" ratio (W/D) would increase from 10.4 to 13 (Arcadis and SCDOT 2004).

Performing extensive grading on both sides of streams may not be possible or desirable (due to unforeseen bedrock formations, for example). Site-specific decisions may be required to determine the extent of grading and stream adjustments that are desirable for each reach. Existing bridges and roadway crossing of streams proposed for restoration will require a hydrologic evaluation to determine any constraints, and if possible redesign of the existing structure may be required.

4.6.2 Floodplain Excavation

New floodplains will be excavated adjacent to the existing streams as depicted in Figure C-10. The objective of floodplain excavation is to reconnect the stream with the historic floodplain at an appropriate bankfull elevation and provide floodplain energy dissipation during periods of high flow. Excavated material is expected to be removed completely from the restoration areas and disposed of in uplands as determined appropriate after discussions with the Forest Service. After excavation, the floodplain will provide a relatively level surface and will be planted with native vegetation that is expected to quickly stabilize and help reduce flow velocities in floodwaters, filter pollutants, and provide wildlife habitat. Opportunities for limited floodplain and oxbow wetland restoration along the restored channel will be evaluated during development of the Final Mitigation Plan.

4.6.3 Soil Scarification and Enhancement

The legacy sediments found in the stream bottoms were generally found to be very coarse, highly porous, and low in nutrients. Soils on valley side slopes have been stripped of topsoil, are poor in nutrients, and are compacted. Soil enhancement measures will be employed during restoration to assist in reversing the effects of past soil degradation. Before the Site is planted, all cleared or disturbed areas will be site-prepared and enhanced as necessary per the specific on-site conditions. For example, soil will be tested for compaction and silvicultural prescriptions will be developed to improve conditions for riparian forest development. Soils will also be tested for nutrient levels and soil amendments will be applied at recommended rates.

4.6.4 Plant Community Restoration

Restoration of floodplain and upland forest communities provides habitat for area wildlife and allows for development and expansion of characteristic species across the landscape. Plant community reestablishment within restoration areas will include planting of vegetation consistent with reference data, on-site observations, and community descriptions adapted from Nelson (1986).

Revegetating the floodplain and stream banks will 1) provide stream bank stability, shading, and moderate surface water temperature, 2) filter pollutants from adjacent runoff, 3) moderate runoff times, and 4) provide habitat for wildlife. The vegetated stream buffer will extend up to 300 feet on both sides of all streams. Forest regeneration areas will be site-prepared and treated as necessary prior to planting (see Section 4.6.3). Variations in vegetative planting may occur based on topographic locations and moisture conditions of the soil. Species distribution and densities are expected to be determined during development of the Final Mitigation Plan.

Planting units expected for this project may include the following plant communities and attendant suites of species (Nelson1986).

Stream-side Assemblage

1. Box Elder (*Acer negundo*)
2. White Ash (*Fraxinus americana*)
3. River Birch (*Betula nigra*)
4. Tag Alder (*Alnus serrulata*)
5. American Sycamore (*Platanus occidentalis*)
6. Ironwood (*Carpinus caroliniana*)
7. Giant Cane (*Arundinaria gigantea*)
8. Elderberry (*Sambucus canadensis*)
9. Arrow-wood Viburnum (*Viburnum dentatum*)
10. Blackhaw Viburnum (*Viburnum prunifolium*)
11. Swamp Dogwood (*Cornus amomum*)

Small Stream Forest

1. White Ash (*Fraxinus americana*)
2. Bitternut Hickory (*Carya cordiformis*)
3. River Birch (*Betula nigra*)
4. Water Oak (*Quercus nigra*)
5. Willow Oak (*Quercus phellos*)
6. American Sycamore (*Platanus occidentalis*)
7. Yellow Poplar (*Liriodendron tulipifera*)
8. Hackberry (*Celtis laevigata*)
9. American Elm (*Ulmus americana*)
10. American Holly (*Ilex opaca*)
11. Shagbark Hickory (*Carya ovata*)
12. Black Walnut (*Juglans nigra*)
13. Box Elder (*Acer negundo*)

Mesic Mixed Hardwood Forest

1. Yellow Poplar (*Liriodendron tulipifera*)
2. American Beech (*Fagus grandifolia*)
3. White Oak (*Quercus alba*)
4. Red Oak (*Quercus rubra*)
5. Black Oak (*Quercus velutina*)
6. Mockernut Hickory (*Carya alba*)
7. White Basswood (*Tilia heterophylla*)
8. Pignut Hickory (*Carya glabra*)
9. Flowering Dogwood (*Cornus florida*)
10. American Hornbeam (*Carpinus caroliniana*)
11. Sourwood (*Oxydendrum arboreum*)
12. Blackgum (*Nyssa sylvatica*)

4.6.5 Non-Native Invasive Plant Management

A variety of non-native plant species that have been introduced to the United States have spread into the project vicinity. These non-native species are often pests because they have no natural controlling agent and can spread unchecked into the native forest. Some non-native plants are aggressive and displace native species, posing a threat to native ecosystems. Exotic species currently identified within the project area include Japanese stilt grass (*Microstegium vimineum*), Japanese privet (*Ligustrum japonica*), Chinese privet (*Ligustrum sinense*), kudzu (*Pueraria lobata*), sericea lespedeza (*Lespedeza cuneata*), Japanese honeysuckle (*Lonicera japonica*), Chinese wisteria (*Wisteria sinensis*), tree-of-heaven (*Ailanthus altissima*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), and Chinaberry (*Melia azedarach*). Non-native floral species will be documented during the final mitigation plan phase. At this stage of project development, methods for control of these species have not been determined; however, prescribed fire, manual plant removal by cutting and grubbing, or selective chemical herbicide treatments may likely be required to control these and other exotic species.

4.7 MAINTENANCE PLAN

After restoration activities are completed, and yearly during the 5-year monitoring period, the entire limits of the restored sites will be evaluated and any potential problems will be documented in writing, graphics, and photographs. Potential problem areas may include bank instability, in-stream structure failure, unsuccessful vegetation establishment, wildlife management issues (i.e., deer eating new plantings), or vandalism. In the event that the Site or a specific component of the Site fails to achieve the defined success criteria, Duke Energy will develop necessary adaptive management plans and/or implement appropriate remedial actions for the project in coordination with the USFS and the review agencies. Remedial action required will be designed to achieve the success criteria, and will include a work schedule and monitoring that will take into account physical and climatic conditions.

In accordance with the Collection Agreement, future maintenance of the restored sites will be assumed by the USFS after the 5-year monitoring period or in the event that the site is meeting its 5-year success criteria. Future maintenance of the restoration sites will be in accordance with the Conservation Land Use Agreement between the USFS and the USACE, as well as the Sumter National Forest Revised Land and Resource Management Plan (Forest Plan) (USFS 2004).

4.8 PERFORMANCE STANDARDS

Performance standards are observable or measurable physical, chemical and biological attributes that are used to determine if a mitigation project meets its objectives. The restoration performance standards for the project will follow accepted and approved criteria presented in recent site-specific restoration and mitigation plans developed in South Carolina, as well as in monitoring guidelines issued for compensatory mitigation by the USACE (USACE 2010a, 2008b). Based on finalized design objectives identified during detailed planning stages and input from commenting agencies, final performance standards will be specified in the Final Mitigation Plan. A brief description of the typical performance criteria is provided below.

4.8.1 Stream Performance Standards

Bankfull Events

Two bankfull flow events must be documented within the 5-year monitoring period within each stream where restoration is implemented. The two bankfull events must occur in separate years. Otherwise, the stream monitoring will continue until two bankfull events have been documented in separate years.

Cross-Sections

Vertical stability and enlargement rates and direction will be monitored using permanent cross-sections. Annual monitoring will include stream cross-sectional surveys of representative riffles and pools. Over the course of monitoring, there should be little change in the bankfull cross-sectional dimensions as compared with those in the baseline monitoring report (see Section 4.9.1). If significant changes do take place, the stream will be evaluated to determine if the changes represent a movement toward an unstable condition (e.g., down-cutting or erosion) or a movement toward increased stability (e.g., settling, vegetative changes, deposition along the banks, and decreases in width/depth ratio). Riffle cross-sections will be classified using the Rosgen stream classification system and should fall within the quantitative parameters defined for channels of the designed stream type, including width-to-depth ratio, entrenchment ratio, and low bank height.

Channel Pattern and Longitudinal Profile

Annual monitoring will include a survey of channel pattern along the thalweg (stream center line) and a longitudinal profile of each restored reach. Profile measurements consist of the facet slopes for each of the features in the channel (riffle, run, pool, and glide). The pattern data will be checked to ensure that the thalweg is not excessively meandering from the design. The longitudinal profile should show stable bedform features (i.e., not aggrading or degrading). The pools should remain deep with flat water surface slopes, and the riffles should remain steeper and shallower. The pattern and profile survey will provide a comparison between the design plans and previous surveys, and assist in determining stream channel stability.

Bed Material Analyses

The composition of the stream bed is a good indicator of changes in hydraulics, erosion rates, and sediment supply. A pebble count gives a quantitative description of the bed material. Bed material analyses will be collected as part of the annual stream monitoring. A pebble count will be performed at permanent cross section locations within each reach of the project. The pebble count can show that the median grain size (d_{50}) of the channel substrate is trending to or maintaining the designed distribution.

Channel Stability Analysis (Hydrologic and Sediment Transport Studies)

The constructed stream banks will be monitored and assessed for their stability. The monitoring may include bank erosion height index (BEHI) ratings, bank pin installation, bank profile surveys, and/or permanent cross sections. Post-restoration channel stability and bank-erosion monitoring results can be compared to preconstruction data to determine if the restoration work has improved channel stability, and thereby lessened stream bank erosion. The use of reference streams and baseline data will be used to establish performance standards for evaluating bank and bed erosion rates.

Biological Monitoring

Physical changes in stream geomorphology are often directly related to aquatic fauna communities. Stream aggradation, degradation, and enlargement affect in-stream habitats (i.e., pool size and frequency) and therefore species diversity. Biological monitoring can be used to contrast observed data with baseline or reference (expected) data. Biological monitoring may include 1) a limited analysis of habitat rehabilitation through changes in sediment supply, removal of stream instability, or changes in the benthic macroinvertebrate community; 2) ambient water quality monitoring; and 3) fish sampling to detect fish species and habitat types before and after the project.

Photograph Reference Stations

Photographs will be used to qualitatively evaluate channel aggradation or degradation, bank erosion, growth and survival of riparian vegetation, and effectiveness of erosion control measures. Fixed photographic points will be established at locations along the restored streams, including cross sections and vegetation monitoring plots. Photographs will be compared from year to year to evaluate vegetative growth and channel stability. Longitudinal stream photographs should indicate the absence of developing bars within the channel or excessive increases in channel depth. Lateral stream photos should indicate the absence of significant bank erosion and the succession of the vegetation community.

4.8.2 Vegetation Performance Standards

Performance standards will be established to verify that the riparian vegetation community development is on a trajectory to meet mitigation goals, without an abundance of nuisance species. The success criteria for plant community restoration will be based on the annual and cumulative survival and growth of characteristic tree species. All planted and volunteer canopy tree species identified in Nelson (1986) and in reference studies will be utilized to define characteristic tree species.

No quantitative sampling is proposed for the shrub or herbaceous assemblages as part of the vegetation success criteria. Visual estimates of the percent cover of shrub and herbaceous species along with photographic documentation will be submitted for informational purposes. Development of floodplain and upland forests over the course of several decades will dictate the establishment of desired understory and groundcover species. During the monitoring phase, restoration areas are projected to resemble early-successional versions of the target communities described in Nelson (2006) and reference areas (see Sections 4.4.3 and 4.6.4).

Nuisance species will be identified and controlled so that none become dominant or alter the desired plant community structure of the sites. If nuisance plants are identified as a problem for the sites, a species-specific control plan will be developed and implemented.

4.9 MONITORING REQUIREMENTS

4.9.1 Monitoring Reports

A baseline monitoring report documenting the stream restoration construction work will be completed within the 90 days following the substantial completion of vegetation planting. The baseline monitoring report will restate the project goals and objectives, detail restoration components, identify the success criteria and monitoring plan, and provide supporting information and data. Examples of the supporting information or data that will be provided include record drawings, site photographs, permanent stream transect locations, sampling plot locations, a description of initial species composition by community type and density, and monitoring station locations. The report will also describe maintenance and repair requirements and contingencies.

The 5-year monitoring program will be implemented at the beginning of the first growing season following construction. The monitoring program is designed to document both stream and plant community development and progress toward achieving the performance standards referenced in Section 4.8. Stream morphological and ecological surveys, as well as vegetation surveys, will be conducted to determine the success of the restoration work, as determined in the Final Mitigation Plan. The monitoring program will be undertaken for 5 years unless otherwise approved by the USACE.

Annual monitoring reports will be prepared by the end of each calendar year following the guidelines issued for monitoring requirements in the USACE Regulatory Guidance Letter No. 08-03 (USACE 2008b). The annual report will be submitted to the USACE by December 31 of the year during which the monitoring was conducted. The fifth or final report will include a Summary Report that provides an assessment of the entire monitoring period. The monitoring report will include but not be limited to:

- Project Overview
  - USACE Permit Number
  - Name of responsible party
  - Brief description of project describing type of impacts and type of mitigation to compensate for impacts
  - Written description of location
  - Project dates
  - Brief statement on progress toward performance standards
  - Dates of corrective maintenance activities
  - Specific recommendations of remedial actions
- List of Requirements and Performance Standards
- Summary Data
  - Photographs of views of the restored Site taken from fixed photo stations
  - Cross-section and longitudinal profiles
  - Methods, results and interpretation of all data collected
  - Hydrologic information, as described above
  - Vegetation data, as described above
  - Identification and mapping of any nuisance species
  - A description of any damage done by animals or vandalism
  - Wildlife observations
- Maps showing the location of stream monitoring set-up, vegetation sampling plots, and permanent photo points.
- Conclusions

4.9.2 Monitoring Parameters

The monitoring parameters for the project will follow accepted and approved criteria presented in recent site-specific restoration and mitigation plans developed in South Carolina, as well as in monitoring guidelines issued for compensatory mitigation by the USACE (USACE 2010a, 2008b). Based on finalized design objectives identified during detailed planning stages and input from commenting agencies, final monitoring parameters will be specified in the Final Mitigation Plan. A brief description of the typical monitoring parameters is provided below.

4.9.2.1 Stream Monitoring Parameters

Bankfull Events

The occurrence of bankfull events within the monitoring period will be documented by the use of a crest gauge and photographs. One crest gauge will be installed within each restored stream. The crest gauge will record the highest watermark between site visits. Photographs will be used to supplement the documentation of bankfull events including occurrences of recent debris lines and sediment deposition on the floodplain.

Cross-Sections

Permanent surveyed cross-sections will be established along the restoration reaches at a frequency sufficient for assessing dimensional stream stability. Cross-section locations will be selected that represent the stream type and capture the variability in the dimensional features. Each cross-section will be established and marked on both banks with permanent pins. A common benchmark will be used for cross-sections and consistently used to facilitate comparison of year-to-year data. The annual survey will include points measured at all breaks in slopes including top of bank, bankfull, inner berm, edge of water, and thalweg.

Channel Pattern and Longitudinal Profile

Baseline and annual monitoring surveys will be completed to track the channel pattern and longitudinal profile of the restored channel. The pattern and profile will be measured for a minimum of 3,000 linear feet of restored channel within each stream. Measurements will include thalweg (e.g., riffle, run, pool, glide), water surface, bankfull (at head of each riffle), and additional features along the thalweg that best describes the channel.

Bed Material Analyses

A Wolman pebble count will be completed at every cross-section as part of the annual stream monitoring (Wolman 1954). A pebble count will be completed to show that the median grain size (d_{50}) of the channel substrate is trending to or maintaining the designed distribution.

Photo Reference Stations

Photographs will be used to visually document stream stability and plant community restoration success. Fixed photo station will be used before construction and be continued for at least 5 years following construction. Fixed photo station shots will be taken a minimum of once per year. Photographs will be taken from a height of the photographer. Permanent markers will be established to ensure that the same locations and views are photographed.

Lateral and longitudinal photographs will be taken at each permanent cross-section. Photographs will be taken from both banks and up and down stream. Photographers will make every effort to consistently maintain the same area in each photo over time.

4.9.2.2 Vegetation Monitoring Parameters

After planting has been completed in late winter or early spring, an initial evaluation will be performed to verify planting methods and determine the initial species composition and density.

Supplemental planting and additional site modifications will be implemented, if necessary. During the first year, vegetation will receive preliminary visual evaluation on a periodic basis to monitor any overtopping of character tree species by nuisance species.

Vegetation sampling will be collected in late summer or early fall for five years or until the vegetation success criteria is achieved. Permanent 100-square-meter sampling plots will be established at stratified locations in all restored reaches at a frequency sufficient for interpreting vegetation success criteria. The sampling plots will equally represent the various hydrologic regimes and plant communities that are established. Vegetation parameters to be monitored include species composition and species density. Sample visual observations of the percent cover of shrub and herbaceous species will also be recorded for informational purposes. Nuisance vegetation will also be noted during data collection. One yearly photograph of each plot will be collected.

Successful restoration of the plant community on a stream restoration site is dependent upon proper soil remediation, proper planting procedures, good planting stock and volunteer recruitment of native plants. In order to determine if the vegetation success criteria have been achieved, a vegetation monitoring protocol will be developed for the Site.

4.10 LONG-TERM MANAGEMENT PLAN

4.10.1 Ownership of the Mitigation Site

The USFS currently owns and will retain ownership of the Woods Ferry mitigation sites. Duke Energy and the USFS will enter into a Collection Agreement to formalize a cooperative relationship and provide the framework for coordinating activities and responsibilities necessary to implement and monitor the mitigation work. Details of the agreement will be specified in the Final Mitigation Plan.

4.10.2 Identity of Long-Term Steward

As property owner, the USFS will also be the long-term steward of the Woods Ferry mitigation sites, with specific land use restrictions and maintenance obligations, if any, defined in the Sumter Forest Plan [USFS 2004] and the Conservation Land Use Agreement between the USFS and USACE. Additional details concerning roles and responsibilities as long-term steward will be specified in the Final Mitigation Plan.

4.10.3 Identification of Long-Term Management Activities

The restoration sites would benefit from continuing forest management following the minimum 5-year monitoring program typically associated with mitigation sites. To ensure long-term protection of the mitigation sites, they will be managed in accordance with the Conservation Land Use

Agreement and Forest Plan. The entities involved in long-term management, and their respective roles, will be discussed in the Final Mitigation Plan.

4.10.4 Funding Mechanism

The funding mechanism for long-term management activities, if any, will be addressed through the Collection Agreement and will be specified in the Final Mitigation Plan.

4.10.5 Justification for Level of Funding

Long-term management funding, if any, will be addressed through the Collection Agreement and will be specified in the Final Mitigation Plan.

4.11 ADAPTIVE MANAGEMENT

The stream mitigation sites are proposed to be managed by the USFS under the terms of the Conservation Land Use Agreement between the USFS and USACE, as well as the Forest Plan. Adaptive Management will be addressed in the Final Mitigation Plan.

4.12 FINANCIAL ASSURANCES

Financial assurances will be addressed per the terms and conditions developed in the site Collection Agreement and/or Final Mitigation Plan, as appropriate.

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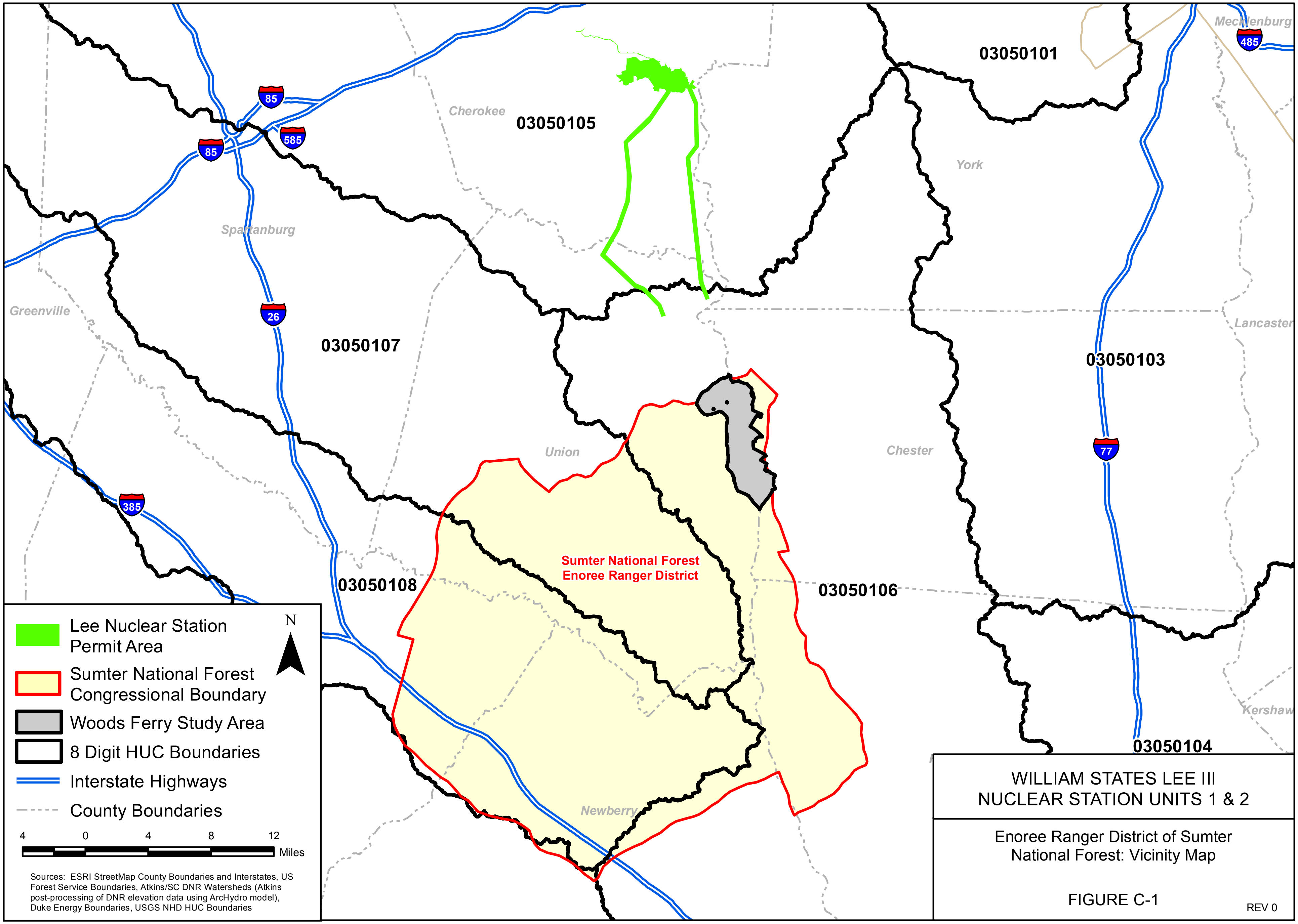
Attachment C-1

Figures

Attachment C-1: Figures

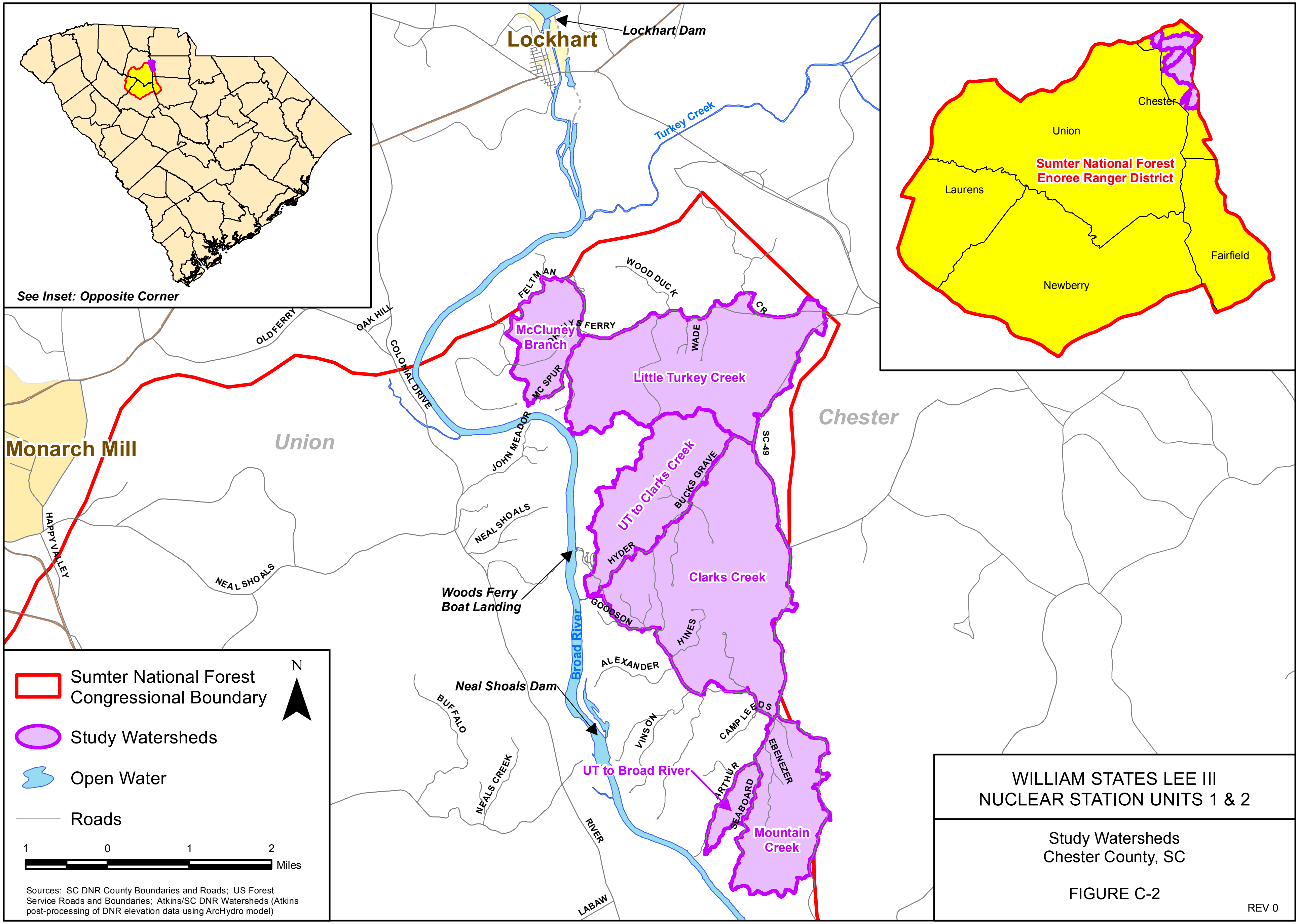


WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Enoree Ranger District of Sumter National Forest: Vicinity Map

FIGURE C-1

REV 0

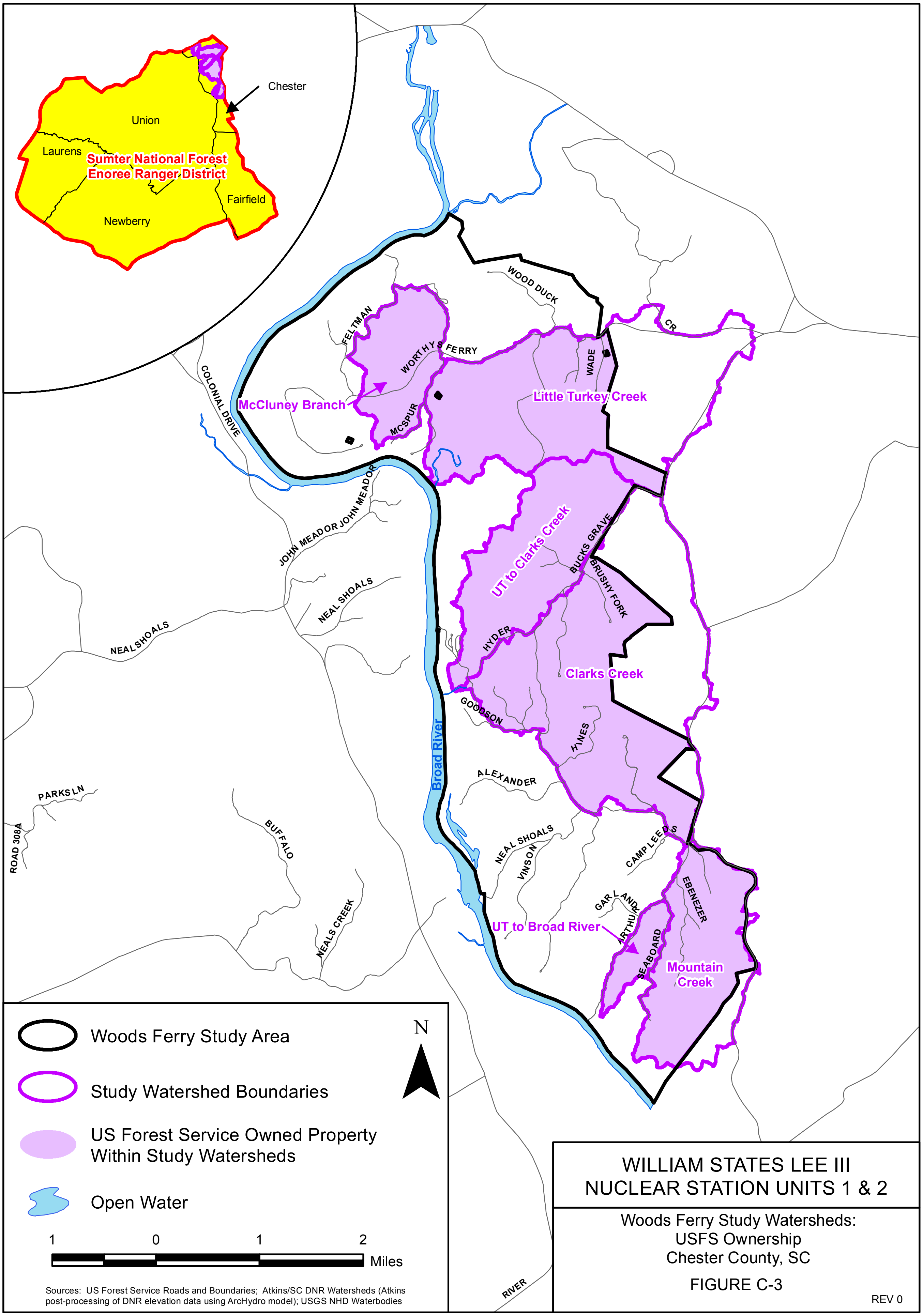


WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Study Watersheds
Chester County, SC

FIGURE C-2

REV 0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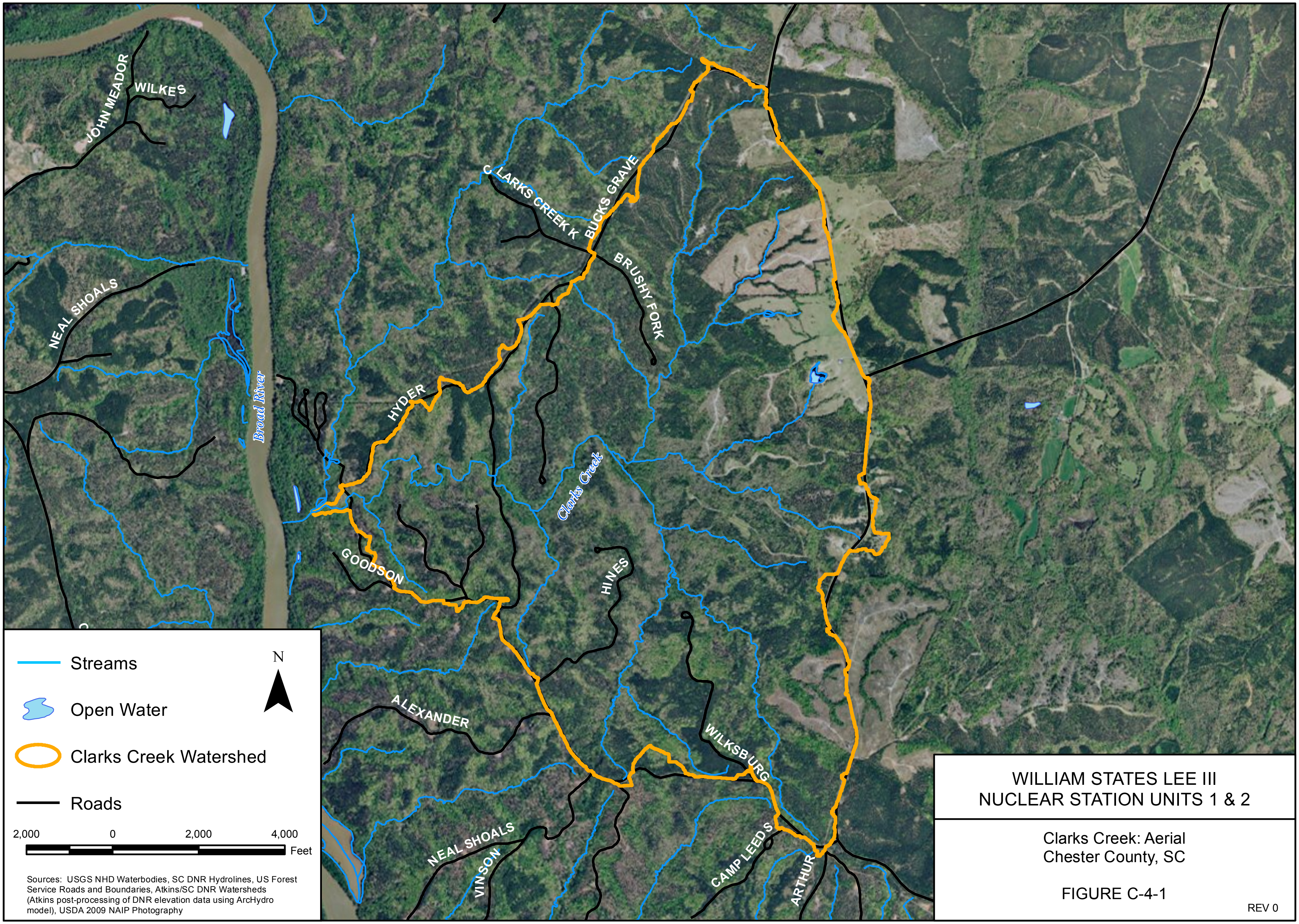
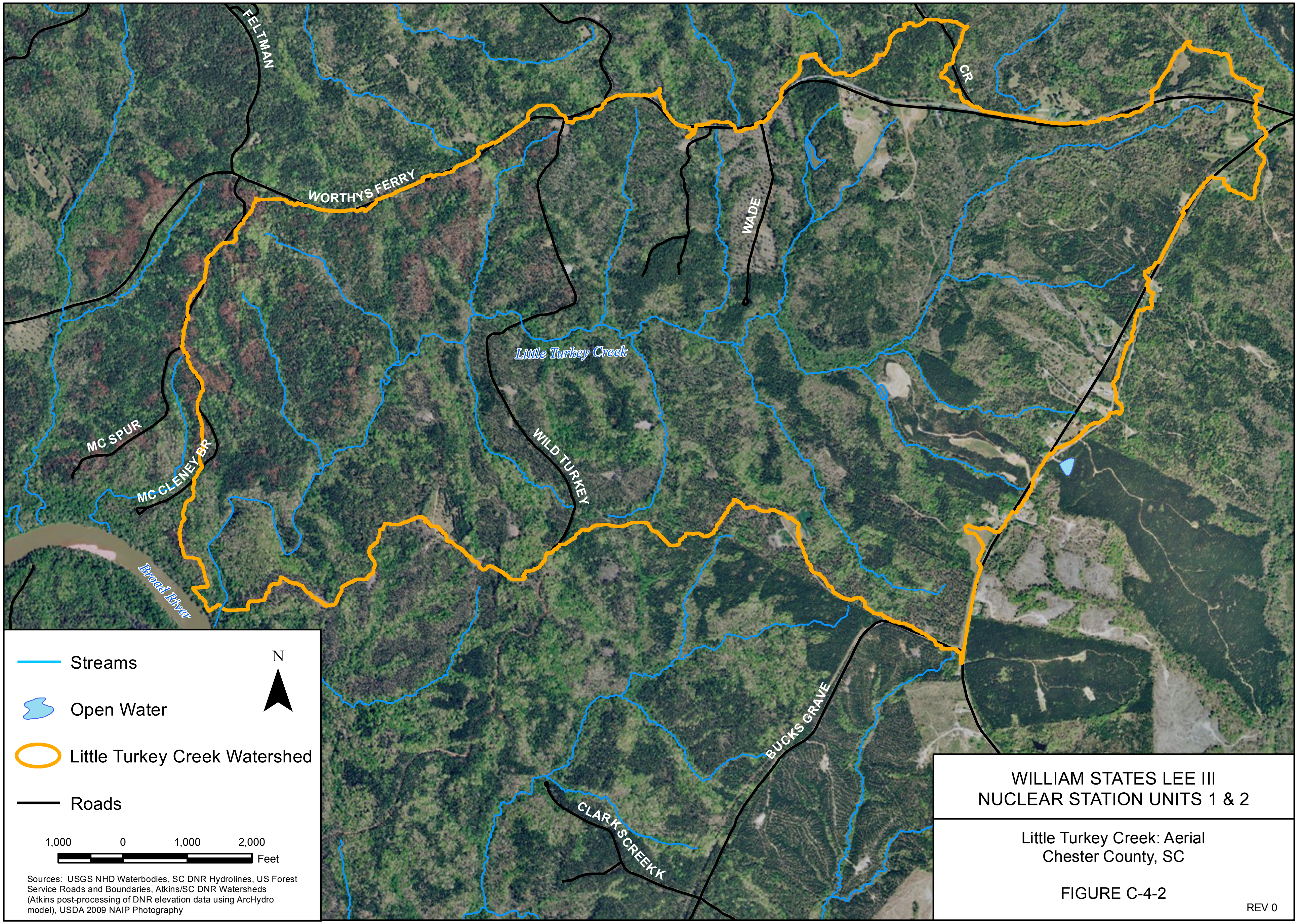
Union
Laurens
Sumter National Forest
Enoree Ranger District
Fairfield
Newberry
WOOD DUCK
CR
FELTMAN
WORTHYS FERRY
WADE
Little Turkey Creek
McCluney Branch
MCSPUR
COLONIAL DRIVE
JOHN MEADOR
UT to Clarks Creek
BUCKS GRAVE
BRUSHY FORK
NEAL SHOALS
HYDER
Clarks Creek
GOODSON
HINES
Broad River
ALEXANDER
PARKS LN
ROAD 308A
BUFFALO
CAMP LEEDS
VINSON
GARLAND
ARTHUR
EBENEZER
UT to Broad River
SEABOARD
Mountain Creek
NEALS CREEK
RIVER
Woods Ferry Study Area
Study Watershed Boundaries
US Forest Service Owned Property Within Study Watersheds
Open Water
N
1 0 1 2
Miles
Sources: US Forest Service Roads and Boundaries; Atkins/SC DNR Watersheds (Atkins post-processing of DNR elevation data using ArcHydro model); USGS NHD Waterbodies
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
Woods Ferry Study Watersheds:
USFS Ownership
Chester County, SC
FIGURE C-3
REV 0



WILKES
JOHN MEADOR
NEAL SHOALS
Broad River
CLARKS CREEK K
BUCKS GRAVE
BRUSHY FORK
HYDER
Clarks Creek
GOODSON
HINES
ALEXANDER
WILKSBURG
NEAL SHOALS
VINSON
CAMP LEEDS
ARTHUR
Streams
Open Water
Clarks Creek Watershed
Roads
N
2,000
0
2,000
4,000
Feet
Sources: USGS NHD Waterbodies, SC DNR Hydrolines, US Forest Service Roads and Boundaries, Atkins/SC DNR Watersheds (Atkins post-processing of DNR elevation data using ArcHydro model), USDA 2009 NAIP Photography
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
Clarks Creek: Aerial
Chester County, SC
FIGURE C-4-1
REV 0

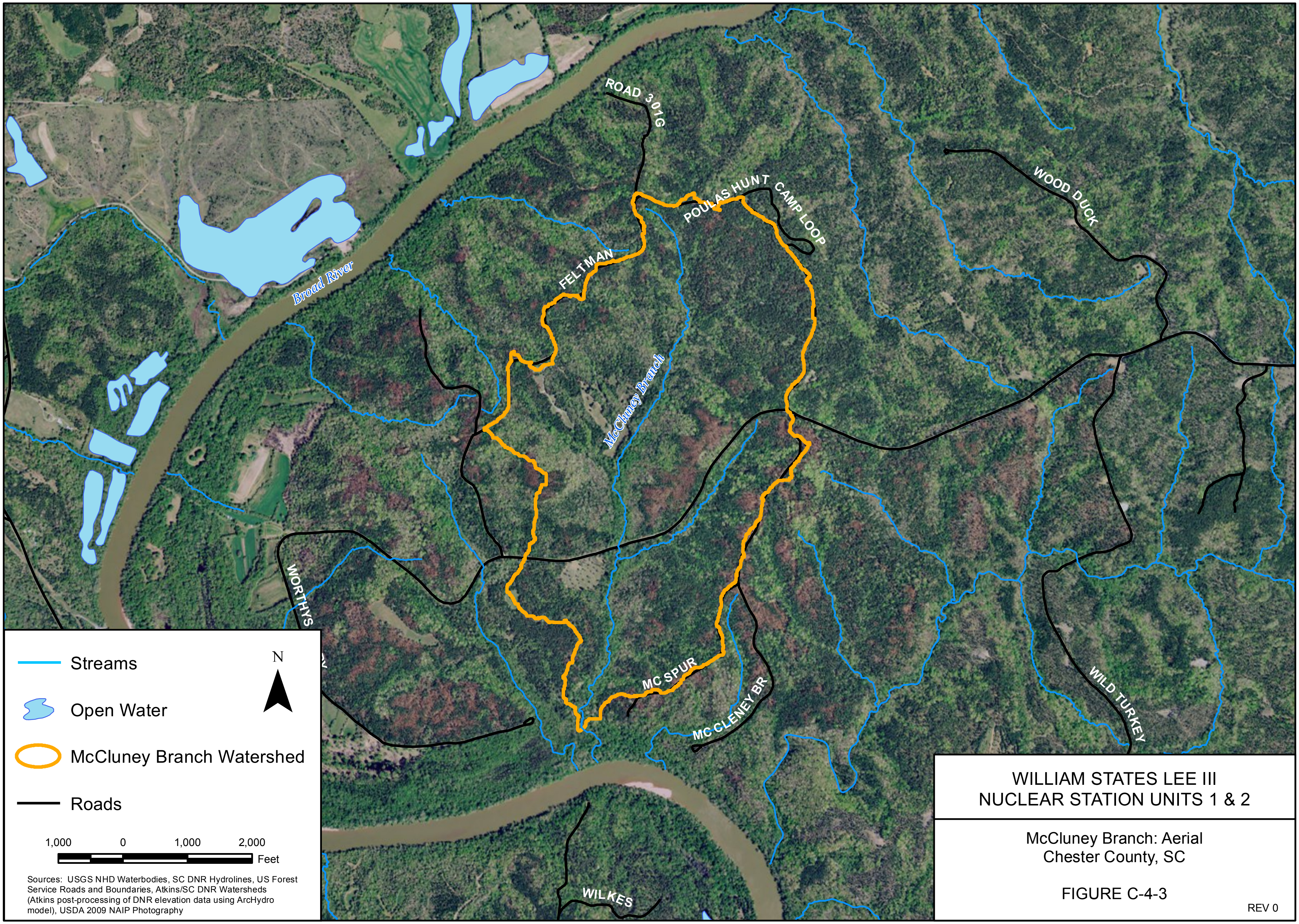


WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

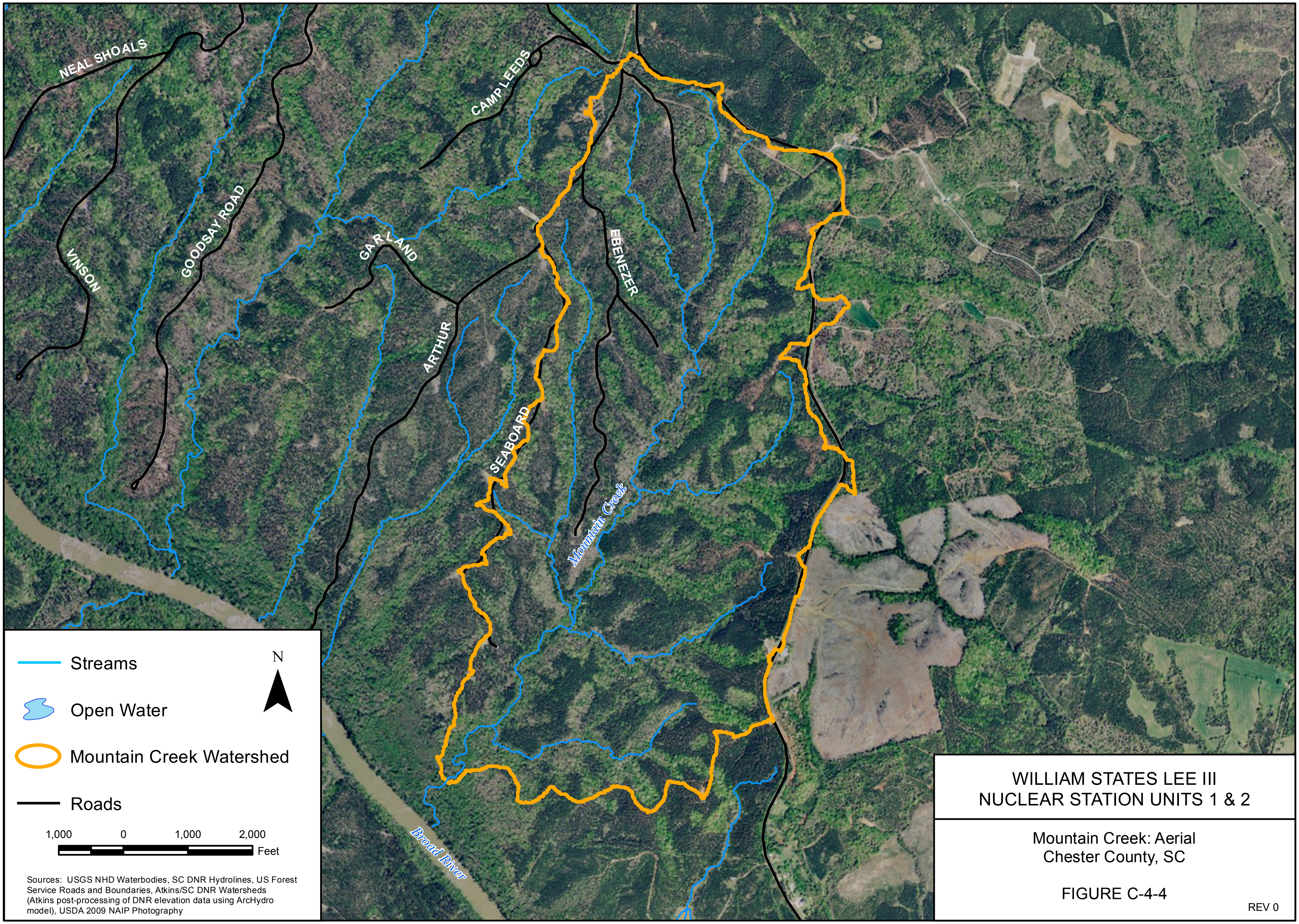
Little Turkey Creek: Aerial
Chester County, SC

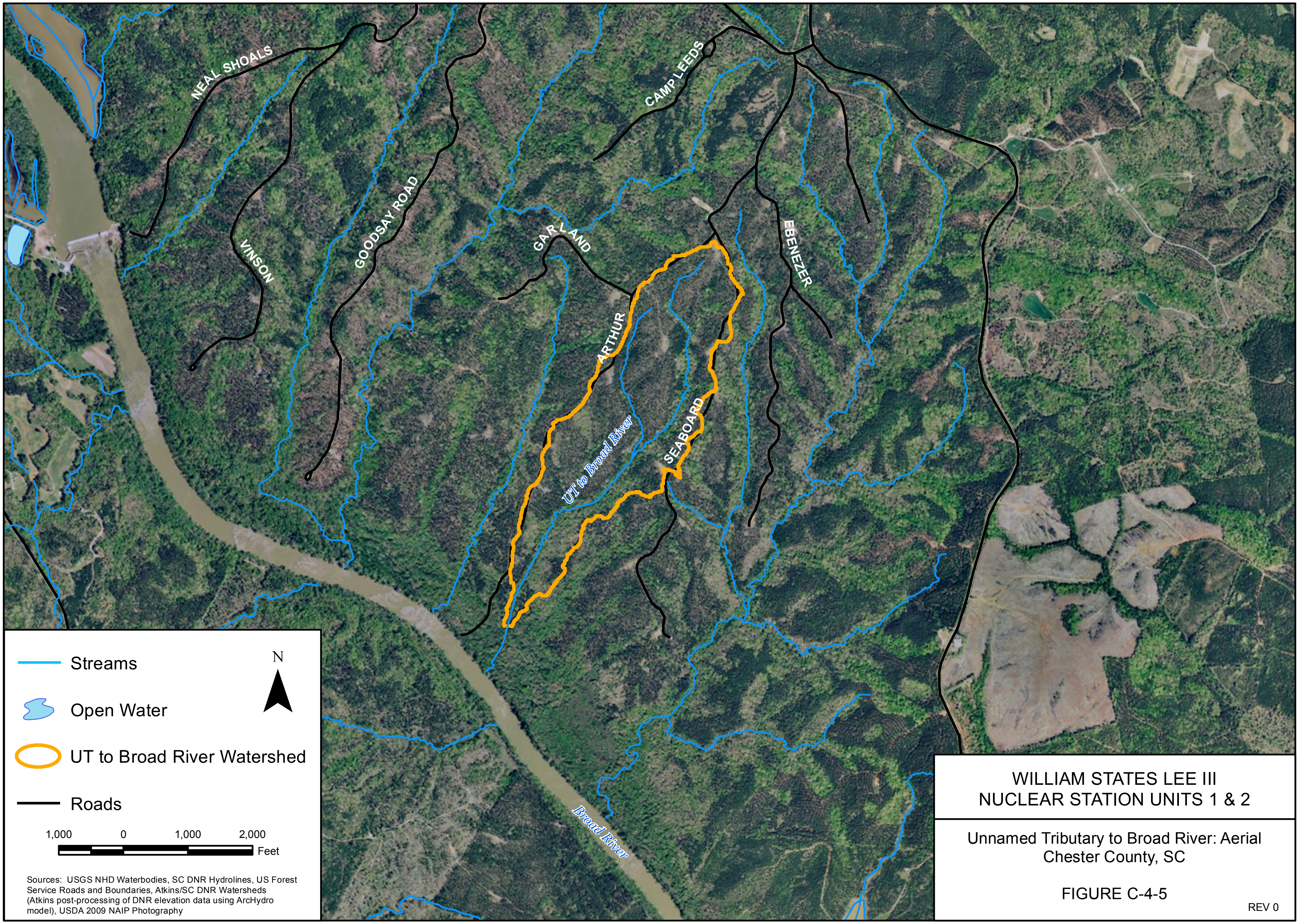
FIGURE C-4-2

REV 0



ROAD 301G
POULAS HUNT CAMP LOOP
WOOD DUCK
FELTMAN
Broad River
McCluney Branch
WORTHYS
MC SPUR
MC CLENEY BR
WILD TURKEY
WILKES
Streams
Open Water
McCluney Branch Watershed
Roads
N
1,000 0 1,000 2,000
Feet
Sources: USGS NHD Waterbodies, SC DNR Hydrolines, US Forest Service Roads and Boundaries, Atkins/SC DNR Watersheds (Atkins post-processing of DNR elevation data using ArcHydro model), USDA 2009 NAIP Photography
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
McCluney Branch: Aerial
Chester County, SC
FIGURE C-4-3
REV 0


NEAL SHOALS
CAMP LEEDS
VINSON
GOODSAY ROAD
GARLAND
EBENEZER
ARTHUR
SEABOARD
Mountain Creek
Broad River
Streams
Open Water
Mountain Creek Watershed
Roads
N
1,000 0 1,000 2,000
Feet
Sources: USGS NHD Waterbodies, SC DNR Hydrolines, US Forest Service Roads and Boundaries, Atkins/SC DNR Watersheds (Atkins post-processing of DNR elevation data using ArcHydro model), USDA 2009 NAIP Photography
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
Mountain Creek: Aerial
Chester County, SC
FIGURE C-4-4
REV 0

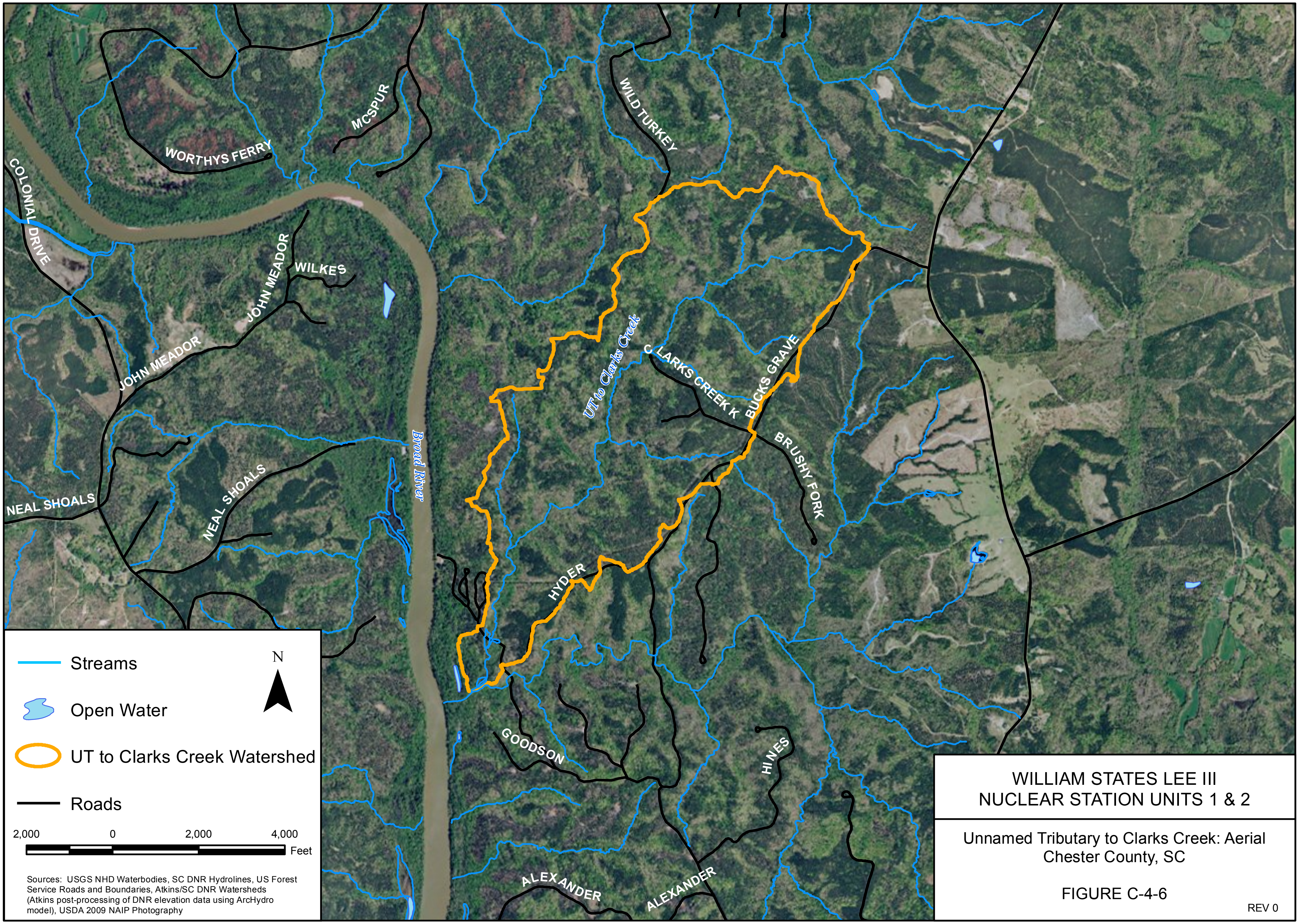


WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Unnamed Tributary to Broad River: Aerial
Chester County, SC

FIGURE C-4-5

REV 0

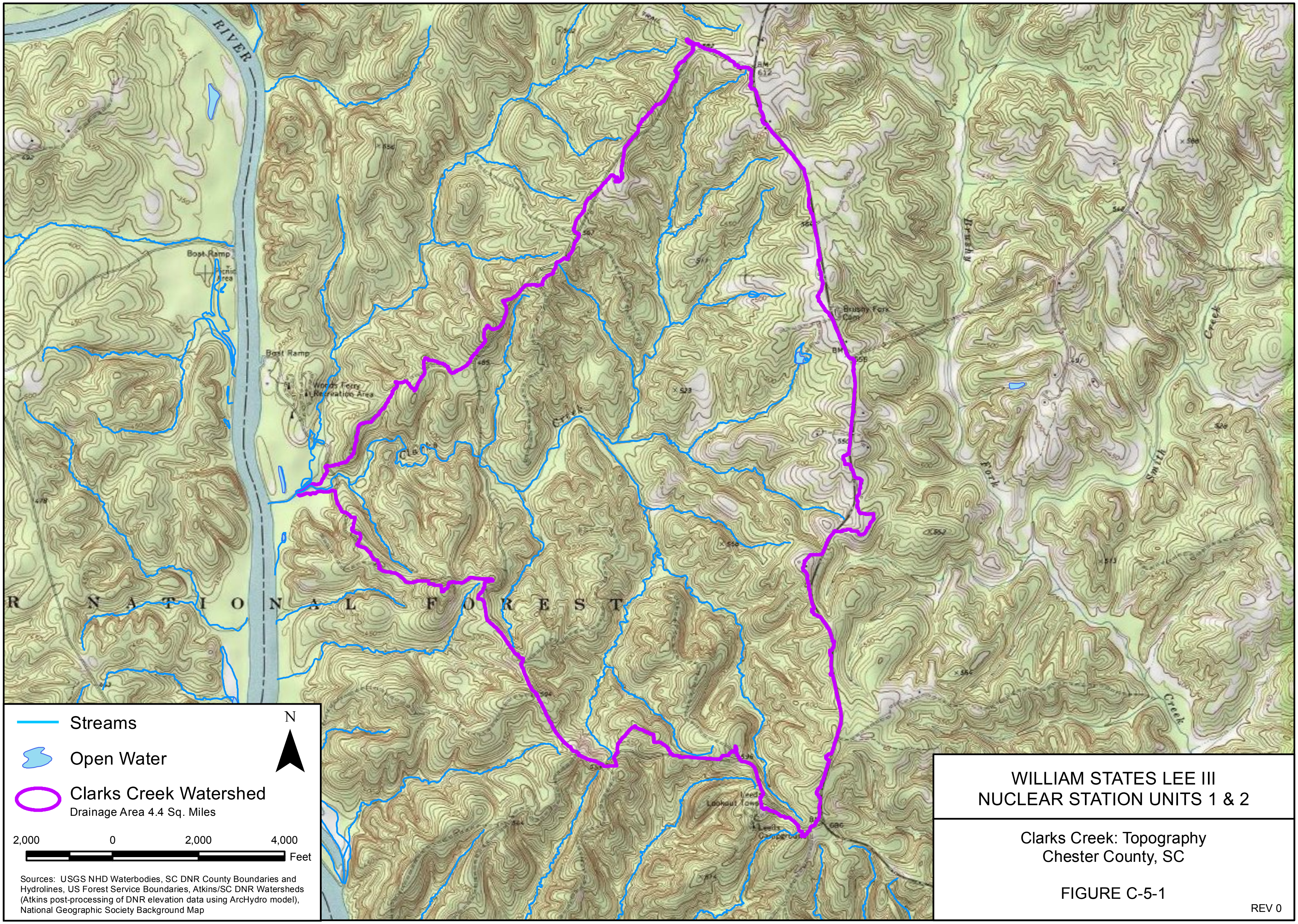


WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

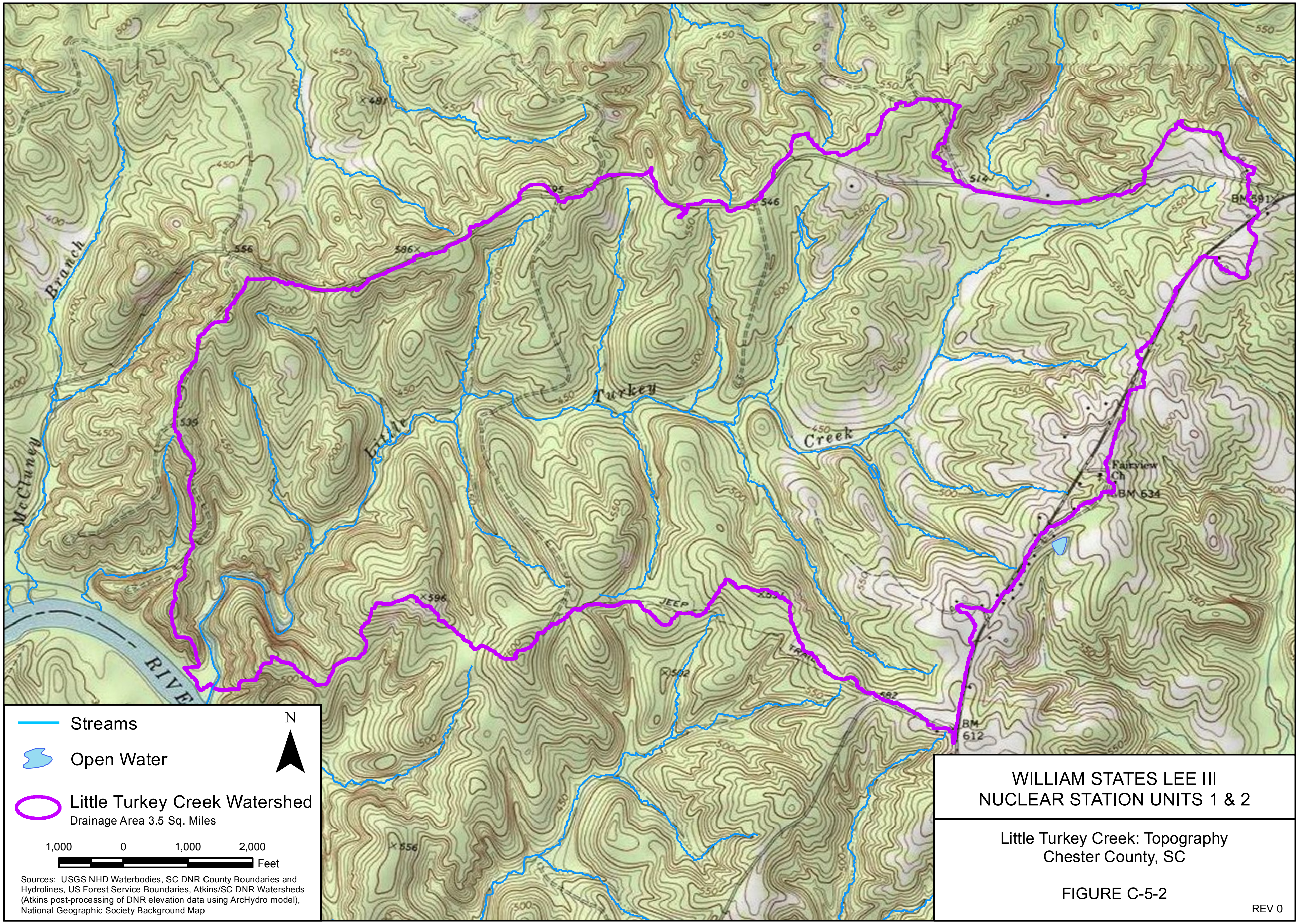
Unnamed Tributary to Clarks Creek: Aerial
Chester County, SC

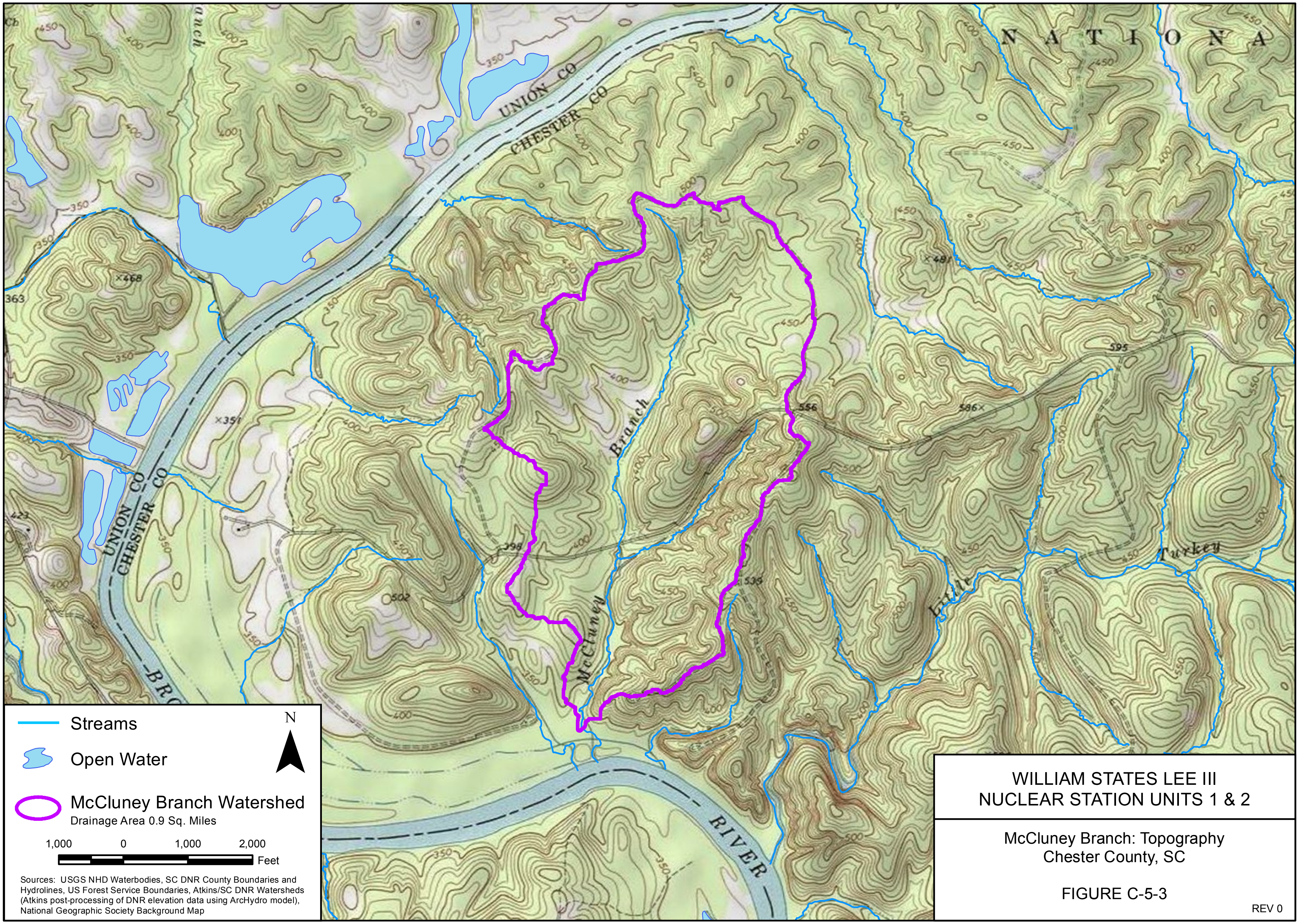
FIGURE C-4-6

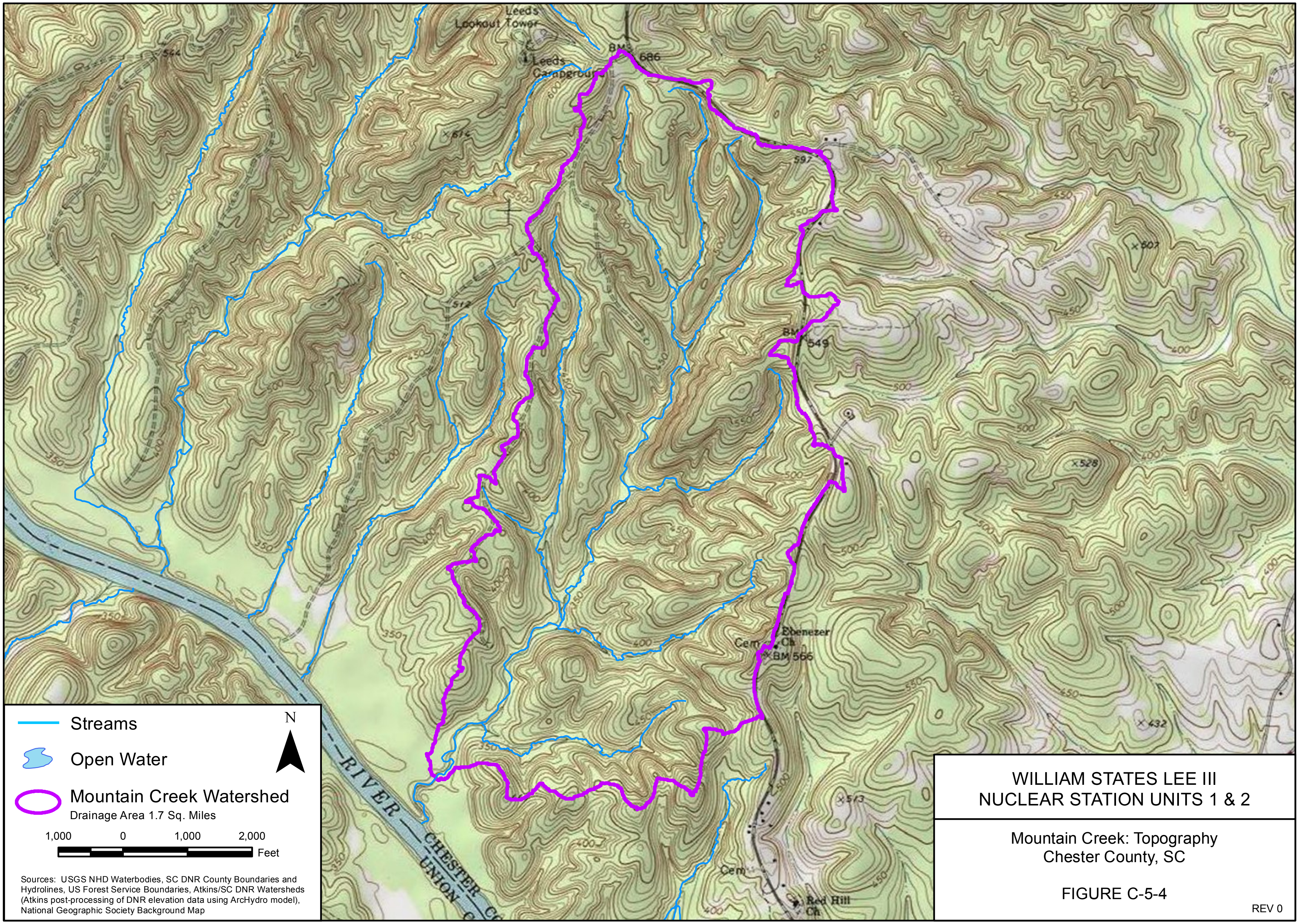
REV 0

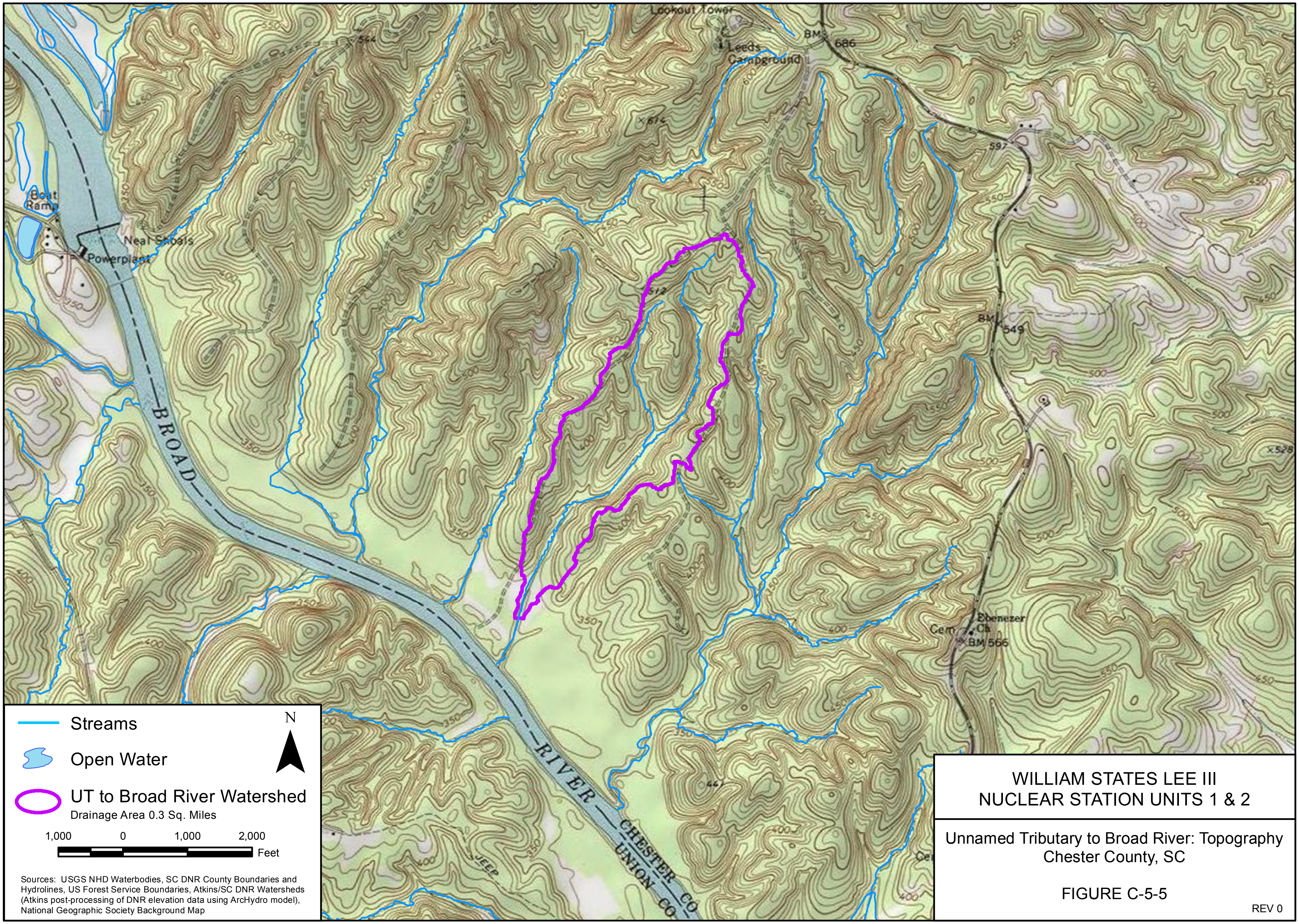


RIVER
Boat Ramp
Picnic Area
Boat Ramp
Woods Ferry Recreation Area
Clarks
Creek
Brushy Fork Camp
Brushy
Fork
Creek
Smith
Creek
N A T I O N A L F O R E S T
Streams
Open Water
Clarks Creek Watershed
Drainage Area 4.4 Sq. Miles
N
2,000 0 2,000 4,000
Feet
Sources: USGS NHD Waterbodies, SC DNR County Boundaries and Hydrolines, US Forest Service Boundaries, Atkins/SC DNR Watersheds (Atkins post-processing of DNR elevation data using ArcHydro model), National Geographic Society Background Map
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
Clarks Creek: Topography
Chester County, SC
FIGURE C-5-1
REV 0


Streams
Open Water
Little Turkey Creek Watershed
Drainage Area 3.5 Sq. Miles
N
1,000 0 1,000 2,000
Feet
Sources: USGS NHD Waterbodies, SC DNR County Boundaries and Hydrolines, US Forest Service Boundaries, Atkins/SC DNR Watersheds (Atkins post-processing of DNR elevation data using ArcHydro model), National Geographic Society Background Map
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
Little Turkey Creek: Topography
Chester County, SC
FIGURE C-5-2
REV 0
McCluney
Branch
Little
Turkey
Creek
RIVE
Fairview Ch
BM 634
BM 591
BM 612


NATIONA
UNION CO
CHESTER CO
McCluney Branch
Little Turkey
BROAD RIVER
RIVER
Streams
Open Water
McCluney Branch Watershed
Drainage Area 0.9 Sq. Miles
N
1,000 0 1,000 2,000
Feet
Sources: USGS NHD Waterbodies, SC DNR County Boundaries and Hydrolines, US Forest Service Boundaries, Atkins/SC DNR Watersheds (Atkins post-processing of DNR elevation data using ArcHydro model), National Geographic Society Background Map
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
McCluney Branch: Topography
Chester County, SC
FIGURE C-5-3
REV 0


Streams
Open Water
Mountain Creek Watershed
Drainage Area 1.7 Sq. Miles
N
1,000 0 1,000 2,000
Feet
Sources: USGS NHD Waterbodies, SC DNR County Boundaries and Hydrolines, US Forest Service Boundaries, Atkins/SC DNR Watersheds (Atkins post-processing of DNR elevation data using ArcHydro model), National Geographic Society Background Map
Leeds Lookout Tower
Leeds Campground
BM 686
BM 549
Ebenezer Ch
Cem
BM 566
Red Hill Ch
RIVER
CHESTER
UNION
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
Mountain Creek: Topography
Chester County, SC
FIGURE C-5-4
REV 0

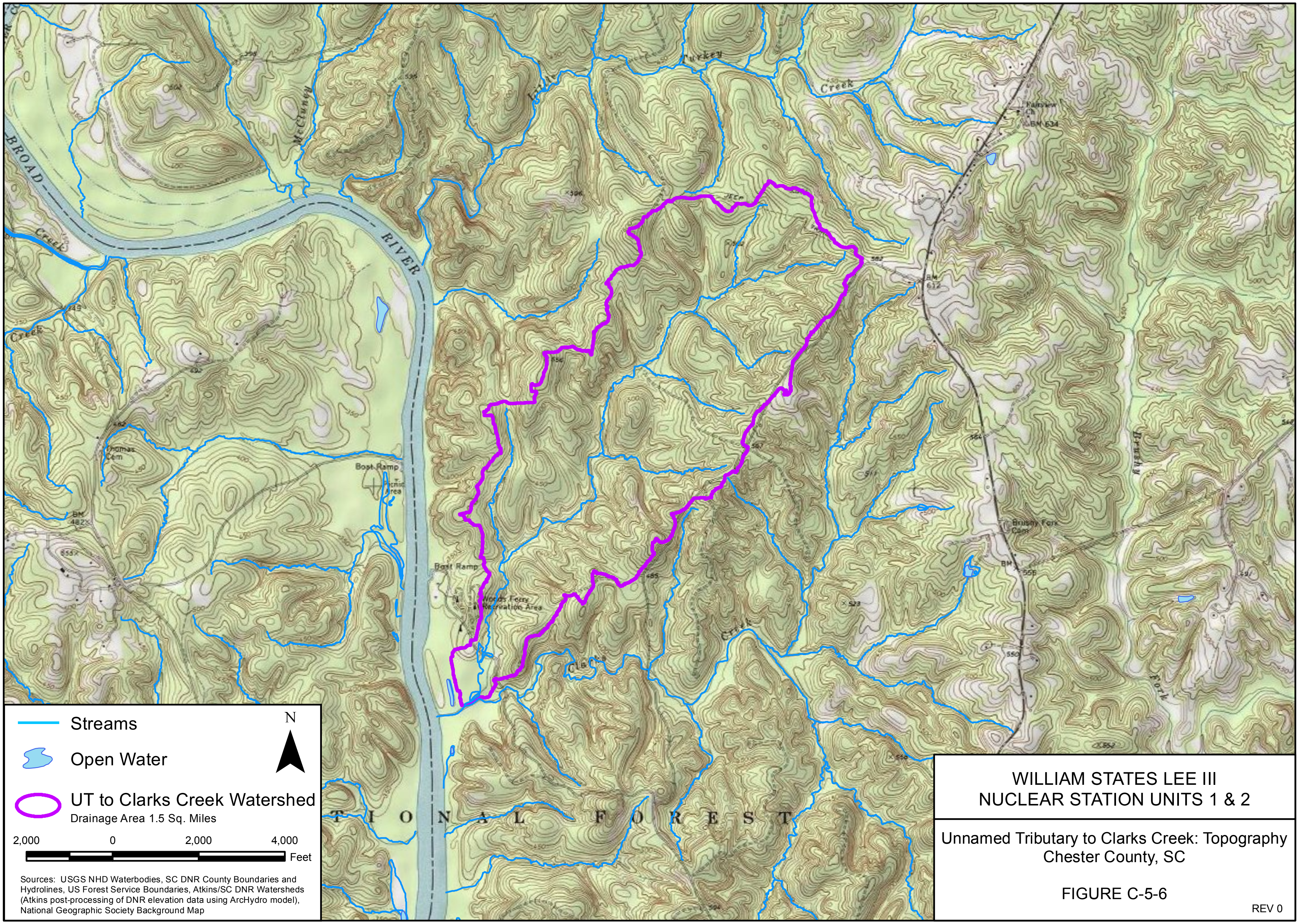


WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Unnamed Tributary to Broad River: Topography
Chester County, SC

FIGURE C-5-5

REV 0

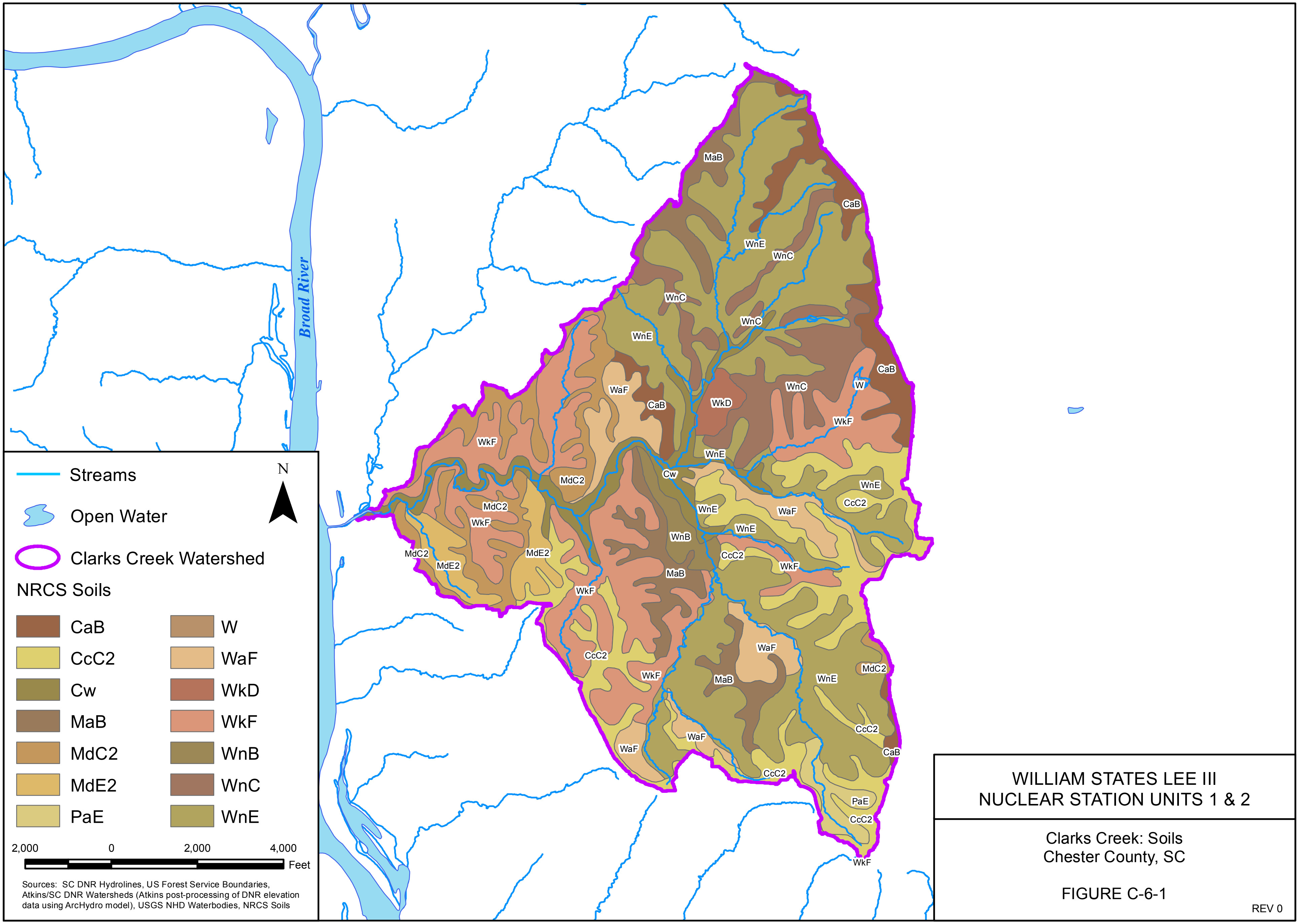


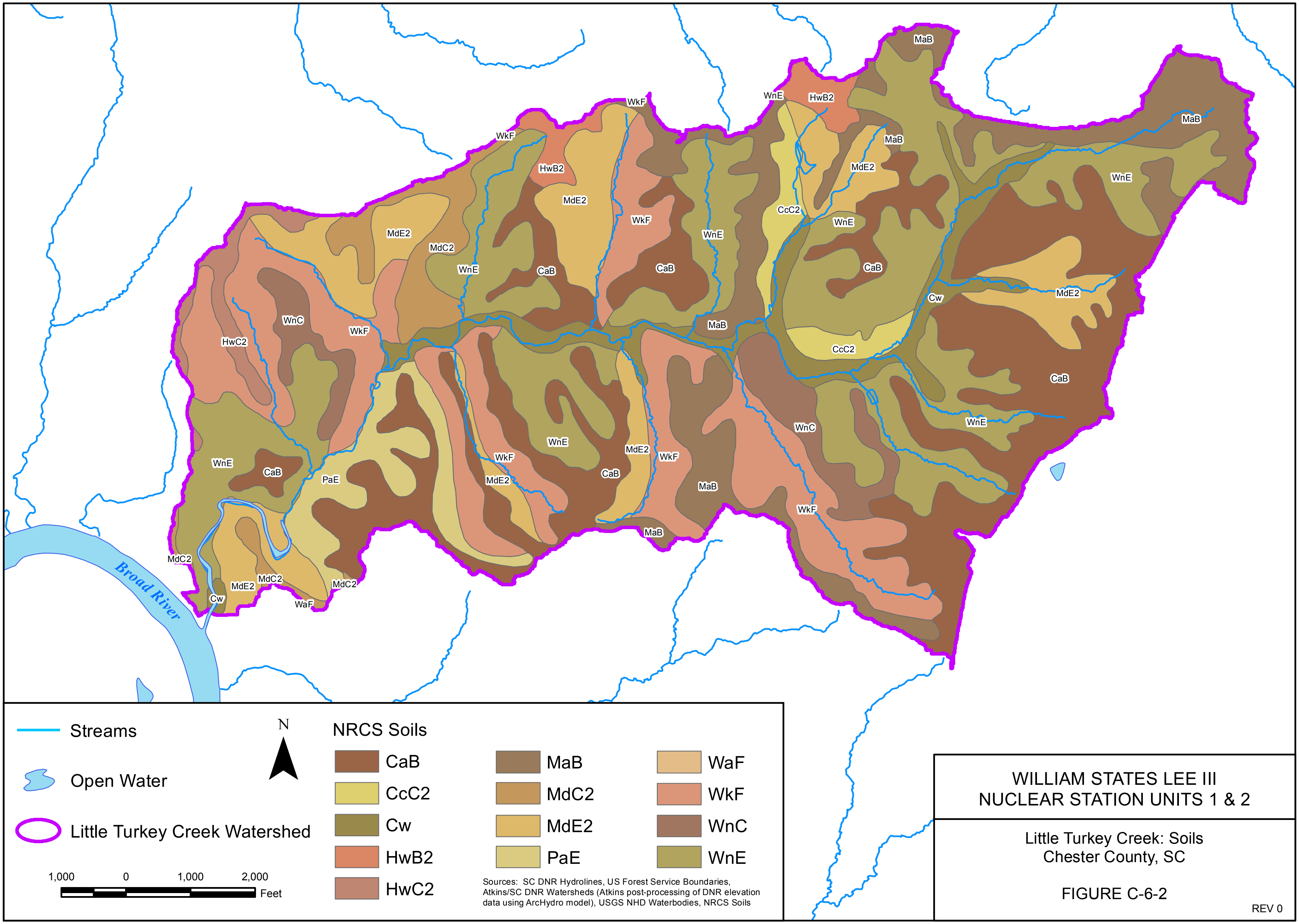
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

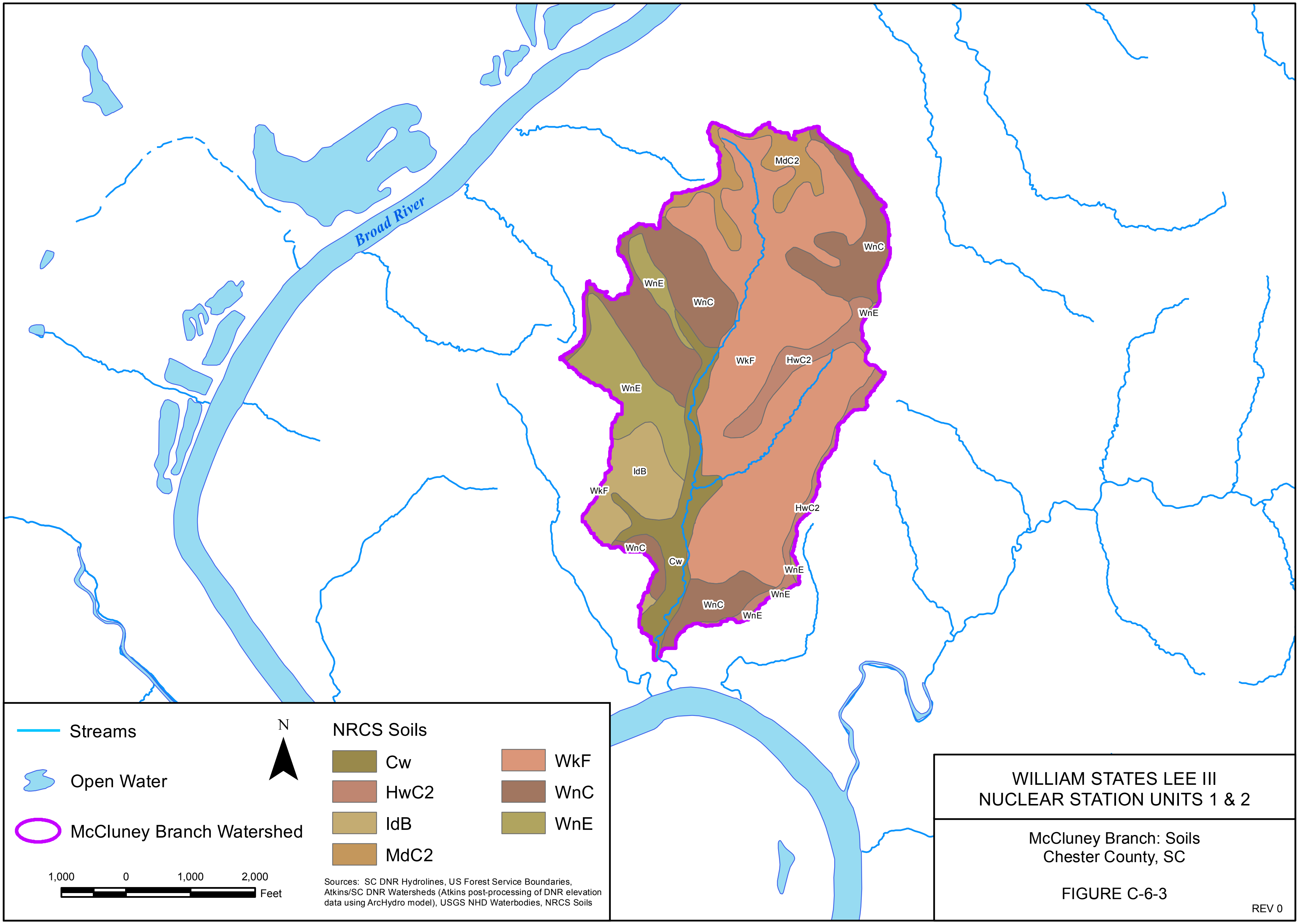
Unnamed Tributary to Clarks Creek: Topography
Chester County, SC

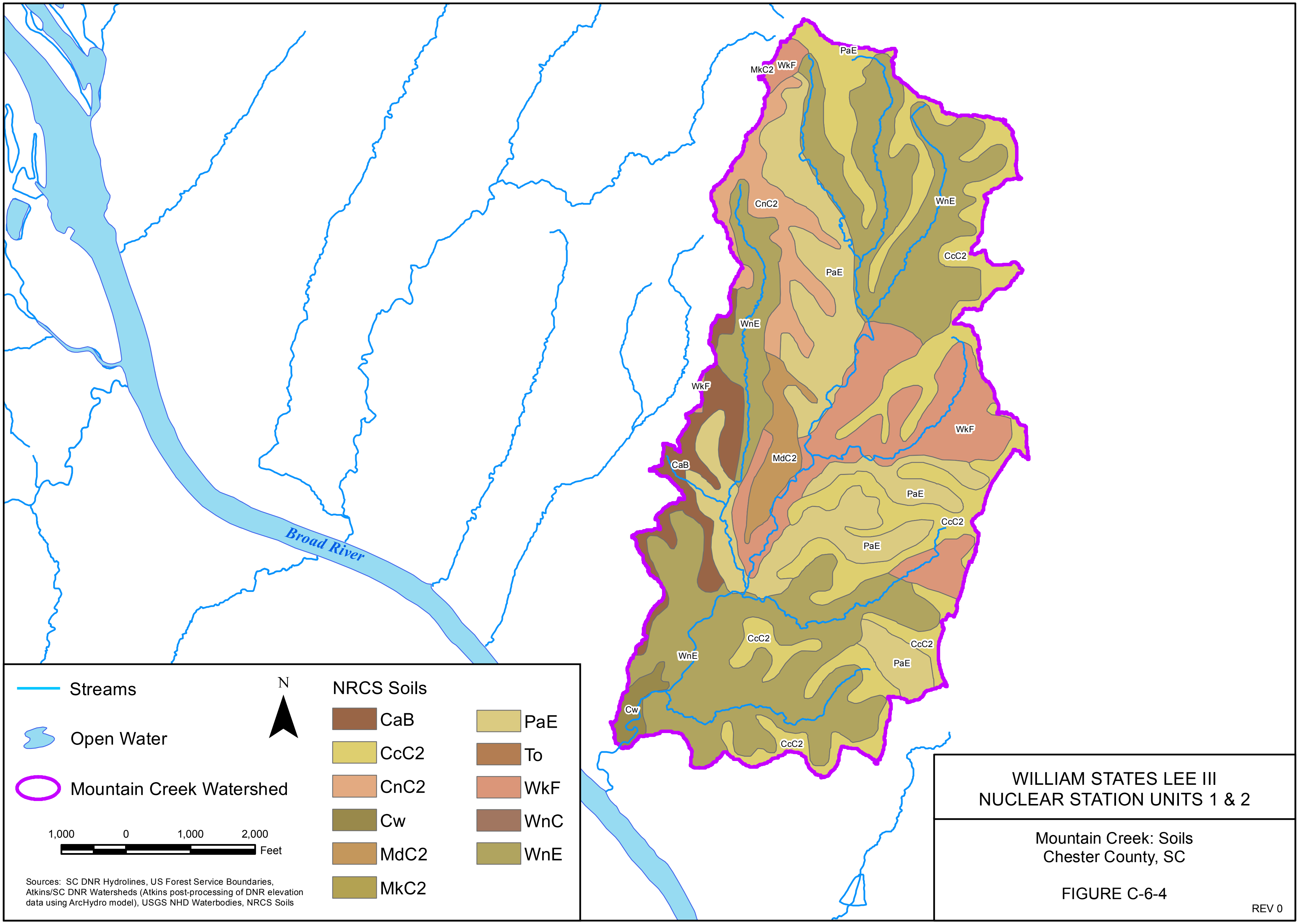
FIGURE C-5-6

REV 0

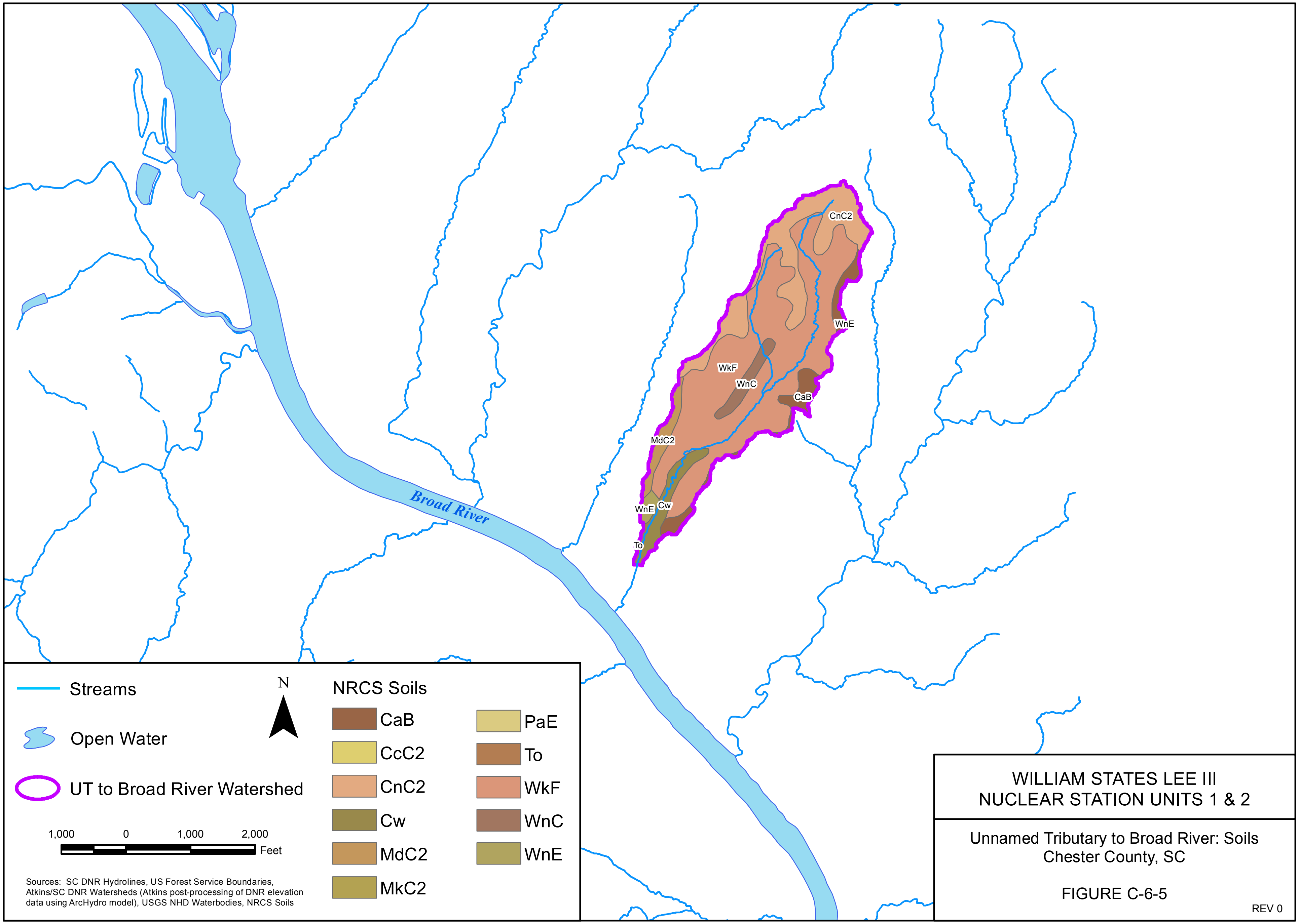

Broad River
Streams
Open Water
Clarks Creek Watershed
NRCS Soils
CaB
CcC2
Cw
MaB
MdC2
MdE2
PaE
W
WaF
WkD
WkF
WnB
WnC
WnE
N
2,000 0 2,000 4,000
Feet
Sources: SC DNR Hydrolines, US Forest Service Boundaries, Atkins/SC DNR Watersheds (Atkins post-processing of DNR elevation data using ArcHydro model), USGS NHD Waterbodies, NRCS Soils
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
Clarks Creek: Soils
Chester County, SC
FIGURE C-6-1
REV 0


Broad River
Streams
Open Water
Little Turkey Creek Watershed
N
1,000 0 1,000 2,000
Feet
NRCS Soils
CaB
CcC2
Cw
HwB2
HwC2
MaB
MdC2
MdE2
PaE
WaF
WkF
WnC
WnE
Sources: SC DNR Hydrolines, US Forest Service Boundaries, Atkins/SC DNR Watersheds (Atkins post-processing of DNR elevation data using ArcHydro model), USGS NHD Waterbodies, NRCS Soils
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
Little Turkey Creek: Soils
Chester County, SC
FIGURE C-6-2
REV 0

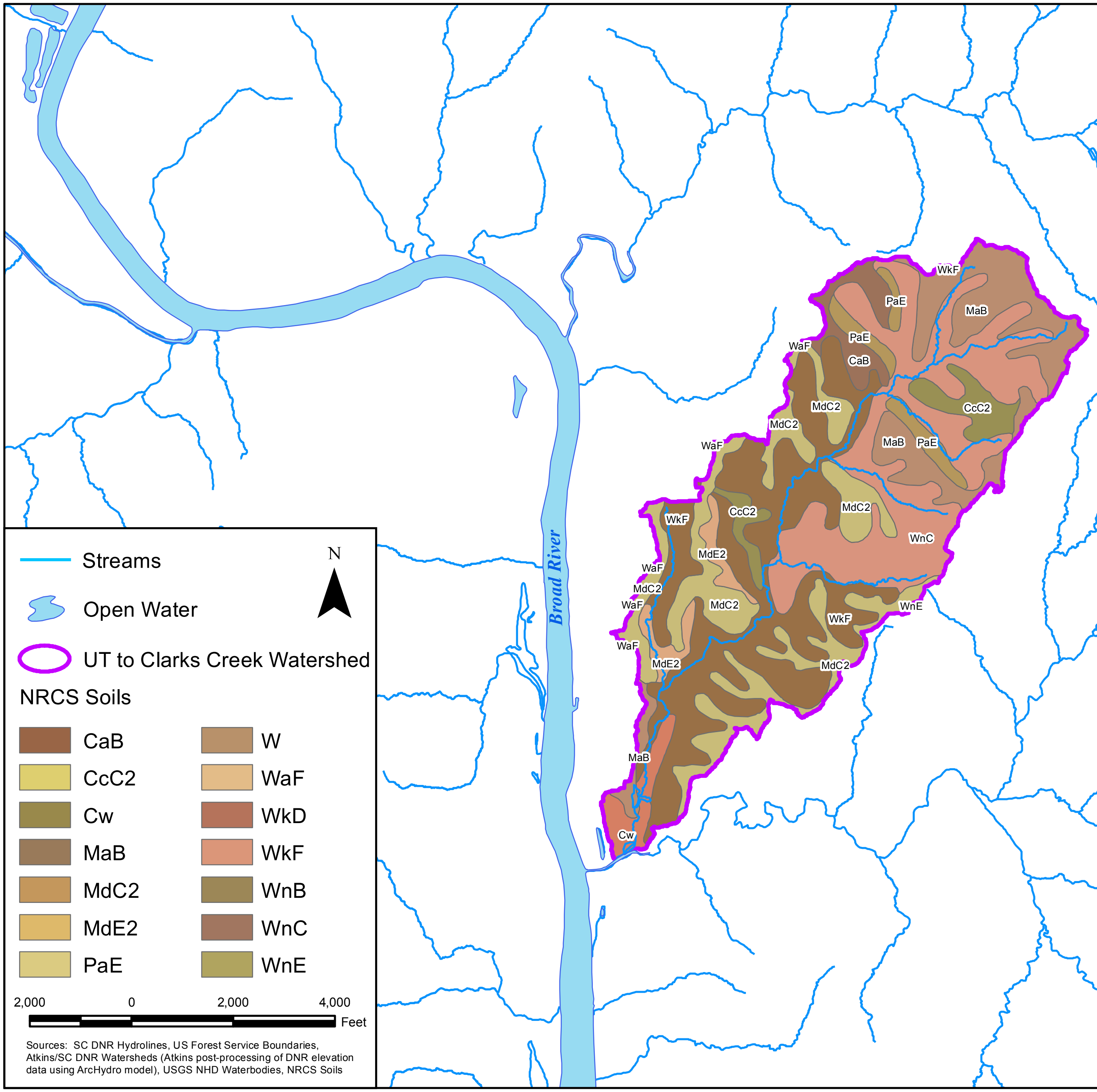

Broad River
MdC2
WnC
WnE
WkF
HwC2
IdB
Cw
Streams
Open Water
McCluney Branch Watershed
N
1,000 0 1,000 2,000
Feet
NRCS Soils
Cw
HwC2
IdB
MdC2
WkF
WnC
WnE
Sources: SC DNR Hydrolines, US Forest Service Boundaries, Atkins/SC DNR Watersheds (Atkins post-processing of DNR elevation data using ArcHydro model), USGS NHD Waterbodies, NRCS Soils
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
McCluney Branch: Soils
Chester County, SC
FIGURE C-6-3
REV 0



Broad River
PaE
MkC2
WkF
CnC2
PaE
WnE
CcC2
WnE
WkF
CaB
MdC2
PaE
CcC2
PaE
WnE
CcC2
CcC2
PaE
Cw
CcC2
Streams
Open Water
Mountain Creek Watershed
N
1,000 0 1,000 2,000
Feet
Sources: SC DNR Hydrolines, US Forest Service Boundaries, Atkins/SC DNR Watersheds (Atkins post-processing of DNR elevation data using ArcHydro model), USGS NHD Waterbodies, NRCS Soils
NRCS Soils
CaB
CcC2
CnC2
Cw
MdC2
MkC2
PaE
To
WkF
WnC
WnE
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
Mountain Creek: Soils
Chester County, SC
FIGURE C-6-4
REV 0



Broad River
CnC2
WnE
WkF
WnC
CaB
MdC2
WnE
Cw
To
Streams
Open Water
UT to Broad River Watershed
N
NRCS Soils
CaB
CcC2
CnC2
Cw
MdC2
MkC2
PaE
To
WkF
WnC
WnE
1,000 0 1,000 2,000
Feet
Sources: SC DNR Hydrolines, US Forest Service Boundaries, Atkins/SC DNR Watersheds (Atkins post-processing of DNR elevation data using ArcHydro model), USGS NHD Waterbodies, NRCS Soils
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
Unnamed Tributary to Broad River: Soils
Chester County, SC
FIGURE C-6-5
REV 0

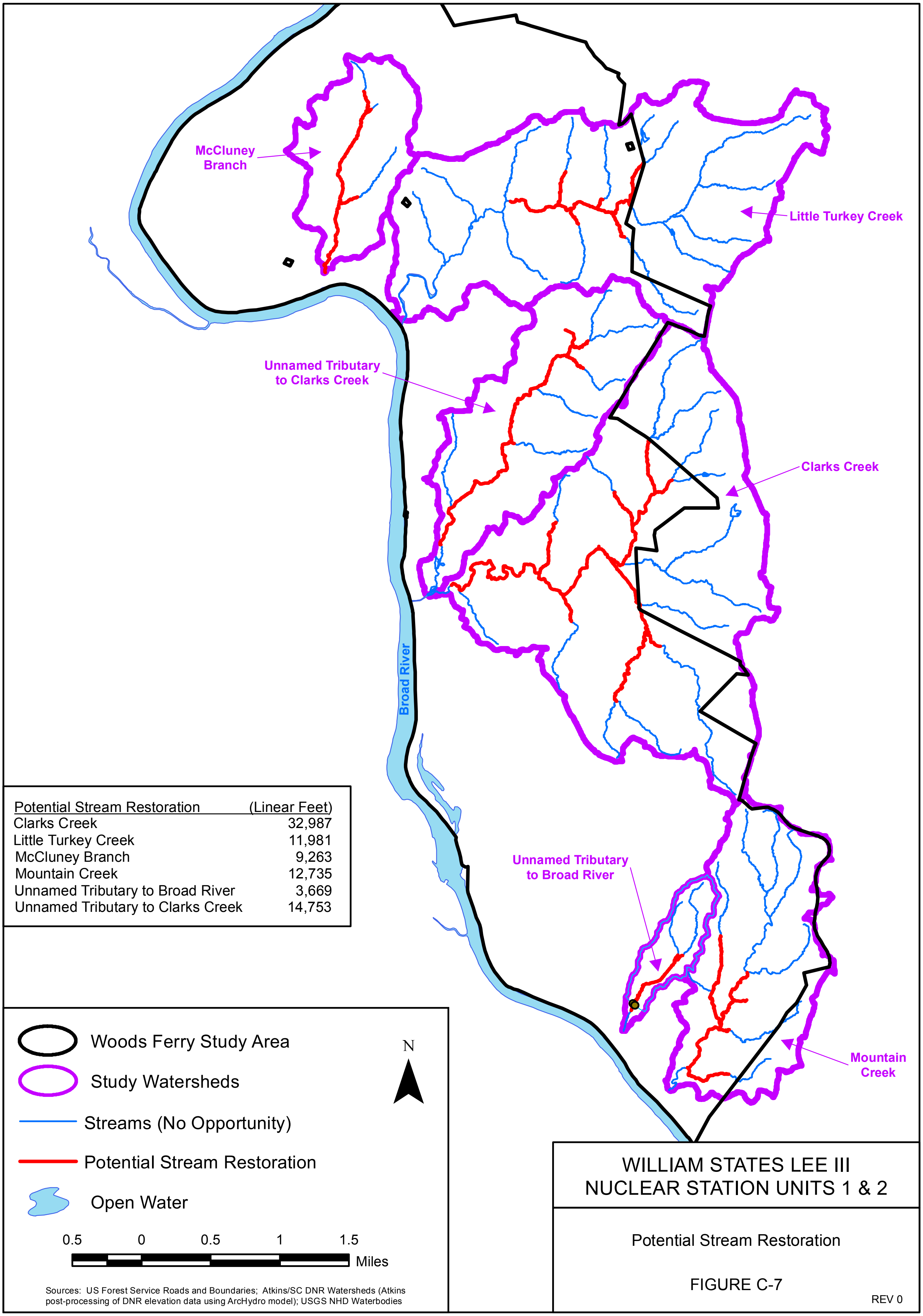


WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Unnamed Tributary to Clarks Creek: Soils
Chester County, SC

FIGURE C-6-6

REV 0



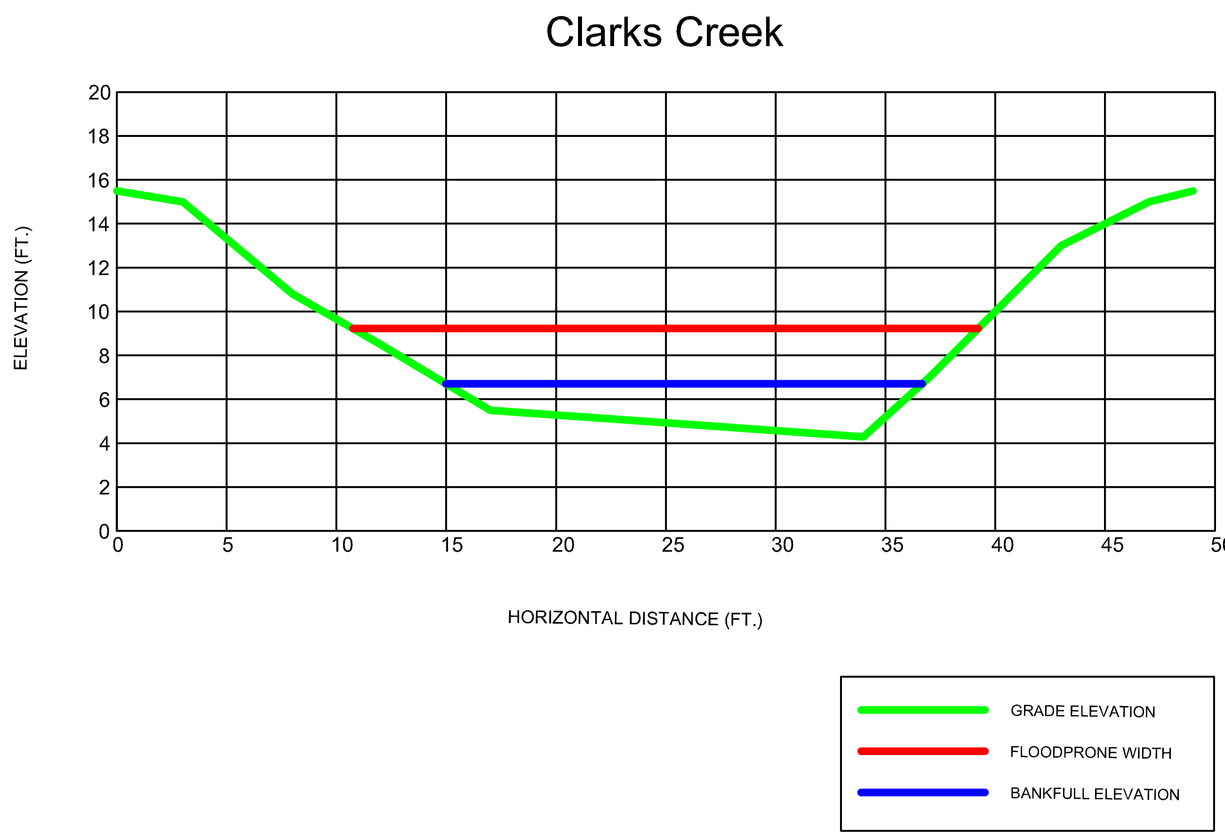
Potential Stream Restoration	(Linear Feet)
Clarks Creek	32,987
Little Turkey Creek	11,981
McCluney Branch	9,263
Mountain Creek	12,735
Unnamed Tributary to Broad River	3,669
Unnamed Tributary to Clarks Creek	14,753

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Potential Stream Restoration

FIGURE C-7

REV 0



*Based on area calculated from hydraulic geometry curves (Arcadis and SCDOT 2004)

Watershed Drainage Area: 3.7 sq. mi.

Bankfull based on
South Carolina Rural Piedmont Curves
(Arcadis and SCDOT 2004)

- **Area: 35.9 sq. ft.**
- **Width: 21.4 ft.**
- **Depth: 1.6 ft.**
- **Width/Depth Ratio: 13.4**
- **Discharge (Q): 120 cfs**

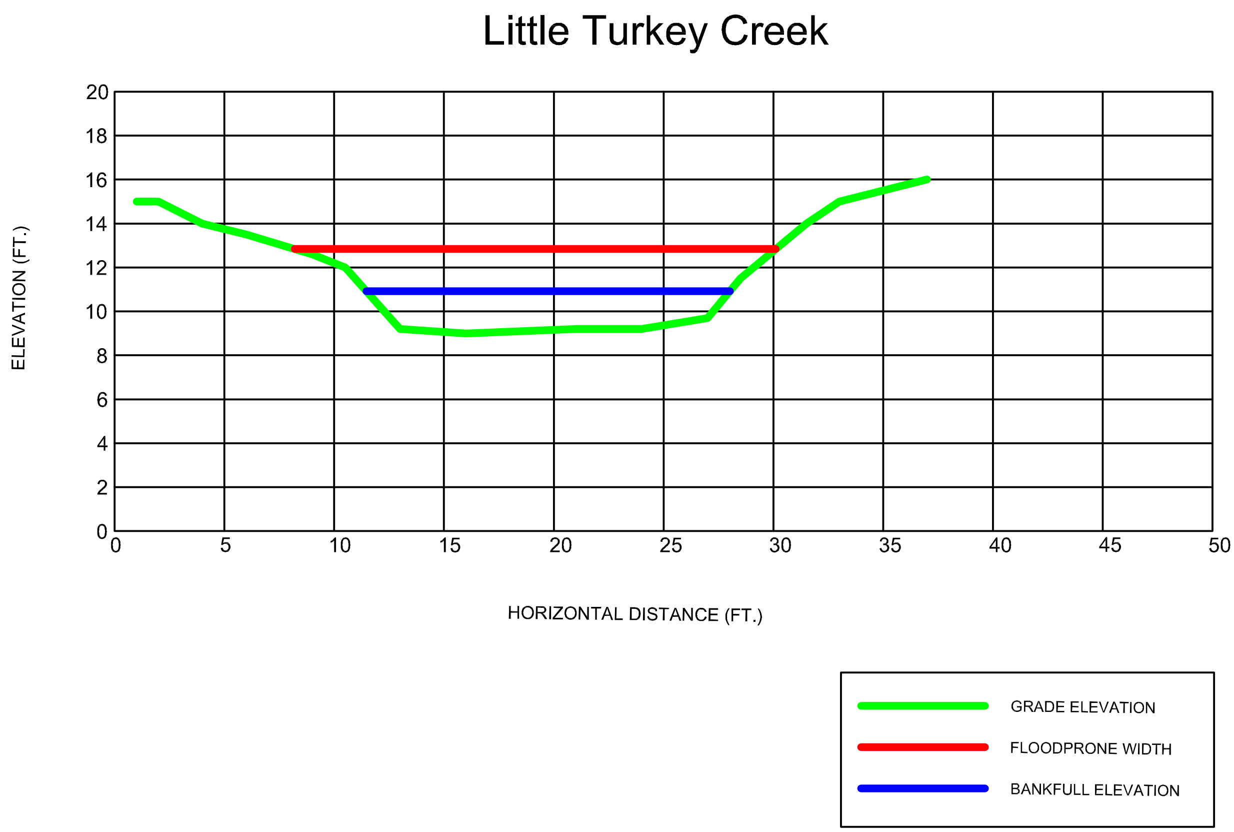
Existing
Entrenchment Ratio: 1.4
Width/Depth Ratio: 13.7
Bank Height Ratio: 4.5
Bed Material: Sand
Stream Type (Rosgen): F5

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Clarks Creek: Cross Section

FIGURE C-8-1

Rev 0



Watershed Drainage Area: 2.4 sq. mi.

*Based on area calculated from hydraulic geometry curves (Arcadis and SCDOT 2004)

Bankfull data based on
South Carolina Rural Piedmont Curves
(Arcadis and SCDOT 2004)

- **Area: 26.1 sq. ft.**
- **Width: 18.1 ft.**
- **Depth: 1.4 ft.**
- **Width/Depth Ratio: 12.9**
- **Discharge (Q): 86 cfs**

Existing
Entrenchment Ratio: 1.4
Width/Depth Ratio: 13.2
Bank Height Ratio: 4.5
Bed Material: Sand
Stream Type (Rosgen): F5

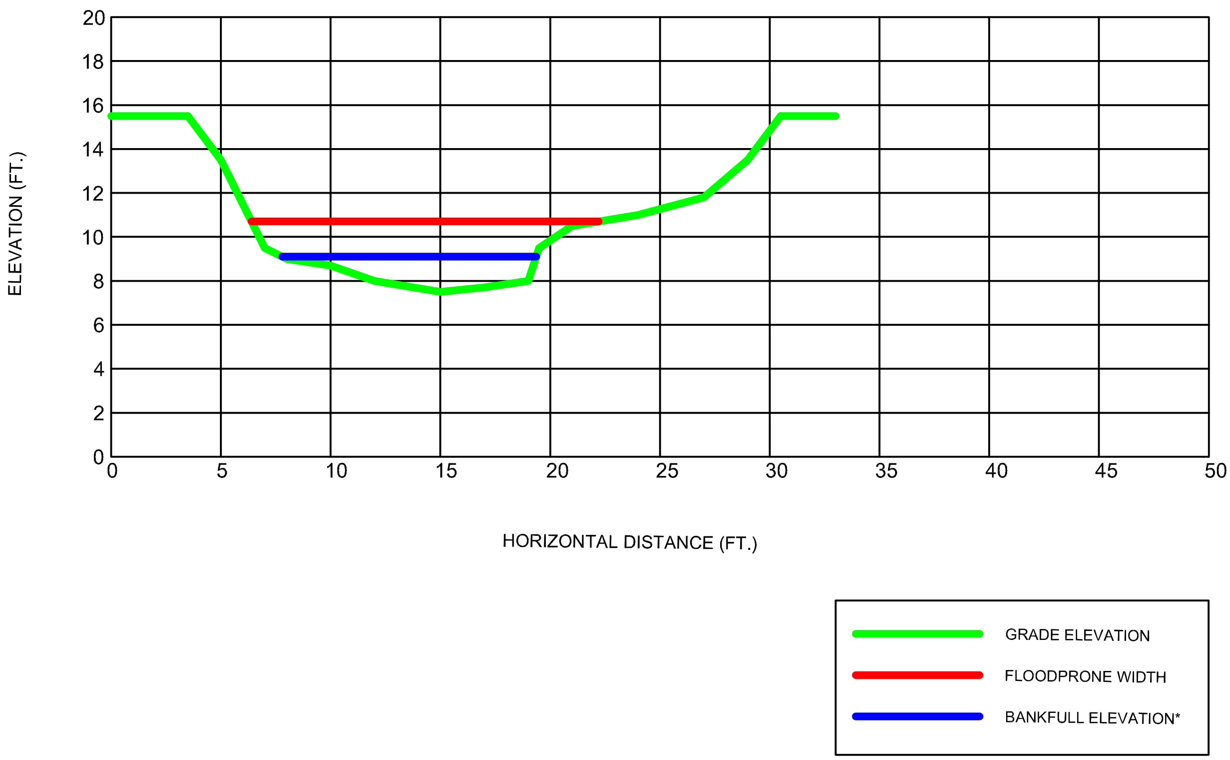
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Little Turkey Creek: Cross Section

FIGURE C-8-2

Rev 0

McCluney Branch



*Based on area calculated from hydraulic geometry curves (Arcadis and SCDOT 2004)

Watershed Drainage Area: 1.4 sq. mi.

Bankfull data based on
South Carolina Rural Piedmont Curves
(Arcadis and SCDOT 2004)
- **Area: 11.7 sq. ft.**
- **Width: 11.8 ft.**
- **Depth: 1.0 ft.**
- **Width/Depth Ratio: 11.8**
- **Discharge (Q): 38 cfs**

Existing
Entrenchment Ratio: 2.1
Width/Depth Ratio: 11.6
Bank Height Ratio: 5.0
Bed Material: Gravel
Stream Type (Rosgen): F4-->C4

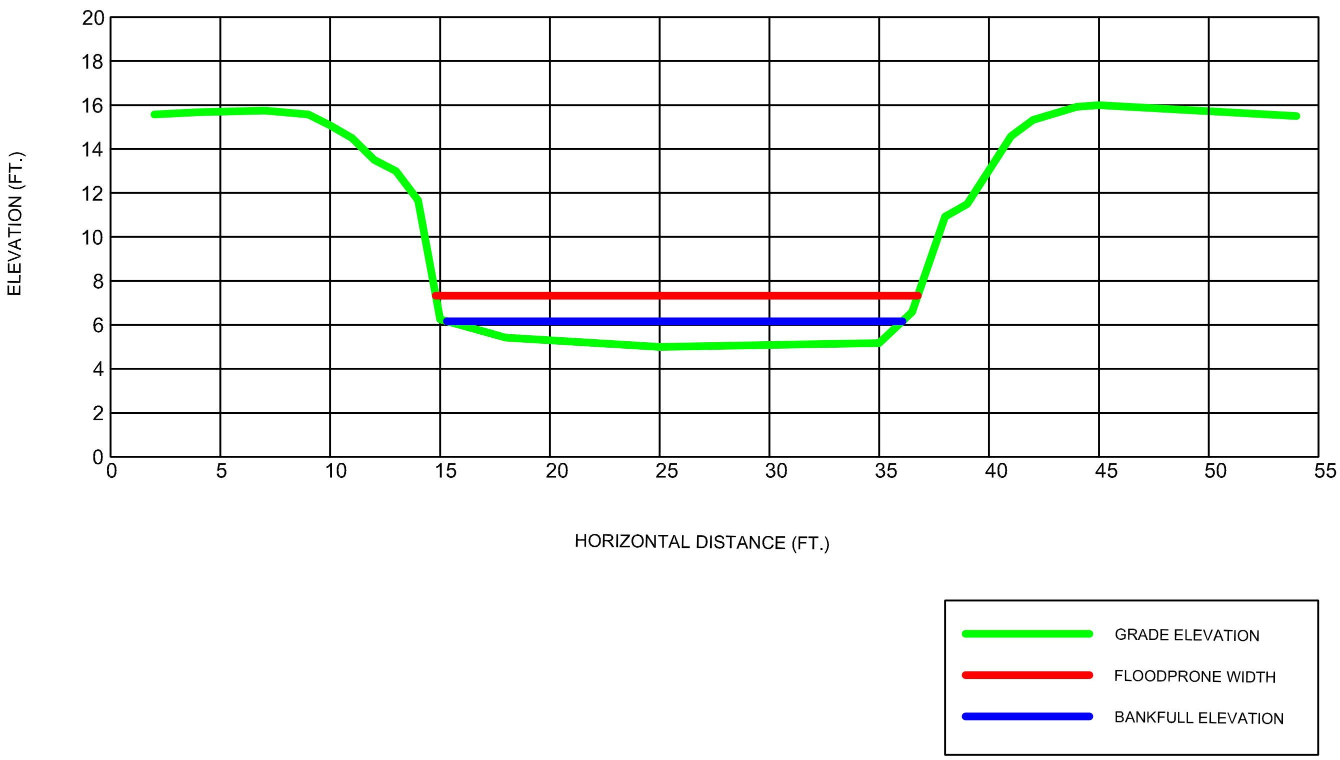
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

McCluney Branch: Cross Section

FIGURE C-8-3

Rev 0

Mountain Creek



*Based on area calculated from hydraulic geometry curves (Arcadis and SCDOT 2004)

Watershed Drainage Area: 1.4 sq. mi.

Bankfull data based on
South Carolina Rural Piedmont Curves
(Arcadis and SCDOT 2004)

- **Area: 19 sq. ft.**
- **Width: 15.3 ft.**
- **Depth: 1.2 ft.**
- **Width/Depth Ratio: 12.8**
- **Discharge (Q): 63 cfs**

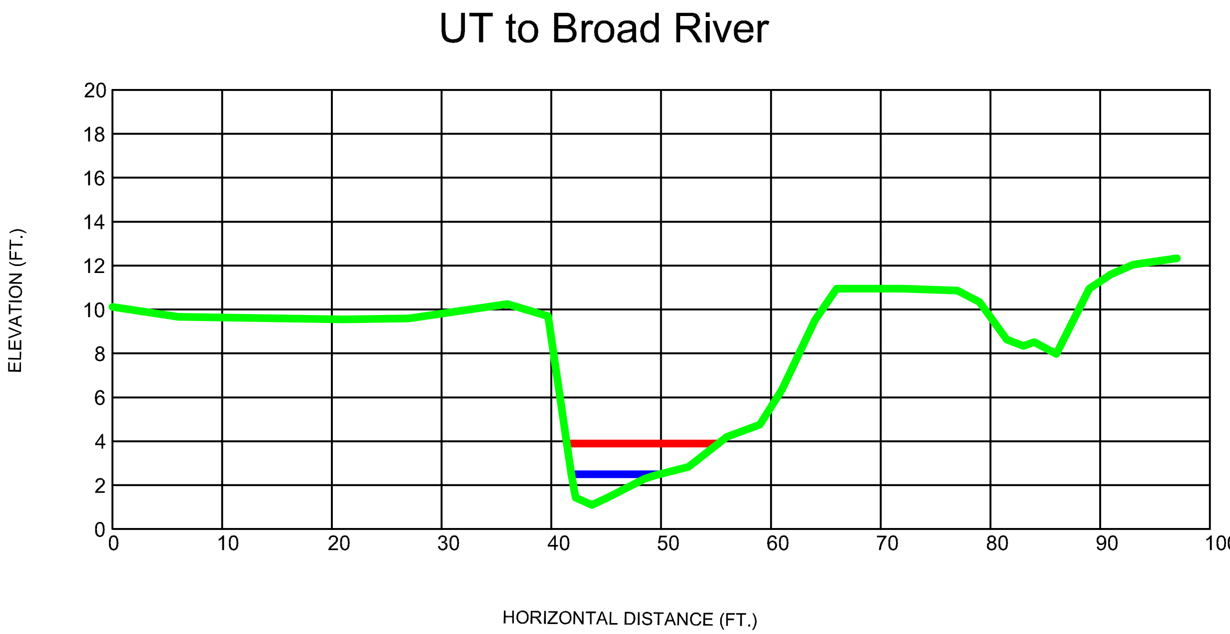
<u>Existing</u>
Entrenchment Ratio: 1.3
Width/Depth Ratio:16.7
Bank Height Ratio: 6.9
Bed Material: Cobble
Stream Type (Rosgen): F3

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Mountain Creek: Cross Section

FIGURE C-8-4

Rev 0



*Based on area calculated from hydraulic geometry curves (Arcadis and SCDOT 2004)

Watershed Drainage Area = 0.3 sq. mi.

South Carolina Rural Piedmont Curves
(Arcadis and SCDOT 2004)
Area = 6.0 sq ft.
Width = 8.2 ft.
Depth = 0.7 ft.
Width/Depth Ratio = 11.7
Q = 19 cfs

Existing
Entrenchment Ratio: 1.2
Width/Depth Ratio 10.8
Bed Material: Sand
Stream Type (Rosgen): G5

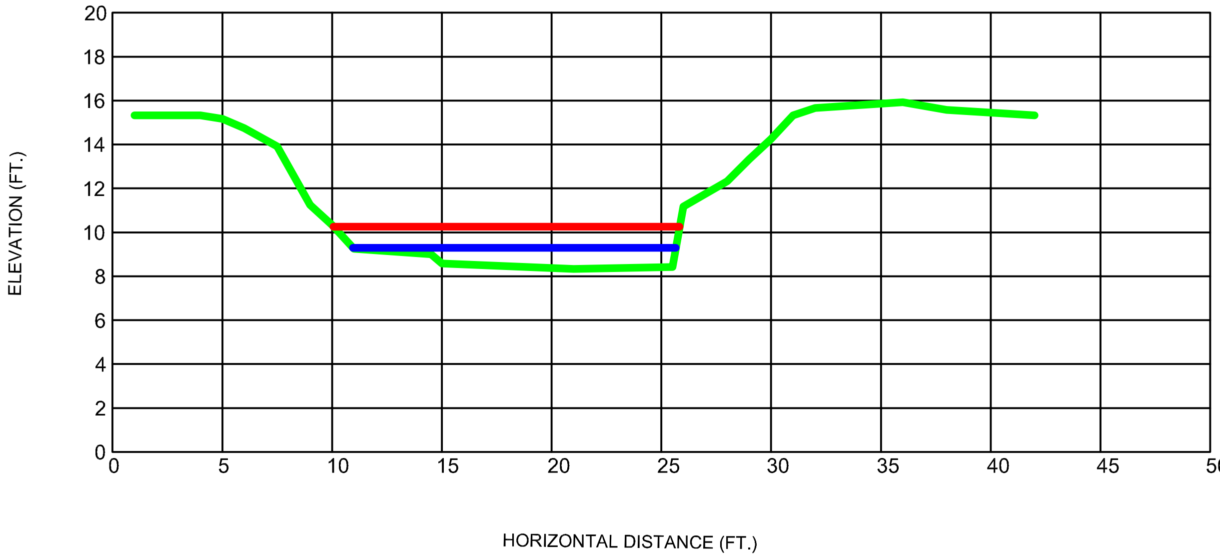
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

UT to Broad River: Cross Section
Chester County, SC

FIGURE C-8-5

Rev 0

Unnamed Tributary to Clarks Creek



*Based on area calculated from hydraulic geometry curves (Arcadis and SCDOT 2004)

Watershed Drainage Area: 0.6 sq. mi.

Bankfull data based on
South Carolina Rural Piedmont Curves
(Arcadis and SCDOT 2004)

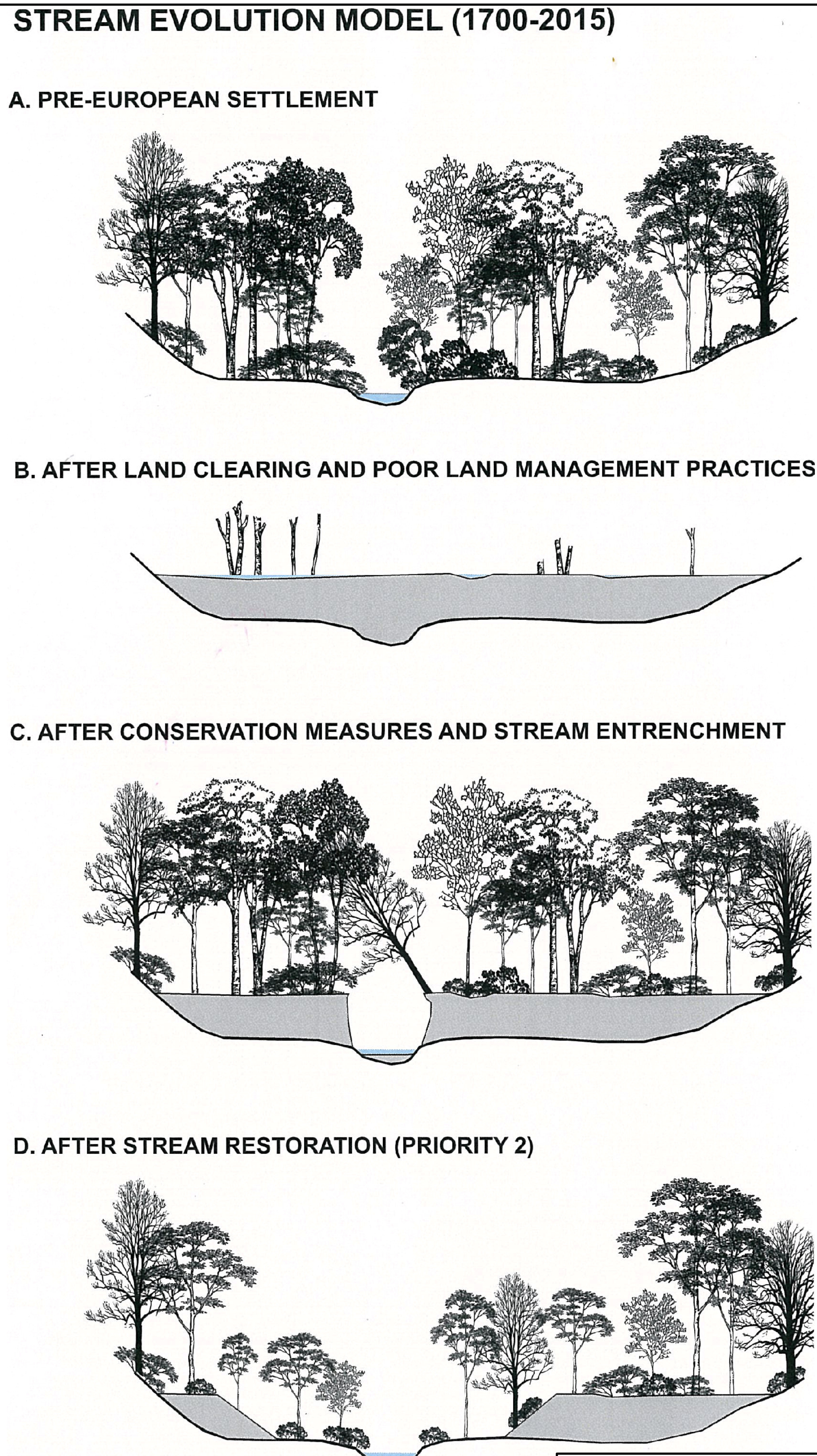
- **Area: 10.1 sq. ft.**
- **Width: 10.9 ft.**
- **Depth: 0.9 ft.**
- **Width/Depth Ratio: 12.1**
- **Discharge (Q): 33 cfs**

Existing
Entrenchment Ratio: 1.4
Width/Depth Ratio: 21.4
Bank Height Ratio: 7.0
Bed Material: Cobble
Stream Type (Rosgen): G4-->E4

WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Unnamed Tributary to Clarks Creek:
Cross Section

FIGURE C-8-6 Rev 0

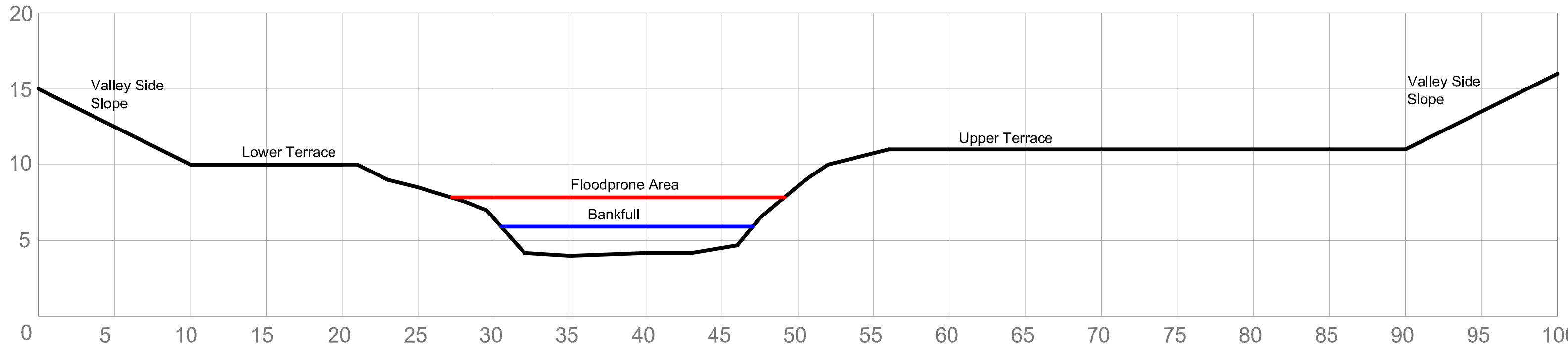


WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

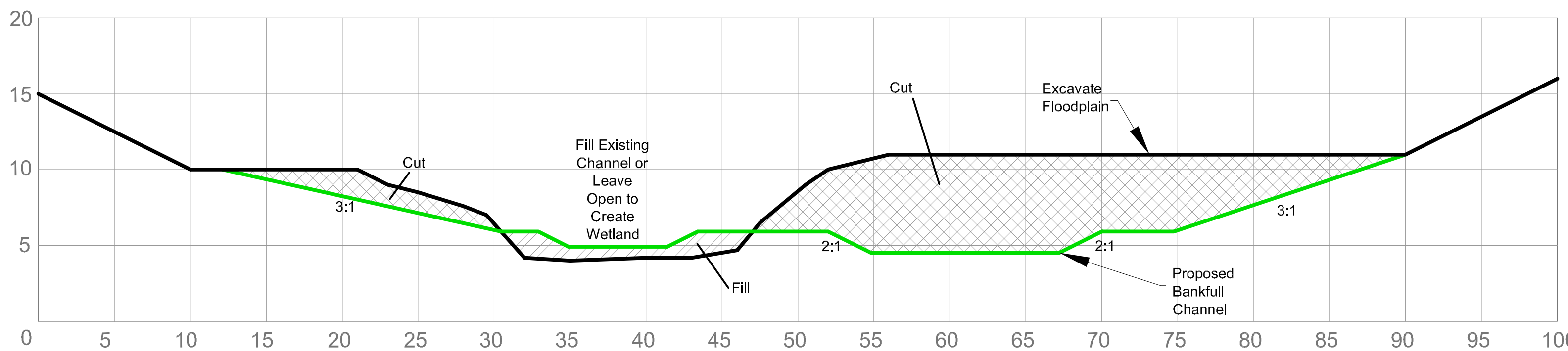
CONCEPTUAL STREAM
EVOLUTIONARY MODEL

FIGURE C-9

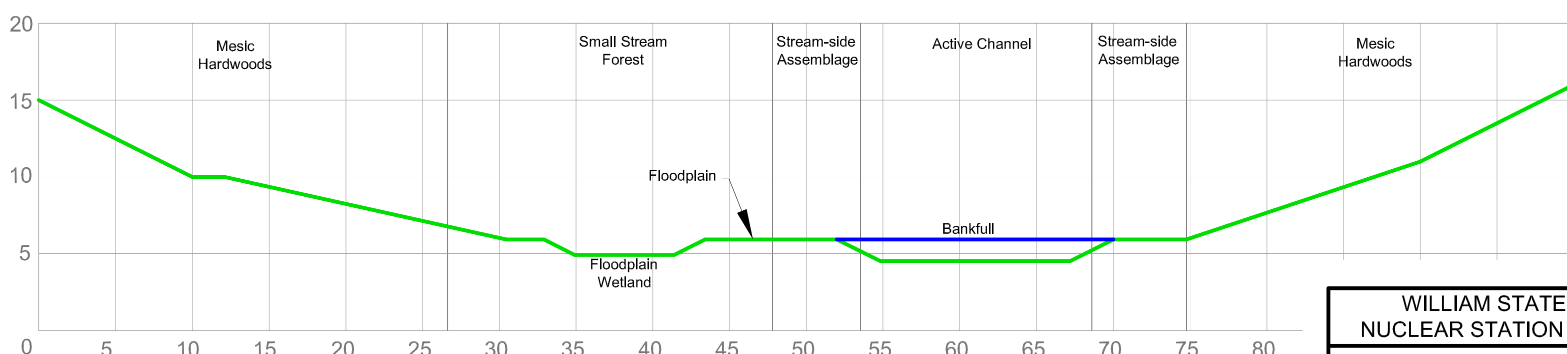
REV 0



(a) Typical Existing Stream Cross Section (units in feet)



(b) Priority 2 Stream Restoration



(c) Proposed Cross Section Features and Vegetation Zones

WILLIAM STATES LEE III NUCLEAR STATION UNITS 1 & 2
Priority 2 Stream Restoration
FIGURE C-10 REV 0

Attachment C-2

Stream Credit Calculation Worksheets

Clarks Creek

Determination of Stream Credits
Working Draft, Subject to Change
Last Revised November 5, 2010

RESTORATION MITIGATION FACTORS FOR LINEAR SYSTEMS				
FACTORS	**OPTIONS**			
Stream Type[1]	Seasonal RPWs 0.05	1st and 2nd Order Perennial RPWs 0.4		All Other Streams 0.2
Priority Category	Tertiary 0.05	Secondary 0.2		Primary 0.3
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1]Stream type does not include man-made linear features.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for LINEAR SYSTEMS

Factor	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6
Stream Type	0.2					
Priority Category	0.3					
Net Improvement	3.0					
Credit Schedule	0.05					
Location	0.1					
Riparian Buffer Side A	0.3					
Riparian Buffer Side B	0.3					
Sum of Restoration Mitigation Factors=	M_1 = 4.25	M_2 =	M_3 =	M_4 =	M_5 =	M_6 =
Linear Feet Proposed Restoration	LL_1 = 1	LL_2 =	LL_3 =	LL_4 =	LL_5 =	LL_6 =
M × LL=	4.25					
Total Proposed Credits = $\sum$ (M × LL) =						

HIGH GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name Clarks Creek	Basin/Watershed: Broad	USGS Quad: Leeds	
Latitude:	Longitude:	County: Chester	
Date: 5-23-2011	Time:	Investigator: Atkins	
Stream width:	Stream Depth:	Length of Stream Reach:	
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc):		

Habitat Parameter	Condition Category: Fully Functional	Partially Impaired	Impaired	Very Impaired
1.Epifaunal Substrate or Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e. logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat lack of habitat is obvious; substrate unstable or lacking.
SCORE	2.0	1.5	1.0	**(0.5)**
2.Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine Sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	2.0	1.5	1.0	**(0.5)**
3.Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow shallow, fast-deep, fast shallow). Slow is <0.3 m/s, deep is >0.5 m/s.	Only 3 of the 4 regimes Present.	Only 2 of the 4 habitat regimes present.	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE	2.0	1.5	**(1.0)**	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	2.0	1.5	1.0	**(0.5)**
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	2.0	**(1.5)**	1.0	0.5
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.
SCORE	2.0	1.5	1.0	**(0.5)**
7.Frequency of Riffles (or bends)	Frequent occurrence of riffles; distance of riffles/width of stream is <7. Variety of habitat is key.	Occurrence of riffles infrequent; distance of riffles/width of stream is between 7 and 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles/stream width is 15 to 25.	All flat water or shallow riffles; poor habitat; distance between riffles/stream width > 25.
SCORE	2.0	1.5	1.0	**(0.5)**
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.
SCORE	Left Bank 1.0	0.75	0.50	**(0.25)**
SCORE	Right Bank 1.0	0.75	**(0.50)**	0.25
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.
SCORE	Left Bank 1.0	0.75	0.50	**(0.25)**
SCORE	Right Bank 1.0	0.75	**(0.50)**	0.25
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.
SCORE	Left Bank **(1.0)**	0.75	0.50	0.25
SCORE	Right Bank **(1.0)**	0.75	0.50	0.25

Total Score: 8.5 NOTES/COMMENTS:

20 − 8.5 = 11.5

Max Improvement 3.0

Determination of Stream Credits
Working Draft, Subject to Change
Last Revised November 5, 2010

Little Turkey Creek

RESTORATION MITIGATION FACTORS FOR LINEAR SYSTEMS				
FACTORS	**OPTIONS**			
Stream Type[1]	Seasonal RPWs 0.05	1st and 2nd Order Perennial RPWs 0.4		All Other Streams 0.2
Priority Category	Tertiary 0.05	Secondary 0.2		Primary 0.3
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1]Stream type does not include man-made linear features.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for LINEAR SYSTEMS

Factor	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6
Stream Type	0.2					
Priority Category	0.3					
Net Improvement	2.0					
Credit Schedule	0.05					
Location	0.1					
Riparian Buffer Side A	0.3					
Riparian Buffer Side B	0.3					
Sum of Restoration Mitigation Factors=	M_1 = 3.25	M_2 =	M_3 =	M_4 =	M_5 =	M_6 =
Linear Feet Proposed Restoration	LL_1 = 1	LL_2 =	LL_3 =	LL_4 =	LL_5 =	LL_6 =
M × LL=	3.25					
Total Proposed Credits = $\sum$ (M × LL) =						

HIGH GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name Little Turkey C.	Basin/Watershed: Broad	USGS Quad: Leeds
Latitude:	Longitude:	County: Chester
Date: 5-23-2011	Time:	Investigator: Atkins
Stream width:	Stream Depth:	Length of Stream Reach:
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc):	

Habitat Parameter	Condition Category: Fully Functional	Partially Impaired	Impaired	Very Impaired
1.Epifaunal Substrate or Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e. logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat lack of habitat is obvious; substrate unstable or lacking.
SCORE	2.0	(1.5)	1.0	0.5
2.Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine Sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	2.0	(1.5)	1.0	0.5
3.Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow shallow, fast-deep, fast shallow). Slow is <0.3 m/s, deep is >0.5 m/s.	Only 3 of the 4 regimes Present.	Only 2 of the 4 habitat regimes present.	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE	2.0	1.5	(1.0)	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	2.0	1.5	(1.0)	0.5
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	2.0	(1.5)	1.0	0.5
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.
SCORE	2.0	1.5	1.0	(0.5)
7.Frequency of Riffles (or bends)	Frequent occurrence of riffles; distance of riffles/width of stream is <7. Variety of habitat is key.	Occurrence of riffles infrequent; distance of riffles/width of stream is between 7 and 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles/stream width is 15 to 25.	All flat water or shallow riffles; poor habitat; distance between riffles/stream width > 25.
SCORE	2.0	(1.5)	1.0	0.5
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.
SCORE	Left Bank 1.0	0.75	(0.50)	0.25
SCORE	Right Bank 1.0	(0.75)	0.50	0.25
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.
SCORE	Left Bank 1.0	0.75	(0.50)	0.25
SCORE	Right Bank 1.0	(0.75)	0.50	0.25
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.
SCORE	Left Bank (1.0)	0.75	0.50	0.25
SCORE	Right Bank (1.0)	0.75	0.50	0.25

Total Score: ______________ NOTES/COMMENTS:

20 − 13 = 7 Significant Improv. 2.0

McCluney

Determination of Stream Credits
Working Draft, Subject to Change
Last Revised November 5, 2010

RESTORATION MITIGATION FACTORS FOR LINEAR SYSTEMS				
FACTORS	**OPTIONS**			
Stream Type[1]	Seasonal RPWs 0.05	1st and 2nd Order Perennial RPWs 0.4		All Other Streams 0.2
Priority Category	Tertiary 0.05	Secondary 0.2		Primary 0.3
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1]Stream type does not include man-made linear features.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for LINEAR SYSTEMS

Factor	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6
Stream Type	0.4					
Priority Category	0.3					
Net Improvement	2.0					
Credit Schedule	0.05					
Location	0.1					
Riparian Buffer Side A	0.3					
Riparian Buffer Side B	0.3					
Sum of Restoration Mitigation Factors=	M_1 = 3.45	M_2 =	M_3 =	M_4 =	M_5 =	M_6 =
Linear Feet Proposed Restoration	LL_1 = 1	LL_2 =	LL_3 =	LL_4 =	LL_5 =	LL_6 =
M × LL=	3.45					
Total Proposed Credits = $\sum$ (M × LL) =						

HIGH GRADIENT STREAM ASSESSMENT DATA SHEET		
Stream Name: McCluney	Basin/Watershed: Broad	USGS Quad: Leeds
Latitude:	Longitude:	County: Chester
Date: 5-23-2011	Time:	Investigator: Atkins
Stream width:	Stream Depth:	Length of Stream Reach:
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc):	

Habitat Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired
1.Epifaunal Substrate or Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e. logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat lack of habitat is obvious; substrate unstable or lacking.
SCORE	2.0	1.5	**1.0**	0.5
2.Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine Sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	2.0	**1.5**	1.0	0.5
3.Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow shallow, fast-deep, fast shallow). Slow is <0.3 m/s, deep is >0.5 m/s.	Only 3 of the 4 regimes Present.	Only 2 of the 4 habitat regimes present.	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE	2.0	1.5	**1.0**	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	2.0	**1.5**	1.0	0.5
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	2.0	**1.5**	1.0	0.5
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.
SCORE	2.0	1.5	1.0	**0.5**
7.Frequency of Riffles (or bends)	Frequent occurrence of riffles; distance of riffles/width of stream is <7. Variety of habitat is key.	Occurrence of riffles infrequent; distance of riffles/width of stream is between 7 and 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles/stream width is 15 to 25.	All flat water or shallow riffles; poor habitat; distance between riffles/stream width > 25.
SCORE	2.0	**1.5**	1.0	0.5 — 8.5
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.
SCORE	Left Bank 1.0	0.75	0.50	**0.25** — 9.5
SCORE	Right Bank 1.0	**0.75**	0.50	0.25
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.
SCORE	Left Bank 1.0	0.75	0.50	**0.25** — 10.5
SCORE	Right Bank 1.0	**0.75**	0.50	0.25
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.
SCORE	Left Bank 1.0	**0.75**	0.50	0.25
SCORE	Right Bank 1.0	**0.75**	0.50	0.25 — 12.0

Total Score: 12 NOTES/COMMENTS:

20

20-12 = 8 Sig. Improvement 2.0

Mountain Creek

Determination of Stream Credits
Working Draft, Subject to Change
Last Revised November 5, 2010

RESTORATION MITIGATION FACTORS FOR LINEAR SYSTEMS				
FACTORS	**OPTIONS**			
Stream Type[1]	Seasonal RPWs 0.05	1st and 2nd Order Perennial RPWs 0.4		All Other Streams 0.2
Priority Category	Tertiary 0.05	Secondary 0.2		Primary 0.3
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1]Stream type does not include man-made linear features.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for LINEAR SYSTEMS

Factor	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6
Stream Type	0.4					
Priority Category	0.3					
Net Improvement	2.0					
Credit Schedule	0.05					
Location	0.1					
Riparian Buffer Side A	0.3					
Riparian Buffer Side B	0.3					
Sum of Restoration Mitigation Factors=	M_1 = 3.45	M_2 =	M_3 =	M_4 =	M_5 =	M_6 =
Linear Feet Proposed Restoration	LL_1 = 1	LL_2 =	LL_3 =	LL_4 =	LL_5 =	LL_6 =
M × LL=	3.45					
Total Proposed Credits = $\sum$ (M × LL) =						

HIGH GRADIENT STREAM ASSESSMENT DATA SHEET				
Stream Name Mtn Creek		Basin/Watershed: Broad	USGS Quad: Leeds	
Latitude:		Longitude:	County: Chester	
Date: 5-23-2011		Time:	Investigator: Atkins	
Stream width:		Stream Depth:	Length of Stream Reach:	
Has it rained within the past 48 hours?		Adjacent land use? (Industrial, agriculture, etc):		
Habitat	**Condition Category**			
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired
1.Epifaunal Substrate or Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e. logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat lack of habitat is obvious; substrate unstable or lacking.
SCORE	2.0	1.5	(1.0)	0.5
2.Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine Sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	2.0	(1.5)	1.0	0.5
3.Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow shallow, fast-deep, fast shallow). Slow is <0.3 m/s, deep is >0.5 m/s.	Only 3 of the 4 regimes Present.	Only 2 of the 4 habitat regimes present.	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE	2.0	1.5	(1.0)	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	2.0	1.5	(1.0)	0.5
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	2.0	(1.5)	1.0	0.5
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.
SCORE	2.0	1.5	1.0	(0.5)
7.Frequency of Riffles (or bends)	Frequent occurrence of riffles; distance of riffles/width of stream is <7. Variety of habitat is key.	Occurrence of riffles infrequent; distance of riffles/width of stream is between 7 and 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles/stream width is 15 to 25.	All flat water or shallow riffles; poor habitat; distance between riffles/stream width > 25.
SCORE	2.0	1.5	(1.0)	0.5
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.
SCORE	Left Bank 1.0	0.75	(0.50)	0.25
SCORE	Right Bank 1.0	(0.75)	0.50	0.25
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.
SCORE	Left Bank 1.0	0.75	(0.50)	0.25
SCORE	Right Bank 1.0	(0.75)	0.50	0.25
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.
SCORE	Left Bank (1.0)	0.75	0.50	0.25
SCORE	Right Bank (1.0)	0.75	0.50	0.25

Total Score: 12 NOTES/COMMENTS:

Sig. Impr. 2.0

20 - 12 = 8

UT to Broad River

Determination of Stream Credits
Working Draft, Subject to Change
Last Revised November 5, 2010

RESTORATION MITIGATION FACTORS FOR LINEAR SYSTEMS				
FACTORS	**OPTIONS**			
Stream Type[1]	Seasonal RPWs 0.05	1st and 2nd Order Perennial RPWs 0.4		All Other Streams 0.2
Priority Category	Tertiary 0.05	Secondary 0.2		Primary 0.3
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1]Stream type does not include man-made linear features.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for LINEAR SYSTEMS

Factor	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6
Stream Type	0.4					
Priority Category	0.3					
Net Improvement	2.0					
Credit Schedule	0.05					
Location	0.1					
Riparian Buffer Side A	0.3					
Riparian Buffer Side B	0.3					
Sum of Restoration Mitigation Factors=	M_1 = 3.45	M_2 =	M_3 =	M_4 =	M_5 =	M_6 =
Linear Feet Proposed Restoration	LL_1 =	LL_2 =	LL_3 =	LL_4 =	LL_5 =	LL_6 =
M × LL=						
Total Proposed Credits = ∑ (M × LL) =						

HIGH GRADIENT STREAM ASSESSMENT DATA SHEET		
Stream Name Ut Broad R.	Basin/Watershed: Broad	USGS Quad: Leeds
Latitude:	Longitude:	County: Chester
Date: 5-23-2011	Time:	Investigator: Atkins
Stream width:	Stream Depth:	Length of Stream Reach:
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc):	

Habitat Parameter	Condition Category: Fully Functional	Partially Impaired	Impaired	Very Impaired
1.Epifaunal Substrate or Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e. logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat lack of habitat is obvious; substrate unstable or lacking.
SCORE	2.0	**1.5**	1.0	0.5
2.Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine Sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	2.0	**1.5**	1.0	0.5
3.Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow shallow, fast-deep, fast shallow). Slow is <0.3 m/s, deep is >0.5 m/s.	Only 3 of the 4 regimes Present.	Only 2 of the 4 habitat regimes present.	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE	2.0	1.5	**1.0**	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	2.0	1.5	**1.0**	0.5
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	2.0	**1.5**	1.0	0.5
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.
SCORE	2.0	1.5	1.0	**0.5**
7.Frequency of Riffles (or bends)	Frequent occurrence of riffles; distance of riffles/width of stream is <7. Variety of habitat is key.	Occurrence of riffles infrequent; distance of riffles/width of stream is between 7 and 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles/stream width is 15 to 25.	All flat water or shallow riffles; poor habitat; distance between riffles/stream width > 25.
SCORE	2.0	**1.5**	1.0	0.5
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.
SCORE	Left Bank 1.0	0.75	**0.50**	0.25
SCORE	Right Bank 1.0	**0.75**	0.50	0.25
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.
SCORE	Left Bank 1.0	0.75	**0.50**	0.25
SCORE	Right Bank 1.0	**0.75**	0.50	0.25
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.
SCORE	Left Bank **1.0**	0.75	0.50	0.25
SCORE	Right Bank **1.0**	0.75	0.50	0.25

Total Score: ______________ NOTES/COMMENTS:

20 - 13 = 7 Significant Improvement 7.0

UT to
Clarks Creek

Determination of Stream Credits
Working Draft, Subject to Change
Last Revised November 5, 2010

RESTORATION MITIGATION FACTORS FOR LINEAR SYSTEMS				
FACTORS	**OPTIONS**			
Stream Type[1]	Seasonal RPWs 0.05	1st and 2nd Order Perennial RPWs 0.4		All Other Streams 0.2
Priority Category	Tertiary 0.05	Secondary 0.2		Primary 0.3
Net Improvement [2]	Refer to Net Improvement in Section 2.0 (Definitions), page 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1]Stream type does not include man-made linear features.

[2] Net Improvement values are for in-stream work only. For riparian buffer enhancement or preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer.

Proposed Restoration Mitigation Worksheet for LINEAR SYSTEMS

Factor	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6
Stream Type	0.4					
Priority Category	0.3					
Net Improvement	2.0					
Credit Schedule	0.05					
Location	0.1					
Riparian Buffer Side A	0.3					
Riparian Buffer Side B	0.3					
Sum of Restoration Mitigation Factors=	M_1 = 3.45	M_2 =	M_3 =	M_4 =	M_5 =	M_6 =
Linear Feet Proposed Restoration	LL_1 =	LL_2 =	LL_3 =	LL_4 =	LL_5 =	LL_6 =
M × LL=						
					Total Proposed Credits = $\sum$ (M × LL) =	

HIGH GRADIENT STREAM ASSESSMENT DATA SHEET

Stream Name UT Clarks	Basin/Watershed: Broad	USGS Quad: Leeds
Latitude:	Longitude:	County: Chester
Date: 5-23-2011	Time:	Investigator: Atkins
Stream width:	Stream Depth:	Length of Stream Reach:
Has it rained within the past 48 hours?	Adjacent land use? (Industrial, agriculture, etc):	

Habitat Parameter	Condition Category: Fully Functional	Partially Impaired	Impaired	Very Impaired
1.Epifaunal Substrate or Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e. logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat lack of habitat is obvious; substrate unstable or lacking.
SCORE	2.0	1.5	(1.0)	0.5
2.Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine Sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	2.0	(1.5)	1.0	0.5
3.Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow shallow, fast-deep, fast shallow). Slow is <0.3 m/s, deep is >0.5 m/s.	Only 3 of the 4 regimes Present.	Only 2 of the 4 habitat regimes present.	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE	2.0	1.5	(1.0)	0.5
4.Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment. 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	2.0	(1.5)	1.0	0.5
5.Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	2.0	(1.5)	1.0	0.5
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (greater than past 20 yr.) may be present, but recent channelization not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat greatly altered or removed entirely.
SCORE	2.0	1.5	1.0	(0.5)
7.Frequency of Riffles (or bends)	Frequent occurrence of riffles; distance of riffles/width of stream is <7. Variety of habitat is key.	Occurrence of riffles infrequent; distance of riffles/width of stream is between 7 and 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles/stream width is 15 to 25.	All flat water or shallow riffles; poor habitat; distance between riffles/stream width > 25.
SCORE	2.0	(1.5)	1.0	0.5
8.Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosion scars.
SCORE	Left Bank 1.0	0.75	0.50	(0.25)
SCORE	Right Bank 1.0	(0.75)	0.50	0.25
9.Vegetative Protection	>90% of SB surfaces and adjacent riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes. minimal or no evidence of grazing or mowing; almost all plants allowed to grow naturally	70-90% of the SB surfaces covered by native vegetation but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential more than ½ of potential plant stubble height remaining	50-70% of SB covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than ½ potential plant stubble height remaining.	<50% of SB surfaces covered by vegetation; disruption of SB vegetation is very high; vegetation has been removed to 5 cm. or less in average stubble height.
SCORE	Left Bank 1.0	0.75	0.50	(0.25)
SCORE	Right Bank 1.0	(0.75)	0.50	0.25
10.Riparian Veg Zone Width	Width of riparian zone>18 meters; human activities (roads, clear-cuts, lawns, crops, parking lots) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.
SCORE	Left Bank 1.0	(0.75)	0.50	0.25
SCORE	Right Bank 1.0	(0.75)	0.50	0.25

Total Score: 12 NOTES/COMMENTS:

Sig. Improvement 2.0

20-12-9

Attachment C-3

Representative Photographs

Photo 1. Example of legacy sediment continuing to overwhelm Johns Creek, a tributary to Enoree River . Enoree Ranger District, Sumter National Forest.

Photo 2. High sediment load from in-stream bank erosion in Sparks Creek. Calhoun Experimental Forest, Sumter National Forest.

Photo 3. Legacy sediment in Tyger River at confluence with Sparks Creek. Note high sand/silt bed load. Calhoun Experimental Forest, Sumter National Forest.

Photo 4. Sediment plume from Sparks Creek at confluence with Tyger River. Calhoun Experimental Forest, Sumter National Forest.

Photo 5. Example of geomorphologically stable gullies along lower valley slopes within in Woods Ferry.

Photo 6. Remnant agricultural gullies under secondary forest vegetation in Woods Ferry.

Photo 7. Deep, semi active gulley in Woods Ferry.

Photo 8. Example of an active gulley in Enoree Ranger District, Sumter National Forest.

Photo 9. Example of a Small Stream Forest, Woods Ferry.

Photo 10. Bottomland Hardwoods in a larger floodplain within the lower reaches of Clarks Creek, Woods Ferry.

Photo 11. Fire-managed Mesic Mixed Hardwood Forest adjacent to Mountain Creek, Woods Ferry.

Photo 12. Confluence of Clarks Creek and the Broad River, Woods Ferry.

Photo 13. Reference E-channel, unnamed tributary to Broad River, Woods Ferry.

Photo 14. Reference B-channel, unnamed tributary to Broad River, Woods Ferry.

Photo 15. Reference E-channel, unnamed tributary to Broad River, Woods Ferry.

Photo 16. Reference B-channel, unnamed tributary to Broad River, Woods Ferry.

Photo 17. Deeply incised channel, Mountain Creek, Woods Ferry.

Photo 18. Mass wasting along outer meander on Clarks Creek, Woods Ferry.

Photo 19. Severe bank erosion on Clarks Creek, Woods Ferry.

Photo 20. Mass wasting and evidence of high sediment load in channel of Clarks Creek, Woods Ferry.

Appendix III.D

Turkey Creek Tract Component Conceptual Mitigation Plan

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Tables

1.0 PROJECT DESCRIPTION

Duke Energy is proposing to construct the Lee Nuclear Station in the eastern portion of Cherokee County, South Carolina. The proposed project site is adjacent to the Ninety-Nine Islands Reservoir on the Broad River and directly upstream of the Ninety-Nine Islands Dam, approximately eight miles southeast of Gaffney. The project is located within the Upper and Lower Broad River watersheds (United States Geologic Service [USGS] Hydrologic Unit Codes 03050105 and 03050106). A detailed project description for the Lee Nuclear Station can be found in Volume 1, Part II, Section 2.0 of the Permit Application Package.

The total permit area for the Lee Nuclear Station encompasses approximately 9,900 acres, which is divided into six permit area components that consist of the Lee Nuclear Site, a drought contingency pond and associated features, a railroad corridor, two off-site transmission line corridors, and off-site roads. The Permit Application Package includes an evaluation of the proposed impacts, including the following components:

- Alternatives analysis for the various facets of the project including site selection, supplemental water needs, and off-site transmission lines (Volume 1, Part II, Section 3.0)
- On-site avoidance and minimization (Volume 1, Part II, Section 4.0)
- Quantified Impacts, including impacts to waters of the United States pursuant to Section 404 of the Clean Water Act (Volume 1, Part II, Section 7.0)
- Secondary and Cumulative Effects (Volume 1, Part II, Section 8.0)

Mitigation for the Lee Nuclear Station will involve a combination of mitigation bank credits and permittee-responsible mitigation, including restoration/enhancement and preservation of wetland and stream components. Mitigation opportunities have been sought within the defined mitigation search area following the watershed approach (see Volume 2, Part III, Section 1.0, Conceptual Mitigation Plan). The watershed approach is a strategic site selection process that seeks to maintain and improve water quality and aquatic resources within the Broad River watershed where the proposed project is located. The Turkey Creek Tract (located in the Lower Broad River watershed) was identified as a unique opportunity to provide wetland and stream mitigation at a landscape level to compensate for the proposed impacts at the Lee Nuclear Station (Attachment D-1, Figure D-1).

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2.0 AVAILABLE MITIGATION CREDITS

Four existing mitigation banks having service areas that include the primary mitigation search area (Upper Broad River watershed and Lower Broad River watershed) were identified. These banks and their credit potential are discussed in Volume 2, Part III, Section 1.2.2, Conceptual Mitigation Plan. The Lee Nuclear Station project will need an estimated 54 wetland credits (27 credits of which must be restoration/enhancement credits), and will need an estimated 483,583 stream credits (241,792 credits of which must be restoration/enhancement credits). Overall, Duke Energy plans to utilize an appreciable number of wetland and stream mitigation bank credits in satisfying mitigation needs. It is anticipated at this time that approximately 10 to 20 percent of the mitigation need will be satisfied through mitigation banks.

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3.0 WATERSHED APPROACH

The permittee-responsible mitigation project was developed under a watershed approach to offset losses to aquatic functions commensurate with those from the proposed project. Volume 2, Part III, Section 1.0, Conceptual Mitigation Plan discusses conditions in the Upper and Lower Broad River watersheds, sources of functional impairments, and resources in need of protection. One of the primary sources of watershed functional impairment identified in these two watersheds is the presence of legacy sediments within streams and floodplains.

As a part of this approach, Duke Energy has been evaluating a relatively large privately owned forested tract that contains wetlands and a relatively dense network of streams as a component of the overall conceptual mitigation plan. The Turkey Creek Tract is located in the Lower Broad River watershed and has the potential to provide multiple landscape-level benefits to the immediate and surrounding area based on its location in the watershed, ecological conditions, and proximity to the Lee Nuclear Station and the Woods Ferry area of the Sumter National Forest.

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4.0 PROPOSED COMPENSATORY MITIGATION PLAN

4.1 PROJECT GOALS AND OBJECTIVES

Wetland and stream mitigation for the Lee Nuclear Station will include a combination of mitigation bank credit purchases and permittee-responsible mitigation to include restoration, enhancement, and preservation. This proposed mitigation approach is integrated, watershed-based, and regionally significant, while conforming to the USACE mitigation rule.

Mitigation banks currently have the potential to provide approximately 45 percent of the overall wetland and 15 percent of the overall stream credit needs of the project. The goal of the permittee-responsible component of the mitigation plan is to establish landscape-scale, ecologically meaningful, Piedmont stream and floodplain restoration and preservation that will benefit the Broad River, and meet the credit requirements for the permittee. Stream restoration/enhancement mitigation areas identified on the Sumter National Forest (Volume 2, Part III, Appendix C), have the potential to provide approximately 319,222 credits or 66 percent of the total and 132 percent of the stream restoration/enhancement credits needed, respectively. The Turkey Creek Tract has the potential to provide the remaining number of wetland and stream credits needed while providing direct ecological benefits to Turkey Creek, which flows into the Broad River approximately 3 miles downstream of the tract at a point of entry just upstream of the proposed Woods Ferry restoration/enhancement area. In addition, the Turkey Creek Tract is located approximately 3 miles from the proposed Woods Ferry stream restoration/enhancement area on the Sumter National Forest. Utilizing this tract as part of the permittee-responsible mitigation component will provide long-term, landscape-scale benefits by protecting approximately 20 acres of wetlands and 110,000 linear feet of stream and buffers within a contiguous tract of land and will operate in combination with the Woods Ferry restoration/enhancement area to directly benefit the segment of the Broad River just downstream of the Lockhart Dam, as well as reaches of the Broad River further downstream.

4.2 SITE SELECTION

The Lee Nuclear Station mitigation search for potential permittee-responsible mitigation sites has been multifaceted and focused within the Upper and Lower Broad River watersheds. Screening criteria were developed to provide a framework for and evaluation of potential sites in the context of the watershed approach. These criteria included factors as discussed in the 33 C.F.R. 332.3(d)(1) and additional criteria developed for this site selection process, and include:

- Hydrological conditions, soil characteristics, and other physical and chemical characteristics
- Watershed-scale features, such as aquatic habitat diversity, habitat connectivity, and other landscape scale functions

- Size and location of the compensatory mitigation site relative to hydrologic sources and other ecological features
- Compatibility with adjacent land uses and watershed management plans
- Reasonably foreseeable ecological effects of the compensatory mitigation project
- Other relevant factors including, but not limited to, habitat status and trends, local or regional goals for the restoration or protection of particular habitat types or functions
- Appropriate and practical mitigation based on existing design methodology, logistics, and cost
- Public benefit opportunity (e.g., helping to meet resource agency goals, providing for increased public use/benefit of the resource)

Three large, forested tracts located within the primary search area were identified and evaluated as potential mitigation sites. Alternative Site 1 (located in the Upper Broad River watershed) was ruled out due to incompatible adjacent land uses after an on-site inspection revealed that recently employed land-use practices on an adjacent upstream property were impacting water quality (sedimentation) within portions of this potential mitigation site. As a result, Alternative Site 1 was eliminated from consideration. Alternative Site 2 (located in the Upper Broad River watershed) did not meet certain screening criteria related to potential stream length and did not have the potential for landscape scale mitigation, and was therefore excluded from consideration. Alternative Site 3 (Turkey Creek Tract) (Figure D-1) does meet relevant screening criteria for a permittee-responsible mitigation site (described in more detail in the following subsections) and is therefore being proposed.

The Turkey Creek Tract (privately-owned) comprises approximately 5,055 contiguous acres located primarily in the Lower Broad River watershed (approximately 0.1 mile east of the watershed divide with the Upper Broad River watershed; Figures D-1 and D-2). The Turkey Creek Tract is located in York and Chester Counties, South Carolina and is essentially bordered by Center Road (Hwy 97) to the east, Gilchrist Road (SR 306) to the south, Lockhart Road (Hwy 49) to the west, and West McConnells Highway (Hwy 322) to the north (Figure D-2). In addition, the Turkey Creek Tract is situated approximately 3 miles northeast of the proposed Woods Ferry stream restoration/enhancement area, located within the Enoree Ranger District of the Sumter National Forest and includes portions of Turkey Creek that flow into the Broad River just upstream of the proposed Woods Ferry restoration/enhancement area. This is significant since a considerable amount of stream restoration/enhancement mitigation credits are proposed to be generated from this area of the Sumter National Forest (also located within the Lower Broad River watershed). The location of the Turkey Creek Tract directly supports the landscape-approach to mitigation and both the Turkey Creek Tract and the Woods Ferry area benefit the same segment of the Broad River.

Based on a GIS analysis using hydrologic data from U.S. Geological Survey (USGS), Natural Resources Conservation Service (NRCS) soils data, National Wetlands Inventory (NWI) data, recent aerial photographs, and limited ground truthing, the Turkey Creek Tract is estimated to contain approximately 20 acres of wetlands, 3.5 acres of open water habitat, and 110,000 linear feet of stream (mainly first- through third-order streams). Results of preliminary site inspections suggest that wetlands are primarily palustrine forested (Cowardin et al., 1979). Additional information on wetland and stream conditions will be addressed in the final mitigation plan.

4.2.1 Hydrological Conditions, Soil Characteristics, and Other Physical and Chemical Characteristics

Hydrological conditions, soil characteristics, and other physical and chemical characteristics of the Turkey Creek Tract can be found in Section 4.4.

4.2.2 Watershed-Scale Features, Such as Aquatic Habitat Diversity, Habitat Connectivity, and Other Landscape Scale Functions

Watershed-scale features, such as aquatic habitat diversity, habitat connectivity, and other landscape scale functions are discussed in Sections 4.2.5, 4.2.6, and 4.4. Additionally, Turkey Creek, in combination with the proposed mitigation at Sumter National Forest, provides a holistic mitigation approach for watershed-scale features (e.g., extension of upland/riparian habitat connectivity and protecting water quality in the Broad River watershed).

4.2.3 Size And Location of the Compensatory Mitigation Site Relative to Hydrologic Sources and Other Ecological Features

The size and location of the compensatory mitigation site relative to hydrologic sources and other ecological features are discussed in Section 4.4.

4.2.4 Compatibility with Adjacent Land Uses and Watershed Management Plans

The Turkey Creek Tract is approximately 95 percent forested, which is compatible with surrounding land uses that are approximately 75 percent forested and 15 percent agricultural.

4.2.5 Reasonably Foreseeable Ecological Effects of the Compensatory Mitigation Project

Wetland and stream mitigation on the Turkey Creek Tract are expected to benefit ecologically important aquatic and terrestrial resources by protecting a relatively dense network of streams along with wide vegetation buffers.

4.2.6 Other Relevant Factors

Protecting wetland and stream resources in perpetuity will enhance water quality, aquatic habitats, associated plants and wildlife, and the overall ecological functionality of the site and, in combination with the proposed Woods Ferry restoration/enhancement, will directly benefit the segment of the Broad River just downstream of the Lockhart Dam, as well as reaches of the Broad River further downstream. Additionally, the Turkey Creek Tract is a larger site with a reasonable number of interested/willing landowners, and is practicable when considering availability, existing design methodology, logistics, and cost.

4.3 SITE PROTECTION INSTRUMENT

Wetland and stream resources on the Turkey Creek Tract are expected to be protected through an appropriate real estate instrument, such as a restrictive deed that includes buffers for streams and wetlands .

4.4 BASELINE CONDITIONS

4.4.1 Project Site

Project site information for the Lee Nuclear Station can be found as follows:

- On-site aquatic resources (i.e., wetlands, open water, and streams) are discussed in Volume 1, Part II, Section 6.0 of the Permit Application Package and Chapter 2 of the Environmental Report.
- Quantified impacts to jurisdictional systems are discussed in Volume 1, Part II, Section 7.0 of the Permit Application Package.
- Credit calculations are discussed in Volume 2, Part III, Section 1.0, Conceptual Mitigation Plan.

4.4.2 Proposed Mitigation Site

4.4.2.1 Physiography, Topography, and Land Use

The Turkey Creek Tract is located in the Lower Broad River watershed (USGS Hydrologic Unit 03050106) (Figure D-2) and the Southern Outer Piedmont ecoregion of the piedmont physiographic province (Griffith et al. 2002). The Southern Outer Piedmont ecoregion extends from northern Virginia, across a large swath of the Carolinas and Georgia, and into Alabama. Once largely cultivated or deforested, much of the region has reverted to pine and hardwood woodlands. Loblolly-shortleaf pine is the major forest type, with lesser coverage in oak-hickory and oak-pine. Gneiss, schist and granite are the dominant rock types that are associated with deep, erosive-prone saprolite and mostly red, clayey subsoils (Griffith et al. 2002).

The Broad River flows across the Piedmont of South Carolina and encompasses 1.4 million acres within the Broad River watershed. The Broad River watershed is characterized by several land uses including forest (72.1 percent), agriculture (13.4 percent), urban (6.9 percent), scrub/shrub (5.3 percent), open water (1.8 percent), and barren (0.5 percent) (SCDHEC 2005). The Piedmont of South Carolina is further characterized by gently rolling to hilly slopes and narrow stream valleys dominated by forests, farms, and orchards. Elevations range from approximately 375 to 1,000 feet above mean sea level (SCDHEC 2001).

Overall, the Turkey Creek Tract is characterized by relatively steep terrain with elevations ranging between 675 feet National Geodetic Vertical Datum (NGVD) along ridge tops to a low of approximately 375 feet NGVD within the Turkey Creek floodplain. Per the Soil Surveys for York County (USDA 1965) and Chester and Fairfield Counties (USDA 1982), 44 soil series are associated with this proposed mitigation site. Per GIS analysis using soil survey maps (USDA 1965, 1982), approximately 400 acres (<10 percent) of the Turkey Creek Tract are characterized by hydric soils and approximately 90 percent are non-hydric soils. A general description of each soil series associated with the Turkey Creek Tract can be found in Section 4.4.2.2.

Across the Piedmont, legacy sediments emanating from eroded cropland dominate stream channel geomorphology and have subsequently affected the physical, chemical, and biological/ecological condition of streams and associated floodplains. This condition is not new to piedmont streams in South Carolina as they continue to recover from agricultural practices originating in the 1800s. On-site streams are characterized by a mixture of intact and stable reaches marked by exposed bedrock, sediment bedloads, and varying degrees of entrenchment (Attachment D-2). The overall proportions of these stream conditions will be developed and presented in the Final Mitigation Plan.

The Turkey Creek Tract is a privately-owned forested property. This tract is located in a rural setting that is dominated by privately-owned forested properties and to a lesser extent, privately owned agricultural land (Figure D-3). Several miles of county-maintained roads cross the tract. Preliminary observations indicate that forest management has been conducted on this tract in accordance with South Carolina's Forestry Best Management Practices and in some cases above and beyond what is recommended. For example, streamside management zones (riparian areas subjected to specific management regimes) were found along all perennial and intermittent streams and a considerable percentage of streamside management zones associated with ephemeral streams were characterized by naturally regenerated forest stands comprising native hardwood and pine species.

4.4.2.2 Soils

Soils within the Turkey Creek Tract have been mapped (USDA 1965, 1982) and are depicted in Figure D-4 and summarized in Table D-1. The dominant soils series for the Turkey Creek Tract are described below (USDA 1965, 1982).

Appling sandy loam, 6 to 10 percent slopes (ApC) consist of gently sloping to sloping soils that are well drained and adjacent to drainageways. Permeability is moderate and available water capacity is medium. Equipment limitations and erosion hazard are low.

Cataula clay loam, 6 to 10 percent slopes, severely eroded (CaC3) consist of deep to moderately deep, moderately well drained soils. Permeability is low and available water capacity is low. Erosion and equipment limitations are moderate.

Cecil clay loam, 6 to 10 percent slopes, severely eroded (CcC3) are soils consisting of deep, well drained, on medium and broad irregularly shaped ridgetops with smooth and convex slopes. Permeability is moderate and available water capacity is medium. Erosion and equipment limitations are high.

Cecil sandy loam, 2 to 6 percent slopes, eroded (CdB2), and 2 to 6 percent slopes, eroded (CnB2) consist of deep, well drained, on broad irregularly shaped ridgetops with smooth and convex slopes. Permeability is moderate and available water capacity is medium. Erosion and equipment limitations are moderate.

Cecil sandy clay loam, 6 to 10 percent slopes, eroded (CnC2) consist of deep, well drained, on broad irregularly shaped ridgetops with smooth and convex slopes. Permeability is moderate and available water capacity is medium. Erosion and equipment limitations are moderate.

Chewacla loam (Cw) consists of deep, somewhat poorly drained, nearly level soils found along floodplains and perennial streams. These soils are commonly flooded for brief periods from November to April. The soils have moderate permeability and high available water capacity.

Enon clay loam, 6 to 10 percent slopes, severely eroded (EnC3) consist of well drained soils on narrow side slopes of uplands. Permeability is low and the available water capacity is low. The shrink-swell potential is high and erosion potential is also high.

Enon sandy loam, 2 to 6 percent slopes, eroded (EsB2), 6 to 10 percent slopes, eroded (EsC2), 10 to 15 percent slopes, eroded (EsD2), and 15 to 25 percent slopes, eroded (EsE2) consist of well drained soils on broad, smooth, inter-stream divides in uplands. Permeability is low and available water capacity is low. The shrink-swell potential and erosion potential are high.

Table D-1
Soil Characteristics of the Dominant Soil Series Within the Turkey Creek Tract

Soil Series	Taxonomic classification	Slope (percent)	Landscape Position	Depth to root restrictive layer (inches)	Drainage class
Appling ApC	Typic Kanhapludults	6 to 10	Interfluves	>60	well drained
Cataula CaC3	Oxyaquic Kanhapludults	6 to 10, severely eroded	Interfluves	16 to 40	well drained
Cecil CcC3	Typic Kanhapludults	6 to 10, severely eroded	Interfluves	>60	well drained
Cecil CdB2	Typic Kanhapludults	2 to 6, eroded	Interfluves	>60	well drained
Cecil CnB2	Typic Kanhapludults	2 to 6, eroded	Interfluves	>60	well drained
Cecil CnC2	Typic Kanhapludults	6 to 10, eroded	Interfluves	>60	well drained
Chewacla Cw	Fluvaquentic Dystrudepts	0 to 2	Floodplain	>60	somewhat poorly drained
Enon EnC3	Ultic Hapludalfs	6 to 10, severely eroded	Interfluves	>60	well drained
Enon EsB2	Ultic Hapludalfs	2 to 6, eroded	Interfluves	>60	well drained
Enon EsC2	Ultic Hapludalfs	6 to 10, eroded	Interfluves	>60	well drained
Enon EsD2	Ultic Hapludalfs	10 to 15, eroded	interfluve	>60	well drained
Enon EsE2	Ultic Hapludalfs	15 to 25, eroded	interfluve	>60	well drained
Helena HaB	Aquic Hapludalfs	2 to 6	interfluve	>60	well drained
Hiwassee HsC	Rhodic Kanhapludults	6 to 10	interfluve	>60	well drained
Lloyd LaB3	Rhodic Kanhapludults	2 to 6, severely eroded	interfluve	40 to 60	well drained
Lloyd LaC3	Rhodic Kanhapludults	6 to 10, severely eroded	interfluve	40 to 60	well drained
Lloyd LaD3	Rhodic Kanhapludults	10 to 15, severely eroded	interfluve	40 to 60	well drained
Lloyd LdB2	Rhodic Kanhapludults	2 to 6, eroded	interfluve	40 to 60	well drained
Lloyd LmE2	Rhodic Kanhapludults	15 to 25, eroded	interfluve	40 to 60	well drained
Madison MaB	Typic Kanhapludults	2 to 6	interfluve	40 to 60	well drained
Madison MdC2	Typic Kanhapludults	6 to 10, eroded	interfluve	40 to 60	well drained
Madison MdE2	Typic Kanhapludults	10 to 25, eroded	interfluve	40 to 60	well drained
Mecklenburg McB2	Ultic Hapludalfs	2 to 6, eroded	interfluve	>60	well drained
Mecklenburg McE2	Ultic Hapludalfs	15 to 25, eroded	interfluve	>60	well drained
Mecklenburg MkC2	Ultic Hapludalfs	6 to 10, eroded	interfluve	>60	well drained
Pacolet PaE	Typic Kanhapludults	10 to 25	interfluve	>60	well drained
Toccoa To	Typic Udifluvents	0 to 4	floodplain	>60	well drained
Wateree-Rion WaD	Typic Dystrudepts	6 to 15	interfluve	20 to 40	well drained
Wateree-Rion WaF	Typic Dystrudepts	15 to 40	interfluve	20 to 40	well drained
Wickham WcB2	Typic Hapludalfs	2 to 6	interfluve	40 to 60	well drained
Wickham WcD2	Typic Hapludalfs	6 to 15	interfluve	40 to 60	well drained
Wilkes WkC	Typic Hapludalfs	6 to 10	interfluve	40 to 60	well drained
Wilkes WkD	Typic Hapludalfs	10 to 15	interfluve	40 to 60	well drained

Table D-1, cont'd

Soil Series	Taxonomic classification	Slope (percent)	Landscape Position	Depth to root restrictive layer (inches)	Drainage class
Wilkes WkE	Typic Hapludalfs	15 to 35	interfluve	40 to 60	well drained
Wilkes WkF	Typic Hapludalfs	15 to 40	interfluve	40 to 60	well drained
Winnsboro WnB	Typic Hapludalfs	2 to 6	interfluve	40 to 60	well drained
Winnsboro WnC	Typic Hapludalfs	6 to 10	interfluve	40 to 60	well drained

Gullied land, friable materials, rolling (GuC) and hilly (GuD) are miscellaneous land types consisting of steep to vertical streambanks and branching gully walls. Permeability and available water capacity are low. The shrink-swell potential and erosion potential are high.

Helena sandy loam, 2 to 6 percent slopes (HaB) consist of deep, moderately well drained, soils on broad ridges and narrow side slopes at the head of and adjacent to drainageways. Slopes are gentle, smooth and convex. Permeability is slow and available water capacity is high. The shrink-swell potential is high and erosion potential is moderate.

Hiwassee sandy loam, 6 to 10 percent slopes (HsC) consists of deep, well drained, soils on ridgetops with irregular, short, convex slopes. These soils are usually found at the head of or adjacent to shallow drainageways. Permeability is moderate and available water capacity is medium. Erosion potential is moderate.

Lloyd clay loam, 2 to 6 percent slopes, severely eroded (LaB3), 6 to 10 percent slopes, severely eroded (LaC3) and 10 to 15 percent slopes, severely eroded (LaD3) consist of deep, well drained soils with strong and shorter slopes. Permeability is moderate and available water capacity is medium. Erosion potential is high.

Lloyd loam, 2 to 6 percent slopes, eroded (LdB2) consist of deep, well drained soils with strong and shorter slopes. Permeability is moderate and available water capacity is medium. Erosion potential is high.

Lloyd sandy loam, 15 to 25 percent slopes, eroded (LmE2) consist of deep, well drained soils with moderately steep breaks along other Lloyds and associated soils. Permeability is moderate and available water capacity is medium. Erosion potential is high.

Madison sandy loam, 2 to 6 percent slopes (MaB), 6 to 10 percent slopes, eroded (MdC2) and 10 to 25 percent slopes, eroded (MdE2) consist of deep, well drained, soils on ridgetops and broad side slopes. Slopes are irregular and convex. Permeability is moderate and available water capacity is medium. Erosion and equipment limitations are moderate.

Mecklenburg loam, 2 to 6 percent slopes, eroded (McB2) and 15 to 25 percent slopes, eroded (McE2) consist of deep, well drained soils on irregular, moderately steep, convex, strongly sloping areas adjacent to drainageways. Permeability is moderate, and available water capacity is medium. Equipment limitations are moderate and erosion hazard is high.

Mecklenburg sandy clay loam, 6 to 10 percent slopes, eroded (MkC2) consist of deep, well drained, soils on long narrow side slopes on uplands. Permeability is moderate, and available water capacity is medium. Equipment limitations are moderate and erosion hazard is high.

Mixed alluvial land (Mn) comprises washed alluvial soils that occur on the first bottoms of medium and small sized streams. Permeability is moderate, and available water capacity is medium. Equipment limitations are moderate and erosion hazard is high.

Mixed alluvial land, wet (Mw) consist of poorly drained, saturated soils. Permeability is low, and available water capacity is low. Equipment limitations are high and erosion hazard is high.

Pacolet sandy loam, 10 to 25 percent slopes (PaE) consists of deep well drained, strongly sloping to steep, convex slopes adjacent to drainageways. Permeability is moderately rapid to rapid and available water capacity is low. The soil is droughty and wind erosion is a moderate hazard.

Toccoa Loam (To) soils are deep and well drained; occur on medium and broad irregularly shaped ridgetops with smooth and convex slopes. Permeability is moderate and available water capacity is high. Shrink-swell potential is low and erosion potential is moderate.

Water (W) This map unit consists of areas of water, including ponds, lakes, and rivers. The largest mapped areas of water in, or partially in, Chester and York Counties are Turkey Creek, Rainey Branch, and McKelvey Creek.

Wateree-Rion complex, 6 to 15 percent slopes (WaD) and 15 to 40 percent slopes (WaF) comprises areas of Wateree sandy loam and Rion loamy sand that form an intricate mix of small soil mapping units that are difficult to map separately. The complex is found on narrow to broad, long, moderately steep to steep, convex side slopes. Permeability is moderate to moderately rapid and available water capacity is low to medium. Erosion is a severe hazard.

Wickham sandy loam, 2 to 6 percent slopes, eroded (WcB2) and 6 to 15 percent slopes, eroded (WcD2) consist of deep, well drained, soils near streams terraces. Permeability is moderate and available water capacity is medium. Erosion potential is low.

Wilkes complex, 6 to 10 percent slopes (WkC), 10 to 15 percent slopes (WkD), and 15 to 35 percent slopes (WkE) consist of strongly sloping and moderately steep soils on well drained uplands. Permeability is low and available water capacity is low. The shrink-swell potential is moderate and erosion potential is high.

Wilkes sandy loam, 15 to 40 percent slopes (WkF) consist of strongly sloping and moderately steep soils on well drained uplands. Permeability is low and available water capacity is low. The shrink-swell potential is moderate and erosion potential is high.

Winnsboro sandy loam, 2 to 6 percent slopes (WnB) and 6 to 10 percent slopes (WnC) consist of deep well drained, irregularly shaped ridgetops with gently convex sloping soils. Permeability is slow and available water capacity is medium. The shrink-swell potential is high and erosion potential is moderate.

4.4.2.3 Jurisdictional Systems

Site jurisdictional areas on the Turkey Creek Tract will include primarily surface waters as bank-to-bank streams but, also include areas of vegetated wetlands. A jurisdictional determination (RGL 08-02, 2008) will be requested and will be provided in the Final Mitigation Plan.

4.4.2.4 Plant Communities

Overall, approximately 25 percent of the Turkey Creek Tract is characterized by bottomland hardwood, riparian (hardwood-pine), and somewhat rare, upland hardwood communities (Figure D-3). The remaining 75 percent of the Turkey Creek Tract comprises planted pine stands ranging in age between approximately 5 and 30 years old. Pine plantations are located mainly uphill of riparian areas occupying side slopes and upland ridges. Several hardwood-dominated forest stands (late-successional/mature oak-hickory-beech-Virginia pine) are also present. A detailed description of on-site vegetation communities and habitats will be provided in the Final Mitigation Plan

Distribution and composition of plant communities reflect landscape-level variation in topography, soils, hydrology, and past or present land-use practices. General plant community classifications identified within Turkey Creek Tract stream floodplains and adjacent side slopes include small stream forests, mesic, mixed hardwood forest, and pine woodland. Plant community classifications are based on “The Natural Communities of South Carolina” (Nelson 1986). Pine woodland is not described by Nelson (1986) but, is used to describe the upland forest community dominated by planted loblolly pine (*Pinus taeda*).

Small stream forests persist within primary floodplains, tributaries, and lower slope drainages. Common tree species included sweetgum (*Liquidambar styraciflua*), tulip poplar (*Liriodendron tulipifera*), river birch (*Betula nigra*), water oak (*Quercus nigra*), loblolly pine, green ash (*Fraxinus pennsylvanica*), sugarberry (*Celtis laevigata*), and American beech (*Fagus grandifolia*). Sub-canopy layers are characterized by box-elder (*Acer negundo*), ironwood (*Carpinus caroliniana*), hophornbeam (*Ostrya virginiana*), paw paw (*Asimina triloba*), and flowering dogwood (*Cornus florida*). In a few locations, high concentrations of giant cane (*Arundinaria gigantea*), false nettle (*Boehmeria cylindrica*), and river oats (*Chasmanthium latifolium*) were also observed.

Mesic, mixed hardwood forests occupy lower slopes and north-facing bluffs. Mesic, mixed forest stands on the Turkey Creek Tract are dominated by several oak and hickory species including white oak (*Quercus alba*), black oak (*Quercus velutina*), northern red oak (*Quercus rubra*), mockernut hickory (*Carya alba*), and pignut hickory (*C. glabra*). Other canopy species included tulip poplar, red maple (*Acer rubrum*), American beech, black walnut (*Juglans nigra*), and sycamore (*Platanus occidentalis*). On cooler and wetter north-facing slopes, sub-canopy species included redbud (*Cercis canadensis*), hophornbeam, American basswood (*Tilia heterophylla*), and deciduous holly (*Ilex decidua*). On drier south- and west-facing slopes, the sub-canopy was dominated by flowering dogwood, American holly (*Ilex opaca*), painted buckeye (*Aesculus sylvatica*), and sparkleberry (*Vaccinium arboreum*).

Pine woodland is the predominant upland community type within the Turkey Creek Tract. The oldest stands appear to be approximately 30 years old. The pine woodland type is dominated by loblolly pine and is maintained as a single dominant tree through thinning, selective logging, and occasional prescribed fires. Several other trees are present as seedlings and saplings, including dogwood, sweetgum, red maple, sourwood (*Oxydendron arboreum*), various oaks (*Quercus* spp.), hickories (*Carya* spp.), and eastern red cedar (*Juniperus virginiana*). Several young (5–10 years old) pine plantations also occur on the Turkey Creek Tract. These stands are characterized by loblolly pine overstories and mid- and understories comprising various oak species, blackberry (*Rubus* spp.), and muscadine (*Vitis* spp.).

4.4.2.5 Hydrology

Watershed Description and Site Hydrology Characterization

Turkey Creek is located in 11-digit hydrologic unit code 03050106020 and has a watershed area encompassing 87,988 acres. Turkey Creek originates near York, South Carolina and Caldwell Lake. The southern tip of the watershed lies within the Sumter National Forest - Enoree Ranger District. Approximately 13 named tributaries feed into Turkey Creek (the watershed comprises approximately 190 stream miles) while ponds and lakes total 100.5 acres (SCDHEC 2001). Approximately 79 percent of the watershed is forested followed by pastures (5 percent), row crops (6 percent), and residential development (1 percent). Soils are dominated by an association of the Wilkes-Cecil-Madison series. Terrain is rolling-hilly having an average slope of 12 percent, with a range of 2–40 percent (SCDHEC 2007).

On-Site Streams

The Turkey Creek Tract lies primarily in the 12-digit hydrologic unit code 030501060105; it also intersects portions of hydrologic unit code 030501051604 to the west and 030501060103 to the southeast (Figure D-5). Turkey Creek traverses the southern portion of the Turkey Creek Tract. Several named tributaries to Turkey Creek flow through portions of the tract: Rainey Branch, Palmer Branch, Kirk Patrick Branch (upper reach of Rainey Branch), McKelvey Creek, and Susybole

Creek. In addition, several unnamed tributaries to these creeks are also found on site (Figure D-5). On-site tributaries to Turkey Creek are primarily first through third order. These streams comprise a local drainage area of approximately 8,640 acres and the Turkey Creek Tract (5,055 acres) accounts for 4,605 acres (53 percent) of this combined drainage area. On a per stream basis, 68 percent of Rainey Branch, 59 percent of Palmer Branch, 83 percent of unnamed tributaries 2 and 3, 51 percent of unnamed tributary 1, and 12 percent of McKelvey Creek watersheds are within the boundaries of the Turkey Creek Tract. With the exception of a few small ponds (approximately 3.5 acres) assumed to be the result of damming small tributary streams, no other significant hydrologic obstructions appear to be affecting the Turkey Creek Tract.

4.4.2.6 Water Quality

The Broad River crossing at the intersection of State Highways 72/215/121 has been assigned a Freshwaters (Class FW) usage classification. Class FW waters are suitable for primary and secondary contact recreation and as a source of drinking water after conventional treatment. These waters are suitable for fishing and reproducing populations of indigenous aquatic plants and animals. This class is also suitable for industrial and agricultural uses. Streams associated with the Turkey Creek Tract are assumed to also be Class FW.

According to SCDHEC (2005), Turkey Creek is impaired for fecal coliform, which is also the number one cause of waterbody impairment across the country and South Carolina. In fact, nearly 60 percent of the river/stream miles monitored for water quality within South Carolina are impaired due to fecal coliform bacteria (http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T, accessed on August 11, 2011). Fecal coliform bacteria are produced by warm-blooded animals, including humans, deer, feral hogs, wild turkey, raccoons, other small mammals, birds, cattle, and household pets. Fecal coliform bacteria are associated with both point and nonpoint sources of pollution.

The U.S. Environmental Protection Agency's 303 (d) Water Quality Monitoring Station B-136 is located at the State Road 9 crossing of Turkey Creek approximately 1.5 miles upstream of the confluence with the Broad River and approximately 1.5 miles downstream of the southwest corner of the Turkey Creek Tract. Thirty-three water samples were collected at station B-136 from May 1998 through November 2002. Eight (24 percent) of the samples exceeded the fecal coliform criterion for primary contact recreation. There is no active NPDES-permitted wastewater treatment plant discharging fecal coliform and no sanitary sewer overflows were reported within this watershed (SCDHEC 2001, 2005). There are an estimated 1,664 on-site waste disposal systems within the Turkey Creek watershed, an estimated 2,422 cattle, and a native deer population ranging from 30 to more than 45 deer per square-mile (0.6 deer per acre). According to SCDHEC (2001, 2005), the most probable sources of fecal coliform in Turkey Creek are a combination of nonpoint sources, including land application fields, failing on-site waste disposal systems, native wildlife, and cattle watering in creeks.

Kirk Patrick Branch, which forms an upper reach of Rainey Branch (12-digit hydrologic unit code 030501060105), was formerly included on the 303 (d) list for fecal coliform impairment. Since a total maximum daily load has been developed, this stream is no longer included on the 303 (d) list (SCDHEC 2010).

Mitigation goals at Turkey Creek do not specifically address the impairment due to fecal coliform bacteria. Impairments to recreational uses are not anticipated to affect the stream and riparian functions proposed in this mitigation plan.

4.4.2.7 Protected Species

Threatened and endangered species are those plants or animals, which the Secretary of the Interior classifies as "threatened" or "endangered", based on the best available scientific and commercial data. Species with the federal classification of endangered or threatened are protected under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.). The U.S. Fish and Wildlife Service also identifies "candidate species," which are taxa being considered for "Proposed Status" and possible addition to the threatened and endangered species list.

Publically maintained databases that track threatened and endangered species occurrences in South Carolina were reviewed. The South Carolina Heritage Trust Geographic database of rare and endangered species was accessed on August 12, 2011, and data concerning threatened and endangered species were reviewed for Chester County (records last updated on April 15, 2010) and York County (records last updated on December 3, 2009). In addition, the United States Fish and Wildlife Service's South Carolina County List (website accessed on August 12, 2011, records last updated May 2011) was also reviewed for both counties. Five federally listed species (endangered or threatened) occur in the two-county area, one species is considered a federal candidate species, and one species is protected solely by the state. One additional species, the bald eagle (*Haliaeetus leucocephalus*), is federally protected via the Bald and Golden Eagle Protection Act and the State of South Carolina lists it as endangered (Table D-2). Additional due-diligence investigations concerning the potential location of listed species related to the Turkey Creek Tract will be conducted as part of the Final Mitigation Plan.

4.4.2.8 Site Design and Implementation Constraints

Conditions or characteristics that have the potential to hinder preservation activities on the Turkey Creek Tract have been preliminarily evaluated. Currently, no evidence of natural or man-made conditions has been identified that could potentially impede proposed mitigation activities. The lower reaches of Palmer Branch and most of Rainey Branch and Turkey Creek have areas of varying width mapped by FEMA as being within each stream's 100-year floodplain. A more-detailed evaluation of potential impediments will be undertaken during the Final Mitigation Plan phase of the project. That evaluation will include, but is not limited to, inquiries concerning the presence of

Table D-2
Listed species that Occur within Chester and York Counties, South Carolina

Common Name	Scientific Name	Type	Listing Status	Chester County	York County
Carolina Heelsplitter	*Lasmigona decorate*	Mussel	FE, SE	X	X
Red-cockaded Woodpecker	*Picoides borealis*	Bird	FE	X	
Bald Eagle	*Haliaeetus leucocephalus*	Bird	BGEPA, SE	X	X
Schweinitz's Sunflower	*Helianthus schweinitzii*	Plant	FE		X
Dwarf-flowered heartleaf	*Hexastylis naniflora*	Plant	FT		X
Pool Sprite	*Amphianthus pusillus*	Plant	FT		X
Georgia Aster	*Aster georgianus*	Plant	FC	X	X
Carolina Darter	*Etheostoma collis*	Fish	ST		X

FE-Federally Endangered, FT-Federally Threatened, FC-Federal Candidate, SE-State Endangered,
ST-State Threatened, BGEPA-Bald and Golden Eagle Protection Act

hazardous materials, utilities and restrictive easements, rare/threatened/endangered species and/or their critical habitats, and the potential for hydrologic impacts on t adjacent properties.

4.4.3 Reference Site

Baseline information gathered by a permittee for the reference site will be used to assist in developing the plant species lists and developing appropriate performance standards. Reference sites for wetland, riparian and upland plant communities will be identified for mitigation activities.

4.5 DETERMINATION OF CREDITS

As previously described, the Turkey Creek Tract provides approximately 20 acres of wetlands, 3.5 acres of open water, and 110,000 linear feet of stream. Subsequent phases of project development, e.g., Final Mitigation Plan, may involve more-detailed studies including wetland and stream delineations and finalization of wetland and stream credit estimates. At this stage of mitigation plan development, a mitigation factor of approximately one credit per acre of wetland will be assumed to be appropriate for this site. Stream mitigation factors per the USACE Charleston District Guidelines (USACE 2010) were also considered for generalized stream preservation reaches that were either seasonal, relatively permanent waters or first and second order perennial waters. The permittee intends to utilize a buffer width two times the minimum required for all streams (300-foot buffers on each stream bank), which will generate at a minimum, approximately 0.79 to 0.99 stream preservation credit per linear foot of stream, and 1.13 to 1.33 stream buffer enhancement credits per linear foot of stream (Table D-3). Based on these values, the Turkey Creek Tract has the potential to provide approximately 86,900 to 146,300 stream credits. Wetlands on-site at Turkey Creek may generate approximately 1.3 wetland preservation credits and 2.2 wetland buffer enhancement credits (Table D-4). Based on these values, the Turkey Creek Tract has the potential to provide approximately 26 to 44 wetlands credits. Buffer enhancement actions associated with streams and wetlands usually involve the planting of native plant species and/or the removal of exotic species within riparian and/or wetland areas. Estimates for all on-site stream reaches and wetlands will be fully assessed and refined during the Final Mitigation Plan phase.

Table D-3
Estimated Minimum Mitigation Factors for Stream Reaches on the Turkey Creek Tract

	Preservation		Buffer Enhancement	
	Seasonal RPW (Credit Values)	**Perennial RPW (Credit Values)**	**Seasonal RPW (Credit Values)**	**Perennial RPW (Credit Values)**
Stream Type	0.20	0.40	0.20	0.40
Priority Category	0.05	0.05	0.05	0.05
Net Improvement	0.00	0.00	0.00	0.00
Credit Schedule	0.10	0.10	0.10	0.10
Location	0.10	0.10	0.10	0.10
Riparian Buffer Side A	0.17	0.17	0.34	0.34
Riparian Buffer Side B	0.17	0.17	0.34	0.34
Sum of Mitigation Factors	**0.79**	**0.99**	**1.13**	**1.33**
Potential Mitigation Credits	**86,900**	**108,900**	**124,300**	**146,300**

Note: Values based on generalized stream conditions at the Turkey Creek Tract for seasonal relatively permanent waters and 1st and 2nd order perennial relatively permanent waters utilizing two times the minimum required buffer for both stream banks.

Table D-4
Estimated Minimum Mitigation Factors for Wetlands on the Turkey Creek Tract

	Wetland Preservation (Credit Values)	**Wetland Enhancement (Credit Values)**
Net Improvement	0	1.0
Upland Buffer	0.5	0.5
Credit Schedule	0	0.3
Temporary Loss	0	-0.4
Kind	0.4	0.4
Location	0.4	0.4
Sum of Mitigation Factors	**1.3**	**2.2**
Potential Mitigation Credits	**26**	**44**

4.6 MITIGATION WORK PLAN

The Turkey Creek Tract presents a potential opportunity to provide watershed-based, landscape-scale wetland and stream mitigation. In addition, the Turkey Creek Tract encompasses a relatively large, contiguous acreage that offers the opportunity to protect a relatively dense network of streams, buffers, and diverse assemblages of plant communities within the Lower Broad River watershed. The primary mitigation action proposed at this time will be to establish and map the 600-foot riparian/upland buffers associated with on-site streams. With the possible exception of isolated road drainage and crossing repairs that may occur over time, no other direct or specific actions that would directly affect aquatic resources are proposed or anticipated.

4.7 MAINTENANCE PLAN

Long-term stewardship of the Turkey Creek Tract will include responsibility for any necessary site maintenance upon execution of the site protection instrument. Initial site maintenance may possibly involve the installation of property boundary signs, preventing trespass and/or vandalism, and ensuring that roads, culverts, and small bridges are in working order. Other maintenance needs will be addressed during development of the Final Mitigation Plan.

4.8 PERFORMANCE STANDARDS

Performance standards for the Turkey Creek Tract, as appropriate, will be provided during development of the Final Mitigation Plan.

4.9 MONITORING REQUIREMENTS

Monitoring requirements for the Turkey Creek Tract, as appropriate, will be provided during development of the Final Mitigation Plan.

4.10 LONG-TERM MANAGEMENT PLAN

Details concerning the long-term management plan for the Turkey Creek Tract will be provided during development of the Final Mitigation Plan, as appropriate. Upon completion of any required monitoring, primary long-term management activities may include periodic inspections of the Turkey Creek Tract focused on site security, e.g., perimeter signs and trespass, and stream crossings (culverts, bridges, low water crossings).

4.11 ADAPTIVE MANAGEMENT

Adaptive management will be addressed per the terms and conditions developed in the site protection instrument and/or Final Mitigation Plan, as appropriate.

4.12 FINANCIAL ASSURANCES

Financial assurances will be addressed per the terms and conditions developed in the site protection instrument and/or Final Mitigation Plan, as appropriate.

5.0 REFERENCES

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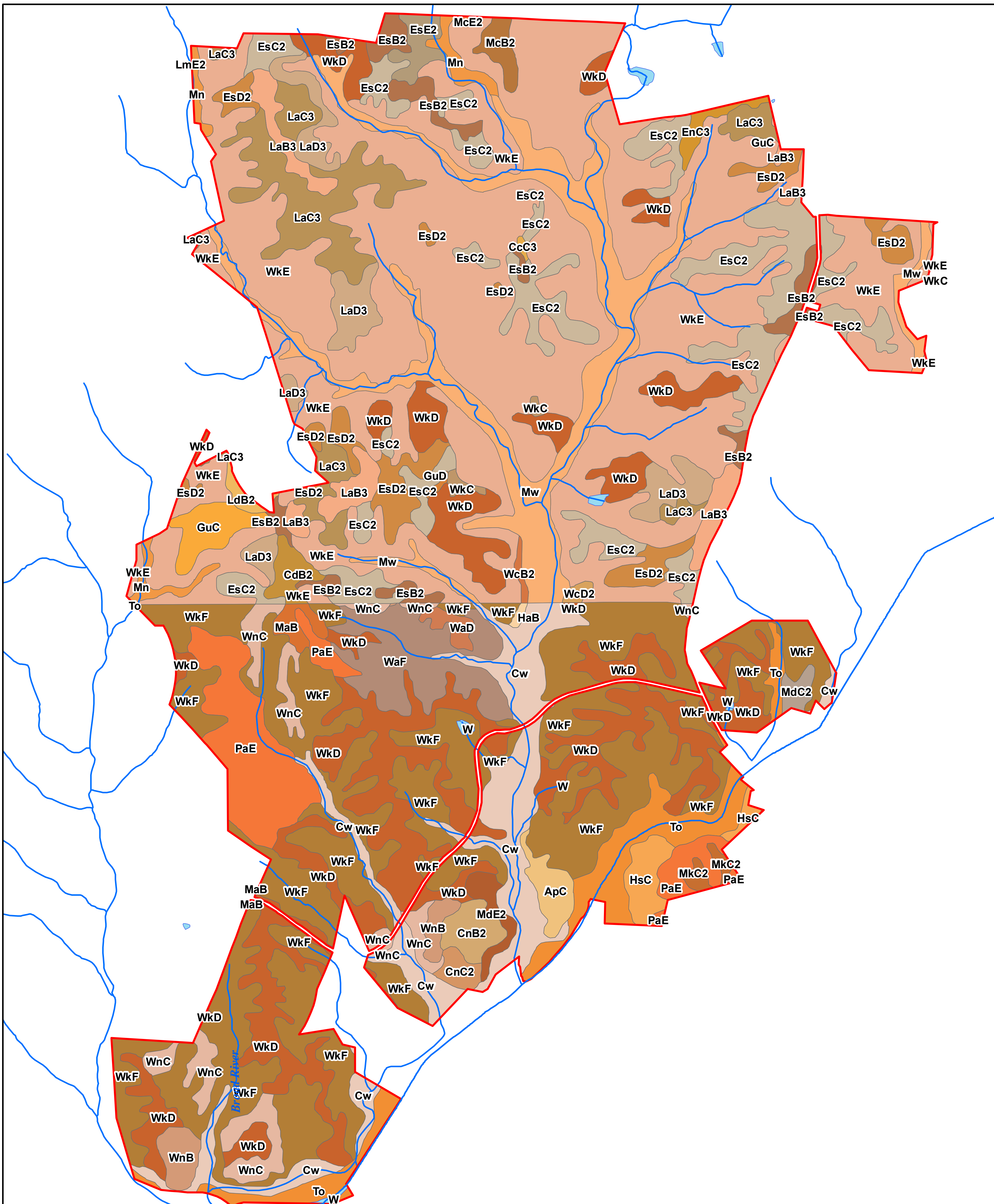
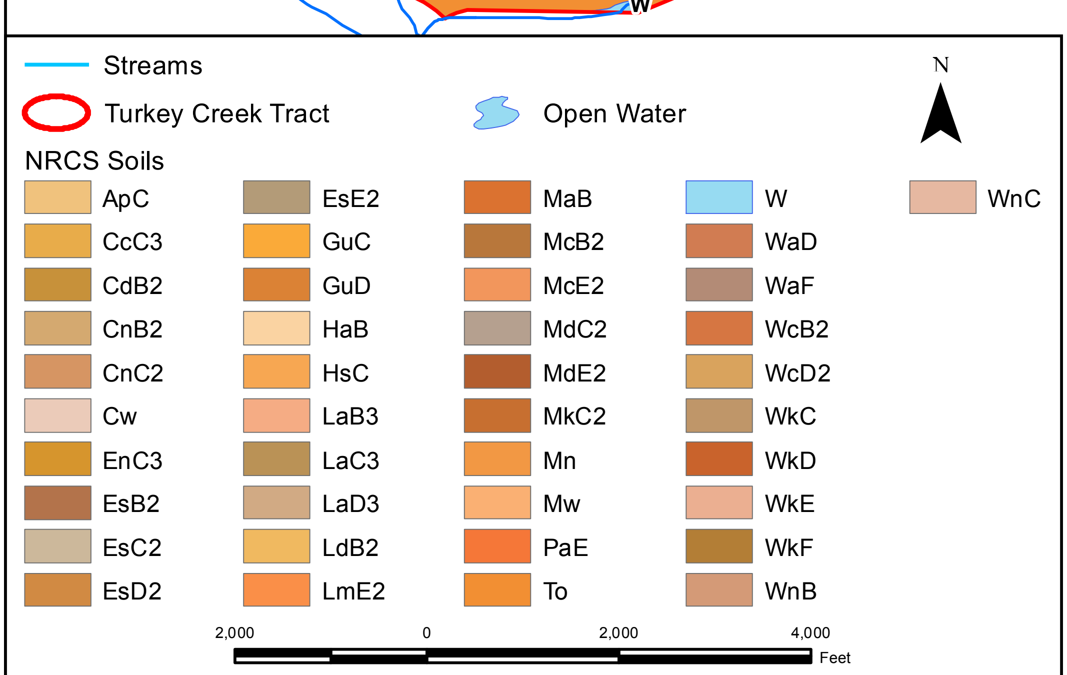
Attachment D-1

Figures





WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Turkey Creek Tract: Soils
Chester and York Counties, SC

FIGURE D-4

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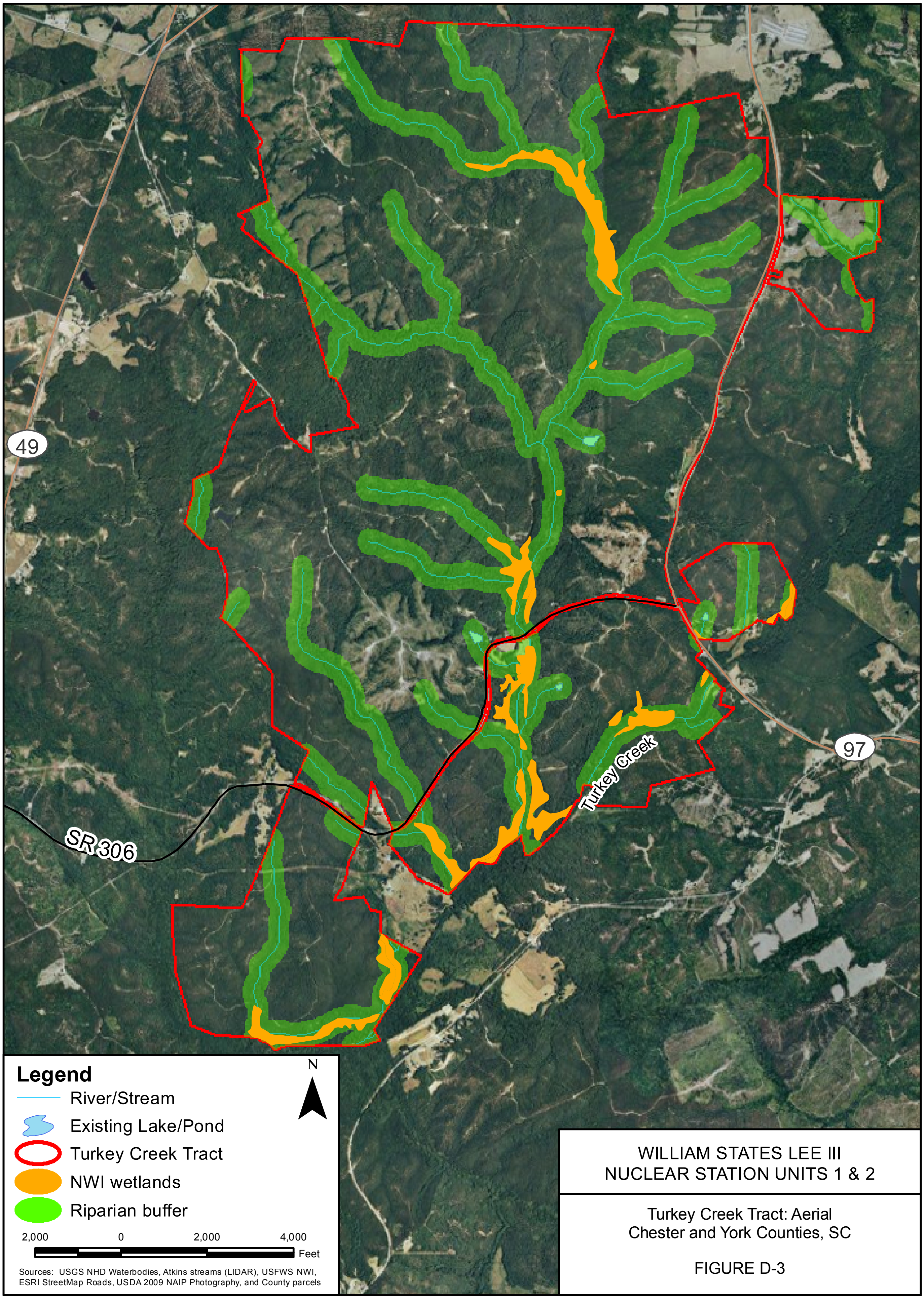
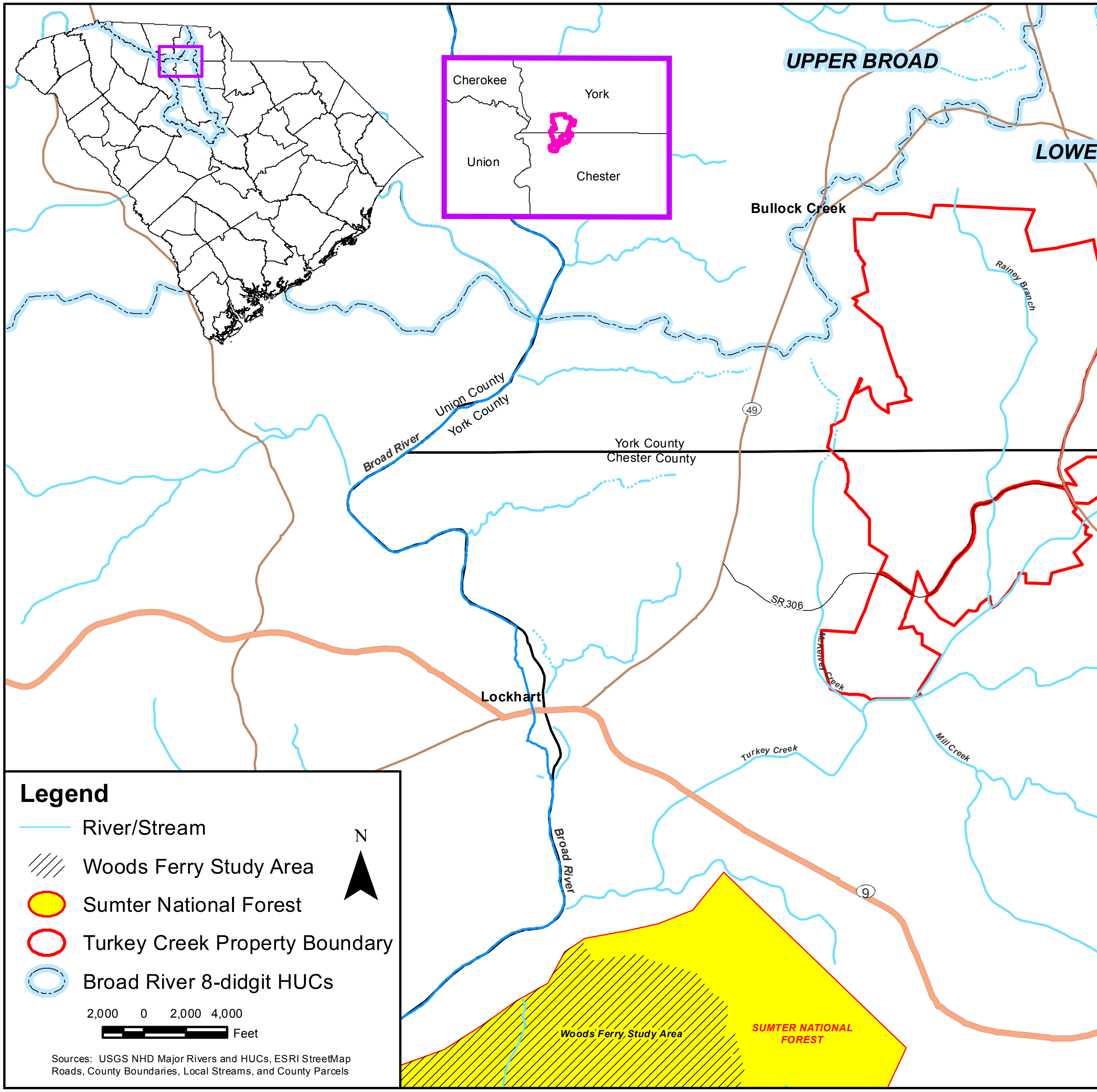
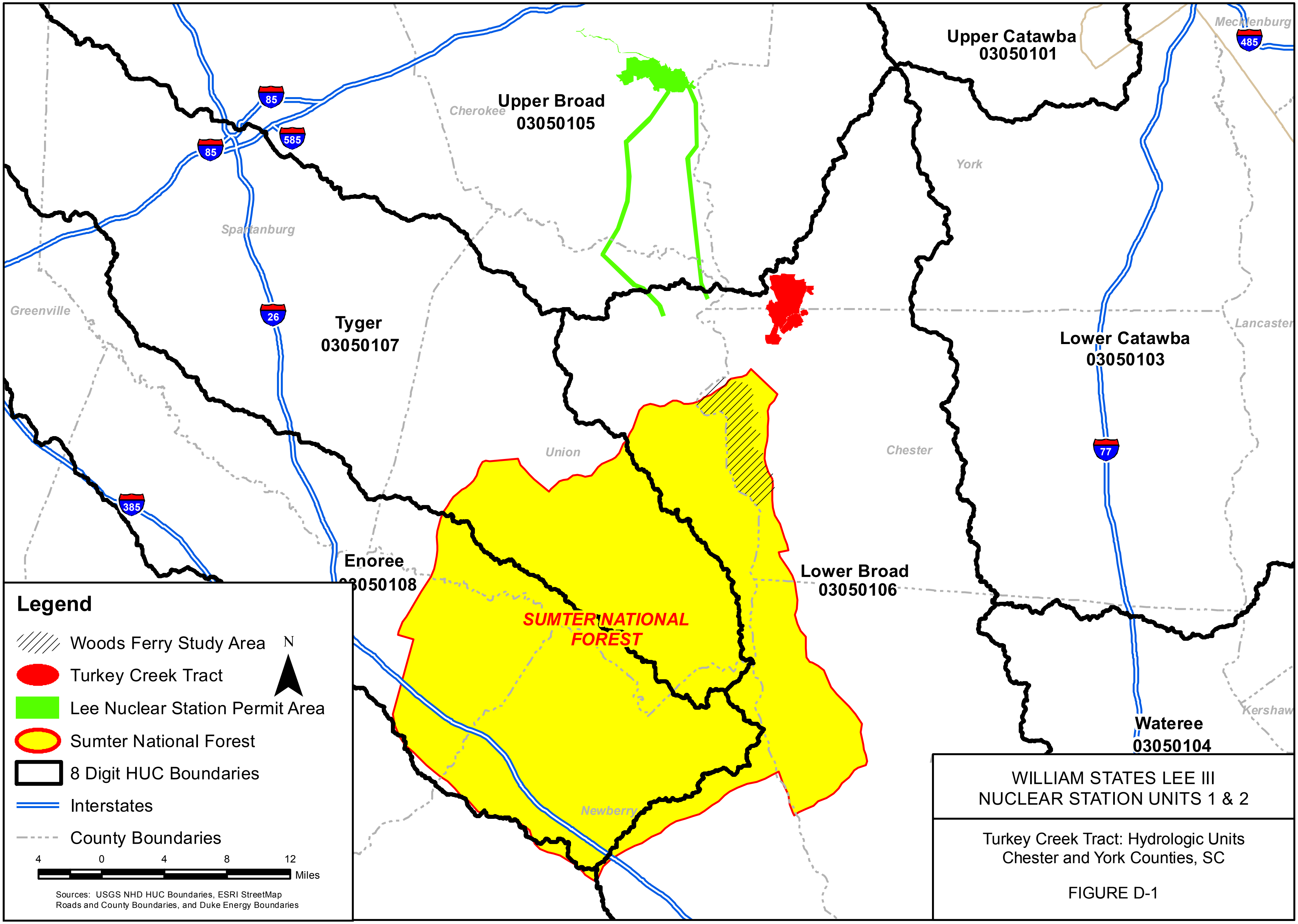

49
97
SR 306
Turkey Creek
Legend
River/Stream
Existing Lake/Pond
Turkey Creek Tract
NWI wetlands
Riparian buffer
N
2,000 0 2,000 4,000
Feet
Sources: USGS NHD Waterbodies, Atkins streams (LIDAR), USFWS NWI, ESRI StreetMap Roads, USDA 2009 NAIP Photography, and County parcels
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
Turkey Creek Tract: Aerial
Chester and York Counties, SC
FIGURE D-3



WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2

Turkey Creek Tract: Location
Chester and York Counties, SC

FIGURE D-2



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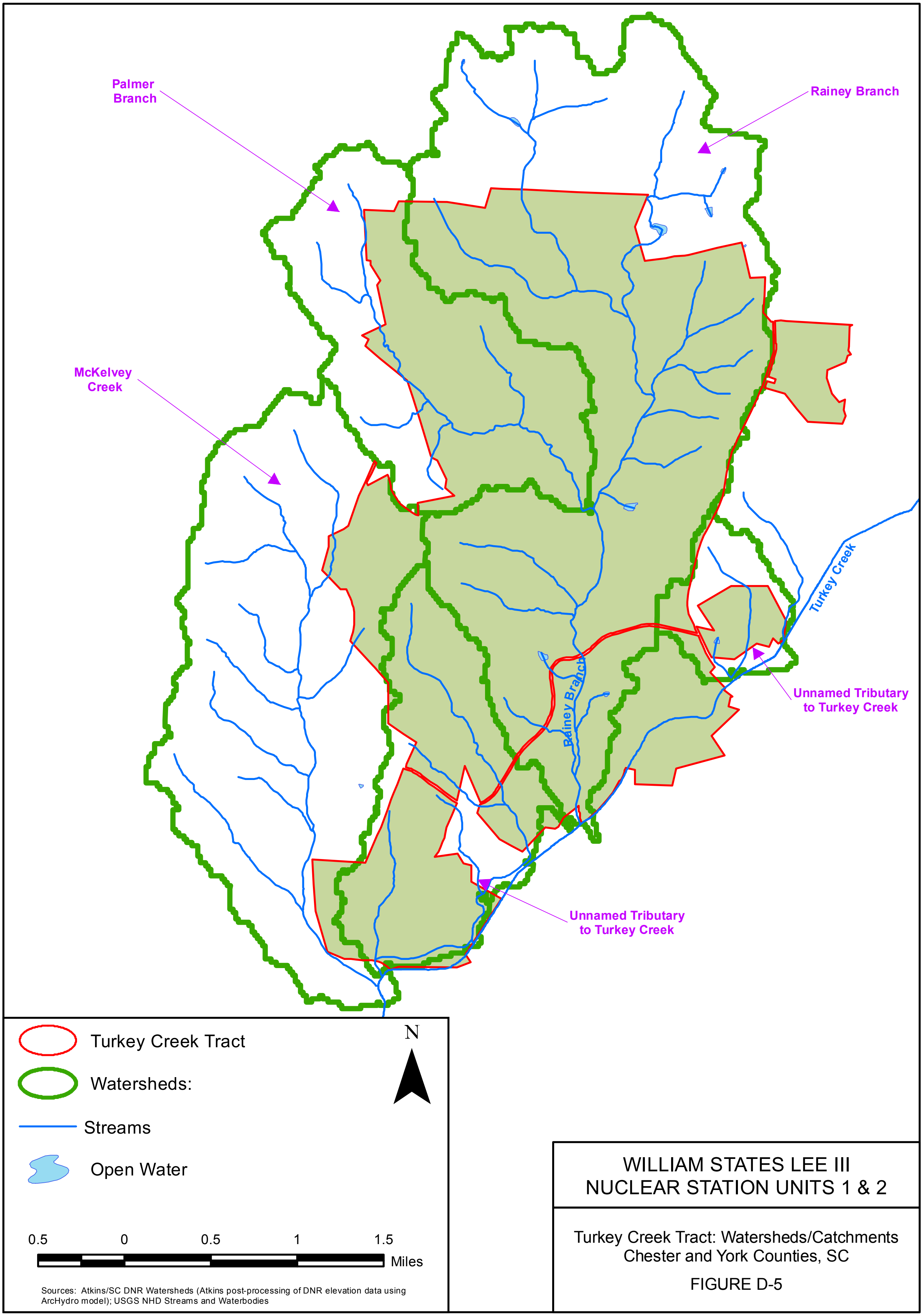
NUCLEAR STATION UNITS 1 & 2

Turkey Creek Tract: Hydrologic Units
Chester and York Counties, SC

FIGURE D-1


Palmer Branch
Rainey Branch
McKelvey Creek
Turkey Creek
Rainey Branch
Unnamed Tributary to Turkey Creek
Unnamed Tributary to Turkey Creek
Turkey Creek Tract
Watersheds:
Streams
Open Water
N
0.5 0 0.5 1 1.5
Miles
Sources: Atkins/SC DNR Watersheds (Atkins post-processing of DNR elevation data using ArcHydro model); USGS NHD Streams and Waterbodies
WILLIAM STATES LEE III
NUCLEAR STATION UNITS 1 & 2
Turkey Creek Tract: Watersheds/Catchments
Chester and York Counties, SC
FIGURE D-5

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Attachment D-2

Representative Photographs

Photo 1. Wetland associated with an Unnamed Tributary to Turkey Creek.

Photo 2. Wetland associated with lower reaches of Rainey Branch near Gilchrist Road (CR 306).

Photo 3. Small, isolated wetland along Rainey Branch.

Photo 4. Backwater slough along lower reach of Rainey Branch.

Photo 5. Bedrock controlled tributary to upper reaches of Palmer Branch.

Photo 6. Steep side slopes associated with upper reaches of Palmer Branch.

Photo 7 . First order stream associated with Unnamed Tributary to Turkey Creek (stream is partially frozen).

Photo 8 . First order stream associated with Unnamed Tributary to Turkey Creek.

Photo 9. B-type channel; Unnamed Tributary to Palmer Branch.

Photo 10. Upper reach of Rainey Branch.

Photo 11. Cobble and boulder substrate in upper reaches of Rainey Branch.

Photo 12. Upper reach of Rainey Branch.

Photo 13. Palmer Branch tributary; B-type channel.

Photo 14.Unnamed Tributary to Palmer Branch.

Photo 15. Saprolite streambed substrate in Palmer Branch.

Photo 16. Boulders blocking current course of Palmer Branch.

Photo 17. Young pine plantation located in upland habitat on Turkey Creek Tract.

Photo 18. Manmade pond in headwater of Unnamed Tributary to Rainey Branch.

Photo 19. Early successional riparian area associated with lower reaches of Rainey Branch near Gilchrist Road (CR 306).

Photo 20. Unnamed Tributary to Rainey Branch (braided).

Photo 21. Rainey Branch near confluence with Palmer Branch.

Photo 22. Rainey Branch immediately downstream of confluence with Palmer Branch.

Photo 23. Rainey Branch at confluence with Palmer Branch.

Photo 24. Palmer Branch upstream of confluence with Rainey Branch.


Photo 25. Unnamed Tributary to Palmer Branch.


Photo 26. Floodplain associated with Unnamed Tributary to Palmer Branch.


Photo 27. Unnamed Tributary to Palmer Branch.


Photo 28. Unnamed Tributary to Palmer Branch.

Photo 29 Unnamed Tributary to Palmer Branch.

Photo 30. Palmer Branch upstream of confluence with Rainey Branch.

Photo 31. Dry streambed of Turkey Creek looking east.

Photo 32. Dry streambed of Turkey Creek looking west (note ATV tracks).