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UniStar
NUCLEAR ENERGY

10 CFR 52.3
10 CFR 52.79

March 3, 2009

UN#09-144

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Calvert Cliffs Nuclear Power Plant, Unit 3
Phase 1 Mitigation Plan

Enclosed is a CD containing the Calvert Cliffs Unit 3 Phase 1 Mitigation Plan. This document represents the first step of the development of the compensatory mitigation plan for proposed impacts to nontidal wetlands on the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 project.

If you have any questions, please call Mr. Dimitri Lutchenkov at (410) 470-5524.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on March 3, 2009

Greg Gibson

D079
NRO

Enclosure: 1. CD Calvert Cliffs Unit 3 Phase 1 – Mitigation Plan, MACTEC Project No. 8093-07-6565

cc: U.S. NRC Region I Office (w/o enclosure)
Silas Kennedy, U.S. NRC Resident Inspector, Calvert Cliffs Nuclear Power Plant, Units 1 and 2 (w/o enclosure)
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10 CFR 50.4
10 CFR 52.79

June 5, 2009

UN#09-268

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Calvert Cliffs Nuclear Power Plant, Unit 3, Calvert County, Maryland
Response to Request for Phase I Compensatory Mitigation Plan

Reference: UniStar Nuclear Energy Letter UN#09-139, Dimitri Lutchenkov to Amanda Sigillito, Maryland Department of the Environment, Phase I Compensatory Mitigation Plan for Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC, Calvert Cliffs Nuclear Power Plant Site, February 18, 2009.

The NRC staff requested that the Phase I Compensatory Mitigation Plan, submitted to the Maryland Department of the Environment (Reference) with a copy to the NRC, be submitted in electronic format.

The enclosure to this letter contains the response to the NRC request. An electronic copy of the Phase I Compensatory Mitigation Plan is contained on the enclosed disc.

This letter does not generate any new regulatory commitments.

D096
NRO

If there are any questions regarding this transmittal, please contact me at 410-470-4205, or Mr. Dimitri Lutchenkov at (410) 470-5524.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on June 5, 2009

Greg Gibson

Enclosure: Calvert Cliffs Nuclear Power Plant Unit 3 Phase I Compensatory Mitigation Plan (Electronic Disc)

cc: Laura Quinn, NRC Environmental Project Manager, U.S. EPR COL Application (w/enclosure)

GTG/KAB/KAT

Enclosure
Calvert Cliffs Nuclear Power Plant Unit 3 Phase I Compensatory Mitigation Plan
(Electronic Disc)

PHASE I COMPENSATORY MITIGATION PLAN

Prepared for:

CALVERT CLIFFS 3 NUCLEAR PROJECT, LLC and
UNISTAR NUCLEAR OPERATING SERVICES, LLC
CALVERT CLIFFS NUCLEAR POWER PLANT UNIT 3
CALVERT COUNTY, MARYLAND

Prepared by:

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.
3301 Atlantic Avenue
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February 18, 2009

MACTEC Project Number 8093-07-6565

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LIST OF ACRONYMS

Acronym	Definition
ACM	Annotated Code of Maryland
BDRP	Baltimore District Regulatory Program
BMP	best management practices
CAC	Critical Area Commission
CBCA	Chesapeake Bay Critical Area
CC3	Calvert Cliffs 3 Nuclear Project, LLC
CCNPP	Calvert Cliffs Nuclear Power Plant
CCSWCD	Calvert County Soil and Water Conservation District
COMAR	Code of Maryland
CPCN	Certificate of Public Convenience and Necessity
ESD	environmental site design
FEMA	Federal Emergency Management Agency
FIDS	forest interior dwelling species
Ft/ft	foot per foot
GIS	Geographical Information System
IMFT	Interagency Management Task Force
in/hr	inch(es) per hour
I/P	intermittent/perennial
JPA	Joint Permit Application
L_m	meander length, or wavelength
MACTEC	MACTEC Engineering and Consulting, Inc.
MBSS	Maryland Biological Stream Survey
MDE	Maryland Department of the Environment
MD 2/4	Maryland Highway 2/4
MDEWMA	Maryland Department of the Environment, Water Management Administration
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
ORAM	Ohio Rapid Assessment Method
PFDS	Precipitation Frequency Data Server

Acronym	Definition
R_c	radius of curvature
RBP	Rapid Bioassessment Protocols
UniStar	Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC
UNO	UniStar Nuclear Operating Services, LLC
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
W_{belt}	meander beltwidth, or amplitude

1.0 EXECUTIVE SUMMARY

On behalf of Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC (UniStar) MACTEC Engineering and Consulting, Inc. (MACTEC) has reviewed the protocols in the Maryland Compensatory Mitigation Guidance (Interagency Management Task Force [IMTF], 1994). While there are many steps to accomplishing the Phase II Final Mitigation Plan in accordance with the IMTF guidance, the immediate effort requires that the existing concept elements be refined as provided in the draft mitigation plan presented in Section 7.0 of the "Supplemental Environmental Resource Report" (May 16, 2008), as included in the Joint Permit Application (JPA). This refinement has been accomplished by incorporating a greater level of detail and technical quality onto that previously submitted document. Please note that this document and the aforementioned Phase II Final Mitigation Plan present the compensatory mitigation plan for proposed impacts to nontidal wetlands on the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 project.

MACTEC is herein providing a concept level design, with the intent to later develop intermediate and final Phase II permitting documents. This concept design consists of:

1. **Supplemental Qualitative/Quantitative Observations and Data** regarding the potential and need for ecological lift at each proposed wetland and stream mitigation sites. Photos of existing conditions depict the disturbed condition of each proposed mitigation site, based on 2007 LIDAR data and ground-level photography acquired during 2008 site visits. Accompanying narrative describes the observed condition and the proposed treatment to restore ecological function and value.
2. **Concept Design Plans** (not for construction) that show in plan view the existing contours of the proposed mitigation sites at the location of the proposed treatment. Corresponding concept-representative channel treatments, instream structures, wetland creation and enhancement activities, and planting plan and monitoring program are provided as the design progresses toward a Phase II mitigation plan.

The compensatory mitigation plan (inclusive of the concept design) for the CCNPP Unit 3 project proposes wetland creation and enhancement and stream restoration and enhancement as mitigation for the loss of jurisdictional, nontidal waters of the United States and nontidal waters of the State of Maryland as a result of development of the Unit 3 facility. Refining the concept design to an acceptable level of detail and quality sufficient for the Phase II Mitigation Plan submittal will include additional field data collection to establish a more detailed understanding of the existing conditions and site potential and to provide discrete evidence of the associated lift in ecological function and value.

In addition to requirements of the U.S. Army Corps of Engineers (USACE), the State of Maryland identifies the requirements and considerations (COMAR 26.23.04.05) of the mitigation plan including information to be included with the permit application, elements of the Phase I mitigation plan to be reviewed by the MDE for ultimate rendering of approval or disapproval, and, in the case of approval, subsequent guidance toward a Phase II mitigation plan.

With these considerations, the Phase II Final Mitigation Plan for CCNPP Unit 3 cannot be initiated until the review agency provides concurrence; i.e., the MDE accepts the Phase I Conceptual Mitigation Plan as the appropriate approach to provide compensatory mitigation for project related impacts to waters of the State of Maryland.

The draft mitigation plan presented in Section 7.0 of the Supplemental Environmental Resource Report, as included in the JPA, addressed the above items that are relevant to the project. The concept design document presented herein provides refinement to the basic components of the Phase I Mitigation Plan, i.e., supplemental qualitative/quantitative observations and data and the concept design plan for the proposed wetland creation and enhancement and stream restoration and enhancement activities.

Finally, the Phase II Final Mitigation Plan will be prepared in accordance with the protocols presented in the *Maryland Compensatory Mitigation Guidance* (IMTF, 1994) and the U.S. Army Corp of Engineers (USACE) Regulatory Guidance Letter No. 08-03 (*Minimum Monitoring Requirements for Compensatory Mitigation Projects Involving the Restoration, Establishment, and/or Enhancement of Aquatic Resources*), dated October 10, 2008.

2.0 WETLAND AND STREAM MITIGATION PLAN BACKGROUND

2.1 IMPACTED WETLAND AND STREAM INFORMATION

2.1.1 Description of Impact Areas

The construction footprint for the CCNPP Unit 3 facility has been designed to avoid or minimize encroachment into areas delineated as wetlands or other waters of the United States (Figure 2.1-1). However, the construction of the project would not be possible without permanently impacting approximately 8,350 linear feet of intermittent and perennial stream channels (jurisdictional) and approximately 11.72 acres of the delineated wetland and open water areas (USACE and/or MDE jurisdictional). Most of the impacts to jurisdictional wetlands and streams would take place in Wetland Assessment Areas II and IV. Minor impacts are proposed for Wetland Assessment Areas I, VII, and IX. Figure 2.1-1 depicts the location and extent of the wetland and stream impact areas on the CCNPP Unit 3 site.

The proposed impacts and types of impacts to wetland areas are presented in the Table 2.1-1. These impacts encompass 7.88 acres of forested wetlands (including 0.08 acre of isolated wetlands), 1.21 acres of emergent wetlands, and 2.63 acres of open water. The wetland impact areas are specifically characterized as poorly drained bottomland hardwood forest and freshwater marsh. The open water impacts include Camp Conoy Fishing Pond. No temporary wetland impacts are proposed for the construction of the CCNPP Unit 3 facility.

Table 2-1 Nontidal Wetlands and Nontidal Wetland Buffer Losses (in acres) from Construction of Proposed CCNPP Unit 3 Site, Calvert County, Maryland

Wetland Assessment Area (Potential Jurisdiction)	Permanent Grading Losses				Temporary Grading Losses				Total Losses	
	PFO	PEM	POW	Buffer	PFO	PEM	POW	Buffer	Wetland	
I- Total (MDE only)	0.03	-	-	2.09	-	-	-	-	0.03	2.09
II- Total (USACE & MDE)	1.47	0.75	2.63	6.79	-	-	-	-	4.85	6.79
II- Total (MDE only)	0.05	-	-	-	-	-	-	-	0.05	-
III- Total	No Impacts to Wetland Assessment Area III									

Wetland Assessment Area (Potential Jurisdiction)	Permanent Grading Losses				Temporary Grading Losses				Total Losses	
	PFO	PEM	POW	Buffer	PFO	PEM	POW	Buffer	Wetland	
IV-Total (USACE & MDE)	4.97	-	-	15.84	-	-	-	-	4.97	15.84
V-Total	**No Impacts to Wetland Assessment Area V**									
VI-Total	**No Impacts to Wetland Assessment Area VI**									
VII-Total (USACE & MDE)	0.72	-	-	3.41	-	-	-	-	0.72	3.41
VIII-Total	**No Impacts to Wetland Assessment Area VIII**									
IX-Total (USACE & MDE)	0.64	0.46	-	2.56	-	-	-	-	1.10	2.56
Total	7.88	1.21	2.63	30.69	-	-	-	-	11.72	30.69

Notes: USACE = U.S. Army Corps of Engineers; MDE = Maryland Department of Environmental; PFO = Palustrine Forested; PEM = Palustrine Emergent; POW = Palustrine Open Water.

PREPARED BY/DATE: RGH 3/1/08
CHECKED BY/DATE: JDC 5/12/08

Common functions of wetlands are groundwater recharge, groundwater discharge, flood flow alteration, sediment/shoreline stabilization, sediment/toxicant retention, nutrient removal/transformation, production export, aquatic diversity/abundance, and wildlife diversity/abundance. Common values of wetlands are recreation, uniqueness/heritage, education/scientific value, and visual quality/aesthetics. The Ohio Rapid Assessment Method (ORAM), as outlined in the *Ohio Rapid Assessment Method for Wetlands* (Mack, 2001) was used by MACTEC to quantify the functions and values of wetland communities on the CCNPP Unit 3 project site to determine the appropriate level of mitigation. The areas assessed were the wetlands that would be impacted by the proposed development and, to determine the viability of mitigation sites, the wetlands not being impacted.

The wetlands proposed for impact, which were evaluated through ORAM, are located in the headwaters of Johns Creek, the headwaters of Goldstein Branch, the Camp Conoy area, and Branch 1 and Branch 2 located along Chesapeake Bay. A substantial portion of the impacts to wetland areas on the CCNPP Unit 3 site consists of wetland systems that are degraded. Most of the proposed wetland impact areas exhibited moderate functions and values. Section 5.0 of the Supplemental Environmental Resource

Report, as included in the JPA, presents the results of the February 2008 field evaluation of the functions and values of the wetland areas proposed for impact, as well as the wetland areas considered for selection as potential mitigation sites.

Approximately 8,350 linear feet of jurisdictional (perennial and intermittent) stream channels were identified within the proposed impact area (limits of clearing) on the CCNPP Unit 3 project site. Within the proposed impact area, 5,076 linear feet of streams have wetland areas immediately abutting them, while 3,274 linear feet of streams are not contain abutted by wetlands. The proposed impacts to the jurisdictional stream channels, within individual wetland assessment areas, are presented in Table 2.1-2.

Table 2-2 Impacts to Jurisdictional Stream Channels from Construction of Proposed CCNPP Unit 3 Site, Calvert County, Maryland

Wetland Assessment Area	Stream Reach Identification No.	Impact Stream Length (lf)	12-Digit Hydrologic Unit Code
I	RA-I-A	729	020600040403
IV Central	RA-IVC-A	1,595	020600060706
IV North	RA-IVN-A	102	020600060706
IV North	RA-IVN-B	2,943	020600060706
IV North	RA-IVN-C	555	020600060706
IV North	RA-IVN-D	1,342	020600060706
VII North	RA-VIIN-A	521	020600060706
VII South	RA-VIIS-A	563	020600060706
Total		8,350	

PREPARED BY/DATE: RLS 4/1/08
CHECKED BY/DATE: JDC 5/9/08

The proposed impact area contains approximately 11 stream reaches. To better understand the current conditions of each stream impact reach, MACTEC conducted an onsite resource assessment in March 2008. The resource assessment included observation and measurement of stream quality, function, general dimension and biology. Using the Rapid Bioassessment Method (USEPA, 1999), a reach representative of each stream impact segment was assessed for habitat quality. In situ water quality was measured in each reach using a multi-parameter water quality monitoring system, the Horiba-U22. Stream function, width, and depth were observed and estimated by a Rosgen-trained professional. In addition, a benthic macro-invertebrate assessment was conducted in each qualified stream reach as identified in the Maryland Biological Stream Survey (MBSS) guidelines (Kazyak, 2001). Most of the stream reaches proposed for impact received scores of suboptimal, as based on the Rapid Bioassessment

Protocols (RBP). Section 6.0 of the Supplemental Environmental Resource Report, as included in the JPA, presents the results of the March 2008 field evaluation of the stream reaches proposed for impact.

2.2 PHOTOGRAPHIC EVIDENCE OF PROPOSED IMPACT AREAS

Photographs 2-1 through 2-8 present current site conditions in jurisdictional wetland areas that are proposed for impact through construction of the CCNPP Unit 3 facility. The photography series is representative of the wetland communities to be impacted, but does not include all proposed impact sites. The locations of the photo-points are depicted on Figure 2.2-1.

Photo 2-1 Photo depicting a view to the north of forested wetland strand, north of Camp Conoy Fishing Pond in Wetland Assessment Area II, occurring within proposed impact zone (February 2008).

Photo 2-2 Photo depicting a view to the south of forested wetland strand, west of Camp Conoy Fishing Pond in Wetland Assessment Area II, occurring within proposed impact zone (February 2008).

Photo 2-3 Photo depicting a view to the west of forested wetland strand (unnamed tributary to Johns Creek) in Wetland Assessment Area IV, occurring within proposed impact zone (February 2008).

Photo 2-4 Photo depicting a view to the south of forested wetland strand (unnamed tributary to Johns Creek) in Wetland Assessment Area IV, occurring within proposed impact zone (February 2008).

Photo 2.2-5: Photo depicting a view to the east of narrow wetland strand (unnamed tributary to Goldstein Branch) in Wetland Assessment Area VII, occurring within proposed impact zone (February 2008).

Photo 2-5 Photo depicting a view to the north of narrow wetland strand (unnamed tributary to Goldstein Branch) in Wetland Assessment Area VII, occurring within proposed impact zone (February 2008).

Photo 2-6 Photo depicting a view to the northeast of emergent wetland area in Wetland Assessment Area IX, occurring within proposed impact zone (February 2008).

Photo 2-7 Photo depicting a view to the south of forested wetland strand in Wetland Assessment Area IX, occurring within proposed impact zone (February 2008).

Photographs 2-8 through 2-18 present current site conditions along stream reaches that are proposed for impact through construction of the CCNPP Unit 3 facility. The photography series is representative of the stream features to be impacted. Note that several wetland assessment areas contain more than one stream. The locations of the photo-points are depicted on Figure 2.2-1.

Photo 2-8 Photo depicting a jurisdictional stream (view to the west or downstream) in Wetland Assessment Area IV S (south), occurring within proposed impact zone (March 2008). USEPA rapid bioassessment (RBP) Score of 105 and an MBSS benthic IBI Score of 3.00 (Fair)—location: 4253437.270N 374439.899W

Photo 2-9 Photo depicting an unnamed stream (view to the northwest or upstream) in Wetland Assessment Area IV C (Central), occurring within proposed impact zone (March 2008). USEPA RBP Score of 138 and an MBSS benthic IBI Score of 3.86 (Fair)—location 4253718.961N 374239.312W

Photo 2-10 Photo depicting a jurisdictional stream (view to the north or upstream) in Wetland Assessment Area V, occurring within proposed impact zone (March 2008). USEPA RBP Score of 129 and an MBSS benthic IBI Score of 3.29 (Fair)—location: 4253685.616N 374100.673W

Photo 2-11 Photo depicting a jurisdictional stream (view to the northwest or upstream) in Wetland Assessment Area IV N, occurring within proposed impact zone (March 2008). This stream rated: USEPA RBP Score of 126; no benthic data taken—location: 4253906.035N 374192.319W

Photo 2-12 Photo depicting a jurisdictional stream (view to the west or upstream) in Wetland Assessment Area IV N, occurring within proposed impact zone (March 2008). EPA RBP Score of 111; no benthic data taken at this location—location: 4253832.754N 374018.516W

Photo 2-13 Photo depicting a jurisdictional stream (view to the north or upstream) in Wetland Assessment Area IX, occurring within proposed impact zone (March 2008). USEPA RBP Score of 132; no benthic data taken at this location--location: 4254047.852N 374033.955W

Photo 2-14 Photo depicting a jurisdictional stream (view to the north) in Wetland Assessment Area VII N (north), occurring within proposed impact zone (March 2008). USEPA RBP Score of 124 and an MBSS benthic IBI Score of 2.43 (Poor)—location: 4254526.996N 372877.743W

Photo 2-15 Photo depicting a jurisdictional stream (view to the north or upstream) in Wetland Assessment Area VII N (north) occurring within proposed impact zone (March 2008). EPA rapid bio-assessment (RBP) Score of 134; no benthic data taken at this location—location: 4254596.393N 372835.232W.

Photo 2-16 Photo depicting a jurisdictional stream (view to the north) in Wetland Assessment Area VII S (south), occurring within proposed impact zone (March 2008). USEPA RBP Score of 60 and an MBSS benthic IBI Score of 2.17 (Very Poor). Location: 4254175.606N 373016.555W

Photo 2-17 Photo depicting a jurisdictional stream (view to the north or upstream) in Wetland Assessment Area VII S (south), occurring within proposed impact zone (March 2008). This stream rated: USEPA RBP Score of 86; no benthic data taken at this location—location: 4254210.886N 372908.912W.

Photo 2-18 Photo depicting a jurisdictional stream (view to the west or upstream) in Wetland Assessment Area I, occurring within proposed impact zone (March 2008). This stream rated: USEPA RBP Score of 129 and an MBSS benthic IBI Score of 3.00 (Fair). Location: 4254505.788N 374473.021W

Photographs 2-19 through 2-24 present current site conditions along the Chesapeake Bay cliff area, specifically at points where stream channels on the CCNPP property discharge into the bay waters. The locations of the photo-points are depicted on Figure 2.2-1.

Photo 2-19 Photo depicting a view to the north side, the outlet pipe of the historic Camp Conoy Fishing Pond (November 2008). Photo taken facing south or upstream during high-flow runoff events.

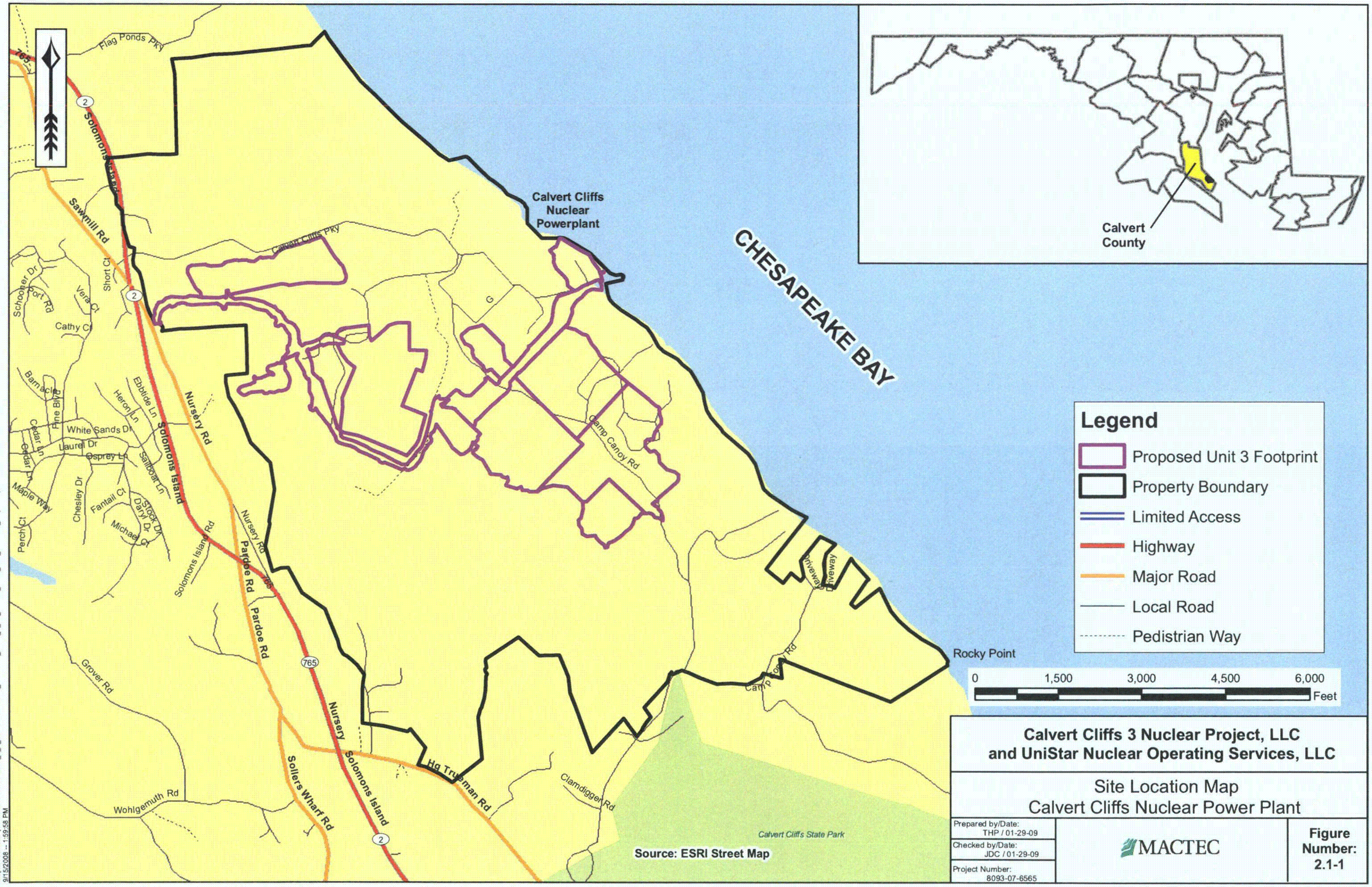
Photo 2-20 Photo depicting a headcut on the unnamed tributary of the historic Camp Conoy Fishing Pond, located about 50 feet upstream from another headcut at the confluence with the Chesapeake Bay (see photo 2-23) (taken facing south, November 2008).

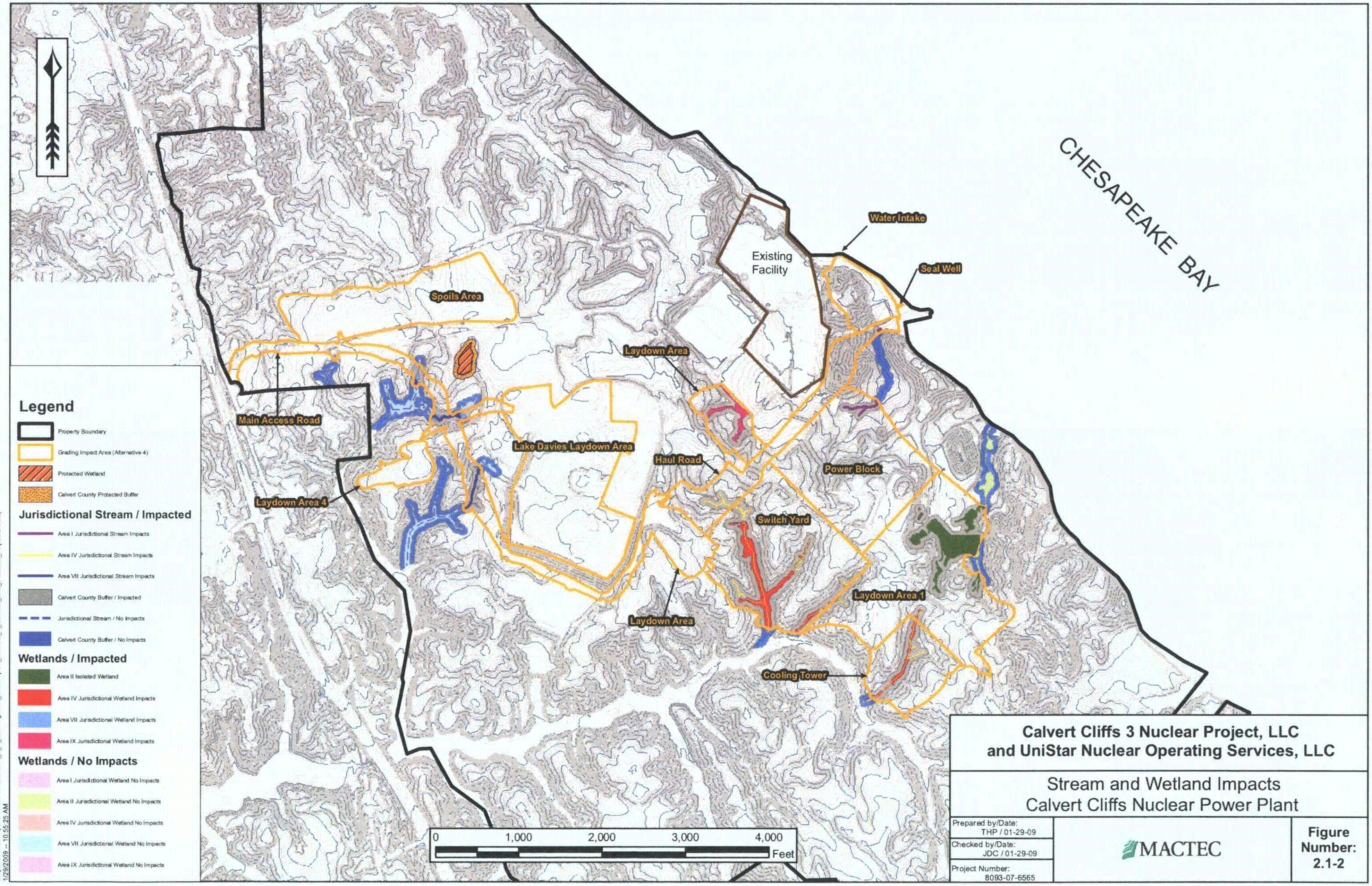
Photo 2-21 Photo depicting the channel between headcuts on the unnamed tributary of the historic Camp Conoy Fishing Pond, located about 30 feet upstream from the confluence with the Chesapeake Bay (taken facing northeast, November 2008).

Photo 2-22 Photo depicting the most downstream headcut, located at the confluence to the Chesapeake Bay, the unnamed tributary coming from the historic Camp Conoy Fishing Pond (February 2008).

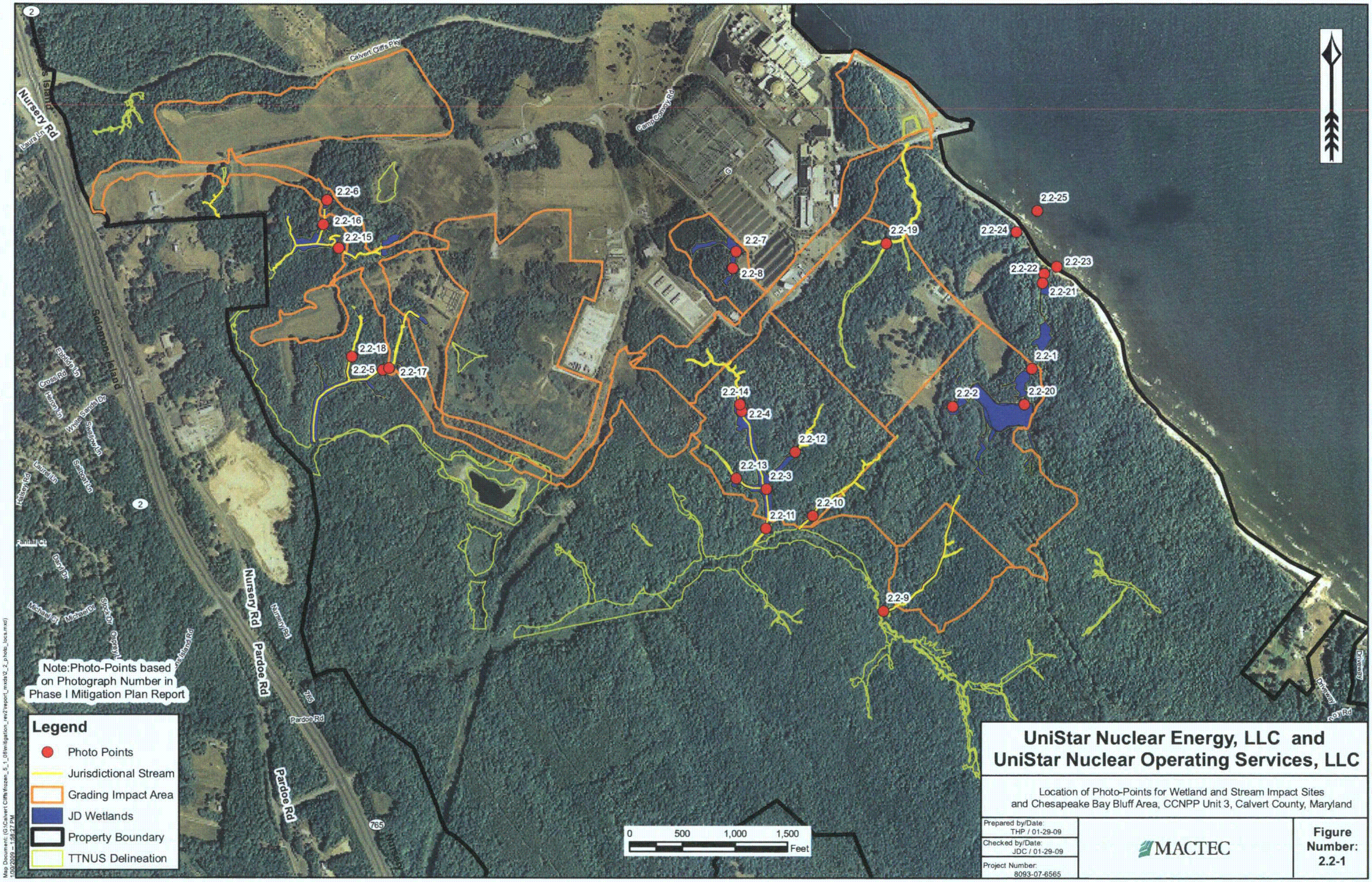
Photo 2-23 Photo depicting the proposed storm water outlet location, near the confluence to the Chesapeake Bay (taken facing northeast, November 2008).

Photo 2-24 Photo depicting the proposed storm water outlet location, located near the confluence to the Chesapeake Bay (taken facing southwest, November 2008).


CHESAPEAKE BAY
Calvert Cliffs Nuclear Powerplant
Rocky Point
Calvert County
Calvert Cliffs State Park
Source: ESRI Street Map
Flag Ponds Pky
Solomons Island
Sawmill Rd
Nursery Rd
Pardoe Rd
Sollers Wharf Rd
Hg Trueman Rd
Clamdigger Rd
Camp Canoy Rd
Grover Rd
Wohlgemuth Rd
Driveway
Legend
Proposed Unit 3 Footprint
Property Boundary
Limited Access
Highway
Major Road
Local Road
Pedistrian Way
0
1,500
3,000
4,500
6,000
Feet
Calvert Cliffs 3 Nuclear Project, LLC
and UniStar Nuclear Operating Services, LLC
Site Location Map
Calvert Cliffs Nuclear Power Plant
Prepared by/Date: THP / 01-29-09
Checked by/Date: JDC / 01-29-09
Project Number: 8093-07-6565
MACTEC
Figure Number: 2.1-1



Map Document: (G:\Calvert Cliffs\frozen_5_1_08\mitigation_rev2\report_mxds\2_1_Stream_and_Wetland_Impacts.mxd)
1/29/2009 -- 10:55:25 AM



Note: Photo-Points based on Photograph Number in Phase I Mitigation Plan Report
Legend
Photo Points
Jurisdictional Stream
Grading Impact Area
JD Wetlands
Property Boundary
TTNUS Delineation
2.2-1
2.2-2
2.2-3
2.2-4
2.2-5
2.2-6
2.2-7
2.2-8
2.2-9
2.2-10
2.2-11
2.2-12
2.2-13
2.2-14
2.2-15
2.2-16
2.2-17
2.2-18
2.2-19
2.2-20
2.2-21
2.2-22
2.2-23
2.2-24
2.2-25
Nursery Rd
Pardoe Rd
Calvert Cliffs Pkwy
Solomons Island
0 500 1,000 1,500 Feet
UniStar Nuclear Energy, LLC and
UniStar Nuclear Operating Services, LLC
Location of Photo-Points for Wetland and Stream Impact Sites
and Chesapeake Bay Bluff Area, CCNPP Unit 3, Calvert County, Maryland
Prepared by/Date: THP / 01-29-09
Checked by/Date: JDC / 01-29-09
Project Number: 8093-07-6565
MACTEC
Figure Number: 2.2-1

3.0 MITIGATION PLAN GOALS

3.1 OVERVIEW

To determine the required compensatory mitigation for wetland impacts, the Baltimore District of the USACE was consulted to determine the appropriate mitigation strategies for the project. The proposed compensatory "in kind" mitigation for the scheduled impacts to wetlands and surface waters on site is intended to meet the mitigation requirements of the USACE Baltimore District and includes the creation and enhancement of wetlands to conditions more suitable for use by wildlife species native to the region. Appropriate and practicable steps to minimize the adverse impacts were conducted through analysis of multiple site development plan concepts. The mitigation areas were chosen following a mitigation site selection process. Four general mitigation strategies were initially identified: 1) on site and in kind; 2) on site and not in kind; 3) off site and in kind; and 4) off site and not in kind. The mitigation strategy chosen for the CCNPP Unit 3 project was on-site and in-kind mitigation, as this strategy, or mitigation action, would replace nontidal wetland acreage and functional losses more effectively than the other three strategies. The project was designed to adhere to the Code of Maryland Regulations, Subsection 26.23.04.03 (COMAR, 2005).

The proposed wetland and stream impacts on the CCNPP Unit 3 site occur within the same hydrologic units as the wetland enhancement and creation areas and the stream enhancement and restoration areas; i.e., the Patuxent River Lower and West Chesapeake Bay hydrologic units. The geographic relationship between the areas of nontidal wetland and stream losses and the proposed mitigation sites provide an opportunity to mitigate impacts at an upper watershed level. The watershed approach used in the design of the compensatory mitigation plan for CCNPP Unit 3 is consistent with the ongoing natural resource management activities that have been conducted at CCNPP over the years. The mitigation activities are also compatible with comprehensive watershed management plans for CCNPP. No purchase of bank credits will be made to satisfy compensatory mitigation requirements, as the project site does not lie within the service area of any approved, State of Maryland, wetland/stream mitigation bank (COMAR 2005).

3.2 WETLAND MITIGATION

As previously stated, compensatory mitigation for unavoidable impacts to approximately 11.72 acres of jurisdictional, nontidal forested wetlands, emergent (herbaceous) wetlands, and surface waters (including

Camp Conoy Fishing Pond) (USACE and/or MDE jurisdictional) will be required to complete the project. After field reconnaissance and site walk-through of the CCNPP property in 2007 and 2008, including the CCNPP Unit 3 project area, specific locations were identified as having ecological lift potential for wetland enhancement or as being suitable for the creation of wetland communities from upland landscape. Data on vegetative, hydrologic, and soil conditions were collected at potential mitigation site locations to determine whether enhancement or creation could be successfully achieved. Before intermediate design implementation, additional detail data will be collected to meet the requirements in the *Mitigation and Monitoring Guidelines* (Baltimore District Regulatory Program, USACE, November 2004) and the protocols in the *Maryland Compensatory Mitigation Guidance* (IMTF) and to supplement the reconnaissance field data collected in 2007 and 2008.

Among the group of wetlands that will not be impacted by development of the CCNPP Unit 3 facility, specific sites were selected that would benefit from mitigation through an increase in wetland values and functions. The wetland mitigation opportunities will include creation and enhancement within the Lake Davies Disposal Area (sediment basins), the portion of Johns Creek to the south of the sediment basins, and an upland grassed field at the Camp Conoy area (wetland creation site).

Phragmites (*Phragmites communis*) are found throughout the entire site, especially within the wetland sites proposed for mitigation. By eradicating phragmites, the wetlands infested with this nuisance species will have uplift for wildlife habitat (wetland function). Increased diversification of native plant species will also be provided by planting these mitigation sites with native bottomland hardwood tree species and/or shrubs. Finally, by removing the phragmites from the degraded wetlands, a more normal hydropattern will be established.

As previously stated, field reconnaissance and site walk-through of the CCNPP property was conducted in 2007 and 2008, including the CCNPP Unit 3 project area, to identify suitable mitigation sites for wetland enhancement and wetland creation. Potential mitigation sites were eliminated from further consideration if it was determined that enhancement or creation could not be achieved without difficulty. In some cases, the footprint of the CCNPP Unit 3 facility precluded the selection of potentially suitable mitigation sites, where modifications to the site layout would be problematic. The most desirable mitigation site eliminated from further consideration was the open grass field northwest of the old Visitor Center parking lot (approximately 2 acres in size). This field drains into an unnamed tributary of Woodland Branch. This potential mitigation site was not selected because the watershed that encompasses this area would not provide a sufficient source of hydrology to offer an opportunity for wetland creation.

The wetland mitigation component of the compensatory mitigation plan includes the following proposed activities:

- The creation of forested wetland habitat within the Camp Conoy area that lies within the CBCA (Mitigation Site WC-1)
- The creation of forested and herbaceous wetland habitat within the middle manmade, abandoned, sediment basin of the Lake Davies Disposal Area (Mitigation Site WC-2)
- The enhancement of a smaller manmade, abandoned, sediment basin within the Lake Davies Disposal Area (Mitigation Site WE-1)
- The enhancement of a portion of Johns Creek and a linear drainageway extension occurring to the south of the Lake Davies Disposal Area (Mitigation Site WE-2)
- The eradication of phragmites through herbicide application (Mitigation Sites WC-2, WE-1, and WE-2)
- The use of soil material from impacted on-site wetland areas that do not contain phragmites to create mitigations sites as a supplemental growth medium (Mitigation Sites WC-1 and WC-2).

Following the on-site wetland creation and wetland enhancement activities for the CCNPP Unit 3 project, a five-year annual monitoring program will be implemented in accordance with the requirements of the *Mitigation and Monitoring Guidelines* (USACE) and the protocols in the *Maryland Compensatory Mitigation Guidance* (IMTF). Furthermore, the monitoring program will be conducted pursuant to the Maryland Department of the Environment, Water Management Administration (MDEWMA) mitigation monitoring guidelines and protocols. The target goals for the creation and enhancement efforts will be divided into two specific components:

1. The creation and enhancement of wetland communities
2. The creation of wetland hydrology within the created wetlands

The success criteria for the monitoring program will include, at a minimum, the success of the planted vegetation, as measured through survivorship counts and observations of vitality and growth, and the existence of wetland hydrology for the created wetlands. If success criteria have been satisfied at the completion of the five-year monitoring program, a request for release from monitoring will be made to the USACE and/or MDEWMA.

Regarding protective mechanisms, the wetland mitigation area will be protected in perpetuity through establishment of a legally binding deed restriction. The deed restrictions generally will follow the standard USACE Baltimore District model for such instruments. Ownership of the mitigation area will likely reside with Calvert Cliffs 3 Nuclear Project, LLC or its affiliates or assigns, until it is decided to sell the property or donate it to a public agency or private conservation organization. If the mitigation area should be sold, all appropriate protective mechanisms (which will have been recorded) will remain in effect and will remain with the site in perpetuity. Section 6.0 of this document provides further elaboration of proposed protective mechanisms for the project, along with information on adaptive management plans for the mitigation areas, if required.

For the CCNPP Unit 3 project, Table 3-1 summarizes the mitigation measures used for the wetland component of the compensatory mitigation plan:

Table 3-1 Wetland Mitigation Summary, CCNPP Unit 3 Site, Calvert County, Maryland

Type of Wetland	Mitigation Type	Mitigation Quantity (Acre)	Mitigation Ratio	Credit Amount
Emergent	Creation	1.3	1:1	1.3
Forested	Creation	11.8	2:1	5.9
Forested	Enhancement	18.1	3:1	6.03
			TOTAL	13.23

TABLE CREATED BY: JDC 11/2008
TABLE CHECKED BY: RGH 11/2008

The use of a 3:1 mitigation credit ratio for enhancement is based on controlling phragmites coupled with the planting of native bottomland hardwood species.

3.3 STREAM MITIGATION

The CCNPP Unit 3 site contains five potential stream restoration reaches and five potential stream enhancement reaches (perennial and intermittent) on site. Of these sites, three restoration reaches and two enhancement reaches are located within or just outside the 1,000 foot Critical Area defined by the CAC (see Figures A and B). Of the ten proposed mitigation reaches, only Branch 1 (SR-3) and Branch 2 (SE-4) drain directly to the Chesapeake Bay (see Concept Plan Sheet 2, Appendix A). The proposed stream mitigation opportunities are summarized below.

Stream restoration and stream enhancement are intended to compensate for the unavoidable, direct loss of physical, biological and/or riparian function of impacted streams. In general, the physical stream functions are divided into hydrologic and hydraulic components. Hydrologic function compromised by development includes infiltration/groundwater recharge, channel/floodplain storage, and routing of precipitation and runoff. Hydrologic function also includes the resultant timing, duration, and quantity of surface runoff delivered to the receiving streams as discharge. Similarly, hydraulic function often disrupted by watershed development includes efficient flow conveyance and effective sediment transport. Aquatic resources can be adversely affected by any temporary or permanent change to a physical, biological, chemical, and/or riparian component in an otherwise natural environment.

Site reconnaissance has revealed that natural, physical migration barriers such as beaver dams and stream head-cuts exist on-site. The stream restoration and enhancement areas will be designed specifically for the physiological needs of the American eel, other migratory fish species, and the remaining resident fish and benthic macro-invertebrate populations. These designs will incorporate hydrologic (watershed routing to determine timing, quantity and quality of discharge) and hydraulic (one-dimensional discharge modeling assuming steady, uniform flow) analyses. The design will also address migratory (resting, darting, bursting, and sustained swimming speeds) and residential habitat needs, including appropriate depth, velocity, and substrate during a range of flows (normal low to normal high flow conditions).

A complete reconnaissance and inventory of all streams on the CCNPP property was conducted on February 21 and 22, 2008, by MACTEC scientists and engineers to observe existing conditions and assess potential for ecological lift. Since then, cursory-level data (geomorphic and biologic) has been collected during various repeat visits. Sites demonstrating geomorphic stability and corresponding biological indicators were quickly excluded as potential mitigation sites. Many historically disturbed sites that exhibited a strong tendency to evolve toward stability were also discarded. However, some sites displayed persistent instability and the tendency to continue to degrade. Based on the reconnaissance and initial data collection efforts, all of these sites were identified and selected as part of the proposed Phase I mitigation plan. These mitigation sites were revisited on November 10, 2008, for further photographic documentation and refinement of mitigation concepts. Following this walkthrough, field notes and photographic logs were compiled, and the opportunity for physical, biological, and/or riparian "lift" and corresponding compensatory mitigation activity was identified at various locations throughout the CCNPP property. Table 3.3-1 summarizes the stream mitigation activities (enhancement/restoration) by site, and provides location information:

Table 3-2 Stream Mitigation Summary, CCNPP Unit 3 Site, Calvert County, Maryland

Stream Segment	Segment Length (lf)	Width (ft) of Up-lift	Area (ac)
SR-1 (Lower Woodland Branch)	2,114	varies*	6.78
SR-2 (Upper Woodland Branch)	1,534	varies*	2.90
SR-3 (Branch 1)	1,237	varies*	0.77
SR-4 (Johns Creek mainstem)	951	varies*	2.76
SR-5 (Unnamed trib. Johns Creek)	447	varies*	1.15
Stream Restoration Total	6,283		14.36
SE-1 (Unnamed trib. L.W. Branch)	1,160	30	0.80
SE-2 (Middle Woodland Branch)	655	30	0.45
SE-3 (Unnamed trib. U.W. Branch)	507	30	0.35
SE-4 (Branch 2)	920	30	0.63
SE-5 (Unnamed trib. Johns Creek)	904	30	0.62
Stream Enhancement Total	4,146		2.86

*Varies per measurement of valley width.

TABLE CREATED BY: RLS; 11/2008
TABLE CHECKED BY: RGH; 11/2008

Stream restoration will take advantage of opportunities to reconnect channels to their historic flow paths and restore active access to wooded floodplains. Areas where degraded channels are abandoned will be designed to function as pockets of seasonal wetlands, ephemeral ponds, and oxbow lakes in the riparian zone. Stream enhancement activities, intended to improve existing stream physical and ecological functions within the channel's current flow path include bank grading operations and floodplain creation at lower elevations, bank treatments, and native plantings.

The stream restoration and enhancement mitigation opportunities, combined with the proposed stormwater management plan, will offset losses to watershed functions by increasing the ability to provide flood storage, naturally recharge local aquifers, improve water quality, and maintain stream and riparian functions that support corresponding ecology.

Regarding protective mechanisms, the stream mitigation area will be protected in perpetuity through establishment of a legally binding deed restriction. The deed restrictions generally will follow the standard USACE Baltimore District model for such instruments. Ownership of the mitigation area will likely reside with CCNPP or its assigns, until CCNPP decides to sell the property or donate it to a public agency or private conservation organization. If the mitigation area should be sold, all appropriate protective mechanisms (which will have been recorded) will remain in effect and will remain with the site in perpetuity. Section 6.0 of this document provides further elaboration of proposed protective mechanisms for the project, along with information on adaptive management plans for the mitigation areas, if required.

Finally, the hearing held with the Maryland Public Service Commission in August 2008 regarding the application for a CPCN for the CCNPP Unit 3 project, the basic components of the compensatory mitigation plan were discussed. The approximate amount of mitigation that would be provided by the applicant to offset stream impacts was presented by MACTEC. The amount of stream mitigation proposed herein is based on a mitigation ratio of 1:1 for stream impacts.

4.0 EXISTING CONDITIONS OF PROPOSED MITIGATION SITES

4.1 LOCATION OF MITIGATION SITES

The location of the CCNPP Unit 3 site is presented in Figure 2.1-1. The locations and spatial relationships of the wetland and stream mitigation sites and the wetland and stream impact areas are presented in Figure 4.1-1.

4.2 EXISTING CONDITIONS OF MITIGATION SITES

4.2.1 General Site Conditions

The CCNPP property consists of 2,070 acres near Lusby, Calvert County, Maryland. The site is located on the west shore of Chesapeake Bay, approximately halfway between the mouth of the bay and its headwaters at the Susquehanna River. The site is bound to the north and south by wooded land, to the east by the Chesapeake Bay, and to the west by Solomons Island Road, also known as Maryland State Highway 2/4 (MD 2/4). The proposed CCNPP Unit 3 facility will be constructed primarily on the South Parcel of the CCNPP property.

The CCNPP Unit 3 site consists primarily of forested areas south and southwest of the existing reactors. The site topography is generally rolling and dissected by a dendritic pattern of stream valleys with narrow floodplains, adjoined by steep side slopes. The Chesapeake Bay shore consists of a narrow sandy beach abutted by sheer sandy cliffs that exceed 100 feet in height at some locations. Streams within the CCNPP Unit 3 site are nontidal, as shoreline cliffs prevent tidal influence from extending west of the beach bordering Chesapeake Bay. Tidal waters on the CCNPP Unit 3 site are limited to the Chesapeake Bay shoreline. The majority of the site is situated outside the Federal Emergency Management Agency (FEMA) 500-year and 100-year flood zones.

The distribution, structure, and species composition of the vegetative communities that occur at the CCNPP property reflect historical and current land use practices, such as selective silviculture, agriculture, recreational hunting, and construction. The wetland communities that occur at the site primarily include poorly drained, bottomland deciduous forest and herbaceous marsh. The forested wetlands are areas of poorly drained, seasonally saturated soils in lowlands adjoining Johns Creek, Goldstein Branch, their headwaters, and other streams on the site. The herbaceous marsh habitat includes a marshy fringe surrounding the shore of the Camp Conoy Fishing Pond, two smaller impoundments on the wetland/stream drainage way carrying the outflow from Camp Conoy Fishing Pond to the Chesapeake Bay, a constructed wetland (mitigation area) in the northwestern part of the project site, and a marshy fringe surrounding a stormwater pond immediately west of the existing CCNPP Barge Dock on the Chesapeake Bay. Open water habitat exists within the Camp Conoy Fishing Pond and in the largest of the three sediment basins at the Lake Davies Disposal Area.

The CCNPP site is well drained by a natural network of short ephemeral, intermittent, and perennial streams. Approximately 80% of the land area of the site is drained through the St. Leonard Creek drainage basin of the Lower Patuxent River watershed. The remaining 20% drains through the Maryland Western Shore watershed discharging northeastward and directly into Chesapeake Bay by two unnamed creeks, known as Lone Creek (*Branch 2*) and Conoy Creek (*Branch 1*). All the streams that drain the site, as located east of MD 2/4, are nontidal. Runoff from the site that lies within the St. Leonard Creek watershed mainly drains through Johns Creek, a tributary to St. Leonard Creek. The tributaries upstream of MD 2/4 that contribute to Johns Creek are the Goldstein Branch, Laveel Branch, and two unnamed branches. The St. Leonard Creek watershed includes St. Leonard Creek and its tributaries, including the Perrin Branch, Woodland Branch, Planters Wharf Creek, Johns Creek and its tributaries, Grovers Creek, Rollins Cove, and Grapevine Cove. The combined flow from these streams discharges into the Patuxent River through St. Leonard Creek. St. Leonard Creek is tidally influenced at the confluence with Johns Creek.

4.2.2 Wetland Mitigation Sites

After field reconnaissance and site walk-through of the CCNPP property in 2007 and 2008, including the CCNPP Unit 3 project area, specific locations were identified as having ecological lift potential for wetland enhancement or as being suitable for the creation of wetland communities from upland landscape. Data on vegetative, hydrologic, and soil conditions (Natural Resources Conservation Service [NRCS] custom soil resource report) were collected at potential mitigation site locations to determine whether enhancement or creation could be successfully achieved. The detailed soils mapping and data acquired from the NRCS will be included with the Phase II mitigation plan. Before intermediate design implementation, additional detail data will be collected as required to meet the *Mitigation and Monitoring Guidelines* (Baltimore District Regulatory Program, USACE, November 2004) and to supplement the reconnaissance field data collected in 2007 and 2008.

4.2.3 Wetland Creation Mitigation Sites

Mitigation Site WC-1

Mitigation Site WC-1 is next to the northern boundary of the CCNPP Unit 3 project area within the Camp Conoy area, which lies within the CBCA (see Concept Plan Sheet 8, Appendix A). The WC-1 site is the only mitigation area of the four proposed wetland mitigation sites that occurs within the CBCA. The selection of the WC-1 site resulted from an opportunity to route stormwater from the Unit 3 facility to the proposed forested wetland creation site, thereby providing a source of hydrology for this mitigation site. The proposed forested wetland creation site within the CBCA is not required by the CAC as mitigation for impacts to jurisdictional streams or wetlands within the CBCA. Although the CAC will require mitigation for impacts within the CBCA, no CAC/CBCA rules exist that require this mitigation to be in the form of forested wetlands. The existing vegetation and the soil profile within the WC-1 site were examined during field reconnaissance. Soil probing was conducted to describe profile horizons and determine the general hydrology of the area. The WC-1 site is a ruderal area that primarily consists of grasses and forbs (Photo 4-1). A fenced tennis court occurs within the northern portion of the mitigation site. Based on soil probes, it appears that fill material of varying depths and soil textures have been placed over native soils. Drainage is generally to the east to forested uplands.

Photo 4-1 Photo depicts the current site conditions within the proposed WC-1 site. Photo taken from southern end of site, looking to the north (November 2008).

<u>Mitigation Site WC-2</u>

Mitigation Site WC-2 is located within the Lake Davies Disposal Area, near the western boundary of the CCNPP Unit 3 project area (see Concept Plan Sheet 5, Appendix A). The Lake Davies Disposal Area was created during the construction of CCNPP Units 1 and 2 as a disposal area for dredged material from the project area. The WC-2 site occurs as the middle of three sediment basins (i.e., upper, middle, and lower basins) that are separated from each other by elevated berms. The middle and lower basins are man-made, but appear to support hydrophytes within areas of hydric soils and exhibit wetland hydrology. The existing site conditions of the basins provide an opportunity for the implementation of nontidal wetland mitigation strategies.

The existing vegetation and the soil profile within the WC-2 site were examined during field reconnaissance (Photos 4-2 and 4-3). The dredge materials are covered by a dense stand of phragmites (*Phragmites australis*). Its presence on the dredge material piles and within the two sediment basins is likely a result of propagules (seeds and rhizome fragments) contained in the dredge materials. The WC-2 site is presently dominated by phragmites. The perimeter of this mitigation site consists of red maple

(*Acer rubrum*), tulip poplar (*Liriodendron tulipifera*), black willow (*Salix nigra*), and rattlebush (*Sesbania* sp.). The central portion of the WC-2 site is generally flooded and lacks emergent vegetation. Based on soil probes, sands and other soil material appear to have migrated into the basin from the surrounding uplands and the berm area. In addition, field observations indicate the presence of hydric soils and wetland hydrology within this proposed wetland creation mitigation site. These sequentially connected basins carry water from the dredge materials area to Johns Creek and Goldstein Branch. A culvert hydrologically connects the middle basin to the lower sediment basin (WE-1).

Photo 4-2 Photo depicts the current site conditions within the proposed WC-2 site. Photo taken from northeast corner of site (from top of berm), looking to the southwest (November 2008).

Photo 4-3 Photo depicts the current site conditions within the proposed WC-2 site. Photo taken from northeast corner of site, looking to the west (November 2008).

4.2.4 Wetland Enhancement Mitigation Sites

Mitigation Site WE-1

Mitigation Site WE-1 is located within the aforementioned Lake Davies Disposal Area (see Concept Plan Sheet 5, Appendix A). The WE-1 site occurs as the lower sediment basin within the disposal area. Berms physically separate this basin from the middle sediment basin (WC-2) and a linear drainageway extension to the south (WE-2). The existing vegetation and the soil profile within the WE-1 site were examined during field reconnaissance (Photo 4-4). The mitigation site is presently dominated by phragmites. The plant associates include false nettle (*Boehmeria cylindrica*), giant cane (*Arundinaria gigantea*), and black willow. Based on soil probes, sands and other soil material appear to have migrated into the basin from the surrounding uplands and the berm areas. In addition, field observations indicate the presence of hydric soils and wetland hydrology within this proposed wetland enhancement mitigation site. Culverts hydrologically connect this basin to the middle sediment basin (WC-2) and the linear drainageway extension to the south (WE-2).

Photo 4-4 Photo depicts the current site conditions within the proposed WE-1 site. Photo taken from north central end of site (from berm), looking to the south (November 2008).

Mitigation Site WE-2

Mitigation Site WE-2 is generally located within Johns Creek (see Concept Plan Sheets 5 and 6, Appendix A). This mitigation site includes a linear drainageway extension to the south of the aforementioned lower sediment basin (WE-1), i.e., next to the southern end of the Lake Davies Disposal Area. The downstream portion of Johns Creek that is proposed for enhancement includes the portion of the reach that extends from a point approximately 1,000 feet upstream of the MD 2/4 bridge to a point near the western end of stream mitigation site SR-4. The WE-2 site lies outside the CCNPP Unit 3 boundary but within the CCNPP property boundary. Therefore, as with the other three previously described wetland mitigation sites, all mitigation activities will be implemented on site. The existing vegetation, hydroperiod, and soil profile within the WE-2 site were examined during field reconnaissance (Photos 4-5, 4-6, and 4-7). The portions of the Johns Creek reach that are not infested with phragmites (i.e., as occurring downstream and upstream of the mitigation site) are not included within the WE-2 mitigation area. The bottomland hardwood forest community that encompasses Johns Creek comprises red maple, sweetgum (*Liquidambar styraciflua*), and black gum (*Nyssa sylvatica*). The groundcover is typically dominated by phragmites. The plant associates include New York fern (*Thelypteris noveboracensis*), sensitive fern (*Onoclea sensibilis*), royal fern (*Osmunda regalis*), tussock sedge (*Carex stricta*), eastern bur-reed (*Sporangium americanum*), soft rush (*Juncus effusus*), lizard tail (*Saururus cernuus*), and skunk cabbage (*Symplocarpus foetida*). The linear drainageway extension is presently dominated by phragmites. No berm exists at the confluence of the linear drainageway extension and Johns Creek.

Photo 4-5 Photo depicts the current site conditions within the linear drainageway extension of the proposed WE-2 site. Photo taken from east side of drainageway extension, looking to the southwest (November 2008).

Photo 4-6 Photo depicts the current site conditions within the proposed WE-2 site. Photo taken from southeast corner of linear drainageway extension, looking to the southwest at the confluence of the drainageway extension and Johns Creek (November 2008).

Photo 4-7 Photo depicts the current site conditions within the proposed WE-2 site. Photo taken within the Johns Creek reach, looking to the east (upstream) (November 2008).

4.2.5 Stream Mitigation Sites

A complete reconnaissance and inventory of all streams on the CCNPP property was conducted on February 21 and 22, 2008, by scientists and engineers to observe existing conditions and assess potential for ecological lift. Since then, cursory level data (geomorphic and biologic) have been collected during various repeat visits. Sites demonstrating geomorphic stability and corresponding biological indicators were quickly excluded as potential mitigation sites. Many historically disturbed sites that exhibited a strong tendency to evolve toward stability were also discarded. However, some sites displayed persistent instability and the tendency to continue to degrade. Based on the reconnaissance and initial data collection efforts, all of these sites were identified and selected as part of the proposed Phase I mitigation plan. Soil survey data obtained from an NRCS custom soil resource report revealed that the selected sites, located primarily within floodplains, consisted almost entirely of mixed alluvium (My) or various gravelly silt loam riverine deposits. Though typically this material has moderately high to high hydraulic conductivity (0.57 inch to 1.98 inches per hour [in/hr]), the general relief (less than 2 percent slope), very low available water capacity (about 0.9 inch), and frequent flooding often contribute to a poorly drained condition with a shallow depth to water table ranging from 0 to 12 inches.

These mitigation sites were revisited on November 10, 2008, for further photographic documentation and refinement of mitigation concepts. Following this walkthrough, field notes and photographic logs were compiled and the opportunity for physical, biological, and/or riparian "lift" and corresponding compensatory mitigation activity was identified at various locations throughout CCNPP. Table 4-1 summarizes the mitigation activity (enhancement/restoration) by site, and provides location information.

Table 4-1 Stream Mitigation Summary, CCNPP Unit 3 Site, Calvert County, Maryland

Stream Segment	Segment Length (lf)	Width (ft) of Up-lift	Area (ac)
SR-1 (Lower Woodland Branch)	2,114	varies*	6.78
SR-2 (Upper Woodland Branch)	1,534	varies*	2.90
SR-3 (Branch 1)	1,237	varies*	0.77
SR-4 (Johns Creek mainstem)	951	varies*	2.76
SR-5 (Unnamed trib. Johns Creek)	447	varies*	1.15
Stream Restoration Total	6,283		14.36
SE-1 (Unnamed trib. L.W. Branch)	1,160	30	0.80
SE-2 (Middle Woodland Branch)	655	30	0.45
SE-3 (Unnamed trib. U.W. Branch)	507	30	0.35
SE-4 (Branch 2)	920	30	0.63
SE-5 (Unnamed trib. Johns Creek)	904	30	0.62

Stream Segment	Segment Length (lf)	Width (ft) of Up-lift	Area (ac)
Stream Enhancement Total	4,146		2.86

*Varies per measurement of valley width.

TABLE CREATED BY: RLS 11/2008
TABLE CHECKED BY: RGH 11/2008

Table 4-2 summarizes initial supporting data collected at mitigation segments, located in representative areas. These data assisted in identifying the potential for ecological lift and allowed for qualitative comparisons within and among proposed mitigation sites. These data helped identify stream positive and negative stressors of each potential mitigation reach during the conceptual restoration process. This process was conducted on potential restoration reaches only. Note that bank pins were installed in restoration segments and in the reference reach to validate bank loss erosion rates later, as needed. Before the Phase II mitigation plan is completed, additional data will be collected throughout the proposed mitigation sites to document existing conditions and serve as the datum to evaluate ecological lift following completion of mitigation efforts.

Table 4-2 Summary of Existing Stream Data, CCNPP Unit 3 Site, Calvert County, Maryland

Stream Segment	Representative Cross-Section	BEHI Rating	Phankuch Rating	MBSS Benthic IBI	RBP Score	Bankloss (tons/ yr.)	Bank Pin Installed
SR-1				4.7 (Good)	87		
SR-2	Yes	Extreme	Poor	3.6 (Fair)	71	32.7	Yes
SR-3	Yes	Extreme	Poor	1.9 (V.Poor)	130	663	Yes
SR-4				4.4 (Good)	89		
SR-5				3.3 (Fair)	149		
Reference Reach (John's Creek)	Yes	Moderate	Good			6.4	Yes

TABLE CREATED BY: RLS 11/2008
TABLE CHECKED BY: RGH 11/2008

4.2.6 Woodland Branch

Five proposed mitigation reaches within Woodland Branch were identified as stream restoration or enhancement sites; SR-1 (Lower Woodland Branch), SE-1 (UT to Lower Woodland Branch), SR-2 (Upper Woodland Branch), SE-2 (Middle Woodland Branch), and SE-3 (UT to Upper Woodland

Branch). Although Woodland Branch watershed drains to a tributary stream of the Patuxent River, stream restoration efforts will be completed in consideration with Critical Area requirements.

Woodland Branch SR-1

SR-1 (Lower Woodland Branch) – Located near the northern boundary on the CCNPP property, this site begins below a significant head-cut. Because of the extreme degree of entrenchment, practical improvements to the channel would include Priority 1 restoration (Photos 4-8, 4-9, and 4-10).

Photo 4-8 Photo depicts a representative section of the proposed mitigation reach along Woodland Branch. Note the roots have been undermined by down-cutting. Photo taken looking upstream (November 2008).

Photo 4-9 Views of Woodland Branch showing degree if incision and a depositional feature below an exposed bank.

Photo 4-10 Views of Woodland Branch showing degree if incision and a depositional feature below an exposed bank.

Woodland Branch SE-1

SE-1 (UT to Lower Woodland Branch) – This site begins below an existing stream crossing/culvert (12-inch CMP). The culvert has acted to protect the upstream from further degradation by: 1) arresting upstream migration of headcuts; 2) providing flood storage upstream of the roadway embankment, suppressing modified peak discharge and timing; and 3) capturing excess sediment from downstream transport (Photo 4-11).

Photo 4-11 Photo is representative section of the proposed mitigation reach along an unnamed tributary to lower Woodland Branch. See Concept Plan Sheet 3, Appendix A, SE 1 (November 2008).

Woodland Branch SR-2

SR-2 (Upper Woodland Branch) – Located in the northeast section of the CCNPP property, this site begins at an identified intermittent/perennial (I/P) transition of flow, and continues down valley until bank height ratios provide the opportunity to reconnect with the existing, semi-active floodplain (Photos 4-12, 4-13, and 4-14).

Photo 4-12 Photo depicts a representative section of the proposed mitigation reach along Woodland Branch. Photo taken looking upstream; see Concept Plan Sheet 4, Appendix A, SR-2 (November 2008).

Photo 4-13 The photos are of SR-2 showing an incised reach and sand deposits typical in the bed and flood deposit areas, particularly in the downstream locations (November 2008).

Photo 4-14 The photos are of SR-2 showing an incised reach and sand deposits typical in the bed and flood deposit areas, particularly in the downstream locations (November 2008).

Woodland Branch SE-2

SE-2 (Middle Woodland Branch) – This site begins below an existing stream crossing/culvert (12-inch CMP). The culvert has acted to protect the upstream from further degradation by: 1) arresting upstream migration of headcuts; 2) providing flood storage upstream of the roadway embankment, suppressing modified peak discharge and timing; and 3) capturing excess sediment from downstream transport. Photos 4-15 and 4-16 were taken downstream of the culvert.

Photo 4-15 Depict representative sections of the proposed mitigation reach along Woodland Branch. Note the roots have been undermined by down-cutting activity. See Concept Plan Sheet 4, Appendix A, SE-2 (November 2008).

Photo 4-16 Depict representative sections of the proposed mitigation reach along Woodland Branch. Note the roots have been undermined by down-cutting activity. See Concept Plan Sheet 4, Appendix A, SE-2 (November 2008).

Woodland Branch SE-3

SE-3 (Unnamed Tributary to Upper Woodland Branch) – This tributary is located in the northeastern portion of the CCNPP and forms part of the headwaters within Woodland Branch. A series of headcuts exist in this reach. While it appears that the existence of in stream woody debris has softened the impact of headcutting, active channel scour, and down cutting, degradation persists (Photo 4-17).

Photo 4-17 Photo depicts representative sections of the proposed mitigation reach along Woodland Branch. Note the roots have been undermined by down-cutting activity. See Concept Plan Sheet 4, Appendix A, SE-3 (November 2008).

4.2.7 Western Bay Tributaries

Two proposed mitigation reaches consist of low-order streams that discharge directly into the western Chesapeake Bay, SR-3 (Branch 1), and SE-4 (Branch 2). These sites will be recognized independently from the others requiring unique reference reach design data.

Branch 1:

The Branch 1 proposed mitigation reach is almost entirely located within the 1,000-foot Critical Area; this reach is identified as *SR-3 (Branch 1)* on Concept Plan Sheet 8, Appendix A.

SR-3 (Branch 1) – This channel, next to the proposed Unit 3 impact zone, appears to have undergone severe stream bank erosion and deep scour; possibly due to prior land use. It is highly entrenched, gully-shaped, and low-gradient. The gully is about 50 feet wide with the channel substrate composed of small gravel, fragipan clay, and broken seashells (Photo 4-18).

Photo 4-18 Photo depicts a representative section of the proposed mitigation reach along Branch 1. Photo taken looking downstream. Note the 17-foot-high, nearly vertical stream bank (see Concept Plan Sheet 8, Appendix A, SR-3) (November 2008).

Branch 2:

The Branch 2 proposed mitigation reach is entirely located within the 1,000 foot Critical Area; this reach is identifiable as *SE-4 (Branch 2)*.

SE-4 (Branch 2) – This stream originates in Camp Conoy flowing from Lake Conoy toward the Chesapeake Bay and does not suffer from excessive degradation (see Photos 4-19 and 4-20). This stream includes a sequence of impoundments built decades ago, which have since been naturalized and function as wetlands.

Photo 4-19 Photo of representative section of the proposed mitigation reach along Branch 2. Note the undermined tree roots and small impoundment about 100 feet up stream on this section; photo taken looking upstream. See Concept Plan Sheet 8, Appendix A, SE-4 (November 2008).

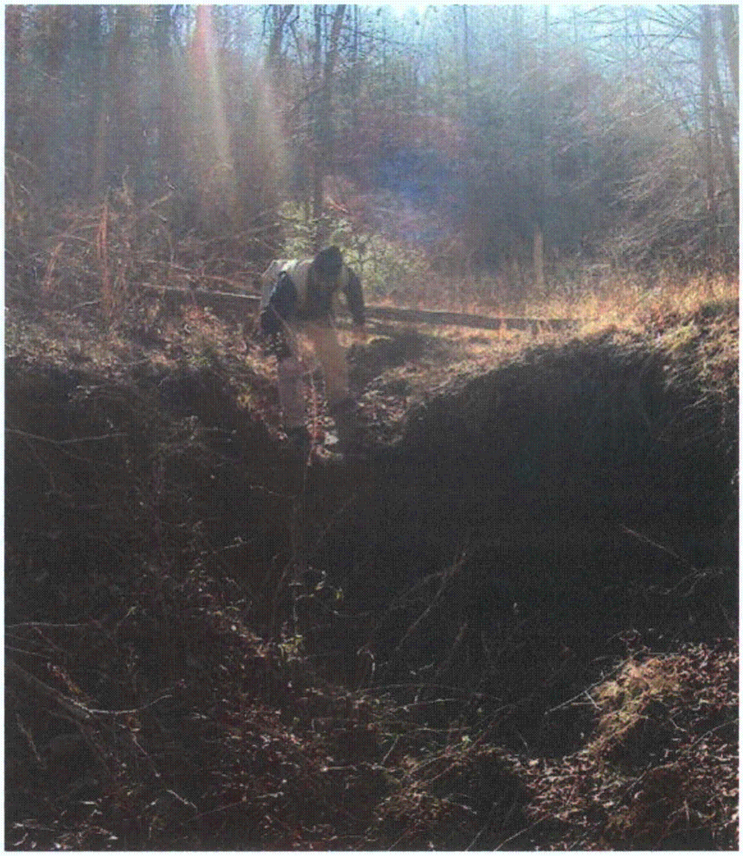


Photo 4-20 Photo depicts a representative section of the proposed mitigation reach along Branch 2. Note the large headcut with a measurement of approximately 7 feet; photo taken looking upstream. The individual is standing in the streambed looking down into the pool formed by the headcut or small, eroding waterfall. See Concept Plan Sheet 8, Appendix A, SE-4 (November 2008).

4.2.8 Johns Creek

Three proposed mitigation reaches within Johns Creek have been identified as stream restoration or enhancement sites: SR-4 (Johns Creek mainstem ~951 lf), SR-5 (UT to Johns Creek~ 447 lf), and SE-5 (UT to Johns Creek~ 904 lf). These stream restoration and enhancement reaches are outside the Critical Area limits.

Johns Creek SR-4

SR-4 (Johns Creek mainstem) has been affected by a series of headcut activities resulting in this section of stream channel being over widened and incised (Photo 4.2-21).

Photo 4-21 Photo is a representative section of the proposed mitigation reach along Johns Creek (main stem). Note the roots have been undermined by down-cutting. Photo taken looking downstream. See Concept Plan Sheet 6, Appendix A, SR-4 (November 2008).

<u>John's Creek SR-5</u>

SR-5 (Unnamed Tributary to Johns Creek) – Located southeast of John Creek in the southwest portion of the CCNPP property, this unnamed tributary to John's Creek is located upstream and next to a proposed wetland enhancement zone. This channel exhibits a series of medium-size headcuts and seems to have been relocated at some point in the past due to the presence of very small levee-like features on both banks in the upper section of this restoration reach that could be old excavated material (Photo 4-22).

Photo 4-22 Photo depicts a representative section of the proposed mitigation reach along an unnamed tributary to Johns Creek. Note the stream channel is incised in this section. Photo taken looking downstream (November 2008).

John's Creek SE-5

SE-5 (Unnamed Tributary to Johns Creek) – This stream mitigation reach is in the southwest portion of CCNPP near the southern property boundary. This unnamed stream channel is a tributary to Johns Creek and is upstream of SR-5. The degradation seen in this stream segment is likely due to a combination of the downstream degraded SR-5 and that of historical land use in the valley. This segment appears to be in a state of transition from a slightly entrenched Bc to a highly entrenched G (Photo 4.2-23).

Photo 4-23 Photo depicts a representative section of the proposed mitigation reach along Woodland Branch. Note the roots have been undermined by down-cutting activity that may be an affect from historical land use activity. Photo taken looking upstream (November 2008).

4.3 HISTORIC HYDROLOGY

Based on historic photos (refer to Appendix B), some conclusions may be drawn regarding the past land use and the corresponding hydrology. Between 1892 and up until the mid-1960s (U.S. Geological Survey [USGS] maps) a roadway was maintained within the narrow valleys of the Woodland Branch mainstem and upper tributaries. In addition, the headwaters of this system were intensely cleared for timber and farmed (NRCS, 1953 aerial). These land management practices independently have had a significant impact on runoff over the highly erodible parent Miocene sediment deposits and the corresponding stream flow and sediment discharge regime. The combined impact of these land management practices likely resulted in profound increases in sediment and discharge. Because of such fluctuating independent variables, the receiving stream system would need to adjust to accommodate the changes in flow and sediment. Streams in depositional material generally adjust to altered flow and sediment loads through channel incision and/or widening before evolving into a form capable of carrying the range of flows and sediment loads provided to it without aggrading or degrading. Following such an initial disturbance and degradational response, the channel would likely remain on this adverse evolutionary trend (Simon and Hupp, 1986) until a balance is met. Concurrently, impacts to downstream receiving waters resulting in a similar pattern of incision and overwidening would migrate upstream along the mainstem and into the tributaries. In an attempt to bolster this case, additional aerial photos were acquired. Comparison of the existing hydrologic conditions with the historic hydrologic conditions is summarized below.

Historic hydrologic features on the CCNPP site included the a network of short, ephemeral, intermittent, and perennial streams discussed in greater detail of the 2007 CPCN Technical Report. The same referenced report also provides general background on the local and regional groundwater aquifers (from shallow to deep: the surficial Piney Point–Nanjemoy aquifer, and the Aquia aquifer. Unlike the shallow aquifers used rarely as an agricultural source of irrigation, the deeper aquifers serve as substantial sources for local domestic and southern Maryland (Calvert and St. Mary's Counties).

Most of the site drained through the St. Leonard Creek drainage basin of the Lower Patuxent River watershed. A smaller portion of the site drained through the Maryland Western Shore watershed and discharged into the Chesapeake Bay. All streams that drained the site, as located east of MD 2/4, were nontidal.

Outside normal variations and cycles of precipitation inputs, the single most important parameter dictating surface hydrology is land use. Because the historical land use of this site is farming, it is reasonable to speculate on the associated changes to the hydrology resulting from standard farm practice on land that would otherwise be wooded. Typically, forest clearing and farm practices result in reduced retention time, increased peak discharge, reduced time of concentration, increased runoff volume and less groundwater recharge.

The hydroperiod or hydropattern of most of the wetland communities on the CCNPP property were likely more affected by the construction of Units 1 and 2 than by prior farming practices. Review of historic photographs revealed that extreme clearing and earthwork disturbances, as well as modifications to conveyance systems (such as ditching, channel widening, and watershed diversions) took place during construction of Units 1 and 2 throughout the headwaters of the Johns Creek and Western Bay tributary watersheds and portions of the Woodland Branch watersheds. These activities would have affected the surface and subsurface hydrology. Similar to impacts from farming, but greater by an order of magnitude, the discharge and sediment flowing into and through these systems would have been extremely impacted. The reduced groundwater recharge would affect the baseflow and spring-fed discharge delivered to the streams. As a result of these modified processes, this level of disturbance would have modified the overall morphology of the receiving streams and wetlands as well as the wetlands in similar, but more exaggerated ways than, the prior farming practice.

Of particular interest is an impact to the hydropattern of the forested wetland area abutting the southern edge of the main parking lot near the administration building (Wetland Assessment Area IX), which occurred as a result of the construction. Stormwater from this wetland area is routed under the parking lot into a stormwater management pond, which in turn discharges into Branch 2 and then into Chesapeake Bay. A more recent impact to the hydroperiod of this forested wetland area has occurred as a result of beaver (*Castor canadensis*) activities and the resultant impoundment of water along the northern edge of the wetland.

4.4 EXISTING HYDROLOGY

Since the beginning of construction of CCNPP Units 1 and 2 in 1968, some changes in site hydrology occurred with the rerouting of stormwater through manmade drainage ditches and culverts. Stormwater management ponds were constructed on site as collection points to receive stormwater. Treated stormwater was discharged into Chesapeake Bay via manmade drainage ditches and culverts. The surface water management plan for CCNPP, as permitted, is in place today and functions as designed.

The CCNPP site is well drained by a natural network of short, ephemeral, intermittent, and perennial streams. Approximately 80 percent of the land area of the site is drained through the St. Leonard Creek drainage basin of the Lower Patuxent River watershed. The remaining 20 percent drains through the Maryland Western Shore watershed discharging northeastward and directly into the Chesapeake Bay by two unnamed creeks, known as Lone Creek (*Branch 1*) and Conoy Creek (*Branch 2*). All the streams that drain the site, as located east of MD 2/4, are nontidal. Runoff from the site that lies within the St. Leonard Creek watershed mainly drains through Johns Creek, a tributary to St. Leonard Creek. The tributaries located upstream of MD 2/4 that contribute to Johns Creek are the Goldstein Branch, Laveel Branch, and two unnamed branches. The St. Leonard Creek watershed includes St. Leonard Creek and its tributaries, including the Perrin Branch, Woodland Branch, Planters Wharf Creek, Johns Creek and its tributaries, Grovers Creek, Rollins Cove, and Grapevine Cove. The combined flow from these streams discharges into the Patuxent River through St. Leonard Creek. St. Leonard Creek is tidally influenced at the confluence with Johns Creek. Open water habitat exists within the Camp Conoy Fishing Pond and in the largest of the three sediment basins at the Lake Davies Disposal Area.

Of particular hydrologic significance for both the wetland and stream mitigation sites, is the hydroperiod (elevation and temporal variation) of existing groundwater. While initial reconnaissance and observations of the wetland sites reveal speculations of sufficient groundwater to support restored or enhanced systems, installation of monitoring wells will provide better insight and serve to develop the associated design criteria. Similarly, regarding the proposed stream mitigation sites, among the various morphological qualities indicative of degradation common to all stream channels selected for enhancement or restoration is the bank height ratio. This measured value (actual bank height divided by the appropriate bankfull height) indicates the incised condition and reduced, or abandoned, access to an active floodplain (Simon and Hupp, 1986). As a result, the adjacent riparian water table is threatened by drawdown, and continued downcutting threatens to dewater the entire riparian zone and transform these areas into upland systems. Overall, this deprives wildlife of unique and valuable ecosystems and overall reduces the ecological diversity.

Rational Method Comparing Hydrology of Historical vs. Existing Land Use.

In an attempt to develop a better understanding of the existing degraded conditions as a function of historic land uses (see Section 4.3 Historic Hydrology), a gross hydrology model suggests discrepancies with runoff then and now. As discussed in section 4.2 CCNPP has identified ten potential stream mitigation reaches on-site. These reaches each show various signs of degradation; some signs are more obvious than others. CCNPP has identified five restoration reaches and five enhancement reaches. These mitigation candidates have been described and photographed in detail but without much discussion about what might have caused the degradation and how to prevent such degradation in the future.

A preliminary study was conducted in an effort to better hypothesize what caused the stream degradation seen today (see photos 4.2-8 through 4.2-22). To conduct such a study CCNPP conducted an exhaustive research effort to find historical photos. Very few historical aerials that depict an accurate level of detail in the study watersheds were found (see Appendix B). However, watershed analysis was still possible by making assumptions based on the limited historical documents available. For example, CCNPP suspects that the entire property was logged at one point in time and that parts of the site were cleared during the original construction of the Units 1 and 2.

These "worst case" and "existing" type assumptions were used to model peak flow events based on four primary components: rainfall duration and intensity, drainage area (acres), land use vegetation (historical and current) and slope (foot per foot [ft/ft]). Rainfall duration and intensity curves were acquired from the National Oceanic and Atmospheric Administration (NOAA), National Weather Service; Hydro-meteorological Design Studies Center; Precipitation Frequency Data Server (PFDS), Solomon's, Maryland location. Twelve drainage areas were delineated, graphically, using 2-foot topographic information, referenced in a geographical information system (GIS) (see Appendix C, Figures 1 through

12). Land use vegetation both historical (worst case) and current (as vegetated today). All data were compiled in an Excel spreadsheet and computed using the Kirpich Method (Kirpich, 1940) and the Rational Method (Chow et al., 1988).

The Rational Method estimates the peak rate of runoff at any location in a watershed as a function of the drainage area, runoff coefficient, and mean rainfall intensity for a duration equal to the time of concentration (the time required for water to flow from the most remote point of the basin to the location being analyzed). The Kirpich Method was used to compute time of concentration (Tc).

The Rational Method formula: Q=CiA

Where C = a dimensionless runoff coefficient
i = rainfall intensity (referencing Tc)
A = the sub-catchment area

Typical C values onsite vary from 0.05 to 0.25 for woodlands, while suspected, worst case, historical C values likely ranged from 0.45 to 0.60 for disturbed land and smooth, bare packed soil. C-values used for this study were assumed to be uniform over the entire delineated drainages area so as to compare one land use scenario to another without having additional assumptions that are unnecessary at this time. The peak discharge in cubic feet per second is a function of the rainfall intensity, which is based on the time of concentration. A time of concentration value was calculated for all proposed mitigation reaches with results ranging from 7 to 18 minutes. Based on these values a 15-minute return interval was used for each reach; a 2- and 25-year return interval storm were referenced to demonstrate relationships found at differing intervals (see Tables 4.4-1, 4.4-2, and 4.4-3).

Table 4-3 Mitigation site drainage areas and time of concentrations calculated for mitigation reaches.

Mitigation Site	Drainage Area (acres)	Time of Concentration (minutes)
SE-1	61	16
SE-2	42	8
SE-3	33	11
SE-4	43	8
SE-5	172	18
SR1	188	15
SR2	42	8
SR3	28	9
SR4	273	15
SR5	196	18
WC-1	23	7
WC-2	77	12

TABLE CREATED BY: RLS 2/2009
TABLE CHECKED BY: RGH 2/2009

Table 4-4 Hydrological peak discharge comparisons for worst-case land use compared with existing land use for proposed stream mitigation reaches.

Mitigation Site	15 Minute Duration	Estimated Current Landuse (open space/ grass/ forest) (C=.19)	Worst Case; Historical Landuse (smooth bare packed soil) (C=.60)
SE-1	2 year RI	40.7	128.6
SE-1	25 year RI	61.5	194.3
SE-2	2 year RI	28.2	88.9
SE-2	25 year RI	42.5	134.4
SE-3	2 year RI	22.0	69.4
SE-3	25 year RI	33.2	104.9
SE-4	2 year RI	29.1	91.9
SE-4	25 year RI	44.0	138.8
SE-5	2 year RI	114.8	362.7
SE-5	25 year RI	173.6	548.1
SR1	2 year RI	125.9	397.5
SR1	25 year RI	190.3	600.8
SR2	2 year RI	28.2	88.9
SR2	25 year RI	42.5	134.4
SR3	2 year RI	18.8	59.4
SR3	25 year RI	28.4	89.7
SR4	2 year RI	182.1	575.1
SR4	25 year RI	275.2	869.2
SR5	2 year RI	130.8	413.0
SR5	25 year RI	197.7	624.2
Note: Estimated Discharge in cubic feet per second (CFS)			

TABLE CREATED BY: RLS 2/2009
TABLE CHECKED BY: RGH 2/2009

Study results indicate that worst case land use, produced a historical peak discharge of at least three times the volume and associated water velocity compared to today's estimated land use discharge. These greater volumes and associated velocities hypothetically have caused the stream channel degradation that we see today (see Photos 4.2-8 through 4.2-22).

In addition to a comparison of land use runoff within the stream mitigation reaches, a comparison was conducted for the two wetland creation sites (see Table 4.4-3). This comparison was made for reference purposes only and will be expounded on during the Phase II investigations and reporting.

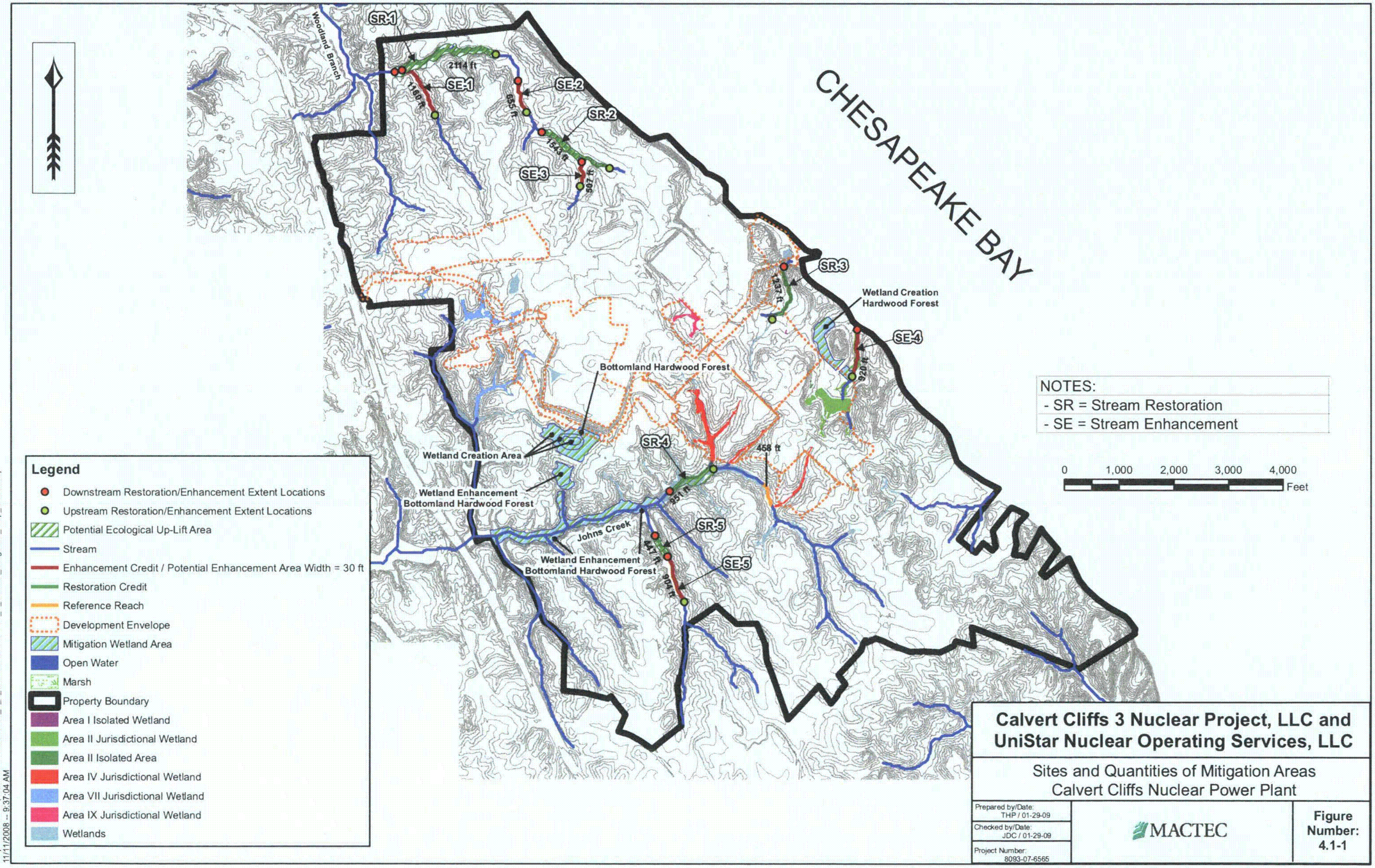
Table 4-5 Hydrological peak discharge comparisons for worst-case land use compared with existing land use for proposed wetland creation areas.

Mitigation Site	15 Minute Duration	Estimated Current Landuse (open space/ grass/ forest) (C=.19)	Worst Case; Historical Landuse (smooth bare packed soil) (C= .60)
WC-1	2 year	0.001	0.004
WC-1	25 year	0.002	0.006
WC-2	2 year	15.4	48.5
WC-2	25 year	23.2	73.3

Note: Estimated Discharge in cubic feet per second (CFS)

TABLE CREATED BY: RLS 2/2009
TABLE CHECKED BY: RGH 2/2009

While the current understanding of the existing hydrology is based on professional observation, field efforts including detailed precipitation, runoff and groundwater data shall be collected toward the completion of the Phase II mitigation plan.



Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC

Sites and Quantities of Mitigation Areas
Calvert Cliffs Nuclear Power Plant

Prepared by/Date: THP / 01-29-09	MACTEC	Figure Number: 4.1-1
Checked by/Date: JDC / 01-29-09		
Project Number: 8093-07-6565		

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5.0 PRELIMINARY MITIGATION PLAN

5.1 STREAM MITIGATION DESIGN

Following a review of conceptual-level restoration alternatives, the primary general design approach incorporates elements of natural channel design. Future watershed development will occur under Maryland's existing and new stormwater management regulations (MDE, 2007). The new regulations were developed to reduce watershed development-related impacts and will be enacted on or around December 31, 2008. For this reason, future impacts to the contributing watersheds of the mitigation reaches are expected to be minimized; therefore, a natural channel design approach is applied as the initial iteration of design.

Because the use of a reference reach and natural channel design provides limited application for unique systems, the proposed design method will later incorporate a combination of empirical, analog, and analytical approaches, capitalizing on their respective values. Initial analog design values (included herein) are a result of preliminary review of dimensionless ratios produced from regional reference reach data and a single reference reach.

Empirical relationships for determining design flows and channel geometry criteria will later be applied to our sites. Comparison of the analog with the empirical criteria will produce converging lines of evidence for use in determining the explicit range of values to be used as actual design criteria. Additional and ultimate final design criteria will be developed drawing from our experiences to improve the overall sensibility (site constraints [tree-saves, property lines, utilities, and future development], constructibility, cost, public perception, etc.) of the proposed design. Following development of final design criteria, the preliminary design will be refined to produce an Intermediate Design. The Intermediate Design will incorporate sediment transport and it will address stakeholder comments of the concept design.

Drawing from a multitude of analytical models, this next step in design attempts to identify and select those appropriate to the Calvert Cliffs mitigation project site and will incorporate more detailed sediment transport capacity considerations based on our first iteration concept design. Examining detailed sediment modeling parameters, design criteria are refined and this intermediate design provides a nearly final horizontal alignment, average slope, typical cross sections, and standard details for other proposed in-stream treatments. A final set of design documents will include construction plans and technical specifications incorporating all elements of work to be performed under the mitigation plan. For reference, some example details of the type and configuration of various structures and bank treatments have been provided (see Concept Plan Sheet 8, Appendix A).

Throughout this project area, the focus of the stream mitigation plan will be to capture the natural function where possible, while accounting for the transition areas between the constructed and natural environments. This requires a conscious focus on the proposed stormwater management plan, as described in Section 5-4, and on how the discharge and sediment regime for the receiving waters will be accommodated. For preservation reaches, no treatments are prescribed. For enhancement reaches, it is expected that a combination of one or more of the following will be proposed in specific locations: 1) minor bank grading/preparation, 2) bank armoring (log toe protection, root wad, stone toe protection, etc.), or 3) bioengineering (incorporation of large wood, live staking, soil wraps/lifts, branch packing). For restoration reaches, this plan proposes a blend of Priority I and Priority II treatments whereby the channel would be relocated or raised to access the existing abandoned floodplain and/or the floodplain would be graded to relieve shear stress. Additionally, it is expected that a combination of in-stream flow structures be proposed in specific locations: 1) grading channel dimension, pattern and profile, 2) log vanes (or variations of), 3) step-pools, x-weirs or constructed riffles where grade needs to be stepped down, and 4) additional enhancement treatments. Live transplants may also be used where they are available and appropriate. Woody and herbaceous riparian species native to Maryland and the Chesapeake Bay will be specified in the plans and efforts will be made to control or eliminate invasive species in the mitigation corridors.

5.1.1 Stream Design Criteria

A certain range of flows is responsible for the majority of sediment carried to and distributed throughout a riparian system. One such index flow of interest is the channel forming discharge (RDC/CHL CHETN-VIII-5) and can be estimated by determining: 1) bankfull discharge, 2) specified recurrence interval discharge (R.I. ~ between 1.25 and 1.50-YR), and 3) effective discharge (requiring sediment and flow discharge rating curves).

5.1.1.1 Maryland Regional Curves

Regression equations developed for the Maryland coastal plain regional curves relate bankfull area (square feet), bankfull width (feet), bankfull mean depth (feet), and bankfull discharge (cubic feet per second) to the contributing drainage area (square miles). Virginia and Maryland Coastal Plain regression equations are as follows (Kristolic and Chaplin, 2007):

Bankfull area:	$y = 11.9899x^{0.63803}$	***Equation 1***
Bankfull width:	$y = 10.4459x^{0.36543}$	***Equation 2***
Bankfull mean depth:	$y = 1.145x^{0.27345}$	***Equation 3***
Bankfull discharge:	$y = 28.3076x^{0.59834}$	***Equation 4***

Note: x represents the drainage area of interest in square miles
y represents the predicted parameter

5.1.1.2 Concept Design Criteria

Stream mitigation treatments must be qualified as one of the following: 1) preservation, 2) enhancement, or 3) restoration. In general, streams that exist in their pristine condition and optimally perform physical, biological and chemical (ecological) functions do not require any active restoration treatments. When portions of pristine streams, usually contiguous with other watershed treatments, are protected from future development (placed under conservation easement) and adjacent existing, or future land use, they shall qualify as **preservation** components of a larger mitigation plan. However, streams that exist in a less than pristine condition and do not optimally perform ecological functions do require some level active restoration treatments. This level of treatment (not including modification to dimension, pattern *and* profile) shall constitute **enhancement**. In the more extremely degraded circumstance whereby the existing streams no longer performs a specific ecological function, that function is thought to be absent, then active treatments to regain those functions shall be considered **restoration**. Current restoration, enhancement and preservation treatment selections included in this Phase I Plan are subject to change. Reasons for potential changes may include, but is not limited to: 1) on-site regulatory recommendations, 2) future detailed field investigations revealing discrepancy (positive or negative) in potential ecological lift and 3) other unforeseen circumstances.

For each proposed stream mitigation site, the watershed areas were delineated and a bankfull discharge estimated based on the limited data, design criteria for each mitigation site have been established (Table5.1-1). Table 5.1-1 summarizes the concept dimension design criteria, per mitigation site. Note that these criteria are not final and merely depict an initial iteration based on the limited available data. Additional data collection shall include reference reach data for the Woodland Branch watershed and the western coastal systems.

Table 5-1 CCNPP Stream Mitigation – Regional Prediction for Bankfull Dimension

CCNPP Stream Mitigation - Regional Prediction for Bankfull Dimension (2008.11.17)

Watershed	Site	A_w (mi^2)	A_{bkf} (ft^2)	W_{bkf} (ft)	d_{bkf} (ft)	Q_{bkf} (ft^3/s)
Woodland Branch	SR-1	0.55	8.2	8.4	1.0	20
	SE-1	0.13	3.3	5.0	0.7	8
	SR-2	0.17	3.9	5.5	0.7	10
	SE-2	0.27	5.2	6.5	0.8	13
Coastal Tributaries	SR-3	0.19	4.2	5.7	0.7	10
	SE-4	0.10	2.8	4.5	0.6	7
Johns Creek	SR-4	0.58	8.5	8.6	1.0	20
	SR-5	0.31	5.7	6.8	0.8	14
	SE-5	0.25	5.0	6.3	0.8	12

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Additional pattern parameters were calculated for stream reaches designated as restoration. The calculations (Table 5.1-2) were used to depict a conceptual pattern, or horizontal stream alignment, that incorporates standard sinusoidal characteristics of L_m (meander length, or wavelength), W_{belt} (meander beltwidth, or amplitude), and R_c (radius of curvature). The result of these calculations is a conceptual stream layout shown as "proposed channel" on the attached sheets.

Table 5-2 CCNPP Stream Mitigation – Local Predictions for Stream Dimensions

Stream	Channel type	W_{bkf}	W_{belt} min	W_{belt} max	K min	K max	L_m min	L_m max
WB SR1	Ce	8.4	38	46	1.125	1.375	67.2	84
WB SR2	Bc/C	5.5	14	19	1.08	1.32	66	77
CT SR-3	B	5.7	11	17	1.035	1.265	85.5	114
JC SR-4	Ce	8.6	39	47	1.125	1.375	68.8	86
JC SR-5	C	6.8	24	31	1.215	1.485	74.8	88.4

Stream	R_c min	R_c max	L_m/W_{bkf} min	L_m/W_{bkf} max	R_c/W_{bkf} min	R_c/W_{bkf} max	W_{blt}/W_{bkf} min	W_{blt}/W_{bkf} max
WB SR1	17.4	17.0	8	10	2.1	2.0	4.5	5.5
WB SR2	20.1	15.9	12	14	3.7	1.9	2.5	3.5
CT SR-3	37.0	24.2	15	20	6.5	2.9	2	3
JC SR-4	17.9	17.4	8	10	2.1	2.1	4.5	5.5
JC SR-5	16.6	17.7	11	13	2.4	2.1	3.5	4.5

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CHECKED BY: JBG 1/2009

These criteria are not final and merely depict an initial iteration based on the limited available data. Additional data collection shall include reference reach data for the Woodland Branch watershed and the western bay tributary systems.

Additional detailed reference reach stream survey and subsequent data analysis will identify flood prone width and access to floodplain, changes in channel slope, width to depth ratios, entrenchment ratios, riffle and pool lengths, pool-to-pool spacing, sinuosity, radius of curvature, meander width, meander length, and sediment characterization (pebble counts and bulk samples). Field survey data may be supplemented with any or all of the following: sediment supply and transport capacity analysis, hydraulic modeling, and regional curve data. Without sufficient reference reach data, the application of natural channel design methodology suffers diminished credibility and possible failure with regard to restoration uplift.

5.1.2 Additional Design Concepts

Before proposing disturbance of the existing forested areas, wetlands and wetland buffers, a conscious effort to minimize disturbance and temporary impacts was applied. While some areas appeared as appropriate candidates for enhancement, the consideration of staging, access and other construction activity was weighed against the expected benefit. Only areas next to excellent restoration sites were considered for enhancement, thereby minimizing collateral damage to the existing natural areas.

Functional lift that can be achieved using this approach includes reconnection to floodplain and flood dissipation, creation of complex bed features including riffles and pools to provide habitat for aquatic organisms, amphibian habitat in the ephemeral ponds, and woody planting to provide bank protection, shade, nutrient uptake, and food supply. Where channels can be modified in place, the hyporheic zone (where groundwater emerges through the bed of the channel) maintains its integrity, and the benthos living in this zone experience less disruption.

American eels (*Anguilla rostrata*) were collected at the Calvert Cliffs site during both the fall of 2006 and spring 2007 aquatic surveys at the following locations: Goldstein Branch, the most downstream location of Johns Creek, Lake Conoy, Pond #1, and Pond #2 (see CPCN 2007). Some of these collection locations are within or next to segments of streams that have been identified as good potential candidates for restoration or enhancement. Therefore the stream restoration and enhancement portion of the proposed compensatory mitigation plan will be designed to maintain existing, and promote improved passage of migratory fish species and more specifically, the catadromous American eel. Although there is little currently known about the fresh water habitat of the American eel, design criteria for stream restoration and enhancement activities will incorporate known physiological and habitat needs, such as vegetation, substrate, and flow characteristics (depth, velocity) (Gulf of Maine Council on the Marine Environment, 2007).

An example of a tool that may be implemented to facilitate eel migration on the Branch 2 system may include a natural fish way using step pools or other systems. Another example of a tool that may be implemented to facilitate eel migration for John's Creek includes the shading of streambeds and stabilization of stream banks to discourage further siltation.

UniStar will use qualified professional fisheries biologists to shock and/or seine existing populations (if present) before construction activities. Eels will be relocated to an appropriate location and various best management practices (BMPs), such as silt fencing with smaller mesh, will be applied in an attempt to prevent eel re-entry during construction. Every effort will be made to ensure that American eels are not harmed during stream restoration and enhancement construction activities. Additional information regarding eel management in the context of the disturbance areas is included in Section 5.3.2.

5.1.3 Site Specific Design Strategies

5.1.3.1 Woodland Branch

Five proposed mitigation reaches within Woodland Branch have been identified as stream restoration or enhancement sites: SR-1 (Lower Woodland Branch), SE-1 (unnamed tributary to Lower Woodland Branch), SR-2 (Upper Woodland Branch), SE-2 (Middle Woodland Branch), and SE-3 (unnamed tributary to Upper Woodland Branch). Although the Woodland Branch watershed drains to a tributary stream of the Patuxent River, stream restoration efforts will be completed in consideration with CBCA requirements.

Woodland Branch SR-1

Priority 1 restoration would include relocating the main channel alignment away from the existing "F" type channel, beginning at a severe headcut and continuing downstream to an area where floodplain access is more available (Figure 5.1-1). As is typical for proposed relocation, the abandoned reach of channel will be plugged throughout to prevent bypass, however it will still retain depressional qualities allowing it to serve as an ephemeral pond.

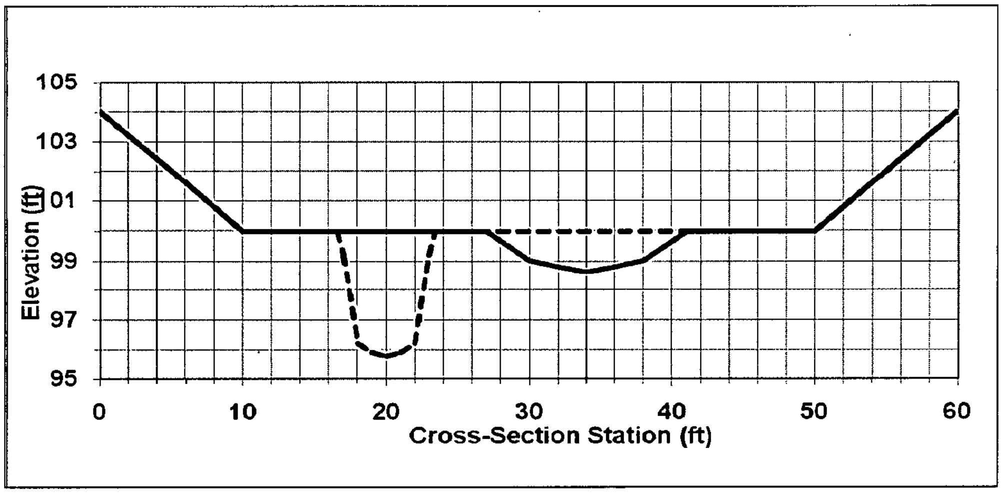

Figure 5-1 Example Cross-Section view showing an existing stream channel (dotted line) and a proposed new channel excavated to accommodate Priority 1 restoration (solid line). Example is not based on actual field measurement.

<u>**Woodland Branch SE-1**</u>

The entrenchment of this stream reach has not escalated to unmanageable proportions, therefore allowing corrective measures to be addressed through minor changes to existing channel dimension. Maintaining the existing channel alignment, slight adjustments to the profile and channel cross section will allow the stream to transform from an existing "F" type channel toward a more stable "C" or "E" type channel (Figure 5.1-2) through bank sloping and/or creating inner berm features.

Functional lift that can be achieved using this approach includes creating a small floodplain at a lower elevation, creation of complex bed features including riffles and pools to provide habitat for aquatic species, and woody planting to provide bank protection, shade, nutrient uptake, and food supply. One advantage of modifying a channel in place is that the hyporheic zone maintains its integrity and the benthos living in this zone experience less disruption.

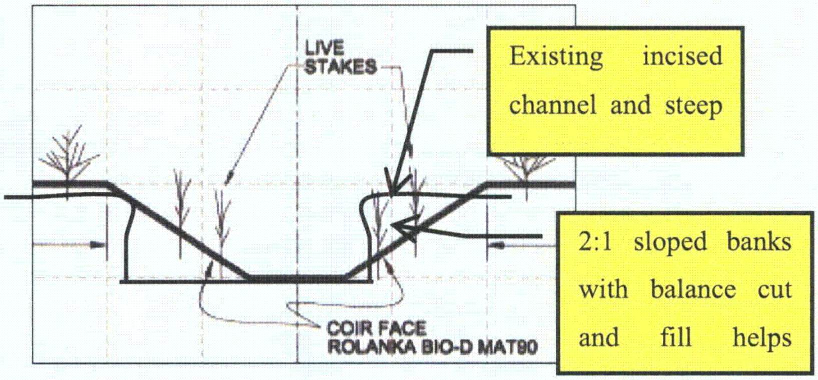

Figure 5-2 Example Cross-Section showing an existing over-widened stream channel and proposed slightly excavated enhanced stream banks. Example is not based on actual field measurement.

Woodland Branch SR-2

Similar to SR-1, practical improvements to Upper Woodland Branch would require Priority 1 restoration inclusive of relocating the main channel alignment away from the existing "G" type channel, or gully, beginning at a severe headcut upstream of the I/P point and continuing downstream to an area where floodplain access is more available (Figure 5.1-3).

Bed and streambank treatments may include an incorporation of large wood, live staking, soil wrapping, branch packing, and a step-pool, x-weir or constructed riffles where stream gradient needs to be stepped down.

Functional lift can be achieved using this approach, similar to those described in the general description of channel improvements section of this document. Large quantities of sand deposited in the bed and overbanks areas downstream will be reduced by reducing the amount of bed and bank degradation.

Woodland Branch SE-2

The entrenchment of this stream reach has not escalated to unmanageable proportions, thereby allowing corrective measures to be addressed through minor changes to existing channel dimension. Maintaining the existing channel alignment, slight adjustments to the profile and channel cross section will allow the stream to transform from an existing "F" type channel toward a more stable "C" or "E" type channel (see Figure 5.1-4) through bank sloping and/or creating inner berm features.

Woodland Branch SE-3

The current condition exhibits vulnerability to repeat occurrences and combined with restoration of the main channel, enhancement in the form of adjustment of channel dimension and assertive revegetation would decrease the average channel shear stress and increase the resistance.

5.1.3.2 Western Bay Tributaries:

Two proposed mitigation reaches consist of low order streams that discharge directly into the western Chesapeake Bay, SR-3 (Branch 1), and SE-4 (Branch 2). These sites will be recognized independently form the others requiring unique reference reach design data.

SR-3 (Branch 1)

Because of the extreme nature of the over widening and incision, this stream allows for Priority 2 restoration in the form of establishing a "new" active floodplain within the existing "F" type channel (Figure 5.1-3). However, this can only be accomplished through bank (future valley wall) grading and substantial adjustment of the existing alignment and profile. This restoration activity will begin immediately below the proposed fill zone and continue downstream until reconnection with the adjacent floodplain becomes practical, near an existing culvert. CCNPP would create a new channel within this gully shape. This construction effort would minimize the loss of healthy trees by stabilizing steep valley slopes using bioengineering applications.

SE-4 (Branch 2)

The primary element of enhancement at this site involves providing a channel stabilization grade control feature at the confluence with the Bay. By preventing upstream migration of a single seven-foot headcut, this feature will preserve the upstream sequence of wetlands and stream channels. Additional enhancement throughout this reach includes riparian re-vegetation and minor bank grading where knickpoints have initiated. Minor bank grading plus other enhancements will be performed in preparation for bioengineering application and native plant landscaping (see Figure 5.1-3).

5.1.3.3 Johns Creek

Three proposed mitigation reaches within Johns Creek have been identified as stream restoration or enhancement sites: SR-4 (Johns Creek mainstem ~951 lf), SR-5 (unnamed tributary to Johns Creek~ 447 lf), and SE-5 (unnamed tributary to Johns Creek~ 904 lf). These stream restoration and enhancement reaches are located outside the Critical Area limits.

Johns Creek SR-4

To remediate this condition, Priority I restoration is proposed whereby the existing channel will be abandoned and relocated toward the center of the valley, allowing for restored stream function. This treatment will continue for 950 lf until acceptable access to the active floodplain is achieved (Figure 5.1-3). Using Maryland Regional Curve regression Equations 1-3, the design channel can be expected to approximate the following dimensions.

John's Creek SR-5

Priority I restoration is proposed whereby the existing channel will be abandoned and relocated toward the center of the valley where a remnant channel is visible, allowing for restored stream function. This treatment will continue nearly 450 lf until acceptable access to the active floodplain is achieved (Figure 5.1-3).

John's Creek SE-5

Enhancement activity in the stream segment would include the grading of streambanks to an angle more representative of natural stream slopes. The reduced streambank slope angle would allow the stream to better access its floodplain and improve ecological connectivity. Success of this enhancement reach could be contingent, in part, to effective re-establishment of grade control in the downstream, SR-5. (Figure 5.1-4)

5.1.4 Stream Monitoring

The purpose of monitoring is to determine the degree of success a mitigation project has achieved in meeting the objectives of providing proper channel function and increased habitat quality. Success criteria (specific to the selected mitigation objectives) such as physical channel measurements to demonstrate dynamic equilibrium, photographs, native riparian plant density and vigor, and evidence of aquatic species present in the stream systems will be gathered annually to show how well the proposed mitigation plan achieves its goals of no net loss of stream function. Depending on the preferences of the mitigation review team (federal and state agencies), various levels of monitoring may be required based on the complexity of the mitigation project being proposed. At a minimum, the monitoring plan shall include:

1. Identify parties responsible for monitoring. If more than one, identify primary party
2. Data to be collected and reported, how often and for what duration (identify proposed monitoring stations, including transect locations on map).
3. Assessment tools and/or methods to be used for data collection monitoring the progress towards attainment of performance standard targets.
4. Format for reporting monitoring data and assessing mitigation status.
5. Monitoring schedule – Monitoring will be conducted for a minimum period of five years.

Per the USACE Wilmington District Stream Mitigation Guidelines (2003) and Baltimore District Stream Mitigation Guidelines (2004), the explicit directives provide the framework for project monitoring. Following final construction, an as-built topographic survey (including identification and location of actual plantings) shall be conducted and corresponding plans with explanations of any deviations from the approved mitigation plan. As-built plans should be certified by a professional engineer and should document the dimension, pattern, and profile of the restored channel. Permanent cross-sections should be established at an approximate frequency of one per 20 (bankfull-width) lengths. In general, the locations should be selected to represent approximately 50 percent pools and 50 percent riffle areas. The as-built survey should also include photo documentation at all cross-sections and structures, a plan view diagram, a longitudinal profile, vegetation information and a pebble count/bulk sampling data.

Depending on the level of treatment (creation and enhancement) different levels of ecological function and geomorphic stability success criteria identified and corresponding data may be required.

The following criteria may be used to evaluate success:

1. Photo documentation
2. Channel aggradation or degradation
3. Bank erosion
4. Success of riparian vegetation
5. Effectiveness of erosion control measures
6. Presence or absence of developing instream bars (should be absent)

7. Ecological function
8. Health and survival of vegetation (80 percent survival of planted species required after 5 years)
9. Restoration reach should mimic upstream conditions (or reference reach when applicable)
10. Channel stability
11. Should be insignificant change from the as-built dimension
12. Changes should be minor and represent an increase in stability (e.g., decreased width to depth ratio without a decrease in entrenchment ratio)
13. Pool/riffle spacing should remain fairly constant
14. Pools should not aggradate nor should riffles degrade
15. Pebble count should show a change in the size of bed material toward a desired composition

Annual monitoring forms require as-built plans and current data. Monitoring reports should contain a discussion of any deviations from as-built and evaluate the significance of these deviations and whether they indicate a stabilizing or destabilizing situation.

Finally, the stream mitigation monitoring program will be implemented in accordance with the requirements of the *Mitigation and Monitoring Guidelines* (USACE, 2004), the protocols presented in the *Maryland Compensatory Mitigation Guidance* (IMTF, 1994), and the guidance provided in Regulatory Guidance Letter No. 08-03 (USACE, October 2008). The monitoring program will be conducted pursuant to the MDEWMA mitigation monitoring guidelines and protocols.

5.2 WETLAND MITIGATION DESIGN

Compensatory mitigation for unavoidable impacts to approximately 11.72 acres of jurisdictional, nontidal forested wetlands, emergent (herbaceous) wetlands, and surface waters (including Camp Conoy Fishing Pond) (USACE and/or MDE jurisdictional) will include:

- The creation of forested wetland habitat within the Camp Conoy area which lies within the CBCA (Mitigation Site WC-1);
- The creation of forested and herbaceous wetland habitat within the middle manmade, abandoned, sediment basin of the Lake Davies Disposal Area (Mitigation Site WC-2);

- The enhancement of a smaller manmade, abandoned, sediment basin within the Lake Davies Disposal Area (Mitigation Site WE-1);
- The enhancement of a portion of Johns Creek and a linear drainageway extension occurring to the south of the Lake Davies Disposal Area (Mitigation Site WE-2);
- The eradication of phragmites through herbicide application (Mitigation Sites WC-2, WE-1, and WE-2); and

Soil material from impacted on-site wetland areas that do not contain phragmites will be used in the creation mitigations sites as a supplemental growth medium (Mitigation Sites WC-1 and WC-2).

5.2.1 Wetland Creation Mitigation Sites

Mitigation Site WC-1

A critical component of wetland creation design is hydrology. If hydrologic conditions are inadequate, the vigor and survivorship of the planted hydrophytes within a created wetland will decrease and success criteria may not be met. For the WC-1 site, stormwater from the proposed power block and adjacent laydown area will be used to drive the hydrology of the created wetlands. Three wetland cells in series are proposed. Discharge from the site will enter into the cell at the highest elevation. A catch basin with an overflow elevation set approximately one foot above the ground elevation and equipped with a small outlet pipe will drain water from this cell through the berm into the middle cell in approximately 24 hours. Likewise, water from the middle cell will flow into the lower cell through a catch basin set about 1 foot above base elevation. Water in the lowest cell will discharge slowly into an existing channel leading down to the Chesapeake Bay. The uppermost wetland cell will also be equipped with an overflow spillway to handle discharges up to the 25-year storm. These peaks will be reduced through temporary storage in the wetland and then released into the channel below Camp Conoy. The 24-hour drawdown time in the wetland cells was determined to reduce inundation of tree roots for excessive periods of time. There may be some micropools and other microtopography features added to the wetland cells to diversify habitat for wetland flora and fauna. Finally, the WC-1 site will receive treated stormwater to drive the hydrology of the site. The WC-1 site has not been designed to provide attenuation (water quality treatment) for stormwater being routed from the constructed CCNPP Unit 3 facility to this location.

The bottom elevations within the aforementioned cells will not be uniform; i.e., an assemblage of hummocks will be created during site excavation to provide areas of shallow and deeper water and areas of saturated soil conditions. This manipulation of the hydropattern through design and construction will provide more diversity in habitat conditions for the proposed wetland creation than would be expected to occur in a created wetland with a "flatter" floor construction and uniform conditions of inundation. Based on the results of recent site evaluations, the soils within this proposed mitigation area are sandy; therefore, additional clay material will be incorporated into the existing soil material within the mitigation area during construction to increase soil water retention capability. Soil material from impacted on-site wetland areas will be used for the creation of the WC-1 mitigation site; however, only impacted wetlands that do not contain phragmites will be considered for a source of hydric soil material.

The WC-1 site will be planted with seedlings of native hydrophytic tree species to create a wetland hardwood forest community. Approximately 4.6 acres of forested wetlands will be created in this location. At a mitigation credit ratio of 2:1, this mitigation site will yield approximately 2.3 acres of credit. Finally, wetland function will be increased by creating wildlife habitat for wetland dependent and wetland independent species. These created wetlands will provide waterfowl habitat; i.e., winter flooded conditions for resident and migratory species, with drawdown in the spring to maintain the vitality of the planted tree species and provide a suitable substrate for plant regeneration.

Mitigation Site WC-2

Within the Lake Davies Disposal Area, wetland creation will be provided for the middle abandoned sediment basin through the establishment of the following vegetative zones:

- An interior open water (pond) area will be planted with floating aquatic species;
- A surrounding freshwater marsh fringe will be planted with herbaceous plant species; and
- An outer zone will be planted with woody bottomland hardwood species.

Regarding the opportunity to provide wetland creation, wetland fill material will be deposited within the sediment basin to raise the ground elevation across the central portion of the basin. Soil material from impacted on-site wetland areas will be used for the WC-2 mitigation site; however, only impacted wetlands that do not contain phragmites will be considered for a source of hydric soil material. The undesirable, exotic, plant species phragmites, which is currently infesting the sediment basin, will be eradicated through the application of chemical herbicide before the filling and planting activities. The hydroperiod of this created wetland area will be manipulated through the establishment of a water control structure. Through these mitigation activities, approximately 0.9 acre of open water (pond) habitat and 1.3 acres of freshwater marsh habitat will be created. At a mitigation credit ratio of 1:1, this mitigation site will yield approximately 1.3 acres of credit for emergent marsh. The planting of approximately 7.2 acres of bottomland hardwood forest will provide forested wetland creation. At a mitigation credit ratio of 2:1, this mitigation site will yield approximately 3.6 acres of credit for forested wetlands. The creation of zones of open water, marsh, and bottomland hardwood forest will greatly increase wetland habitat diversity (wetland function) and wetland value within this basin and be an improvement over the existing habitat condition; i.e., a monoculture of phragmites. During the construction of the WC-2 site, the phragmites will be sprayed with herbicide.

5.2.2 Wetland Enhancement Mitigation Sites

WC-1 is designed to be a three celled forested wetland fed with stormwater runoff from the power block and lay down area.

Based on the current design of the forested wetlands, flow will be diverted from the upper wetland cell to the middle wetland cell and from the middle wetland cell to the lowest wetland cell through orifices and connecting pipes. One foot of water will be stored in each wetland cell before the discharge pipe becomes activated. This volume of water is designed to draw down over the course of 24 hours. The outlet pipe from the lowest wetland cell is 8-inches. Storm runoff above the volume that fills the three wetland cells will be diverted through a principal spillway in the uppermost cell to the south where it will flow into the channel draining Camp Conoy.

Within the wetland cells microtopography will be created to support a greater diversity of wetland species, particularly freshwater marsh fringe for herbaceous species and bottomland hard forest species.

In WC-2 and the wetland enhancement areas, control of phragmites and re-establishment of bottomland hardwoods will recreate habitat lost to an invasive, exotic weed. WC-2 will also contain open water and freshwater marsh fringe habitat. In areas influenced by shallow flooding associated with beaver dams, localized fill will be placed to create planting zones for the woody species.

Mitigation Site WE-1

The lower sediment basin within the Lake Davies Disposal Area will be enhanced through the eradication of phragmites, by application of chemical herbicide, and the planting of woody bottomland hardwood species (trees and shrubs). These mitigation activities will provide approximately 2.4 acres of wetland enhancement. At a mitigation credit ratio of 3:1, this mitigation site will yield approximately 0.8 acre of credit for forested wetlands.

The planting of desirable woody species within the enhancement area, along with phragmites eradication, will provide suitable wildlife habitat (wetland function) and wetland values within this phragmites-infested basin. The benefits of eradicating phragmites would be the replacement of a somewhat sterile environment with a more diverse community through the planting of desirable plant species.

Mitigation Site WE-2

Wetland enhancement will also be provided within a significant portion of the Johns Creek system through the eradication of phragmites, by application of chemical herbicide, and the planting of woody bottomland hardwood species. The target areas encompass:

- The eastern (upstream) and western (downstream) portions of Johns Creek near the confluence of Johns Creek and the linear drainageway extension occurring to the south of the Lake Davies Disposal Area and
- The portion of Johns Creek that is proposed for enhancement includes the portion of the reach, which extends from a point located approximately 1,000 feet upstream of the MD 2/4 bridge to a point located near the western end of stream mitigation site SR-4. The linear drainageway extension appears as a remnant stream system that is presumed to have historically extended northward into the area that is now known as the Lake Davies Disposal Area.

The planting of desirable woody species (trees and shrubs) within the enhancement areas of Johns Creek, along with phragmites control, will provide wildlife habitat within this poorly drained bottomland hardwood forest community. The phragmites-infested portions of Johns Creek have been significantly degraded over time as a result of recruitment of this invasive species. Therefore, the proposed mitigation activities will replace the loss of one or more functions within the targeted wetland community. In addition, there should be no adverse impact on natural resources from the enhancement activity. For example, if phragmites has impeded the flow of water between the linear drainageway extension and Johns Creek, then the control of this invasive species will improve hydrology between these wetland areas. The mitigation activities associated with the WE-2 site will provide approximately 15.7 acres of wetland enhancement. At a mitigation credit ratio of 3:1, this mitigation site will yield approximately 5.23 acres of credit for forested wetlands.

5.2.3 Design Methodology and Design Criteria

5.2.3.1 Wetland Mitigation Planting Plan

The compensatory mitigation plan for the CCNPP Unit 3 project will entail the eradication of phragmites as necessary then the planting of native hydrophytic tree and/or shrub species within the proposed mitigation sites. These mitigation activities will be conducted in accordance with the requirements of the *Mitigation and Monitoring Guidelines*, Baltimore District Regulatory Program, U.S. Army Corps of Engineers, November 2004. The components of the wetland mitigation planting plan for the proposed mitigation sites are discussed below.

5.2.3.2 Wetland Creation Mitigation Sites

Mitigation Site WC-1

After excavation and the establishment of bottom elevations and the installation of water control structures, the WC-1 site will be planted with native hydrophytic trees species. The tree species will be planted at a density of 680 stems per acre (8-foot centers) to allow for anticipated mortality from wildlife depredation by white-tailed deer (*Odocoileus virginianus*) or other browsers and defoliation by insects during early seedling establishment. It is expected that recruited, desirable, woody species will add to the overstory stem density in the mitigation site. The plant material will be representative of the species composition of the adjacent bottomland hardwood forested wetlands within the CCNPP property and native to the region. In addition, the plant material will include species that have been identified as suitable for installation on wetland mitigation projects by the Calvert County Soil and Water Conservation District (CCSWCD) and the CAC. The final selection of plant stock may be determined to some extent by availability. The selected tree species will consist of containerized and/or bare root stock protected by tree shelters (i.e., TUBEX® or Miracle Tube tree shelters). The tree shelters will provide protection from wildlife depredation, wind, or other influences. The tree material for installation will include, but is not limited to, willow oak (*Quercus phellos*), water oak (*Quercus nigra*), black gum, red maple, tulip tree (*Liriodendron tulipifera*), river birch (*Betula nigra*), and/or American sycamore (*Platanus occidentalis*). The palette of tree species will be finalized before installation. Additional species may be added if they are determined to be highly suitable for installation in the WC-1 mitigation site.

<u>Mitigation Site WC-2</u>

Three planting zones are proposed for the WC-2 mitigation site; i.e., open water, freshwater marsh fringe, and bottomland hardwood forest. The open water (pond) habitat will be planted with pondweed (*Potamogeton* sp.), water lily (*Nymphaea* sp.), or other suitable floating aquatic species. The marsh fringe will be planted with native hydrophytic herbaceous species. The herbaceous species will be planted at a density of 4,800 stems per acre (3-foot centers). The plant material will be representative of the species composition of adjacent herbaceous wetlands within the CCNPP property and native to the region. In addition, the plant material will include species that have been identified as suitable for installation on wetland mitigation projects by the CCSWCD. The final selection of plant stock may be determined to some extent by availability. The herbaceous material for installation will include arrow arum (*Peltandra virginica*), duck potato (*Sagittaria latifolia*), water plantain (*Alisma subcordatum*), and/or pickerelweed (*Pontederia cordata*). The palette of herbaceous species will be finalized before installation. Additional species may be added if they are determined to be highly suitable for installation in the WC-2 mitigation site. The tree species for installation within the outer zone (bottomland hardwood forest) of the mitigation site will include, but is not limited to, willow oak, water oak, black gum, red maple, tulip tree, river birch, and/or American sycamore. The palette of tree species will be finalized before installation. Additional species may be added if they are determined to be highly suitable for installation in the WC-2 mitigation site. The tree species will be planted at a density of 680 stems per acre (8-foot centers). The installation of all plant material within the WC-2 mitigation site will be conducted following the deposition of fill material and contour shaping within the basin.

The eradication of the existing phragmites within the WC-2 mitigation site will be conducted through the application of approved herbicide. The eradication of phragmites will be completed before the installation of plant material, and the deposition of fill material and contour shaping within the basin.

5.2.3.3 Wetland Enhancement Mitigation Sites

<u>Mitigation Site WE-1</u>

The enhancement of the WE-1 mitigation site will entail the planting of native hydrophytic trees to establish a bottomland hardwood forest community within this basin. The tree species for installation will include, but is not limited to, willow oak, water oak, black gum, red maple, tulip tree, river birch, and/or American sycamore. The palette of tree species will be finalized before installation and may include the addition of other desirable tree species. The plant material will be representative of the species composition of the adjacent bottomland hardwood forested wetlands within the CCNPP property and native to the region. The tree species will be planted at a density of 680 stems per acre (8-foot centers).

The eradication of phragmites within the WE-1 mitigation site will be conducted through the application of approved herbicide. The eradication of phragmites will be completed before the installation of plant material.

Mitigation Site WE-2

The enhancement of the WE-2 mitigation site will entail the planting of native hydrophytic trees and shrubs to establish a bottomland hardwood forest community within the mitigation site. The proposed mitigation site includes the bottomland hardwood forest component of the eastern (upstream) and western (downstream) portions of Johns Creek (near the confluence of Johns Creek and the linear drainageway extension) and the linear drainageway extension. The tree species for installation will include, but is not limited to, willow oak, water oak, black gum, red maple, tulip tree, river birch, and/or American sycamore. The shrub species for installation will include silky dogwood (*Cornus amomum*), inkberry (*Ilex glabra*), shadbush (*Amelanchier canadensis*), highbush blueberry (*Vaccinium corymbosum*), possum-haw (*Viburnum nudum*), elderberry (*Sambucus canadensis*), and Virginia willow (*Itea virginica*). The palette of tree and shrub species will be finalized before installation and may include the addition of other desirable tree or shrub species. The plant material will be representative of the species composition within Johns Creek and native to the region. The tree and shrub species will be planted at a density of 680 stems per acre (8-foot centers).

The eradication of phragmites within the WE-2 mitigation site will be conducted through the application of approved herbicide. The eradication of phragmites will be completed before the installation of plant material.

5.3 CONCEPTUAL SITE PLAN

5.3.1 Habitat Management Plan

UniStar proposes post-construction habitat improvement to three separate laydown areas within the project boundary. These areas will be referred to as laydown areas 1, 2, and 3 (Figure 4.1-1). Habitat improvement will be accomplished by restoring upland portions of laydown areas to native grassland communities. The vegetative planting plan for streams and wetlands within the laydown areas is addressed in section 5.7 below.

5.3.1.1 Existing Conditions

Existing vegetative conditions have been documented in a flora survey report prepared for Unistar Nuclear Development, LLC (Tetra Tech NUS, 2007a). Upland communities within the laydown areas are described as lawns, old fields and mixed deciduous forest. Laydown area 1 is 6.35 acres of old field vegetation. It is located near the west boundary of the project area and south of Calvert Cliffs Parkway. Laydown area 2 is 10.01 acres southwest of the existing Calvert Cliffs Nuclear Power Plant. This area is primarily mixed deciduous forest and bottomland deciduous forest. Laydown area 3 is 59.88 acres southeast of the existing Calvert Cliffs Nuclear Power Plant. Laydown area 3 encompasses a portion of Camp Conoy, including Camp Conoy Fishing Pond. This area consists of lawns, mixed deciduous forest and bottomland deciduous forest. In a rare plant survey report prepared for Unistar Nuclear Development, LLC, Tetra Tech NUS located 2 rare plant species within laydown area 3 (Tetra Tech NUS, 2007b). The showy golden rod (*Solidago speciosa*) and Shumard's oak (*Quercus shumardii*) are both listed as threatened in the state of Maryland (Maryland DNR 2008). Potential mitigation measures outlined by Tetra Tech NUS will not be addressed in this document.

5.3.1.2 Wildlife Benefits

The post-construction laydown areas provide an excellent opportunity to establish native grassland communities for wildlife habitat. Grassland communities consist of native warm season grasses and forbs. Establishing grassland communities will increase biodiversity by providing habitats not currently available to wildlife species. These communities provide forage and cover for species such as whitetail deer (*Odocoileus virginianus*), turkey (*Meleagris gallopavo*), bobwhite quail (*Colinus virginianus*), and small mammals and nesting habitat for grassland songbirds. The rich diversity of grasses and forbs will also increase insect and pollinator populations. The presence of small mammals and other prey will attract predators such as hawks (*Buteo* spp.), shrikes (*Lanius* spp.) and fox (*Vulpes* spp.).

5.3.1.3 Additional Benefits

Native grassland communities have drastically declined in the United States due to land use practices. As a result, native grasslands are among the most endangered natural community types (Frost 2000, Stein et.

al 2000). Establishing native grasslands communities will contribute to the conservation of biodiversity. Native grasses also contribute to the conservation of soils by increasing soil fertility and reducing erosion.

Native grass species are drought resistant and require minimal maintenance once established. Annual maintenance of the grassland communities by mowing will remove and/or control non-native and exotic plant species.

5.3.1.4 Site Preparation and Planting

Weed Control, mowing, disking, liming, fertilization and planting are proposed under the post-construction habitat improvement plan for the laydown areas on the CCNPP Unit 3 site.

Non-native cool season grasses, e.g. fescue (*Festuca* spp.) and Bermuda grass (*Cynodon* spp.), may become established on the site before planting. If this occurs, it may be necessary to apply herbicides to control these undesirable weeds. Herbicides may be applied in fall before planting or pre-planting in the spring. Recommended herbicides applied to control undesirable species should be Glyphosate, Imazapier, or Garlon. Herbicide representatives should be consulted for rates of application.

The need to fertilize will be determined on a site-by-site basis. Soil samples from the proposed restoration areas will be collected and submitted to the Maryland Cooperative Extension Service for analysis. Results of the soil tests will determine nutrient recommendations and guidance on the timing of fertilization. Ph of the soil is also a factor depending on which plant species are planted. Native warm season grasses require a pH of at least 6.0 or 6.5. Soil tests will also provide information regarding the amount of lime to apply in tons per acre.

Preparation of the site includes disking to mineral soil and killing existing weeds. Native warm season grasses may be established by drilling, hydro-seeding, or broadcasting. Drilling will be the preferred method of planting; however, hydro-seeding may be an alternative where topography restricts successful site preparation. It is important to obtain high quality seed from a local seed source. Seed mixtures for wildlife benefits will contain a blend of grasses, e.g. little bluestem (*Andropogon* spp.) and switch grass (*Panicum virgatum*) and native forbs.

Native warm season grasses may be planted in early spring using practices mentioned previously. Annual maintenance will be required. Once established, native warm season grasses should be mowed in early spring and lightly disked. Dependant on soil analysis requirements, laydown areas should be fertilized with a 10-10-10 or 17-17-17 mixture at the recommended rate. Legumes do not require Nitrogen and should be dressed with a 00-20-20 fertilizer for optimum results.

5.3.2 Eel Management Plan

American eel occupy a unique and significant niche along the Atlantic coastal reaches including embayments, local tributaries, small freshwater streams, lakes and ponds (ASMFC, 2006). The species is highly migratory and has multiple habitat requirements: fresh, brackish, and coastal waters within latitudes of ~7° and~55°, making it the most extensive range of any American fish (Heffman, 1987). Camp Conoy Lake, located in the south parcel of the CCNP parcel, is currently a host to known American eel (*Anguilla rostrata*) populations. Due to proposed construction activities, relocation strategies are necessary for removal of American eel from Camp Conoy Lake to a more suitable habitat on-site.

5.3.2.1 Methods for relocation to suitable habitat

Relocation of American eel in Camp Conoy Pond in the southern parcel of the CCNPP property will be performed before drainage of the Camp Conoy Pond is completed. The sampling strategy for eel relocation will include capture, transportation and release.

Using depletion sampling techniques, removal of eels will continue until no eels are captured after multiple samples have been attempted. Depletion sampling techniques for removing eel populations from Camp Conoy Pond may include a variety of capture methods such as backpack electrofishing, boat electrofishing, barge electrofishing, seine netting, otter trawling, gillnetting, fyke nets, and trawling techniques, and eel pots. Sampling events will be conducted by qualified scientists during daylight hours. In addition, eel pots or similar trapping techniques will be used during nighttime hours to ensure adequate sampling and capture of the majority of eels currently inhabiting Camp Conoy Pond.

After the eels have been captured, they will be transported to a suitable predetermined on-site habitat located within Goldstein Branch or Johns Creek. The eels will be transported from the capture point in Camp Conoy Pond in aerated containers to the suitable habitat release point where they will be released directly into Johns Creek or Goldstein Branch.

During each sampling day, capture and release will occur in multiple intervals. As eels are collected and placed into aerated holding containers, they will be counted and recorded. Once the holding containers have reached capacity, sampling will stop and the captured eels will be transported to the predetermined habitat release point. Once the eels are released, sampling will begin and continue until capacity is reached again. On drainage of Camp Conoy Pond, MACTEC scientists will be present to complete capture and removal of all eels that may have escaped collection during depletion sampling. Once the pond is drained, a visual inspection will be conducted to assure eels do not remain in the pond.

5.3.3 Beaver and Phragmites Control Plan

During site reconnaissance in 2008, beaver (*Castor canadensis*) dam and tree and shrub girdling/cuttings were observed within the downstream portion of the Johns Creek reach (Photo 5.3-1). Beaver ponds and the establishment of dams within riverine systems generally slow the water flow from drainage areas and alter silt deposition. The control of beavers within Johns Creek is a component of the compensatory mitigation plan for the CCNPP Unit 3 project. Rather than trapping with a body gripping/conibear device or live trapping with relocation, passive means will be used to control the activities of beavers in Johns Creek. With trapping/relocation, a strong potential exists for escaped beavers (juveniles and/or adults) to occupy the available habitat. The removal of beaver dams is generally not successful, as beavers will readily construct new dams as long as sufficient building material is available. Dam destruction will also release a surge of water and silt, which will impact downstream waters. With these considerations, a water control flow device will be used to regulate water flow through the beaver dam(s) within Johns Creek. The beaver control activities will be implemented within the proposed wetland mitigation enhancement area in Johns Creek (WE-2).

Photo 5-1 Photo depicts beaver dam and tree girdling in the downstream (western) portion of the Johns Creek reach (November 2008).

Various water control flow devices are readily available for a means of deterring beaver activity. A water control flow device, or beaver pipe, can be used to lower the water levels behind a beaver dam. Beavers prefer ponded conditions to inhabit an area. When water storage and depth control are lost, beavers will abandon a site. The beaver pipe will be installed through the dam. A wire cage will be constructed around the inlet and outlet of the pipe, to prevent debris from clogging it. Beavers are also attracted to running water and may attempt to plug the downstream or upstream ends of the pipe. The installation of the water control flow device within Johns Creek at current beaver damns may not eliminate the activities of beavers, but their use will reduce duration, extent and depth of flooding from impoundment activities by beavers. The survivorship of the planted wetland trees and shrubs within the proposed wetland mitigation enhancement area in Johns Creek (WE-2) should increase with this type of flow regime control method. Under impounded conditions, the depth of the water in the planting area will exceed recommended threshold water depths for planting. Finally, the installation of the water control flow device within current beaver damns in Johns Creek will result in periods of seasonal drawdown within the floodplain, thereby allowing for the recruitment of wetland hardwood seedlings.

To enhance the bottomland hardwood habitat for wildlife within the proposed wetland mitigation enhancement area in Johns Creek (WE-2), wetland fill material may be deposited along the floodplain, in a non-uniform pattern, to create a mosaic of hummocks. These hummocks would be planted with native hydrophytic trees and shrubs. The plant material would be representative of the species composition within Johns Creek and native to the region. The tree and shrub species would be planted at a density of 680 stems per acre (8-foot centers). The final selection of plant stock may be determined to some extent by availability. The selected tree species would consist of containerized and/or bare root stock protected by tree shelters (i.e., TUBEX® or Miracle Tube tree shelters). The tree shelters will provide protection from beavers and is an important component of the passive control of this species. The tree shelters will also reduce depredation of the planted material by other wildlife species.

The control of phragmites (*Phragmites communis*) through herbicide application is proposed under the compensatory mitigation plan for the CCNPP Unit 3 project. Phragmites is a large, coarse, perennial grass that usually forms large, dense stands reducing the diversity of plant and wildlife species. These stands exist in various locations within the CCNPP property. Phragmites can grow to more than 10 ft in height. Flowering and seed set occur between July and September. Germination occurs in spring on exposed moist soils. Vegetative spread by belowground rhizomes (roots) can result in dense patches with up to 20 stems per square foot. Phragmites is capable of vigorous vegetative reproduction and often forms dense, nearly monospecific stands, as have been observed in the sediment basins of the Lake Davies Disposal Area, Johns Creek and other forested wetland areas on the CCNPP Unit 3 site. Therefore, the benefits of eradicating phragmites would be the replacement of a somewhat sterile environment with a more diverse community through the planting of desirable plant species. The eradication of phragmites within the mitigation sites (WC-2, WE-1, and WE-2) will include multiple treatment events through the monitoring period, due to the high density/biomass of this nuisance species. With the control of phragmites and the growth of the planted woody species, the bottomland hardwood forest community of Johns Creek is expected to thrive. Water levels within the mitigation sites are not expected to be impacted by the implementation of the phragmites control program.

5.4 PROPOSED HYDROLOGY

The hydrology of the proposed streams and wetlands varies from that of the existing streams as a result of multiple factors: 1) changes to the land use (from forested, range, or fallow field to paved or constructed), 2) modified conveyance system throughout the constructed facility expansion and associated storage (detention and retention) and discharge control structures, and 3) modified natural conveyance system throughout the restoration sites, specifically the reclamation of floodplain access and associated impacts to storage and discharge. In general, the proposed hydrology performed by Bechtel conforms to the 2000 Maryland Stormwater Design Manual, and other guidance materials. The intent of the stormwater plan is to eliminate impacts to hydrology resulting for disturbance and development.

In October 2008, Bechtel provided a preliminary stormwater management plan (Bechtel Power Corporation, October 2008) that proposes to address potential impacts to hydrology that if otherwise unaddressed would result in impacts to the timing, quantity and quality of discharge into the natural systems, including the proposed mitigation sites. The potential temporary impacts are addressed through design and implementation of phased (initial perimeter controls, intermediate disturbance, and final stabilization control) erosion and sediment control plans that include:

1. Better site design and nonstructural methods by which impacts to sensitive areas are avoided and minimized through designation of practical, yet considerate, staging, access and stockpiling areas.
2. Sequenced construction activities intended to minimize the amount of disturbance at any one time during construction.
3. Inclusion of innovative and effective structural controls.

In addition, permanent integrated storm water management facilities are proposed which are designed to accommodate runoff from the developed areas in the corresponding drainage basins. The storm water management study was conducted to confirm size and placement of specific treatment devices to sufficiently address quality and quantity requirements set forth in the MDE guidance documents. The ordinance sets forth the following criteria for sizing storm water management features:

1. Water Quality Volume (WQ_v) – Treatment of volume generated from 1 inch of rainfall multiplied by the volumetric runoff coefficient and site drainage area.
2. Recharge Volume (Re_v) – Treatment of volume based on the average annual recharge rate for the hydrological soil group present on the site.

3. Channel Protection Volume (Cp_v) – Treatment of the 1-year 24-hour storm event including a 24-hour drawdown period.

4. Over Bank Flood Protection Volume (Q_p) – Treatment provided by setting allowable release rates for a given frequency storm events to equal the watershed's pre-developed rates and maintains discharge quantity requirements.

5. Extreme Flood Protection – Spillway sizing designed to successfully pass the 100-year 24-hour storm event without overtopping.

Given that these criteria are met, it is assumed that the downstream hydrology will remain unaffected. However, if the discharge of the proposed stormwater features contributing to the proposed mitigation sites departs slightly from the pre development discharge, the proposed hydrology will be calculated and incorporated as critical design criteria for the downstream natural systems.

Additional proposed hydrology considerations include the control structures to be included as part of the proposed wetland mitigation. These features will be designed to maintain appropriate hydroperiod required to establish and sustain the associated stable proposed wetland.

5.5 PROPOSED EARTHWORK AND STRATEGY FOR MANAGING SITE HYDROLOGY

Earthwork associated with the stream and wetland mitigation sites includes cut and fill of material, depending on suitability for specified service. Wetland sites will require one or more of the following either, or both, removal of material to achieve desired topography, furnishing of suitable wetland fill. Throughout the proposed stream restoration sites, the channel relocation design will attempt to account for a mass balance where the amount of cut equals the amount of fill. For specific areas throughout the stream restoration sites, select material will be required to achieve necessary compaction, shear resistance or other desired function. Stream enhancement sites will only require excavation incidental to the prescribed treatment (minor grading to prepare stream banks for stabilization installation or planting, installation of stability structures, etc.).

Detailed quantities, type and location of earthwork activities for all proposed mitigation sites will be provided concurrent with the development of draft design documents that accompany the Phase II mitigation plan. For any and all wetland and stream mitigation grading activities, an approved sediment and erosion control plan will be designed, permitted, and implemented to eliminate any potential impacts. This will include both environmental site design and phased implementations (preliminary, intermediate, and permanent stabilization) that promote managed working areas (pumparound and dewatering measures) as well as managed staging, access, and stockpile areas.

5.6 PROPOSED VEGETATIVE COMMUNITIES

The compensatory mitigation plan for the CCNPP Unit 3 project will entail the eradication of phragmites as necessary, then the planting of native hydrophytic tree and/or shrub species within the proposed mitigation sites. These mitigation activities will be conducted in accordance with the requirements of the mitigation and monitoring guidelines of the Baltimore District Regulatory Program (BDRP) (USACE, 2004). The components of the wetland mitigation planting plan for the proposed mitigation sites are discussed below.

Mitigation Site WC-1

After excavation and the establishment of bottom elevations and the installation of water control structures, the WC-1 site will be planted with native hydrophytic trees species. The tree species will be planted at a density of 680 stems per acre (8-foot centers) to allow for anticipated mortality from wildlife depredation by white-tailed deer (*Odocoileus virginianus*) or other browsers and defoliation by insects during early seedling establishment. It is expected that recruited, desirable, woody species will add to the overstory stem density in the mitigation site. The plant material will be representative of the species composition of the adjacent bottomland hardwood forested wetlands within the CCNPP property and native to the region. In addition, the plant material will include species that have been identified as suitable for installation on wetland mitigation projects by the CCSWCD and the CAC. The final selection of plant stock may be determined to some extent by availability. The selected tree species will consist of containerized and/or bare root stock protected by tree shelters (i.e., TUBEX® or Miracle Tube tree shelters). The tree shelters will provide protection from wildlife depredation, wind, or other influences. The tree material for installation will include, but are not limited to, willow oak (*Quercus phellos*), water oak (*Quercus nigra*), black gum, red maple, tulip tree, river birch (*Betula nigra*), and/or American sycamore (*Platanus occidentalis*). The palette of tree species will be finalized before installation. Additional species may be added if they are determined to be highly suitable for installation in the WC-1 mitigation site.

Mitigation Site WC-2

Three planting zones are proposed for the WC-2 mitigation site; i.e., open water, freshwater marsh fringe, and bottomland hardwood forest. The open water habitat of the pond will be planted with pondweed (*Potamogeton* sp.), water lily (*Nymphaea* sp.), or other suitable floating aquatic species. The marsh fringe will be planted with native hydrophytic herbaceous species. The herbaceous species will be planted at a density of 4,800 stems per acre (3-foot centers). The plant material will be representative of the species composition of adjacent herbaceous wetlands within the CCNPP property and native to the region. In addition, the plant material will include species that have been identified as suitable for installation on wetland mitigation projects by the CCSWCD. The final selection of plant stock may be determined to some extent by availability. The herbaceous material for installation will include arrow arum (*Peltandra virginica*), duck potato (*Sagittaria latifolia*), water plantain (*Alisma subcordatum*), and/or pickerelweed (*Pontederia cordata*). The palette of herbaceous species will be finalized before installation. Additional species may be added if they are determined to be highly suitable for installation in the WC-2 mitigation site. The tree species for installation within the outer zone (bottomland hardwood forest) of the mitigation site will include, but are not limited to, willow oak, water oak, black gum, red maple, tulip tree, river birch, and/or American sycamore. The palette of tree species will be finalized before installation. Additional species may be added if they are determined to be highly suitable for installation in the WC-2 mitigation site. The tree species will be planted at a density of 680 stems per acre (8-foot centers). The installation of plant material within the WC-2 mitigation site will be conducted following the deposition of fill material and contour shaping within the basin.

The eradication of the existing phragmites within the WC-2 mitigation site will be conducted through the application of approved herbicide. The eradication of phragmites will be completed before the installation of plant material, the deposition of fill material, and contour shaping within the basin.

Mitigation Site WE-1

The enhancement of the WE-1 mitigation site will entail the planting of native hydrophytic trees to establish a bottomland hardwood forest community within this basin. The tree species for installation will include, but are not limited to, willow oak, water oak, black gum, red maple, tulip tree, river birch, and/or American sycamore. The palette of tree species will be finalized before installation and may include the addition of other desirable tree species. The plant material will be representative of the species composition of the adjacent bottomland hardwood forested wetlands within the CCNPP property and native to the region. The tree species will be planted at a density of 680 stems per acre (8-foot centers).

The eradication of phragmites within the WE-1 mitigation site will be conducted through the application of approved herbicide. The eradication of phragmites will be completed before the installation of plant material.

Mitigation Site WE-2

The enhancement of the WE-2 mitigation site will entail the planting of native hydrophytic trees and shrubs to establish a bottomland hardwood forest community within the mitigation site. The proposed mitigation site includes the bottomland hardwood forest component of the eastern (upstream) and western (downstream) portions of Johns Creek (near the confluence of Johns Creek and the linear drainageway extension) and the linear drainageway extension. The tree species for installation will include, but are not limited to, willow oak, water oak, black gum, red maple, tulip tree, river birch, and/or American sycamore. The shrub species for installation will include silky dogwood (*Cornus amomum*), inkberry (*Ilex glabra*), shadbush (*Amelanchier canadensis*), highbush blueberry (*Vaccinium corymbosum*), possum-haw (*Viburnum nudum*), elderberry (*Sambucus canadensis*), and Virginia willow (*Itea virginica*). The palette of tree and shrub species will be finalized before installation and may include the addition of other desirable tree or shrub species. The plant material will be representative of the species composition within Johns Creek and native to the region. The tree and shrub species will be planted at a density of 680 stems per acre (8-foot centers).

The eradication of phragmites within the WE-2 mitigation site will be conducted through the application of approved herbicide. The eradication of phragmites will be completed before the installation of plant material.

Mitigation Sites SE-1 through 5 and SR-1 through 5

Depending on the final proposed treatments and corresponding proposed access, staging and stockpiling areas (Phase II mitigation plan), the size and type of disturbance is difficult to estimate. However, in general, this Phase I plan reasonably assumes that the actual areas disturbed will consist primarily of those included as actively being enhanced or restored. The operational area disturbances also will be limited in scale and, in an attempt to avoid sensitive areas (i.e., riparian zones), will be located largely along the periphery of the proposed treatments. The final stream restoration and enhancement site plans will ultimately include detailed planting plan that delineates planting zones (i.e., upland, floodplain, and riparian) based on the corresponding topography and local biotic and abiotic factors. Each zone will incorporate native temporary and permanent seed mixtures as well as a mixture of plant species (see sample species list), composition (forbs, herbaceous, and woody), and type of planting (seed, live stake, plug, containerized, balled and burlaped, etc.). Permanent seeding will be applied at a rate of approximately 50 pounds per acre and temporary seeding will be applied at approximately 125 pounds per acre. Live stakes will be placed at 2 feet on center, and the spacing and type of individual plantings will be determined based on the scale of disturbance, stakeholder preference, and the time of planting to aggressively promote stabilization, and successful establishment of the stage of development. The following is a table representing the possible species to be planted for mitigation of the sites SE-1 through 5 and SR-1 through 5.

Table 5-3 Possible mitigation species for sites SE-1 through 5 and SR-1 through 5

Sample Species List Botanical Name	Common Name	Type
Plantings and live stakes		
Acer rubrum	Red maple	FAC
Fraxinus pennsylvanica	Green ash	FACW
Liquidambar styrociflua	Sweetgum	FAC
Quercus phellos	Willow oak	FAC
Quercus palustris	Pin oak	FACW
Betula nigra	River birch	FAC
Liriodendron tulipfera	Yellow poplar	FAC
Pinus taeda	Loblolly pine	FAC
Platanus occidentalis	American sycamore	FACW
Populus deltoides	Eastern cottonwood	FAC
Prunus serotina	Black cherry	FAC
Cornus ammomum	Silky dogwood	FACW
Salix nigra	Black willow	FACW
Seeding mixture (permanent)		
Agrostis alba	Redtop	FACW
Andropogon gerardii	Big bluestem	FAC
Elymus riparius	Riverbank wild rye	FACW
Elymus virginicus	Virginia wild rye	FACW
Lolium multiflorum	Annual bluegrass	NI
Panicum virgatum	Switchgrass	FAC
Seeding mixture (temporary)		
Festuca arundinacea	Tall fescue	
Fistula rubra commutata	Chewing fescue	
Poa compressa	Canada bluegrass	
Agrostis gigantia	Redtop	
Poa pratensis	Kentucky bluegrass	
Lolium perenne	Perennial ryegrass	
Setaria italica	Foxtail millet	

The Phase II mitigation plan will provide detailed zones and detailed planting schedule including: unit, total quantity, size, condition, and spacing for each zone on each sheet.

5.7 POST CONSTRUCTION MONITORING PLAN

5.7.1 Wetland Monitoring Plan

After the on site wetland creation and wetland enhancement activities for the CCNPP Unit 3 project, a five-year annual monitoring program will be implemented in accordance with the requirements of the (USACE, 2004), the protocols presented in the *Maryland Compensatory Mitigation Guidance* (IMTF, 1994), and the guidance provided in Regulatory Guidance Letter No. 08-03 (USACE, October 2008). The monitoring program will be conducted pursuant to the MDEWMA mitigation monitoring guidelines and protocols.

The mitigation monitoring effort will entail the establishment of sample plots and/or belt transects within the mitigation sites to obtain data on vegetative conditions and the collection of hydrologic data, soil data, and other site specific information. The data and information to be collected and reported at the mitigation sites will include:

- The growth and vitality of the planted hydrophytic species;
- The species composition of recruited, desirable plant species;
- The species composition and areal cover of nuisance/non-native plant species;
- Measurements of surface inundation or groundwater;
- Wildlife utilization and depredation; and
- Current site conditions at fixed photographic points.

The monitoring program will include an initial baseline (time-zero) monitoring event, to be conducted immediately following the planting of the mitigation sites and the eradication of phragmites within WC-2, WE-1, and WE-2. After the baseline event is completed, a five-year monitoring schedule will be initiated, which will include annual sample events during September-October of each year. A baseline report and five annual monitoring reports will be prepared for review by regulatory staff. The reports will include the vegetative sampling results, current hydrologic conditions, photodocumentation, descriptions of problems encountered, and discussion of maintenance actions taken. Monitoring reports will be submitted within 90 days of each monitoring event. Monitoring reports will be submitted to the USACE and the MDEWMA. Following agency review and coordination, remedial/contingency measures will be implemented, if required.

The targets for the creation and enhancement efforts will be divided into two specific components:

1. The creation and enhancement of wetland communities, and
2. The creation of wetland hydrology within the created wetlands.

The success criteria for the monitoring program will include, at a minimum, the success of the planted vegetation, as measured through survivorship counts and observations of vitality and growth, and the existence of wetland hydrology for the created wetlands. If success criteria have been satisfied at the completion of the five-year monitoring program, a request for release from monitoring will be made to the USACE and/or MDEWMA.

The primary success criteria for the CCNPP Unit 3 wetland creation/enhancement mitigation sites will include:

- A minimum density of 600 stems per acre of woody tree and shrub species (planted and naturally regenerated/recruited stems) within Mitigation Sites WC-1, WC-2, WE-1, and WE-2;
- The appearance of positive growth indicators for planted species, such as height and/or ground level diameter, within Mitigation Sites WC-1, WC-2, WE-1, and WE-2;
- A value of no more than 10 percent areal cover of phragmites within the treated wetland mitigation sites, WC-2, WE-1, and WE-2; and
- The establishment of appropriate inundated conditions or saturated soil conditions during the growing season and under normal yearly climatological conditions for the wetland creation mitigation sites, WC-1 and WC-2.

Performance standards for the wetland mitigation monitoring program will be conducted in accordance with the MDE guidelines and with consideration of other permitting agencies as mandated by the state of Maryland.

5.7.2 Stream Monitoring Plan

The purpose of stream monitoring is to determine the degree of success a mitigation project has achieved in meeting the objectives of providing proper channel function and increased habitat quality. Success criteria (specific to the selected mitigation objectives) such as physical channel measurements to demonstrate dynamic equilibrium, photographs, native riparian plant density and vigor, and evidence of aquatic species present in the stream systems will be gathered annually to show how well the proposed mitigation plan achieves its goals of no net loss of stream function. Depending on the preferences of the mitigation review team (federal and state agencies), various levels of monitoring may be required based on the complexity of the mitigation project being proposed. At a minimum, the monitoring plan shall include:

- Identification of parties responsible for monitoring. If more than one, identify primary party
- Data to be collected and reported, how often and for what duration (identify proposed monitoring stations, including transect locations on map).
- Assessment tools and/or methods to be used for data collection monitoring the progress towards attainment of performance standard targets.
- Format for reporting monitoring data and assessing mitigation status.
- Monitoring schedule – Monitoring will be conducted for a minimum period of five years.

Per the USACE Wilmington District Stream Mitigation Guidelines (2003) and Baltimore District Stream Mitigation Guidelines (2004), the explicit directives provide the framework for project monitoring. Following final construction, an as-built topographic survey (including identification and location of actual plantings) shall be conducted and corresponding plans with explanations of any deviations from the approved mitigation plan. As-built plans should be certified by a professional engineer and should document the dimension, pattern and profile of the restored channel. Permanent cross-sections should be established at an approximate frequency of one per 20 (bankfull-width) lengths. In general, the locations should be selected to represent approximately 50 percent pools and 50 percent riffle areas. The as-built survey should also include photo documentation at all cross-sections and structures, a plan view diagram, a longitudinal profile, vegetation information and a pebble count/bulk sampling data.

Depending on the level of treatment (creation and enhancement), different levels of ecological function and geomorphic stability success criteria identified and corresponding data may be required.

The following criteria may be used to evaluate success:

- Photo documentation
- Channel aggradation or degradation
- Bank erosion

- Success of riparian vegetation
- Effectiveness of erosion control measures
- Presence or absence of developing instream bars (should be absent)
- Ecological function
- Health and survival of vegetation (80 percent survival of planted species required after 5 years)
- Restoration reach should mimic upstream conditions (or reference reach when applicable)
- Channel stability
- Should be insignificant change from the as-built dimension
- Changes should be minor and represent an increase in stability (e.g., decreased width to depth ratio without a decrease in entrenchment ratio)
- Pool/riffle spacing should remain fairly constant
- Pools should not be aggrading nor should riffles be degrading
- Pebble count should show a change in the size of bed material toward a desired composition.

Annual monitoring forms require as-built plans and current data. Monitoring reports should contain a discussion of any deviations from as-built and an evaluation of the significance of these deviations and whether they are indicative of a stabilizing or destabilizing situation.

Finally, the stream mitigation monitoring program will be implemented in accordance with the requirements of the *Mitigation and Monitoring Guidelines* (USACE, 2004), the protocols presented in the *Maryland Compensatory Mitigation Guidance* (IMTF, 1994), and the guidance provided in Regulatory Guidance Letter No. 08-03 (USACE, October 2008). The monitoring program will be conducted pursuant to the MDEWMA mitigation monitoring guidelines and protocols.