PUBLIC DISCLOSURE VERSION

SOUTHERN NUCLEAR OPERATING COMPANY

Vogtle Early Site Permit Application

Part 3
Environmental Report

Revision 2

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Acronyms and Abbreviations

AADT	Average Annual DailyTraffic
ABWR	Advanced Boiling Water Reactor
ACT	Alabama-Coosa-Tallapoosa
ADCNR	Alabama Department of Conservation and Natural Resources
ADEM	Alabama Department of Environmental Management
AEA	Atomic Energy Act
AEC	Atomic Energy Commission
AECL	Atomic Energy of Canada, Limited
AFUDC	Allowance for Funds Used During Construction
ALARA	as low as reasonably achievable
ANS	Academy of Natural Sciences of Philadelphia
APC	Alabama Power Company
AQCR	Air Quality Control Region
ARLH	Alabama Register of Landmarks and Heritage
Btu	British thermal unit
CDF	core damage frequency
CEDE	committed effective dose equivalent
CEQ	Council on Environmental Quality
cfs	cubic feet per second
Ci/MTU	curies per metric ton uranium
CO	carbon monoxide
COL	combined license
CVS	Chemical and Volume Control System
CWA	Clean Water Act
CWIS	Cooling Water Intake Structures
CWS	Circulating Water System
D&D	Decontamination and Dismantlement
DAW	Dry Active Waste Building
DB	dry-bulb
dB	decibels
DBT	design-base tornado
DCD	Design Control Document
DHR	Department of Human Resources
DNR	Department of Natural Resources
DOE	U.S. Department of Energy
DOT	Department of Transportation
DSM	demand-side management

EAB	Exclusion Area Boundary
EDE	effective dose equivalent
EIA	U. S. Energy Information Administration
EPA	Environmental Protection Agency
EPD	Environmental Protection Division
EPRI	Electric Power Research Institute
ER	environmental report
ESBWR	Economic Simplified Boiling Water Reactor
ESP	early site permit
FAA	Federal Aviation Administration
FES	Final Environmental Statement
FNP	Farley Nuclear Plant
FPR	Fiberglass-reinforced Plastic
fps	feet per second
FR	Federal Register
FRP	Facility Response Plan
GATT	General Agreement on Tariffs and Trade
GDNR	Georgia Department of Natural Resources
GDOT	Georgia Department of Transportation
GE	General Electric
GEIS	Generic Environmental Impact Statement
GEPD	Georgia Environmental Protection Division
GI-LLI	Gastrointestinal-lining of lower intestine
GIS	geographic information system
GPC	Georgia Power Company
gpd	gallons per day
gpm	gallons per minute
GPSC	Georgia Public Service Commission
GTC	Georgia Transmission Corporation
HLW	high level waste
HNP	Hatch Nuclear Plant
NRHP	National Register of Historical Places
HVAC	Heating, ventilation, air conditioning [system]
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiation Protection
iDEN	[Motorola] integrated digital enhanced network
IGCC	Integrated Gasification Combined Cycle
IRP	integrated resource plan
ISFSI	Independent Spent Fuel Storage Installation
JFD	joint frequency distribution
kWh	kilowatt hour

lb	pound
LCD	local climatological data
LLW	Low-level radioactive waste
LPGS	Liquid Pathway Generic Study
LPZ	low population zone
LWA	limited work authorization
LWR	light water reactor
MAAP	Modular Accident Analysis Program
MCWB	mean coincident wet-bulb
MDCC	Meteorological Data Collection Center
MDCT	Mechanical Draft Wet Cooling Tower
MEAG	Municipal Electric Authority of Georgia
MEI	maximally exposed individual
MGD	million gallons per day
Mrem	millirem
msl	Mean Sea Level
MSW	municipal solid wastes
MTU	metric tons of uranium
MWe	megawatt
NAAQS	National Ambient Air Quality Standards
NAFTA	North American Fee Trade Agreement
NCDC	National Climatic Data Center
NDCT	Natural Draft Wet Cooling Tower
NEHS	National Institute of Environmental Health Sciences
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Council, Inc.
NESC	National Electrical Safety Code
NMFS	National Marine Fisheries Services
NOAA	National Oceanic and Atmospheric Administration
NOx	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NSPS	New Source Performance Standard
NSSS	Nuclear Steam Supply System
NWS	National Weather Service
OPC	Oglethorpe Power Corporation
PCS	Passive Containment Cooling System
PFBC	pressurized fluidized bed boiler
PM	particulate matter
PRA	probabilistic risk assessment

PVC	polyvinyl chloride
PT	participant test
QA	quality assurance
RCRA	Resource Conservation and Recovery Act
RCS	reactor coolant system
REMP	Radiological Environmental Monitoring Program
RIM	Rate impact measure
RTP	Rated Thermal Power
SAMA	severe accident mitigation alternatives
SCDHEC	South Carolina Department of Health and Environmental Control
SCE&G	South Carolina Electric and Gas
scfm	standard cubic feet per minute
SCR	selective catalytic reduction
SCT	societal cost test
SERC	Southeastern Electric Reliability Council, Inc.
SERCC	Southeast Regional Climate Center
SG	steam generators
SMZ	Streamside Management Zone
SNC	Southern Nuclear Operating Company
SO_2	sulfur dioxide
SPCCP	Spill Prevention, Control, and Countermeasures Plan
SRP	Standard Review Plan
SRS	Savannah River Site
SSC	Structures, systems, and components
STEP	sales taxes for educational purposes
SWS	service water system
TCS	traffic count sections
TEDE	total effective dose equivalent
TLD	thermoluminescent dosimeter
TRC	total recordable cases
TRC	total resource cost
TRU	transuranic
TSC	Technical Support Center
UHS	ultimate heat sink
USACE	U.S. Army Corps of Engineers
USAR	updated safety analysis report
USCB	US Census Bureau
USDA	US Department of Agriculture
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service

USGS	US Geological Survey
UTM	Universal Transverse Mercator
VEGP	Vogtle Electric Generating Plant
WINGS	Wildlife Incentives for Non-Game and Game Species
WMA	Wildlife Management Area

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Chapter 1 Introduction

1.0 Introduction

In accordance with the provisions of 10 CFR 52, Early Site Permits; Standard Design Certifications; and combined Licenses for Nuclear Power Plants, and supporting guidance, Southern Nuclear Operating Company (SNC or Southern Nuclear) has developed an application to the U.S. Nuclear Regulatory Commission (NRC) for an early site permit. An Early Site Permit (ESP) represents NRC approval of a site or sites for one or more nuclear power facilities, separate from the filing of an application for a construction permit or combined license for such a facility. The SNC ESP application is for the Vogtle Electric Generating Plant (VEGP) site in Burke County, Georgia. In accordance with NRC regulations, SNC has included in its application this environmental report (ER) that analyzes impact to the environment from construction, operation, and decommissioning of two additional nuclear reactors at this site. NRC will use the environmental report to develop an Environmental Impact Statement meeting the National Environmental Policy Act (NEPA) requirement that federal agencies consider the impacts that their actions (e.g., permit issuance) might have on the environment.

1.1 Proposed Action

The proposed Federal action is issuance, under the provisions of 10 CFR Part 52, of an Early Site Permit (ESP) to SNC for the VEGP site for two additional nuclear units, both of which will be Westinghouse Electric Company, LLC (Westinghouse), AP1000, advanced light water reactors. In addition, SNC proposes a plan for redressing the environmental effects of certain site-preparation and preliminary construction activities, i.e., those activities allowed by 10 CFR 50.10(e)(1), performed by an ESP holder under 10 CFR 52.25. In accordance with the plan, the site would be redressed if the NRC issues the requested ESP (containing the site redress plan), the ESP holder performs these site-preparation and preliminary construction activities, the ESP is not referenced in an application for a construction permit or COL, and no alternative use is found for the site. While the ESP would not authorize construction and operation of any new nuclear units (other than those site-preparation and preliminary construction activities addressed herein), this ER analyzes the environmental impacts that could result from the construction and operation of one or two new nuclear units at the VEGP site or at one of the alternative sites. These impacts are analyzed to determine if the proposed ESP site is suitable for the addition of the new nuclear units and whether there is an alternative site that is obviously superior to the proposed site.

1.1.1 Purpose and Need

Georgia Power Company (GPC), through the Georgia Public Service Commission's Integrated Resource Planning process, has identified a need for additional base load generation by no later than 2015. This need was identified through a detailed economic analysis associated with the IRP process. SNC is submitting the ESP application to preserve the option for new nuclear generation to meet GPC needs as well as the needs projected by the co-owners.

Underlying this need for baseload generation is the role that the State of Georgia and the NRC play in GPC business decision to pursue new nuclear generation. States retain approval authority over the types of electric generation that will be constructed and operated within their borders. However, states (and facility owners) cannot include nuclear power in their generation mix without NRC approval of the construction and operation of a nuclear generation facility. Conversely, NRC approval gives the state a generation option that the state may or may not exercise, at its discretion.

The NRC established the licensing process used by SNC in 10 CFR Part 52. NRC regulation 10 CFR 52 Subpart C, *Combined Licenses*, allows generating entities to apply for a combined license, that is, a combined construction permit and operating license for a nuclear facility. A COL authorizes construction and operation of the facility. Part 52 includes the ability to seek an ESP that allows an applicant to bank a reactor site for up to 20 years prior to obtaining a COL. A COL can reference an ESP for environmental issues.

The ESP process addresses and resolves site safety, environmental protection, and emergency preparedness issues. As part of an ESP application, the applicant must prepare an environmental report that addresses the safety and environmental characteristics of the site.

An application for a COL can reference an ESP issued under 10 CFR 52 Subpart A, *Early Site Permits*. In general, if the combined license application references an ESP, the application need not contain certain information or analyses submitted to NRC in connection with the early site permit. Instead, the combined license application must contain the following:

- Information and analyses otherwise required
- Information sufficient to demonstrate that the facility falls within the parameters specified in the ESP
- Information to resolve any other significant environmental issue
- Information not considered in any previous proceeding on the site or design

In accordance with NRC regulations, SNC is submitting this ESP application in order to obtain the option of including new nuclear capability in the future generation mix for the owners and the state of Georgia.

The ESP also allows for a Limited Work Authorization (LWA) to perform certain activities such as backfill and initial concrete pours subject to redress, in advance of issuance of a COL.

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1.2 The Proposed Project

Section 1.2 provides a brief summary of project information that subsequent chapters and sections, particularly Chapter 3, *Plant Description*, describe in detail.

1.2.1 The Applicant and Owners

Georgia Power Company, Oglethorpe Power Corporation, the Municipal Electric Authority of Georgia, and the City of Dalton, Georgia an incorporated municipality in the State of Georgia acting through its Board of Water, Light, and Sinking Fund Commissioners (Dalton Utilities) are the owners of the VEGP site and existing facilities. SNC has been authorized by GPC, acting as agent for the other owners (also known as co-owners) of the existing VEGP, to apply for an ESP for the VEGP site.

SNC is the plant licensee and operates VEGP Unit 1 and Unit 2 under contract with the owners. GPC and SNC are subsidiaries of Southern Company, and SNC is the licensed operator for all existing Southern Company nuclear generating facilities. SNC's business purpose is management and operation of nuclear generating facilities owned or co-owned by Southern Company subsidiaries. The SNC ESP application, Part 1, *Administrative Information*, Section 1.3 provides additional information about Southern Company, GPC, the VEGP co-owners and SNC.

1.2.2 Site Location

The VEGP site is located on the west bank of the Savannah River in eastern Burke County, in east-central Georgia. The site is approximately 100 miles northwest of Savannah, Georgia, and approximately 26 miles southeast of Augusta, Georgia, and across the river from the U.S. Department of Energy's Savannah River Site (Barnwell County, South Carolina). The proposed VEGP Units 3 and 4 footprint will be adjacent to and west of the existing VEGP Units 1 and 2. The original VEGP design was for a four unit plant. The new VEGP Units 3 and 4 will occupy generally the same area that was developed for the original VEGP Units 3 and 4 when the plant was first proposed for construction.

1.2.3 Reactor Information

SNC has selected the Westinghouse Electric Company, LLC (Westinghouse), AP1000 advanced light water reactor for construction and operation of two new units at the VEGP site. The NRC has approved the Design Control Document (DCD) for the AP1000. Previous ESP applications included the AP1000 technology, in addition to others, in their plant parameters envelopes. Unlike previous ESP applicants, SNC is not relying on a plant parameters envelope methodology to bound environmental impacts. The SNC application analyzes the environmental impacts of two AP1000 reactors at the VEGP site to be referred to as VEGP Units 3 and 4 in this application.

ER Section 3.2, *Reactor Power Conversion System*, provides additional information on the AP1000.

1.2.4 Cooling System Information

Each new unit will use a recirculating cooling water system that includes a natural draft cooling tower similar to the towers for Units 1 and 2. A new recessed shoreline intake structure will supply makeup water from the Savannah River to Units 3 and 4. A common line for Units 3 and 4 will be constructed to discharge cooling tower blowdown and other miscellaneous wastewater to the river. ER Section 3.4, *Cooling System*, provides additional detail.

1.2.5 Transmission System Information

The existing VEGP site is interconnected with the regional power grid via two 500 kV transmission lines and four 230 kV transmission lines. SNC has determined one new 500 kV transmission line will be added initially to handle the additional new generation capacity to the electric grid. SNC has performed a Macro-Corridor assessment for this proposed new 500 kV line to evaluate the NEPA aspects of line construction and operation. ER Section 3.7, *Power Transmission System*, provides additional detail.

1.2.6 Pre-application Public Involvement

The NRC held public outreach meetings in Waynesboro, Georgia, on May 10 and 11, 2006, to provide information to the public on the ESP review process, and to provide information on opportunities for public involvement in that process for the VEGP site. The meetings included a discussion of perspectives, roles, and responsibilities of the NRC with regard to VEGP. The May 10 meeting was held at the Burke County library. It utilized an informal open house format that allowed the public the opportunity to speak directly with NRC staff. On May 11, the NRC staff held a second public meeting at the Augusta Technical College Waynesboro Branch. The meeting began with another open house, followed by staff presentations on the regulatory framework for the ESP review process and a question-and-answer session. The staff also discussed opportunities for public involvement during the application review process.

1.2.7 Construction Start Date

The ESP does not constitute a decision or approval to build new units. SNC is pursuing the necessary steps to preserve the nuclear generation option. SNC has notified the NRC that they plan to submit a COL application in March of 2008 that could support a projected construction start date sometime in 2010. NRC regulations (10 CFR 50.10, *License Required*) provide for ESP holders to perform limited site preparation activities. SNC estimates that such site preparation activities will take 18 months to complete. SNC estimates that construction of two

AP1000 units will occur over about a 5-year period, beginning after NRC approval of an SNC COL application. ER Section 3.9, *Construction Activities*, provides additional detail.

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1.3 Status of Reviews, Approvals and Consultations

SNC has divided its discussion of the status of Federal, state, and local environmental protection licenses, permits, reviews, approvals, and consultations, collectively called authorizations, by activity. Tables 1.3-1 through 1.3-5 identify, for each activity, the following information:

- Jurisdictional agency
- Authority, law, or regulation that dictates the requirement
- Name of the required authorization
- License or permit number as applicable
- Expiration date of any existing licenses or permits
- Description of the requirements to be fulfilled by SNC prior to issuance of the authorization

The tables are structured on the assumption that authorizations for previously-initiated and ongoing activities were captured in the table representing the initiation of the work and, therefore, not repeated in subsequent tables. Except for ESP issuance, discussed below, SNC has not completed work to secure any other necessary authorizations and, therefore, the columns for permit numbers and expiration dates have been left blank. SNC will apply for and receive any required authorizations prior to initiating the activity. The following sections describe the activities to be authorized.

1.3.1 ESP Issuance

Table 1.3-1 lists ESP authorizations required prior to NRC issuance of an ESP. As shown, four authorizations are consultations that NRC must undertake in accordance with following statutes:

<u>Endangered Species Act</u> - The Endangered Species Act requires Federal agencies to ensure that agency action is not likely to jeopardize any species that is listed or proposed for listing as endangered or threatened. Depending on the action involved, the Act requires consultation with the U.S. Fish and Wildlife Service (USFWS) regarding effects on non-marine species, the National Marine Fisheries Service (NMFS) for marine species, or both. Due to the presence of diadromous fish categorized as marine species in the Savannah River near the Vogtle site, the NRC must consult with both USFWS and NMFS. In addition, as a matter of policy, the NRC consults with states regarding state-protected species.

<u>National Historic Preservation Act</u> - The National Historic Preservation Act requires federal agencies having the authority to license any major federal action, prior to issuing the license, to take into account the effect of the undertaking on historic properties and to afford the Advisory Committee on Historic Preservation an opportunity to comment on the undertaking. Committee regulations provide for establishing an agreement with any State Historic Preservation Officer (SHPO) to substitute state review for Committee review (35 CFR 800.7). The NRC will consult with both the Georgia SHPO and the South Carolina SHPO due to the site's location.

Federal Clean Water Act Section 401 requires for any activity that may result in a discharge into navigable waters, a certification from the state that the discharge will comply with applicable Clean Water Act requirements, including state Water Quality Standards. Certain construction-related activities conducted under the authority of the ESP will likely require a Construction Stormwater Permit issued by the Georgia Department of Natural Resources – Environmental Protection Division. This is a general permit and coverage is obtained by submitting a Notice of Intent (NOI) requesting coverage under the general permit. The State of Georgia provides a generic 401 certification for the general permit.

The Federal Coastal Zone Management Act imposes requirements on applicants for a federal license to conduct an activity that could affect a state's coastal zone. The Act requires the applicant to certify to the licensing agency that the proposed activity will be consistent with the state's federally approved coastal zone management program. The VEGP site is approximately 100 air miles and 150 river miles from the ocean. An existing VEGP transmission line traverses Georgia coastal counties. Construction of new reactors at the VEGP site will not result in any changes to this line. Due to the site's distance from the coast, small environmental effects, and lack of transmission line changes, SNC has concluded that the proposed action will not affect Georgia's coastal resources and that consistency certification requirements are not applicable.

1.3.2 Pre-Construction Activities

Pre-construction activities are those that NRC can authorize for undertaking prior to NRC issuance of a construction permit. A subset of these activities is limited to site preparation and construction of structures, systems, and components that are not nuclear-safety related. NRC approval of such activities can be obtained in either of two ways. First, if an ESP application includes a site redress plan, ESP issuance constitutes NRC authorization to conduct the activities. Second, rather than waiting for permit issuance, the ESP applicant can apply for authorization to perform these activities, commonly referred to as Limited Work Authorization 1, or LWA-1, early. The NRC would grant such authorization only after the presiding officer for the mandatory ESP hearing determines that NRC has satisfied NEPA requirements and that there is reasonable assurance that the proposed site and reactor are suitable from an environmental and radiological standpoint. This enables the applicant to start pre-construction before resolution of all safety issues and exhaustion of all appeals to construction permit issuance. SNC has included a site redress plan in this ESP application and is also preserving its option to seek a separate LWA-1 authorization. Table 1.3-2 lists authorization required for pre-construction activities.

The other subset of pre-construction activities is nuclear-safety-related and is commonly referred to as Limited Work Authorization 2, or LWA-2. The NRC would grant such authorization only after, in addition to making the same determinations as for LWA-1, making a determination that there are no unresolved safety issues relating to the LWA-2 activities. SNC is preserving its option to seek an LWA-2 but has identified no required non-NRC authorizations not already included for LWA-1 or actual construction.

1.3.3 Site Redress Activities

Table 1.3-3 lists authorizations required prior to conducting site redress activities. "Redress activities" are activities that the licensee must perform to return the site to an environmentally stable and aesthetically acceptable state if LWA activities were undertaken but construction abandoned.

1.3.4 Construction Activities

Table 1.3-4 lists authorizations required prior to start of construction activities.

1.3.5 Operation

Table 1.3-5 lists authorizations required prior to start of operation.

Table 1.3-1 Authorizations Required for Early Site Permit

Agency	Authority	Requirement	License/ Permit No. (1)	Expiration Date (1)	Activity Covered
USFWS	Endangered Species Act	Consultation regarding potential to adversely impact protected species (non-marine species)	NA	NA	Concurrence with no adverse impact or consultation on appropriate mitigation measures.
NMFS	Endangered Species Act	Consultation regarding potential to adversely impact protected species (marine species)	NA	NA	Concurrence with no adverse impact or consultation on appropriate mitigation measures.
GDNR	National Historic Preservation Act, (36 CFR 800)	Consultation regarding potential to adversely affect historic resources	NA	NA	Confirm site construction or operation would not affect protected historic resources.
South Carolina Department of Archives and History	National Historic Preservation Act, (36 CFR 800)	Consultation regarding potential to adversely affect historic resources	NA	NA	Confirm site construction or operation would not affect protected historic resources.
GDNR	Federal Clean Water Act (FCWA) (33 U.S.C. 1251 et seq.)	Section 401 Certification			Compliance with water quality standards.

USFWS - U.S. Fish and Wildlife Service
NMFS - National Marine Fisheries Service
GDNR - Georgia Department of Natural Resources
[1] No permits have been issued.

Table 1.3-2 Authorizations Required for Pre-Construction Activities

Agency	Authority	Requirement	License/ Permit No. (1)	Expiration Date (1)	Activity Covered
NRC	10 CFR 52.25 or 10 CFR 50.10(e)(1)	Early Site Permit with Site Redress Plan or Limited Work Authorization			Non-nuclear construction, including site preparation.
USACE	Clean Water Act (CWA)	Section 404 Permit			Disturbance or crossing wetland areas or navigable waters. For site and rail corridor upgrade.
USACE	33 CFR 323	Dredge and Fill Discharge Permit			Construction/ modification of intake/ discharge to Savannah River. For site and rail corridor upgrade[2].
USACE	Rivers and Harbors Act	Section 10 Permit			Barge slip modification impacts to navigable waters of the U.S.
USDOT	49 CFR 107, Subpart G	Certificate of Registration			Transportation of hazardous materials.
USFWS	Migratory Bird Treaty Act, 50 CFR 21	Federal Depredation Permit			Adverse impacts on protected species and/or their nests. For site and rail corridor upgrade.
FAA	49 USC 1501 14 CFR 77	Construction Notice			Notice of erection of structures (>200 feet high) potentially impacting air navigation.

Table 1.3-2 (cont.) Authorizations Required for Pre-Construction Activities

Agency	Authority	Requirement	License/ Permit No. (1)	Expiration Date (1)	Activity Covered
GPSC	GA Public Utilities Act (O.C.G.A. Section 46-3-1 et seq.), GA Rules and Regulations 515-3-4-.07	Certificate of Public Convenience and Necessity			Present and future public convenience and necessity require the operation of such equipment or facility.
GDNR	GA Endangered Wildlife Act (O.C.G.A. Section 27-3-130 et seq.), GA Rules and Regulations 391-4-10	Depredation Permit			Adverse impacts on state designated protected species and/or their habitat. For site and rail corridor.
GDNR	Federal Clean Air Act (FCAA), GA Air Quality Act (O.C.G.A. Section 12-9-1 et seq.), GA Rules and Regulations 391-3-1	Part 70 Air Quality Construction Permit			Construction air emission sources.
GDNR	FCWA, GA Water Quality Control Act	Revision of existing National Pollutant Discharge Elimination System Permit			Regulates limits of pollutants in liquid discharge to surface water.
GDNR	FCWA, GA Water Quality Control Act (O.C.G.A. 12-5-20), GA Rules and Regulations 391-3-6	General Permit Registration for Storm Water Discharges Associated with Construction Activity for Common Developments	GAR10000 3	July 31, 2008	Discharge storm water from site during construction.

Table 1.3-2 (cont.) Authorizations Required for Pre-Construction Activities

Agency	Authority	Requirement	License/ Permit No. (1)	Expiration Date (1)	Activity Covered
GDNR	FCWA, GA Water Quality Control Act (O.C.G.A. 12-5-20), GA Rules and Regulations 391-3-6	General Permit Registration for Storm Water Discharges Associated with Construction Activity for Infrastructure Construction Projects	GAR10000 2	July 31, 2008	Discharge storm water from linear construction sites (e.g., roadways and rail corridor).
GDNR	GA Safe Drinking Water Act (O.C.G.A. 12-5-170 et seq.), GA Rules and Regulations 391-3-5	Revision of existing permit to operate a public water system			Operate a public, non-transient, non-community water system.
GDNR	GA Safe Drinking Water Act (O.C.G.A. 12-5-170 et seq.), GA Rules and Regulations 391-3-5	Revision of existing permit to operate a public water system			Operate a public, transient, non-community water system.
GDNR	GA Groundwater Use Act (O.C.G.A. 12-5-90 et seq.), GA Rules and Regulations 391-3-2-.03	Modification of Existing Permit to Use Groundwater			Consumptive use of 100,000 gallons per day or more of groundwater.
GDNR	GA Groundwater Use Act (O.C.G.A. 12-5-90 et seq.), GA Rules and Regulations 391-3-2-.09	Permit to Withdraw Groundwater			Dewater for foundation if needed for more than 60 days.

Table 1.3-2 (cont.) Authorizations Required for Pre-Construction Activities

Agency	Authority	Requirement	License/ Permit No. (1)	Expiration Date (1)	Activity Covered
GDNR	GA Groundwater Use Act (O.C.G.A. 12-5-90 et seq.), GA Rules and Regulations 391-3-2-.14	Certification of Abandoned Wells			Abandoned wells have been filled, plugged and sealed.
GDNR	GA Erosion and Sedimentation Act (O.C.G.A. Section 12-7-1 et seq.), GA Rules and Regulations 391-3-7	Land Disturbing Activity Permit			Permission to conduct land disturbing activities of one acre or larger, or within 200 feet of the bank of any state waters. For site and rail corridor upgrade.
GDNR	GA Comprehensive Solid Waste Management Act (O.C.G.A. 12-8-20 et seq.), GA Rules and Regulations 391-3-4-.06	Permit by Rule - Inert Landfill Permit			On-site disposal of solid waste consisting of earth and earth-like products, concrete, cured asphalt, rock, bricks, and land clearing debris.
GDNR	GA Comprehensive Solid Waste Management Act (O.C.G.A. 12-8-20 et seq.), GA Rules and Regulations 391-3-4	Private Industry Landfill Permit			On-site disposal of solid waste consisting of construction and demolition debris.
GDNR	GA Comprehensive Solid Waste Management Act (O.C.G.A. 12-8-20 et seq.), GA Rules and Regulations 391-3-4	Solid Waste Handling Permit			Disposal of industrial solid wastes. Transportation of putrescible waste for disposal in a permitted landfill.

Table 1.3-2 (cont.) Authorizations Required for Pre-Construction Activities

Agency	Authority	Requirement	License/ Permit No. (1)	Expiration Date (1)	Activity Covered
GDNR	Federal Clean Air Act (FCAA), GA Air Quality Act (O.C.G.A. Section 12-9-1 et seq.), GA Rules and Regulations 391-3-1	Revision of existing Title V Operating Permit			Operation of air emission sources.
Burke County Building Office	Burke County Code of Ordinances, Article VII, Sec. 26-331	Land Disturbing Activity Permit			All land disturbing activities within the boundaries of Burke County.
Burke County Building Office	Burke County Code of Ordinances, Article VII, Sec. 26-336	Building Permit			Construction, alteration, repair, or demolition of any building or structure within the boundaries of Burke County.

NRC - U.S. Nuclear Regulatory Commission
USACE - U.S. Army Corps of Engineers
USDOT - U.S. Department of Transportation
FAA - Federal Aviation Administration
GPSC - Georgia Public Service Commission

1 No permits have been issued.

2 The VEGP rail spur was recently upgraded, and SNC will verify that additional upgrades are not needed. For completeness, this table assumes upgrades to the rail corridor will be made.

Table 1.3-3 Authorizations Required for Redress Activities

Agency	Authority	Requirement	License/Permit No. (1)	Expiration Date (1)	Activity Covered
USACE	Clean Water Act (CWA)	Section 404 Permit			Disturbance or crossing wetland areas or navigable waters.
USACE	33 CFR 323	Dredge and Fill Discharge Permit			Construction / modification of intake / discharge to Savannah River.
USACE	Rivers and Harbors Act	Section 10 Permit			Impacts to navigable waters of the U.S. Barge Slip Modification.
USDOT	49 FR 107, Subpart G	Certificate of Registration			Transportation of hazardous materials.
GDNR	Federal Clean Water Act (FCWA) (33 U.S.C. 1251 et seq.)	Section 401 Certification			Compliance with water quality standards.
GDNR	FCWA, GA Water Quality Control Act (O.C.G.A. 12-5-20), GA Rules and Regulations 391-3-6	General Permit Registration for Storm Water Discharges Associated with Construction Activity for Common Developments	GAR100003	July 31, 2008	Discharge storm water from site during construction (might be covered by existing registration).

Table 1.3-3 (cont.) Authorizations Required for Redress Activities

Agency	Authority	Requirement	License/Permit No. (1)	Expiration Date (1)	Activity Covered
GDNR	FCWA, GA Water Quality Control Act (O.C.G.A. 12-5-20), GA Rules and Regulations 391-3-6	General Permit Registration for Storm Water Discharges Associated with Construction Activity for Infrastructure Construction Projects	GAR100002	July 31, 2008	Discharge storm water linear construction sites (e.g., roadways, transmission lines) during construction)(might be covered by existing registration).
GDNR	GA Erosion and Sedimentation Act (O.C.G.A. Section 12-7-1 et seq.), GA Rules and Regulations 391-3-7	Land Disturbing Activity Permit			Permission to conduct land disturbing activities of one acre or larger, or within 200 feet of the bank of any state waters. For site and rail corridor.
GDNR	Federal Clean Air Act (FCAA), GA Air Quality Act (O.C.G.A. Section 12-9-1 et seq.), GA Rules and Regulations 391-3-1	Part 70 Air Quality Construction Permit			Construction air emission sources.
GDNR	GA Safe Drinking Water Act (O.C.G.A. 12-5-170 et seq.), GA Rules and Regulations 391-3-5	Notice of Termination (NOT) -Permit to operate a Public Water System			Operate a public, non-transient, non-community water system.

Table 1.3-3 (cont.) Authorizations Required for Redress Activities

Agency	Authority	Requirement	License/Permit No. (1)	Expiration Date (1)	Activity Covered
GDNR	GA Safe Drinking Water Act (O.C.G.A. 12-5-170 et seq.), GA Rules and Regulations 391-3-5	NOT - Permit to operate a Public Water System			Operate a public, transient, non-community water system.
GDNR	GA Groundwater Use Act (O.C.G.A. 12-5-90 et seq.), GA Rules and Regulations 391-3-2-.03	NOT - Permit to Use Groundwater			Consumptive use of 100,000 gallons per day or more of groundwater.
GDNR	GA Groundwater Use Act (O.C.G.A. 12-5-90 et seq.), GA Rules and Regulations 391-3-2-.09	Permit to Withdraw Groundwater			Dewater for foundation if needed for more than 60 days.
GDNR	GA Groundwater Use Act (O.C.G.A. 12-5-90 et seq.), GA Rules and Regulations 391-3-2-.14	Certification of Abandoned Wells			Abandoned wells have been filled, plugged and sealed.
GDNR	GA Comprehensive Solid Waste Management Act (O.C.G.A. 12-8-20 et seq.), GA Rules and Regulations 391-3-4-.06	Permit by Rule - Inert Landfill Permit			On-site disposal of solid waste consisting of earth and earth-like products, concrete, cured asphalt, rock, bricks, and land clearing debris.
GDNR	GA Comprehensive Solid Waste Management Act (O.C.G.A. 12-8-20 et seq.), GA Rules and Regulations 391-3-4	Private Industry Landfill Permit			On-site disposal of solid waste consisting of construction and demolition debris.

Table 1.3-3 (cont.) Authorizations Required for Redress Activities

Agency	Authority	Requirement	License/Permit No. (1)	Expiration Date (1)	Activity Covered
GDNR	GA Comprehensive Solid Waste Management Act (O.C.G.A. 12-8-20 et seq.), GA Rules and Regulations 391-3-4	Solid Waste Handling Permit			Disposal of industrial solid wastes. Transportation of putrescible waste for disposal in a permitted landfill.
Burke County Building Office	Burke County Code of Ordinances, Article VII, Sec. 26-331	Land Disturbing Activity Permit			All land disturbing activities within the boundaries of Burke County.
Burke County Building Office	Burke County Code of Ordinances, Article VII, Sec. 26-336	Building Permit			Construction, alteration, repair, or demolition of any building or structure within the boundaries of Burke County.

[1] No permits have been issued.

Table 1.3-4 Authorizations Required for Construction Activities[1]

Agency	Authority	Requirement	License/ Permit No. (2)	Expiration Date (2)	Activity Covered
NRC	10 CFR 52, Subpart C or 10 CFR 50.10(e)(3)	Combined Operating License or Limited Work Authorization 2			Safety-related construction for a nuclear power facility.
FAA	49 USC 1501 14 CFR 77	Construction Notice			Notice of erection or structures (>200 feet high) potentially impacting air navigation.
USACE	Clean Water Act (CWA)	Section 404 Permit			Disturbance or crossing wetland areas or navigable waters. For transmission line corridor.
USACE	33 CFR 323	Dredge and Fill Discharge Permit			Construction/ modification of intake/ discharge to Savannah River. For transmission line corridor.
USFWS	Migratory Bird Treaty Act, 50 CFR 21	Federal Depredation Permit			Adverse impacts on protected species and/or their nests. For site transmission line corridor.
GDNR	GA Endangered Wildlife Act (O.C.G.A. Section 27-3-130 et seq.), GA Rules and Regulations 391-4-10	Depredation permit			Adverse impacts on state designated protected species and/or their habitat. For transmission line corridor.

Table 1.3-4 (cont.) Authorizations Required for Construction Activities[1]

Agency	Authority	Requirement	License/ Permit No. (2)	Expiration Date (2)	Activity Covered
GDNR	Federal Clean Air Act (FCAA), GA Air Quality Act (O.C.G.A. Section 12-9-1 et seq.), GA Rules and Regulations 391-3-1	Part 70 Air Quality Construction Permit			Construction air emission sources.
GDNR	FCWA, GA Water Quality Control Act (O.C.G.A. 12-5-20), GA Rules and Regulations 391-3-6	General Permit Registration for Storm Water Discharges Associated with Construction Activity for Infrastructure Construction Projects	GAR10000 2	July 31, 2008	Discharge storm water linear construction sites (e.g., roadways, transmission lines) during construction.
GDNR	GA Comprehensive Solid Waste Management Act (O.C.G.A. 12-8-20 et seq.), GA Rules and Regulations 391-3-4	Solid Waste Handling Permit			Disposal of industrial solid wastes. Transportation of putrescible waste for disposal in a permitted landfill.
GDNR	GA Erosion and Sedimentation Act (O.C.G.A. Section 12-7-1 et seq.), GA Rules and Regulations 391-3-7	Land Disturbing Activity Permit			Permission to conduct land disturbing activities of one acre or larger, or within 200 feet of the bank of any state waters. For transmission line corridor.

Table 1.3-4 (cont.) Authorizations Required for Construction Activities[1]

Agency	Authority	Requirement	License/ Permit No. (2)	Expiration Date (2)	Activity Covered
GDNR	FCWA, GA Water Quality Control Act (O.C.G.A. 12-5-20), GA Rules and Regulations 391-3-6	General Permit Registration for Storm Water Discharges Associated with Construction Activity for Infrastructure Construction Projects	GAR10000 2	July 31, 2008	Discharge storm water linear construction sites. For transmission line corridor.
GDOT	23 CFR 1.23	Permit			Utility right-of-way easement.
Burke County Building Office	Burke County Code of Ordinances, Article VII, Sec. 26-331	Land Disturbing Activity Permit			All land disturbing activities within the boundaries of Burke County.
Various county offices responsible for land disturbing activities	Jefferson, Warren, and McDuffie County Ordinances	Land Disturbing Activity Permit.			Land disturbing activities within county boundaries. For transmission line corridor.

GDOT – Georgia Department of Transportation

1 Assumes that SNC obtained the authorizations that Table 1.3-2 identifies.

2 No permits have been issued.

Table 1.3-5 Authorizations Required for Operation[1]

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered
GDNR	FCWA, GA Water Quality Control Act	Revision of existing National Pollutant Discharge Elimination System Permit			Regulates limits of pollutants in liquid discharge to surface water.
GDNR	Federal Clean Air Act (FCAA), GA Air Quality Act (O.C.G.A. Section 12-9-1 et seq.), GA Rules and Regulations 391-3-1	Revision of existing Title V Operating Permit			Operation of air emission sources.
GDNR	GA Groundwater Use Act (O.C.G.A. 12-5-90 et seq.), GA Rules and Regulations 391-3-2-.03	Revision of existing Permit to Use Groundwater			Consumptive use of 100,000 gallons per day or more of groundwater.
GDNR	GA Water Quality Control Act (O.C.G.A. 12-5-31 et seq.), GA Rules and Regulations 391-3-6	Revision of existing Surface Water Withdrawal Permit to Withdraw, Divert or Impound Surface Water			Withdraw water from the Savannah River for cooling makeup and in-plant use.
South Carolina Department of Health and Environmental Control – Division of Waste Management	South Carolina Radioactive Waste Transportation and Disposal Act (Act No. 429)	Revision of existing South Carolina Radioactive Waste Transport Permit			Transportation of radioactive waste into the State of South Carolina.

Table 1.3-5 (cont.) Authorizations Required for Operation[1]

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered
State of Tennessee Department of Environment and Conservation Division of Radiological Health	Tennessee Department of Environment and Conservation Rule 1200-2-10.32	Revision of existing Tennessee Radioactive Waste License-for-Delivery			Transportation of radioactive waste into the State of Tennessee.
State of Utah Department of Environmental Quality Division of Radiation Control	R313-26 of the Utah Radiation Control Rules	Revision of existing General Site Access Permit			Transportation of radioactive materials into the State of Utah.
GPSC	GA Radiation Control Act (O.C.G.A. 31-13-1 et seq.), GA Rules and Regulations 391-3-17-.06	Revision of existing General Permit – Transportation of Radioactive Materials			Transportation of radioactive materials in the State of Georgia.

1 Assumes that SNC obtained the authorizations that Tables 1.3-2 and 1.3-4 identify.

1.4 Methodology

NRC regulation 10 CFR 52.17(a)(2) specifies the contents of an Environmental Report (ER) for an ESP application and Regulatory Guide 4.2, *Preparation of Environmental Reports for Nuclear Power Stations, Revision 2,* July 1976 (RG 4.2) provides guidance to applicants preparing environmental reports for nuclear power stations. The NRC's *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Revision 0,* 1999 (NUREG-1555), provides guidance for NRC staff to use when conducting environmental reviews of applications related to nuclear power plants. Because RG 4.2 is an earlier NRC document (1976) and NUREG-1555 is relatively new (1999), SNC chose to look to the latter for guidance in establishing the format and content of its environmental report. SNC has provided additional information and organization in the material presented as seemed appropriate when applying lessons learned from the first three ESP applicants. SNC prepared Table 1.4-1 to verify conformance with regulatory requirements. The table identifies each requirement and indicates where in the ER SNC has responded to the requirement.

SNC also evaluated the conclusions of NRC's *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, Revision 0, 1996 (NUREG-1437), for input in assessing the impacts of the new nuclear units on the VEGP site. SNC concluded that if characteristics of the proposed reactors are similar to those of the existing fleet, then NUREG-1437 significance determination criteria could be applied in the ESP environmental review. SNC has indicated in its ER where it has used NUREG-1437 in assessing VEGP environmental impacts.

Table 1.4-1 Environmental Report Responses to Early Site Permit Regulatory Requirements

No.	Regulatory Requirement (10 CFR)[1]	Responsive Environmental Report Section
1.	51.45(a), Signed original	Transmittal letter
2.	51.45(b), Description of proposed action	Chapter 3, *Plant Description*
3.	51.45(b), Statement of purpose of proposed action	Section 1.1.1, *Purpose and Need*
4.	51.45(b), Description of environment affected by proposed action	Chapter 2, *Environmental Description*
5.	51.45(b)(1), Environmental impact of proposed action	Chapters 4, *Environmental Impacts of Construction*; 5, *Environmental Impacts of Station Operation*; 7, *Environmental Impact of Postulated Accidents Involving Radioactive Materials*, and 10, *Environmental Consequences of the Proposed Action*
6.	51.45(b)(2), Unavoidable adverse impacts	Section 10.1, *Unavoidable Adverse Environmental Impacts*
7.	51.45(b)(3), Alternatives to proposed action	Chapter 9, *Alternatives to the Proposed Action*
8.	51.45(b)(4), Relationship between short-term use and long-term productivity	Section 10.3, *Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment*
9.	51.45(b)(5), Irreversible and irretrievable commitments of resources	Section 10.2, *Irreversible and Irretrievable Commitments of Resources*
10.	51.45(c), Comparison of environmental effects of proposed action and alternatives	Chapters 4, *Environmental Impacts of Construction*; 5, *Environmental Impacts of Station Operation*; 7, *Environmental Impact of Postulated Accidents Involving Radioactive Materials*, 10, *Environmental Consequences of the Proposed Action* and 9, *Alternatives to the Proposed Action*
11.	51.45(c), Alternatives for reducing or avoiding adverse environmental impacts	Sections 4.6 *Measures and Controls to Limit Adverse Impacts During Construction* and 5.10, *Measures and Controls to Limit Adverse Impacts During Operations*
12.	51.45(c), Economic, technical, and other benefits and costs of proposed action and alternatives	Section 10.4, *Benefit-Cost Balance*

Table 1.4-1 (cont.) Environmental Report Responses to Early Site Permit Regulatory Requirements

No.	Regulatory Requirement (10 CFR)[1]	Responsive Environmental Report Section
13.	51.45(d), Federal permits and other entitlements and status of compliance	Section 1.3, *Status of Reviews, Approvals, and Consultations*
14.	51.45(d), Compliance with Federal and other environmental quality standards and requirements	Section 1.3, *Status of Reviews, Approvals, and Consultations*
15.	51.45(d), Compliance for alternatives	Section 9.2 *Energy Alternatives* and Section 9.3 *Alternative Sites*
16.	51.45(e), Adverse information	Section 10.1, *Unavoidable Adverse Environmental Impacts*
17.	51.50 and 51.51(a), Uranium fuel cycle	Section 5.7, *Uranium Fuel Cycle Impacts*
18.	51.50 and 51.52, Fuel and waste transportation	Sections 3.8, *Transportation of Radioactive Materials*, 511, *Transportation of Radioactive Materials*, and 7.4, *Transportation Accidents*
19.	51.50, Reporting and record keeping procedures	Chapter 6, *Environmental Measurements and Monitoring Programs*
20.	51.50, Conditions and monitoring	Chapter 6, *Environmental Measurements and Monitoring Programs*

1 Incorporated by reference at 10 CFR 52.17(a)(2)

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Chapter 2 Environmental Description

Chapter 2 describes the existing environmental conditions at the Vogtle Electric Generating Plant (VEGP) site, the site vicinity and the region. The environmental descriptions provide sufficient detail to identify those environmental resources that have the potential to be affected by the construction, operation, or decommissioning of the new units. The chapter is divided into nine sections:

- Site Location (Section 2.1)
- Land (Section 2.2)
- Water (Section 2.3)
- Ecology (Section 2.4)
- Socioeconomics (Section 2.5)
- Geology (Section 2.6)
- Meteorology, Air Quality, and Noise (Section 2.7)
- Related Federal and Other Project Activities (Section 2.8)
- Existing Plant Site Characteristics, Design Parameters, and Site Interface Values (Section 2.9)

The following descriptions should help the reader understand the scope of the discussion:

- VEGP site – the 3,169 acre site as described in the Unit 1 and Unit 2 licenses
- New plant (VEGP Units 3 and 4) footprint – the approximately 500 acres within the VEGP site that will encompass the construction and operation of the new nuclear units
- Vicinity – the area within approximately the 6- or 10-mile (depending on the issue) radius around the VEGP site
- Region – the area within approximately the 50-mile radius around the VEGP site

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2.1 Site Location

SNC proposes to construct and operate two Westinghouse AP1000 reactors at VEGP in Burke County, Georgia. The two AP1000 reactors will be referred to as VEGP Units 3 and 4.

The proposed early site permit (ESP) is for the existing 3,169-acre VEGP site. VEGP Units 3 and 4 and supporting infrastructure will be sited in the area delineated in Figure 2.1-1. The centerline of VEGP Units 3 and 4 will be approximately 2,100 feet west and 400 feet south of the center of the existing Unit 2 containment building. Unit 4 containment will be approximately 800 feet west of Unit 3 containment.

The coordinates of the center of the containment buildings for VEGP Units 3 and 4 are given below in State Plane and Universal Transverse Mercator (UTM) coordinates:

Unit		Georgia East Coordinates (NAD27)	UTM (NAD83)
3	N	1,142,600	3,667,166.728
	E	621,800	428,315.413
4	N	1,142,600	3,667,169.439
	E	621,000	428,071.651

The 3,169-acre VEGP site is located on a Coastal Plain bluff on the southwest side of the Savannah River in eastern Burke County. The site and its exclusion area boundary (EAB) are generally bounded by River Road, Hancock Landing Road, and approximately 1.7 miles of the Savannah River (River Miles 150.0 to 151.7). The site is approximately 30 river miles above the U.S. 301 highway bridge and directly across the river from the Department of Energy's Savannah River Site (Barnwell County, South Carolina). The site is approximately 15 miles east north east of Waynesboro, Georgia and 26 miles southeast of Augusta, Georgia, the nearest population center (i.e., having more than 25,000 residents) (Figure 2.1-2). It is also about 136 miles from Savannah, Georgia and 150 river miles from the mouth of the Savannah River.

Access to the site is from River Road via U.S. Route 25, and Georgia Routes 56, 80, 24 or 23 (Figure 2.1-3). Barge access is available from the Savannah River which is navigable to a point upstream of VEGP. A railroad spur runs to the site from the Norfolk Southern Savannah-to-Augusta track.

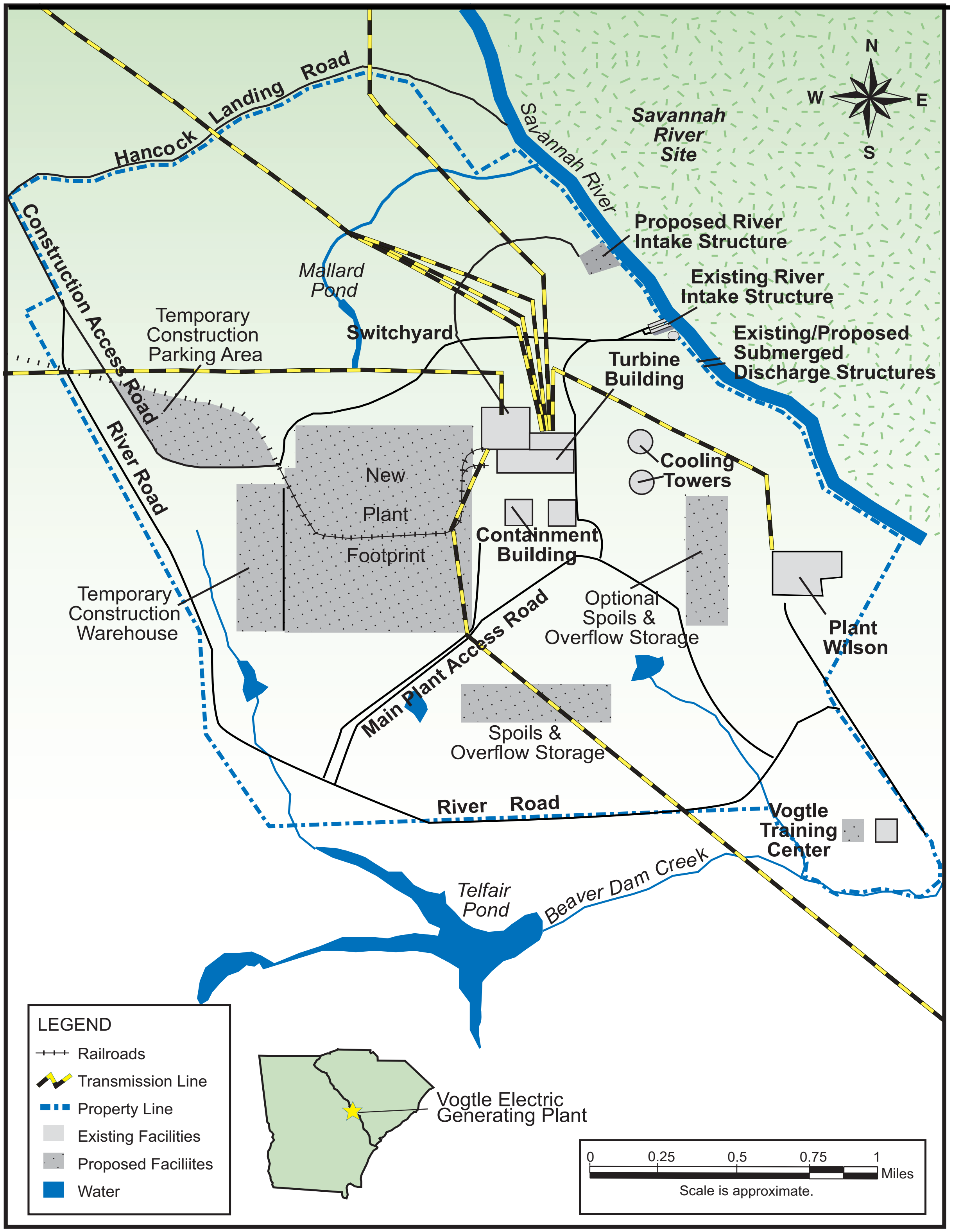

Figure 2.1-1 VEGP Site and Proposed New Plant Footprint

Figure 2.1-2 50-Mile Region

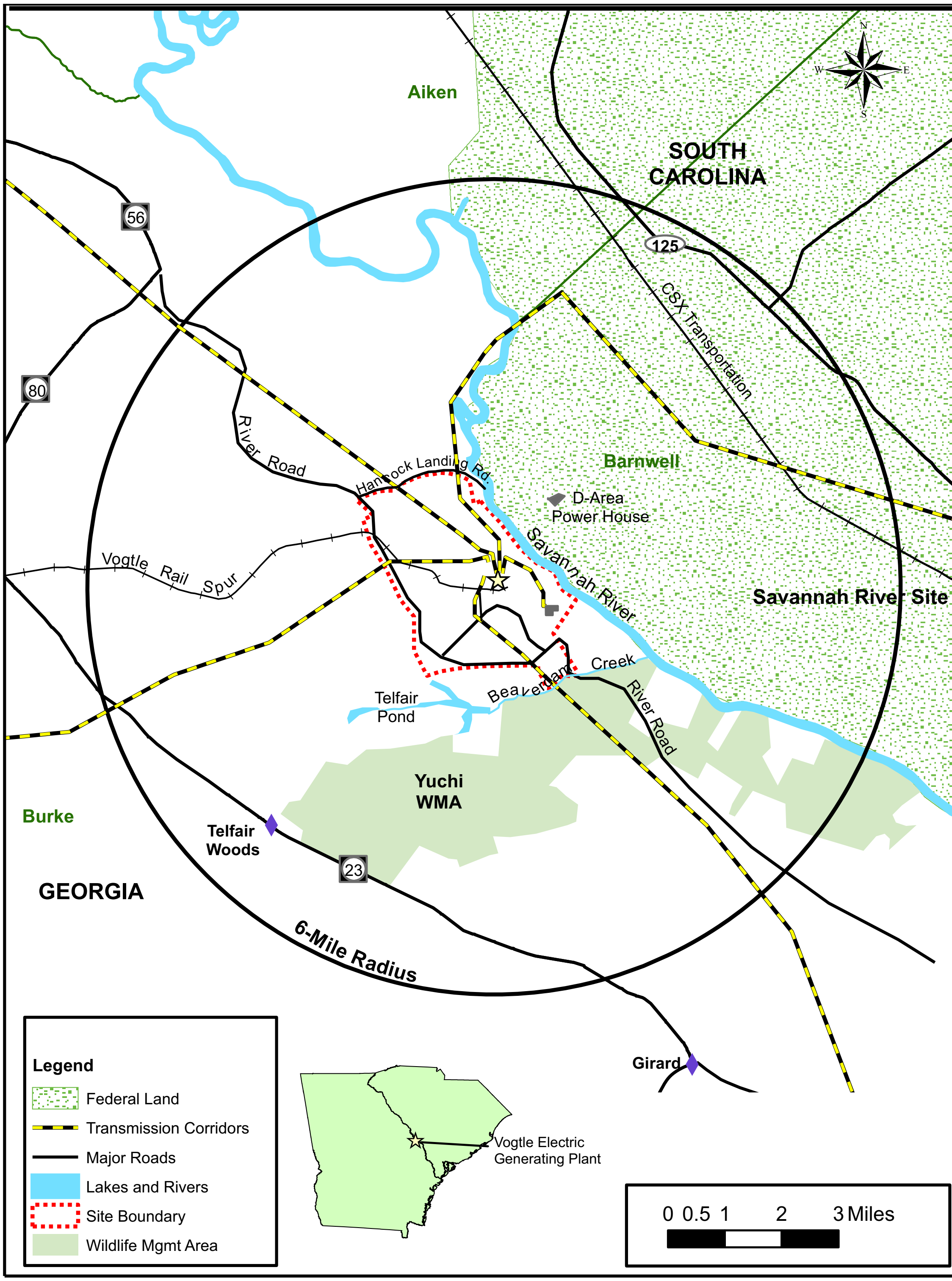

Figure 2.1-3 6-Mile Vicinity

2.2 Land

This section describes the land characteristics of the VEGP site and the vicinity, transmission corridors and offsite areas, and the region.

2.2.1 The Site and Vicinity

2.2.1.1 The Site

The 3,169-acre VEGP site is bounded by the Savannah River on the east, Hancock Landing Road on the north and River Road on the west and south (Figure 2.1-1). Georgia Power Company (GPC), Oglethorpe Power Corporation (OPC), Municipal Electric Authority of Georgia, and the City of Dalton, a municipality in the State of Georgia, doing business by and through the Water, Light and Sinking Fund Board of Commissioners (Dalton Utilities) own the VEGP Units 1 and 2 and most of the site property. Also on the VEGP site is the GPC-owned 354 MWe Plant Wilson facility composed of six oil-fueled combustion turbines. GPC provides support and direction for land management activities for the VEGP site property. Southern Nuclear Operating Company (SNC) is the Nuclear Regulatory Commission (NRC) licensed operator for VEGP Units 1 and 2 and manages and controls access to the site.

GPC developed a land management plan to ensure compliance with environmental regulations and permits and implemented a program with emphasis on forestry and wildlife. The plan also considers the needs of plant security, project management, construction, and power generation. The plan went into effect in January 1983 and is periodically updated. The plan dedicates undeveloped areas of the site to managing natural longleaf pine, and maintaining the existing hardwood communities. Slash pine and cover crops were used to revegetate parts of the original VEGP Units 1 and 2 construction site. **(GPC 1985)**

The 3,169-acre site includes land developed for industrial use, previously disturbed land and undeveloped land. The existing VEGP Units 1 and 2 and auxiliary facilities, including the Vogtle Training Center, Plant Wilson, construction facilities, and transmission rights-of-way occupy about 800 acres. Areas on the site that have been previously disturbed, including the proposed VEGP Units 3 and 4 footprint, have been revegetated with a mix of planted pines and old field vegetation. Much of the site is wooded. Figure 2.2-1 illustrates the U.S. Geological Survey (USGS) land use classifications on the VEGP site. Section 2.4.1.1 provides a description of the undeveloped portion of the site.

Several water bodies and streams exist on the site or border the site. Beaverdam Creek which drains Telfair Pond (located south of VEGP) is a major stream that borders the VEGP site south of the Vogtle Training Center. Several drainages drain from VEGP property to Beaver Dam Creek (Figure 2.1-3). A second, small stream drains north out of Mallard Pond, north of the proposed new plant footprint. Both ponds are impounded blackwater creeks **(GPC 1985).** Several borrow pits and two sediment retention basins constructed to control storm water runoff are on site. The sediment retention basins south of the industrial area are permanent ponds and will be used to support management of stormwater from the new Unit 3 and 4 construction area.

Most of the VEGP site property lies outside the 500-year floodplain. The Savannah River 100-year floodplain ranges from approximately 100 to 800 feet wide at the VEGP site **(FEMA 1989)**. The floodplain is separated from the rest of the VEGP site by steep bluffs along virtually all of the VEGP site river shoreline. The Savannah River is not designated a wild and scenic river **(**16 USC 1271 – 1287; **NPS No Date)**.

In 1993, the VEGP site was designated as a Certified Wildlife Habitat by the Wildlife Habitat Council, a non-profit, Washington D.C.-based wildlife organization. The certification considered the wildlife enhancement work performed after original construction and a new plan developed in the early 1990's.

No railroads, transmission corridors (other than those owned and operated by GPC), natural gas pipelines, or major waterways traverse the VEGP site. Several communication facilities are on GPC property. West of the facility is the Vogtle Fiberoptic Site (the old Microwave Site). Fiberoptic fiber from offsite comes into VEGP through this building. The fiber to Augusta exits the building to the south on poles to the 150 kV line near River Road. The fiber that goes south goes underground to the 500 kV line tower just to the southwest of the building. The fiber into the facility leaves the building underground east-southeast to the Security duct. The tower is home to the antennas for the NOAA transmitter, the Emergency Alert Siren Radio, and a variety of radios for the emergency notification network. Southwest of the facility are two meteorological towers which are discussed in detail in Section 6.4. Southeast of the plant is the Motorola iDEN (Integrated Digital Enhanced Network) tower, a SouthernLinc (Southern Company communications) site but the tower is owned by Global Signal Inc. (formerly Pinnacle Towers Inc.). The tower at Plant Wilson has an antenna for the Georgia Department of Natural Resources and antenna for the Emergency Alert Siren Radio in South Carolina. Access to the VEGP site is primarily through a VEGP-owned and maintained road off River Road.

No prime farmland soils occur on the VEGP site **(USDA 1986)**. Burke County is developing zonin regulations, but the VEGP site currently is not zoned.

2.2.1.2 The Vicinity

The VEGP site is in the Coastal Plain, approximately 25 miles east of the Piedmont Province **(GPC 1972)**. The topography of the vicinity consists of low rolling hills with elevations ranging from 80 feet to 280 feet above mean sea level **(GPC 1985)**.

The Georgia side of the Savannah River within 6 miles of the VEGP site is primarily rural undeveloped land with a few homes and small farms. Figure 2.2-2 identifies USGS land use classifications in the vicinity of VEGP. The crossroads community of Telfair Woods is approximately 5 miles southwest of VEGP (Figure 2.1-3). Girard (population 230) is approximately 8 miles to the south. A small, privately-owned airstrip, known as Rhodes Air Ranch, is located just north of the site boundary.

Much of the undeveloped land in the vicinity is sandhill-upland pine or oak-hickory hardwood communities. GPC provides access to the Savannah River via a concrete boat ramp, along with parking and a recreational area with picnic tables at its boat landing, immediately downstream of the VEGP property. The 7,000-acre Yuchi Wildlife Management Area (WMA) managed by Georgia Department of Natural Resources (DNR) is adjacent to VEGP property. Hunting, fishing, and primitive camping are allowed on the Yuchi WMA. No other recreation areas are within 6 miles of the VEGP site. No mineral deposits or mines occur in Burke County **(USGS 2003a)**. Forty-five percent of the soils in Burke County are classified as prime farmland **(USDA 1986)**. Forty-one percent of Burke County was farmland in 2002 **(NASS no date; Georgia.gov 2005)**. Of that 41 percent, 48 percent was in cropland, 42 percent was in woodland 6 percent was pasture and 4 percent was other uses. The largest money crops in the county are cotton and cottonseed, and milk and other dairy products from cows **(NASS no date)**. Burke County is revising its comprehensive plan, and has indicated zoning classifications will be established. Burke County currently does not have zoning classifications.

The Savannah River Site (SRS), a U.S. Department of Energy facility with restricted access, is directly across the Savannah River from VEGP. SRS has two industrial areas which are no longer active and have undergone remediation and one fossil-fueled power plant within the 6-mile radius. The remainder of the SRS within the 6-mile radius is river swamp, bottomland hardwood or upland pine-hardwood communities. The U.S. Forest Service maintains pine plantations on SRS land that is not industrial. Barnwell County, South Carolina has no mineral deposits or mines **(USGS 2003b)**.

2.2.2 Transmission Corridors and Offsite Areas

2.2.2.1 Existing Corridors

The existing transmission system supporting VEGP Units 1 and 2 has two 50 kV lines and four 230 kV lines in four corridors. There is an additional 230 kV line to the Wilson Station. The Wilson connection provides offsite power in case of emergency.

The two 500 kV transmission lines (Scherer and Thalmann) run in separate corridors, and the four 230 kV lines (Goshen [black], Goshen [white], Augusta Newsprint, and SCE&G), generally run in two additional corridors. The Plant Wilson line connects the Wilson Plant switchyard to the VEGP switchyard and is totally within the owners' property, and thus is not further discussed in this section. Figure 2.2-3 depicts the existing transmission system. The figure also shows major highway crossings and historically or environmentally significant areas. Table 2.2-1 provides information on land use along the corridors. Each corridor is described as follows:

Scherer – This corridor runs generally westward to Plant Scherer, north of Macon, Georgia. Built in 1986, it is 154 miles long and is mostly 150 feet wide, but up to 400 feet wide in some locations. The terrain is flat to rolling.

Thalmann – Running 159 miles to the south, this 150-foot-wide corridor connects VEGP to the West McIntosh substation near Plant McIntosh, just north of Savannah, Georgia then continues to its termination at the Thalmann substation near Brunswick. The VEGP Final Environmental Statement (FES) **(NRC 1985)** examined the entire 159 miles of transmission line, however, today, the VEGP line terminates at West McIntosh. Data for the entire Thalmann corridor are provided in Table 2.2-1. This line is also known as the McIntosh line.

South Augusta – This corridor contains three 230-kV transmission lines that run north to the Goshen and Augusta Newsprint substations. The Goshen substation (2 lines) is approximately 19 corridor miles from VEGP, and the corridor is 275 feet wide. The Augusta Newsprint substation is approximately 20 corridor miles from VEGP. Augusta Newsprint shares the South Augusta corridor with the Goshen lines for approximately 17 miles. From that point to its termination at the substation it is 100 to 125 feet wide. The Augusta Newsprint line was built in 1983 and the Goshen lines were built in 1986. The terrain is generally flat.

SCE&G – Built in 1986, this corridor runs north and east for 4.5 miles to cross the Savannah River and then an additional 17 miles to a substation operated by South Carolina Electric and Gas. The corridor in South Carolina is 100 feet wide and the 4.5-mile Georgia segment is 125 feet wide. The part of the corridor in South Carolina is wholly contained on the SRS. The terrain is mostly flat.

2.2.2.2 Proposed Transmission Corridor

The existing transmission corridors to the VEGP site will support generation from existing Units 1 and 2 as well as the new Units 3 and 4. GPC and SNC estimate one additional 500 kV line will be required to distribute the additional generation. The proposed new switchyard will contain an extra 500 KV bay to support an additional 500 KV line for potential future expansion. The final route of the new transmission line has not been determined. Initially, SNC developed a bounding analysis based on the known end point and counties the line will traverse. SNC evaluated the proposed new corridor route through Burke, Jefferson, McDuffie and Warren Counties. Land use in these counties is presented in Table 2.2-2 and Figure 2.2-4. The impact analysis is addressed at a county level in Section 4.1.2. GPC recently completed a study of the proposed route macro-corridor for this transmission line to provide detailed information to support the NRC NEPA analysis. This study (**Photo Science 2007**), was developed in early 2007 to identify potential corridors for the proposed transmission line relative to existing land uses and habitats, including special land use classifications (e.g., National or State Parks, military reservations, floodplains, wetlands), and previously-confirmed cultural resources and threatened or endangered species. The study also examined corridor route alternatives in general, based on the attributes of the identified corridors. Corridors are defined as transmission line routes of variable widths though a larger land area (study area) between VEGP and the end point of the transmission line. The term right-of-way refers to a precisely described routing of a transmission line, such as an easement of specific width; whereas a “corridor” is a more general route of sufficient width to contain the eventual right-of-way. The macro-corridor study utilized an established process and techniques for identification of corridors supported by computerized, state-of-the-art data analysis and mapping. The study defined a macro-corridor that varies from less than one mile to a little over three miles in width over the more than 50-mile length of the corridor. GPC then prepared a study of route alternatives using the EPRI-GTC Transmission Line Siting Methodology **(EPRI 2006)** to develop options for final line routing based on environmental, social, and cultural impacts. Additional detailed analysis will be conducted by a GPC team that will evaluate each alternate route within the corridor and ultimately select the preferred route.

The EPRI-GTC Transmission Line Siting Methodology incorporates a computer-based methodology developed by the Electric Power Research Institute (EPRI) and Georgia Transmission Corporation (GTC). It is used as a tool to evaluate the suitability of individual land tracts (grid cells) based on land use types for locating transmission facilities. Based on analysis of a large area between and in the vicinity of the endpoints of a line, a macro-corridor and study area are developed. By evaluating more detailed information about the grid cells within the study area, alternate corridors are identified. The EPRI-GTC method is objective, comprehensive, and consistent. It allows the utility to consider vast amounts of information and to quantitatively consider stakeholder input to develop the alternate corridors that ultimately lead to selection of the preferred corridor.

2.2.2.3 Land Use Issues

Land use along the existing corridors is presented in Table 2.2-1. The table breaks the Thalmann corridor into two segments (VEGP-West McIntosh and West McIntosh-Thalmann) to facilitate an understanding of how the proposed action will affect existing transmission corridors.

Special land uses along these corridors include the following as depicted on Figure 2.2-3:

- 17.1 miles on the SRS, which has restricted public access except along South Carolina Highway 125, which the transmission line crosses
- 4.4 miles of Oconee National Forest, northeast of Plant Scherer
- Ebenezer Creek Swamp crossed by the VEGP-West McIntosh line near its termination. Although privately owned, Ebenezer Creek Swamp is designated as a National Natural Landmark. It is part of the 29,000-acre Savannah National Wildlife Refuge. The State of Georgia has designated 7 miles of Ebenezer Creek as a Georgia Scenic River (Georgia Code Chapter 12, Section 12-5-352). Appendix J of the VEGP Units 1 and 2 FES identifies this crossing as receiving attention by the U.S. Fish and Wildlife Service (USFWS), which provided recommendations on crossing the swamp. GPC implemented special construction practices to protect the swamp and has procedures that specifically address corridor and

transmission line maintenance in this swamp, in accordance with the VEGP Environmental Protection Plan.

- Francis Plantation in Washington County, crossed by the VEGP-Scherer transmission corridor. The current VEGP Units 1 and 2 Environmental Protection Plan specifies that vegetation trimming in the Plantation shall be performed manually.
- A Georgia Power Company Transmission Bulletin identifies 196 cultural properties on existing Vogtle transmission lines and provides specifications for protecting these sites based on the Cultural Resources Plan approved by the Georgia State Historic Preservation Officer.

Land use associated with the proposed 500 kV Vogtle-Thompson line is discussed in detail in the macro-Corridor Report (**Photo Science 2007**).

2.2.3 The Region

All or parts of 28 counties (12 in South Carolina and 16 in Georgia) are within 50 miles of the VEGP site (Figure 2.1-2). The 50-mile radius is bordered by interstates on all sides; I-16 from Atlanta to Savannah lies to the southwest, I-95 lies to the east, I-26 from Columbia to Charleston, SC, lies to the northeast and I-20 from Atlanta to Columbia, is to the northwest. Only I-20 actually has any mileage within the 50-mile radius. Additional major transportation infrastructure within the region is discussed in Section 2.5.2.2.

This section focuses on three Georgia counties as the region of impact for the construction and operation of new units at VEGP - Burke, Columbia and Richmond - where 79 percent of current VEGP employees reside (see Section 2.5.1). Most land use changes will be due to increases in tax revenues associated with new units at VEGP, which will be limited to the county where the site is located (Burke), or population changes in counties where the greatest number of construction or operations employees will live (Burke, Richmond, and Columbia).

The State of Georgia mandates that cities and counties have comprehensive land use plans, and Burke, Richmond and Columbia Counties have such plans. Table 2.2-3 shows a breakdown of land use type and area in those counties.

Burke County

Burke County has the second largest land area of any county in Georgia. The predominant land uses are agriculture and forestry (76 percent of the unincorporated area in the county in 1990). Fifteen percent of the county is classified as preferential agriculture, and thus bound by covenant to remain agricultural for a given time. Less than 1 percent of the land was classified as industrial or commercial in 1990. The only major park, recreation area or conservation area is the Yuchi Wildlife Management Area, owned by the Georgia DNR. **(Burke County 1991)**

In 2002, Burke County had 494 farms; 176 produced cattle (up from 157 in 1997), 18 had hogs. Very few farms had poultry. In 2002, 248 had harvested cropland: 54 farms produced cotton (down from 66 in 1997), 36 produced soybeans (down from 73 in 1997), and 50 produced peanuts (down from 56 in 1997). **(USDA 2004)**

Columbia County

Sixteen percent of the total land in Columbia County is non-forestry farmland. Crops include corn, soybeans, and wheat. Commodities include forestry, dairy, beef, and greenhouse production (nursery plants). Harvested crops and livestock production have been steadily decreasing. In 1992 the county reported 3,046 acres of harvested cropland. By 1997, harvested cropland had decreased to 2,292 acres. In 1992, 5,400 head of cattle were reported. In 1997, that number had declined to 4,600 head. **(Columbia County 2000)**

Currently 140,500 acres (76 percent) of Columbia County is forested. The forest industry owns 31,600 acres and timber is the highest-valued commodity in the county. **(Columbia County 2000)**

Major parks, recreation and conservation areas in Columbia County include a portion of Clarks Hill Lake, the Augusta Canal, Mistletoe State Park, Heggie's Rock, and Stallings Island. The county is developing a greenway system. Clarks Hill Lake (known as S. Strom Thurmond Lake in South Carolina) is a 70,000 acre U.S. Army Corps of Engineers reservoir on the Savannah River. It provides recreation, wildlife refuges and conservation, flood prevention and drinking water to Georgia and South Carolina. Heggie's Rock is near Appling and is one of Georgia's 12 natural landmarks. It is home to many endangered plant and animal species and is owned by The Nature Conservancy. Stallings Island is in the Savannah River and is thought to be the earliest Colonial settlement in the county. It is on the National Register of Historic Places. **(Columbia County 2000)**

Richmond County

Seven percent of Richmond County was non-forestry farmland in 1997. Crops include corn, soybeans, and peanuts. Commodities include forestry, dairy and beef production, and ornamental horticulture. Harvested cropland increased by 16 percent between 1992 and 1997. **(ARC 2004)**

Currently 121,000 acres (58 percent) of Richmond County is forested. Fifty-six thousand acres are owned by private individuals, 39,000 acres are owned by the Federal government (Fort Gordon), and 17,000 acres by the forest products industry. **(ARC 2004)**

Major parks, recreation and conservation areas in Richmond County include the Savannah River, the Augusta Canal, Phinizy Swamp WMA and Nature Park, Merry Brickyard Ponds, and Spirit Creek Education Forest. Phinizy Swamp WMA is a 1,500-acre, state-owned cypress wetland approximately 2 miles from downtown Augusta. Phinizy Swamp Nature Park is an 1,100-acre park south of Phinizy Swamp WMA. It is owned by the City of Augusta. Merry Brickyard Ponds are clay strip pits that have filled with water and evolved into nationally recognized waterfowl habitat. **(ARC 2004)**

There are no Native American tribal land use plans for areas within the region.

Table 2.2-1 Land Use Along Existing Transmission Corridors

Corridor	Land Use Categories			
	Agricultural	Forest	Industrial	Residential
VEGP-Scherer				
Percent	29	63	<1	<1
Area (acres)	1,041	2,299	21.5	34.5
VEGP-Thalmann				
VEGP-West McIntosh				
Percent	32	29	0	0
Area (acres)	397	362	0	0
West McIntosh-Thalmann[1]				
Percent	5	68	<1	3
Area (acres)	74.8	1,113	13.4	53.7
VEGP-South Augusta				
Percent	14	75	<1	2.8
Area (acres)	92.5	494	0.62	18.2
VEGP-SCE&G				
Percent	4	69	0	0
Area (acres)	11.4	188	0	0

Source: EPA 1994
[1] Provided to be consistent with the VEGP license renewal application.

Table 2.2-2 Land Use as Percent in Burke, Jefferson, McDuffie and Warren Counties

County	Land Use Categories					
	Agricultural	Forest	Water	Wetland	Barren	Urban[1]
Burke	46	43	<1	9	1	<1
Jefferson	40	48	<1	10	<1	1
McDuffie	16	78	3	<1	<1	3
Warren	22	76	<1	<1	<1	1

Source: EPA 1994
[1] Includes residential, commercial, industrial, transportation, communication, utilities, and other urban or built-up land.

Table 2.2-3 Land Use in Acres in Burke, Columbia and Richmond Counties

Land Uses	Burke County[1] (1990)	Columbia County[2] (2000)	Richmond County[3] (2003)
Residential	25,767	43,172	54,328
Commercial	731	2,416	5,772
Industrial	201	2,211	9,402
Transportation/ Communications/ Utilities	No data	7,671	11,893
Public/Institutional	9,254	4,322	52,890
Parks/Open Space/ Conservation	No data	10,304	5,903
Agriculture/Forestry/ Undeveloped	440,307 (includes open space)	126,727	70,020

1 **Burke County 1991**, Table 6-1
2 **Columbia County 2000**, Table L-1
3 **ARC 2004**, Table L-1

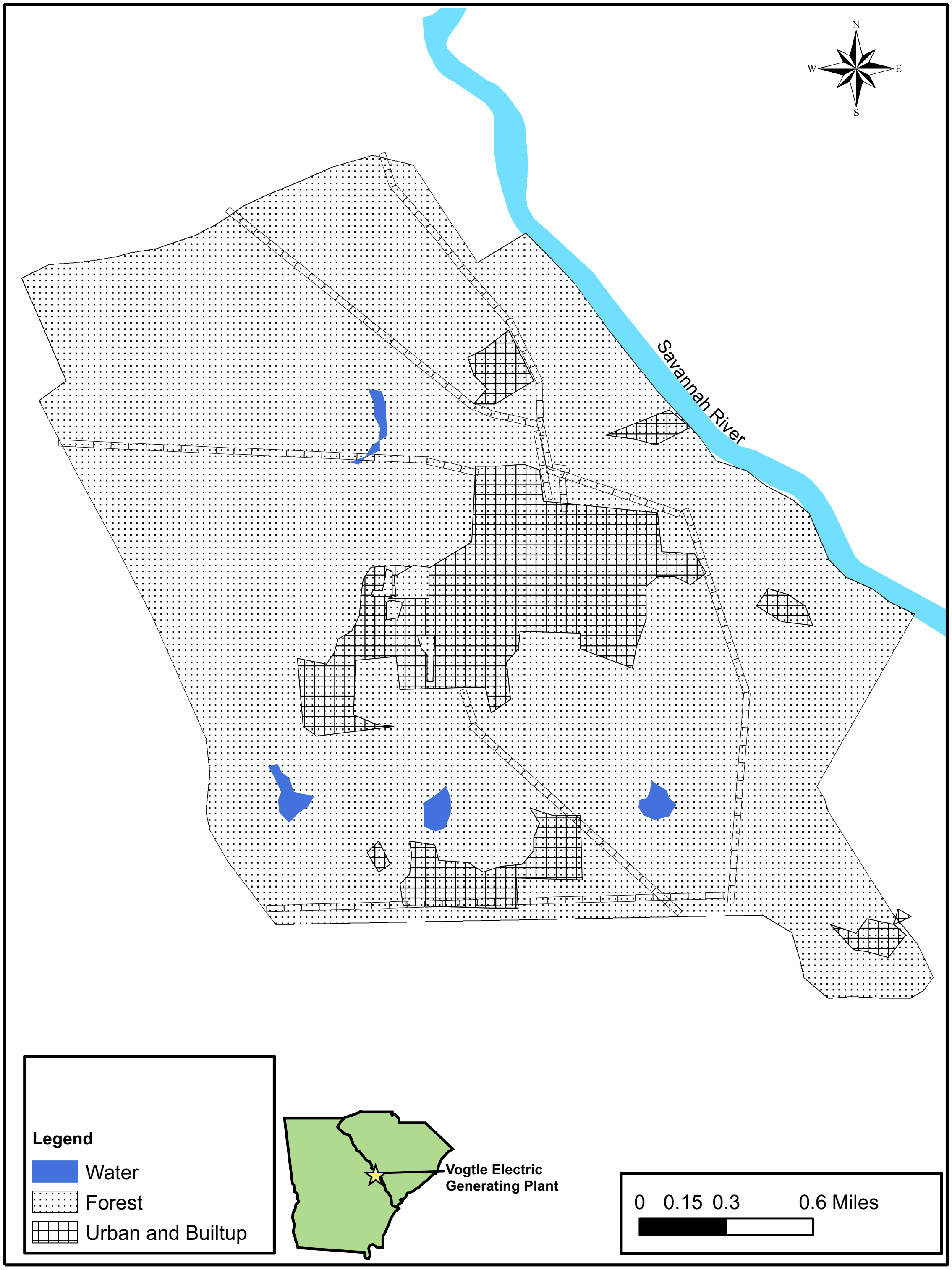

Figure 2.2-1 USGS Land Use Classifications at VEGP Site

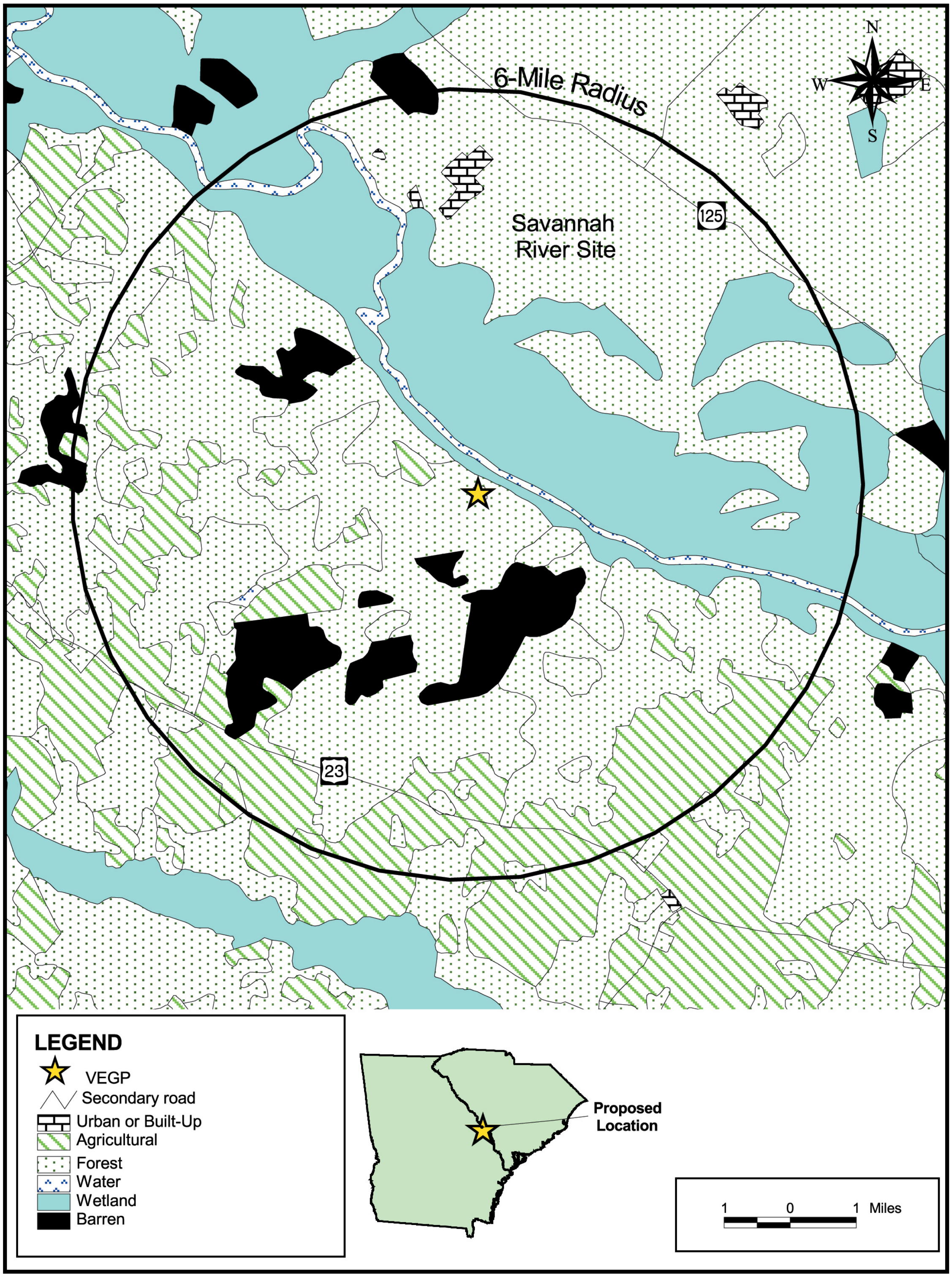

Figure 2.2-2 USGS Land Use Classifications in the Vicinity of the VEGP Site

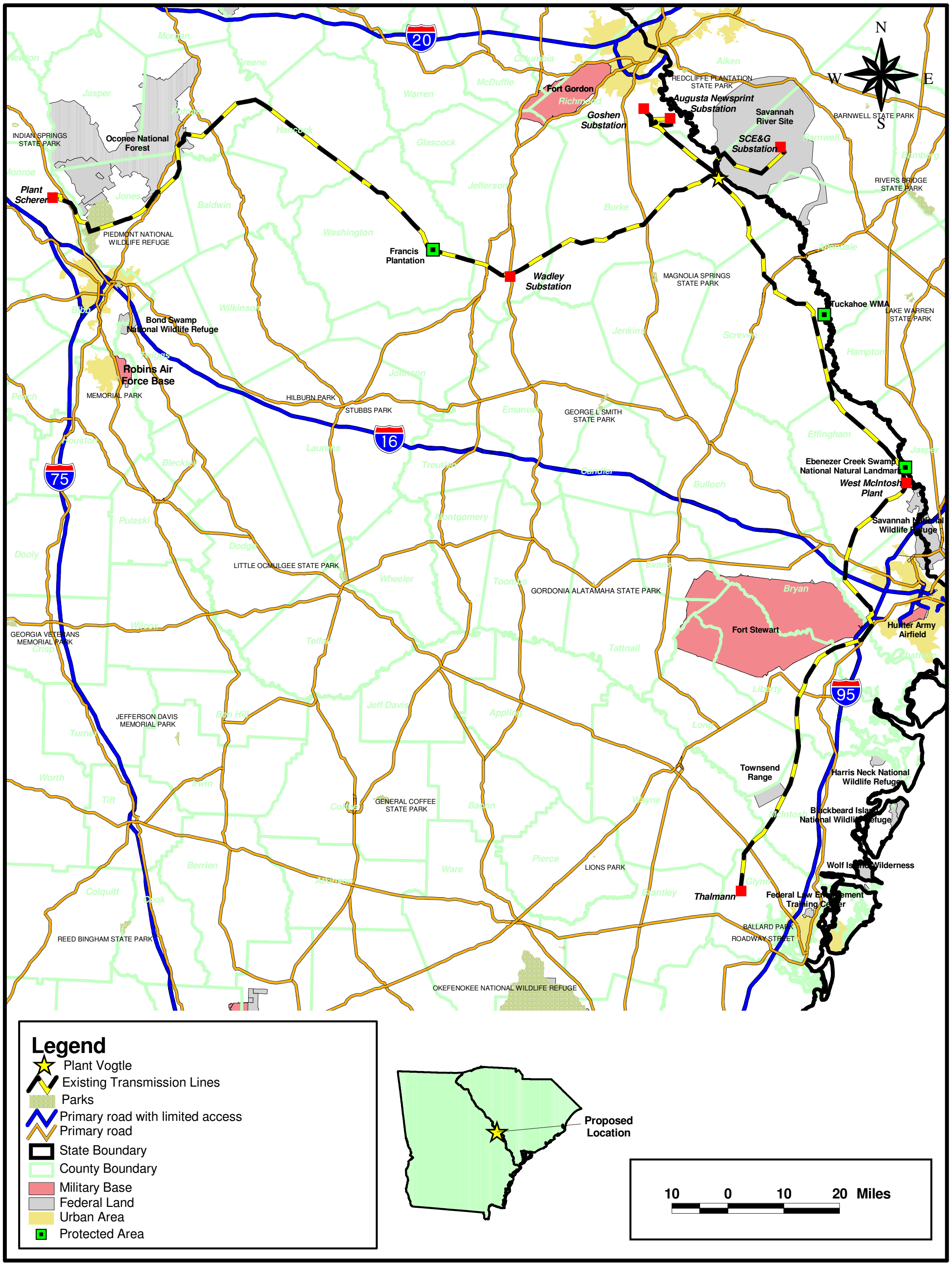

Figure 2.2-3 Existing Transmission System

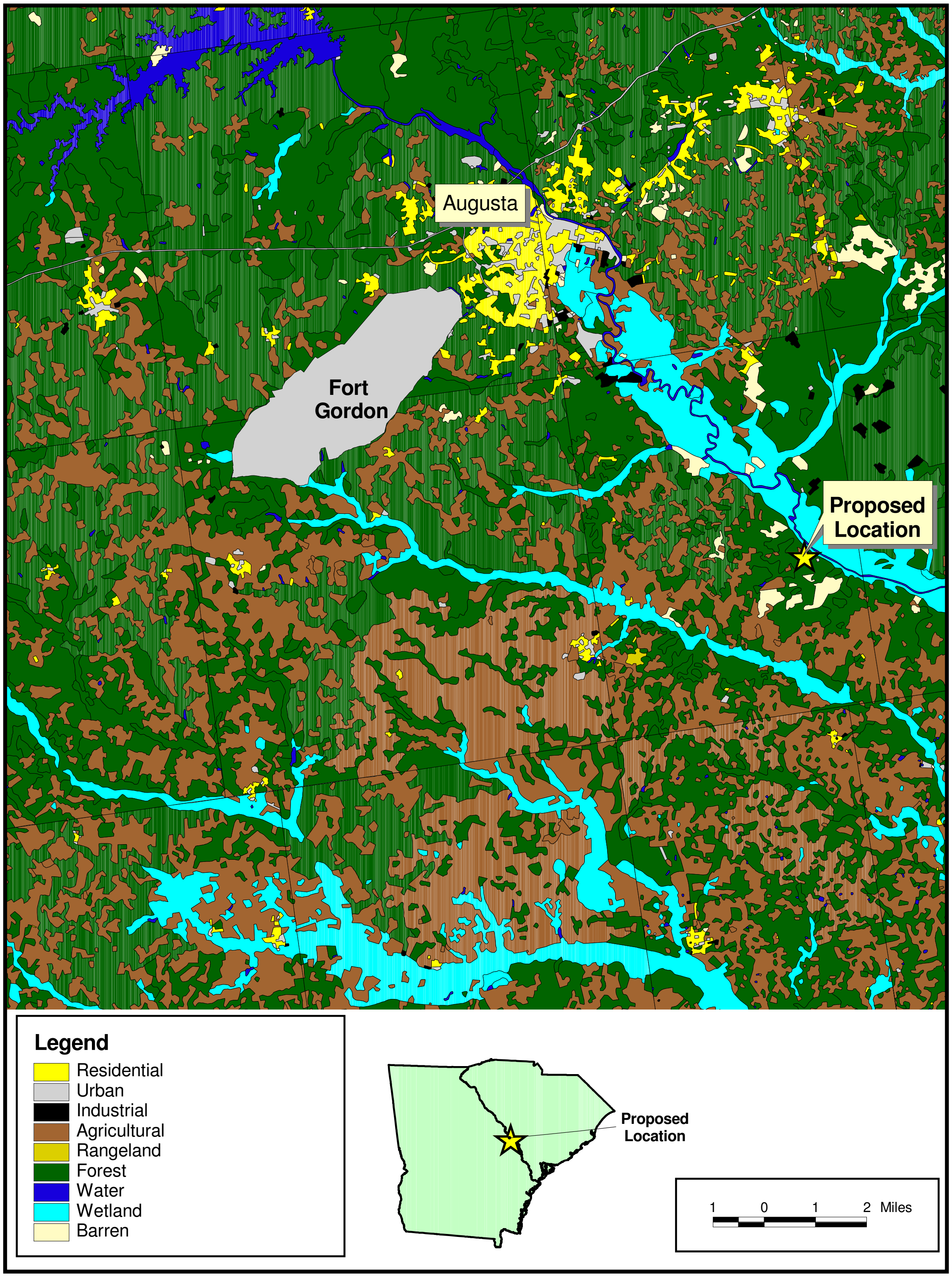

Figure 2.2-4 Land use in Proposed Corridor

Section 2.2 References

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2.3 Water

This section describes the physical and hydrological characteristics of the VEGP site and surrounding region that could affect or be affected by the construction and operation of two new AP1000 units at the VEGP site. The new units will be referred to as VEGP Units 3 and 4. The potential construction and operational impacts of the project on near- and far-field water resources are discussed in Chapters 4 and 5, respectively.

The 3,169-acre VEGP site is located high on a coastal plain bluff on the west bank of the Savannah River in eastern Burke County Georgia. The new AP1000 units will be located approximately 220 feet above mean sea level (msl). This site is located at River Mile 151; approximately 30 river miles upstream of the U.S. Highway 301 Bridge and directly across the river from the Department of Energy's Savannah River Site (Barnwell, South Carolina). It is approximately 26 miles southeast of Augusta, Georgia.

2.3.1 Hydrology

This section describes surface water bodies and groundwater resources that could be affected by the construction and operation of VEGP Units 3 and 4. The site-specific and regional data on the physical and hydrologic characteristics of these water resources are summarized in the following sections.

2.3.1.1 Surface Water Resources

The watershed of the Savannah River extends into the mountains of North Carolina, South Carolina, and Georgia near Ellicott Rock, the point where the borders of those three states meet. The river system drains a basin of 10,577 sq mi, divided between the three states as follows **(SR 2006)**:

- 4,581 sq mi in South Carolina
- 5,821 sq mi in Georgia
- 175 sq mi in North Carolina

Within the three states, the Savannah River basin includes portions of 44 counties and two major metropolitan centers, Augusta and Savannah. The lower 50-mi reach of the river is tidally influenced **(USACE 1996)**.

The Savannah River watershed and sub-basins, as delineated by the National Weather Service **(NWS 2005)** and further subdivided by USGS Hydrologic Unit Code (HUC-12) sub-basins **(USGS 2006f)**, are shown in Figure 2.3.1-1. The drainage areas of the NWS sub-basins are given in Table 2.3.1-1.

The watershed crosses through three distinct physiographic provinces: the Mountain, Piedmont, and Coastal Plain. The Mountain and Piedmont provinces are within the Appalachian Mountain range, with the border between them extending from northeast to southwest, crossing the

Tallulah River at Tallulah Falls. The Fall Line, or division between the Piedmont province and the Coastal Plain province, also crosses the basin in a generally northeast to southwest direction, near Augusta, Georgia **(USACE 1996)**.

Watershed elevations range from 5,030 ft msl at Little Bald Peak in North Carolina, to sea level at Savannah. The approximate range of elevations for each physiographic region is **(USACE 1996)**:

- 5,030 to 1,800 ft msl within the Mountain province
- 1,800 to 500 ft msl within the Piedmont province
- 500 to 0 ft msl within the Coastal Plain province

The Savannah River, together with certain of its tributaries, forms the border between the states of Georgia and South Carolina. The confluence of the Seneca and Tugaloo rivers, formerly known as "The Forks" but now inundated by Hartwell Lake, marks the upstream end of the Savannah River. The length of the Savannah River from The Forks to its mouth on the Atlantic Ocean is about 312 mi **(USACE 1996)**.

The following principal streams make up the Savannah River stream system **(USACE 1996)**:

- The Tallulah and Chatooga Rivers combine to form the Tugaloo River at River Mile 358.1
- Twelve Mile Creek and the Keowee River join to form the Seneca River at River Mile 338.5.
- The Tugaloo and Seneca rivers join to form the Savannah River proper at River Mile 312.1, at the point known as The Forks.

The entire 312-mi length of the Savannah River is regulated by a series of three U.S. Army Corps of Engineers (USACE) multipurpose projects, forming a chain along the Georgia–South Carolina border 120 mi long. The three lakes, from upstream to downstream, are:

- Hartwell Lake and Dam, with 2,550,000 acre-feet of gross storage
- Richard B. Russell Lake and Dam, with 1,026,000 acre-feet of gross storage
- J. Strom Thurmond (also known as Clarks Hill) Lake and Dam, with 2,510,000 acre-feet of gross storage

Of the 6,144 sq mi drainage basin above Thurmond Dam, 3,244 sq mi (53 percent) are between Thurmond and Russell Dams, 812 sq mi (13 percent) are between Russell and Hartwell Dams, and 2,088 sq mi (34 percent) are above the Hartwell Dam **(USACE 1996)**. Table 2.3.1-2 is a list of key natural and man-made landmarks along the Savannah River with the distance in river miles upstream of the mouth of Savannah Harbor noted.

The climate in the upper Savannah River watershed is classified as temperate, with generally mild winters and long summers. The basin is protected by the Blue Ridge Mountains from the extremes of winter continental weather experienced in the adjacent Tennessee Valley. The annual mean temperature for the basin is 60°F. January, which is usually the coldest month of the year, frequently has night temperatures of 20°F or lower. July and August, the hottest months of the year, have many days with temperatures over 90°F. In the lower section of the basin, the winters are milder and the summer temperatures higher **(USACE 1996)**.

There are generally two periods of maximum rainfall in the upper basin: February–March and July–August, although heavy rainfall has occurred in practically every month. The mean annual precipitation decreases from 83.5 in. at the upper end of the watershed, near Highlands, North Carolina, down to 49.2 in. at Savannah, Georgia **(USACE 1996)**.

2.3.1.1.1 USGS Topographic Maps

USGS seven-and-one-half-minute topographic maps are available for the entire Savannah River watershed. The river miles upstream of the mouth of the Savannah River are marked off along the stream centerline on each of the quadrangles photo-revised in 1989.

Figure 2.3.1-2 provides an index map showing an identification number and the outline of each USGS quadrangle superimposed on a line map of the Savannah River watershed. The name and map identification number of each quadrangle is listed with its reference coordinates (latitude and longitude of the lower right hand corner of the quadrangle) in Table 2.3.1-3, ordered from upper left to lower right throughout the coverage area.

2.3.1.1.2 Local Site Drainage

The VEGP site is bordered on the east by the Savannah River and by Beaverdam Creek to the south. The Savannah River Plant Site (SRS) is located directly across the river to the east.

Local drainage is shown in Figure 2.3.1-3, which was developed from the Shell Bluff Landing, Girard NW, Alexander, and Girard USGS quadrangle sheets (see Figure 2.3.1-2 and Table 2.3.1-3). The site is on a high, steep bluff on the west bank of the Savannah River. State Road 23 (River Road) runs roughly parallel to the river, about 4 miles from the VEGP site. It runs along the ridge line that separates local drainage running northeast to the river from runoff draining generally to the southwest.

An unnamed, highly incised creek drains the area of the site north of River Road into the Savannah River just upstream of the site, at the point denominated Hancock Landing on the USGS quadrangle Shell Bluff Landing.

To the west, the site is drained by the Red Branch and Daniels Branch, which join with Beaverdam Creek just upstream of Telfair Pond, south of the site. Beaverdam Creek intercepts three streams draining runoff from north of State Road 23 before it reaches the site. The names, estimated channel lengths, and slopes of the natural channels draining the VEGP site area are provided in Table 2.3.1-4.

2.3.1.1.3 Savannah River Flow Series Data

The USGS maintains stream flow records for nine stream gages on the Savannah River between River Miles 288.9 and 60.9, upstream and downstream of the VEGP site. A tenth gage was recently installed at the VEGP intake at Waynesboro, Georgia (Gage 21973269), but the period of record is too short to support statistical analysis. The location, datum elevation, upstream drainage area, start and stop date, and number of flow records for each of the ten gages are presented in Table 2.3.1-5.

As indicated in Table 2.3.1-5, the nearest USGS gage upstream of the VEGP site with a significant period of record is Gage 2197320, near Jackson, South Carolina (5.9 River Miles upstream); the nearest gage downstream of the VEGP site is Gage 2197500 at Burtons Ferry near Millhaven, Georgia (about 39 River Miles downstream of the site). While the Jackson gage is less than 6 mi upstream of the site, the record length for Gage 2197000, at Augusta, Georgia (48.7 River Miles upstream) is much longer, making it desirable to evaluate all three sets of records.

A number of statistics are presented in this section for flow data on these three gages to facilitate the evaluation of the water supply and flood hazard characteristics of the site, including:

- Average daily and monthly flow series
- Low flow series
- Historic flooding and analytical annual peak flood frequencies

After 1952, flows on the Savannah River at the three gage sites, were impacted by regulation from upstream reservoirs: J. Strom Thurmond (a.k.a. Clarks Hill) Lake and Dam in 1952, Hartwell Lake and Dam in 1961, and Richard B. Russell Lake and Dam in 1984 **(USACE 1996)**. The records for the Augusta, Georgia and Burtons Ferry gages include regulated and unregulated periods. The entire length of record for the Jackson, South Carolina, gage occurs after closure of upstream dams and is, in that sense, homogenous. In this subsection, stream flow statistics for each of the gages is presented as necessary for both the regulated and the unregulated period, as detailed in the text.

2.3.1.1.3.1 Annual Average Daily and Mean Daily Flow Series

Table 2.3.1-6 **(USGS 2006c)** presents the mean daily flow for each day of the year for the Savannah River at Augusta, Georgia, based on the entire 98-year gage record, without respect to upstream regulation after 1952.

Table 2.3.1-7 **(USGS 2006d)** presents the mean daily flow for each day of the year for the Savannah River near Jackson, South Carolina, based on the entire 31-year (regulated) gage record.

Table 2.3.1-8 **(USGS 2006g)** presents the mean daily flow for each day of the year for the Savannah River at Burtons Ferry, near Millhaven, Georgia, based on the entire 52-year gage record, without respect to upstream regulation after 1952.

The mean daily flow series for each of these gages are plotted together in Figure 2.3.1-4. For all sites, the mean daily flow exhibits a strong seasonality, with higher mean flows in the winter season and lower mean flows in the summer.

Additionally, the figure gives a qualitative indication of the impact of upstream regulation on flow: daily mean values at Jackson, South Carolina, are based on a fully regulated period of record, while the daily mean values for the Augusta and Burtons Ferry gages are based on periods of record that include substantial periods prior to the completion of the upstream dams; as a consequence, these gages show a substantially higher mean daily flow in the winter season compared with the Jackson mean flows based on records during the regulated period only. Taking mean daily flows for only the unregulated period of record exacerbates this difference.

In addition to the mean daily flows for each day of the year, the USGS publishes statistics on the annual mean flow, which provide a lumped annual statistic masking all seasonality.

Table 2.3.1-9 **(USGS 2006c; USGS 2006g)** presents the annual mean stream flow for the periods of record at Augusta, Georgia, and Burtons Ferry. Data are not presented for the Jackson, South Carolina and Waynesboro, Georgia (VEGP intake) gages because of insufficient record length.

2.3.1.1.3.2 Monthly Flow Series

Table 2.3.1-10 **(USGS 2006d)** presents mean daily discharges by month for the Savannah River at Jackson, South Carolina, for the period of record between 1971 and 2002. A number of “holes” in the USGS series occur where a sufficient number of daily readings were not available to make meaningful monthly averages.

Table 2.3.1-11 **(USGS 2006c)** presents mean daily discharges by month for the Savannah River at Augusta, Georgia, upstream of the VEGP site, for the period of record between 1883 and 2003.

Table 2.3.1-12 **(USGS 2006g)** presents mean daily discharges by month for the Savannah River at Burtons Ferry, near Millhaven, Georgia, downstream of the VEGP site, for the period of record between 1939 and 2003.

Mean daily flows for the Jackson, Augusta, and Burtons Ferry gage sites for each month are provided in Table 2.3.1-13.

Figure 2.3.1-5 provides a plot of the seasonal variation in mean daily flows for each month on the Savannah River between Augusta, Georgia, for the full-period and regulated periods, and Jackson, South Carolina, for the full, regulated period. It can be inferred from the plot that the operation of the upstream dams has had a significant impact on the mean daily flow for each month in the period from January to May, inclusively.

2.3.1.1.3.3 Low Flow Series

Flow duration curves are developed by ranking the recorded mean daily flows for the period of record to estimate the percentage of days that a flow of a given value is equaled or exceeded. Flow duration curves for the Savannah River at Augusta, Georgia, for the entire period of record (1883 to 2003) and the period after closure of the three upstream dams (1984 to 2003) are presented in Figure 2.3.1-6. As would be expected, the curves indicate that regulation has increased minimum daily flows and has reduced maximum daily flow on the Savannah River downstream.

The n-day low flow for a stream is the mean flow measured during the n consecutive days of lowest flow during any given year. It is customary to group the mean daily flow data into low-flow years (defined from April 1 to March 31 in North America) to prevent splitting the low-flow season into two parts for each year. The 7-day, 10-year low flow statistic, 7Q10, is an estimate of the lowest mean flow that would be experienced during a consecutive 7-day period with an average recurrence interval of 10 years, and is used as an indicator of low flow conditions during drought periods **(McMahon and Mein 1986)**.

Table 2.3.1-14 shows the 3-, 7-, 10-, 30-, 60-, 90-, 183-, and 365-day mean low flows for each year of record for the Savannah River gage at Augusta (Gage 2197000) as determined from the daily flow data for the low-flow years between 1986 and 2003, the available period of continuous upstream regulation, using the USGS program SWSTAT **(USGS 1994)**.

The 7-day low flow data for each complete low-flow year in the regulated period was used to estimate 7-day low flow frequency based on a Log-Pearson Type III (LP3) distribution, from which the 7Q10 low flow parameter is estimated as 3,828 cfs (see Table 2.3.1-15). The assumption of an LP3 distribution provides a good fit of the calculated 7-day low flows, as indicated in Figure 2.3.1-7.

2.3.1.1.3.4 Historic Flooding and Annual Peak Flood Frequencies

Table 2.3.1-16 **(USGS 2006c)** provides the date, stage elevation, and annual peak discharge for the entire period of record for USGS Gage 02197000 on the Savannah River at Augusta, Georgia, approximately 48.7 River Miles upstream of the VEGP site. The annual peak floods include estimated values from historic floods reported in 1796, 1840, 1852, 1864, and 1865.

The maximum annual peak flood discharge for the period of record is 350,000 cfs, from the storm of October 2, 1929. The storm of January 17, 1796, estimated from reported stages using slope-conveyance methods, is the oldest event used to extend the record length. The estimated value of the peak flow for this storm ranges between 280,000 cfs for a reported stage of 38 ft **(USGS 2006c)** and 360,000 cfs for a reported maximum flood stage of 40 ft **(USGS 1990a)**. This puts the maximum flood elevation of the Savannah River at Augusta, Georgia, for the historic period between 134.6 and 136.6 ft msl, based on an El. 96.58 ft msl for the Augusta, Georgia, stream gage datum (see Table 2.3.1-5).

After 1952, annual peaks on the Savannah River at Augusta, Georgia, are attenuated by regulation from upstream reservoirs: J. Strom Thurmond (a.k.a. Clarks Hill) Lake and Dam in 1952, Hartwell Lake and Dam in 1961, and Richard B. Russell Lake and Dam in 1984 **(USACE 1996)**. This attenuation of floods is shown in Figure 2.3.1-8 **(USGS 1990a)**, which is based on the historic record from 1796 to 1985.

Annual peak flood frequency curves for regulated and unregulated conditions for the Savannah River at Augusta, Georgia, were developed for the period between 1796 and 1985 and are presented in Figure 2.3.1-9 **(USGS 1990a)**. Unregulated annual peak discharge values for the period after 1952 and regulated annual peak discharge values for the years previous to 1952 were generated by modeling reservoir operation based on the stage-storage-discharge characteristics reported for the three projects, using the 1990 operating rule set for the entire period **(USGS 1990a)**.

Figure 2.3.1-9 clearly shows the convergence of the regulated and unregulated annual flood frequency plots as discharge increases. On the left-hand side of the graph, for the 80 percent chance-of-exceedence event (a return period of 1.25 years), the unregulated peak discharge exceeds the regulated peak by a factor of about 2.14; on the left-hand side, for the 0.2 percent chance-of-exceedence event (a return period of 500 years), the unregulated peak discharge exceeds the regulated peak by a factor of about 1.29. On this basis, regulation would not be expected to significantly affect the probable maximum flood on the Savannah River downstream of Augusta, provided that the upstream dams do not fail.

2.3.1.1.4 Dams and Reservoirs

There are a number of water control structures on the Savannah River and its major tributaries, as identified in **USGS (1990a)** and **USACE (1996)**. Table 2.3.1-17 presents a list of these structures with hydraulic design information for each project and identification of its location with respect to the VEGP site.

Three projects operated by the Corps of Engineers upstream of the VEGP site have a significant influence on the discharge of the Savannah River:

- Hartwell Lake and Dam, with 2,550,000 acre-feet of gross storage
- Richard Russell Lake and Dam, with 1,026,000 acre-feet of gross storage
- J. Strom Thurmond Lake and Dam, with 2,510,000 acre-feet of gross storage

The authorized water management goals of the three-dam, multiuse project are specified for normal operation, flood operation, and drought condition operation in the Corps Water Control Plan as follows:

- For normal conditions, the operation policy is designed to maximize the public benefits of hydroelectric power, flood damage reduction, recreation, fish and wildlife, water supply, and water quality **(USACE 1996)**.
- Under flood conditions, the water management objective is to operate the reservoir system to minimize flooding downstream by timing turbine discharge, gate openings, and spillway discharge as required.
- For drought conditions, the water management objectives of the project are:
  - To prevent draw-down of lake levels below the bottom of the conservation pool
  - To make use of most of the available storage in the lake during the drought-of-record
  - To maintain hydroelectric plant capacity throughout the drought
  - To minimize adverse impacts to recreation during the recreation season (generally considered from May 1 through Labor Day)

The Corps also operates the New Savannah Bluff Lock and Dam, 36.8 River Miles upstream of the VEGP site. This project has very little impact on flows at the site, due to its run-of-river status and negligible storage volume **(USACE 1996)**.

The four projects are described briefly in the following paragraphs **(USACE 1996)**.

The Hartwell Lake and Dam is located at River Mile 288.9, 7 mi east of Hartwell, Georgia, and 138 River Miles upstream of the VEGP site. The top of the conservation pool is set at El. 660 ft msl. At this level, the reservoir extends 49 mi up the Tugaloo River in Georgia and 45 mi up the Seneca and Keowee rivers in South Carolina. The shoreline at El. 660 ft msl is about 962 mi long, excluding island areas. The project became operational in 1965.

The reservoir has a total storage capacity of 2,550,000 acre-feet below El. 660 ft msl, and 293,000 acre-feet of flood control storage between El. 660 ft msl and El. 665 ft msl. The dam consists of a concrete gravity section, which is 1,900 ft long and rises about 204 ft above the streambed, and two earth embankment sections extending to high ground on the Georgia and South Carolina shores of the river, for a total length of 17,880 ft.

The Richard B. Russell Lake and Dam is located at River Mile 259.1 in Elbert County, Georgia, and Abbeville County, South Carolina, 108.2 River Miles upstream of the VEGP site. The dam is 18 mi southwest of Elberton, Georgia; 4 mi southwest of Calhoun Falls, South Carolina; and 40 mi northeast of Athens, Georgia. Operation of the project began in 1985.

The top of the conservation pool is set at El. 475 ft msl, at which elevation the reservoir has a total storage volume of about 1,026,000 acre-feet and a useable storage capacity of 126,800 acre-feet. The flood control pool provides about 140,000 acre-feet of additional storage between elevations 475 and 480 ft msl.

The dam consists of a concrete gravity section, which is 1,883.5 ft long, and two earth embankment sections, 2,180 ft long in Georgia and 460 ft long in South Carolina. A concrete overflow spillway section is located in what was formerly the stream channel. It has an ogee-shaped crest controlled by 10 tainter gates.

The J. Strom Thurmond Lake and Dam (also known as the Clarks Hill Lake and Dam) is at River Mile 221.6 on the Savannah River, 22 mi upstream of Augusta, Georgia, and 70.7 River Miles upstream of the VEGP site. The project became operational in 1952. The reservoir at the top of the flood control pool, El. 335 ft msl, has an area of 78,500 acres. At El. 330 ft msl, the top of the conservation pool, the reservoir extends about 40 mi up the Savannah River and about 30 mi up the Little River in Georgia and has about 1,050 mi of shoreline, excluding island areas.

The reservoir has a total storage capacity of 2,510,000 acre-feet below El. 330 ft msl, with an additional 390,000 acre-feet of flood control storage between El. 330 ft msl and El. 335 ft msl. The dam consists of a concrete gravity section, which is 2282 feet long, and two earth embankment sections extending to high ground on the Georgia and South Carolina shores, with at total length of 5680 feet,

The New Savannah Bluff Lock and Dam is at River Mile 187.7, 36.8 river miles upstream of the VEGP site. The structure is located on the Savannah River about 13 mi below Augusta. It is a concrete dam 360 ft long containing five vertical-lift crest control gates. The lock chamber, located on the Georgia side of the river, is 56 ft by 360 ft and is closed by miter gates. The lift is 15 ft. The normal pool elevation is about 115.0 ft msl. The dam was originally constructed to provide a lock to support navigation to Augusta, Georgia. Currently it is used primarily to re-regulate upstream releases for downstream water supply withdrawals.

In 2000, the Savannah District Corps of Engineers issued a Disposition Study under Section 216 of the Flood Control Act of 1970 to examine the current uses of the New Savannah Bluff Lock and Dam and recommend disposition for the future. The study concluded that the only feasible option was to remove the dam. This result was met with vehement opposition by property owners, water supply, recreational interests and in 2005 a decision was made to repair the lock chamber and keep the dam in service. This decision has no significant impact on existing or proposed units at VEGP.

2.3.1.1.5 Estimated Erosion Characteristics

Bank erosion caused by wave action has been measured in the reservoirs upstream of the VEGP site **(Hoke 2000)**, but no references to measurements of river cross-sections to assess bank erosion along the middle reaches of the Savannah River or at the site were found in the literature.

A number of meanders are a feature of the plan-form of the middle reaches of the Savannah River, but the river near the site has a relatively straight and stable reach extending approximately from River Mile 143 to River Mile 152. A comparison of river bank-lines along this reach between 1965 and 1989, obtained from USGS topographic maps **(USGS 1989a; USGS**

1989b; USGS 1989d) and topographic maps used for VEGP Units 1 and 2 shows a nearly unchanged river plan-form.

Hale and Jackson (2003) describe how dredging for navigation has altered the hydrology and geomorphology of the Savannah River over the past century. They present a table of 40 cut-offs constructed on the lower Savannah River between 1889 and 1962 that had the cumulative effect of reducing stream length by a total of 26.5 miles. Each of these cut-offs will have had some impact on local channel conditions and sediment transport due to change in bed slope.

According to their table, the 4,350-foot Cox Point cut-off at River Mile 153.2 (about 2.3 miles upstream of the Vogtle site) was completed in 1959. The cutoff is visible on the Shell Bluff Landing 1:24,000-scale USGS topographic map.

It can be inferred from the alignment of the channel shown on the map, which is based on aerial photography from 1965 with photorevisons from 1989, that the stability of the Savannah River channel section at the VEGP site does not appear to have been adversely affected by the cut-off, as would be expected for the relatively short length of the cut-off and the mild gradient of the reach.

In general, channel straightening of the type affected by the Cox Point cutoff will cause a local reduction in water level and an increase in velocity, so that the small creeks that are tributary to the reach may experience increased gradients causing scour and head cutting **(USDOT, 1977)**. No evidence of such impacts is noticeable at the scale of the available mapping, however.

2.3.1.1.6 Sediment Transport Rates

A search of the literature shows that there have been a number of studies of sediment transport on the Savannah River within the piedmont physiographic region, resulting from requirements to establish Total Maximum Daily Loads for the E.P.A. **(**i.e. **EPA 1999, Keyes and Radcliffe, 2002, Freshley, 2003)**. There have also been a number of studies of sedimentation in Savannah Harbor **(Goodrich, Way, and Liu 2003; Semmes et al 2003; Phillips and Slattery 2006)**. Sedimentation rates resulting from these studies, where available, are not directly applicable at the study site within the coastal plain physiographic region because of the different bed slopes and stream power typical of each physiographic region.

There have been very few studies of sedimentation on the Savannah River near the site because sedimentation has not been considered a critical environmental issue in the coastal plain below the Corps's three-dam reservoir project, where the Vogtle site is located. According to the Savannah District of the U.S. Army Corps of Engineers **(USACE 1996)**:

> *The problem of sediment in the Savannah River Basin has been greatly reduced since the early 1900's by the conversion of much former cropland to silviculture and pasture. Cotton farming, considered a highly erosive land use, has greatly declined during this century in central Georgia and western South Carolina. The combination of agricultural decline, transition of cropland to timber and pasture, and widespread implementation of soil conservation practices have resulted in lessened stream sediment loads. Deposits of silt in the reservoirs and channel retrogression below the dams are not major problems.*

Duncan and EuDaly (2003) discuss the possibility that the reduced variation in discharge downstream of the dams since closure has lead to accumulations of silt with an adverse impact on fish habitats in the shoals, but they present no measurements or quantitative estimates of sedimentation rates.

2.3.1.1.6.1 Suspended Load Transport Rates

Table 2.3.1-24 summarizes the availability of water quality data for the USGS gages on the Savannah River. There is no bed-load measurement information, and, of the 23 gage stations listed as having water quality data, only 2 have data on suspended load transport rates and only the gage at Clyo is in the coastal plain reach **(USGS 2006h)**.

While water quality data for the Savannah River at Clyo, Georgia (2198500) includes entries from 1938 to the present, only 97 records of suspended sediment load measurement between 1974 and 1983 are reported (as time-weighted daily mean values).

These data points are listed in Table 2.3.1-25 and are plotted in Figure 2.3.1-28 against the average daily discharge recorded for those days. There is only a slight correlation between average daily discharge in cubic feet per second and suspended sediment load in tons per day, so the suspended load data time series cannot be extended with much reliability.

There are gages on the Savannah River nearer to the site than Clyo for which turbidity measurements are available, offering the possibility of estimating suspended sediment loads from a correlation with turbidity measurements, but no statistically significant relation was discerned between turbidity measurements and average daily suspended sediment discharge for these data sets.

The 97 reported measurements of daily suspended sediment loads were sorted to permit the calculation of monthly statistics, as summarized in Table 2.3.1-26 and plotted in Figure 2.3.1-28. The data shows some seasonality, but because the relationship between discharge and suspended load is not strong, the seasonality is not pronounced.

Based on the assumption that the suspended sediment load at Clyo is not significantly different from the load at the Vogtle site, 90 miles upstream, the monthly average suspended load at the site will range between 200 and 1,600 tons per day with a 95 percent probability.

2.3.1.1.6.2 Bed Load Sediment Transport Rates

No bed-load sediment transport measurements have been reported for any reach of the Savannah River and cannot be easily estimated as a fraction of the suspended load because the portion of sediment that moves as bed load varies widely between rivers and on the same river over time **(Keyes & Radcliffe 2002)**. However, to obtain an order-of-magnitude estimate, the globally averaged ratio of suspended load to bed load sediment flux for rivers of 9:1 reported by Syvitski et al. (2003) can be used. For the suspended load range of 320 to 880 tons per year calculated from the data at Clyo, Georgia, this would indicate a range for bed load transport of between about 35 and 100 tons per day.

2.3.1.2 Groundwater Resources

The VEGP site lies within the Coastal Plain Physiographic Province. The site is underlain by approximately 1,000 ft of Coastal Plain sediments. The hydrogeologic conditions within the Coastal Plain sediments can be summarized as permeable coarse-grained materials separated by less-permeable fine-grained materials, resulting in a multiple aquifer system.

2.3.1.2.1 Regional Hydrogeology

The region within a 200-mi radius around the VEGP site encompasses parts of four physiographic provinces. These include, from northwest to southeast, the Valley and Ridge, Blue Ridge, Piedmont, and Coastal Plain Physiographic Provinces. Several major aquifers or aquifer systems are present within these physiographic provinces. Figure 2.3.1-10 illustrates the extent of these major aquifers or aquifer systems at the land surface. The VEGP site and associated groundwater are located within the Coastal Plain Physiographic Province. However, groundwater within the other provinces is discussed below to provide a complete picture of regional hydrogeologic conditions.

The Valley and Ridge Physiographic Province lies about 180 mi northwest of the VEGP site. Aquifers underlying the Valley and Ridge province occur within Paleozoic-age folded and faulted sedimentary rock. The sedimentary strata consist predominantly of sandstone, shale, and limestone, with minor amounts of dolomite, conglomerate, chert, and coal. The carbonate and sandstone layers form the principal aquifers in the province. Typical well yields are from 10 gpm in sandstone formations to 10 to 50 gpm within the limestone units. Locally high yields, equal to 100 gpm or greater, are possible within highly fractured strata or solution cavities. Localized weathered rock and alluvium can provide lesser, but adequate, groundwater yields for domestic use. **(Miller 1990)**

The Piedmont and Blue Ridge Physiographic Provinces are hydrologically similar in nature. Both provinces are composed primarily of metamorphic and igneous rocks. Surface materials in the Blue Ridge Province consist mainly of thin residual soils, alluvium, and colluvium. Surface materials in the Piedmont Province consist generally of more deeply weathered residual soils (saprolite) and alluvium. Groundwater occurs both in the fractured portions of bedrock and within the saprolite and alluvium material. Well yields generally depend on the local fracture density and fracture connectivity of the bedrock and range from a few to 30 gpm. Localized groundwater well yields of 100 gpm or greater are possible. **(Miller 1990)**

The majority of Georgia's groundwater use occurs in the Coastal Plain Physiographic Province. The Coastal Plain sediments are thin, less than 200 ft thick, along the western boundary of the province (where they terminate at the contact with the Piedmont province, the Fall Line) and thicken to over 4,000 ft in an eastern-to-southeastern direction. The sediments range in age from Holocene to Cretaceous and overlie crystalline igneous and metamorphic bedrock, which is an eastward extension of the Piedmont province **(Miller 1990)**.

Groundwater in the Coastal Plain is withdrawn from both unconfined, shallow aquifer systems and deeper, confined aquifer systems. These aquifers are recharged principally from their outcrop area along the western boundary of the province near the Fall Line and from localized infiltration of precipitation within the province. Precipitation migrates downward and laterally through the unconsolidated surficial materials and discharges to nearby streams and low areas or percolates downward into the deeper unconsolidated and consolidated material. The thickness and areal extent of the Coastal Plain sediments result in a storage capacity for groundwater that exceeds that of any other physiographic provinces in Georgia **(Miller 1990)**.

2.3.1.2.1.1 Conceptual Model Description

The conceptual hydrogeological model for the VEGP site was developed using site-specific data acquired to support the ESP application, information and data included in the VEGP Updated Final Safety Analysis Report (UFSAR), U.S Geological Survey studies, and Georgia Geologic Survey studies.

As discussed above, the VEGP site is located in the Coastal Plain physiographic province. Coastal Plain sediments comprise three aquifer systems consisting of seven aquifers that are separated hydraulically by confining units. As presented by Clarke and West (1997), the aquifer systems are, in descending order: (1) the Floridan aquifer system, which consists of the Upper Three Runs and Gordon aquifers in sediments of Eocene age; (2) the Dublin aquifer system, consisting of the Millers Pond, upper Dublin, and lower Dublin of Paleocene-Late Cretaceous age; and (3) the Midville aquifer system, consisting of the upper Midville and lower Midville aquifers in sediments of Late Cretaceous age. Note that nomenclature used by the U.S. Geological Survey **(Clarke and West 1997)** for geologic and hydrogeologic units differs from that used in this ESP application. In this ESP application, the Water Table aquifer comprises the Upper Three Runs aquifer, the Tertiary sand aquifer comprises the Gordon aquifer, and the Cretaceous aquifer comprises the Dublin and Midville aquifers. Figure 2.3.1-11 and Figure 4 of Clarke and West (1997) provide additional details.

The Upper Three Runs aquifer is the shallowest aquifer and is unconfined-to-semi-confined throughout most of the area. Groundwater levels in the Upper Three Runs aquifer respond to a local flow system and are affected mostly by topography and climate. Groundwater flow in the deeper, Gordon aquifer and Dublin and Midville aquifer systems is characterized by local flow near outcrop areas to the northwest, changing to intermediate flow and then regional flow downdip (southeastward) as the aquifers become more deeply buried. Water levels in these deeper aquifers show a pronounced response to topography and climate in the vicinity of outcrops that diminishes southeastward where the aquifer is more deeply buried. Stream stage and pumpage affect groundwater levels in these deeper aquifers to varying degrees throughout the area. **(Clarke and West 1997)**

The geologic characteristics of the Savannah River alluvial valley substantially control the configuration of potentiometric surfaces, groundwater flow directions, and stream-aquifer relations. Data from 18 shallow borings **(Leeth and Nagle 1996)** indicate incision into each aquifer by the paleo Savannah River and subsequent infill by permeable alluvium have resulted in direct hydraulic connection between the aquifers and the Savannah River along various parts of its reach. This hydraulic connection may be the cause of large groundwater discharge to the river near Jackson, South Carolina, as evidenced by stream baseflow and potentiometric measurements, where the Gordon aquifer is in contact with Savannah River alluvium, and also the cause of lows or depressions in potentiometric surfaces of confined aquifers that are in contact with the alluvium. Groundwater in these aquifers flows toward the depressions. The influence of the river diminishes downstream where the aquifers become deeply buried beneath the river channel, and where upstream and downstream groundwater flow is possibly separated by a water divide or "saddle." Water-level data indicate that saddle features probably exist in the Gordon aquifer and Dublin aquifer system, with the groundwater divide occurring just downstream of the VEGP site, and also might be present in the Midville aquifer system. **(Clarke and West 1997)**.

Basin-wide potentiometric-surface maps for the unconfined Upper Three Runs aquifer and confined Gordon, Dublin, and Midville aquifer systems have been prepared using historical data **(Clarke and West 1997)** and numerical simulation **(Cherry 2006)**. Detailed discussions of these maps are provided in the cited references. Data from observation wells installed and monitored for an 18-month period at the VEGP site have also been used to develop potentiometric-surface maps on a more highly resolved, site-specific basis. These maps are discussed in detail in Section 2.3.1.2.3. The groundwater flow directions inferred from these maps are generally consistent with the larger-scale maps produced by Clarke and West (1997) and Cherry (2006), i.e., groundwater flow in the Upper Three Runs (Water Table) aquifer generally conforms with surface topography, while that in the confined Gordon (Tertiary) aquifer is toward the Savannah River.

Recharge to the Upper Three Runs (Water Table) aquifer is almost exclusively by precipitation, while discharge is primarily to local drainages. Recharge to the confined Gordon, Dublin, and

Midville (Tertiary and Cretaceous) aquifers occurs primarily by direct infiltration of rainfall in their outcrop areas northwest of the VEGP site that are generally parallel to the Fall Line (the boundary between the Coastal Plain and Piedmont physiographic provinces). Because the permeable alluvium of the Savannah River valley allows for direct hydraulic connection between aquifers and the Savannah River, the river serves as the major discharge area for the confined aquifers in hydraulic connection with the river valley alluvium. Potentiometric maps presented by Clarke and West (1997) indicate groundwater discharge from the confined Gordon, Dublin, and Midville aquifers to the Savannah River. For the shallower Gordon confined aquifer, groundwater flow directions are generally perpendicular to the river reach. In the case of the deeper Dublin and Midville aquifers, there are upriver components to the groundwater flow directions that depend on where the paleo river channel has breached confining units. Clarke and West (1997) provide a detailed discussion of this phenomenon.

Although a water budget for the VEGP site has not been quantified, recharge and discharge rates have been estimated on a basin-wide basis by other investigators. Clarke and West (1997) estimated groundwater discharge to the Savannah River based on the net gain in stream discharge for local, intermediate, and regional groundwater flow systems and for different hydrologic conditions. Groundwater discharge ranged from 910 ft^3/s during a drought year (1941) to 1,670 ft^3/s during a wet year (1949), and averaged 1,220 ft^3/s. Of the average discharge, the local flow system contributed an estimated 560 ft^3/s and the intermediate and regional flow systems contributed an estimated 660 ft^3/s. Clarke and West (1997) approximated the long-term average recharge by weighting these values according to drainage area, and estimated the average groundwater recharge in the Savannah River basin to be 14.5 in., of which 6.8 in. is to the local flow system, 5.8 in. is to the intermediate flow system, and 1.9 in. is to the regional flow system. Mean-annual precipitation in the basin ranges from 44 to 48 in. Cherry (2006) presents simulated water budgets for different hydrologic conditions using a numerical model for groundwater flow near the Savannah River Site, Georgia, and South Carolina. Estimates of inflow or outflow across lateral boundaries, recharge, discharge, groundwater pumpage, and vertical flow upward and downward across confining units are obtained from the numerical model.

2.3.1.2.1.2 Tritium in Unconfined and Confined Aquifers

Several investigators have documented the presence of tritium in groundwater in eastern Burke County, Georgia. These investigations include those of Summerour et al. (1994), Summerour et al. (1998), and Georgia Department of Natural Resources (DNR) (2004). Descriptions of the data resulting from these investigations and associated conclusions are summarized below.

Summerour et al. (1994) reports the results of seven sub-investigations conducted to determine any possible threat to public health due to tritium in eastern Burke County. These sub-investigations included: (1) sampling and analyzing 109 domestic and public water wells; (2) performing baseflow studies to measure tritium abundance in local springs and creeks; (3)

installing and sampling 15 new groundwater monitoring wells at six cluster sites in eastern Burke County; (4) defining the local lithostratigraphic and hydrostratigraphic framework using core sample analyses, field mapping, and literature; (5) characterizing the hydrologic characteristics of the unconfined Upper Three Runs aquifer, the Gordon aquitard, and the confined Gordon aquifer using data from aquifer tests; (6) characterizing the geochemical characteristics of the Upper Three Runs and Gordon aquifers using analyses of water samples from public, private, and monitoring wells; and (7) conducting a seismic refraction survey of the Savannah River channel to evaluate the extension of the Pen Branch fault into the channel of the Savannah River and investigate the thickness of the river alluvium, the possible breaching of aquitards, and the correlation of seismic stratigraphic sequences with the local stratigraphy. The main conclusions resulting from this study are as follows:

- There is no evidence of a public health threat due to tritium pollution of aquifers in Burke County.
- There is widespread evidence of tritium in the water table aquifer in eastern Burke County, at levels well below the maximum concentration level (MCL) standard for drinking water set by the United States Environmental Protection Agency.
- There is no evidence of regional tritium pollution of the Gordon aquifer in eastern Burke County.
- Existing data do not fully resolve the issue of the tritium occurrence in water table aquifer. However, the investigation shows that some pathways are more likely than others and suggests specific pathway models for future investigations.

Follow-on, Phase II sub-investigations were conducted by the Georgia Geological Survey, results of which are reported by Summerour et al. (1998). The Phase II sub-investigations, conducted in eastern Burke County, recommended the following: (1) continued monitoring of tritium in the unconfined aquifer; (2) conducting high-resolution tritium analyses of groundwater in confined aquifers; (3) investigating the vertical distribution of tritium in the vadose zone; (4) investigating the vertical distribution of tritium in the unconfined aquifer; (5) completing a seismic survey across the projected location of the Pen Branch fault into Georgia; (6) investigating well construction in the public water supply well in which tritium was first discovered in Burke County groundwater; and (7) revising the lithostratigraphy and hydrostratigraphy of Burke County. Conclusions resulting from these sub-investigations, pertinent to the VEGP site, are summarized below.

- Tritium concentrations in the unconfined aquifer are declining. This decline in tritium concentration is probably due to a combination of radioactive decay, dilution by untritiated groundwater, and recharge by untritiated (or low tritium) rainwater.
- Very low, but measurable, levels of tritium are present in all of the confined aquifers. Because the water in these aquifers is very old (11,000 to 32,000 years) compared with the half-life of tritium (12.35 years), there should be no tritium present within the confined aquifers. The

tritium in these deep aquifers is believed to be due to cross contamination during drilling and well installation or to cross-contamination sampling. There is insufficient evidence to distinguish between these alternatives.

- Tritium is not uniformly distributed with depth in either the unsaturated (vadose) zone or in the unconfined aquifer. Within the vadose zone, tritium concentrations generally increase with increasing depth. Within the unconfined aquifer, tritium concentrations increase with increasing depth but then rapidly drop to below the detection limit in the basal units of the unconfined aquifer. Vertical tritium variations observed in the unsaturated zone and the upper part of the unconfined aquifer may represent a historical record of tritium influx into the water table aquifer.
- A seismic reflection survey across the projected location of the Pen Branch fault identified a series of 13 high-angle faults along approximately 4,550 ft of a 7,620-ft seismic line. The entire series of faults is considered to represent an extension of the Pen Branch fault zone into Georgia from South Carolina. Figure 23 of Summerour et al. (1998) shows the locations of the seismic survey line and the projected location of the Pen Branch fault. All 13 faults affect the basement rock and project upwards into the overlying Cretaceous-age sediments. None of these faults appear to have disturbed the Gordon aquitard, which isolates the unconfined aquifer from underlying confined aquifers. The seismic profile also shows other numerous minor fractures or faults within the Cretaceous and Tertiary Coastal Plain sediments. Summerour et al. (1998) indicate that while these minor fractures may cut the lower Midville, upper Midville, lower Dublin, upper Dublin, and Millers Pond aquitards, it is unclear whether the fractures also cut the Gordon aquitard (Lisbon Formation). The effect of the Pen Branch fault zone and other minor faults on groundwater flow patterns and pathways was not resolved in this investigation.
- The preponderance of evidence indicates that the primary pathway for tritium into the Upper Three Runs aquifer is through recharge of the aquifer by tritiated rainfall related to atmospheric tritium releases at the Savannah River Site. A possible secondary pathway for tritium is suggested by the presence of very low levels of tritium in all confined aquifers in Burke County.

More recently, the Georgia DNR (2004) reported tritium sampling results for the 2000–2002 period from monitoring wells and public water-supply wells located in the Savannah River Site/ Vogtle Electric Generating Plant area. Georgia DNR (2004) concludes that no significant tritium contamination has been positively identified in any confined aquifers in Georgia, based on monitoring well data. On the other hand, it notes that extensive tritium contamination was present in groundwater in the relatively shallow (up to 200 ft deep) Upper Three Runs aquifer during the 2000–2002 period, with tritium concentrations averaging less than 1,000 pCi/l, which is well below the drinking water MCL of 20,000 pCi/l established by EPA. Georgia DNR (2004) indicates that contamination appears to be concentrated primarily within the Savannah River Site's downwind footprint, suggesting a possible connection with airborne (or rain-borne) tritium from the Savannah River Site.

Based on the results of the investigations described above, it is likely that tritium is present in the Upper Three Runs (Water Table) aquifer at the VEGP site, given that tritium has been detected in adjacent monitoring wells and springs and creeks. The source of the tritium is most likely associated with atmospheric releases of tritium from the Savannah River Site because the VEGP site falls within the downwind footprint of the Savannah River Site and is in an area where elevated levels of tritium have been detected in the rainfall. The same investigations suggest the possibility of very low, but measurable, levels of tritium in the deeper, confined aquifers underlying the VEGP site. Possible sources of tritium in the confined aquifers of Burke County, Georgia, include cross contamination from well drilling, installation and during sampling.

2.3.1.2.1.3 Trans-River Flow

The potential for trans-river flow in the vicinity of the Savannah River Site and VEGP site has been discussed by Clarke and West (1997). Trans-river flow is a term that describes a condition under which groundwater originating on one side of a river migrates beneath the river floodplain to the other side of the river. Although some groundwater could discharge into the river floodplain on the opposite side of the river from its point of origin, such flow would likely be discharged to the river because flow in the alluvium is toward the river. Potentiometric-surface maps developed by Clarke and West (1997) for the Upper Three Runs aquifer and Gordon aquifers do not indicate the possible occurrence of trans-river flow. However, flow lines on potentiometric-surface maps of the confined Dublin and Midville aquifer systems do suggest the possible occurrence of trans-river flow for a short distance into the Savannah River alluvial valley. The possible occurrence of trans-river flow in the Dublin aquifer system also is suggested by the chemical and isotopic composition of water from the Brighams Landing well-cluster site in Georgia. Clarke and West (1997) suggest that the potential for trans-river flow may be facilitated by groundwater withdrawal, particularly at pumping centers located near the Savannah River. Pumped wells on one side of the river could intercept groundwater that originates on the other side. For this to occur, pumping would need to be sufficient to reverse the hydraulic gradient away from the river and towards the pumping center.

Numerical simulation techniques have been used to further evaluate areas of previously documented trans-river flow on the Georgia side of the Savannah River **(Clarke and West 1998; Cherry 2006)**. At such areas, local head gradients might allow the migration of contaminants from the Savannah River Site into the underlying aquifers and beneath the Savannah River into Georgia. Cherry (2006) identified the area near Flowery Gap Landing (covering about 1 mi^2) as an area of potential trans-river discharge. Backward particle tracking analysis was conducted to better quantify trans-river flow. Between 29 and 37 percent of the particles released in this area backtracked to recharge areas on the Savannah River Site (trans-river flow), depending on the scenario being evaluated. Of the particles exhibiting trans-river flow, the median time-of-travel ranged from 366 to 507 years. For the worst-case scenario evaluated (deactivation of Savannah River Site production wells), the median time-of-travel decreased to about 370 years, with a shortest time-of-travel period of about 80 years.

While the potential for trans-river flow exists, it is likely that such flow would be quickly discharged to the river because flow in the river alluvium is toward the river. Also, any tritiated water originating from the Savannah River Site and participating in trans-river flow would undergo significant radioactive decay, considering its 12.35-year half-life, relative to even the worst-case 80-year time-of-travel. Furthermore, pumping of the current makeup water wells for VEGP Units 1 and 2 does not appear to have intercepted groundwater originating from the other side of the river, based on the particle tracking results presented **by Cherry (2006). It** is also unlikely that pumping the additional water needed to supply VEGP Units 3 and 4 would be sufficient to reverse that hydraulic gradient and cause groundwater originating from South Carolina to be drawn any further into Georgia, given the high transmissivities of the confined Tertiary and Cretaceous aquifers. Therefore, trans-river flow does not appear to be a mechanism that would contribute to the contamination of aquifers underlying the VEGP site.

2.3.1.2.1.4 The Location and Role of the Pen Branch Fault

There is no evidence to suggest that the potential for groundwater leakage between the Upper Three runs (Water Table) aquifer and Gordon (Tertiary sand) aquifer in the vicinity of the Pen Branch fault exists at the VEGP site. SSAR Section 2.5.1.2.4 describes previous investigations of the Pen Branch fault and the site subsurface investigation of the fault that was conducted for the ESP application. Results of this investigation, which included seismic reflection and refraction surveys, clearly document that the Pen Branch fault strikes northeast and dips southeast beneath the VEGP site. SSAR Figure 2.5.1-42 shows the vertical projection of the Pen Branch fault from the top of basement rock in relation to VEGP Units 3 and 4. The plan projection of the intersection of the Pen Branch fault with the top of basement rock is located beneath or slightly southeast of the antiformal hinge at the top of the monocline in the Blue Bluff Marl (SSAR Figure 2.5.1-39). Because of its spatial association with the Pen Branch fault, it is likely that this monocline feature is the result of reverse or reverse-oblique slip on the Pen Branch fault. The seismic survey data further indicate that the fault terminates in the Cretaceous Coastal Plain deposits and overlying Tertiary deposits, including those comprising the Gordon (Tertiary sand) aquifer, Gordon aquitard (Blue Bluff Marl), and Upper Three Runs (Water Table) aquifer, are not considered to be affected by the Pen Branch fault. This result is consistent with that of Summerour et al. (1998), who reported that none of the faults identified in their seismic surveys appear to have disturbed the Gordon aquitard (Blue Bluff Marl), which isolates the unconfined aquifer from underlying confined aquifers.

Based on the results and discussion presented above, the Pen Branch fault has not affected the Tertiary age deposits at the VEGP site and would be neither a barrier nor a conduit for groundwater transport in these deposits. Insufficient data is available to determine if the fault would be a barrier or conduit in the deeper, Cretaceous deposits that have been affected by the fault.

2.3.1.2.2 Local Hydrogeology

The VEGP site lies within the Coastal Plain Physiographic Province. The site is located approximately 40 mi southeast of the Fall Line, the northwestern boundary of the Coastal Plain province, and is adjacent to the Savannah River. Geologic conditions beneath the VEGP site generally consist of about 1000 ft of Coastal Plain sediments with underlying Triassic Basin rock southeast of the Pen Branch fault and Paleozoic crystalline rock northwest of this fault.

The Savannah River lies along the northeast border of the VEGP site and influences the local hydrogeologic conditions within the site area. This local hydrogeology discussion is restricted to the VEGP site vicinity (approximate radius of 5 mi) south of the Savannah River.

Geotechnical and hydrogeological investigations performed for this ESP application provide information on the VEGP site from the Triassic Basin rock to the ground surface. Results from these investigations indicate that there are three aquifers underlying the VEGP site, the Cretaceous, Tertiary, and Water Table (or Upper Three Runs), all of which belong to the Southeastern Coastal Plain aquifer system. Although present regionally, the Surficial aquifer system, consisting of Miocene (Hawthorne Formation) through Quaternary deposits, is not continuous over Burke County or the VEGP site **(Miller 1990)**.

The lower aquifer at the VEGP site overlies the bedrock and is comprised of Cretaceous-age sediments. Locally, this aquifer system is known as the Cretaceous aquifer. The sediments include sands, gravels, and clays of the Cape Fear Formation, Pio-Nono Formation and associated unnamed sands, Gaillard Formation, Black Creek Formation, and Steel Creek Formation. The middle aquifer is made up of Tertiary-age sediments occurring over the Cretaceous-age sediments described above. The middle aquifer system is locally known as the Tertiary aquifer. It consists primarily of the permeable sands of the Still Branch and Congaree Formations. The relatively impermeable clays and silts of the Snapp and Black Mingo Formations overlie and confine the Cretaceous aquifer, while the clays and clayey sands of the Lisbon Formation overlie and confine the Tertiary aquifer**.** The upper aquifer is unconfined and is comprised of Tertiary-age sands, clays, and silts of the Barnwell Formation, which overlie the relatively impermeable Lisbon Formation. This aquifer is known locally as the Water Table aquifer or Upper Three Runs aquifer. A hydrostratigraphic section showing geologic units, confining units, and aquifers for the VEGP site and surrounding areas is shown in Figure 2.3.1-11. Further discussion of the aquifers underlying the VEGP site and surrounding area is provided below.

Cretaceous Aquifer

The Cretaceous aquifer locally comprises the Cape Fear Formation, Pio-Nono Formation/ unnamed sands, Gaillard Formation/Black Creek Formation, and Steel Creek Formation. These formations generally consist of fluvial and estuarine deposits of cross-bedded quartzitic sand and gravel interbedded with silt and clay. The coarse-grained sediments are mostly unconsolidated and are generally permeable, while the fine-grained sediments are partially consolidated and are generally impermeable. In addition to the varying lithology, the formation also exhibits lateral facies changes, on-lap and off-lap relationships, and discontinuous lenses **(Huddlestun and Summerour 1996)**. The elevations, thicknesses, and descriptions of these geologic formations, as determined from VEGP geotechnical boring B-1003, are summarized below:

- The basal Cape Fear Formation overlies the Triassic Dunbarton Basin bedrock, which is of Paleozoic age and consists of alternating mudstone, sandstone, and breccia. Boring B-1003 encountered top of bedrock at an elevation of approximately -826 ft msl and was advanced an additional 289 ft to elevation of -1,115 ft msl. The Cape Fear Formation consists of interbedded sands, silts, clays, and gravels. The formation is approximately 191 ft thick, with the top of the formation being at El. -635 ft msl.
- The Pio-Nono Formation and other unnamed sands overlie the Cape Fear Formation. This formation consists of sand, silt, and clay. The formation is approximately 60 ft thick, while the top of the formation is at approximately El. -575 ft msl.
- The undifferentiated Gaillard Formation and Black Creek Formation overlie the Pio-Nono Formation and unnamed sands. Most of the formation consists of sand with silt and clay, and layers of gravel. The deposit is approximately 211 ft thick, with the top of the formation being at approximately El. -364 ft msl.
- The Steel Creek Formation overlies the undifferentiated Gaillard Formation and Black Creek Formation. It consists mainly of sand with clay and silt. The formation is approximately 110 ft thick; the top of the formation is at approximately El. -254 ft msl.

The Cretaceous aquifer system has not been extensively developed, primarily because the shallower Tertiary system is adequate for most groundwater needs and is available for use throughout the region. Quantitative data from the limited number of test and production wells in the Cretaceous strata, and inferred data from geologic and stratigraphic studies, indicate clearly that the Cretaceous aquifer system is highly capable of yielding large quantities of good quality groundwater.

Recharge to the Cretaceous aquifer system is primarily by direct infiltration of rainfall in its outcrop area, located north of the VEGP site in a 10- to 30-mile-wide belt extending from Augusta, Georgia, northeastward across South Carolina to near the state line separating North and South Carolina. In the outcrop areas, precipitation penetrates the Cretaceous sediments. Groundwater in the outcrop areas is under water table conditions, but as it moves progressively downdip, it becomes confined beneath the overlying Snapp and Black Mingo Formations in the vicinity of the VEGP site. Hence, the Cretaceous aquifer system is under confined conditions for most of its areal extent. Discharge of the Cretaceous aquifer system is primarily from subaqueous exposures of the aquifer that are presumed to occur along the Continental Shelf. Other discharge sources are to the Savannah River and by pumping.

Tertiary Aquifer

The most productive aquifer at the VEGP site consists of the Congaree and Still Branch Formations, which are hydraulically connected and are referred to as the Tertiary sand aquifer. The overlying Lisbon Formation, containing the Blue Bluff Marl, acts as a confining layer. The elevations, thicknesses, and descriptions of geologic formations comprising the Tertiary aquifer, as encountered in boring B-1003, are described below.

- The Black Mingo and Snapp Formations constitute a semi-confining hydrogeologic unit under the VEGP site that separates the underlying Cretaceous aquifer from the overlying Tertiary sand aquifer as they dip to the southeast. The Paleocene-age Black Mingo Formation is approximately 39 ft thick and consists of sand, clay, and silt. The top of the formation is at approximately El. -215 ft msl. The Snapp Formation overlies the Black Mingo Formation and consists of sand, clay and silt, and includes a basal gravel layer. The stratum is also Paleocene in age. The formation is approximately 107 ft thick. The top of the formation is at approximately El. -108 ft msl.
- Above the Snapp is the Eocene-age Congaree Formation. The Congaree Formation has a thickness of about 115 ft and consists primarily of sand with clay and silt, and a basal gravel layer. The top of the formation is at an elevation of approximately 7.3 ft msl. The overlying Still Branch and Bennock Millpond Sands Formation consist of sand, clay, and silt and has a weak carbonate component. The formation thickness is approximately 67 ft, with the top of the formation being approximately El. 74 ft msl.
- The Lisbon Formation overlies the Tertiary sediments is the Lisbon Formation. The Lisbon Formation is Eocene in age and is comprised of sand, clay, and silt with interbedded layers of fossiliferous limestone. The Lisbon Formation contains a marl known as the Blue Bluff Member (Blue Bluff Marl). The Lisbon Formation also contains the McBean Limestone Member, a fossiliferous limestone layer. The formation has a thickness of approximately 63 ft, and the top of the formation is at approximately El. 137 feet msl. This formation separates the confined and unconfined aquifer systems beneath the VEGP site.

  VEGP Units 1 and 2 UFSAR Section 2.5.1.2.2.2.1.1 states that the Blue Bluff marl is a distinct unit that is relatively constant in thickness over many square miles, although variable in lithology. Contours of the upper and lower surfaces, as well as an isopach map of the marl in the vicinity of the plant, are shown on drawings AX6DD352, AX6DD371, and AX6DD372 of the UFSAR. These drawings indicate the Blue Bluff Marl to be continuous over the entire VEGP site. On the VEGP site, the ESP subsurface investigation (SSAR Appendix 2.5A) determined that the Blue Bluff Marl ranges in thickness from 63 to 95 ft at three locations where the stratum was fully penetrated, with an average thickness of 76 ft and a median thickness of 69 ft.

Recharge to the Tertiary aquifer is primarily by infiltration of rainfall in its outcrop area, which is a belt 20 to 60 miles wide extending northeastward across central Georgia and into portions of Alabama to the west and South Carolina to the east. Discharge from the Tertiary aquifer occurs from pumping, from natural springs in areas where topography is lower than the piezometric level of the aquifer, and from subaqueous outcrops that are presumed to occur offshore. Discharge also occurs to the Savannah River where the river has completely eroded the Blue Bluff Marl confining layer allowing discharge from the aquifer to the river.

Water Table Aquifer

The uppermost aquifer at the VEGP site is unconfined and consists of the Barnwell Group, including the discontinuous deposits of the Utley limestone, as well as Quaternary deposits along adjacent stream channels. The saturated interval within the Barnwell Group is commonly referred to as the Water Table aquifer (also known as the Upper Three Runs aquifer) and is the first water-bearing zone encountered beneath the VEGP site. The descriptions of the Barnwell Group were determined from VEGP ESP geotechnical and hydrogeological borings and are described below.

- The basal Utley Limestone Member of the Barnwell Group consists of sand, clay, and silt with carbonate-rich layers. The stratum is discontinuous across the VEGP site and was not encountered in several of the borings. To assess its degree of discontinuity, borings logged for the hydrogeological and geotechnical investigations have been examined for the presence/absence of the Utley limestone. Logs for these borings are included in SSAR Appendices 2.4A and 2.5A. In completing this assessment, effort was made to eliminate spatial bias. Therefore, only one boring log was considered when there were adjacent borings from OW-series well pairs, or adjacent B- and OW-series borings. The results are summarized in Table 2.3.1-27.

  The data presented in Table 2.3.1-27 indicates that the Utley limestone is absent in 8 out of 18 borings, or 44 percent of the borings. Spatial trends in the presence/absence of the Utley limestone indicate that the unit tends to be present in the power block area for VEGP Units 3 and 4 and the area to the north toward Mallard Pond. The Utley limestone tends to be absent in the cooling tower area for VEGP Units 3 and 4 and the area to the south. These results are consistent with the Utley limestone isopachs presented in the UFSAR for VEGP Units 1 and 2 (Drawing No. AX6DD376). These isopachs indicate that the limestone increases in thickness to a maximum of about 80 ft and then decreases in thickness to 10 ft or less along a profile extending from the power block to Mallard Pond, with the long axis of this unit trending in a northeast-southwest direction.

- Overlying the Utley limestone are undifferentiated sands, clays, and silts. The thickness of the group is variable with a range of approximately 14 to 119 ft. The top of the group ranges from approximately El. 205 to 264 ft msl. At boring B-1003, the formation is approximately 48 ft thick with the top of the formation being at an elevation of approximately 223 ft msl.

Recharge to the Water Table aquifer is almost exclusively by infiltration of rainfall. The presence of porous surface sands and the moderate topographic relief in the VEGP site area suggest that a significant fraction of the precipitation either infiltrates the ground or is lost to the atmosphere by evapotranspiration. Discharge is to localized drainages and wells.

2.3.1.2.3 Observation Well Data

Data from a combination of new wells installed for the ESP application and existing VEGP site wells were used to develop the groundwater elevation contour maps. The new wells, designated OW-1001 through OW-1015, were installed in May and June 2005. (One of the wells, OW-1001, had very little change in groundwater levels and is not included in the analysis. A replacement well, OW-1001A, was installed in October 2005.) Ten of the new wells are screened in the Water Table aquifer and five are screened in the confined Tertiary aquifer system below the Blue Bluff Marl. No wells were installed into the deeper Cretaceous aquifer. Existing wells 142 and 179, remaining from the pre-construction monitoring network for VEGP Units 1 and 2, are screened in the Water Table aquifer. Existing wells with identifications beginning with the number 8 were installed between 1979 and 1985 to monitor construction dewatering of VEGP Units 1 and 2. These wells are screened in either the Water Table or Tertiary aquifers. Existing wells with an LT designation were installed in 1985 as part of post-construction monitoring activities and screened in the Water Table aquifer.

Observation well OW-1001A was installed at the site in October 2005 to replace OW-1001. Observation well OW-1001 was replaced because, following a period of groundwater level monitoring from June to September 2005, the groundwater level data from this well was considered invalid. This is discussed in more detail in the following section. Observation well OW-1001A was the only new “A” well installed at the site for the ESP application. Observation well OW-1001A should not be confused with the borings or drill logs contained in SSAR Appendix 2.4A that also use the suffix “A.” The confusion arises because the boring or drill logs contained in SSAR Appendix 2.4A are labeled “OW” (for Observation Well) as opposed to “B” (for Boring log) or “D” (for Drill log). A summary of borings or holes drilled at the site to accommodate installation of the new observation wells is provided in Table 2.3.1-28.

Groundwater level elevations in OW-1001 measured between the period June 2005 and November 2006 (groundwater level data continues to be collected in wells OW-1001 and OW-1001A for observation purposes) range from about 114 to 118 ft msl, with a seasonal fluctuation of about 4.4 ft. These groundwater levels and seasonal fluctuations are not consistent with the groundwater levels and seasonal fluctuations of groundwater levels in the Water Table aquifer and suggest that the screened portion of the well is not in good hydraulic communication with the Water Table aquifer. Review of the boring log, daily field log, well development log, and in situ hydraulic conductivity test results for the well indicate that either the formation material adjacent to the well was adversely affected by well construction or that the well was inadvertently installed in the confining unit underlying the formation material. Observation well OW-1001A was installed to replace well OW-1001, as discussed above. The construction log for OW-1001A contained in SSAR Appendix 2.5A (report Appendix D) indicates that the screened portion of the well ranges in elevation from 146.13 to 136.13 ft msl, while groundwater level elevations for the 17-month monitoring period range from 135.91 to 135.99 ft msl. These groundwater level data reveal that groundwater levels in the well are close to or below the bottom of the screened interval of the well, indicating no hydraulic communication with the Water Table aquifer. Groundwater data obtained from OW-1001 and OW-1001A are considered invalid and are not used in the following groundwater evaluations.

Monthly water levels in the observation wells were measured to characterize seasonal trends in groundwater levels and flow directions for the VEGP site. Monthly monitoring of these wells began in June 2005 and is continuing. An 18-month data set representing June 2005 through November 2006 is used for this ESP application. In addition, longer-term data is available for some of the existing wells completed in the Water Table and Tertiary aquifers, which are used to characterize historic trends.

The locations of VEGP site observation wells that are being monitored are shown in Figure 2.3.1-12. Table 2.3.1-18 lists the observation wells currently being used to monitor the Water Table aquifer, while Table 2.3.1-19 lists the observation wells currently being used to monitor the Tertiary aquifer.

The following groundwater piezometric surface trend discussion is based on the information presented in Figures 2.3.1-30 through 2.3.1-35, Figures 2.4.12-16 through 2.4.12-21, Figures 2.3.1-23 through 2.3.1-27, and Tables 2.3.1-18 and 2.3.1-19.

Water Table Aquifer

Groundwater level data for the Water Table aquifer available for 1979 through 2006 is provided in Figure 2.3.1-30. Also shown on this figure is annual precipitation measured at three climate stations close to the VEGP site, which includes the Augusta WSO Airport, Waynesboro 2 NE, and Milen 4N climate stations. Precipitation data was obtained from the South Carolina Department of Natural Resources website **(SC DNR 2007).** In addition, the Palmer Drought Severity Index (PDSI) and Palmer Hydrological Drought Index (PHDI) are plotted on Figure 2.3.1-31 for the same period. The PDSI attempts to measure the duration and intensity of the long-term cumulative meteorological drought and wet conditions. The PDHI is another long-term drought index intended to measure the hydrological impacts of drought (e.g., reservoir levels, groundwater levels, etc.). PDSI and PHDI data were obtained from the National Climatic Data Center website **(NCDC 2007).** These indices provide an indication of the severity of a wet or dry spell. The indices generally range from +6 to –6, with negative values denoting dry spells and positive values denoting wet spells. Values of +0.5 to –0.5 indicate normal conditions.

Figure 2.3.1-30 shows that for the period 1979 to 1984, groundwater level elevations in the Water Table aquifer were affected (lowered) by construction dewatering of the power block excavation for VEGP Units 1 and 2 that was in effect from June 1976 to March 1983. Groundwater levels for subsequent years exhibit variability in response to meteorological conditions. The magnitude of the variability can be estimated using data from the wells having the longest period of record, which include wells 802A, 805A, 808, LT-7A, LT-12, and LT-13. Table 2.3.1-29 summarizes the minimum and maximum water levels recorded at each of these wells. These results indicate a 5-to-8-ft range in water levels over the 17-year period of record for these wells. Inspection of the long-term hydrographs for wells 802A, 805A, 808, LT-7A, LT-12, and LT-13 in conjunction with the drought severity indices for the same period indicates that groundwater levels in the Water Table aquifer generally correlate with the PDSI and PDHI. Water levels tend to remain unchanged when the drought severity indices remain near normal (±1). During drought periods when the PDSI or PDHI index falls to –2 or below, groundwater levels tend to decline. Conversely, during wet periods when the PDSI or PDHI increases to +2 or more, groundwater levels tend to rise. Increases or decreases in the drought indices would be associated with the increases or decreases in the rate of recharge of the Water Table aquifer. Because of the relatively large depth to the water table (at least 60 ft), prolonged wet or dry periods on the order of a year in duration are apparently required to affect the recharge to the water table at these depths.

Groundwater data from June 2005 to November 2006 for the Water Table aquifer is summarized in Table 2.1.1-18 and shown in Figure 2.3.1-32. Groundwater elevations for this 18-month monitoring period range from about 133 to 165 ft msl, with seasonal fluctuations averaging about 1 ft. This data exhibits very little variability because the recharge during this period was evidently relatively constant. Comparison of historical groundwater level elevations with precipitation events and other meteorological indices over a longer period of time suggest that persistent and significant wet weather is required to elicit significant water table response, as discussed above. The annual precipitation, the PDSI, and the PDHI for 2004 to 2006 have been relatively stable and near normal values. Due to the absence of any upward or downward trends in these indices, it is expected that groundwater elevations in the Water Table aquifer would be relatively steady over this period.

The groundwater elevation data summarized in Table 2.3.1-18 were used to develop quarterly groundwater surface elevation contour maps for the Water Table aquifer. These maps are presented in Figures 2.3.1-16 through 2.3.1-20 and Figure 2.3.1-33 for June 2005 through November 2006. Note that a contour map for November 2006 was developed because no groundwater level data was available for September and October 2006. Note that October 2005 data, as opposed to September 2005 data, were used to develop the contour map for the second quarter so that data from replacement well OW-1001A, installed in October 2005, could be incorporated. For each quarter, the spatial trend in the piezometric surface is similar, with elevations ranging from a high of approximately El. 165 ft msl in the vicinity of well OW-1013 to a low of less than El. 135 ft msl at well OW-1005. The groundwater surface contour maps indicate that horizontal groundwater flow across the VEGP site is in a north-northwest direction toward Mallard Pond (also known as Mathes Pond). This surface water feature is a local discharge point for the shallow groundwater flowing beneath the VEGP site. The horizontal hydraulic gradient across the site for the Water Table aquifer is relatively consistent between the five figures and is approximately 0.014 ft/ft.

Tertiary Aquifer

Historical groundwater elevations from 1971 through 1985 for Tertiary aquifer wells 27 and 29 are provided in Figure 2.3.1-21.

Recent groundwater elevation data from June 2005 to November 2006 for the Tertiary aquifer is summarized in Table 2.3.1-19 and shown in Figure 2.3.1-34. Groundwater elevations for this 18-month monitoring period range from about 82 to 128 ft msl. Elevations are relatively constant from June to August 2005. In most cases, the piezometric head of the aquifer declines from August 2005 through November 2005. The elevations begin to rebound in December 2006, continuing through February 2006. The lowering of the piezometric surface is likely in response to a decrease in precipitation. October and November are the months with the lowest precipitation during the year for this area. Well 27 shows a higher degree of variability than the others and is likely influenced by its proximity to the river.

The groundwater elevation data summarized in Table 2.3.1-19 were used to develop piezometric surface maps for the Tertiary aquifer. The Tertiary aquifer piezometric surface is presented in Figures 2.3.1-23 through 2.3.1-27 and Figure 2.3.1-35 for June 2005 through November 2006. The piezometric surfaces for the Tertiary aquifer show a relatively consistent flow pattern. In general, the groundwater in this aquifer unit shows an east-to-northeast flow pattern, toward the Savannah River. Head elevations range from approximately El. 125 ft msl in the western portion of the VEGP site to less than El. 100 ft msl in the vicinity of the bluff next to the Savannah River flood plain. The elevation of the piezometric head at the bluff and that of the Savannah River flood plain suggest groundwater is discharging to the Savannah River. The piezometric elevations in the Tertiary aquifer decreased at least 1.5 ft across the VEGP site in December 2005, reflecting the seasonal decrease in precipitation.

The horizontal hydraulic gradient across the site for the Tertiary aquifer is relatively consistent among the five figures and is approximately 0.006 ft/ft. In the center of the VEGP site, there is a downward head difference of approximately 50 ft between the Water Table aquifer and the Tertiary aquifer, suggesting hydraulic separation of the two aquifers. The Blue Bluff Marl confining unit that separates the aquifer systems has an average thickness of about 70 ft at the VEGP site.

Cretaceous Aquifer

At the VEGP site, both the Cretaceous and the Tertiary aquifers are considered confined beneath the Blue Bluff Marl but are in apparent hydraulic connection with each other. At some distance downdip of the VEGP site, the Cretaceous aquifer becomes hydraulically separated from the Tertiary aquifer. This separation is believed to be due to facies changes in the intervening clays and silts of the Snapp and Black Mingo formations becoming relatively impermeable. The point at which this occurs is not well defined but it is believed to be a few miles downdip (south) of the site.

The regional direction of the groundwater flow in the Cretaceous (and the Tertiary) aquifer system is south-by-southeast at a hydraulic gradient of approximately 6 to 20 ft/mi (0.001 to 0.004 ft/ft) **(Siple 1967)**. From the vicinity of the Fall Line to a point expected to be a few miles south of the site, the Savannah River has downcut through the Blue Bluff Marl confining layer and into the underlying strata. The Savannah River channel cut allows both the Cretaceous and the Tertiary aquifers to discharge to the riverbed, resulting in a localized hydraulic (groundwater) sink. The aquifer flow directions in the vicinity of the river cut are affected by the hydraulic sink and do not follow regional trends.

2.3.1.2.4 Hydrogeologic Properties and Groundwater Travel Time

Slug tests were performed in the new groundwater observation wells installed in connection with the ESP application to determine in situ hydraulic conductivity values for the Water Table and Tertiary aquifers. Table 2.3.1-20 summarizes the test results. Soil samples collected from selected geotechnical and hydrogeological borings were submitted for laboratory tests to determine grain size, moisture content, and specific gravity, results from which are included in Tables 2.3.1-21 through 2.3.1-23. Similar data are available for the adjacent VEGP Units 1 and 2 site. The hydrogeological properties of the Water Table aquifer, Lisbon Formation (Blue Bluff Marl) confining unit, Tertiary aquifer, and Cretaceous aquifer at the VEGP site are discussed below.

Water Table Aquifer

In the vicinity of the VEGP site, the basal unit of the Barnwell Group, the Utley limestone member, is capable of transmitting groundwater but is of limited areal and vertical extent. In addition, the horizontal and vertical hydraulic conductivity of the saturated clays, silts, and sands within the Barnwell Group varies considerably, due to variable clay content.

The hydraulic conductivity of the Water Table aquifer within the vicinity of the VEGP site was measured previously by both in situ and laboratory testing methods during site characterization investigations for VEGP Units 1 and 2. In situ hydraulic conductivity values for the Barnwell Group sands, silts, and clays were found to range between 200 and 267 ft/yr (0.5 to 0.7 ft/day). Laboratory values varied considerably beyond the range of the in situ tests from 9.8 to 302 fy/yr (0.03 to 0.8 ft/day). Well pumping tests conducted in the Utley limestone resulted in hydraulic conductivities ranging from 3,250 to 125,400 ft/yr (9 to 343 ft/day), while falling and constant head tests suggested lower values, ranging from 96 to 5,800 ft/yr (0.3 to 16 ft/day). These results indicate the possibility of localized, highly permeable zones in the Utley limestone. Laboratory porosity values for the Barnwell Group sands, silts, and clays were found to range from 34 to 61 percent, with a mean value of 44 percent.

Hydraulic conductivities were determined for the VEGP Units 3 and 4 site as part of the ESP investigation. Slug test results for the Water Table aquifer range from 0.12 to 2.65 ft/day, with a geometric mean of 0.41 ft/day (Table 2.3.1-20). Table 2.3.1-21 summarizes the laboratory test results for geotechnical samples of the Barnwell Formation, which were at depths ranging from El. 108 to 248 ft msl. Sand and clay make up the majority of samples, with some gravel present. Measured moisture contents, by weight, range from 4 to 93 percent and have a median value of about 25 percent. Specific gravity analysis was performed only for the samples collected from the observation well borings. Values range between 2.59 to 2.75 and have a median value of 2.66. Using the median moisture content of 25 percent and a value of 2.66 for the specific gravity, the void ratio is estimated to be about 0.67. A total porosity of 40 percent is calculated from this void ratio **(Craig 1994),** and an effective porosity of about 32 percent is estimated based on 80 percent of the total porosity **(de Marsily 1986)**. The specific yield for the Water Table aquifer was not determined; however, an estimate of this value taken from published literature for similar aquifer materials indicates that it may be in the range of 0.20 to 0.33 **(McWhorter and Sunada 1977)**.

The groundwater travel time in the Water Table aquifer was calculated from the ESP site to the projected discharge point (Mallard Pond). A horizontal hydraulic gradient of 0.014 ft/ft was estimated using the maximum water level observed at OW-1009 (163.03 ft msl), the minimum water level observed at OW-1005 (132.53 ft msl), and the distance between the two observation wells of about 2,200 ft. A hydraulic conductivity value of 0.5 ft/day was used, which is considered to be a representative hydraulic conductivity value for the Barnwell Formation, which includes the Utley limestone. Using this hydraulic conductivity of 0.5 ft and an effective porosity of 32 percent, an average horizontal groundwater velocity of 0.02 ft/day was calculated **(Heath 1998).** Using a distance of approximately 2,450 ft from center of the power block area for the new AP1000 units to the closest point of Mallard Pond, the groundwater travel time from the power block area to Mallard Pond is estimated to be about 336 years.

The geotechnical boring logs contained in SSAR Appendix 2.5A, which report some occurrences of water loss during drilling through the Utley limestone, and high hydraulic conductivity test results for the Utley limestone obtained during site investigations for VEGP Units 1 and 2 indicate the possibility of localized highly permeable zones in the Utley limestone. These zones could act as preferential pathways for groundwater flow if there was an accidental liquid release of effluents to the groundwater at the VEGP site.

As described in SSAR Section 2.5.4.5, construction of the new Units 3 and 4 will require a substantial amount of excavation and backfill. The excavation will be necessary to completely remove the sands, silt, clays, and Utley limestone of the Barnwell Group. Total excavation depth to the Blue Bluff Marl bearing stratum is expected to range from approximately 80 to 90 ft below existing grade. Backfilling will be performed from the top of the Blue Bluff Marl to the bottom of the containment and auxiliary buildings at a depth of about 40 ft below final grade. Filling will continue up around these structures to final grade. The fill will primarily consist of granular materials, selected from portions of the excavated sands and from other available borrow sources. Following the guidelines used during construction of VEGP Units 1 and 2, structural fill will be a sandy or silty sand material with no more than 25 percent of the particle sizes smaller than the No. 200 sieve. This structural fill will be compacted to a minimum of 97 percent of the maximum dry density.

Excavating existing soils and replacing these soils with structural fill will alter the hydrogeologic characteristics of the subsurface materials within the footprint of VEGP Units 3 and 4. In situ hydraulic testing of fill material for VEGP Units 1 and 2 indicates a hydraulic conductivity range of 480 ft/yr (1.3 ft/day) to 1,220 ft/yr (3.3 ft/day), based on data included in UFSAR Table 2.4.12-15. Values for Units 3 and 4 are expected to be similar because the borrow sources and compaction criteria for the fill will be the same. Compared with the hydraulic conductivities for the Water Table aquifer, as described above, it can be seen that the hydraulic conductivity of the fill is generally higher than that of the in situ soils.

Development of VEGP Units 3 and 4 will also increase the impervious area across the VEGP site where power generation and associated facilities are constructed. Storm water management facilities (e.g., catch basins, storm sewers) will be used to convey runoff from precipitation offsite. The increased impervious area and use of storm water management facilities will tend to reduce the recharge to the Water Table aquifer in areas affected by Unit 3 and 4 construction.

Construction of VEGP Units 3 and 4 will entail the placement of relatively large and impermeable structures below grade. The base elevations of the major structures (containment and auxiliary buildings) will be at about El. 180.5 ft msl. This elevation is at least 20 ft above the water table. Because these structures will not extend below the water table, they will not affect the hydrogeologic characteristics of the underlying saturated zone.

Lisbon Formation (Blue Bluff Marl) Confining Unit

The hydraulic conductivity of the marl layer is very low, and it effectively confines the aquifer underlying it. It is considered a barrier to vertical groundwater movement. In situ permeability tests (packer tests) were performed in the marl during site characterization investigations for VEGP Units 1 and 2. In 90 percent of the intervals tested, no measurable water inflow occurred. Laboratory permeability tests were also conducted on core samples collected from the marl. Laboratory measurements ranged from 0.0052 to 8.8 ft/yr (1.4×10^{-5} to 2.4×10^{-2} ft/day) with a geometric mean of 1.3×10^{-3} ft/day, indicating the marl is nearly impermeable. Porosity values ranged from 24 to 62 percent, with a mean value of 48 percent.

Geotechnical laboratory results for the Lisbon Formation (Blue Bluff Marl) confining unit are summarized in Table 2.3.1-22 for the VEGP site. Soil samples were collected between El. 51 and 135 ft msl. The samples consist of gravel, sand, and clay. Moisture contents range from 13.5 to 67 percent, with porosities of 25 to 59 percent. Using the median moisture content of 29 percent from geotechnical laboratory results and an assumed specific gravity of 2.65, the void ratio of the confining unit is estimated to be 77 percent. Based on the void ratio value, total porosity is calculated to be 44 percent. The effective porosity of the Lisbon Formation was estimated using Figure 2.17 of de Marsily (1986). This figure plots total and effective porosity as a function of grain size. To estimate the effective porosity for the Lisbon Formation (Blue Bluff Marl), the ratio of effective to total porosity determined from Figure 2.17 was applied to the site-specific total porosity value for the VEGP site. Using the median D50 value of 0.24 mm as a representative grain size (Table 2.3.1-22), a ratio of effective to total porosity of about 0.8 was determined. Multiplying the median total porosity of 0.44 by this ratio yields an effective porosity of 0.35.

The effective porosity was also estimated as the difference between the total porosity and the residual water content, as given by Equation 4.4 of Yu et al. (1993). Grain size distribution data indicate that most of the Lisbon Formation samples can be classified as a silty sand (SM) or clayey sand (SC). The residual water content for SM or SC soils obtained from Carsel and Parrish (1988) using equivalent USDA-SCS soil textural classifications, ranges from 0.07 to 0.10. The effective porosity would then range from 0.34 to 0.37. This result indicates that the 0.35 value for effective porosity is representative of the Lisbon Formation.

Tertiary Aquifer

Hydraulic conductivities determined from Tertiary aquifer slug tests range from 0.35 to 2.1 ft/day, with a geometric mean of 0.83 ft/day (Table 2.3.1-20). These results are consistent with those for the VEGP Units 1 and 2 site for which the geometric mean was determined to be 0.51 ft/day. The laboratory results from the selected geotechnical samples collected in the Tertiary aquifer are presented in Table 2.3.1-23. Sample elevations range from El. -273 ft msl to 69 ft msl, with the samples consisting mainly of sand and fine particles, with some gravel. Moisture content ranges from 19 to 41 percent, with specific gravity values varying from 2.62 to 2.69. Using the median moisture content of 24 percent and a value of 2.67 for the specific gravity, the void ratio of the Tertiary aquifer is estimated to be about 0.64. A total porosity of 39 percent is calculated from this void ratio **(Craig 1994),** and an effective porosity of about 31 percent is estimated based on 80 percent of the total porosity **(de Marsily 1986)**. The storage coefficient for the Tertiary aquifer alone was not determined; however, previous tests of wells completed in the combined Cretaceous/Tertiary aquifers suggest that a value on the order of 10^{-4} would be a reasonable estimate (see below).

The horizontal hydraulic gradient of the Tertiary aquifer is approximately 0.005 ft/ft, based on the maximum water level observed at well OW-1008 (127.99 ft msl), the minimum water level observed at well 27 (81.5 ft msl), and the distance between the two observation wells of about 8,700 ft. The average horizontal groundwater velocity was calculated at 0.013 ft/day using a hydraulic conductivity of 0.83 ft/day, a hydraulic gradient of 0.005 ft/ft, and an effective porosity of 31 percent **(Heath 1998).** Using a distance of 5,600 ft from center of the power block area for the new AP1000 units to the closest point of the Savannah River, the groundwater travel time from the power block area to the Savannah River in the Tertiary aquifer is estimated to be about 1,180 years.

Cretaceous Aquifer

Two makeup water wells (designated as MU-1 and MU-2A) for VEGP Units 1 and 2 were reported to be capable of supplying water at 2,000 gal./min and 1,000 gal./min, respectively. The water is withdrawn from the combined Cretaceous/Tertiary aquifers. Pumping tests were conducted at these wells in 1977. Transmissivity values ranged between 110,400 to 130,900 gallons per day per foot (gpd/ft). A storage coefficient was calculated at 1.07×10^{-4}.

A pumping test was also conducted in a Cretaceous aquifer test well identified as TW-1 during site characterization activities for VEGP Units 1 and 2. A transmissivity value of 158,000 gpd/ft was calculated as an average value for the aquifer. The storage coefficient ranged between 3.3×10^{-4} and 2.1×10^{-4}, indicating the aquifer is effectively under confined conditions.

Vertical hydraulic conductivities were estimated assuming that the anisotropy ratio between the vertical and horizontal directions is 1:3, based on measured horizontal and vertical hydraulic conductivities for sandstone deposits **(Freeze and Cherry 1979)**. The vertical hydraulic conductivities for the Water Table aquifer, Lisbon Formation confining unit, and Tertiary aquifer are estimated to be 0.14, 0.00045, and 0.28 ft/day, respectively.

2.3.1.2.5 Summary

The VEGP site lies within the Coastal Plain Physiographic Province. Geologic conditions beneath the VEGP site generally consist of about 1000 ft of Coastal Plain sediments with underlying Paleozoic sedimentary Triassic sediments and Paleozoic crystalline rock Groundwater at the site occurs in three aquifers that are part of the Southeastern Coastal Plain aquifer system. The lower (Cretaceous) aquifer is comprised of Cretaceous-age sediments, while the middle (Tertiary) aquifer is comprised of Tertiary-age sediments. Both are under confined conditions. The upper (Water Table) aquifer, comprised of Tertiary-age sediments, is unconfined. Recharge to the Cretaceous and Tertiary aquifers occurs in their outcrop areas north of the VEGP site. These aquifers discharge to the Savannah River and to subaqueous outcrops along the Continental Shelf. Recharge to the Water Table aquifer occurs by infiltration of precipitation. Discharge is to localized drainage and stream incisions.

Observation wells completed in the Water Table and Tertiary aquifers were used to develop piezometric contour maps and hydraulic gradients. Hydrogeologic properties of these aquifers were determined by laboratory testing of soil samples and by in situ testing. Piezometric contour maps for the Water Table aquifer indicate that groundwater flow across the VEGP site is northward towards Mallard Pond, which serves as a discharge area. The groundwater travel time from the center of the VEGP site to Mallard Pond is estimated to be about,336 years. Piezometric contour maps for the Tertiary aquifer show groundwater flow across the VEGP site to be in the east-to-northeast direction toward the Savannah River, which serves as a discharge area. The groundwater travel time in the Tertiary aquifer, from the center of the VEGP site to the Savannah River, is estimated to be about 1,180 years. The Water Table and Tertiary aquifers are separated by a very low permeability stratum known as the Lisbon formation. Observation well data suggest that there is little to no hydraulic connectivity between the Water Table and Tertiary aquifers. No sole-source aquifers have been designated within the VEGP site region.

Table 2.3.1-1 Savannah River Sub-basins and Drainage Areas Above VEGP

NWS Subbasin		NWS Subbasin Name	Drainage Area, mi^2	
No.	I.D.		upstream of site (1)	downstream of site (2)
1	TIGG1	Burton Dam, GA	122.3	0.0
2	JCSS1	Jocassee Dam, SC	157.7	0.0
3	KEOS1	Keowee Dam, SC	288.0	0.0
4	HRTG1	Hartwell Dam, GA	1544.7	0.0
5	RBRS1	R.B. Russell Dam	738.2	0.0
6	CARG1	Carlton Bridge, GA	760.6	0.0
7	CHDS1UP	Clark Hill - Thurmon Dam (upstream)	665.9	0.0
8	CHDS1	Clark Hill Dam	1847.7	0.0
9	MODS1	Modoc, S.C.	539.9	0.0
10	AGTG1	Steven Creek Dam, GA	454.8	0.0
11	AGSG1	Augusta 5th Street	77.1	0.0
12	AUGG1	Augusta/Butler Creek	273.6	0.0
13	JACS1	Jackson, S.C.	651.2	0.0
14	BFYG1	Burton's Ferry, GA	182.5	293.4
15	BRIG1	Millhaven, GA	0.0	646.2
16	CLYG1	Clyo, GA	0.0	634.7
Estimated Savannah River drainage area at site			**8304.2**	

1) Based on data from Southeast River Flood Forecasting Center, Atlanta, GA. (NWS 2005)
2) As estimated from HUC-12 shapefiles

Table 2.3.1-2 River Miles for Key Landmarks Along the Savannah River

Land Mark	River Mile *
Confluence of White Water & Toxaway Rivers	368.6
Confluence of Tallulah & Chatooga (forming the Tugaloo)	358.1
Confluence of the Keowee & Twelve Mile Creek (forming Seneca River)	338.5
Confluence of the Senaca & Tugaloo Rivers (forming the Savannah)	312.1
Hartwell Dam (USGS gage 02187250)	288.9
Iva gage (USGS gage 02187500)	280.4
Confluence of Broad River	269.6
Calhoun Falls (USGS gage 02189000)	263.6
Richard B. Russell Dam (USGS gage 02189004)	259.1
Conflence of Little River	223.4
J. Strom Thurmond Dam (USGS gage 02194500)	221.6
Confluence of Stevens Creek	208.1
Augusta City Dam	207.0
Augusta, GA at Fifth Street gage site (02197000)	199.6
Horse Creek at mouth	197.4
New Savannah Bluff Lock and Dam	187.7
Shell Bluff Landing, Georgia	161.9
Jackson, SC gage (02197320)	156.8
Vogtle Electric Generating Plant	150.9
Burtons Ferry Gage (02197500)	118.7
Confluence of Brier Creek	102.5
Clyo gage (02198500)	60.9
Ebenezer Landing, Georgia	48.1
Houlihan Bridge (U.S. Highway 17)	21.6
City of Savannah, GA at Bull Street	14.4
Mouth of the Savannah River	0.0

* River miles measured from the mouth of Savannah Harbor, as reported by USACE 1996.

Source: Adapted from USACE 1996

Table 2.3.1-3 USGS 7.5-Minute Quadrangles for Savannah River Watershed

Map ID	7.5-minute Quadsheet Name	State	N. Latitude	W. Longitude
1	Tuckasegee	NC	35 ° 15 ' 00 "	83 ° 00 ' 00 "
2	Sam Knob	NC	35 ° 15 ' 00 "	82 ° 52 ' 30 "
3	Wayah Bald	NC	35 ° 07 ' 30 "	83 ° 30 ' 00 "
4	Glenville	NC	35 ° 07 ' 30 "	83 ° 07 ' 30 "
5	Big Ridge	NC	35 ° 07 ' 30 "	83 ° 00 ' 00 "
6	Lake Toxaway	NC	35 ° 07 ' 30 "	82 ° 52 ' 30 "
7	Rosman	NC	35 ° 07 ' 30 "	82 ° 45 ' 00 "
8	Rainbow Springs	NC	35 ° 00 ' 00 "	83 ° 30 ' 00 "
9	Prentiss	NC	35 ° 00 ' 00 "	83 ° 22 ' 30 "
10	Scaly Mountain	NC	35 ° 00 ' 00 "	83 ° 15 ' 00 "
11	Highlands	NC	35 ° 00 ' 00 "	83 ° 07 ' 30 "
12	Cashiers	NC	35 ° 00 ' 00 "	83 ° 00 ' 00 "
13	Reid	NC	35 ° 00 ' 00 "	82 ° 52 ' 30 "
14	Eastatoe Gap	NC	35 ° 00 ' 00 "	82 ° 45 ' 00 "
15	Table Rock	SC	35 ° 00 ' 00 "	82 ° 37 ' 30 "
16	Macedonia	GA	34 ° 52 ' 30 "	83 ° 37 ' 30 "
17	Hightower Bald	GA	34 ° 52 ' 30 "	83 ° 30 ' 00 "
18	Dillard	GA	34 ° 52 ' 30 "	83 ° 22 ' 30 "
19	Rabun Bald	GA	34 ° 52 ' 30 "	83 ° 15 ' 00 "
20	Satolah	GA	34 ° 52 ' 30 "	83 ° 07 ' 30 "
21	Tamassee	SC	34 ° 52 ' 30 "	83 ° 00 ' 00 "
22	Salem	SC	34 ° 52 ' 30 "	82 ° 52 ' 30 "
23	Sunset	SC	34 ° 52 ' 30 "	82 ° 45 ' 00 "
24	Pickens	SC	34 ° 52 ' 30 "	82 ° 37 ' 30 "
25	Dacusville	SC	34 ° 52 ' 30 "	82 ° 30 ' 00 "
26	Tray Mountain	GA	34 ° 45 ' 00 "	83 ° 37 ' 30 "
27	Lake Burton	GA	34 ° 45 ' 00 "	83 ° 30 ' 00 "
28	Tiger	GA	34 ° 45 ' 00 "	83 ° 22 ' 30 "
29	Rainy Mountain	GA	34 ° 45 ' 00 "	83 ° 15 ' 00 "
30	Whetstone	SC	34 ° 45 ' 00 "	83 ° 07 ' 30 "
31	Walhalla	SC	34 ° 45 ' 00 "	83 ° 00 ' 00 "
32	Old Pickens	SC	34 ° 45 ' 00 "	82 ° 52 ' 30 "
33	Six Mile	SC	34 ° 45 ' 00 "	82 ° 45 ' 00 "
34	Liberty	SC	34 ° 45 ' 00 "	82 ° 37 ' 30 "
35	Easley	SC	34 ° 45 ' 00 "	82 ° 30 ' 00 "
36	Greenville	SC	34 ° 45 ' 00 "	82 ° 22 ' 30 "
37	Clarkesville NE	GA	34 ° 37 ' 30 "	83 ° 30 ' 00 "
38	Tallulah Falls	GA	34 ° 37 ' 30 "	83 ° 22 ' 30 "
39	Tugaloo Lake	GA	34 ° 37 ' 30 "	83 ° 15 ' 00 "
40	Holly Springs	SC	34 ° 37 ' 30 "	83 ° 07 ' 30 "
41	Westminster	SC	34 ° 37 ' 30 "	83 ° 00 ' 00 "
42	Seneca	SC	34 ° 37 ' 30 "	82 ° 52 ' 30 "
43	Clemson	SC	34 ° 37 ' 30 "	82 ° 45 ' 00 "
44	Five Forks	SC	34 ° 37 ' 30 "	82 ° 37 ' 30 "
45	Piercetown	SC	34 ° 37 ' 30 "	82 ° 30 ' 00 "
46	Pelzer	SC	34 ° 37 ' 30 "	82 ° 22 ' 30 "
47	Clarkesville	GA	34 ° 30 ' 00 "	83 ° 30 ' 00 "
48	Ayersville	GA	34 ° 30 ' 00 "	83 ° 22 ' 30 "
49	Toccoa	GA	34 ° 30 ' 00 "	83 ° 15 ' 00 "
50	Avalon	GA	34 ° 30 ' 00 "	83 ° 07 ' 30 "
51	Oakway	SC	34 ° 30 ' 00 "	83 ° 00 ' 00 "
52	Fair Play	SC	34 ° 30 ' 00 "	82 ° 52 ' 30 "
53	La France	SC	34 ° 30 ' 00 "	82 ° 45 ' 00 "
54	Anderson North	SC	34 ° 30 ' 00 "	82 ° 37 ' 30 "
55	Belton West	SC	34 ° 30 ' 00 "	82 ° 30 ' 00 "
56	Belton East	SC	34 ° 30 ' 00 "	82 ° 22 ' 30 "
57	Lula	GA	34 ° 22 ' 30 "	83 ° 37 ' 30 "
58	Baldwin	GA	34 ° 22 ' 30 "	83 ° 30 ' 00 "
59	Lake Russell	GA	34 ° 22 ' 30 "	83 ° 22 ' 30 "
60	Red Hill	GA	34 ° 22 ' 30 "	83 ° 15 ' 00 "

Table 2.3.1-3 (cont.) USGS 7.5-Minute Quadrangles for Savannah River Watershed

Map ID	7.5-minute Quadsheet Name	State	N. Latitude	W. Longitude
61	Martin	GA	34 ° 22 ' 30 "	83 ° 07 ' 30 "
62	Lavonia	GA	34 ° 22 ' 30 "	83 ° 00 ' 00 "
63	Reed Creek	GA	34 ° 22 ' 30 "	82 ° 52 ' 30 "
64	Hartwell NE	SC	34 ° 22 ' 30 "	82 ° 45 ' 00 "
65	Anderson South	SC	34 ° 22 ' 30 "	82 ° 37 ' 30 "
66	Saylors Crossroads	SC	34 ° 22 ' 30 "	82 ° 30 ' 00 "
67	Honea Path	SC	34 ° 22 ' 30 "	82 ° 22 ' 30 "
68	Ware Shoals West	SC	34 ° 22 ' 30 "	82 ° 15 ' 00 "
69	Gillsville	GA	34 ° 15 ' 00 "	83 ° 37 ' 30 "
70	Maysville	GA	34 ° 15 ' 00 "	83 ° 30 ' 00 "
71	Homer	GA	34 ° 15 ' 00 "	83 ° 22 ' 30 "
72	Ashland	GA	34 ° 15 ' 00 "	83 ° 15 ' 00 "
73	Carnesville	GA	34 ° 15 ' 00 "	83 ° 07 ' 30 "
74	Royston	GA	34 ° 15 ' 00 "	83 ° 00 ' 00 "
75	Hartwell	GA	34 ° 15 ' 00 "	82 ° 52 ' 30 "
76	Hartwell Dam	GA	34 ° 15 ' 00 "	82 ° 45 ' 00 "
77	Iva	SC	34 ° 15 ' 00 "	82 ° 37 ' 30 "
78	Antreville	SC	34 ° 15 ' 00 "	82 ° 30 ' 00 "
79	Due West	SC	34 ° 15 ' 00 "	82 ° 22 ' 30 "
80	Shoals Junction	SC	34 ° 15 ' 00 "	82 ° 15 ' 00 "
81	Cokesbury	SC	34 ° 15 ' 00 "	82 ° 07 ' 30 "
82	Waterloo	SC	34 ° 15 ' 00 "	82 ° 00 ' 00 "
83	Apple Valley	GA	34 ° 07 ' 30 "	83 ° 30 ' 00 "
84	Commerce	GA	34 ° 07 ' 30 "	83 ° 22 ' 30 "
85	Ila	GA	34 ° 07 ' 30 "	83 ° 15 ' 00 "
86	Danielsville North	GA	34 ° 07 ' 30 "	83 ° 07 ' 30 "
87	Bowman	GA	34 ° 07 ' 30 "	83 ° 00 ' 00 "
88	Dewy Rose	GA	34 ° 07 ' 30 "	82 ° 52 ' 30 "
89	Rock Branch	GA	34 ° 07 ' 30 "	82 ° 45 ' 00 "
90	Lowndesville	SC	34 ° 07 ' 30 "	82 ° 37 ' 30 "
91	Latimer	SC	34 ° 07 ' 30 "	82 ° 30 ' 00 "
92	Abbeville West	SC	34 ° 07 ' 30 "	82 ° 22 ' 30 "
93	Abbeville East	SC	34 ° 07 ' 30 "	82 ° 15 ' 00 "
94	Greenwood	SC	34 ° 07 ' 30 "	82 ° 07 ' 30 "
95	Ninety Six	SC	34 ° 07 ' 30 "	82 ° 00 ' 00 "
96	Dyson	SC	34 ° 07 ' 30 "	81 ° 52 ' 30 "
97	Nicholson	GA	34 ° 00 ' 00 "	83 ° 22 ' 30 "
98	Hull	GA	34 ° 00 ' 00 "	83 ° 15 ' 00 "
99	Danielsville South	GA	34 ° 00 ' 00 "	83 ° 07 ' 30 "
100	Carlton	GA	34 ° 00 ' 00 "	83 ° 00 ' 00 "
101	Elberton West	GA	34 ° 00 ' 00 "	82 ° 52 ' 30 "
102	Elberton East	GA	34 ° 00 ' 00 "	82 ° 45 ' 00 "
103	Heardmont	GA	34 ° 00 ' 00 "	82 ° 37 ' 30 "
104	Calhoun Falls	SC	34 ° 00 ' 00 "	82 ° 30 ' 00 "
105	Calhoun Creek	SC	34 ° 00 ' 00 "	82 ° 22 ' 30 "
106	Verdery	SC	34 ° 00 ' 00 "	82 ° 15 ' 00 "
107	Bradley	SC	34 ° 00 ' 00 "	82 ° 07 ' 30 "
108	Kirksey	SC	34 ° 00 ' 00 "	82 ° 00 ' 00 "
109	Good Hope	SC	34 ° 00 ' 00 "	81 ° 52 ' 30 "
110	Saluda North	SC	34 ° 00 ' 00 "	81 ° 45 ' 00 "
111	Athens East	GA	33 ° 52 ' 30 "	83 ° 15 ' 00 "
112	Crawford	GA	33 ° 52 ' 30 "	83 ° 07 ' 30 "
113	Sandy Cross	GA	33 ° 52 ' 30 "	83 ° 00 ' 00 "
114	Vesta	GA	33 ° 52 ' 30 "	82 ° 52 ' 30 "
115	Jacksons Crossroads	GA	33 ° 52 ' 30 "	82 ° 45 ' 00 "
116	Broad	GA	33 ° 52 ' 30 "	82 ° 37 ' 30 "
117	Chennault	GA	33 ° 52 ' 30 "	82 ° 30 ' 00 "
118	Willington	SC	33 ° 52 ' 30 "	82 ° 22 ' 30 "
119	McCormick	SC	33 ° 52 ' 30 "	82 ° 15 ' 00 "
120	Winterseat	SC	33 ° 52 ' 30 "	82 ° 07 ' 30 "

Table 2.3.1-3 (cont.) USGS 7.5-Minute Quadrangles for Savannah River Watershed

Map ID	7.5-minute Quadsheet Name	State	N. Latitude	W. Longitude
121	Limestone	SC	33 ° 52 ' 30 "	82 ° 00 ' 00 "
122	Owdoms	SC	33 ° 52 ' 30 "	81 ° 52 ' 30 "
123	Saluda South	SC	33 ° 52 ' 30 "	81 ° 45 ' 00 "
124	Maxeys	GA	33 ° 45 ' 00 "	83 ° 07 ' 30 "
125	Lexington	GA	33 ° 45 ' 00 "	83 ° 00 ' 00 "
126	Rayle	GA	33 ° 45 ' 00 "	82 ° 52 ' 30 "
127	Celeste	GA	33 ° 45 ' 00 "	82 ° 45 ' 00 "
128	Tignall	GA	33 ° 45 ' 00 "	82 ° 37 ' 30 "
129	Metasville	GA	33 ° 45 ' 00 "	82 ° 30 ' 00 "
130	Lincolnton	GA	33 ° 45 ' 00 "	82 ° 22 ' 30 "
131	Plum Branch	SC	33 ° 45 ' 00 "	82 ° 15 ' 00 "
132	Parksville	SC	33 ° 45 ' 00 "	82 ° 07 ' 30 "
133	Red Hill	SC	33 ° 45 ' 00 "	82 ° 00 ' 00 "
134	Edgefield	SC	33 ° 45 ' 00 "	81 ° 52 ' 30 "
135	Johnston	SC	33 ° 45 ' 00 "	81 ° 45 ' 00 "
136	Penfield	GA	33 ° 37 ' 30 "	83 ° 07 ' 30 "
137	Woodville	GA	33 ° 37 ' 30 "	83 ° 00 ' 00 "
138	Philomath	GA	33 ° 37 ' 30 "	82 ° 52 ' 30 "
139	Washington West	GA	33 ° 37 ' 30 "	82 ° 45 ' 00 "
140	Washington East	GA	33 ° 37 ' 30 "	82 ° 37 ' 30 "
141	Aonia	GA	33 ° 37 ' 30 "	82 ° 30 ' 00 "
142	Woodlawn	GA	33 ° 37 ' 30 "	82 ° 22 ' 30 "
143	Leah	GA	33 ° 37 ' 30 "	82 ° 15 ' 00 "
144	Clarks Hill	SC	33 ° 37 ' 30 "	82 ° 07 ' 30 "
145	Colliers	SC	33 ° 37 ' 30 "	82 ° 00 ' 00 "
146	Ropers Crossroads	SC	33 ° 37 ' 30 "	81 ° 52 ' 30 "
147	Trenton	SC	33 ° 37 ' 30 "	81 ° 45 ' 00 "
148	Aiken NW	SC	33 ° 37 ' 30 "	81 ° 37 ' 30 "
149	Union Point	GA	33 ° 30 ' 00 "	83 ° 00 ' 00 "
150	Crawfordville	GA	33 ° 30 ' 00 "	82 ° 52 ' 30 "
151	Sharon	GA	33 ° 30 ' 00 "	82 ° 45 ' 00 "
152	Cadley	GA	33 ° 30 ' 00 "	82 ° 37 ' 30 "
153	Wrightsboro	GA	33 ° 30 ' 00 "	82 ° 30 ' 00 "
154	Winfield	GA	33 ° 30 ' 00 "	82 ° 22 ' 30 "
155	Appling	GA	33 ° 30 ' 00 "	82 ° 15 ' 00 "
156	Evans	GA	33 ° 30 ' 00 "	82 ° 07 ' 30 "
157	Martinez	GA	33 ° 30 ' 00 "	82 ° 00 ' 00 "
158	North Augusta	SC	33 ° 30 ' 00 "	81 ° 52 ' 30 "
159	Graniteville	SC	33 ° 30 ' 00 "	81 ° 45 ' 00 "
160	Aiken	SC	33 ° 30 ' 00 "	81 ° 37 ' 30 "
161	Oakwood	SC	33 ° 30 ' 00 "	81 ° 30 ' 00 "
162	Sparta NE	GA	33 ° 22 ' 30 "	82 ° 45 ' 00 "
163	Warrenton	GA	33 ° 22 ' 30 "	82 ° 37 ' 30 "
164	Thomson West	GA	33 ° 22 ' 30 "	82 ° 30 ' 00 "
165	Thomson East	GA	33 ° 22 ' 30 "	82 ° 22 ' 30 "
166	Harlem	GA	33 ° 22 ' 30 "	82 ° 15 ' 00 "
167	Grovetown	GA	33 ° 22 ' 30 "	82 ° 07 ' 30 "
168	Augusta West	GA	33 ° 22 ' 30 "	82 ° 00 ' 00 "
169	Augusta East	GA	33 ° 22 ' 30 "	81 ° 52 ' 30 "
170	Hollow Creek	SC	33 ° 22 ' 30 "	81 ° 45 ' 00 "
171	New Ellenton	SC	33 ° 22 ' 30 "	81 ° 37 ' 30 "
172	Windsor	SC	33 ° 22 ' 30 "	81 ° 30 ' 00 "
173	Williston	SC	33 ° 22 ' 30 "	81 ° 22 ' 30 "
174	Bastonville	GA	33 ° 15 ' 00 "	82 ° 30 ' 00 "
175	Bowdens Pond	GA	33 ° 15 ' 00 "	82 ° 22 ' 30 "
176	Avondale	GA	33 ° 15 ' 00 "	82 ° 15 ' 00 "
177	Blythe	GA	33 ° 15 ' 00 "	82 ° 07 ' 30 "
178	Hephzibah	GA	33 ° 15 ' 00 "	82 ° 00 ' 00 "
179	Mechanic Hill	GA	33 ° 15 ' 00 "	81 ° 52 ' 30 "
180	Jackson	SC	33 ° 15 ' 00 "	81 ° 45 ' 00 "

Table 2.3.1-3 (cont.) USGS 7.5-Minute Quadrangles for Savannah River Watershed

Map ID	7.5-minute Quadsheet Name	State	N. Latitude	W. Longitude
181	New Ellenton SW	SC	33 ° 15 ' 00 "	81 ° 37 ' 30 "
182	New Ellenton SE	SC	33 ° 15 ' 00 "	81 ° 30 ' 00 "
183	Long Branch	SC	33 ° 15 ' 00 "	81 ° 22 ' 30 "
184	Wrens	GA	33 ° 07 ' 30 "	82 ° 22 ' 30 "
185	Matthews	GA	33 ° 07 ' 30 "	82 ° 15 ' 00 "
186	Keysville	GA	33 ° 07 ' 30 "	82 ° 07 ' 30 "
187	Storys Millpond	GA	33 ° 07 ' 30 "	82 ° 00 ' 00 "
188	McBean	GA	33 ° 07 ' 30 "	81 ° 52 ' 30 "
189	Shell Bluff Landing	GA	33 ° 07 ' 30 "	81 ° 45 ' 00 "
190	Girard NW	SC	33 ° 07 ' 30 "	81 ° 37 ' 30 "
191	Girard NE	SC	33 ° 07 ' 30 "	81 ° 30 ' 00 "
192	Snelling	SC	33 ° 07 ' 30 "	81 ° 22 ' 30 "
193	Barnwell	SC	33 ° 07 ' 30 "	81 ° 15 ' 00 "
194	Kellys Pond	GA	33 ° 00 ' 00 "	82 ° 15 ' 00 "
195	Gough	GA	33 ° 00 ' 00 "	82 ° 07 ' 30 "
196	Waynesboro	GA	33 ° 00 ' 00 "	82 ° 00 ' 00 "
197	Idlewood	GA	33 ° 00 ' 00 "	81 ° 52 ' 30 "
198	Alexander	GA	33 ° 00 ' 00 "	81 ° 45 ' 00 "
199	Girard	GA	33 ° 00 ' 00 "	81 ° 37 ' 30 "
200	Millett	SC	33 ° 00 ' 00 "	81 ° 30 ' 00 "
201	Martin	SC	33 ° 00 ' 00 "	81 ° 22 ' 30 "
202	Allendale	SC	33 ° 00 ' 00 "	81 ° 15 ' 00 "
203	Bellevue	GA	32 ° 52 ' 30 "	82 ° 00 ' 00 "
204	Perkins	GA	32 ° 52 ' 30 "	81 ° 52 ' 30 "
205	Sardis	GA	32 ° 52 ' 30 "	81 ° 45 ' 00 "
206	Hilltonia	GA	32 ° 52 ' 30 "	81 ° 37 ' 30 "
207	Burtons Ferry Landing	GA	32 ° 52 ' 30 "	81 ° 30 ' 00 "
208	Bull Pond	SC	32 ° 52 ' 30 "	81 ° 22 ' 30 "
209	Barton	SC	32 ° 52 ' 30 "	81 ° 15 ' 00 "
210	Bay Branch	GA	32 ° 45 ' 00 "	81 ° 45 ' 00 "
211	Sylvania North	GA	32 ° 45 ' 00 "	81 ° 37 ' 30 "
212	Jacksonboro Bridge	GA	32 ° 45 ' 00 "	81 ° 30 ' 00 "
213	Brier Creek Landing	GA	32 ° 45 ' 00 "	81 ° 22 ' 30 "
214	Solomons Crossroads	SC	32 ° 45 ' 00 "	81 ° 15 ' 00 "
215	Sylvania South	GA	32 ° 37 ' 30 "	81 ° 37 ' 30 "
216	Hunters	GA	32 ° 37 ' 30 "	81 ° 30 ' 00 "
217	Blue Springs Landing	GA	32 ° 37 ' 30 "	81 ° 22 ' 30 "
218	Shirley	SC	32 ° 37 ' 30 "	81 ° 15 ' 00 "
219	Furman	SC	32 ° 37 ' 30 "	81 ° 07 ' 30 "
220	Oliver	GA	32 ° 30 ' 00 "	81 ° 30 ' 00 "
221	Kildare	GA	32 ° 30 ' 00 "	81 ° 22 ' 30 "
222	Brighton	SC	32 ° 30 ' 00 "	81 ° 15 ' 00 "
223	Pineland	SC	32 ° 30 ' 00 "	81 ° 07 ' 30 "
224	Springfield North	GA	32 ° 22 ' 30 "	81 ° 15 ' 00 "
225	Hardeeville NW	SC	32 ° 22 ' 30 "	81 ° 07 ' 30 "

Source: Compiled from Data, ESRI 2004

Table 2.3.1-4 Approximate Lengths and Slopes of Local Streams

Map ID	Stream Identification	Approximate length, ft *	Upstream Elevation	Outfall Elevation	Approximate Slope
1	Unnamed creek at Hancock Landing to the Savannah River	7,000	163	85	0.0111
2	Unnamed tributary to Daniels Branch to Daniels Branch	6,000	190	105	0.0142
3	Red Branch to Daniels Branch	10,500	235	115	0.0114
4	Daniels Branch D/S of embankment dam to confluence with Red Br.	5,500	140	115	0.0045
5	Unnamed tributary to Beaverdam Creek	8,500	235	87	0.0174
6	Beaverdam Creek to Telfair Pond	13,500	100	85	0.0011
7	Beaverdam Creek, D/S of Telfair Pond to Savannah River	21,000	190	105	0.0040

* from outfall to end of longest tributary

Table 2.3.1-5 USGS Gage Data for the Savannah River

USGS Gage ID	Location on Savannah River	River Mile *	Coordinates		Gage datum, ft MSL **	Area drained, mi^2	Average daily flow series			Annual Peak flow series		
							Start	End	No.	Qp start	Qp end	No.
2187252	below Hartwell Lake nr Hartwell, GA	288.9	34°21'15" N,	82°48'55" W	470.00	2,090	10/1/1984	9/30/1999	4,502	1/21/1985	8/24/1999	15
2187500	near Iva, SC	280.4	34°15'20" N,	82°44'42" W	432.26	2,231	10/1/1950	9/30/1981	11,323	10/8/1949	7/24/1981	32
2189000	near Calhoun Falls, SC	263.6	34°04'15" N,	82°38'30" W	363.53	2,876	10/1/1896	9/30/1979	17,044	4/5/1897	3/28/1980	82
2195000	near Clarks Hill, SC	NR	33°38'40" N,	82°12'05" W	182.69	6,150	5/14/1940	6/30/1954	5,161	--	--	0
2196484	near North Augusta, SC	207.0	33°33'06" N,	82°02'19" W	150.00	7,150	10/1/1988	9/30/2002	5,113	9/21/1989	3/4/2002	13
2197000	at Augusta, GA	199.6	33°22'25" N,	81°56'35" W	96.58	7,508	10/1/1883	9/30/2003	35,793	1/17/1796	6/14/2004	133
2197320	near Jackson, SC	156.8	33°13'01" N,	81°46'04" W	77.00	8,110	10/1/1971	9/30/2002	10,733	1/21/1972	3/5/2002	30
2197500	at Burtons Ferry Bridge nr Millhaven, GA	118.7	32°56'20" N,	81°30'10" W	52.42	8,650	10/1/1939	9/30/2003	18,993	10/1/1929	3/21/2003	53
2198500	near Clyo, GA	60.9	32°31'41" N,	81°16'08" W	13.39	9,850	10/1/1929	9/30/2003	25,567	1/24/1925	3/3/2004	80

* River miles measured from the mouth of Savannah Harbor, as reported by USACE 1996.

** NGVD 1929

Source: Adapted from USGS 2006a

Table 2.3.1-6 Mean Daily Flows on the Savannah River at Augusta, Georgia

Day of month	Mean of daily mean values for this day for 98 years of record[1], in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	10790	11320	17390	16289	10680	8129	7708	8359	8281	7717	5987	8172
2	11380	11860	15900	16230	10950	8078	8381	8139	8205	10460	6316	7694
3	11360	11960	14110	17210	10570	8107	7871	8541	7546	10080	6574	7651
4	12460	12860	13420	15820	10130	7917	7126	8446	7586	8478	6847	8232
5	13170	13380	14440	14099	9711	7943	7085	7901	7451	7249	6990	8680
6	12130	13339	14920	15170	9621	8233	7356	8065	7634	7143	6782	8617
7	11860	13850	15029	15920	9875	8760	7357	8125	7709	6793	6303	8444
8	12600	15250	15910	15740	10160	8985	7993	7921	7986	6526	6310	8281
9	12650	15590	16410	15490	10140	8532	8653	8440	7689	6696	6763	8289
10	12080	15459	16070	15120	10110	8316	8541	8329	8819	7243	6846	8670
11	11550	15330	14549	14560	9318	8103	7732	7352	9687	7243	6650	8512
12	11790	15190	13940	13650	8830	8026	7387	7287	7867	7047	6635	8372
13	12240	14620	14520	12780	8648	8111	7342	7680	6671	7058	6901	8580
14	11610	14330	14940	12730	8600	8570	7788	8807	6223	6582	7357	8793
15	11200	14090	14690	13110	8388	8829	7669	9442	6372	6121	7344	9559
16	10860	13469	15490	13619	8393	9036	7872	9381	6331	5916	7227	10260
17	11570	13880	15880	13450	8369	8825	7699	9570	6543	6188	7475	9995
18	12350	15020	14779	12270	7988	8540	7635	9034	7583	6975	7398	9486
19	13900	15020	13869	11650	7629	8056	7612	8447	7598	6931	7311	9025
20	15450	14170	14490	11670	8318	7589	7735	8776	6913	6854	7297	8854
21	14820	14130	15780	11620	9137	7369	7393	8078	6540	7215	6879	9797
22	12730	15110	16450	11370	9283	7657	7171	7790	6591	7233	6834	9845
23	11580	14790	16189	10830	9216	7228	6961	7473	6438	7373	6792	9854
24	11800	14010	16550	10380	8788	7318	6879	7321	6270	7584	7131	9289
25	11990	13780	15960	10060	8499	8373	7196	7213	6418	7035	7296	9232
26	12190	13880	15079	10500	7805	8399	7623	7367	6989	6491	7352	9595
27	11760	14160	15370	10500	7795	7699	7499	7301	8905	6709	7551	10100
28	11260	16089	15380	10190	7904	7406	7428	7615	8902	6778	7584	10090
29	11310	11980	15300	9767	7866	7209	7655	8207	7516	6342	7950	10160
30	11450		16800	10480	7794	7598	8445	8447	7140	6319	8448	11020
31	11250		16920		7823		8962	8352		6173		11100
1 -- Available period of record may be less than value shown for certain days of the year												

Source: USGS 2006c

Table 2.3.1-7 Mean Daily Flows on the Savannah River near Jackson, South Carolina

Day of month	Mean of daily mean values for this day for 31 years of record[1], in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	8843	10990	10650	11520	9351	8778	8337	7511	7725	7052	7188	8115
2	9091	11140	11050	10540	8757	8383	7974	7581	7334	7079	7167	8850
3	9807	11920	11320	10560	8860	7941	7691	7778	7141	7541	7088	8730
4	9931	11990	11470	10660	8858	8393	7922	7877	7433	7708	7193	8524
5	9759	11430	12559	10900	9146	8316	7743	7420	7791	7885	7261	8674
6	9677	11560	12140	11150	8650	8323	8097	7441	7891	7779	7233	8840
7	9407	11650	12040	10630	8578	8328	8102	7409	7778	7589	7218	8908
8	9032	11730	12160	10290	7630	8169	7924	7463	7395	7581	7141	9053
9	9086	11620	12240	10180	7377	8247	7316	7566	7322	7791	7225	9121
10	9402	11830	12020	10470	8088	7944	7700	7752	7428	7937	7354	8978
11	9922	11430	11100	10920	7937	8374	7524	7465	7247	7994	7435	9219
12	10540	11980	11480	10510	8381	8175	7107	7766	7042	7991	7510	9271
13	10800	12060	11790	10360	8695	8682	7079	7695	7059	7850	7542	9356
14	10870	11850	11920	9937	8551	8554	7042	7798	7047	7693	7745	9084
15	10640	11930	11740	9614	8096	8441	7183	7859	7299	7367	8222	9007
16	10430	11840	11510	10490	8221	8061	7270	7835	7208	7330	8354	9235
17	10510	10920	11570	10510	8368	7730	7478	7945	7015	7739	7940	9326
18	10770	10540	11340	10150	8784	7774	7583	8110	6855	7308	7681	9248
19	11290	11110	10750	9529	9375	7715	7551	8038	6841	7717	7734	9064
20	11480	10840	10560	9320	8814	7670	7688	7437	6826	7695	7644	9841
21	11260	10200	10800	9484	8461	8276	7558	7482	6702	7905	7584	9628
22	11430	10260	10990	9388	8173	8800	7393	7431	7010	7758	7739	9536
23	11580	10760	10220	9379	8739	8878	7469	7361	7161	7848	8381	9469
24	11300	11080	9758	9780	9255	8404	7360	7312	7366	8257	8387	9350
25	11240	11250	10010	9456	9503	8230	7209	7335	7141	8340	8529	9362
26	10980	11090	11160	9380	9236	8154	7234	7284	7216	8108	8117	9653
27	10900	11380	11150	9780	9021	8113	7057	7332	7115	7974	7992	9524
28	11230	10990	10860	9542	8956	8240	6866	7430	6977	8022	7863	9155
29	10720	10540	11550	9237	9177	8481	6835	8035	7106	7759	8077	8781
30	10850		11950	9728	9396	8469	7195	7984	7017	7360	8527	8777
31	10870		11900		9236		7465	7957		7160		8816

1 -- Available period of record may be less than value shown for certain days of the year.

Source: USGS 2006d

Table 2.3.1-8 Mean Daily Flows on the Savannah River at Burtons Ferry

Day of month	Mean of daily mean values for this day for 52 years of record[1], in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	11640	11900	14530	16120	11670	8270	7836	7533	8094	6845	7130	8937
2	11370	12130	14499	16080	11890	8214	7980	7644	8149	6871	7009	9615
3	11430	12170	14549	15980	11930	8037	8060	7695	8228	6858	7056	9981
4	11910	12180	14720	15720	12160	7935	8041	7682	8357	6918	7115	9803
5	11980	12120	14829	15609	12410	7801	8040	7712	8495	6889	7252	9366
6	11760	11810	14840	15400	12360	7713	7950	7830	8406	6957	7376	9141
7	11410	11680	14850	15070	12120	7718	8050	7961	8309	6954	7402	8978
8	11230	11920	15160	14779	11940	7653	8087	8053	8129	6974	7470	8855
9	11120	12310	15659	14430	11780	7742	8060	8098	7913	7054	7448	8950
10	11510	12609	15920	14140	11660	7946	8133	8123	7887	7166	7363	9013
11	12070	12860	16480	14090	11650	8173	8250	8114	7852	7272	7351	9081
12	12220	13239	17170	14560	11620	8339	8346	7986	7718	7372	7425	9075
13	11970	13650	17390	15040	11490	8564	8400	7962	7743	7492	7330	9058
14	11700	14110	17120	15230	11300	8704	8333	7931	7677	7566	7299	9178
15	11650	14480	16650	15129	11110	8718	8310	7944	7562	7597	7443	9410
16	11760	14530	16310	14729	10880	8806	8327	8556	7498	7674	7685	9572
17	11740	14440	16120	14490	10610	8694	8304	9731	7277	7613	7674	9626
18	11730	14249	16050	14430	10290	8511	8376	10130	7150	7411	7548	9686
19	11840	14120	15900	14420	10050	8397	8615	9983	7060	7316	7639	9708
20	12220	14060	15790	14260	9678	8231	8642	9682	7006	7304	7758	9599
21	12680	14099	15960	14120	9302	8082	8769	9205	6937	7412	7778	9540
22	13339	14640	16260	13710	9030	8146	8665	8847	6899	7499	7781	9636
23	14080	15359	16460	13280	8872	8375	8532	8534	7032	7498	7776	9637
24	14240	15750	17200	13100	8857	8257	8510	8351	7109	7566	7873	9662
25	13940	15480	18060	12920	9013	7987	8231	8309	7194	7657	8028	9821
26	13410	15070	18340	12420	8956	8036	8057	8310	7155	7856	8088	10070
27	12910	14810	18150	12020	8702	8025	7911	8290	7161	8068	8070	10410
28	12400	14690	17620	11750	8601	7838	7647	8208	6929	8098	8036	10550
29	11770	15150	16870	11520	8470	7682	7516	8102	6723	8005	8162	10850
30	11450		16350	11510	8421	7723	7498	8116	6761	7699	8371	11320
31	11560		16180		8327		7573	8088		7339		11660
1 -- Available period of record may be less than value shown for certain days of the year												

Source: USGS 2006g

Table 2.3.1-9 Annual Mean Daily Flows on the Savannah River at Augusta, Georgia, and at Burtons Ferry Near Millhaven, Georgia

Year	Annual mean streamflow, in ft^3/s		Year	Annual mean streamflow, in ft^3/s		Year	Annual mean streamflow, in ft^3/s		Year	Annual mean streamflow, in ft^3/s	
	Augusta	Burtons F.		Augusta	Burtons F.		Augusta	Burtons F.		Augusta	Burtons F.
1884	10,630	--	**1931**	6,806	--	**1955**	5,367	5,974	**1979**	11,710	--
1885	9,642	--	**1932**	11,990	--	**1956**	5,550	6,309	**1980**	11,670	--
1886	12,620	--	**1933**	7,461	--	**1957**	7,645	8,312	**1981**	5,921	--
1887	9,718	--	**1934**	8,112	--	**1958**	10,300	11,040	**1982**	7,409	--
1888	16,780	--	**1935**	7,492	--	**1959**	8,569	9,748	**1983**	10,990	--
1889	12,700	--	**1936**	17,100	--	**1960**	11,110	13,110	**1984**	11,220	12,760
1890	8,665	--	**1937**	12,800	--	**1961**	9,349	10,910	**1985**	6,556	7,167
1891	14,050	--	**1938**	7,671	--	**1962**	8,746	10,580	**1986**	5,803	6,175
1896	7,802	--	**1939**	9,298	--	**1963**	10,020	11,140	**1987**	8,203	8,955
1897	9,730	--	**1940**	8,898	9,607	**1964**	18,530	20,500	**1988**	4,888	5,367
1898	9,894	--	**1941**	6,765	7,546	**1965**	10,800	12,780	**1989**	7,153	7,966
1899	11,270	--	**1942**	8,982	10,010	**1966**	9,398	11,180	**1990**	10,630	11,860
1900	12,310	--	**1943**	10,820	12,490	**1967**	9,152	10,570	**1991**	10,010	11,670
1901	16,430	--	**1944**	10,360	11,750	**1968**	8,281	9,624	**1992**	10,510	11,860
1902	12,290	--	**1945**	7,930	8,301	**1969**	9,821	10,950	**1993**	12,160	14,449
1903	13,530	--	**1946**	11,070	12,470	**1970**	6,967	12,350	**1994**	10,220	11,800
1904	5,528	--	**1947**	10,360	11,770	**1971**	9,479	--	**1995**	11,340	12,770
1905	8,676	--	**1948**	14,099	15,640	**1972**	9,957	--	**1996**	10,120	11,440
1906	15,840	--	**1949**	13,890	15,459	**1973**	12,740	--	**1997**	9,270	10,440
1925	7,892	--	**1950**	7,691	8,764	**1974**	9,840	--	**1998**	13,669	16,020
1926	7,743	--	**1951**	6,222	7,010	**1975**	13,590	--	**1999**	5,409	6,320
1927	6,219	--	**1952**	8,221	9,328	**1976**	12,290	--	**2000**	4,729	5,451
1928	11,210	--	**1953**	7,372	8,622	**1977**	10,320	--	**2001**	4,827	5,772
1929	21,130	--	**1954**	6,944	7,382	**1978**	9,336	--	**2002**	4,419	5,168

Source: USGS 2006c; USGS 2006g

Table 2.3.1-10 Mean Monthly Stream Flow on the Savannah River near Jackson, South Carolina

YEAR	Monthly mean streamflow, in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1971	*	*	*	*	*	*	*	*	*	6,973	7,280	13,969
1972	*	16,350	8,499	7,641	9,220	9,777	9,149	7,106	6,868	6,682	6,765	11,710
1973	14,810	18,670		*	11,180		9,275	8,005	6,852	6,695	6,692	8,437
1974	16,960	*	9,538	*	8,120	7,244	7,295	8,364	7,554	7,206	7,250	7,406
1975	12,839	*	*	*	13,930	9,854	8,653	7,502	8,194	11,750	14,570	13,590
1976	13,230	11,640	*	*	*	*	*	7,396	7,692	9,382	9,967	*
1977	14,870	9,364	13,760	*	8,704	7,573	7,368	7,276	7,133	7,249	12,910	13,020
1978	*	*	11,110	8,677	13,289	9,101	6,879	6,830	6,524	6,180	6,461	6,387
1979	6,737	*	*	*	*	16,820	8,685	8,529	7,794	8,745	11,460	12,550
1980	*	*	*	*	11,090	13,030	7,822	7,242	7,073	6,927	7,208	6,655
1981	6,803	7,836	6,898	6,641	5,679	6,710	5,465	5,689	5,656	5,071	4,563	5,734
1982	10,120	11,570	8,308	8,070	6,393	5,926	5,900	5,959	6,669	6,714	6,016	8,753
1983	14,779	*	*		9,075	10,500	6,951	6,627	6,701	6,136	5,798	9,127
1984	12,950	14,240	*	14,560	*	8,859	8,265	*	7,655	6,500	6,451	6,084
1985	6,482	13,260	7,478	6,283	5,568	5,351	5,820	5,725	5,486	6,521	6,876	6,694
1986	7,601	7,170	6,904	5,750	5,403	5,739	5,869	6,354	5,555	4,859	4,582	5,986
1987	9,399	11,590	*	11,010	5,896	5,434	6,221	8,941	9,859	7,552	6,455	5,816
1988	6,160	6,193	5,728	5,461	4,720	4,560	4,530	4,628	5,423	5,487	4,958	4,750
1989	5,162	5,833	6,983	6,701	5,123	5,334	6,739	5,978	8,670	14,280	6,924	16,880
1990	11,380	*	*	9,043	11,950	6,817	6,401	8,358	7,180	*	7,105	7,033
1991	8,097	10,170	*	13,160	*	9,750	11,430	16,510	7,645	6,621	7,560	7,410
1992	8,793	8,283	12,910	10,080	5,990	8,673	7,509	8,723	7,806	12,630	*	*
1993	*	*	*	*	9,660	8,632	7,620	7,573	6,437	6,147	6,498	6,624
1994	8,413	8,672	10,990	10,070	6,594	7,270	*	*	11,270	*	12,860	15,430
1995	15,210	*	*	8,012	6,330	6,937	7,422	9,027	10,630	11,290	*	14,140
1996	9,469	*	*	11,820	9,943	10,710	7,407	8,096	8,050	8,769	5,634	7,684
1997	11,790	14,850	*	11,160	11,490	9,784	8,263	9,418	6,090	7,312	7,570	12,210
1998	*	*	*	*	*	8,659	7,476	7,018	8,901	7,826	7,416	6,787
1999	7,096	9,446	7,075	6,901	5,789	5,672	6,427	6,761	6,528	5,088	4,600	4,583
2000	6,505	5,637	5,746	4,883	4,680	4,990	4,901	5,659	6,342	5,041	4,956	5,128
2001	5,531	5,637	8,030	5,830	4,837	5,968	5,169	5,094	4,763	4,659	4,744	5,000
2002	5,110	5,306	5,355	5,185	4,575	4,388	4,441	4,462	4,711	*	*	*
Mean of monthly stream flows	9,858	10,090	8,457	8,426	7,893	7,933	7,080	7,409	7,216	7,458	7,315	8,813

* inidcates a month for which no value is reported by the USGS due to insufficient number of daily readings for meaningful average

Source: USGS 2006d

Table 2.3.1-11 Mean Monthly Stream Flow on the Savannah River at Augusta, Georgia

YEAR	Monthly mean streamflow, in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1883										2,611	3,901	4,263
1884	10,570	13,300	33,180	18,100	6,536	14,979	8,337	4,618	2,698	2,370	2,903	9,979
1885	21,820	15,800	8,516	5,878	7,036	6,463	3,888	3,929	7,793	11,730	11,970	11,270
1886	23,720	9,367	13,100	21,560	19,570	16,580	19,230	7,259	5,363	3,283	5,261	6,784
1887	6,128	13,080	9,900	5,387	4,645	6,398	12,450	35,030	4,957	5,570	4,305	8,510
1888	16,940	19,880	24,650	14,740	13,790	8,493	5,256	6,097	47,850	12,250	19,510	12,850
1889	26,570	30,840	15,830	10,650	6,219	7,451	10,750	15,509	9,469	4,975	10,060	5,443
1890	5,137	9,023	12,340	7,661	9,608	5,491	8,192	6,002	8,249	19,540	5,429	7,080
1891	14,660	34,300	43,060	17,650	8,755	8,647	6,534	13,669	5,622	3,520	5,951	7,591
1896	11,260	16,820	7,005	5,298	4,907	3,951	16,800	3,431	3,403	2,792	7,904	10,290
1897	9,167	24,470	20,200	18,630	7,516	5,538	7,301	8,177	4,100	3,741	3,857	5,265
1898	6,519	4,929	6,298	11,710	4,415	3,574	11,160	13,440	21,490	14,520	10,130	10,300
1899	16,020	34,870	24,790	14,380	7,638	6,090	5,145	5,128	5,554	5,608	4,808	7,045
1900	7,262	26,240	18,330	20,090	9,265	22,700	9,589	5,775	6,197	6,681	7,432	9,705
1901	14,280	16,560	15,140	25,380	15,340	19,570	8,979	26,260	20,570	9,170	7,547	18,570
1902	11,690	27,600	36,000	13,460	8,394	7,487	5,525	5,843	7,460	6,423	5,850	12,700
1903	10,590	39,560	32,930	19,900	10,040	17,280	7,275	8,195	5,316	4,179	4,979	4,405
1904	5,585	9,206	8,579	5,512	4,292	4,088	3,769	11,700	3,795	2,079	3,015	4,772
1905	7,073	18,780	7,274	5,416	9,759	4,704	12,609	7,745	4,218	3,916	3,789	19,270
1906	28,670	10,650	23,290	10,760	8,022	16,100	19,480	16,180	19,620	18,140	8,824	9,576
1925	40,410	10,240	8,892	7,369	5,211	3,258	3,001	1,706	1,453	2,656	5,757	4,540
1926	12,960	16,330	11,920	11,930	3,985	3,434	4,958	6,858	3,992	3,118	5,437	8,611
1927	5,840	10,400	10,340	5,845	3,427	5,613	9,276	3,569	2,727	2,625	3,121	12,010
1928	6,566	9,379	9,545	13,289	13,339	8,328	10,060	29,970	14,470	7,495	6,317	5,538
1929	8,176	22,690	52,440	14,870	20,670	10,350	8,318	5,870	35,850	42,170	16,990	15,110
1930	13,400	12,010	12,010	8,906	7,296	5,588	4,806	3,645	4,511	3,348	7,627	8,795
1931	9,933	6,967	8,287	10,780	9,360	3,794	4,720	4,304	2,501	2,399	2,614	15,790
1932	20,430	17,890	12,260	9,640	7,203	10,600	4,157	9,261	3,409	11,020	10,510	27,389
1933	14,860	19,910	9,088	8,305	6,966	5,020	5,124	4,611	5,284	3,385	3,580	4,355
1934	5,286	6,111	15,430	7,816	8,017	15,900	6,368	5,920	4,748	10,580	4,387	6,586
1935	11,620	8,819	12,130	10,510	6,963	4,361	6,805	6,899	6,247	2,923	7,043	5,656
1936	40,960	23,470	16,640	58,700	7,889	5,766	4,322	6,857	4,024	18,750	5,770	12,620
1937	31,619	23,180	13,610	18,320	13,710	7,244	5,518	8,195	6,793	13,270	6,245	6,427
1938	6,468	4,812	8,597	19,680	6,218	8,517	13,919	7,191	3,978	3,010	4,387	5,190
1939	6,503	25,090	22,400	10,740	8,399	6,032	5,860	11,830	4,927	3,412	3,192	4,304
1940	8,433	13,890	10,150	8,762	4,497	4,436	4,571	27,130	8,205	2,682	6,602	7,500
1941	8,308	5,188	10,730	7,052	3,615	6,138	15,870	5,322	2,735	2,325	2,673	10,800
1942	7,382	13,650	26,590	8,490	8,897	5,832	5,784	7,266	5,046	4,072	4,472	10,360
1943	26,329	14,670	19,380	14,610	8,975	6,725	13,619	6,219	4,932	3,662	4,528	6,157
1944	10,460	18,720	33,670	20,620	9,586	5,936	4,745	4,493	3,701	3,953	4,066	4,671
1945	5,802	13,400	9,961	12,720	6,855	4,507	5,182	5,008	7,770	3,897	4,527	15,989
1946	26,179	21,370	16,560	15,740	13,080	7,316	5,522	5,368	3,906	7,506	5,844	5,093
1947	21,560	8,909	16,070	14,610	6,030	5,870	4,366	4,336	3,248	4,887	20,450	13,969
1948	11,310	29,049	24,120	17,220	8,419	6,631	10,330	8,349	6,834	4,791	21,250	21,670
1949	17,920	25,140	12,860	14,549	18,670	11,900	14,190	11,800	13,080	9,557	9,393	8,433
1950	9,481	8,759	11,570	7,607	5,907	7,448	6,916	4,358	8,250	8,541	5,165	8,319
1951	6,581	7,451	9,764	11,440	6,580	5,963	4,570	3,464	3,389	2,728	4,196	8,662
1952	8,654	5,842	29,080	21,820	6,782	4,342	3,627	3,889	3,332	3,385	4,017	3,751
1953	4,084	5,889	11,390	6,460	15,150	5,778	5,750	5,696	7,231	7,171	6,498	7,115
1954	7,247	7,269	9,420	11,460	7,306	6,575	6,230	5,677	5,584	5,818	5,846	4,982
1955	4,600	5,278	5,767	7,119	5,804	5,227	5,205	5,225	4,995	4,976	5,076	5,150
1956	4,418	4,861	5,668	6,171	6,031	5,425	5,266	5,547	6,189	5,437	5,622	5,961
1957	6,105	5,988	6,772	8,225	9,802	6,138	6,143	6,171	6,452	7,347	9,310	13,130
1958	12,780	14,030	15,120	23,520	12,260	6,609	8,796	7,835	5,879	5,722	5,675	5,763
1959	6,026	7,395	7,322	6,721	5,780	13,060	6,613	7,070	8,559	12,680	12,400	9,298
1960	15,070	28,480	18,660	18,020	9,029	6,267	6,414	7,344	6,538	6,514	5,867	5,943
1961	6,198	9,951	11,980	21,770	7,425	6,783	8,840	7,700	7,835	5,679	5,537	12,700
1962	14,960	9,978	13,180	15,420	7,963	8,189	5,676	5,992	6,050	5,960	5,852	5,865

Table 2.3.1-11 (cont.) Mean Monthly Stream Flow on the Savannah River at Augusta, Georgia

YEAR	Monthly mean streamflow, in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1963	9,178	9,885	18,450	7,675	14,900	10,090	11,220	7,875	7,488	6,559	6,826	9,818
1964	16,360	16,720	27,510	43,850	27,050	7,143	10,970	11,900	14,480	17,740	10,950	17,670
1965	17,610	10,120	17,450	16,370	9,574	12,760	7,652	9,027	7,959	7,057	6,958	7,060
1966	8,783	13,610	23,610	7,201	10,480	9,031	6,830	6,731	6,896	6,478	6,478	6,795
1967	8,718	8,439	9,228	6,870	7,036	14,440	8,713	8,625	8,740	6,286	7,593	15,100
1968	18,440	7,175	7,199	7,554	7,620	9,607	7,366	7,500	6,808	6,649	6,834	6,469
1969	10,210	13,590	11,350	20,800	13,680	7,370	6,942	7,128	7,177	6,602	6,586	6,867
1970	6,945	7,093	8,552	8,093	6,582	6,548	7,059	6,889	6,562	6,460	6,283	6,536
1971	7,151	7,314	21,580	8,658	9,374	7,339	7,248	8,471	7,306	7,198	7,504	14,160
1972	19,250	16,160	8,569	7,737	9,347	10,390	8,429	7,129	7,078	6,581	6,385	12,550
1973	15,260	19,080	18,180	25,620	11,030	22,830	7,906	7,469	6,344	6,076	6,153	7,845
1974	16,160	22,350	8,762	13,900	7,865	7,093	7,302	8,181	7,238	6,451	6,814	7,044
1975	12,170	18,140	28,490	21,380	13,430	9,235	8,231	7,546	7,882	11,100	13,139	12,680
1976	12,250	10,410	16,750	12,600	11,120	16,940	13,200	7,379	7,612	8,880	9,583	20,530
1977	13,210	8,924	13,020	20,180	8,396	7,745	7,612	7,235	6,909	7,045	11,940	11,610
1978	16,300	17,990	9,746	8,012	12,070	8,532	7,082	6,833	6,694	6,470	6,435	6,452
1979	6,821	11,040	18,690	24,720	11,800	14,449	7,629	7,778	7,317	8,491	10,800	11,300
1980	13,160	12,520	23,610	26,750	10,610	11,590	7,720	7,196	7,094	6,535	6,916	6,560
1981	6,670	7,211	6,390	6,179	5,691	6,203	5,587	5,667	5,840	5,294	4,624	5,794
1982	9,346	11,620	7,779	8,098	6,104	5,985	5,931	5,988	6,855	6,697	5,975	8,855
1983	13,780	17,210	17,230	26,210	8,244	9,724	6,489	6,573	6,467	6,067	5,534	9,062
1984	12,780	14,160	19,060	14,190	17,040	8,252	8,120	15,570	7,367	6,239	6,014	5,789
1985	6,252	12,360	7,050	6,133	5,515	5,256	5,715	5,678	5,575	6,581	6,636	6,402
1986	7,461	6,609	6,534	5,557	5,479	5,834	5,954	6,092	5,516	4,514	4,561	5,546
1987	8,365	10,660	15,290	9,937	5,639	5,353	6,136	8,671	9,440	7,036	6,284	5,804
1988	5,998	6,082	5,637	5,172	4,476	4,271	4,219	4,320	4,847	4,939	4,442	4,305
1989	4,734	5,290	6,149	5,794	4,672	4,810	6,001	5,541	7,814	13,150	5,977	15,590
1990	10,120	21,640	25,100	7,892	11,580	6,450	6,546	8,340	6,825	10,580	6,433	6,596
1991	7,422	9,371	12,310	11,570	16,830	9,222	10,900	14,810	6,983	6,353	7,201	6,881
1992	7,825	7,483	12,030	8,722	5,664	8,098	6,524	8,050	7,050	11,240	15,880	27,270
1993	30,240	22,920	22,910	19,040	8,241	7,644	6,938	6,885	5,553	5,223	5,363	5,657
1994	7,362	7,544	9,658	8,775	5,779	7,576	12,050	15,820	9,531	13,460	11,280	13,450
1995	13,930	19,020	18,980	7,388	5,897	6,127	6,843	8,000	9,342	9,907	18,610	12,630
1996	9,627	24,210	23,460	9,290	7,935	8,307	5,220	6,047	6,986	8,204	5,455	7,270
1997	10,640	13,860	14,960	9,127	9,117	8,644	7,325	8,489	5,306	6,430	6,491	11,050
1998	21,530	30,600	24,960	22,460	19,020	7,571	6,768	6,522	7,651	6,566	6,183	5,535
1999	5,669	7,711	5,704	5,620	4,735	4,878	5,499	6,173	5,812	4,764	4,288	4,239
2000	5,921	4,882	5,014	4,371	4,089	4,269	4,359	5,180	5,661	4,387	4,196	4,416
2001	4,853	4,908	7,038	4,764	4,037	5,160	4,564	4,589	4,284	4,436	4,527	4,749
2002	4,690	4,774	4,687	4,641	4,250	4,139	4,246	4,204	4,318	3,973	4,304	4,824
2003	4,126	5,548	17,820	13,660	19,060	14,199	16,850	10,420	5,514			
Mean of monthly stream flows	12,100	14,120	15,370	13,080	8,979	8,098	7,669	8,168	7,413	7,115	7,038	9,170
Mean from 1984 to 2003	9,477	11,982	13,218	9,205	8,453	6,803	7,039	7,970	6,569	7,262	7,059	8,316

Source: USGS 2006c

Table 2.3.1-12 Mean Monthly Stream Flow on the Savannah River at Burtons Ferry Near Millhaven, Georgia

YEAR	Monthly mean streamflow, in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1939										4,182	3,807	4,792
1940	9,086	14,790	10,680	9,345	5,114	5,071	5,078	28,040	9,677	3,573	6,783	8,139
1941	9,548	6,139	9,687	9,919	4,192	5,262	19,400	6,375	3,597	2,984	3,284	9,764
1942	11,030	14,670	28,120	11,900	9,450	7,007	6,498	7,473	5,739	4,945	5,249	8,129
1943	27,530	21,820	21,240	16,320	10,740	7,371	15,380	7,433	5,931	4,566	5,540	6,401
1944	12,630	18,780	33,880	25,430	13,270	6,894	5,651	5,308	4,576	4,602	4,332	5,919
1945	6,787	12,290	11,690	10,270	11,840	5,172	5,405	6,006	8,201	4,877	5,024	12,300
1946	33,190	22,330	16,690	19,180	14,099	8,167	6,172	5,966	4,574	8,020	6,210	5,573
1947	21,510	10,480	17,680	16,660	7,625	7,618	5,541	5,497	4,479	5,954	22,070	16,130
1948	12,860	30,440	26,710	21,570	9,045	8,674	10,430	9,177	7,979	6,818	12,150	32,410
1949	21,650	26,870	14,970	15,759	20,630	13,050	15,050	12,100	16,100	10,510	10,470	9,305
1950	11,070	10,450	12,580	9,574	6,944	8,663	7,730	5,608	8,917	8,696	6,109	8,939
1951	7,864	8,425	10,550	12,730	7,483	6,615	5,233	4,147	3,861	3,598	5,094	8,658
1952	9,916	7,315	28,710	26,620	8,169	4,705	4,178	4,628	4,091	4,074	4,813	4,677
1953	5,649	7,137	13,350	8,969	16,640	6,878	6,571	6,314	8,058	7,910	7,320	8,412
1954	8,609	8,011	9,425	12,670	7,786	6,591	6,422	5,844	5,742	5,880	6,198	5,524
1955	5,594	6,256	6,401	8,094	6,331	5,648	5,604	5,629	5,523	5,233	5,578	5,859
1956	5,067	6,192	7,342	7,745	7,098	5,941	5,531	5,890	6,665	5,842	5,887	6,528
1957	6,522	6,820	7,753	8,958	10,450	7,000	6,497	6,433	7,137	8,660	8,769	14,560
1958	13,660	15,270	16,660	24,310	13,980	7,559	9,066	8,178	5,881	5,810	6,080	6,394
1959	6,972	9,057	8,823	7,846	6,365	13,990	7,128	7,198	9,130	14,240	15,650	10,760
1960	15,609	32,429	24,520	23,490	11,250	7,593	7,534	8,249	7,261	7,252	6,478	6,685
1961	7,255	9,672	16,130	24,200	10,900	7,413	10,650	8,817	9,717	6,181	6,540	13,440
1962	18,760	11,860	17,820	18,270	9,399	9,320	6,808	6,866	6,834	6,812	7,032	7,275
1963	10,640	11,920	17,980	10,670	15,480	10,130	13,260	8,787	8,462	7,695	7,566	10,890
1964	17,850	20,040	27,080	46,240	29,980	8,418	11,140	13,310	20,010	20,150	14,240	17,700
1965	21,180	12,770	19,010	21,870	11,770	13,640	9,797	10,580	8,836	8,121	7,934	7,940
1966	10,130	13,289	30,180	9,741	12,850	11,030	8,041	7,988	7,776	7,530	7,543	7,920
1967	10,460	9,752	11,230	8,155	8,282	15,960	10,530	9,677	10,580	7,252	8,632	16,320
1968	22,200	10,070	8,643	8,535	8,479	10,500	8,075	8,093	7,524	7,459	7,937	7,870
1969	10,500	17,050	12,709	18,970	17,910	8,366	7,751	7,910	8,092	7,342	7,433	7,864
1970	7,954	8,308	9,695	10,070	7,660	7,457	7,685	7,794	7,268			
1982										7,158	6,356	8,959
1983	15,609	19,670	20,720	29,540	9,621	10,460	7,268	6,929	7,027	6,408	6,150	9,597
1984	13,780	14,950	23,540	15,580	21,300	9,361	8,470	17,810	7,924	6,848	6,770	6,551
1985	6,987	13,719	7,813	6,530	5,873	5,779	6,156	6,098	5,658	6,413	7,681	7,830
1986	8,158	8,178	7,887	5,915	5,481	5,953	5,649	6,153	5,558	4,657	4,529	6,087
1987	9,893	11,700	17,780	11,650	6,246	5,639	6,298	8,660	9,573	7,495	6,596	6,117
1988	6,502	6,516	6,089	5,886	4,994	4,856	4,510	4,484	5,469	5,336	4,981	4,839
1989	5,419	5,785	7,108	6,855	5,053	5,296	6,717	5,694	8,867	14,800	6,450	17,200
1990	11,560	20,770	30,240	10,620	12,310	7,526	6,788	8,535	7,623	12,690	7,136	6,860
1991	8,217	10,760	14,929	14,560	19,830	10,210	11,810	19,220	8,322	6,619	7,845	7,503
1992	9,016	8,560	13,230	11,120	6,385	9,812	8,122	9,026	7,731	13,210	14,380	31,390
1993	35,290	28,220	27,389	26,000	9,788	8,379	7,016	6,858	6,259	5,993	6,632	6,627
1994	8,378	9,021	11,290	10,420	6,387	6,717	15,709	16,010	12,420	15,509	13,010	16,260
1995	16,550	19,080	24,640	8,388	6,253	7,288	7,138	8,834	10,290	10,780	18,210	16,150
1996	9,575	26,379	25,450	13,630	9,622	10,380	6,764	7,482	7,518	8,511	5,336	7,262
1997	11,510	14,610	19,350	10,360	11,250	9,212	7,737	8,795	5,654	6,932	7,497	12,500
1998	24,510	33,880	31,310	27,200	24,420	8,671	7,436	6,903	8,613	7,375	6,929	6,350
1999	6,745	9,690	6,946	6,653	5,536	5,325	6,420	6,431	6,418	5,685	5,119	5,148
2000	7,143	6,080	6,029	4,849	4,514	4,786	4,718	5,268	6,258	5,096	5,205	5,480
2001	5,961	5,806	7,900	6,501	5,319	6,313	5,645	5,445	5,256	4,935	4,984	5,204
2002	5,517	5,870	5,687	5,734	4,881	4,700	4,746	4,718	4,573	4,577	5,197	5,868
2003	5,224	6,419	18,730	16,410	19,140	19,110	19,510	13,320	7,211			
Mean monthly flow	12,131	13,584	16,192	14,202	10,489	8,144	8,163	8,346	7,547	7,381	7,591	9,670
Mean from 1984 to 2003	10,797	13,300	15,667	11,243	9,729	7,766	7,868	8,787	7,360	8,077	7,605	9,538

Source: USGS 2006g

Table 2.3.1-13 Average Daily Flows by Month for Three Gages on the Savannah River for Entire Record Length and Common Period of Complete Regulation

	Augusta 1884-2003	Augusta 1984-2002	Jackson 1971-2002	Jackson 1984-2002	Burtons Ferry 1939-2003	Burtons Ferry 1984-2002
Jan	12,101	9,759	9,858	8,538	12,131	10,304
Feb	14,122	12,320	10,086	9,021	13,584	14,202
Mar	15,370	12,975	8,457	7,720	16,192	16,227
Apr	13,077	8,971	8,426	8,583	14,202	11,081
May	8,979	7,894	7,893	6,784	10,489	10,104
Jun	8,098	6,414	7,933	7,028	8,144	8,421
Jul	7,669	6,522	7,081	6,773	8,163	7,790
Aug	8,168	7,841	7,409	7,549	8,346	7,466
Sep	7,413	6,624	7,216	7,316	7,547	6,866
Oct	7,115	7,262	7,458	7,536	7,381	6,736
Nov	7,038	7,059	7,315	6,574	7,591	7,310
Dec	9,170	8,316	8,813	8,132	9,670	7,995

Table 2.3.1-14 N-Day Low Flow Values for the Savannah River at Augusta, Georgia

Year	N-day Low Flow Values from SWSTAT for USGS Gage 02197000							
	3-day	7-day	10-day	30-day	60-day	90-day	183-day	365-day
1885	2060. 11	2160. 9	2230. 9	2330. 6	2430. 4	2620. 4	4780. 17	9670. 51
1886	2510. 22	2710. 21	2890. 22	3710. 26	3810. 23	4140. 21	5820. 38	9700. 53
1887	3050. 32	3080. 28	3150. 27	3230. 19	3520. 15	4420. 27	5580. 34	11100. 68
1888	2890. 27	3050. 27	3160. 28	3840. 30	4720. 41	4780. 32	8550. 83	12200. 80
1889	3530. 36	4070. 45	4460. 52	5100. 53	5430. 49	6180. 68	14900. 94	17700. 94
1890	3960. 50	4010. 43	4120. 44	4780. 48	5200. 45	5960. 58	7100. 67	8910. 43
1891	2890. 28	3110. 29	3550. 33	4300. 42	6210. 74	6370. 70	7540. 77	14000. 87
1897	2070. 13	2210. 10	2300. 10	2580. 7	3100. 9	3130. 7	5540. 31	9310. 47
1898	2350. 20	2440. 14	2560. 16	3330. 21	3550. 17	3740. 17	4720. 15	6830. 19
1899	2340. 19	2420. 13	2510. 13	3150. 17	3620. 18	5210. 41	10800. 91	14600. 89
1900	2800. 24	3000. 25	3140. 26	3770. 29	4570. 37	4880. 37	5300. 24	9320. 48
1901	4040. 52	4110. 47	4370. 50	4810. 49	5590. 54	6070. 62	7500. 75	11900. 76
1902	5750. 80	6400. 89	7210. 93	7530. 95	7700. 94	9280. 94	14000. 93	18800. 95
1903	3920. 48	4280. 52	4450. 51	4870. 50	5650. 56	5790. 52	6330. 49	12800. 85
1904	3630. 38	3640. 35	3660. 35	4150. 37	4380. 34	4440. 28	5190. 23	8600. 35
1905	1740. 6	1880. 3	1850. 3	2060. 2	2420. 3	2780. 6	4670. 14	6270. 12
1906	2860. 26	3020. 26	3090. 24	3550. 22	3740. 22	3880. 18	6170. 44	11200. 69
1926	1140. 1	1170. 1	1180. 1	1300. 1	1510. 1	1640. 1	2850. 1	6290. 13
1927	1720. 5	1960. 5	1900. 4	2680. 10	2940. 7	3430. 9	4240. 6	6550. 15
1928	1220. 2	1360. 2	1420. 2	2100. 3	2440. 5	2620. 5	4420. 9	6130. 9
1929	4160. 53	5060. 64	4950. 61	5470. 63	5790. 63	6410. 71	9380. 88	16000. 91
1930	3980. 51	4210. 50	4220. 47	5110. 55	6140. 73	7470. 89	15900. 95	17300. 93
1931	2120. 14	2540. 17	2530. 15	2900. 13	3730. 21	3650. 13	4630. 12	6640. 17
1932	1420. 3	1920. 4	2010. 6	2170. 4	2360. 2	2500. 2	3370. 2	8880. 42
1933	2040. 10	2360. 11	2340. 11	3150. 16	3990. 24	5530. 45	6730. 59	11400. 70
1934	2230. 16	2640. 18	2610. 17	2980. 14	3330. 13	3500. 12	4380. 8	6130. 8
1935	2840. 25	3620. 34	3460. 32	4220. 40	4940. 42	5660. 47	6330. 50	8580. 34
1936	1930. 8	2500. 16	2470. 12	2840. 11	3640. 19	4790. 34	5480. 29	11500. 71
1937	2920. 29	3150. 30	3280. 30	4020. 33	5020. 43	5100. 40	7610. 80	16000. 90
1938	3610. 37	3770. 38	3820. 38	4690. 47	5130. 44	5780. 51	7020. 64	8820. 41
1939	2180. 15	2680. 19	2630. 18	2890. 12	3280. 11	3690. 15	5020. 20	10400. 59
1940	2270. 17	2860. 23	2860. 20	3080. 15	3150. 10	3480. 11	5500. 30	7500. 22
1941	1980. 9	2110. 8	2200. 8	2670. 9	3290. 12	4150. 22	5850. 39	8260. 29
1942	1690. 4	2010. 6	1980. 5	2300. 5	2470. 6	2540. 3	5160. 22	8680. 37
1943	2930. 30	3000. 24	3090. 25	3730. 27	4080. 28	4440. 29	5400. 28	10100. 56
1944	3130. 34	3340. 32	3350. 31	3560. 23	4060. 26	4020. 19	5810. 37	10900. 66
1945	2960. 31	3260. 31	3270. 29	3560. 24	3680. 20	3700. 16	4280. 7	7520. 23
1946	2540. 23	2850. 22	3070. 23	3770. 28	4120. 30	4650. 30	5110. 21	10800. 63
1947	2060. 12	2490. 15	2880. 21	3630. 25	4010. 25	4670. 31	5550. 32	9680. 52
1948	2280. 18	2400. 12	2510. 14	3190. 18	3530. 16	3670. 14	4750. 16	11800. 72
1949	3630. 39	4090. 46	4340. 49	4650. 46	5740. 61	6120. 66	7510. 76	13400. 86
1950	6030. 85	6380. 88	6340. 87	7150. 92	8110. 95	8630. 93	9240. 86	11800. 74
1951	3200. 35	3470. 33	3590. 34	4250. 41	5620. 55	5930. 55	6280. 48	7190. 21
1952	1830. 7	2090. 7	2100. 7	2620. 8	2970. 8	3150. 8	4030. 4	7850. 26
1953	2420. 21	2680. 20	2740. 19	3270. 20	3330. 14	3440. 10	3660. 3	6340. 14
1954	4350. 57	5240. 66	5530. 71	5680. 69	5700. 59	5740. 50	6350. 51	7580. 24
1955	4210. 54	4240. 51	4300. 48	4440. 45	4680. 40	4920. 38	5340. 25	6260. 11
1956	3730. 41	4180. 49	4180. 46	4350. 44	4590. 38	4780. 33	4900. 19	5310. 5
1957	4800. 63	4830. 59	4840. 56	5260. 58	5320. 48	5390. 43	5570. 33	5880. 7
1958	5170. 69	5690. 75	5670. 74	6010. 76	6080. 70	6120. 65	6520. 52	9540. 50
1959	5390. 75	5550. 73	5580. 73	5650. 67	5680. 57	5690. 49	6050. 42	8560. 33
1960	5360. 74	5400. 71	5420. 69	5690. 70	6120. 71	6890. 83	7940. 82	11900. 77

Table 2.3.1-14 (cont.) N-Day Low Flow Values for the Savannah River at Augusta, Georgia

Year	N-day Low Flow Values from SWSTAT for USGS Gage 02197000							
	3-day	7-day	10-day	30-day	60-day	90-day	183-day	365-day
1961	5260. 72	5660. 74	5690. 75	5850. 74	5880. 65	5990. 61	6240. 47	8320. 30
1962	4860. 64	5110. 65	5140. 64	5370. 61	5520. 51	5630. 46	7020. 65	10200. 58
1963	5240. 71	5380. 70	5410. 68	5640. 66	5780. 62	5830. 54	5890. 40	8700. 38
1964	5530. 77	5810. 78	5810. 77	6440. 85	6650. 86	6850. 82	7860. 81	11800. 75
1965	6710. 93	6840. 93	6930. 92	7020. 91	7480. 92	9330. 95	12100. 92	17300. 92
1966	6350. 91	6610. 90	6600. 88	6840. 87	6920. 87	6960. 84	7580. 78	10800. 64
1967	6180. 88	6250. 85	6300. 86	6450. 86	6470. 80	6530. 74	6690. 57	7770. 25
1968	5880. 83	6020. 80	6020. 79	6270. 79	6330. 77	7320. 88	8730. 84	9710. 54
1969	5850. 82	6010. 79	6110. 80	6390. 82	6510. 84	6550. 75	6790. 60	8430. 32
1970	6070. 87	6170. 82	6260. 84	6420. 84	6500. 82	6650. 78	6840. 61	8810. 40
1971	5450. 76	5760. 77	5760. 76	5840. 73	6250. 76	6290. 69	6580. 54	8110. 28
1972	5980. 84	6340. 87	6750. 91	7000. 90	7140. 89	7230. 87	7490. 74	10100. 57
1973	5800. 81	6030. 81	6130. 81	6250. 78	6360. 78	6520. 73	7590. 79	10600. 61
1974	5600. 78	5750. 76	5920. 78	6000. 75	6050. 69	6160. 67	6930. 62	12300. 81
1975	6040. 86	6240. 84	6190. 83	6370. 81	6510. 83	6620. 76	7140. 71	10900. 65
1976	6910. 95	7330. 95	7390. 95	7470. 94	7670. 93	7810. 91	9350. 87	11900. 78
1977	6740. 94	7240. 94	7230. 94	7300. 93	7470. 91	7950. 92	9990. 90	11900. 79
1978	6620. 92	6770. 92	6750. 90	6870. 88	6930. 88	6990. 85	7370. 72	11000. 67
1979	6200. 89	6300. 86	6290. 85	6390. 83	6430. 79	6440. 72	6600. 55	8760. 39
1980	6310. 90	6740. 91	6710. 89	6980. 89	7470. 90	7560. 90	8890. 85	12700. 84
1981	5680. 79	6180. 83	6180. 82	6300. 80	6570. 85	6630. 77	6710. 58	9250. 46
1982	3060. 33	3750. 36	3740. 36	4200. 39	4670. 39	5010. 39	5360. 26	6600. 16
1983	5070. 68	5470. 72	5540. 72	5840. 72	5900. 67	5940. 56	6240. 46	9020. 45
1984	4860. 65	5030. 62	5130. 63	5370. 60	5730. 60	5970. 60	6640. 56	10800. 62
1985	5330. 73	5380. 69	5450. 70	5720. 71	5870. 64	5950. 57	7080. 66	9500. 49
1986	4870. 66	5030. 63	5060. 62	5160. 56	5310. 47	5460. 44	5640. 35	6170. 10
1987	3830. 45	3940. 41	4000. 41	4140. 35	4480. 35	4820. 35	5360. 27	6930. 20
1988	4610. 62	4760. 58	4820. 55	5080. 52	5480. 50	5660. 48	6140. 43	6810. 18
1989	3880. 47	3940. 42	4000. 42	4150. 36	4220. 32	4270. 24	4500. 11	4760. 2
1990	3870. 46	4140. 48	4140. 45	4320. 43	4520. 36	4850. 36	5760. 36	10500. 60
1991	4470. 60	4880. 60	4930. 59	5420. 62	6250. 75	6690. 80	7480. 73	8370. 31
1992	4220. 55	4530. 54	4950. 60	6170. 77	6480. 81	6660. 79	7120. 69	9850. 55
1993	4950. 67	5300. 67	5340. 66	5660. 68	6130. 72	6730. 81	7120. 68	14500. 88
1994	4410. 59	4600. 56	4590. 53	4940. 51	5220. 46	5300. 42	5920. 41	7910. 27
1995	4560. 61	5020. 61	5220. 65	5580. 64	5880. 66	7050. 86	9830. 89	12500. 83
1996	5210. 70	5310. 68	5370. 67	5630. 65	5920. 68	5970. 59	7130. 70	11800. 73
1997	3810. 43	4480. 53	4700. 54	5100. 54	5560. 53	6070. 63	6530. 53	8650. 36
1998	4340. 56	4540. 55	4880. 58	5310. 59	5690. 58	6090. 64	6970. 63	12300. 82
1999	4400. 58	4750. 57	4860. 57	5260. 57	5550. 52	5790. 53	6210. 45	8930. 44
2000	3950. 49	4060. 44	4090. 43	4180. 38	4260. 33	4390. 25	4820. 18	5150. 4
2001	3680. 40	3750. 37	3800. 37	4040. 34	4080. 27	4200. 23	4640. 13	4810. 3
2002	3740. 42	3780. 39	3870. 39	3960. 32	4130. 31	4390. 26	4480. 10	4600. 1
2003	3820. 44	3840. 40	3870. 40	3920. 31	4120. 29	4130. 20	4170. 5	5550. 6

Table 2.3.1-15 SWSTAT Output for Log Pearson Frequency Analysis of 7-Day Low Flows on the Savannah River at Augusta, Georgia

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                Log-Pearson Type III Statistics
                           SWSTAT 4.1
                  (based on USGS Program A193)

 Notice -- Use of Log-Pearson Type III or Pearson-Type III
           distributions are for preliminary computations.
           User is responsible for assessment and
           interpretation.


               SAVANNAH RIVER AT AUGUSTA, GA
                   April  1 - start of season
                   March 31 - end of season
                1986 - 2003 - time period
                  7-day low - parameter
                         18 - non-zero values
                          0 - zero values
                          0 - negative values (ignored)

       5025.714    3935.714    4758.571    3940.000    4138.571
       4884.286    4531.429    5304.286    4600.000    5020.000
       5307.143    4477.143    4540.000    4752.857    4057.143
       3745.714    3775.714    3844.286

 The following 7 statistics are based on non-zero values:

 Mean (logs)                                    3.648
 Variance (logs)                                0.003
 Standard Deviation (logs)                      0.051
 Skewness (logs)                               -0.075
 Standard Error of Skewness (logs)              0.536
 Serial Correlation Coefficient (logs)          0.339
 Coefficient of Variation (logs)                0.014

      Non-exceedance     Recurrence       Parameter
       Probability        Interval          Value
       -----------       ----------       ---------
            0.0100          100.00         3369.406
            0.0200           50.00         3484.674
            0.0500           20.00         3663.468
            0.1000           10.00         3828.398
            0.2000            5.00         4035.955
            0.3333            3.00         4235.952
            0.5000            2.00         4457.744
            0.8000            1.25         4913.406
            0.9000            1.11         5165.582
            0.9600            1.04         5445.413
            0.9800            1.02         5632.292
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Table 2.3.1-16 Annual Peak Discharges on the Savannah River at Augusta, Georgia

Water Year	Date	Gage Height (feet)	Peak discharge (cfs)	Water Year	Date	Gage Height (feet)	Peak discharge (cfs)
1796	Jan. 17, 1796	38	280,000 (2)	1937	Jan. 04, 1937	30.1	91,400
1840	May 28, 1840	37.5	260,000 (2)	1938	Oct. 21, 1937	30.1	91,400
1852	Aug. 29, 1852	36.8	230,000 (2)	1939	Mar. 02, 1939	24.1	90,900
1864	Jan. 01, 1864	34	160,000 (2)	1940	Aug. 15, 1940	29.4	239,000
1865	Jan. 11, 1865	36.4	220,000 (2)	1941	Jul. 08, 1941	22.89	53,300
1876	Dec. 30, 1875	28.6	86,400	1942	Mar. 23, 1942	24.56	105,000
1877	Apr. 14, 1877	31.4	119,000	1943	Jan. 20, 1943	25.1	117,000
1878	Nov. 23, 1877	23.5	51,500	1944	Mar. 22, 1944	25.53	128,000
1879	Aug. 03, 1879	22	44,000	1945	Apr. 27, 1945	23.16	64,000
1880	Dec. 16, 1879	30.1	102,000	1946	Jan. 09, 1946	24.43	97,200
1881	Mar. 18, 1881	32.2	130,000	1947	Jan. 22, 1947	23.97	86,000
1882	Sep. 12, 1882	29.3	93,300	1948	Feb. 10, 1948	23.9	83,200
1883	Jan. 22, 1883	30.8	111,000	1949	Nov. 30, 1948	26.61	154,000
1884	Apr. 16, 1884	28	81,000	1950	Oct. 09, 1949	20.1	32,500
1885	Jan. 26, 1885	27.5	77,000	1951	Oct. 22, 1950	22.32	46,300
1886	May 21, 1886	32.5	135,000	1952	Mar. 06, 1952	21.53	39,300 (5)
1887	Jul. 31, 1887	34.5	173,000	1953	May 8, 1953	20.8	35,200 (6)
1888	Sep. 11, 1888	38.7	303,000	1954	Mar. 30, 1954	17.39	25,500 (6)
1889	Feb. 19, 1889	33.3	149,000	1955	Apr. 15, 1955	16.77	23,900 (6)
1890	Feb. 27, 1890	22.9	48,500	1956	Apr. 12, 1956	14.7	18,600 (6)
1891	Mar. 10, 1891	35.5	197,000	1957	May 7, 1957	14.08	18,000 (6)
1892	Jan. 20, 1892	32.8	140,000	1958	Apr. 18, 1958	22.91	66,300 (6)
1893	Feb. 14, 1893	25	60,000	1959	Jun. 08, 1959	18.65	28,500 (6)
1894	Aug. 07, 1894	24	54,000	1960	Feb. 14, 1960	20.58	34,900 (6)
1895	Jan. 11, 1895	30.4	106,000	1961	Apr. 02, 1961	20.56	34,800 (6)
1896	Jul. 10, 1896	30.5	107,000	1962	Jan. 09, 1962	20.09	32,500 (6)
1897	Apr. 06, 1897	29.3	93,300	1963	Mar. 23, 1963	19.52	31,300 (6)
1898	Sep. 02, 1898	31.3	117,000	1964	Apr. 09, 1964	24.16	87,100 (6)
1899	Feb. 08, 1899	31	113,000	1965	Dec. 27, 1964	20.62	34,600 (6)
1900	Feb. 15, 1900	32.7	138,000	1966	Mar. 06, 1966	21.5	39,300 (6)
1901	Apr. 04, 1901	31.8	124,000	1967	Aug. 25, 1967	18.1	26,500 (6)
1902	Mar. 01, 1902	34.6	175,000	1968	Jan. 12, 1968	20.94	35,900 (6)
1903	Feb. 09, 1903	33.2	147,000	1969	Apr. 21, 1969	22.24	45,600 (6)
1904	Aug. 10, 1904	25.5	63,000	1970	Apr. 01, 1970	17.68	25,200 (6)
1905	Feb. 14, 1905	25.8	64,800	1971	Mar. 05, 1971	23.3	63,900 (6)
1906	Jan. 05, 1906	29.6	96,600	1972	Jan. 20, 1972	20.36	33,700 (6)
1907	Oct. 05, 1906	23.6	52,000	1973	Apr. 08, 1973	21.63	40,200 (6)
1908	Aug. 27, 1908	38.8	307,000	1974	Feb. 23, 1974	20.13	32,900 (6)
1909	Jun. 05, 1909	28.7	87,300	1975	Mar. 25, 1975	22.24	45,600 (6)
1910	Mar. 02, 1910	26.4	69,800	1976	Jun. 05, 1976	20.27	33,300 (6)
1911	Apr. 14, 1911	19.1	32,800	1977	Apr. 07, 1977	20.5	34,200 (6)
1912	Mar. 17, 1912	36.8	234,000	1978	Jan. 26, 1978	21.98	43,100 (6)
1913	Mar. 16, 1913	35.1	156,000	1979	Feb. 27, 1979	21.13	37,300 (6)
1914	Dec. 31, 1913	24.3	48,000	1980	Mar. 31, 1980	22.33	47,200 (6)
1915	Jan. 20, 1915	28.2	61,000	1981	Feb. 12, 1981	14.7	17,700 (6)
1916	Feb. 03, 1916	31	82,400	1982	Jan. 02, 1982	19.39	30,700 (6)
1917	Mar. 06, 1917	29.2	68,000	1983	Apr. 10, 1983	23.21	66,100 (6)
1918	Jan. 30, 1918	25.5	45,500	1984	May 05, 1984	20.35	34,000 (6)
1919	Dec. 24, 1918	35	128,000	1985	Feb. 07, 1985	17.89	25,700 (6)
1920	Dec. 11, 1919	35.4	133,000	1986	Oct. 03, 1985	15.74	21,000 (6)
1921	Feb. 11, 1921	35.1	129,000	1987	Mar. 06, 1987	18.98	29,200 (6)
1922	Feb. 16, 1922	32	92,000	1988	Feb. 05, 1988	10.61	13,600 (6)
1923	Feb. 28, 1923	28	59,700	1989	Sep. 22, 1989	15.33	20,200 (6)

Table 2.3.1-16 (cont.) Annual Peak Discharges on the Savannah River at Augusta, Georgia

Water Year	Date	Gage Height (feet)	Peak discharge (cfs)	Water Year	Date	Gage Height (feet)	Peak discharge (cfs)
1924	Sep. 22, 1924	28	59,700	1990	Feb. 27, 1990	20.69	35,300 (6)
1925	Jan. 20, 1925	36.5	150,000	1991	Oct. 13, 1990	22.8	59,200 (6)
1926	Jan. 20, 1926	27.3	55,300	1992	Mar. 27, 1992	16.29	22,100 (6)
1927	Dec. 30, 1926	24	39,000	1993	Jan. 14, 1993	21.81	45,100 (6)
1928	Aug. 17, 1928	40.4	226,000	1994	Jul. 01, 1994	21.4	40,700 (6)
1929	Sep. 27, 1929	46.3	343,000	1995	Feb. 19, 1995	20.28	33,600 (6)
1930	Oct. 02, 1929	45.1	350,000	1996	Feb. 05, 1996	20.48	34,400 (6)
1931	Nov. 17, 1930	19.9	26,100	1997	Mar. 10, 1997	18.11	26,300 (6)
1932	Jan. 09, 1932	30.4	93,800	1998	Feb. 07, 1998	21.63	43,000 (6)
1933	Oct. 18, 1932	30.3	92,600	1999	Feb. 02, 1999	14.72	19,000 (6)
1934	Mar. 05, 1934	28.5	73,200	2000	Jan. 25, 2000	13.25	16,800 (6)
1935	Mar. 14, 1935	27.4	63,700	2002	Mar. 04, 2002	7.14	8,510 (6)
1936	Apr. 08, 1936	41.2	258,000	2003	May 24, 2003	20.42	31,600 (6)
				2004	Jun. 14, 2004	13.82	17,600 (6)

2 -- Discharge is an Estimate
5 -- Discharge affected to unknown degree by Regulation or Diversion
6 -- Discharge affected by Regulation or Diversion

Source: USGS 2006c

Table 2.3.1-17 Inventory of Savannah River Watershed Water Control Structures

Name of Dam or Reservoir	Owner or Operator	Stream	Savannah River Mile	Distance U/S of Vogtle Site	Drainage Area above dam (sq. mi.)	Storage, in thousands of acre-feet	Normal Pool Elev, ft MSL	Spillway Crest Elevation, ft. MSL	Top of Dam Elevation, ft. MSL	Generator Capacity, MW
New Savannah Bluff Lock & Dam	USACE	Savannah River	187.7	36.8	7,508	RoR	115.0	n/a	n/a	n/a
Stevens Creek	SC Electric & Gas	Savannah River	208.1	57.2	7,173	11	n/a	n/a	n/a	19.2
J. Strom Thurmond Lake & Dam	USACE	Savannah River	221.6	70.7	6,144	2,510	335.0	300	351	280
Richard B. Russell Lake & Dam	USACE	Savannah River	259.1	108.2	2,900	1,020	475.0	436	495	300
Hartwell Lake & Dam	USACE	Savannah River	288.9	138.0	2,088	2,550	660.0	630	679	330
Yonah Dam	GA Power Company	Tugaloo-Chatooga	340.0	189.1	470	10.2	744.2	742	757	22.5
Keowee Lake & Dam	Duke Power Company	Senaca-Keowee	341.0	190.1	439	940	800.0	765	815	157.5
Tugaloo Lake & Dam	GA Power Company	Tugaloo	343.1	192.2	464	43.2	891.5	885	905	45
Tallulah Falls Dam	GA Power Company	Tallulah River	346.7	195.8	186	2.46	1,500.0	1493	1514	72
Mathis Lake & Dam	GA Power Company	Tallulah River	353.4	202.5	151	31.4	1,689.6	1681	1704	16
Jocassee Lake & Dam	Duke Power Company	Senaca-Keowee	357.0	206.1	148	1,100	1,110.0	1077	1125	612
Nacoochee Dam	GA Power Company	Tallulah River	362.1	211.2	136	8.2	1,752.5	1753	1765	4.8
Little River Lake & Dam	Duke Power Company	Senaca-Keowee	366.0	215.1	439	940	800.0	765	815	
Burton Lake & Dam	GA Power Company	Tallulah River	366.4	215.5	118	108	1,866.6	1860	1873	6.1

Source: Compiled from USACE 1996

Table 2.3.1-18 Monthly Groundwater Level Elevations in the Water Table Aquifer

	Groundwater Level Elevation (ft msl)																	
Well No.	Jun-05	Jul-05	Aug-05	Sep-05	Oct-05	Nov-05	Dec-05	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06
142	154.37	154.38	154.49	154.64	154.75	154.69	154.60	154.71	154.78	154.71	154.63	154.55	154.48	154.41	154.36	0.00	0.00	154.16
179	147.42	148.40	148.42	148.72	148.69	148.75	148.52	148.61	148.64	148.72	148.66	148.76	148.78	148.56	148.75	0.00	0.00	148.79
802A	157.88	157.86	158.07	158.23	158.29	158.34	158.28	158.28	158.39	158.23	158.17	158.09	157.99	157.91	157.89	0.00	0.00	157.56
803A	159.98	159.91	160.15	160.32	160.39	160.48	160.39	160.37	160.48	160.45	160.30	160.20	160.12	159.96	159.88	0.00	0.00	159.64
804	163.73	163.62	163.92	164.10	164.21	164.23	164.05	164.08	164.23	164.30	164.11	163.99	163.88	163.69	163.69	0.00	0.00	162.84
805A	158.53	158.57	158.84	158.98	159.09	159.09	159.05	158.94	158.92	158.98	158.82	158.82	158.63	158.53	158.45	0.00	0.00	158.19
806B	155.62	155.65	155.78	155.90	155.96	155.98	155.88	155.97	155.98	156.03	155.85	155.78	155.73	155.68	155.62	0.00	0.00	155.42
808	158.88	159.14	159.42	159.55	159.49	159.37	159.15	159.04	159.19	159.15	158.99	158.53	158.80	158.72	158.65	0.00	0.00	158.40
809	152.78	152.70	152.75	152.89	152.98	152.97	152.98	153.10	153.22	153.18	153.05	153.02	153.00	152.88	152.86	0.00	0.00	152.71
LT-1B	154.92	154.82	155.01	155.16	155.18	155.22	155.06	155.18	155.52	155.28	155.18	155.15	154.95	154.95	154.95	0.00	0.00	154.78
LT-7A	154.39	154.15	154.33	154.46	154.48	154.46	154.31	154.57	154.83	154.59	154.57	154.50	154.41	154.30	154.34	0.00	0.00	154.25
LT-12	158.21	157.90	158.07	158.22	158.31	158.28	158.21	158.53	158.66	158.48	158.54	158.48	158.23	158.19	158.18	0.00	0.00	158.11
LT-13	156.10	155.92	156.13	156.30	156.32	156.37	156.23	156.36	156.66	156.35	156.32	156.32	156.23	156.08	156.14	0.00	0.00	155.93
OW-1003	155.94	155.89	156.06	156.29	156.24	156.36	156.26	156.34	156.37	156.43	156.32	157.24	156.16	156.03	155.98	0.00	0.00	155.90
OW-1005	132.95	132.73	132.88	133.01	132.67	132.65	132.53	132.74	133.04	133.12	133.14	133.20	133.12	132.94	132.84	0.00	0.00	132.50
OW-1006	147.66	147.48	147.57	147.60	147.49	147.20	147.18	147.41	147.40	147.37	147.35	147.12	147.05	146.88	146.80	0.00	0.00	146.47
OW-1007	151.82	151.72	151.78	151.63	151.45	151.15	151.05	151.41	151.49	151.45	151.22	151.11	150.99	150.76	150.53	0.00	0.00	150.08
OW-1009	162.38	162.40	162.71	162.90	163.01	163.03	162.87	162.93	163.01	163.01	162.89	162.79	162.65	162.50	162.44	0.00	0.00	162.17
OW-1010	163.06	163.26	163.59	163.77	163.81	163.78	163.62	163.60	163.63	163.57	163.44	163.29	163.09	162.91	162.84	0.00	0.00	162.51
OW-1012	161.83	161.93	162.07	162.06	161.98	161.80	161.71	161.82	161.86	161.80	161.68	161.53	161.37	161.22	161.00	0.00	0.00	160.49
OW-1013	164.95	165.00	165.29	165.47	165.48	165.42	165.21	165.29	165.46	165.31	165.23	165.11	164.96	164.79	164.68	0.00	0.00	164.25
OW-1015	159.63	159.58	159.78	159.90	159.96	159.96	159.82	159.81	159.79	159.89	159.75	159.66	159.58	159.45	159.35	0.00	0.00	159.06

Notes:

Groundwater level data for the period between June 2005 and February 2006 provided Request For Information (RFI) Number 25144-000-GRI-GEX-00027, SNC ALWR ESP Project. **(Bechtel Power Corporation, March 2006).**

Groundwater level data for the period between March 2006 and June 2006 provided Request For Information (RFI) Number 25144-000-GRI-GEX-00038, SNC ALWR ESP Project. **(Bechtel Power Corporation, June 2006).**

Groundwater level data for the period between July 2006 and November 2006 provided Request For Information (RFI) Number 25144-000-GRI-GEX-00039, SNC ALWR ESP Project **(Bechtel Power Corporation, November 2006).**

Table 2.3.1-19 Monthly Groundwater Level Elevations in the Tertiary Aquifer

Well No.	Groundwater Level Elevation (ft msl)																	
	Jun-05	Jul-05	Aug-05	Sep-05	Oct-05	Nov-05	Dec-05	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06
27	91.50	89.96	91.63	83.96	82.13	88.24	82.57	84.62	85.77	84.49	83.42	83.08	83.03	84.54	84.73	0.00	0.00	81.50
29	98.88	97.80	98.33	93.17	91.86	91.89	92.59	93.97	94.19	93.63	93.05	92.16	91.76	91.86	91.44	0.00	0.00	89.97
850A	105.27	104.68	104.76	101.04	100.03	99.91	100.70	101.86	101.69	101.48	101.14	100.07	99.63	99.23	98.57	0.00	0.00	97.56
851A	114.54	114.40	114.02	111.59	111.38	110.60	112.34	112.32	112.43	112.42	112.23	111.08	110.36	109.31	108.00	0.00	0.00	107.77
852	114.71	114.49	114.00	111.88	111.09	111.21	111.88	113.06	113.51	113.14	112.82	111.74	110.38	108.78	107.20	0.00	0.00	108.35
853	108.60	108.17	107.98	104.51	103.64	103.45	104.18	105.32	105.14	104.97	104.65	103.58	103.15	102.57	101.86	0.00	0.00	101.13
854	107.06	106.88	106.65	103.37	102.38	102.23	102.38	104.13	103.85	103.73	103.45	102.31	101.86	101.31	100.57	0.00	0.00	99.87
855	102.63	101.74	102.00	97.22	96.08	96.21	96.85	98.43	98.48	98.15	97.53	96.75	95.93	95.85	94.96	0.00	0.00	94.12
856	114.07	113.94	113.49	111.37	110.57	110.63	111.31	112.52	112.46	112.39	112.07	111.21	109.94	108.36	106.75	0.00	0.00	107.75
OW-1002	120.76	120.61	120.04	118.65	117.81	117.71	118.44	119.36	119.63	119.64	119.43	118.37	117.65	116.45	114.48	0.00	0.00	114.77
OW-1004	108.27	108.14	108.01	105.06	104.05	103.75	104.51	105.56	105.38	105.28	105.12	103.88	103.54	102.81	102.06	0.00	0.00	101.26
OW-1008	126.06	127.99	125.09	124.24	123.49	123.51	124.19	125.10	125.46	125.54	125.21	124.33	123.42	122.18	119.64	0.00	0.00	120.42
OW-1011	122.50	122.38	121.49	120.37	119.59	119.73	120.46	121.41	121.64	121.70	121.48	120.47	119.37	117.67	115.35	0.00	0.00	116.59
OW-1014	111.18	111.00	110.74	108.34	107.34	107.11	107.81	108.87	108.73	108.75	108.66	107.41	106.94	105.98	104.86	0.00	0.00	104.44

Notes:

Groundwater level data for the period between June 2005 and February 2006 provided Request For Information (RFI) Number 25144-000-GRI-GEX-00027, SNC ALWR ESP Project. **(Bechtel Power Corporation, March 2006).**

Groundwater level data for the period between March 2006 and June 2006 provided Request For Information (RFI) Number 25144-000-GRI-GEX-00038, SNC ALWR ESP Project. **(Bechtel Power Corporation, June 2006).**

Groundwater level data for the period between July 2006 and November 2006 provided Request For Information (RFI) Number 25144-000-GRI-GEX-00039, SNC ALWR ESP Project. **(Bechtel Power Corporation, November 2006).**

Table 2.3.1-20 Hydraulic Conductivity Values

Observation Well No.	Depth Test Interval	Aquifer	Material	Hydraulic Conductivity	
	(ft)			(cm/sec)	(ft/day)
OW-1003	72 - 91	Water Table	Reddish brown silty SAND (SM) with Light tan silty SAND with Tan and grey clayey COQUINA.	4.4E-05	0.12
OW-1005	143 - 169	Water Table	Pale yellow, silty SAND, calcareous (SM), fine-coarse-grained with shell pieces.	1.1E-04	0.32
OW-1006	113 - 136	Water Table	Very light tan silty SAND (SM) with light gray COQUINA, unconsolidated (OW-1006A). Tan sandy and shelly CLAY (CH), saturated with light tan, fine-coarse grained SAND with shell (SW) (OW-1006).	4.8E-04	1.4
OW-1007	99 - 120	Water Table	Tan fine-grained silty SAND (SM), saturated with very light tan silty SAND (SM) becoming shelly with light olive grey CLAY (CH).	9.3E-04	2.65
OW-1009	81 - 98	Water Table	Very light tan silty SAND (SM) with Tan limestone shell hash, very light tan silty SAND (SM) WITH “Brown silty CLAY.	4.0E-04	1.1
OW-1010	70 - 92	Water Table	Tan poorly graded SAND with silt (SP-SM) with brownish yellow clayey silty SAND (SC-SM), soft with white SHELL HASH.	6.4E-05	0.18
OW-1012	71 - 94	Water Table	Brown SAND, fine-to-medium-grained with pale yellow silt (SM) with Pale olive silt (ML) with pale yellow SILT, micaceous (ML).	1.4E-04	0.39
OW-1013	81 - 104	Water Table	Tan fine-to-medium-grained SAND (SP-SM) with tan or clay tubes or bioturbation with light olive tan calcareous silty fine grained-grained SAND (SP-SM) with light olive tan calcareous CLAY (CL), wet but not saturated.	1.3E-04	0.38
OW-1015	90 - 120	Water Table	Grayish white, fine-to-medium-grained SAND (SP) saturated with very light tan poorly graded SAND with silt (SP-SM) with tan shelly (coarse) fine to medium grained clayey SAND (SC).	1.5E-04	0.44

Table 2.3.1-20 (cont.) Hydraulic Conductivity Values

Observation Well No.	Depth Test Interval	Aquifer	Material	Hydraulic Conductivity	
	(ft)			(cm/sec)	(ft/day)
OW-1002	216 - 237	Tertiary	Light greenish gray fine- to medium- grained silty, glauconitic SAND with gray clay layer (SM).	3.2E-04	0.9
OW-1004	150 - 187	Tertiary	Fine- to medium- grained dark gray SAND with organics, wet, poorly graded with silt (SP-SM).	1.3E-04	0.35
OW-1008	226 - 247	Tertiary	Gray, fine SAND (SW) with light gray fine sand (SM).	7.5E-04	2.1
OW-1011	197 - 218	Tertiary	Dark bluish-gray silty fine- to medium- grained SAND, very moist with gray, poorly graded sand with silt (SP-SM) with silty gravelly sand with fossils, shark teeth with gray medium- to coarse-grained SAND.	3.8E-04	1.1
OW-1014	179 - 197	Tertiary	Dark gray silty SAND (SM-SP), high organic content, saturated with light gray fine quartz SAND (SP), silty SAND (SM) and dark gray Sandy SILT (ML).	1.9E-04	0.54
			Geometric Mean Water Table Aquifer	1.75E-04	0.5
			Geometric Mean Tertiary Aquifer	2.95E-04	0.83

Note.

Hydraulic conductivity values provided in SSAR Appendix 2.5A (report Appendix D)

Material descriptions from the borings logs provided in SSAR Appendix 2.4A (report Appendix E)

Table 2.3.1-21 Summary of Laboratory Test Results on Grain Size, Moisture Content, and Specific Gravity for the Barnwell Formation

Borehole / Well No.	Sample Elevation	Grain Size Distribution			Moisture Content	Specific Gravity
		Gravel	Sand	Clay/Silt		
	(ft msl)	(%)	(%)	(%)	(%)	
OW-1003	144.5	0.0	65.1	34.9	ND	2.69
OW-1003	139.5	31.1	50.0	18.4	ND	2.68
OW-1005	115.9	8.9	57.0	34.1	ND	2.63
OW-1005	110.9	18.2	47.6	34.3	ND	2.61
OW-1006	113.6	7.0	61.1	31.9	ND	2.67
OW-1006	108.6	3.6	74.4	22.0	ND	2.59
OW-1007	113.4	0.0	85.0	15.0	ND	2.65
OW-1007	108.4	0.0	85.0	18.1	ND	2.66
OW-1009	135.9	2.7	74.6	22.7	ND	2.61
OW-1009	130.9	34.7	45.9	19.2	ND	2.75
OW-1010	143.4	0.0	89.3	10.7	ND	2.67
OW-1010	138.4	0.0	63.5	36.5	ND	2.63
OW-1012	131.9	0.0	76.1	23.9	ND	2.66
OW-1012	126.9	0.0	14.1	85.9	ND	2.66
OW-1013	132.9	0.0	91.1	8.9	ND	2.65
OW-1013	122.9	0.0	91.1	8.9	ND	2.65
OW-1015	126.9	0.0	97.7	2.8	ND	2.63
OW-1015	125.4	0.0	93.2	6.8	ND	2.67
B-1002	214.3	6.6	84.0	9.4	6.2	ND
B-1002	203.5	0.0	62.9	37.1	24.4	ND
B-1002	193.5	0.0	75.1	24.9	31.8	ND
B-1002	188.5	0.0	68.4	31.6	58.8	ND
B-1002	168.5	0.0	89.5	10.5	42.9	ND
B-1002	158.5	0.0	92.8	7.2	29.3	ND
B-1002	148.5	0.4	89.6	10.0	24.5	ND
B-1002	138.5	0.0	93.9	6.1	27.6	ND
B-1003	208.2	0.0	79.1	20.9	13.4	ND
B-1003	185.2	0.0	70.2	29.8	42.1	ND
B-1003	168.2	52.2	34.4	13.4	17.5	ND
B-1003	148.2	0.0	91.8	8.2	32.3	ND
B-1004	240.8	0.0	75.6	24.4	13.8	ND
B-1004	237.8	0.7	76.2	23.1	14.5	ND
B-1004	226.3	0.2	84.9	14.9	18.5	ND
B-1004	206.3	0.0	40.0	60.0	46.2	ND
B-1004	196.3	0.0	59.0	41.0	62.9	ND
B-1004	181.3	10.5	69.6	19.9	24.1	ND

Table 2.3.1-21 (cont.) Summary of Laboratory Test Results on Grain Size, Moisture Content, and Specific Gravity for the Barnwell Formation

Borehole / Well No.	Sample Elevation	Grain Size Distribution			Moisture Content	Specific Gravity
		Gravel	Sand	Clay/Silt		
	(ft msl)	(%)	(%)	(%)	(%)	
B-1004	166.3	0.0	88.5	11.5	28.8	ND
B-1004	126.3	48.6	32.2	19.2	19.7	ND
B-1006	248.5	0.0	92.7	7.3	3.8	ND
B-1006	222.5	0.1	73.8	26.1	19.7	ND
B-1006	197.5	0.0	41.7	58.3	92.8	ND
B-1006	187.5	0.1	96.8	3.1	25.4	ND
B-1006	167.5	0.0	84.3	15.7	51.9	ND
B-1006	147.5	30.7	47.8	21.5	22.0	ND
B-1010	211.1	0.0	92.2	7.8	5.7	ND
B-1010	185.1	0.0	83.0	17.0	18.9	ND
B-1010	160.1	0.0	86.7	13.3	27.3	ND
				Median	25	2.66

Note.
ND – Not Determined
OW-series data are provided in SSAR Appendix 2.4A
B-series data are provided in SSAR Appendix 2.5A
Moisture content is by weight percent.

Table 2.3.1-22 Summary of Laboratory Test Results on Grain Size, Moisture Content, and Porosity for the Lisbon Formation

Borehole / Well No.	Sample Elevation	Grain Size Distribution			Moisture Content	D50	Porosity
		Gravel	Sand	Clay/Silt			
	(ft msl)	(%)	(%)	(%)	(%)	(mm)	
B-1002	130.0	49.4	21.7	28.9	52.1	3.49	0.59
B-1002	118.5	22.9	41.2	35.9	56.5	0.26	0.56
B-1002	108.5	12.8	53.4	33.8	25.5	0.21	0.36
B-1002	98.5	53.7	21.8	24.5	13.5	7.52	0.25
B-1002	88.5	26.3	49.4	24.3	28.6	0.87	0.45
B-1003	135.2	16.5	50.1	33.4	67.4	0.43	ND
B-1003	130.2	1.6	57.8	40.6	30.6	0.14	0.46
B-1003	118.5	1.2	67.1	31.7	40.6	0.27	0.52
B-1003	101.5	11.7	45.8	42.5	28.0	0.12	0.42
B-1003	81.5	7.3	58.5	34.2	25.9	0.15	0.39
B-1004	105.8	1.0	52.7	46.3	44.6	0.10	0.56
B-1004	96.3	0.7	57.6	41.7	30.1	0.15	0.45
B-1004	86.3	38.0	29.8	32.2	25.1	0.49	0.43
B-1004	72.8	20.9	37.4	41.7	20.8	0.12	0.38
B-1004	61.3	34.9	41.3	23.8	29.0	0.85	0.44
B-1004	51.3	5.2	60.3	34.5	26.2	0.18	0.39
				Median	29	0.24	0.44

Note.
ND – Not Determined
B-series data are provided in SSAR Appendix 2.5A
Moisture content is by weight percent.
Porosity calculated assuming specific gravity of 2.65.

Table 2.3.1-23 Summary of Laboratory Test Results on Grain Size, Moisture Content, and Specific Gravity for the Still Branch And Congaree Formations

Borehole / Well No.	Sample Elevation	Grain Size Distribution			Moisture Content	Specific Gravity
		Gravel	Sand	Clay/Silt		
	(ft msl)	(%)	(%)	(%)	(%)	
OW-1002	8.9	0.2	79.6	20.2	ND	2.65
OW-1002	-9.6	0.0	1.4	90.6	ND	2.62
OW-1004	69.4	0.1	89.7	10.2	ND	2.69
OW-1004	64.4	0.0	93.4	6.6	ND	2.67
OW-1008	-11.9	0.0	83.2	16.8	ND	2.69
OW-1008	-21.9	2.2	67.9	20.3	ND	2.68
OW-1011	12.3	0.0	88.9	10.8	ND	2.67
OW-1011	-2.7	4.5	89.6	5.9	ND	2.66
OW-1014	37.4	0.0	87.8	12.2	ND	2.69
OW-1014	32.4	0.0	89.6	10.4	ND	2.66
B-1002	68.5	20.0	40.6	39.4	23.3	ND
B-1002	33.5	0.0	93.4	6.6	40.7	ND
B-1002	-16.5	3.1	84.6	12.3	18.5	ND
B-1003	57.5	0.0	94.6	5.4	23.6	ND
B-1003	37.5	0.9	82.7	16.4	32.3	ND
B-1003	17.5	1.4	77.2	21.4	39.3	ND
B-1003	-17.5	0.0	89.1	10.9	23.2	ND
B-1003	-57.5	0.3	85.5	14.2	23.2	ND
B-1003	-92.5	70.7	26.0	3.3	32.7	ND
B-1003	-127.5	0.0	21.5	78.5	21.3	ND
B-1003	-177.5	0.3	83.9	15.8	18.9	ND
B-1003	-227.5	0.0	84.1	15.9	28.6	ND
B-1003	-273.5	0.0	86.8	13.2	26.4	ND
				Median	24.0	2.67

Note.
ND – Not Determined
OW-series data are provided in SSAR Appendix 2.4A
B-series data are provided in SSAR Appendix 2.5A
Moisture content is by weight percent.

Table 2.3.1-24 Availability of USGS Water Quality Data for the Savannah River

USGS Site Number	Site Name	From	To	Count	suspended sediment data available
2187303	SAVANNAH RIVER AT GA 181 NEAR MONTEVIDEO, GA.	1/10/2002	12/11/2002	22	turbidity only
2187500	SAVANNAH RIVER NEAR IVA,S.C.	5/24/1957	11/14/1985	138	suspended solids, residue
2189000	SAVANNAH RIVER NEAR CALHOUN FALLS, S. C.	3/29/1956	7/10/1974	63	turbidity only
21964839	SAVANNAH RIVER NEAR MARTINEZ, GA	7/24/1990	2/16/1994	44	none
2196560	SAVANNAH RIVER (AUGUSTA INTAKE) NR AUGUSTA, GA.	10/12/1970	10/12/1970	1	none
2196650	SAVANNAH R NR BEECH ISLAND, S. C.	12/10/1971	7/12/1972	5	none
2196670	SAVANNAH RIVER JEFFERSON DAVIS BR, AT AUGUSTA, GA.	1/14/2002	12/16/2002	20	residue
2196671	SAVANNAH RIVER (US 1) AT AUGUSTA, GA.	1/28/1997	8/13/1998	18	turbidity, residue
2196993	SAVANNAH RIVER ABOVE LOCK AND DAM AT AUGUSTA, GA.	1/14/2002	12/16/2002	20	turbidity, residue
2197000	SAVANNAH RIVER AT AUGUSTA, GA	7/24/1990	7/20/1998	62	turbidity, residue
					turbidity
2197065	SAVANNAH RIVER BELOW SPIRIT CREEK, NEAR AUGUSTA,GA	7/23/1990	8/9/2005	243	turbidity, residue
2197320	SAVANNAH R. NR JACKSON, SC	10/3/1972	6/27/1974	23	turbidity
2197375	SAVANNAH RIVER AT STONY BLUFF LANDING, GA.	11/3/1937	12/17/2002	83	turbidity, residue
2197500	SAVANNAH R AT BURTONS FERRY BR NR MILLHAVEN, GA	10/19/1993	2/15/1994	5	turbidity
2198500	SAVANNAH RIVER NEAR CLYO, GA	5/1/1938	7/8/2003	771	suspended solids, residue
2198920	SAVANNAH RIVER AT GA 25, AT PORT WENTWORTH, GA	5/2/1958	8/10/2005	101	turbidity, residue
2198975	SAVANNAH RIVER AT SAVANNAH, GA	1/16/2002	12/2/2004	63	turbidity, residue
219897991	SAVANNAH RIVER AT FORT JACKSON, NEAR SAVANNAH, GA	1/17/2002	12/2/2004	63	turbidity, residue
219897992	SAVANNAH RIVER AT SOUTH CHANNEL,NEAR SAVANNAH, GA	1/17/2002	12/2/2004	63	turbidity
219897996	SAVANNAH RIVER AT FIELDS CUT, NEAR SAVANNAH, GA	1/17/2002	12/2/2004	63	turbidity, residue
219897998	SAVANNAH RIVER NEAR FORT PULASKI, GA	1/17/2002	12/2/2004	63	turbidity, residue
2198980	SAVANNAH RIVER AT FORT PULASKI, GA	3/7/1960	3/8/1960	3	residue

Table 2.3.1-25 Suspended Sediment Loads and Average Daily Flows for the Savannah River at Clyo, Georgia

Date	Average daily flow, cfs	Suspended sediment discharge, tons per day		Date	Average daily flow, cfs	Suspended sediment discharge, tons per day
1/17/1974	19800	1970		3/8/1978	11600	469
2/14/1974	26300	2120		4/5/1978	10300	609
3/21/1974	10100	1270		5/3/1978	9670	342
4/26/1974	13300	1450		6/7/1978	10300	72
5/22/1974	9190	1350		7/6/1978	7220	660
8/1/1974	7810	522		8/9/1978	7870	170
8/30/1974	9040	731		9/7/1978	8850	337
9/26/1974	7620	518		10/4/1978	6880	15
10/23/1974	7480	850		11/2/1978	6690	54
11/22/1974	8300	627		12/6/1978	7460	200
12/18/1974	8700	353		1/4/1979	7710	166
1/17/1975	14600	3150		2/7/1979	8370	386
2/21/1975	23500	771		4/4/1979	16800	544
3/13/1975	23200	643		5/2/1979	35200	762
4/17/1975	38700	847		6/7/1979	18800	1260
5/8/1975	14500	1170		7/19/1979	7840	462
6/19/1975	11400	948		8/23/1979	7760	251
7/17/1975	12800	1170		9/6/1979	11400	400
8/13/1975	9700	627		10/4/1979	11600	345
9/11/1975	9020	497		11/9/1979	9040	243
10/16/1975	9940	485		12/14/1979	16600	538
11/12/1975	16200	797		1/10/1980	8640	140
12/18/1975	15400	994		2/6/1980	24700	603
1/14/1976	15900	926		3/6/1980	12400	439
2/12/1976	18600	492		4/2/1980	51600	1570
3/17/1976	13000	1120		5/7/1980	12000	758
4/14/1976	22200	754		6/11/1980	17500	950
5/12/1976	8070	367		7/2/1980	9030	24
6/9/1976	21200	592		8/6/1980	6480	273
7/14/1976	18000	544		9/4/1980	6120	234
8/11/1976	8400	530		10/8/1980	7950	372
9/14/1976	8230	152		11/21/1980	8770	309
10/6/1976	8900	301		12/9/1980	7820	233
11/4/1976	9200	400		1/8/1981	7870	214
12/2/1976	15900	1350		2/4/1981	7850	148
1/12/1977	19100	363		4/16/1981	7380	278
2/10/1977	11700	57		5/5/1981	6350	223
3/9/1977	14700	591		6/3/1981	7510	734
4/7/1977	24300	643		7/9/1981	6180	67
5/5/1977	11400	745		8/26/1981	6870	149
6/2/1977	7820	484		9/3/1981	6450	313
7/13/1977	7320	332		11/4/1981	5430	147
8/10/1977	8090	440		1/6/1982	15200	1070
9/14/1977	7590	326		3/3/1982	18500	549
10/20/1977	7050	266		5/13/1982	6660	215
11/17/1977	13700	769		7/13/1982	6680	332
12/7/1977	15700	899		9/2/1982	6250	284
1/11/1978	11100	366		2/8/1983	19300	1060
2/8/1978	28600	318				

Table 2.3.1-26 Calculation of Monthly Statistics for Suspended Sediment Load at Clyo, Georgia

	January samples	tons/day	February samples	tons/day	March samples	tons/day	April samples	tons/day	May samples	tons/day	June samples	tons/day
	1/17/1974	1970	2/14/1974	2120	3/21/1974	1270	4/26/1974	1450	5/22/1974	1350	6/19/1975	948
	1/17/1975	3150	2/21/1975	771	3/13/1975	643	4/17/1975	847	5/8/1975	1170	6/9/1976	592
	1/14/1976	926	2/12/1976	492	3/17/1976	1120	4/14/1976	754	5/12/1976	367	6/2/1977	484
	1/12/1977	363	2/10/1977	57	3/9/1977	591	4/7/1977	643	5/5/1977	745	6/7/1978	72
	1/11/1978	366	2/8/1978	318	3/8/1978	469	4/5/1978	609	5/3/1978	342	6/7/1979	1260
	1/4/1979	166	2/7/1979	386	3/6/1980	439	4/4/1979	544	5/2/1979	762	6/11/1980	950
	1/10/1980	140	2/6/1980	603	3/3/1982	549	4/2/1980	1570	5/7/1980	758	6/3/1981	734
	1/8/1981	214	2/4/1981	148			4/16/1981	278	5/5/1981	223		
	1/6/1982	1070	2/8/1983	1060					5/13/1982	215		
Samp size		9		9		7		8		9		7
Avg		929.4		661.7		725.9		836.9		659.1		720.0
Std Dev		1024.1		627.8		330.7		448.5		409.2		384.9
C.I., 95%, α = .05		**669.0**		**410.2**		**245.0**		**310.8**		**267.3**		**285.1**
C.I., 50%, α = .50		**230.2**		**141.2**		**84.3**		**107.0**		**92.0**		**98.1**

	July samples	tons/day	August samples	tons/day	September samples	tons/day	October samples	tons/day	November samples	tons/day	December samples	tons/day
	7/17/1975	1170	8/1/1974	522	9/26/1974	518	10/23/1974	850	11/22/1974	627	12/18/1974	353
	7/14/1976	544	8/30/1974	731	9/11/1975	497	10/16/1975	485	11/12/1975	797	12/18/1975	994
	7/13/1977	332	8/13/1975	627	9/14/1976	152	10/6/1976	301	11/4/1976	400	12/2/1976	1350
	7/6/1978	660	8/11/1976	530	9/14/1977	326	10/20/1977	266	11/17/1977	769	12/7/1977	899
	7/19/1979	462	8/10/1977	440	9/7/1978	337	10/4/1978	15	11/2/1978	54	12/6/1978	200
	7/2/1980	24	8/9/1978	170	9/6/1979	400	10/4/1979	345	11/9/1979	243	12/14/1979	538
	7/9/1981	67	8/23/1979	251	9/4/1980	234	10/8/1980	372	11/21/1980	309	12/9/1980	233
	7/13/1982	332	8/6/1980	273	9/3/1981	313			11/4/1981	147		
			8/26/1981	149	9/2/1982	284						
Samp size		8		9		9		7		8		7
Avg		448.9		410.3		340.1		376.3		418.3		652.4
Std Dev		364.0		208.5		117.6		253.5		282.7		437.3
C.I., 95%, α = .05		**252.2**		**136.2**		**76.8**		**187.8**		**195.9**		**324.0**
C.I., 50%, α = .50		**86.8**		**46.9**		**26.4**		**64.6**		**67.4**		**111.5**

Table 2.3.1-27 Presence of Utley Limestone in the VEGP ESP Site Borings

Boring	Northing	Easting	Utley Limestone
B-1001	1,142,661.92	620,220.42	Present
B-1002	1,142,998.52	620,985.47	Absent
B-1003	1,142,974.36	621,889.85	Present
B-1004	1,142,985.41	620,131.44	Present
B-1005	1,143,991.57	620,155.35	Present
B-1006	1,143,810.26	621,342.90	Absent
B-1007	1,142,662.29	621,120.13	Present
B-1008	1,142,670.93	621,996.15	Present
B-1009	1,141,000.54	620,361.26	Absent
B-1010	1,141,000.12	621,279.68	Absent
B-1011	1,143,741.13	622,378.01	Present
B-1013	1,140,976.08	622,272.50	Absent
OW-1006	1,143,817.85	619,179.75	Present
OW-1008	1,142,347.94	619,306.69	Present
OW-1009	1,141,891.65	620,888.61	Present
OW-1012	1,139,969.50	621,045.92	Absent
OW-1013	1,140,805.40	621,715.03	Absent
OW-1015	1,140,550.58	623,086.32	Absent

Note.
B-series data are provided in SSAR Appendix 2.5A
OW-series data are provided in SSAR Appendix 2.4A

Table 2.3.1-28 Summary of Holes Drilled at the Site for the Installation of Observation Wells

Boring / Drill Log No.	Drilling Method	Drill Dates		Sampled Depth		Drilled Depth Below the GS	Boring "Abandoned" or "Well" Installed
		Start	End	From (ft)	To (ft)	(ft)	
OW-1001A	3.25" HSA	25-May	25-May	No sampling		100	Abandoned
OW-1001	4.25" HSA	24-May	29-May	113.5	140	140	Well
OW-1002A	3.25" HSA	24-May	25-May	0	108.5	108.5	Abandoned
OW-1002	Rotosonic	2-Jun	6-Jun	87	237	237	Well
OW-1003A	3.25" HSA	24-May	24-May	0	90	90	Abandoned
OW-1003	4.25" HSA	25-May	25-May	No sampling		90.5	Well
OW-1004	Rotosonic	3-Jun	11-Jun	87	187	187	Well
OW-1005A	3.25" HSA	31-May	31-May	0	75	75	Abandoned
OW-1005	4.25" HSA	2-Jun	7-Jun	68.5	170	170	Well
OW-1006A	4.25" HSA	3-Jun	4-Jun	0	125	125	Abandoned
OW-1006	4.25" HSA	9-Jun	14-Jun	118.5	135	135	Well
OW-1007	4.25" HSA	4-Jun	7-Jun	98.5	122	122	Well
OW-1008A	3.25" HSA	26-May	26-May	0	107.5	105	Well OW-1008
OW-1008	Rotosonic	31 May	1-Jun	108	247	247	Well
OW-1009	4.25" HSA	24-May	27-May	0	100	100	Well
OW-1010	4.25" HSA	1-Jun	1-Jun	0	93.5	93.5	Well
OW-1011	Rotosonic	11-Jun	12-Jun	87	217	217	Well
OW-1012	4.25" HSA	31-May	1-Jun	0	93.6	93.6	Well
OW-1013	4.25" HSA	9-Jun	10-Jun	0	103.5	103.5	Well
OW-1014	Rotosonic	11-Jun	11-Jun	97	197.4	197.4	Well
OW-1015	4.25" HSA	30-May	3-Jun	0	120	120	Well

Note.

Borings OW-1001A, OW-1002A, OW-1003A, and OW-1005A were abandoned due to the use of 3.25-in hollow stem auger, which would not adequately accommodate well installation.

Boring OW-1006A was abandoned due to the of shortage hollow stem auger flights.

Boring OW-1008A is the upper portion of boring OW-1008 and was not abandoned. The "A" is designated to show that the upper portion of this boring was drilled using 3.25-in hollow-stem augers while the lower portion was drilled using the rotosonic drilling method.

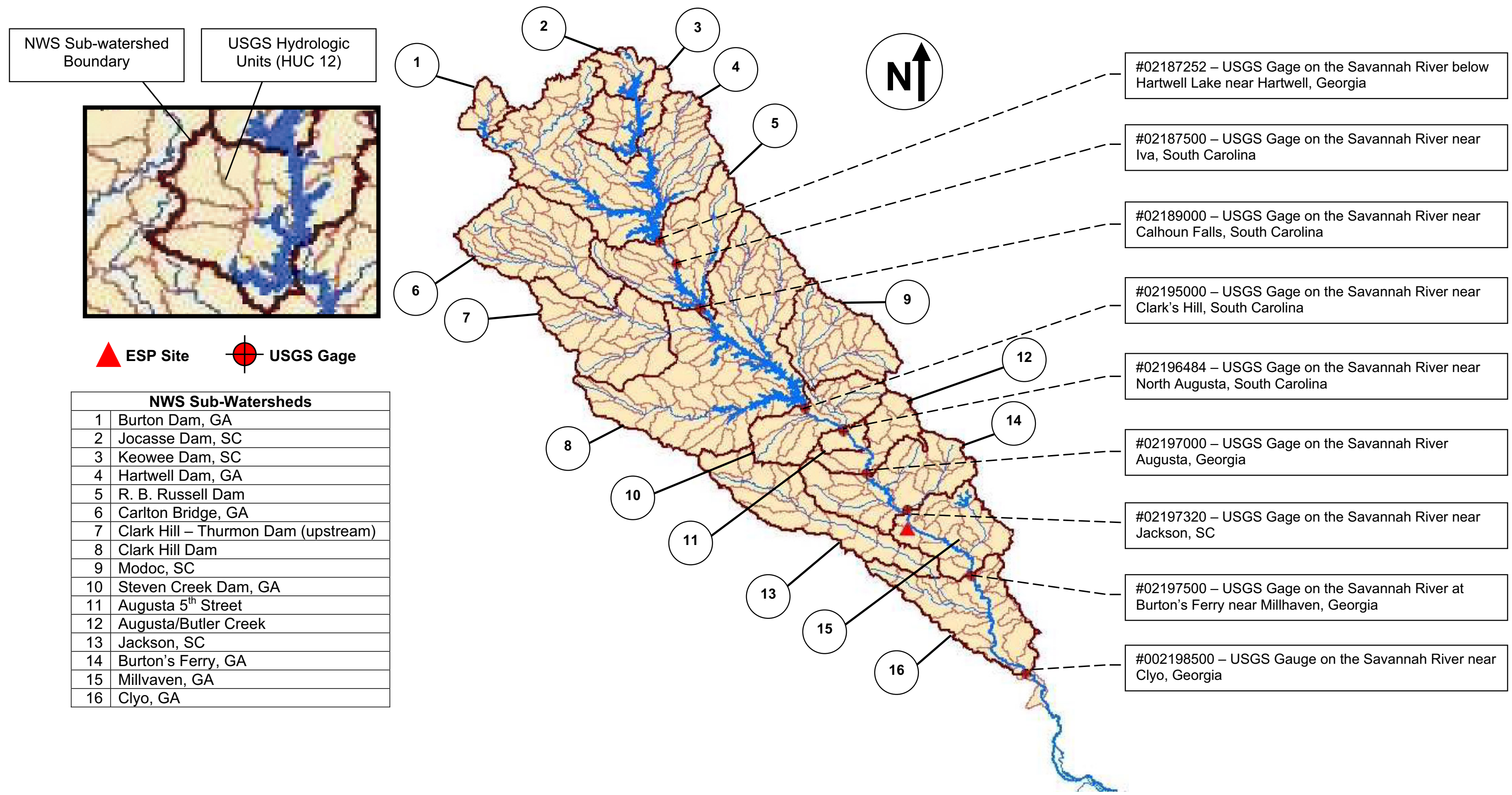
Boring log OW-1003 contained in SSAR Appendix 2.4A (report Appendix E) should read OW-1003A.

The drilling method for boring OW-1006 is assumed to be 4.25" HSA (not described in SSAR Appendix 2.4A (report Appendix E)).

Table 2.3.1-29 Minimum and Maximum Water Levels Recorded at Observation Wells 802A, 805A, 808, LT-7A, LT-12, and LT-13.

Observation Well	Minimum Water Level Elevation (ft msl)	Date	Maximum Water Level Elevation (ft msl)	Date
802A	156.1	5-Dec-02	160.8	17-Jun-99
805A	156.9	5-Dec-02	162.5	17-Jun-99
808	155.0	12-Jun-01	160.6	9-Dec-03
LT7A	152.0	30-Jun-85	159.6	19-Feb-86
LT12	155.8	10-Mar-03	162.4	26-Feb-86
LT13	154.3	10-Mar-03	159.0	1-Feb-88

Note:
Water level data provided in SSAR Table 2.4.12-15.



NWS Sub-Watersheds	
1	Burton Dam, GA
2	Jocasse Dam, SC
3	Keowee Dam, SC
4	Hartwell Dam, GA
5	R. B. Russell Dam
6	Carlton Bridge, GA
7	Clark Hill – Thurmon Dam (upstream)
8	Clark Hill Dam
9	Modoc, SC
10	Steven Creek Dam, GA
11	Augusta 5th Street
12	Augusta/Butler Creek
13	Jackson, SC
14	Burton's Ferry, GA
15	Millvaven, GA
16	Clyo, GA

Figure 2.3.1-1 Savannah River Watershed and HUCs (No Scale)

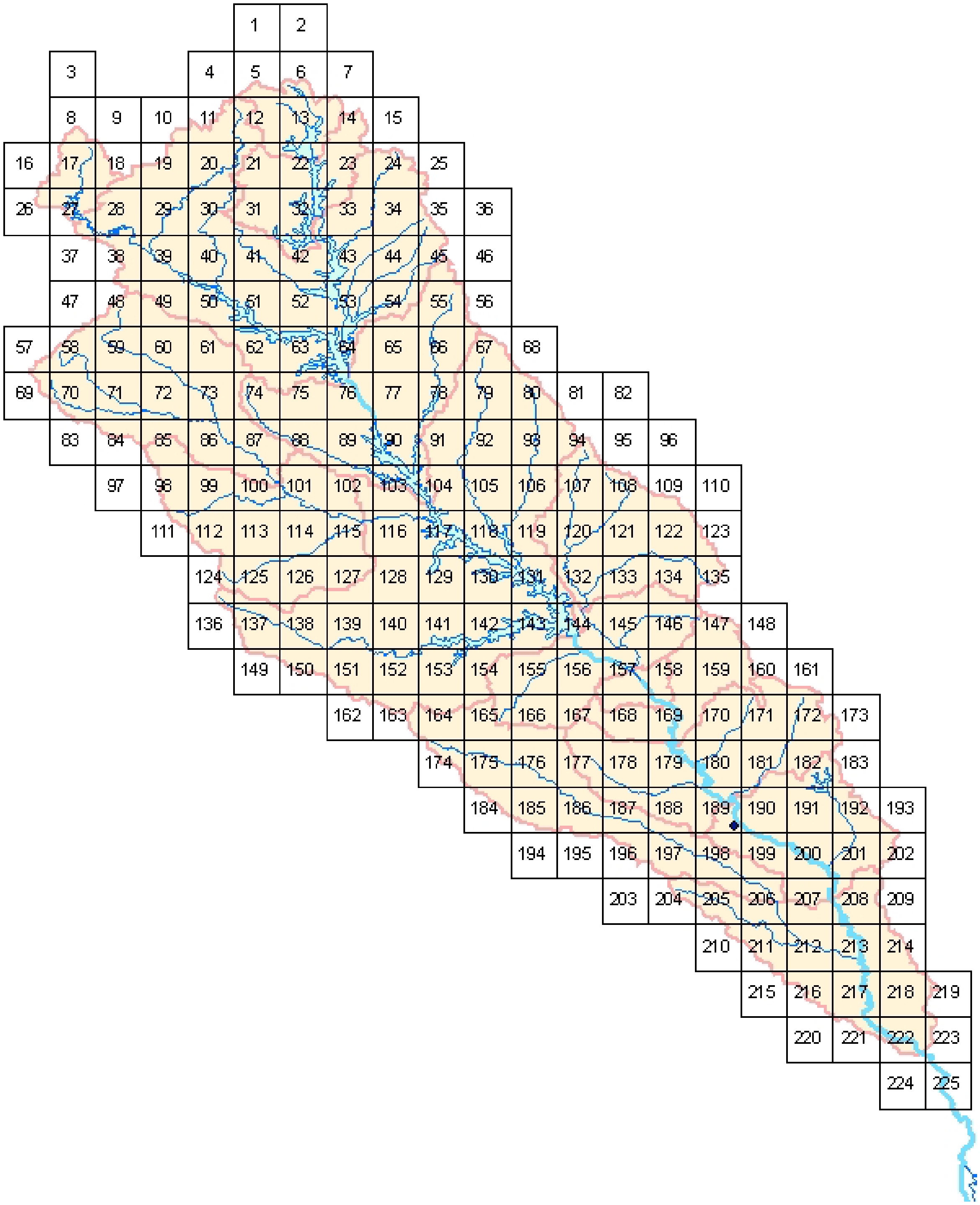
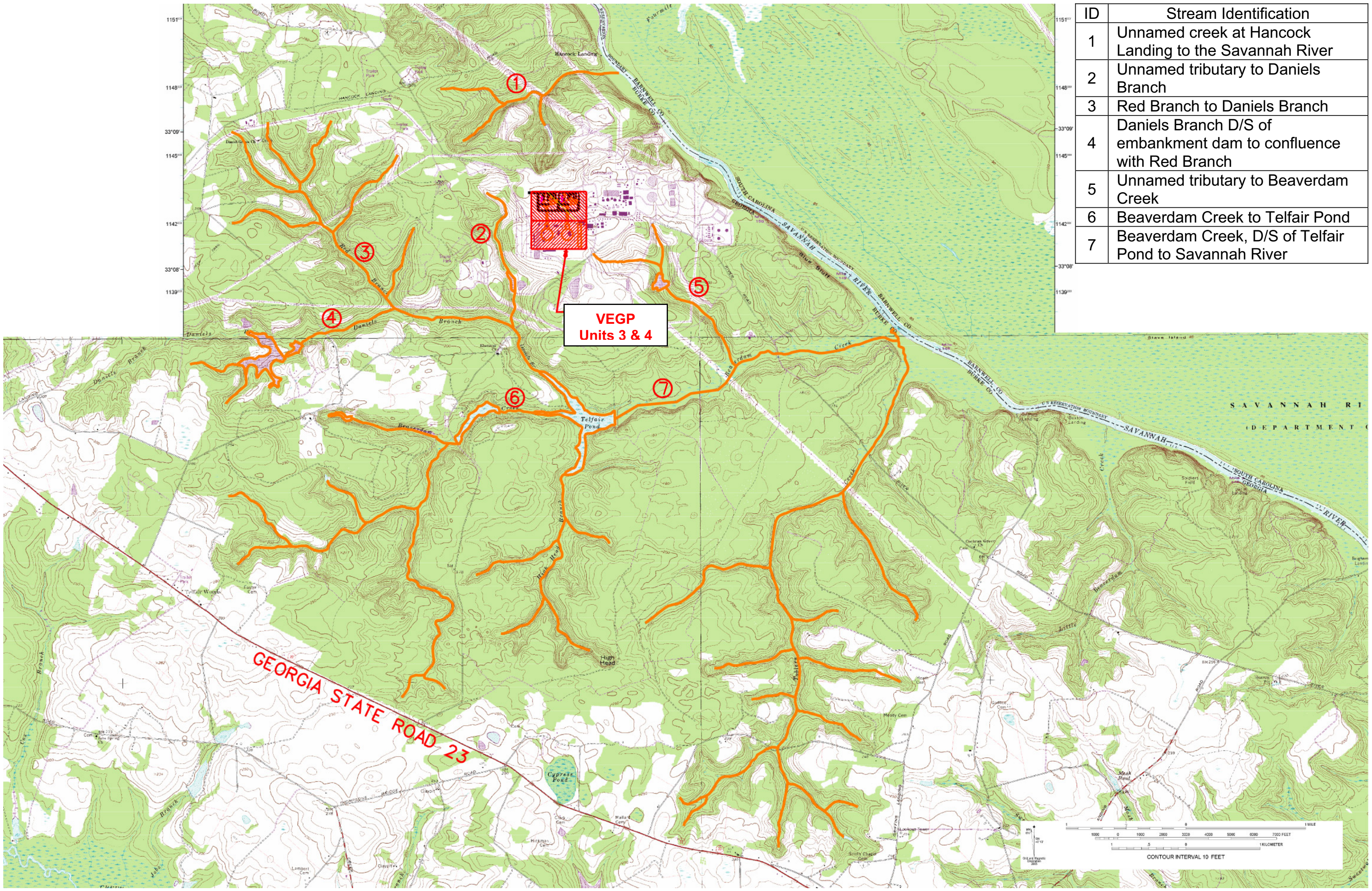


Figure 2.3.1-2 USGS 7.5-Minute Quadrangle Coverage for Savannah River Watershed



ID	Stream Identification
1	Unnamed creek at Hancock Landing to the Savannah River
2	Unnamed tributary to Daniels Branch
3	Red Branch to Daniels Branch
4	Daniels Branch D/S of embankment dam to confluence with Red Branch
5	Unnamed tributary to Beaverdam Creek
6	Beaverdam Creek to Telfair Pond
7	Beaverdam Creek, D/S of Telfair Pond to Savannah River

Figure 2.3.1-3 Local Area Drainage Map

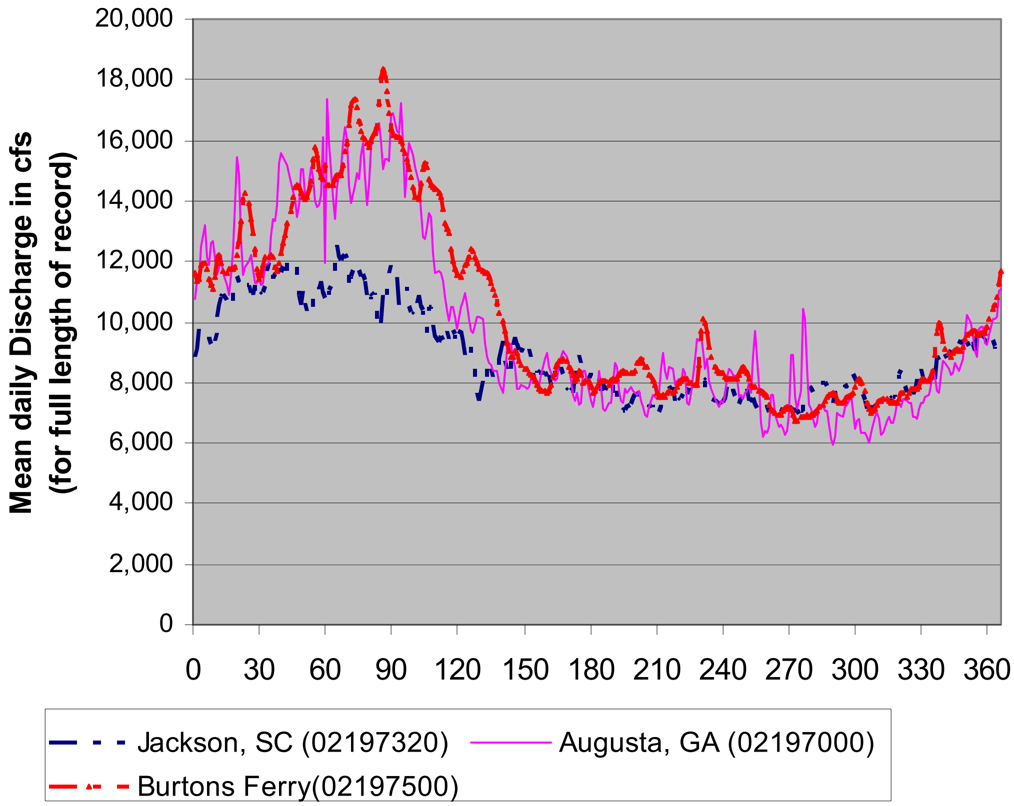


Figure 2.3.1-4 Mean Daily Discharge on the Savannah River at Augusta, Georgia; Jackson, South Carolina; and Burtons Ferry for Entire Period of Record

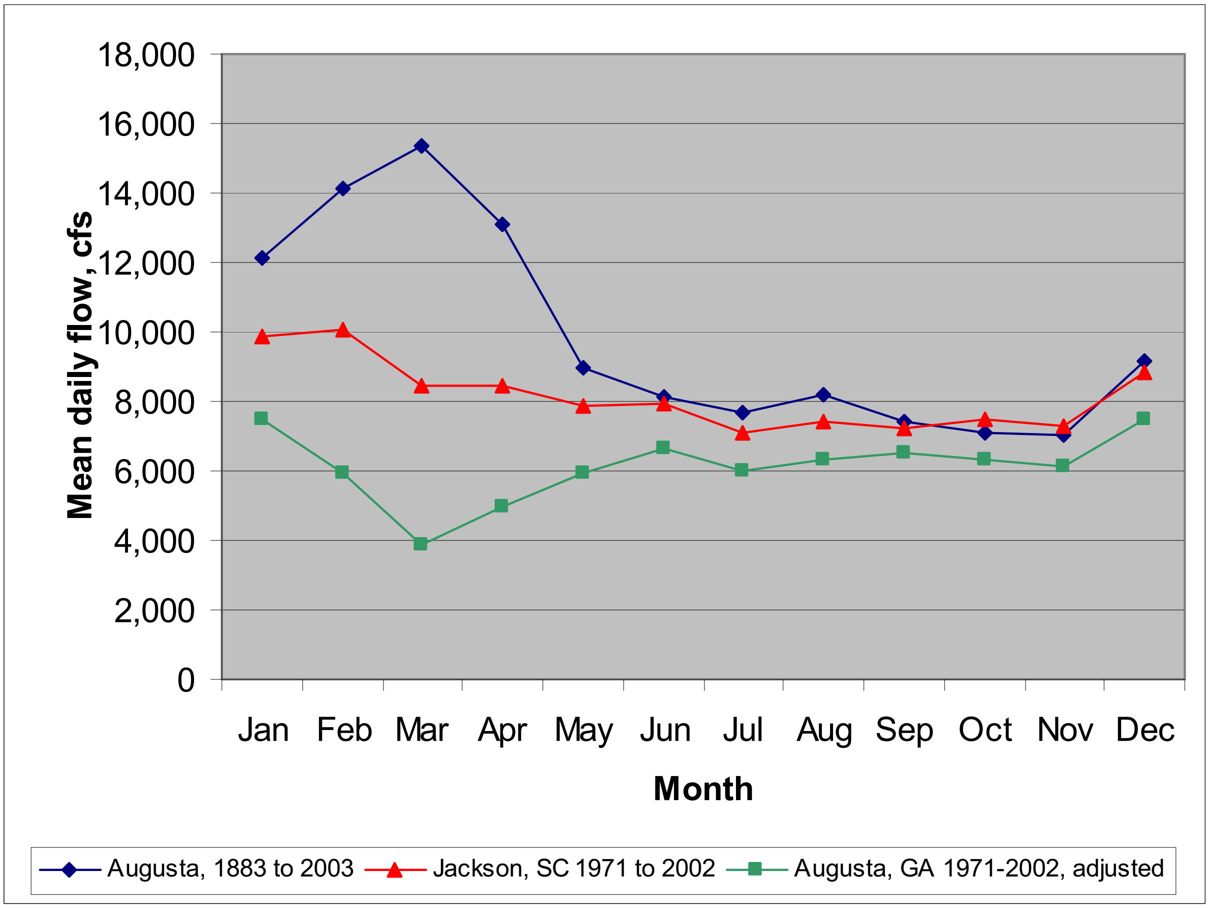


Figure 2.3.1-5 Full-Period and Adjusted Mean Discharges for Each Month on the Savannah River at Augusta, Georgia, and Jackson, South Carolina

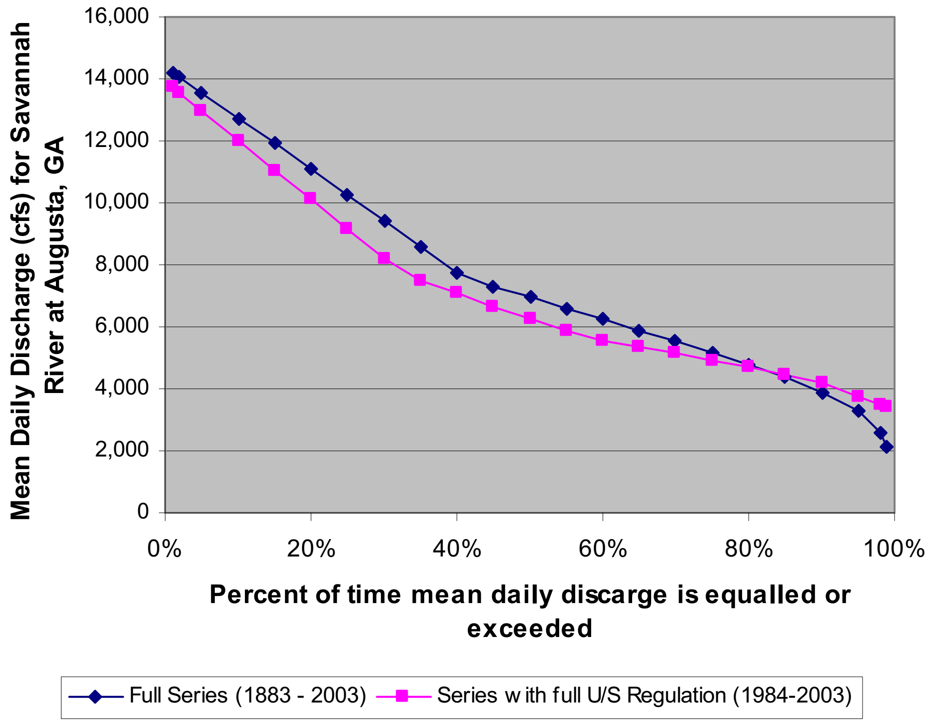


Figure 2.3.1-6 Flow-Duration Curves for the Savannah River at Augusta, Georgia, for Unregulated and Regulated Periods

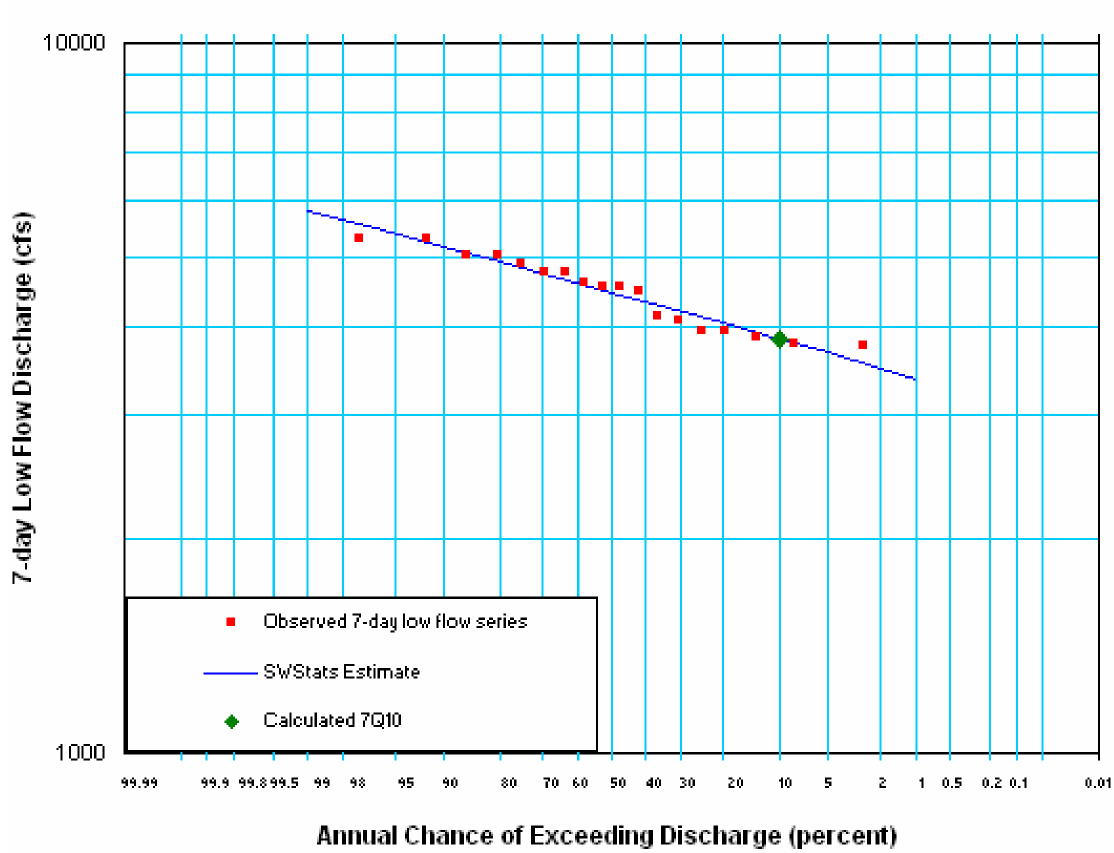
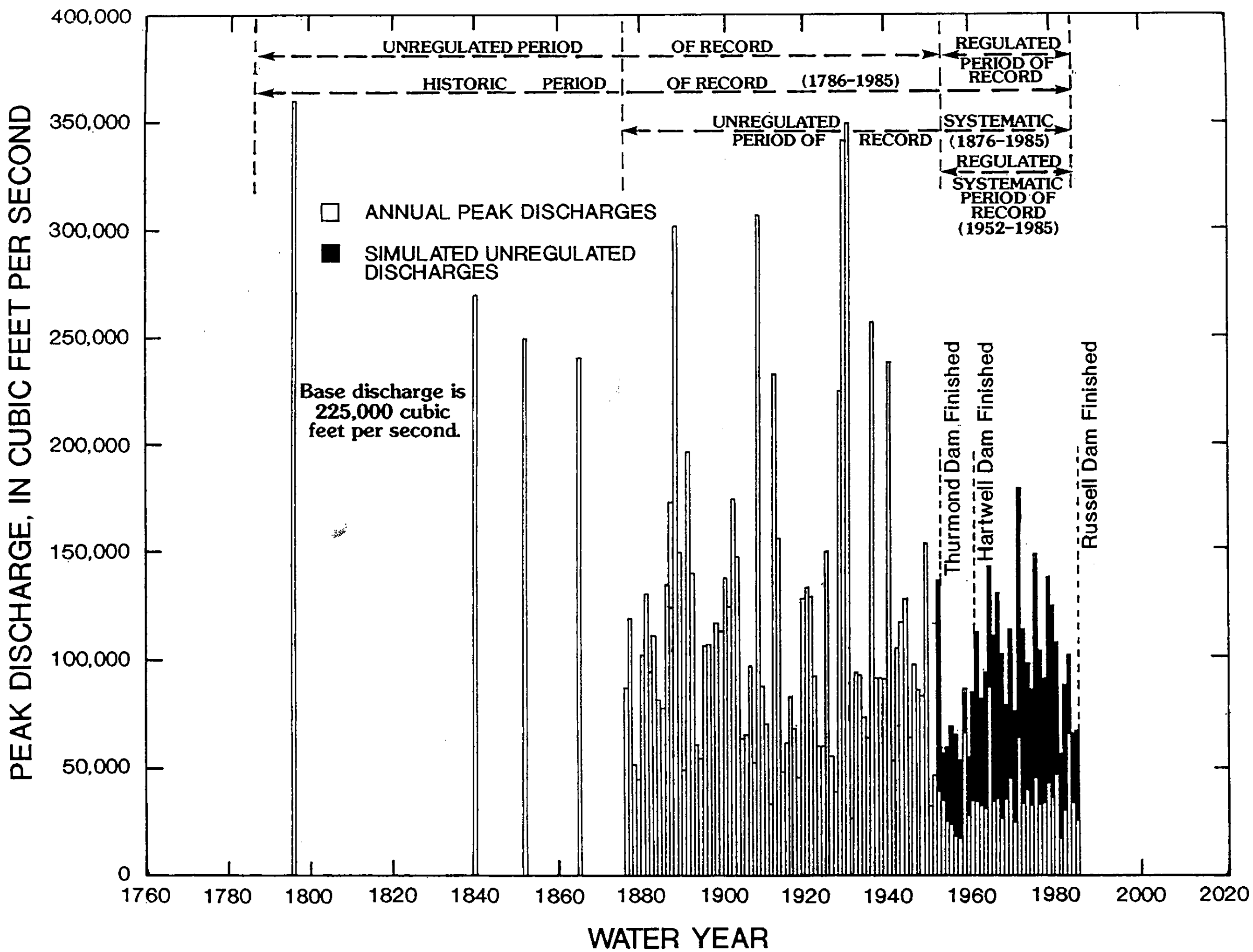
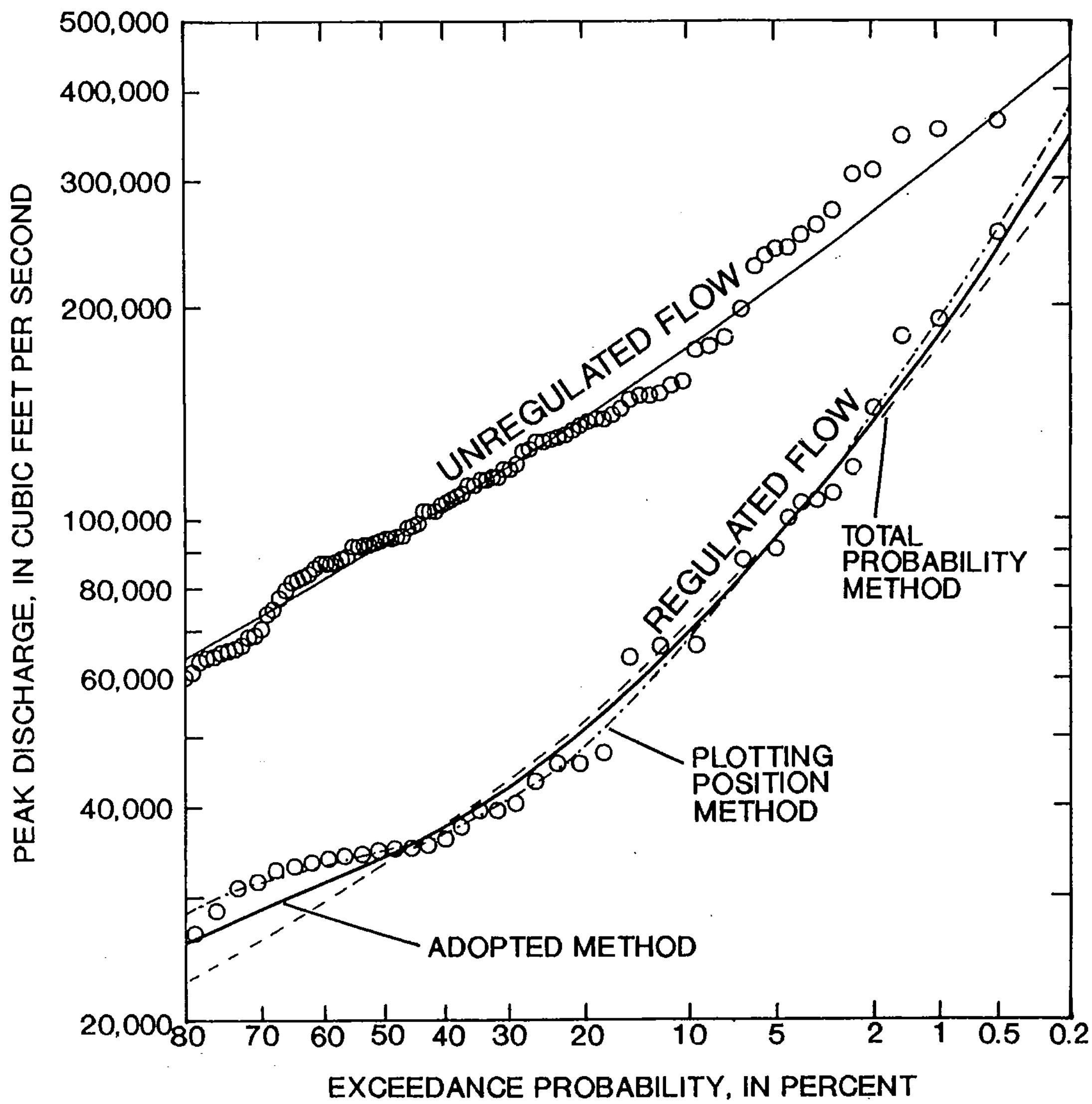


Figure 2.3.1-7 Log-Pearson III Frequency Plot of 7-Day Low-Flow for Regulated Period on the Savannah River at Augusta, Georgia



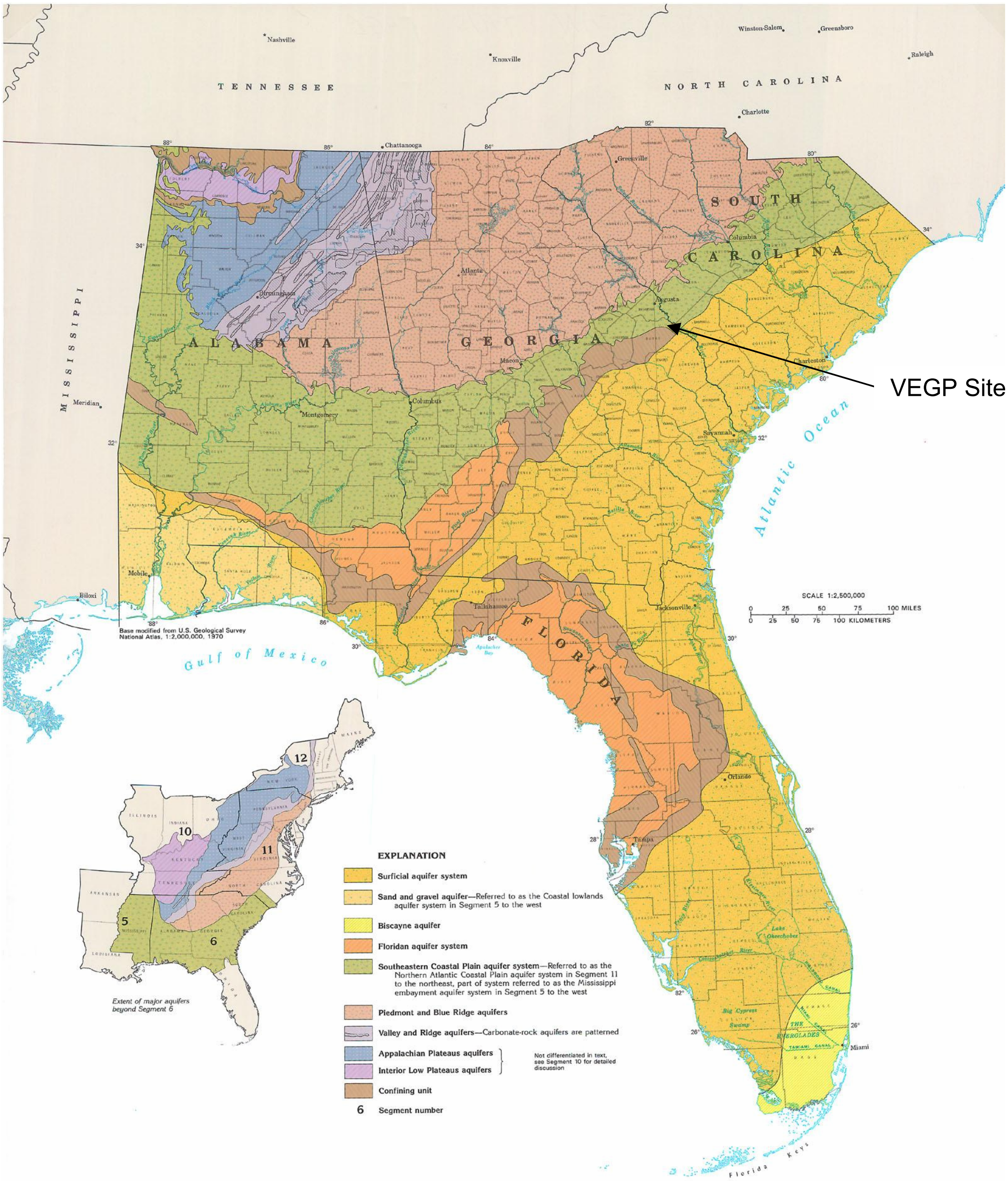
Source: Figure 2 from USGS 1990

Figure 2.3.1-8 Unregulated and Regulated Peak Discharge Values for the Savannah River at Augusta, Georgia (02197000)



Source: Figure 35 from USGS 1990

Figure 2.3.1-9 Unregulated and Regulated Annual Peak Discharge Frequency Curves for the Savannah River at Augusta, Georgia



Source: Figure 3 from Miller 1990

Figure 2.3.1-10 Extent of Major Aquifers or Aquifer Systems at the Land Surface in the VEGP Site Region

GEOLOGIC TIME		SNC ESP NOMENCLATURE		
PERIOD	SERIES	GEOLOGIC UNIT	HYDROGEOLOGIC UNIT	REGIONAL HYDROGEOLOGIC UNIT
TERTIARY	Eocene	Barnwell Gr.	Water Table aquifer	Southeastern Coastal Plain Aquifer System
		Lisbon Fm. / Blue Bluff Mbr.	Confining unit	
		Still Branch Fm. Congaree Fm.	Tertiary sand aquifer	
	Paleocene	Snapp Fm. Black Mingo Fm.	Semi-confining unit	
Cretaceous		Steel Creek Fm.	Cretaceous aquifer	
		Gaillard Fm. / Black Creek Fm.		
		Pio-Nono Fm. / unnamed sands		
		Cape Fear Fm.		

Notes: Geologic unit naming convention **(Huddlestun and Summerour 1996; Falls and Prowell 2001)**
Regional hydrogeologic unit naming convention **(Miller 1990)**

Figure 2.3.1-11 Schematic Hydrostratigraphic Classification for the VEGP Site

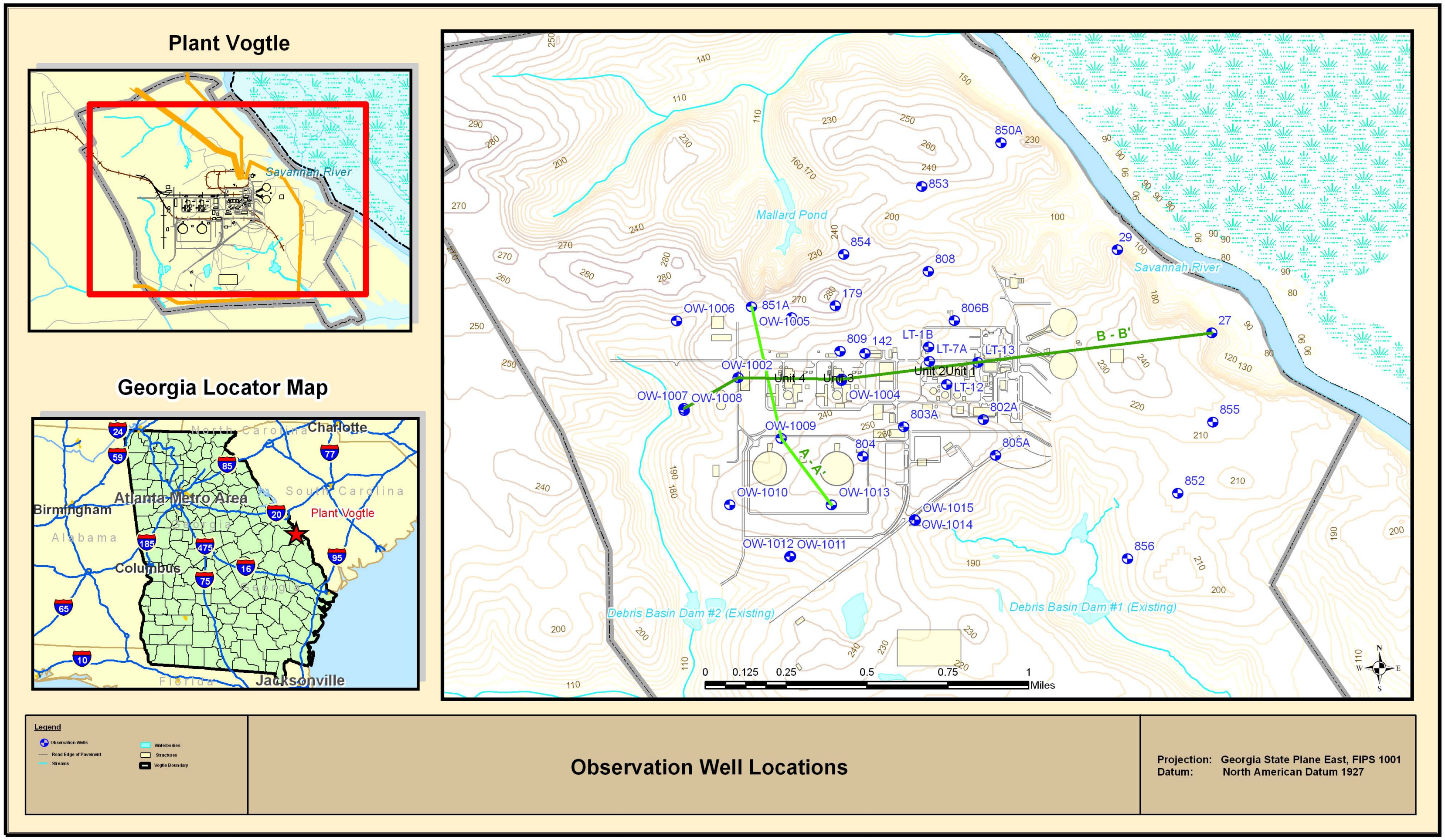


Figure 2.3.1-12 Observation Well Locations

Figure 2.3.1-13 Deleted in Revision 2

Figure 2.3.1-14 Deleted in Revision 2

Figure 2.3.1-15 Deleted in Revision 2

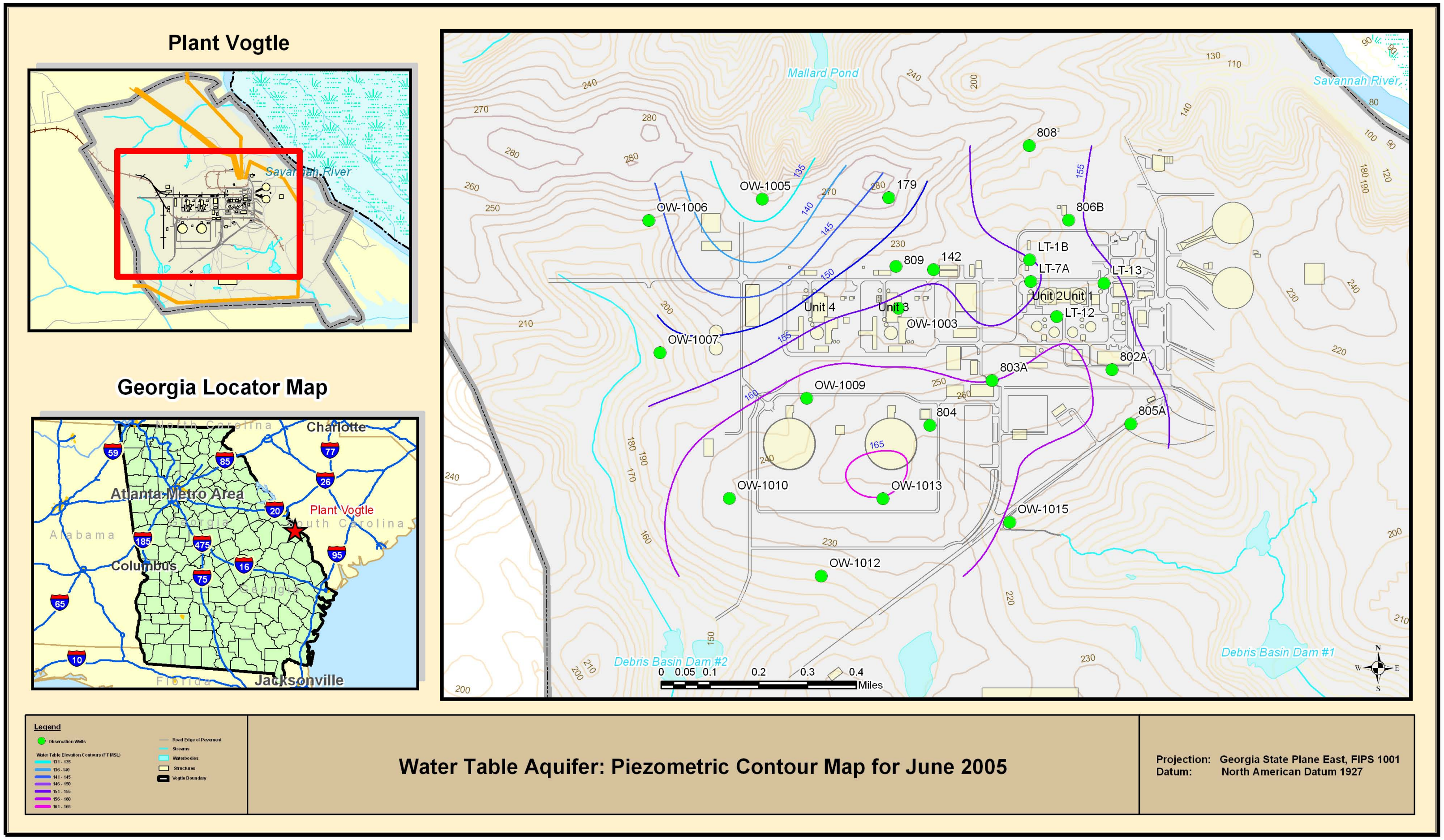


Figure 2.3.1-16 Water Table Aquifer: Piezometric Contour Map for June 2005

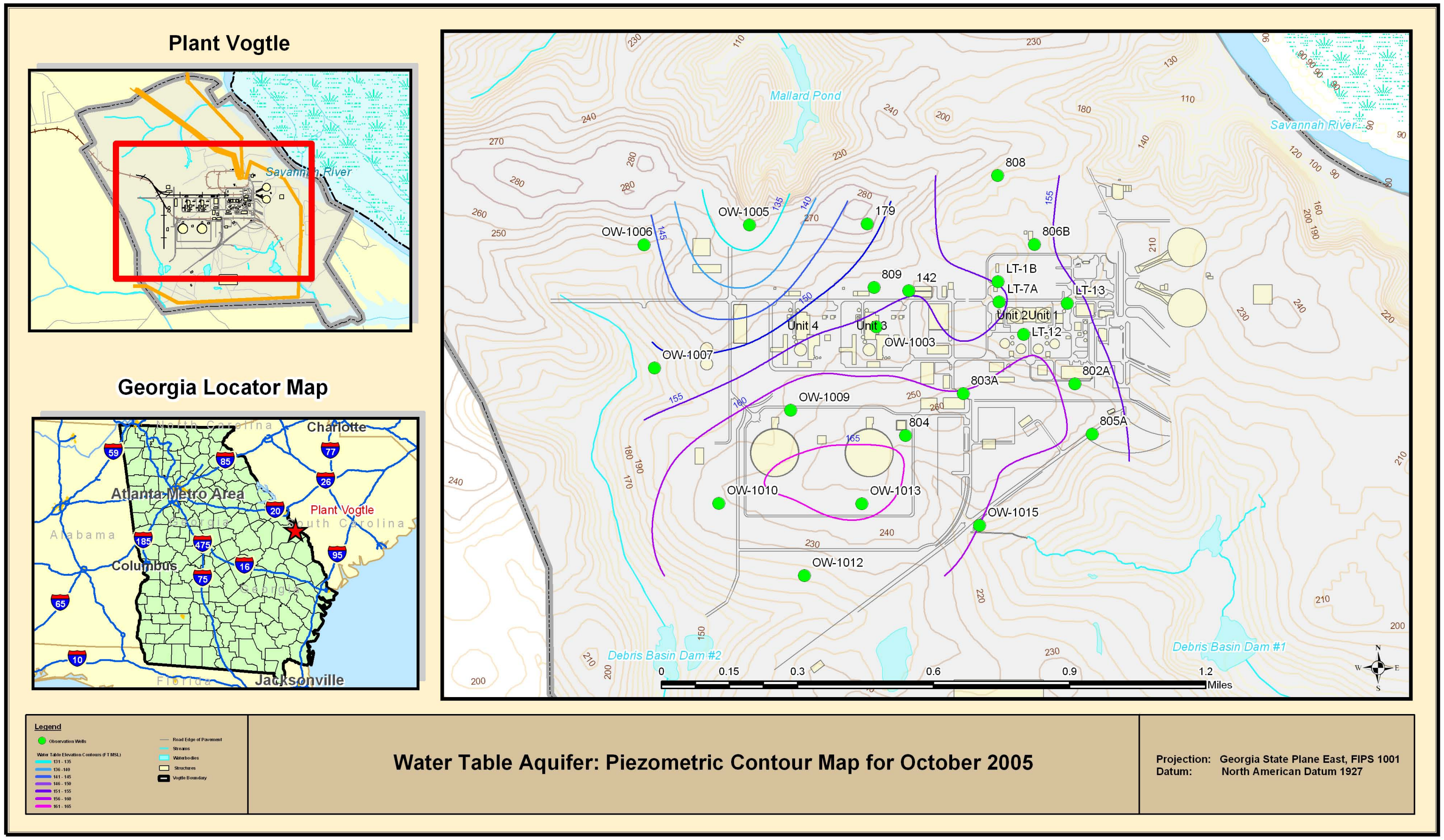


Figure 2.3.1-17 Water Table Aquifer: Piezometric Contour Map for October 2005

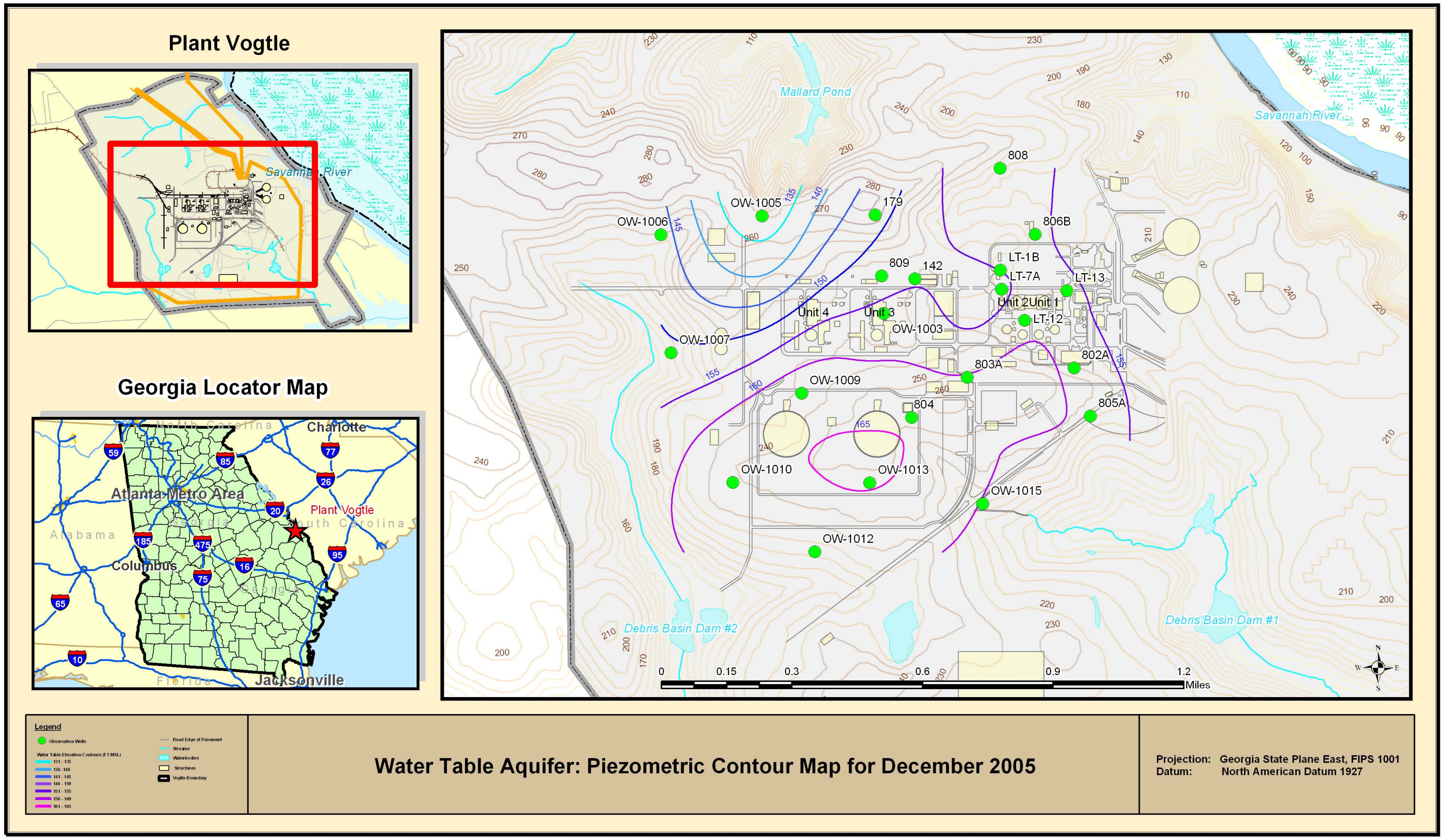


Figure 2.3.1-18 Water Table Aquifer: Piezometric Contour Map for December 2005

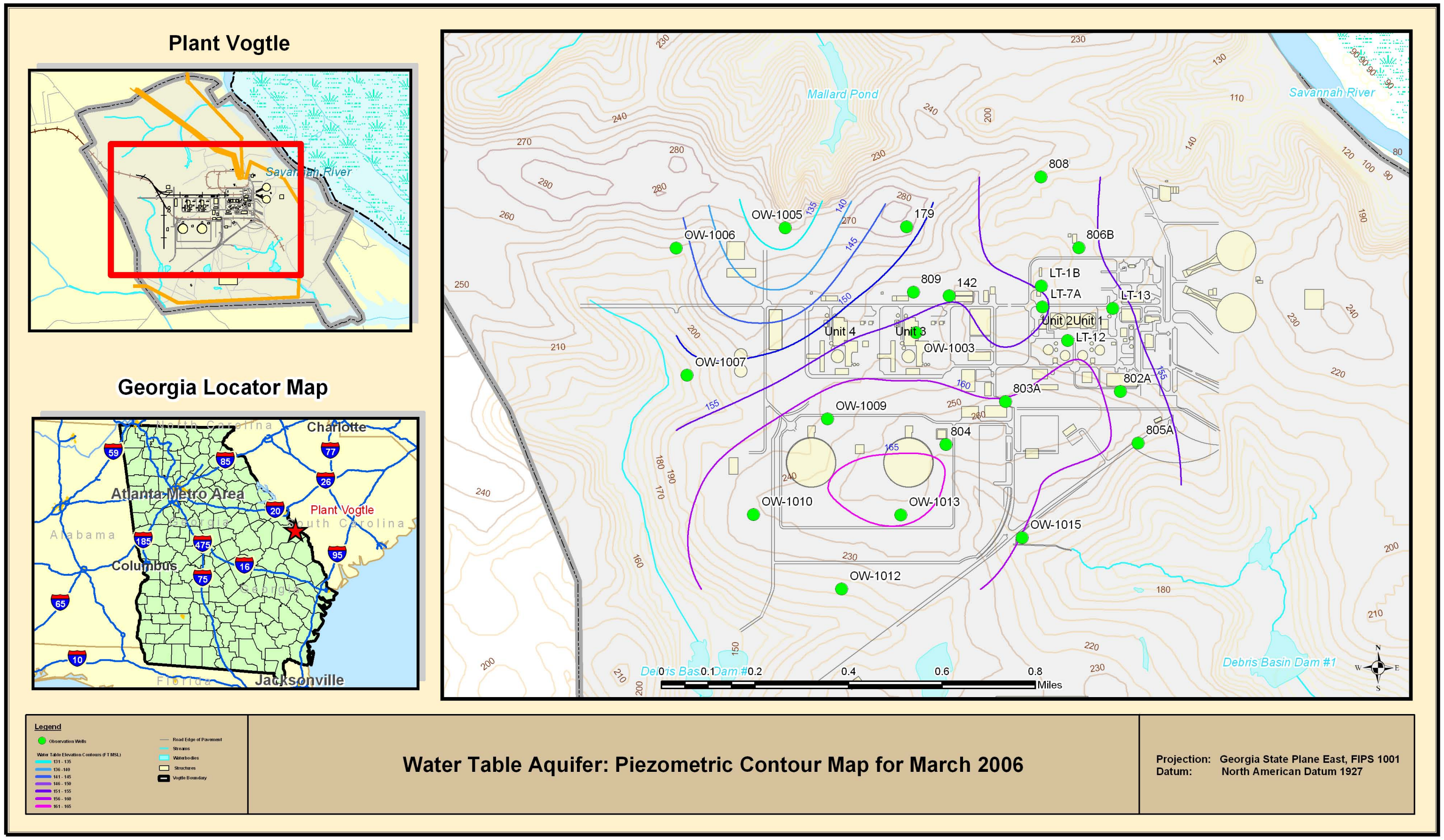


Figure 2.3.1-19 Water Table Aquifer: Piezometric Contour Map for March 2006

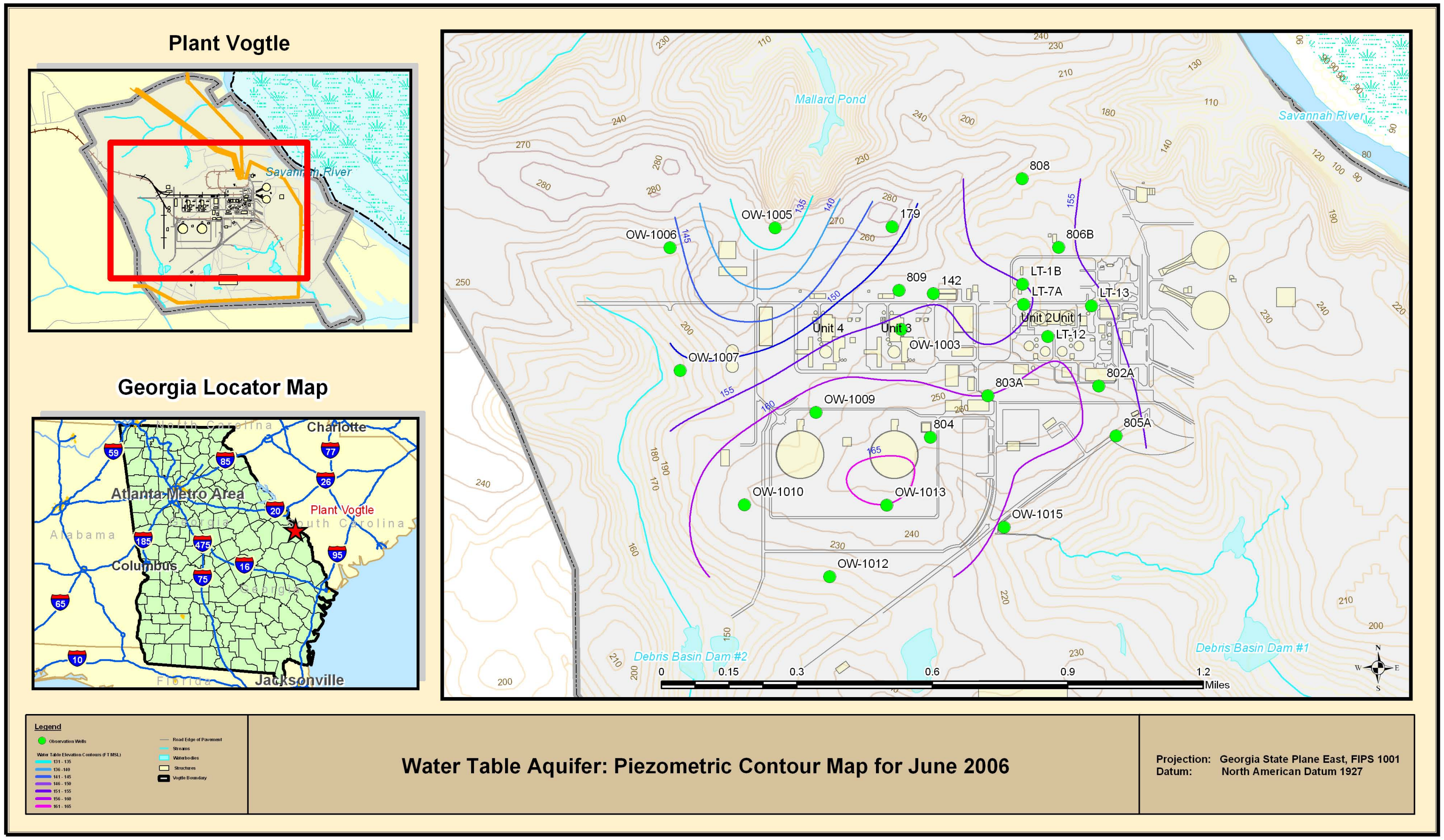


Figure 2.3.1-20 Water Table Aquifer: Piezometric Contour Map for June 2006

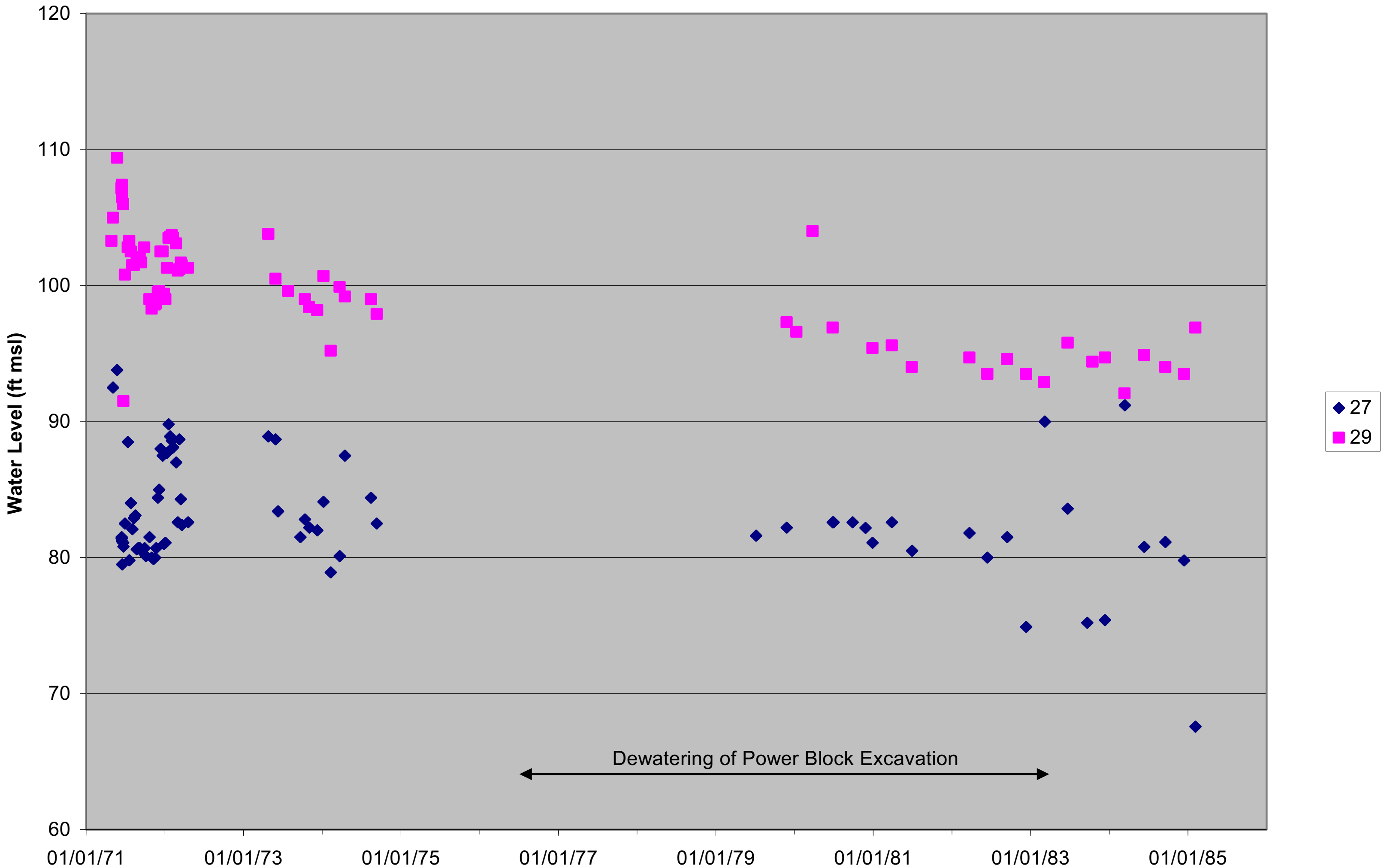


Figure 2.3.1-21 Tertiary Aquifer: 1971–1985 Hydrographs

Figure 2.3.1-22 Deleted in Revision 2

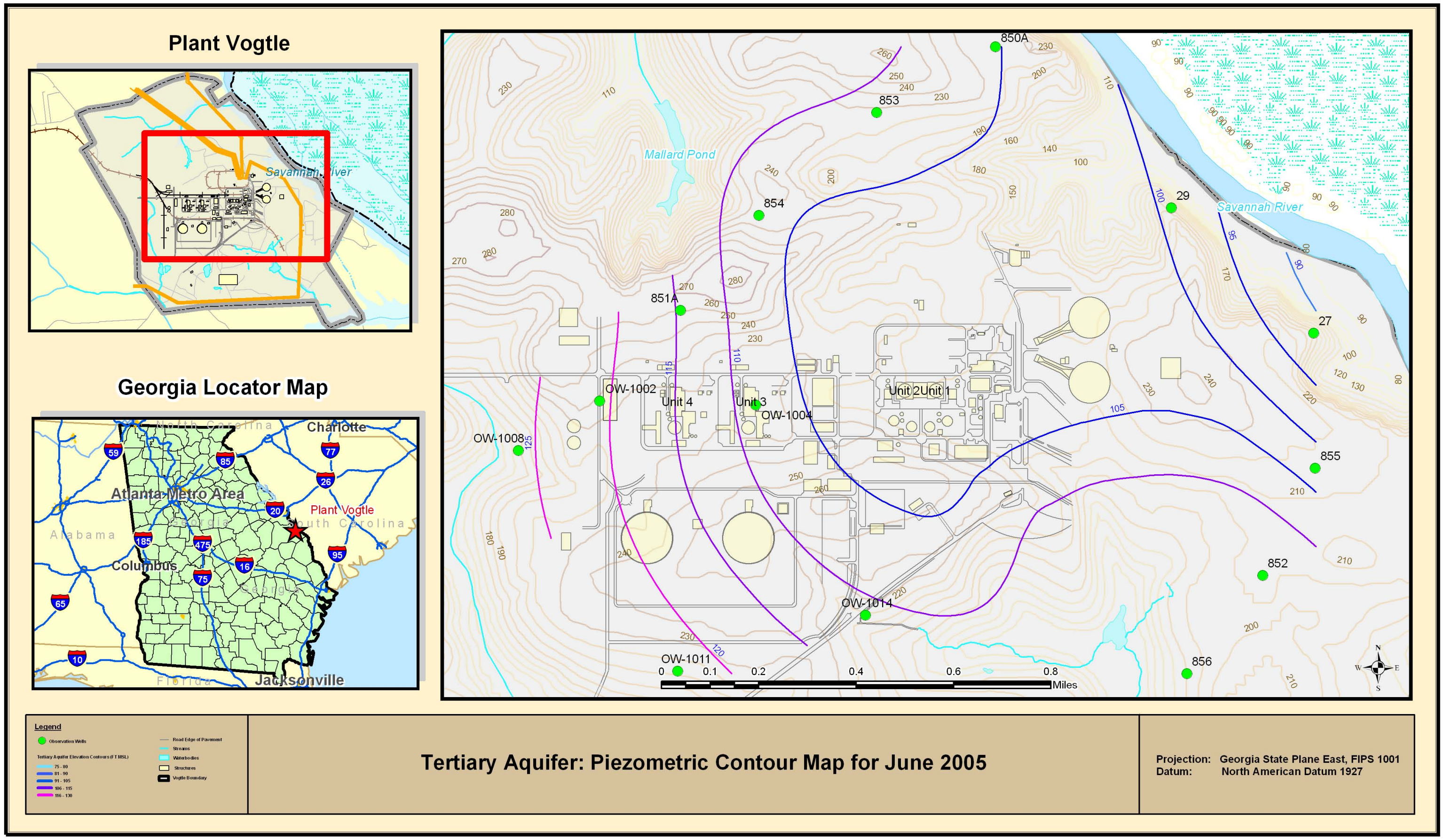


Figure 2.3.1-23 Tertiary Aquifer: Piezometric Contour Map for June 2005

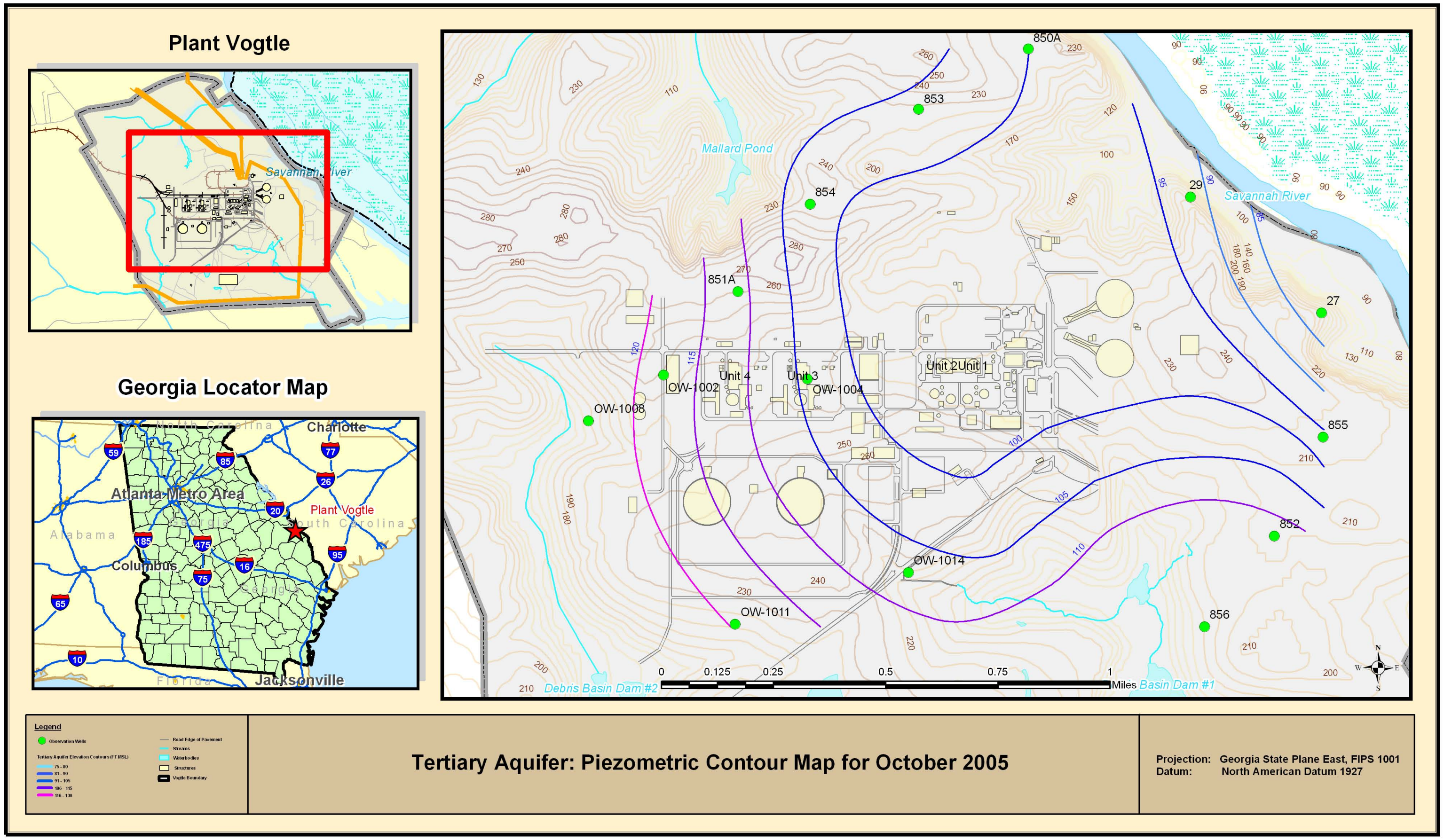
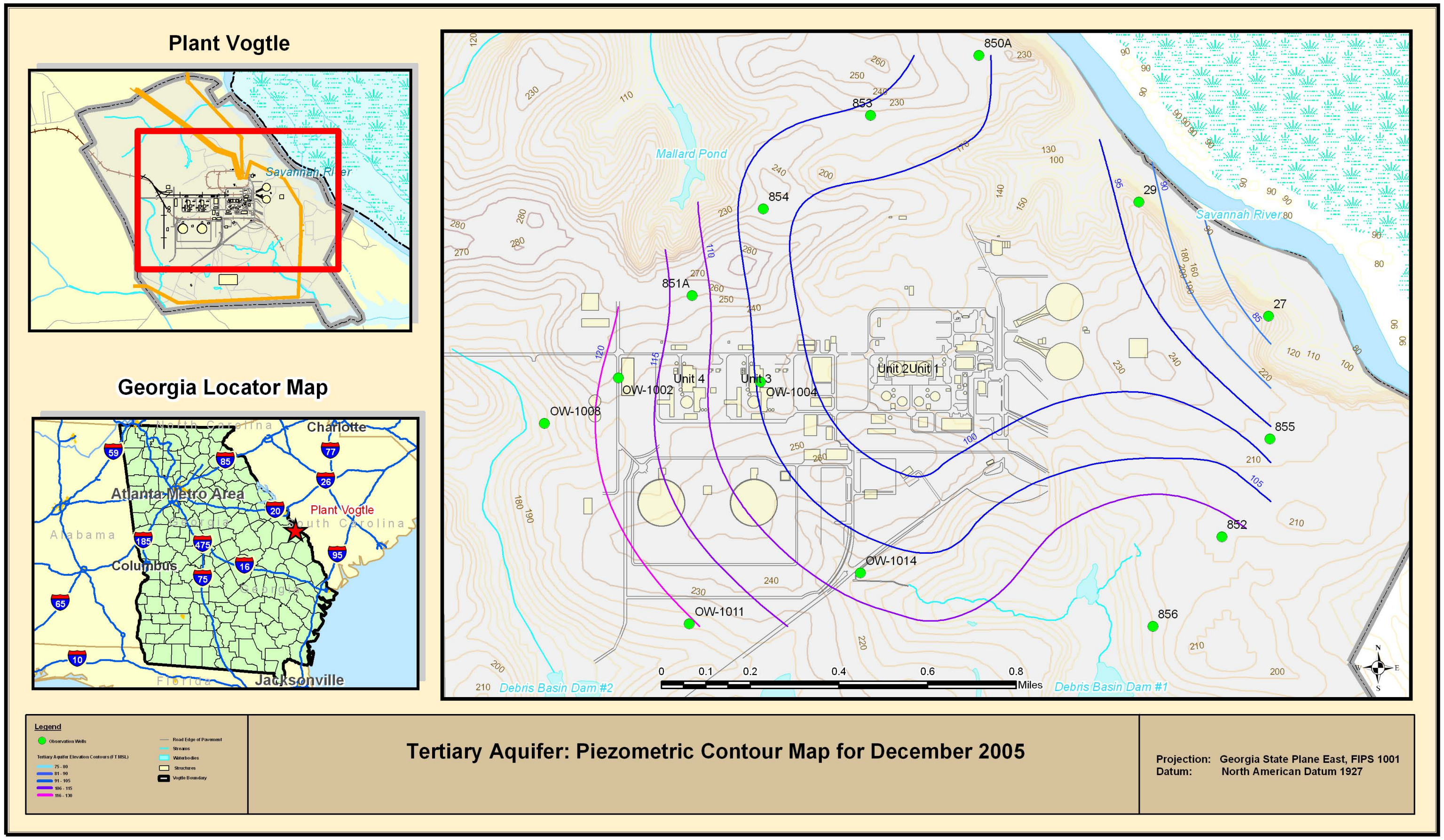


Figure 2.3.1-24 Tertiary Aquifer: Piezometric Contour Map for October 2005



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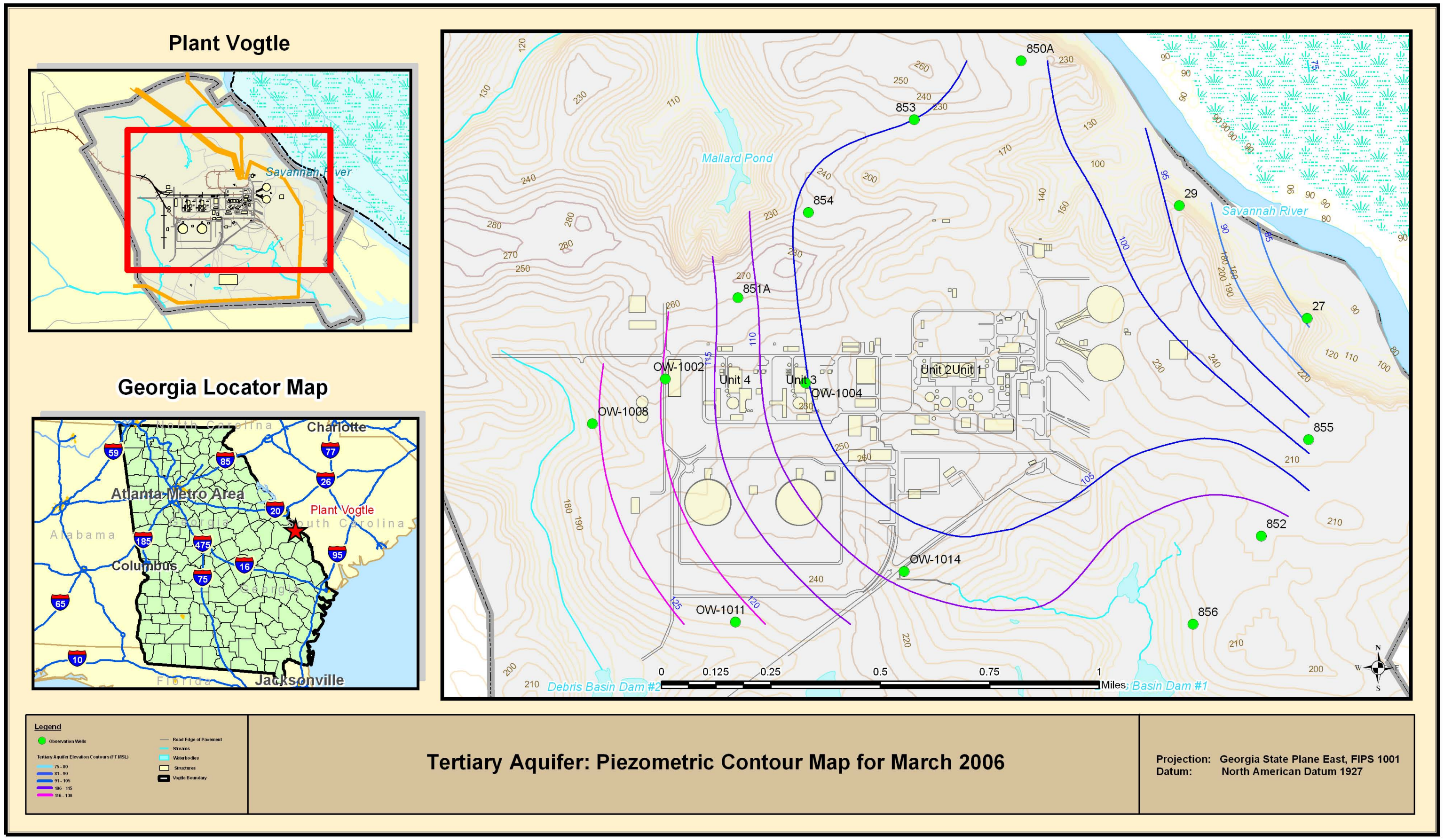

Figure 2.3.1-26 Tertiary Aquifer: Piezometric Contour Map for March 2006

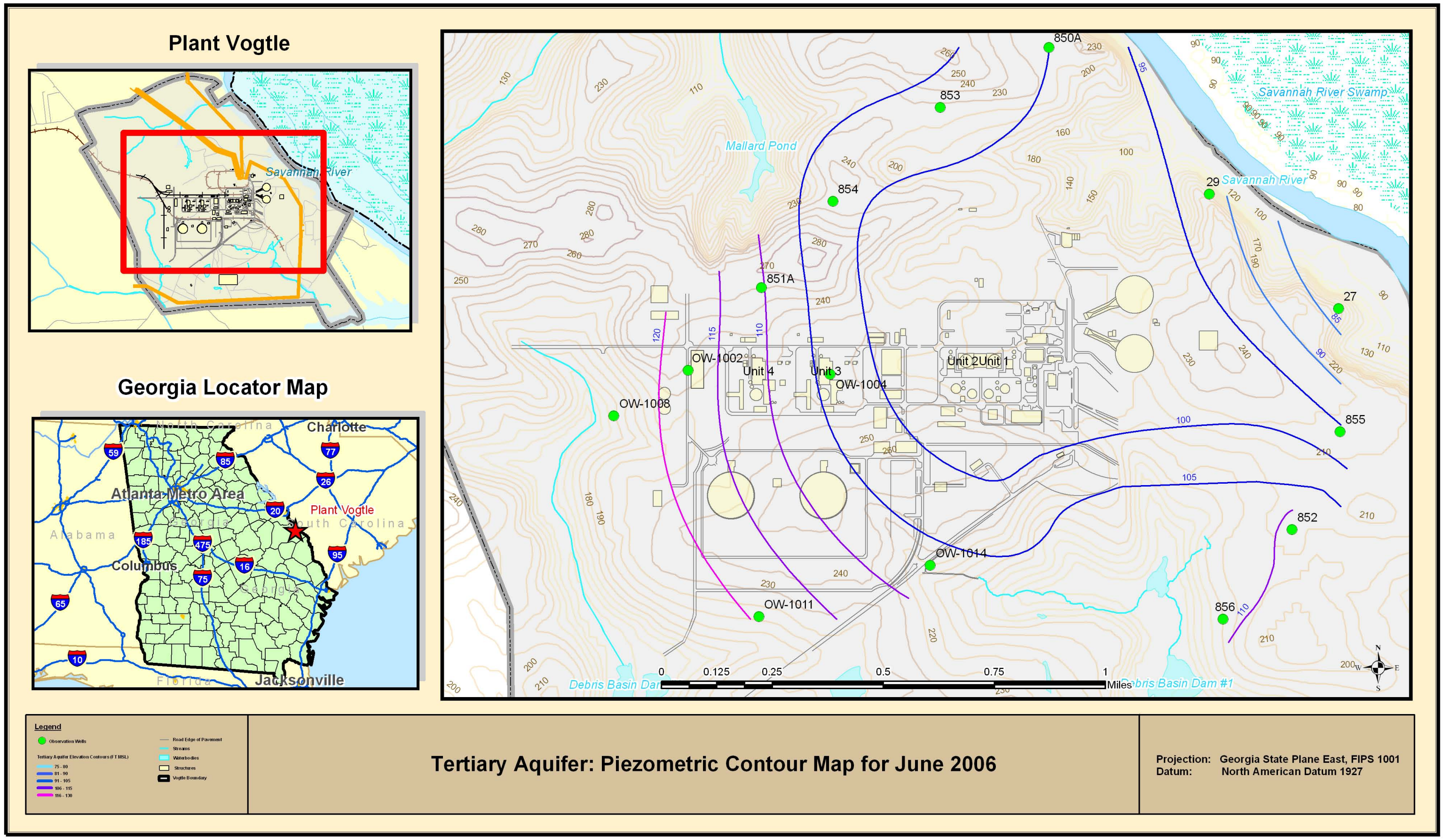

Figure 2.3.1-27 Tertiary Aquifer: Piezometric Contour Map for June 2006

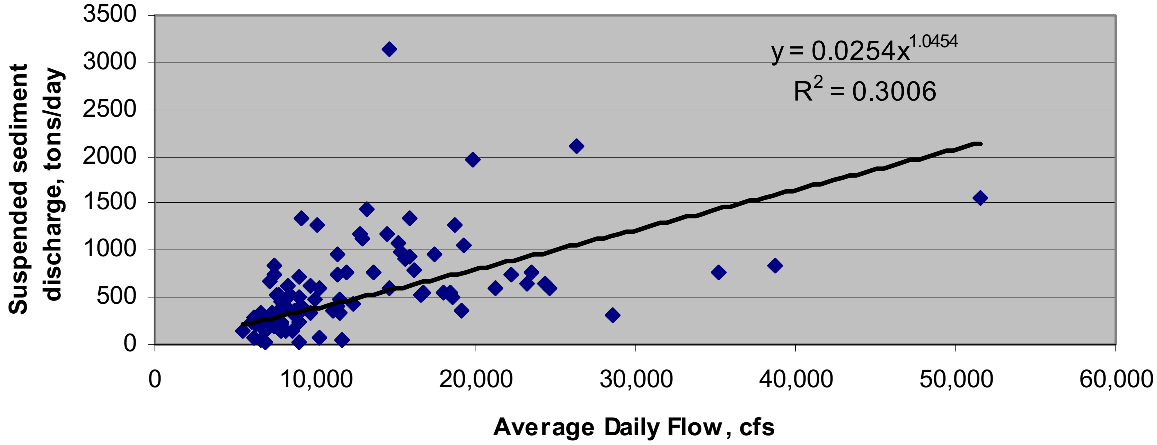

Figure 2.3.1-28 Average Daily Suspended Sediment Load For Savannah River at Clyo, Georgia (USGS Gage No. 2198500)

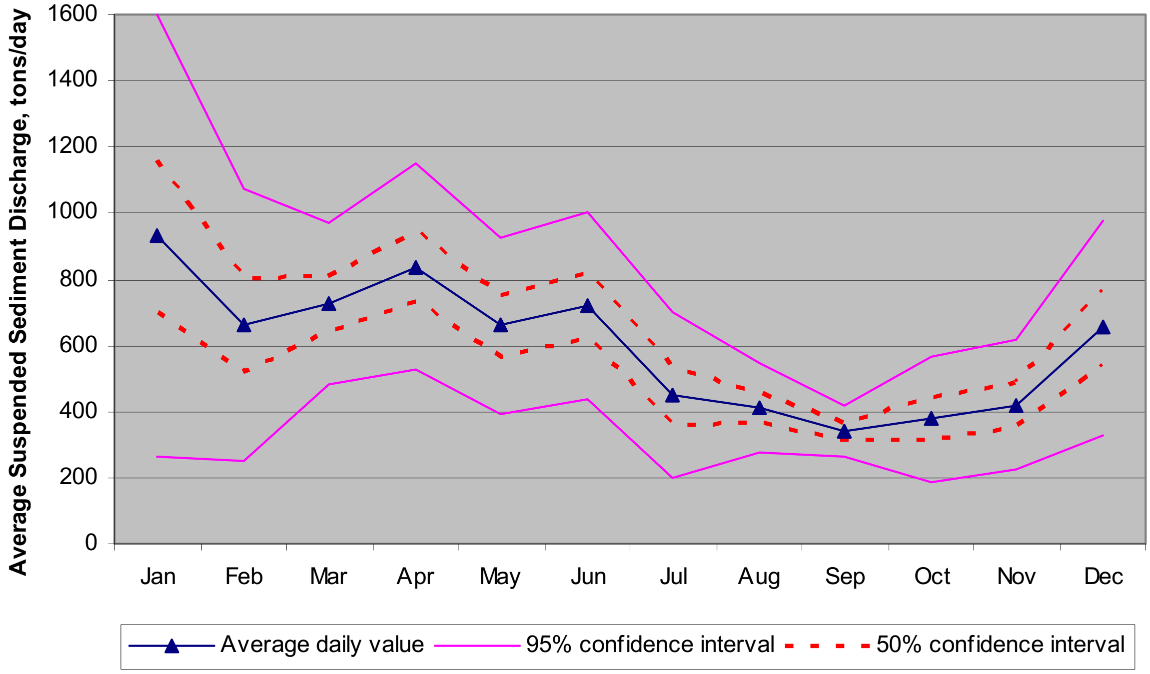

Figure 2.3.1-29 Average Monthly Suspended Sediment Discharge Measured on the Savannah River at Clyo, Georgia (USGS Gage No. 2198500)

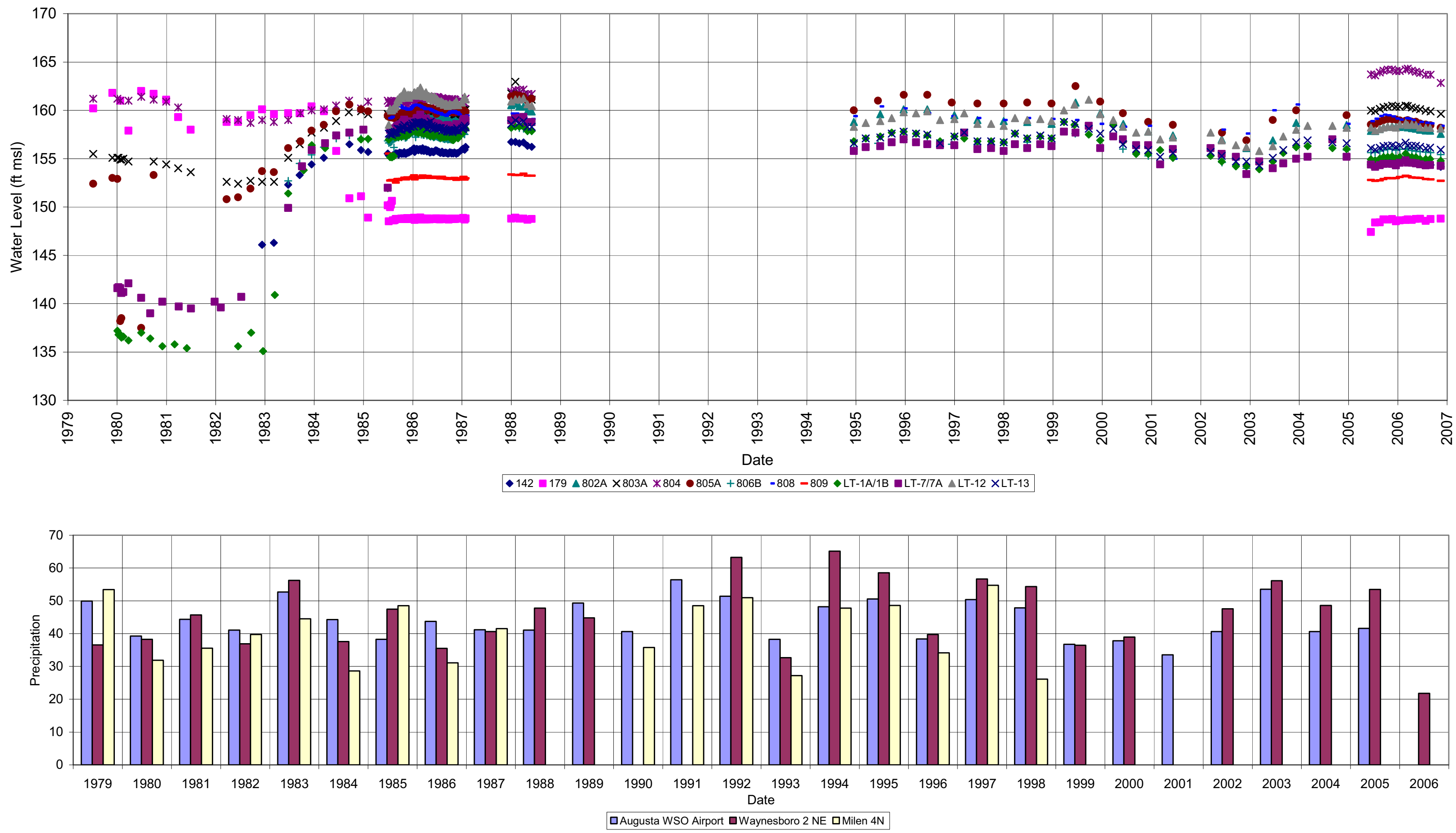

Figure 2.3.1-30 Water Table Aquifer: 1979-2006 Hydrographs

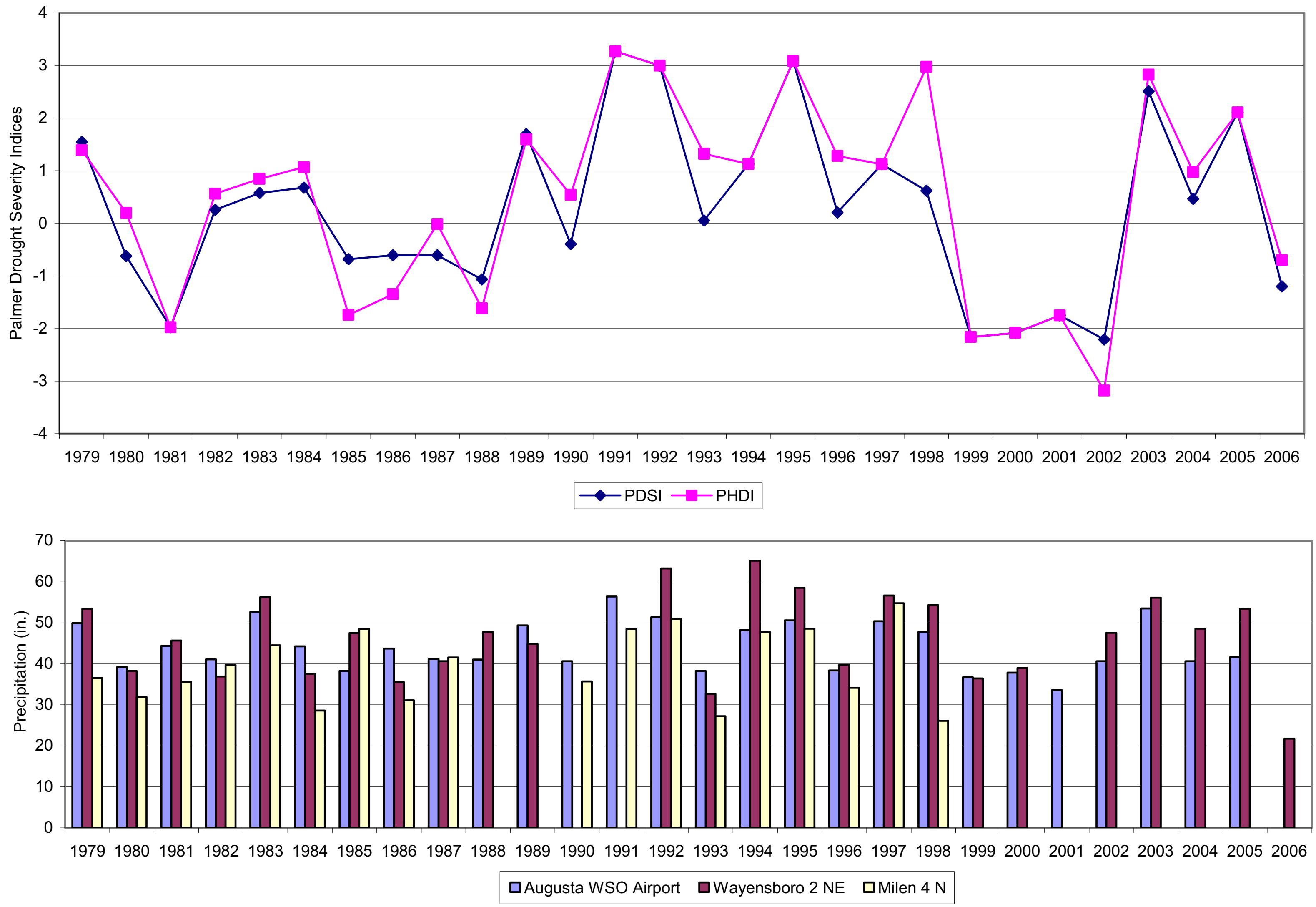

Figure 2.3.1-31 Average Annual PDSI and PHDI for Georgia and Total Annual Precipitation for the Period 1979–2006

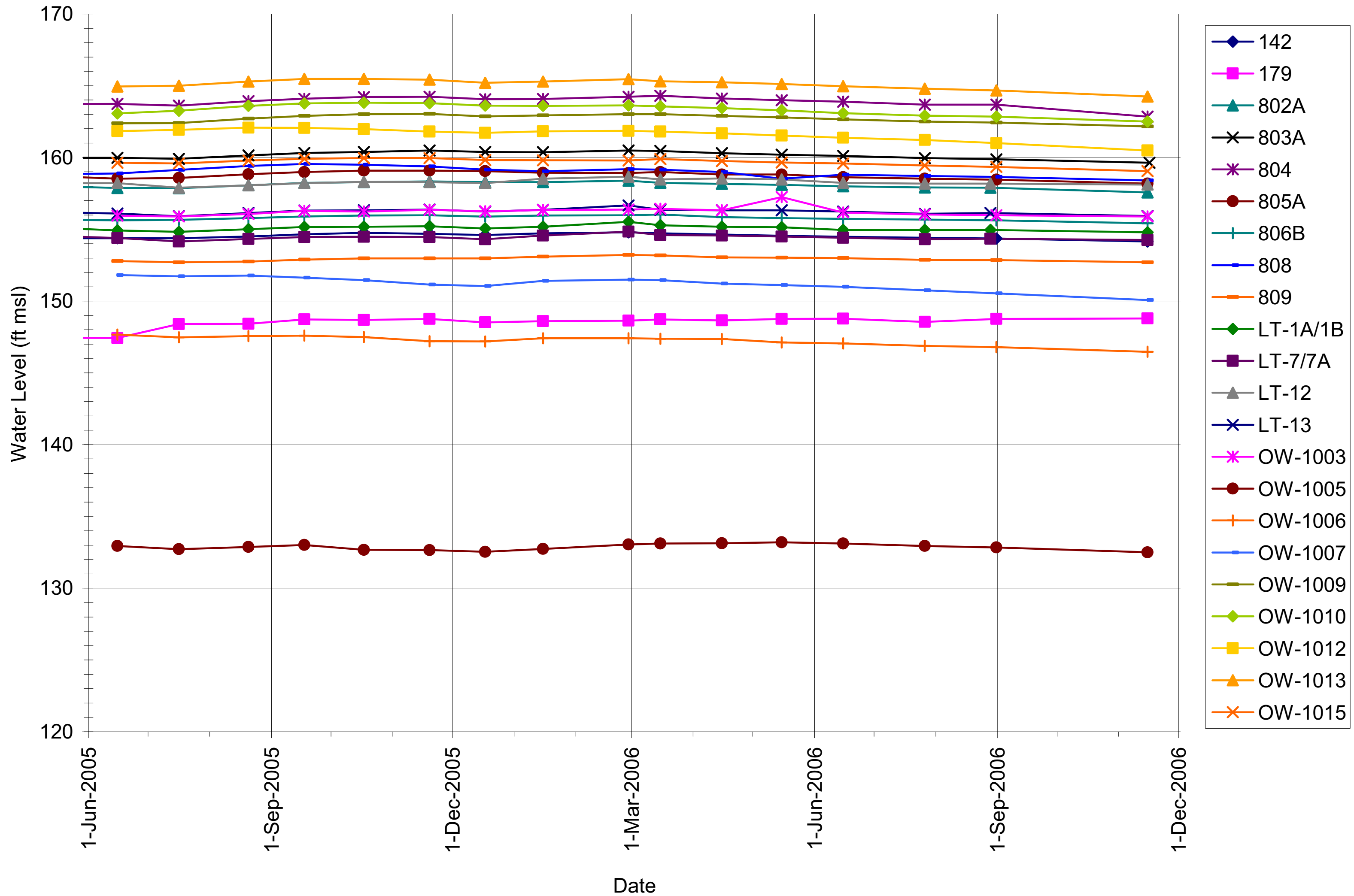

Figure 2.3.1-32 Water Table Aquifer: June 2005 – November 2006 Hydrographs

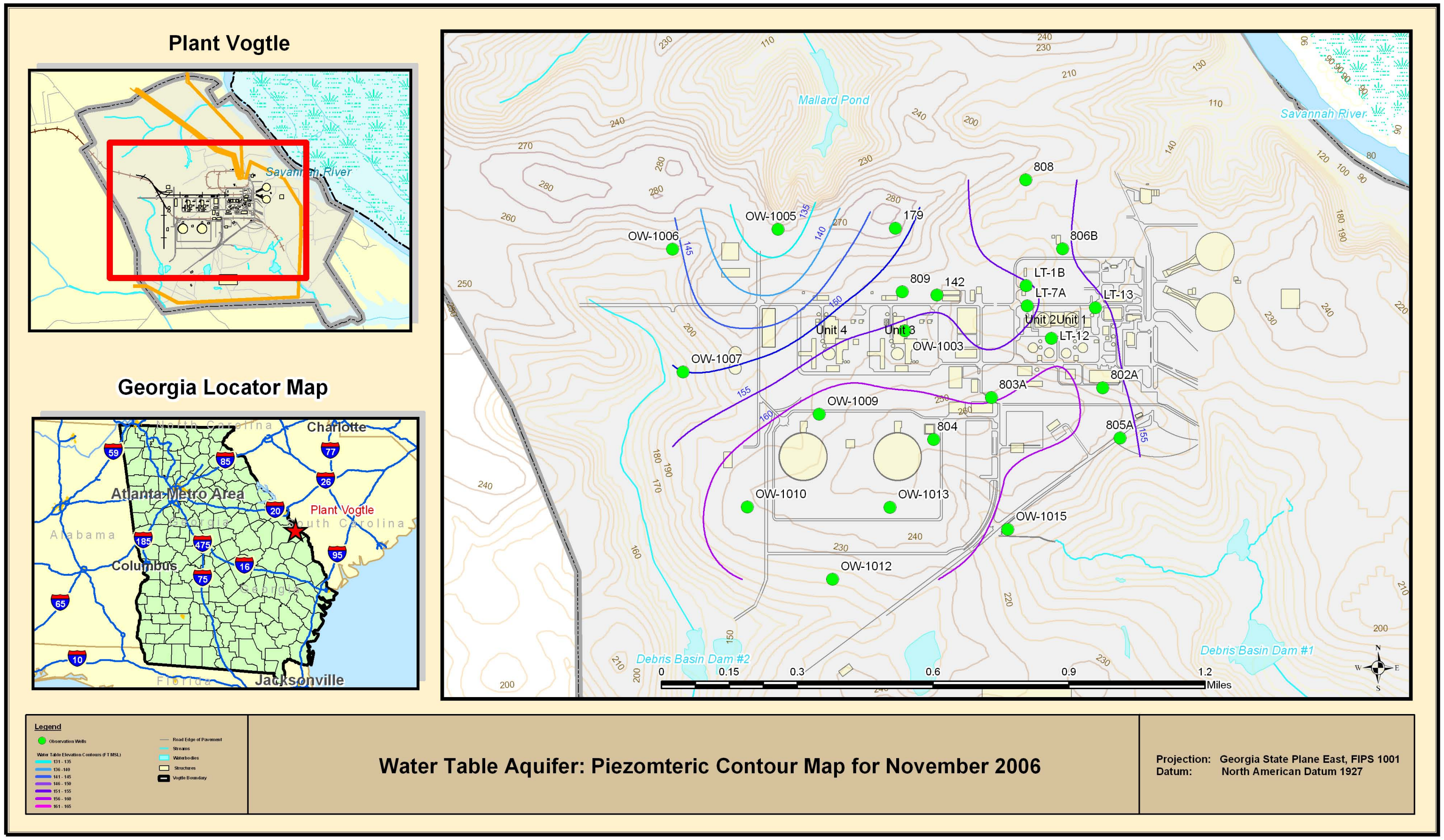

Figure 2.3.1-33 Water Table Aquifer: Piezometric Contour Map for November 2006

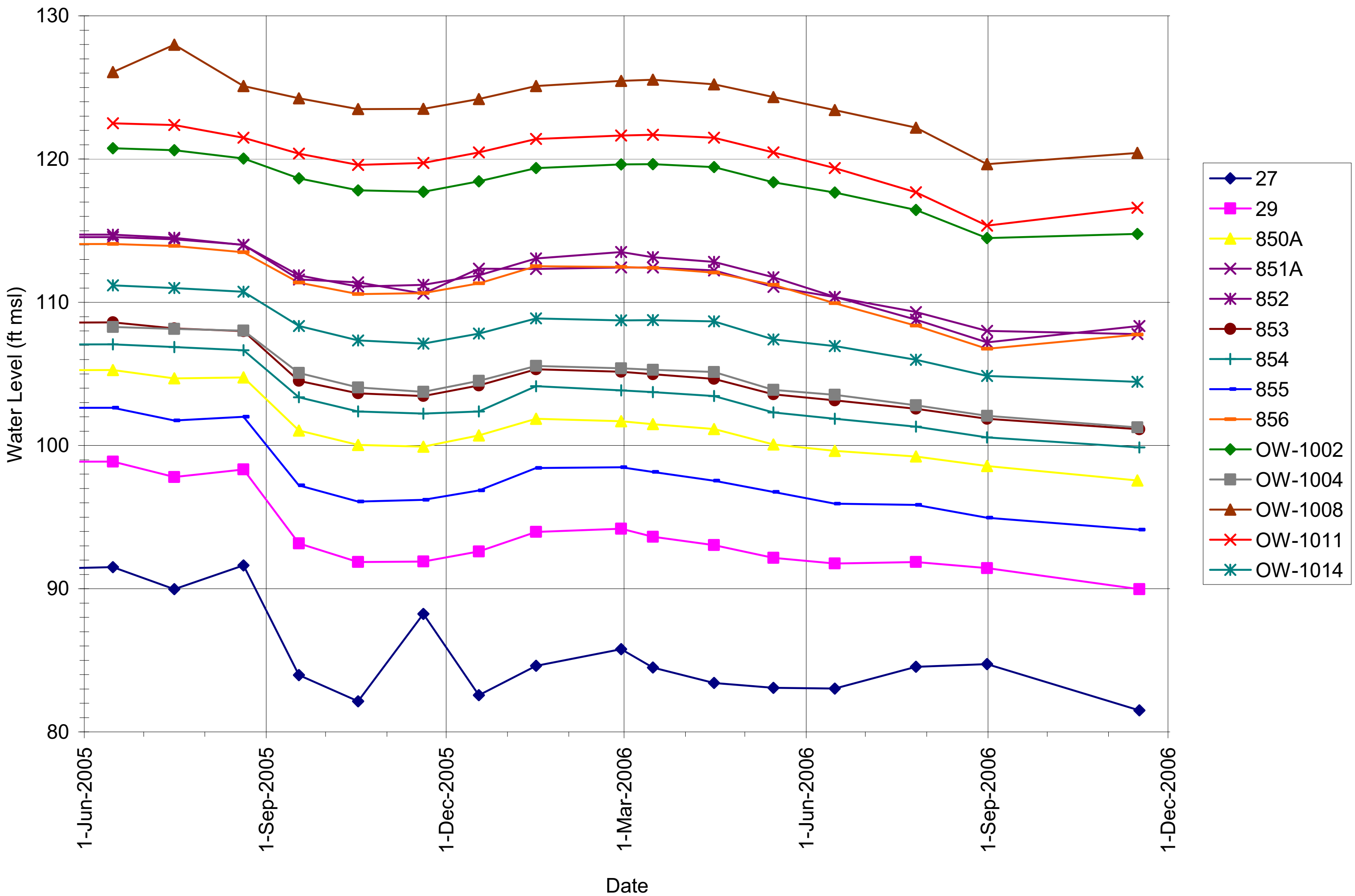

Figure 2.3.1-34 Tertiary Aquifer: June 2005 - November 2006 Hydrographs

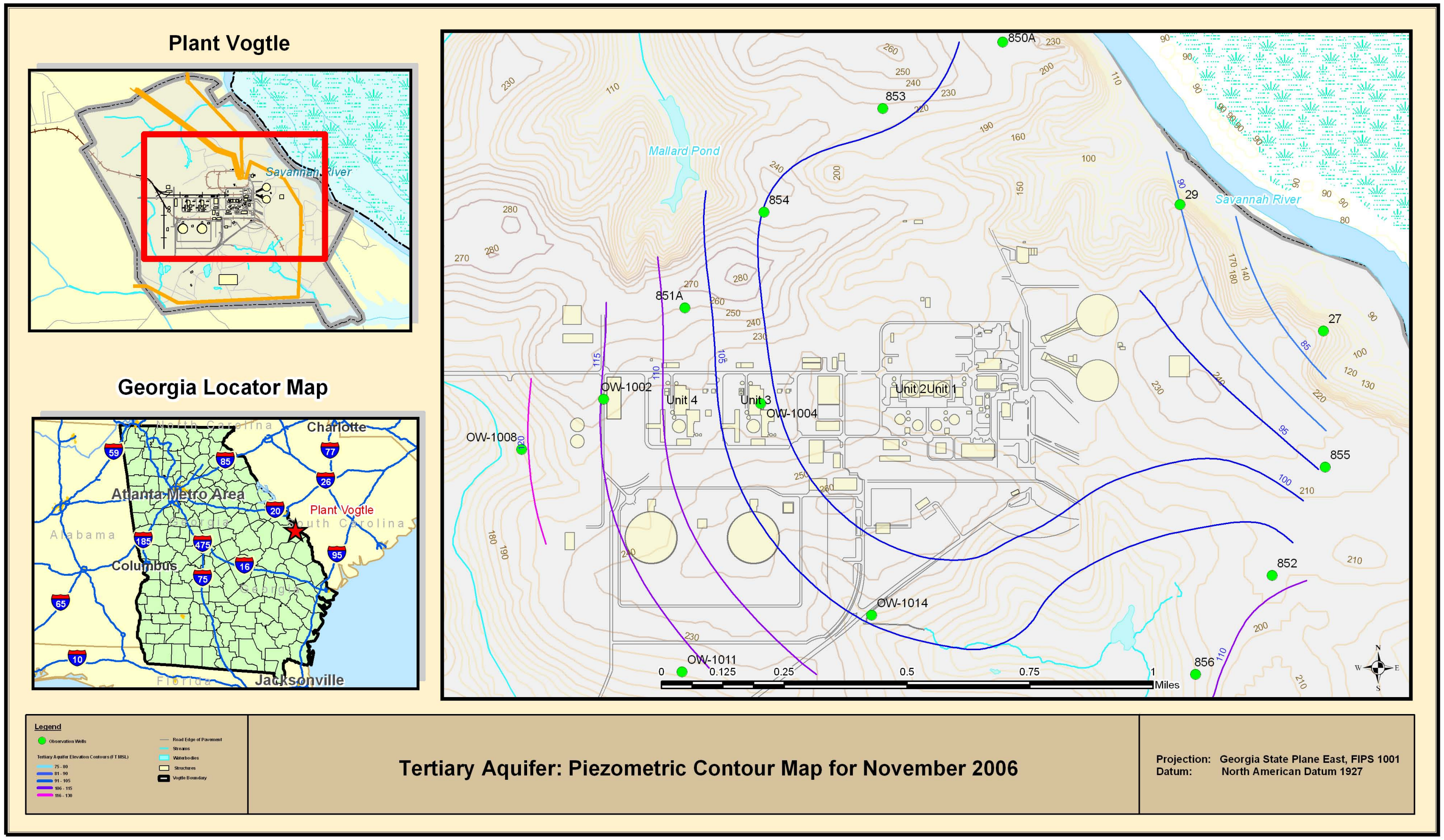

Figure 2.3.1-35 Tertiary Aquifer: Piezometric Contour Map for November 2006

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2.3.2 Water Use

This section describes surface water and groundwater uses that could affect or be affected by the construction or operation of two AP1000 units (VEGP Units 3 and 4) at the VEGP site. Included are descriptions of the types of consumptive and non-consumptive water uses, identification of their locations, and quantification of water withdrawals and returns.

2.3.2.1 Surface Water

The surface water bodies that are within the hydrologic system in which the VEGP site is located and that may affect or be affected by the construction and operation of VEGP Units 3 and 4, include streams and surface water bodies in the Savannah River basin, which extends a length of over 350 mi. The major rivers in the Savannah River basin watershed area include the Tugaloo River, Keowee River, Seneca River, Savannah River, Broad River, two Little Rivers (one in Georgia and one in South Carolina), Stephens Creek, Brier Creek, Horse Creek, and Ebenezer Creek. A number of reservoirs and lakes are also located within the river basin on the Savannah River and its major tributaries **(USGS 1990a; USACE 1993; USACE 1996)**. Among these reservoirs and lakes, three large federal multipurpose projects on the Savannah River—Hartwell Lake and Dam, Richard B. Russell Lake and Dam, and J. Strom Thurmond (also known as Clarks Hill) Lake and Dam—maintain the maximum influence on the river discharge downstream from the J. Strom Thurmond Dam. These reservoirs are respectively located approximately 138, 108, and 71 River Miles upstream from the VEGP site. Figure 2.3.2-1 presents a mosaic of satellite images, and Figure 2.3.2-2 illustrates the major rivers, along with the locations of major reservoirs in the Savannah River basin.

The Savannah River, which is the principal surface water system in the basin, defines the state boundary between Georgia and South Carolina, and nearly all of the river basin area is shared by the two states. The agencies with important roles in the watershed include the US Army Corps of Engineers (USACE), Savannah District, which is responsible for managing the three dams and the in-stream reservoirs of the Savannah River, and the US Environmental Protection Agency (USEPA) in cooperation with the Georgia Environmental Protection Division (EPD) and the South Carolina Department of Health and Environmental Control (SCDHEC), the organizations responsible for maintaining water quality in the basin. Counties located within 50 mi of the VEGP site and within the Savannah River basin are shown in Figure 2.3.2-3 and listed in Table 2.3.2-1.

EPD and SCDHEC maintain the records of surface water and groundwater withdrawals within the river basin for the states of Georgia and South Carolina, respectively. The water withdrawal types defined by EPD and SCDHEC in maintaining state water use databases differ. EPD defines water withdrawals as public supply, domestic and commercial, industrial and mining, irrigation, livestock, thermoelectric power generation, navigation, recreation, fish and wildlife, waste assimilation, and environmental water demand **(Fanning 2003)**. SCDHEC water withdrawal categories are specified as aquaculture, golf course irrigation, hydroelectric, industrial, irrigation, mining process, other use, thermoelectric, and water supply **(SC DHEC 2005)**.

Among the water use categories specified by EPD and SCDHEC, hydroelectric water use, navigation, fish (aquaculture) and wildlife, and environmental water demand constitute non-consumptive water usage. The remaining categories constitute consumptive water use, which is considered lost from the immediate surface water environment. Consumptive water uses have been identified from the water use database maintained by EPD **(Georgia DNR 2006)** and from the water use report by SCDHEC **(SC DHEC 2005)**. EPD's water use database includes users whose average daily withdrawal during any single month exceeds 100,000 gallons per day (gpd) **(Fanning 2003)**. SCDHEC maintains records of registered water use that withdraws water in excess of 3 million gallons in any given month from a single groundwater well or surface water intake, or multiple wells or surface water intakes under common ownership **(SC DHEC 2005)**.

As of September 2005, 46 intake facilities in Georgia were registered for surface water withdrawal activities within the Savannah River basin **(Georgia DNR 2006)**. This excludes the permits identified in the EPD database as suspended, revoked, or expired. In South Carolina, 55 facilities were registered (with 71 intake locations) in 2004; an additional 5 facilities registered for dual surface water and groundwater withdrawals **(SC DHEC 2005)**. Figure 2.3.2-4 shows the locations of the surface water intakes in the Savannah River basin within 50 miles of the VEGP site. Table 2.3.2-2 identifies the surface water user, the water body from which withdrawals are made, and the permitted maximum volume of surface water withdrawals within the Savannah River basin in Georgia. County-wide surface water uses within the South Carolina part of the river basin are presented in Table 2.3.2-3.

These data indicate that the use of water in thermoelectric power generation constitutes the largest consumptive use of surface water in the Savannah River basin. Surface water withdrawal from the Savannah River by the existing VEGP Units 1 and 2 for cooling purposes is one of the major consumptive uses in the basin. The combined GPC surface water withdrawals from the Savannah River, at several locations in Chatham and Effingham counties in Georgia, constitute the largest water use downstream from the VEGP site.

Upstream, thermoelectric water use in Oconee County, South Carolina, which is in the headwaters of the Savannah River in the Blue Ridge Mountains, constitutes the largest water use in the basin. However, this water is used in the once-through cooling system of the Oconee Nuclear Power Plant, most of which is immediately returned to the Savannah River basin surface water system.

The other major water uses in the Savannah River basin include public water supply for the cities of Augusta, Port Wentworth, and Savannah in Georgia, and the counties of Beaufort and Jasper in South Carolina. Major industrial users include International Paper and PCS Nitrogen Fertilizer in Richmond County, Georgia.

Approximately 80 percent of all surface water used in the basin is returned back to the river system **(USACE 2006)**.

2.3.2.1.1 Local and Onsite Water Use

Surface water bodies within a 6-mile radius of the VEGP site include the Savannah River and several small tributaries. The tributaries in the site vicinity include Beaverdam Creek, Daniel's Branch, and Newberry Creek on the west bank of the Savannah River, and Fourmile Branch and Pen Branch on the east bank, as illustrated in Figure 2.3.2-5. Major consumptive uses of surface water within the 6-mile area include VEGP and the Savannah River Site (SRS) including the D-Area power house. No surface water is withdrawn for municipal water supply from this river reach. Further upstream from the VEGP site, SCE&G withdraws water from the Savannah River for its Urquhart power station in South Carolina. Monthly water uses from these facilities in recent years are presented in Table 2.3.2-4.

Current non-consumptive use of Savannah River water includes hydroelectric power generation, minimum stream flow requirements for navigation and environmental maintenance, fish and wildlife water demand, and recreation. Water use classification for the Savannah River within 6 miles of the VEGP site shows that the river is classified as fishing, the non-consumptive use category for fish and wildlife **(Georgia DNR 2001)**. The only section of the Savannah River classified by EPD as impaired under Sections 305(b) and 303(d) of the Federal Clean Water Act is the reach from J. Strom Thurmond Lake to the Stevens Creek Dam, upstream of Augusta, Georgia **(Georgia EPD 2006)**. Although improved navigation from Augusta to Savannah was included in the project objectives for the Hartwell and J. Strom Thurmond Dams, except for occasional freight transport, regular commercial navigation between Savannah and Augusta ceased operation in 1979 **(USACE 1989)**. No information on recreational use of the river within 6 miles from the VEGP site is available; however, public boat landings are located just downstream of VEGP; at Jackson, SC, upstream of VEGP; and below Steel Creek, downstream of VEGP on the South Carolina side of the river.

Compilation of water use data for Georgia between 1980 and 2000 indicates that surface water and groundwater withdrawal rates remained nearly unchanged during this period **(Fanning 2003)**. However, for Burke County, where the VEGP site is located, the total increase in future water demand for combined surface water and groundwater usage is estimated to be over 50 percent by 2035 **(Rutherford 2000)**. For South Carolina, combined water demand for industry, public supply, irrigation, and domestic use is projected to increase by nearly 50 percent by 2045 **(SC DNR 2004)**. This future water use estimate also includes water use for power generation.

Most water users in the Savannah River basin depend primarily on surface water to satisfy current and future demands. Many groundwater users in the lower basin will be required to replace groundwater use with surface water due to concerns about salt water intrusion into groundwater. Because of increased saltwater intrusion in the lower basin, Georgia and South

Carolina capped current groundwater use at specified levels, directing that future coastal water supply be met with surface water from the Savannah River **(USACE 1999)**.

The USACE, Savannah District, along with Georgia and South Carolina, are developing an updated comprehensive water resources management plan to determine water supply allocations, including future demands in the Savannah River basin. The study will also examine flood control, drought contingency, hydropower, water quality, habitat, aquatic plant control, and recreation issues **(USACE 2006)**. As part of their comprehensive water management scenarios, a revised drought management plan is now actively considered, which would increase the low flow release through J. Strom Thurmond Dam under some drought conditions **(USACE 2006c)**.

2.3.2.1.2 Surface Water Use for VEGP Units 3 and 4

VEGP Units 3 and 4 will use Westinghouse AP1000 (AP1000) reactor plants for power generation. The only use of water from the Savannah River for the AP1000 units will be for the circulating water system/turbine plant cooling water system makeup, where river water will be required to replace cooling tower evaporative water losses, drift losses, and blowdown discharge. Under normal operating conditions and design ambient conditions, river water demand for the two AP1000 units will be 82.9 cfs (37,224 gpm). The maximum water requirement for plant operation will be 128.7 cfs (57,784 gpm) for the two units. Depending on the cycles of concentration at which the cooling tower is operated, approximately 50-75 percent of the cooling tower makeup flow will be to replace water lost to evaporation. The total cooling tower blowdown volume would likely vary between approximately 25 and 50 percent of the makeup flow. Further detailed discussion on plant water use for VEGP Units 3 and 4 is provided in Section 3.3.1. Water use diagrams for the new VEGP units are shown in Figure 3.3-1 and Figure 3.3-2. Components of the conceptually-designed intake system are described in Section 3.4.2.

As described in ESP SSAR Section 2.4.13, accidental radionuclide release to surface water would be through the groundwater system moving northward to Mallard Pond, which drains to the Savannah River northeast of the VEGP site. The proposed VEGP Units 3 and 4 will have a grade elevation of approximately 220 ft msl. The AP1000 radiological effluent holdup tanks will be located at the lowest level of the auxiliary building. The base elevation of the auxiliary building is approximately 180.5 ft msl, which is approximately 20 to 25 ft above the water table. Consequently, direct release of radiological effluents in to the surface water system is very unlikely. The nearest surface water users downstream from the VEGP site on the Savannah River include Fort James Operating Company and GPC located in Effingham County, Georgia, approximately 106 River Miles from the VEGP site, as shown in Table 2.3.2-2.

Non-radiological effluents from VEGP Units 3 and 4 will consist of cooling tower blowdown and other wastewater streams and will be discharged into the Savannah River through a pipe at a location downstream from the discharge location for existing VEGP Units 1 and 2. The discharge system described in Section 3.4 will be designed to meet federal, state and USACE regulatory and design guidelines for effluent discharge and navigation and maintenance criteria. The nearest users of surface water downstream from the effluent discharge location include Fort James Operating Company and GPC approximately 106 River Miles from the VEGP site, as shown in Table 2.3.2-2.

2.3.2.2 Groundwater Use

The majority of Georgia's groundwater use occurs in the Coastal Plain Physiographic Province. Groundwater is withdrawn from both unconfined, shallow aquifer systems and deeper, confined aquifer systems. These aquifers are recharged principally in their outcrop areas along the western boundary of the province and from localized infiltration of precipitation within the province. Precipitation migrates downward and laterally through the unconsolidated surficial materials for discharge to nearby streams and low areas, or percolates vertically downward into the deeper unconsolidated and consolidated material. The thickness and areal extent of the Coastal Plain sediments result in a storage capacity for groundwater that exceeds that of any other physiographic province in Georgia **(Miller 1990)**.

Within the Savannah River basin, as of September 2005, 72 facilities were registered for groundwater withdrawal activities in Georgia **(Georgia DNR 2006)**. Table 2.3.2-5 identifies the permitted groundwater users, permitted withdrawal rates, number of wells, and source aquifers within 50 mi of the VEGP site in Georgia, excluding those for irrigation use. In South Carolina, 43 facilities consisting of 158 groundwater wells were registered in 2004 **(SC DHEC 2005)**. The water withdrawal locations for groundwater wells within the Savannah River basin and within 50 mi of the VEGP site are shown in Figure 2.3.2-6. County-wide groundwater use data within the river basin in South Carolina are presented in Table 2.3.2-6 for 2004 for the counties within 50 mi of the VEGP site. A county-wide summary of groundwater use for irrigation is provided in Table 2.3.2-7 for Georgia within 50 mi of the VEGP site. The table also shows the range of groundwater well depths and diameters, and total permitted withdrawal rates in the counties. There were no permitted irrigation water wells in Glascock County.

No sole-source aquifers are designated within the 200-mi radius of the site **(EPA 2006a)**.

2.3.2.2.1 Local Use

Present groundwater uses within 25 mi of the VEGP site are primarily municipal, industrial, and agricultural. Most of the groundwater wells withdraw water from the Cretaceous aquifer. Apart from water withdrawals for VEGP Units 1 and 2, the immediate area near the VEGP site has mainly domestic users, with no other nearby large groundwater users. The nearest domestic well is located just west of the VEGP site across River Road.

The Georgia EPD issues permits for industrial, municipal and agricultural wells having average daily withdrawals that exceed 100,000 gpd during any single month. Table 2.3.2-8 lists the permitted groundwater users, aquifer and withdrawal rates, and annual average withdrawal rates for municipal and industrial wells within 25 mi of the VEGP site and permitted by the Georgia EPD. Table 2.3.2-9 lists similar data for agricultural wells within 25 mi of the VEGP site and permitted by the Georgia EPD. The Safe Drinking Water Information System (SDWIS) maintained by the US EPA lists community, non-transient non-community, and transient non-community water systems that serve the public. Community water systems are defined as those that serve the same people year-round (e.g., in homes or businesses). Non-transient non-community water systems are those that serve the same people, but not year-round (e.g., schools that have their own water system). Transient non-community water systems are those that do not consistently serve the same people (e.g., rest stops, campground, gas stations). Table 2.3.2-10 lists the community, non-transient non-community, and transient non-community water systems using groundwater as their primary water source within 25 mi of the VEGP site.

The locations of the agricultural, industrial, and municipal wells permitted by the Georgia EPD along with the public water system wells listed in the SDWIS database within 25 mi of the VEGP site are shown in Figure 2.3.2-7. (Note that wells currently serving existing VEGP Units 1 and 2 are not shown on Figure 2.3.2-7; these wells are discussed in Section 2.3.2.2.2, Onsite Use.) These data indicate the nearest permitted agricultural well (William Hatcher, A-28 to be about 3.4 mi northwest of the VEGP site, while the nearest permitted industrial well (International Paper, I-1) is about 8.5 mi northwest of the site. The nearest municipal well (City of Waynesboro, M-1) is seen to be about 14.5 mi west-southwest of the VEGP site. The nearest SDWIS-listed well (Delaigle Mobile Home Park, C-6) is about 4.9 mi southwest of the VEGP site. These wells are sufficiently distant from the VEGP site such that pumping these wells would have no effect on groundwater levels at the VEGP site. The recharge areas for the source aquifers for the nearest Georgia EPD-permitted wells are in their outcrop areas located up-gradient of the VEGP site and beyond the influence of the new units.

Regionally, projected overall water use is expected to increase through 2035 for Burke County. Surface water usage is also increasing; however, it is increasing at a much slower rate than groundwater usage, approximately 5 percent versus 17 percent. Burke County's water usage, including both surface and groundwater, is projected to be 100 to 120 mgd for 2035 **(Fanning et al. 2003)**. Projections for Burke County total water demand are provided in the Comprehensive Water Supply Management Plan for Burke County and its Municipalities **(Rutherford 2000)**. Assuming current water use usage patterns, daily water demands are projected to nearly double between 2000 and 2050 with 2050 demands projected to be 10.94 mgd for domestic use, 14.73 mgd for industrial use, and 40.96 mgd for agricultural use, which totals 66.63 mgd **(Rutherford 2000)**.

2.3.2.2.2 Onsite Use

Local groundwater use includes domestic wells and wells supplying water to existing VEGP Units 1 and 2. Operating plant uses include makeup process water, utility water, potable water, and supply for the fire protection system. Table 2.3.2-11 lists these wells, while Figure 2.3.2-8 identifies their location. Current permitted withdrawal rates are a monthly average of 6 mgd and an annual average of 5.5 mgd, as permitted by the Georgia EPD. Three of the wells are in the Cretaceous aquifer at depths varying from 851 to 884 ft, with design yields of 1,000 to 2,000 gpm. These wells provide makeup water for the plant processes. The remaining six wells extend into the Tertiary aquifer, range in depth from 200 to 370 ft, and have design yields of 20 to 150 gpm. Average annual usage levels for 1999 to 2004 from all wells excluding SEC are from 0.79 to 1.44 mgd **(SNC 2005b)**. The SEC well was added in 2005 and will be included in water usage data for 2006. Recent groundwater usage from June 2005 to December 2005 is in Table 2.3.2-12.

Table 3.3-1 in Section 3.3 and Table 2.3.2-13 show projected groundwater use for two AP1000 units with normal and maximum usage values. Service water system make-up, potable water system, demineralized water system, fire protection system, and miscellaneous users are the intended uses. Groundwater needed to supply VEGP Units 3 and 4 will be obtained from two 1,500 gpm wells installed in the Cretaceous aquifer. The maximum case water demand is conservatively based on several plant operating modes that are not expected to operate concurrently. During normal operation, only one pump will be required to run approximately 50 percent of the time to supply the plant water needs. Based on the wells that currently supply makeup water for plant processes for the existing Units 1 and 2 (MU-1 and MU-2A), the proposed wells will extend to a depth of approximately 850 ft below the ground surface and will be open to selected aquifer zones within the Cretaceous aquifer. The proposed locations of the new wells are shown in Figure 2.3.2-9. SNC's groundwater use permit **(SNC 2005a)** will be modified accordingly.

Table 2.3.2-1 List of Counties Located in the Savannah River Basin and Within 50 Miles of the VEGP Site

Counties within the Savannah River Basin		
Georgia	**South Carolina**	**Comments**
McDuffie		
Glascock		A small area is within the river basin
Columbia		
Jefferson		A small area is within the river basin
Richmond		
Burke		
Jenkins		A small area is within the river basin
Screven		
Effingham		A small area is within 50-mi radius
	McCormick	A small area is within 50-mi radius
	Edgefield	
	Aiken	
	Barnwell	
	Allendale	
	Hampton	
	Jasper	A small area is within the river basin and 50- mi radius

Table 2.3.2-2 Registered Surface Water Uses in the Savannah River Basin Within the State of Georgia

Serial No.	County	Facility	Municipal/ Industrial[1]	Source Water	Max Daily Withdrawal (mgd)[2]	Monthly Average (mgd)	Approximate Location
1	Banks	Banks County Board of Commissioners	M	Mtn. Cr. Res. Strctr 11	1.00	1.00	Tributary to the Broad River[a]
2	Burke	Southern Nuclear Operating Co., Inc.	I	Savannah River	127.00	85.00	River Mile 151.1
3	Burke	Waynesboro, City of	M	Brier Creek	1.50	1.00	The Brier Creek[b]
4	Chatham	International Paper Corporation	I	Savannah River	58.00	50.00	Between River Miles 8.0 and 29.0
5	Chatham	Kerr-McGee Chemical, LLC	I	Savannah River	30.00	20.00	Between River Miles 8.0 and 29.0
6	Chatham	Georgia Power Co-Riverside	I	Savannah River	174.00	174.00	Between River Miles 8.0 and 29.0
7	Chatham	Georgia Power Co-Pt Wentworth	I	Savannah River	267.00	267.00	Between River Miles 8.0 and 29.0
8	Chatham	Weyerhauser Company	I	Savannah River	30.50	27.50	Between River Miles 8.0 and 29.0
9	Chatham	Weyerhauser Company	I	Savannah River	60.00	30.00	Between River Miles 8.0 and 29.0
10	Columbia	Columbia County Water System	M	J.S. Thurmond[3] Reservoir	8.00	8.00	From J.S. Thurmond Reservoir[c]
11	Columbia	Columbia County Water System	M	Stevens Creek Reservior	31.00	31.00	Approximate River Mile 210.0
12	Effingham	Fort James Operating Company	I	Savannah River	35.00	35.00	Approximate River Mile 45.0
13	Effingham	Georgia Power Co-McIntosh	I	Savannah River	130.00	130.00	Approximate River Mile 45.0
14	Effingham	Savannah Ind. & Domestic Water	M	Abercorn Creek	55.00	50.00	Aabercorn Creek[d]
15	Elbert	Elberton, City of	M	Beaverdam Creek	2.20	1.70	Beaverdam Creek[e]
16	Elbert	Elberton, City of	M	Lake Russell	4.10	3.70	Beaverdam Creek[e]
17	Franklin	Lavonia, City of	M	Crawford Creek	1.50	1.50	Tributary to the Broad River[a]
18	Franklin	Lavonia, City of	M	Lake Hartwell	3.00	3.00	Hartwell Reservoir[f]
19	Franklin	Royston, City of	M	N Fork of Broad River	1.00	1.00	The Broad River[a]
20	Greene	Union Point, City of	M	Sherrill Cr Reservoir	0.45	0.33	Tributary to the Little River, GA[g]
21	Hart	Hartwell, City of	M	Lake Hartwell	4.50	3.50	Hartwell Reservoir[f]
22	Jackson	Commerce, City of	M	Grove Creek	4.50	4.20	Tributary to the Broad River[a]

Table 2.3.2-2 (cont.) Registered Surface Water Uses in the Savannah River Basin Within the State of Georgia

Serial No.	County	Facility	Municipal/ Industrial[1]	Source Water	Max Daily Withdrawal (mgd)[2]	Monthly Average (mgd)	Approximate Location
23	Jefferson	J M Huber Corp - Reedy Creek	I	Reedy Creek	5.80	4.00	Tributary to the Brier Creek[b]
24	Lincoln	Lincolnton, City of	M	J.S. Thurmond Reservoir	0.63	0.63	J.S. Thurmond Reservoir[c]
25	Madison	Turner Concrete Company, Incorporated	I	Broad River	0.60	0.30	The Broad River[a]
26	McDuffie	Thomson-McDuffie County W/S Commission	M	J.S. Thurmond Reservoir	3.00	2.00	J.S. Thurmond Reservoir[c]
27	McDuffie	Thomson-McDuffie County W/S Commission	M	Usry's Lake	2.00	1.50	Tributary to the Brier Creek[b]
28	Oglethorpe	Crawford, City of	M	Trib To Long Creek	0.43	0.25	Tributary to the Broad River[a]
29	Rabun	Clayton-Rabun Co. Water & Sewer Authority	M	Lake Rabun	2.00	2.00	Close to the border with North Carolina
30	Richmond	Augusta-Richmond County	M	Augusta Canal	50.00	45.00	Between River Miles 187 and 210
31	Richmond	Augusta-Richmond County	M	Savannah River	21.00	15.00	Between River Miles 187 and 210
32	Richmond	Avondale Mills - Augusta Canal	I	Augusta Canal	1.44	0.65	Between River Miles 187 and 210
33	Richmond	DSM Chemicals Augusta, Inc.	I	Savannah River	8.20	6.80	Between River Miles 187 and 210
34	Richmond	Fort Gordon - Butler Creek	I	Butler Creek	5.40	5.00	Between River Miles 187 and 210
35	Richmond	Fort Gordon - Cow Branch	I	Cow Branch	0.70	0.60	Between River Miles 187 and 210
36	Richmond	Fort Gordon - Lietner Lake	I	Lietner Lake	0.50	0.40	Between River Miles 187 and 210
37	Richmond	Fort Gordon - Union Mill Pond	I	Union Mill Pond	0.25	0.20	Between River Miles 187 and 210
38	Richmond	General Chemical Corp., Augusta Plant	I	Savannah River	5.65	5.30	Between River Miles 187 and 210
39	Richmond	International Paper - Augusta Mill	I	Savannah River	79.00	72.00	Between River Miles 187 and 210
40	Richmond	PCS Nitrogen Fertilizer, L.P	I	Savannah River	21.60	10.80	Between River Miles 187 and 210
41	Stephens	Toccoa, City of	M	Lake Yonah	6.00	6.00	Tributary to the Tugaloo River[h]
42	Stephens	Toccoa, City of - Lake Toccoa	M	Lake Toccoa	9.00	9.00	Tributary to the Tugaloo River[h]
43	Warren	J M Huber Corp -Brier Creek	I	Brier Creek	5.00	2.50	The Brier Creek[b]
44	Warren	Thiele Kaolin Company	I	Newsome's Mill Pond	0.75	0.50	Tributary to the Brier Creek[b]

Table 2.3.2-2 (cont.) Registered Surface Water Uses in the Savannah River Basin Within the State of Georgia

Serial No.	County	Facility	Municipal/ Industrial[1]	Source Water	Max Daily Withdrawal (mgd)[2]	Monthly Average (mgd)	Approximate Location
45	Wilkes	Washington, City of - Clarks Hill	M	J.S. Thurmond Reservoir	2.20	2.00	J.S. Thurmond Reservoir[c]
46	Wilkes	Washington, City of - Old Plant	M	Little Beaverdam Cr	2.20	1.80	Tributary to the Little River, GA[g]

[1] M = Municipal; I =Industrial
[2] (mgd) million gallons per day
[3] J. Strom Thurmond
[a] Confluence of the Broad River with the Savannah River is at River Mile 269.6
[b] Confluence of the Brier Creek with the Savannah River is at River Mile 102.5
[c] J. Storm Thurmond Dam located at River Mile 221.6
[d] Abercorn Creek mouth at River Mile 29.0
[e] The Beaverdam Creek is tributary to Richard B. Russell Reservoir; the Richard B. Russell Dam is located at River Mile 259.1
[f] Hartwell Dam located at River Mile 288.9
[g] Mouth of the Little River at River Mile 223.4
[h] Tugaloo River fork at River Mile 312.1
Location Source: Georgia DNR 2006; Fanning 2003; and USACE 1996

Source: Georgia DNR 2006

Table 2.3.2-3 County-Wide Surface Water Withdrawals, in Million Gallons Per Day (mgd), for Different Consumptive Surface Water Use Categories Within the State of South Carolina for 2004

Serial No.	County	Agriculture	Golf Course	Industrial	Water Supply	Thermo-electric	Total	Comments
1	Greenville	0.00	0.00	0.00	18.89	0.00	18.89	
2	Pickens	0.00	0.19	8.32	3.26	0.00	11.77	
3	Oconee	0.09	0.28	1.84	9.78	5891.37	5,903.36	Thermoelectric water use is for once-through cooling in the Oconee Nuclear Power Plant
4	Anderson	0.00	0.25	0.16	18.34	0.80	19.54	
5	Abbeville	0.00	0.00	0.00	2.78	0.00	2.78	
6	Greenwood	0.00	0.06	0.00	0.00	0.00	0.06	
7	McCormick	0.00	0.11	0.00	1.15	0.00	1.26	
8	Edgefield	0.19	0.12	0.00	4.22	0.00	4.53	
9	Aiken	0.00	0.49	3.42	3.99	0.00	7.90	
10	Barnwell	0.00	0.00	0.00	0.00	0.00	0.00	
11	Allendale	0.00	0.00	0.00	0.00	0.00	0.00	
12	Hampton	0.04	0.00	0.00	0.00	0.00	0.04	
13	Jasper	0.00	0.00	0.00	0.00	0.00	0.00	
14	Beaufort	0.00	0.00	0.00	19.62	0.00	19.62	

Note: mgd values are obtained from the reported annual total water use.

Source: SC DHEC 2005

Table 2.3.2-4 Annual Surface Water Use Within 6 Miles of the VEGP Site

Location	VEGP (mgd)				SRS (mgd)	D-Area Power house (mgd)				Urquhart Station (mgd)			
Year	2004		2003		2004	2004		2005		2004		2005	
Month	Monthly Avg.	Daily Max.	Monthly Avg.	Daily Max.	Monthly Avg.	Monthly Avg.	Daily Max.	Monthly Avg.	Daily Max.	Monthly Avg.	Daily Max.	Monthly Avg.	Daily Max.
January	63.4	63.4	63.4	63.4	2.9			37.3	40.1			96.0	190.0
February	64.0	75.6	63.3	66.3	2.9			45.6	55.6			78.0	78.0
March	64.5	70.8	63.8	70.0	2.9			49.1	58.8			70.0	78.0
April	66.8	80.6	64.0	71.0	2.9			56.6	66.6			78.0	78.0
May	64.1	68.9	65.2	75.6	2.9			47.1	63.3			78.0	78.0
June	63.5	67.3	63.9	67.0	2.9	60.8	65.0			80.0	134.0		
July	64.1	68.8	65.0	74.8	2.9	43.1	53.6			103.0	190.0		
August	64.3	71.3	55.2	76.2	2.9	36.3	37.5			91.0	190.0		
September	63.8	71.9	67.6	78.1	2.9	38.5	43.3			83.0	190.0		
October	63.4	65.7	63.4	63.5	2.9	36.2	38.8			82.0	134.0		
November	63.8	69.8	63.8	70.5	2.9	42.6	53.6			75.0	134.0		
December	64.3	74.2	63.4	63.4	2.9	37.4	40.7			75.0	78.0		

Table 2.3.2-5 Registered Groundwater Users in the Savannah River Basin Within 50 Miles of the VEGP Site in Georgia

Serial No.	COUNTY	PERMIT USER NAME	PERMIT EXPN. DATE	PERMITTED MONTHLY AVG W/D (mgd)[1]	PERMITTED YEARLY AVG W/D (mgd)	# OF WELLS	PERMITTED AQUIFER
1	Burke	Waynesboro, City of	21-Dec-07	4.00	3.50	3	Cretaceous Sand
2	Burke	Southern Nuclear Operating Co-Plant Vogtle	6-Aug-10	6.00	5.50	8	Cretaceous Sand
3	Burke	International Paper - McBean Woodyard	2-Oct-08	0.95	0.95	2	Cretaceous Sand
4	Burke	Sardis, City of	31-Oct-13	0.40	0.40	2	Cretaceous Sand
5	Columbia	Harlem, City of	21-Dec-14	0.28	0.25	4	Crystalline Rock
6	Columbia	Grovetown, City of	18-Apr-15	0.90	0.90	4	Crystalline Rock
7	Columbia	Columbia County Water Department	22-Dec-06	0.58	0.58	1	Crystalline Rock
8	Columbia	Southern Beverage Packers, Inc	10-Nov-12	0.14	0.14	7	Crystalline Rock
9	Effingham	Rincon, City of	31-Dec-05[a]	1.25	0.87	4	Floridan
10	Effingham	Springfield, City of	31-Dec-05[a]	0.40	0.38	2	Floridan
11	Effingham	Georgia Power Co - Plant McIntosh	31-Dec-05[a]	0.55	0.45	2	Floridan
12	Effingham	Fort James Operating Company	31-Dec-05[a]	4.00	3.00	5	Floridan
13	Effingham	Lost Plantation Golf Course	31-Dec-05[a]	0.40	0.40	1	Floridan
14	Effingham	Springfield, City of - Effingham county Industrial Development Authority	31-Dec-05[a]	0.40	0.40	2	Floridan
15	Effingham	Coastal Water & Sewerage Company	31-Dec-05[a]	0.30	0.30	2	Floridan
16	Effingham	Effingham County Board of Commissioners	31-Dec-05[a]	0.12	0.12	3	Floridan
17	Glascock	Thiele Kaolin Co - Reedy Creek Plant	23-Jan-15	0.10	0.10	2	Barnwell (Eocene Age)
18	Jefferson	J.M. Huber Corp - Wrens Plant	26-Sep-14	1.87	1.69	4	Dublin - Midville
19	Jefferson	Wrens, City of	21-Aug-15	0.80	0.65	4	Cretaceous Sand
20	Jefferson	J.M. Huber Corp - Wrens Plant	10-Mar-11	0.70	0.60	2	Cretaceous Sand
21	Richmond	Prayon, Inc	29-Aug-14	0.42	0.38	2	Cretaceous Sand
22	Richmond	Hephzibah, City of	1-Oct-10	1.20	1.20	3	Cretaceous Sand
23	Richmond	Augusta-Richmond Utilities Department	29-Jan-05[b]	18.40	17.40	31	Cretaceous Sand

Table 2.3.2-5 (cont.) Registered Groundwater Users in the Savannah River Basin Within 50 Miles of the VEGP Site in Georgia

Serial No.	COUNTY	PERMIT USER NAME	PERMIT EXPN. DATE	PERMITTED MONTHLY AVG W/D (mgd)[1]	PERMITTED YEARLY AVG W/D (mgd)	# OF WELLS	PERMITTED AQUIFER
24	Richmond	East Central Regional Hospital - Gracewood Campus	19-Mar-06	0.50	0.40	4	Cretaceous Sand
25	Richmond	Olin Corporation	25-Apr-15	1.22	1.22	2	Cretaceous Sand
26	Richmond	Thermal Ceramics, Inc.	6-Mar-15	0.90	0.90	5	Cretaceous Sand
27	Richmond	Pine Hill W&S / Bought by Richmond County	12-Dec-99[b]				Cretaceous Sand
28	Richmond	Procter & Gamble Manufacturing Company	21-Mar-08	0.70	0.70	2	Cretaceous Sand
29	Richmond	Olin Corporation - Corrective Action Wells	23-Jul-06	0.91	0.91	15	Cretaceous Sand, KT-3, KT-1
30	Richmond	Alternate Energy Resources, Inc	27-Sep-07	0.43	0.43	15	Cretaceous Sand (Upper)
31	Richmond	Southern Wood Piedmont Company	13-Nov-10	0.65	0.65	12	Cretaceous Sand (Gaillard)
32	Richmond	Fort Gordon - Department of the Army	12-Oct-11	0.15	0.15	12	Crystalline Rock, Cretaceous Sand
33	Screven	Sylvania, City of	7-Jan-07	1.50	1.30	4	Floridan

[1] (mgd) million gallons per day
[a] Information updated as of September 2005
[b] Water used not specified as expired

Source: Georgia DNR 2006

Table 2.3.2-6 Groundwater Withdrawals for 2004, in Million Gallons Per Day (mgd), within South Carolina Part of the Savannah River Basin and within 50 Miles of the VEGP Site by Different Counties and for Different Consumptive Water Use Categories

Serial No.	County	Agriculture	Golf Course	Industrial	Water Supply	Mining	Total
1	Edgefield	0.00	0.21	0.00	0.00	0.00	0.21
2	Aiken	0.01	0.08	3.62	10.80	0.08	14.59
3	Barnwell	0.00	0.00	0.00	0.15	0.00	0.15
4	Allendale	1.94	0.00	2.43	0.00	0.00	4.37
5	Hampton	0.36	0.08	0.00	0.34	0.00	0.78
6	Jasper	0.14	0.00	0.00	0.26	0.00	0.40

Note: mgd values are obtained from the reported annual total water use.

Source: SC DHEC 2005

Table 2.3.2-7 Groundwater Withdrawals, in Million Gallons per Day (mgd), for Irrigation Use within Georgia Part of the Savannah River Basin and within 50 Miles of the VEGP Site by Different Counties

County	State	No. of Permitted Wells	Well Depth Range (ft)		Well Diameter (in.)		Total Permitted Withdrawal (mgd)
			Min.	Max.	Min.	Max.	
Burke	GA	87	58	640	4	18	122.2
Columbia	GA	8	100	285	3	6	0.8
Jefferson	GA	60	200	598	4	18	92.7
Jenkins	GA	55	120	650	4	16	53.8
McDuffie	GA	17	150	410	6	8	3.4
Richmond	GA	6	170	340	4	6	1.1
Screven	GA	133	110	750	4	16	140.8

Table 2.3.2-8 Georgia EPD Permitted Municipal and Industrial Groundwater Use Within 25 Miles of the VEGP Site

Well ID	Permit Holder	County	Aquifer	Year	Permitted Monthly Average, gpm (mgpd)	Permitted Annual Average, gpm (mgpd)	Average Annual Water Use, gpm (mgpd)
C-2	City of Sardis	Burke	Floridan	2004	278 (0.40)	278 (0.40)	63 (0.09)
				2005	278 (0.40)	278 (0.40)	NA
C-12	East Central Regional Hospital - Gracewood Campus	Richmond	Cretaceous Sand	2004	347 (0.50)	278 (0.40)	146 (0.21)
				2005	NA	NA	76 (0.11)
C-13	City of Hephzibah	Richmond	Cretaceous Sand	2004	833 (1.20)	833 (1.20)	160 (0.23)
				2005	NA	NA	236 (0.34)
C-19	Olin Corporation	Richmond	Cretaceous Sand	2004	847 (1.22)	847 (1.22)	514 (0.74)
				2005	NA	NA	486 (0.70)
C-19	Olin Corporation - Corrective Action Wells	Richmond	Cretaceous Sand	2004	632 (0.91)	632 (0.91)	229 (0.33)
				2005	NA	NA	250 (0.36)
I-1	International Paper	Burke	Cretaceous Sand	2004	660 (0.95)	660 (0.95)	181 (0.26)
				2005	660 (0.95)	660 (0.95)	35 (0.05)
I-2	Prayon, Inc	Richmond	Cretaceous Sand	2004	292 (0.42)	264 (0.38)	35 (0.05)
				2005	NA	NA	63 (0.09)
I-3	Thermal Ceramics, Inc.	Richmond	Cretaceous Sand	2004	625 (0.90)	625 (0.90)	313 (0.45)
				2005	NA	NA	208 (0.30)
I-4	Procter & Gamble Manufacturing Company	Richmond	Cretaceous Sand	2004	486 (0.70)	486 (0.70)	278 (0.40)
				2005	NA	NA	243 (0.35)
I-5	Southern Wood Piedmont Company	Richmond	Cretaceous Sand	2004	451 (0.65)	451 (0.65)	188 (0.27)
				2005	NA	NA	174 (0.25)
M-1	City of Waynesboro	Burke	Cretaceous Sand	2004	2778 (4.00)	2431 (3.50)	NA
				2005	2778 (4.00)	2431 (3.50)	NA
M-2	Augusta-Richmond Utilities Department	Richmond	Cretaceous Sand	2004	12778 (18.40)	12083 (17.40)	8285 (11.93)
				2005	NA	NA	8.40
	Southern Nuclear Operating Co.	Burke	Cretaceous Sand	2004	4167 (6.00)	3819 (5.50)	556 (0.80)
				2005	4167 (6.00)	3819 (5.50)	583 (0.84)

Notes:
NA – not available
Groundwater permit and usage data **(Voudy 2006)**
Groundwater aquifer description **(Georgia DNR 2006)**
Well locations are labeled on Figure 2.3.2-7 using the listed Well IDs.
Southern Nuclear Operating Co. well locations are shown on Figure 2.3.2-8.

Table 2.3.2-9 Georgia EPD Permitted Agricultural Groundwater Use Within 25 Miles of the VEGP Site

Well ID	Permit Holder	County	Depth (ft)	Permit (gpm)
A-1	ANDERSON JOHN	Burke	363	1500
A-2	BLANCHARD HENRY	Burke	500	1200
A-3	BLANCHARD HENRY	Burke	450	1400
A-4	BOLLWEEVIL PLANTATION	Burke	300	190
A-5	Chance Bill	Burke	500	450
A-6	CHANDLER FARM	Burke	580	1600
A-7	Chandler Michael	Burke	556	2400
A-8	Chandler Randall	Burke	579	2500
A-9	COCHRAN IRBY	Burke	420	1350
A-10	COLLINS ROBERT	Burke	430	1350
A-11	COLLINS ROBERT	Burke	530	1200
A-12	COLLINS ROBERT	Burke	480	1100
A-13	COLLINS ROBERT	Burke	440	1100
A-14	Collins Robert	Burke	490	1700
A-15	DIXON CARL	Burke	600	2000
A-16	DIXON JAMES	Burke	210	400
A-17	DIXON JAMES	Burke	200	200
A-18	DIXON JOANNE	Burke	640	1150
A-19	DIXON PERCY	Screven	560	2000
A-20	DIXON PERCY	Burke	560	2000
A-21	DIXON PERCY	Burke	350	115
A-22	DIXON PERCY	Burke	350	115
A-23	DIXON PERCY	Burke	550	3400
A-24	DIXON PERCY	Burke	350	200
A-25	DIXON PERCY	Burke	575	2500
A-26	DIXON PERCY	Burke	550	2500
A-27	GWR Partnership LLP	Burke	360	200
A-28	Hatcher William	Burke	300	500
A-29	HEATH CLAXTON	Burke	300	150
A-30	HEATH CLAXTON	Burke	400	250
A-31	HEATWOLE BYARD	Burke	325	200
A-32	HOPKINS HENRY	Burke	363	350
A-33	Horst Isaac	Burke	260	250
A-34	MALLARD CLYDE	Burke	320	400
A-35	MALLARD CLYDE MALLARD FARMS	Burke	210	250
A-36	MALLARD J.	Burke	200	150
A-37	McGregor Charles	Burke	430	350
A-38	MOBLEY DANNY	Burke	396	350
A-39	Mobley Danny	Burke	424	650
A-40	MOBLEY HERBERT	Burke	465	1100
A-41	MOBLEY HERBERT	Burke	500	1250
A-42	MOBLEY JAMES F.	Burke	572	2000
A-43	PENNINGTON FARMS- INC.	Burke	240	250
A-44	RAYMOND NEIL	Burke	430	1350
A-45	Shepherd Joseph	Burke	421	1500
A-46	SMART DARRELL	Burke	300	350
A-47	SMART DARRELL	Burke	300	350

Table 2.3.2-9 (cont.) Georgia EPD Permitted Agricultural Groundwater Use Within 25 Miles of the VEGP Site

Well ID	Permit Holder	County	Depth (ft)	Permit (gpm)
A-48	SMART DARRELL	Burke	300	350
A-49	SMART DARRELL	Burke	300	400
A-50	MIMS JOHN	Jenkins	445	1500
A-51	MIMS JOHN	Jenkins	460	1500
A-52	MULKEY A.	Jenkins	300	1000
A-53	MULKEY A.	Jenkins	400	500
A-54	PARKER GEORGE	Jenkins	450	700
A-55	PARKER GEORGE	Jenkins	300	450
A-56	PARKER GEORGE	Jenkins	300	450
A-57	Parker George	Jenkins	450	450
A-58	POINTE SOUTH GOLF CLUB- INC.	Richmond	311	400
A-59	BRAGG SOL	Screven	380	240
A-60	BRIAR CREEK COUNTRY CLUB	Screven	180	300
A-61	CAIN BRIAN	Screven	390	600
A-62	Cain Brian	Screven	493	1100
A-63	CLEMENT INVESTMENTS	Screven	282	1250
A-64	FOREHAND FARMS	Screven	160	250
A-65	Lee Mike	Screven	480	1800
A-66	Mill Haven Company Inc.	Screven	600	1200
A-67	MILLHAVEN CO.- INC.	Screven	553	1900
A-68	MILLHAVEN CO.- INC.	Screven	565	1400
A-69	NEWTON JAMES	Screven	350	400
A-70	SOWELL CAROLYN	Screven	275	300
A-71	STEPONGZI FRANK & PEARL	Screven	225	300
A-72	THOMPSON JAMES	Screven	475	750
A-73	THOMPSON ROGER	Screven	500	1000
A-74	WADE PLANTATION	Screven	215	200
A-75	WADE PLANTATION	Screven	250	190
A-76	WADE PLANTATION	Screven	460	1200
A-77	WADE PLANTATION	Screven	119	1000
A-78	WADE PLANTATION	Screven	750	1800
A-79	WADE PLANTATION	Screven	494	900
A-80	WADE PLANTATION	Screven	475	1200
A-81	WADE PLANTATION	Screven	672	1100
A-82	WADE PLANTATION	Screven	475	1100
A-83	WADE PLANTATION	Screven	525	1400
A-84	Wade Plantation	Screven	467	1100

Notes:
Groundwater permit data **(Lewis 2006)**
Well locations are labeled on Figure 2.3.2-7 using the listed Well IDs.

Table 2.3.2-10 SDWIS Listed Public Water Systems Supplied From Groundwater Within 25 Miles of the VEGP Site in Georgia

Well ID	Water System ID	Water System Name	County Served	Type	System Status
C-1	GA0330000	Girard	Burke	Community	Active
C-2	GA0330002	Sardis	Burke	Community	Active
C-3	GA0330013	Mamie Joe Rhodes Harrison Subdivision	Burke	Community	Closed
C-4	GA0330006	Burke Academy	Burke	Non-Transient Non-Community	Active
C-5	GA0330022	Burke County Training Center	Burke	Non-Transient Non-Community	Active
C-6	GA0330020	Delaigle Mobile Home Park	Burke	Transient Non-Community	Closed
C-7	GA1650000	Millen	Jenkins	Community	Active
C-8	GA1650001	Perkins Water Authority	Jenkins	Community	Active
C-9	GA1650006	Jockey International, Inc.	Jenkins	Non-Transient Non-Community	Active
C-10	GA1650005	DNR - Magnolia Springs State Pk.	Jenkins	Transient Non-Community	Active
C-11	GA1650008	National Fish Hatchery	Jenkins	Transient Non-Community	Closed
C-12	GA2450023	East Central Regional Hospital	Richmond	Community	Active
C-13	GA2450002	Hephzibah	Richmond	Community	Active
C-14	GA2450017	Hephzibah - Oakridge	Richmond	Community	Active
C-15	GA2450014	Mars Trailer Park	Richmond	Community	Active
C-16	GA2450016	Mobile Home Country Club MHP	Richmond	Community	Active
C-17	GA2450004	Richmond County	Richmond	Community	Closed
C-18	GA2450159	Albion Kaolin Company	Richmond	Non-Transient Non-Community	Closed
C-19	GA2450152	Olin Chemicals	Richmond	Non-Transient Non-Community	Closed
C-20	GA2510000	Hiltonia	Screven	Community	Active
C-21	GA2510015	Buck Creek M.H.P.	Screven	Community	Closed
C-22	GA2510052	Millhaven Plantation	Screven	Community	Closed
C-23	GA2510011	DOT - Georgia Welcome Center	Screven	Transient Non-Community	Active
C-24	GA2510057	Savannah River Challenge Program	Screven	Transient Non-Community	Active
	GA0330035	Southern Nuclear - Simulator Bld	Burke	Non-Transient Non-Community	Active
	GA0330017	Southern Nuclear - Vogtle Makeup	Burke	Non-Transient Non-Community	Active
	GA0330036	Southern Nuclear - Vogtle Rec	Burke	Transient Non-Community	Active

Notes:
US EPA SDWIS Database **(EPA 2006b)**
Well locations are labeled on Figure 2.3.2-7 using the listed Well IDs.
Southern Nuclear Operating Co. well locations are shown on Figure 2.3.2-8.

Table 2.3.2-11 VEGP Water-Supply Well Specifications and Yields[1]

Water Supply Well No.	Well Depth (ft)	Aquifer	Design Yield (gpm)[2]	Water Use
MU-1 [a]	851	Cretaceous	2000	Make-up water for plant use (e.g. nuclear service cooling water system; make-up to the water treatment plant demineralizer, and potable water source).
MU-2A [a]	884	Cretaceous	1000	Make-up water for plant use (e.g. nuclear service cooling water system; make-up to the water treatment plant demineralizer, and potable water source).
TW-1 [a]	860	Cretaceous	1000	Back-up water for the production make-up well system.
SW-5[a]	200	Tertiary	20	Water supply for old security tactical training area.
IW-4 [a]	370	Tertiary	120	Irrigation water for ornamental vegetation.
CW-3 [a]	220	Tertiary		Water supply for nuclear operations garage.
REC [a]	265	Tertiary	150	Potable water supply for recreation area.
SB [a]	340	Tertiary	50	Potable water supply for simulator training building.
SEC [b]	320	Tertiary	10	Non-potable water for lavatory use at a new plant entrance security building

Notes:
[1] Well locations, excluding Well REC, are shown on Figure 2.3.2-8. Well REC is located approximately 9300 ft southwest from Well IW-4.
[2] (gpm) gallons per minute

Sources:
[a] SNC 2005b
[b] SNC 2005a

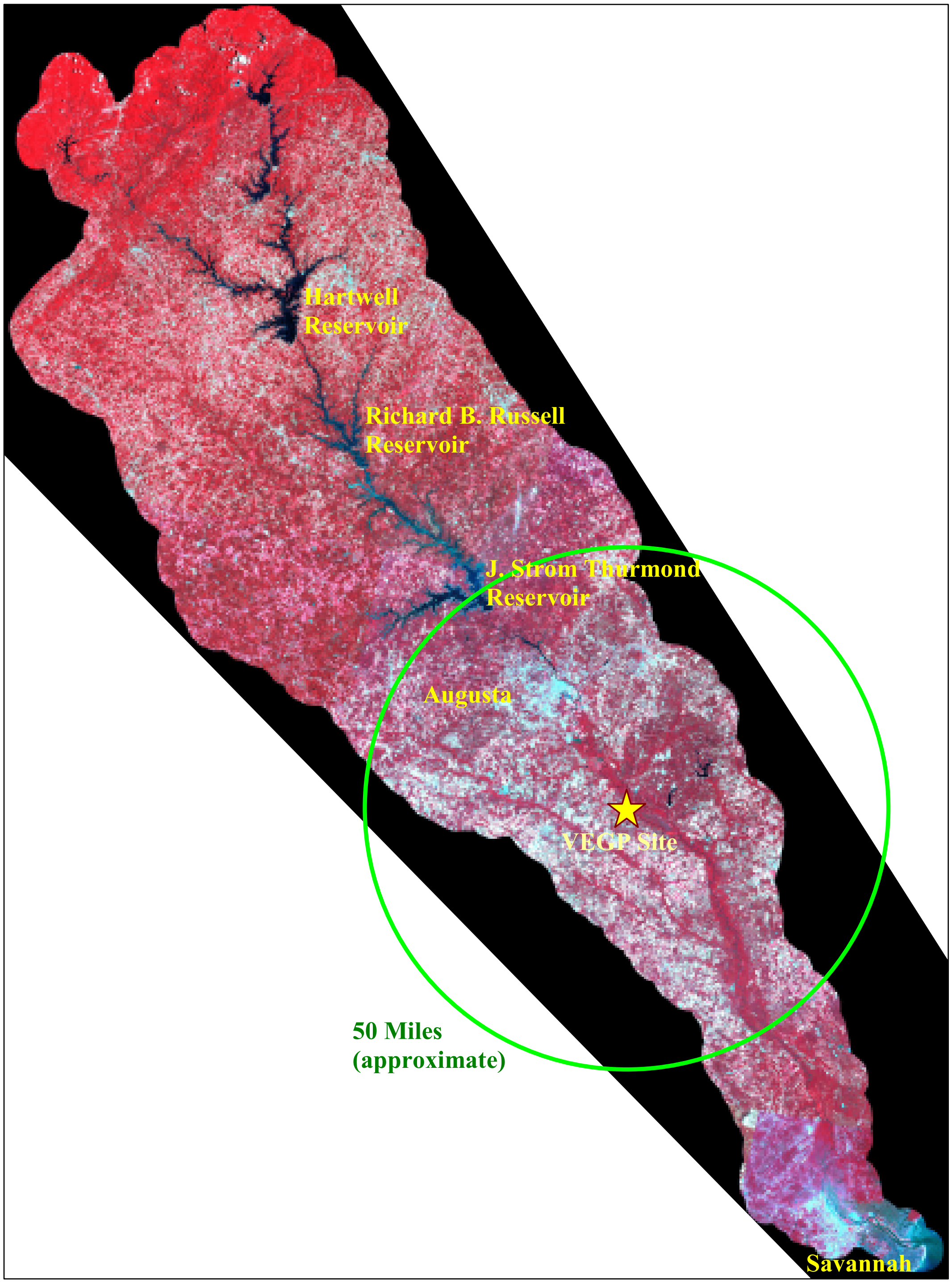
Table 2.3.2-12 Onsite Groundwater Use by VEGP for 2005, in Thousand Gallons per Month

Month	Well MU-1	Well MU-2A	Well TW-1	Well SW-5	Well IW-4	Well CW-3	Well REC	Well SB
January	19,209	0	0	0	0	3	28	2
February	17,416	0	0	0	0	2	50	58
March	21,601	0	0	0	0	2	41	54
April	26,211	0	0	0	0	1	47	65
May	29,648	0	0	0	0	2	67	75
June	35,625	0	0	0	14	2	42	83
July	23,846	0	0	0	55	2	125	118
August	24,560	0	0	0	126	6	104	66
September	28,020	0	0	0	134	4	84	69
October	30,290	0	0	0	0	3	79	49
November	20,282	2,880	0	0	0	2	72	104
December	26,363	0	0	0	0	2	41	160
Total	303,071	2,880	0	0	329	31	779	904
Monthly Average	25,256	240	0	0	27	3	65	75

Table 2.3.2-13 Projected Groundwater Use by AP1000, in Gallons per Minute (gpm)

Well Water Supply[a]	Normal Case (gpm)	Maximum Case (gpm)
Total well water demand	752	3,140
Power plant makeup water	215	787
Well water for service water system makeup	537	2,353

a. Values are from Figure 3.3-1 and Figure 3.3-2 in Section 3.3.1.



Note: River basin within approximately 50 mi of the VEGP site shown by the green circle

Source: EPA 1999

Figure 2.3.2-1 Major Surface Water Bodies Within the Affected Hydrologic System

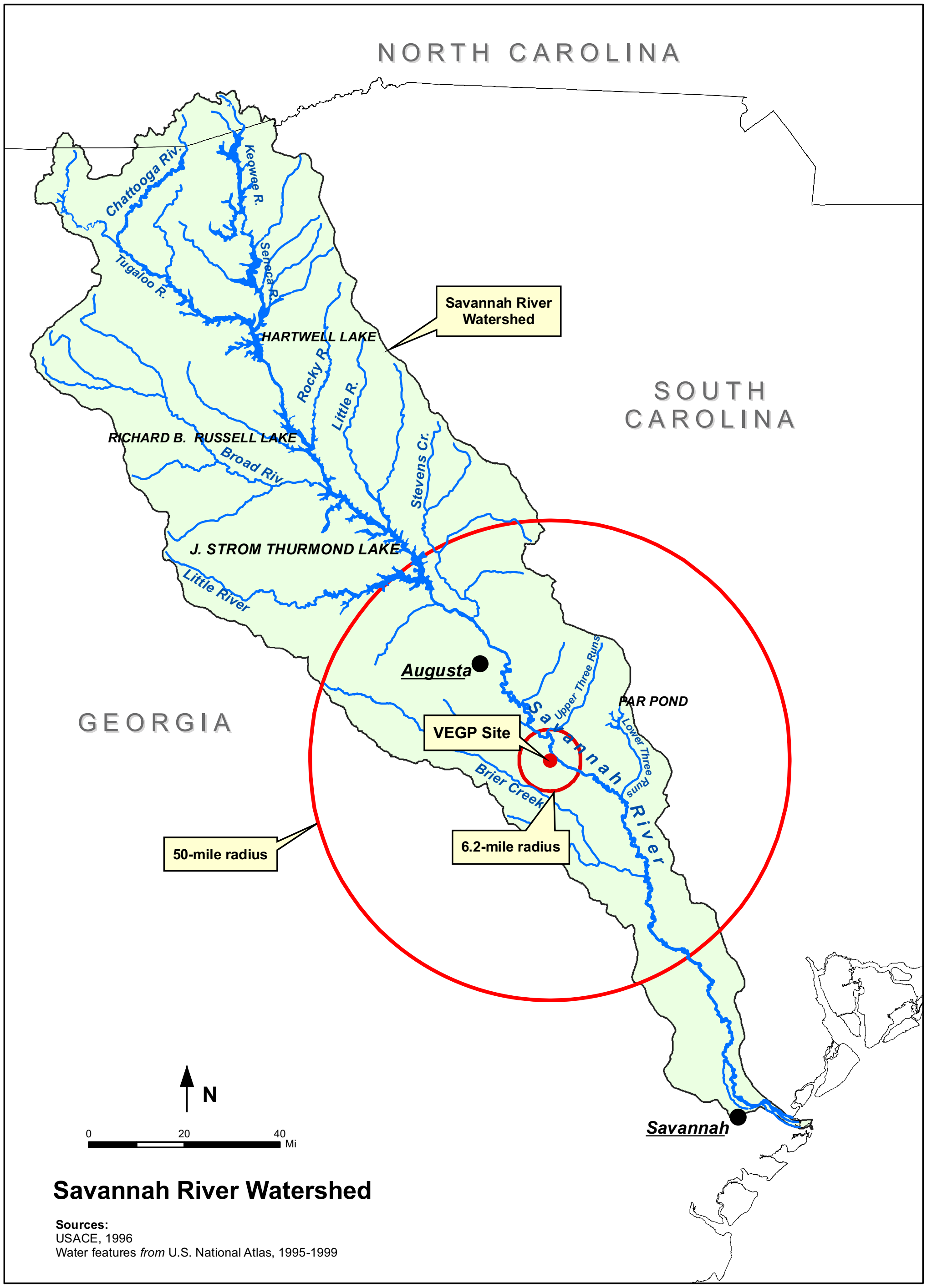


Figure 2.3.2-2 Major Rivers and Streams, and the Location of Major Reservoirs in the Savannah River Basin

Figure 2.3.2-3 Counties Located within a 50-Mile Radius from the VEGP Site and within the Savannah River Basin

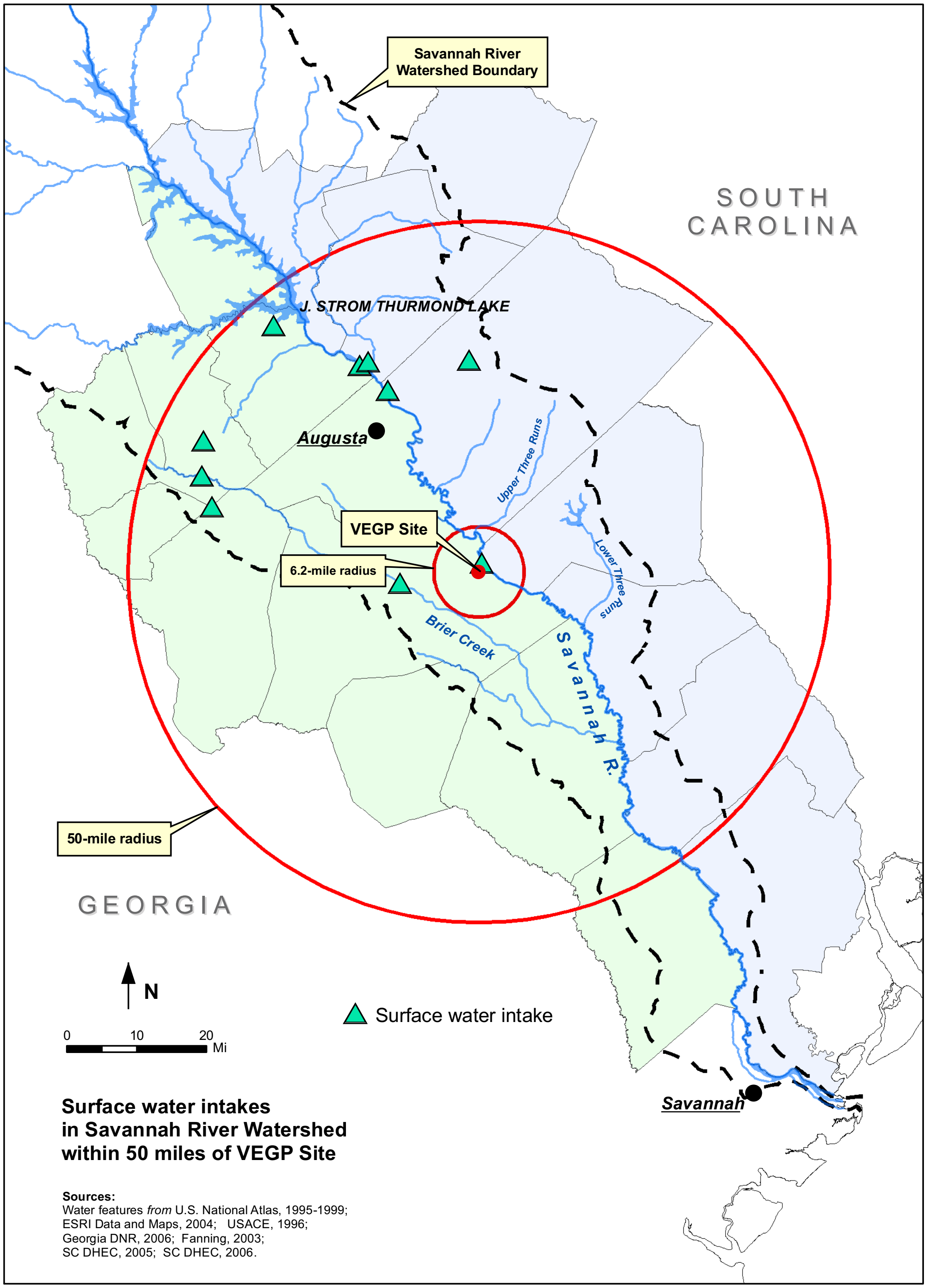


Figure 2.3.2-4 Location of Surface Water Withdrawal Intakes Within the Savannah River Basin and Within 50 Miles of the VEGP Site

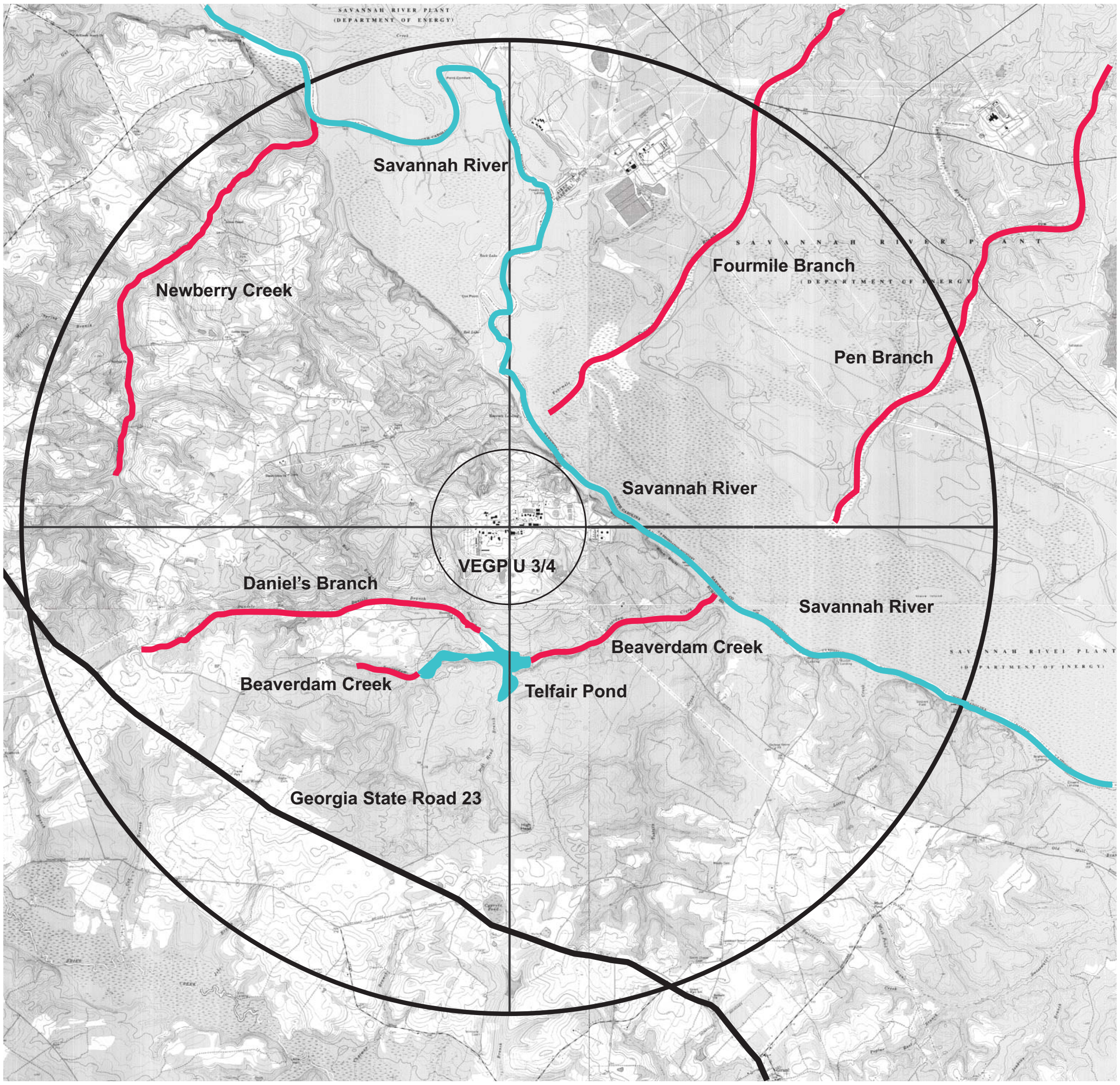


Figure 2.3.2-5 Major Surface Water Bodies Within a 6.2-Mile (10-km) Radius of the VEGP Site

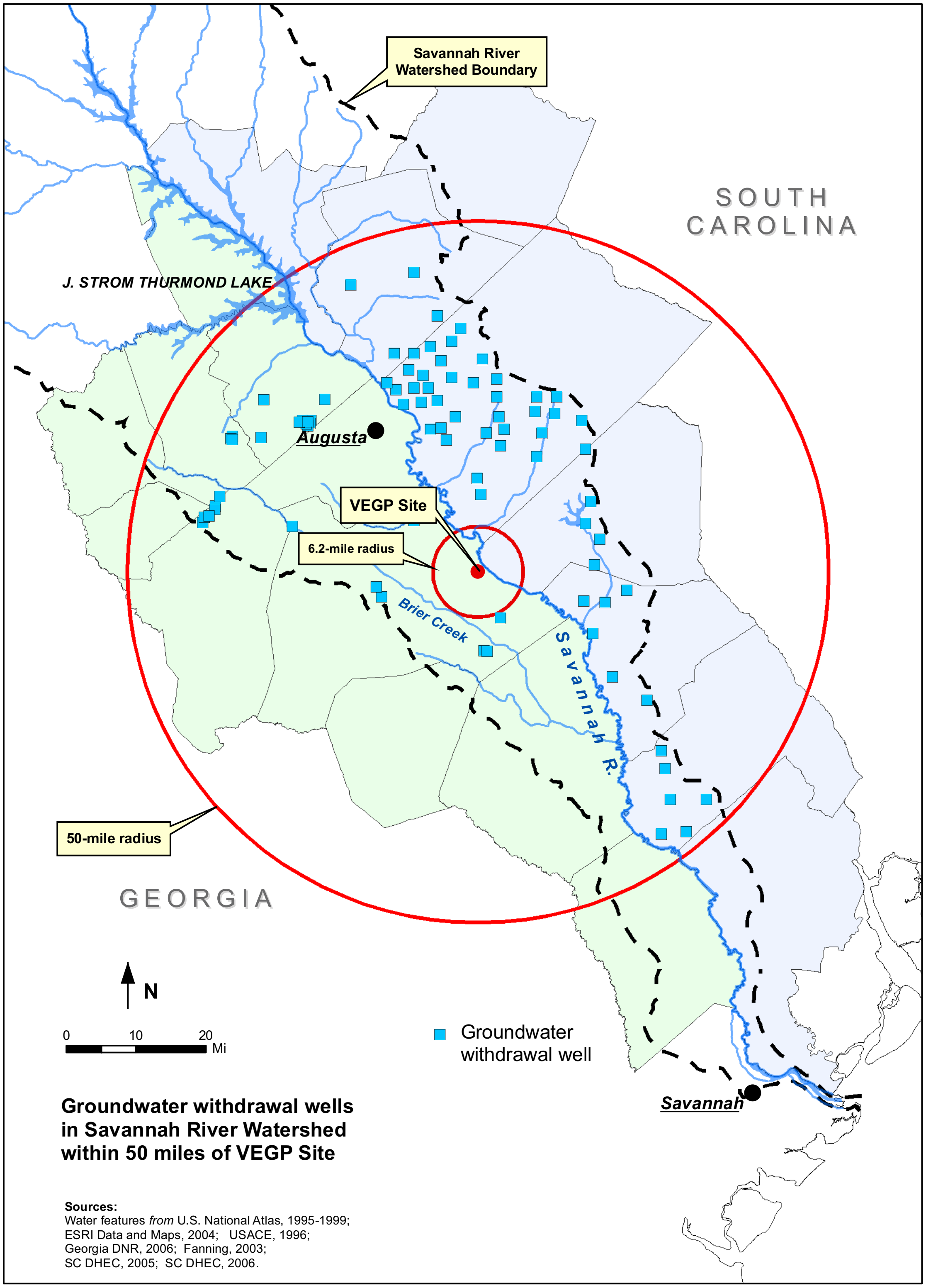


Figure 2.3.2-6 Location of Groundwater Withdrawal Wells Within the Savannah River Basin and Within 50 Miles of the VEGP Site

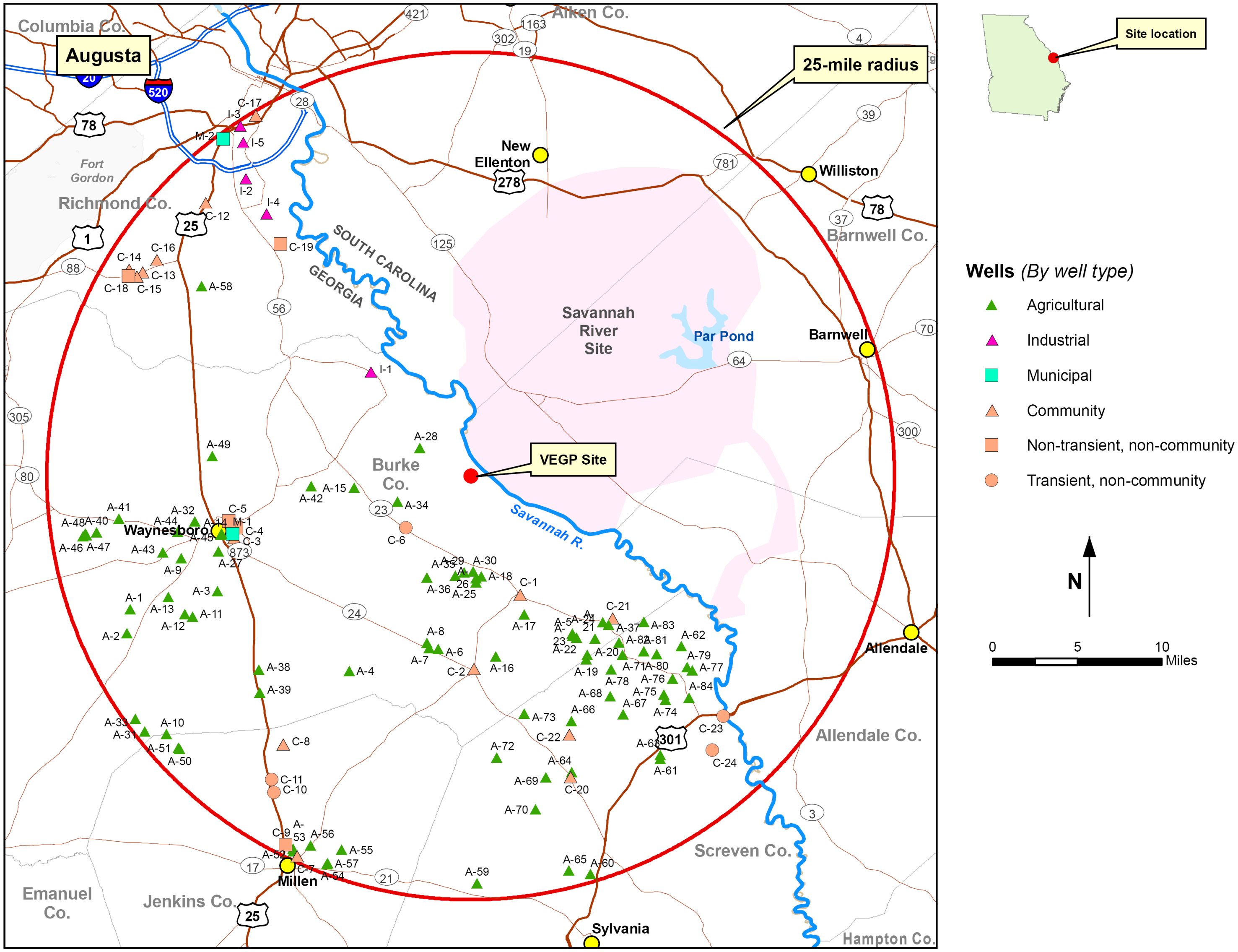


Figure 2.3.2-7 Locations of Water-Supply Wells Within 25 Miles of the VEGP Site

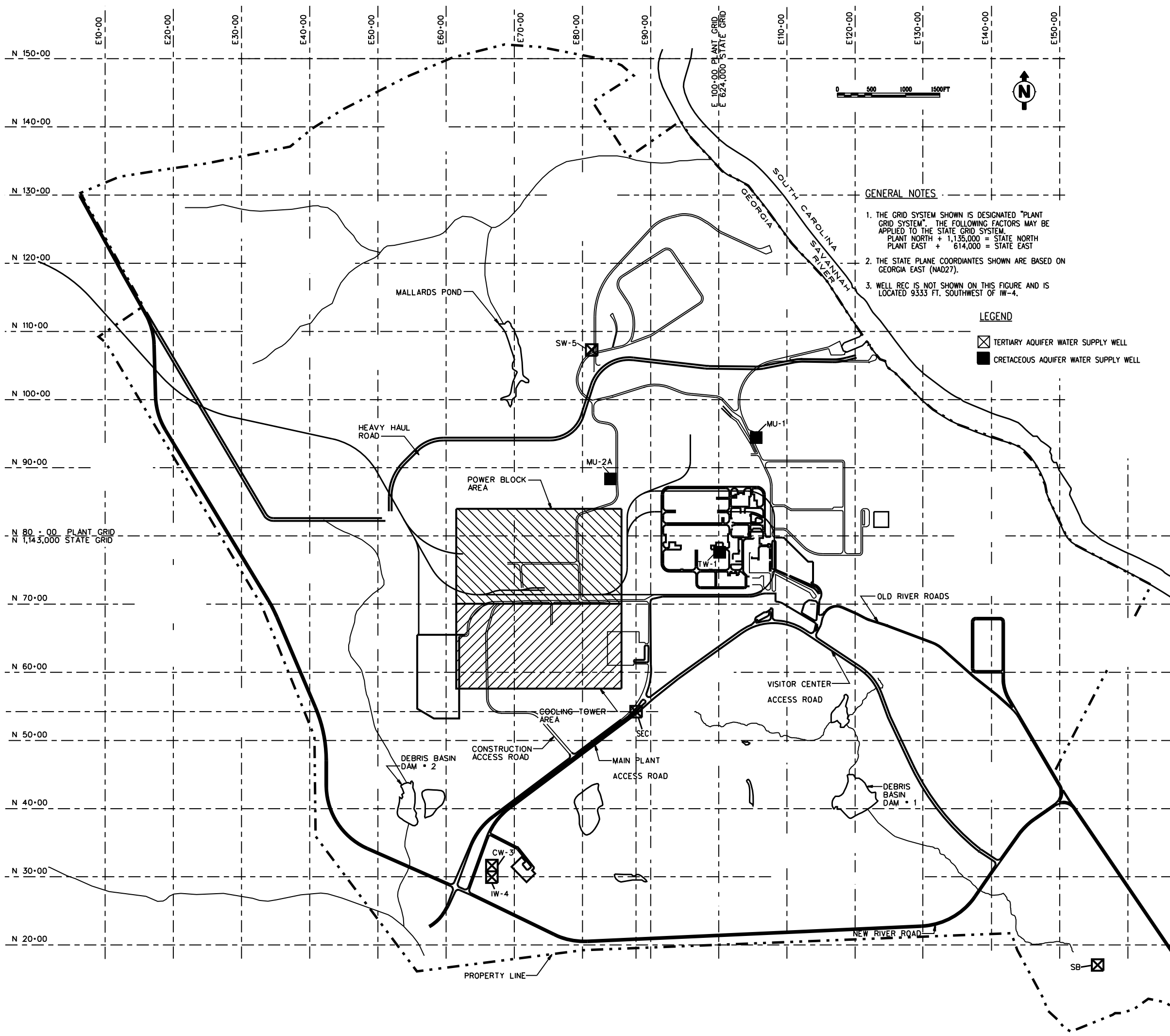


Figure 2.3.2-8 Location of Groundwater Withdrawal Wells for VEGP Units 1 and 2

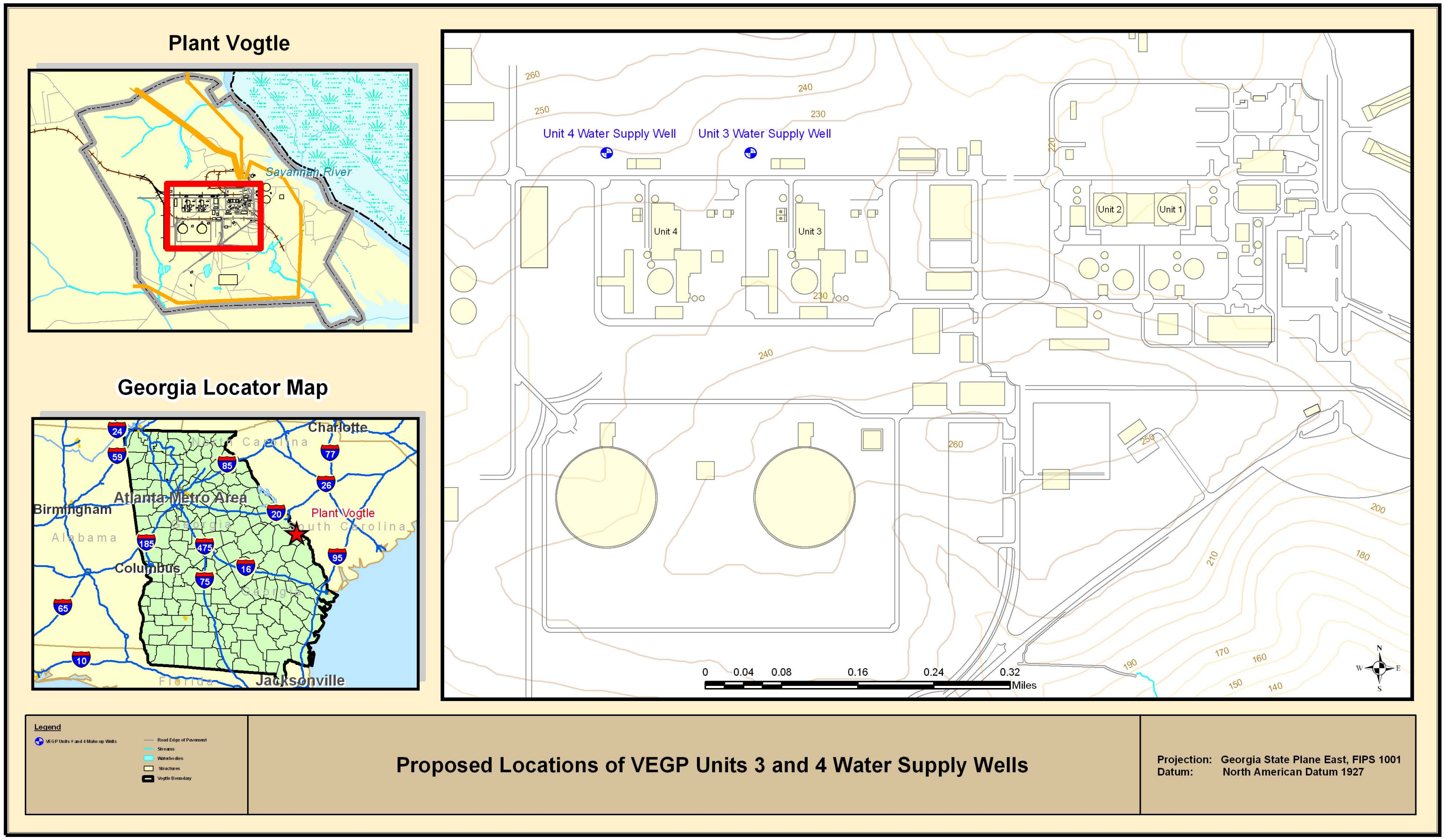


Figure 2.3.2-9 Locations of Proposed Groundwater Withdrawal Wells for VEGP Units 3 and 4

Section 2.3.2 References

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2.3.3 Water Quality

2.3.3.1 Surface Water

The new units will withdraw makeup water from the Savannah River through a new intake structure located upstream of the existing intake structure as discussed in Section 1.2.4. All cooling system discharges from the new units, including cooling tower blowdown, will be discharged to the Savannah River via a new discharge structure that will be built downstream of the existing discharge structure. Aside from some small on-site ponds and streams, the Savannah River is the only surface water body that could be affected by construction and operation of new units at the VEGP site.

The Environmental Protection Division (EPD) of Georgia Department of Natural Resources (GDNR) monitors water quality of the Savannah River as part of its River Basin Management Planning (RBMP) initiative **(GDNR 2001)**. This initiative was intended to promote cooperation between the public and private sectors and to encourage citizens and agencies to work together to identify and reduce sources of pollution, improve water quality, protect fish and wildlife habitats, restore degraded habitats, and enhance public recreational opportunities.

The USGS has divided the Savannah River into seven sub-basins and assigned Hydrologic Unit Codes (HUCs) to each. The approximately 122-mile-long portion of the river from J. Strom Thurmond Dam (impounding Clarks Hill Lake) to Brier Creek, downstream of VEGP, has been designated HUC 03060106, Middle Savannah River (see Figure 2.3.3-1). To facilitate monitoring water quality trends in the greater Augusta, Georgia area, GDNR has subdivided this reach of river into four segments (see Table 2.3.3-1), two upstream, one including VEGP, and one downstream of VEGP.

Water quality in the Middle Savannah River Basin is generally good, with 104 of 122 river miles fully supporting designated uses **(GDNR 2002)**. The two stream segments with degraded water quality are both upstream of VEGP, in Columbia and Richmond Counties. The tailwaters of both Clarks Hill Lake and Stevens Creek Reservoir periodically experience low levels of dissolved oxygen, particularly in late summer when Clarks Hill Lake is stratified and hypolimnetic water, low in oxygen, is released to generate electricity at the J. Strom Thurmond Dam powerhouse. The U.S. Army Corps of Engineers installed five auto-venting turbines at the J. Strom Thurmond Dam powerhouse in 2004 (two more will be installed in 2006) which are expected to increase dissolved oxygen downstream in the Savannah River by more than 2 parts per million **(COE 2004; Pavey 2004)**. The water use classification of Fishing/Drinking Water was not fully supported in the Stevens Creek to Highway 78/278 segment due to low dissolved oxygen and exceedances of the water quality standards for fecal coliform bacteria. These deficiencies have, in the past, been attributed to a combination of urban runoff, malfunctioning septic systems, sanitary sewer overflow, and/or animal wastes **(GDNR 2001)**.

Although water quality in the Middle Savannah River generally supports designated uses, Georgia DNR has announced fish consumption advisories based on elevated mercury concentrations in certain fish species for several reaches of river including between J. Strom Thurmond Dam and Burke County. **(GDNR 2005a)**

Like Georgia, South Carolina monitors Savannah River water quality. The South Carolina Department of Health and Environmental Control (SCDHEC) maintains three water quality monitoring stations in Aiken County upstream of VEGP and another downstream of VEGP in Allendale County **(SCDHEC 2003)**. The three upstream stations are at US 1 (Station SV-251), SC Highway 28 (Station SV-252), and Savannah River Lock and Dam (Station SV-323). In a Watershed Water Quality Assessment, SCDHEC examined Savannah River Basin water quality at these three stations for the 1996-2000 period and concluded that recreational uses were fully supported at all three sites. **(SCDHEC 2003)**. Recreational uses also were fully supported at the downstream monitoring station (Station SV-118). **(SCDHEC 2003)**

In 2004, SCDHEC issued a Fish Consumption Advisory for 53 South Carolina waterbodies, including the Savannah River, because of concerns about mercury contamination. The advisory also cautioned that "some fish also contain [the radionuclides] cesium-137 and strontium-90." **(SCDHEC 2005b)**

In addition to Georgia and South Carolina, the U.S. Department of Energy (DOE) has monitored Savannah River water quality for more than 50 years, initially to assess potential impacts of the SRS's nuclear and industrial facilities on the river's aquatic communities and later to ensure compliance with the provisions of the Clean Water Act, enacted in 1972. These water quality data provide a valuable long-term baseline dataset against which to measure man-induced change in the middle reach of the Savannah River.

DOE monitors Savannah River water quality at a series of stations up- and downstream of SRS tributary streams that receive NPDES-regulated effluents from SRS facilities **(Mamatey 2004).** These river sampling sites are located at RM-160, RM-150.4, RM-141.5, RM-129.1, and RM-118. The existing VEGP discharge is at RM-150.4 (see Figure 2.3-1 for approximate location). In 2003, the last year for which data are available, water quality data from the five Savannah River stations showed no indication of water quality degradation or impairment (Table 2.3.3-2). Temperatures and dissolved oxygen levels were within a range known to support aquatic organisms. Contaminants were either present in low concentrations (metals) or below the lower limit of detection (pesticides).

In addition to non-radiological constituents, DOE monitors radionuclides in Savannah River water at points above and below SRS, and below the point at which VEGP liquid discharges enter the river **(Mamatey 2004)**. Composite samples are collected weekly at five river locations and analyzed for tritium, cobalt-60 (Co-60), cesium-137 (Cs-137), gross alpha, and gross beta. An annual grab sample is obtained at each location and analyzed for strontium-89/90 (Sr-89/90), technetium-99 (Tc-99), isotopes of uranium (234, 235, and 238), isotopes of plutonium (238 and

239), americium-241 (Am-241), and curium-244 (Cm-244). The results of these analyses for 2003, which is the latest year for which data are available, are shown in Table 2.3.3-3. All measured concentrations were below the applicable regulatory criteria.

2.3.3.2 Groundwater

Information on the quantity and quality of groundwater in the vicinity of VEGP may be found in the VEGP UFSAR. There are two aquifers of interest at the VEGP site. The lower aquifer system is referred to as the Cretaceous aquifer system (now generally referred to as the Dublin and Midville aquifer systems) and consists primarily of the sands, gravels, and clays of the Tuscaloosa Formation. The upper aquifer system is variously referred to as the Tertiary aquifer system, the principal artesian aquifer, the limestone aquifer, and as the Floridan aquifer system. In the vicinity of the site, the Floridan also includes the water table aquifer. It consists primarily of the limestones and permeable sands of the Lisbon formation or stratigraphic equivalents. They are separated by a 60 to 70 foot thick aquiclude of hard, clayey marl referred to as "Blue Bluff marl." The Blue Bluff marl, which is the principal load-bearing stratum for the plant, is located about 85 feet below grade at 134 feet below mean sea level **(NRC 1985)**. The water table aquifer system beneath the plant is hydraulically isolated by stream channels (Savannah River to the east, Hancock Landing drainage to north, Beaverdam Creek to the south that represent hydraulic bearing to groundwater flow). Groundwater in this shallow aquifer is replenished by precipitation that percolates to the water table and moves laterally to the aforementioned interceptor streams **(GPC 1972)**.

Overall, the groundwater of the VEGP area is the calcium-sodium bicarbonate type, with total dissolved solids less than 200 parts per million. Groundwater from the water table aquifer contains from 20 to 170 parts per million total dissolved solids; groundwater from the deeper confined aquifer contains from 110 to 194 parts per million. The variation in total dissolved solids is apparently due to the length of time the water has remained in the ground; more time allows more leaching of solids. Sodium is the dominant cation in groundwater from both shallow and confined aquifers.

EPD is the entity within GDNR with the responsibility for protecting the state's groundwater quality. To this end, EPD has implemented a comprehensive state-wide groundwater management policy of anti-degradation and instituted a groundwater quality assessment program that includes the Georgia Ground-Water Monitoring Network **(Donahue 2004)**. The Geological Survey Branch of EPD maintains the network, which is designed to monitor the ambient groundwater quality of nine major aquifer systems in Georgia. One of these nine, locally named aquifer systems, the Jacksonian Aquifer System (part of Floridan aquifer system) of central and east-central Georgia, underlies VEGP.

Over the last 50 years as the coastal region of Georgia developed, subtle changes began to occur in the Upper Floridan aquifer that supplies the majority of the groundwater in the region. This porous limestone aquifer has extremely high productivity and provides drinking water to the major population centers on the Georgia, South Carolina and northern Florida Atlantic Coasts. Over time as a result of increasing use, the direction of flow in the aquifer changed and groundwater containing salt began to flow upward into major pumping centers in Savannah, GA-Hilton Head, SC; Brunswick, GA; and Jacksonville-Fernandina beach FL. This problem was first recognized in the 1960s. In the late 1970s and 1980s, a number of studies were done to define the problem and in 1995, Georgia EPD began a public education program and voluntary efforts to control the saltwater intrusion problems in the Upper Floridan aquifer. In 1997, the Georgia Department of Natural Resources, Environmental Protection Division (GADNR EPD) developed a two-stage approach to addressing the issue. The first stage was the implementation of an interim strategy that addressed groundwater withdrawal permitting from 1997 to 2005. The interim strategy instituted a moratorium on groundwater withdrawal permits for municipal, industrial, and agricultural uses within a 24-county area of coastal Georgia (including Burke but not Richmond or Columbia counties). The second stage, called the Coastal Sound Science Initiative (CSSI), consisted of scientific and engineering investigations to generate information and data to build a plan for managing salt water intrusion. The results indicate that there are three major locations where salt water intrusion is taking place. Model simulation indicates that if current pumping rates are maintained through the 21st century, the rate of movement of the largest of the three plumes will be about 130 feet per year. GADNR EPD believes that if the plumes continue to expand at the 1965-2004 rates, then salt water will not be a problem in Georgia for more than 100 years. Groundwater management will vary by county and be guided by each county’s proximity to the three plumes **(GDNR 2005b)**. Burke County is one of the more distant counties from the plumes. The interim Strategy defined three sub-regions with requirements that become more stringent near the coast. Burke County, where the VEGP site is located is in sub-region 3, the least restrictive sub-region. It consists of 19 full counties plus the portion of Effingham County north of Highway 119. The strategy for this region provides for conservation and reuse, justification of need, and monitoring to ensure the groundwater resource is protected for the future. Although more stringent than for some other counties in Georgia, the requirements placed on groundwater withdrawal in Burke County should not significantly impact withdrawal of groundwater to support the proposed VEGP Units 3 and 4.

Between January 2003 and January 2004, EPD monitored the water quality of eight wells in the Jacksonian Aquifer System **(Donahue 2004)**. Three of the wells, arrayed around a significant recharge area, were in Burke County west of VEGP. The other five wells were south and west of VEGP in Jefferson, Emanuel, Johnson, and Bleckley counties. Five of the wells are in the northern clastic facies (sands) of the Barnwell Group; two wells are in the less permeable silts and clays of a transition facies **(Donahue 2004)**. One well, north of the VEGP site, draws from an isolated limestone body.

The pH of water in the eight wells ranged from 4.62 to 7.44, while conductivity ranged from 37 to 228 micro-siemens per centimeter. Lowest pH and conductivity values were from the shallow “updip” well (J-7, approximately 25 miles west of the VEGP site) in the clastic facies. All samples were tested for volatile organic compounds (VOC), including the gasoline additive methyl tert-butyl ether (MTBE). No VOCs were detected. Excessive levels of beryllium have been detected in the past in well J-8 (approximately 40 miles west of the VEGP site), but in 2003-2004 concentrations were below the primary maximum contaminant limit (MCL; 4 parts per billion). Nitrate/nitrite, as nitrogen, ranged from undetectable to 7.6 ppm, and was detectable in six of the eight wells. The elevated nitrogen value was also from well J-8.

EPD is also responsible for monitoring radiation and radioactive materials in the environment. Since 1976, EPD has monitored radiation at nine nuclear facilities in Georgia and the bordering states of Alabama, Tennessee, and South Carolina **(GDNR 2004**, Executive Summary). Georgia DNR's most extensive environmental radiation monitoring network is focused on an area in Georgia adjacent to and downstream of the SRS and VEGP **(GDNR 2004)**. Because the two sites are across the Savannah River from one another, EPD has, since 1978, combined monitoring at the two facilities into a single program or "monitoring network" designed to detect radionuclides not only in groundwater but also in air, soils, crops, wildlife, surface water, and fish in the region.

Tritium was reported from several relatively deep wells in Burke County in 1991, and the Geologic Survey Branch of GDNR, with the assistance of DOE, began an investigation of the source of the tritium and the extent of contamination. The groundwater testing program in Burke County included an examination of existing wells, drilling and monitoring of several test wells, and testing of rainfall to determine its tritium content. As of 2002, no significant tritium contamination had been found in any deep aquifers in the VEGP area. More tritium was found in groundwater associated with the shallow (up to 200 feet deep) Upper Three Runs aquifer, however. Tritium concentrations averaged less than 1,000 pico-curies per liter (pci/L) over the 2000-2002 period, less than or equal to 5 percent of the MCL. Based on the areas with highest concentrations (southwest of SRS facilities), tritium appears to be transported by air (rain) from SRS **(GDNR 2004)**.

Tritium concentrations have been highest in the Tobacco Road Sand and Irwington Sand Member formations (20 to 80 feet deep) of the Upper Three Runs aquifer (**GDNR 2004**, Figure D-14B). Tritium concentrations in other Upper Three Runs formations have been much lower, and have been undetectable in the deeper Gordon, Millers Pond, and Dublin aquifers **(Georgia DNR 2004)**. EPD geologists theorize that the vertical profile reflects the historical rainout of airborne tritium from SRS, looking backward in time, from top to bottom of the Upper Three Runs aquifer. Maximum concentrations are presumed to relate to deposition of tritium in 1950s, 1960s, and 1970s, when SRS production facilities were operating at or near capacity and airborne releases from tritium facilities were at their highest levels.

Table 2.3.3-1 Stream Segments and Classifications, Middle Savannah River

Segment Described	County or Counties	Length (mi)	Classification	Fully or Partially Supporting Designated Uses
Thurmond Dam to Stevens Creek	Columbia	9	Drinking Water	Partially[a]
Stevens Creek Dam to Hwy 78/278	Columbia Richmond	9	Drinking Water	Partially[b]
Hwy 78/278 to Johnsons Landing (reach adjacent to VEGP)	Richmond Burke Screven	78	Fishing	Fully
Johnsons Landing to Brier Creek	Screven	26	Fishing/Drinking Water	Fully

Source: GDNR 2002, Appendix A

[a] Did not meet water quality standard for dissolved oxygen

[b] Did not meet water quality standards for dissolved oxygen and fecal coliforms

Table 2.3.3-2 Savannah River Water Quality in 2003

		Location				
		RM-118.8	RM-129.1	RM-141.5	RM-150.4[a]	RM-160
Parameter	Unit	Range (Mean)	Range (Mean)	Range (Mean)	Range (Mean)	Range (Mean)
Temperature	°C	9.4-25.7 (18.05)	9-23.3 (17.558)	9-22.8 (17.408)	9.2-23.1 (17.267)	9-22.4 (17.025)
Dissolved Oxygen (DO)	mg/L	5.25-11.33 (8.042)	6.11-10.53 (7.767)	6.04-10.96 (7.788)	6.13-11.4 (8.37)	7.19-10.21 (8.473)
pH	SU	5.8-7.02 (6.6)	5.7-7.27 (6.628)	5.8-7.09 (6.518)	6.24-6.93 (6.682)	5.94-7.3 (6.697)
Hardness	mg/L	11-18 (15.333)	12-27 (18.417)	13-19 (15.417)	12-20 (15.583)	12-19 (15.455)
Total Suspended Solids	mg/L	4-20 (8.5)	1-17 (8.636)	2-26 (9.25)	4-34 (11.75)	2-26 (9.167)
Nitrate Nitrogen	mg/L	0.19-0.42 (0.29)	0.026-0.32 (0.226)	0.2-0.37 (0.284)	0.23-0.38 (0.303)	0.24-0.34 (0.285)
Total Phosphate Phosphorus	mg/L	0.084-0.16 (0.116)	0.034-0.16 (0.091)	0.038-0.15 (0.103)	0.064-0.42 (0.138)	0.03-0.23 (0.103)
Total Organic Carbon (TOC)	mg/L	3.8-6 (4.742)	4-15 (6.025)	3.7-6.8 (4.792)	3-7.6 (4.517)	3.1-6.1 (4.245)
Aluminum	mg/L	0.055-0.696 (0.316)	0.049-0.695 (0.3)	0.045-1.207 (0.369)	0.059-1.071 (0.391)	0.057-0.71 (0.36)
Beryllium	mg/L	0.306-0.306 (0.306)	0.002-0.002 (0.002)	0.002-0.002 (0.002)	0.002-0.002 (0.002)	0.0004-0.002 (0.001)
Cadmium	mg/L	0.0003-0.002 (0.001)	0.0001-0.003 (0.001)	0.001-0.003 (0.001)	0.0001-0.003 (0.001)	0.0002-0.003 (0.001)
Chromium	mg/L	0.001-0.001 (0.001)	0.001-0.001 (0.001)	0.001-0.002 (0.001)	0.001-0.002 (0.001)	0.001-0.001 (0.001)
Copper	mg/L	0.001-0.002 (0.002)	0.001-0.002 (0.001)	0.001-0.002 (0.002)	0.001-0.002 (0.001)	0.001-0.744 (0.15)
Iron	mg/L	0.487-1.402 (0.867)	0.396-1.893 (0.915)	0.41-1.905 (0.921)	0.396-1.566 (0.782)	0.422-1.165 (0.656)
Mercury	ug/L	0.011-1.158 (0.237)	0.015-0.141 (0.074)	0.024-0.153 (0.07)	0.018-0.246 (0.111)	0.01136-0.165 (0.072)
Manganese	mg/L	0.023-0.162 (0.097)	0.017-0.18 (0.092)	0.063-0.205 (0.114)	0.072-0.293 (0.121)	0.066-0.486 (0.144)

Table 2.3.3-2 (cont.) Savannah River Water Quality in 2003

		Location				
		RM-118.8	**RM-129.1**	**RM-141.5**	**RM-150.4[a]**	**RM-160**
Parameter	**Unit**	**Range (Mean)**	**Range (Mean)**	**Range (Mean)**	**Range (Mean)**	**Range (Mean)**
Nickel	mg/L	0.004-0.134 (0.031)	0.004-0.01 (0.006)	0.005-0.009 (0.007)	0.003-0.009 (0.006)	0.005-0.01 (0.008)
Lead	mg/L	0-0 (ND)	0-0 (ND)	0-0 (ND)	0-0 (ND)	0-0 (ND)
Thallium	mg/L	0-0 (ND)	0-0 (ND)	0.009-0.009 (0.009)	0-0 (ND)	0.011-0.011 (0.011)
Zinc	mg/L	0-0 (ND)	0-0 (ND)	0-0 (ND)	0.011-0.014 (0.013)	0-0 (ND)

Source: **Mamatey 2004**
ND = no data
[a] Location of VEGP discharge

Table 2.3.3-3 Radioactivity in Savannah River Water in 2003

Radionuclide	Location	Number of samples	Sample mean (pCi/l)	Standard Deviation (pCi/l)
H-3	River Mile 118.8	52	7.49E+02	4.32E+01
	River Mile 141.5	52	8.89E+02	6.03E+01
	River Mile 150.0	52	7.24E+02	6.06E+01
	River Mile 150.4	52	1.17E+03	1.45E+02
	River Mile 160.0	52	1.20E+02	1.26E+01
Co-60	River Mile 118.8	52	1.29E-01	5.78E-02
	River Mile 141.5	52	1.06E-01	5.09E-02
	River Mile 150.0	52	1.01E-01	4.11E-02
	River Mile 150.4	52	2.32E-01	1.11E-01
	River Mile 160.0	52	1.15E-01	5.80E-02
Cs-137	River Mile 118.8	52	8.08E-02	6.35E-02
	River Mile 141.5	52	4.21E-02	6.25E-02
	River Mile 150.0	52	3.27E-02	5.50E-02
	River Mile 150.4	52	-4.15E-04	6.76E-02
	River Mile 160.0	52	7.19E-02	5.96E-02
Sr-89/90	River Mile 118.8	1	1.55E-01	4.28E-02
	River Mile 141.5	1	1.13E-01	3.97E-02
	River Mile 150.0	1	4.81E-02	2.69E-02
	River Mile 150.4	1	7.36E-02	3.86E-02
	River Mile 160.0	1	5.20E-02	3.43E-02
Tc-99	River Mile 118.8	1	-1.10E+00	1.64E+00
	River Mile 141.5	1	1.21E+00	1.83E+00
	River Mile 150.0	1	-1.56E-03	1.74E+00
	River Mile 150.4	1	1.10E+00	1.83E+00
	River Mile 160.0	1	-1.56E-03	1.74E+00
U-234	River Mile 118.8	1	2.01E-01	1.67E-01
	River Mile 141.5	1	4.15E-01	3.81E-01
	River Mile 150.0	1	3.58E-01	3.69E-01
	River Mile 150.4	1	9.37E-01	4.47E-01
	River Mile 160.0	1	-3.91E-01	2.91E-01
U-235	River Mile 118.8	1	2.02E-01	1.73E-01
	River Mile 141.5	1	4.84E-01	4.43E-01
	River Mile 150.0	1	6.33E-01	4.53E-01
	River Mile 150.4	1	7.93E-01	4.92E-01
	River Mile 160.0	1	-4.03E-01	3.24E-01

Table 2.3.3-3 (cont.) Radioactivity in Savannah River Water in 2003

Radionuclide	Location	Number of samples	Sample mean (pCi/l)	Standard Deviation (pCi/l)
U-238	River Mile 118.8	1	1.18E-01	1.55E-01
	River Mile 141.5	1	6.74E-01	3.71E-01
	River Mile 150.0	1	-4.49E-01	2.40E-01
	River Mile 150.4	1	7.79E-02	3.21E-01
	River Mile 160.0	1	2.40E-01	3.19E-01
Pu-238	River Mile 118.8	1	-2.08E-02	4.63E-02
	River Mile 141.5	1	-7.17E-02	5.34E-02
	River Mile 150.0	1	-5.08E-02	7.65E-02
	River Mile 150.4	1	-7.38E-04	7.36E-02
	River Mile 160.0	1	3.41E-01	1.39E-01
Pu-239	River Mile 118.8	1	7.28E-03	1.56E-02
	River Mile 141.5	1	1.52E-01	9.32E-02
	River Mile 150.0	1	3.79E-01	1.40E-01
	River Mile 150.4	1	2.18E-01	1.05E-01
	River Mile 160.0	1	-3.59E-02	3.76E-02
Am-241	River Mile 118.8	1	-7.87E-02	3.15E-02
	River Mile 141.5	1	1.67E-01	1.65E-01
	River Mile 150.0	1	1.58E-01	1.41E-01
	River Mile 150.4	1	-2.10E-02	9.53E-02
	River Mile 160.0	1	3.13E-02	1.16E-01
Cm-244	River Mile 118.8	1	4.51E-02	4.52E-02
	River Mile 141.5	1	5.94E-02	5.96E-02
	River Mile 150.0	1	5.24E-02	5.26E-02
	River Mile 150.4	1	-3.14E-02	3.14E-02
	River Mile 160.0	1	0.00E+00	2.17E+01
Gross beta	River Mile 118.8	52	2.28E+00	8.91E-02
	River Mile 141.5	52	2.30E+00	8.02E-02
	River Mile 150.0	52	2.14E+00	9.97E-02
	River Mile 150.4	52	2.51E+00	1.13E-01
	River Mile 160.0	52	2.08E+00	1.04E-01
Gross alpha	River Mile 118.8	52	3.52E-01	7.22E-02
	River Mile 141.5	52	3.36E-01	4.99E-02
	River Mile 150.0	52	3.59E-01	6.50E-02
	River Mile 150.4	52	5.59E-01	7.64E-02
	River Mile 160.0	52	1.47E-01	5.19E-02

Source. **Mamatey 2004**

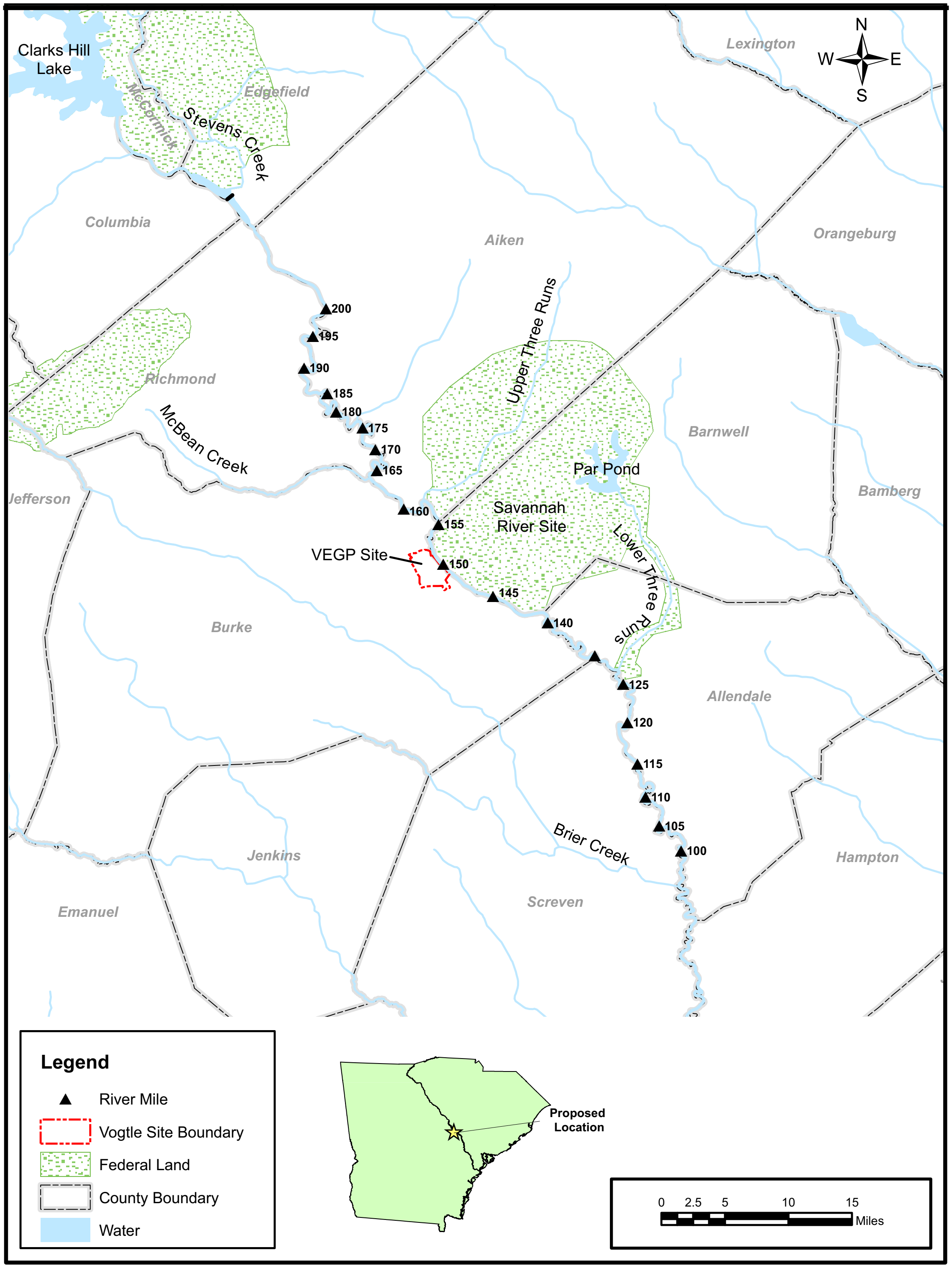

Figure 2.3.3-1 Middle Savannah River

Section 2.3.3 References

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2.4 Ecology

This section presents the ecological resources that have the potential to be impacted by the construction and operation of new nuclear units on the VEGP site. This section addresses resources for the two ecological environments, terrestrial and aquatic.

SNC has begun informal discussions with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, Georgia Natural Heritage Program, and South Carolina Heritage Trust Program that will continue throughout the application review process (see Appendix A).

2.4.1 Terrestrial Ecology

This section describes the terrestrial ecology of the VEGP site and transmission corridors.

2.4.1.1 Site Habitats and Communities

The VEGP site is located in the Georgia Upper Coastal Plain about 30 miles below the fall line. Land use surrounding the VEGP site is an irregular patchwork of pasture or farmland, pine plantations, abandoned (old) fields and second growth forests of hardwoods and mixed pine-hardwoods.

Current land-use at the VEGP site is presented in Section 2.2. Approximately 800 acres of the VEGP site consists of generation and maintenance facilities, parking lots, roads, cleared areas, and mowed grass (termed “facilities” in Figure 2.4-1). No other preexisting stresses or stressors to wildlife are known.

Pine forests (including slash pine plantations) and hardwood forests occur in areas that were not previously cleared for construction or operation of VEGP Units 1 and 2. Vegetation communities at the VEGP site consist of approximately 1,634 acres of pine forests, 612 acres of hardwood forests, and 96 acres of open areas such as mowed grass and old fields. Low areas along the river and streams support bottomland hardwood forests. Upland areas support pine forests (longleaf, loblolly and planted slash pine), hardwood forests, and some areas that could be classified as mixed pine-hardwood stands.

The longleaf and loblolly pine forests and slash pine plantations are of diverse ages, and vary from a nearly closed canopy with very little understory, to areas that more resemble old fields with only scattered pines. Herbaceous ground cover in the pine forests is dominated by bracken fern, while in the more open areas, dog fennel, broomsedge, and blackberry are common. **(TRC 2006)**

Some mixed pine-hardwood stands are found in undisturbed uplands of the VEGP site. These stands are a mix of a xeric longleaf pine-scrub oak community and a slightly more mesic oak-hickory community; the ridge tops and south and west slopes are more xeric while the north and east slopes support the more mesic oak-hickory. Longleaf pine, turkey oak, and bluejack oak form the canopy along with blackjack oak and scattered dogwood and hawthorns. The shrub layer is composed of sparkleberry, dwarf huckleberry, and yellow jessamine. The density and diversity of the herbaceous ground cover varies with the degree of canopy closure. In areas of dense shade, slender wood oats are dominant. In more open areas, gopher weed, jointweed, tread-softly, and reindeer lichen are common. The oak-hickory community canopy is composed of white oak, white ash, mockernut hickory, and dogwood, and to a lesser extent, turkey oak and shortleaf pine. **(TRC 2006)**

Canopy species in the lower, wetter areas along the Savannah River are primarily bald cypress and tupelo gum, while sycamore, boxelder, sugarberry, and swamp chestnut oak occupy the slightly higher ground in the bottomland hardwoods. American holly, ironwood, water locust, cane, and buttonbush form the understory. Ground cover is sparse and limited to those species that can survive inundation and dense shade; these include richweed, lizard tail, sensitive fern, and Virginia dayflower. **(TRC 2006)**

A steep, east-facing bluff lies just west of the bottomland hardwoods along the river. The bluff is completely forested by tree species such as white oak, southern red oak, mockernut hickory, tulip poplar, sweet gum, American elm, basswood, and sugar maple. There is also well developed understory of smaller trees, shrubs and vines along the steep bluff. The most common understory species are pawpaw, hop hornbeam, muscadine, American beautyberry, crossvine, and poison ivy. The herbaceous ground cover varies with soil moisture, varying from dry areas near the top of the slope to wet seeps at the foot of the slope. On the upper slope, Christmas fern, white snakeroot, and several species of aster are common. On the lower slopes and around seeps, mottled trillium, wild ginger, false nettle, and jewelweed are common. **(TRC 2006)**

Two small drainages traverse the VEGP site. A small unnamed stream drains Mallard Pond and flows north and east into the Savannah River (Figures 2.1-1 and 3.1-3). The stream is approximately 2 to 4 feet wide and less than 1 foot deep, except where beavers have created dams and ponds. The second drainage includes two streams that drain into Beaverdam Creek, which flows east out of Telfair Pond and enters the Savannah River approximately two miles downstream of the existing intake structure (Figure 2.1-3). Although Beaverdam Creek is outside the VEGP site, the two small steams mentioned above are within the site. One of these streams is located in the southeastern portion of the VEGP site and drains south through Debris Basin Pond # 1, and the other stream is in the southwestern portion of the site and flows south through the Debris Basin Pond #2 (Figures 2.1-1 and 3.1-3). Two large beaver ponds exist on the western stream.

Dominant tree species in the wetlands associated with the stream draining Mallard Pond and along the two streams that flow into Beaverdam Creek are water oak, red maple, and black gum. The relatively dense understory of vines and shrubs is composed primarily of cane, trumpet creeper, muscadine, and American holly. The herbaceous ground cover is dominated by cinnamon fern and royal fern. **(TRC 2006)**

Man-made ponds at the VEGP site consist of open water and mudflats with heavily vegetated fringes. Dominant species surrounding the open water are broadleaf cattail, sugarcane plume grass, wool grass, bushy bluestem, and black willow. **(TRC 2006)**

The topography of the site consists of low rolling hills with elevations ranging from 80 ft to 280 ft above mean sea level. All streams in the area ultimately drain into the Savannah River.

Wildlife species found in the forested portions of the VEGP site are those typically found in forests of eastern Georgia. Mammals such as the white-tailed deer, raccoon, opossum, gray squirrel, Eastern cottontail, coyotes, and gray fox occur at the site, as do smaller mammals such as moles, shrews, and a variety of mice and voles. Various reptiles and amphibians (e.g., snakes, salamanders, lizards, toads) occur at the VEGP site. Common bird species at the VEGP site include the American crow, Northern bobwhite, blue jay, Carolina chickadee, mourning dove, black vulture, turkey vulture, song sparrow, white-throated sparrow, dark-eyed junco, Northern cardinal, tufted titmouse, red-bellied woodpecker, and Northern flicker. SNC has placed bluebird and wood duck nest boxes in suitable habitats at the VEGP site that are used for nesting by these birds.

The USFWS is responsible for designating areas of "critical habitat" for federally-listed endangered and threatened terrestrial species. Such areas are considered essential to the species' conservation, and may require special management and protection. No areas designated by USFWS as critical habitat exist at or near the VEGP site. "Critical habitat" or similarly defined classifications do not exist for state-listed species in Georgia and South Carolina.

The 7,800 acre Yuchi WMA is immediately south of the VEGP site.

Surveys for federally- and state-listed species classified as threatened or endangered were conducted in Spring, Summer, and Autumn 2005 at VEGP to support license renewal and the ESP application (**TRC 2006;** Appendix B). The American alligator (*Alligator mississippiensis*) was the only Federally-listed animal species observed at the VEGP site during the 2005 surveys. One adult alligator was observed in Mallard Pond north of the Units 3 and 4 footprint during the Summer survey. The American alligator is common in the region, and thus, is not State-listed as a special status species. It is federally-listed as "threatened due to similarity in appearance" to the endangered American crocodile (*Crocodylus acutus*). No State-listed animals were observed on the VEGP site during the 2005 surveys. In October, 2006, the Georgia Department of Natural Resources updated its list of protected species. One of the newly-added species state-listed as threatened is the Southeastern pocket gopher (*Geomys pinetis*). Surface mounds indicative of this species have been observed in property bordering the northern portion of VEGP.

No federally-listed plants were found on the VEGP site during the 2005 surveys. Bay star-vine (*Schisandra glabra*), state-listed as threatened in Georgia, was the only State-listed plant found. Habitat for this vine is rich forested areas, especially bottomlands and slopes. Bay star-vine was found at several locations along the wooded bluff bordering the Savannah River, and in a wooded wetland in the southern portion of the VEGP site. In April 2007, SNC, GPC, and Georgia DNR personnel conducted a walking tour of areas of the site believed to have habitat types conducive to support the protected relict trillium. No occurrences were observed.

Endangered, threatened, and other special-status species known to occur in Burke County are listed in Table 2.4-1. Special status-species indicated in Table 2.4-1 as occurring in Burke County (in which VEGP is located) were taken from county records maintained by USFWS (2004) and the Natural Heritage Program of the Georgia Department of Natural Resources **(GDNR 2007)**. However, SNC recognizes that the USFWS and GDNR databases reflect only recorded occurrences, and the possibility exists that other (unrecorded) special-status species might exist in Burke County. Similarly, although the alligator and bay star-vine were the only special-status species observed during the 2005 Spring, Summer, and Autumn surveys of the 3,169-acre VEGP-site, SNC recognizes that the VEGP site might provide refuge for special-status plants or animals that escaped detection during the surveys. This is true especially for animals, some of which are mobile, secretive, and rarely observed even when present. SNC biologists at VEGP are familiar with special-status species in eastern Georgia.

The proposed VEGP Units 3 and 4 footprint is a previously disturbed location on an existing industrial site, but it does include areas of young planted pines, and some open weedy and brushy areas. These areas are undoubtedly used by birds and mammals common to the vicinity, but use of the proposed footprint by these species is insignificant given the large amount of similar or better habitat in the vicinity.

No streams or wetlands are located within the proposed footprint (see Figure 2.1-1). Wetlands and bottomland hardwood stands are found on the floodplain adjacent to the Savannah River and in the stream drainages mentioned above.

"Important species" are defined in NUREG-1555 *Standard Review Plans for Environmental Reviews for Nuclear Plants,* 1999 (NUREG-1555) as those that are federally- or state- listed as threatened or endangered; proposed for listing as threatened or endangered; commercially or recreationally valuable; essential to the maintenance or survival of species that are rare or commercially or recreationally valuable; critical to the structure and function of the local terrestrial ecosystem; or that serve as biological indicators. Game species fall within the "commercially or recreationally valuable" species category. The primary game species at the VEGP site are deer, gray squirrel, Eastern cottontail, Northern bobwhite, mourning dove, and woodcock. No "travel corridors" for game species cross the VEGP site. The proposed footprint does not provide suitable habitat for the American alligator, and bay star-vine was not observed on the proposed footprint during the 2005 surveys. Similarly, because habitats within most of the project footprint (excluding the location of the new intake in bottomland hardwoods) consist of young pine plantations, weedy or brushy areas or industrial sites, the footprint does not provide habitat for threatened or endangered species, nor significant habitat for other commercially or recreationally valuable species.

NUREG-1555 defines important habitats as wildlife sanctuaries, refuges or preserves; habitats identified by state or federal agencies as unique, rare, or of priority for protection, wetlands, floodplains, or other resources specifically protected by federal or state regulations; or land areas identified as critical habitat for threatened or endangered species. With the exception of wetlands along the Savannah River floodplain and stream drainages, no “important habitats” as defined by NUREG-1555 exist on the proposed footprint or the larger VEGP site.

Although the VEGP site hosts ticks and mosquitoes, no vector-borne diseases have been reported at the site.

2.4.1.2 Transmission Corridor Habitats and Communities

Electric transmission corridors that originate at VEGP pass through forested and agricultural lands typical of eastern Georgia. Land use along the existing transmission corridors is presented in Table 2.2-1. No areas designated by the USFWS as critical habitat for endangered species exist within or adjacent to associated transmission corridors.

Surveys for federally- and state-listed species classified as threatened or endangered were conducted in Spring, Summer, and Autumn 2005 along VEGP-associated transmission lines **(TRC 2006)**. The wood stork (*Mycteria americana*) was the only federally-listed animal species observed along the transmission lines during the 2005 surveys. The wood stork is Federally- and state-listed as endangered. Wood storks were seen foraging in wetlands during the 2005 surveys at two locations on the VEGP-Scherer transmission corridor and at one location on the VEGP-Thalmann corridor **(TRC 2006)**. No nests of wood storks or other wading birds were observed in the adjacent swamps during any of the three seasonal surveys. Active burrows of the gopher tortoise (*Gopherus polyphemus*), state-listed as threatened in Georgia, were observed at three locations on the VEGP-Thalmann transmission corridor during the 2005 surveys. A single spotted turtle (*Clemmys guttata*), state-listed as threatened in Georgia, was observed on the VEGP-Thalmann corridor **(TRC 2006)**.

No federally-listed plants were found along the transmission lines during the 2005 surveys. Pond spice (*Litsea aestivalis*), state-listed as threatened in Georgia, was observed in one wetland on the VEGP-Thalmann corridor. Hooded pitcher plants (*Sarracenia minor*), state-listed as unusual in Georgia, were observed at six locations along the VEGP-Thalmann corridor **(TRC 2006)**.

Endangered, threatened, and other special-status species published as occuring in the counties crossed by existing transmission lines are listed in Table 2.4-1. Special status-species indicated in Table 2.4-1 as occurring in counties crossed by the transmission lines were taken from county records maintained by USFWS (2004), GDNR (2004), and the South Carolina Department of Natural Resources **(SCDNR 2006)**. However, SNC recognizes that the USFWS, GDNR, and SCDNR databases reflect only recorded occurrences, and the possibility exists that other (unrecorded) special-status species might exist in counties crossed by the transmission lines. Similarly, although few special-status species were observed during the 2005 Spring, Summer, and Autumn surveys of the transmission lines **(TRC 2006)**, SNC recognizes that the possibility of other special-status plants or animals along the transmission lines can never be totally ruled out. This is true especially for animals, some of which are mobile, secretive, and rarely observed even when present.

As discussed in Sections 3.7.2, the specific route of the proposed new transmission line has not been determined, but likely will cross Burke, Jefferson, Warren, and McDuffie counties. Special-status species in these four counties are listed in Table 2.4-2. Land use in the same four counties is presented in Table 2.2-2.

Transmission line corridors are maintained in accordance with established procedures to prevent woody growth from reaching the transmission lines. The removal of woody species can provide outstanding grassland and marsh habitat for many rare plant species dependent on open conditions.

GPC currently participates in a wildlife management program with the Georgia DNR on transmission line corridors. The “Wildlife Incentives for Non-Game and Game Species” (WINGS) program is designed to help land users convert GPC transmission corridors into productive habitat for wildlife. WINGS offers grant money and land management expertise to landowners, hunting clubs, and conservation organizations who commit to participating in the program for 3 years.

2.4.2 Aquatic Ecology

2.4.2.1 Onsite Waterbodies

Two small streams traverse the VEGP site. A small, unnamed stream drains Mallard Pond (see Figure 2.1-1) and flows into the Savannah River swamp upstream of the proposed river intake structure. Little is known about the aquatic biota of this stream, which is quite small and probably supports limited communities of aquatic macroinvertebrates and fish. Beaverdam Creek, a larger stream, flows out of Telfair Pond (see Figure 2.1-3) and moves east to the Savannah River approximately two miles downstream of the existing river intake structure. GPC conducted studies of fish **(Wiltz 1982)** and benthic macroinvertebrates **(Staats 1983)** in Beaverdam Creek in the 1970s to determine if construction of Units 1 and 2 had any effect on the stream’s aquatic communities.

GPC biologists sampled fish in Beaverdam Creek over a two-year period (1977-1978) to evaluate potential effects of siltation and sedimentation on resident fish populations. A total of 2,435 fish representing 39 species were collected during the study. Collections were dominated by minnows, sunfish, and darters. Dusky shiners (*Notropis cummingsae*), bluegill (*Lepomis macrochirus*), mosquitofish (*Gambusia affinis*), and blackbanded darter (*Percina nigrofasciata*) were the species most often collected **(Wiltz 1982)**. Collectively, these four species made up 68 percent of all fish collected during the study. To reduce turbidity in Beaverdam Creek from transmission line construction and logging (on adjacent private property), GPC planted grass in eroding areas and installed erosion control devices (silt fences, hay bales). As a result, turbidity was reduced and fish habitat enhanced. Beaverdam Creek supported a diverse fish community before and after these erosion control measures were implemented.

GPC conducted a study over the 1973-1978 period to determine if construction of VEGP and access roads affected abundance and/or diversity of benthic macroinvertebrates in Beaverdam Creek. The study demonstrated that number and diversity of benthic macroinvertebrates in stream segments down-gradient from construction areas were not significantly different from upstream segments. Construction of an access road did reduce number and diversity of benthic organisms, but the benthic community recovered quickly when construction ceased and disturbed areas adjacent to the roadbed were revegetated. The study also demonstrated that Beaverdam Creek supported a surprisingly diverse benthic community, including numerous representatives of taxa (Ephemeroptera, Trichoptera, Plecoptera) that are typically associated with good water quality.

Several detention ponds built on the southern part of the property during construction of the first units have become permanent ponds (Figure 2.1-1). The biota in these ponds and in various small drainages on the property has not been sampled.

2.4.2.2 Savannah River

2.4.2.2.1 Plankton and Benthic Macroinvertebrates

The Academy of Natural Sciences of Philadelphia has monitored the aquatic communities of the middle Savannah River up- and downstream of the SRS (and coincidentally, the VEGP site) since 1951 **(Academy of Natural Sciences 2005)**. These studies, intended to assess impacts of contaminants and thermal discharges from SRS nuclear and industrial facilities, are a valuable source of information on the ecological health of the middle reaches of the Savannah River. These monitoring studies identify long-term trends in aquatic communities that might be confounded or obscured by normal year-to-year variability or by even longer-term occurrences, such as droughts, that can produce substantial change in aquatic communities.

The Academy of Natural Sciences' monitoring includes basic water chemistry and surveys of attached algae, aquatic macrophytes (aquatic vascular plants), aquatic macroinvertebrates, and fish. The study design includes four sampling stations: three exposed to SRS influence, and an unexposed reference station upstream. Multiple exposed stations are employed because of the complex pattern of SRS inputs along the river. Potential impacts are assessed by determining whether differences exist between the exposed and reference stations which are either greater or of a different character than would be expected if they were due merely to natural differences among sampling sites. **(Academy of Natural Sciences 2005)**

Diatoms have generally been the most abundant algal group, with two pollution-tolerant species (*Melosira varians* and *Gomphonema parvulum*) dominating collections **(Halverson et al. 1997)**.

The dominant algae are species characteristic of moderate- to high-nutrient levels and typical of southeastern coastal plain rivers. Algae at sites downstream of SRS influence and upstream of SRS influence both showed evidence of organic pollution, apparently from an upstream (Augusta area) source. **(Halverson et al. 1997)**

Aquatic insect density and diversity are important indicators of water quality. The Academy of Natural Sciences' monitoring of aquatic insects in the Savannah River up- and downstream of SRS (and VEGP) shows a generally increasing abundance of aquatic insects after the mid-1980s **(Halverson et al. 1997)** and increased taxa richness **(Academy of Natural Sciences 2005)**. In 1995, a year in which between-station differences were analyzed, measures of biotic diversity were higher for downstream stations than an upstream (of SRS and VEGP) control station; conversely, measures of pollution tolerance were higher for an upstream station than downstream stations **(Halverson et al. 1997)**. These studies showed that water quality downstream of SRS and VEGP was better than water quality upstream, in the vicinity of the cities of Augusta and North Augusta.

The 2000 ANS survey **(Arnett 2001)** summarizes changes in the mussel community of the middle Savannah River over the period from 1951-2000 as follows: a generally decreasing abundance and diversity of native species, an increasing dominance of "hardier forms," and an increasing scarcity of juveniles of some species. These changes were attributed to increased competition over the last several decades with the non-native Asiatic clam and changes in the flow characteristics of the Savannah River associated with "the construction of dikes, upriver dams, and removal of meanders…" Mollusks have been collected at five locations: one upstream of VEGP, one immediately downstream of VEGP, and three further downstream of VEGP. ANS scientists collected 16 mussel species between 1951 and 2000, none of which were state or federally listed. Mollusks found in the vicinity of VEGP include fingernail clams, peaclams, the Asiatic clam (*Corbicula fluminea*), and native mussels **(Arnett 2001)**.

2.4.2.2.2 Ichthyofauna of the Middle Savannah River

Information on the fishes of the middle Savannah River can be found in hundreds of publications. Three documents are particularly comprehensive and informative: *The Fishes of the Savannah River Plant* **(Bennett and McFarlane 1983)**, the eight-volume Comprehensive Cooling Water Study prepared by Du Pont (1987), *Fishes of the Middle Savannah River Basin* **(Marcy et al. 2005),** and the *Savannah River Biological Surveys for Westinghouse Savannah River Company* **(Arnett 2001)**.

The fishes of the Middle Savannah River include three groups: resident freshwater species, which are found in the area year-round, diadromous species, which are present during seasonal migrations, and marine/estuarine species, which are sometimes found in the middle Savannah River well upstream of the saltwater-freshwater interface. Resident fishes include a variety of minnows (family Cyprinidae), suckers (family Catastomidae), catfish (family Ictaluridae), sunfish (family Centrarchidae), and perch (family Percidae). Diadromous species include eels (family Anguillidae), shad and river herring (family Clupeidae), and striped bass (family Moronidae). Marine/estuarine species that are sometimes collected in the vicinity of VEGP include striped mullet, needlefish, and hogchoker. Relatively small numbers of these marine "strays" are collected, and they are of little commercial or recreational importance. As a consequence, they will not be discussed further in this environmental report.

Resident Fish of the Middle Savannah River

The Savannah River and mouths of creeks draining into the Savannah River were sampled intensively during the period 1983-1985 by the SRS as part of the Comprehensive Cooling Water Study. In a 1983-1984 study of seasonal patterns of distribution and abundance, fish were collected in November, January, June, and August using electrofishing gear and hoop nets. Electrofishing collections were dominated by centrarchids, which made up almost 50 percent of all fish collected. Redbreast sunfish (*Lepomis auritus*), bluegill, and largemouth bass (*Micropterus salmoides*) appeared most frequently in electrofishing collections, representing 16.7, 14.1, and 8.9 percent, respectively of fish collected. They were followed by spotted sucker (*Mingtrema melanops*; 8.5 percent), spotted sunfish (*L. punctatus*; 7.9 percent), chain pickerel (*Esox niger*; 5 percent), and bowfin (*Amia calva*; 5 percent). Hoop net collections were numerically dominated by flat bullhead (*Ameiurus platycephalus*; 29.2 percent), channel catfish (*Ictalurus punctatus*; 21 percent), redbreast sunfish (9.7 percent), and white catfish (*A. catus*; 9 percent). **(DuPont 1987)**

These species are all commonly found in large southeastern Coastal Plain river systems in habitats ranging from sloughs and backwaters to oxbow lakes to small tributary streams to small impoundments on these tributary streams **(Lee et al. 1980; Manooch 1984)**. As such, they are considered habitat generalists that can avail themselves of a range of habitats. Research has shown that fish species with very specific habitat requirements (for spawning, for example) are more likely to go extinct than those with more general habitat requirements **(Angermeier 1995)**. It follows that these generalists are more likely to thrive in large river systems that are subject to periodic droughts and floods.

The 1983-1984 SRS study included separate surveys of "small fish." These surveys were intended to develop relative abundance estimates of small, schooling species that serve as forage for a variety of top-of-the-food-chain predators, including such recreationally important species as largemouth bass, black crappie (*Pomoxis nigromaculatus*), striped bass (*Morone saxatilis*), white bass (*Morone chrysops*) and hybrid bass (*M. saxatilis* X *M. chrysops*). Shiners (genus *Notropis*) made up 89 percent of all fish collected in the small fish surveys **(Du Pont 1987)**. Brook silversides (*Labidesthes sicculus*), lined topminnow (*Fundulus lineolatus*), golden shiner (*Notemigonus crysoleucas*), and mosquitofish (*Gambusia* spp.) also appeared regularly in the small fish surveys. All of these species are common residents of swamps, bayous, and streams in the southeastern U.S. The 1983-1984 study did not distinguish between the various species of *Notropis* collected. A follow-up survey of small, minnow-like fish in the Savannah

River and its tributaries found that three Notropids made up more than two-thirds of minnows collected: coastal shiner (*Notropis petersoni*; 39.6 percent), dusky shiner (*N. cummingsae*; 17.4 percent), and spottail shiner (*N. hudsonius*; 10.4 percent). **(Du Pont 1987)**

With regard to distribution and abundance of fishes in the vicinity of VEGP, the series of reports prepared by the Academy of Natural Sciences of Philadelphia (ANS) provides the most extensive and comprehensive data source known to exist. The ANS study was initiated in 1951 and continues through to present, representing the "longest comprehensive study of a large river in the United States" **(Arnett 2001)**. The study encompasses the Savannah River from river mile 160 to river mile 123 (Vogtle is at river mile 150.5) and is designed to look for special patterns of biological disturbance and temporal patterns of change in the Savannah River adjacent to SRS including basic water chemistry, diatoms/periphyton, protazoa, aquatic insects, macro-invertebrates and fish. Two of the ANS study sample locations are close to VEGP. Station 2A lies just upstream of VEGP at River Mile 151.2 and station 2B lies just downstream at River Mile 149.8. Results from instream electroshocking conducted by boat during the 2000 study showed the same species and species groups dominating the Savannah River fish community as were seen in the 1983-1985 study: spottail shiner (*Notropis hudsonius;* 34.59 percent), bannerfin shiner (*Cyprinella leedsi*; 22.08 percent), bluegill (*Lepomis macrochirus*; 14.24 percent), whitefin shiner (*Cyprinella nivea*; 7.14 percent), brook silverside (*Labidesthes sicculus*; 4.92 percent), and redbreast sunfish (*Lepomis auritus*; 4.57 percent). Other commonly collected species included coastal shiner, largemouth bass, spotted sucker, redear sunfish and rosyface chub **(Arnett 2001).**

Diadromous Fish of the Middle Savannah River

<u>Sturgeons (Acipenseridae)</u>

The shortnose sturgeon (*Acipinser brevirostrum*) is an anadromous fish that spawns in large Atlantic coastal rivers from New Brunswick, Canada, to north Florida **(Scott and Crossman 1973)**. A species of commercial importance around the turn of the century, the shortnose sturgeon is now listed by the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service as an endangered species. The decline of the species has been attributed to the impoundment of rivers, water pollution, and overfishing; recruitment rates appear to be too low to replenish depleted populations.

Shortnose sturgeon grow slowly, reach sexual maturity late in life, and live as long as 30 years. Fish from southern populations can grow faster and mature earlier than those from northern populations. Spawning occurs in or adjacent to <u>deep areas of rivers</u> with significant currents during each spring when water temperatures warm to 9°-12°C degrees (48°-54°F) **(Jenkins and Burkhead 1994)**. This can happen as early as February in Georgia and South Carolina. Adults apparently return to natal streams to spawn at 2 to 5 year intervals. Eggs are demersal and adhesive after fertilization, sinking quickly and adhering to sticks, stones, and gravel on the river bottom. The interaction of water temperature, current velocity, and substrate type determines suitability of spawning habitat and hatching success. Few sturgeon larvae or juveniles have ever been collected, so little is known of their distribution and movement. Substrate in the vicinity of VEGP was characterized as "shifting sands" based on sampling conducted originally in 1972 and subsequently confirmed in 2006 **(GPC 1972, Southern Company 2006)**.

Before 1982, shortnose sturgeon were not known to occur in the middle reaches of the Savannah River. From 1982 through 1985, intensive sampling of the ichthyoplankton in the mid-reaches of the Savannah River was conducted. During the 1982 – 1985 studies, 12 shortnose sturgeon larvae were collected from the Savannah River near SRS **(Paller et al. 1984, Paller et al. 1985, and Paller et al. 1986)**. Westinghouse Savannah River Company conducted a biological assessment to evaluate the potential impacts of SRS operations on shortnose sturgeon and concluded that "existing and proposed operations [specifically L-Reactor] of the Savannah River Plant will not affect the continued existence of the shortnose sturgeon in the Savannah River" **(Muska and Matthews, 1983)**. This conclusion was based on the fact that (1) shortnose sturgeon spawned in the Savannah River up- and downriver of SRS, (2) passage up- and downstream was not blocked by thermal effluents, (3) entrainment was unlikely because shortnose sturgeon eggs are demersal, adhesive, and negatively buoyant, and (4) impingement of healthy juvenile and adult sturgeon on cooling water system screening devices is highly unlikely given their strong swimming ability. NMFS concurred with the DOE determination that SRS operations did not threaten the Savannah River population of shortnose sturgeon **(Du Pont 1987)**.

A South Carolina Wildlife and Marine Resources Division (now South Carolina Department of Natural Resources) study of seasonal movement and spawning habitat preferences of Savannah River shortnose sturgeon found two probable spawning sites, one upstream of VEGP at River Miles 171-173 and the other downstream of VEGP at River Miles 111-118 **(Hall, Smith and Lamprecht 1991)**. A companion radiotelemetry study indicated that spawning occurred between River Miles 111 and River Mile 142 at water temperatures of 9.8°- 16.5°C (50°- 62°F) **(Collins and Smith 1993)**. Plant Vogtle borders the Savannah River from approximately River Mile 150 to River Mile 151.7.

From 1984-1992, more than 97,000 shortnose sturgeon were stocked in the Savannah River as part of a state and federal recovery program **(Smith et al. 2001)**. Recaptures of marked fish after an average time of 7.2 years indicated that fish stocked as juveniles made up at least 38.7 percent of the adult population. Some of the stocked sturgeons did not imprint on the Savannah River and were later found in the Edisto River (SC), the Ogeechee River (GA), the Cooper River (SC), and Winyah Bay (SC).

Population estimates and catch-per-unit-effort data from 1997-2000 suggested that the adult population was larger in 2000 than 1990, but juveniles were still rare. This suggests that a recruitment bottleneck exists during early life stages. Water quality degradation in the nursery habitat is believed to be at least partially responsible for the poor recruitment in the Savannah River. **(Smith et al. 2001)**

A related species, the Atlantic sturgeon (*A. oxyrhynchus*), is also found from Canada (Labrador) to north Florida. Like the shortnose sturgeon, the Atlantic sturgeon is anadromous, ascending coastal rivers to spawn as early as February – March in Florida and as late as July in Canada **(Jenkins and Burkhead 1994)**. There is evidence, however, for fall spawning migrations in some South Carolina rivers **(Collins et al. 2000)**. There are also indications that Atlantic sturgeon in southeastern rivers, including the Savannah, spawn further downstream than shortnose sturgeon in the same rivers, but still "well above" the salt wedge.

<u>Shad and River Herring (Clupeidae)</u>

Three clupeids ascend the Savannah River to spawn in its middle reaches: the American shad (*Alosa sapidissima*), the hickory shad (*A. mediocris*), and the blueback herring (*A. aestivalis*). Two other clupeids, gizzard shad (*Dorosoma cepedianum*) and threadfin shad (*D. petenense*), are also found in the Savannah River, but do not move between the Savannah River and the open ocean, and thus are not anadromous in the strictest sense. Gizzard shad are found in brackish water, and have been referred to as a "semi-anadromous" species.

The American shad is the most important clupeid in terms of the commercial and recreational fishing opportunities it provides. American shad once provided an important commercial fishery in the lower Savannah River, but a decline in the population in the 1980s and 1990s reduced the number of commercial fishermen pursuing shad. This is illustrated by NMFS and Georgia DNR data on commercial landings in Georgia. From 1970 to 1975, commercial fishermen in Georgia landed from 161,700 pounds to 531,500 pounds of American shad annually **(NMFS 2006)**. Over a recent five year period (1999-2004), however, landings ranged from 27,699 in 2002 to 58,081 pounds in 2000 **(GDNR 2005)**. The total value of American shad landed over the 1999-2004 period ranged from $22,682 in 2002 to $45,496 in 1999. Most, if not all, commercial shad fishermen have other full-time jobs and fish for extra money on days off or weekends during the spring run.

Clemson University researchers estimated the population size of American shad that reached the New Savannah River Bluff Lock and Dam to be 157,685 fish in 2001 and 217,077 in 2002. This suggests that substantial numbers of spawning American shad pass VEGP during their annual spawning run: New Savannah River Bluff Lock and Dam are at River Mile 187, approximately 35 river miles upstream of VEGP. **(Bailey, Isely, and Bridges 2004)**

Hickory shad are smaller and less numerous than American shad. They support a modest commercial and recreational fishery. Blueback herring are smaller still, but are netted by commercial operators who sell them for live bait. Blueback herring are the bait of choice for anglers who pursue striped and hybrid bass in Clarks Hill, Russell, and Hartwell reservoirs.

<u>Striped bass</u>

The striped bass is an anadromous species, but in the Savannah River the degree of anadromy is greatly reduced. Unlike striped bass in the northeast and middle Atlantic, which spend their adult lives in the Atlantic Ocean and ascend coastal rivers to spawn, Savannah River striped bass tend to spawn in the lower, tidally-influenced part of the river and move upstream to non-tidal portions of the river after spawning. Fish fitted with radio transmitters have traveled as far upstream as the New Savannah Bluff Lock and Dam (River Mile 187) after spawning. Dudley et al. (1977) theorized that "excessively warm coastal waters" in summer at the mouth of the Savannah River may have led to the development of this behavioral pattern in Savannah River striped bass; water temperatures along the Georgia coast may reach 86°F, exceeding those tolerated by striped bass. **(Dudley, Mullis and Terrell 1977)**

During the 1980s, Savannah River striped bass suffered a precipitous population decline. From 1980 to 1988, catch-per-unit-effort of large striped bass in the lower Savannah River declined by more than 90 percent **(Reinert et al. 2005)**. Not surprisingly, the decline in large adult striped bass was accompanied by a steep decline in egg production. The population decline was attributed to operation of a tide gate, installed in the lower estuary by the U.S. Army Corps of Engineers in 1977. The tide gate, which was intended to prevent sediment from accumulating in the harbor, had the unintended effect of increasing salinity upstream in important striped bass spawning areas and speeding the transport of eggs and larvae from upstream spawning sites to the harbor, where they encountered high salinities and industrial pollutants.

Because of the population decline, the states of Georgia and South Carolina declared moratoriums on the harvest of striped bass (from the mouth of the Savannah River to New Savannah Bluff Lock and Dam) in 1988 and 1990, respectively **(Reinert et al. 2005)**. In response to concerns about the impact of the tide gate on anadromous fisheries, the Corps of Engineers discontinued operation of the tide gate in 1991. A long-standing program of stocking striped bass in the estuary was modified in the early 1990s. Based on research findings, Georgia DNR began stocking larger fish further up-river and improved its transportation and handling methods to reduce stress responses in stocked fish. From 1990 to 2002, 1.6 million striped bass of various sizes and ages were stocked in the Savannah River. Electrofishing surveys were instituted in order to measure the effectiveness of the stocking programs.

Catch-per-unit-effort of adult striped bass in the Savannah River increased sharply in the 1990s in response to the stocking programs **(Reinert et al. 2005)**. The importance of the stocking program was demonstrated by the fact that more than 70 percent of striped bass collected were hatchery-bred fish. The success of the stocking program (and a preponderance of 2-and 3-year old fish) led Georgia DNR to suspend Savannah River stocking in 2003 and 2004.

Egg production has been slower to recover. Egg densities in 2000 were approximately 10 percent of densities recorded in the late 1970s **(Reinert et al. 2005)**. However, with the return of suitable spawning conditions and the increased abundance of large spawning females in the estuary, egg production is expected to increase as well.

Based on fishing reports, striped bass numbers up and downstream of VEGP have increased in response to downstream habitat restoration efforts and stocking programs, and a popular catch and release fishery has developed **(Babb 1999, 2005)**. In its 2005 "Fishing Prospects" newsletter, Georgia DNR notes that "the number of striped bass in the river has increased substantially in recent years. However, it is important for anglers to realize that most of the stripers they catch were stocked and the number of naturally-reproducing striped bass remains low" **(GDNR 2005)**. South Carolina DNR announced in July 2005 that Savannah River striped bass restoration efforts had been so successful that the harvest moratorium on Savannah River striped bass, in place since 1991, would end on October 1, 2005 **(Creel 2005)**. Although the population is currently dominated by hatchery-bred fish, the striped bass population of the Savannah River is obviously expanding and, if current trends continue, should return to levels seen in the 1960s and 1970s. Striped bass populations in river systems up and down the Atlantic coast have largely rebounded as a result of commercial and recreational harvest restrictions that followed enactment of the Atlantic Striped Bass Conservation Act (16 U.S.C. § 1851) in 1984.

American eel (Anguilla rostrata)

The American eel occurs in rivers and streams along the east coast of the U.S. from Maine to Florida. The American eel is catadromous, growing to sexual maturity in freshwater and migrating hundreds of miles into the Atlantic Ocean (the Sargasso Sea) to spawn. Adults do not return to freshwater after spawning. Eggs spawned in the Sargasso Sea drift westward and northward with ocean currents and develop into larvae, then nektonic glass eels, which swim west across the Continental Shelf and enter east coast estuaries, where they darken and become elvers (at about 65 mm in length). At about 100 mm, elvers become fully-pigmented juvenile (yellow) eels. Males, which tend to remain in estuarine areas, grow rapidly and mature into adults at age 3 to 10 years **(Jenkins and Burkhead 1994)**. Females tend to move inland, into tidal freshwater rivers and upriver tributaries, where they mature into adults at age 4 to 18 years.

American eel numbers along the Atlantic coast were relatively stable through the 1970s. Fisheries managers and commercial fishermen noticed a decline in numbers of eels ascending coastal streams in the 1980s and 1990s **(Haro et al. 2000)**. Responding to concerns of state and federal agency biologists, the Atlantic States Marine Fisheries Commission in April 2000, issued an Interstate Fishery Plan for American Eel that summarized and synthesized information on the population decline and proposed a range of measures that will ensure the species' recovery and continued viability.

The USFWS, on July 6, 2005 announced in a 90-day Finding that it was initiating a status review to determine if listing the American eel as a protected species was warranted. The Federal Register (FR) notice listed an array of threats to the species (e.g., commercial harvest, habitat loss and degradation, changes in oceanic conditions) and concluded that "…we find that the petition presents substantial scientific and commercial information indicating that listing the American eel may be warranted." In the discussion of population status, the FR pointed out that population declines have been most dramatic in Canada and New England and populations may be stable in the southeastern U.S. In 2007 the USFWS completed the status review and determined that listing the American eel as either a threatened or endangered species is not warranted (FR Vol 72, No. 22, February 2, 2007).

American eels in the Middle Savannah River Basin are fully pigmented juveniles (yellow eels) and are mostly females **(Marcy et al. 2005)**. McCord (2004) observed high densities of yellow eels in the Middle Savannah River in relatively shallow, non-navigable reaches offering pool-riffle habitats with rocks and submerged aquatic vegetation. In the vicinity of VEGP, eels are found in the Savannah River mainstem, in the Savannah River swamp, in tributary streams, and in small impoundments on these tributaries **(Marcy et al. 2005)**. There is scant information on current population trends in South Carolina and Georgia, but commercial landings of eels in Georgia declined more than 80 percent from 1983 to 1995 **(ASMFC 2000)**. Resource agency biologists in South Carolina and Georgia do not monitor eel population trends in the Savannah River, but anecdotal information suggests that eel numbers are lower now than in the 1970s and 1980s.

2.4.2.3 Sensitive Species

Sensitive Aquatic Populations

As discussed previously in this section, the Academy of Natural Sciences of Philadelphia has monitored the freshwater mussels of the middle Savannah River since 1951 as part of a larger monitoring program designed to assess potential impacts of the SRS on the general health of the river. Mussels are collected annually at five locations, one upstream of VEGP, one immediately downstream of the VEGP, and three further downstream of VEGP. Academy scientists collected 16 mussel species between 1951 and 2000, none of which was state- or federally listed **(Arnett 2001)**.

The only federally-listed fish species known to occur in the Savannah River in the vicinity of VEGP is the endangered shortnose sturgeon (*Acipenser brevirostrum*). This anadromous species, first documented in the middle Savannah River in the early 1980s by SRS researchers, is known to spawn up and downstream of VEGP **(DOE 1997)**. A related species, the Atlantic sturgeon (*Acipenser oxyrinchus*), which has been designated a Species of Concern by the NMFS **(NMFS 2004)**, also ascends the Savannah River to spawn in fresh water but little is known about its spawning habits in the Savannah River. The Atlantic sturgeon was considered for listing under the Endangered Species Act in 1998, but the NMFS ultimately determined that listing was not warranted.

The robust redhorse (*Moxostoma robustum*), a species thought to be extinct, was rediscovered by Georgia DNR biologists in 1991 in the Oconee River, near Toomsboro, Georgia **(USFWS 1998)**. Since 1991, remnant populations have also been found in portions of the Pee Dee River (NC-SC), the Savannah River (SC-GA), and Ocmulgee River (GA) **(RRCC 2003)**. This large sucker (up to 30 inches long and 17 pounds) has large molar-like pharyngeal teeth that its uses to crush and eat bivalves, both native mussels and non-native Asiatic clams (*Corbicula* sp.).

Once common in Atlantic slope river systems from the Pee Dee to the Altamaha, the species' range has been severely reduced by dams, which blocked its movement, and by streamside erosion, which led to siltation of feeding and spawning areas. The robust redhorse has no federal status, but has been designated an endangered species by the State of Georgia. The decline of the species has been attributed to habitat loss (dams and impoundments on native streams) and habitat degradation (pollution, siltation from agricultural and silvicultural activity in watersheds). The non-native flathead catfish, introduced to many southeastern streams by fishermen, may also have contributed to the robust redhorse's decline as this large, aggressive catfish feeds on native catastomids and competes with them for food (crayfish and clams).

The robust redhorse was first documented in the middle Savannah River in 1997, when a single adult was collected near VEGP **(RRCC 1998; Barrett 2000)**. Since that time, robust redhorse have been found at several locations between the Augusta Shoals area and U.S. Highway 301, which is approximately 30 miles down-river from VEGP **(Barrett 2000; Hendricks 2002)**. Spawning has been documented in both the Augusta Shoals and New Savannah Bluff Lock and Dam areas **(Freeman and Freeman 2001; Hendricks 2002)**. The Robust Redhorse Conservation Committee, a multi-agency group, has worked on the recovery of the species since 1995, rearing young redhorse at hatcheries and stocking them in streams in Georgia and the Carolinas. This group was instrumental in stocking fingerling robust redhorse in the Broad River, a major tributary of the Savannah River that empties into Clarks Hill Reservoir. Fish from these stockings have been found as juveniles in both the Broad River and Clarks Hill Reservoir.

The bluebarred pygmy sunfish (*Elassoma okatie*), is a rare species of fish that, until recently, was found only in the Edisto River, New River and eastern Savannah River drainages in South Carolina. During faunal surveys conducted in 1995 and 1996 by the Army Corps of Engineers, the species was found at a single location on the Fort Gordon army installation in Georgia. Subsequent studies performed at Fort Gordon in 1997 and 1998 using more selective equipment found bluebarred pygmy sunfish at four of the five principal streams at the installation **(USACE, 2007)**.

The bluebarred pygmy sunfish is a small fish rarely exceeding an inch in length. The female's base coloration is pinkish-brown with light beige vertical bars while males are blue-grey to black with iridescent blue vertical bars **(Sandel et al. 2006)**. The bluebarred pygmy sunfish is found in specific micro-habitats consisting of roadside ditches and backwaters of creek or rivers with brown stained (tannin) water and abundant vegetation including bladderwort, duckweed, alligatorweed, pondweed, spatterdock, rushes and grasses **(Marcy et al. 2005)**.

Georgia Power **(Wiltz 1982)** conducted surveys in the late 1970s of the resident fishes of Beaverdam Creek, a six-mile long stream that drains much of the area south and west of the Vogtle site. Daniels Branch, a tributary, was also sampled. Wiltz collected no pygmy sunfish (genus *Elassoma*) and no *Lepomis* or *Enneacanthus* species with which it could be easily confused. All sunfish captured were common species (e.g., redbreast, bluegill) or species not likely to be confused with the bluebarred pygmy sunfish. This suggests that few, if any, representatives of the genus *Elassoma* were in the Beaverdam Creek drainage in the late 1970s when the surveys were conducted. The blackwater streams of the SRS, across the river from Plant Vogtle, have been sampled since the early 1950s by Westinghouse and Savannah River Ecology Laboratory scientists, none of whom (based on Marcy et al. 2005) has ever captured a bluebarred pygmy sunfish. According to the distribution map in Marcy et al. **(2005)** a population of bluebarred pygmy sunfish has been found in a small stream in Allendale County, SC, south of the SRS.

Georgia Power has not conducted systematic surveys for the bluebarred pygmy sunfish on the Vogtle site for obvious reasons: it is an obscure species that was first described in 1987 and was only granted legal protection by the state of Georgia in late 2006. The Corps biologists who discovered the bluebarred pygmy sunfish at Fort Gordon used specialized sampling apparatus (floating Plexiglas light traps) normally associated with larval fish studies rather than surveys of adult fish.

In April, 2007 Georgia Power fisheries biologists performed a habitat assessment of Mallard Pond drainage in order to determine the presence or absence of those habitats commonly associated with populations of bluebarred pygmy sunfish. Survey results indicate that neither Mallard Pond nor the pond drainage contains the vegetation types and flow characteristics regarded as the preferred habitat type for the bluebarred pygmy sunfish. Based on the April survey results and the fact Wiltz **(1982)** collected no bluebarred pygmy sunfish in the Beaverdam Creek drainage, it appears unlikely that the species is present at the Vogtle site.

The only pygmy sunfish that has appeared, irregularly, in Savannah River fish samples collected by the ANS is *Elassoma zonatum*, the banded pygmy sunfish (see **Arnett 2001)**. Given that pygmy sunfishes (*Elassoma* spp.) are creatures of backwaters, bayous, oxbows, and swamps rather than river channels, it is unlikely that construction of new intake/discharge structures would not affect this group (or the bluebarred sunfish in particular). It is also unlikely that plant operations would affect this group or species.

Records of the USFWS, Georgia DNR, and South Carolina DNR were reviewed for information on sensitive aquatic species in counties crossed by VEGP transmission lines. The Altamaha spinymussel (*Elliptio spinosa*), a candidate for federal listing, occurs in the Altamaha River and its tributaries in the coastal plain of Georgia. It is found in two counties (Long and McIntosh) crossed by the Vogtle-Thalmann transmission line. This large mussel has experienced a substantial decline in number (of sites occupied) in recent years that has been attributed to habitat degradation and competition with the non-native Asiatic clam, *Corbicula fluminea* **(Georgia Museum undated; Wisniewski, Krakow and Albanese 2005)**. Unauthorized collection of specimens of *E. spinosa* is also thought to have contributed factor to the species' decline.

Table 2.4-1 Protected Species in Burke County or Counties Crossed by Existing Transmission Lines[1]

Common Name	Scientific Name	Federal Status[2]	State Status[2] Georgia	State Status[2] South Carolina
Mammals				
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	-	R	E
Northern right whale[3]	*Eubalaena glacialis*	E	E	-
Southeastern pocket gopher	*Geomys pinetis*	-	T	-
Humpback whale[3]	*Megaptera novaeangliae*	E	E	-
Manatee[3]	*Trichechus manatus*	E	E	E
Birds				
Bachman's sparrow	*Aimophila aestivalis*	-	R	-
Henslow's sparrow	*Ammodramus henslowii*	-	R	-
Bald eagle[4]	*Haliaeetus leucocephalus*	T	T	E
Piping plover	*Charadrius melodus*	T	T	-
Wilson's plover	*Charadrius wilsonia*	-	T	T
Kirtland's warbler	*Dendroica kirtlandii*	E	E	-
Southeastern American kestrel	*Falco sparverius paulus*	-	R	-
American oystercatcher	*Haematopus palliatus*	-	R	-
Wood stork[4,5]	*Mycteria americana*	E	E	E
Red-cockaded woodpecker[4]	*Picoides borealis*	E	E	E
Swallow-tailed kite	*Elanoides forficatus*	-	R	E
Black skimmer	*Rynchops niger*	-	R	-
Least tern	*Sterna antillarum*	-	R	T
Gull-billed tern	*Sterna nilotica*	-	T	-
Bachman's warbler	*Vermivora bachmanii*	E	-	-
Reptiles				
Loggerhead sea turtle	*Caretta caretta*	T	T	T
Green sea turtle	*Chelonia mydas*	T	T	-
Spotted turtle[4,5]	*Clemmys guttata*	-	U	T
Leatherback sea turtle	*Dermochelys coriacea*	E	E	-
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E	-
American alligator[6,7]	*Alligator mississippiensis*	T(S/A)	-	-
Eastern indigo snake	*Drymarchon corais couperi*	T	T	-
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	E	-
Gopher tortoise[4,5]	*Gopherus polyphemus*	-	T	E
Southern hognose snake[4]	*Heterodon simus*	-	T	-
Mimic glass lizard	*Ophisaurus mimicus*	-	R	-
Amphibians				
Gopher frog[4]	*Rana capito*	-	R	E
Striped newt	*Notophthalmus perstriatus*	-	T	-
Flatwoods salamander[4]	*Ambystoma cingulatum*	T	T	E
Fish				
Shortnose sturgeon[4]	*Acipenser brevirostrum*	E	E	E
Altamaha shiner	*Cyprinella xaenura*	-	T	-
Bluebared pygmy sunfish	*Elassoma okatie*	-	E	-
Goldstripe darter	*Etheostoma parvipinne*	-	R	-
Bluefin killifish	*Lucania goodei*	-	R	-
Robust redhorse	*Moxostoma robustum*	-	E	-
Invertebrates				

Table 2.4-1 (cont.) Protected Species in Burke County or Counties Crossed by Existing Transmission Lines[1]

			State Status[2]	
Common Name	**Scientific Name**	**Federal Status[2]**	**Georgia**	**South Carolina**
Oconee burrowing crayfish	*Cambarus truncatus*	-	T	-
Say's spiketail	*Cordulegaster sayi*	-	T	-
Altamaha arcmussel	*Alasmidonta arcula*	-	T	-
Altamaha spinymussel	*Elliptio spinosa*	C	E	-
Atlantic pigtoe mussel[4]	*Fusconaia masoni*	-	E	-
Plants				
Pool sprite	*Amphianthus pusillus*	T	T	T
Georgia aster	*Aster georgianus* (=*Symphyotrichum georgianum)*	C	T	-
Sandhill vetch	*Astragulus michauxii*	-	T	-
Purple honeycomb head	*Balduina atropurpurea*	-	R	-
Velvet sedge	*Carex dasycarpa*	-	R	-
Sandhill rosemary[4]	*Ceratiola ericoides*	-	T	-
Atlantic white-cedar	*Chamaecyparis thyoides*	-	R	-
Floodplain tickseed	*Coreopsis integrifolia*	-	T	-
Harper's dodder	*Cuscuta harperi*	-	E	-
Pink ladyslipper	*Cypripedium acaule*	-	U	-
Radford's mint	*Dicerandra radfordiana*	-	E	-
Smooth coneflower	*Echinacea laevigata*	E	E	E
Georgia plume[4]	*Elliottia racemosa*	-	T	-
Green fly orchid	*Epidendrum conopseum*	-	U	-
Dwarf hatpins	*Eriocaulon koernickianum*	-	E	-
Florida wild privet	*Forestiera segregata*	-	R	-
Dwarf witch-alder	*Fothergilla gardenii*	-	T	-
Shoals spiderlily	*Hymenocallis coronaria*	-	T	-
Mat-forming quillwort	*Isoetes tegetiformans*	E	E	-
Corkwood	*Leitneria floridana*	-	T	-
Pondberry	*Lindera melissifolia*	E	E	E
Pondspice[5]	*Litsea aestivalis*	-	R	-
Pineland Barbara buttons	*Marshallia ramosa*	-	R	-
Trailing milkvine	*Matelea pubiflora*	-	R	-
Indian olive[4]	*Nestronia umbellula*	-	R	-
Canby's dropwort[4]	*Oxypolis canbyi*	E	E	E
Grit beardtongue	*Penstemon dissectus*	-	R	-
Crestless plume orchid	*Pteroglossaspis ecristata*	-	T	-
Harperella	*Ptilimnium nodosum*	E	E	E
Tiny-leaf (climbing) buckthorn	*Sageretia minutiflora*	-	T	-
Soapberry	*Sapindus marginatus*	-	R	-
Yellow flytrap	*Sarracenia flava*	-	U	-
Hooded pitcherplant[4,5]	*Sarracenia minor*	-	U	-
Parrot pitcherplant	*Sarracenia psittacina*	-	T	-
Sweet pitcherplant[4]	*Sarracenia rubra*	-	E	-
Bay star-vine[6]	*Schisandra glabra*	-	T	-
Chaffseed	*Schwalbea americana*	E	E	E
Ocmulgee skullcap[4]	*Scutellaria ocmulgee*	-	T	-
Swamp buckthorn	*Sideroxylon thornei*	-	R	-
Silky camellia[4]	*Stewartia malacodendron*	-	R	-

Table 2.4-1 (cont.) Protected Species in Burke County or Counties Crossed by Existing Transmission Lines[1]

Common Name	Scientific Name	Federal Status[2]	State Status[2] Georgia	State Status[2] South Carolina
Pickering's morning-glory	*Stylisma pickeringii pickeringii*	-	T	-
Relict trillium	*Trillium reliquum*	E	E	E

1 Species has been recorded by **USFWS 2004** or **GDNR 2007** to occur in Georgia counties crossed by the transmission lines, or by **SCDNR 2006** to occur in Barnwell County, South Carolina. Shaded species were observed during 2005 survey.

2 E = Endangered, T = Threatened, C = Candidate for federal listing, T(S/A) = Threatened due to similarity of appearance, R = Rare (Georgia only), U = Unusual (Georgia only), - = not listed.

3 Included for completeness. Some VEGP transmission lines cross Georgia coastal counties that list these marine mammals as protected species.

4 Species has been recorded by **USFWS 2004** or **GDNR 2007** in Burke County, Georgia.

5 Species was observed along VEGP-associated transmission corridors during field surveys conducted in 2005.

6 Species was observed at VEGP site during field surveys conducted in 2005.

7 County occurrences for the American alligator are not maintained by **USFWS 2004**, **GDNR 2007**, or **SCDNR 2006**; this species is included in this table because it is known to occur at the VEGP site.

Table 2.4-2 Protected Species in Counties Likely to be Crossed by the New VEGP Transmission Corridor[1]

Common name	Scientific name	Federal status[2]	Georgia status[2]
Birds			
Bald eagle	*Haliaeetus leucocephalus*	T	T
Wood stork	*Mycteria americana*	E	E
Red-cockaded woodpecker	*Picoides borealis*	E	E
Reptiles			
Spotted turtle	*Clemmys guttata*	-	U
Gopher tortoise	*Gopherus polyphemus*	-	T
Southern hognose snake	*Heterodon simus*	-	T
Amphibians			
Flatwoods salamander	*Ambystoma cingulatum*	T	T
Gopher frog	*Rana capito*	-	R
Fish			
Shortnose sturgeon	*Acipenser brevirostrum*	E	E
Sandbar shiner	*Notropis scepticus*	-	R
Invertebrates			
Atlantic pigtoe mussel	*Fusconaia masoni*	-	E
Plants			
Georgia aster	*Aster georgianus* (=*Symphyotrichum georgianum*)	C	-
Sandhill rosemary	*Ceratiola ericoides*	-	T
Pink ladyslipper	*Cypripedium acaule*	-	U
Georgia plume	*Elliottia racemosa*	-	T
Carolina bogmint	*Macbridea caroliniana*	-	R
Indian olive	*Nestronia umbellula*	-	R
Canby's dropwort	*Oxypolis canbyi*	E	E
Grit beardtongue	*Penstemon dissectus*	-	R
Oglethorpe oak	*Quercus oglethorpensis*	-	T
Hooded pitcherplant	*Sarracenia minor*	-	U
Sweet pitcherplant	*Sarracenia rubra*	-	T
Ocmulgee skullcap	*Scutellaria ocmulgee*	-	T
Granite stonecrop	*Sedum pusillum*	-	T
Silky camellia	*Stewartia malacodendron*	-	R
Georgia aster	*Symphyotrichum georgianum*	C	T

1 Source of County Occurrence: **USFWS 2004**, **GDNR 2007**.
2 E = Endangered, T = Threatened, C = Candidate for federal listing, R = Rare, U = Unusual, - = not listed.

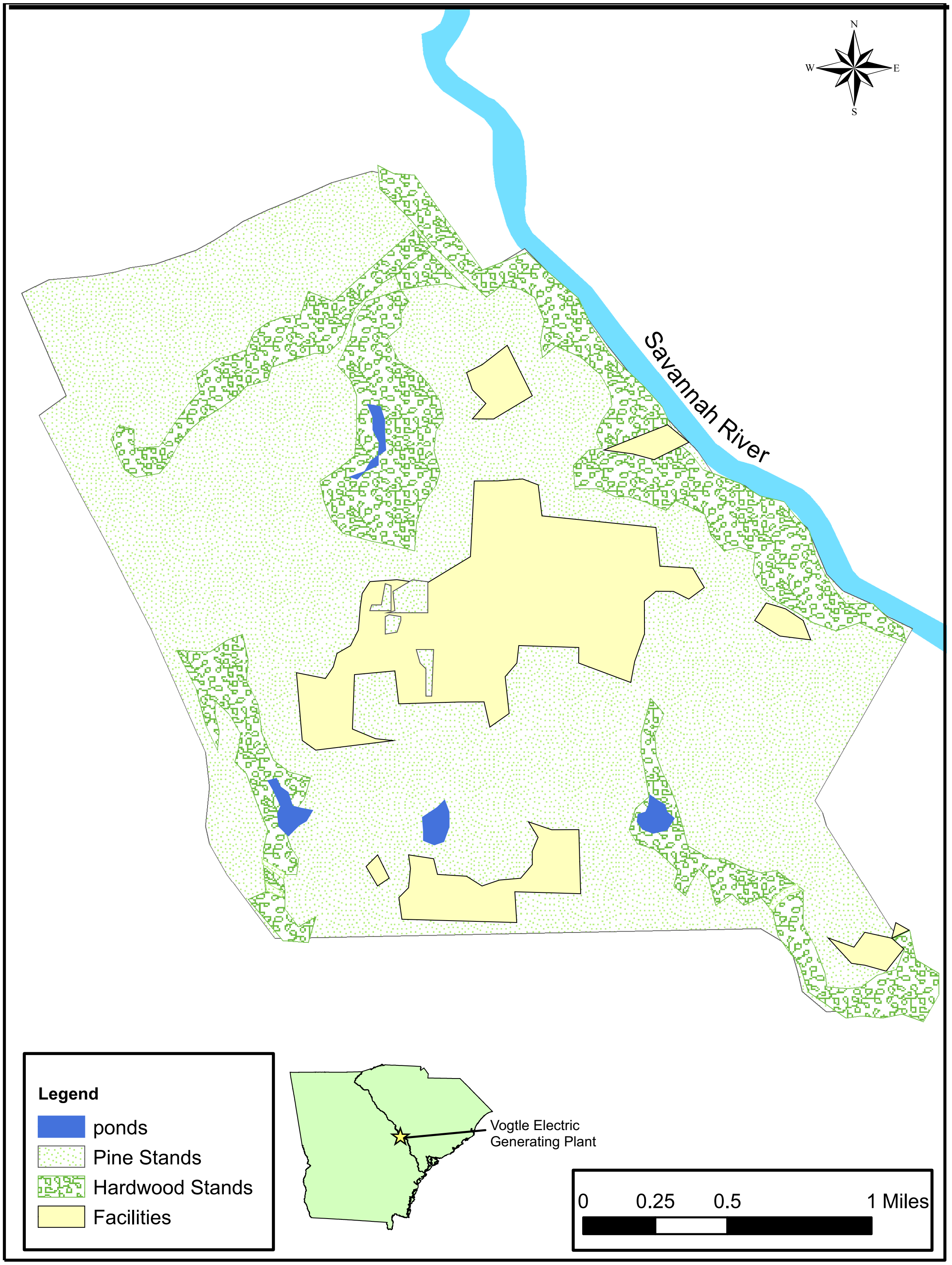

Figure 2.4-1 Vegetation Communities on the VEGP Site

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2.5 Socioeconomics

This section presents the socioeconomic resources that have the potential to be impacted by the construction, operation, and decommissioning of new nuclear units on the VEGP site. The section is divided into four sections: demographics, community characteristics, historic properties, and environmental justice. These sections include discussions of spatial (e.g., regional, vicinity, and site) and temporal (e.g., 10-year increments of population growth) considerations, where appropriate.

For purposes of socioeconomic analysis, SNC has assumed that the residential distribution of the new units' construction and operational workforces would resemble the residential distribution of VEGP's current workforce. Approximately 79 percent of current VEGP employees reside within three counties: Burke (20 percent), Richmond (26 percent), and Columbia (34 percent). The remaining 20 percent are distributed across 24 other counties, with numbers ranging from 1 to 58 (0.1 to 6.7 percent of the existing VEGP workforce) employees per county. The socioeconomic effects would be most evident in Burke, Richmond or Columbia counties so socioeconomic characteristics are analyzed only for those counties.

2.5.1 Demography

Within this section, demographic characteristics are presented in four major sections: population data by sector; population density; population data by political jurisdiction; and transient and migrant populations.

Population Data by Sector

SNC used 1980 and 2000 census data from the U.S. Census Bureau (USCB) website and geographic information system (GIS) software (ArcView®) to determine demographic characteristics in the vicinity of the proposed project and 50-mile region.

Figure 2.5.1-1 shows a 10-mile radius sector chart superimposed over a VEGP site vicinity map. On this map, the power block for the existing facilities is at the center, surrounded by concentric circles representing radii of 1, 2, 3, 4, 5 and 10 miles. The radius is divided into 16° emergency planning zones sectors with each sector centered on one of the 16 compass points (e.g., N, NNE, NE, E, etc.). The new plant footprint would be approximately 1,000 feet due west and 200 feet south of the existing units. SNC chose to use the center of the existing power block as the basis for the demographic analysis of the new units, because SNC is developing a complete and integrated emergency plan for all four units based on the current emergency plan and site maps for analysis of the new units. Figure 2.5.1-2 is the 50-mile radius sector chart, divided into 10-mile radii. Each radius is divided into sectors as described for the vicinity radii.

The sector radii population estimates (based on the most recent USCB decennial census data) were used to determine the population distribution surrounding the VEGP site.

SNC used SECPOP 2000, a computer code that calculates population by emergency planning zone sectors, to determine the year 2000 resident population by sector. The 1980 and 2000 county census data were used to develop an annualized growth rate for each county that fell, either completely or partially, in the area covered by the grid sector. For each grid sector, the percentage of each county's land area that fell, either completely or partially, within that sector, was calculated using ArcView 3.1. SNC prepared a calculation package supporting this analysis.

Population projections for the years 2020, 2030, 2040, 2050, 2060, 2070, 2080, and 2090 were estimated for each sector using the following methodology:

1. The 2000 population of the part of a county in a particular grid sector was estimated by multiplying the sector population, as determined by SECPOP 2000, by the percent of the county land area that fell within that sector, as determined by ArcView 3.1. Thus, if a county occupied 30 percent of the land area of a specific sector, the assumption was made that 30 percent of the sector's population resided in that county, and would be subject to the growth rate of that county.
2. The population of a particular sector residing in a particular county, as determined in Step 1, was multiplied by that county's annualized growth rate, as derived from 1980 to 2000 US census data growth rates, to estimate the future populations.
3. The population projections for each county in a sector were summed to get the total estimate of the sector's future populations.

Table 2.5.1-1 presents the population information for each sector. Although it is unlikely, SNC could hold the ESP permit for 20 years before initiating construction. Assuming 3 years from submitted to approval, 20 years before construction, 5 years for construction, 40 years of operation under the initial licenses and 20 years of continued operation under renewed licenses, VEGP Units 3 and 4 could produce electricity beyond 2090. Population projections for the 0 to 10 miles radii include residents and transients. Transient data were obtained from the Vogtle Electric Generating Plant Emergency Plan, Rev. 43. The population projections for radii of more than 10 miles include only residents.

Population Data by Political Jurisdiction

The area defined by a 50-mile radius from the center of the existing power block (Figure 2.5.1-2) includes all or part of 28 counties in Georgia and South Carolina (Table 2.5.1-2) and one major city in Georgia.

The nearest population center (i.e., more than 25,000 residents) is Augusta, Georgia, approximately 26 air miles northwest of the site. Augusta's 2000 population was 195,182 **(USCB 2000a)**. Other municipalities in the 50-mile region, their 2000 population, and location relative to VEGP, are presented in Table 2.5.1-3.

The 50-mile vicinity includes, in its entirety, the Augusta-Richmond County, GA-SC metropolitan statistical area (MSA). Burke, Richmond, and Columbia Counties are all included in the Augusta-Richmond County, GA-SC MSA. The Augusta-Richmond County, GA-SC MSA is characterized as urban, suburban, and rural, and a 2000 population of 499,684 **(USCB 2003)**. The Augusta-Richmond County, GA-SC MSA is the 89th largest in the U.S. From 1990 to 2000, the MSA grew 14.7 percent **(USCB 2003)**.

Table 2.5.1-4 presents historic and projected population growth rate data for the three counties of interest. Population data from 1970 to 2000 is provided by the U.S. Census Bureau **(USCB 1995, 2000a)**. From 1990 to 2000, Columbia County grew at an average annual growth rate of 3.1 percent. Burke and Richmond Counties grew 0.8 and 0.5 percent, respectively. For the same period, Georgia grew at an average annual rate of 2.4 percent.

Population projections are provided by the State of Georgia's Office of Planning and Budget **(Georgia 2005)**. The 2010-2015 population projections for the three counties were developed using the cohort-survival model (also known as the cohort-component model). The method uses the following demographic equation:

$$\text{Population}_1 = \text{Population}_0 + \text{Births} - \text{Deaths} + \text{Net Migration}$$

Existing population projections were updated with the most recent census data and the actual birth and death data for 1990 through 2003. Additionally, a comparison was made to the USCB 2003 population estimates, which include the most recent migration data **(Georgia 2005)**. The socioeconomic data available for this analysis do not project beyond 2015.

Between 2000 and 2015 Burke County's population annual growth rate is projected to remain approximately steady at 1.0 percent. Columbia County's rate is expected to slow to 2.6 percent annually by 2015. Richmond County is projected to decrease in population at the rate of -0.3 to -0.2 percent annually.

Table 2.5.1-5 lists the age distributions in Burke, Richmond, and Columbia Counties in 2000 and compares them to the age distribution in the State of Georgia.

Population Density for Socioeconomic Analyses

To provide a basis for the socioeconomic analyses in this report, SNC reviewed the population characterization technique used in NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants 1996* (NUREG-1437) (GEIS) and determined it was an appropriate methodology for characterizing the population around the VEGP site.

NUREG-1437 characterizes populations based on two factors: "sparseness" and "proximity". "Sparseness" describes population density and city size within 20 miles of a site as follows:

Demographic Categories Based on Sparseness

		Category
Most sparse	1.	Less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles
	2.	40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles
	3.	60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles
Least sparse	4.	Greater than or equal to 120 persons per square mile within 20 miles

Source: NUREG-1437

“Proximity” describes population density and city size within 50 miles as follows:

Demographic Categories Based on Proximity

		Category
Not in close proximity	1.	No city with 100,000 or more persons and less than 50 persons per square mile within 50 miles
	2.	No city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles
	3.	One or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles
In close proximity	4.	Greater than or equal to 190 persons per square mile within 50 miles

Source: NUREG-1437

NUREG-1437 then uses the following matrix to rank the population category as low, medium, or high.

GEIS Sparseness and Proximity Matrix

Proximity

Sparseness	1	2	3	4
1	1.1	1.2	1.3	1.4
2	2.1	2.2	2.3	2.4
3	3.1	3.2	3.3	
4	4.1	4.2		

Low Population Area

Medium Population Area

High Population Area

Source: NUREG-1437

SNC used 2000 census data **(USCB 2000b, 2000c)** and GIS software (ArcView®) to characterize the population within 50 miles of the VEGP site. SNC prepared a calculation package supporting this analysis.

Based on the 2000 Census Bureau information, 43,857 people lived within 20 miles of the VEGP site resulting in a population density of 46 persons per square mile within 20 miles and therefore falling into a less populated category, Category 2 (40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles). (The SRS land area was excluded from this analysis because no one resides on SRS and at 310 square miles. It is a significant part of the area within 50 miles of the VEGP site).

Based on the 2000 Census Bureau information, approximately 670,000 people live within 50 miles of the VEGP site resulting in a population density of 89 persons per square mile within 50 miles. The VEGP site proximity uses Category 3 (one or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles). Therefore, with sparseness Category 2 and proximity Category 3, the VEGP is in a medium population area.

Transient Populations

The VEGP Emergency Plan provides a quantitative estimate of the transient population to 10 miles from the site. These transients are included in Table 2.5.1-1. This discussion focuses on transients between the 10- and 50-mile radii and is qualitative.

Transients include people in workplaces, schools, hospitals and nursing homes, correctional facilities, hotels and motels, and at recreational areas or special events. The area within 10 miles of the VEGP site is rural and characterized by wooded tracts of land and farms. The transient employment population commutes out of the area closest to VEGP, to workplaces more distant.

With the exception of the SRS, no significant industrial or commercial facilities occur in the 10-mile radius. The SRS employs approximately 11,000 people, most of whom reside within 50 miles of the SRS. The SRS maintains its own emergency plan which would be invoked in case of an emergency at VEGP; therefore, SRS employees are not considered transients in this analysis.

Fort Gordon, in Richmond County, Georgia, has about 18,000 to 19,000 personnel on post at any one time. No other military facilities are within the 50-mile radius.

Hospitals in the region are discussed in Section 2.5.2.7. Seventy-three nursing homes or personal care homes are listed in the Augusta regional telephone directory. Schools, including colleges and universities are discussed in Section 2.5.2.8. Eleven correctional facilities are within the 50-mile radius, seven in Georgia **(GDC 2004)** and four in South Carolina **(SCDC No Date)**. Numerous hotels and motels occur in the 50-mile radius; most are located in population centers such as Augusta, Aiken, or Statesboro, Georgia. Recreation facilities and major special events are described in Section 2.5.2.5.

Magnolia Springs, the state park nearest VEGP had 120,500 visitors in 2004. Redcliffe Plantation, the next closest state park, had 2,500 visitors in 2004. No visitor data are available for the Georgia Wildlife Management Areas (WMAs). During the 2004 hunting season, 3,100 hunters visited Crackerneck WMA on the SRS.

2.5.2 Community Characteristics

This section addresses the following community characteristics for the three counties: economy, transportation, taxes, land use, aesthetics and recreation, housing, community infrastructure and public services, and education.

2.5.2.1 Economy

The principle economic centers include Augusta (Richmond County), Martinez (Columbia County), Evans (Columbia County), and Waynesboro (Burke County). In these counties the service industry employs the greatest number of workers (28.5 percent of employment). Other important sectors of employment include government (24.4 percent); retail trade (18 percent);

manufacturing (10.3 percent), and construction (5.9 percent) **(BEA 2005a)**. From 1990 to 2000, the transportation and utilities (4.7 percent) and service (3.4 percent) industries had the largest growth rates. During the same period, mining (-3.9 percent), wholesale trade (-1.5 percent), farming (-1.4 percent), and construction (-1.3 percent) experienced declines in growth rates. Table 2.5.2-1 details the employment by industry in the three counties.

The three-county area has a diversified, expanding industry base. Manufacturing firms in the three counties produce a variety of products from disposal diapers to golf carts. The area has two natural resource assets – wood and kaolin. The 50-mile region is a large supplier of kaolin for ceramics and fillers. Forestry companies manufacture wood products ranging from paper products and pulpwood to furniture and flooring. Textile firms manufacture fabrics and apparel. Medical supplies, services (including hospitals and physicians), and technology are also important to the area. Medical companies produce pharmaceuticals, medical supplies, and diagnostic equipment **(Columbia County 2000)**. The top ten employers in the Augusta-Richmond County, GA-SC MSA, are listed in Table 2.5.2-2 **(GDOL 2004)**. Although taken together the many manufacturing firms are a large employment sector, no single manufacturing firm ranks among the top 10 employers.

Two of the largest employers in the area are the U.S. Army's Fort Gordon and the Department of Energy's SRS. Fort Gordon, in Richmond County, houses the U.S. Army's Signal Corps and employs over 12,000 military and 5,000 civilian workers. Fort Gordon has an annual income impact of $1.2 billion on the local economy. Income impact includes direct salary dollars, local procurement, and salaries of jobs created as a result of direct jobs and procurement **(CSRA AFG 2003)**. The SRS, in South Carolina, is a nuclear defense facility. SRS employs approximately 11,000 workers and its annual budget is approximately $1.6 billion. Approximately 3,200 of those workers reside in the three Georgia counties of interest **(WSRC 2004)**. With 888 (Table 2.9-1) employees, VEGP is one of the largest employers in Burke County.

Table 2.5.2-3 details employment trends in the three counties. In 2004, the labor force was 141,068, increasing at an average annual rate of 0.9 percent between 1995 and 2004. The labor force in the State of Georgia increased at an average annual rate of 2.0 percent over the same time period **(BLS 2005)**.

In 2004, employment was 133,269 people in the three counties, or 3.2 percent of state employment **(BLS 2005)**. Employment increased at an average annual rate of 1.0 percent between 1995 and 2004. Total employment increased at a slightly faster pace than the labor force. Employment in Georgia increased at an average annual rate of 1.9 percent over the same time period **(BLS 2005)**.

In 2004, a total of 7,799 people in the three counties were unemployed. From 1995 to 2004, the three counties unemployment decreased from 6.6 to 5.5 percent. In Georgia, the number of unemployed workers increased over the same period, but the unemployment rate declined from

4.8 to 4.6 percent (Table 2.5.2-3). This is attributed to the 2.0 percent annual increase in the labor force over the same period **(BLS 2005)**.

Per capita personal income ranged from a high of $31,562 in Columbia County to a low of $19,215 in Burke County in 2003 (Table 2.5.2-4). The Georgia average was $29,000 **(BEA 2005b)**. From 1990 to 2003, Burke County's per capita personal income increased at an average annual rate of 3.8 percent. Columbia and Richmond Counties' per capita personal income average annual growth rates were 3.7 and 2.8 percent respectively. Georgia's rate increased 3.9 percent for the same period.

2.5.2.2 Transportation

The VEGP site is served by a transportation network of interstate and state highway access to main east-west and north-south routes, two primary freight rail carriers (CSX in South Carolina and Georgia and Norfolk Southern in Georgia), and 16 regional airports. Only one airport supports commercial service. Figures 2.5.2-1 and 2.5.2-2 present the road and highway transportation system in the three county areas. Figure 2.5.2-3 presents the airports and rail system in the 50-mile region.

Roads

Within the three counties of interest, there is one interstate highway; I-20, which runs east-west through Georgia and South Carolina connecting Atlanta to Columbia, and includes the I-520 connector being constructed around Augusta. A number of US and State Routes intersect I-20 and connect to the towns within the counties, providing outlying areas access to the interstate system. For example, US Route 221 runs north from I-20 to Appling, the Columbia County seat, and US Route 25 runs south from I-20 to Waynesboro, the Burke County seat.

Workers commuting to VEGP take one of three routes. Workers living in Columbia County take US or State Routes to I-20 east. From I-20, workers follow I-520 south around Augusta to State Route 56 (also known as Old Savannah Road or Mike Padgett Highway). After crossing into Burke County they take the east fork of State Route 56, which is called the 56 Spur and becomes County Road 59, also known as River Road. The VEGP entrance road is off River Road.

Roadways in Richmond County avoid Fort Gordon, a 56,000-acre army installation that covers much of the western part of the county. Richmond County workers commuting from west and north of Fort Gordon use the same route as Columbia County workers. Workers living within the Augusta city limits use I-520 and State Route 56 to River Road and the VEGP. Workers living southeast of Fort Gordon either connect directly to State Route 56 from one of the county roads, or use US Route 25, which runs parallel to State Route 56, until they reach a county road that connects US Route 25 to State Route 56. From there, they follow the same route south and east to the VEGP.

Workers commuting from within Burke County to the VEGP can use a number of State Routes, depending on their location. Commuters living west of Waynesboro can use State Route 56 northeast, State Route 24 east, or State Route 80 east, all of which merge to become State Route 80 east. State Route 80 east runs through Waynesboro, connecting first to State Route 23 and then to River Road. Workers commuting from east of Waynesboro take either State Route 24, which intersects with State Route 80 (following the above route to the VEGP), or State Route 23 northeast to the local Ebenezer Church Road, which connects to River Road. They can also take State Route 23 directly to River Road.

Road and Highway Mileage within Columbia, Burke and Richmond Counties

Table 2.5.2-5 shows the highway mileage in the three-counties of interest for 2004. Of a total of 2,916 miles of road, 16 percent are state routes, 80 percent are county roads, and 4 percent are city streets. In the counties, 20 percent of the total mileage is unpaved. Richmond County is the only county to have more than 90 percent of the roads paved. Columbia County has more than 80 percent of the roads paved. More than 40 percent of Burke County's roads are unpaved.

Traffic Conditions

Table 2.5.2-6 lists the roadways VEGP workers living in Burke, Columbia or Richmond counties use, the Georgia Department of Transportation (GDOT) road classifications for each road, number of lanes, and the 2004 average annual daily traffic (AADT) counts at the traffic count sections (TCS) of the road. Figures 2.5.2-1 and 2.5.2-2 locate the TCSs. There are no Transportation Research Board "Level of Service" determinations for these Georgia roads.

The majority of roadways in both Columbia and Richmond counties are urban. Columbia County also has rural roads, which feed into the urban roads. All roads in Burke County are rural roads.

Vehicle volume on the roads, as measured by AADT counts, reflects the urban and rural character of the counties. In west Columbia County, which is more rural, AADT counts, such as at TCS 147 on State Route 104, and TCS 238 on County Road 575, are small: 7,456 and 5,005, respectively. As traffic progresses east toward the main population centers, Martinez and Augusta, and on the main interstate, I-20, AADT counts increase. For example, from I-20, at TCS 194 in Columbia County to I-520 TCS 221 in Richmond County, near the I-20/I-520 interchange, the AADT count increases from 41,538 to 74,696. East of the I-20/I-520 interchange on I-20, the AADT counts decrease as traffic leaves the interstate for smaller state routes and county roads.

State Route 56, becomes the 56 Spur/County Road 59/River Road in Burke County and is one of the main roads to the VEGP, shows a decrease in traffic from Richmond to Burke County. At TCS 143, in Richmond County, the AADT count is 25,249. On River Road, in Burke County, at TCS 269, the closest TCS point to the VEGP, the AADT count is 1,277.

State routes and county roads in Burke County used to commute to VEGP have much smaller AADT counts than Columbia or Richmond County roads. The highest AADT counts are on US Route 25, which goes through Waynesboro, the Burke County seat (TCS 211; AADT of 8,332) and State Route 56, northeast of Waynesboro (TCS 171; AADT of 8,303).

Atlantic Coast Hurricane Evacuation Routes

In Burke County, US Route 25 and State Route 24 are Atlantic Coast Hurricane Evacuation Routes **(GDOT 2003a)**. In Richmond County, US Route 1 south of Augusta is an evacuation route.

Rail

There is no passenger rail service in Burke, Columbia or Richmond counties. Two primary freight rail carriers service the three counties of interest, CSX and Norfolk Southern. From Augusta, CSX has three lines leading to Atlanta, Greenwood, SC, and Savannah, GA (through South Carolina). Each line runs approximately 12-20 freight trains a day. Also from Augusta, Norfolk Southern has a rail line that goes through Waynesboro to points south and west, running approximately 12-20 freight trains a day. Both rail lines have the capacity to run additional trains.

An approximately 20-mile rail spur runs from VEGP to the Norfolk and Southern line, connecting north of Waynesboro. According to recent Georgia Department of Transportation (GDOT) rail maps, the spur is “out-of-service” however SNC recently upgraded the spur to support the transfer of some heavy equipment to VEGP. Figure 2.5.2-3 presents the rail system.

Waterway

The VEGP site is located on the Savannah River near River Mile 151. The Savannah River is part of the U. S. Inland Waterway System and an authorized navigation channel exists from the mouth of the Savannah River to Augusta, Georgia. All of the major large components for the existing VEGP Units 1 and 2 were delivered to the site by barge utilizing the Savannah River navigation channel. A barge structure parallel to river flow was installed approximately 100 yards downstream of the VEGP Units 1 and 2 intake structure to support unloading major equipment. The structure included dolphins to secure barges and a ring crane to support unloading. SNC plans to construct a new barge slip between the existing ring crane pad and the Unit 1 and 2 intake structure. SNC plans to utilize the Savannah River navigation channel to support delivery of large components and modules for construction of Units 3 and 4. The advanced reactor construction is based around installation of large modules fabricated at a dedicated fabrication facility and delivered to the site.

The Savannah River navigation channel is operated and maintained by the Savannah District Corps of Engineers (the Corps). The Savannah River navigation channel has not had significant use in many years and has not been maintained since 1978. Close coordination with the Corps will be necessary. SNC has contacted the Corps and will be working with them to develop a strategic plan to support the required shipments for VEGP Units 3 and 4. The plan will include a schedule of shipments, identify maintenance needs and navigation aids, and identify contingencies, where appropriate.

Airports

There are 16 public airports within 50 miles of the VEGP site; 9 in Georgia and 7 in South Carolina. (Table 2.5.2-7 and Figure 2.5.2-3) The GDOT classifies airports by runway lengths and the types of planes (from single engine to commercial jet). The South Carolina Department of Commerce, Aeronautics Division, classifies airports as public, public (privately owned), or restricted (for a number of reasons). Restricted airports are not included in Table 2.5.2-7 or Figure 2.5.2-3.

2.5.2.3 Taxes

Several tax revenue categories would be affected by the construction and operation of new nuclear units. These include income taxes on wages, salaries and corporate profits, sales and use taxes on construction- and operation-related purchases and on the purchases of project-related workers; property taxes related to the construction and operation of new nuclear units; and property taxes on owned real property.

The following sections describe each type of tax.

Personal and Corporate Income Taxes

Georgia has an individual income tax, a graduated tax based on a taxpayer's federal adjusted gross income with a maximum rate of six percent. Employees in Georgia pay income taxes to Georgia if (1) their residences are in Georgia, (2) they are nonresidents working in Georgia and filing a federal return which would include income from sources in Georgia that exceeds five percent of income from all sources, or (3) they have income that is subject to Georgia tax that is not subject to federal income tax. **(GDOR 2005a)**

Corporate income tax is a non-graduated percentage based on a corporation's federal taxable net income. Corporations that own property or do business in Georgia are subject to corporate income tax. The rate of taxation is six percent of a corporation's taxable net income attributable to business done in Georgia **(GDOR 2005a)**.

Sales and Use Taxes

Georgia assesses a state sales tax on the retail sales price of tangible personal property. Also, certain types of services are subject to a state sales tax. Service providers who transfer tangible personal property to customers as part of the service they provide incur a state sales tax on the tangible personal property transferred. Therefore, businesses that buy, sell, or use tangible personal property in Georgia are subject to a state sales tax liability of four percent. **(CCH 2005)**

In order to avoid losing tax revenues on sales transactions taking place outside of the state, Georgia also imposes a four percent use tax. The use tax is assessed against all persons who store, use, or otherwise consume tangible personal property in Georgia that was purchased out-of-state. **(CCH 2005)**

Counties' and municipalities' ability to generate revenues is determined by specific revenue-raising authorities granted to them under the Georgia Constitution and state law **(GHC 2004)**. In addition to the state sales and use taxes of four percent, counties and municipalities may elect to add additional sales taxes to generate revenue to meet local budget requirements. Four different local-option sales and use taxes may be levied by local governments on the purchase, sale, rental, storage, use, or consumption of tangible personal property and related services. All local-option sales and use taxes must be approved by the voters in the jurisdiction. Under each type of local-option sales and use tax, counties and cities are subject to a 2 percent cap on the amount they may levy. **(GHC 2004)**

Joint county and municipal local-option sales and use taxes (LOST) are disbursed on the basis of a percentage negotiated by the county and city governments within that county. Proceeds of this tax must be used to reduce the millage rate (for an explanation of millage rates, see the next section, *Property Taxes)*. All counties and municipalities must renegotiate the distribution of this tax every ten years. **(GHC 2004)**

Counties that do not levy a LOST are authorized to impose the homestead-option sales tax (HOST). This tax must be imposed in conjunction with an additional homestead exemption. Both the tax and the exemption must be approved by the voters. Proceeds of this tax must be used to fund capital projects and services equal to the revenue lost to the homestead exemption. Any excess revenues must be used to adjust the millage rate. **(GHC 2004)**

Although the special purpose local-option sales and use tax (SPLOST) is a county tax, counties must include city projects in their referendum if requested by the city. State law specifies the types of capital projects that this tax may fund: roads, streets, and bridges; courthouse, civic center, hospital, jail, library, or coliseum; cultural, recreational, or historic facility; water or sewer project; the retirement of existing debt; and public-safety or airport facilities. The referendum must specify the purpose of the tax, the length of time it will be imposed, and the amount of revenue it will raise. This tax can be levied for five years or until it produces the amount of revenues specified on the ballot. **(GHC 2004)**

Sales taxes for educational purposes (STEP) are levied by boards of education; the revenues are not distributed to county government. The board of education of a county school district (or if there are independent city school districts, the county school board jointly with the independent boards of education) may impose a 1 percent sales tax for educational purposes. In the case of a joint county-city tax, the proceeds are distributed proportionally between county and independent school districts according to enrollment. Proceeds must be expended for capital projects for educational purposes or retirement of the system's existing general-obligation debt.

Excess proceeds must be used to retire school-system debt, or if there is none, to reduce the millage rate. This tax is not subject to the two percent cap on local sales taxes. **(GHC 2004)**

Burke County's sales and use tax, which includes both state and local portions, is six percent. Richmond and Columbia Counties' sales and use taxes are both seven percent. Some foods for home consumption are taxed at lower rates in all three counties and the rates vary from 2 to 3 percent. **(GDOR 2005b)**

Other Sales and Use-Related Taxes

Cities are authorized to impose franchise taxes on electric, gas, telephone, cable television, and any other public utilities within their boundaries, but counties are permitted to levy franchise taxes only on cable-television systems in their unincorporated areas. The amount of franchise fees is generally negotiated between the local government and the franchisee. **(GHC 2004)**

Georgia cities and counties may also levy excise taxes on alcoholic beverages, mixed drinks, insurance premiums, hotel-motel rooms, and rental motor vehicles. **(GHC 2004)**

Property Taxes

Counties and municipalities are authorized by the state constitution to levy and collect a general ad valorem ("according to value") property tax within their jurisdictions. Property taxes are levied on real property such as land and buildings; personal property, including cars, boats, machinery, and the inventoried goods of a business; and on intangible property, including long-term real estate notes such as mortgages and deeds to secure debt and the transfer tax imposed on the sale of real property. **(GHC 2004)**

Georgia law generally requires that tangible real and personal property be assessed at 40 percent of its fair market value. Exceptions apply to special types of property such as historic property, conservation use property, some agricultural use property, and standing timber. The tax rate is stated in terms of "mills," with ten mills equal to 1 percent of a property's assessed value. The amount of taxes due from an individual property owner is the tax rate multiplied by the assessed value of the property. County and city governing authorities set the property tax (millage) rate by dividing the amount of money the local government needs from property taxes by the amount of the digest, which is the value of all property in the jurisdiction. **(GHC 2004)**

Exemptions from the property tax include public property, places of worship, institution of public charity, household furniture, personal clothing, and items of tangible personal property (except motor vehicles, trailers, and mobile homes) with a value of less than $500. Georgia also has a residential homestead exemption. **(GHC 2004)**

GPC and VEGP co-owners pay annual property taxes to Burke County. Table 2.5.2-8 presents information on the total property taxes VEGP pays to Burke County, the total property taxes collected, the percent of the total property taxes that are paid by VEGP, and the portion of Burke County's tax revenues that is disbursed to the Burke County School District.

The VEGP annual property tax payments to Burke County for the 5-year period, 2000 to 2004, ranged from 79.8 to 82.2 percent of the total property taxes collected. In Georgia, electric power generation continues to be regulated.

2.5.2.4 Land Use

Counties with the greatest potential to be impacted socio-economically are Burke County, where the site is located and 20 percent of the VEGP employees reside, and Richmond and Columbia Counties, where 59 percent of the VEGP employees reside. Therefore, this discussion on land use focuses on those three counties.

Burke County

The Burke County Comprehensive Plan **(Burke County 1991)** identifies five land use issues:

- Burke County is the second largest Georgia county in land area
- More than 97 percent of the county is in agriculture or forestry
- Nearly 15 percent of the total county acreage is classified as preferential agriculture, meaning it must remain agricultural for a specific number of years
- Waynesboro has a comprehensive zoning ordinance
- The county has a land development code which sets forth minimum development standards for various land uses.

The plan also identifies four goals:

- Provide for an efficient distribution of land use so that non-residential activities do not adversely impact residential activities
- Identify and acquire a site for a landfill
- Discourage development which would be detrimental to environmentally sensitive and historic areas of the county
- Encourage development in areas which are already served by community services and roads.

Burke County is developing a zoning plan, but currently has no zoning.

Richmond County

Richmond County includes the City of Augusta, the second oldest city in Georgia. Augusta's development has been influenced by history, the economy, advancements in transportation and communication systems, improved building practices, and trends in urban growth. Land use patterns have been influenced by climate and geography, the location of natural features, disasters, the timing and location of major federal and state facilities, extension of public utilities, and local development regulations. In recent decades Augusta has experienced urban sprawl. The following issues were identified in the Comprehensive Plan **(ARC 2004)**:

- Traffic congestion
- Loss of downtown retailers to the suburbs, lack of investment in downtown and consequent urban blight
- Demands on public facilities and services
- Adverse impacts on natural environments
- Disagreement on the definition of “good” quality of life

The plan also identified activities the county would like to encourage:

- Infill development and downtown redevelopment
- Neighborhood revitalization
- Commercial center redevelopment
- Smart growth and growth management initiatives

Columbia County

Columbia County was fairly undeveloped until relatively recently. Growth in the last 30 years is the result of people moving into the area and seeking new homes in close proximity to good schools. Commercial growth is a function of increased accessibility by car. Industrial development has occurred along the major transportation routes. Growth is moving west, along the main thoroughfares. Constraints to growth identified in the Columbia County Growth Management Plan **(Columbia County 2000)** include:

- Significant floodplain acreage
- Challenge to provide public services at a pace to keep up with new growth
- Clark’s Hill lakefront is controlled by the U.S. Army Corps of Engineers

The county also identified guiding land use principles:

- Protect, support and maintain the county’s existing neighborhoods
- Respect and maintain prevailing land use patterns
- Place higher density housing near commercial centers or integrate into mixed use developments
- Encourage a higher level of livability in future multi-family communities while reducing their impact on the county
- Encourage mixed-use development
- Encourage traditional neighborhood development
- Encourage redevelopment of obsolete or economically deteriorating areas
- Emphasize redevelopment over expansion of commercial uses in unforeseen areas

- Encourage industrial development opportunities for employment-oriented basic economy uses in appropriate locations
- Protect the capacity of major thoroughfares through nodal development techniques
- Protect environmentally sensitive areas

2.5.2.5 Aesthetics and Recreation

This section characterizes the aesthetics and recreational opportunities in the 50-mile region.

The VEGP site is located in rural Burke County in the Coastal Plain, about 25 miles east of the Piedmont Province. The topography of the area consists of low rolling hills with elevations ranging from 200 feet to 280 feet above mean sea level. Undeveloped areas are characterized by upland forests, forested wetlands, pine plantations, agriculture, and grasslands. The region has a temperate climate with mild winters and long summers.

Table 2.5.2-9 lists state parks and wildlife management areas within 50 miles of VEGP. The Yuchi WMA is a 7,800-acre site adjacent to VEGP. Crackerneck WMA is a 10,470 acre site on the South Carolina side of the Savannah River, adjacent to the west boundary of the Savannah River Site. Both are within a 6 mile radius of the VEGP site, although Crackerneck is approximately 50 miles from VEGP by road. Mead Farm WMA is about 8 miles from VEGP and Alexander WMA is about 12 miles from VEGP. The closest state parks are Magnolia Springs, in Jenkins County, Georgia (approximately 20 miles from VEGP), and Redcliffe Plantation State Park in Aiken County, South Carolina (approximately 20 air miles from VEGP). J. Strom Thurmond Dam and Clarks Hill Lake are within 50 miles of VEGP. The lake is a major recreation area for the Central Savannah River Area.

Festivals and sporting events throughout the region bring in tourists for several days to a week. Major sporting events in the Augusta area are the Masters Golf Tournament, the Cutting Horse Futurity, the Invitational Rowing Regatta, the Southern National Boat Races, and the Aiken Triple Crown. Redcliffe Plantation hosts annual Heritage Days. Burke County hosts the Redbreast Festival and the Georgia Bird Dog Field Trials.

VEGP Units 1 and 2 have natural draft cooling towers, similar in appearance to those that will be constructed for the new units at VEGP. These are the tallest structures at the site. Georgia Highway 56, River Road, and the Savannah River are the closest points from which the public can glimpse the plant or the cooling towers. Trees and terrain provide barriers to viewing the containment, turbine buildings, and support structures from the road or river. The only structures fully visible from the river are the intake canal, intake structure, and pumphouse. The discharge is a submerged structure. At several points on the river, the top of the existing containment, and the tops of the existing cooling towers are visible. In the same reach of river are three intake canals and a barge facility for the SRS.

The terrain on both sides of the Savannah River slopes to the river, allowing the plumes and in a few cases, the towers to be visible from the vicinity of Highway 125 in Allendale and Barnwell

Counties, S.C., the southern outskirts of Aiken, S.C., some parts of I-520 in South Carolina and Georgia, and from some locations in Burke County, Ga. The plumes resemble cumulus clouds.

2.5.2.6 Housing

Approximately 79 percent of current VEGP employees reside in 3 counties in Georgia: Burke (20 percent), Richmond (26 percent), and Columbia (34 percent). The remaining 20 percent are distributed across 24 other counties, with 1 to 58 employees per county.

Within the 50-mile radius, residential areas are found in cities, towns, and smaller communities with farms scattered throughout the area. Rental property is scarce in the rural areas, but is available in the larger municipalities such as Waynesboro, Augusta, Martinez, and Evans. In the vicinity of the VEGP site, residents are generally isolated, older single-family homes or mobile homes. New residential developments are primarily associated with the cities or towns in the region.

Table 2.5.2-10 provides the number of housing units and housing unit vacancies for the three county area for 1990 and 2000. In 2000, there were 124,475 housing units for Burke, Richmond, and Columbia Counties. Of that total, 38,547 were renter-occupied (31 percent). Nine percent were vacant (11,501 units). **(USCB 1990, 2000e)**

The counties with larger populations (Richmond and Columbia) have more available housing (Table 2.5.2-10). Between 1990 and 2000, both Burke (-3.5 percent) and Richmond County (-0.3 percent) experienced declines in vacant housing, and Columbia County (1.5 percent) experienced an increase **(USCB 1990, 2000e)**. Of 908 vacant housing units in Burke County in 2000, 167 were for rent and 77 were for sale. Of 8,392 vacant housing units in Richmond County, 3,739 were for rent and 1,160 were for sale. Of 2,201 vacant housing units in Columbia County, 560 units were available for rent and 760 were for sale **(USCB 2000e)**. A total of 6,463 vacant housing units were available for sale or rent in the three counties.

Table 2.5.2-11 presents detailed 2000 Census data on vacant housing in communities closest to VEGP: Waynesboro, Millen, and Sylvania. Of 244 vacant housing units in Waynesboro, 83 were for rent. Of 246 vacant housing units in Millen, 85 were for rent. Of 197 vacant housing units in Sylvania, 38 were for rent **(USCB 2000f)**.

2.5.2.7 Community Infrastructure and Public Services

Public services and community infrastructure consist of public water and waste water treatment systems, police and fire departments, medical facilities, social services, and schools. They are typically located within municipalities or near population centers. Schools are described in Section 2.5.2.8. The other services are described below.

Public Water Supplies and Waste Water Treatment Systems

Because VEGP is located in Burke County and most of the current VEGP employees reside in Burke, Richmond, or Columbia Counties, the discussion of public water supply systems will be limited to those three counties.

VEGP averages 1.052 million gallons of potable water per day from three onsite groundwater wells. In general, one well supplies all necessary water for normal plant operation, leaving two wells in standby. VEGP is permitted to withdraw an average of 5.5 million gallons per day (MGD) total.

In the Central Savannah River Area, water sources can be surface water, such as rivers, lakes, and streams, or groundwater. The land north of the Fall Line (approximately north of I-20) is characterized by a limited groundwater supply due to the dense, crystalline rock underlying the area. Most of the large municipal systems above the Fall Line obtain water from the Savannah River or one of its impoundments. However, some of the smaller municipalities above the Fall Line have wells that adequately meet water demands. Columbia County lies north of the Fall Line. **(CSRARDC 2005)**

In the Coastal Plains of Georgia and South Carolina, south of the Fall Line, there are two major regional aquifer systems (see Section 2.3). The lower regimen is referred to as the Cretaceous aquifer system and consists primarily of the sands, gravels, and clays of the Tuscaloosa Formation. It is a highly transmissive aquifer system yielding large quantities of good quality groundwater (estimated 5 billion gallons per day throughout its known extent). The upper regimen is variously referred to as the water table aquifer, the Tertiary aquifer system, the principal artesian aquifer, the limestone aquifer, or the Floridan aquifer. It consists primarily of the limestones and permeable sands of the Lisbon formation or stratigraphic equivalents. The yields from these systems could support systems requiring nearly 3,000,000 gallons per day. Consequently, most counties in the Coastal Plain obtain their water from groundwater. The majority of Richmond and Burke County water suppliers obtain their water from aquifers. Some municipalities use the Savannah River to supplement deep wells. Table 2.5.2-12 details water suppliers in the three counties, their permitted capacities, and their average daily production. **(CSRARDC 2005)** VEGP withdraws groundwater primarily from the Cretaceous aquifer for potable and service water.

According to local planning officials, water supply in the three counties is not a concern. Local communities are adequately served by the existing water supplies and planners estimate that the counties have adequate supply at least through the current planning periods. The only concern is protection of the aquifers from chemical and radiological pollutants, erosion, and sedimentary contamination. **(CSRARDC 2005)**

Waste water treatment is provided by local jurisdictions. Each municipality decides which treatment method to use based on the municipality’s needs and the technology and funds available. The most common types of treatment facilities are primary, and secondary treatments, and oxidation ponds. Currently, municipalities in the three counties are able to meet waste water treatment needs **(CSRARDC 2005)**. Table 2.5.2-13 details public waste water treatment systems, their permitted capacities, and their average daily production. The rural areas of each county are on septic systems.

Police, Fire, and Medical Services

Table 2.5.2-14 provides year 2001 police and fire protection data for the three counties. Local planning officials consider police protection adequate but future expansions and facility upgrades may be needed to accommodate future population growth **(CSRARDC 2005)**.

Fire protection in the three counties is characterized by “persons-per-firefighter” ratios and ISO fire insurance ratings. Table 2.5.2-14 lists the “persons-per-firefighter” ratios by county. Regional planners report the following ISO fire ratings by county: Burke County, 5 and 9; Richmond County, 2, 5, and 7; and Columbia County, 4 and 7. In all three counties multiple ratings indicate that there are different levels of protection with each county.

Richmond County is a regional medical hub and has the highest hospital bed capacity of the three counties and of any county in the 50-mile region. Richmond County’s hospitals include: four general hospitals, one military hospital, one mental and psychiatric hospital, one rehabilitation hospital, and two federal hospitals. More than 25,000 people are employed in medical industry in Richmond County. In addition to the hospitals, state and regional medical centers include the Poison Control Center, the Regional Radiation Therapy Center, a Regional Trauma Center, and the Kidney Dialysis Referral Center which also provides transplant surgery **(CSRARDC 2005)**. Burke County has one general hospital and Columbia County has no hospitals **(CSRARDC 2005)**. Table 2.5.2-15 presents hospital and medical practitioner data by county.

All three counties have health departments, which are available to residents regardless of their ability to pay. Some of the services offered by health departments include: child and adolescent health programs, women's health programs, immunizations, laboratory services, teen pregnancy prevention programs, scoliosis screening, parasite screening, diabetic screening, health education and counseling, homemaker services to the elderly, prenatal services, and sexually transmitted disease prevention and education. Some public schools in the region do not have a school nurse; many rely on the Health Department for nursing support. **(CSRARDC 2005)**

Social Services

Social services in Georgia are overseen by the Department of Human Resources (DHR). DHR serves Georgia citizens through five main divisions: family and children services; public health, and mental health; developmental disabilities; and addictive diseases; and aging services **(GDHR 2004)**.

2.5.2.8 Education

Public Schools – Pre-Kindergarten through 12

The public school systems in Burke, Richmond, and Columbia counties are organized by county. Columbia and Richmond counties provide greater public school resources for much larger populations than does Burke County. Table 2.5.2-16 provides information on the number and types of school in each county.

All publicly-funded Georgia pre-kindergarten through grade 12 schools are required to meet Georgia Department of Education (GDOE) mandated student-teachers ratios. Ratios vary depending on the grade level, subject taught, and presence or absence of a paraprofessional. A full listing of the ratios is provided on the GDOE website: http://www.doe.k12.ga.us/ **(GDOE 2004)**. The school districts in all three counties either meet or are below the state mandated student-teacher ratios. In the past, when a district began exceeding the ratios, the Board of Education acquired the necessary funding to either build new schools or renovate older schools to increase facility capacity. The specific methods that each county school district chose to follow are detailed below. All three school districts have some capacity for additional students.

Burke County

Burke County had a pre-K through 12 public school student population of 4,425 in 2004. The county has six schools and no plans to build additional schools. All of the county's schools were built within the last 20 years, and provide students with the educational facilities and resources that would normally be available in a more urban county. Because all the schools are relatively new, there are no modules on any of the school grounds. Student-teacher ratios are below state mandated levels. All the county schools have some capacity for additional students, but the middle and high schools are closest to capacity. Any need for additional space in these two schools would be met by additions/renovations to the current schools.

The Burke County Board of Education has been able to meet its annual budget and long-term school construction and renovation needs from the county residential and commercial property taxes, with the tax revenues generated by VEGP providing the necessary funding for new school construction and renovations. With its funding needs already met, the Burke County Board of Education does not have a SPLOST fund dedicated to the school system.

Richmond County

Richmond County (2004 student population of 33,432) has 58 schools and plans to build two new elementary schools and one technology and career magnet high school by 2007. Between 2002 and 2004, the county opened a new elementary school every year to meet the Georgia Department of Education mandated student-teacher ratios **(GDOE 2004)**. The Richmond County Board of Education also has completed extensive additions and renovations on a number of middle and high schools, adding collectively 100 classrooms to the infrastructure. Modules are available to provide additional space at elementary, middle and high schools as needed.

With a sizeable commercial, business, retail and residential base, the Richmond County Board of Education has been able to meet its renovation and new construction needs from property taxes and the SPLOST. Additionally, because of the popularity of the three magnet schools – one K through 8 traditional magnet school, one 6 through 12 fine arts school, and one 9 through 12 health science and engineering high school – families from the surrounding counties are moving into Richmond County so their children can attend these schools.

Columbia County

Columbia County (19,674 students in 2004) has 27 schools and plans to build one elementary, two middle schools and a high school. One new elementary school opened in the school year 2004 and another elementary school opened for the 2005 school year. With these two new elementary schools, Columbia County is below the Georgia mandated student/teacher ratios for pre-K through 5th grade.

The addition of middle schools in 2001 and 2003 allowed Columbia County to meet the middle school student/teacher ratio. Two additional middle schools are planned; one will replace an older middle school, and provide approximately 20 percent more capacity than the old school. The replacement school is scheduled to open in 2006/2007. A second new middle school is scheduled to open in 2008/2009.

With modules at middle schools and at all high schools, new school construction is a high priority for the Columbia County Board of Education. Columbia County currently meets its student/teacher ratio for high school students, but there is a need for a new high school. The Columbia County Board of Education has not settled on a location, and the school is not expected to open for another 3 to 4 years. Finding new construction funding is problematic. Property taxes have not been raised in 7 to 8 years. While the residential and retail base has increased in the last few years as more people moved into Columbia County, the revenues that the Board of Education receives from the SPLOST have been used to pay down the Board’s debt. The Board must apply to the GDOE every year for funds for new school construction.

Colleges

There are six 4-year colleges and seven 2-year colleges within a 50-mile radius of VEGP (Table 2.5.2-17). All are public except for Paine College and Voorhees College. Paine College, Voorhees College, and Denmark Technical College are Historically Black Colleges.

2.5.3 Historic Properties

SNC has begun informal discussions with the Georgia and South Carolina State Historic Preservation Officers (SHPO) that will continue throughout the ESP application review process (see Appendix A). In 2005, SNC contracted with New South Associates (NSA) to perform a cultural resource survey of areas of the VEGP site and associated transmission lines to support the ESP application and license renewal **(NSA 2006)**.

SNC has determined that the northern part of the site (generally above the Sherer transmission line) has appropriate backfill material to support the construction of the new units, however, the exact locations and extent of the borrow areas have not yet been determined. Once the areas are identified, NSA will survey those areas. The area designated for borrow is not included in this discussion.

Prehistoric Overview

The following discussion is from NSA (2006). The cultural prehistory of the Savannah River Basin is currently under debate. The University of South Carolina has reported a possible pre-Clovis (>12,000 B.C.) assemblage at a site near the Savannah River in Allendale County, South Carolina. Their excavations into Pleistocene sands yielded several chert artifacts, and an area of abundant charcoal that could be a hearth. The carbon was dated to approximately 50,000 Radiocarbon Years Before Present. If the dates are correct, and are associated with artifacts from human occupations, then the site provides evidence that calls into question the common belief that humans did not inhabit this part of North America prior to 13,000 years Before Present. The debate has not been resolved.

Few Early or Middle Paleoindian sites have been excavated in the Savannah River drainage.

During the Archaic Period (7800 B.C. – 1050 B.C.) early inhabitants developed into mobile groups united by common traditions. The groups traveled seasonally throughout the region, including along rivers. By the late Archaic, populations were more sedentary, and were exploiting local resources, including rivers. Some archaeologists' suspect that the intense use of riverine resources (coupled with climate changes) lead to massive depletions of those resources, and forced settlements to move to smaller, upland tributaries. This period is marked by the development of fiber-tempered pottery and shell middens.

In the Woodland Period (1050 B.C. – 800 A.D.) the inhabitants developed agriculture, food preservation and storage, which allowed the populations of single settlements to increase.

The Mississippian Period (800 A.D. – 1450 A.D.) is known for agricultural-based subsistence, permanent occupations, and ceremonial mounds, indications of cultural development.

From A.D. 1450 to A.D. 1540, chiefdoms dissolved for whatever reason and most Native American groups wandered and left little trace of their presence.

The Historic Indian Period (A.D. 1540 – A.D.1700) was characterized by the decline of earlier chiefdoms, and increased heterogeneity among Native Americans as a result of intermarriage with white and black settlers.

Historic Overview

The Central Savannah River Area (those parts of Georgia and South Carolina that border the middle reach of the Savannah River) is one of the oldest and most historically rich areas of the state. Native Americans and early settlers used the Savannah River as a major transportation route between the Coast and the Piedmont.

James Oglethorpe settled Savannah in 1733 and Augusta in 1736. Oglethorpe viewed the Georgia colony as a Utopia – a haven from conflict where the honest but indigent or persecuted religious could begin a new life. He tried to keep the bad influences of the South Carolina colony, including liquor, slavery, and the rice agriculture that spawned large plantations, out of Georgia. Georgia was to be a colony of small yeoman farmers. Unfortunately without slaves or indentured servants, clearing and settling the land was almost impossible, and the tail-male law prohibiting females and all but the eldest son from inheriting property provided little incentive to improve the land. After slavery was introduced, the tail-male law was rescinded, and the liquor prohibition was lifted, all about 1750, Georgia began to flourish and numerous towns were created.

Burke County is one of Georgia's eight original counties. It was formed in 1777 from St. George Parish and was named for Edmund Burke, an English spokesman for American liberty. In 1796 the state capital was in Louisville, which at the time was in Burke County, but in that year the county was divided to form Jefferson County, and Louisville became part of Jefferson County. In 1793 part of Burke County was taken to form Screven County, and in 1905 another part became Jenkins County. Waynesborough was established as the county seat in 1783. Cotton controlled the economy until the Civil War. Burke County south of Waynesboro was heavily damaged during the War, and did not recover, though farming is still a major part of the economy.

The largest landowner in the vicinity of VEGP was Edward Telfair, a Georgia governor from 1786 to 1791. The 1830 census lists no Telfair landowners but many Utl[e]ys. The first Utley was apparently an overseer for Mr. Telfair. There are still Utleys in the area, and features on the VEGP property bore the name Utley.

In the early 20th century there were several properties between Hancock Landing and Beaverdam Creek, the area now known as VEGP.

2.5.3.1 Historic or Archaeological Sites in the Vicinity of the VEGP Site

The environmental report (ER) prepared for the original VEGP units describes the known historic resources in the area in 1972. Shell Bluff Landing is approximately 7 miles north northwest of the VEGP site. It has both historic and archaeological significance. It was the site of the original grave of Dr. Lyman Hall, a signer of the Declaration of Independence. His body was later reinterred in Augusta. The original ER also reports that Shell Bluff Landing was important during the era of steamboat river traffic and was fortified during the War Between the States. Shell Bluff takes its name from a large bed of fossils of the giant oyster (*Crassostrea gigantissima*) found there. This bed likely was formed during the Eocene when the Coastal Plain of Georgia was under the Atlantic Ocean. The site of an Indian village with artifacts dating from 4,000 years ago, is located between Shell Bluff and Boggy Gut Creek, approximately 7.5 miles upstream of VEGP. **(GPC 1972)**

Seven historical sites in Burke County are on the National Register of Historic Places (Table 2.5.3 1). One National Register listed building, the Sapp Plantation, is within 10 miles of the VEGP site. The SRS, the only other historical site within 10 miles determined to be eligible for listing, is directly across the Savannah River from VEGP, in South Carolina.

Twenty-two archaeological sites within 10 miles of VEGP, and all on the SRS, have been determined eligible for listing.

2.5.3.2 Historic or Archaeological Sites on the VEGP Site or Associated Transmission Lines

In 1973 an archaeological survey of the VEGP site was performed under the direction of the Georgia State Archaeologist and the Georgia Historical Commission and submitted to the U.S. Atomic Energy Commission (the predecessor agency to the NRC). The survey identified seven archaeological sites **(NSA 2006)**. Four sites are along the river bluff, south of the existing barge canal and will not be affected by the proposed construction (Figure 2.5.3-1). One, 9BK21, was destroyed during construction of the existing barge slip. This site is the location of the Brown Cabin, which apparently also was destroyed during construction. The remaining two sites are shown to be on the plateau west of Mallard Pond on the maps in the 1973 report, however, the UTM coordinates for these two sites do not place them in the location shown on the report map **(NSA 2006)**. Based on the 1973 study the State Archaeologist considered that the archaeological resources at the VEGP site had been sufficiently characterized **(GPC 1972)**.

The 2005 NSA survey, which was restricted to areas on VEGP property that will be disturbed by the construction of new units, identified 10 archaeological sites (3 historic and 7 prehistoric) and 7 isolated finds (Figure 2.5.3-1). None of the seven sites identified in the original survey were located during the 2005 survey. Two of the new sites are eligible and two are potentially eligible for inclusion on the National Register of Historic Places. The rest are recommended ineligible. Table 2.5.3-2 provides brief descriptions of the sites. After completing the 2005 survey, SNC reviewed an early plat of the VEGP property, which identifies a cemetery on a bluff overlooking the river, south of the existing intake access road. SNC will investigate the area to determine if a cemetery is present, and if so, will follow existing procedures to protect the area during construction.

It is likely that a new transmission line would be constructed from VEGP to an existing substation northwest of the site. Although the specific route of the corridor has not been determined, it would pass through Burke, Jefferson, McDuffie and Warren Counties. Table 2.5.3-3 lists the National Register historic sites or sites eligible to be listed in those counties.

In 1983, during construction of the original units, the fossil of a 40-million-year-old previously unknown whale species was uncovered in the Blue Bluff marl approximately 30 feet below ground surface. The skeleton of the whale, now known as *Georgiacetus vogtlensis*, is housed at the Georgia Southern University Museum in Statesboro, Georgia. **(Reuters Limited 1998)**

Geomorphological investigations done in conjunction with the 2005 archaeological survey determined that the Blue Bluff marl in which the whale was found does not occur on the bluff north of the existing intake structure. Therefore, construction of the new intake, access road and water line will not encounter the whale-bearing horizon **(NSA 2006)**.

2.5.3.3 Native American Cultural Resources and Concerns

No Federally-recognized tribes reside in the state of Georgia. Through OCGA 44-12-300, the State of Georgia officially recognized the following tribes of Georgia as legitimate American Indian tribes **(500 Nations 2005)**:

- The Georgia Tribe of Eastern Cherokee, P.O. Box 1015, Cummings, Georgia 30028
- The Lower Muscogee Creek Tribe, Route. 2, Box 370, Whigham, Georgia 31797
- The Cherokee of Georgia, Saint George, Georgia 31646

Native Americans that settled in the Burke County area include a band of Chickasaw that “lived near Augusta from about 1723 to the opening of the American Revolution: (Georgia Indian Tribes 2005) and a Shawnee band “which settled near Augusta” (Georgia Indian Tribes 2005). The Muskogee was the dominant tribe on either side of the Savannah River before the Europeans settled in North America **(Sturtevant 1996)**.

The Catawba Indian Nation (P.O. Box 188, Catawba, SC 29704) is the only Federally-recognized tribe in South Carolina. The State of South Carolina (S.C. Code Chapter 139, Section 1-31-40(A)(10) officially recognizes the following tribes/groups as legitimate Native American Tribes and Groups **(SCCMA No Date)**.

- The Waccamaw Indian People, P.O. Box 628, Conway, SC, 29528
- The Pee Dee Indian Nation of Upper South Carolina, 3814 Highway 57 N, Little Rock, SC 29576
- The Pee Dee Indian Tribe of South Carolina, P.O. Box 557, McColl, SC, 29507
- The Santee Indian Organization, 432 Bayview St., Holly Hill, SC 29059
- The Beaver Creek Indians, P.O. Box 699, Salley, SC, 29137
- The Eastern Cherokee, Southern Iroquois and United Tribes of South Carolina
- The Wassaamasaw Tribe of Varnertown Indians
- The Chaloklowa Chickasaw Indian People, 500 Tanner Lane, Hemingway, SC 29554
- The Piedmont American Indian Association, Lower Eastern Cherokee Nation of South Carolina

- The American Indian Chamber of Commerce of South Carolina, 9377 Koester Lane, Ladson, SC 29456

2.5.4 Environmental Justice

2.5.4.1 Methodology

Environmental justice has been defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies **(EPA 2002)**. Concern that minority and/or low-income populations might be bearing a disproportionate share of adverse health and environmental impacts led President Clinton to issue an Executive Order (EO) 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” in 1994 to address these issues. The order directs federal agencies to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. The Council on Environmental Quality has provided guidance for addressing environmental justice **(CEQ 1997).** SNC used guidance from the NRC Office of Nuclear Reactor Regulation **(NRC 2004)** in this analysis.

NRC previously concluded that a 50-mile radius could reasonably be expected to contain potential impact sites and that the state was appropriate as the geographic area for comparative analysis. NRC’s methodology identifies minority and low-income populations within the 50-mile region and then determines if these populations could receive disproportionately high adverse impacts from the proposed action. SNC has adopted this approach for identifying the minority and low-income populations and associated impacts that could be affected by the proposed action. This section locates populations. Potential adverse impacts are identified and discussed in Chapters 4 and 5.

SNC used ArcView® GIS software and USCB 2000 census data to determine the minority and low-income characteristics by block group within 50 miles of the VEGP site. SNC included a block group if any part of its area was within 50 miles of the VEGP site. The 50-mile radius includes 491 block groups. SNC defines the geographic area for the VEGP site as Georgia and South Carolina, independently, for analysis of block groups in each of the two states. SNC prepared a calculation package supporting this analysis.

2.5.4.2 Minority Populations

The NRC Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues defines a “minority” population as: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; or Black races; multiracial; and Hispanic ethnicity **(NRC 2004)**. Additionally, NRC’s guidance requires that all other single minorities are to be treated as one population and analyzed (Other), and that the aggregate of all minority populations (Aggregate) is to be treated as one population and analyzed. The guidance indicates that a minority population exists if either of the following two conditions exists:

1. The minority population of the block group or environmental impact area exceeds 50 percent.
2. The minority population percentage of the environmental impact area is significantly greater (typically at least 20 percentage points) than the minority population percentage in the geographic area chosen for comparative analysis.

For each of the 491 block groups within the 50-mile radius, SNC calculated the percent of the block group's population represented by each minority. If any block group minority percentage exceeded 50 percent, then the block group was identified as containing a minority population. SNC selected the entire states of Georgia and South Carolina as the geographic areas for comparative analysis, and calculated the percentage of each minority category for each state. If any block group percentage exceeded its corresponding state percentage by more than 20 percent, then the block group was identified as having minority population.

Census data for Georgia **(USCB 2000b)** characterizes 28.7 percent of the population as Black races; 0.3 percent American Indian or Alaskan Native; 2.1 percent Asian; 0.1 percent Native Hawaiian or other Pacific Islander; 2.4 percent all other single minorities; 1.4 percent multi-racial; 34.9 percent aggregate of minority races; and 5.3 percent Hispanic ethnicity.

Census data for South Carolina **(USCB 2000b)** characterizes 29.5 percent of the population as Black races; 0.3 percent American Indian or Alaskan Native; 0.9 percent Asian; 0.04 percent Native Hawaiian or other Pacific Islander; 1.0 percent all other single minorities; 1.0 percent multi-racial; 32.8 percent aggregate of minority races; and 2.4 percent Hispanic ethnicity. Table 2.5.4-1 and Figures 2.5.4-1 through 2.5.4-3 present the results of the analysis.

One hundred and seventy-five census block groups within the 50-mile radius have Black races populations that exceed the state average by 20 percent or more (Figure 2.5.4-1). Of those 175 block groups, 171 have Black races populations of 50 percent or more.

One hundred and sixty-eight census block groups within the 50-mile radius have aggregate minority population percentages that exceed the state average by 20 percentage points or more. One hundred and eighty-three census block groups within the 50-mile radius have aggregate minority population percentages that exceed 50 percent (Figure 2.5.4-2). Because both Georgia and South Carolina have relatively large percentages of aggregate minority populations, 34.9 and 32.8 percent, respectively, adding 20 percentage points to these averages equates to 54.9 and 52.8 percent, respectively. Therefore, there are more census block groups that meet the "50 percent" threshold criteria than the "20 percentage points greater than the state average" thresholds.

One census block group within the 50-mile radius has Hispanic ethnicity populations that exceed the state average by 20 percent or more. No census block group within the 50-mile radius had an Hispanic ethnicity population that exceed and 50 percent.

Based on the "more than 20 percent" or the "exceeded 50 percent" criteria, no American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; or multi-racial minorities exist in the geographic area. In addition, no populations defined as "all other single minority races" exceed these criteria.

2.5.4.3 Low-Income Populations

NRC guidance defines low-income households based on statistical poverty thresholds **(NRC 2004)**. A block group is considered low-income if either of the following two conditions is met:

1. The low-income population in the census block group or the environmental impact site exceeds 50 percent.
2. The percentage of households below the poverty level in an environmental impact site is significantly greater (typically at least 20 percentage points) than the low-income population percentage in the geographic area chosen for comparative analysis.

SNC divided USCB low-income households in each census block group by the total households for that block group to obtain the percentage of low-income households per block group. Using the states of Georgia and South Carolina as the geographical areas chosen for comparative analysis, SNC determined that 12.6 percent of Georgia and 14.1 percent of South Carolina households are low-income **(USCB 2000c)**. Table 2.5.4-1 identifies and Figure 2.5.4-4 locates the low-income block groups.

Seventy-two census block groups within the 50-mile radius have low-income households that exceed the state averages by 20 percent or more. Of those 72 block groups, 14 have 50 percent or more low-income households.

2.5.4.4 Migrant Populations

Information on migrants is difficult to collect and evaluate. However, the 2002 Census of Agriculture collected information on migrant workers. Farm operators were asked whether any hired or contract workers were migrant workers, defined as a farm worker whose employment required travel that prevented the worker from returning to his permanent place of residence the same day. In general, the migrant population in the 50-mile radius is expected to be low. Migrants tend to work such short-duration, labor-intensive jobs as harvesting fruits and vegetables. Table 2.5.4-2 provides information on farms in the region that employ migrant labor. Table 2.5.4-3 provides general information on agriculture in the region.

Table 2.5.1-1 Current Populations and Projections to 2090

Radii Distances (miles)

Sectors		0-1[1]	1-2[2]	2-3[2]	3-4[2]	4-5[2]	5-10[2]	Total 0-10[2]	10-20[2,3]	20-30[2,3]	30-40[3]	40-50[3]	Total 0-50[1]
N	**2000**	0	50	0	0	0	0	50	4,792	50,620	15,658	11,829	82,949
	2010	0	54	0	0	0	0	54	5,567	58,805	18,245	13,805	96,476
	2020	0	59	0	0	0	0	59	6,467	68,314	21,260	16,122	112,222
	2030	0	63	0	0	0	0	63	7,513	79,360	24,775	18,841	130,552
	2040	0	69	0	0	0	0	69	8,727	92,192	28,873	22,032	151,893
	2050	0	74	0	0	0	0	74	10,139	107,099	33,650	25,780	176,742
	2060	0	81	0	0	0	0	81	11,778	124,416	39,220	30,183	205,678
	2070	0	87	0	0	0	0	87	13,682	144,534	45,714	35,357	239,374
	2080	0	94	0	0	0	0	94	15,895	167,905	53,286	41,440	278,620
	2090	0	102	0	0	0	0	102	18,465	195,054	62,116	48,593	324,330
NNE	**2000**	0	0	0	0	0	0	0	2,523	7,966	4,245	6,919	21,653
	2010	0	0	0	0	0	0	0	2,931	9,254	4,931	8,166	25,282
	2020	0	0	0	0	0	0	0	3,404	10,750	5,729	9,644	29,527
	2030	0	0	0	0	0	0	0	3,955	12,489	6,655	11,400	34,499
	2040	0	0	0	0	0	0	0	4,594	14,508	7,731	13,488	40,321
	2050	0	0	0	0	0	0	0	5,337	16,854	8,981	15,971	47,143
	2060	0	0	0	0	0	0	0	6,199	19,579	10,434	18,929	55,141
	2070	0	0	0	0	0	0	0	7,201	22,745	12,121	22,455	64,522
	2080	0	0	0	0	0	0	0	8,365	26,423	14,081	26,664	75,533
	2090	0	0	0	0	0	0	0	9,718	30,695	16,357	31,692	88,462
NE	**2000**	0	0	0	0	0	0	0	0	5,997	3,590	6,904	16,491
	2010	0	0	0	0	0	0	0	0	6,683	3,985	7,672	18,340
	2020	0	0	0	0	0	0	0	0	7,456	4,431	8,558	20,445
	2030	0	0	0	0	0	0	0	0	8,327	4,936	9,581	22,844
	2040	0	0	0	0	0	0	0	0	9,309	5,508	10,769	25,586
	2050	0	0	0	0	0	0	0	0	10,419	6,158	12,151	28,728
	2060	0	0	0	0	0	0	0	0	11,674	6,896	13,765	32,335
	2070	0	0	0	0	0	0	0	0	13,094	7,735	15,656	36,485

Table 2.5.1-1 Current Populations and Projections to 2090 (cont.)

Radii Distances (miles)

Sectors		0-1[1]	1-2[2]	2-3[2]	3-4[2]	4-5[2]	5-10[2]	Total 0-10[2]	10-20[2,3]	20-30[2,3]	30-40[3]	40-50[3]	Total 0-50[1]
	2080	0	0	0	0	0	0	0	0	14,703	8,691	17,877	41,271
	2090	0	0	0	0	0	0	0	0	16,528	9,782	20,493	46,803
ENE	2000	0	0	0	0	0	0	0	554	9,612	11,414	10,641	32,221
	2010	0	0	0	0	0	0	0	602	10,449	11,633	10,928	33,612
	2020	0	0	0	0	0	0	0	655	11,359	11,901	11,243	35,158
	2030	0	0	0	0	0	0	0	712	12,348	12,221	11,587	36,868
	2040	0	0	0	0	0	0	0	774	13,423	12,596	11,961	38,754
	2050	0	0	0	0	0	0	0	841	14,591	13,029	12,367	40,828
	2060	0	0	0	0	0	0	0	914	15,862	13,525	12,805	43,106
	2070	0	0	0	0	0	0	0	994	17,242	14,087	13,278	45,601
	2080	0	0	0	0	0	0	0	1,080	18,744	14,721	13,786	48,331
	2090	0	0	0	0	0	0	0	1,174	20,376	15,431	14,331	51,312
E	2000	0	0	0	0	0	9	9	584	2,697	1,888	3,379	8,557
	2010	0	0	0	0	0	10	10	618	2,885	1,861	3,333	8,707
	2020	0	0	0	0	0	11	11	654	3,089	1,838	3,298	8,890
	2030	0	0	0	0	0	12	12	693	3,309	1,820	3,275	9,109
	2040	0	0	0	0	0	13	13	735	3,547	1,805	3,263	9,363
	2050	0	0	0	0	0	14	14	780	3,805	1,794	3,264	9,657
	2060	0	0	0	0	0	15	15	828	4,084	1,787	3,278	9,992
	2070	0	0	0	0	0	16	16	881	4,386	1,785	3,305	10,373
	2080	0	0	0	0	0	18	18	937	4,713	1,787	3,348	10,803
	2090	0	0	0	0	0	19	19	998	5,067	1,793	3,406	11,283
ESE	2000	0	0	0	16	1	257	274	221	5,536	6,348	8,909	21,288
	2010	0	0	0	17	1	277	295	228	5,667	6,685	9,694	22,569
	2020	0	0	0	19	1	298	318	235	5,800	7,046	10,549	23,948
	2030	0	0	0	20	1	321	342	242	5,937	7,433	11,479	25,433
	2040	0	0	0	22	1	346	369	249	6,077	7,848	12,492	27,035
	2050	0	0	0	24	1	373	398	257	6,221	8,293	13,595	28,764
	2060	0	0	0	26	2	401	429	265	6,368	8,771	14,795	30,628

Table 2.5.1-1 Current Populations and Projections to 2090 (cont.)

Radii Distances (miles)

Sectors		0-1[1]	1-2[2]	2-3[2]	3-4[2]	4-5[2]	5-10[2]	Total 0-10[2]	10-20[2,3]	20-30[2,3]	30-40[3]	40-50[3]	Total 0-50[1]
	2070	0	0	0	28	2	433	463	273	6,518	9,284	16,102	32,640
	2080	0	0	0	30	2	466	498	282	6,672	9,835	17,524	34,811
	2090	0	0	0	33	2	503	538	291	6,829	10,428	19,073	37,159
SE	2000	0	0	0	14	13	213	240	274	301	692	7,740	9,247
	2010	0	0	0	15	14	228	257	288	311	732	8,468	10,056
	2020	0	0	0	16	15	245	276	303	322	774	9,271	10,946
	2030	0	0	0	17	16	263	296	319	333	820	10,161	11,929
	2040	0	0	0	19	17	281	317	336	344	869	11,149	13,015
	2050	0	0	0	20	18	302	340	353	356	921	12,249	14,219
	2060	0	0	0	21	20	324	365	372	368	978	13,476	15,559
	2070	0	0	0	23	21	347	391	391	380	1,039	14,851	17,052
	2080	0	0	0	24	23	372	419	412	393	1,104	16,399	18,727
	2090	0	0	0	26	24	399	449	434	407	1,174	18,148	20,612
SSE	2000	0	0	26	0	0	750	776	716	6,465	2,713	2,695	13,365
	2010	0	0	28	0	0	804	832	754	6,764	2,841	3,329	14,520
	2020	0	0	30	0	0	862	892	794	7,078	2,975	4,198	15,937
	2030	0	0	32	0	0	924	956	836	7,406	3,116	5,399	17,713
	2040	0	0	34	0	0	991	1,025	881	7,749	3,263	7,071	19,989
	2050	0	0	37	0	0	1,063	1,100	928	8,108	3,417	9,409	22,962
	2060	0	0	39	0	0	1,139	1,178	977	8,483	3,579	12,693	26,910
	2070	0	0	42	0	0	1,222	1,264	1,030	8,876	3,749	17,324	32,243
	2080	0	0	45	0	0	1,310	1,355	1,085	9,287	3,926	23,869	39,522
	2090	0	0	49	0	0	1,404	1,453	1,144	9,717	4,113	33,141	49,568
S	2000	0	0	0	0	19	238	257	1,942	1,660	2,695	29,356	35,910
	2010	0	0	0	0	20	255	275	2,028	1,725	2,973	36,351	43,352
	2020	0	0	0	0	22	274	296	2,119	1,792	3,302	45,084	52,593
	2030	0	0	0	0	23	293	316	2,217	1,864	3,695	55,989	64,081
	2040	0	0	0	0	25	315	340	2,322	1,938	4,168	69,610	78,378
	2050	0	0	0	0	27	337	364	2,433	2,016	4,738	86,627	96,178

Table 2.5.1-1 Current Populations and Projections to 2090 (cont.)

Radii Distances (miles)

Sectors		0-1[1]	1-2[2]	2-3[2]	3-4[2]	4-5[2]	5-10[2]	Total 0-10[2]	10-20[2,3]	20-30[2,3]	30-40[3]	40-50[3]	Total 0-50[1]
	2060	0	0	0	0	29	362	391	2,552	2,099	5,429	107,891	118,362
	2070	0	0	0	0	31	388	419	2,679	2,185	6,272	134,466	146,021
	2080	0	0	0	0	33	416	449	2,815	2,275	7,303	167,684	180,526
	2090	0	0	0	0	36	446	482	2,959	2,369	8,568	209,208	223,586
SSW	**2000**	0	0	0	0	2	44	46	557	5,673	2,325	5,965	14,566
	2010	0	0	0	0	2	47	49	568	5,587	2,382	6,700	15,286
	2020	0	0	0	0	2	51	53	581	5,502	2,459	7,577	16,172
	2030	0	0	0	0	2	54	56	594	5,419	2,561	8,629	17,259
	2040	0	0	0	0	3	58	61	609	5,337	2,694	9,893	18,594
	2050	0	0	0	0	3	62	65	626	5,256	2,865	11,419	20,231
	2060	0	0	0	0	3	67	70	644	5,176	3,083	13,267	22,240
	2070	0	0	0	0	3	72	75	664	5,098	3,362	15,510	24,709
	2080	0	0	0	0	3	77	80	686	5,021	3,714	18,241	27,742
	2090	0	0	0	0	4	82	86	710	4,944	4,160	21,574	31,474
SW	**2000**	0	5	0	5	1	146	157	660	686	1,781	6,905	10,189
	2010	0	5	0	5	1	157	168	705	697	1,833	7,074	10,477
	2020	0	6	0	6	1	168	181	753	708	1,887	7,247	10,776
	2030	0	6	0	6	1	180	193	804	722	1,945	7,425	11,089
	2040	0	7	0	7	1	193	208	859	737	2,006	7,607	11,417
	2050	0	7	0	7	1	207	222	918	753	2,071	7,793	11,757
	2060	0	8	0	8	2	222	240	982	771	2,139	7,984	12,116
	2070	0	8	0	8	2	238	256	1,050	791	2,211	8,180	12,488
	2080	0	9	0	9	2	255	275	1,123	813	2,288	8,381	12,880
	2090	0	9	0	9	2	273	293	1,201	838	2,368	8,586	13,286
WSW	**2000**	0	0	14	60	17	577	668	6,970	603	5,480	5,697	19,418
	2010	0	0	15	64	18	619	716	7,473	647	5,492	5,642	19,970
	2020	0	0	16	69	20	663	768	8,013	693	5,518	5,595	20,587
	2030	0	0	17	74	21	711	823	8,591	743	5,556	5,556	21,269
	2040	0	0	19	79	22	763	883	9,211	797	5,609	5,525	22,025

Table 2.5.1-1 Current Populations and Projections to 2090 (cont.)

		Radii Distances (miles)											
Sectors		0-1[1]	1-2[2]	2-3[2]	3-4[2]	4-5[2]	5-10[2]	Total 0-10[2]	10-20[2,3]	20-30[2,3]	30-40[3]	40-50[3]	Total 0-50[1]
	2050	0	0	20	85	24	818	947	9,876	854	5,675	5,503	22,855
	2060	0	0	21	91	26	877	1,015	10,589	916	5,758	5,489	23,767
	2070	0	0	23	98	28	940	1,089	11,353	982	5,856	5,484	24,764
	2080	0	0	24	105	30	1,008	1,167	12,173	1,053	5,971	5,488	25,852
	2090	0	0	26	112	32	1,080	1,250	13,051	1,129	6,103	5,502	27,035
W	**2000**	0	0	53	7	3	297	360	3,279	1,250	5,231	3,404	13,524
	2010	0	0	57	8	3	318	386	3,516	1,331	5,080	3,369	13,682
	2020	0	0	61	8	3	341	413	3,769	1,418	4,934	3,339	13,873
	2030	0	0	65	9	4	366	444	4,042	1,512	4,794	3,312	14,104
	2040	0	0	70	9	4	392	475	4,333	1,613	4,660	3,290	14,371
	2050	0	0	75	10	4	421	510	4,646	1,721	4,531	3,271	14,679
	2060	0	0	81	11	5	451	548	4,981	1,837	4,407	3,256	15,029
	2070	0	0	86	11	5	484	586	5,341	1,962	4,288	3,246	15,423
	2080	0	0	93	12	5	519	629	5,727	2,097	4,175	3,240	15,868
	2090	0	0	99	13	6	556	674	6,140	2,241	4,067	3,237	16,359
WNW	**2000**	0	0	68	0	65	171	304	3,328	8,582	6,798	17,503	36,515
	2010	0	0	73	0	70	183	326	3,540	9,060	7,503	18,462	38,891
	2020	0	0	78	0	75	197	350	3,765	9,568	8,503	19,564	41,750
	2030	0	0	84	0	80	211	375	4,006	10,108	9,938	20,853	45,280
	2040	0	0	90	0	86	226	402	4,262	10,681	12,014	22,397	49,756
	2050	0	0	96	0	92	242	430	4,536	11,292	15,041	24,291	55,590
	2060	0	0	103	0	99	260	462	4,827	11,940	19,478	26,679	63,386
	2070	0	0	111	0	106	279	496	5,137	12,630	26,011	29,772	74,046
	2080	0	0	119	0	114	299	532	5,469	13,363	35,664	33,883	88,911
	2090	0	0	127	0	122	320	569	5,822	14,142	49,962	39,478	109,973
NW	**2000**	0	38	0	118	92	118	366	10,087	117,824	80,353	6,498	215,128
	2010	0	41	0	127	99	126	393	10,613	123,570	114,577	9,176	258,329
	2020	0	44	0	136	106	136	422	11,169	129,596	165,349	13,122	319,658
	2030	0	47	0	145	113	145	450	11,755	135,917	240,788	18,955	407,865

Table 2.5.1-1 Current Populations and Projections to 2090 (cont.)

Radii Distances (miles)

Sectors		0-1[1]	1-2[2]	2-3[2]	3-4[2]	4-5[2]	5-10[2]	Total 0-10[2]	10-20[2,3]	20-30[2,3]	30-40[3]	40-50[3]	Total 0-50[1]
	2040	0	50	0	156	122	156	484	12,373	142,545	353,009	27,595	536,006
	2050	0	54	0	167	130	167	518	13,027	149,497	520,082	40,420	723,544
	2060	0	58	0	179	140	179	556	13,717	156,787	768,966	59,478	999,504
	2070	0	62	0	192	150	192	596	14,447	164,434	1,139,874	87,830	1,407,181
	2080	0	66	0	206	161	206	639	15,219	172,453	1,692,801	130,037	2,011,149
	2090	0	71	0	221	172	221	685	16,035	180,863	2,517,245	192,905	2,907,733
NNW	**2000**	0	0	0	0	0	53	53	2,809	87,042	27,670	5,506	123,080
	2010	0	0	0	0	0	61	61	3,219	97,706	33,239	6,469	140,694
	2020	0	0	0	0	0	69	69	3,693	109,927	40,177	7,602	161,468
	2030	0	0	0	0	0	80	80	4,241	123,950	48,915	8,937	186,123
	2040	0	0	0	0	0	91	91	4,875	140,058	60,057	10,509	215,590
	2050	0	0	0	0	0	105	105	5,610	158,578	74,445	12,362	251,100
	2060	0	0	0	0	0	121	121	6,461	179,892	93,283	14,545	294,302
	2070	0	0	0	0	0	139	139	7,446	204,441	118,291	17,118	347,435
	2080	0	0	0	0	0	160	160	8,589	232,738	151,953	20,151	413,591
	2090	0	0	0	0	0	184	184	9,912	265,379	197,876	23,728	497,079
TOTAL	**2000**	0	93	161	220	213	2,873	3,560	39,296	312,514	178,881	139,850	674,101
	2010	0	100	173	236	228	3,085	3,822	42,650	341,141	223,992	158,638	770,243
	2020	0	109	185	254	245	3,315	4,108	46,374	373,372	288,083	182,013	893,950
	2030	0	116	198	271	261	3,560	4,406	50,520	409,744	379,968	211,379	1,056,017
	2040	0	126	213	292	281	3,825	4,737	55,140	450,855	512,710	248,651	1,272,093
	2050	0	135	228	313	300	4,111	5,087	60,307	497,420	705,691	296,472	1,564,977
	2060	0	147	244	336	326	4,418	5,471	66,086	550,252	987,733	358,513	1,968,055
	2070	0	157	262	360	348	4,750	5,877	72,569	610,298	1,401,679	439,934	2,530,357
	2080	0	169	281	386	373	5,106	6,315	79,857	678,653	2,011,300	548,012	3,324,137
	2090	0	182	301	414	400	5,487	6,784	88,054	756,578	2,911,543	693,095	4,456,054

1 Within the 10-mile radius, the transient population has been deleted from the west, 0-1 mile sector, as the data are not accurate for new units.

2 SRS population (all transients in sectors N,NNE, NE, ENE, E, ESE; see Figure 2.5.1-1) is not included because SRS has an emergency plan that would be activated in a Vogtle emergency, therefore that transient population is not considered in the VEGP emergency plan.

3 Does not include transient population.

Table 2.5.1-2 Counties within 50 Miles of the VEGP Site

Georgia Counties	South Carolina Counties
Bulloch	Aiken
Burke	Allendale
Candler	Bamberg
Columbia	Barnwell
Effingham	Colleton
Emanuel	Edgefield
Glascock	Hampton
Jefferson	Jasper
Jenkins	Lexington
Johnson	McCormick
Lincoln	Orangeburg
McDuffie	Saluda
Richmond	
Screven	
Warren	
Washington	

Table 2.5.1-3 Municipalities in the 50-Mile Region

Municipality	2000 Population	Distance from VEGP (miles)	Direction
Georgia			
Augusta	195,182	26	NNW
Evans	17,727	34	NW
Girard	227	8	SSE
Hephzibah	3,880	25	WNW
Louisville	2,712	38	WSW
Martinez	27,749	31	NW
Millen	3,492	24	SSW
Sardis	1,171	11	S
Statesboro	22,698	46	S
Swainsboro	6,943	50	SW
Sylvania	2,675	27	SSE
Thomson	6,827	46	WNW
Wadley	2,088	40	WSW
Waynesboro	5,813	16	WSW
South Carolina			
Aiken	25,337	29	N
Allendale	4,052	28	ESE
Barnwell	5,035	25	ENE
Blackville	2,973	33	ENE
Edgefield	4,449	45	NNW
Hampton	3,857	36	ESE
Jackson	1,625	15	N
New Ellenton	2,250	20	NNE
North Augusta	17,574	26	NNW
Williston	3,307	28	NE

Table 2.5.1-4 Population Growth in the Three Counties and the State of Georgia, 1970 to 2015

	Burke		Richmond		Columbia		Georgia	
	Population	Annual Percent Growth	Population	Annual Percent Growth	Population	Annual Percent Growth	Population	Annual Percent Growth
1970[1]	18,255	N/A	162,437	N/A	22,327	N/A	4,589,575	N/A
1980[1]	19,349	0.6	181,629	1.1	40,118	6.0	5,463,105	1.8
1990[1]	20,579	0.6	189,719	0.4	66,031	5.1	6,478,216	1.7
2000[2]	22,243	0.8	199,775	0.5	89,288	3.1	8,186,453	2.4
2010[3]	24,561	1.0	193,914	-0.3	116,642	2.7	9,864,970	1.9
2015[3]	25,765	1.0	191,563	-0.2	132,303	2.6	10,813,573	1.9

1 **USCB 1995**
2 **USCB 2000a**
3 **Georgia 2005**

Table 2.5.1-5 Age Distribution of Population in 2000 for the Three Counties and State of Georgia

	Burke		Richmond		Columbia		Georgia	
Age Group	Number	Percent of Population	Number	Percent of Population	Number	Percent of Population	Number	Percent of Population
Under 18	6,954	31.3	53,608	26.8	26,430	29.6	2,169,234	26.5
18 to 24	2,032	9.1	23,881	12.0	6,504	7.3	837,732	10.2
25 to 44	6,072	27.3	59,686	29.9	27,679	31.0	2,652,764	32.4
45 to 64	4,769	21.4	40,955	20.5	21,545	24.1	1,741,448	21.3
65 and over	2,416	10.9	21,645	10.8	7,130	8.0	785,275	9.6
Totals	22,243	100.0	199,775	100.0	89,288	100.0	8,186,453	100.0

Source: **USCB 2000d**

Table 2.5.2-1 Employment by Industry - 1990 and 2000

County	Burke		Richmond		Columbia		Total		Avg. Annual Growth Percent (3 counties)
Year	**1990**	**2000**	**1990**	**2000**	**1990**	**2000**	**1990**	**2000**	**1990-2000**
Total Employment	8,313	9,086	129,509	135,974	18,859	32,489	156,681	177,549	1.3
Wage and Salary Employment	7,170	7,418	120,858	125,103	14,714	23,195	142,742	155,716	0.9
Proprietors Employment	1,143	1,668	8,651	10,871	4,145	9,294	13,939	21,833	4.6
Farm	759	592	178	167	259	285	1,196	1,044	-1.4
Agricultural Services, Forestry, Fishing and Other	106	214	411	612	296	(1)	813	826	0.2
Mining	(2)	(2)	133	113	36	(1)	169	113	-3.9
Construction	178	(a)	9,439	7,052	2,304	3,373	11,921	10,425	-1.3
Manufacturing	1,473	1,523	14,016	13,436	2,700	3,333	18,189	18,292	0.1
Transportation and Utilities	(1)	(1)	3,320	5,132	445	840	3,765	5,972	4.7
Wholesale Trade	223	343	4,496	3,403	517	760	5,236	4,506	-1.5
Retail Trade	1,037	1,203	22,979	23,861	3,028	6,825	27,044	31,889	1.7
Finance, Insurance, and Real Estate	220	279	5,789	5,148	1,665	2,993	7,674	8,420	0.9
Services	(1)	1,813	31,348	38,728	4,880	10,027	36,228	50,568	3.4
Government	1,471	1,584	37,400	38,322	2,729	3,434	41,600	43,340	0.4

Source: **BEA 2005a**

1 Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.

2 Less than 10 jobs, but the estimates for this item are included in the totals.

Table 2.5.2-2 Top 10 Employers Located in the Augusta, Georgia Area

U.S. Army -- Fort Gordon	Augusta/Richmond County Government
Medical College of Georgia	Georgia Department of Human Resources
Richmond County Schools	U.S. Veterans Administration Services
University Health Services	Columbia County School System
MCG Health Incorporated	Wal-Mart Associates

Source: **GDOL 2004**

Note: SRS is not included in this list because it is not physically located in Georgia. However, SRS is one of the largest employers in the Augusta-Richmond County, GA-SC MSA.

Table 2.5.2-3 Employment Trends - 1995 - 2004

	Burke			Richmond			Columbia			Total			Georgia		
	1995	**2004**	**Avg. Annual Change (percent)**	**1995**	**2004**	**Avg. Annual Change (percent)**	**1995**	**2004**	**Avg. Annual Change (percent)**	**1995**	**2004**	**Avg. Annual Change (percent)**	**1995**	**2004**	**Avg. Annual Change (percent)**
Labor Force	8,709	9,337	0.8	81,641	84,940	0.4	40,211	46,791	1.7	130,561	141,068	0.9	3,699,727	4,390,395	2.0
Employed	7,516	8,401	1.2	75,814	79,695	0.6	38,567	45,173	1.8	121,897	133,269	1.0	3,522,905	4,188,271	1.9
Unemployed	1,193	936	-2.7	5,827	5,245	-1.2	1,644	1,618	-0.2	8,664	7,799	-1.2	176,822	202,124	1.5
Unemployment Rate	13.7%	10.0%		7.1%	6.2%		4.1%	3.5%		6.6%	5.5%		4.8%	4.6%	

Sources: **BLS 2005**

Table 2.5.2-4 Personal Income - 1990, 2000, and 2003

	1990	2000	2003	Avg. Annual Growth percent (1990-2003)
Georgia	$17,603	$27,989	$29,000	3.9
Burke County	$11,902	$17,407	$19,215	3.8
Richmond County	$16,931	$22,105	$24,320	2.8
Columbia County	$19,584	$29,751	$31,562	3.7

Source: **BEA 2005b**

Table 2.5.2-5 Road and Highway Mileage within the Three Counties (2004)

		Mileage						
County	Total Road Mileage	State Routes	County Roads	City Streets	Unpaved Mileage Total	Unpaved Mileage (Percent of Total)	Paved Mileage Total	Paved Mileage (Percent of Total)
Burke	1,063	204	810	49	437	41	626	59
Columbia	749	129	588	32	101	13	648	87
Richmond	1,104	135	947	22	33	3	1,071	97
Total:	**2,916**	**468**	**2345**	**103**	**571**	**20**	**2,345**	**80**

Source: **GDOT 2004a**

Table 2.5.2-6 Statistics for Most Likely Routes to the VEGP Site[1]

	Roadway and Location	Number of Lanes	GDOT Road Classification	Traffic Count Marker	Average Annual Daily Traffic (AADT) for 2004
	Columbia County				
1	State Route 104 (between Evans and the SR 104/SR 232 interchange)	4	Urban Principal Arterial	143[b]	33,437
2	State Route 104 (between Pollard's Corner and Evans, near Tubman Road)	2	Minor Arterial (R)[3]	147	7,456
3	Interstate 20 (between the US Route 221/Interstate 20 intersection and the SR 388/ Interstate 20 intersection)	4	Interstate Principal Arterial (R and U)	194	41,538
4	Interstate 20 (between the SR 338/Interstate 20 intersection and the SR 383/Interstate 20 intersection)	4	Interstate Principal Arterial (U)	196	52,957
5	Interstate 20 (between the SR 383/Interstate 20 intersection and the SR 232/Interstate 20 intersection)	4-6	Interstate Principal Arterial (U)	198	54,381
6	County Road 176 (just south of Evans)	2	Minor Arterial Street (U)	209	8,132
7	State Road 383 (between Evans and the SR 383/SR 232 intersection)	3-4	Urban Principal Arterial	223	18,833
8	County Road 575 (between Harlem and Grovetown)	2	Major Collector (R)/ Minor Arterial Street (U)	238	5,005
9	State Road 388 (between Grovetown and the SR 388/ Interstate 20 interchange)	2	Minor Arterial Street (U)	258	10,664
	Richmond County				
10	State Route 56 (near Clark Road and Richmond/Burke County border)	4	Minor Arterial Street (U)	132[b]	8,889

Table 2.5.2-6 (cont.) Statistics for Most Likely Routes to the VEGP Site[1]

	Roadway and Location	Number of Lanes	GDOT Road Classification	Traffic Count Marker	Average Annual Daily Traffic (AADT) for 2004
11	State Route 56 (north of Browns Road intersection)	4	Minor Arterial Street (U)	138[b]	13,139
12	State Route 56 (south of Tobacco Road intersection)	4	Minor Arterial Street (U)	141[b]	18,311
13	State Route 56 (just north of Phinizy Road intersection)	4	Urban Principal Arterial	143[b]	25,249
14	US Route 25 (between the US Route 25/Interstate 520 intersection and the US Route 25/Rozier Road intersection)	6	Urban Principal Arterial	196	30,346
	Richmond County (cont.)				
15	Interstate 20 (between the Interstate 20/Wheeler Road intersection and the Interstate 20/Interstate 520 intersection)	4-6	Interstate Principal Arterial (U)	214[b]	54,373
16	Interstate 20 (between the Interstate 20/Interstate 520 intersection and the Interstate 20/State Route 28 intersection)	4	Interstate Principal Arterial (U)	216	62,100
17	Interstate 520 (just south of the Interstate 20/Interstate 520 intersection)	5-6	Interstate Principal Arterial (U)	221	74,696
18	Interstate 520 (between the Interstate 520/US Route 1 intersection and the Interstate 520/Richmond Road intersection)	4	Interstate Principal Arterial (U)	228	58,996
19	County Road 1504 (Hephzibah-McBean Road) (between Hephzibah and the CR 1504/US Route 25 intersection)	2	Minor Arterial Street (U)	234	1,571
20	County Road 1503 (Tobacco Road) (between the US Route 25/CR 1503 intersection and the SR 56/CR 1503 intersection)	4	Urban Principal Arterial	272[b]	7,778

Table 2.5.2-6 (cont.) Statistics for Most Likely Routes to the VEGP Site[1]

	Roadway and Location	Number of Lanes	GDOT Road Classification	Traffic Count Marker	Average Annual Daily Traffic (AADT) for 2004
21	County Road 1514 (Browns Road) (between the CR 1514/ Liberty Road intersection and the CR 1514/CR 1516 [Waynesboro Road] intersection)	2	Minor Arterial Street (U)	289	3,322
	Burke County				
22	State Route 23 (outside Girard heading southeast)	2	Major Collector (R)	117	1,735
23	State Route 23 (outside Girard heading northwest)	2	Major Collector (R)	121	2,473
24	State Route 23 (between Girard and SR 23/SR 80 interchange, near Rouse Stone Road)	2	Major Collector (R)	123	2,240
25	State Route 23 (between SR 56/ SR 23 interchange and SR 23/ SR 80 interchange)	2	Major Collector (R)	125	3,049
26	State Route 24 (intersection of SR 56, SR 24 and SR 80)	2	Major Collector (R) Minor Arterial (R)	149	4,654
	Burke County (cont.)				
27	State Route 56 (at McBean Club Road)	2	Minor Arterial (R)	159	887
28	State Route 80 (approximately 2 miles west of State Route 23)	2	Major Collector (R)	187	927
29	State Route 80 (approximately 3 miles east of State Route 23)	2	Major Collector (R)	189	264
30	State Route 56 (northeast of Waynesboro, near Thompson Road)	2	Minor Arterial (R)	171	8,303
31	US Route 25 (State Route 121) – from Augusta (near Hunnicutt Road)	2	Principal Arterial (R)	211	8,332
32	County Road 455 (Story Mill Road) – from Hephzibah (near CR 456)	2	Major Collector (R)	267	804

Table 2.5.2-6 (cont.) Statistics for Most Likely Routes to the VEGP Site[1]

	Roadway and Location	Number of Lanes	GDOT Road Classification	Traffic Count Marker	Average Annual Daily Traffic (AADT) for 2004
33	County Road 59 (River Road) (near CR 57 [Hatcher Road])	2	Major Collector (R)	269	1,277
34	County Road 57 (Hatcher Road) (west of SR 23 intersection)	2	Major Collector (R)	279	534
35	County Road 57 (Hatcher Road) (east of SR 23 intersection)	2	Local (R)	279	534

Sources: **GDOT 1987a, 1987b, 1992, 1999, 2004b, NATRB 2000**.

1 See also Figures 2.5.2-1 and 2.5.2-2. The traffic counts are identified on the figures with numbers that correspond to the numbers on this table.

2 Traffic counts for both directions of route.

3 R= Rural; U = Urban. "R" or "U" designation is included if not apparent from definition of roadway.

Table 2.5.2-7 Major Airports within 50 Miles of VEGP

Airport Name	Closest City	Type of Airport
Georgia		
Daniel Field	Augusta	General Aviation Airport
Bush Field	Augusta	Business Airport of Regional Impact and Commercial Service
Louisville Municipal Airport	Louisville	Business Airport of Regional Impact
Millen Airport	Millen	General Aviation Airport
Statesboro Municipal Airport	Statesboro	Business Airport of Regional Impact
Emmanuel County Airport	Swainsboro	Business Airport of Local Impact
Plantation Airport	Sylvania	Business Airport of Local Impact
Burke County Airport	Waynesboro	General Aviation Airport
Wrens Memorial Airport	Wrens	General Aviation Airport
South Carolina		
Aiken Municipal Airport	Aiken	Public
Twin Lakes Airport	Graniteville	Public (Privately Owned)
Edgefield County Airport	Trenton	Public
Barnwell County Airport	Barnwell	Public
Allendale County Airport	Allendale	Public
Hampton-Varnville Airport	Hampton	Public
Bamburg County Airport	Bamberg	Public

Source: **GDOT 2003b, SCDOC 2005**

Table 2.5.2-8 Property Tax Information, 2000-2004

Year	Total Burke County Property Tax Revenues ($)	Burke County Tax Revenues Disbursed to the Burke County School District ($)	Property Tax Paid by SNC ($)	Percent of Total Property Taxes
2000	30,329,024	19,116,331	24,930,927	82.2
2001	30,758,563	18,691,850	25,276,404	82.2
2002	29,713,972	18,022,492	23,699,476	79.8
2003	30,029,880	18,160,393	24,341,247	81.1
2004	29,805,738	17,838,847	24,358,042	81.7

Table 2.5.2-9 Recreation Areas Within 50-Miles of VEGP[1]

Name	Acreage	Location	Annual Visitors	Overnight Facilities
Wildlife Management Areas[1]				
		Georgia		
Phinizy Swamp	1,500	Richmond County	No information available	No overnight facilities at WMAs.
Alexander	1,300	Burke County	No information available	
DiLane	8,100	Burke County	No information available	
Yuchi	7,800	Burke County; less than 10 miles from VEGP	No information available	
Mead Farm	200	Burke County, less than 10 miles from VEGP	No information available	
Hiltonia Tract	500	Hiltonia, Screven County	No information available	
Tuckahoe	15,100	Sylvania, Screven County	No information available	
		South Carolina		
Crackerneck	10,470	Aiken County; less than 10 air miles from VEGP	3,100	
Gopher Tortoise Heritage Preserve	1,395	Aiken County	No information available	

Table 2.5.2-9 (cont.) Recreation Areas Within 50-Miles of VEGP[1]

Name	Acreage	Location	Annual Visitors	Overnight Facilities
State Parks				
		Georgia		
Magnolia Springs	1,071	Millen, Jenkins County	120,500	P
George L. Smith	1,634	Twin City, Emanuel County	44,136	P
Mistletoe State Park	1,920	Appling, Columbia County	132,314	P
Wildwood Park	975	Columbia County	141,751	P
		South Carolina		
Hamilton Branch	731	Plum Branch, McCormick County	117,200	P
Aiken Natural Area	1,067	Windsor, Aiken County	42,645	P
Redcliffe Plantation	369	Beech Island, Aiken County	2,400	–
Barnwell	300	Blackville, Barnwell County	76,845	P
Rivers Bridge	390	Ehrhardt, Bamberg County	6,027	–
Lake Warren	440	Hampton, Hampton County	49,962	P

Sources: **GDNR 2004, Georgia Outdoor 2003, SCDNR 2005, SCDPRT 2005, Burke County 2004**,

1 Visitor records not kept except for Crackerneck which is part of SRS land area.

Table 2.5.2-10 Housing, 1990-2000

	Burke			Richmond			Columbia			Three-County Total		
	1990	2000	Avg. Annual Change (percent)	1990	2000	Avg. Annual Change (percent)	1990	2000	Avg. Annual Change (percent)	1990	2000	Avg. Annual Change (percent)
Total Housing Units	8,329	8,842	0.6	77,288	82,312	0.6	23,745	33,321	3.4	109,362	124,475	1.3
Occupied	7,037	7,934	1.2	68,675	73,920	0.7	21,841	31,120	3.6	97,553	112,974	1.5
Owner-Occupied	4,981	6,030	1.9	38,762	42,840	1.0	17,322	25,557	4.0	61,065	74,427	2.0
Renter-Occupied	2,056	1,904	-0.8	29,913	31,080	0.4	4,519	5,563	2.1	36,488	38,547	0.6
Vacant Units	1,292	908	-3.5	8,613	8,392	-0.3	1,904	2,201	1.5	11,809	11,501	-0.3

Sources: **USCB 1990; 2000e**

Table 2.5.2-11 Housing in Communities Closest to VEGP, 1990-2000

	Waynesboro			Millen			Sylvania		
	1990	2000	Avg. Annual Change (percent)	1990	2000	Avg. Annual Change (percent)	1990	2000	Avg. Annual Change (percent)
Total Housing Units	2,223	2,395	0.7	1,496	1,567	0.5	1,237	1,285	0.4
Occupied	2,018	2,151	0.6	1,369	1,321	-0.4	1,147	1,088	-0.5
Owner-Occupied	1,176	1,177	0.0	896	849	-0.5	711	683	-0.4
Renter-Occupied	842	974	1.5	473	472	0.0	436	405	-0.7
Vacant Units	205	244	1.8	127	246	6.8	90	197	8.1

Sources: **USCB 1990, 2000f**.

Table 2.5.2-12 State-Regulated Public Water Systems in the Three County Area, 2005[1]

System Name	Permitted *Annual* Average Withdrawal (MGD)	Reported *Annual* Average Withdrawal (MGD)	Population Served – Groundwater and Surface Water
	Groundwater		
Burke County			
Waynesboro	3.50	0.79	5,813
Sardis	0.40	0.07	1,152
Columbia County			
Columbia County	0.58	0.00	77,280
Grovetown	0.90	0.13	5,500
Harlem	0.25	0.02	4,290
Richmond County			
Augusta-Richmond County Water System	17.40	8.40	200,000
Hephzibah	1.20	0.34	3,011

System Name	Permitted *Monthly* Average Withdrawal (MGD)	Reported *Monthly* Average Withdrawal – 12 Month Range (MGD)	Population Served – Groundwater and Surface Water
	Surface Water		
Burke County			
Waynesboro	1.00	0.10 – 0.19	5,813
Sardis	N/A	N/A	1,152
Columbia County			
Columbia County – Permit # 036-0109-04	8.0	0.82 – 2.69	77,280
Columbia County – Permit # 036-0110-01	31.00	7.53 – 15.09	Included above
Grovetown	N/A	N/A	5,500
Harlem	N/A	N/A	4,290
Richmond County			
Augusta-Richmond County Water System – Permit # 121-0191-06	45.00	24.40 – 35.10	200,000
Augusta-Richmond County Water System – Permit # 121-0191-09	15.00	0.00 – 9.24	Included above
Hephzibah	N/A	N/A	3,011

Sources: **EPA 2005**

N/A System does not use this type of water.

1 Systems using 100,000 or more gallons of water per day.

Table 2.5.2-13 Largest Public Waste Water Treatment Systems in the Three County Area

System Name	Average Daily Waste Water Processed (MGD)	Maximum Capacity (MGD)
Burke County		
Waynesboro	1.0	2.0
Sardis[1]	0.043	0.20
Columbia County		
Kiokee Creek [1]	0.02	0.30
Crawford Creek	1.00	1.50
Little River	2.50	3.00
Reed Creek	3.30	4.60
Richmond County		
Augusta-Richmond-J. B. Messerly Plant	31.00	46.20

1 Not included in the analysis of sufficient capacity in Chapter 4.

Table 2.5.2-14 Police and Fire Protection, 2001

County	Total Population[1]	Police	Ratio of Residents per Police Officer	Firefighters (full time and volunteer)	Ratio of Residents per Firefighter
Burke	22,243	82	271:1	25	890
Richmond	199,775	200	998:1	300	666
Columbia	89,288	90	992:1	132	676:1

Source: **CSRARDC 2005**
1 **USCB 2000e**

Table 2.5.2-15 Medical Facility and Personnel Data, 2000

County	Hospital beds per 1,000 population	Physicians per 1,000 population
Burke	1.7	0.6
Richmond	10.1	6.1
Columbia	0	0.5

Source: **GDCA 2002**

Table 2.5.2-16 Number and Type of Public Grade Schools in Burke, Columbia and Richmond Counties

	Number and Types of Schools								
		Elementary		Middle		High School		Alternative/	
County	Primary[1]	Current	Proposed	Current	Proposed	Current	Proposed	Magnet	Total
Burke	1	2	0	1	0	1	0	1	6
Columbia	0	15	1	7	1	4	1	1	30
Richmond	0	34	2	10	0	8	0	7[2]	60
Subtotals:	1	51	3	18	1	13	1	8	96

Source: **GSCI 2005**.

1 Burke County has primary schools for pre-kindergarten through second grade.

2 3 – alternatives, 3 – magnets, 1 – proposed magnet

Table 2.5.2-17 Two-Year and Four-Year Colleges within 50-Miles of VEGP

College	Total Enrollment[1]	
Georgia		
4-Year		
Augusta State University, Augusta	6,386	
Medical College of Georgia, Augusta	2,115	
Paine College, Augusta	882	
Georgia Southern University, Statesboro	16,100	
2-Year		
Augusta Technical College, Augusta	4,351	
Ogeechee Technical College, Statesboro	2,081	(2003)
East Georgia College, Swainsboro	1,420	(2003)
Swainsboro Technical College, Swainsboro	662	(2003)
South Carolina		
4-Year		
University of South Carolina, Aiken	3,382	
Voorhees College, Denmark	662	
2-Year		
Aiken Technical College, Aiken	2,503	(2003)
Denmark Technical College, Denmark	1,464	(2003)
University of South Carolina - Salkehatchie, Allendale	789	(2003)

Sources: **NCES 2003, ASU 2005, MCG 2005, GSU 2005, Lunch-Money.com 2005, USCA 2005**

1 All enrollment for 2004 unless otherwise noted.

Table 2.5.3-1 National Register of Historic Sites in Burke County, Georgia

Resource Name	Address	City	Distance from VEGP
Burke County Courthouse	Courthouse Square	Waynesboro	15 miles
Haven Memorial Methodist Episcopal Church	Barron St., South of Junction of Barron St. and 6^{th} St.	Waynesboro	15 miles
Hopeful Baptist Church	Winter Rd., East of Junction with Blythe Road	Keysville	30 miles
John James Jones house	525 Jones Ave.	Waynesboro	15 miles
McCanaan Missionary Baptist Church and Cemetery	McCanaan Church Road	Sardis	12 miles
Sapp Plantation	NW of Sardis on GA 24	Sardis	10 miles
Waynesboro Commercial Historic District	E. 6^{th}, E. 7^{th}, E. 8^{th}, S. Liberty, and Myrick Streets	Waynesboro	15 miles

Source: **NPS 2005.**

Table 2.5.3-2 Historic or Archaeological Sites Identified During a 2005 Survey of the Proposed New Units' Footprint

Site Number / Location	Description	Eligibility
9BK414; on plateau W of Mallard Pond	Homesite, likely the W. M. Buxton home	
9BK415; just W of railroad cut and approximately 2000 ft E of the nearest site boundary	Homesite identified from a 1989 topographic map that noted a home and outbuilding	
9BK416; on river bluff at location of Barge Option 2	Large multicomponent prehistoric site	Eligible; Barge Option 2 not being pursued; proposed intake structure moved upstream to avoid as much of the site as possible
9BK417; N of road to barge landing and intake	Liquor still	
9BK418; overlooking headwaters of Mallard Pond; composed of dirt road and landfill pit	Undiagnostic lithic scatter	
9BK419; under transmission line from existing switchyard to Plant Wilson [a]	Woodland prehistoric site	Potentially eligible
9BK420; under transmission line to Plant Wilson on ridge overlooking Savannah River [a]	Undiagnostic lithic site	Potentially eligible
9BK421; under SCE&G transmission line; bench of a ridge side overlooking Savannah River	Undiagnostic lithic scatter	
9BK422; near the training center overlooking Beaverdam Creek	Small scatter of historic and prehistoric artifacts; disturbed by logging and clearcutting	
9BK423; on a small bench above the floodplain in the vicinity of the proposed intake location	Multicomponent prehistoric campsite	Eligible

[a] Surveyed because original plan was to reroute Thalmann line to this right-of-way. This right-of-way no longer subject to construction due to reroute.

Table 2.5.3-3 National Register of Historic Sites in Burke, Jefferson, McDuffie, and Warren Counties, Georgia

Resource Name	Address	City	Distance from VEGP
	Burke County		
Burke County Courthouse	Courthouse Square	Waynesboro	15 miles
Haven Memorial Methodist Episcopal Church (also known as Haven-Munnerlyn United Methodist Church)	Barron Street, South of Junction of Barron Street and 6th Street	Waynesboro	15 miles
Hopeful Baptist Church	Winter Road, East of Junction with Blythe Road	Keysville	30 miles
John James Jones House (also known as Jones-Cox House and The Shadows)	525 Jones Avenue	Waynesboro	15 miles
McCanaan Missionary Baptist Church and Cemetery (also known as First McCanaan Baptist Church)	McCanaan Church Road	Sardis	12 miles
Sapp Plantation	NW of Sardis on GA 24	Sardis	10 miles
Waynesboro Commercial Historic District	E. 6th, E. 7th, E. 8th, S. Liberty, and Myrick Streets	Waynesboro	15 miles
	Jefferson County		
Cunningham-Coleman House	SE of Wadley	Wadley	
Jefferson County Courthouse	Courthouse Square	Louisville	
Louisville Commercial Historic District	Area surrounding Broad Street between Peachtree and Screven Streets, including parts of Walnut, Mulberry and Green Streets	Louisville	
Old Market (also known as Slave Market)	US 1 and GA 24 (designated by monument/ marker)	Louisville	

Table 2.5.3-3 (cont.) National Register of Historic Sites in Burke, Jefferson, McDuffie, and Warren Counties,

Resource Name	Address	City	Distance from VEGP
Bridge over Rocky Comfort Creek[1]	Unavailable	Unavailable	
	McDuffie County		
Boneville Historic District	Junction of Boneville Road, and GA RR, approximately 5 miles SE of Thomson	Boneville	
Bowdre-Rees-Knox House (also known as Half Way House)	SW of Thomson on Old Wrightsboro Road	Thomas	
Carr, Thomas District	North of Thomson near Junction of GA 150 and I-20	Thomson	
Hayes Line Historic District	Junction of Twin Oaks Road and GA 233	Thomson	
Hickory Hill (also known as Thomas E. Watson House)	Hickory Hill Drive and Lee Street	Thomson	
Hillman-Bowden House (also known as Pylant Place)	1348 Pyland Crossing Road	Thomson	
James L. Hardaway House	Old Mesena Road, West of Thomson	Thomson	
McNeill House	220 Lee Street	Thomson	
Old Rock House	Northwest of Thomson on Old Rock House Road	Thomson	
Pine Top Farm (also known as John S. Watson Homeplace)	Junction of US 78 and US 278, 2 miles East of Thomson	Thomson	
Sweetwater Inn	Off GA 17 on Old Milledgeville Road	Thomson	
Thomson Commercial Historic District	Bounded by Journal, Greenway, Railroad, Hendricks, and Church Streets	Thomson	
Usry House	211 Milledge Street	Thomson	

Table 2.5.3-3 (cont.) National Register of Historic Sites in Burke, Jefferson, McDuffie, and Warren Counties,

Resource Name	Address	City	Distance from VEGP
Wrightsboro Historic District (also known as Wrightsboro, Quaker Reserve, Wrightsboro Township)	Wrightsboro Road, East of Ridge Road	Wrightsboro	
New Waycross Historic District	Unavailable	Unavailable	
	Warren County		
Jewell Historic District	GA 248 and GA 16	Jewell	
Roberts-McGregor House	Depot Street	Warrenton	
Warren County Courthouse	Courthouse Square	Warrenton	
Warrenton Downtown Historic District	Entered at the Junction of Main and Depot Streets	Warrenton	
Warrenton Gymnasium-Auditorium	304 South Gibson Street	Warrenton	

Source: **NationalRegisterofHistoricPlaces.com. ND a,b,c,d**

[1] Determined eligible.

Table 2.5.4-1 Minority and Low-Income Population Census Blocks within 50-Mile Radius of VEGP Site

Block Groups Where Minorities and Low-Income Populations Exceed the State Averages by 20 Percent or More[1]

State	County	Total Block Groups	Minority								Low-Income (Households)
			Black Races	American Indian or Native Alaskan	Asian	Native Hawaiian or Other Pacific Islander	Other	Multi-Racial	Aggregate[2]	Hispanic	
Georgia	Bulloch	30	7	0	0	0	0	0	7	0	10
Georgia	Burke	18	11	0	0	0	0	0	11	0	7
Georgia	Candler	3	0	0	0	0	0	0	0	0	0
Georgia	Columbia	30	1	0	0	0	0	0	1	0	0
Georgia	Effingham	2	0	0	0	0	0	0	0	0	0
Georgia	Emanuel	12	2	0	0	0	0	0	2	0	2
Georgia	Glascock	3	0	0	0	0	0	0	0	0	0
Georgia	Jefferson	17	11	0	0	0	0	0	10	0	4
Georgia	Jenkins	8	2	0	0	0	0	0	1	0	2
Georgia	Johnson	1	0	0	0	0	0	0	0	0	0
Georgia	Lincoln	2	0	0	0	0	0	0	0	0	0
Georgia	McDuffie	19	7	0	0	0	0	0	6	0	0
Georgia	Richmond	125	63	0	0	0	0	0	61	0	30
Georgia	Screven	14	5	0	0	0	0	0	4	0	0
Georgia	Warren	1	0	0	0	0	0	0	0	0	0
Georgia	Washington	2	2	0	0	0	0	0	2	0	0
South Carolina	Aiken	101	17	0	0	0	0	0	17	1	6
South Carolina	Allendale	11	10	0	0	0	0	0	10	0	5
South Carolina	Bamberg	17	9	0	0	0	0	0	9	0	3
South Carolina	Barnwell	19	8	0	0	0	0	0	8	0	1
South Carolina	Colleton	2	0	0	0	0	0	0	0	0	0
South Carolina	Edgefield	15	7	0	0	0	0	0	6	0	1
South Carolina	Hampton	13	6	0	0	0	0	0	6	0	1

Table 2.5.4-1 (cont.) Minority and Low-Income Population Census Blocks within 50-Mile Radius of VEGP Site

Block Groups Where Minorities and Low-Income Populations Exceed the State Averages by 20 Percent or More[1]

			Minority								
State	County	Total Block Groups	Black Races	American Indian or Native Alaskan	Asian	Native Hawaiian or Other Pacific Islander	Other	Multi-Racial	Aggregate[2]	Hispanic	Low-Income (Households)
South Carolina	Jasper	2	1	0	0	0	0	0	1	0	0
South Carolina	Lexington	6	0	0	0	0	0	0	0	0	0
South Carolina	McCormick	1	0	0	0	0	0	0	0	0	0
South Carolina	Orangeburg	13	4	0	0	0	0	0	4	0	0
South Carolina	Saluda	4	2	0	0	0	0	0	2	0	0
Totals:		491	175	0	0	0	0	0	168	1	72
Georgia	Bulloch	30	7	0	0	0	0	0	7	0	3
Georgia	Burke	18	11	0	0	0	0	0	11	0	1
Georgia	Candler	3	0	0	0	0	0	0	0	0	0
Georgia	Columbia	30	1	0	0	0	0	0	1	0	0
Georgia	Effingham	2	0	0	0	0	0	0	0	0	0
Georgia	Emanuel	12	2	0	0	0	0	0	2	0	0
Georgia	Glascock	3	0	0	0	0	0	0	0	0	0
Georgia	Jefferson	17	10	0	0	0	0	0	12	0	0
Georgia	Jenkins	8	2	0	0	0	0	0	2	0	0
Georgia	Johnson	1	0	0	0	0	0	0	0	0	0
Georgia	Lincoln	2	0	0	0	0	0	0	0	0	0
Georgia	McDuffie	19	6	0	0	0	0	0	7	0	0
Georgia	Richmond	125	62	0	0	0	0	0	68	0	9
Georgia	Screven	14	4	0	0	0	0	0	4	0	0
Georgia	Warren	1	0	0	0	0	0	0	0	0	0
Georgia	Washington	2	2	0	0	0	0	0	2	0	0

Table 2.5.4-1 (cont.) Minority and Low-Income Population Census Blocks within 50-Mile Radius of VEGP Site

Block Groups Where Minorities and Low-Income Populations Exceed the State Averages by 20 Percent or More[1]

			Minority								
State	**County**	**Total Block Groups**	**Black Races**	**American Indian or Native Alaskan**	**Asian**	**Native Hawaiian or Other Pacific Islander**	**Other**	**Multi-Racial**	**Aggregate[2]**	**Hispanic**	**Low-Income (Households)**
South Carolina	Aiken	101	17	0	0	0	0	0	17	0	1
South Carolina	Allendale	11	10	0	0	0	0	0	10	0	0
South Carolina	Bamberg	17	9	0	0	0	0	0	10	0	0
South Carolina	Barnwell	19	8	0	0	0	0	0	9	0	0
South Carolina	Colleton	2	0	0	0	0	0	0	0	0	0
South Carolina	Edgefield	15	7	0	0	0	0	0	8	0	0
South Carolina	Hampton	13	6	0	0	0	0	0	6	0	0
South Carolina	Jasper	2	1	0	0	0	0	0	1	0	0
South Carolina	Lexington	6	0	0	0	0	0	0	0	0	0
South Carolina	McCormick	1	0	0	0	0	0	0	0	0	0
South Carolina	Orangeburg	13	4	0	0	0	0	0	4	0	0
South Carolina	Saluda	4	2	0	0	0	0	0	2	0	0
Totals:		491	171	0	0	0	0	0	183	0	14
					State Percentages[1]						
Georgia	28.70	0.27	2.12	0.05	2.40	1.39	34.93	5.32	12.64	Georgia	28.70
South Carolina	29.54	0.34	0.90	0.04	1.00	1.00	32.81	2.37	14.11	South Carolina	29.54

1 Shaded counties are completely within the 50-mile radius of VEGP.

2 Because both Georgia and South Carolina have relatively large percentages of aggregate minority populations, 34.9 and 32.8 percent, respectively, adding 20 percentage points to these averages equates to 54.9 and 52.8 percent, respectively. Therefore, there are more census block groups that meet the “50 percent” threshold criteria than the “20 percentage points greater than the state average” thresholds.

Table 2.5.4-2 Farms that Employ Migrant Labor in the 50-Mile Region[1]

County	Total Farms[2]	Farms with Migrant Labor[3]	Percent of Total Farms
Georgia			
Burke	494	9	2
Richmond	140	0	0
Columbia	196	0	0
Jenkins	240	2	<1
Screven	347	4	1
Emanuel	554	5	1
Jefferson	388	1	<1
McDuffie	296	48	16
South Carolina			
Aiken	929	21	2
Edgefield	325	9	3
Allendale	156	6	4
Barnwell	370	16	4
Bamberg	340	13	4
Hampton	248	0	0

1 Includes counties with more than approximately half their area within the 50-mile radius.
2 From Table 1 **(USDA 2004a, 2004b)**
3 From Table 7 **(USDA 2004a, 2004b)**

Table 2.5.4-3 Regional Agriculture Information, 2002

County	Number of Farms	Land in Farms (acres)	% Cropland (% of Land in Farms)	Top Crop Items
Georgia				
Burke	494	218,954	47.79	Cotton, Forage, Peanuts, Soybeans, Corn for grain
Richmond	140	12,439	40.27	Forage, Vegetables, Pecans, Oats, Corn for grain
Columbia	196	23,296	21.41	Forage, Nursery stock, Pecans, Corn for silage and grain
Jenkins	240	94,632	41.00	Cotton, Forage, Peanuts, Wheat for grain, Corn for grain
Screven	347	184,170	47.49	Cotton, Forage, Peanuts, Soybeans, Corn for grain
Emanuel	554	159,723	35.17	Cotton, Forage, Peanuts, Pecans, Corn for grain
Jefferson	388	137,217	53.55	Cotton, Forage, Soybeans, Wheat for grain, Corn for grain
McDuffie	296	46,774	33.93	Forage, Nursery stock, Pecans, Corn for silage, Cotton
South Carolina				
Aiken	929	143,942	39.51	Cotton, Forage, Wheat for grain, Soybeans, Corn for grain
Allendale	156	107,703	47.29	Cotton, Forage, Soybeans, Wheat for grain, Corn for grain
Edgefield	325	74,494	34.85	Forage, Peaches, Soybeans, Oats, Rye for grain
Barnwell	370	85,114	42.00	Cotton, Forage, Peanuts, Soybeans, Corn for grain
Bamberg	340	105,277	45.23	Forage, Vegetables, Soybeans, Cotton, Corn for grain
Hampton	248	127,913	34.63	Cotton, Forage, Soybeans, Corn for grain, Wheat for grain

Source: **USDA 2002**
Forage – Land used for all hay and haylage, grass silage, and greenchop.

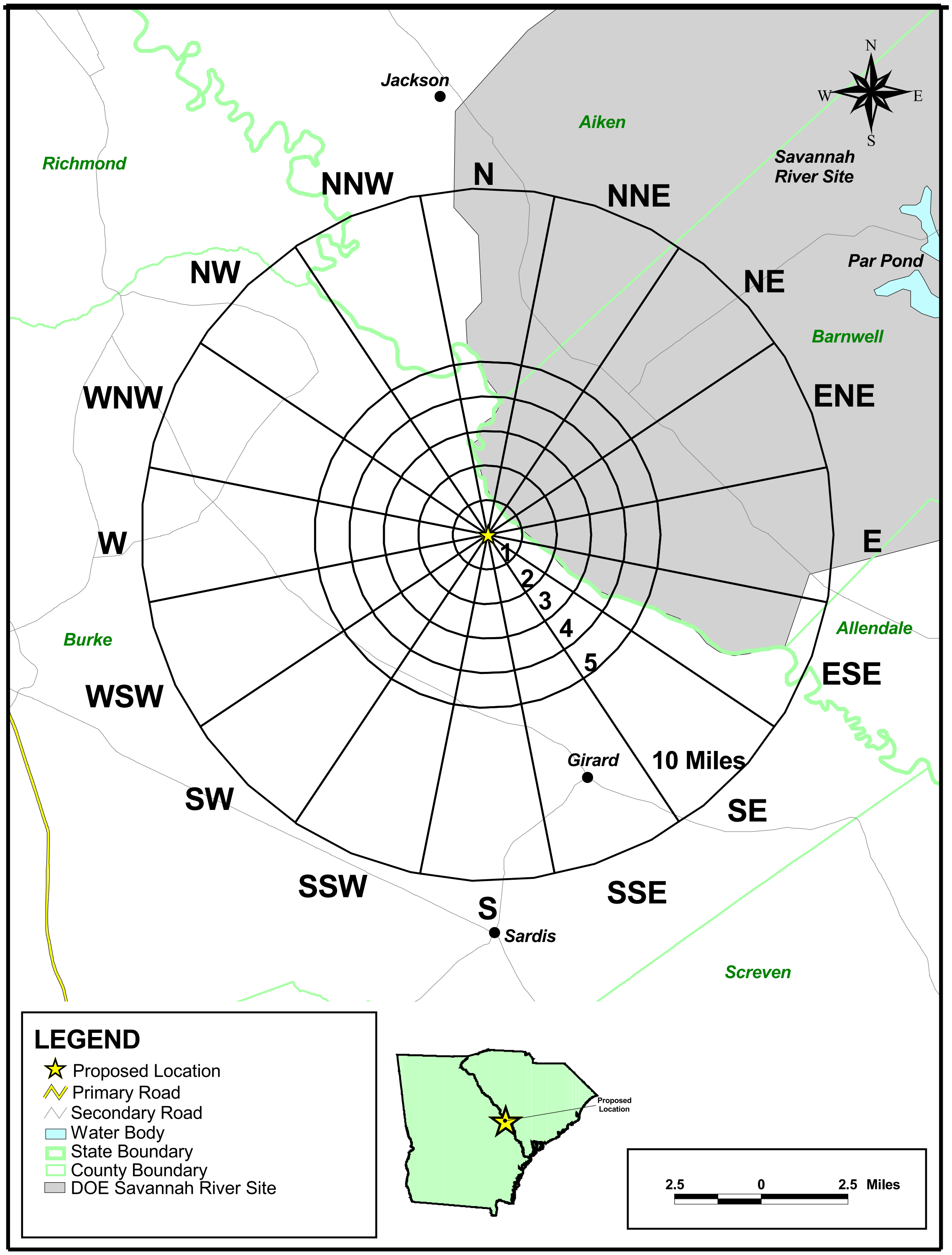

Figure 2.5.1-1 10-Mile Vicinity with Direction Sectors Identified

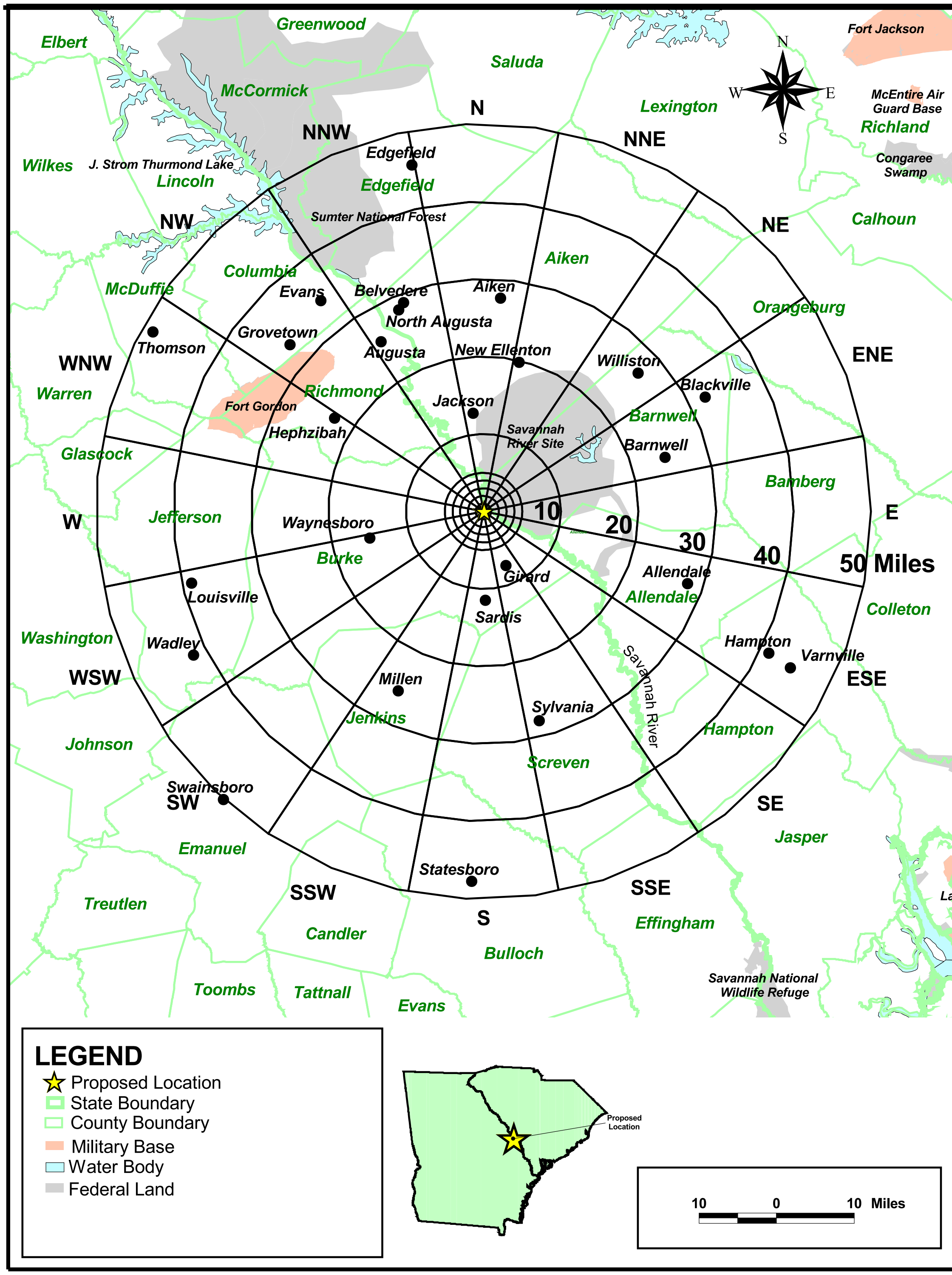

Figure 2.5.1-2 50-Mile Region with Direction Sectors Identified

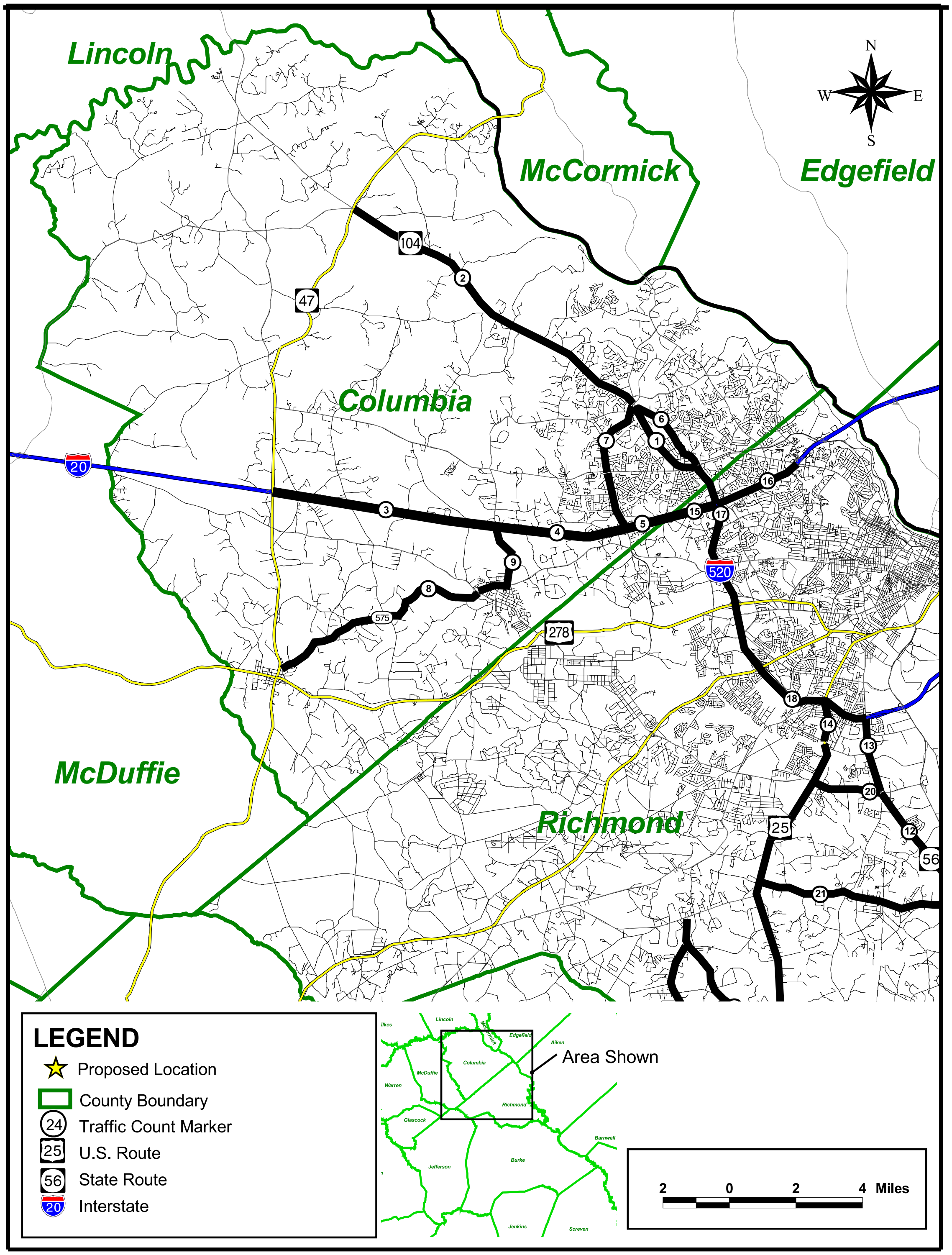

Figure 2.5.2-1 Transportation System in Columbia and Richmond Counties

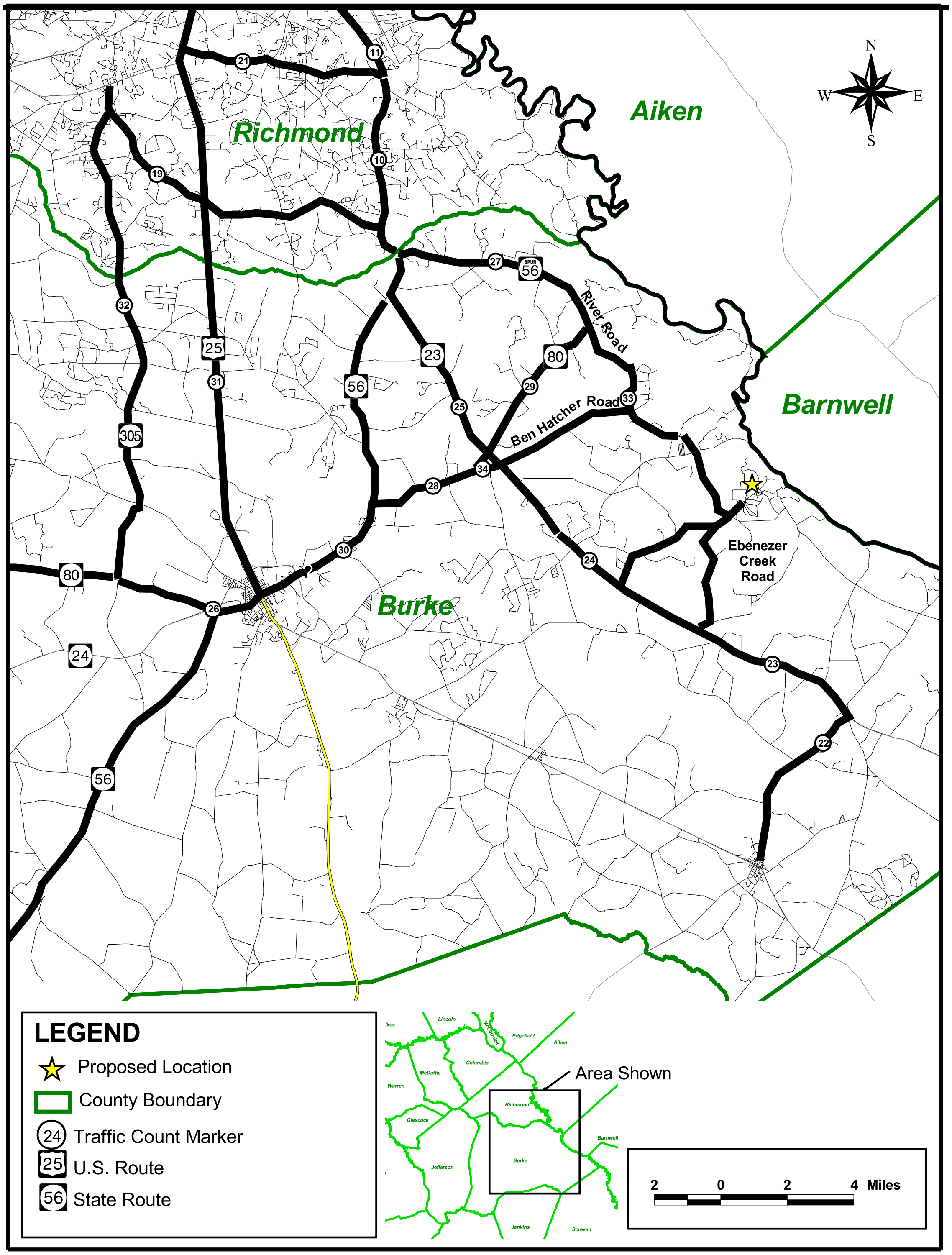

Figure 2.5.2-2 Transportation System in Burke and Richmond Counties

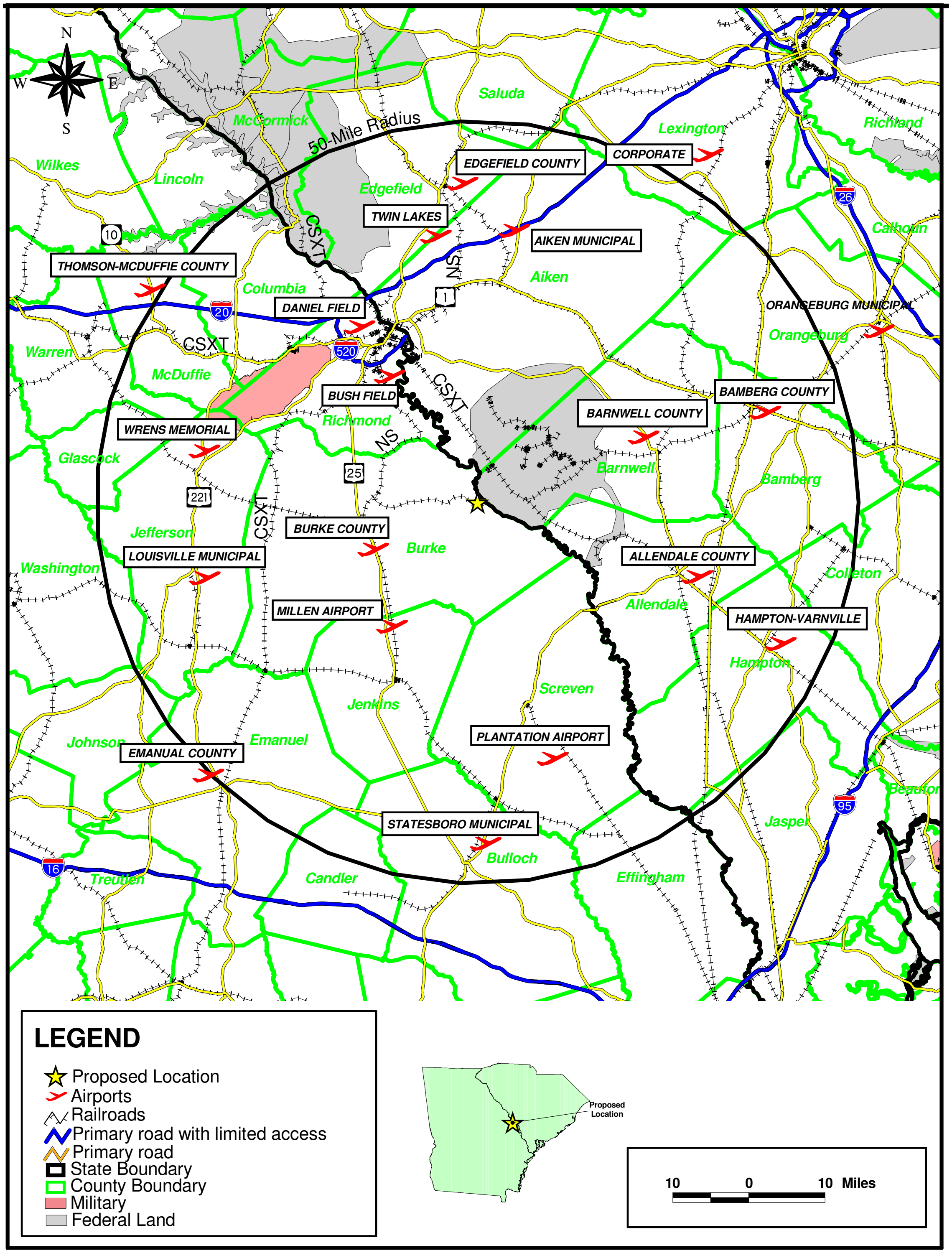

Figure 2.5.2-3 Airports and Rail System in the 50-Mile Region

Figure 2.5.3-1 (Deleted per NRC Request)

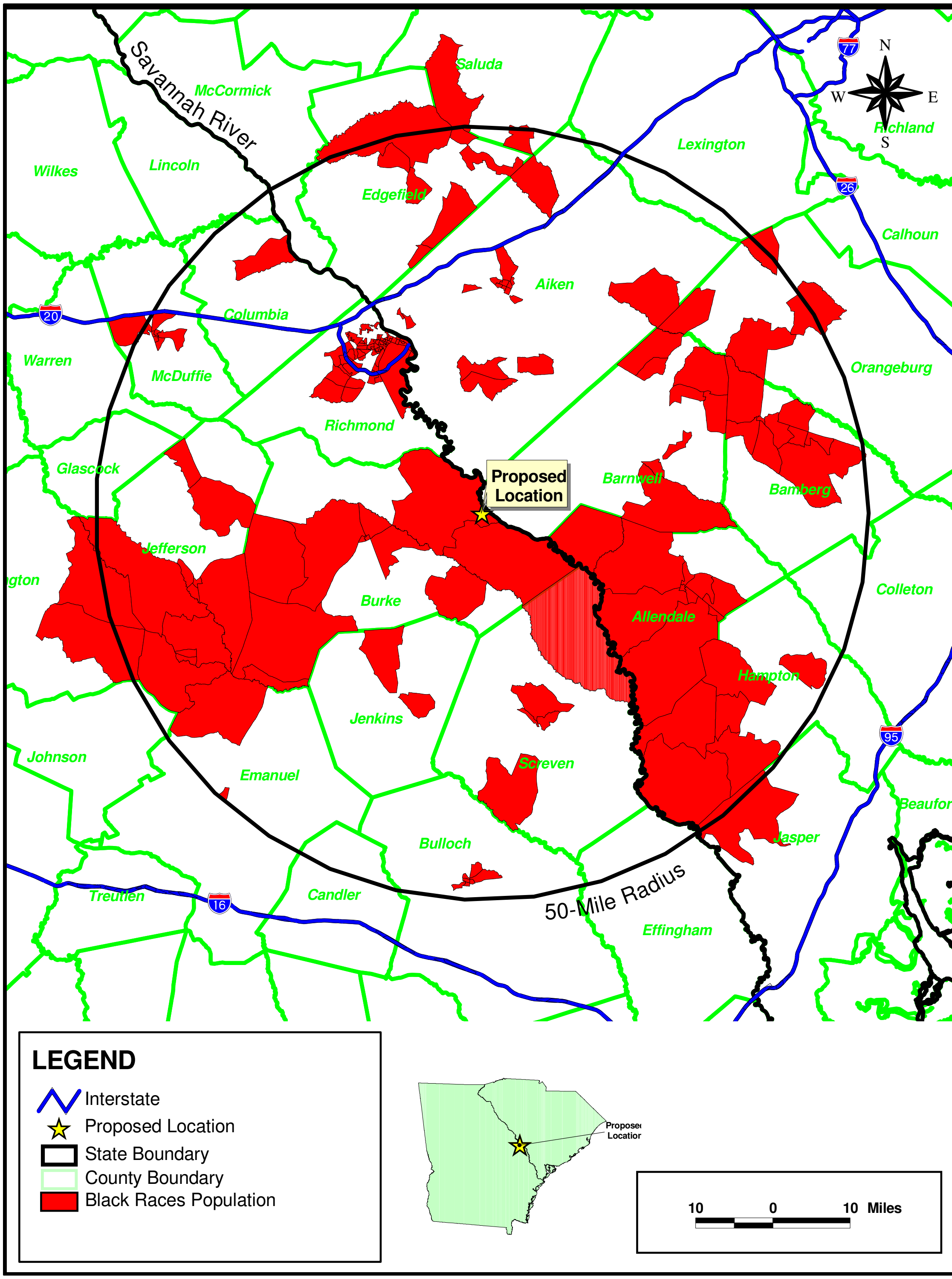

Figure 2.5.4-1 Black Races Block Groups within the 50-Mile Radius of VEGP

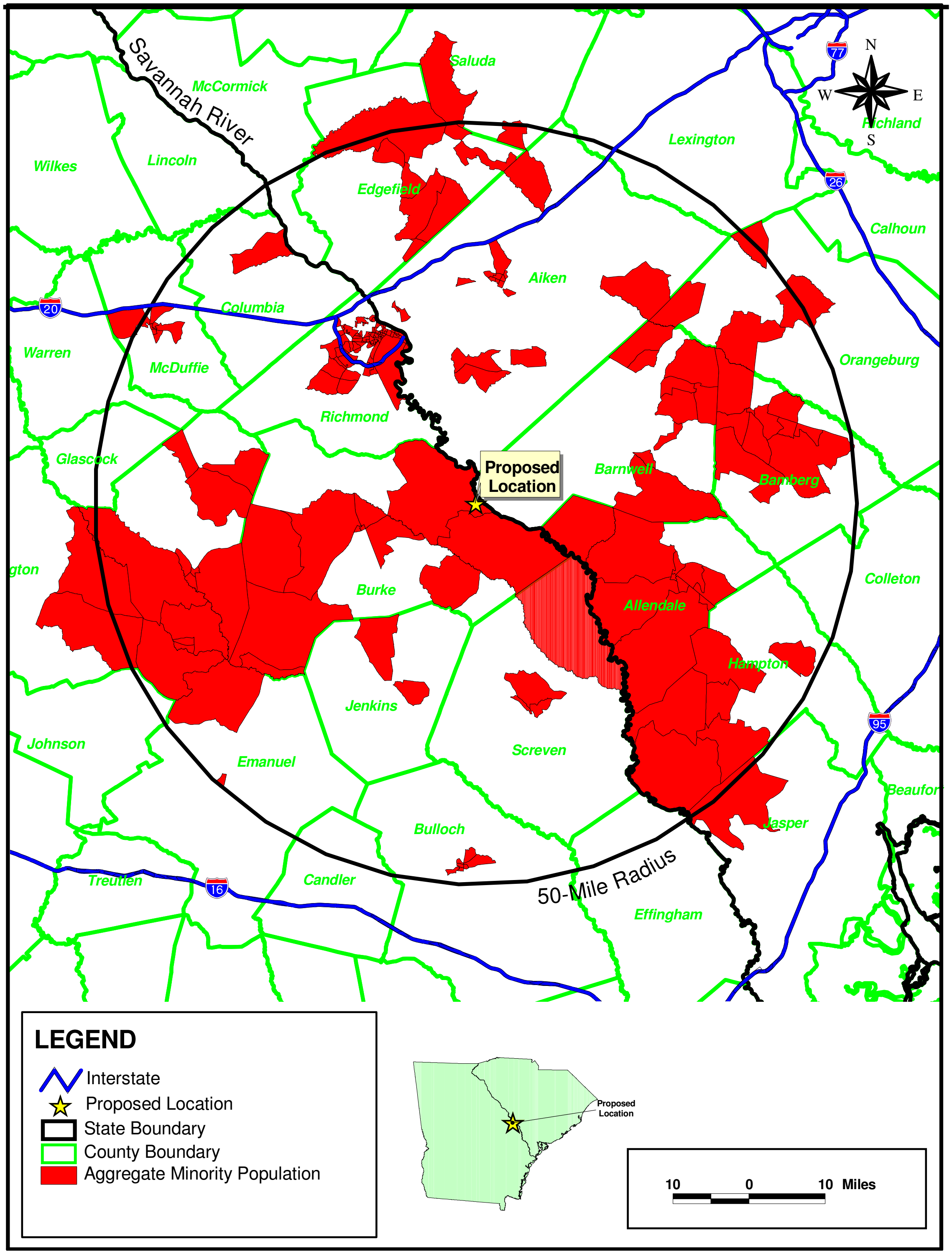

Figure 2.5.4-2 Aggregate Minority Populations Block Groups within the 50-Mile Radius

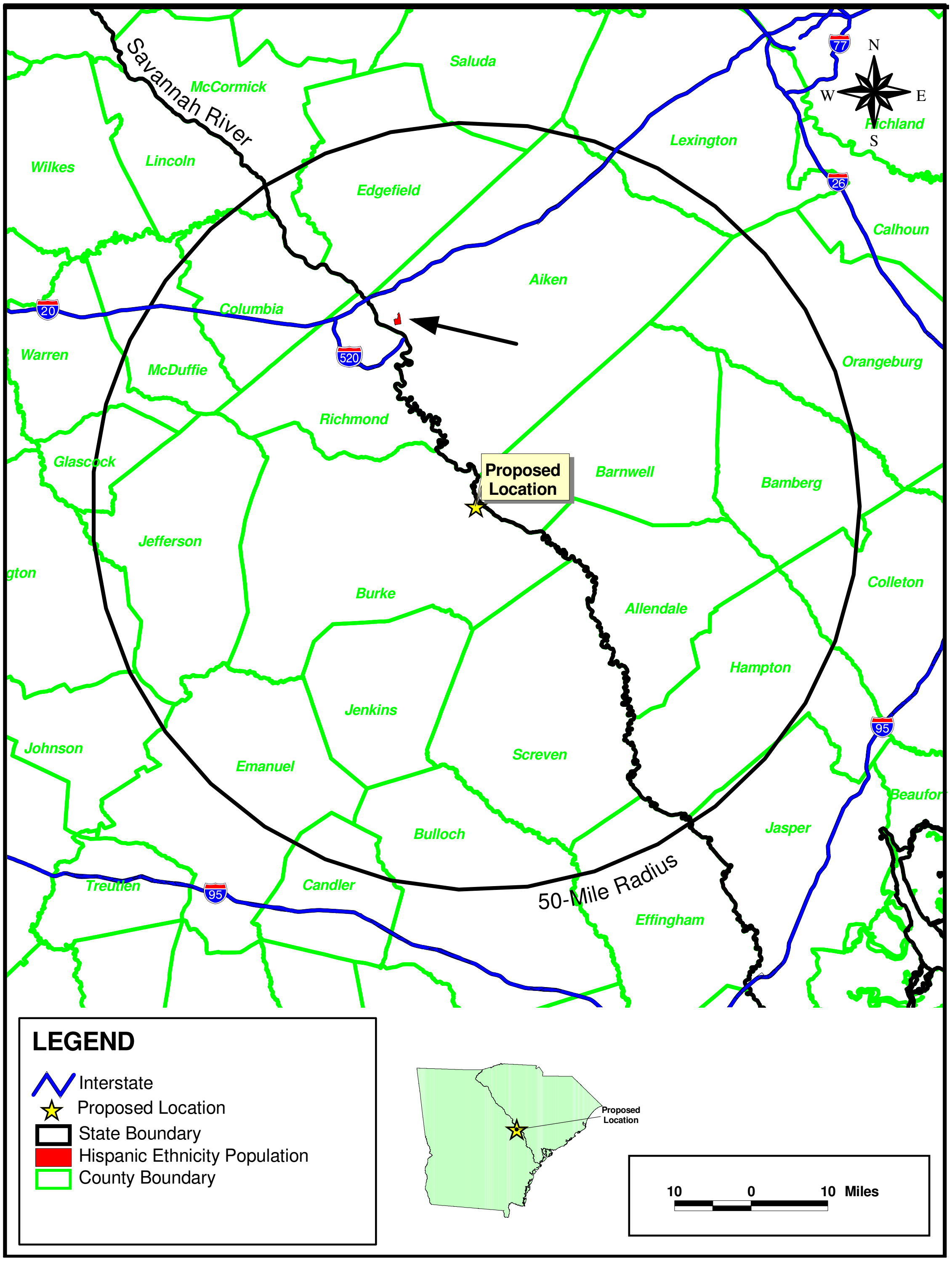

Figure 2.5.4-3 Hispanic Ethnicity Block Groups within the 50-Mile Radius

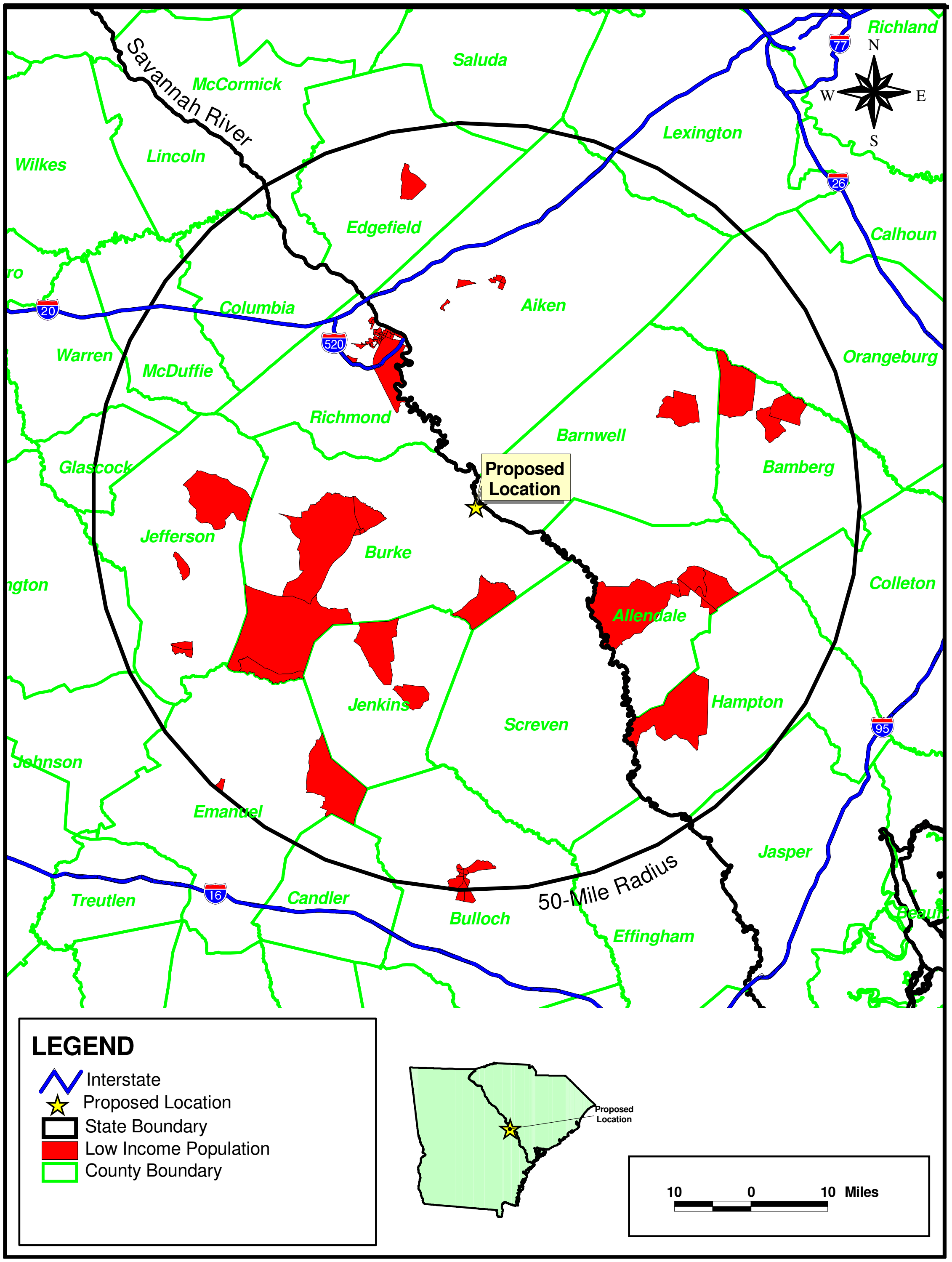

Figure 2.5.4-4 Low-Income Population Block Groups within the 50-Mile Radius

Section 2.5 References

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2.6 Geology

This section presents a brief description of the geologic conditions that are present at and in the vicinity of the VEGP site. The ESP Site Safety Analysis Report (SSAR) presents a detailed site geologic evaluation in SSAR Section 2.5.

2.6.1 Geologic Setting

The VEGP site lies within the Coastal Plain physiographic province (Figure 2.6-1). The surrounding topography consists of gently rolling hills with a principally dendritic drainage pattern. The surface topography ranges in elevation from less than 90 ft msl to nearly 300 ft msl in the site area. The ground surface in the developed portions of the site is at an elevation of approximately 220 ft msl. Incision of the adjacent Savannah River has formed steep bluffs and topographic relief of nearly 150 ft from the river surface to the VEGP site. The river level adjacent to the site is at an elevation of approximately 80 ft msl. The floodplain is a broad alluvial surface that is 6 to 10 ft above the river. All major streams are tributary to the Savannah River.

The Coastal Plain province consists of a seaward-dipping wedge of unconsolidated and semi-consolidated sediments that extend eastward from their contact with the Piedmont province at the Fall Line west of the VEGP site to the edge of the continental shelf. Sediment thickness increases from zero at the contact with the Piedmont province to over 4,000 ft at the coastline.

The bedrock surface in the VEGP site vicinity has been leveled by erosion and dips to the southeast at approximately 50 ft/mi **(Fallaw and Price 1995)**. Bedrock within the site vicinity consists of sedimentary Triassic basin rock and Paleozoic crystalline rock.

The Paleozoic and Triassic bedrock complex is overlain by poorly consolidated to unconsolidated Coastal Plain sediments that dip and thicken to the southeast. These sediments range in age from Upper Cretaceous to Quaternary. To support characterization of the site, a deep boring drilled as part of the ESP subsurface investigation program indicates these sediments to be approximately 1,050 ft thick beneath the VEGP site. The Cretaceous and Tertiary sediments have been subdivided into multiple formations based on both lithology and carbonate fossils where present. The youngest sediments of Quaternary age consist of alluvial deposits within stream and river valleys. Figure 2.6-2 is a generalized stratigraphic column showing the formations present beneath the VEGP site and vicinity.

Beneath the VEGP site, the Blue Bluff member of the Lisbon Formation will form the bearing layer on which structural fill will be placed to form the foundation for the proposed plant structures. The Blue Bluff member is composed of sand, silt, and clay with interbedded layers of fossiliferous limestone and is exposed in the bluffs along the southwest bank of the Savannah River. It forms a confining layer between the underlying Tertiary aquifer system and the overlying Water Table aquifer. Borings drilled as part of the ESP subsurface investigation program encountered the top of the Blue Bluff member beneath the VEGP site at a depth of about 80 ft (140 ft msl). It was determined to have a thickness of about 60 ft.

The Barnwell Group overlying the Blue Bluff member includes, from oldest to youngest, the Clinchfield Formation, the Dry Branch Formation, and the Tobacco Road Sand. Most of these units are exposed along the bluffs of the Savannah River or within stream valleys, or lie on topographically higher areas surrounding the site area (Figure 2.6-3). The Clinchfield Formation consists predominantly of calcareous sands and biomoldic limestones. Some silty and clayey sands are also present, with varying amounts of carbonate material and silicified zones. Evidence of solution cavities in the Clinchfield indicate that the process of carbonate removal is occurring, which could be a primary contributing factor to the development of surface depressions noted in the site area. The top of the Clinchfield Formation beneath the VEGP site was encountered at depths on the order of 50 ft, but the depth to and thickness of the unit is variable.

The Dry Branch Formation consists primarily of silty, clayey quartz sands. Varying amounts of carbonate material are sometimes present, often in the form of bioherms. Portions of the Dry Branch Formation become significantly more clayey, with finely laminated beds of variable thickness. The top of the Dry Branch Formation at the VEGP site ranges from the ground surface to depths on the order of 30 ft.

The Tobacco Road Sand consists of moderately to poorly sorted sands and clayey sands with varying amounts of kaolin. The unit is exposed in stream valleys and road cuts surrounding the site area. The thickness of the Tobacco Road Sand varies due to incision by the overlying Hawthorne Formation but can reach thicknesses in excess of 50 ft. Where present at the VEGP site, the top of the Tobacco Road Sand generally occurs at the ground surface.

The Hawthorne Formation overlies the Barnwell Group in the vicinity of the VEGP site and consists of poorly sorted sands and clayey sands. The sands range from fine to cobble size and are well rounded. Clay is present in the form of laminae to cobble-size clasts. This unit was not identified in any of the borings drilled as part of the ESP subsurface investigation program. It was likely removed during excavation for the existing units and, therefore, is no longer present in the developed portions of the VEGP site. However, it is present in higher elevations of the site and surrounding area. The age of the Hawthorne Formation is problematic due to the lack of fossils. However, Falls and Prowell 2001 indicate a Miocene age for this formation.

Alluvium exists within the surrounding stream and river valleys and forms terraces that can be locally delineated and mapped. A modern alluvial floodplain and several alluvial terraces are present on the east side of the Savannah River. The relative position of the higher terraces above the Holocene floodplain indicates a Pleistocene age **(Prowell 1996)**.

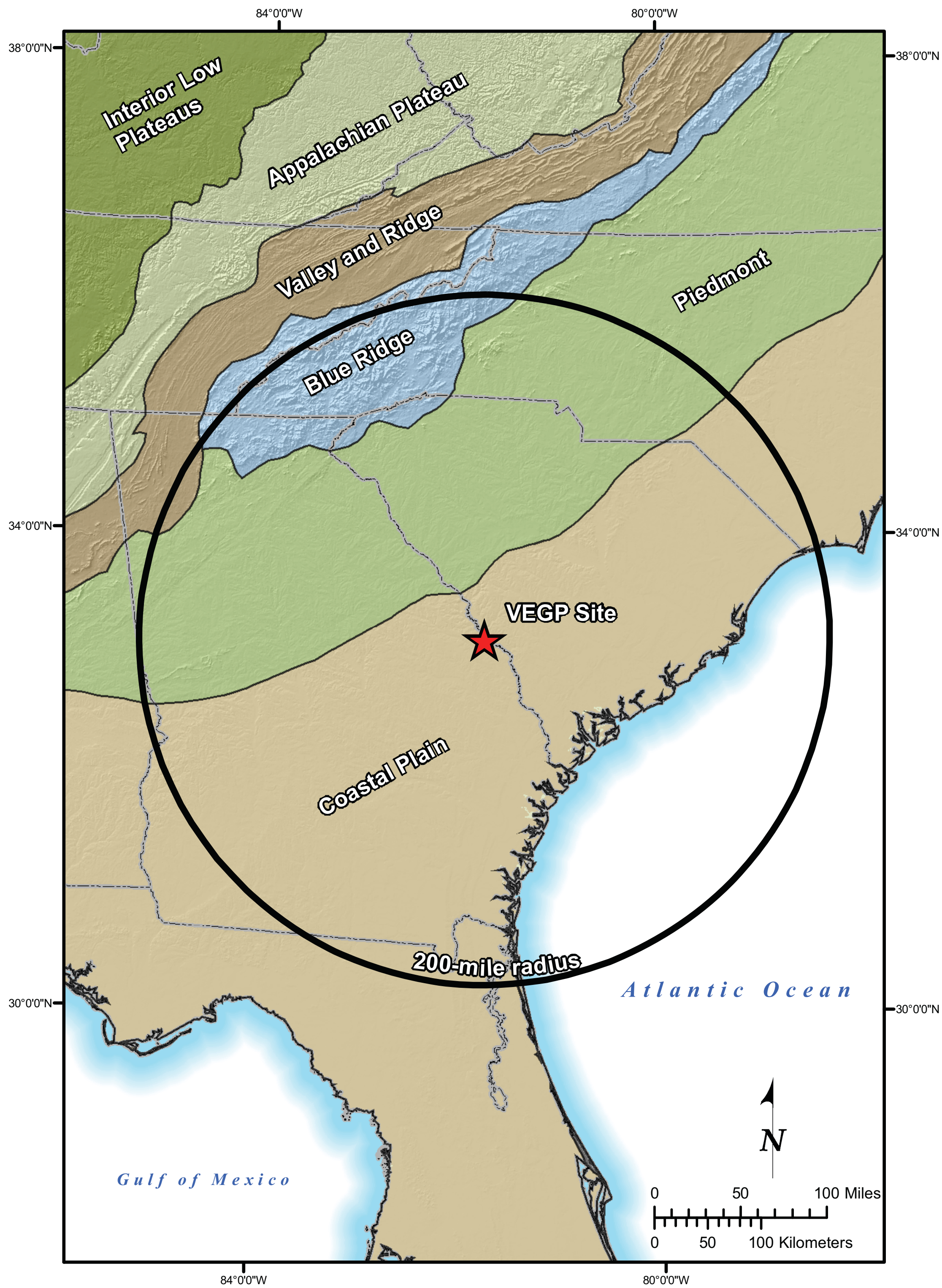

Figure 2.6-1 Physiographic Map

AGE				UNIT	DESCRIPTION
Cenozoic	Quaternary	Pleistocene / Recent		Alluvium and terrace deposits	Gravel, sand, silt and clay deposited along river and stream valleys
	Tertiary	Miocene		• Hawthorn Formation	Cobbles, gravel, sand and clayey sand
		Eocene	Upper	Barnwell Group • Tobacco Road Sand • Dry Branch Formation • Clinchfield Formation o Utley Limestone Member	Sand, clayey sand, silty sand, calcareous sand, clay and limestone
			Middle	Claiborne Group • Lisbon Formation o Blue Bluff Member / McBean Member • Still Branch Sand • Congaree Formation	Sand, silt, clay, limestone and sandstone
			Lower		
		Paleocene	Upper	• Snapp Formation • Black Mingo Formation	Clay, silty clay, silty sand and sand
			Lower		
Mesozoic	Cretaceous	Upper		• Steel Creek Formation • Gaillard Formation • Black Creek Formation • Pio Nono Formation / Unnamed Sand • Cape Fear Formation	Sand, silty sand, silty to clayey sand, silty clay and clay
	Triassic			Triassic (Dunbarton) basin	Sandstone, siltstone, and claystone, with beds of conglomerate and fanglomerate
Precambrian & Paleozoic				Crystalline basement	Gneiss, phyllite and greenstone

Refs: Huddlestun and Summerour 1996
Falls and Prowell 2001

Figure 2.6-2 Generalized Stratigraphic Column

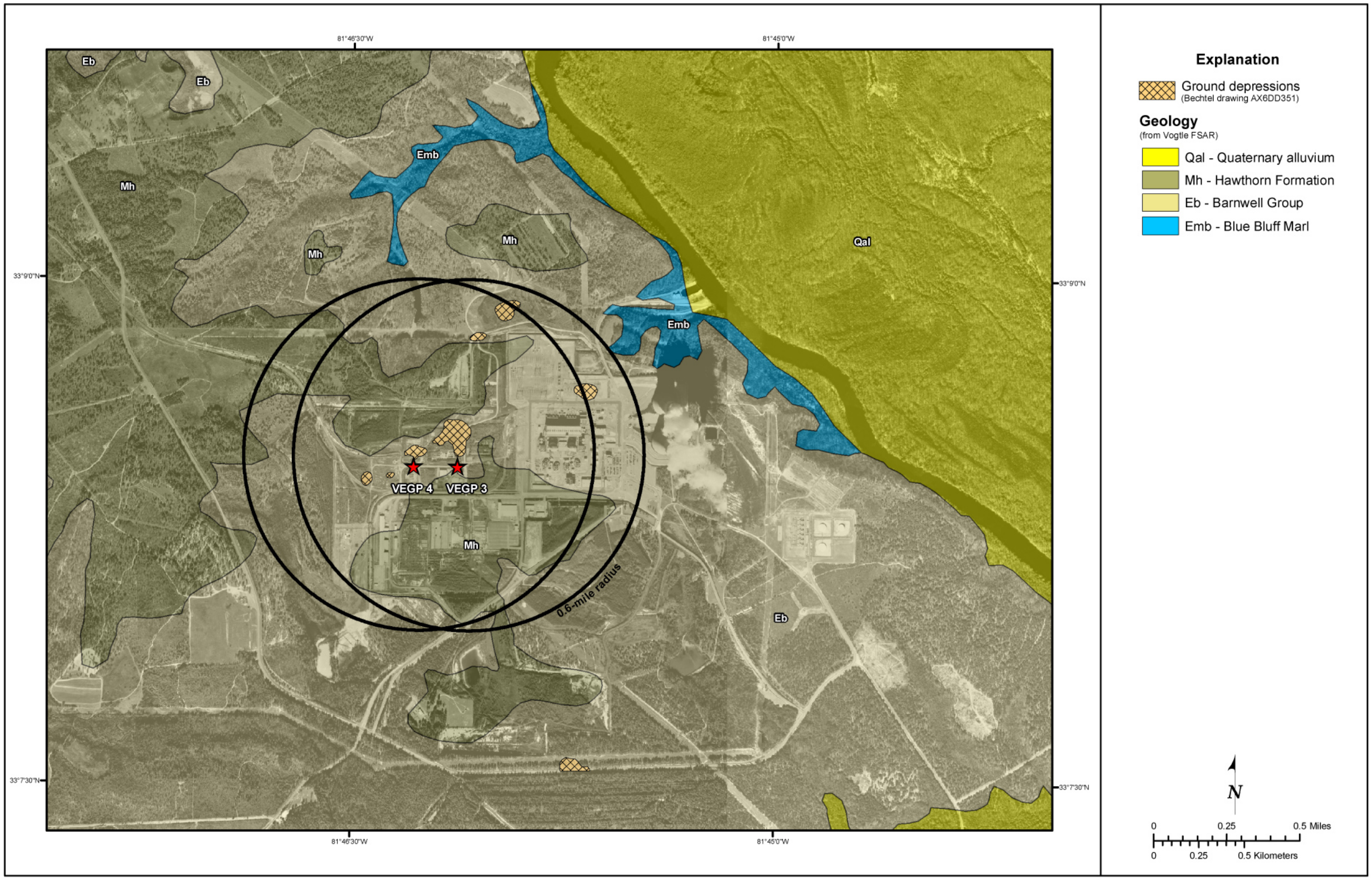

Figure 2.6-3 Site Geologic Map (0.6-mile radius)

Section 2.6 References

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2.7 Meteorology, Air Quality, and Noise

This section describes the regional and local climatological and meteorological characteristics applicable to the VEGP site. This section also provides site-specific meteorological information for use in evaluating construction and operational impacts. This section concludes with a brief discussion of existing noise generating sources at the VEGP site and predicted noise levels relative to measured background conditions.

2.7.1 Regional Climatology

2.7.1.1 Data Sources

SNC used several sources of data to characterize regional climatological conditions pertinent to the VEGP site. This includes data acquired by the National Weather Service (NWS) at its Augusta, Georgia (Bush Field), first-order station and from nine other nearby locations in its network of cooperative observer stations, as compiled and summarized by the National Climatic Data Center (NCDC).

These climatological observing stations are located in Burke, Richmond, Jenkins, Screven and Jefferson Counties, Georgia, and in Aiken, Barnwell, Orangeburg, and Bamberg Counties, South Carolina. Table 2.7-1 identifies the specific stations and lists their approximate distance and direction from the existing reactors at the VEGP site. Figure 2.7-1 identifies these station locations relative to the VEGP site.

The objective of selecting nearby, off-site climatological monitoring stations is to demonstrate that the mean and extreme values measured at those locations are reasonably representative of conditions that might be expected to be observed at the VEGP site. The 50-mi radius circle shown in Figure 2.7-1 provides a relative indication of the distance between the climate observing stations and the VEGP site.

However, a 50-km (about 31-mi) grid spacing is considered to be a reasonable fine mesh grid in current regional climate modeling, and this distance was used as a nominal radius for the station selection process. The identification of stations to be included was based on the following considerations:

- Proximity to the site (i.e., within the nominal 50-km radius indicated above, to the extent practicable).
- Coverage in all directions surrounding the site (to the extent possible).
- Where more than one station exists for a given direction relative to the site, a station was chosen if it contributed one or more extreme conditions (e.g., rainfall, snowfall, maximum and/or minimum temperatures) for that general direction.

Nevertheless, if an overall extreme precipitation or temperature condition was identified for a station located within a reasonable distance beyond the nominal 50-km radius and that event was considered to be reasonably representative for the site area, such stations were also included, regardless of directional coverage.

Normals (i.e., 30-year averages), means, and extremes of temperature, rainfall, and snowfall are based on the following data sources:

- The *2004 Local Climatological Data Annual Summary with Comparative Data for Augusta, Georgia* **(NCDC 2005a)**
- *Climatography of the United States, No. 20, 1971–2000, Monthly Station Climate Summaries* **(NCDC 2005b)**
- *Climatography of the United States, No. 81, 1971–2000, U.S. Monthly Climate Normals* **(NCDC 2002a)**
- Southeast Regional Climate Center (SERCC)*, Historical Climate Summaries and Normals for the Southeast* **(SERCC 2006)**
- *Cooperative Summary of the Day, TD3200, Period of Record Through 2001, for the Eastern United States, Puerto Rico, and the Virgin Islands* **(NCDC 2002c)**

First-order NWS stations also record measurements, typically on an hourly basis, of other weather elements, including winds, several indicators of atmospheric moisture content (i.e., relative humidity, dew point, and wet-bulb temperatures), and barometric pressure, as well as other observations when those conditions occur (e.g., fog, thunderstorms). Table 2.7-2, excerpted from the 2004 local climatological data (LCD) summary for the Augusta NWS Station, presents the long-term characteristics of these parameters.

Additional data sources were also used to develop the description of the climatological characteristics of the VEGP site area and region:

- *Engineering Weather Data, 2000 Interactive Edition*, Version 1.0 **(AFCCC-NCDC 1999)**
- *Minimum Design Loads for Buildings and Other Structures* **(ASCE 2002)**
- *Storm Events for Georgia and South Carolina*, Tornado Event Summaries, accessed July 2005 and January 2006 **(NCDC 2006a)**
- *Historical Hurricane Tracks Storm Query*, 1851 through 2004 **(NOAA-CSC 2005)**
- *The Climate Atlas of the United States* **(NCDC 2002b)**
- *Storm Events for Georgia and South Carolina,* Hail Event and Snow and Ice Event Summaries for Burke, Jenkins, Richmond, and Screven Counties in Georgia, and Aiken, Allendale, and Barnwell Counties in South Carolina **(NCDC 2006b)**
- *Storm Data (and Unusual Weather Phenomena with Late Reports and Corrections),* January 1959 (Volume 1, Number 1) to January 2004 (Volume 42, Number 1) **(NCDC 2004)**
- *Air Stagnation Climatology for the United States (1948-1998)* **(Wang and Angell 1999)**

- *Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States* **(Holzworth 1972)**

2.7.1.2 General Climate Description

The VEGP site is located in the region known as the Upper Coastal Plain, lying between the Appalachian Mountains and the Atlantic Ocean, just south of the Fall Line that separates the Piedmont from the Coastal Plain (see Figure 2.6-1). Elevation is generally 150 to 250 ft above sea level in this region, which is cut by the valley of the Savannah River. The river valley ranges from 2 to 5 mi wide near the VEGP site.

The general climate in this region is characterized by mild, short winters; long periods of mild sunny weather in the autumn; somewhat more windy but mild weather in spring; and long, hot summers.

The regional climate is predominantly influenced by the Azores high-pressure system. Due to the clockwise circulation around the western extent of the Azores High, maritime tropical air mass characteristics prevail much of the year, especially during the summer with the establishment of the Bermuda High and the Gulf High. Together, these systems govern Georgia's summertime temperature and precipitation patterns. This macro-circulation feature also affects the frequency of high air pollution potential in the site region. These characteristics and their relationship to the Bermuda High, especially in the late summer and autumn, are addressed in Section 2.7.2.3.

This macro-scale circulation feature continues during the transitional seasons and winter months; however, it is regularly disrupted by the passage of synoptic- and meso-scale weather systems. During winter, cold air masses may briefly intrude into the region with the cyclonic (i.e., counter-clockwise) northerly flow that follows the passage of low-pressure systems. These systems frequently originate in the continental interior around Colorado, pick up moisture-laden air due to southwesterly through southeasterly airflow in advance of the system, and result in a variety of precipitation events that include rain, snow, sleet, and freezing rain, or mixtures, depending on the temperature characteristics of the weather system itself and the temperature of the underlying air (see Section 2.7.3.4). Similar cold air intrusion and precipitation patterns may also be associated with secondary low-pressure systems that form in the eastern Gulf of Mexico or along the Atlantic Coast and move northeastward along the coast (also referred to as "nor'easters").

Larger and relatively more persistent outbreaks of very cold, dry air associated with massive high-pressure systems that move southeastward out of Canada also periodically affect the VEGP site region. These weather conditions are moderated by the Appalachian Mountains to the northwest, which shelter the region in winter from these cold air masses that sweep down through the continental interior. In general, the cold air that does reach the VEGP site area is warmed by its descent to the relatively lower elevations of the region, as well as by modification due to heating as it passes over the land.

Monthly precipitation exhibits a cyclical pattern, with one maximum during the winter into early spring and a second maximum during late spring into summer (see Section 2.7.1.3.3). The winter and early spring maximum is associated with low-pressure systems moving eastward and northward through the Gulf States and up the Atlantic Coast, drawing in warm, moist air from the Gulf of Mexico and the Atlantic Ocean. These air masses receive little modification as they move into the region. The late spring and summer maximum is due to thunderstorm activity. Heavy precipitation associated with late summer and early autumn tropical cyclones, as discussed in Section 2.7.3.5, is not uncommon. The VEGP site is located far enough inland that the strong winds associated with tropical cyclones are much reduced by the time that such systems affect the site area.

2.7.1.3 Normal, Mean, and Extreme Climatological Conditions

This section discusses normals and period-of-record means and extremes for several standard weather elements (i.e., temperature, atmospheric water vapor, precipitation, wind conditions) representative of this climate setting.

As indicated previously, Table 2.7-2 presents the more extensive set of meteorological measurements and observations made at the Augusta NWS Station, located 20 mi northwest of the VEGP site. For comparison, Table 2.7-3 summarizes the annual normal daily maximum, minimum, and mean temperatures, as well as the normal annual rainfall and snowfall totals for Augusta, Georgia, and the nine other nearby cooperative observing stations.

With the exception of temperature measurements from Springfield, South Carolina, long-term periods of record for temperature and precipitation for the other climatological observing stations, as well as summaries of the latest 30-year station normals from 1971 through 2000, are readily available from the NCDC and the SERCC.

More detailed discussions of these and other climatological characteristics, including measured extremes, are addressed in Section 2.7.4.1.

2.7.1.3.1 Temperature

Daily mean temperatures are based on the average of the daily mean maximum and minimum temperature values. Annual daily normal temperatures are similar over the VEGP site area ranging from 63.1°F at Waynesboro 2NE to 65.0°F at the Midville Experiment Station. Likewise, the diurnal (day-to-night) temperature ranges, as indicated by the differences between the daily mean maximum and minimum temperatures, are fairly comparable, ranging from 21.9°F at Bamberg to 26.3°F at Aiken 4NE. **(NCDC 2002a)**

On a monthly basis, the LCD summary for Augusta, Georgia, indicates that the daily normal temperature is highest during July (80.8°F) and reaches a minimum in January (44.8°F) **(NCDC 2005a)**.

The highest temperature observed in the VEGP site area (112°F) was recorded on July 24, 1952, at the Louisville 1E Station, located about 37 mi to the west-southwest. The lowest temperature observed in the VEGP site area (-4°F) was recorded on January 21, 1985, at the Aiken 4NE Station, located 25 mi to the north-northeast. **(NCDC 2005b)**

2.7.1.3.2 Atmospheric Water Vapor

Based on a 49-year period of record, the LCD summary for the Augusta, Georgia NWS Station (see Table 2.7-2) indicates that the mean annual wet-bulb temperature is 56.7°F, with a seasonal maximum during the summer months (June through August) and a seasonal minimum during the winter months (December through February). The highest monthly mean wet-bulb temperature is 72.7°F in July (only slightly less during August); the lowest monthly mean value (40.3°F) occurs during January. **(NCDC 2005a)**

The LCD summary shows a mean annual dew point temperature of 51.9°F, also reaching its seasonal maximum and minimum during the summer and winter, respectively. The highest monthly mean dew point temperature is 69.7°F in July; again, only slightly less during August. The lowest monthly mean dew point temperature (34.4°F) occurs during January. **(NCDC 2005a)**

The 30-year normal daily relative humidity averages 72 percent on an annual basis, typically reaching its diurnal maximum in the early morning (around 0700 hours) and its diurnal minimum during the early afternoon (around 1300 hours). There is less variability in this day-to-night pattern with the passage of weather systems, persistent cloud cover, and precipitation. Nevertheless, this diurnal pattern is evident throughout the year. The LCD summary shows that average early morning relative humidity levels exceed 90 percent during August, September, and October. **(NCDC 2005a)**

2.7.1.3.3 Precipitation

With the exception of the Aiken 4NE Station, normal annual rainfall totals are similar for the nine other nearby observing stations listed in Table 2.7-3, differing by only about 4.7 in. (or about 10 percent) and ranging from 43.85 to 48.57 in. The current 30-year average for Aiken 4NE is somewhat higher, at 52.43 in. **(NCDC 2002a)**

The LCD summary of normal rainfall totals for Augusta, Georgia, indicates two “seasonal” maximums — the highest (13.22 in.) during the winter into early spring (January through March) and the second (12.74 in.) during late spring into summer (June through August). Together, these periods account for almost 60 percent of the annual total for the Augusta Station, although rainfall is greater than 2.6 in. during every month of the year. The overall maximum monthly total rainfall occurs during March (4.61 in.). **(NCDC 2005a)**

The overall highest 24-hour rainfall total in the VEGP site area — 9.68 in. on April 16, 1969 — was recorded at the Aiken 4NE Station in South Carolina **(NCDC 2005b)**. While Section 2.7.3.5 indicates that most of the individual station 24-hour rainfall records were established as a result of precipitation associated with tropical cyclones that passed within a 100-nautical-mile radius of the VEGP site, this particular event was not. Similarly, the overall highest monthly rainfall total recorded in the site area — 17.32 in. during June 1973 at Springfield, South Carolina **(SERCC 2006; NCDC 2002c)**, 37 mi northeast of the VEGP site — represents the accumulation of 21 days of measurable precipitation during that month **(NCDC 2002c)**.

Snowfall is an infrequent occurrence, as discussed in Section 2.7.3.4, with normal annual totals of only 0.1 to 1.4 in. **(NCDC 2005b; SERCC 2006)**. With one exception, all of the 24-hour and monthly record snowfall totals were established during the storm of early February 1973, the highest 24-hour and monthly totals (19.0 and 22.0 in., respectively) being recorded at the Bamberg Station in South Carolina, about 44 mi east-northeast of the VEGP site. Similar amounts, ranging from 14.0 to 17.0 in., were recorded at most of the other stations. **(NCDC 2002c, 2005b; SERCC 2006)**

See Section 2.7.4.1.3 for more details regarding these events and a discussion of other station precipitation records.

2.7.1.3.4 Wind Conditions

Based on a 29-year period of record, the LCD summary for the Augusta NWS Station (see Table 2.7-2) indicates that the annual prevailing wind direction (i.e., the direction from which the wind blows most often) is from 240 degrees (i.e., west-southwest). Monthly average prevailing wind directions from November through March have more of a westerly to west-northwesterly component due to increased cold frontal passages. Prevailing wind directions during the other months are more variable, generally having a southerly to southeasterly component reflecting the establishment and influence of the Bermuda High (see Section 2.7.1.2). **(NCDC 2005a)**

Based on a similar period of record, the LCD summary shows an annual mean wind speed of 6.1 mph. On a seasonal basis, the highest average wind speeds occur during the spring (about 7.1 mph), are slightly less during the winter (about 6.7 mph), and are lowest during the autumn and summer (averaging between 5.3 and 5.4 mph, respectively). On average, the LCD indicates that the highest monthly wind speed (7.4 mph) occurs during March. **(NCDC 2005a)**

Characteristics of extreme wind conditions for design basis purposes are discussed in Section 2.7.3.2. Wind data summaries, based on measurements from the existing VEGP meteorological monitoring program, for the purpose of climatological characterization and as they relate to the dispersion of radioactive effluents released into the atmosphere, are discussed in Sections 2.7.4.2 and 2.7.4.3.

2.7.2 Regional Air Quality

2.7.2.1 Background Air Quality

The VEGP site is located within the Augusta (Georgia) – Aiken (South Carolina) Interstate Air Quality Control Region (40 CFR 81.114). The counties within this region are designated as being in attainment or unclassified for all criteria air pollutants (40 CFR 81.311; 40 CFR 81.341). Attainment areas are areas where the ambient air quality levels are better than the EPA-promulgated National Ambient Air Quality Standards (NAAQS). Criteria pollutants are those for which NAAQS have been established: sulfur dioxide, particulate matter (i.e., PM_{10} and $PM_{2.5}$ — particles with nominal aerodynamic diameters less than or equal to 10.0 and 2.5 microns, respectively), carbon monoxide, nitrogen dioxide, ozone, and lead (40 CFR Part 50).

Four pristine areas in the States of Georgia and South Carolina are designated as "Mandatory Class I Federal Areas Where Visibility is an Important Value." They include the Cohutta Wilderness Area, the Okefenokee Wilderness Area, and the Wolf Island Wilderness Area in Georgia (40 CFR 81.408), and the Cape Romain Wilderness Area in South Carolina (40 CFR 81.426). The two closest of these Class I areas are both about 130 mi away from the VEGP site — the Wolf Island Wilderness Area to the south-southeast and the Cape Romain Wilderness Area to the east-southeast.

2.7.2.2 Projected Air Quality

The new nuclear steam supply system and other related radiological systems are not sources of criteria pollutant or other air toxics emissions. Non-radiological emission-generating sources and activities are identified and discussed further in Section 3.6.3.1.

Characteristics of these emission sources and the potential effects on air quality and visibility associated with their operation or activity are addressed in Section 5.8.1.2. Current State and Federal air quality-related regulations and permits, expected to be applicable to VEGP Units 3 and 4, are also identified in that section.

2.7.2.3 Restrictive Dispersion Conditions

Atmospheric dispersion can be described as the horizontal and vertical transport and diffusion of pollutants released into the atmosphere. Horizontal and along-wind dispersion is controlled primarily by wind direction variation and wind speed. Section 2.7.4.2 addresses wind characteristics for the VEGP site vicinity based on measurements from the existing meteorological monitoring program at the VEGP site. The persistence of those wind conditions is discussed in Section 2.7.4.3.

In general, lower wind speeds represent less-turbulent air flow, which is restrictive to horizontal and vertical dispersion. And, although wind direction tends to be more variable under lower wind speed conditions (which increases horizontal transport), air parcels containing pollutants often recirculate within a limited area, thereby increasing cumulative exposure.

Major air pollution episodes are usually related to the presence of stagnating high-pressure weather systems (or anti-cyclones) that influence a region with light and variable wind conditions for 4 days or more. An updated air stagnation climatology report has been published with data for the continental US based on over 50 years of observations from 1948 through 1998. Although inter-annual frequency varies, the data in Figures 1 and 2 of that report indicate that, on average, the VEGP site area can expect about 20 days per year with stagnation conditions, or about 4 cases per year, with the mean duration of each case lasting about 5 days. **(Wang and Angell 1999)**

Air stagnation conditions primarily occur during an "extended" summer season that runs from May through October. This is a result of the weaker pressure and temperature gradients, and therefore weaker wind circulations, during this period (as opposed to the winter season). Based on the *Air Stagnation Climatology for the United States (1948-1998),* Figures 17 to 67, the highest incidence is recorded in the latter half of that period between August and October, typically reaching its peak in September. As the LCD summary for Augusta, Georgia, in Table 2.7-2 indicates, this 3-month period coincides with the lowest monthly mean wind speeds during the year. Within this "extended" summer season, air stagnation is at a relative minimum during July due to the influence of the Bermuda High pressure system. **(Wang and Angell 1999)**

The mixing height (or depth) is defined as the height above the surface through which relatively vigorous vertical mixing takes place. Lower mixing heights (and wind speeds), therefore, are a relative indicator of more restrictive dispersion conditions. Holzworth (1972) reports mean seasonal and annual morning and afternoon mixing heights and wind speeds for the contiguous US based on observations over the 5-year period from 1960 to 1964. Out of the network of 62 NWS stations in the 48 contiguous US at which daily surface and upper air sounding measurements were routinely made, one station was located in Athens, Georgia, about 105 mi northwest of the VEGP site. The information in that report indicates that the results from that station should be reasonably representative of conditions at the VEGP site.

Table 2.7-4 summarizes the mean seasonal and annual morning and afternoon mixing heights and wind speeds for Athens, Georgia **(Holzworth 1972)**. From a climatological standpoint, considering all weather conditions, the lowest morning mixing heights occur in the autumn and are highest during the winter although, on average, morning mixing heights are only slightly lower in the spring and summer months than during the winter. Conversely, afternoon mixing heights reach a seasonal minimum in the winter and a maximum during the summer, as might be expected due to more intense summertime heating.

The wind speeds listed in Table 2.7-4 for Athens, Georgia, are consistent with the LCD summary for Augusta, Georgia, in Table 2.7-2 in that the lowest mean wind speeds are shown to occur during summer and autumn. This period of minimum wind speeds likewise coincides with the "extended" summer season described by Wang and Angell (1999) that is characterized by relatively higher air stagnation conditions.

2.7.3 Severe Weather

2.7.3.1 Thunderstorms and Lightning

Thunderstorms can occur in the VEGP site area at any time during the year. Based on a 54-year period of record, Augusta, Georgia, averages about 52 thunderstorm-days (i.e., days on which thunder is heard at an observing station) per year. On average, July has the highest monthly frequency of occurrence — about 12 days. Annually, nearly 60 percent of thunderstorm-days are recorded between late spring and mid-summer (i.e., from June through August). From October through January, a thunderstorm might be expected to occur about 1 day per month. **(NCDC 2005a)**

The mean frequency of lightning strokes to earth can be estimated using a method attributed to the Electric Power Research Institute, as reported by the US Department of Agriculture Rural Utilities Service in the publication entitled *Summary of Items of Engineering Interest* **(DOA-RUS 1998)**. This methodology assumes a relationship between the average number of thunderstorm-days per year (T) and the number of lightning strokes to earth per square mile per year (N), where:

$$N = 0.31T$$

Based on the average number of thunderstorm-days per year at Augusta, Georgia (i.e., 52; see Table 2.7-2), the frequency of lightning strokes to earth per square mile is about 16 per year for the VEGP site area. This frequency is essentially equivalent to the mean of the 5-year (1996 to 2000) flash density for the area that includes the VEGP site, as reported by the NWS — 4 to 8 flashes per square kilometer per year **(NWS 2002)** — and, therefore, a reasonable indicator.

The potential reactor area for VEGP Units 3 and 4 is represented in Figure 3.1-3 as an area bounded by a 775-ft-radius circle (or approximately 0.068 mi^2). Given the estimated annual average frequency of lightning strokes to earth in the VEGP site area, the frequency of lightning strokes in the reactor area can be calculated as follows:

$$(16 \text{ lightning strokes/mi}^2\text{/year}) \times (0.068 \text{ mi}^2) = 1.09 \text{ lightning strokes/year}$$

or about once each year in the reactor area.

2.7.3.2 Extreme Winds

Estimating the wind loading on plant structures for design and operating bases considers the "basic" wind speed, which is the "3-second gust speed at 33 ft (10 m) above the ground in Exposure Category C," as defined in Sections 6.2 and 6.3 of the ASCE-SEI design standard, *Minimum Design Loads for Buildings and Other Structures* **(ASCE 2002)**.

The basic wind speed for the VEGP site is about 97 mph, as estimated by linear interpolation from the plot of basic wind speeds in Figure 6-1 of ASCE (2002) for that portion of the US that includes the VEGP site. This interpolated value is about 7.5 percent higher than the basic wind speed reported in the Engineering Weather Data summary for the Augusta (Bush Field) NWS Station (90 mph) **(AFCCC-NCDC 1999)**, which is located about 20 mi northwest of the VEGP site. The former value is, therefore, considered to be a reasonably conservative indicator of the basic wind speed.

From a probabilistic standpoint, these values are associated with a mean recurrence interval of 50 years. Section C6.0 of the ASCE-SEI design standard provides conversion factors for estimating 3-second-gust wind speeds for other recurrence intervals **(ASCE 2002)**. Based on this guidance, the 100-year return period value is determined by multiplying the 50-year return period value by a scaling factor of 1.07, which yields a 100-year return period 3-second-gust wind speed for the VEGP site of about 104 mph.

2.7.3.3 Tornadoes

The design-basis tornado (DBT) characteristics applicable to structures, systems, and components important to safety at the proposed VEGP site include the following parameters as identified in Draft Regulatory Guide DG-1143, *Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants, Proposed Revision 1 of NRC Regulatory Guide 1.76 (dated April 1974)*, January 2006 (DG-1143) and the predecessor US Atomic Energy Commission (USAEC) guidance document WASH-1300, *Technical Basis for Interim Regional Tornado Criteria* **(USAEC 1974)**, on which the original version of Regulatory Guide 1.76 is based:

- Tornado strike probability
- Maximum wind speed
- Translational speed
- Maximum rotational wind speed
- Radius of maximum rotational speed
- Pressure drop
- Rate of pressure drop

The tornado strike probability is determined by evaluating certain characteristics of tornadoes that have been observed within a 2-degree latitude and longitude square centered on the VEGP site. These characteristics include the Fujita-scale wind speed classification (or “F-scale”) and the Pearson-scale path length and path width classification (or “P-scale”). As tornado intensity increases, so does the magnitude or the dimensions of these parameters along with the assigned numerical classification, which ranges from 0 to 5.

The 2-degree square area was assumed to be centered on the VEGP Unit 1 reactor, adjacent to the new unit footprint, and located at the following coordinates:

Latitude = 33° 08' 30" N; Longitude = 81° 45' 44" W

A searchable database of tornado occurrences by location, date and time; starting and ending coordinates; F-scale classification; P-scale dimensions; and damage statistics has been compiled by the NCDC beginning with January 1950 **(NCDC 2006a)**. The 2-degree square area for this evaluation includes all or portions of 30 counties in Georgia and all or portions of 18 counties in South Carolina.

Through the nearly 55-year period ending April 30, 2005, the records in the database indicate that a total of 348 tornadoes or portions of a tornado path passed within the 2-degree square area centered on the VEGP site. Tornado F-scale classifications (with corresponding wind speed range) and respective frequencies of occurrence are as follows:

- F5 (wind speed > 117 m/sec) = 0
- F4 (wind speed 93 to 116 m/sec) = 1
- F3 (wind speed 70 to 92 m/sec) = 18
- F2 (wind speed 50 to 69 m/sec) = 62
- F1 (wind speed 33 to 49 m/sec) = 151
- F0 (wind speed 18 to 32 m/sec) = 116

Following the WASH-1300 methodology, the probability that a tornado will strike a particular location during any one year is given as:

$$P_S = n\ (a / A)$$

where:

P_S = mean tornado strike probability per year

n = average number of tornadoes per year in the area being considered

a = average individual tornado area

A = total area being considered (i.e., the 2-degree square area)

Based on an average occurrence of 6.29 tornadoes per year (i.e., 348 tornadoes over a 55.33-year period of record), an average individual tornado area of 0.197 sq mi (i.e., an average tornado path length of 3.3 mi and an average tornado path width of 105.3 yds), and a total area of 16,010 sq mi for the 2-degree square under consideration, the tornado strike probability (P_S) for the VEGP site area is estimated to be about 774 x 10^{-7} (about 0.0000774 per year), or a recurrence interval of once every 12,920 years.

WASH-1300 indicates that determination of the DBT characteristics is based on the premise that the probability of occurrence of a tornado that exceeds the DBT should be on the order of 10^{-7} per year per nuclear power plant. DG-1143 retains that threshold criterion.

The estimated recurrence interval for the VEGP site area exceeds this threshold; therefore, it is necessary to determine the DBT parameters listed at the beginning of this section. These parameters are able to be calculated from the area-specific database used to determine P_S. However, DG-1143 also provides DBT characteristics for three tornado intensity regions, each with a 10^{-7} probability of occurrence, that are acceptable to the agency.

As indicated in DG-1143, Figure 1, the VEGP site is adjacent to Tornado Intensity Regions I and II. The more conservative DBT parameters for Region I will be used for the design of structures, systems, and components that are important to safety that must take DBT characteristics into account. DG-1143, Table 1, provides the following DBT parameter values for Tornado Intensity Region I:

- Maximum wind speed = 300 mph
- Translational speed = 60 mph
- Maximum rotational wind speed = 240 mph
- Radius of maximum rotational speed = 150 ft
- Pressure drop = 2.0 psi
- Rate of pressure drop = 1.2 psi/sec

2.7.3.4 Hail, Snowstorms, and Ice Storms

Frozen precipitation typically occurs in the form of hail, snow, sleet, and freezing rain. The frequency of occurrence of these types of weather events in the VEGP site area is based on the latest version of *The Climate Atlas of the United States* **(NCDC 2002b)**, which has been developed from observations made over the 30-year period of record from 1961 to 1990.

Though hail can occur at any time of the year and is associated with well-developed thunderstorms, it has been observed primarily during the spring and early summer months and least often during the late summer and autumn months. The Climate Atlas indicates that Burke County, Georgia, and adjacent Barnwell County, South Carolina, can expect, on average, hail with diameters 0.75 in. or greater about 1 day per year. The occurrence of hailstorms with hail greater than or equal to 1.0 in. in diameter averages less than 1 day per year in Burke County.

However, the annual mean number of days with hail 0.75 in. or greater is slightly higher in nearby Richmond and Columbia Counties, Georgia (just to the northwest of the VEGP site), and in Aiken and Edgefield Counties, South Carolina (just to the north and north-northwest of the VEGP site), ranging from 1 to 2 days per year with hail 0.75 in. diameter or greater, and up to 1 day per year with hail 1.0 in. diameter or greater.

NCDC cautions that hailstorm events are point observations and somewhat dependent on population density. While no hailstorms of note have been recorded in some years, multiple events have been observed in other years, including 16 events on 9 separate dates in 1998 and 8 events on 8 separate dates during 1999 in Aiken County, and 8 events on 6 separate dates during 1998 in Richmond County **(NCDC 2006b)**. Therefore, the slightly higher annual mean number of hail days may be a more representative indicator of frequency for the relatively less-populated VEGP site area.

Despite these long-term statistics, golfball-size hail (about 1.75 in. in diameter) is not a rare occurrence **(NCDC 2004, 2006b)**. However, in terms of extreme hailstorm events, the NCDC publication *Storm Data* indicates that baseball size hail (about 2.75 in. in diameter) was observed at one location in the general VEGP site area **(NCDC 2004)** on May 21, 1964, at Hampton, South Carolina, about 43 mi southeast of the VEGP site.

Snow is infrequent in the Upper Coastal Plain of Georgia and South Carolina, where the VEGP site is located, but can occur when a source of moist air from the Atlantic Ocean or the Gulf of Mexico interacts with a very cold air mass that penetrates across the otherwise protective Appalachian mountain range in northern Georgia and northwestern South Carolina. The Climate Atlas **(NCDC 2002b)** indicates that the occurrence of snowfalls 1 in. or greater in the VEGP site area averages less than 1 day per year.

Heavy snow is a rarity. The greatest snowfall on record in the VEGP site area occurred between February 9 and 11, 1973, depending on the cooperative observing station records. Snowfall totals for the overall event typically ranged between 14 and 22 in., the highest single-day total recorded at the Bamberg Station (19.0 in.) which contributed to the highest cumulative monthly total for that station and for the site area. Single-day and cumulative monthly record snowfall totals were also set at nearly all of the other nearby cooperative observing stations as a result of this event. Additional details are given in Section 2.7.4.1.3 and Table 2.7-5.

Depending on the temperature characteristics of the air mass, snow events are often accompanied by or alternate between sleet and freezing rain as the weather system traverses the VEGP region. The Climate Atlas **(NCDC 2002b)** indicates that, on average, freezing precipitation occurs only about 1 or 2 days per year at the VEGP site.

However, the site area appears to be in a transition zone for frequency of occurrence, with the eastern two-thirds of Aiken and Barnwell Counties and all of Allendale County (immediately to the northeast, east, and southeast in South Carolina), and the northeastern quadrant of Screven County, Georgia (just to the southeast of the VEGP site in northeastern Burke County), showing an average frequency of 3 to 5 days of freezing precipitation per year **(NCDC 2002b)**. So, it is not unreasonable to expect a slightly higher annual frequency of occurrence of freezing precipitation events at the VEGP site.

Storm event records from the winters of 2000 through 2005 for the seven-county area surrounding the VEGP site note that ice accumulations of up to 1 in. have occurred, although it is typically less than this thickness **(NCDC 2006b)**.

2.7.3.5 Tropical Cyclones

Tropical cyclones include not only hurricanes and tropical storms, but systems classified as tropical depressions, sub-tropical depressions, and extra-tropical storms, among others. This characterization considers all “tropical cyclones” (rather than systems classified only as hurricanes and tropical storms) because storm classifications are generally downgraded once landfall occurs and the system weakens, although they may still result in significant rainfall events as they travel through the site region.

NOAA’s Coastal Services Center (NOAA-CSC) provides a comprehensive historical database, extending from 1851 through 2004, of tropical cyclone tracks based on information compiled by the National Hurricane Center. This database indicates that a total of 102 tropical cyclone centers or storm tracks have passed within a 100-nautical-mile radius of the VEGP site during this historical period **(NOAA-CSC 2005)**. Storm classifications and respective frequencies of occurrence over this 154-year period of record are as follows:

- Hurricanes – Category 3 (5), Category 2 (4), Category 1 (16)
- Tropical storms — 46
- Tropical depressions — 23
- Sub-tropical storms — 1
- Sub-tropical depressions — 2
- Extra-tropical storms — 5

Tropical cyclones within this 100-nautical-mile radius have occurred as early as May and as late as November, with the highest frequency (36 out of 102 events) recorded during September, including all classifications except sub-tropical depressions. August and October account for 21 and 20 events, respectively, indicating that 75 percent of the tropical cyclones that affect the VEGP site area occur from mid-summer to early autumn. Three of the five Category 3 hurricanes have occurred during September, and the other two occurred in August.

Tropical cyclones are responsible for at least 12 separate rainfall records at 8 NWS cooperative observer network stations in the VEGP site area – eight 24-hour (daily) rainfall totals and 3 monthly rainfall totals (see Section 2.7.4.1.3 and Table 2.7-5). In October 1990, rainfall associated with Tropical Depression Marco (along with a slow-moving cold frontal system) resulted in historical daily maximum totals of 8.60 in. at the Louisville 1E Station, 8.19 in. at the Midville Experiment Station, and 5.50 in. at the Newington 2NE Station, all located in Georgia. Two daily records were established due to Hurricane Gracie in September 1959, at the Blackville 3W (7.53 in.) and Springfield (7.10 in.) stations in South Carolina. In August 1964, a 24-hour rainfall total of 8.02 in. was recorded at the Millen 4N Station (in Georgia) due to Tropical Storm Cleo, and in September 2000, Tropical Depression Helene produced 8.02 in. of rain in a 24-hour period at the Bamberg, South Carolina, observing station. A daily maximum total of 7.30 in. was measured at the Augusta Weather Service Office (WSO) (also in Georgia) in September 1998 during the passage of Tropical Storm Earl. **(NCDC 2004, 2006b; SERCC 2006)**

Monthly station records were established due to contributions from the following tropical cyclones: Tropical Depression Marco in October 1990 (14.82 in. at Augusta WSO and 14.67 in. at Blackville 3W), and Tropical Storm Cleo in August 1964 (13.45 in. at Millen 4N); and to some extent, Tropical Depression Jerry in August 1995 (15.26 in. at Bamberg). **(NCDC 2002c, 2004, 2006b)**

2.7.4 Local Meteorology

Data acquired by the NWS at its Augusta, Georgia (Bush Field), first-order station and from nine other nearby locations in its network of cooperative observer stations, as compiled and summarized by the NCDC, are used to characterize normals, means, and extremes of temperature, rainfall, and snowfall in the vicinity of the VEGP site. Section 2.7.1.1 identifies the sources of these climatological summaries and data resources. The approximate distances and directions of these climatological observing stations relative to the VEGP site are listed in Table 2.7-1; their locations are shown in Figure 2.7-1.

As indicated in Section 2.7.1.1, first-order NWS stations also record measurements, typically on an hourly basis, of other weather elements, including winds, relative humidity, dew point and wet-bulb temperatures, barometric pressure, and other observations (e.g., fog, thunderstorms).

Besides using data from these nearby climatological observing stations, measurements from the tower-mounted meteorological monitoring system that supports operation of the two existing VEGP units are also used to characterize local meteorological conditions. The onsite primary meteorological tower is about 1 mi south-southwest of the VEGP Unit 1 and Unit 2 Containment Buildings (see Figure 3.1-3) and about 0.9 mi south of the proposed VEGP Units 3 and 4. Consequently, based on this proximity, the meteorological parameters related to dispersion (i.e., wind speed, wind direction, and atmospheric stability) collected at the primary tower are also representative of dispersion conditions for the VEGP site.

2.7.4.1 Normal, Mean, and Extreme Values

Section 2.7.1.3 summarizes normals, and period-of-record means and extremes for several standard weather elements (i.e., temperature, atmospheric water vapor, precipitation, and wind conditions).

To substantiate that mean and extreme values at these stations, based on their long-term records of observations, are representative of conditions that might be expected at the VEGP site, this section provides additional details regarding the individual station records from which the values presented in Section 2.7.1.3 were obtained.

Historical extremes of temperature, rainfall, and snowfall are listed in Table 2.7-5 for the ten NWS and cooperative observing stations in the VEGP site area.

2.7.4.1.1 Temperature

Characteristics of the normal daily maximum and minimum temperatures, the daily mean temperatures, and the diurnal temperature ranges for the ten nearby climatological observing stations are discussed in Section 2.7.1.3.1 and in Table 2.7-3. The overall maximum and minimum temperature extremes observed in the VEGP site area are summarized in Section 2.7.1.3.1 as well.

Extreme maximum temperatures recorded in the vicinity of the VEGP site have ranged from 105°F to 112°F, with the highest reading observed at the Louisville 1E Station on July 24, 1952. The station record high temperature for the Midville Experiment Station (i.e., 105°F) has been reached on four separate occasions. As Table 2.7-5 shows, individual station extreme maximum temperature records were set at multiple locations on the same or adjacent dates (i.e., Waynesboro 2NE, Louisville 1E, and Millen 4N; Augusta, Midville Experiment Station, and Aiken 4NE; and Waynesboro 2NE, Midville Experiment Station, and Newington 2NE). **(NCDC 2005b; SERCC 2006)**

Extreme minimum temperatures in the vicinity of the VEGP site have ranged from 2°F to -4°F, with the lowest reading on record observed at the Aiken 4NE Station on January 21, 1985, the same date on which the record low temperature was set at the nine other nearby stations **(NCDC 2005b; SERCC 2006)**.

The extreme maximum and minimum temperature data indicate that synoptic-scale conditions responsible for periods of record-setting excessive heat as well as significant cold air outbreaks tend to affect the overall VEGP site area. The similarity of the respective extremes suggests that these statistics are reasonably representative of the temperature extremes that might be expected to be observed at the VEGP site.

Long-term, engineering-related climatological data summaries prepared by the AFCCC and the NCDC for the nearby Augusta NWS Station **(AFCCC-NCDC 1999)** are used to characterize typical design basis dry-bulb (DB) temperatures. These characteristics include:

- Maximum ambient threshold DB temperatures at annual exceedance probabilities of 2.0 and 0.4 percent, along with mean coincident wet-bulb (MCWB) temperatures at those values.
- Minimum ambient threshold DB temperatures at annual exceedance probabilities of 1.0 and 0.4 percent.

Based on the 24-year period of record from 1973 to 1996 for Augusta, Georgia, the maximum DB temperature with a 2.0 percent annual exceedance probability is 92°F, with a MCWB temperature of 75°F. The maximum DB temperature with a 0.4 percent annual exceedance probability is 97°F, with a corresponding MCWB temperature value of 76°F. **(AFCCC-NCDC 1999)**

For the same period of record, the minimum DB temperatures with 1.0 and 0.4 percent annual exceedance probabilities are 25°F and 21°F, respectively.

2.7.4.1.2 Atmospheric Moisture Content

Annual, seasonal, and monthly characteristics of the wet-bulb and dew point temperatures, along with relative humidity (including diurnal variations), based on measurements at the Augusta NWS Station, are discussed in Section 2.7.1.3.2.

Long-term, engineering-related climatological data summaries for the nearby Augusta NWS Station also indicate that a typical design basis ambient wet-bulb temperature with a 0.4 percent annual exceedance probability is 79°F **(AFCCC-NCDC 1999)**.

2.7.4.1.3 Precipitation

Characteristics of the normal annual rainfall and snowfall totals for the ten nearby climatological observing stations are discussed in Section 2.7.1.3.3 and are presented in Table 2.7-3. The overall maximum daily and monthly totals observed in the VEGP site area for these forms of precipitation are summarized in Section 2.7.1.3.3 as well.

Because precipitation is a point measurement, mean and extreme statistics, such as individual storm event, or daily or cumulative monthly totals typically vary from station to station. Assessing the variability of precipitation extremes over the VEGP site area, in an effort to evaluate whether the available long-term data are representative of conditions at the site, is largely dependent on station coverage.

Historical precipitation extremes (rainfall and snowfall) are presented in Table 2.7-5 for the ten nearby climatological observing stations listed in Table 2.7-1. Based on the similarity of the maximum recorded 24-hour and monthly totals among these stations and the areal distribution of these stations around the VEGP site, the data suggest that these statistics are reasonably representative of precipitation extremes that might be expected to be observed at the site.

As indicated in Section 2.7.3.5, most of the individual station 24-hour rainfall records (and to a lesser extent the monthly record totals) were established as a result of precipitation associated with tropical cyclones that passed within a 100-nautical-mile radius of the VEGP site.

However, the overall highest 24-hour rainfall total in the vicinity of the VEGP site — 9.68 in. on April 16, 1969, at the Aiken 4NE Station in South Carolina **(NCDC 2005b)** — was not associated with a low-pressure system or other well-defined synoptic-scale feature. Rather, this appears to have been an embedded, localized event in an otherwise widespread area of disturbed weather that brought precipitation to the entire East Coast **(ESSA 1969)**.

Similarly, the overall highest monthly rainfall total recorded in the vicinity of the VEGP site — 17.32 in. during June 1973 at the cooperative observing station in Springfield, South Carolina **(SERCC 2006; NCDC 2002c)** — represents the accumulation of 21 days of measurable precipitation during that month **(NCDC 2002c)** due to both synoptic-scale weather features (e.g., stationary frontal boundaries and stalled low-pressure areas off the Carolina coast) and more regional- to local-scale events (e.g., thunderstorms).

For the most part, when daily or monthly rainfall records were established at a given station, regardless of their cause(s), significant amounts of precipitation were usually measured at the other stations in the VEGP site area **(NCDC 2002c)**.

Although the disruptive effects of any winter storm accompanied by frozen precipitation can be significant in the Upper Coastal Plain of Georgia and South Carolina, storms that produce large measurable amounts of snow occur infrequently. With one exception, all of the 24-hour and monthly record snowfall totals listed in Table 2.7-5 were established during the storm of early February 1973, the highest 24-hour and monthly totals (19.0 and 22.0 in., respectively) being recorded at the Bamberg Station in South Carolina. Similar amounts, ranging from 14.0 to 17.0 in., were recorded at most of the other stations. **(NCDC 2005b; SERCC 2006)**

The stations with lower maximum 24-hour snowfall totals — 8.0 in. at the Augusta WSO on February 9 and 5.0 in. at Newington 2NE on February 10 (both in Georgia) **(NCDC 2005b; SERCC 2006)**, and 8.0 in. at Springfield, South Carolina, on February 11 **(SERCC 2006; NCDC 2002c)** — recorded a comparable amount of snowfall on the preceding or following day, making the 2-day totals for these stations similar to the single-day records at the other stations (except at the Newington 2NE Station, the lowest of all the station records).

The record monthly snowfall total at the Millen 4N Station (15.0 in. in February 1968) represents the cumulative amount from two smaller snow events that occurred around February 8 and from February 22 to 24. A review of the daily records for the other stations indicates that except for the Augusta (Georgia) and Blackville 3W (South Carolina) stations, the data are missing for these time periods. **(NCDC 2002c)**

2.7.4.1.4 Fog

The closest station to the VEGP site at which observations of fog are made and routinely recorded is the Augusta NWS Station about 20 mi to the northwest. The 2004 LCD summary for this station (Table 2.7-2) indicates an average of 35.1 days per year of heavy fog conditions, based on a 54-year period of record. The NWS defines heavy fog as fog that reduces visibility to 1/4 mi or less.

The frequency of fog conditions at the VEGP site would be expected to be similar to that of Augusta because of their proximity to one another and because of the similarity of topographic features at both locations (i.e., gently rolling terrain, adjacent to the Savannah River, and location within that broad river valley).

2.7.4.2 Average Wind Direction and Wind Speed Conditions

The distribution of wind direction and wind speed is an important consideration when characterizing the dispersion climatology of a site. Long-term average wind motions at the macro- and synoptic scales (i.e., on the order of several thousand down to several hundred kilometers) are influenced by the general circulation patterns of the atmosphere at the macro-scale and by large-scale topographic features (e.g., mountain ranges, land-water interfaces such as coastal areas). These characteristics are addressed in Section 2.7.1.2.

Site-specific or micro-scale (i.e., on the order of 2 km or less) wind conditions, while reflecting these larger-scale circulation effects, are influenced primarily by local and, to a lesser extent (generally), by meso- or regional-scale (i.e., up to about 200 km) topographic features. Wind measurements at these smaller scales are available from the existing meteorological monitoring program at the VEGP site and from data recorded at the nearby Augusta NWS Station.

Section 6.4 provides a summary description of the onsite meteorological monitoring program at the VEGP site. In its current configuration, wind direction and wind speed measurements are made at two levels on an instrumented 60-m tower (i.e., the lower level at 10 m and the upper level at 60 m).

Figures 2.7-2 through 2.7-6 present annual and seasonal wind rose plots (i.e., graphical distributions of the direction from which the wind is blowing and wind speeds for each of sixteen, 22.5-degree compass sectors centered on north, north-northeast, northeast, etc.) for the 10-m level based on measurements at the VEGP site over the composite 5-year period from 1998 through 2002.

For the VEGP site, the wind direction distribution at the 10-m level generally follows a southwest-northeast orientation on an annual basis (see Figure 2.7-2). The prevailing wind (i.e., defined as the direction from which the wind blows most often) is from the southwest, with nearly 25 percent of the winds blowing from the southwest through west sectors. Conversely, winds from the northeast through east sectors occur about 20 percent of the time. On a seasonal basis, winds from the southwest quadrant predominate during the spring and summer months (see Figures 2.7-4 and 2.7-5). This is also the case during the winter, although westerly winds prevail and the relative frequency of west-northwest winds during this season is greater (see Figure 2.7-3) due to increased cold frontal passages. Winds from the northeast quadrant predominate during the autumn months (see Figure 2.7-6). Plots of individual monthly wind roses at the 10-m measurement level are presented in Figure 2.7-7 (Sheets 1 to 12).

Wind rose plots based on measurements at the 60-m level are shown in Figures 2.7-8 through 2.7-13. By comparison, wind direction distributions for the 60-m level are fairly similar to the 10-m level wind roses on a composite annual (see Figure 2.7-8) and seasonal basis (see Figures 2.7-9 through 2.7-12). Plots of individual monthly wind roses at the 60-m measurement level are presented in Figure 2.7-13 (Sheets 1 to 12).

Wind information summarized in the LCD for the Augusta NWS Station (see Table 2.7-2) indicates a prevailing west-southwesterly wind direction **(NCDC 2005a)** that appears to be similar to the 10-m level wind flow at the VEGP site, at least on an annual basis (see Figure 2.7-2).

Table 2.7-6 summarizes seasonal and annual mean wind speeds based on measurements from the upper and lower levels of the existing VEGP site meteorological tower (1998–2002) and from wind instrumentation at the Augusta NWS Station (1971–2000 station normals) **(NCDC 2005a)**. The elevation of the wind instruments at the Augusta NWS Station is nominally 20 ft (about 6.1 m) **(NCDC 2005a)**, comparable to the lower (10-m) level measurements at the VEGP site.

On an annual basis, mean wind speeds at the 10- and 60-m levels are 2.5 m/sec and 4.6 m/sec, respectively, at the VEGP site. The annual mean wind speed at Augusta (i.e., 2.7 m/sec) is similar to the 10-m level at the VEGP site, differing by only 0.2 m/sec; seasonal average wind speeds at Augusta are likewise slightly higher. Seasonal mean wind speeds for both measurement levels at the VEGP site follow the same pattern discussed in Section 2.7.2.3 for Augusta and Athens, Georgia, and their relationship to the seasonal variation of relatively higher air stagnation and restrictive dispersion conditions in the site region.

Based on the joint frequency distributions of wind speed and wind direction by atmospheric stability class (see Section 2.7.4.4.), the annual frequencies of calm wind conditions are 0.35 and 0.05 percent of the time for the 10- and 60-m tower levels, respectively, at the VEGP site.

2.7.4.3 Wind Direction Persistence

Wind direction persistence is a relative indicator of the duration of atmospheric transport from a specific sector-width to a corresponding downwind sector-width that is 180 degrees opposite. Atmospheric dilution is directly proportional to the wind speed (other factors remaining constant). When combined with wind speed, a wind direction persistence/wind speed distribution further indicates the downwind sectors with relatively more or less dilution potential (i.e., higher or lower wind speeds, respectively) associated with a given transport wind direction.

Tables 2.7-7 and 2.7-8 present wind direction persistence/wind speed distributions based on measurements at the VEGP site for the 5-year period of record from 1998 through 2002. The distributions account for durations ranging from 1 to 48 hours for wind directions from 22.5-degree and 67.5-degree upwind sectors centered on each of the 16 standard compass radials (i.e., north, north-northeast, northeast, etc.). Further, the distributions are provided for wind measurements made at the lower (10-m) and the upper (60-m) tower levels, respectively.

2.7.4.4 Atmospheric Stability

Atmospheric stability is a relative indicator for the potential diffusion of pollutants released into the ambient air. Atmospheric stability, as discussed in this ER, is determined by the delta-temperature (ΔT) method as defined in Table 1 of Proposed Revision 1 to Regulatory Guide 1.23, *Meteorological Programs in Support of Nuclear Power Plants*, September 1980 (RG 1.23).

The approach classifies stability based on the temperature change with height (i.e., the difference in °C per 100 m). Stability classifications are assigned according to the following criteria:

- Extremely Unstable (Class A) — $\Delta T/\Delta Z \leq$ -1.9°C
- Moderately Unstable (Class B) — -1.9°C < $\Delta T/\Delta Z \leq$ -1.7°C
- Slightly Unstable (Class C) — -1.7°C < $\Delta T/\Delta Z \leq$ -1.5°C
- Neutral Stability (Class D) — -1.5°C < $\Delta T/\Delta Z \leq$ -0.5°C
- Slightly Stable (Class E) — -0.5°C < $\Delta T/\Delta Z \leq$ +1.5°C
- Moderately Stable (Class F) — +1.5°C < $\Delta T/\Delta Z \leq$ +4.0°C
- Extremely Stable (Class G) — +4.0°C < $\Delta T/\Delta Z$

The diffusion capacity is greatest for extremely unstable conditions and decreases progressively through the remaining unstable, neutral stability, and stable classifications.

During the 1998 through 2002 time period at the VEGP site, ΔT was determined from the difference between temperature measurements made at the 10- and 60-m tower levels. Seasonal and annual frequencies of atmospheric stability class and associated 10-m level mean wind speeds for this period of record are presented in Table 2.7-9.

The data indicate a predominance of slightly stable (Class E) and neutral stability (Class D) conditions, ranging from about 50 to 60 percent of the time on a seasonal and annual basis. Extremely unstable conditions (Class A) are more frequent during the spring and summer months due to greater solar insolation. Extremely stable conditions (Class G) are most frequent during the fall and winter months, owing in part to increased radiational cooling at night.

Joint frequency distributions (JFDs) of wind speed and wind direction by atmospheric stability class and for all stability classes combined for the 10-m and 60-m wind measurement levels at the VEGP site are presented in Table 2.7-10 and Table 2.7-11, respectively, for the 5-year period of record from 1998 through 2002. The 10-m level JFDs are used to evaluate short-term dispersion estimates for accidental atmospheric releases (see Section 2.7.5) and long-term diffusion estimates of routine releases (see Section 2.7.6).

2.7.4.5 Topographic Description and Potential Modifications

The VEGP site (approximately 3,169 acres) is located in Burke County, Georgia, along (west of) the Savannah River. Topographic features within a 5-mi radius of the VEGP site are shown in Figure 2.7-14. Terrain elevation profiles along each of the 16 standard 22.5-degree compass radials out to a distance of 50 mi from the VEGP site are illustrated in Figure 2.7-15 (Sheets 1 through 4).

These profiles indicate that the terrain in the VEGP site area is flat to gently rolling. The only other nearby topographic feature of note is the Savannah River, located adjacent to the VEGP site; the broad river valley represents a depression running northwest to southeast.

The site for proposed VEGP Units 3 and 4 is immediately west of existing VEGP Units 1 and 2 (see Figure 3.1-3). During construction of the new units, a portion of the currently undeveloped area of the VEGP site would be cleared of existing vegetation and subsequently graded to accommodate VEGP Units 3 and 4 and their ancillary structures.

Consequently, terrain modifications would be expected to be minimal, limited to the proposed site for VEGP Units 3 and 4 and the immediately surrounding area, and not represent a significant alteration to the flat to gently rolling topographic character of the area and region around the site.

2.7.5 Short-Term Diffusion Estimates

2.7.5.1 Basis

To evaluate potential health effects for Westinghouse AP1000 design-basis accidents, Section 7.1 of NUREG-1555, *Environmental Standard Review Plan, Standard Review Plans for Environmental Reviews for Nuclear Power Plants*, October 1999 (NUREG-1555), specifically requires the applicant to account for the 50-percentile χ/Q values at appropriate distances from the release points of effluents to the atmosphere. These 50-percentile χ/Q values are determined using onsite meteorological data, and they represent more realistic dispersion conditions for the VEGP site vicinity and area than those assumed in the safety evaluation of SSAR Section 2.3.4. The NRC-sponsored PAVAN model (NUREG/CR-2858, *PAVAN: An Atmospheric Dispersion Program for Evaluating Design Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations*, PNL-4413, November 1982 [NUREG/CR-2858]) has been used to generate these overall site 50-percentile χ/Q values.

Recent, readily-available site data (1998–2002) have been used for a quantitative evaluation of the hypothetical accident at the proposed VEGP site. The use of a recent 5-year data set for dispersion analyses involving accidental releases in this ESP application satisfies the requirement of Regulatory Guide 4.7, *General Site Suitability Criteria for Nuclear Power Stations*, Revision 2, April 1998 (RG 4.7). These 5-year composite joint frequency distributions of wind direction, wind speed, and atmospheric stability recorded at the VEGP site are presented in Table 2.7-10.

The PAVAN program implements the guidance provided in Regulatory Guide 1.145, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants*, Revision 1, November 1982 (Re-issued February 1983) (RG 1.145). Mainly, the code computes χ/Q values at the Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) for each combination of wind speed and atmospheric stability class for each of 16 downwind direction sectors (i.e., north, north-northeast, northeast, etc.). The χ/Q values calculated for each direction sector are then ranked in descending order, and an associated cumulative frequency distribution is derived based on the frequency distribution of wind speeds and stabilities for the complementary upwind direction sector. The χ/Q values are also ranked independently of wind direction into a cumulative frequency distribution for the entire site.

Compared to an elevated release, a ground-level release usually results in higher ground-level concentrations at downwind receptors due to less dilution from shorter traveling distances. Since the ground-level release scenario provides a bounding case, elevated releases are not considered in this ESP application.

As shown in Figure 3.1-3, the EAB for VEGP Units 3 and 4 is entirely contained within the site property line. This is the same as the exclusion area for the existing VEGP units. For the purposes of determining χ/Qs and subsequent radiation dose analyses, an effective EAB, hereafter referred to as the Dose Calculation EAB, was developed for the proposed units. The AP1000 units will be located within the power block area, shown in Figure 3.1-3, which is the perimeter of a 775-ft-radius circle with the centroid at a point between the two AP1000 units. The Dose Calculation EAB is a circle that extends 1/2 mi beyond the power block area (i.e., a circle with a 3,415-ft radius with its centroid at the centroid of the power block circle). The Dose Calculation EAB is completely within the actual plant EAB and, thus, the χ/Qs and the subsequent radiation doses are conservatively higher.

The PAVAN model has been configured to calculate offsite χ/Q values assuming both wake-credit allowed and wake-credit not allowed. No residential areas are located within the Dose Calculation EAB. The AP1000 design **(Westinghouse 2005)** indicates that the highest structure (i.e., the Reactor Building) will be about 234 ft above grade level. Therefore, the closest point on the Dose Calculation EAB is more than 10 building heights (or, 2,340 ft) away from the boundary of the plant envelope developed for the VEGP site. As a result, the entire Dose Calculation EAB is located beyond the wake influence zone induced by the Reactor Building. The LPZ is a 2-mi-radius (3,218 m) circle centered at the midpoint of the existing VEGP reactors. Because it is located beyond the Dose Calculation EAB, the “wake-credit not allowed” scenario of the PAVAN results has been used for the χ/Q analyses at both the Dose Calculation EAB and the LPZ.

To be conservative, the 1/2 mi (or approximately 800 m) distance between the VEGP Units 3 and 4 power block area circle and the Dose Calculation EAB has been entered as input for each downwind sector to calculate the χ/Q values at the Dose Calculation EAB. Similarly, the shortest distance from the power block area circle to the LPZ has been input for all direction sectors to calculate the χ/Q values at the LPZ. The shortest distance from the center-point of the existing units is to the western perimeter of the power block area, which is about 914 m. Therefore, the minimum distance from the power block area circle to the LPZ is about 2,304 m (or about 1.4 mi).

2.7.5.2 PAVAN Modeling Results

Based on the upper envelope of the ordered 5-percent overall site limit χ/Q values as calculated by the PAVAN model (see Tables 2.7-12 and 2.7-13), the 50-percentile overall site (i.e., nondirection specific) χ/Qs at the Dose Calculation EAB and the LPZ are estimated to be 7.38 x 10^{-5} sec/m^3 and 1.83 x 10^{-5} sec/m^3, respectively. These model-predicted χ/Q values represent a 0- to 2-hour time interval with no credit for building wake effects as indicated in the preceding section.

To estimate χ/Qs for longer time intervals, the program calculates an annual average χ/Q value using the procedure described in Regulatory Guide 1.111, *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors*, Revision 1, July 1977 (RG 1.111). The values for intermediate time periods (i.e., 8 hours, 16 hours, 72 hours, and 624 hours) were determined by logarithmic interpolation between the 50-percentile, 0- to 2-hour χ/Qs at the Dose Calculation EAB and the LPZ and the corresponding annual average χ/Qs. These results, along with the 50-percentile, 0- to 2-hour and the annual average χ/Q values, are summarized below.

Summary of Interpolated χ/Q Values for Intermediate Time Periods

Source Location	Receptor Distance	50-Percentile 0-2 hr	0-8 hours (8 hours)	8-24 hour (16 hours)	1-4 days (72 hours)	4-30 days (624 hours)	Annual Average
PBAC[a]	Dose Calculation EAB	7.38E-05	6.59E-05	6.23E-05	5.52E-05	4.63E-05	3.74E-05
PBAC[a]	LPZ	1.83E-05	1.40E-05	1.22E-05	9.15E-06	6.04E-06	3.63E-06

a. PBAC = Power Block Area Circle

2.7.6 Long-Term (Routine) Diffusion Estimates

2.7.6.1 Basis

The NRC-sponsored computer program XOQDOQ (NUREG/CR-2919, *XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations*, PNL-4380, September 1982 [NUREG/CR-2919]), was used to estimate χ/Q values due to routine releases of gaseous effluents to the atmosphere. The XOQDOQ model implements the assumptions outlined in RG 1.111. The XOQDOQ model assumes a straight-line trajectory between the release point and all receptors.

The primary function of the XOQDOQ computer code is to calculate annual χ/Q values and annual average relative deposition (*D*/Q) values at receptors of interest (e.g., the Dose Calculation EAB and the LPZ boundaries, the nearest milk cow, residence, garden, meat animal). The program assumes that the material released to the atmosphere follows a Gaussian distribution around the plume centerline. In estimating concentrations for longer time periods, the Gaussian distribution is assumed to be evenly distributed within a given directional sector.

The following input data and assumptions were used in the XOQDOQ modeling analysis:

- Meteorological data: 5-year (January 1, 1998 to December 31, 2000) composite onsite JFD of wind speed, wind direction, and atmospheric stability.
- Type of release: Ground-level.
- Wind sensor height: 10 m.
- Vertical temperature difference: 10m – 60 m.
- Number of wind speed categories: 11.
- Release height: 10 m (default height).
- Minimum building cross-sectional area: 2,926 sq m.
- Containment structure equivalent height: 65.6 m.
- Distances from the release point to the nearest site boundary, meat animal, residence, and vegetable garden (see Table 2.7-14).

The AP1000 reactor design has been used to calculate the minimum building cross-sectional area as called for in NUREG/CR-2919. The containment building minimum cross-sectional area contains two parts; the reactor enclosure building plus a Passive Cooling Containment System (PCS) water tank on the top of that structure. The height of the entire contiguous building is assumed to be 234.4 ft (71.4 m), while the bottom (W_B) and the top (W_T) widths of the building are 146.3 ft (44.6 m) and 89 ft (27.1 m), respectively. The height of the PCS is 39.1 ft (11.9 m).

The total calculated cross-sectional area of the structure (A_T) is 31,498 ft^2 (2,926 m^2). Using this total area, and dividing by the actual width of the bottom of the reactor enclosure building (i.e., 146.3 ft), the equivalent structural height is calculated ($H_e = A_T / W_B$) to be 215.2 ft (65.6 m), which assumes that the structure width is uniform in the vertical direction. Since all receptors are located beyond the wake influence zone (see Section 2.7.5.1), the building height has no effect on the modeling results.

When compared to elevated releases, ground-level releases usually produce higher pollutant concentrations for receptors located at ground level. Thus, only ground-level releases are conservatively assumed in the χ/Q analysis.

Distances from the midpoint between the VEGP Unit 1 and Unit 2 reactors to various receptors of interest (i.e., nearest residence, meat animal, site boundary, and vegetable garden) for each directional sector are provided in AREOR (2004). The distance to the nearest residence (0.67 mi) was conservatively used in all the directional sectors for all types of sensitive receptors (meat animal, vegetable garden, and residence). The results are presented in Table 2.7-14.

2.7.6.2 XOQDOQ Modeling Results

The overall maximum annual average χ/Q value (with no decay) is 5.5 x 10^{-6} sec/m^3 and occurs at the Dose Calculation EAB at a distance of 800 m (about 0.5 mi) to the northeast of the VEGP site. The maximum annual average χ/Q values (along with the direction and distance of the receptor locations relative to the VEGP site) for the other sensitive receptor types are:

- 3.4×10^{-6} sec/m^3 for the nearest residence occurring in the northeast sector at a distance of 1,071 m (0.67 mi).
- Because the same shortest distance (1,071 m) was used to estimate χ/Q values for the nearest vegetable garden and meat animal, the same χ/Q value (3.4×10^{-6} sec/m^3) was obtained at these receptors.

Table 2.7-15 summarizes the maximum χ/Q and D/Q values predicted by the XOQDOQ model for the sensitive receptors of interest due to routine releases. Table 2.7-16 summarizes the maximum annual average χ/Q and D/Q values at the 22 standard radial distances between 0.25 and 50 mi and for the model's 10 distance-segment boundaries between 0.5 and 50 mi downwind.

Detailed annual average χ/Q and D/Q estimates generated by the XOQDOQ model for the receptors of interest, and at distances between 0.25 and 50 mi, as well as for the standard distance-segment boundaries, are also presented. Table 2.7-17 presents χ/Q estimates at the specific points of interest. Tables 2.7-18 and 2.7-19 list χ/Q estimates with no radioactive decay and no plume depletion at downwind distances between 0.25 and 50 mi, and for the standard distance-segment boundaries, respectively. Tables 2.7-20 and 2.7-21 contain χ/Q estimates that include radioactive decay with a half-life of 2.26 days for short-lived noble gases and no plume depletion. Tables 2.7-22 and 2.7-23 contain χ/Q estimates that include radioactive decay with a half-life of 8 days for all iodines released to the atmosphere as well as plume depletion. Finally, Tables 2.7-24 and 2.7-25 contain estimates of long-term average D/Q values at downwind distances between 0.25 and 50 mi, as well as for the standard distance-segment boundaries, respectively.

2.7.7 Noise

Noise at VEGP comes from normal plant operations. Sources of noise at the VEGP site include the cooling towers, transformers and other electrical equipment, circulating water pumps, and public address system. These noise sources are sufficiently distant from the VEGP site boundary that the noise generated diminishes to near ambient levels before reaching receptors outside the VEGP site boundary. As shown in Table 2.7-26, background plus VEGP-generated noise levels predicted at seven locations along the VEGP site boundary range from 25 to 40 dBa, approximately within the range of the average measured background noise levels of 22 to 39 dBa **(GPC 1985)**.

Table 2.7-1 NWS and Cooperative Observing Stations Near the VEGP Site

Station[a]	State	County	Approximate Distance (miles)	Direction Relative to Site	Elevation (feet)
Waynesboro 2NE	GA	Burke	16	WSW	270
Augusta WSO (Bush Field)	GA	Richmond	20	NW	132
Millen 4N	GA	Jenkins	22	SSW	195
Midville Experiment Station	GA	Burke	32	SW	280
Louisville 1E	GA	Jefferson	37	WSW	322
Newington 2NE	GA	Screven	41	SSE	209
Aiken 4NE	SC	Aiken	25	NNE	502
Blackville 3W	SC	Barnwell	29	ENE	324
Springfield	SC	Orangeburg	37	NE	300
Bamberg	SC	Bamberg	44	ENE	165

a. Numeric and letter designators following a station name (e.g., Waynesboro 2NE) indicate the station’s approximate distance in miles (e.g., 2) and direction (e.g.., northeast) relative to the place name (e.g., Waynesboro).

Table 2.7-2 Local Climatological Data Summary for Augusta, Georgia

NORMALS, MEANS, AND EXTREMES

AUGUSTA, GA (AGS)

LATITUDE:	LONGITUDE:	ELEVATION (FT):		TIME ZONE:	WBAN: 03820
33° 22′ 11″ N	81° 57′ 53″ W	GRND: 160	BARO: 163	EASTERN (UTC + 5)	

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	NORMAL DAILY MAXIMUM	30	56.5	61.3	69.2	76.7	83.9	89.6	92.0	90.2	85.3	76.5	67.8	59.1	75.7
	MEAN DAILY MAXIMUM	48	56.4	60.6	68.3	76.8	84.0	89.4	91.9	90.6	85.6	76.9	68.3	59.1	75.7
	HIGHEST DAILY MAXIMUM	54	82	86	89	96	99	105	107	108	101	97	90	82	108
	YEAR OF OCCURRENCE		2002	1962	1995	1986	2000	1952	1980	1983	1999	1954	1961	1998	AUG 1983
	MEAN OF EXTREME MAXS.	56	74.4	76.0	80.7	88.8	93.4	98.1	99.0	97.9	94.5	88.3	81.5	76.1	87.4
	NORMAL DAILY MINIMUM	30	33.1	35.5	42.5	48.1	57.2	65.4	69.6	68.4	62.4	49.6	40.9	34.7	50.6
	MEAN DAILY MINIMUM	48	32.7	34.7	40.4	48.9	58.0	66.0	70.1	69.1	63.3	50.7	41.5	34.3	50.8
	LOWEST DAILY MINIMUM	54	-1	0	0	26	35	47	55	52	36	22	15	5	-1
	YEAR OF OCCURRENCE		1985	1998	1998	1982	1971	1984	1951	2004	1967	1952	1970	1981	JAN 1985
	MEAN OF EXTREME MINS.	56	16.6	19.0	25.0	33.4	43.5	54.7	62.5	60.4	49.7	34.4	24.9	18.5	36.9
	NORMAL DRY BULB	30	44.8	48.4	55.9	62.4	70.5	77.5	80.8	79.3	73.8	63.1	54.4	46.9	63.1
	MEAN DRY BULB	56	45.2	48.4	55.3	63.0	71.2	77.9	81.0	80.1	74.6	64.1	54.5	46.9	63.5
	MEAN WET BULB	49	40.3	42.8	48.4	55.5	63.4	69.8	72.7	72.3	67.4	57.4	48.5	41.7	56.7
	MEAN DEW POINT	49	34.4	36.0	41.5	49.4	58.9	66.0	69.7	69.4	64.3	53.4	43.2	36.1	51.9
	NORMAL NO. DAYS WITH:														
	MAXIMUM ≥ 90°	30	0.0	0.0	0.0	0.6	5.9	16.0	23.5	19.4	9.4	0.6	0.0	0.0	75.4
	MAXIMUM ≤ 32°	30	0.4	0.2	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7
	MINIMUM ≤ 32°	30	15.0	11.5	4.6	0.9	0.0	0.0	0.0	0.0	0.0	0.6	6.5	13.1	52.2
	MINIMUM ≤ 0°	30	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H/C	NORMAL HEATING DEG. DAYS	30	617	469	301	129	21	1	0	0	5	118	317	547	2525
	NORMAL COOLING DEG. DAYS	30	1	2	15	52	191	385	506	459	285	74	15	1	1986
RH	NORMAL (PERCENT)	30	70	67	66	66	70	72	74	77	77	75	74	72	72
	HOUR 01 LST	30	80	77	77	80	86	87	88	91	90	89	86	82	84
	HOUR 07 LST	30	84	84	85	86	87	87	89	92	92	91	89	85	88
	HOUR 13 LST	30	55	50	48	45	48	52	54	56	55	50	51	54	52
	HOUR 19 LST	30	68	61	57	55	60	63	67	72	77	78	74	71	67
S	PERCENT POSSIBLE SUNSHINE														
W/O	MEAN NO. DAYS WITH:														
	HEAVY FOG(VISBY≤1/4 MI)	54	3.5	2.7	2.1	2.5	2.5	1.4	1.6	3.1	3.8	3.9	4.0	4.0	35.1
	THUNDERSTORMS	54	0.9	1.8	2.7	3.6	6.0	9.4	11.9	9.3	3.4	1.3	0.8	0.7	51.8
CLOUDINESS	MEAN:														
	SUNRISE-SUNSET (OKTAS)	1			7.2		3.2	4.0	5.6	4.8		5.6		4.0	
	MIDNIGHT-MIDNIGHT (OKTAS)	1			6.4		4.0	4.0	4.8	4.0					
	MEAN NO. DAYS WITH:														
	CLEAR	1	2.0	2.0	9.0		14.0	7.0	2.0	6.0	3.0	7.0	5.0	10.0	
	PARTLY CLOUDY	1		2.0	1.0		2.0	8.0	2.0	2.0	2.0	4.0	1.0	1.0	
	CLOUDY	1	2.5	3.0	12.0		3.0	4.0		6.0	7.0	3.0	1.0	7.0	
PR	MEAN STATION PRESSURE(IN)	31	29.97	29.93	29.89	29.86	29.83	29.84	29.87	29.88	29.89	29.93	29.96	29.98	29.90
	MEAN SEA-LEVEL PRES. (IN)	47	30.14	30.09	30.04	30.02	30.00	29.99	30.03	30.01	30.04	30.08	30.11	30.15	30.06
WINDS	MEAN SPEED (MPH)	28	6.7	7.1	7.4	6.9	6.1	5.7	5.6	5.0	5.3	5.2	5.5	6.2	6.1
	PREVAIL.DIR(TENS OF DEGS)	29	27	29	29	18	14	14	24	14	04	04	29	29	24
	MAXIMUM 2-MINUTE:														
	SPEED (MPH)	10	40	37	40	37	49	45	36	38	36	38	38	35	49
	DIR. (TENS OF DEGS)		26	30	29	28	23	34	21	01	02	34	18	28	23
	YEAR OF OCCURRENCE		1997	2003	1999	2001	2004	1998	1995	2002	1997	1995	2001	2000	MAY 2004
	MAXIMUM 5-SECOND:														
	SPEED (MPH)	10	54	45	51	55	74	53	47	49	45	52	49	43	74
	DIR. (TENS OF DEGS)		25	31	29	34	23	33	21	01	01	33	03	28	23
	YEAR OF OCCURRENCE		1997	2003	1999	1997	2004	1998	1998	2002	1997	1995	1995	2000	MAY 2004
PRECIPITATION	NORMAL (IN)	30	4.50	4.11	4.61	2.94	3.07	4.19	4.07	4.48	3.59	3.20	2.68	3.14	44.58
	MAXIMUM MONTHLY (IN)	54	8.91	7.67	11.92	8.43	9.61	10.57	11.43	11.34	9.51	14.82	7.76	8.65	14.82
	YEAR OF OCCURRENCE		1987	1961	1980	1961	1979	2004	1967	1986	1975	1990	1985	1981	OCT 1990
	MINIMUM MONTHLY (IN)	54	0.75	0.69	0.88	0.60	0.36	0.68	1.02	0.65	0.31	T	0.09	0.32	T
	YEAR OF OCCURRENCE		1981	1968	1968	1970	2000	1984	1987	1980	1984	1953	1960	1955	OCT 1953
	MAXIMUM IN 24 HOURS (IN)	54	3.61	3.69	5.31	3.96	4.44	5.08	3.71	5.98	7.30	8.57	3.82	3.12	8.57
	YEAR OF OCCURRENCE		1960	1985	1967	1955	1981	1981	1979	1964	1998	1990	1985	1970	OCT 1990
	NORMAL NO. DAYS WITH:														
	PRECIPITATION ≥ 0.01	30	11.0	8.7	9.8	7.4	9.0	10.1	11.2	10.9	7.8	6.2	7.2	9.5	108.8
	PRECIPITATION ≥ 1.00	30	1.2	1.2	1.3	0.8	0.8	1.4	1.1	1.4	0.9	1.0	0.8	0.7	12.6
SNOWFALL	NORMAL (IN)	30	0.3	1.0	0.*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.4
	MAXIMUM MONTHLY (IN)	50	2.6	14.0	1.1	T	0.0	T	0.0	0.0	0.0	0.0	T	1.0	14.0
	YEAR OF OCCURRENCE		1992	1973	1980	1992		1994					1968	1993	FEB 1973
	MAXIMUM IN 24 HOURS (IN)	50	2.6	13.7	1.1	T	0.0	T	0.0	0.0	0.0	0.0	T	1.0	13.7
	YEAR OF OCCURRENCE		1992	1973	1980	1992		1994					1968	1993	FEB 1973
	MAXIMUM SNOW DEPTH (IN)	48	2	13	1	0	0	0	0	0	0	0	0	1	13
	YEAR OF OCCURRENCE		1988	1973	1980									1958	FEB 1973
	NORMAL NO. DAYS WITH:														
	SNOWFALL ≥ 1.0	30	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3

Source: NCDC 2005a

Table 2.7-3 Climatological Normals (Means) at Selected NWS and Cooperative Observing Stations in the VEGP Site Area

Station	Normal Annual Temperatures (°F)[a]			Normal Annual Precipitation	
	Daily Maximum	Daily Minimum	Daily Mean	Rainfall[a] (inches)	Snowfall (inches)
Waynesboro 2NE	75.2	51.0	63.1	47.20	1.0[b]
Augusta	75.7	50.6	63.2	44.58	1.4[b]
Millen 4N	76.1	50.6	63.4	43.85	0.5[c]
Midville Exp Station	76.9	52.9	65.0	44.90	0.1[b]
Louisville 1E	75.6	51.7	63.7	45.92	0.9[b]
Newington 2NE	76.2	52.5	64.4	47.81	0.8[b]
Aiken 4NE	77.2	50.9	64.1	52.43	1.4[b]
Blackville 3W	77.6	51.6	64.6	47.23	0.7[b]
Springfield	NA[d]	NA[d]	NA[d]	46.28	0.7[e]
Bamberg	75.0	53.1	64.1	48.57	1.3[b]

a. NCDC 2002a
b. NCDC 2005b
c. SERCC 2006, based on available Period of Record (1930–1998)
d. NA = Measurements not made at this station
e. SERCC 2006, based on available Period of Record (1948–2005)

Table 2.7-4 Mean Seasonal and Annual Morning and Afternoon Mixing Heights and Wind Speeds for Athens, Georgia

Parameter	Winter	Spring	Summer	Autumn	Annual
Mixing Height – AM (m)	407	383	390	314	374
Wind Speed – AM (m/sec)	6.0	5.3	3.8	4.4	4.9
Mixing Height – PM (m)	1,042	1,754	1,918	1,455	1,542
Wind Speed – PM (m/sec)	7.0	7.2	4.9	5.7	6.2

Note: Mean wind speed values represent the arithmetic average of speeds observed at the surface and aloft within the mixed layer.

Source: Holzworth 1972

Table 2.7-5 Climatological Extremes at Selected NWS and Cooperative Observing Stations in the VEGP Site Area

Parameter	Waynesboro 2NE	Augusta WSO	Millen 4N	Midville Exp Station	Louisville 1E	Newington 2NE	Aiken 4NE	Blackville 3W	Springfield	Bamberg
Maximum Temperature	108 °F [a, b] (7/25/52); (7/14/80)	108 °F [a] (8/21/83)	109 °F [b] (7/24/52)	105 °F [a, b] (7/13/80); (8/21/83) (7/19/86); (7/21/86)	112 °F [a] (7/24/52)	110 °F [a] (7/13/80)	109 °F [a] (8/22/83)	108 °F [a] (8/1/99)	NA [d]	109 °F [a] (7/24/52)
Minimum Temperature	-1 °F [a, b] (1/20/85); (1/21/85)	-1 °F [a] (1/21/85)	0 °F [b] (1/21/85)	-1 °F [a] (1/21/85)	-2 °F [a] (1/21/85)	-1 °F [a] (1/21/85)	-4 °F [a] (1/21/85)	-1 °F [a] (1/21/85)	NA [d]	2 °F [a] (1/21/85)
Maximum 24-hr Rainfall	7.40 in. [a] (10/3/94)	7.30 in. [a] (9/3/98)	8.02 in. [b] (8/29/64)	8.19 in. [a] (10/12/90)	8.60 in. [a] (10/12/90)	5.50 in. [a] (10/10/90)	9.68 in. [a] (4/16/69)	7.53 in. [a] (9/30/59)	7.10 in. [b, c] (9/30/59)	8.02 in. [a, c] (9/23/00)
Maximum Monthly Rainfall	16.99 in. [a, b] (10/94)	14.82 in. [a, b] (10/90)	13.45 in. [b] (8/64)	15.97 in. [b, c] (8/70)	14.76 in. [b, c] (8/91)	15.29 in. [a, b] (7/89)	14.45 in. [a, b] (3/80)	14.67 in. [a, b] (10/90)	17.32 in. [b, c] (6/73)	15.26 in. [a, b] (8/95)
Maximum 24-hr Snowfall	16.0 in. [a, b] (2/10/73)	8.0 in. [a, b] (2/9/73)	14.0 in. [b] (2/10/73)	14.0 in. [b, c] (2/10/73)	14.8 in. [a, b] (2/10/73)	5.0 in. [a, b] (2/10/73)	15.0 in. [a, b] (2/10/73)	17.0 in. [b, c] (2/10/73)	8.0 in. [b, c] (2/11/73)	19.0 in. [a, b] (2/10/73)
Maximum Monthly Snowfall	16.0 in. [a, b] (2/73)	14.0 in. [a, b] (2/73)	15.0 in. [b] (2/68)	14.0 in. [b, c] (2/73)	14.8 in. [a, b] (2/73)	8.0 in. [a, b] (2/73)	15.0 in. [a, b] (2/73)	17.0 in. [b, c] (2/73)	15.0 in. [b, c] (2/73)	22.0 in. [a, b] (2/73)

Sources: a - NCDC 2005b
b - SERCC 2006
c - NCDC 2002c
d - NA = Measurements not made at this station

Table 2.7-6 Seasonal and Annual Mean Wind Speeds for the VEGP Site (1998–2002) and the Augusta, Georgia NWS Station (1971–2000, Normals)

Primary Tower Elevation	Location	Winter	Spring	Summer	Autumn	Annual
Upper Level (60 m) (m/sec)	Plant Vogtle	5.0	5.0	4.1	4.4	4.6
Lower Level (10 m) (m/sec)	Plant Vogtle	2.6	2.8	2.4	2.3	2.5
Single Level (6.1 m) (m/sec)	Augusta WSO[a]	3.0	3.0	2.4	2.4	2.7

a. Source: NCDC 2005a

Notes:
Winter = December, January, February
Spring = March, April, May
Summer = June, July, August
Autumn = September, October, November

Table 2.7-7 Wind Direction Persistence/Wind Speed Distributions for the VEGP Site – 10-m Level

1998 TO 2002 WIND PERSISTENCE
VEGP METEOROLOGICAL TOWER – 10-M LEVEL
22.5° SECTOR WIDTH
START AND END OF PERIOD 98010101 - 02123124
PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 22.5 DEGREES)

Speed Greater than or Equal to 5.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	1180	1133	1919	2028	1392	822	948	863	906	1298	1541	1478	1804	1444	856	894
2	439	376	919	983	538	231	353	294	305	493	621	526	830	639	266	310
4	99	75	343	326	139	27	88	58	56	102	164	105	246	197	51	52
8	6	4	97	65	13	4	5	2	3	4	14	4	28	30	3	0
12	0	0	36	10	0	0	0	0	0	0	0	0	2	9	0	0
18	0	0	9	0	0	0	0	0	0	0	0	0	0	3	0	0
24	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 22.5 DEGREES)

Speed Greater than or Equal to 10.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	136	126	323	415	149	58	116	85	74	167	246	250	362	361	150	59
2	42	51	129	197	39	16	37	27	24	57	106	91	156	167	46	22
4	7	9	40	63	5	3	8	5	3	9	25	21	47	45	11	6
8	0	0	11	7	0	0	0	0	0	0	0	1	4	5	0	0
12	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-7 (cont.) Wind Direction Persistence/Wind Speed Distributions for the VEGP Site – 10-m Level

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 22.5 DEGREES)
Speed Greater than or Equal to 15.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	3	9	13	25	8	1	6	3	4	14	21	17	40	43	19	2
2	0	3	2	10	0	0	0	0	0	4	6	5	13	14	5	1
4	0	0	0	5	0	0	0	0	0	0	3	0	0	2	0	0
8	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 22.5 DEGREES)
Speed Greater than or Equal to 20.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	1	0	0	4	0	0	0	0	0	2	0	1	3	5	0	0
2	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0
4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-7 (cont.) Wind Direction Persistence/Wind Speed Distributions for the VEGP Site – 10-m Level

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 22.5 DEGREES)

Speed Greater than or Equal to 25.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-7 (cont.) Wind Direction Persistence/Wind Speed Distributions for the VEGP Site – 10-m Level

1998 TO 2002 WIND PERSISTENCE
VEGP METEOROLOGICAL TOWER - 10-M LEVEL
67.5° SECTOR WIDTH

START AND END OF PERIOD 98010101 - 02123124

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 67.5 DEGREES)

Speed Greater than or Equal to 5.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	3207	4232	5080	5339	4242	3162	2633	2717	3067	3745	4317	4823	4726	4104	3194	2930
2	1885	2649	3569	3875	2751	1762	1438	1539	1694	2224	2686	3187	3226	2738	1881	1630
4	901	1461	2358	2587	1495	830	666	740	733	1031	1363	1765	1941	1635	908	738
8	310	653	1331	1443	570	271	219	248	208	250	455	623	824	749	297	216
12	129	358	828	880	237	96	78	116	68	73	168	209	361	376	119	80
18	54	187	466	471	87	23	19	29	4	15	57	64	134	148	41	20
24	32	107	283	287	32	0	3	6	0	3	20	15	52	67	17	2
30	17	69	164	178	2	0	0	0	0	0	6	2	22	33	2	0
36	11	48	96	117	0	0	0	0	0	0	0	0	4	20	0	0
48	0	27	33	38	0	0	0	0	0	0	0	0	0	8	0	0

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 67.5 DEGREES)

Speed Greater than or Equal to 10.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	321	585	864	887	622	323	259	275	326	487	663	858	973	873	570	345
2	160	271	484	515	328	114	115	127	143	243	354	489	592	549	332	143
4	74	115	212	243	128	26	42	49	40	71	135	218	299	313	168	59
8	33	44	69	74	24	0	12	15	0	2	15	36	81	115	55	16
12	19	21	26	20	4	0	2	3	0	0	0	2	30	43	18	4
18	5	6	3	1	0	0	0	0	0	0	0	0	6	13	4	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-7 (cont.) Wind Direction Persistence/Wind Speed Distributions for the VEGP Site – 10-m Level

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 67.5 DEGREES)

Speed Greater than or Equal to 15.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	14	25	47	46	34	15	10	13	21	39	52	78	100	102	64	24
2	5	6	20	17	10	0	0	0	4	14	23	29	49	56	29	7
4	0	0	7	7	5	0	0	0	0	5	5	6	16	21	9	0
8	0	0	1	1	1	0	0	0	0	0	0	0	3	3	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 67.5 DEGREES)

Speed Greater than or Equal to 20.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	1	1	4	4	4	0	0	0	2	2	3	4	9	8	5	1
2	0	0	3	3	3	0	0	0	0	0	0	0	3	3	1	0
4	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-7 (cont.) Wind Direction Persistence/Wind Speed Distributions for the VEGP Site – 10-m Level

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 67.5 DEGREES)

Speed Greater than or Equal to 25.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-8 Wind Direction Persistence/Wind Speed Distributions for the VEGP Site - 60-m Level

1998 TO 2002 WIND PERSISTENCE
VEGP METEOROLOGICAL TOWER - 60-M LEVEL
22.5° SECTOR WIDTH
START AND END OF PERIOD 98010101 - 02123124
PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 22.5 DEGREES)

Speed Greater than or Equal to 5.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	1610	1940	3083	2713	2037	1558	1645	2015	2294	2694	3397	3268	3052	2001	1615	1488
2	641	889	1687	1343	946	666	734	986	1057	1266	1739	1594	1576	910	663	575
4	168	245	736	446	273	167	218	319	290	346	569	492	586	293	146	131
8	20	33	192	70	43	19	20	56	35	27	73	51	122	67	6	3
12	4	7	67	7	15	1	4	15	0	0	5	13	17	16	0	0
18	0	0	20	0	5	0	0	0	0	0	0	0	0	0	0	0
24	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 22.5 DEGREES)

Speed Greater than or Equal to 10.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	616	954	1922	1457	984	747	802	713	1006	1597	2138	2098	2036	1247	775	615
2	240	435	1107	710	442	303	339	305	433	750	1106	1066	1106	619	322	231
4	68	116	515	219	114	77	100	82	118	207	366	359	444	233	73	59
8	14	16	161	33	23	10	13	6	12	13	43	44	101	60	4	2
12	4	6	63	5	12	0	1	0	0	0	3	13	13	15	0	0
18	0	0	20	0	2	0	0	0	0	0	0	0	0	0	0	0
24	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-8 (cont.) Wind Direction Persistence/Wind Speed Distributions for the VEGP Site - 60-m Level

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 22.5 DEGREES)

Speed Greater than or Equal to 15.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	131	211	522	254	106	66	112	75	171	364	628	721	732	436	147	123
2	53	87	264	94	31	11	33	15	52	123	277	314	362	211	49	39
4	23	27	117	29	6	0	10	2	8	26	81	94	140	89	15	9
8	12	10	44	8	0	0	3	0	0	0	3	9	34	21	2	1
12	4	6	24	4	0	0	0	0	0	0	0	3	1	2	0	0
18	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 22.5 DEGREES)

Speed Greater than or Equal to 20.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	24	21	44	25	12	8	16	4	19	48	97	135	183	118	36	12
2	13	6	20	10	4	0	5	0	3	14	21	48	87	54	16	4
4	7	1	7	5	0	0	3	0	0	2	0	12	30	19	7	2
8	3	0	0	1	0	0	0	0	0	0	0	0	6	1	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-8 (cont.) Wind Direction Persistence/Wind Speed Distributions for the VEGP Site - 60-m Level

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 22.5 DEGREES)

Speed Greater than or Equal to 25.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	2	0	5	5	1	0	0	0	2	6	15	26	37	21	5	3
2	0	0	1	3	0	0	0	0	0	2	2	12	16	7	1	2
4	0	0	0	1	0	0	0	0	0	0	0	6	6	2	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-8 (cont.) Wind Direction Persistence/Wind Speed Distributions for the VEGP Site - 60-m Level

1998 TO 2002 WIND PERSISTENCE
VEGP METEOROLOGICAL TOWER - 60-M LEVEL
67.5° SECTOR WIDTH
START AND END OF PERIOD 98010101 - 02123124
PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 67.5 DEGREES)

Speed Greater than or Equal to 5.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	5038	6633	7736	7833	6308	5240	5218	5954	7003	8385	9359	9717	8321	6668	5104	4713
2	3401	4871	6139	6199	4565	3663	3670	4240	5098	6291	7318	7740	6402	4858	3475	3173
4	1887	3216	4448	4396	2827	2165	2126	2561	3130	4099	5024	5525	4399	3100	1942	1745
8	842	1778	2685	2516	1215	905	847	1122	1331	1939	2694	3133	2539	1549	726	666
12	459	1095	1746	1561	527	398	376	556	576	953	1523	1874	1606	876	295	286
18	225	581	1046	836	152	127	134	198	184	370	671	934	842	425	112	121
24	123	355	665	449	61	52	44	77	69	151	331	511	460	223	51	71
30	82	241	417	251	19	28	14	46	24	57	146	308	217	110	17	49
36	52	162	253	145	11	16	4	28	5	13	58	186	84	54	3	38
48	18	66	95	49	0	0	0	1	0	0	4	80	9	11	0	26

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 67.5 DEGREES)

Speed Greater than or Equal to 10.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	2185	3492	4333	4363	3188	2533	2262	2521	3316	4741	5833	6272	5381	4058	2637	2006
2	1281	2389	3217	3156	2011	1548	1344	1406	2029	3291	4248	4711	4052	2884	1663	1170
4	627	1465	2159	1982	998	757	620	620	959	1932	2698	3182	2793	1848	876	557
8	245	751	1218	993	313	228	183	188	223	775	1306	1701	1607	984	325	207
12	139	460	754	570	119	74	69	76	50	330	700	985	1007	555	125	109
18	84	230	449	296	26	8	14	21	0	118	275	496	503	264	24	52
24	45	131	285	165	5	0	1	4	0	48	104	273	252	130	2	32
30	26	76	176	97	0	0	0	0	0	19	30	170	108	56	0	20
36	12	45	108	62	0	0	0	0	0	1	6	106	35	29	0	14
48	0	13	44	19	0	0	0	0	0	0	0	41	0	10	0	2

Table 2.7-8 (cont.) Wind Direction Persistence/Wind Speed Distributions for the VEGP Site - 60-m Level

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 67.5 DEGREES)

Speed Greater than or Equal to 15.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	465	864	987	882	426	284	253	358	610	1163	1713	2081	1889	1315	706	401
2	223	470	549	462	163	104	90	126	243	606	1005	1322	1217	814	369	189
4	100	233	276	207	46	32	29	32	63	239	482	731	711	456	173	92
8	51	106	121	79	11	5	8	8	1	41	111	257	304	206	59	48
12	37	59	75	47	7	0	0	0	0	8	31	97	145	95	8	33
18	19	24	44	29	1	0	0	0	0	0	5	12	37	40	0	21
24	10	11	26	19	0	0	0	0	0	0	0	0	18	25	0	10
30	4	5	14	13	0	0	0	0	0	0	0	0	11	18	0	4
36	0	0	6	7	0	0	0	0	0	0	0	0	5	12	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 67.5 DEGREES)

Speed Greater than or Equal to 20.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	57	89	90	81	45	36	28	39	71	164	280	415	436	337	166	72
2	26	43	44	38	15	10	5	9	21	55	122	210	240	194	88	38
4	14	16	17	15	5	3	3	3	3	12	38	82	107	92	41	23
8	5	3	1	1	1	0	0	0	0	1	2	16	18	19	7	10
12	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	2
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-8 (cont.) Wind Direction Persistence/Wind Speed Distributions for the VEGP Site - 60-m Level

PERSISTENCIES FROM 98010101 TO 02123124 (SECTOR WIDTH = 67.5 DEGREES)

Speed Greater than or Equal to 25.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	5	7	10	11	6	1	0	2	8	23	47	78	84	63	29	10
2	2	1	5	5	3	0	0	0	2	6	21	36	40	30	12	3
4	0	0	1	1	1	0	0	0	0	1	9	16	17	12	3	0
8	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-9 Seasonal and Annual Vertical Stability Class and Mean 10-m Level Wind Speed Distributions for the VEGP Site (1998–2002)

	Vertical Stability Categories[a]						
Period	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Winter							
Frequency (%)	2.23	2.94	6.40	31.25	28.96	14.06	14.14
Wind Speed (m/sec)	3.4	3.9	3.6	3.1	2.6	1.7	1.4
Spring							
Frequency (%)	11.49	5.29	7.04	25.18	27.10	13.94	9.95
Wind Speed (m/sec)	3.6	3.7	3.6	3.3	2.5	1.8	1.4
Summer							
Frequency (%)	8.27	6.12	7.60	24.73	33.00	14.22	6.04
Wind Speed (m/sec)	3.4	3.1	2.9	2.7	2.1	1.5	1.4
Autumn							
Frequency (%)	3.76	3.79	8.36	28.90	26.92	13.65	14.62
Wind Speed (m/sec)	3.2	3.3	3.2	2.8	2.2	1.7	1.2
Annual							
Frequency (%)	6.48	4.54	7.34	27.50	28.99	13.97	11.17
Wind Speed (m/sec)	3.5	3.5	3.3	3.0	2.4	1.7	1.3

Note: a - Vertical stability based on temperature difference (ΔT) between 10-m and 60-m measurement levels.

Table 2.7-10 Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record: 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Stability Class: A Delta Temperature Extremely Unstable

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
	Wind Speed (m/s)												
N	0	0	0	3	7	38	63	4	0	0	0	0	115
NNE	0	0	2	3	17	48	33	13	0	0	0	0	116
NE	0	0	0	7	6	36	79	17	0	0	0	0	145
ENE	0	0	1	3	13	75	127	30	0	0	0	0	249
E	0	0	0	5	15	77	133	10	0	0	0	0	240
ESE	0	0	1	4	17	66	55	0	0	0	0	0	143
SE	0	1	1	4	11	41	49	5	0	0	0	0	112
SSE	0	0	1	9	2	32	36	2	1	0	0	0	83
S	0	1	0	10	22	42	51	5	0	0	0	0	131
SSW	0	0	2	6	19	59	97	12	0	0	0	0	195
SW	0	0	2	8	18	71	117	20	3	0	0	0	239
WSW	0	0	2	6	23	74	167	26	3	0	0	0	301
W	0	2	0	4	17	79	156	26	2	0	0	0	286
WNW	0	0	0	5	9	39	88	16	3	0	0	0	160
NW	0	0	0	6	9	28	57	14	3	0	0	0	117
NNW	1	0	1	2	6	23	59	1	0	0	0	0	93
Totals	1	4	13	85	211	828	1367	201	15	0	0	0	2725

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	11
Number of Invalid Hours	1633
Number of Valid Hours for this Table	2725
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-10 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record: 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Stability Class: B Delta Temperature Moderately Unstable

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	0	0	1	3	9	39	64	5	0	1	0	0	122
NNE	0	0	0	5	13	38	36	8	2	0	0	0	102
NE	0	1	0	4	7	40	48	7	0	0	0	0	107
ENE	1	0	0	1	11	54	69	23	0	0	0	0	159
E	0	0	0	5	4	44	65	8	0	0	0	0	126
ESE	0	0	1	6	6	31	22	3	0	0	0	0	69
SE	0	0	4	7	8	23	22	1	0	0	0	0	65
SSE	0	0	0	7	14	21	18	1	0	0	0	0	61
S	0	1	0	2	12	30	27	4	0	0	0	0	76
SSW	0	0	0	3	17	53	51	5	2	0	0	0	131
SW	0	0	1	9	18	51	75	19	2	0	0	0	175
WSW	0	0	0	4	7	58	64	18	1	0	0	0	152
W	0	0	0	2	8	60	96	22	3	0	0	0	191
WNW	0	0	0	2	7	37	75	28	4	1	0	0	154
NW	0	0	0	3	5	33	42	12	2	0	0	0	97
NNW	0	0	0	1	11	37	70	4	0	0	0	0	123
Totals	1	2	7	64	157	649	844	168	16	2	0	0	1910

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	44
Number of Invalid Hours	1633
Number of Valid Hours for this Table	1910
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-10 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record: 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Stability Class: C Delta Temperature Slightly Unstable

	Wind Speed (m/s)												
Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	1	1	8	24	81	84	5	1	0	0	0	205
NNE	0	0	4	6	17	72	72	3	0	0	0	0	174
NE	0	0	0	5	15	60	72	13	0	0	0	0	165
ENE	0	0	3	6	19	74	115	17	0	0	0	0	234
E	0	0	1	9	21	58	105	1	1	0	0	0	196
ESE	0	0	2	9	15	52	44	1	0	0	0	0	123
SE	0	1	2	11	19	43	35	5	1	0	0	0	117
SSE	0	0	2	10	9	28	45	10	1	0	0	0	105
S	0	0	3	8	29	70	47	4	0	0	0	0	161
SSW	0	1	0	7	26	70	84	8	1	0	0	0	197
SW	0	0	0	11	22	74	127	21	3	0	0	0	258
WSW	0	1	0	11	24	94	101	23	1	0	0	0	255
W	0	0	3	10	27	110	138	41	5	0	0	0	334
WNW	0	0	0	8	22	53	71	43	7	0	0	0	204
NW	0	2	1	3	24	68	66	14	4	0	0	0	182
NNW	2	1	2	4	20	81	67	1	0	0	0	0	178
Totals	2	7	24	126	333	1088	1273	210	25	0	0	0	3088

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	114
Number of Invalid Hours	1633
Number of Valid Hours for this Table	3088
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-10 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record: 01/01/98 1:00 - 12/31/02 23:00Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Stability Class: D Delta Temperature Neutral

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	7	13	78	137	345	215	29	0	0	0	0	824
NNE	2	6	8	72	106	278	209	32	2	0	0	0	715
NE	3	4	15	57	99	342	507	75	1	0	0	0	1103
ENE	1	2	12	61	95	303	454	87	4	1	0	0	1020
E	1	10	18	67	114	268	215	21	3	0	0	0	717
ESE	3	5	14	49	71	165	124	9	0	0	0	0	440
SE	1	16	9	48	80	138	149	39	2	0	0	0	482
SSE	4	9	17	65	96	186	152	18	0	0	0	0	547
S	2	9	14	78	114	240	125	10	0	0	0	0	592
SSW	1	9	21	47	96	229	219	38	3	0	0	0	663
SW	3	3	14	83	117	269	238	40	7	0	0	0	774
WSW	1	8	18	68	141	294	246	53	2	1	0	0	832
W	1	4	11	72	123	269	334	81	16	0	0	0	911
WNW	6	3	19	59	109	222	287	83	14	0	0	0	802
NW	2	4	11	69	97	212	123	31	4	0	0	0	553
NNW	0	3	12	60	98	244	154	17	0	0	0	0	588
Totals	31	102	226	1033	1693	4004	3751	663	58	2	0	0	11563

Number of Calm Hours for this Table	4
Number of Variable Direction Hours for this Table	543
Number of Invalid Hours	1633
Number of Valid Hours for this Table	11563
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-10 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002

Hours at Each Wind Speed and Direction

Period of Record: 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Stability Class: E Delta Temperature Slightly Stable

Wind Direction (from)	Wind Speed (m/s) 0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	9	16	26	87	94	154	108	12	1	0	0	0	507
NNE	9	11	37	89	93	224	112	13	1	0	0	0	589
NE	9	20	26	88	124	338	272	23	3	0	0	0	903
ENE	12	14	33	94	149	327	206	29	6	1	0	0	871
E	7	23	38	95	164	330	114	19	2	0	0	0	792
ESE	12	8	50	123	184	246	86	14	0	0	0	0	723
SE	13	21	45	110	184	293	160	9	0	0	0	0	835
SSE	13	25	47	167	250	322	101	8	0	0	0	0	933
S	10	21	60	239	233	271	76	9	1	0	0	0	920
SSW	3	21	43	151	200	272	135	17	1	0	0	0	843
SW	8	18	53	167	245	335	170	13	1	0	0	0	1010
WSW	9	18	40	191	223	266	82	10	1	0	0	0	840
W	5	13	59	127	156	281	169	15	0	0	0	0	825
WNW	9	11	22	113	122	216	185	29	1	0	0	0	708
NW	8	14	27	102	107	147	84	9	1	0	0	0	499
NNW	7	8	21	57	85	128	75	6	2	0	0	0	389
Totals	143	262	627	2000	2613	4150	2135	235	21	1	0	0	12187

Number of Calm Hours for this Table	35
Number of Variable Direction Hours for this Table	396
Number of Invalid Hours	1633
Number of Valid Hours for this Table	12187
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-10 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002

Hours at Each Wind Speed and Direction

Period of Record: 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Stability Class: F Delta Temperature Moderately Stable

Wind Direction (from)	Wind Speed (m/s) 0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	11	20	20	56	61	65	15	0	0	0	0	0	248
NNE	16	21	30	62	44	61	25	0	0	0	0	0	259
NE	22	15	24	70	71	97	19	0	0	0	0	0	318
ENE	17	29	27	77	86	162	24	1	0	0	0	0	423
E	16	28	45	103	128	117	5	0	0	0	0	0	442
ESE	16	25	37	94	112	69	2	0	0	0	0	0	355
SE	21	17	35	85	112	52	6	0	0	0	0	0	328
SSE	15	28	30	88	106	65	7	0	0	0	0	0	339
S	12	22	47	143	111	55	0	1	0	0	0	0	391
SSW	20	14	36	138	135	88	10	0	0	0	0	0	441
SW	19	24	36	148	224	99	7	0	0	0	0	0	557
WSW	12	19	47	183	228	110	1	0	0	0	0	0	600
W	10	18	50	169	129	64	9	1	0	0	0	0	450
WNW	10	24	30	103	110	45	11	3	0	0	0	0	336
NW	6	16	21	66	57	34	3	0	0	0	0	0	203
NNW	12	14	18	44	49	38	7	0	0	0	0	0	182
Totals	235	334	533	1629	1763	1221	151	6	0	0	0	0	5872

Number of Calm Hours for this Table	39
Number of Variable Direction Hours for this Table	230
Number of Invalid Hours	1633
Number of Valid Hours for this Table	5872
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-10 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002

Hours at Each Wind Speed and Direction

Period of Record: 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Stability Class: G Delta Temperature Extremely Stable

Wind Direction (from)	Wind Speed (m/s) 0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	26	31	49	75	46	18	5	0	0	0	0	0	250
NNE	25	26	34	33	13	16	1	0	1	0	0	0	149
NE	45	30	35	58	24	16	0	0	0	0	0	0	208
ENE	29	26	42	73	61	36	2	0	0	0	0	0	269
E	28	33	55	101	78	30	3	0	0	0	0	0	328
ESE	28	33	56	110	40	17	1	0	0	0	0	0	285
SE	21	31	39	48	48	20	3	0	0	0	0	0	210
SSE	20	34	43	46	36	14	2	0	0	0	0	0	195
S	15	20	41	58	47	22	1	0	1	0	0	0	205
SSW	24	22	56	104	111	49	5	0	0	0	0	0	371
SW	32	34	56	150	203	68	2	0	0	0	0	0	545
WSW	19	38	61	207	170	50	2	0	0	0	0	0	547
W	25	36	78	178	133	42	0	0	0	0	0	0	492
WNW	26	34	43	83	56	14	2	1	0	0	0	0	259
NW	35	32	32	41	21	6	0	0	0	0	0	0	167
NNW	22	25	45	81	28	16	1	0	0	0	0	0	218
Totals	420	485	765	1446	1115	434	30	1	2	0	0	0	4698

Number of Calm Hours for this Table	67
Number of Variable Direction Hours for this Table	432
Number of Invalid Hours	1633
Number of Valid Hours for this Table	4698
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-10 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (10-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002

Hours at Each Wind Speed and Direction

Period of Record: 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP10M **Direction:** DI10M **Lapse:** DT60M

Summary of All Stability Classes: Delta Temperature

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	46	75	110	310	378	740	554	55	2	1	0	0	2271
NNE	52	64	115	270	303	737	488	69	6	0	0	0	2104
NE	79	70	100	289	346	929	997	135	4	0	0	0	2949
ENE	60	71	118	315	434	1031	997	187	10	2	0	0	3225
E	52	94	157	385	524	924	640	59	6	0	0	0	2841
ESE	59	71	161	395	445	646	334	27	0	0	0	0	2138
SE	56	87	135	313	462	610	424	59	3	0	0	0	2149
SSE	52	96	140	392	513	668	361	39	2	0	0	0	2263
S	39	74	165	538	568	730	327	33	2	0	0	0	2476
SSW	48	67	158	456	604	820	601	80	7	0	0	0	2841
SW	62	79	162	576	847	967	736	113	16	0	0	0	3558
WSW	41	84	168	670	816	946	663	130	8	1	0	0	3527
W	41	73	201	562	593	905	902	186	26	0	0	0	3489
WNW	51	72	114	373	435	626	719	203	29	1	0	0	2623
NW	51	68	92	290	320	528	375	80	14	0	0	0	1818
NNW	44	51	99	249	297	567	433	29	2	0	0	0	1771
Totals	833	1196	2195	6383	7885	12374	9551	1484	137	5	0	0	42043

Number of Calm Hours for this Table	147
Number of Variable Direction Hours for this Table	1770
Number of Invalid Hours	1633
Number of Valid Hours for this Table	42043
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-11 Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record: 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Stability Class: A Delta Temperature Extremely Unstable

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
						Wind Speed (m/s)							
N	0	0	0	4	5	22	36	33	6	0	0	0	106
NNE	0	0	0	1	6	24	34	21	9	1	0	0	96
NE	0	0	0	0	4	23	84	88	28	0	0	0	227
ENE	0	0	1	3	7	35	141	71	15	1	0	0	274
E	0	0	0	1	2	31	86	26	2	0	0	0	148
ESE	1	0	0	4	3	19	52	21	1	0	0	0	101
SE	0	0	0	2	2	10	31	7	0	0	0	0	52
SSE	0	0	1	2	4	27	49	14	1	0	0	0	98
S	0	0	2	4	6	15	51	32	8	0	0	0	118
SSW	0	0	0	2	11	27	80	51	23	3	0	0	197
SW	0	0	0	3	14	33	98	110	60	13	0	0	331
WSW	0	1	1	2	9	26	96	104	76	15	5	0	335
W	0	1	0	2	9	34	57	48	46	5	0	0	202
WNW	0	0	1	2	1	12	37	37	12	7	0	0	109
NW	0	0	0	2	10	19	46	30	4	1	2	0	114
NNW	0	0	1	0	5	22	47	33	2	0	0	0	110
Totals	1	2	7	34	98	379	1025	726	293	46	7	0	2618

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	6
Number of Invalid Hours	3217
Number of Valid Hours for this Table	2618
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-11 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed: SP60M** **Direction:** DI60M **Lapse:** DT60M

Stability Class B Delta Temperature Moderately Unstable

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	0	1	4	4	17	48	20	8	0	0	0	102
NNE	0	0	0	1	5	15	33	22	5	0	0	0	81
NE	0	1	0	4	1	20	60	46	12	0	0	0	144
ENE	0	0	0	2	3	23	67	35	4	0	0	0	134
E	0	0	0	2	3	18	43	21	1	0	0	0	88
ESE	0	0	0	1	2	18	27	10	0	0	0	0	58
SE	0	0	1	0	3	12	20	10	0	0	0	0	46
SSE	0	0	0	3	1	15	19	5	0	0	0	0	43
S	0	0	0	1	4	15	29	11	8	0	0	0	68
SSW	0	0	1	1	1	17	48	22	18	1	1	0	110
SW	0	0	0	0	8	28	80	46	35	4	1	0	202
WSW	0	0	0	1	6	26	73	49	35	7	1	0	198
W	0	0	0	1	6	17	67	48	29	12	0	0	180
WNW	0	0	0	0	3	14	46	26	17	7	2	0	115
NW	0	0	0	2	4	17	52	27	8	1	0	0	111
NNW	0	0	0	0	5	18	53	28	2	0	0	0	106
Totals	0	1	3	23	59	290	765	426	182	32	5	0	1786

Wind Speed (m/s)

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	26
Number of Invalid Hours	3217
Number of Valid Hours for this Table	1786
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-11 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record: 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Stability Class: C Delta Temperature Slightly Unstable

Wind Direction (from)	Wind Speed (m/s) 0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	0	0	2	12	54	80	27	4	0	0	0	179
NNE	1	1	1	3	10	34	62	24	8	0	0	0	144
NE	0	2	0	6	7	36	99	48	6	0	0	0	204
ENE	0	0	2	5	8	45	97	49	8	0	0	0	214
E	0	0	0	6	11	44	100	16	2	1	0	0	180
ESE	0	0	1	6	5	18	34	11	0	1	0	0	76
SE	0	0	1	1	7	19	41	14	2	0	0	0	85
SSE	0	0	0	6	5	26	51	13	6	1	0	0	108
S	0	0	0	4	13	38	63	21	10	0	0	0	149
SSW	0	0	0	4	9	37	85	38	13	3	0	0	189
SW	0	0	2	3	4	49	102	73	34	7	0	0	274
WSW	0	1	0	5	9	52	122	60	41	6	1	0	297
W	0	1	1	1	12	47	111	54	44	11	1	0	283
WNW	0	0	0	4	5	34	69	43	26	12	2	0	195
NW	0	0	1	5	12	40	92	30	5	2	0	0	187
NNW	0	1	3	5	4	46	89	22	5	0	0	0	175
Totals	1	6	12	66	133	619	1297	543	214	44	4	0	2939

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	60
Number of Invalid Hours	3217
Number of Valid Hours for this Table	2939
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-11 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record: 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Stability Class: D Delta Temperature Neutral

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	2	2	1	24	47	152	291	114	39	2	0	0	674
NNE	0	4	9	24	49	129	319	182	62	2	0	0	780
NE	0	3	5	25	42	147	425	382	125	1	0	0	1155
ENE	1	1	8	27	59	158	352	199	47	3	2	0	857
E	1	4	6	24	40	115	237	91	27	1	0	0	546
ESE	2	0	6	21	32	76	134	50	12	2	0	0	335
SE	2	2	9	20	38	72	170	100	41	1	0	0	455
SSE	1	5	7	23	43	114	210	109	22	0	0	0	534
S	1	4	4	29	59	148	233	100	22	3	0	0	603
SSW	2	3	7	19	36	102	231	138	57	12	1	0	608
SW	1	3	6	22	48	135	307	186	111	13	1	0	833
WSW	2	3	6	23	37	149	299	253	155	22	2	0	951
W	0	4	9	24	45	143	286	212	166	46	8	0	943
WNW	0	5	6	26	33	93	189	139	93	21	0	0	605
NW	0	2	11	18	34	122	206	109	31	5	0	0	538
NNW	2	2	5	22	42	158	258	109	45	1	0	0	644
Totals	17	47	105	371	684	2013	4147	2473	1055	135	14	0	11061

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	257
Number of Invalid Hours	3217
Number of Valid Hours for this Table	11061
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-11 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Stability Class E Delta Temperature Slightly Stable

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	3	2	7	18	17	91	205	107	21	8	0	0	479
NNE	0	0	3	20	25	93	248	212	58	0	0	0	659
NE	2	1	4	12	32	87	331	373	122	4	0	0	968
ENE	1	1	4	19	31	89	347	277	50	4	3	0	826
E	1	2	4	15	21	82	312	204	27	3	0	0	671
ESE	1	2	6	16	24	71	289	221	24	1	0	0	655
SE	0	1	6	9	16	81	345	215	18	0	0	0	691
SSE	0	4	6	31	48	196	513	163	11	1	0	0	973
S	0	3	5	25	41	179	421	222	29	2	1	0	928
SSW	1	3	6	13	21	90	371	336	57	3	0	0	901
SW	1	4	3	18	27	71	419	368	98	7	0	0	1016
WSW	2	2	2	11	25	64	310	288	106	9	0	0	819
W	3	3	5	13	26	48	253	364	146	10	1	0	872
WNW	2	1	6	11	15	61	170	204	112	9	0	0	591
NW	1	3	3	16	14	60	169	147	41	2	0	0	456
NNW	1	0	8	15	25	61	131	91	17	3	1	0	353
Totals	19	32	78	262	408	1424	4834	3792	937	66	6	0	11858

Number of Calm Hours for this Table	8
Number of Variable Direction Hours for this Table	83
Number of Invalid Hours	3217
Number of Valid Hours for this Table	11858
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-11 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Stability Class F Delta Temperature Moderately Stable

	Wind Speed (m/s)												
Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	1	3	1	8	9	39	78	43	8	0	0	0	190
NNE	0	0	1	3	13	39	117	68	15	0	0	0	256
NE	1	2	0	8	9	39	100	156	33	0	0	0	348
ENE	2	1	1	8	16	27	150	174	26	0	0	0	405
E	1	1	2	8	7	30	163	142	2	0	0	0	356
ESE	3	2	1	13	14	44	157	89	3	0	0	0	326
SE	1	1	3	6	15	41	157	85	6	0	0	0	315
SSE	1	2	4	18	27	94	142	94	5	0	0	0	387
S	1	1	11	25	30	80	156	149	8	0	0	0	461
SSW	1	5	3	4	8	47	187	212	28	0	0	0	495
SW	3	1	5	10	15	40	156	280	44	0	0	0	554
WSW	0	0	3	8	11	26	150	242	37	1	0	0	478
W	2	1	4	6	14	29	133	216	49	0	0	0	454
WNW	1	0	2	7	13	31	89	142	31	0	0	0	316
NW	0	0	3	5	8	30	87	80	5	0	0	0	218
NNW	2	2	2	4	9	27	75	51	7	0	0	0	179
Totals	20	22	46	141	218	663	2097	2223	307	1	0	0	5738

Number of Calm Hours for this Table	4
Number of Variable Direction Hours for this Table	14
Number of Invalid Hours	3217
Number of Valid Hours for this Table	5738
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-11 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Stability Class G Delta Temperature Extremely Stable

Wind Direction (from)	Wind Speed (m/s) 0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	2	2	4	10	16	32	69	17	0	0	1	0	153
NNE	2	2	2	12	15	56	86	17	1	0	0	0	193
NE	1	1	7	15	22	37	90	55	7	0	0	0	235
ENE	0	3	8	13	12	40	118	88	20	0	0	0	302
E	0	4	3	9	13	24	123	97	10	0	0	0	283
ESE	2	2	5	7	8	28	111	72	1	0	0	0	236
SE	1	1	4	9	20	38	90	43	2	0	0	0	208
SSE	1	2	7	17	29	76	82	39	4	0	0	0	257
S	1	1	7	18	33	70	113	94	27	0	0	0	364
SSW	1	3	5	13	12	34	135	172	45	0	0	0	420
SW	1	0	2	9	13	43	147	171	58	0	0	0	444
WSW	4	1	2	7	15	41	103	216	37	0	0	0	426
W	4	5	3	12	15	47	126	159	33	0	0	0	404
WNW	1	3	3	8	10	41	102	90	11	0	0	0	269
NW	1	1	6	11	12	47	98	50	4	0	0	0	230
NNW	0	0	3	8	16	44	57	31	2	0	0	0	161
Totals	22	31	71	178	261	698	1650	1411	262	0	1	0	4585

Number of Calm Hours for this Table	9
Number of Variable Direction Hours for this Table	42
Number of Invalid Hours	3217
Number of Valid Hours for this Table	4585
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-11 (cont.) Joint Frequency Distribution of Wind Speed and Wind Direction (60-m Level) by Atmospheric Stability Class for the VEGP Site (1998–2002)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/98 1:00 - 12/31/02 23:00 Total Period

Elevation: **Speed:** SP60M **Direction:** DI60M **Lapse:** DT60M

Summary of All Stability Classes Delta Temperature

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	8	9	14	70	110	407	807	361	86	10	1	0	1883
NNE	3	7	16	64	123	390	899	546	158	3	0	0	2209
NE	4	10	16	70	117	389	1189	1148	333	5	0	0	3281
ENE	4	6	24	77	136	417	1272	893	170	8	5	0	3012
E	3	11	15	65	97	344	1064	597	71	5	0	0	2272
ESE	9	6	19	68	88	274	804	474	41	4	0	0	1787
SE	4	5	24	47	101	273	854	474	69	1	0	0	1852
SSE	3	13	25	100	157	548	1066	437	49	2	0	0	2400
S	3	9	29	106	186	545	1066	629	112	5	1	0	2691
SSW	5	14	22	56	98	354	1137	969	241	22	2	0	2920
SW	6	8	18	65	129	399	1309	1234	440	44	2	0	3654
WSW	8	8	14	57	112	384	1153	1212	487	60	9	0	3504
W	9	15	22	59	127	365	1033	1101	513	84	10	0	3338
WNW	4	9	18	58	80	286	702	681	302	56	4	0	2200
NW	2	6	24	59	94	335	750	473	98	11	2	0	1854
NNW	5	5	22	54	106	376	710	365	80	4	1	0	1728
Totals	80	141	322	1075	1861	6086	15815	11594	3250	324	37	0	40585

Number of Calm Hours for this Table	21
Number of Variable Direction Hours for this Table	488
Number of Invalid Hours	3217
Number of Valid Hours for this Table	40585
Total Hours for the Period	43823

Note: Stability class based on temperature difference (ΔT or lapse) between 10-m and 60-m measurement levels.

Table 2.7-12 PAVAN Output – Upper Envelope of the 5 Percent Overall Site Limit χ/Qs at the Dose Calculation EAB (Building Wake Credit Not Included)

```
         X/Q PERCENTILES
 (BASED ON THE UPPER ENVELOPE OF THE
ORDERED X/Q-FREQUENCY VALUES, AND AS
PLOTTED ON A LOG-NORMAL GRAPH.)
PERCENT OF TIME CHI/Q IS EQUALED OR EXCEEDED
       CHI/Q      WITH RESPECT TO     WHEN THE WIND BLOWS
SEC/CUBIC METER  THE TOTAL TIME      INTO THIS SECTOR ONLY
```

CHI/Q SEC/CUBIC METER	WITH RESPECT TO THE TOTAL TIME	WHEN THE WIND BLOWS INTO THIS SECTOR ONLY
7.398E-04	1.000	1.000
4.508E-04	3.000	3.000
3.486E-04	5.000	5.000
2.346E-04	10.000	10.000
1.814E-04	15.000	15.000
1.442E-04	20.000	20.000
1.229E-04	25.000	25.000
1.078E-04	30.000	30.000
9.747E-05	35.000	35.000
8.860E-05	40.000	40.000
8.079E-05	45.000	45.000
7.378E-05	50.000	50.000
6.738E-05	55.000	55.000
6.069E-05	60.000	60.000
5.399E-05	65.000	65.000
4.773E-05	70.000	70.000
4.178E-05	75.000	75.000
3.602E-05	80.000	80.000

Table 2.7-13 PAVAN Output – Upper Envelope of the 5 Percent Overall Site Limit χ/Qs at the LPZ (Building Wake Credit Not Included)

```
         X/Q PERCENTILES
(BASED ON THE UPPER ENVELOPE OF THE
ORDERED X/Q-FREQUENCY VALUES, AND AS
PLOTTED ON A LOG-NORMAL GRAPH.)
PERCENT OF TIME CHI/Q IS EQUALED OR EXCEEDED
       CHI/Q      WITH RESPECT TO     WHEN THE WIND BLOWS
SEC/CUBIC METER  THE TOTAL TIME      INTO THIS SECTOR ONLY
```

CHI/Q SEC/CUBIC METER	WITH RESPECT TO THE TOTAL TIME	WHEN THE WIND BLOWS INTO THIS SECTOR ONLY
2.826E-04	1.000	1.000
1.677E-04	3.000	3.000
1.267E-04	5.000	5.000
8.316E-05	10.000	10.000
6.254E-05	15.000	15.000
4.946E-05	20.000	20.000
4.013E-05	25.000	25.000
3.348E-05	30.000	30.000
2.850E-05	35.000	35.000
2.446E-05	40.000	40.000
2.110E-05	45.000	45.000
1.825E-05	50.000	50.000
1.586E-05	55.000	55.000
1.378E-05	60.000	60.000
1.192E-05	65.000	65.000
1.023E-05	70.000	70.000
8.544E-06	75.000	75.000
6.960E-06	80.000	80.000

Table 2.7-14 Shortest Distances Between the VEGP Units 3 and 4 Power Block Area and Receptors of Interest by Downwind Direction Sector [a]

Direction	Meat Animal	Residence	Vegetable Garden	EAB[b]
N	1,071	1,071	1,071	800
NNE	1,071	1,071	1,071	800
NE	1,071	1,071	1,071	800
ENE	1,071	1,071	1,071	800
E	1,071	1,071	1,071	800
ESE	1,071	1,071	1,071	800
SE	1,071	1,071	1,071	800
SSE	1,071	1,071	1,071	800
S	1,071	1,071	1,071	800
SSW	1,071	1,071	1,071	800
SW	1,071	1,071	1,071	800
WSW	1,071	1,071	1,071	800
W	1,071	1,071	1,071	800
WNW	1,071	1,071	1,071	800
NW	1,071	1,071	1,071	800
NNW	1,071	1,071	1,071	800

a. Distances shown are in meters.
b. EAB = Exclusion Area Boundary.

Note: There are no milk-giving animals (i.e., cows, goats) within a 5 mile radius of the VEGP Units 3 and 4 Site.

Table 2.7-15 XOQDOQ-Predicted Maximum χ/Q and D/Q Values at Receptors of Interest

Type of Location	Direction from Site	Distance meters / (miles)	χ/Q (sec/m^3) (No Decay) (Undepleted)	χ/Q (sec/m^3) (2.26 Day Decay) (Undepleted)	χ/Q (sec/m3) (8 Day Decay) (Depleted)	D/Q (1/m2)
Residence	NE	1,071 (0.67)	3.4E-06	3.4E-06	3.0E-06	1.0E-08[a]
Dose Calculation EAB	NE	800 (0.5)	5.5E-06	5.5E-06	5.0E-06	1.7E-08[b]
Meat Animal	NE	1,071 (0.67)	3.4E-06	3.4E-06	3.0E-06	1.0E-08[a]
Vegetable Garden	NE	1,071 (0.67)	3.4E-06	3.4E-06	3.0E-06	1.0E-08[a]

a. NE, ENE, and E
b. NE and ENE

Table 2.7-16 XOQDOQ-Predicted Maximum Annual Average χ/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

No Decay Uudepleted	DISTANCE IN MILES FROM THE SITE									
NE	0.25	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
X/Q (s/m^3)	1.832E-5	5.438E-6	2.773E-6	1.778E-6	9.945E-7	6.633E-7	4.952E-7	3.914E-7	3.208E-7	2.702E-7	2.322E-7
	DISTANCE IN MILES FROM THE SITE										
NE	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
X/Q (s/m^3)	2.029E-7	1.209E-7	8.394E-8	5.038E-8	3.517E-8	2.666E-8	2.127E-8	1.759E-8	1.492E-8	1.291E-8	1.135E-8
	SEGMENT BOUNDARIES IN MILES FROM THE SITE										
NE	0.5 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50	
X/Q (s/m^3)	2.923E-6	1.021E-6	4.985E-7	3.217E-7	2.326E-7	1.227E-7	5.108E-8	2.677E-8	1.763E-8	1.293E-8	
2.26 Day Decay, Undepleted	DISTANCE IN MILES FROM THE SITE										
NE	0.25	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
X/Q (s/m^3)	1.828E-5	5.416E-6	2.757E-6	1.764E-6	9.828E-7	6.529E-7	4.855E-7	3.821E-7	3.120E-7	2.616E-7	2.240E-7
	DISTANCE IN MILES FROM THE SITE										
NE	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
X/Q (s/m^3)	1.949E-7	1.139E-7	7.753E-8	4.482E-8	3.019E-8	2.211E-8	1.708E-8	1.368E-8	1.128E-8*	9.497E-9*	8.125E-9*
	SEGMENT BOUNDARIES IN MILES FROM THE SITE										
NE	0.5 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50	
X/Q (s/m^3)	2.907E-6	1.010E-6	4.888E-7	3.128E-7	2.244E-7	1.157E-7	4.559E-8	2.225E-8	1.373E-8	9.517E-9*	

Note: * ENE

Table 2.7-16 (cont.) XOQDOQ-Predicted Maximum Annual Average χ/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

8.0 Day Decay, Depleted	DISTANCE IN MILES FROM THE SITE									
NE	0.25	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
X/Q (s/m^3)	1.732E-5	4.961E-6	2.467E-6	1.553E-6	8.418E-7	5.468E-7	3.989E-7	3.087E-7	2.483E-7	2.055E-7	1.737E-7
	DISTANCE IN MILES FROM THE SITE										
NE	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
X/Q (s/m^3)	1.495E-7	8.375E-8	5.508E-8	3.024E-8	1.960E-8	1.391E-8	1.046E-8	8.186E-9	6.598E-9	5.439E-9	4.564E-9
	SEGMENT BOUNDARIES IN MILES FROM THE SITE										
NE	0.5 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50	
X/Q (s/m^3)	2.615E-6	8.687E-7	4.023E-7	2.493E-7	1.742E-7	8.562E-8	3.103E-8	1.405E-8	8.231E-9	5.458E-9	
Relative Deposition /Area	DISTANCE IN MILES FROM THE SITE										
NE	0.25	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
D/Q (1/m^2)	4.897E-8	1.656E-8	8.503E-9	5.221E-9	2.603E-9	1.579E-9	1.067E-9	7.735E-10	5.882E-10	4.634E-10	3.751E-10
	DISTANCE IN MILES FROM THE SITE										
NE	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
D/Q (1/m^2)	3.103E-10	1.521E-10	9.541E-11	4.823E-11	2.919E-11	1.957E-11	1.402E-11	1.053E-11	8.187E-12	6.540E-12	5.338E-12
	SEGMENT BOUNDARIES IN MILES FROM THE SITE										
NE	0.5 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 – 40	40 - 50	
D/Q(1/m^2)	8.835E-9	2.730E-9	1.086E-9	5.936E-10	3.773E-10	1.620E-10	5.025E-11	1.992E-11	1.064E-11	6.583E-12	

Note: * ENE

Table 2.7-17 Long-Term Average χ/Q Values (sec/m^3) for Routine Releases at Specific Receptors of Interest (1998–2002 Meteorological Data)

GROUND LEVEL RELEASE - NO PURGE RELEASES

Type of Location	Direction From Site	Distance (Miles)	Distance (Meters)	X/Q(Sec/m^3) NO DECAY UNDEPLETED	X/Q(Sec/m^3) 2.26 DAY DECAY UNDEPLETED	X/Q(Sec/m^3) 8.00 Day DECAY DEPLETED	D/Q (1/m^2)
RE MA VG	S	.67	1071.	2.1E-06	2.0E-06	1.8E-06	6.6E-09
RE MA VG	SSW	.67	1071.	1.9E-06	1.9E-06	1.7E-06	6.2E-09
RE MA VG	SW	.67	1071.	2.5E-06	2.5E-06	2.2E-06	8.6E-09
RE MA VG	WSW	.67	1071.	2.5E-06	2.5E-06	2.3E-06	9.4E-09
RE MA VG	W	.67	1071.	2.6E-06	2.6E-06	2.4E-06	8.3E-09
RE MA VG	WNW	.67	1071.	2.4E-06	2.3E-06	2.1E-06	6.3E-09
RE MA VG	NW	.67	1071.	2.2E-06	2.2E-06	1.9E-06	6.3E-09
RE MA VG	NNW	.67	1071.	2.3E-06	2.3E-06	2.1E-06	6.6E-09
RE MA VG	N	.67	1071.	2.4E-06	2.3E-06	2.1E-06	7.2E-09
RE MA VG	NNE	.67	1071.	2.6E-06	2.6E-06	2.4E-06	8.3E-09
RE MA VG	NE	.67	1071.	3.4E-06	3.4E-06	3.0E-06	1.0E-08
RE MA VG	ENE	.67	1071.	3.3E-06	3.3E-06	2.9E-06	1.0E-08
RE MA VG	E	.67	1071.	3.0E-06	3.0E-06	2.7E-06	1.0E-08
RE MA VG	ESE	.67	1071.	2.3E-06	2.2E-06	2.0E-06	7.7E-09
RE MA VG	SE	.67	1071.	1.8E-06	1.8E-06	1.6E-06	5.3E-09
RE MA VG	SSE	.67	1071.	1.7E-06	1.7E-06	1.5E-06	5.2E-09
Unit3-4	WSW	.15	244.	3.3E-05	3.3E-05	3.2E-05	9.3E-08
Unit3-4	W	.15	244.	3.5E-05	3.5E-05	3.4E-05	8.2E-08
Unit3-4	WNW	.15	244.	3.1E-05	3.1E-05	3.0E-05	6.2E-08
SITE BOUNDARY	S	.50	800.	3.3E-06	3.3E-06	3.0E-06	1.1E-08
SITE BOUNDARY	SSW	.50	800.	3.0E-06	3.0E-06	2.8E-06	9.9E-09
SITE BOUNDARY	SW	.50	800.	4.0E-06	4.0E-06	3.7E-06	1.4E-08
SITE BOUNDARY	WSW	.50	800.	4.1E-06	4.0E-06	3.7E-06	1.5E-08
SITE BOUNDARY	W	.50	800.	4.3E-06	4.3E-06	3.9E-06	1.3E-08
SITE BOUNDARY	WNW	.50	800.	3.8E-06	3.8E-06	3.5E-06	1.0E-08
SITE BOUNDARY	NW	.50	800.	3.5E-06	3.5E-06	3.2E-06	1.0E-08
SITE BOUNDARY	NNW	.50	800.	3.7E-06	3.6E-06	3.3E-06	1.1E-08
SITE BOUNDARY	N	.50	800.	3.8E-06	3.7E-06	3.4E-06	1.2E-08
SITE BOUNDARY	NNE	.50	800.	4.3E-06	4.3E-06	3.9E-06	1.3E-08
SITE BOUNDARY	NE	.50	800.	5.5E-06	5.5E-06	5.0E-06	1.7E-08
SITE BOUNDARY	ENE	.50	800.	5.3E-06	5.3E-06	4.9E-06	1.7E-08
SITE BOUNDARY	E	.50	800.	4.9E-06	4.9E-06	4.5E-06	1.6E-08
SITE BOUNDARY	ESE	.50	800.	3.7E-06	3.7E-06	3.3E-06	1.2E-08
SITE BOUNDARY	SE	.50	800.	2.9E-06	2.9E-06	2.7E-06	8.6E-09
SITE BOUNDARY	SSE	.50	800.	2.7E-06	2.7E-06	2.5E-06	8.3E-09

RE = Residence
MA = Meat Animal
VG = Vegetable Garden

Table 2.7-18 Long-Term Average χ/Q Values (sec/m^3) for Routine Releases at Distances Between 0.25 and 50 mi, No Decay, Undepleted

NO DECAY, UNDEPLETED

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	1.097E-05	3.306E-06	1.697E-06	1.088E-06	6.032E-07	3.998E-07	2.971E-07	2.339E-07	1.912E-07	1.606E-07	1.377E-07
SSW	9.903E-06	2.986E-06	1.546E-06	9.958E-07	5.570E-07	3.707E-07	2.750E-07	2.160E-07	1.762E-07	1.478E-07	1.265E-07
SW	1.326E-05	3.993E-06	2.063E-06	1.328E-06	7.408E-07	4.926E-07	3.660E-07	2.881E-07	2.353E-07	1.976E-07	1.694E-07
WSW	1.342E-05	4.026E-06	2.076E-06	1.336E-06	7.479E-07	4.982E-07	3.702E-07	2.912E-07	2.378E-07	1.996E-07	1.711E-07
W	1.421E-05	4.237E-06	2.168E-06	1.392E-06	7.796E-07	5.201E-07	3.877E-07	3.059E-07	2.504E-07	2.106E-07	1.808E-07
WNW	1.282E-05	3.803E-06	1.947E-06	1.251E-06	7.014E-07	4.684E-07	3.498E-07	2.764E-07	2.266E-07	1.908E-07	1.639E-07
NW	1.157E-05	3.450E-06	1.790E-06	1.156E-06	6.516E-07	4.357E-07	3.241E-07	2.552E-07	2.086E-07	1.751E-07	1.502E-07
NNW	1.210E-05	3.626E-06	1.899E-06	1.231E-06	6.940E-07	4.637E-07	3.443E-07	2.706E-07	2.208E-07	1.852E-07	1.586E-07
N	1.239E-05	3.719E-06	1.951E-06	1.266E-06	7.147E-07	4.779E-07	3.543E-07	2.781E-07	2.266E-07	1.898E-07	1.624E-07
NNE	1.424E-05	4.240E-06	2.171E-06	1.395E-06	7.821E-07	5.221E-07	3.892E-07	3.071E-07	2.515E-07	2.115E-07	1.816E-07
NE	1.832E-05	5.438E-06	2.773E-06	1.778E-06	9.945E-07	6.633E-07	4.952E-07	3.914E-07	3.208E-07	2.702E-07	2.322E-07
ENE	1.781E-05	5.295E-06	2.696E-06	1.728E-06	9.670E-07	6.451E-07	4.816E-07	3.805E-07	3.119E-07	2.626E-07	2.257E-07
E	1.645E-05	4.895E-06	2.488E-06	1.591E-06	8.856E-07	5.890E-07	4.395E-07	3.473E-07	2.847E-07	2.397E-07	2.060E-07
ESE	1.211E-05	3.630E-06	1.865E-06	1.198E-06	6.685E-07	4.449E-07	3.310E-07	2.607E-07	2.132E-07	1.791E-07	1.537E-07
SE	9.657E-06	2.893E-06	1.486E-06	9.531E-07	5.289E-07	3.509E-07	2.611E-07	2.058E-07	1.684E-07	1.415E-07	1.215E-07
SSE	9.037E-06	2.711E-06	1.382E-06	8.836E-07	4.892E-07	3.242E-07	2.413E-07	1.903E-07	1.558E-07	1.310E-07	1.125E-07

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	1.201E-07	7.112E-08	4.917E-08	2.936E-08	2.045E-08	1.546E-08	1.232E-08	1.018E-08	8.626E-09	7.459E-09	6.552E-09
SSW	1.102E-07	6.491E-08	4.471E-08	2.655E-08	1.841E-08	1.388E-08	1.103E-08	9.093E-09	7.694E-09	6.642E-09	5.826E-09
SW	1.477E-07	8.727E-08	6.025E-08	3.589E-08	2.493E-08	1.883E-08	1.498E-08	1.236E-08	1.046E-08	9.039E-09	7.932E-09
WSW	1.492E-07	8.812E-08	6.081E-08	3.621E-08	2.515E-08	1.899E-08	1.511E-08	1.246E-08	1.055E-08	9.113E-09	7.996E-09
W	1.579E-07	9.376E-08	6.494E-08	3.885E-08	2.707E-08	2.048E-08	1.632E-08	1.348E-08	1.143E-08	9.884E-09	8.682E-09
WNW	1.432E-07	8.529E-08	5.918E-08	3.548E-08	2.475E-08	1.875E-08	1.495E-08	1.236E-08	1.048E-08	9.067E-09	7.967E-09
NW	1.309E-07	7.737E-08	5.339E-08	3.178E-08	2.206E-08	1.664E-08	1.323E-08	1.091E-08	9.232E-09	7.971E-09	6.992E-09
NNW	1.381E-07	8.131E-08	5.597E-08	3.318E-08	2.297E-08	1.730E-08	1.373E-08	1.130E-08	9.553E-09	8.239E-09	7.221E-09
N	1.413E-07	8.295E-08	5.697E-08	3.369E-08	2.328E-08	1.751E-08	1.388E-08	1.142E-08	9.644E-09	8.313E-09	7.281E-09
NNE	1.585E-07	9.419E-08	6.524E-08	3.904E-08	2.720E-08	2.058E-08	1.640E-08	1.355E-08	1.149E-08	9.932E-09	8.724E-09
NE	2.029E-07	1.209E-07	8.394E-08	5.038E-08	3.517E-08	2.666E-08	2.127E-08	1.759E-08	1.492E-08	1.291E-08	1.135E-08
ENE	1.971E-07	1.174E-07	8.150E-08	4.889E-08	3.413E-08	2.586E-08	2.064E-08	1.706E-08	1.447E-08	1.253E-08	1.101E-08
E	1.800E-07	1.073E-07	7.453E-08	4.477E-08	3.129E-08	2.373E-08	1.895E-08	1.568E-08	1.331E-08	1.152E-08	1.013E-08
ESE	1.341E-07	7.943E-08	5.492E-08	3.279E-08	2.282E-08	1.725E-08	1.374E-08	1.134E-08	9.613E-09	8.310E-09	7.297E-09
SE	1.060E-07	6.292E-08	4.357E-08	2.607E-08	1.818E-08	1.376E-08	1.097E-08	9.066E-09	7.689E-09	6.652E-09	5.845E-09
SSE	9.818E-08	5.836E-08	4.046E-08	2.425E-08	1.693E-08	1.283E-08	1.024E-08	8.467E-09	7.186E-09	6.220E-09	5.468E-09

Table 2.7-19 Long-Term Average χ/Q Values (sec/m^3) for Routine Releases at the Standard Distance Segments Between 0.5 and 50 mi, No Decay, Undepleted

	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	1.784E-06	6.205E-07	2.992E-07	1.917E-07	1.380E-07	7.225E-08	2.980E-08	1.554E-08	1.020E-08	7.469E-09
SSW	1.621E-06	5.717E-07	2.769E-07	1.767E-07	1.268E-07	6.600E-08	2.697E-08	1.395E-08	9.115E-09	6.651E-09
SW	2.165E-06	7.609E-07	3.686E-07	2.360E-07	1.697E-07	8.868E-08	3.643E-08	1.892E-08	1.238E-08	9.051E-09
WSW	2.181E-06	7.677E-07	3.727E-07	2.385E-07	1.714E-07	8.955E-08	3.676E-08	1.908E-08	1.249E-08	9.125E-09
W	2.283E-06	8.003E-07	3.903E-07	2.511E-07	1.812E-07	9.519E-08	3.941E-08	2.057E-08	1.351E-08	9.897E-09
WNW	2.050E-06	7.200E-07	3.521E-07	2.272E-07	1.642E-07	8.656E-08	3.598E-08	1.883E-08	1.238E-08	9.079E-09
NW	1.877E-06	6.678E-07	3.263E-07	2.092E-07	1.504E-07	7.861E-08	3.226E-08	1.672E-08	1.093E-08	7.982E-09
NNW	1.986E-06	7.111E-07	3.467E-07	2.215E-07	1.589E-07	8.267E-08	3.371E-08	1.738E-08	1.133E-08	8.251E-09
N	2.039E-06	7.319E-07	3.568E-07	2.273E-07	1.627E-07	8.438E-08	3.424E-08	1.760E-08	1.145E-08	8.325E-09
NNE	2.286E-06	8.027E-07	3.918E-07	2.521E-07	1.819E-07	9.562E-08	3.960E-08	2.068E-08	1.358E-08	9.945E-09
NE	2.923E-06	1.021E-06	4.985E-07	3.217E-07	2.326E-07	1.227E-07	5.108E-08	2.677E-08	1.763E-08	1.293E-08
ENE	2.843E-06	9.930E-07	4.847E-07	3.127E-07	2.260E-07	1.192E-07	4.958E-08	2.598E-08	1.710E-08	1.254E-08
E	2.624E-06	9.106E-07	4.425E-07	2.854E-07	2.064E-07	1.089E-07	4.539E-08	2.383E-08	1.571E-08	1.154E-08
ESE	1.961E-06	6.867E-07	3.333E-07	2.138E-07	1.540E-07	8.068E-08	3.328E-08	1.733E-08	1.137E-08	8.321E-09
SE	1.562E-06	5.440E-07	2.629E-07	1.688E-07	1.217E-07	6.390E-08	2.645E-08	1.382E-08	9.086E-09	6.660E-09
SSE	1.456E-06	5.035E-07	2.430E-07	1.562E-07	1.127E-07	5.925E-08	2.460E-08	1.289E-08	8.486E-09	6.228E-09

Table 2.7-20 Long-Term Average χ/Q Values (sec/m^3) for Routine Releases at Distances Between 0.25 and 50 mi, 2.26-Day Decay, Undepleted

2.260 DAY DECAY, UNDEPLETED

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) — DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	1.094E-05	3.291E-06	1.685E-06	1.078E-06	5.950E-07	3.926E-07	2.903E-07	2.275E-07	1.850E-07	1.547E-07	1.320E-07
SSW	9.877E-06	2.971E-06	1.534E-06	9.859E-07	5.488E-07	3.634E-07	2.682E-07	2.096E-07	1.701E-07	1.419E-07	1.208E-07
SW	1.322E-05	3.970E-06	2.046E-06	1.314E-06	7.293E-07	4.824E-07	3.565E-07	2.790E-07	2.266E-07	1.892E-07	1.613E-07
WSW	1.339E-05	4.007E-06	2.062E-06	1.324E-06	7.381E-07	4.895E-07	3.620E-07	2.835E-07	2.305E-07	1.926E-07	1.643E-07
W	1.418E-05	4.218E-06	2.154E-06	1.380E-06	7.698E-07	5.114E-07	3.795E-07	2.981E-07	2.430E-07	2.035E-07	1.740E-07
WNW	1.279E-05	3.784E-06	1.933E-06	1.239E-06	6.915E-07	4.596E-07	3.416E-07	2.686E-07	2.191E-07	1.836E-07	1.570E-07
NW	1.154E-05	3.433E-06	1.777E-06	1.145E-06	6.424E-07	4.275E-07	3.165E-07	2.480E-07	2.017E-07	1.685E-07	1.438E-07
NNW	1.208E-05	3.609E-06	1.887E-06	1.221E-06	6.849E-07	4.556E-07	3.368E-07	2.635E-07	2.140E-07	1.787E-07	1.524E-07
N	1.237E-05	3.704E-06	1.940E-06	1.256E-06	7.066E-07	4.707E-07	3.476E-07	2.717E-07	2.206E-07	1.841E-07	1.569E-07
NNE	1.421E-05	4.222E-06	2.158E-06	1.384E-06	7.729E-07	5.139E-07	3.815E-07	2.998E-07	2.445E-07	2.048E-07	1.751E-07
NE	1.828E-05	5.416E-06	2.757E-06	1.764E-06	9.828E-07	6.529E-07	4.855E-07	3.821E-07	3.120E-07	2.616E-07	2.240E-07
ENE	1.778E-05	5.276E-06	2.682E-06	1.716E-06	9.571E-07	6.363E-07	4.734E-07	3.727E-07	3.044E-07	2.554E-07	2.187E-07
E	1.642E-05	4.877E-06	2.474E-06	1.580E-06	8.761E-07	5.806E-07	4.316E-07	3.398E-07	2.774E-07	2.327E-07	1.993E-07
ESE	1.208E-05	3.614E-06	1.852E-06	1.187E-06	6.598E-07	4.372E-07	3.238E-07	2.539E-07	2.067E-07	1.729E-07	1.476E-07
SE	9.629E-06	2.877E-06	1.474E-06	9.430E-07	5.206E-07	3.436E-07	2.543E-07	1.993E-07	1.621E-07	1.355E-07	1.157E-07
SSE	9.014E-06	2.698E-06	1.372E-06	8.751E-07	4.822E-07	3.180E-07	2.355E-07	1.848E-07	1.505E-07	1.259E-07	1.076E-07

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) — DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	1.146E-07	6.625E-08	4.475E-08	2.555E-08	1.704E-08	1.237E-08	9.479E-09	7.538E-09	6.161E-09	5.143E-09	4.365E-09
SSW	1.047E-07	6.009E-08	4.035E-08	2.281E-08	1.510E-08	1.089E-08	8.297E-09	6.564E-09	5.340E-09	4.439E-09	3.753E-09
SW	1.398E-07	8.037E-08	5.400E-08	3.052E-08	2.017E-08	1.453E-08	1.105E-08	8.735E-09	7.099E-09	5.895E-09	4.980E-09
WSW	1.425E-07	8.232E-08	5.556E-08	3.170E-08	2.114E-08	1.535E-08	1.177E-08	9.371E-09	7.669E-09	6.410E-09	5.448E-09
W	1.512E-07	8.787E-08	5.958E-08	3.421E-08	2.292E-08	1.671E-08	1.285E-08	1.025E-08	8.402E-09	7.033E-09	5.985E-09
WNW	1.365E-07	7.939E-08	5.383E-08	3.087E-08	2.064E-08	1.501E-08	1.152E-08	9.172E-09	7.505E-09	6.270E-09	5.325E-09
NW	1.248E-07	7.200E-08	4.855E-08	2.763E-08	1.839E-08	1.332E-08	1.019E-08	8.096E-09	6.610E-09	5.513E-09	4.676E-09
NNW	1.321E-07	7.604E-08	5.121E-08	2.911E-08	1.936E-08	1.402E-08	1.072E-08	8.517E-09	6.954E-09	5.799E-09	4.918E-09
N	1.360E-07	7.827E-08	5.275E-08	3.006E-08	2.005E-08	1.457E-08	1.118E-08	8.907E-09	7.293E-09	6.099E-09	5.186E-09
NNE	1.522E-07	8.863E-08	6.019E-08	3.466E-08	2.328E-08	1.701E-08	1.311E-08	1.048E-08	8.613E-09	7.225E-09	6.161E-09
NE	1.949E-07	1.139E-07	7.753E-08	4.482E-08	3.019E-08	2.211E-08	1.708E-08	1.368E-08	1.126E-08	9.457E-09	8.075E-09
ENE	1.904E-07	1.115E-07	7.610E-08	4.418E-08	2.989E-08	2.197E-08	1.702E-08	1.367E-08	1.128E-08	9.497E-09	8.125E-09
E	1.735E-07	1.015E-07	6.923E-08	4.014E-08	2.711E-08	1.990E-08	1.540E-08	1.235E-08	1.017E-08	8.554E-09	7.309E-09
ESE	1.282E-07	7.428E-08	5.025E-08	2.876E-08	1.922E-08	1.398E-08	1.073E-08	8.548E-09	6.998E-09	5.850E-09	4.972E-09
SE	1.004E-07	5.796E-08	3.906E-08	2.217E-08	1.470E-08	1.061E-08	8.086E-09	6.396E-09	5.200E-09	4.319E-09	3.648E-09
SSE	9.345E-08	5.419E-08	3.667E-08	2.098E-08	1.401E-08	1.018E-08	7.804E-09	6.208E-09	5.075E-09	4.237E-09	3.596E-09

Table 2.7-21 Long-Term Average χ/Q Values (sec/m^3) for Routine Releases at the Standard Distance Segments Between 0.5 and 50 mi, 2.26-Day Decay, Undepleted

	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	1.772E-06	6.124E-07	2.925E-07	1.856E-07	1.323E-07	6.743E-08	2.603E-08	1.246E-08	7.568E-09	5.157E-09
SSW	1.610E-06	5.635E-07	2.701E-07	1.706E-07	1.211E-07	6.123E-08	2.328E-08	1.098E-08	6.593E-09	4.452E-09
SW	2.148E-06	7.494E-07	3.590E-07	2.273E-07	1.616E-07	8.186E-08	3.114E-08	1.464E-08	8.774E-09	5.913E-09
WSW	2.167E-06	7.579E-07	3.646E-07	2.312E-07	1.646E-07	8.381E-08	3.231E-08	1.546E-08	9.409E-09	6.427E-09
W	2.269E-06	7.905E-07	3.821E-07	2.437E-07	1.743E-07	8.936E-08	3.483E-08	1.682E-08	1.029E-08	7.050E-09
WNW	2.036E-06	7.101E-07	3.439E-07	2.197E-07	1.573E-07	8.072E-08	3.142E-08	1.512E-08	9.208E-09	6.286E-09
NW	1.864E-06	6.587E-07	3.187E-07	2.023E-07	1.441E-07	7.330E-08	2.817E-08	1.342E-08	8.129E-09	5.528E-09
NNW	1.973E-06	7.020E-07	3.392E-07	2.147E-07	1.526E-07	7.746E-08	2.968E-08	1.412E-08	8.552E-09	5.815E-09
N	2.028E-06	7.238E-07	3.501E-07	2.213E-07	1.572E-07	7.975E-08	3.065E-08	1.468E-08	8.942E-09	6.115E-09
NNE	2.273E-06	7.935E-07	3.841E-07	2.452E-07	1.754E-07	9.012E-08	3.528E-08	1.712E-08	1.052E-08	7.242E-09
NE	2.907E-06	1.010E-06	4.888E-07	3.128E-07	2.244E-07	1.157E-07	4.559E-08	2.225E-08	1.373E-08	9.478E-09
ENE	2.829E-06	9.832E-07	4.765E-07	3.053E-07	2.191E-07	1.133E-07	4.492E-08	2.210E-08	1.372E-08	9.517E-09
E	2.611E-06	9.012E-07	4.346E-07	2.782E-07	1.996E-07	1.032E-07	4.082E-08	2.002E-08	1.239E-08	8.573E-09
ESE	1.948E-06	6.780E-07	3.261E-07	2.073E-07	1.479E-07	7.558E-08	2.930E-08	1.408E-08	8.582E-09	5.865E-09
SE	1.550E-06	5.358E-07	2.561E-07	1.626E-07	1.159E-07	5.899E-08	2.261E-08	1.069E-08	6.423E-09	4.332E-09
SSE	1.446E-06	4.966E-07	2.372E-07	1.509E-07	1.078E-07	5.513E-08	2.137E-08	1.025E-08	6.232E-09	4.248E-09

Table 2.7-22 Long-Term Average χ/Q Values (sec/m^3) for Routine Releases at Distances Between 0.25 and 50 mi, 8.00-Day Decay, Depleted

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	1.037E-05	3.015E-06	1.509E-06	9.497E-07	5.103E-07	3.294E-07	2.391E-07	1.843E-07	1.478E-07	1.219E-07	1.029E-07
SSW	9.366E-06	2.723E-06	1.375E-06	8.692E-07	4.710E-07	3.052E-07	2.211E-07	1.701E-07	1.361E-07	1.121E-07	9.441E-08
SW	1.254E-05	3.640E-06	1.834E-06	1.159E-06	6.264E-07	4.055E-07	2.943E-07	2.267E-07	1.816E-07	1.498E-07	1.263E-07
WSW	1.269E-05	3.671E-06	1.847E-06	1.167E-06	6.328E-07	4.105E-07	2.979E-07	2.295E-07	1.839E-07	1.517E-07	1.279E-07
W	1.344E-05	3.864E-06	1.928E-06	1.215E-06	6.597E-07	4.286E-07	3.121E-07	2.412E-07	1.937E-07	1.601E-07	1.352E-07
WNW	1.213E-05	3.468E-06	1.731E-06	1.092E-06	5.933E-07	3.858E-07	2.814E-07	2.178E-07	1.751E-07	1.448E-07	1.224E-07
NW	1.094E-05	3.146E-06	1.592E-06	1.010E-06	5.511E-07	3.588E-07	2.608E-07	2.011E-07	1.612E-07	1.330E-07	1.121E-07
NNW	1.145E-05	3.307E-06	1.689E-06	1.075E-06	5.872E-07	3.821E-07	2.772E-07	2.133E-07	1.708E-07	1.407E-07	1.185E-07
N	1.172E-05	3.392E-06	1.736E-06	1.105E-06	6.050E-07	3.940E-07	2.855E-07	2.194E-07	1.755E-07	1.444E-07	1.216E-07
NNE	1.347E-05	3.867E-06	1.931E-06	1.218E-06	6.620E-07	4.304E-07	3.135E-07	2.423E-07	1.946E-07	1.609E-07	1.359E-07
NE	1.732E-05	4.961E-06	2.467E-06	1.553E-06	8.418E-07	5.468E-07	3.989E-07	3.087E-07	2.483E-07	2.055E-07	1.737E-07
ENE	1.685E-05	4.830E-06	2.399E-06	1.510E-06	8.188E-07	5.321E-07	3.882E-07	3.005E-07	2.417E-07	2.000E-07	1.691E-07
E	1.556E-05	4.465E-06	2.214E-06	1.390E-06	7.498E-07	4.858E-07	3.542E-07	2.741E-07	2.205E-07	1.824E-07	1.543E-07
ESE	1.145E-05	3.311E-06	1.658E-06	1.046E-06	5.657E-07	3.666E-07	2.664E-07	2.055E-07	1.649E-07	1.361E-07	1.149E-07
SE	9.132E-06	2.638E-06	1.321E-06	8.317E-07	4.472E-07	2.888E-07	2.099E-07	1.620E-07	1.300E-07	1.073E-07	9.057E-08
SSE	8.546E-06	2.472E-06	1.229E-06	7.713E-07	4.138E-07	2.670E-07	1.941E-07	1.499E-07	1.203E-07	9.942E-08	8.395E-08

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	8.830E-08	4.910E-08	3.212E-08	1.750E-08	1.128E-08	7.974E-09	5.973E-09	4.658E-09	3.742E-09	3.075E-09	2.573E-09
SSW	8.093E-08	4.473E-08	2.913E-08	1.576E-08	1.011E-08	7.112E-09	5.306E-09	4.124E-09	3.302E-09	2.706E-09	2.257E-09
SW	1.083E-07	6.005E-08	3.917E-08	2.123E-08	1.362E-08	9.585E-09	7.151E-09	5.556E-09	4.447E-09	3.642E-09	3.037E-09
WSW	1.097E-07	6.089E-08	3.977E-08	2.162E-08	1.391E-08	9.820E-09	7.348E-09	5.727E-09	4.598E-09	3.776E-09	3.158E-09
W	1.162E-07	6.485E-08	4.253E-08	2.325E-08	1.502E-08	1.063E-08	7.975E-09	6.228E-09	5.010E-09	4.122E-09	3.453E-09
WNW	1.053E-07	5.888E-08	3.865E-08	2.115E-08	1.367E-08	9.672E-09	7.254E-09	5.662E-09	4.553E-09	3.744E-09	3.134E-09
NW	9.623E-08	5.340E-08	3.487E-08	1.894E-08	1.217E-08	8.583E-09	6.417E-09	4.996E-09	4.007E-09	3.289E-09	2.748E-09
NNW	1.016E-07	5.621E-08	3.662E-08	1.983E-08	1.272E-08	8.959E-09	6.692E-09	5.207E-09	4.174E-09	3.424E-09	2.861E-09
N	1.042E-07	5.750E-08	3.742E-08	2.024E-08	1.299E-08	9.151E-09	6.839E-09	5.326E-09	4.274E-09	3.509E-09	2.935E-09
NNE	1.168E-07	6.523E-08	4.280E-08	2.342E-08	1.514E-08	1.073E-08	8.055E-09	6.296E-09	5.069E-09	4.174E-09	3.499E-09
NE	1.495E-07	8.375E-08	5.508E-08	3.024E-08	1.960E-08	1.391E-08	1.046E-08	8.186E-09	6.598E-09	5.439E-09	4.564E-09
ENE	1.455E-07	8.155E-08	5.366E-08	2.950E-08	1.915E-08	1.361E-08	1.025E-08	8.034E-09	6.485E-09	5.353E-09	4.498E-09
E	1.327E-07	7.444E-08	4.899E-08	2.694E-08	1.749E-08	1.244E-08	9.364E-09	7.338E-09	5.921E-09	4.886E-09	4.104E-09
ESE	9.864E-08	5.490E-08	3.594E-08	1.960E-08	1.264E-08	8.935E-09	6.696E-09	5.224E-09	4.199E-09	3.452E-09	2.889E-09
SE	7.778E-08	4.330E-08	2.833E-08	1.543E-08	9.936E-09	7.011E-09	5.243E-09	4.081E-09	3.272E-09	2.684E-09	2.241E-09
SSE	7.214E-08	4.026E-08	2.640E-08	1.443E-08	9.323E-09	6.599E-09	4.948E-09	3.863E-09	3.105E-09	2.553E-09	2.137E-09

Table 2.7-23 Long-Term Average χ/Q Values (sec/m^3) for Routine Releases at the Standard Distance Segments Between 0.5 and 50 mi, 8.00-Day Decay, Depleted

SEGMENT BOUNDARIES IN MILES FROM THE SITE

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	1.595E-06	5.275E-07	2.412E-07	1.484E-07	1.031E-07	5.027E-08	1.799E-08	8.056E-09	4.685E-09	3.087E-09
SSW	1.450E-06	4.858E-07	2.231E-07	1.367E-07	9.466E-08	4.584E-08	1.622E-08	7.189E-09	4.149E-09	2.716E-09
SW	1.935E-06	6.465E-07	2.969E-07	1.824E-07	1.266E-07	6.150E-08	2.184E-08	9.688E-09	5.589E-09	3.657E-09
WSW	1.950E-06	6.526E-07	3.006E-07	1.847E-07	1.282E-07	6.235E-08	2.223E-08	9.923E-09	5.760E-09	3.791E-09
W	2.042E-06	6.805E-07	3.148E-07	1.945E-07	1.355E-07	6.634E-08	2.387E-08	1.074E-08	6.263E-09	4.138E-09
WNW	1.833E-06	6.119E-07	2.838E-07	1.758E-07	1.227E-07	6.020E-08	2.171E-08	9.769E-09	5.694E-09	3.758E-09
NW	1.678E-06	5.675E-07	2.630E-07	1.618E-07	1.124E-07	5.468E-08	1.947E-08	8.674E-09	5.025E-09	3.301E-09
NNW	1.776E-06	6.045E-07	2.796E-07	1.715E-07	1.188E-07	5.760E-08	2.040E-08	9.056E-09	5.238E-09	3.438E-09
N	1.824E-06	6.224E-07	2.880E-07	1.762E-07	1.219E-07	5.895E-08	2.084E-08	9.250E-09	5.357E-09	3.523E-09
NNE	2.045E-06	6.826E-07	3.162E-07	1.954E-07	1.362E-07	6.672E-08	2.404E-08	1.084E-08	6.331E-09	4.189E-09
NE	2.615E-06	8.687E-07	4.023E-07	2.493E-07	1.742E-07	8.562E-08	3.103E-08	1.405E-08	8.231E-09	5.458E-09
ENE	2.544E-06	8.449E-07	3.915E-07	2.426E-07	1.695E-07	8.336E-08	3.027E-08	1.374E-08	8.077E-09	5.372E-09
E	2.348E-06	7.747E-07	3.572E-07	2.213E-07	1.546E-07	7.609E-08	2.764E-08	1.256E-08	7.377E-09	4.904E-09
ESE	1.753E-06	5.838E-07	2.688E-07	1.655E-07	1.151E-07	5.619E-08	2.014E-08	9.027E-09	5.254E-09	3.465E-09
SE	1.396E-06	4.622E-07	2.118E-07	1.305E-07	9.079E-08	4.431E-08	1.586E-08	7.084E-09	4.105E-09	2.694E-09
SSE	1.302E-06	4.280E-07	1.959E-07	1.208E-07	8.416E-08	4.118E-08	1.482E-08	6.665E-09	3.884E-09	2.563E-09

Table 2.7-24 Long-Term Average D/Q Values (1/m^2) for Routine Releases at Distances Between 0.25 and 50 mi

GROUND LEVEL RELEASE - NO PURGE RELEASES

******************** RELATIVE DEPOSITION PER UNIT AREA (M**-2) AT FIXED POINTS BY DOWNWIND SECTORS ********************

DISTANCES IN MILES

DIRECTION FROM SITE	.25	.50	.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
S	3.128E-08	1.058E-08	5.431E-09	3.335E-09	1.663E-09	1.008E-09	6.817E-10	4.940E-10	3.756E-10	2.959E-10	2.396E-10
SSW	2.900E-08	9.807E-09	5.035E-09	3.092E-09	1.541E-09	9.348E-10	6.321E-10	4.580E-10	3.483E-10	2.744E-10	2.221E-10
SW	4.066E-08	1.375E-08	7.059E-09	4.334E-09	2.161E-09	1.311E-09	8.861E-10	6.421E-10	4.882E-10	3.847E-10	3.114E-10
WSW	4.440E-08	1.502E-08	7.710E-09	4.734E-09	2.360E-09	1.431E-09	9.678E-10	7.013E-10	5.333E-10	4.201E-10	3.401E-10
W	3.911E-08	1.323E-08	6.791E-09	4.170E-09	2.079E-09	1.261E-09	8.525E-10	6.177E-10	4.697E-10	3.701E-10	2.996E-10
WNW	2.948E-08	9.971E-09	5.119E-09	3.143E-09	1.567E-09	9.505E-10	6.426E-10	4.657E-10	3.541E-10	2.790E-10	2.258E-10
NW	2.963E-08	1.002E-08	5.145E-09	3.159E-09	1.575E-09	9.552E-10	6.458E-10	4.680E-10	3.559E-10	2.804E-10	2.270E-10
NNW	3.119E-08	1.055E-08	5.415E-09	3.325E-09	1.658E-09	1.005E-09	6.797E-10	4.925E-10	3.745E-10	2.951E-10	2.389E-10
N	3.408E-08	1.152E-08	5.917E-09	3.633E-09	1.811E-09	1.099E-09	7.427E-10	5.382E-10	4.092E-10	3.224E-10	2.610E-10
NNE	3.910E-08	1.322E-08	6.789E-09	4.169E-09	2.078E-09	1.260E-09	8.522E-10	6.175E-10	4.696E-10	3.699E-10	2.995E-10
NE	4.897E-08	1.656E-08	8.503E-09	5.221E-09	2.603E-09	1.579E-09	1.067E-09	7.735E-10	5.882E-10	4.634E-10	3.751E-10
ENE	4.850E-08	1.640E-08	8.422E-09	5.171E-09	2.578E-09	1.564E-09	1.057E-09	7.661E-10	5.825E-10	4.589E-10	3.715E-10
E	4.798E-08	1.622E-08	8.330E-09	5.115E-09	2.550E-09	1.547E-09	1.046E-09	7.578E-10	5.762E-10	4.539E-10	3.675E-10
ESE	3.612E-08	1.221E-08	6.271E-09	3.851E-09	1.920E-09	1.164E-09	7.872E-10	5.704E-10	4.338E-10	3.417E-10	2.766E-10
SE	2.507E-08	8.478E-09	4.353E-09	2.673E-09	1.333E-09	8.082E-10	5.464E-10	3.960E-10	3.011E-10	2.372E-10	1.920E-10
SSE	2.440E-08	8.252E-09	4.237E-09	2.602E-09	1.297E-09	7.867E-10	5.319E-10	3.854E-10	2.931E-10	2.309E-10	1.869E-10

DISTANCES IN MILES

0DIRECTION FROM SITE	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
S	1.982E-10	9.712E-11	6.094E-11	3.080E-11	1.864E-11	1.250E-11	8.956E-12	6.725E-12	5.229E-12	4.177E-12	3.409E-12
SSW	1.837E-10	9.004E-11	5.650E-11	2.856E-11	1.728E-11	1.159E-11	8.304E-12	6.235E-12	4.848E-12	3.873E-12	3.161E-12
SW	2.576E-10	1.262E-10	7.920E-11	4.003E-11	2.423E-11	1.625E-11	1.164E-11	8.741E-12	6.796E-12	5.429E-12	4.431E-12
WSW	2.813E-10	1.379E-10	8.651E-11	4.372E-11	2.646E-11	1.774E-11	1.271E-11	9.547E-12	7.423E-12	5.930E-12	4.840E-12
W	2.478E-10	1.214E-10	7.620E-11	3.851E-11	2.331E-11	1.563E-11	1.120E-11	8.409E-12	6.538E-12	5.223E-12	4.263E-12
WNW	1.868E-10	9.155E-11	5.744E-11	2.903E-11	1.757E-11	1.178E-11	8.442E-12	6.339E-12	4.929E-12	3.937E-12	3.214E-12
NW	1.877E-10	9.200E-11	5.773E-11	2.918E-11	1.766E-11	1.184E-11	8.484E-12	6.371E-12	4.954E-12	3.957E-12	3.230E-12
NNW	1.976E-10	9.683E-11	6.075E-11	3.071E-11	1.859E-11	1.246E-11	8.929E-12	6.705E-12	5.213E-12	4.164E-12	3.399E-12
N	2.159E-10	1.058E-10	6.639E-11	3.356E-11	2.031E-11	1.362E-11	9.757E-12	7.327E-12	5.697E-12	4.551E-12	3.714E-12
NNE	2.477E-10	1.214E-10	7.617E-11	3.850E-11	2.330E-11	1.562E-11	1.120E-11	8.406E-12	6.536E-12	5.221E-12	4.262E-12
NE	3.103E-10	1.521E-10	9.541E-11	4.823E-11	2.919E-11	1.957E-11	1.402E-11	1.053E-11	8.187E-12	6.540E-12	5.338E-12
ENE	3.073E-10	1.506E-10	9.450E-11	4.776E-11	2.891E-11	1.938E-11	1.389E-11	1.043E-11	8.109E-12	6.477E-12	5.287E-12
E	3.040E-10	1.490E-10	9.347E-11	4.724E-11	2.859E-11	1.917E-11	1.374E-11	1.032E-11	8.021E-12	6.407E-12	5.229E-12
ESE	2.288E-10	1.121E-10	7.036E-11	3.557E-11	2.153E-11	1.443E-11	1.034E-11	7.766E-12	6.038E-12	4.823E-12	3.937E-12
SE	1.588E-10	7.784E-11	4.884E-11	2.469E-11	1.494E-11	1.002E-11	7.178E-12	5.390E-12	4.191E-12	3.348E-12	2.733E-12
SSE	1.546E-10	7.577E-11	4.754E-11	2.403E-11	1.454E-11	9.752E-12	6.988E-12	5.247E-12	4.080E-12	3.259E-12	2.660E-12

Table 2.7-25 Long-Term Average D/Q Values ($1/m^2$) for Routine Releases at the Standard Distance Segments Between 0.5 and 50 mi

GROUND LEVEL RELEASE - NO PURGE RELEASES

************************ RELATIVE DEPOSITION PER UNIT AREA (M**-2) BY DOWNWIND SECTORS ************************

SEGMENT BOUNDARIES IN MILES

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	5.643E-09	1.743E-09	6.937E-10	3.791E-10	2.409E-10	1.035E-10	3.209E-11	1.272E-11	6.793E-12	4.204E-12
SSW	5.232E-09	1.616E-09	6.432E-10	3.515E-10	2.234E-10	9.595E-11	2.975E-11	1.179E-11	6.298E-12	3.898E-12
SW	7.335E-09	2.266E-09	9.017E-10	4.927E-10	3.132E-10	1.345E-10	4.171E-11	1.653E-11	8.829E-12	5.465E-12
WSW	8.011E-09	2.475E-09	9.848E-10	5.382E-10	3.420E-10	1.469E-10	4.556E-11	1.806E-11	9.643E-12	5.968E-12
W	7.056E-09	2.180E-09	8.675E-10	4.740E-10	3.013E-10	1.294E-10	4.013E-11	1.591E-11	8.494E-12	5.257E-12
WNW	5.319E-09	1.643E-09	6.539E-10	3.574E-10	2.271E-10	9.756E-11	3.025E-11	1.199E-11	6.403E-12	3.963E-12
NW	5.346E-09	1.652E-09	6.572E-10	3.591E-10	2.283E-10	9.804E-11	3.040E-11	1.205E-11	6.435E-12	3.983E-12
NNW	5.626E-09	1.738E-09	6.917E-10	3.780E-10	2.402E-10	1.032E-10	3.200E-11	1.268E-11	6.772E-12	4.192E-12
N	6.148E-09	1.899E-09	7.558E-10	4.130E-10	2.625E-10	1.128E-10	3.496E-11	1.386E-11	7.400E-12	4.580E-12
NNE	7.054E-09	2.179E-09	8.672E-10	4.739E-10	3.012E-10	1.294E-10	4.012E-11	1.590E-11	8.491E-12	5.255E-12
NE	8.835E-09	2.730E-09	1.086E-09	5.936E-10	3.773E-10	1.620E-10	5.025E-11	1.992E-11	1.064E-11	6.583E-12
ENE	8.751E-09	2.703E-09	1.076E-09	5.879E-10	3.736E-10	1.605E-10	4.977E-11	1.972E-11	1.053E-11	6.520E-12
E	8.656E-09	2.674E-09	1.064E-09	5.815E-10	3.696E-10	1.587E-10	4.923E-11	1.951E-11	1.042E-11	6.449E-12
ESE	6.516E-09	2.013E-09	8.011E-10	4.377E-10	2.782E-10	1.195E-10	3.706E-11	1.469E-11	7.843E-12	4.855E-12
SE	4.523E-09	1.397E-09	5.560E-10	3.039E-10	1.931E-10	8.295E-11	2.572E-11	1.020E-11	5.444E-12	3.370E-12
SSE	4.403E-09	1.360E-09	5.413E-10	2.958E-10	1.880E-10	8.075E-11	2.504E-11	9.924E-12	5.300E-12	3.280E-12

Table 2.7-26 Predicted Existing VEGP Noise Levels at Locations Along the Northern, Western, and Southern Site Boundaries

Measurement Location	Average Measured Background Noise Level (dBa)	Predicted VEGP Units 1 and 2 Noise Emission Level (dBa)	Predicted Total Noise Level (dBa)
River Road at North Boundary	27-30	15	27-30
River Road at the Construction Entrance	25-30	19	26-30
River Road West of Proposed Cooling Towers	25-34	21	26-34
River Road at the Entrance Road	22-25	22	25-27
River Road at South Boundary	25	25	28
Plant Wilson	39	35	40
Augusta Newsprint Transmission Corridor at Northern Plant Boundary	34	20	34

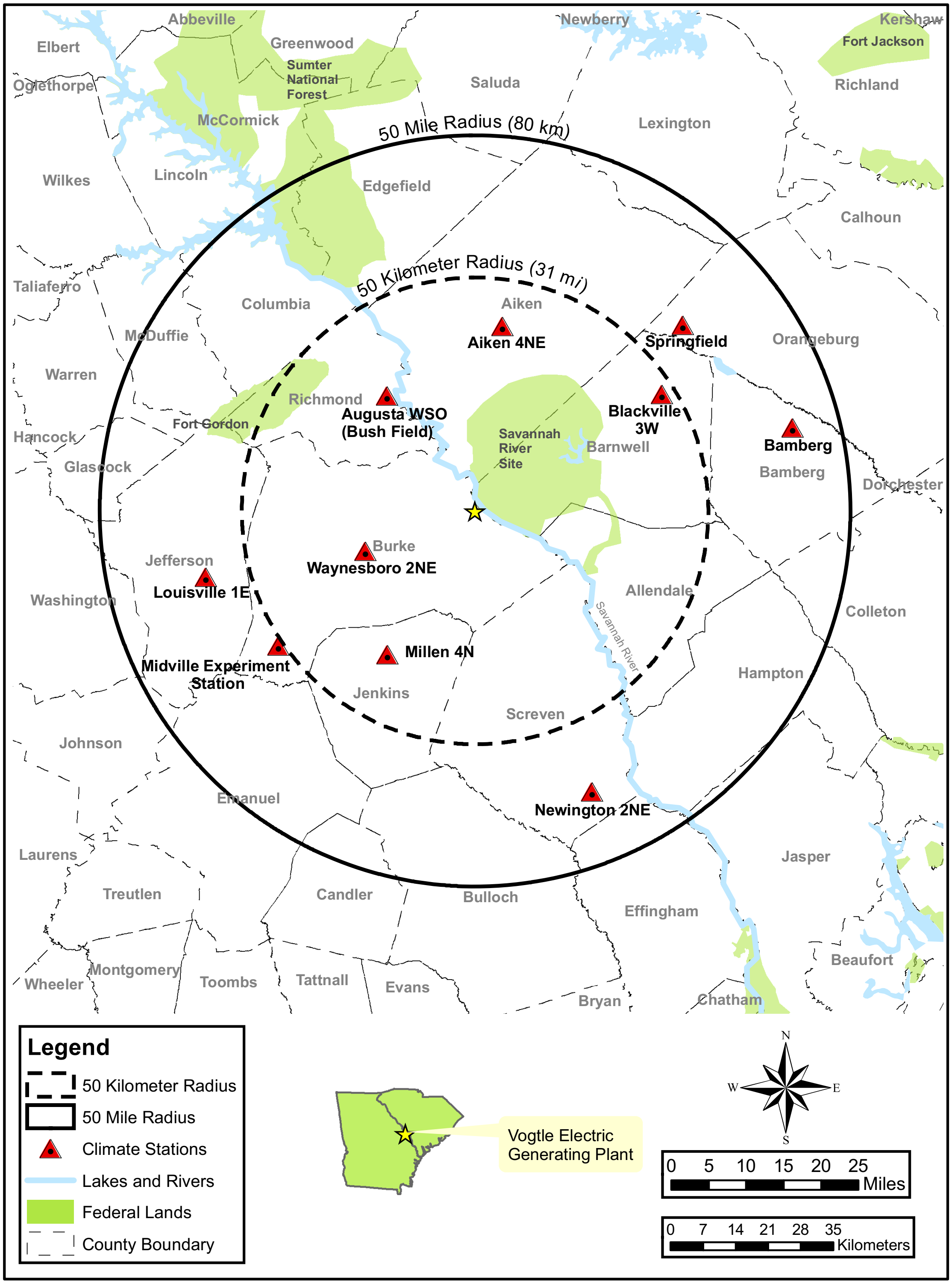

Figure 2.7-1 Climatological Observing Stations Near the VEGP Site

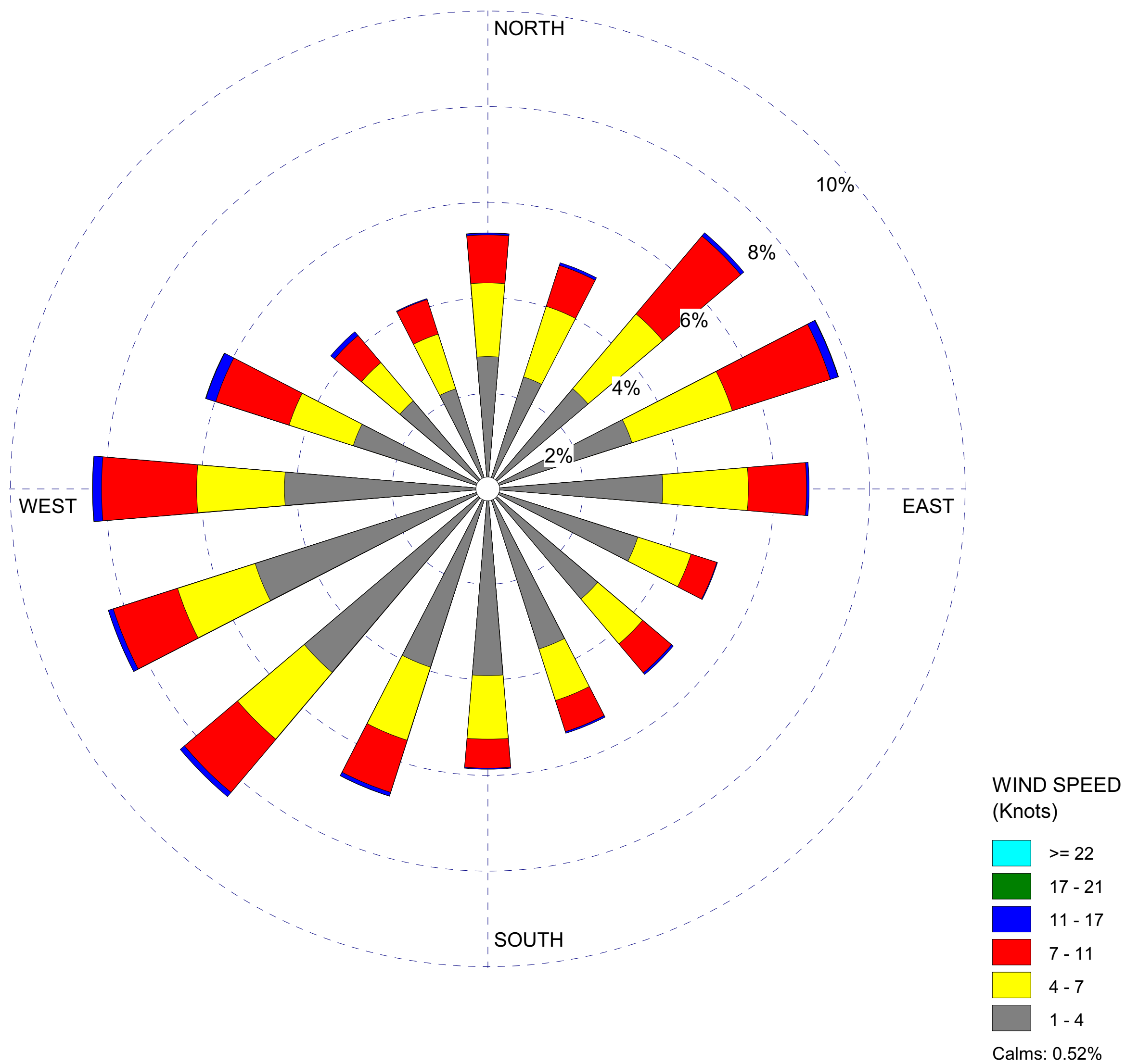

Figure 2.7-2 VEGP 10-m Level Annual Wind Rose (1998-2002)

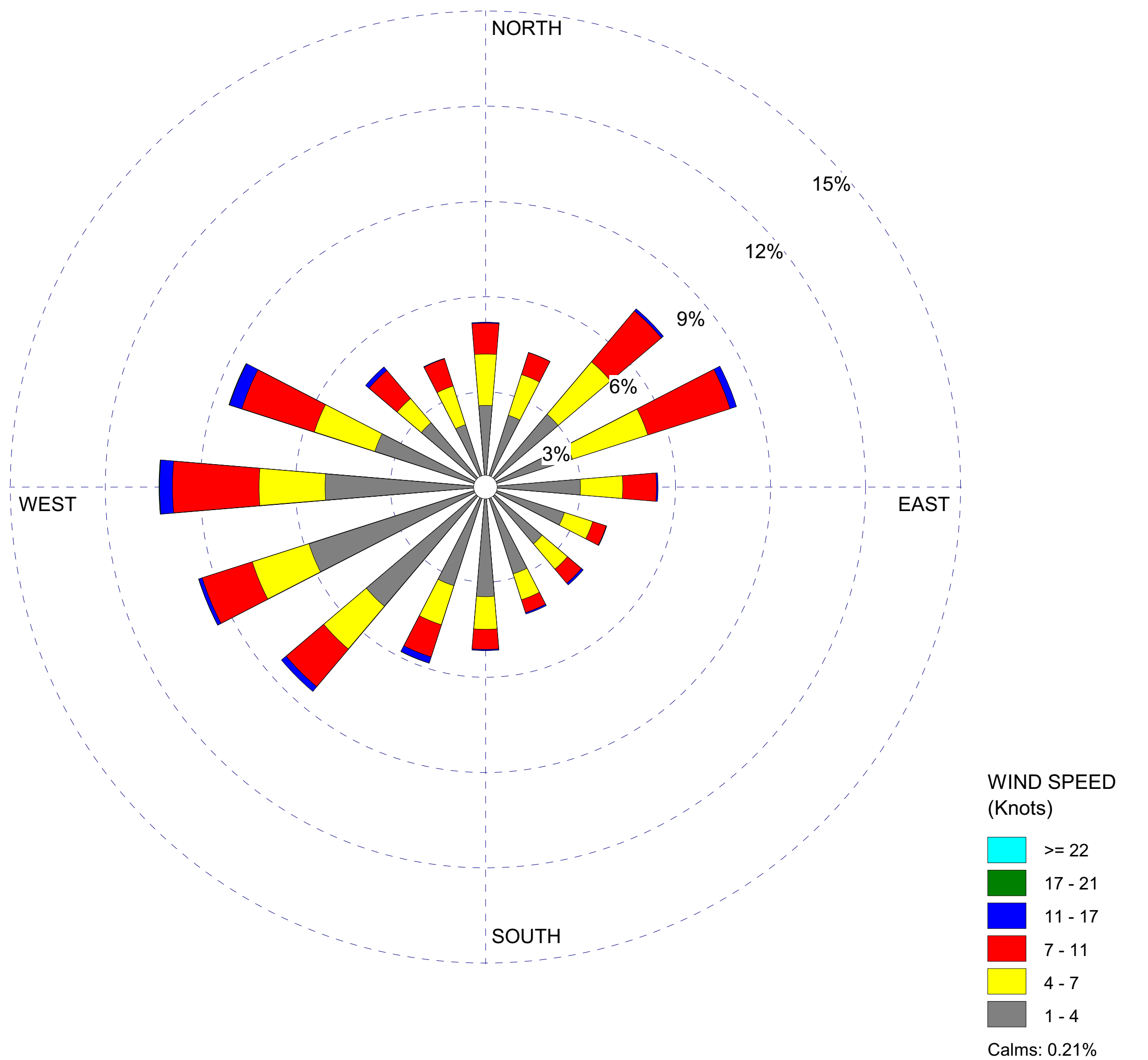

Figure 2.7-3 VEGP 10-m Level Winter Wind Rose (1998-2002)

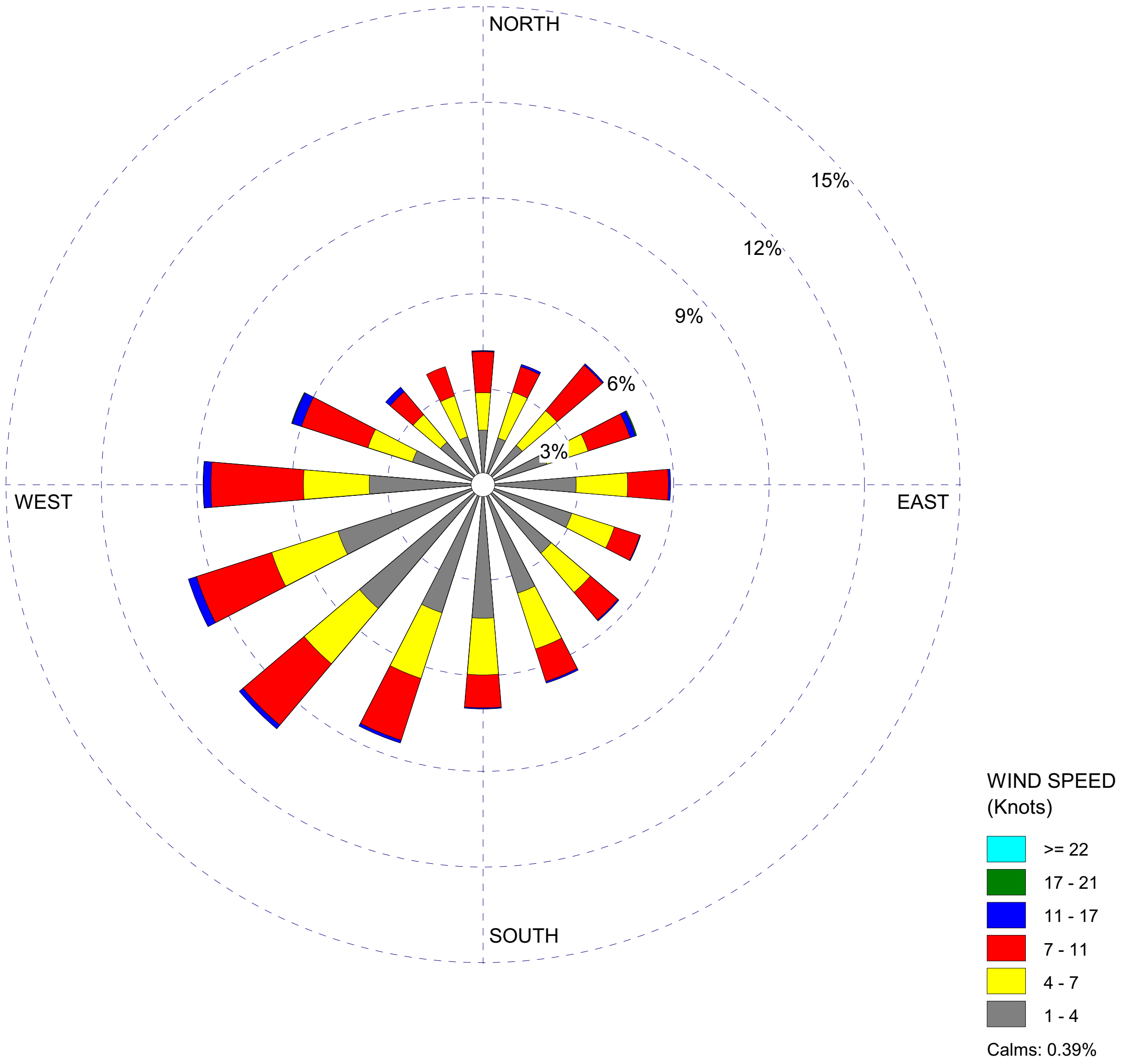

Figure 2.7-4 VEGP 10-m Level Spring Wind Rose (1998-2002)

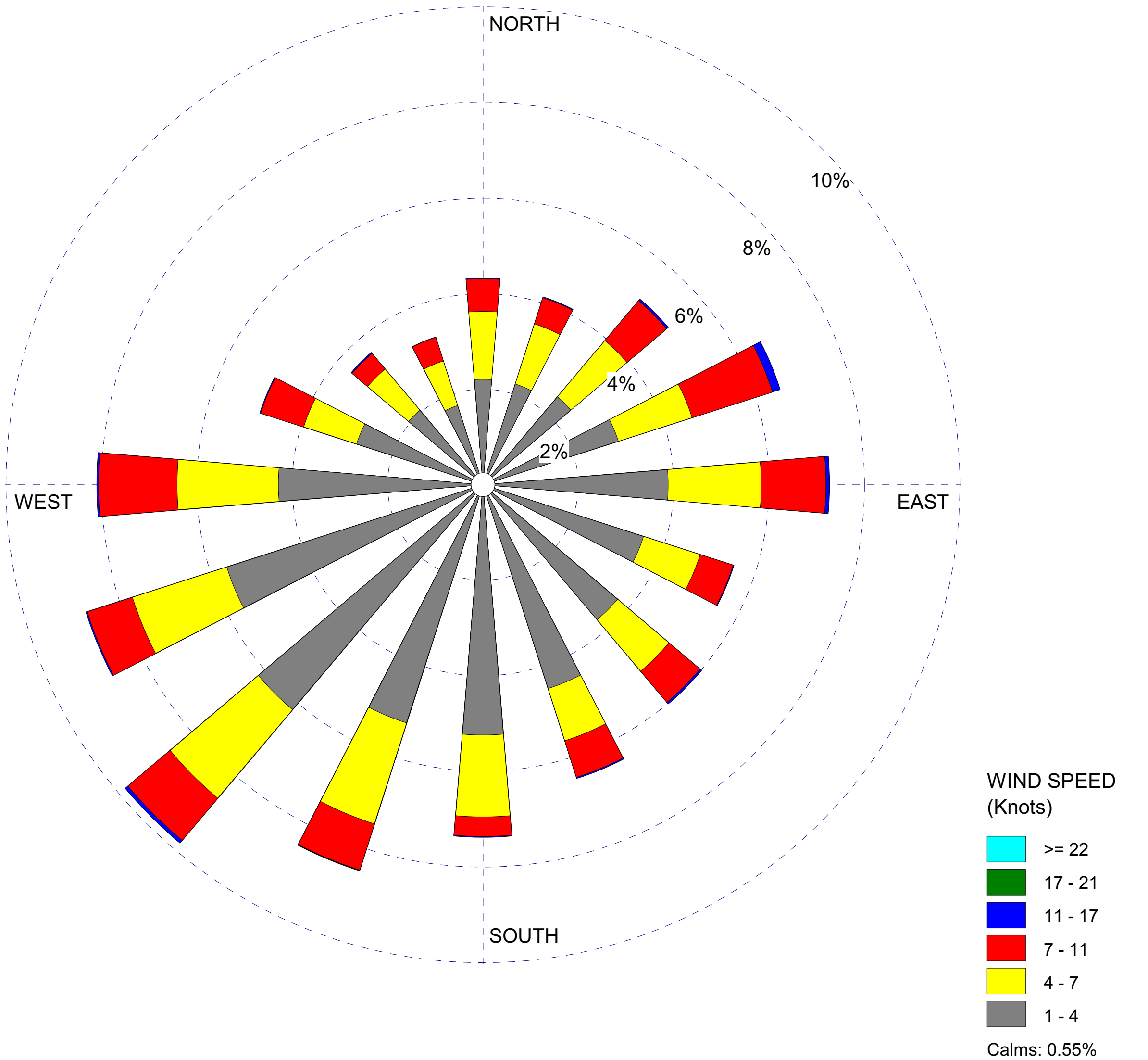

Figure 2.7-5 VEGP 10-m Level Summer Wind Rose (1998-2002)

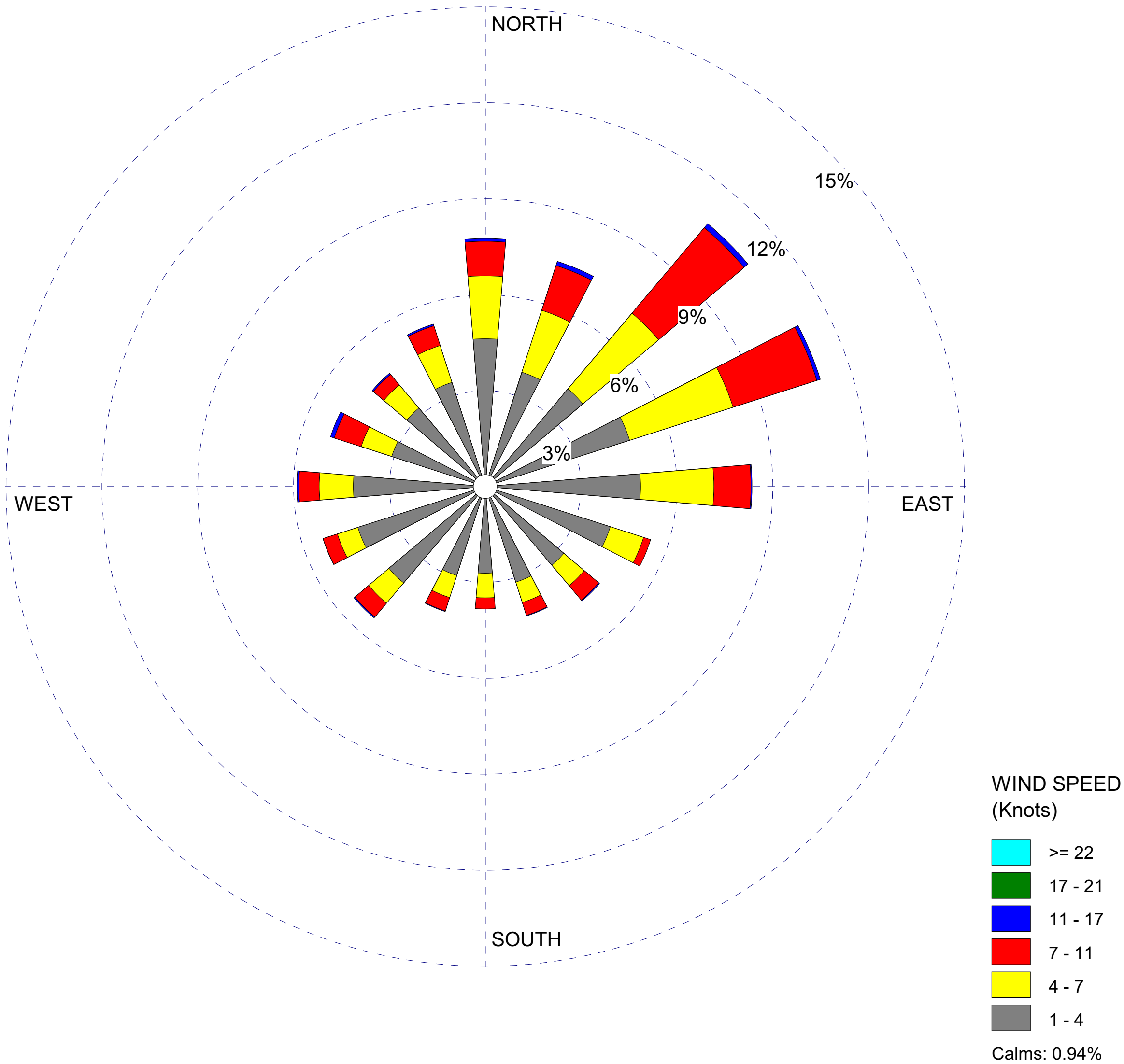

Figure 2.7-6 VEGP 10-m Level Autumn Wind Rose (1998-2002)

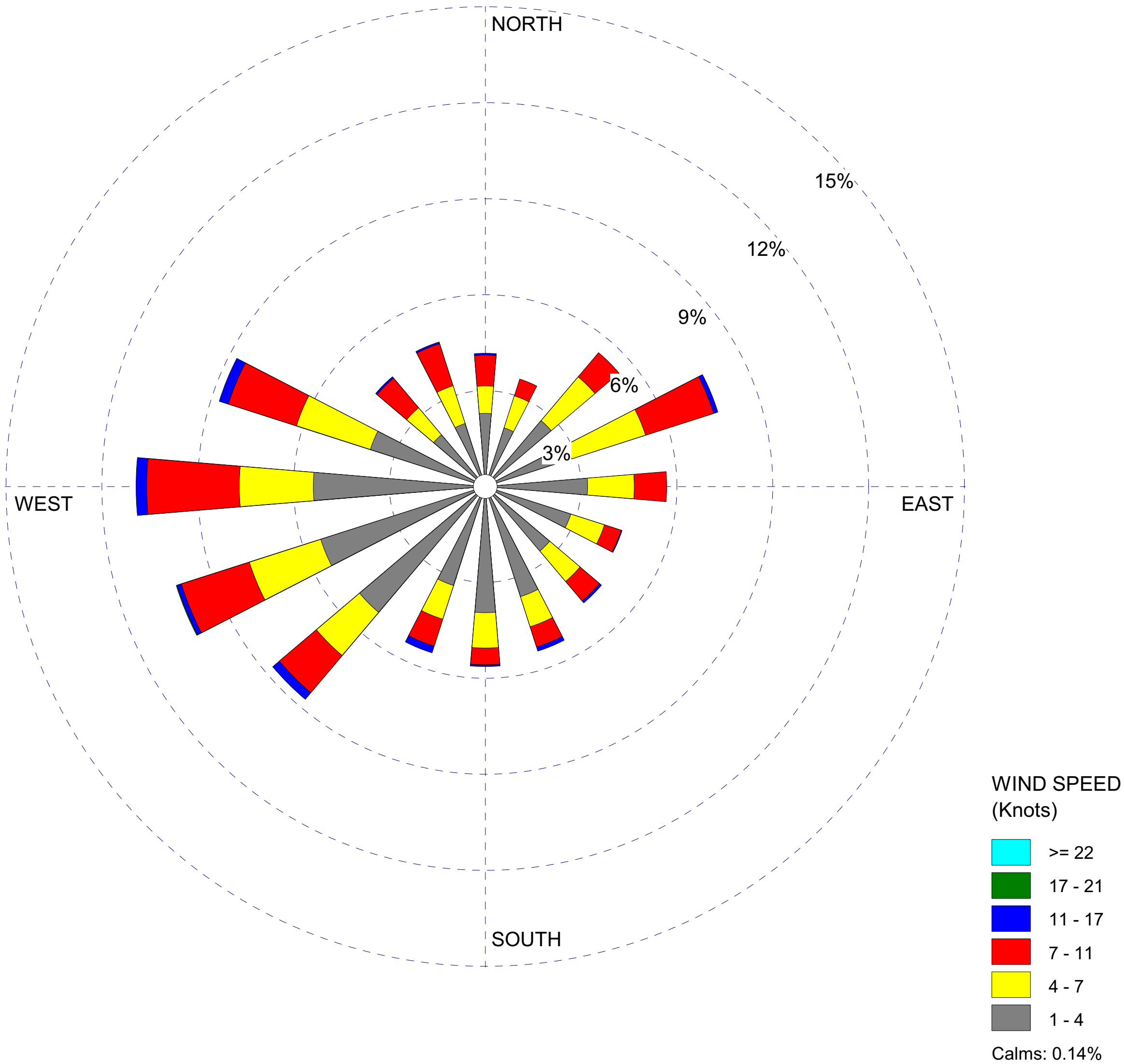

Figure 2.7-7 VEGP 10-m Level January Wind Rose (1998–2002) (Sheet 1 of 12)

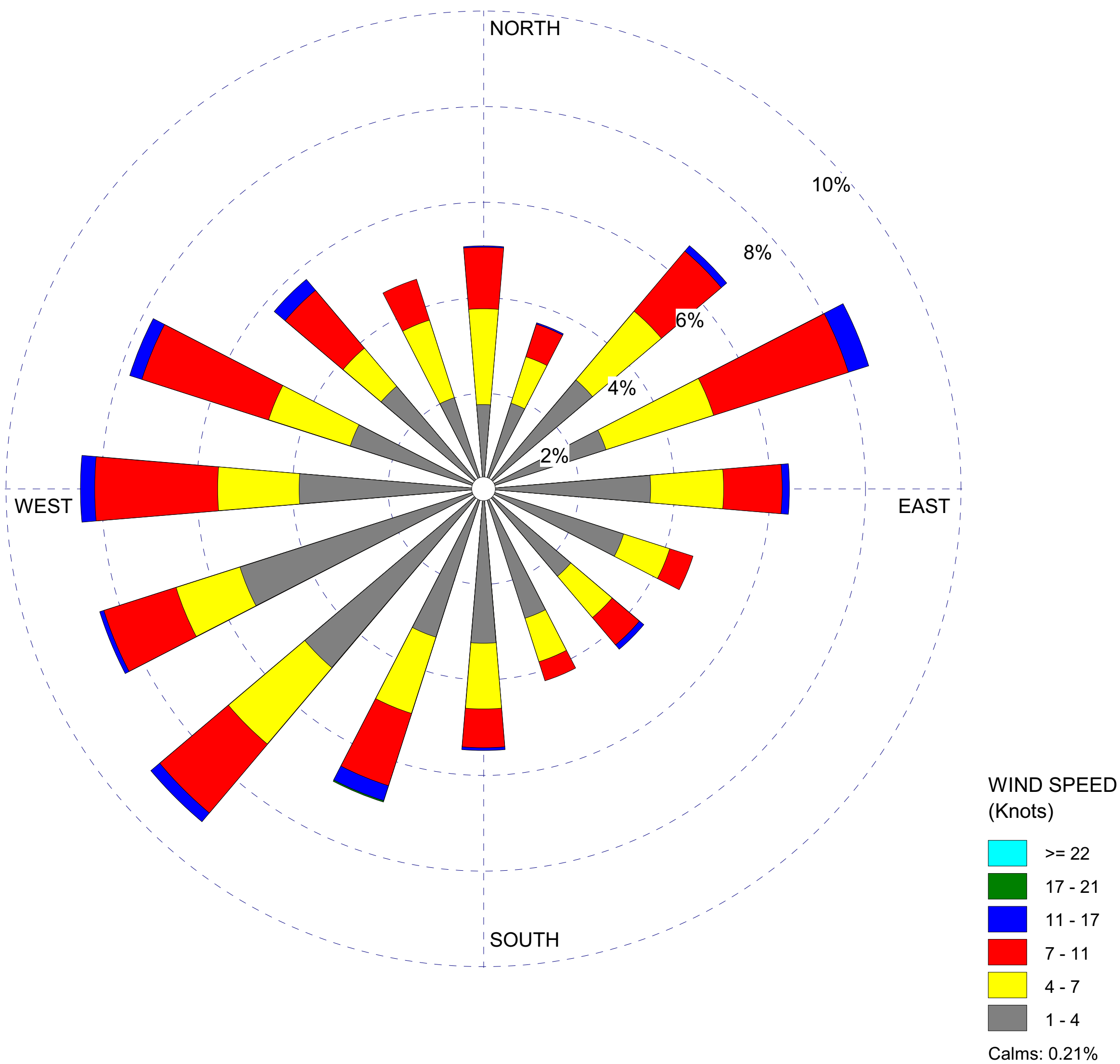

Figure 2.7-7 VEGP 10-m Level February Wind Rose (1998–2002) (Sheet 2 of 12)

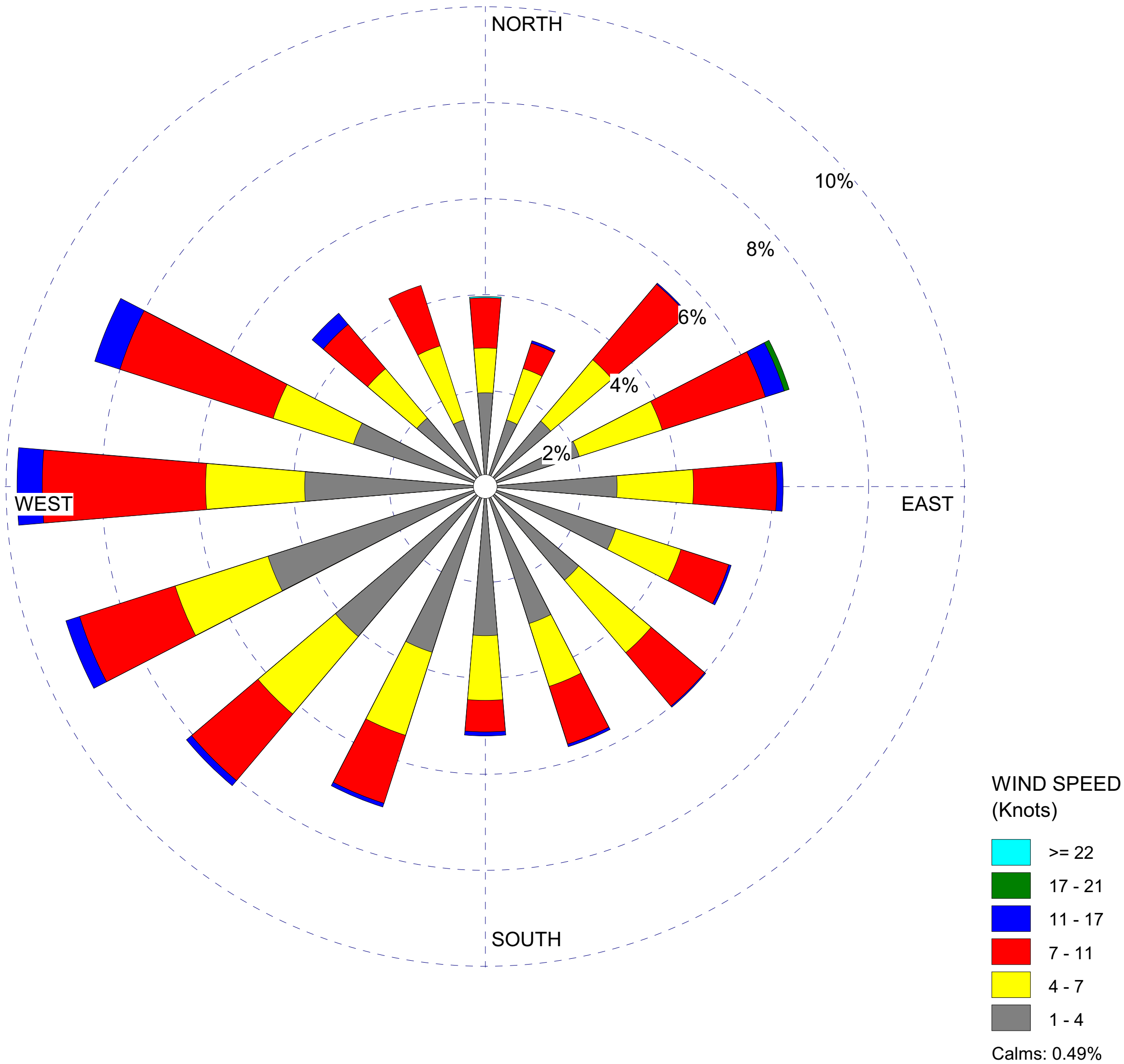

Figure 2.7-7 VEGP 10-m Level March Wind Rose (1998–2002) (Sheet 3 of 12)

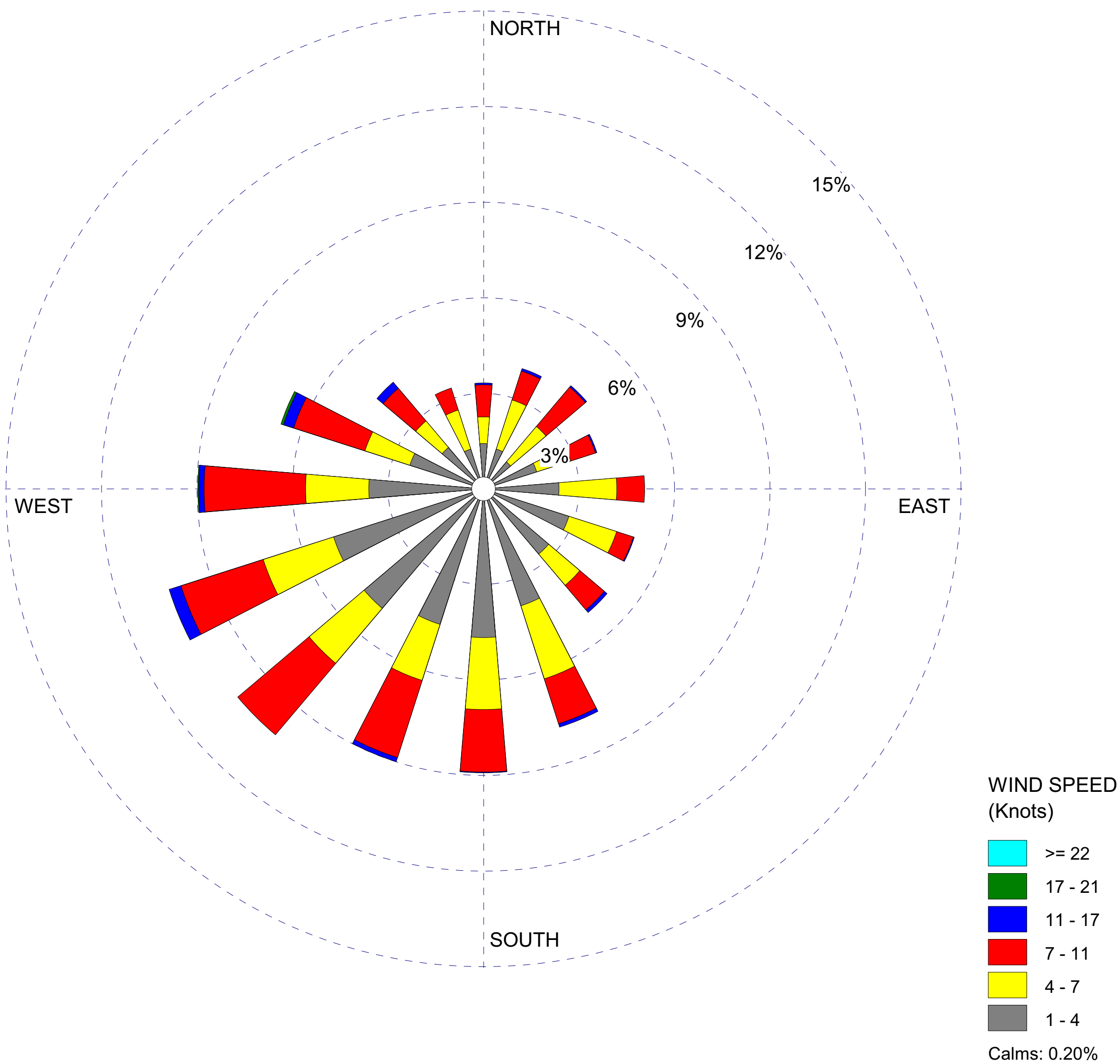

Figure 2.7-7 VEGP 10-m Level April Wind Rose (1998–2002) (Sheet 4 of 12)

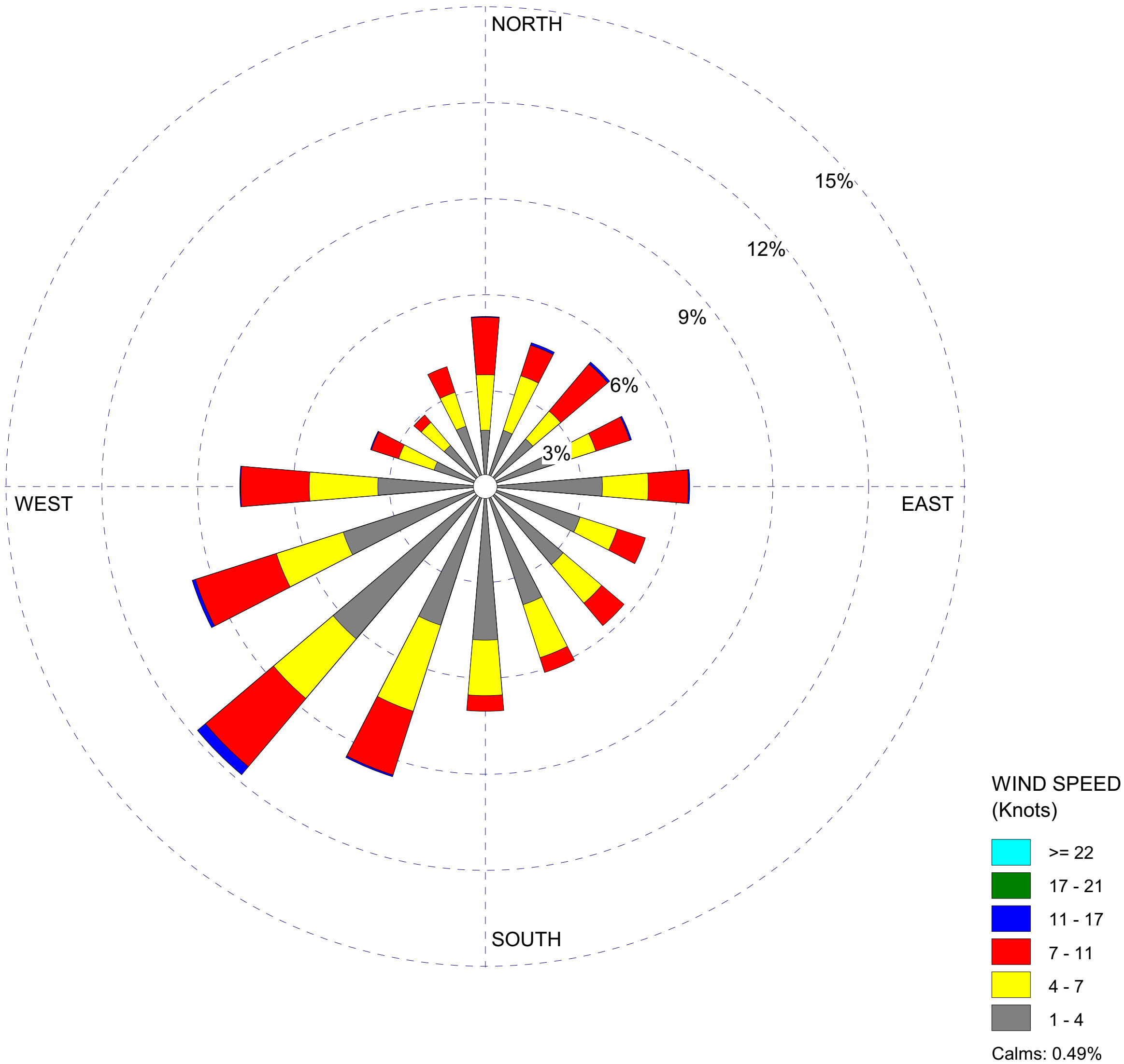

Figure 2.7-7 VEGP 10-m Level May Wind Rose (1998–2002) (Sheet 5 of 12)

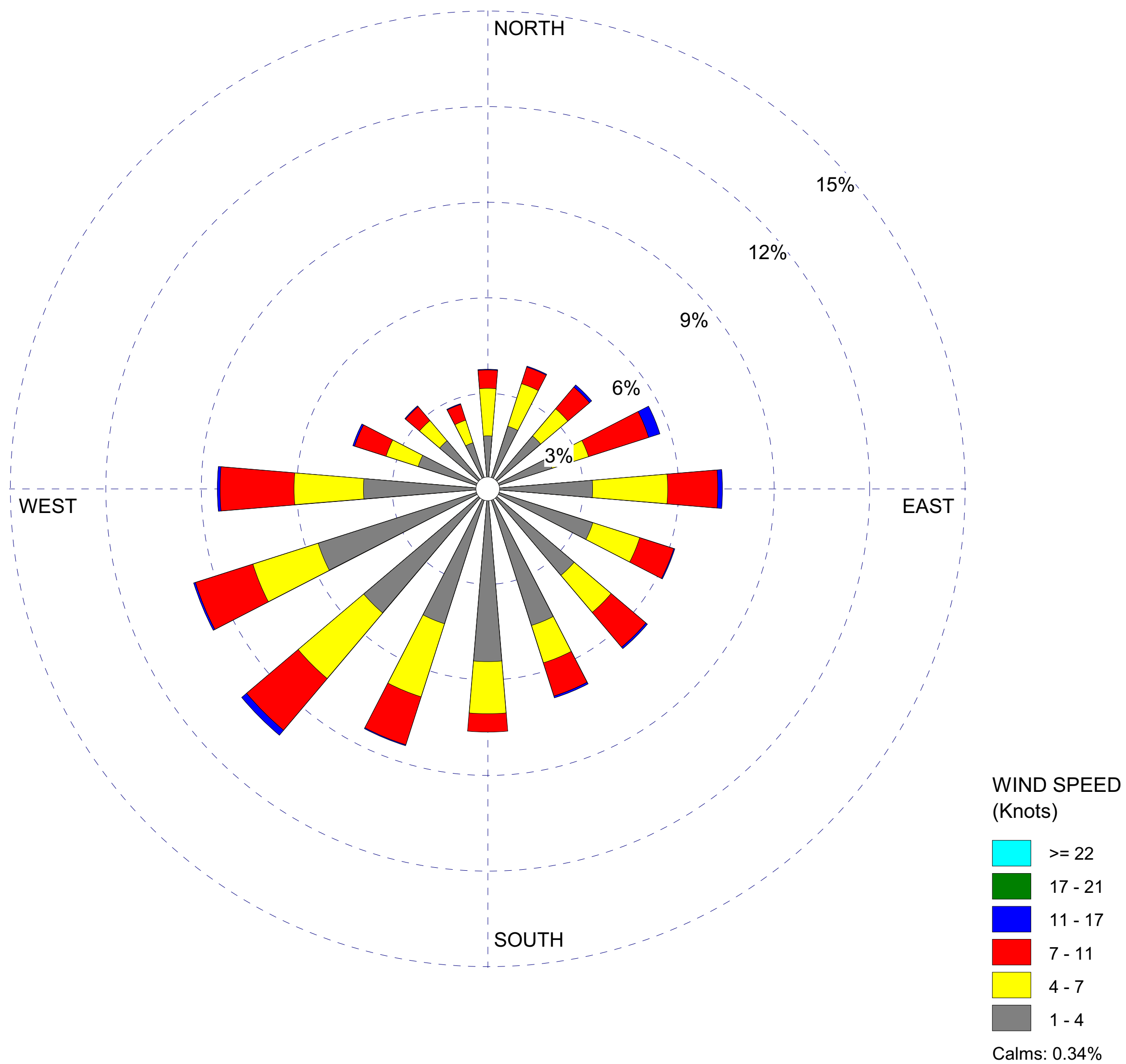

Figure 2.7-7 VEGP 10-m Level June Wind Rose (1998–2002) (Sheet 6 of 12)

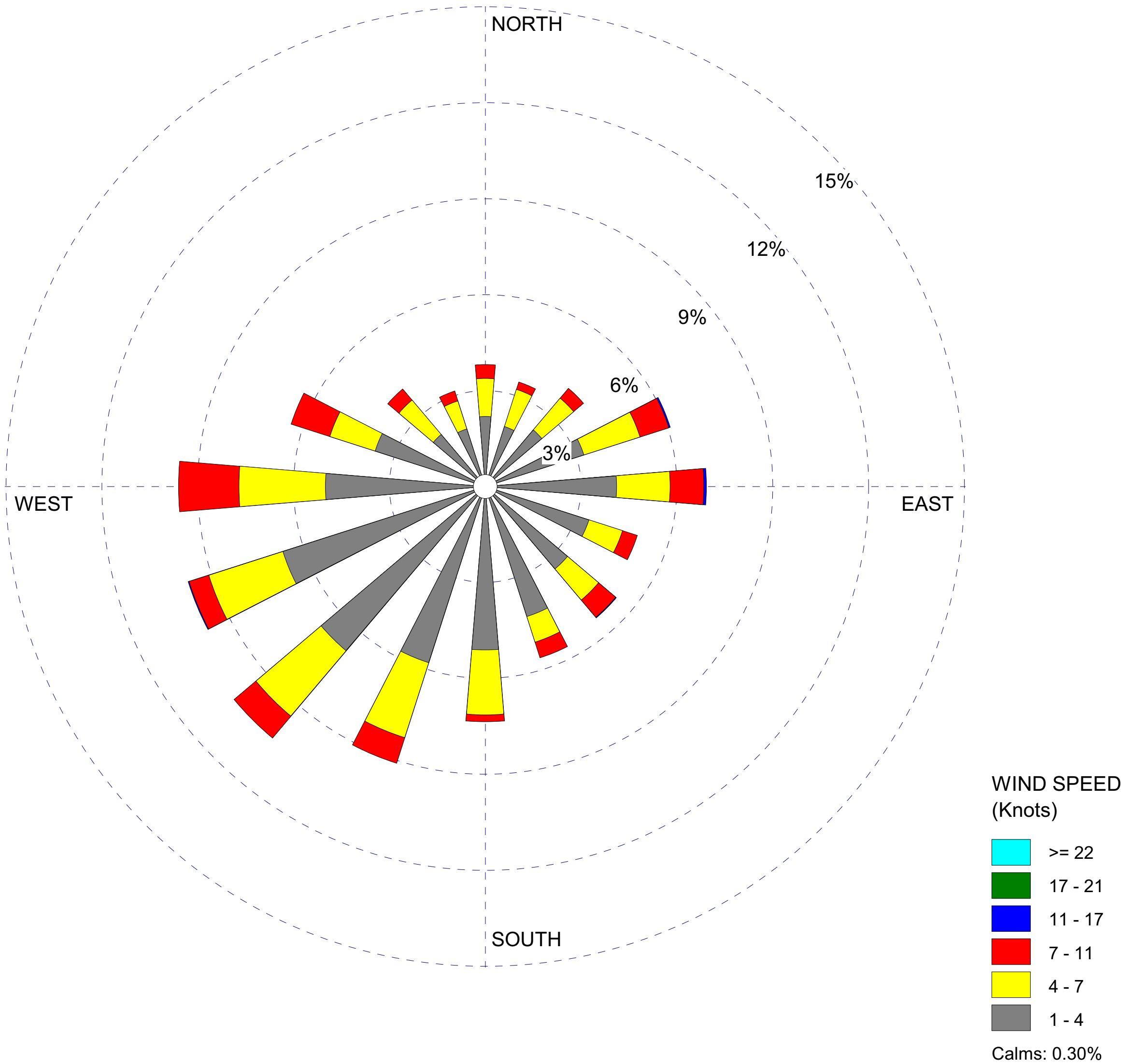

Figure 2.7-7 VEGP 10-m Level July Wind Rose (1998–2002) (Sheet 7 of 12)

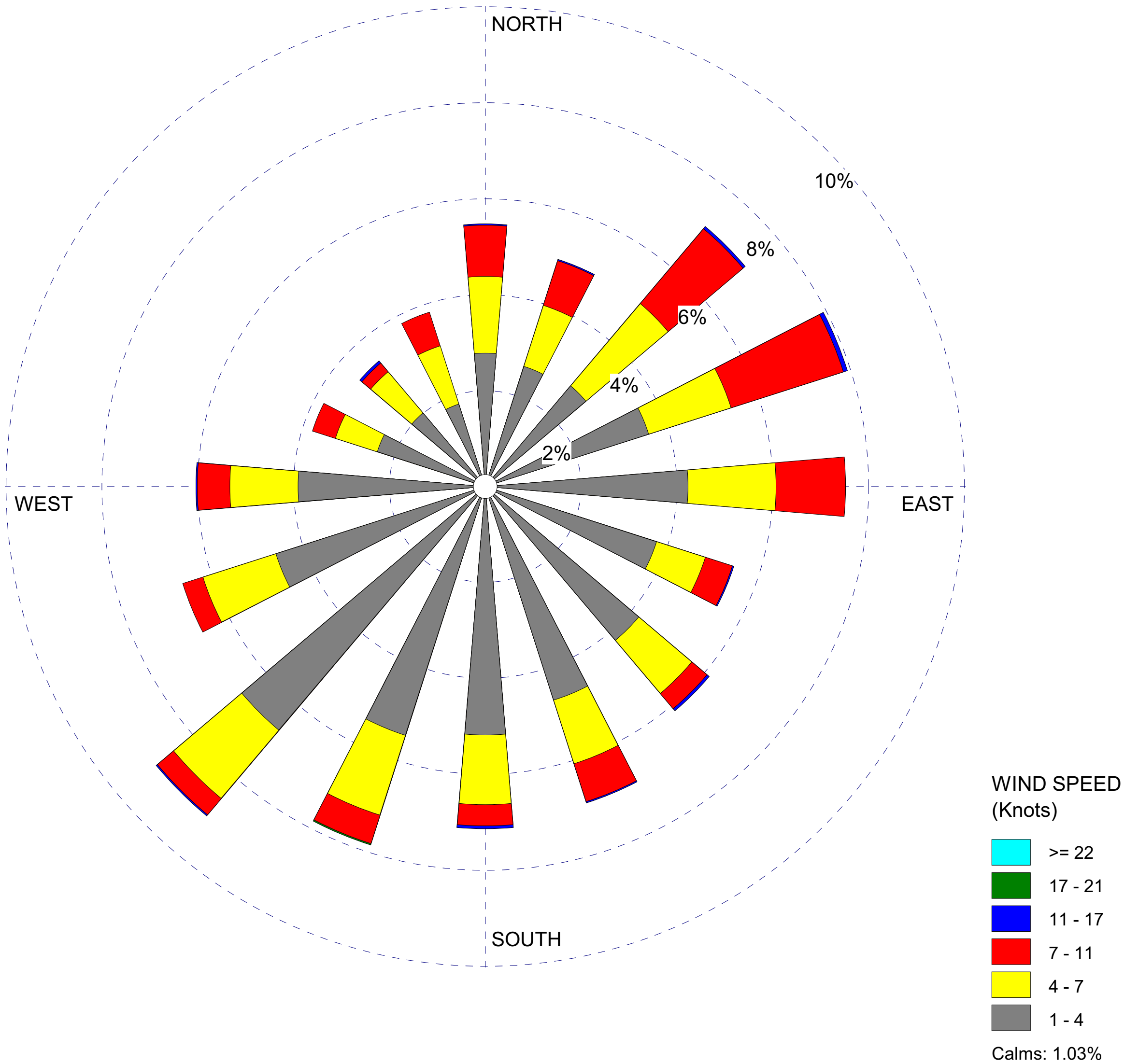

Figure 2.7-7 VEGP 10-m Level August Wind Rose (1998–2002) (Sheet 8 of 12)

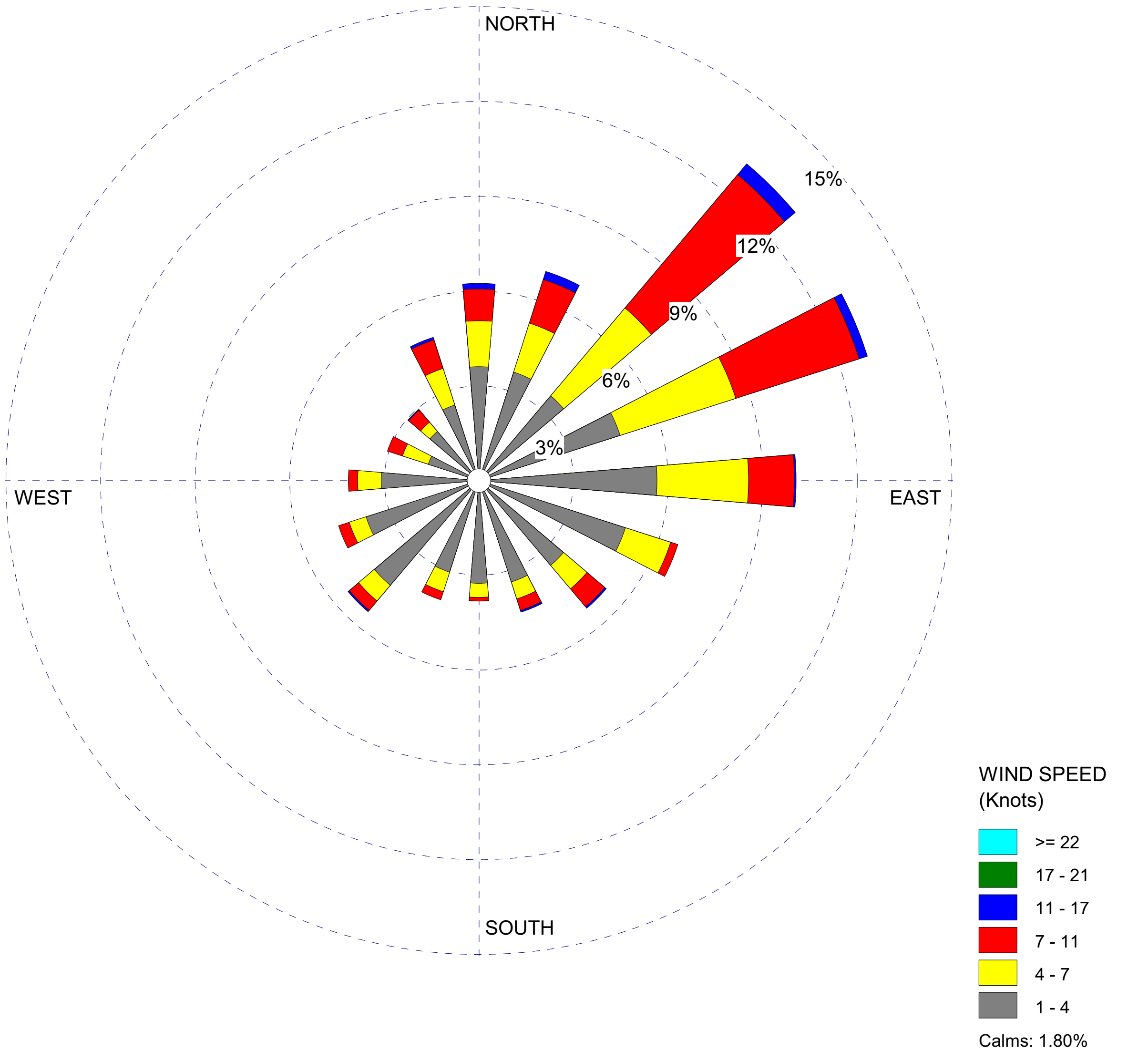

Figure 2.7-7 VEGP 10-m Level September Wind Rose (1998–2002) (Sheet 9 of 12)

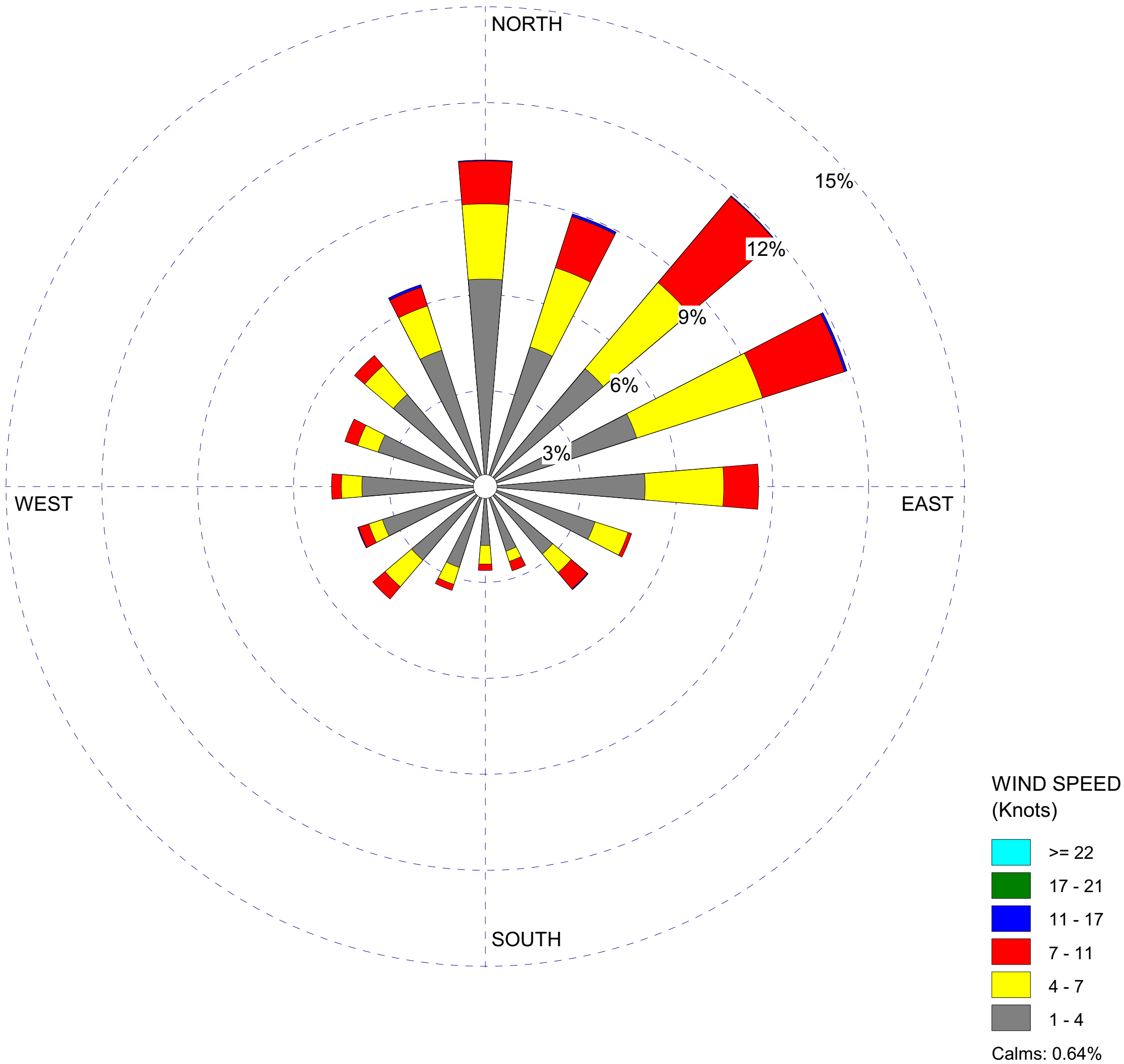

Figure 2.7-7 VEGP 10-m Level October Wind Rose (1998–2002) (Sheet 10 of 12)

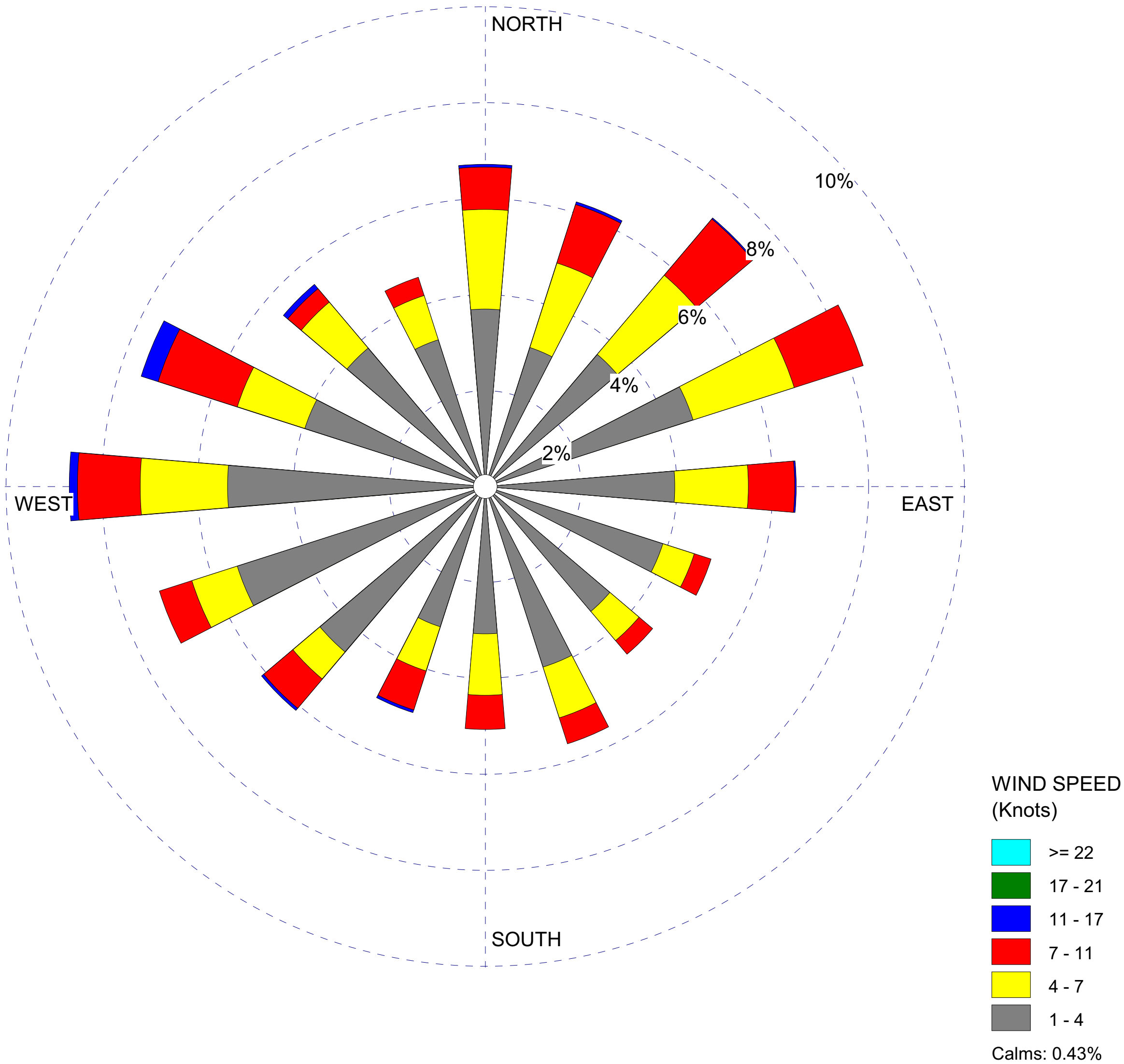

Figure 2.7-7 VEGP 10-m Level November Wind Rose (1998–2002) (Sheet 11 of 12)

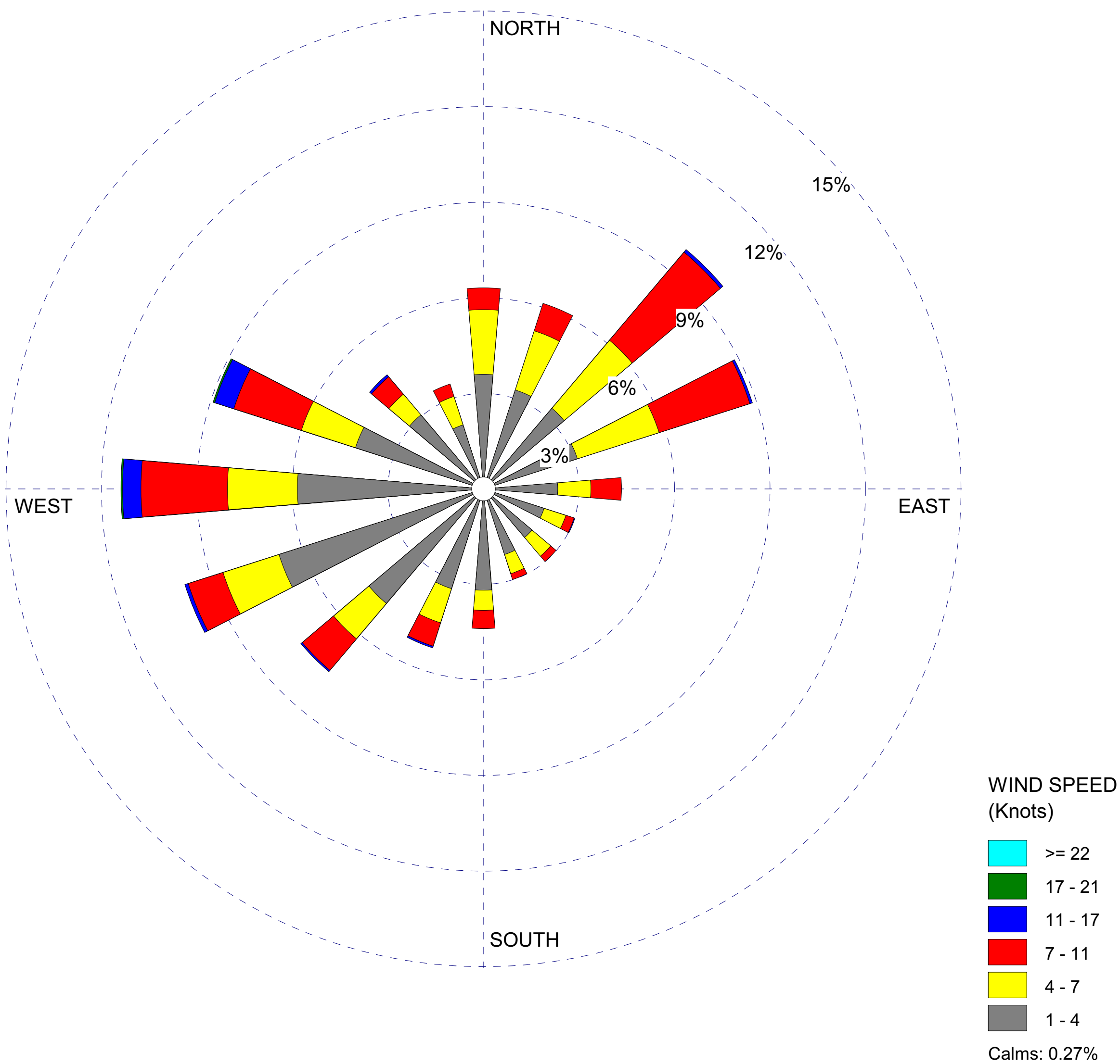

Figure 2.7-7 VEGP 10-m Level December Wind Rose (1998–2002) (Sheet 12 of 12)

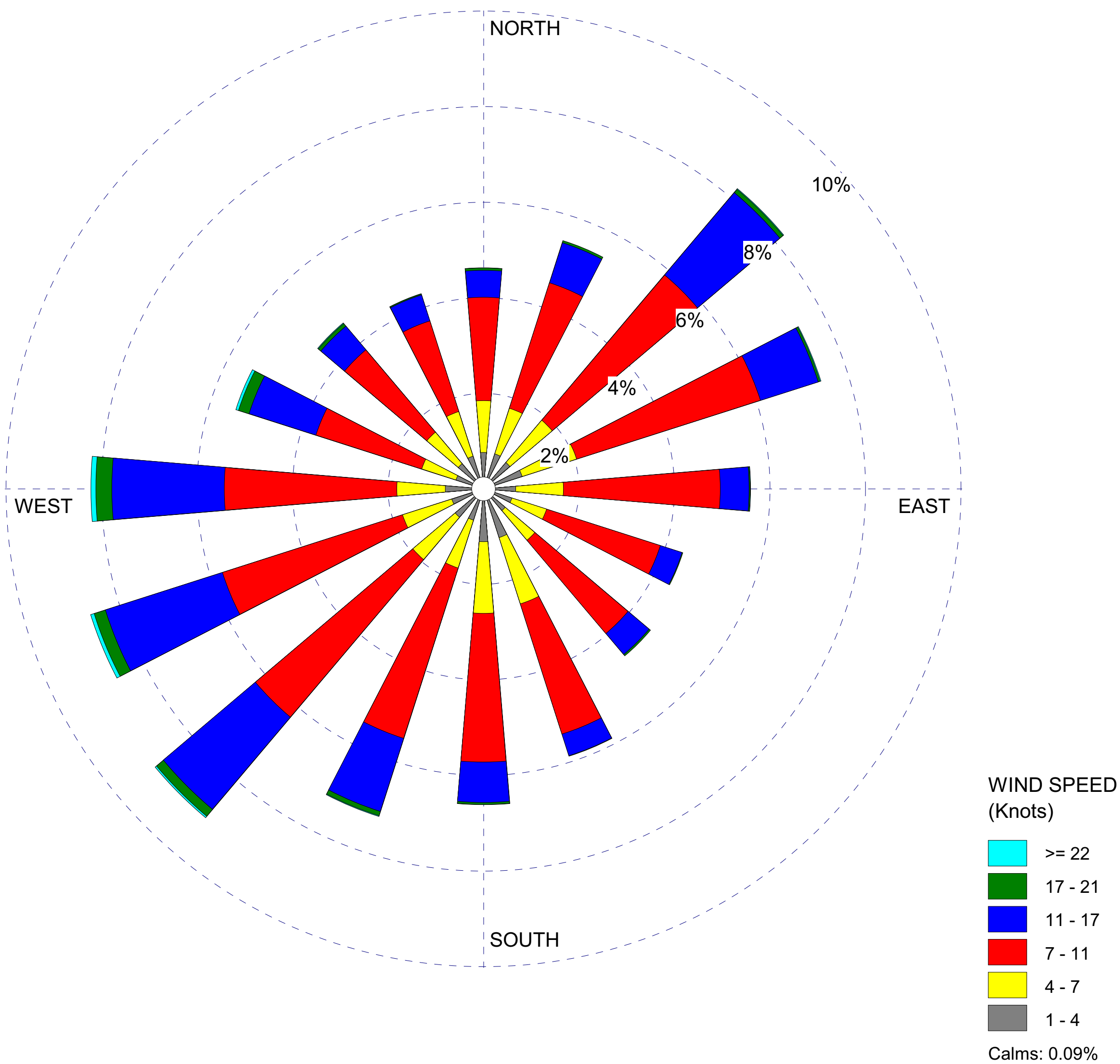

Figure 2.7-8 VEGP 60-m Level Annual Wind Rose (1998-2002)

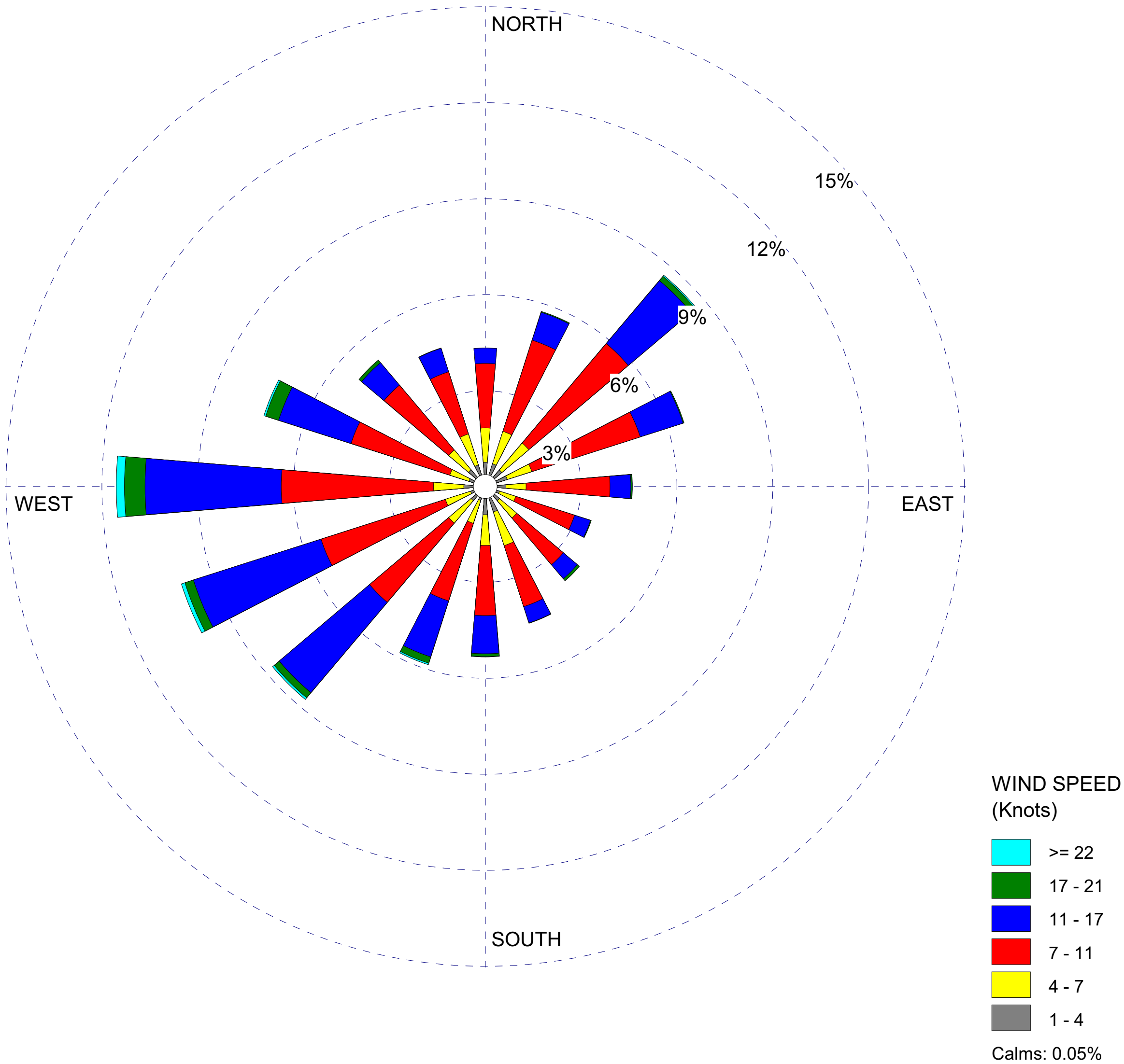

Figure 2.7-9 VEGP 60-m Level Winter Wind Rose (1998-2002)

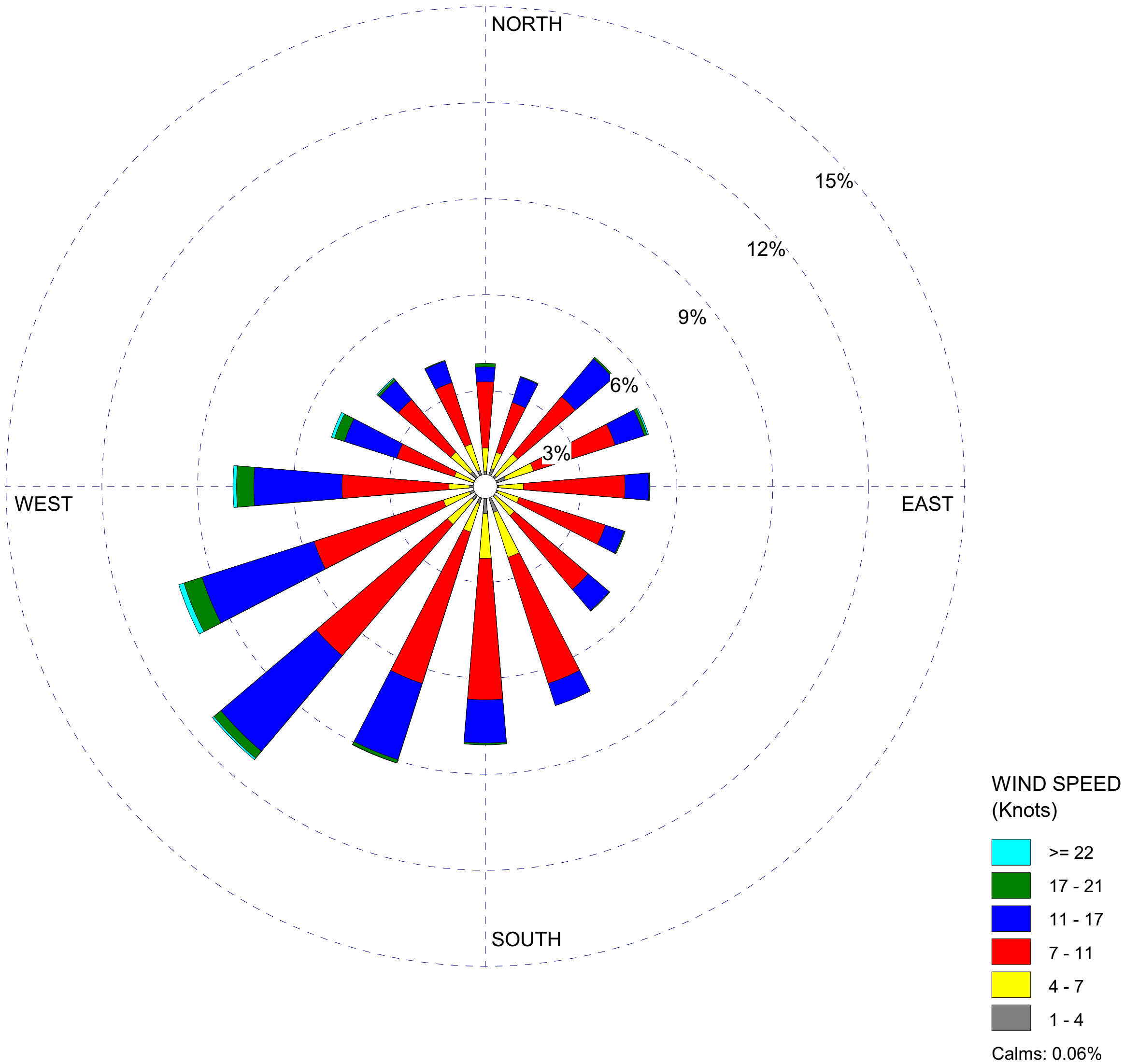

Figure 2.7-10 VEGP 60-m Level Spring Wind Rose (1998-2002)

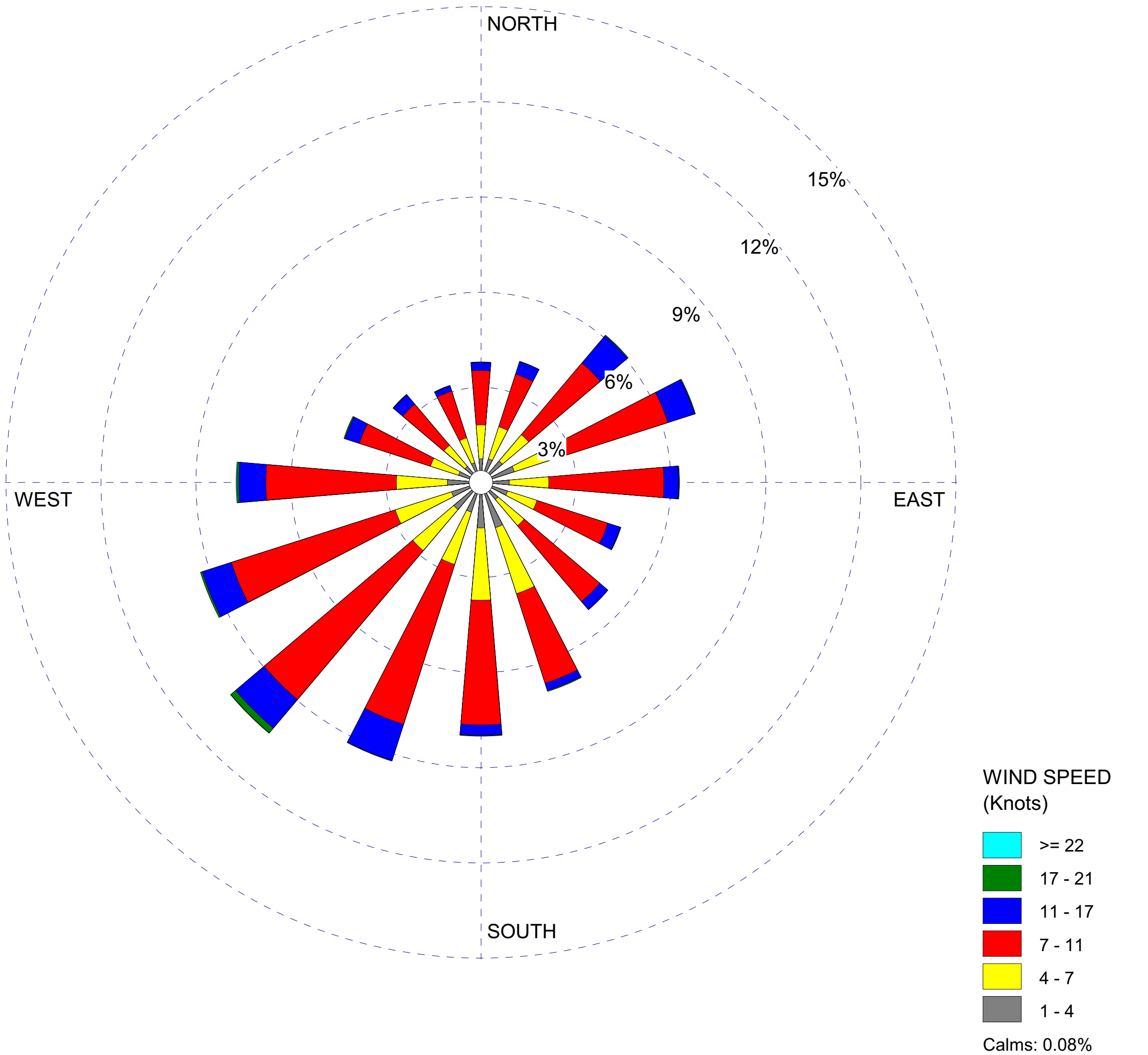

Figure 2.7-11 VEGP 60-m Level Summer Wind Rose (1998-2002)

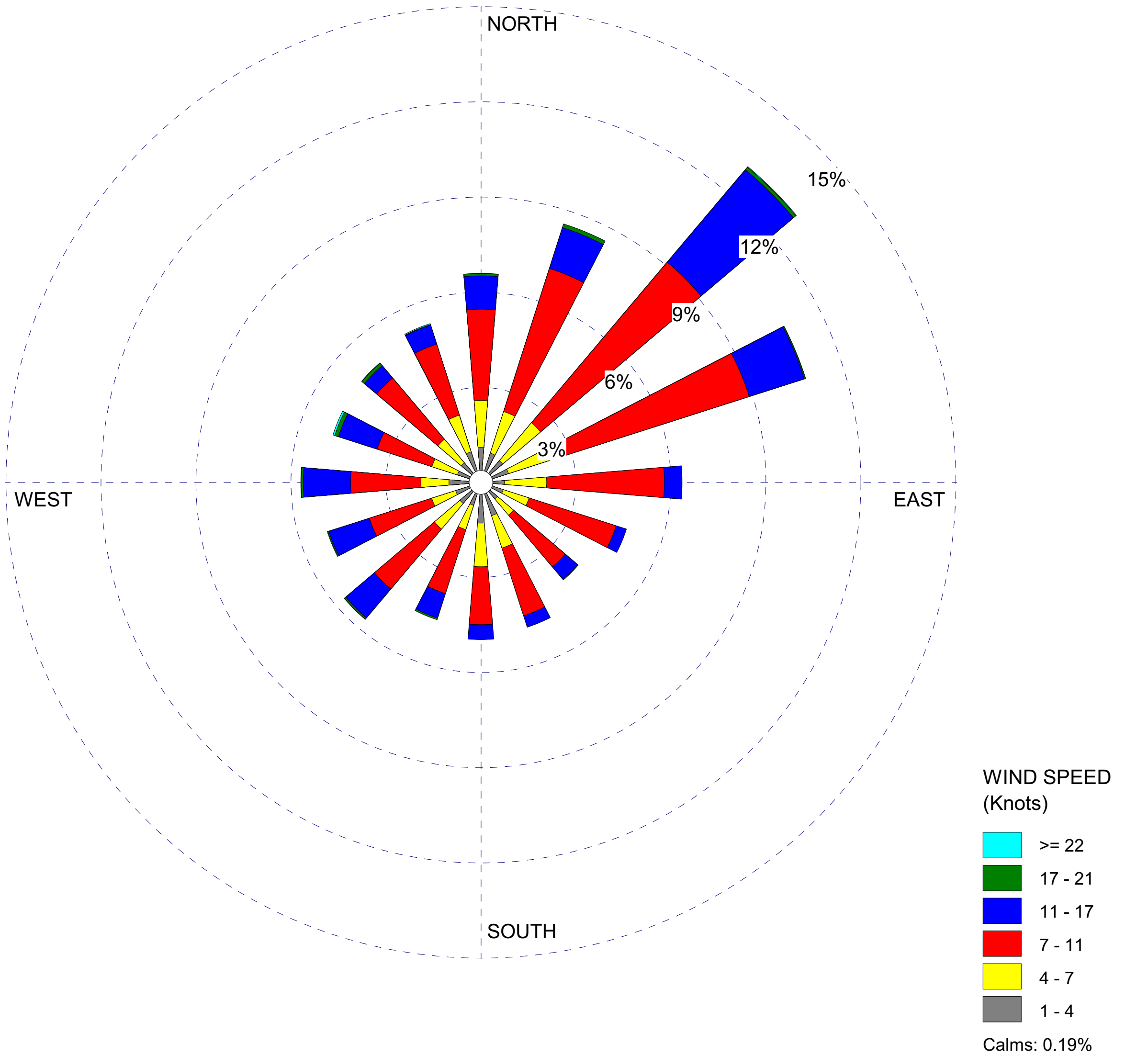

Figure 2.7-12 VEGP 60-m Level Autumn Wind Rose (1998-2002)

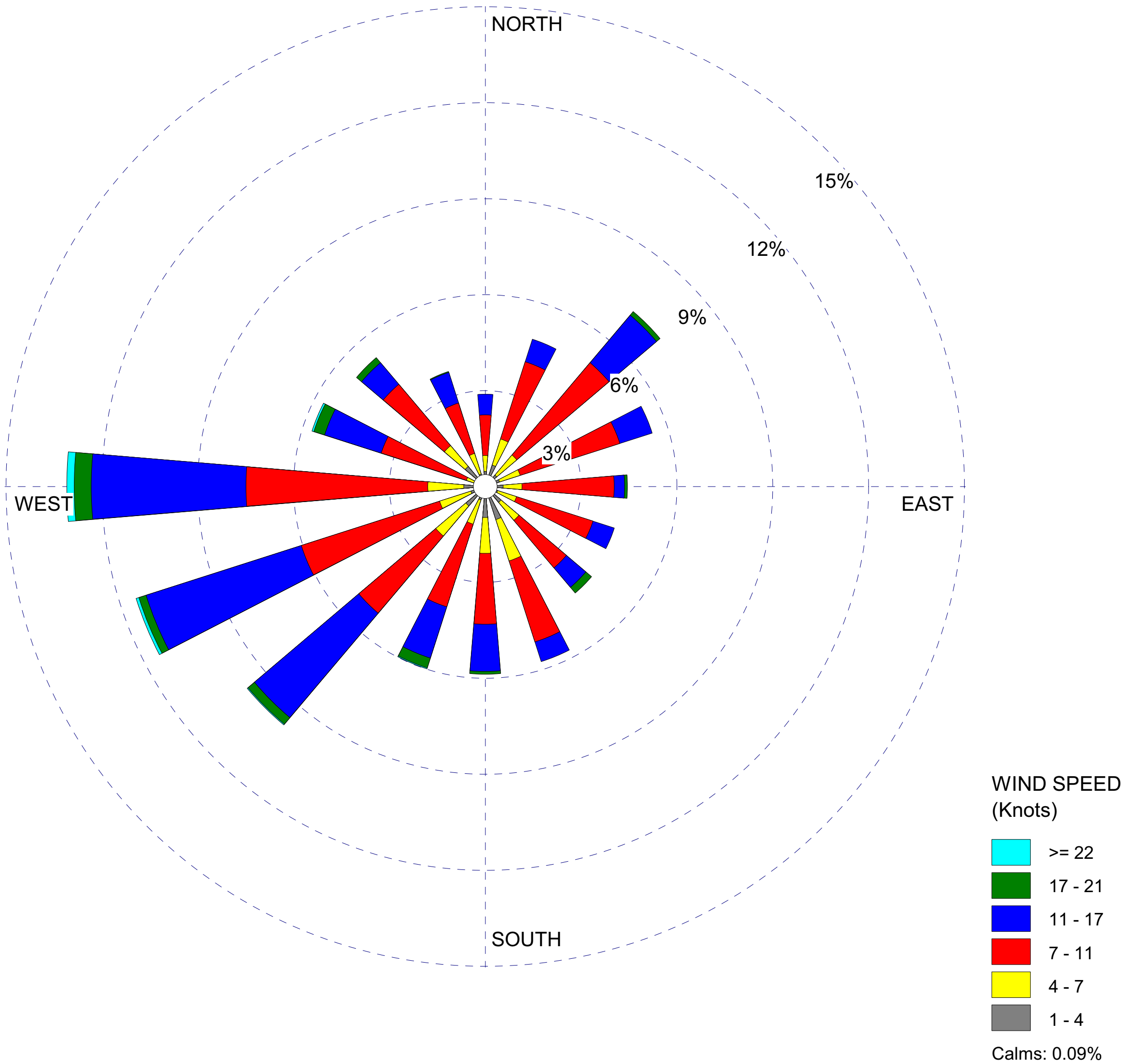

Figure 2.7-13 VEGP 60-m Level January Wind Rose (1998–2002) (Sheet 1 of 12)

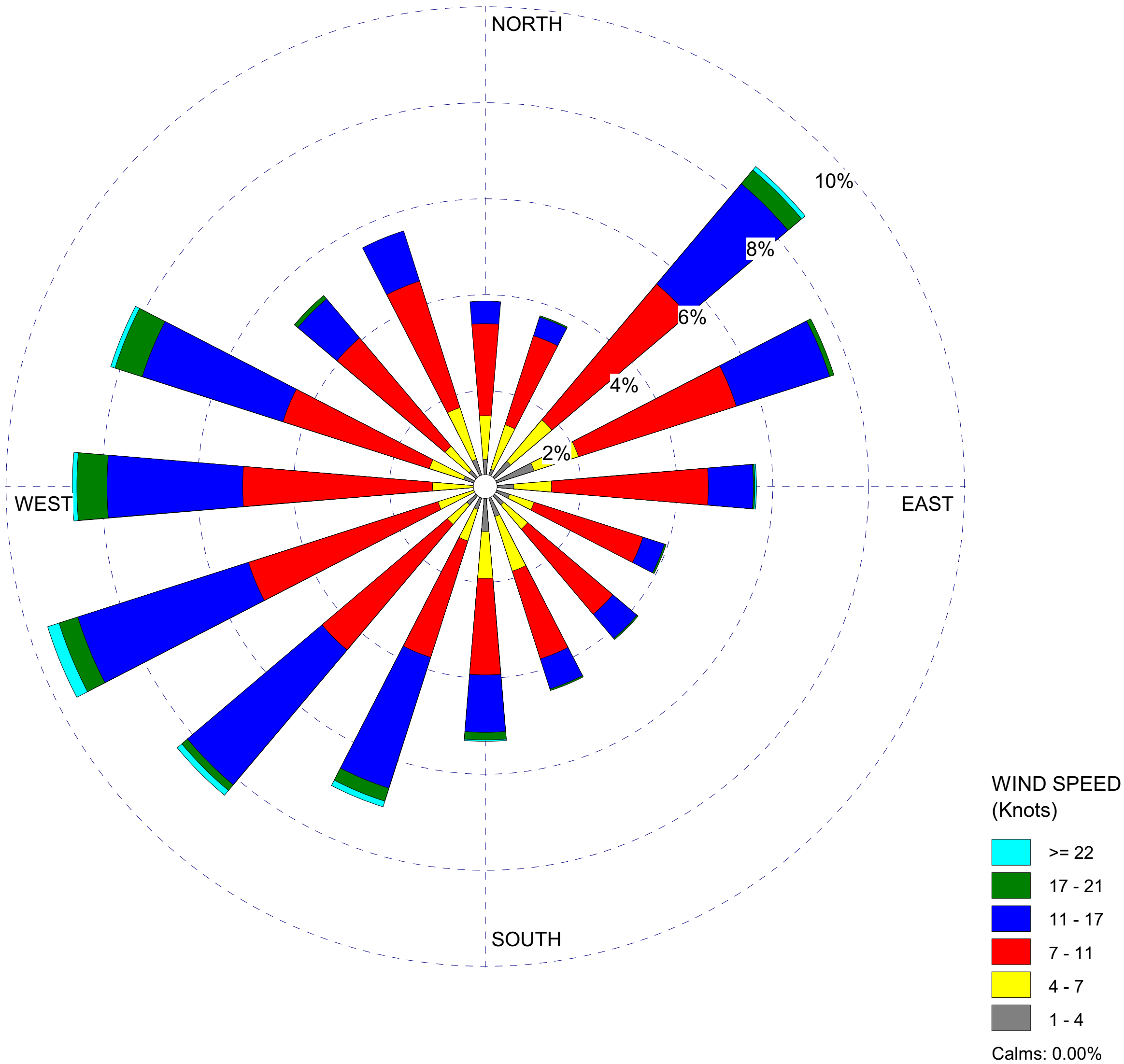

Figure 2.7-13 VEGP 60-m Level February Wind Rose (1998–2002) (Sheet 2 of 12)

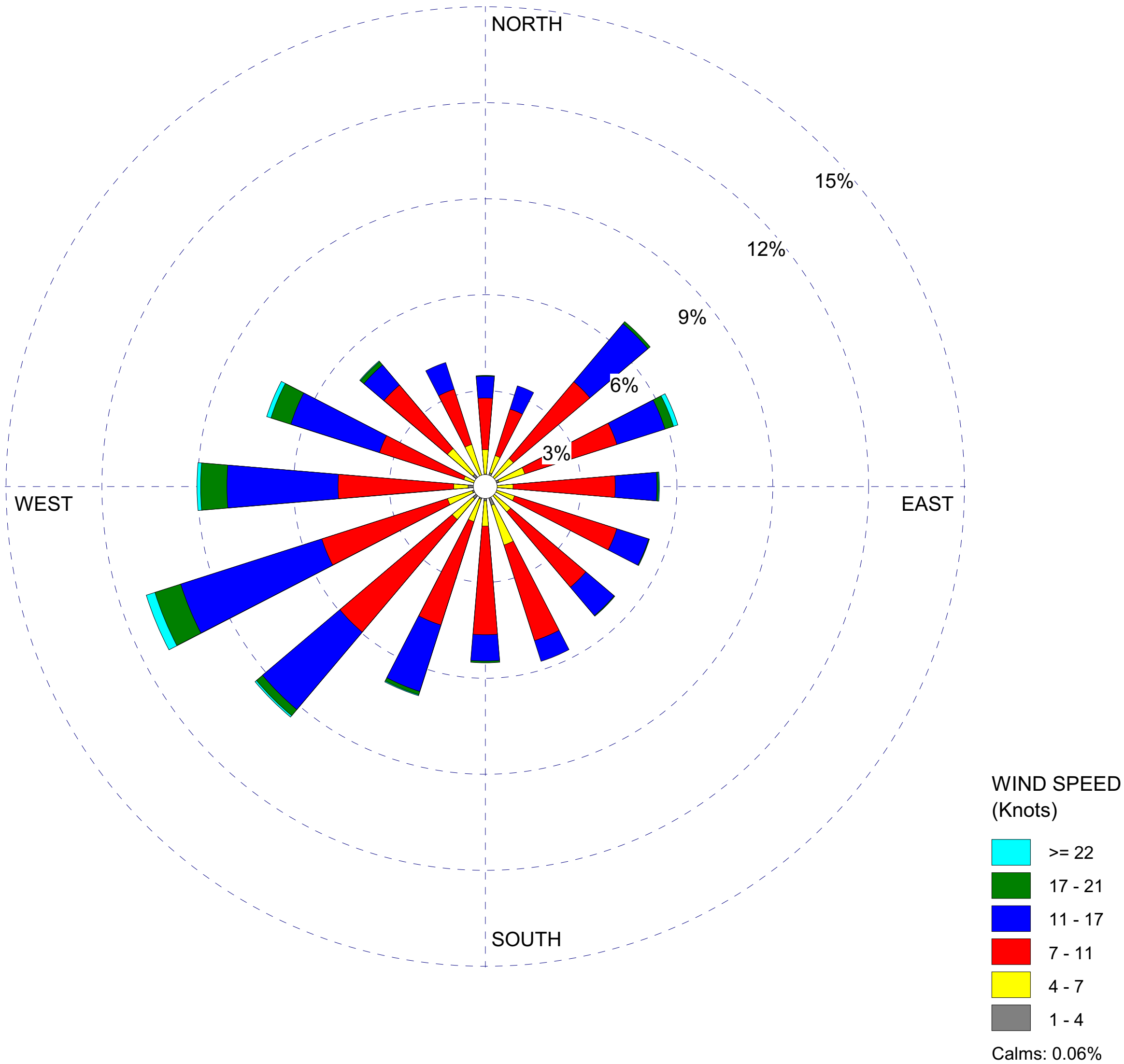

Figure 2.7-13 VEGP 60-m Level March Wind Rose (1998–2002) (Sheet 3 of 12)

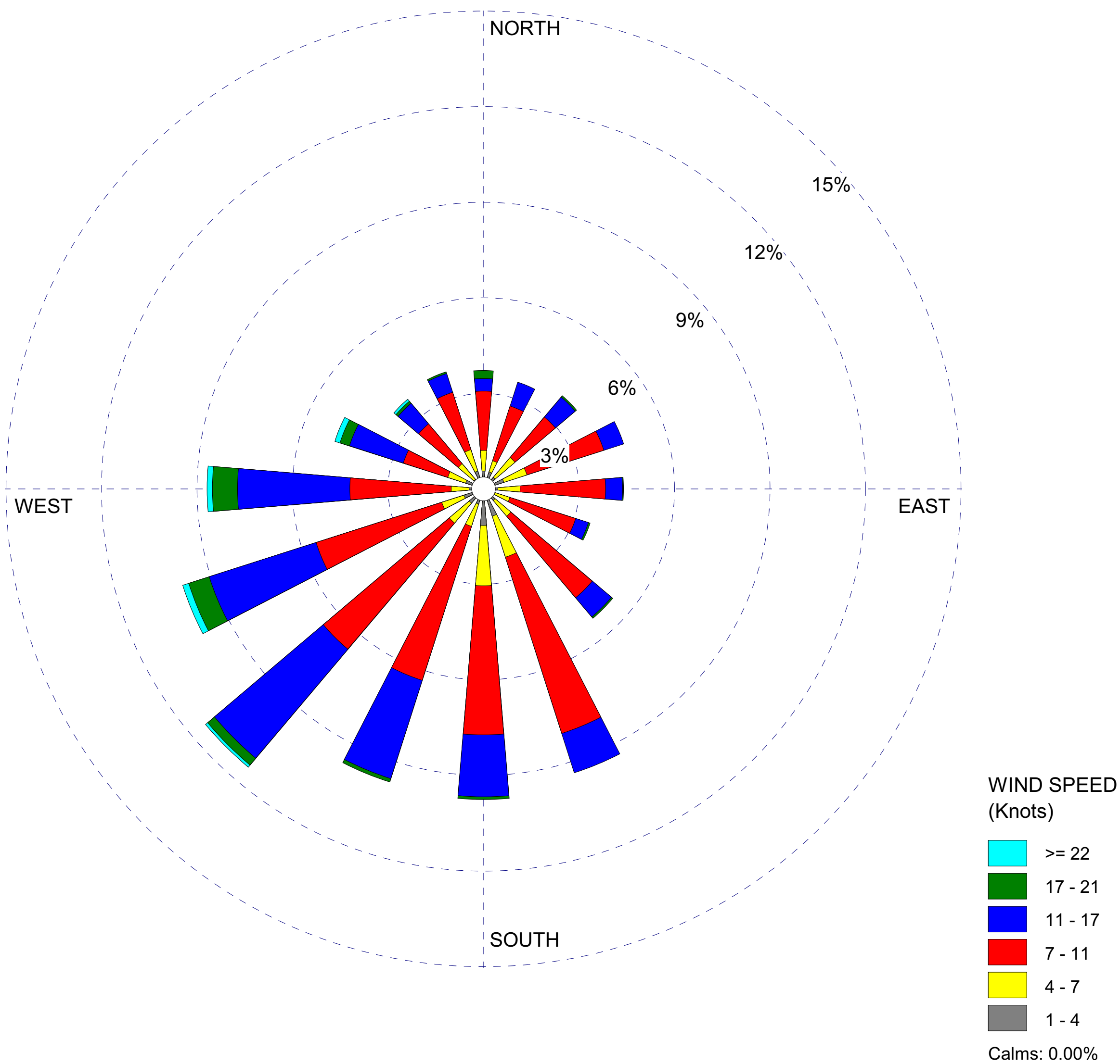

Figure 2.7-13 VEGP 60-m Level April Wind Rose (1998–2002) (Sheet 4 of 12)

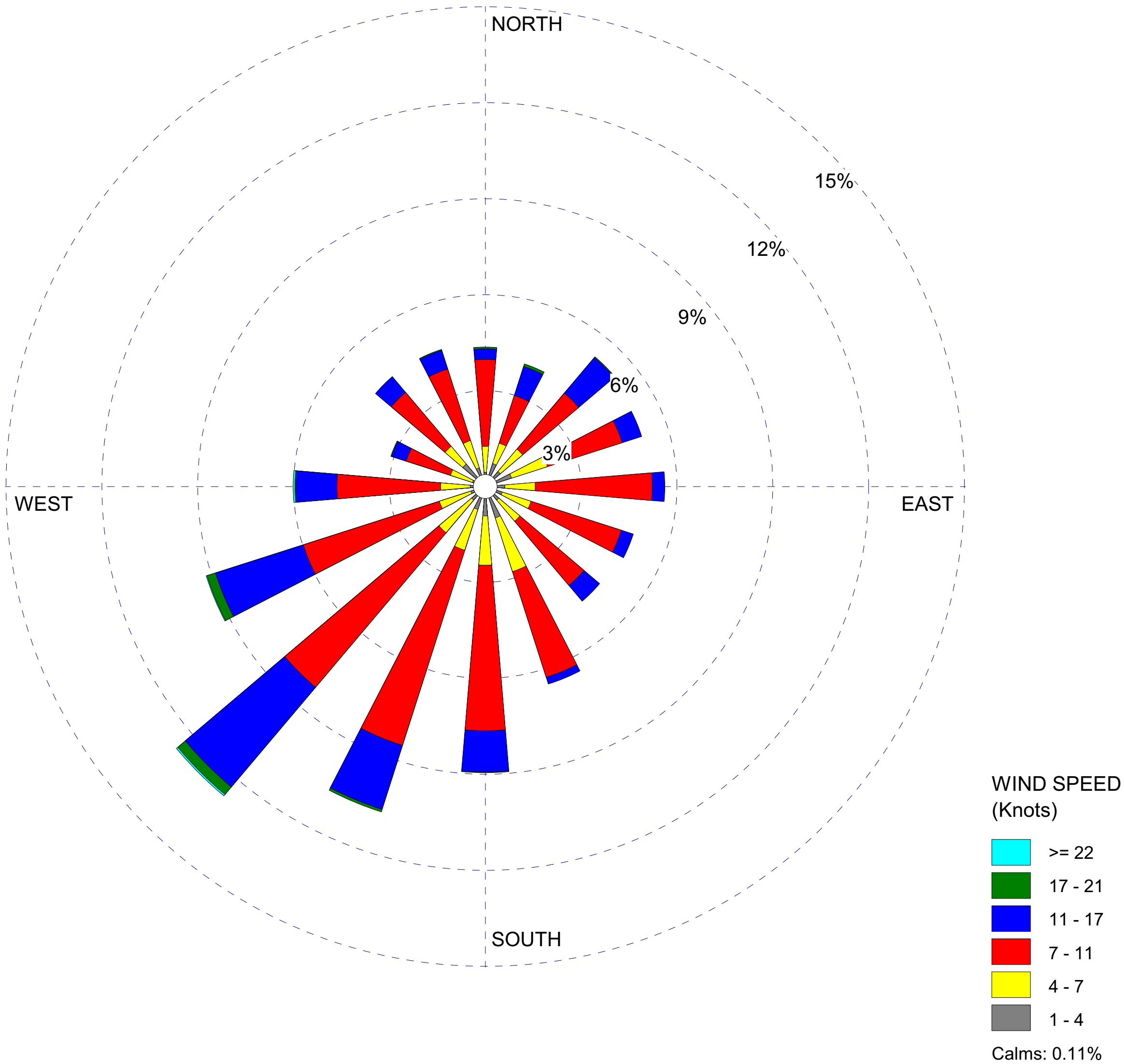

Figure 2.7-13 VEGP 60-m Level May Wind Rose (1998–2002) (Sheet 5 of 12)

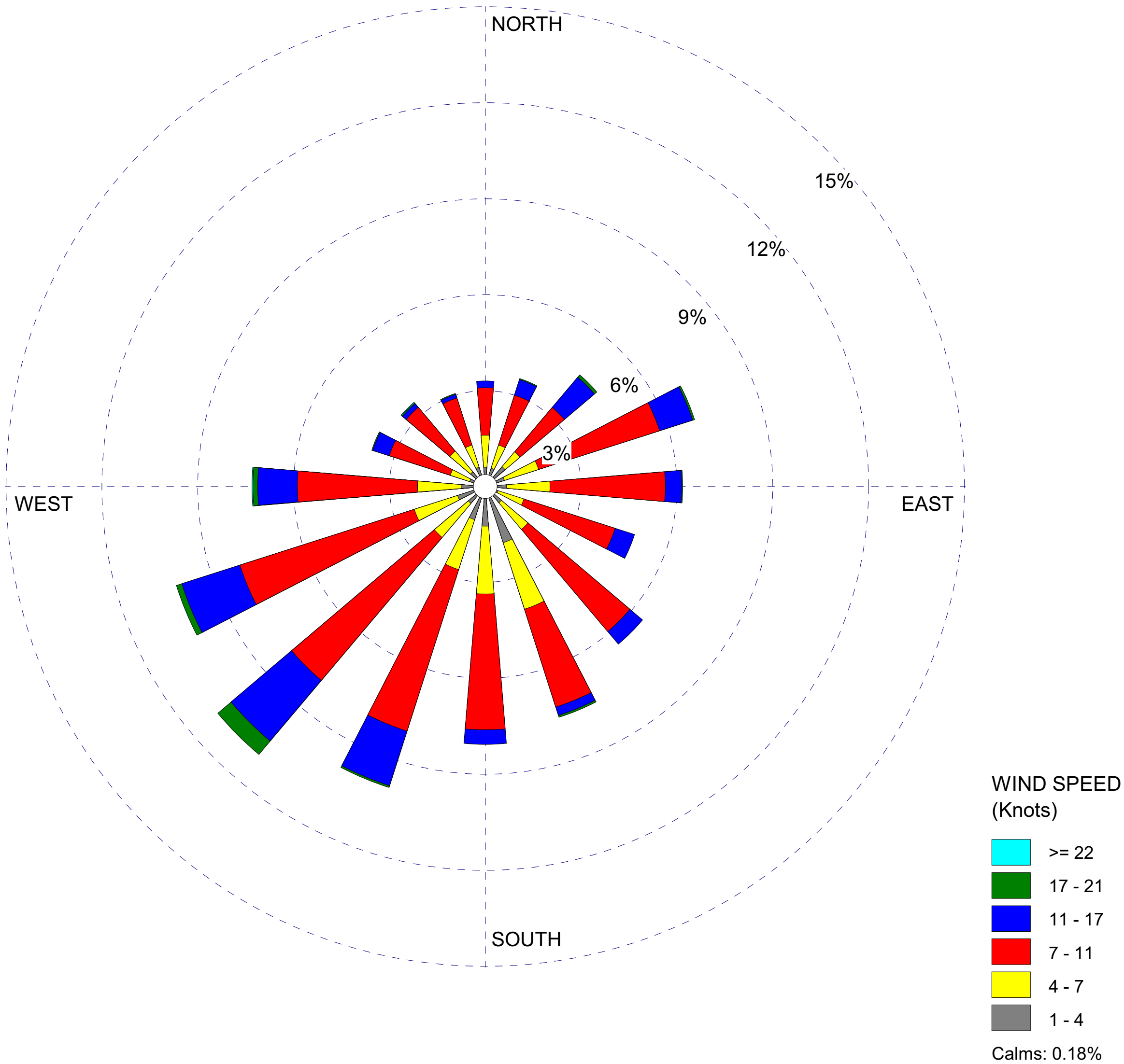

Figure 2.7-13 VEGP 60-m Level June Wind Rose (1998–2002) (Sheet 6 of 12)

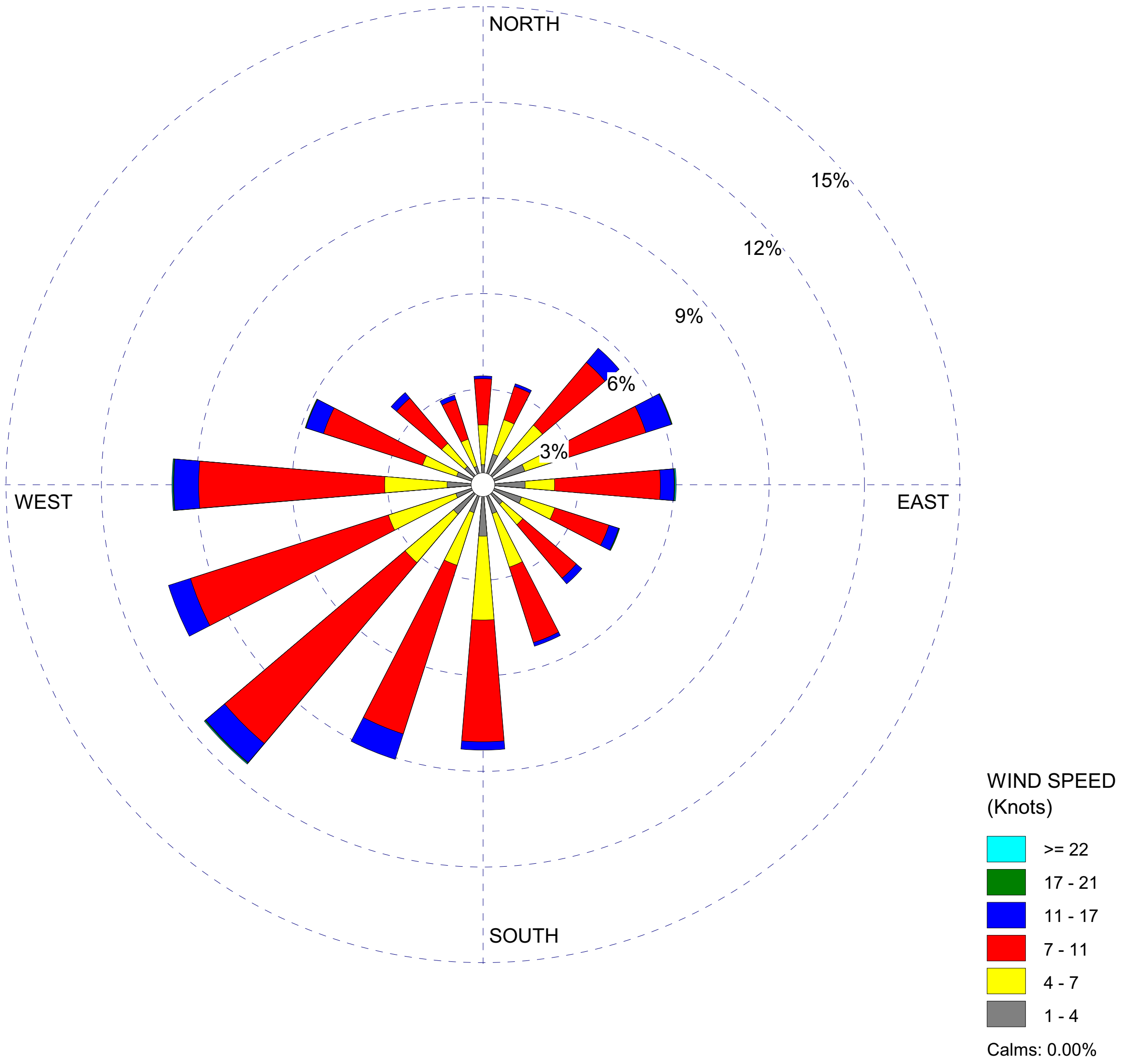

Figure 2.7-13 VEGP 60-m Level July Wind Rose (1998–2002) (Sheet 7 of 12)

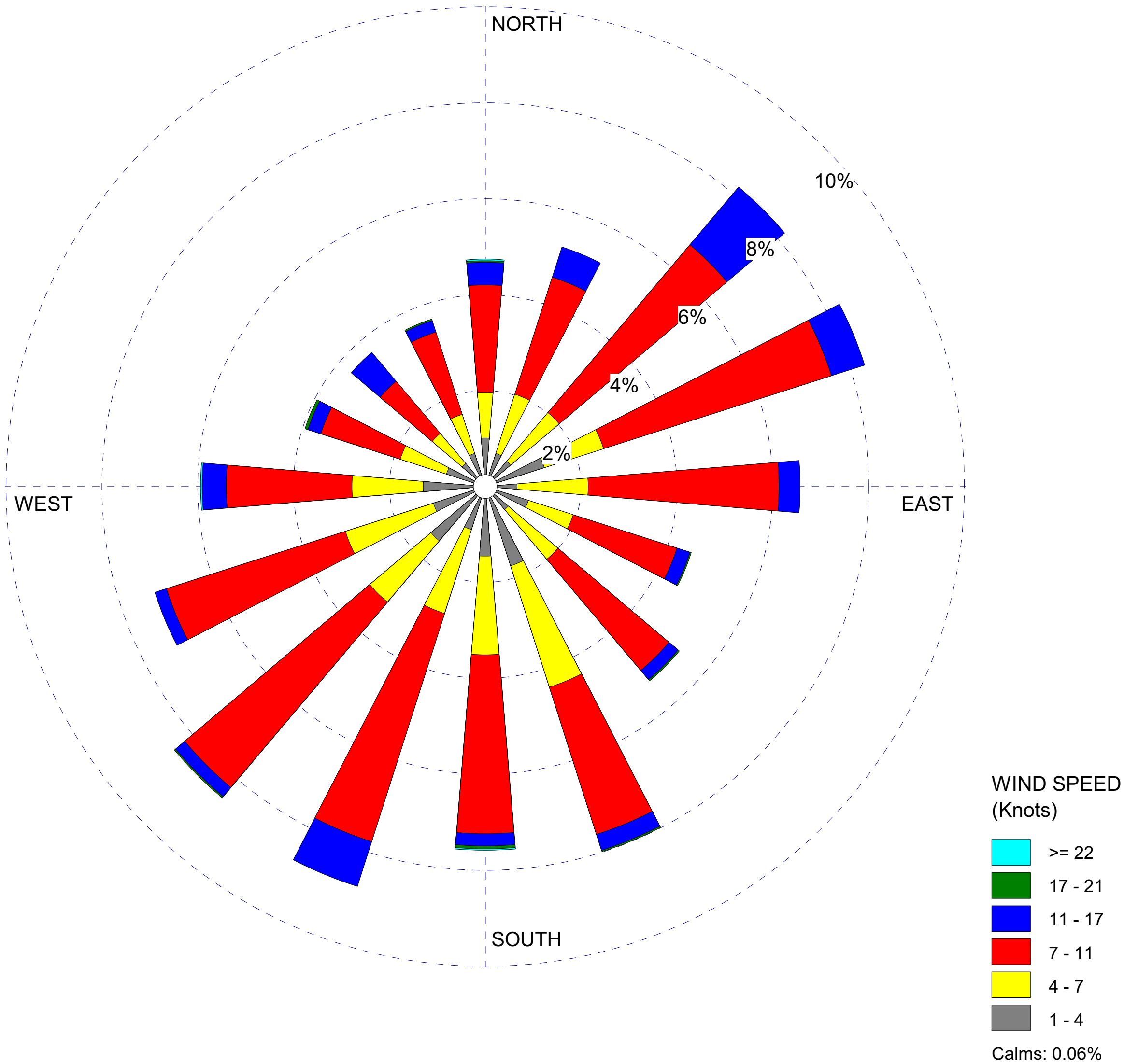

Figure 2.7-13 VEGP 60-m Level August Wind Rose (1998–2002) (Sheet 8 of 12)

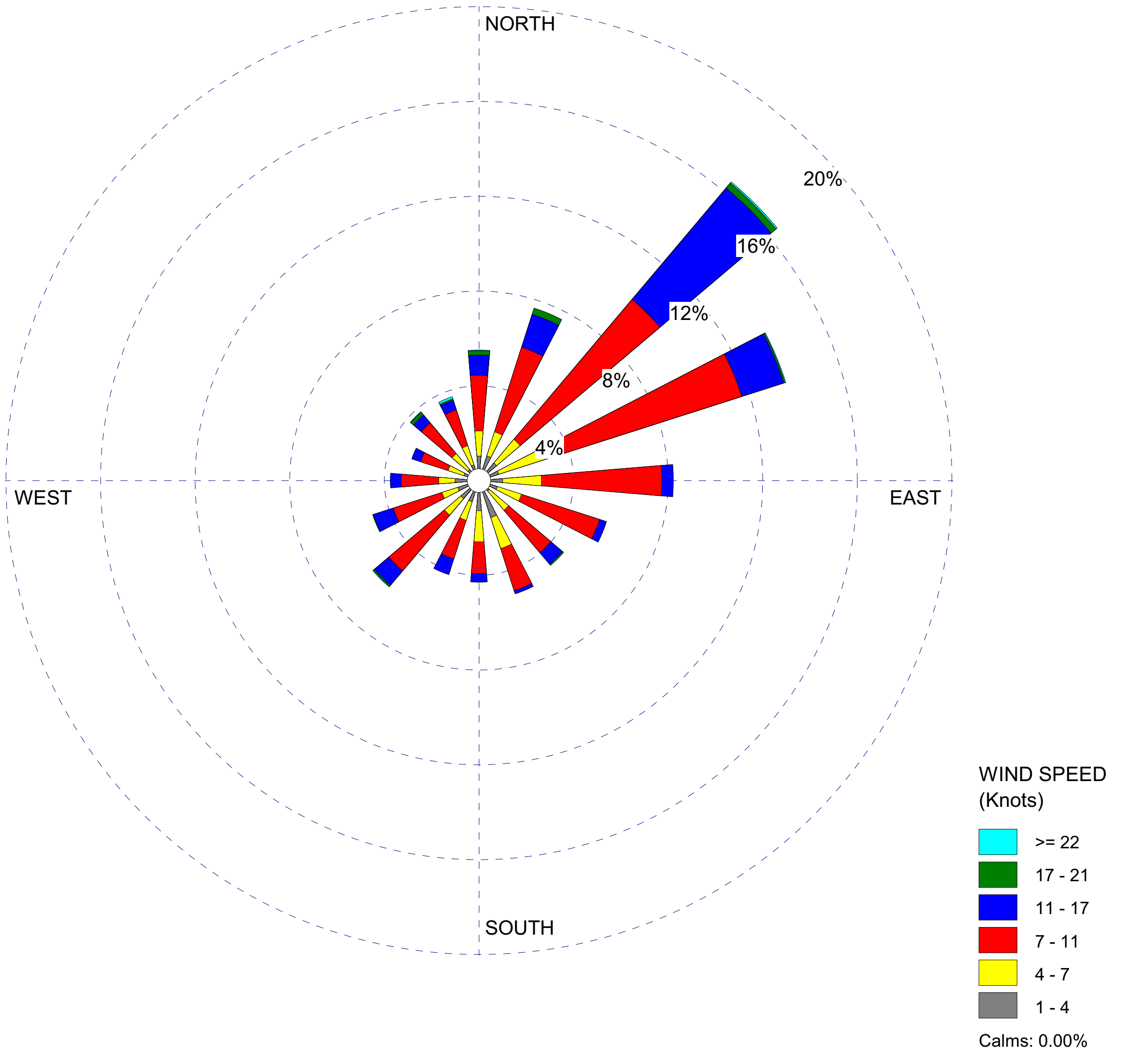

Figure 2.7-13 VEGP 60-m Level September Wind Rose (1998–2002) (Sheet 9 of 12)

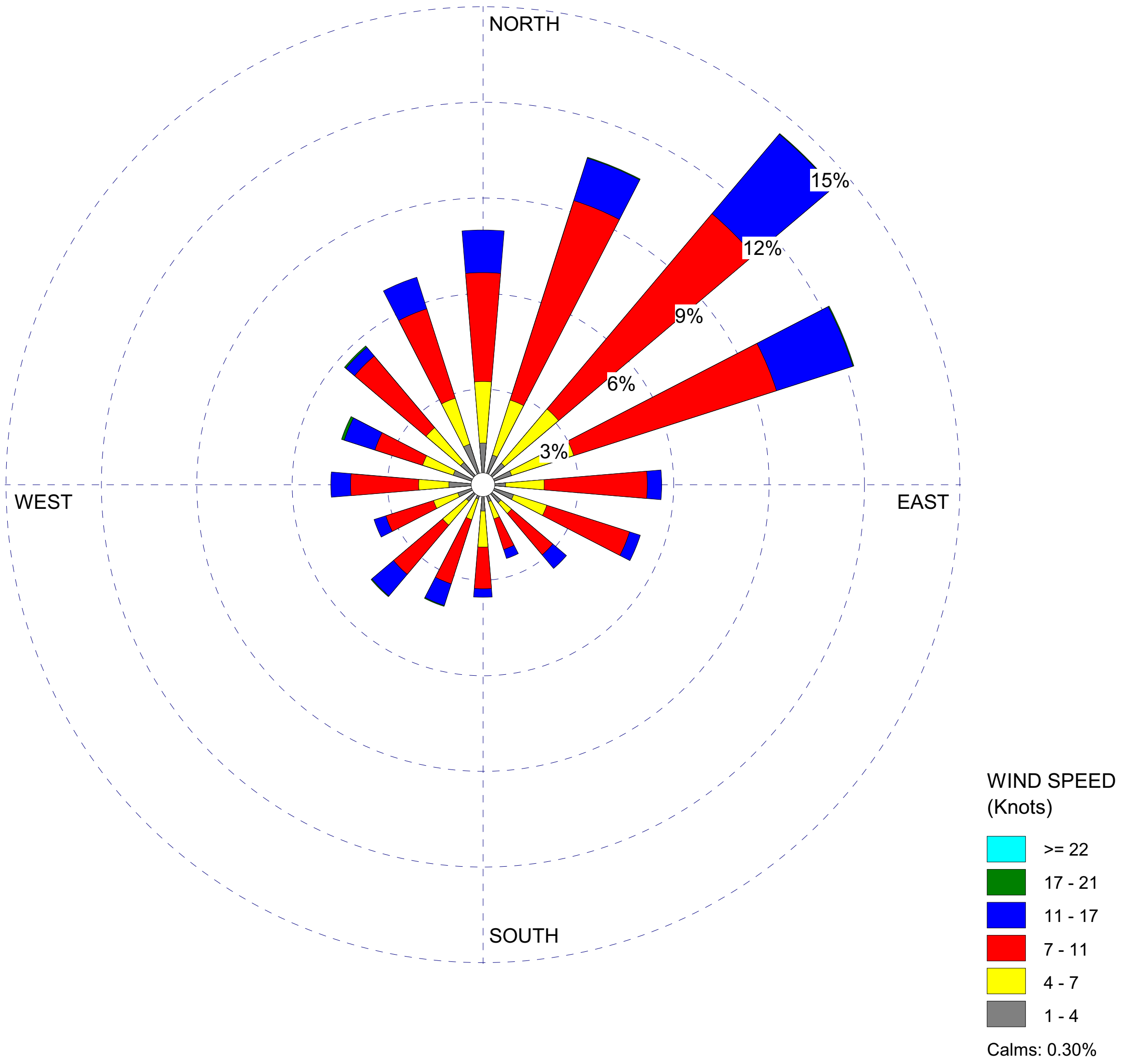

Figure 2.7-13 VEGP 60-m Level October Wind Rose (1998–2002) (Sheet 10 of 12)

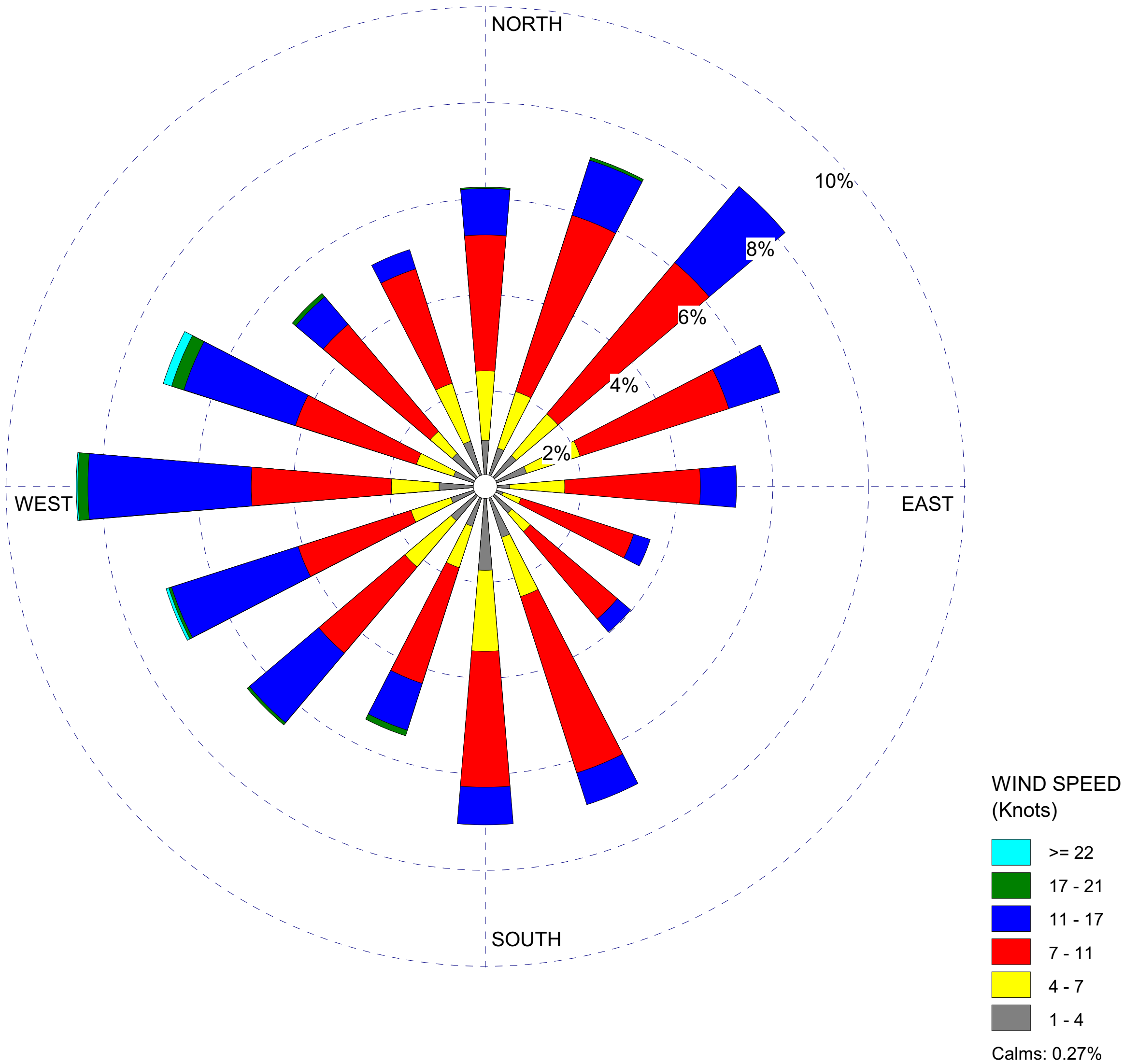

Figure 2.7-13 VEGP 60-m Level November Wind Rose (1998–2002) (Sheet 11 of 12)

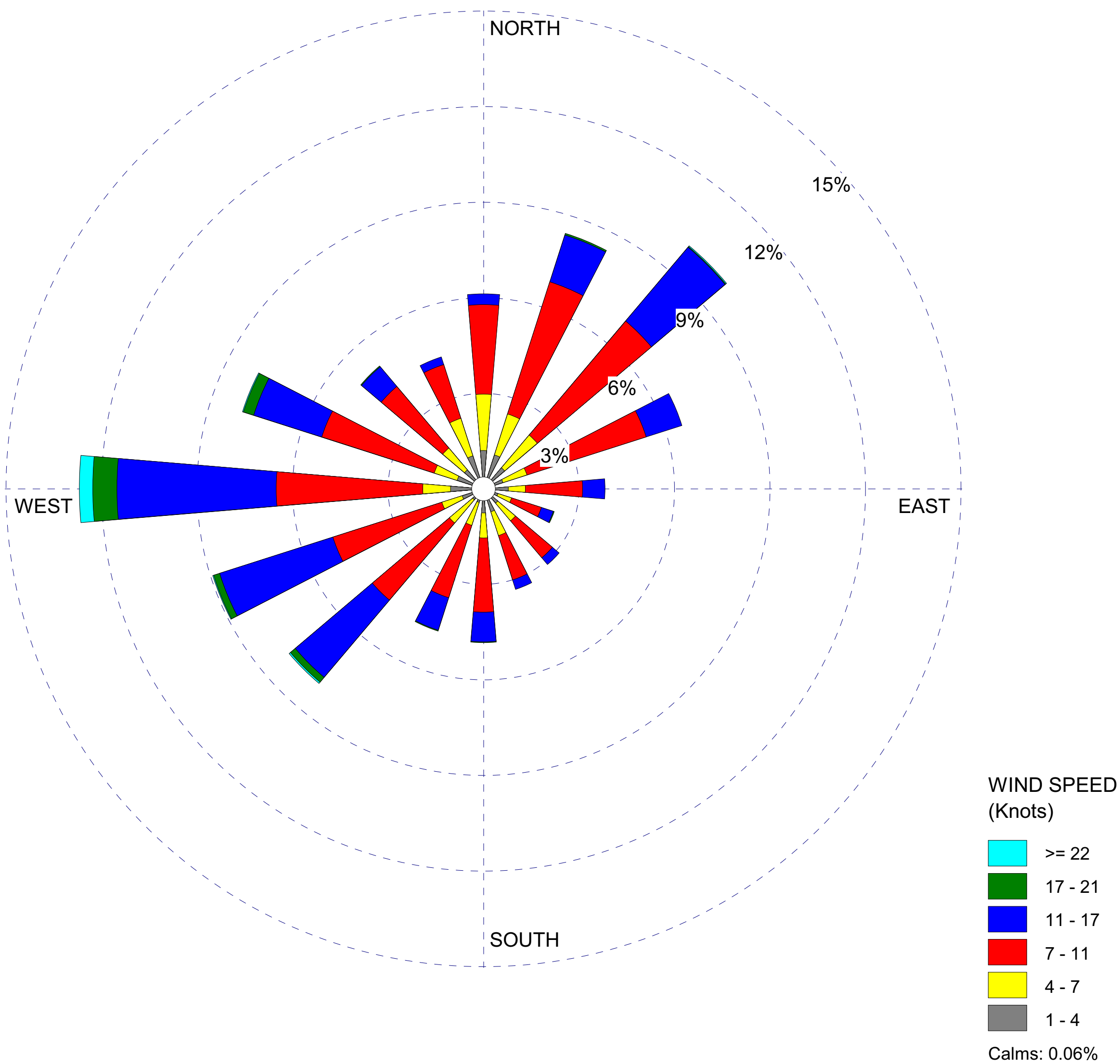

Figure 2.7-13 VEGP 60-m Level December Wind Rose (1998–2002) (Sheet 12 of 12)

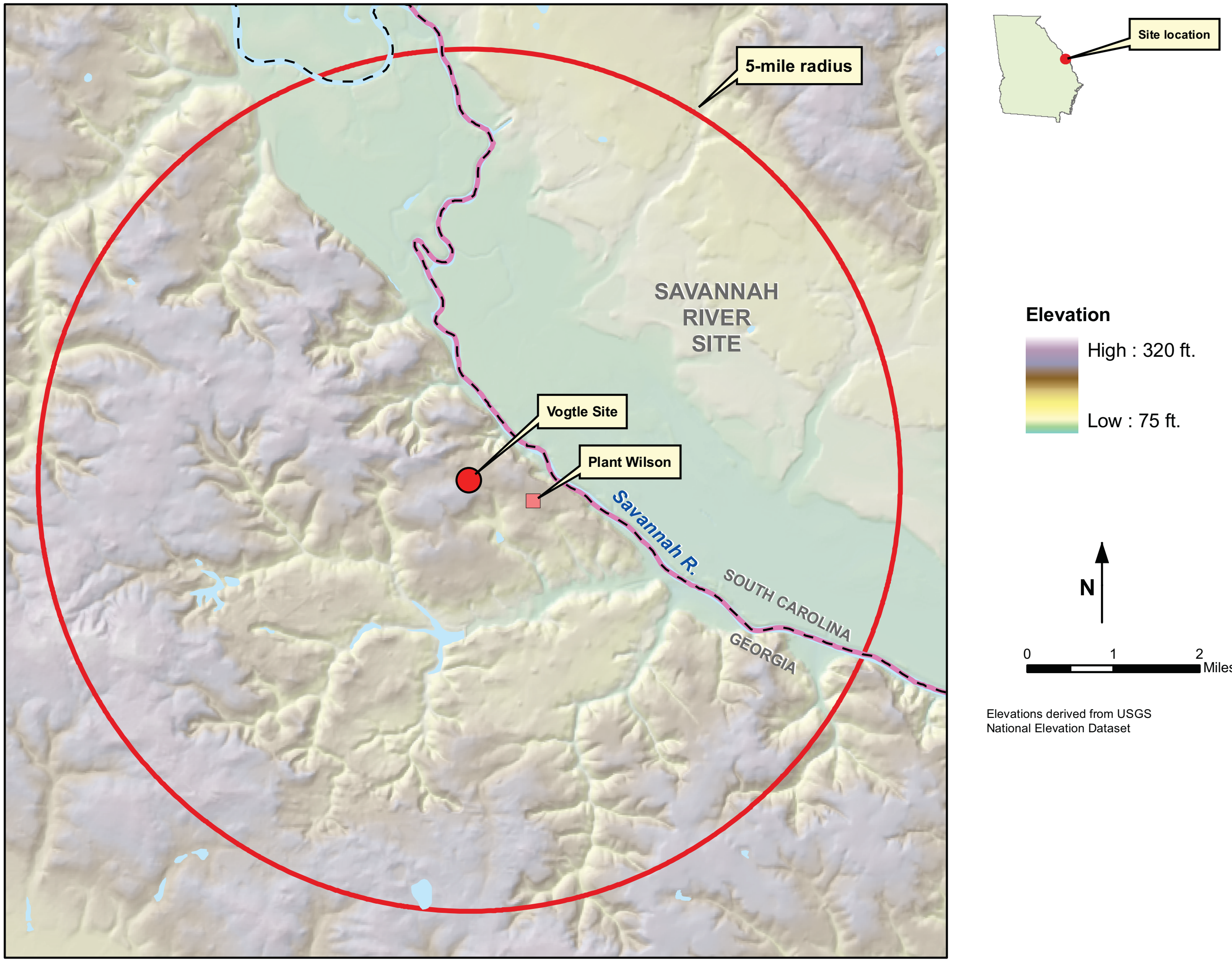

Figure 2.7-14 Topographic Features Within a 5-Mile Radius of the VEGP Site

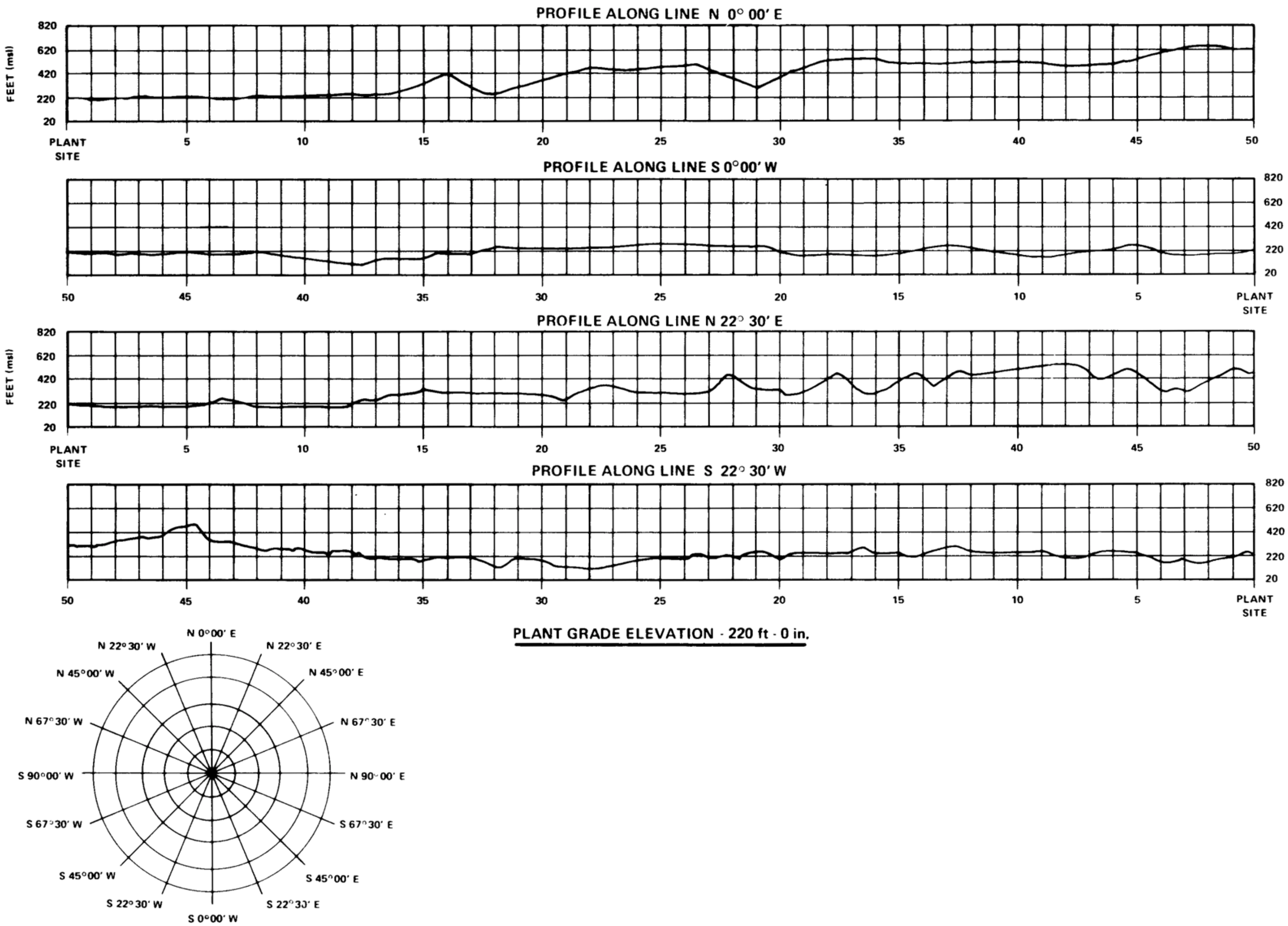

Figure 2.7-15 Terrain Elevation Profiles Within 50 Miles of the VEGP Site (Sheet 1 of 4)

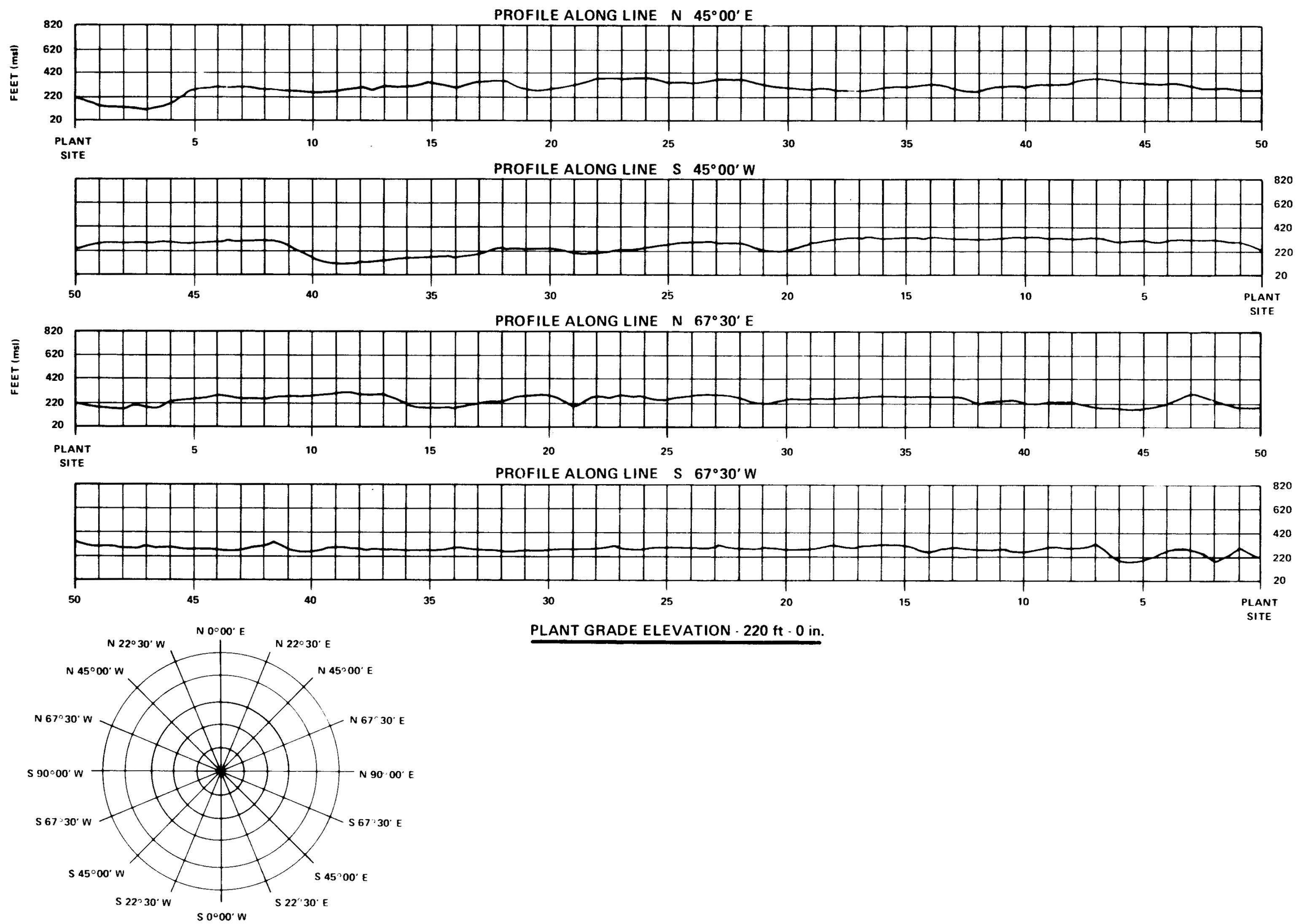

Figure 2.7-15 Terrain Elevation Profiles Within 50 Miles of the VEGP Site (Sheet 2 of 4)

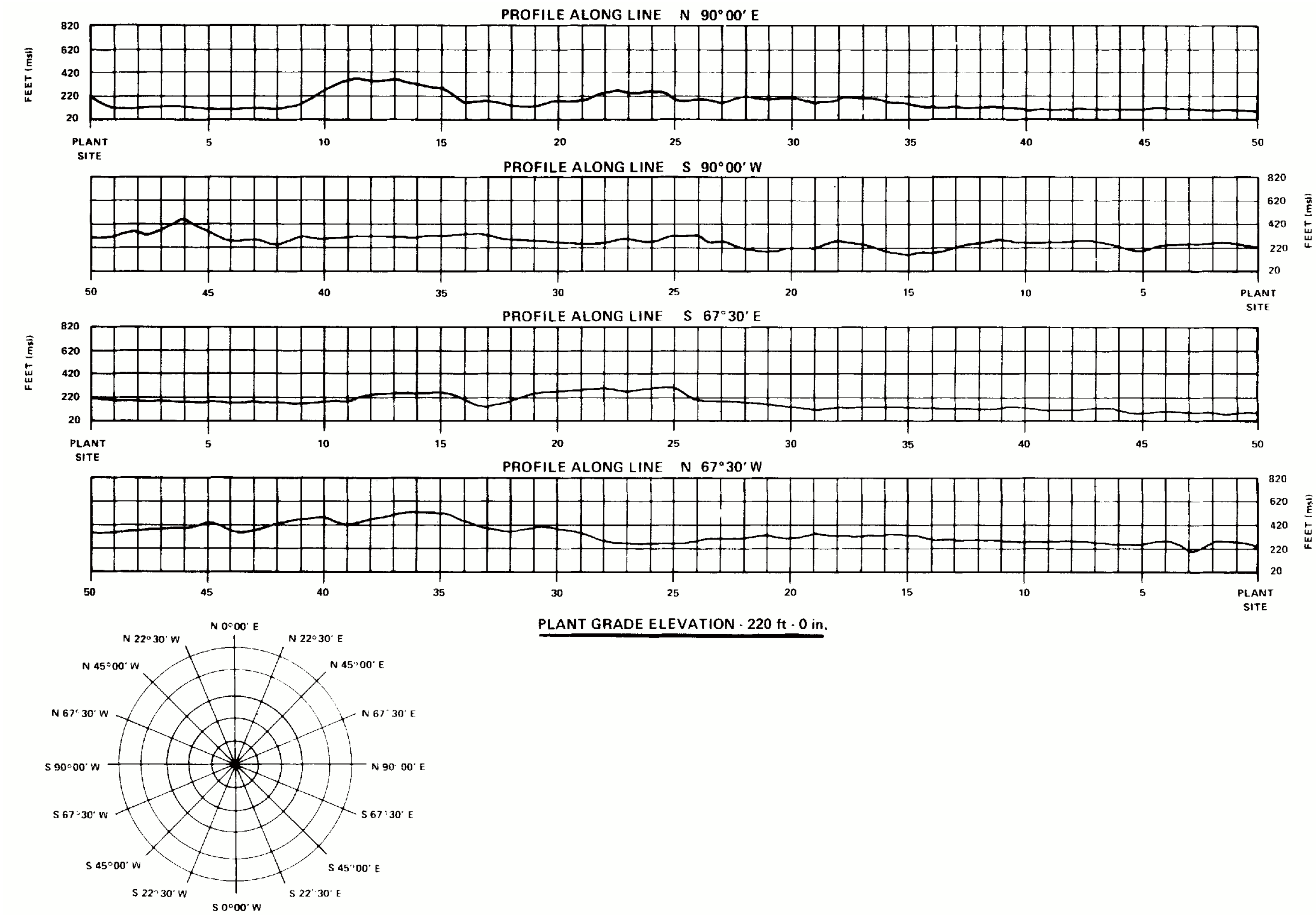

Figure 2.7-15 Terrain Elevation Profiles Within 50 Miles of the VEGP Site (Sheet 3 of 4)

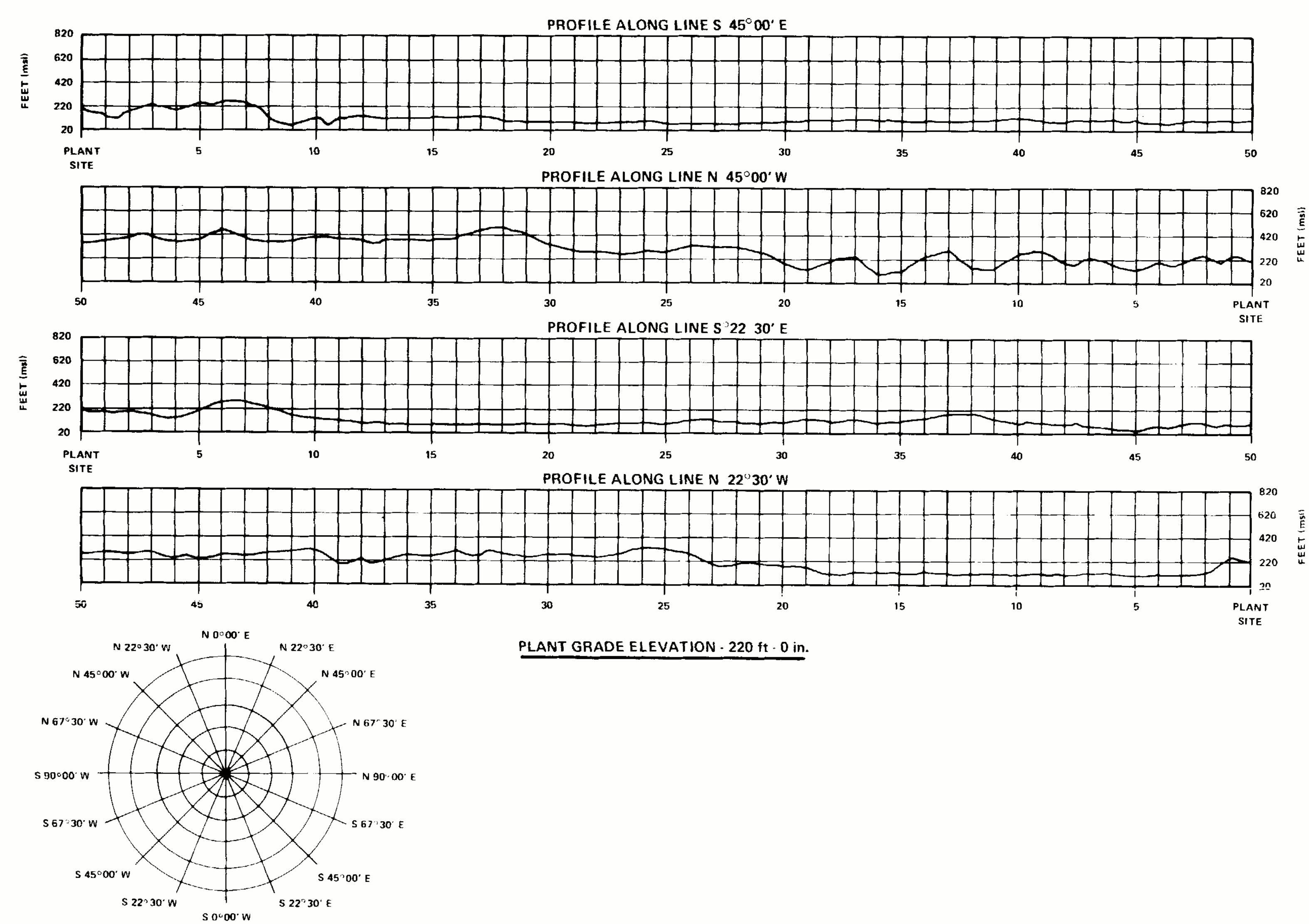

Figure 2.7-15 Terrain Elevation Profiles Within 50 Miles of the VEGP Site (Sheet 4 of 4)

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2.8 Related Federal and Other Project Activities

This section briefly describes Federal and other activities within the region that could have cumulative impacts with the proposed action.

Two existing Westinghouse pressurized water reactors, Units 1 and 2, are located on the VEGP site. Unit 1 began operation in 1987 and Unit 2 began operation in 1989. Each unit currently produces 1232 MWe of power. The units are cooled by natural draft cooling towers and the Savannah River supplies the makeup water. VEGP Units 1 and 2 are currently licensed to operate through 2027 and 2029, respectively. SNC will apply to the NRC to renew the licenses of these facilities. If the renewal is granted, these nuclear reactors will operate through 2047 and 2049.

Adjacent to the VEGP site and inside the exclusion area boundary, Georgia Power Company maintains a small oil-fired peaking facility, known as Plant Wilson, which is operated by SNC employees.

Two fossil-fueled plants are located near VEGP. The first, the SRS D-Area Powerhouse, is directly across the Savannah River and within 6 miles of VEGP. It burns 42 tons of pulverized coal per hour at full load and can produce a maximum of 45 MW of electricity in its four units (its main purpose is to provide steam to SRS facilities). **(SCE&G 2006)**

Urquhart Station is a 250 MW plant located on the Savannah River, 4 miles below Augusta, GA, owned by South Carolina Electric & Gas. The plant has three units and burns 99 tons of pulverized coal per hour at full load. Urquhart can burn natural gas as an alternate fuel.

The Army Signal Corps is stationed at Fort Gordon in Richmond County, Georgia. The Fort has a population of approximately 19,000. The individuals in the population change, but the population remains fairly constant. At this time there are no plans to expand the installation or reduce its size.

The U.S. Department of Energy's SRS is directly across the Savannah River from VEGP site. The SRS has released radioactive and hazardous contaminants into groundwater and surface water, including the Savannah River. SRS is remediating past releases, disposing of low-level radioactive waste in a designated disposal facility and preparing high level radioactive waste and spent [non-commercial] nuclear fuel for ultimate disposal in a geologic repository. SRS has a tritium processing facility, and releases tritium into the atmosphere and on-site streams which drain into the Savannah River. SRS continues to reduce its workforce as missions are completed. Additional information on the SRS is available at its web site, www.srs.gov.

Besides the SRS and VEGP, two other sources of radiation, hospitals and a state owned commercial facility, are within the 50-mile radius of VEGP. The hospitals include Medical College of Georgia and its teaching hospital, a VA hospital, an Army hospital at Fort Gordon, and several large private hospitals located in Augusta. All of these hospitals use medical isotopes that are discharged into the municipal water treatment system, and ultimately, the Savannah River.

Chem-Nuclear operates a commercial radioactive waste disposal facility in Barnwell County, SC, adjacent to the eastern side of the SRS. The Barnwell facility is the only state-owned facility currently available to most of the nation for disposal of commercially-generated low-level radioactive waste. After June 30, 2008, the site will accept waste only from facilities located in South Carolina, Connecticut or New Jersey. In accordance with Federal guidelines (10 CFR 61.59) and State law (13-7-30 S.C.C.), the State of South Carolina accepts and assumes responsibility for ongoing monitoring, maintenance and custodial care of the site after it is closed **(South Carolina Energy Office, no date).**

The USACE is responsible for the water quantity in the Savannah River. The Corps is conducting a basin-wide water resources management study focusing on water-quantity related issues. It is investigating current operational plans for the three Federal reservoirs on the river to determine if changes or reallocations are warranted to meet current and future needs for, among other things, flood control, water supply, and water quality. Much of the impetus for the study is the realization that consumptive water use demands will increase in the future. The Corps also maintains the New Savannah Bluff Lock and Dam located between VEGP and Augusta. The lock and dam was constructed in 1937 to serve commercial navigation, which ceased in 1979. The lock and dam are necessary to maintain a constant pool elevation, which serves Augusta and North Augusta municipal and industrial water supply intakes and boat races and regattas, even during periods of low flow. **(USACE 2004)**

Approximately 80 percent of the water withdrawn from the Savannah River is returned **(USACE no date)**, however there are several significant consumptive users on the river. In addition to the existing units at VEGP, major consumptive users include the Augusta and North Augusta water systems, the Beaufort-Jasper Water Authority and the Savannah City water supply.

Section 2.8 References

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2.9 Existing Plant Site Characteristics, Design Parameters, and Site Interface Values

Impacts of the proposed reactors are cumulative with the impacts of the existing Units 1 and 2. Therefore, parameters describing the existing plant comprise a baseline of impacts against which parameters for the new reactors can be analyzed. Accordingly, Table 2.9-1 presents existing plant parameters that are important for assessing the environmental impacts of constructing and operating proposed new nuclear power plants at the VEGP site. The table is organized into the resource or impact topics discussed in Chapters 2, 4, and 5, as appropriate: land use, water, socioeconomics, radiological impacts, and nonradiological impacts. The ecology resource area is not listed, because plant parameters that affect this resource are identified under other topics.

The existing plant parameters are used variously in analyses in Chapters 4, 5, and 10.5, Cumulative Impacts.

Table 2.9-1 Plant Parameters for VEGP Units 1 and 2

Parameter	Quantity and Units	Explanation
Land Use		
Developed acreage	3,169 acres; Plant facilities occupy 717 acres with remaining 2,452 acres landscaped, fertilized, and reseeded after completion of construction. 1,778 acres not involved in construction.	Source: OLSER 2.1.3; 5.7; See also OLSER pg 5.7.3 for detailed breakdown of land use
Exclusion Area Boundary	~1 mile radius (Owner Controlled Area)	Source: SNC Emergency Plan
Low Population Zone Boundary	2 miles radius	Source: FSAR
Water		
River water consumptive use	30,000 gallons per minute	Source: FES p. 4-14 (OLSER 3.3.3) Average 2 units
Groundwater withdrawal	730 gallons per minute average 2,300 gallons per minute maximum	Source: Groundwater Use Reports Average/Maximum, 2 units
Blowdown flow rate	5,000 gallons per minute/unit	Source: OLSER 3.3.1 Expected value at 4 cycles of concentration
Blowdown temperature	89 degrees Fahrenheit	Source: OLSER Table 3.4.1 Design water outlet temperature (prior to mixing)
Cycles of concentration	2 to 6	Source: FES p. 4-45; OSLER Table 3.4-2
Evaporation/drift rate	30,000 gallons per minute	Source: Maximum expected, 2 units, FES p. 4-45
Socioeconomics		
Permanent plant workforce[1]	888	
Outage workforce	2000 – 937	
	2001 – 674	
	2002 – 479 Spring/575 Fall * 2003 – 665	

Table 2.9-1 (cont.) Plant Parameters for VEGP Units 1 and 2

Parameter	Quantity and Units	Explanation
	2004 – 755 2005 – 738 Spring/600 Fall** Average = 817 (2000-2004) 897.2 (2000-2005)** * two outage year ** fall outage workforce is estimated	Source: 5-year average (2000-2004), 2 units
Population within 10 miles	3,560 people	Source: 2000 Census as calculated by SECPOP 2000
Population within 50 miles	674,101	Source: 2000 Census as calculated by SECPOP 2000
Radiological Impacts		
Airborne emissions (curies/yr)	Fission/Activation Products 22.52	
	Radioiodines – 0.00451 Particulates – 1.07E-05 Tritium - 115	Source: Vogtle Annual Effluent Reports Five-year average (curies/year), 2 units (2000-2004)
Airborne pathway collective dose	Unit 1 – 5.42E0-5 mrem Unit 2 – 1.95E-04 mrem	Source: Vogtle Effluent Reports Five-year average (mrem), 2 units (2000-2004)
Liquid discharges (curies/yr)	Fission/Activation Products 0.142 Tritium – 1414 Dissolved/Entrained Gases 0.00172 Gross Alpha – 2.98E-05	Source: Vogtle Effluent Report Five-year average (curies/year), 2 units (2000-2004)
Liquid pathway collective dose	Unit 1 – 0.0451 mrem Unit 2 – 0.0195 mrem	Source: Vogtle Effluent Report Five-year average (mrem), 2 units (2000–2004)

Table 2.9-1 (cont.) Plant Parameters for VEGP Units 1 and 2

Parameter	Quantity and Units	Explanation
Solid radiological waste volume	49 m^3/yr (average)	Source: Vogtle Effluent Report Five-year average (m^3), 2 units (2000-2004)
Solid radiological waste radioactivity	583 curies/yr (average)	Source: Vogtle Annual Effluent Report Five-year average (curies/ year), 2 units (2000-2004)
Worker collective dose	Year Dose 2000 – 121.312 rem 2001 – 129.270 rem 2002 – 243.957 rem (two outage year) 2003 – 84.344 rem 2004 – 80.763 rem Average 131.929 rem/year	Source: Vogtle Annual Effluent Report Five-year average (rem/year), 2 units (2000-2004)
Nonradiological Impacts		
Air emissions	VEGP Units 1 and 2 Tons per year of criteria pollutants NOx = 26 tons/year Sox = 4.1 tons/year Ozone = N/A PM_{10} = 0.46 tons/year $PM_{2.5}$ = 0.57 tons/year CO = 6.9 tons/year	Source: Vogtle/Wilson Title V permit documentation
	Plant Wilson Tons per year of criteria pollutants NOx =163 tons/year Sox = 93 tons/year Ozone = N/A PM_{10} = N/A $PM_{2.5}$ = 2.2 tons/year CO = 0.92 tons/year	Five-year average for diesel generators and combustion turbines and Black Start diesel at Plant Wilson. Vogtle no longer has an auxiliary boiler. The original auxiliary boiler was taken out of service and subsequently removed from the site many years ago.
Noise	Ambient 22 - 44 dBa; Operating plant conditions 25 - 40 dBa measured at 7 points along Vogtle property line.	Source: OLSER 5.6.1

Table 2.9-1 (cont.) Plant Parameters for VEGP Units 1 and 2

Parameter	Quantity and Units	Explanation
Building height	Containment dome: 180 feet above grade Cooling towers: 550 feet above grade	Source: OLSER 3.1.2; 3.1.4
Other		
Megawatts thermal	3565 MWt per unit	Source: FSAR
Gross megawatts electrical	1232 MWe per unit	Source: FSAR

[1] Includes SNC/GPC and long-term contractors
mrem = millirem (1/1000 rem.)
NOx – oxides of nitrogen
Sox – sulphur dioxide
PM_{10} – Particulate matter <10 microns in diameter
$PM_{2.5}$ – Particulate matter <2.5 microns in diameter
CO – carbon monoxide
FSAR – Final Safety Analysis Report, VEGP Units 1 and 2
OLSER – Operating License Safety Evaluation Report, VEGP Units 1 and 2
FES – Final Environmental Statement, VEGP Units 1 and 2

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