PSEG Site
ESP Application
Part 3, Environmental Report

CHAPTER 3

PLANT DESCRIPTION

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ABWR	Advanced Boiling Water Reactor
ac.	acre
ALARA	as low as reasonably achievable
AP1000	Advanced Passive 1000
BOD_5	five-day biochemical oxygen demand
BOP	balance of plant
Btu/hr	British thermal units per hour
BWR	boiling water reactor
CDF	confined disposal facility
CFR	Code of Federal Regulations
Ci	curie
Ci/yr	curies per year
COL	combined license
CWS	circulating water system
dBA	A-weighted decibels
DOE	U.S. Department of Energy
DOT	Department of Transportation
DWDS	demineralized water distribution system
EAB	Exclusion Area Boundary
ESF	engineered safety feature
ESPA	early site permit application
fpm	feet per minute
fps	feet per second
FPS	fire protection system
ft.	feet
ft^3	cubic feet
ft^3/yr	cubic feet per year

ACRONYMS AND ABBREVIATIONS (CONTINUED)

Acronym	Definition
gpd	gallons per day
gpm	gallons per minute
HCGS	Hope Creek Generating Station
hr.	hour
km	kilometer
kV	kilovolt
lbm/hr	pound mass per hour
m	meter
m^3	cubic meter
MBq	megabecquerel
mi.	mile
MW	megawatt
MWd/MTU	megawattdays per metric ton of uranium
MTU	metric ton of uranium
MWe	megawatts electric
MWt	megawatts thermal
NAVD	North American Vertical Datum (1988)
NJPDES	New Jersey Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
PJM	PJM Interconnection, LLC
PPE	plant parameter envelope
PSWS	potable and sanitary water system
PWR	pressurized water reactor
RTO	regional transmission organization
RTP	rated thermal power
SGS	Salem Generating Station
SSAR	Site Safety Analysis Report

ACRONYMS AND ABBREVIATIONS (CONTINUED)

Acronym	Definition
SWS	service water system
U-235	uranium-235
UHS	ultimate heat sink
USACE	U.S. Army Corps of Engineers
US-APWR	U.S. Advanced Pressurized Water Reactor
U.S. EPR	U.S. Evolutionary Power Reactor
yr	year

CHAPTER 3

PLANT DESCRIPTION

3.0 INTRODUCTION

This chapter describes the new plant design based on the plant parameter envelope (PPE) and provides general information about the new plant on the PSEG Site, which includes the existing Salem Generating Station (SGS) and Hope Creek Generating Station (HCGS).

The existing 734 acre (ac.) PSEG property is located on the southern part of Artificial Island on the east bank of the Delaware River in Lower Alloways Creek Township, Salem County New Jersey. PSEG is developing an agreement in principle with the U.S. Army Corps of Engineers (USACE) to acquire an additional 85 ac. immediately to the north of Hope Creek Generating Station (HCGS). Therefore, with the land acquisition, the site is 819 ac. The specific timing of land acquisition is not currently known and is subject to further PSEG and USACE actions. However the agreement in principle with the USACE serves to establish the basis for eventual land acquisition and Exclusion Area Boundary (EAB) control, necessary to support the issuance of a future combined license.

Subsequent to the agreement in principle with the USACE, PSEG will develop a lease agreement for the USACE confined disposal facility (CDF) land to the north of the PSEG Site, depicted on the Site Utilization Plan for the concrete batch plant and temporary construction/laydown use. At the completion of construction, the leased land will be returned to the USACE, subject to any required long-term EAB control conditions.

The specific reactor type has not been selected; however, bounding information from the PPE as presented in this chapter is used as a basis for the evaluation of environmental effects. The reactor types considered are the Advanced Boiling Water Reactor (ABWR), Advanced Passive 1000 (AP1000), U.S. Evolutionary Power Reactor (U.S. EPR), and U.S. Advanced Pressurized Water Reactor (US-APWR). A description of the PPE development and intended use is provided in Site Safety Analysis Report (SSAR) Section 1.3. NUREG-1555, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan*, identifies specific items that should be discussed in Chapter 3. However, the new plant designs have not been developed to the point where this information can be provided in the ESPA in all cases.

This chapter presents detailed information about the new plant in the following sections:

- External Appearance and Plant Layout (Section 3.1)
- Reactor Power Conversion System (Section 3.2)
- Plant Water Use (Section 3.3)
- Cooling System (Section 3.4)
- Radioactive Waste Management System (Section 3.5)
- Nonradioactive Waste Management System (Section 3.6)
- Power Transmission System (Section 3.7)
- Transportation of Radioactive Materials (Section 3.8)

3.1 EXTERNAL APPEARANCE AND PLANT LAYOUT

This section provides a general discussion of the plant layout and appearance. Subsection 3.1.1 describes the existing site, and Subsection 3.1.2 discusses the proposed site. Bounding parameters from the PPE and site-specific characteristics within the SSAR are used to establish conceptual site descriptions.

3.1.1 EXISTING SITE

The existing site is located on the southern part of Artificial Island on the east bank of the Delaware River in Lower Alloways Creek Township, Salem County, NJ. The site is 15 miles (mi.) south of the Delaware Memorial Bridge, 18 mi. south of Wilmington, DE, 30 mi. southwest of Philadelphia, Pennsylvania, and 7-1/2 mi. southwest of Salem, NJ. Artificial Island was created, beginning early in the twentieth century, when the USACE began disposing of hydraulic dredge spoils within a progressively enlarged diked area established around a natural bar that projected into the river. The PSEG Site is generally developed. Surrounding habitats can best be characterized as tidal marsh and grassland. The population density of the area surrounding the site is low, and land use is primarily agricultural. The existing site consists of SGS and HCGS. Figure 3.1-1 provides an aerial photograph of the existing site.

SGS consists of two pressurized water reactors (PWR) each with a rated power level of 3459 megawatts thermal (MWt) generating capacity. Unit 1 began producing electricity in 1976. Unit 2 began producing electricity in 1980.

HCGS is located just north of SGS. HCGS is a single 3840 MWt boiling water reactor (BWR) nuclear plant. The plant was originally designed as a two-unit plant, but during the construction phase the project was scaled back to one unit. HCGS began operation in 1986.

The combined SGS and HCGS site occupies 734 ac. The minimum distance from the SGS reactor containment buildings to the nearest exclusion area boundary formed by land is 1270 meters (m) (4166 feet [ft.]). The minimum distance from the HCGS accident release point to the nearest exclusion area boundary formed by land is 900 m (2953 ft.).

Both SGS units have steel-lined concrete containment vessels consisting of a reinforced concrete cylindrical wall, a hemispherical dome, and a reinforced concrete base. Supporting structures include a common auxiliary building, service building, turbine generator building, administration building, circulating and service water intake structures, station switchyard, and separate fuel handling buildings for each unit.

The HCGS primary containment is a steel shell enclosed in reinforced concrete, and interconnected to a torus type steel suppression chamber. Supporting structures for HCGS include an auxiliary building, turbine building, administration building and warehouse, service water intake structure, switchyard, and natural draft cooling tower.

3.1.2 PROPOSED SITE

Building structures and site arrangement will be designed and constructed in a manner that is both functional and aesthetically consistent, to the degree practical, with the existing site architecture.

The new plant location is north of the existing HCGS plant. The new plant requires 225 ac. of permanent land impact as delineated in Figure 3.1-2 and the PPE in Section 1.3 of the SSAR. As discussed in Section 3.0, PSEG is developing an agreement with the USACE to acquire an additional 85 ac. immediately to the north of the current PSEG property line. Therefore, with the land acquisition, the site will be 819 ac.

The new plant location and layout on the PSEG Site is shown on the Site Utilization Plan in Figure 3.1-2. The EAB minimum distance of 600 m (1968.5 ft.), is measured from the perimeter of the power block envelope. The new plant site center and the EAB, are shown on the Site Utilization Plan. An architectural rendering will be provided during the combined license (COL) application phase following the selection of a reactor technology.

The Site Utilization Plan is prepared by first establishing site layouts for each of the four reactor technology configurations considered for the PSEG Site. The primary power generation areas (power block area, switchyard, cooling tower area, etc.) are located in the same general area on the PSEG Site for each layout considered. Once the layouts are established, the bounding footprint for each specific area (e.g., power block area) is developed by determining the maximum east/west and north/south dimensions. For example, to define the power block area, the east/west dimension of the U.S. EPR and north/south dimension of the dual unit AP1000 are used to establish the power block rectangle area. This approach provides a bounding and conservative estimate of overall land usage on the PSEG Site.

Permanent land impact is indicated on the Site Utilization Plan as a cross-hatched area. The land used during construction is indicated as diagonal hatching. The specific areas used for permanent and construction support features are not defined until after a reactor technology is selected, but will be within the overall established Site Utilization Plan boundary.

The possible designs are conventional-style plants, based on single-unit or dual-unit construction, with individual turbine and reactor buildings for each unit. The AP1000 is a dual-unit plant while the ABWR, U.S. EPR, and US-APWR are single-unit plants.

The power block structure height varies depending upon the reactor design chosen. The bounding structure height (excluding any cooling towers) from finished grade to the top of the tallest power block structure is 234 ft. (SSAR Table 1.3-1, Item 1.1.1). In general, buildings are constructed with concrete, metal with metal siding, or wood with metal, vinyl, or other aesthetically acceptable siding.

The new plant circulating water system (CWS) includes one or two natural draft, mechanical draft or fan-assisted natural draft wet cooling towers. The new plant also includes smaller mechanical draft cooling towers for service water system cooling. The Delaware River is used for make-up water for the cooling water systems. The new river intake and discharge structures are described in Section 3.4.

Existing infrastructure will be modified to integrate the new unit(s) with the existing units; however, none of the existing units' structures or facilities that directly support power generation are shared or modified. As described in Section 3.7, depending on the reactor technology selected, up to two new switchyards are required for the new plant, and the existing on-site transmission lines will be modified as required to incorporate the new generation capacity into the electric grid. One new off-site transmission line may be required depending on future studies and transmission improvement projects by the Regional Transmission Organization – PJM Interconnection, LLC (PJM). The existing security perimeter will be expanded to include the new plant. The existing sewage treatment facility, training, administrative buildings, warehouses, and other support facilities will be used, expanded, or replaced, to support the new plant, based on economic and operational considerations.

During construction, the laydown area and temporary construction support facilities require 205 ac. (SSAR Table 1.3-1, Item 18.2). After new plant construction is complete, areas used for construction support are restored where appropriate to match the overall site appearance or used for other necessary site or industrial support purposes. These areas include equipment laydown and module fabrication areas, batch plant area, areas around completed structures, and construction parking.

3.2 REACTOR POWER CONVERSION SYSTEM

This section provides a general discussion of the reactor, engineered safety features, and the power conversion system. Reactor-specific design parameters, such as fuel assembly description, core fuel capacity, and condenser total heat transfer area will be provided during the COL application phase following reactor technology selection. Bounding parameters from the PPE and site-specific characteristics within the SSAR are used to establish conceptual reactor descriptions.

3.2.1 REACTOR DESCRIPTION

The four reactor types considered for the new plant are the ABWR, the AP1000, the U.S. EPR, and the US-APWR. The AP1000 plant consists of two units and associated turbines and power conversion equipment, and the ABWR, U.S. EPR, and US-APWR consist of one unit and associated turbine and power conversion equipment. The ABWR is a boiling water reactor (BWR), and the AP1000, U.S. EPR, and US-APWR are pressurized water reactors (PWR). The design life for a new facility is 60 years (SSAR Table 1.3-1, Item 17.4), and the initial licensed operating life is 40 years based on the Atomic Energy Act and current regulations.

The rated thermal power (RTP) of 4590 MWt is the bounding RTP for one unit and 6800 MWt for two units (SSAR Table 1.3-1, Item 19.11). The approximate gross and net electrical output for one unit is 1710 MWe and 1600 MWe, respectively, for the bounding design. The bounding design gross and net electrical output for two units is approximately 2400 MWe and approximately 2200 MWe, respectively.

All proposed reactor designs use uranium as their fissile material. The maximum uranium enrichment is five weight percent of uranium-235 (U-235) for the initial fuel load (SSAR Table 1.3-1, Item 19.7). The maximum average assembly discharge burnup is 54,200 megawattdays per metric ton of uranium (MWd/MTU) (SSAR Table 1.3-1, Item 19.8). The peak fuel rod burnup is 62,000 MWd/MTU (SSAR Table 1.3-1, Item 19.9). As discussed in Subsection 5.7.2, these values are within acceptable NRC limits.

3.2.2 ENGINEERED SAFETY FEATURES

The proposed reactor designs employ active and/or passive types of engineered safety features (ESF) systems. Active systems rely on active components, such as pumps, to move coolant to the needed locations, while passive systems use gravity and thermal convection to achieve equivalent results. Active systems are typically powered by redundant power sources, such as emergency diesel generators or gas turbine generators. Passive systems use gravity to move coolant, and valves are typically actuated by safety-related dc power. The selected design relies on an ultimate heat sink (UHS) to remove heat from safety-related systems and discharge it to the atmosphere.

3.2.3 POWER CONVERSION SYSTEM

The power conversion system for each of the advanced reactor designs under consideration uses a steam turbine to generate power by converting the reactor heat to mechanical energy. The turbines reject exhaust heat to the normal plant cooling water system. The tube material for the condenser or turbine exhaust cooling heat exchangers has not been selected.

3.3 PLANT WATER USE

Water is required to support the new facility during construction and operation, including the CWS, cooling water systems for plant auxiliary components (e.g., the service water system [SWS]), and makeup for the UHS cooling system. The majority of the water is withdrawn from the Delaware River via an intake structure. The bounding CWS flows were determined for site-specific Delaware River water quality and PSEG Site meteorological conditions, and the bounding SWS flows are modified for site-specific river water quality. The fresh water aquifer supplies water for general site purposes including the potable and sanitary water system (PSWS), demineralized water distribution system (DWDS), fire protection system (FPS), and other miscellaneous systems.

Subsection 3.3.1 discusses water consumption and discharge by the various cooling water and consumptive water systems, including the expected monthly average and maximum water makeup and discharge flow. Monthly water consumption and water consumption by plant operating status will be provided during the COL application phase following the reactor technology selection. Water availability during periods of drought is discussed in Chapter 5. Subsection 3.3.2 discusses possible treatment methods for water used in the plant and discharged back to the receiving water body. Bounding parameters from the PPE and site-specific characteristics within the SSAR are used to establish conceptual water consumption and water treatment descriptions.

3.3.1 WATER CONSUMPTION

The average and maximum water consumption and discharge by the various cooling and water systems is given in Table 3.3-1. This includes maximum and average makeup water flow rates, evaporation rates, drift rates, and blowdown rates for the CWS and SWS; and water supply for the PSWS, DWDS, and FPS. Also included is the discharge flow rate for applicable systems, including miscellaneous drains and liquid radwaste. The average values are the expected limiting values for normal plant operation and the maximum values are those expected for upset or abnormal conditions. The makeup water supply source for the CWS and the SWS/UHS is the Delaware River. Depending on the reactor technology, the UHS may not require a safety-related makeup system or an active safety-related makeup system (AP1000). For the PSWS, DWDS, FPS, and other miscellaneous systems, plant makeup flows are from an on-site freshwater aquifer. The blowdown and discharge water flow is discharged to the Delaware River. Figure 3.3-1 provides a water balance diagram. The total intake from the Delaware River is 78,196 gallons per minute (gpm) (average) and 80,600 gpm (maximum). The total intake from the fresh water aquifer is 210 gpm (average) and 953 gpm (maximum).

The CWS and SWS/UHS cooling towers lose water from evaporation, blowdown, and drift. Evaporation, blowdown, and drift estimates for the CWS and SWS/UHS cooling towers are shown in Table 3.3-1. Cooling tower performance curves have not yet been generated, thus a single design point is used to determine CWS parameters. The normal operating design point for the cooling tower is based on a one percent maximum annual non-coincident wet bulb temperature of 76.6°F. No seasonal variability is evaluated in the water consumption values presented. Seasonal variability in wet and dry bulb temperature and relative humidity results in changes to cold water temperature, system flow rates and, ultimately, evaporation rates from the cooling tower. Historically, the natural draft cooling tower that provides heat dissipation for the HCGS CWS produces higher evaporation rates in the summer months than the winter

months. The design point noted above is representative of a one percent exceedance summer condition at the PSEG Site. As such, the normal operating design values presented for water use at the new plant are conservative when considered from an annual use perspective.

The combined plant blowdown consists of CWS blowdown, SWS/UHS blowdown, PSWS blowdown, DWDS blowdown, miscellaneous drains blowdown, liquid radwaste blowdown, and SWS/UHS makeup filter backwash. The combined plant blowdown flows discharge into the Delaware River at a flowrate of 51,946 gpm (average) and 53,222 gpm (maximum).

The CWS functions as the heat sink for normal plant processes and is essential to power generation. It provides a continuous supply of cooling water from the normal plant heat sink to the main condensers to remove the heat rejected by the turbine cycle. The main condenser receives exhaust steam from the turbines and cooled water is pumped from the cooling tower through the main condenser and back to the cooling tower, where heat is rejected to the atmosphere by evaporation. The CWS also accommodates heat loads associated with turbine auxiliary equipment.

For those plant designs that employ an active safety-related SWS and UHS cooling towers (ABWR, US-APWR, U.S. EPR), the SWS provides essential cooling to safety-related equipment and may also cool nonsafety-related auxiliary components used for normal plant operation. It removes heat from plant components by providing cooling water flow during normal operation, during safe shutdown of the reactor and following a design basis accident. Cooling water from the UHS cooling towers is provided to the component cooling water system heat exchangers, emergency diesel generator heat exchangers and pump room coolers that are necessary for normal safe shutdown and cooldown, anticipated operational events, and accident conditions. The AP1000 design does not require an active external safety-related UHS system to reach safe shutdown. It employs a nonsafety-related SWS to accommodate plant heat loads.

Additional plant systems require freshwater. The PSWS supplies water needed for plant operation including potable water, sanitary water, and miscellaneous systems. The DWDS supplies makeup water of reactor coolant quality and treated water for other station operating requirements, including reactor coolant makeup. The FPS supplies water to the wet system type fire suppression systems.

The plant water use during construction activities requires freshwater for potable and sanitary use, concrete mixing and curing, and dust control. The total freshwater requirement for construction is 171,932 gallons per day (gpd) or 119 gpm. Of this, the sanitary discharge is 123,000 gpd or 85 gpm. The remainder of the supply is consumed. These construction flows are bounded by the higher total freshwater requirements and potable and sanitary flows during operation.

3.3.2 WATER TREATMENT

A description of expected water treatment methods and associated chemical use is described below. Detailed descriptions of these processes and points of injection will be provided during the COL application phase following the selection of a reactor technology.

Treatment systems are required for systems supplied by surface water and groundwater, including circulating water makeup, reactor water makeup, service water makeup, condensate,

potable water, radwaste, and fire protection. The majority of the water is withdrawn from the Delaware River via the intake structure. The intake structure is located at River Mile 52 and is situated in the tidal estuary zone of the Delaware River where it is subject to tidal saltwater intrusion and at the turbidity maxima on the Delaware River. The water is hard and brackish with elevated levels of total dissolved solids and chlorides, elevated levels of both calcium and magnesium, and moderately high suspended solids levels.

The source of raw water makeup for the CWS is the Delaware River. Sulfuric acid is used to control calcite scale as required and acid addition maintains a slightly alkaline pH level. This is typical when using tidal estuary water makeup and is consistent with the operational experience at the adjacent HCGS. The combination of low cycles of concentration and acid addition is used so that other scale inhibitors are not anticipated. Chlorination controls microbial growth in the piping and condenser to prevent biofouling and microbiological deposits. Sodium hypochlorite solution is used to control biofouling and is limited by New Jersey Pollutant Discharge Elimination System (NJPDES) permit requirements. Dechlorination of CWS cooling tower blowdown may be required by the NJPDES permit. A sodium bisulfite solution or equivalent is injected as necessary to react with residual chlorine prior to discharge.

The source of raw water makeup for the SWS/UHS is the Delaware River. The river water is treated to remove suspended solids by settling in clarifiers. The influent is coagulated and flocculated with polyelectrolyte addition to increase sedimentation rates and improve effluent quality. Settled sludge is dewatered for disposal using mechanical dewatering facilities or in a managed impoundment. Media filters, downstream of the clarifiers, and filter backwash may be used to provide additional suspended solids removal. More comprehensive chemical treatment is provided for the SWS/UHS. The river water requires control of calcite scale and control of iron and sediment deposition. Treatment chemicals include sulfuric acid, an additional blended deposit control agent, and an oxidizing biocide. Sulfuric acid is used for pH reduction to aid in calcium carbonate scale control. A deposit control agent is used to control calcium carbonate scaling, to protect against calcium phosphate scaling, and to control silt and iron deposition. Sodium hypochlorite solution is used to control biofouling. Dechlorination of SWS/UHS cooling tower blowdown may be required by the NJPDES permit. A sodium bisulfite solution or equivalent is injected as necessary to react with residual chlorine prior to discharge.

The source for plant makeup flows to the PSWS, DWDS, FPS, and other miscellaneous systems is the on-site freshwater aquifer. Makeup flows to the PSWS and FPS are not treated. Chlorination is provided for the PSWS. The DWDS makeup flow uses a demineralization treatment system such as a dedicated reverse osmosis system to reduce solids, salts, organics, and colloids in the treated water.

Table 3.3-1
Plant Water Use

System	Average Flow (gpm)	Maximum Flow[a] (gpm)	PPE Item (SSAR Table 1.3-1)
River Water Streams			
Circulating Water System			
Evaporation	25,264	25,264	2.4.7, 2.5.7, 2.6.7
Drift[b]	12	12	2.4.17, 2.5.17, 2.6.17
Makeup	75,792	75,792	2.4.9, 2.5.9, 2.6.9
Blowdown	50,516	50,516	2.4.4, 2.5.4, 2.6.4
Service Water/UHS System			
Evaporation	1142	2284	3.3.7a and 3.3.7b
Drift[c]	2	4	3.3.17
Makeup (before filter)	2404	4808	3.3.9a and 3.3.9b
Makeup (after filter)	2284	4568	(d)
Blowdown	1140	2280	3.3.4a and 3.3.4b
Makeup Filter Backwash	120	240	(d)
UHS Makeup (emergency only)	4568	4568	(d)
Fresh Water Aquifer Streams			
Plant Makeup			
PSWS Makeup	93	216	5.2.2 and 5.2.1
DWDS Makeup	107	107	6.2.2 and 6.2.1
FPS Makeup	5	625	7.1.2 and 7.1.1
Floor Wash Drain Makeup	5	5	8.2.2 and 8.2.1
Discharge Streams			
Plant Blowdown			
PSWS Blowdown	93	93	5.1.1 and 5.1.2
DWDS Blowdown	27	27	6.1.1
Misc. Drains Blowdown	39	55	8.1.1 and 8.1.2
Liquid Radwaste Flow	11	11	10.2.1
Combined Plant Blowdown (includes CWS Blowdown, SWS/UHS Blowdown, SWS/UHS Makeup Filter Backwash, and Plant Blowdown)	51,946	53,222	(d)

a) These flows are not necessarily concurrent.
b) The cooling tower drifts are 0.001% of the tower circulating water flow.
c) The cooling tower drifts are <0.005% of the tower circulating water flow.
d) Values shown on Figure 3.3-1.

3.4 COOLING SYSTEM

This section provides a general discussion of the cooling water system. The plant cooling system and the anticipated cooling system modes of operation are described in Subsection 3.4.1. Design data and performance characteristics for the cooling system components are presented in Subsection 3.4.2. Bounding parameters from the PPE and site-specific characteristics within the SSAR are used to establish conceptual cooling system descriptions.

3.4.1 DESCRIPTION AND OPERATIONAL MODES

3.4.1.1 Normal Plant Cooling

The primary heat dissipation system is the CWS. The CWS is essential to power generation as it provides a continuous supply of cooling water to the main condenser for condensing turbine exhaust steam and cooling for other turbine auxiliaries, depending on the reactor technology. The CWS transfers this rejected heat to the environment by means of cooling towers that cool the water to an acceptable level through evaporation and subsequently returns it to the cooling tower basin (normal heat sink).

The closed loop CWS is composed of pumps, a water basin, and wet cooling towers. Circulating water flowing through the tube bundles of the main condenser absorbs heat from turbine exhaust steam on the condenser shell side. The bounding CWS configuration for the new plant circulates 1,200,000 gpm (SSAR Table 1.3-1, Item 2.4.12) of water through the CWS by circulating water pumps located in the cooling tower basin pump house. The CWS is able to dissipate up to 1.508E10 British thermal units per hour (Btu/hr) of waste heat from the new plant main condensers and other turbine auxiliaries (SSAR Table 1.3-1, Item 2.3.2).

The new plant cooling tower design uses either mechanical draft, natural draft, or fan-assisted natural draft wet cooling towers. Figure 3.1-2 shows the relationship of the cooling tower(s) location to the rest of the new plant. The towers use evaporative cooling to transfer up to 1.508E10 Btu/hr of heat to the atmosphere (SSAR Table 1.3-1, Items 2.4.13, 2.5.13, and 2.6.13). Subsection 3.4.2.3 provides further discussion of the CWS cooling tower operation. Cooling tower alternatives are addressed in Chapter 9.

A conceptual closed loop cooling water balance diagram is provided in Figure 3.4-1.

3.4.1.2 Service Water System

Waste heat from the balance of plant (BOP) auxiliary equipment and heat exchangers not cooled by the plant CWS are cooled by the plant SWS that dissipates this heat to the atmosphere by evaporation through the SWS/UHS cooling towers. All reactor technologies being considered contain a SWS, which may also perform safety-related functions. The SWS associated with the ABWR, US-APWR, and U.S. EPR performs both safety-related and nonsafety-related functions. The SWS associated with the AP1000 performs only nonsafety-related functions.

The active safety-related SWS/UHS (ABWR, US-APWR, and U.S. EPR) supplies cooling water to the reactor cooling systems, structures, and components important to safety that are necessary for plant safe shutdown and cooldown, under normal operation, anticipated

operational occurrences, and accident conditions. The system is reactor technology specific, but is generally comprised of pumps, heat exchangers, a dedicated water basin, and cooling towers. The heat transferred to the safety-related SWS for rejection to the environment in UHS heat removal devices is 2.06E8 Btu/hr (normal) and 4.72E8 Btu/hr (peak) during cooldown (SSAR Table 1.3-1, Item 3.2.2). Although a reactor technology has not been selected, for bounding purposes, it is assumed that safety-related mechanical draft cooling towers provide the UHS function for the PSEG Site. The UHS heat rejection rate to the atmosphere is 3.95E8 Btu/hr during accident operation (SSAR Table 1.3-1, Item 3.3.13b). Subsection 3.4.2.3 provides further discussion of the UHS cooling towers. The quantity of UHS blowdown is discussed in Section 3.3.

The UHS associated with the AP1000 design does not require an active safety-related system to reach safe shutdown. The reactor design employs a passive UHS system using water stored in a tank above the containment structure for safety-related cooling. The passive containment cooling system does not require an active external safety-related UHS system to reach safe shutdown. The tank is filled and maintained filled with demineralized water. In the event of a Loss of Coolant Accident or Main Steam Line Break inside containment, water in the tank is dispersed over the steel containment. The passive containment cooling system has no normal plant operation function. Once filled, the storage tank above containment requires minimal demineralized water for evaporation make-up.

3.4.1.3 Operational Modes

The CWS provides cooling during the power operation mode. The dissipation rate to the environment for operating modes other than full-power is less than the bounding values for the full-power operational mode. It is anticipated that the new plant is normally operating at 100 percent of its rated thermal power; therefore, bounding heat rejection rates for the CWS represent both average and maximum flows.

The SWS/UHS provides heat removal during all modes of normal operation, power operation, cooldown, refueling, and plant startup. During refueling, the SWS/UHS may also support the spent fuel pool heat load during a full core offload. The power operation mode is 18 or 24 months and requires the most makeup water over its duration. Therefore, all other modes are bounded by the power operation mode.

3.4.1.3.1 Station Load Factor

The anticipated maximum load factor for the new plant is 96.3 percent (SSAR Table 1.3-1, Item 17.6); however the final maximum load factor is ultimately influenced by factors such as weather conditions, plant efficiency, operating cycle performance, and outage durations. The annualized load factor is the average percentage of time that a plant is capable of providing power to the grid within a year. On a long-term basis, an average heat load of 1.45E10 Btu/hr (96.3 percent of the new plant’s rated heat load discussed in Subsection 3.4.1.1) is dissipated to the atmosphere.

3.4.1.3.2 Delaware River Water Temperature

The range of Delaware River water temperatures near the new plant is discussed in SSAR Chapter 2. The intake structure contains ice mitigation features.

3.4.1.3.3 Delaware River Water Level

Depending on the reactor technology selected, the Delaware River may or may not serve as an active nuclear safety-related makeup water supply for UHS cooling. If a reactor technology is selected that requires a safety-related makeup water supply, then the safety-related makeup pumps and the safety-related portion of the intake structure design will provide for the ability to draw water from the extreme low water level defined in SSAR Chapter 2.

The design basis flood level is discussed in SSAR Chapter 2. The safety-related portions of the intake structure will be designed to preclude any water impacts from the design basis floods.

3.4.1.3.4 Anti-Fouling Treatment

This description is found in Subsection 3.3.2.

3.4.2 COMPONENT DESCRIPTIONS

This section describes the design data and performance characteristics of the cooling system components during the anticipated system operation modes. Bounding values from the PPE are used to describe the intake system, discharge system, and heat dissipation system.

3.4.2.1 Intake System

The intake structure is designed to meet the bounding makeup requirements of normal and safety-related (reactor technology dependent) cooling systems by drawing water directly from the Delaware River. Makeup water flow rates drawn into the intake structure are discussed in Section 3.3. The intake structure will be located along the east shoreline of the Delaware River, west of the plant site. This location is 2800 ft. north of the existing HCGS service water intake structure as shown in Figure 3.1-2. The approximate intake structure dimensions are 110 ft. by 200 ft. to meet the requirements of the bounding CWS and SWS/UHS demands for the different reactor technologies under consideration. The forebay for the intake extends into the river and the area in front of the intake structure will be dredged to an elevation of -19 ft. 10 in. NAVD. Figure 3.4-2 shows the plan view of the intake along the river with the bathymetry of the river around the intake. It is assumed that the river bottom will be dredged from the shoreline to the -19 ft. 10 in. NAVD river bottom contour on both sides of the intake to provide sufficient depth for the intake water withdrawal.

As shown in Figure 3.4-3, the intake structure design consists of a bar rack at the inlet that prevents debris in the river from entering the intake bays. Debris on the bar rack is mechanically cleared by the trash rake, which can traverse across the track installed above the forebay along the face of the intake structure. A baffle wall in each bay is provided to prevent any floating contaminant from reaching the intake pumps. Stop logs can be inserted in the intake bays for maintenance access.

To remove small debris, the intake water passes through traveling water screens. The intake structure bay and intake screens are sized so that the average intake through-screen flow velocity is less than 0.5 fps, as required by Clean Water Act, Section 316(b) Phase I requirements specified in 40 CFR 125.84. In accordance with these rules, this design value is subject to conditions of maximum flow (i.e., all pumps in the bay operating at full capacity) so as

to enhance the performance of the debris-filtering system and minimize organism mortality due to impingement and entrainment. Debris and aquatic life accumulated by the traveling water screens is returned to the Delaware River.

The bounding combined cooling water intake flow from the Delaware River by CWS makeup and SWS makeup is provided in Table 3.3-1.

3.4.2.2 Discharge System

The plant discharge consists of cooling tower blowdown and other site wastewater streams, including the domestic water treatment and circulation water treatment systems. The volume and concentration of each constituent discharged to the environment will meet requirements established in the NJPDES permit. The discharge system is shown in Figure 3.4-4. Dilution and dissipation of the discharge heat and other effluent constituents are affected by both the discharge system design and the flow characteristics of the receiving water. The bounding combined blowdown flow discharges into the Delaware River are provided in Table 3.3-1. Discharge constituents are discussed in Section 3.6.

3.4.2.3 Heat Dissipation System

Heat dissipation for the CWS described in Subsection 3.4.1 occurs by means of wet cooling tower(s) within a closed loop system. The CWS cooling tower basins will be used as the normal heat sink. Makeup water to replenish losses from evaporation, blowdown, and drift is taken from the Delaware River. The quantity of water makeup, evaporation and discharge as blowdown is discussed in Section 3.3. As water evaporates and heat is rejected to the atmosphere, solids will drop out and reenter the CWS, increasing the amount of total dissolved solids. To sustain the heat transfer efficiency and maintain cooling tower water chemistry, a portion of the basin inventory is continuously discharged through the plant blowdown path to the Delaware River. The cooling towers are either mechanical draft, natural draft, or fan-assisted natural draft wet cooling tower design. A mechanical draft cooling tower creates air flow through the use of motor driven fans. Heat from the system is released to the environment by fans forcing air to flow through the cooling tower. A natural draft cooling tower uses the properties of air to create air flow. Warm, moist air naturally rises due to the density differential between the cool, dry air outside of the cooling tower. Thereby, the heat from the system is naturally released to the environment. Fan-assisted natural draft cooling towers combine characteristics of a natural draft tower with forced draft fans. They use short stacks relative to natural draft towers and are equipped with fans to augment air flow. Table 3.4-1 provides a tabulation of CWS cooling tower design specifications.

The new plant requires SWS/UHS cooling towers for heat dissipation. These towers will be mechanical draft cooling towers and located in the power block area. Makeup for the cooling towers is from the Delaware River. Blowdown discharges are sent to the plant blowdown path to the Delaware River. Subsection 3.4.1 contains a discussion on SWS/UHS heat loads. Table 3.4-2 provides a tabulation of SWS/UHS cooling tower design specifications.

Table 3.4-1
Circulating Water System Cooling Tower Design Specifications

Design Conditions	Cooling Tower	PPE Item (SSAR Table 1.3-1)
Number of Towers	2[(a)]	N/A
Heat Load	1.508E10 Btu/hr	2.3.2
Circulating Water	1,200,000 gpm	2.3.3
Approximate Dimensions		
Mechanical Draft:	100 ft. by 820 ft.	N/A
	46 ft. (Height)	2.4.20
Natural Draft:	410 ft. (Diameter)	N/A
	590 ft. (Height)	2.5.20
Fan-Assisted:	400 ft. (Diameter)	N/A
	224 ft. (Height)	2.6.20
Design Wet Bulb Temperature	76.6°F	N/A
Design Temperature Range	25.2°F	2.4.11 / 2.5.11 / 2.6.11
Approximate Exit Air Velocity		
Mechanical Draft:	1730 fpm	2.4.18
Natural Draft:	995 fpm	2.5.18
Fan-Assisted:	902 fpm	2.6.18
Drift Rate	0.001%	N/A
Noise Level	60 dBA at 1000 ft. from tower	2.6.10

a) The bounding CWS design is based on a dual unit plant. A single unit plant may also require two cooling towers.

Table 3.4-2
SWS/UHS Cooling Tower Design Specifications

Design Conditions	Cooling Tower	PPE Item (SSAR Table 1.3-1)
Heat Load		
Normal:	2.06E8 Btu/hr	3.2.2
Peak:	4.72E8 Btu/hr	3.2.2
Accident:	3.95E8 Btu/hr	3.3.13b
Approximate Dimensions		
Cooling Tower Deck Height:	63 ft.	3.3.8a
Exhaust Stack Height:	35 ft.	3.3.8b
Drift	2 gpm	3.3.17
Noise Level	57 dBA at 200 ft. from tower	3.3.10

3.5 RADIOACTIVE WASTE MANAGEMENT SYSTEM

This section provides a general discussion of the new plant radioactive waste management systems. Detailed information regarding the description of the liquid and gaseous radioactive waste management and effluent control systems, instrumentation and process flow diagrams, release points, and sources of waste will be provided during the COL application phase following reactor technology selection. A description of the development and intended use of the PPE is provided in Section 1.3 of the SSAR. Bounding parameters from the PPE and site-specific characteristics within the SSAR are used to establish radioactive waste management system descriptions.

Radioisotopes are produced during normal operation of a nuclear power plant, primarily through the processes of fission and activation. The radioactive waste may be liquid, solid, or gaseous. Through leakage or diffusion, fission products may enter the reactor coolant. These radioisotopes may enter the environment from plant systems designed to remove impurities, small leaks in reactor coolant or auxiliary systems, or breaching of systems for maintenance.

The quantities of radioactive waste that are projected to be generated and processed and then stored or released annually as liquid or gaseous effluents or as solid waste are provided in this section. Radioactive waste management and effluent control systems are designed to minimize releases from reactor operations to values as low as reasonably achievable (ALARA). These systems are designed to meet the requirements of 10 CFR 20, *Standards for Protection Against Radiation,* and 10 CFR 50, *Domestic Licensing of Production and Utilization Facilities,* Appendix I and are maintained in accordance with ALARA principles, protective of the environment, and minimize radiological doses to the public.

3.5.1 LIQUID RADIOACTIVE WASTE MANAGEMENT SYSTEM

Liquid radioisotopes are produced during the normal operation of nuclear reactors. The liquid radwaste system is designed to control, collect, process, handle, store, and dispose of liquid radioactive waste generated during normal operation, including anticipated operational occurrences. The system is designed to gather liquids that may leak from radioactive and potentially radioactive sources and store those liquids for further processing. The liquid waste sources include leakage from the reactor coolant system, detergent wastes, cleanup and purification systems, chemical wastes, and other similar sources.

These sources and potential sources are identified and collected in systems designed to contain any leakage and return it to the system or transport it to a liquid waste management system collection point for treatment or disposal. The system is designed to store and process the waste to maintain radiation exposure ALARA.

After processing, small quantities of radioactive effluents may be released to the environment at release points, typically in the cooling water discharge stream, and are monitored to measure the activity released. The flow rate at the discharge release point of potentially radioactive liquid effluent streams is 11 gpm (SSAR Table 1.3-1, Item 10.2.1).

The following sources are considered in calculating the release of radioactivity in liquid effluents from normal operations and anticipated operational occurrences:

- Processed liquid wastes from the equipment drain subsystems
- Processed liquid wastes from the floor drain subsystems
- Processed liquid wastes from the chemical waste subsystems
- Processed liquid regenerant wastes
- Detergent wastes

The estimated bounding annual average activity released to the environment in liquid effluents from a new plant is provided in SSAR Table 1.3-8. Additionally, a bounding annual average release of tritium is 1660 curies per year (Ci/yr) (SSAR Table 1.3-8).

3.5.2 GASEOUS RADIOACTIVE WASTE MANAGEMENT SYSTEM

Gaseous radioisotopes are produced during the normal operation of nuclear reactors. The gaseous radwaste system is designed to control, collect, process, store, and dispose of potentially radioactive gases including noble gases, radioactive particulates, tritium, and iodine during normal operation. The system is designed to retain these gases and remove them in a controlled fashion through a gaseous waste collection system, which collects waste from multiple sources and then stores the gas to allow short-lived isotopes to decay. The remaining activity is released to the environment through a waste gas processing system designed to minimize the release to and the impact on the environment through a monitored release point. The system is designed to store and process released waste to maintain radiation exposure ALARA.

Some hydrogen and oxygen is generated from the hydrolysis and radiolysis of the coolant water. At sufficiently high concentrations, these gases can form flammable and explosive mixtures. Therefore, applicable streams in the gaseous radwaste system are monitored for both hydrogen and oxygen concentration so a flammable limit is not reached. The gaseous radwaste system maintains hydrogen and oxygen levels through nitrogen dilution or removal by a recombiner.

A small fraction of gaseous waste may leak from the plant systems into the plant atmosphere. Monitoring systems are designed to detect and quantify the leakage. These gases are released through the monitored building ventilation system release points, or in some cases, through filtration systems designed to remove particulates and selected isotopes. The ventilation and gaseous radwaste systems’ release points are designed to dilute the waste stream and release the gas at an elevated location. The bounding elevation for the normal release point is ground level for routine operational releases (SSAR Table 1.3-1, Item 9.4.2).

The following sources are considered in calculating the release of radioactive materials (noble gases, radioactive particulates, tritium, and iodine) in gaseous effluents from normal operations and anticipated operational occurrences:

- Main condenser offgas system (ABWR plant)
- Mechanical vacuum pumps (ABWR plant)
- Ventilation exhaust air from the various plant buildings with potentially contaminated ventilation systems
- Waste gas processing and handling systems

The estimated bounding annual average activity released to the environment in gaseous effluents, is found in SSAR Table 1.3-7. Additionally, a bounding annual average release of tritium is 350 Ci/yr (SSAR Table 1.3-7).

3.5.3 SOLID RADIOACTIVE WASTE MANAGEMENT SYSTEM

Solid radioactive wastes are produced during the normal operation of nuclear reactors. Solid radioactive wastes can be either dry or wet solids. The sources are from an operational activity, maintenance, or other functions. The solid radwaste system is designed to receive, collect, and store any solid radioactive wastes prior to their processing and packaging for on-site storage or shipment off-site.

The PSEG Site currently has a solid radwaste system in place for the HCGS and SGS. The low-level solid waste storage from the new plant will be coordinated with that from the existing plants. The solid radwaste system is designed to handle the following waste types: dry active waste, spent filter elements, spent resin, spent activated carbon, oil, and sludge. The system is designed to store and process the waste to maintain ALARA radiation exposure. Radiation monitors are used to monitor the area and the waste to ensure that applicable requirements are met.

The system design ensures that the solid radioactive wastes are collected, monitored, segregated, stored, and packaged for shipment in a manner that minimizes exposure to plant personnel and the public in accordance with 10 CFR 20 and 10 CFR 50, Appendix I. The bounding annual volume of radioactive solid waste is 16,721.5 cubic feet per year (ft^3/yr) (SSAR Table 1.3-1, Item 11.2.3). SSAR Table 1.3-3 provides the bounding annual radionuclide activities from routine plant operations.

3.6 NON-RADIOACTIVE WASTE SYSTEMS

This section provides a general discussion of typical non-radioactive waste streams expected at the new plant, including cooling water and auxiliary boiler blowdown that may contain water-treatment chemicals or biocides, water-treatment wastes, floor and equipment drains, storm water runoff, laboratory waste, trash, hazardous waste, effluents from the sanitary sewer system, and miscellaneous gaseous, liquid and solid effluents.

Non-radioactive liquid wastes are collected in the wastewater treatment system. The system is designed to stop the discharge of wastewater upon detection of high radiation in the stream to the discharge point.

Detailed information regarding the description of the non-radioactive waste management and effluent control systems, process/instrumentation diagrams, and system process flow diagrams will be provided during the COL application phase following reactor technology selection. Bounding parameters from the PPE and site-specific characteristics within the SSAR are used to establish conceptual non-radioactive waste system descriptions.

3.6.1 EFFLUENTS CONTAINING CHEMICALS OR BIOCIDES

Proper plant water chemistry includes the treatment of water used in various secondary systems as described in Subsections 3.3.2 and 3.4.1.3.4. Effluents from these new plant water systems are processed to minimize the release of these treatments, but they may still contain some low-level chemicals and/or biocides. The chemical concentrations within new plant effluent streams are controlled through engineering and operational/administrative controls to meet NJPDES requirements, and requirements and limitations set by appropriate federal, regional, or local regulatory agencies at the time of construction and operation. The following list identifies chemicals that may be present in the permitted discharge from the new plant:

- Sodium hydroxide and sulfuric acid, which are used to regenerate resins (depending on plant design), will be neutralized; resulting effluent will contain sodium and sulfate salts.
- Sulfuric acid for calcite scale control in cooling water systems
- Phosphate in cleaning solutions
- Biocides used for condenser defouling
- Boiler blowdown chemicals
- Oil and grease from plant floor drains
- Chloride
- Total residual oxidants

SSAR Table 1.3-2 provides the estimated concentrations of impurities in the blowdown water.

3.6.2 SANITARY SYSTEM EFFLUENTS

This section identifies anticipated volumes of sanitary effluent during the new plant construction and operation, including the nature of sanitary effluents.

The sewage treatment system treats the daily flow from the new plant and the existing site. Conceptually, the facility will be a package plant equipped with an extended aeration activated sludge system. Two units, each with a capacity of 70,000 gpd, will be provided. Each unit

includes an aeration tank and clarifier followed by a chlorine contact chamber. A single surge tank is provided to equalize variations in influent flows to the treatment units. A sludge holding tank is provided for waste sludge. Residuals are disposed off-site in a manner similar to current practices at the existing facility. Performance of the sewage treatment system will conform to NJPDES permit requirements.

The sewage treatment system will also be sufficient to treat sanitary wastes during construction. The bounding influent flow to the sanitary treatment system for the new plant is an average of 93 gpm (SSAR Table 1.3-1, Item 5.2.2). This equates to an average daily flow of 134,000 gpd. The bounding influent flow during construction is 123,000 gpd (85 gpm average) based on a peak construction population of 4100 persons (SSAR Table 1.3-1, Item 18.4.1) and a flow of 30 gallons per capita per day. This flow is within the proposed design capacity of the system.

New plant effluent discharges are regulated under the provisions of the Clean Water Act and the conditions of discharge, including total suspended solids and five-day biochemical oxygen demand (BOD_5), will be specified in the NJPDES permit. The estimated operational normal and maximum effluent flow rate from the sanitary waste water system is 93 gpm (SSAR Table 1.3-1, Item 5.1.1 and 5.1.2).

3.6.3 OTHER EFFLUENTS

This section addresses miscellaneous gaseous, liquid, and solid effluents that are non-radioactive including gaseous releases from operation of auxiliary boilers, standby diesel generators, gas turbines, cooling water blowdown, plant and mechanical drain systems, and storm drainage.

3.6.3.1 Gaseous Effluents

Non-radioactive gaseous effluents result from the seasonal and intermittent operation of the auxiliary boilers, and from intermittent testing and operation of the standby power system which may be diesel and/or gas turbine generators. These effluents commonly include particulates, sulfur oxides, carbon monoxide, hydrocarbons, and nitrogen oxides.

The auxiliary boiler exhausts from an elevation of 150 ft. above grade (SSAR Table 1.3-1, Item 13.1), and the emissions are provided in SSAR Table 1.3-4. The standby diesel generators' exhaust is at an elevation of 50 ft. above grade (SSAR Table 1.3-1, Item 16.1.2), and the emissions are provided in SSAR Table 1.3-5. The gas-turbines exhaust is at an elevation of 50 ft. above grade (SSAR Table 1.3-1, Item 16.2.2), and the emissions are provided in SSAR Table 1.3-6.

Gaseous effluent releases will comply with federal, state, and local emissions standards.

3.6.3.2 Liquid Effluents

Non-radioactive liquid effluents that potentially drain to the Delaware River are limited under the NJPDES permit. These liquid effluents are primarily discharges of site storm drainage and other power block discharges, such as oily waste, acid/caustic wastes, and normal waste. Existing site storm drainage outfalls may be modified and new outfalls to the Delaware River may be constructed to accommodate adjusted flow paths, or volumes created by the construction and

operation of the new plant. Liquid effluents from the power block of the new plant are combined with the cooling tower blowdown and sanitary system effluent, and routed to the common plant outfall that discharges to the Delaware River.

The design of the storm water systems for the new plant will comply with relevant federal, state, and local storm water regulations.

The overall plant blowdown constituents and concentrations are provided in SSAR Table 1.3-2.

3.6.3.3 Solid Effluents

Non-radioactive solid wastes include typical industrial wastes such as metal, wood, and paper, as well as process wastes such as non-radioactive resins and sludge. PSEG is currently a conditionally exempt small-quantity hazardous waste generator, generating less than 100 kilograms/month (220 pounds/month). PSEG maintains the program required of a small-quantity generator and monitors the amount of hazardous waste generated each month. Hazardous waste is disposed of through licensed disposal facilities. Universal waste, such as paint waste, lead-acid batteries, used lamps, and mercury-containing switches, is segregated and disposed of through licensed disposal facilities.

Normal station waste (e.g., paper, plastic, glass, river vegetation) is segregated and, as much as possible, processed for recycling. Approximately two-thirds (2/3) of the normal station waste is transferred to recycling vendors, and the remainder either incinerated or land filled. It is anticipated that there will be no change to the method for handling solid wastes created by the new plant.

3.7 POWER TRANSMISSION SYSTEM

The new plant will be located adjacent to the HCGS and SGS. The electric power systems for these plants generate and transmit power into the PJM Interconnection, LLC (PJM) power grid. PJM is a regional transmission organization (RTO) that manages the high-voltage power grid and coordinates the movement of wholesale electricity in a market that serves 13 states and the District of Columbia (Reference 3.7-1). PJM coordinates planning and operation for its members, and with adjacent nonmember utilities and power pools, under a wide range of normal and emergency conditions.

3.7.1 SWITCHYARD INTERFACES

HCGS and SGS have separate, dedicated switchyards. Both switchyards operate nominally at 500 kilovolts (kV). The switching station designs at each plant incorporate a breaker-and-a-half scheme for high reliability. A new plant switchyard is required to support new plant operation. The new plant switchyard is electrically integrated with the existing switchyards via a site interposing switchyard to provide 500 kV connections. Electric power generated by the new plant is fed through isolated phase bus to a main transformer bank(s) where it is stepped up to 500 kV and delivered to the new plant switchyard. The bounding land usage required within the PSEG Site for the switchyards is 63 ac. (SSAR Table 1.3-1, Item 15.1.1). The Site Utilization Plan shown in Figure 3.1-2 depicts the relative locations of the switchyards.

The configuration of the switchyards is dependent on the reactor technology, number of units, and the approach for integration with the existing HCGS and SGS switchyards. The switchyards require additional support services and structures for grounding, lightning protection, switchyard control power, and area lighting.

3.7.2 TRANSMISSION SYSTEM

Presently, there are two 500 kV transmission lines to the HCGS switchyard from off-site, and one 500 kV tie line from HCGS to the SGS switchyard. One off-site line is a 17-mi. tie to the Red Lion Substation, located northwest near Newark, DE, and the other line is a 43-mi. tie to the New Freedom Switching Station, located northeast in Camden County, NJ. All three lines are physically independent sources of off-site power to HCGS.

In addition, there are two 500 kV transmission lines to the SGS switchyard from off-site, and one 500 kV tie line from SGS to the HCGS switchyard. One off-site line is a 42-mi. tie to the New Freedom Switching Station, described above. The second off-site line is a 50-mi. tie to the New Freedom Switching Station. During 2008, a new substation (Orchard) was installed along this line, dividing it into two segments. All three lines are physically independent sources of off-site power to SGS and are available for either or both units.

Transmission lines meet or exceed design requirements set forth by the National Electrical Safety Code and meet with Lower Delaware Valley 500-kV Transmission Design Criteria. Lines meet the USACE requirements for clearance over flood levels.

The existing transmission lines servicing the PSEG Site have adequate thermal capacity to accommodate the additional new plant generation. To support the new plant, one additional off-site transmission line may be required for transient stability purposes. Formal PJM analyses are

required to fully identify the requisite transmission system upgrades that are necessary to accommodate a new nuclear plant at the PSEG Site. These PJM analyses have not been initiated, but formal entry into the PJM generation queue and commencement of these analyses is anticipated when a reactor technology is selected. PJM will evaluate the additional new plant generation along with the regional transmission system configuration and independent projects in the planning cycle at that time (Reference 3.7-1).

As is summarized in Subsection 1.2.5, PSEG completed a conceptual evaluation during development of the ESP application to identify potential transmission requirements associated with the addition of generation at the PSEG Site. This evaluation included the PJM Regional Transmission Expansion Plan, existing operational limits at HCGS and SGS, and other PJM transmission planning inputs. PJM routinely performs analyses of the regional transmission system and forecasts appropriate upgrades to the system as part of its long-term planning cycle. These evaluations are not specific to the addition of new generation at the PSEG Site. In order to capture the potential effects of developing off-site transmission, PSEG analyzed the potential effects of two new off-site macro-corridors during development of the ESP application. Information pertaining to alternative off-site transmission system corridors considered by PSEG is presented in Subsection 9.4.3.

PSEG transmission lines and rights-of-way are patrolled about five times each year to ensure that the physical and electrical integrity of transmission line supports, hardware, insulators, and conductors are acceptable for safe and reliable service. This periodic transmission line patrol is conducted by helicopter and ground patrols. Climbing inspections of structures are performed approximately every three years depending on the age of the line. Additional information on maintenance of transmission corridors, electric field effects, induced current hazards, corona noise, and radio/television interference is provided in Section 5.6.

3.7.3 REFERENCES

3.7-1 PJM Interconnection, Website, http://www.pjm.com/ , accessed June 17, 2009.

3.8 TRANSPORTATION OF RADIOACTIVE MATERIALS

This section describes the transportation of unirradiated fuel, irradiated fuel (spent nuclear fuel), and radioactive waste required at the PSEG Site and alternative sites.

Subsection 5.7.2 also addresses 10 CFR 51.52, *Environmental Effects of Transportation of Fuel and Waste,* (a)(1) through (a)(5) regarding use of Table S-4 to characterize both the impacts of radioactive materials transportation and provide an analysis of the radiological impacts from incident-free transportation of these materials. Section 7.4 addresses postulated radiological transportation accidents.

3.8.1 TRANSPORTATION OF UNIRRADIATED FUEL

New fuel assemblies are transported to the PSEG Site from a fuel fabrication facility in accordance with Department of Transportation (DOT) (49 CFR Parts 173, *Shippers – General Requirements for Shipments and Packagings,* 178, *Specifications for Packagings,* and 397, *Transportation of Hazardous Materials; Driving and Parking Rules*) and NRC regulations (10 CFR Part 71, *Packaging and Transportation of Radioactive Material*). The fuel assemblies are shipped by truck to the PSEG Site shortly before they are required. The container designs, shipping procedures, and transportation routing will be in accordance with DOT and NRC regulations and depend on the requirements of the suppliers providing the fuel fabrication services. The truck shipments will not exceed 73,000 pounds as governed by federal or state gross vehicle weight restrictions.

3.8.2 TRANSPORTATION OF IRRADIATED FUEL

Spent fuel assemblies are discharged from each unit and will remain in spent fuel pools associated with the new units at least five years while short half-life isotopes decay. The new plant has sufficient spent fuel capacity to ensure that irradiated fuel can be stored for at least five years before being removed from the spent fuel pool. After a sufficient decay period, the fuel will be removed from the pool and packaged in spent fuel shipping/storage casks, licensed in accordance with 10 CFR 72, *Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste,* and transferred either to an independent spent fuel storage installation facility on-site or an off-site disposal facility. Packaging of the fuel for off-site shipment will comply with applicable DOT (49 CFR 173, 49 CFR 178, and 49 CFR 397) and NRC regulations (10 CFR 71) for transportation of radioactive material. By law, the Department of Energy (DOE) is responsible for spent fuel transportation from reactor sites to a repository (Nuclear Waste Policy Act of 1982, as amended). DOE will determine the mode of transport.

3.8.3 TRANSPORTATION OF RADIOACTIVE WASTE

As described in Subsection 3.5.3, low-level radioactive waste is packaged to meet transportation and disposal site acceptance requirements. Waste packaging for off-site shipment will comply with applicable DOT (49 CFR 173 and 49 CFR 178) and NRC regulations (10 CFR 71) for transportation of radioactive material. The packaged waste will be stored on-site on an interim basis before being shipped off-site to a licensed processing, storage, or disposal facility. Radioactive waste is shipped off-site by truck.

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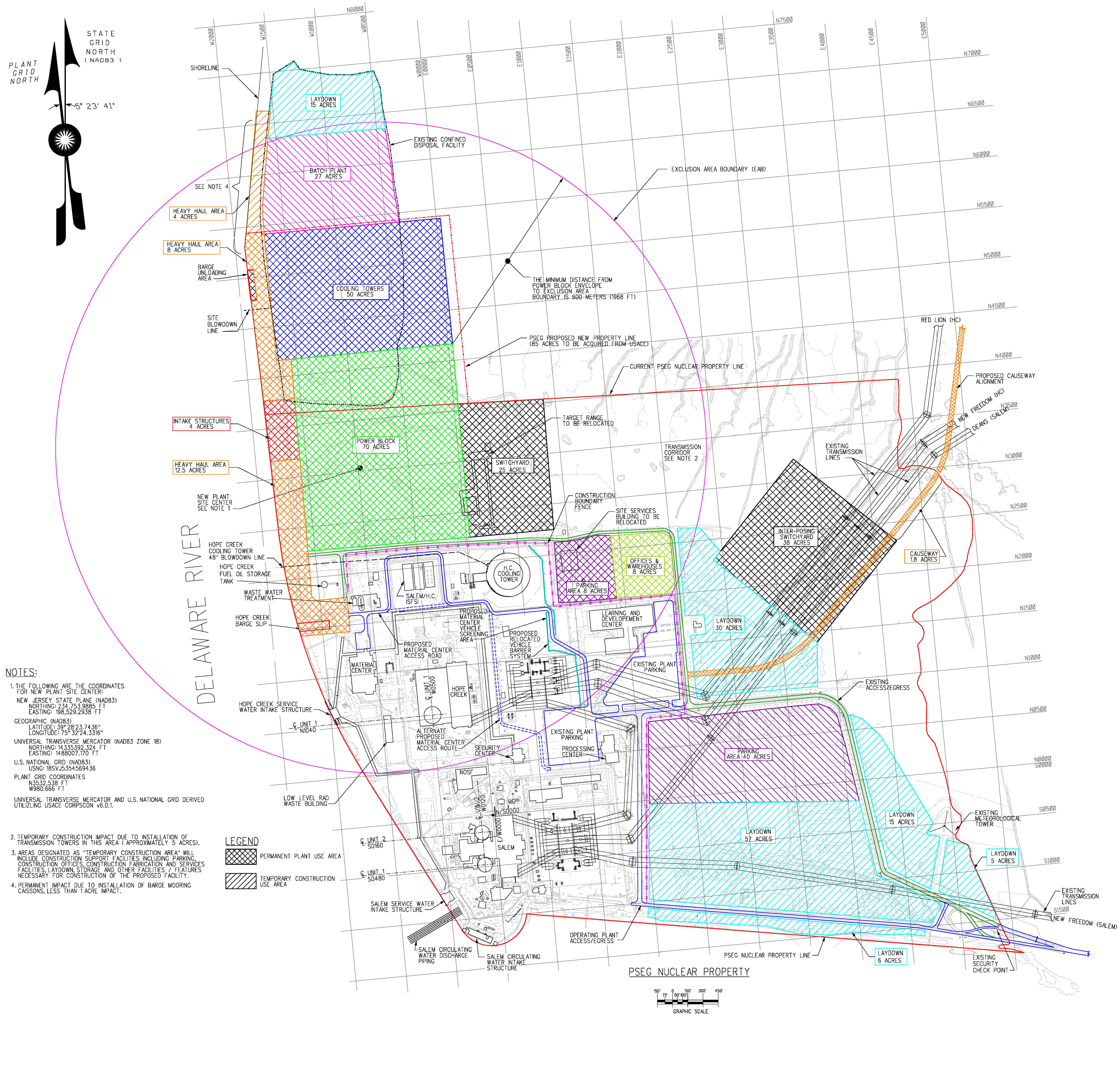
Existing Salem and
Hope Creek Site

FIGURE 3.1-1

Rev 0



NOTES:

1. THE FOLLOWING ARE THE COORDINATES FOR NEW PLANT SITE CENTER:

   NEW JERSEY STATE PLANE (NAD83)
   NORTHING: 234,753.9885 FT
   EASTING: 198,529.2938 FT

   GEOGRAPHIC (NAD83)
   LATITUDE: 39° 28'23.7436"
   LONGITUDE: 75° 32'24.3316"

   UNIVERSAL TRANSVERSE MERCATOR (NAD83 ZONE 18)
   NORTHING: 14335392.324 FT
   EASTING: 1488007.170 FT

   U.S. NATIONAL GRID (NAD83)
   USNG: 18SVJ5354569436

   PLANT GRID COORDINATES
   N3532.538 FT
   W980.666 FT

   UNIVERSAL TRANSVERSE MERCATOR AND U.S. NATIONAL GRID DERIVED UTILIZLING USACE CORPSCON v6.0.1.

2. TEMPORARY CONSTRUCTION IMPACT DUE TO INSTALLATION OF TRANSMISSION TOWERS IN THIS AREA (APPROXIMATELY 5 ACRES).
3. AREAS DESIGNATED AS "TEMPORARY CONSTRUCTION AREA" WILL INCLUDE CONSTRUCTION SUPPORT FACILITIES INCLUDING PARKING, CONSTRUCTION OFFICES, CONSTRUCTION FABRICATION AND SERVICES FACILITIES, LAYDOWN, STORAGE AND OTHER FACILITIES / FEATURES NECESSARY FOR CONSTRUCTION OF THE PROPOSED FACILITY.
4. PERMANENT IMPACT DUE TO INSTALLATION OF BARGE MOORING CAISSONS, LESS THAN 1 ACRE IMPACT.

LEGEND

- PERMANENT PLANT USE AREA
- TEMPORARY CONSTRUCTION USE AREA

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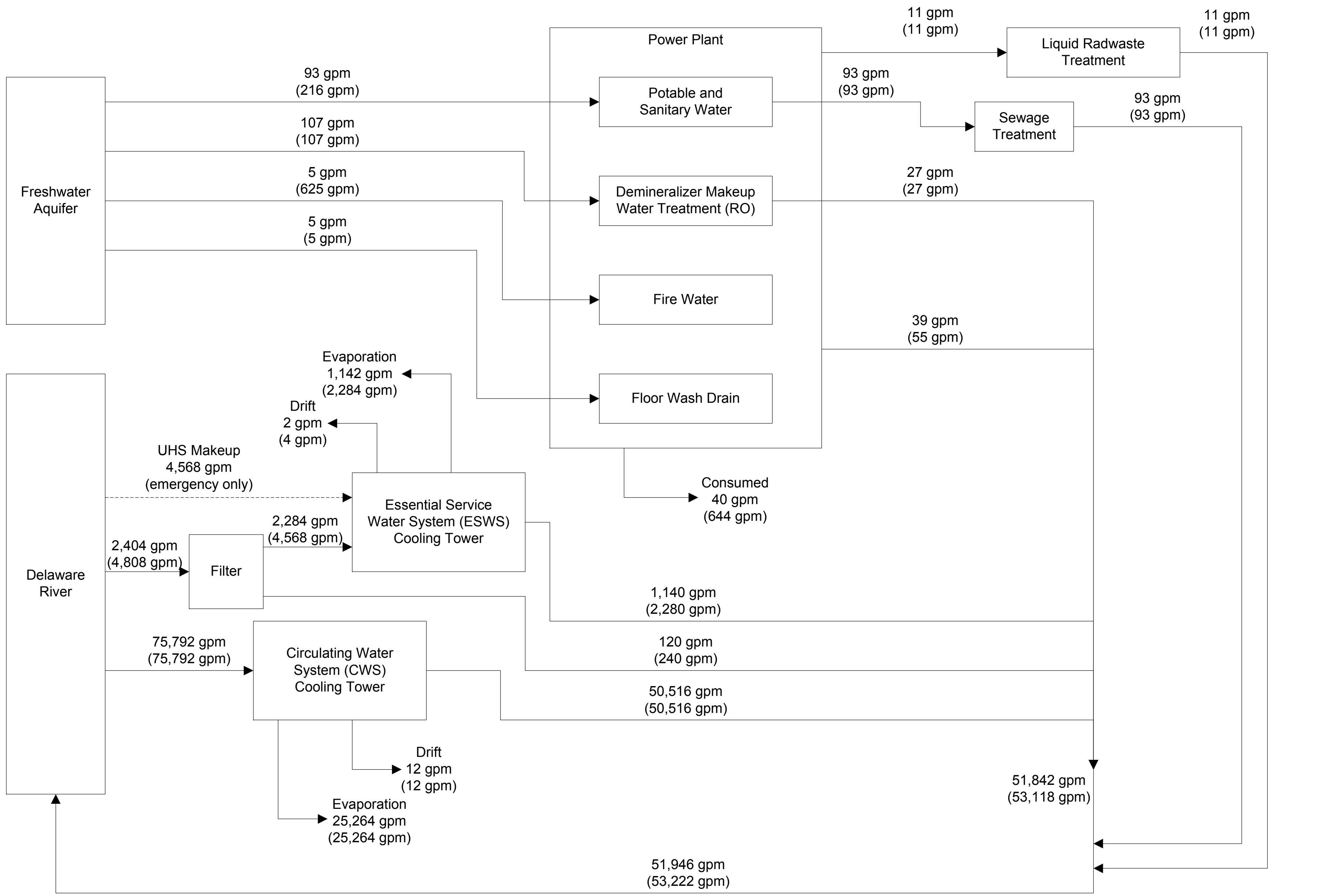
Site Utilization Plan

FIGURE 3.1-2

Rev.1



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Plant Water Use

FIGURE 3.3-1

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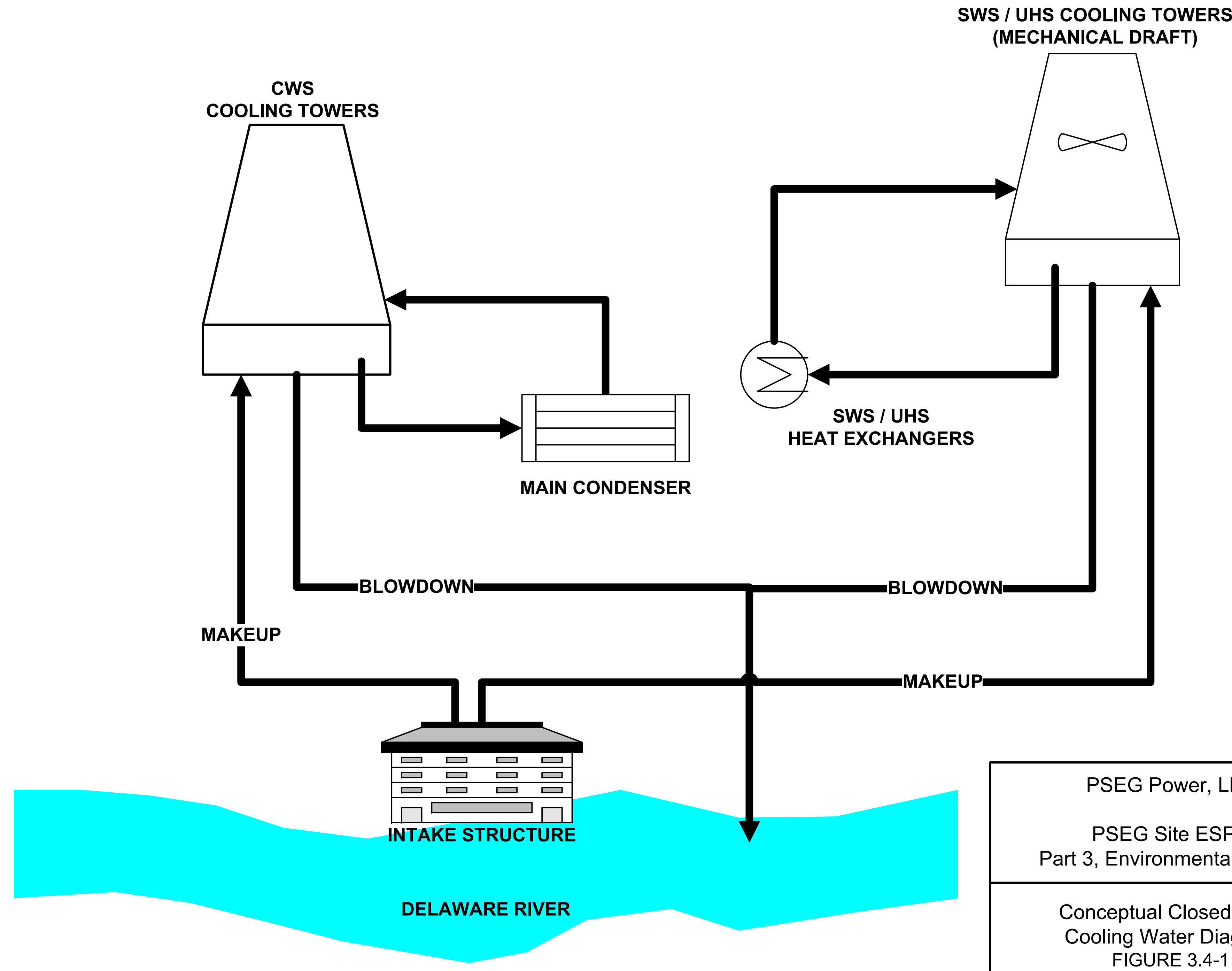

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Conceptual Closed Loop
Cooling Water Diagram
FIGURE 3.4-1

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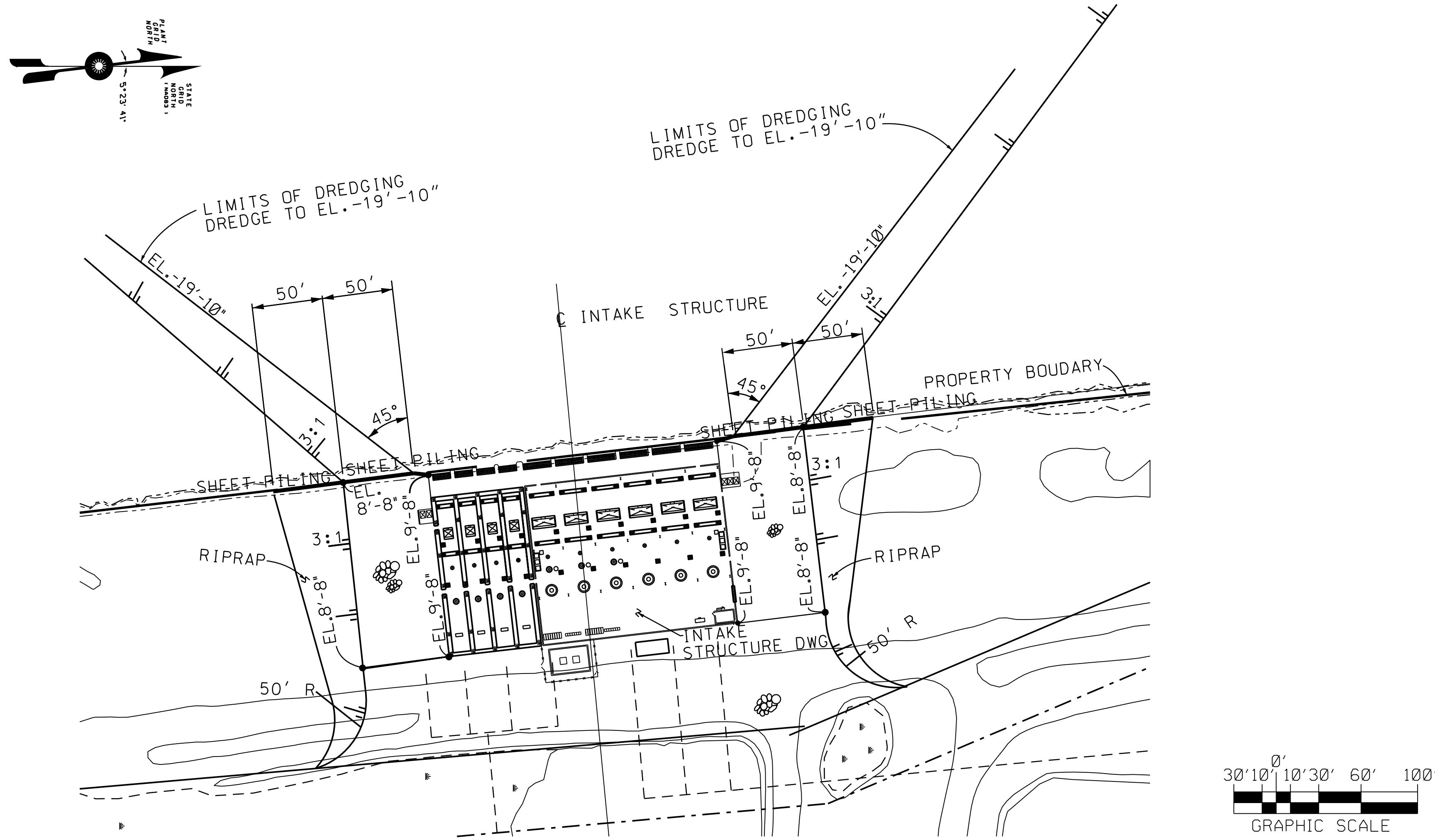

NOTE:

1. THE RIVER BOTTOM CONTOURS SHOWN ARE APPROXIMATE AND INTENDED FOR DESCRIPTION OF SITE IN GENERAL (REFERENCE DRAWING #59272; DELAWARE RIVER PHILADELPHIA TO THE SEA, REEDY ISLAND & BAKER RANGES EXAMINATION STA 255+000 TO 275 + 57.48; U.S. ARMY CORPS OF ENGINEERS, 2001).

2. ELEVATIONS SHOWN ARE NAVD 88 DATUM.

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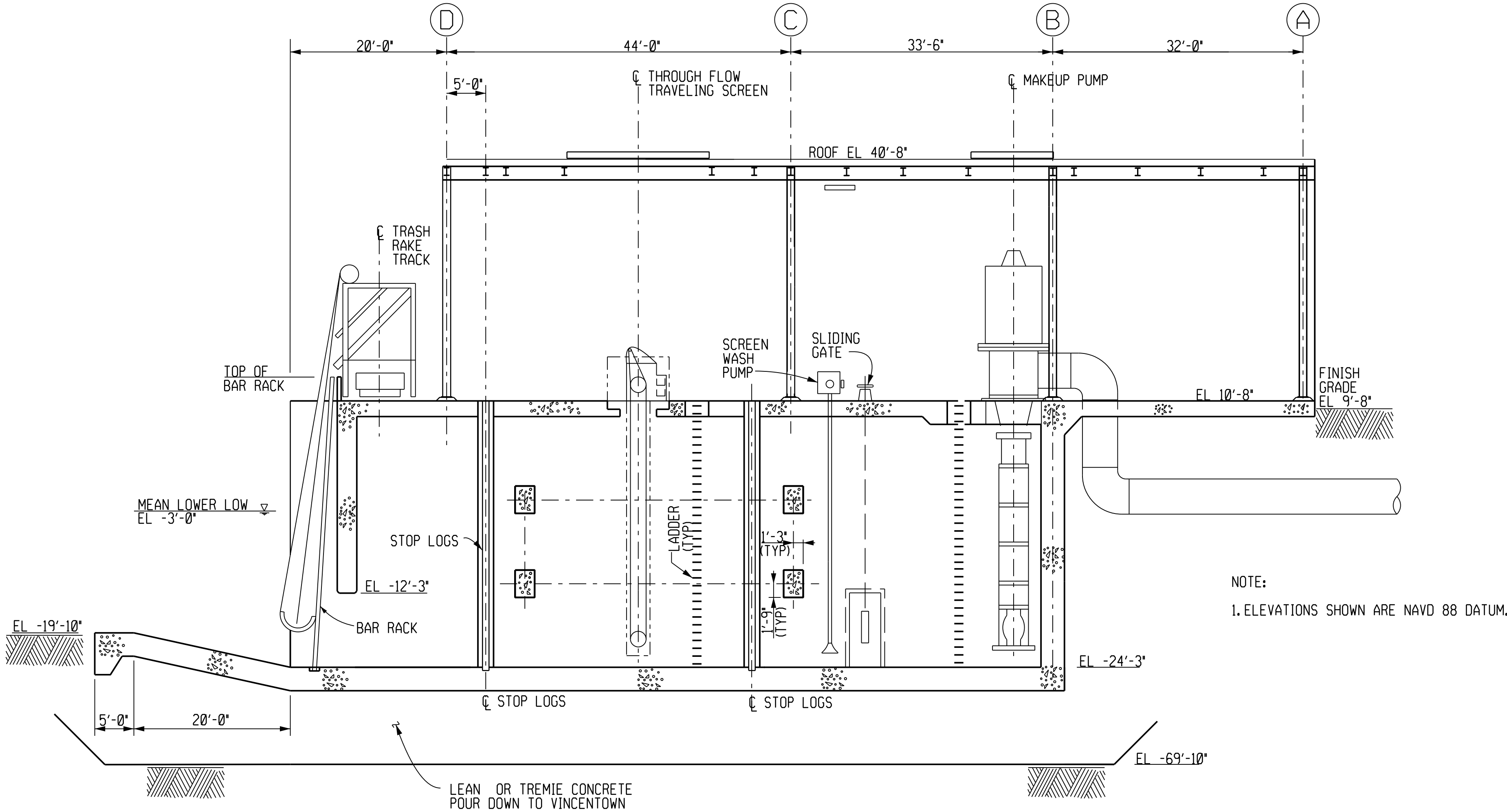
Part 3, Environmental Report

Layout View Of Intake

FIGURE 3.4-2

Rev. 0



PSEG Power, LLC

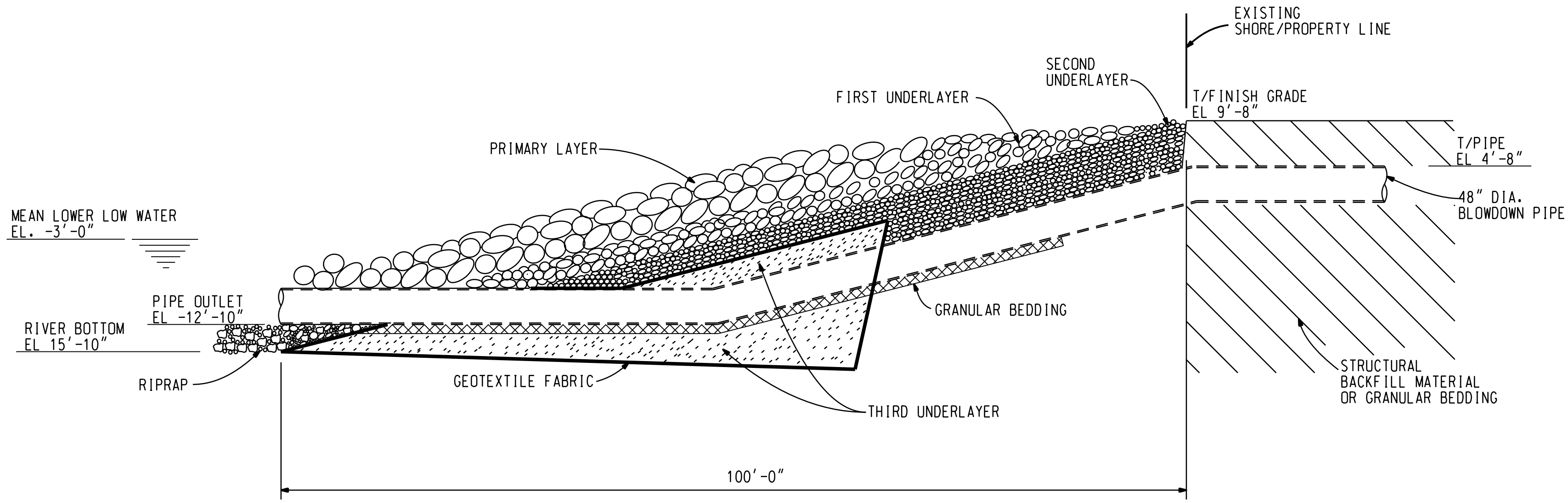
PSEG Site ESPA

Part 3, Environmental Report

Elevation View Of Intake

FIGURE 3.4-3

Rev. 0



NOTE:

1. ELEVATIONS SHOWN ARE NAVD 88 DATUM.

PSEG Power, LLC

PSEG Site ESPA

Part 3, Environmental Report

Discharge System Layout

FIGURE 3.4-4

Rev. 0

CHAPTER 4

ENVIRONMENTAL IMPACTS OF CONSTRUCTION

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ABWR	Advanced Boiling Water Reactor
ac.	acre
AP1000	Advanced Passive 1000
APE	Area of Potential Effect
bgs	below ground surface
BMP	best management practice
BUD	beneficial use determination
CDF	confined disposal facility
CEDE	committed effective dose equivalent
CEQ	Council on Environmental Quality
cfs	cubic feet per second
CWIS	circulating water intake structure
dBA	A-weighted decibels
DCD	design control document
DDE	deep dose equivalent
DRBC	Delaware River Basin Commission
EEP	Estuary Enhancement Program
EFH	essential fish habitat
ESP	early site permit
ESPA	early site permit application
ft.	foot
FRVS	filtration, recirculation, and ventilation system
GIS	geographic information system
gpd	gallons per day
gpm	gallons per minute
HCGS	Hope Creek Generating Station
HPO	Historic Preservation Office

ACRONYMS AND ABBREVIATIONS (CONTINUED)

Acronym	Definition
hr/yr	hours per year
ISFSI	independent spent fuel storage installation
kV	kilovolt
LOS	level of service
LULC	land use and land cover
LWA	Limited Work Authorization
m	meter
MCNP	Monte Carlo N-Particle
mi.	mile
mrem	millirem
mrem/hr	millirem per hour
mrem/yr	millirem per year
NAVD	North American Vertical Datum of 1988
NJDEP	New Jersey Department of Environmental Protection
NJPDES	New Jersey Pollution Discharge Elimination System
NOAA	National Oceanic and Atmospheric Administration
NPV	north plant vent (Hope Creek Generating Station)
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
ODCM	Offsite Dose Calculation Manual
PJM	PJM Interconnection, LLC
PRM	Potomac-Raritan-Magothy
PSWS	potable and sanitary water system
RG	Regulatory Guide
RERR	Radioactive Effluent Release Report
SGS	Salem Generating Station

ACRONYMS AND ABBREVIATIONS (CONTINUED)

Acronym	Definition
SHPO	State Historic Preservation Office
SPV	south plant vent (Hope Creek Generating Station)
sq. ft.	square foot
sq. mi.	square mile
SSAR	Site Safety Analysis Report
SSC	structures, systems, or components
SWPPP	Storm Water Pollution Prevention Plan
TEDE	total effective dose equivalent
TIA	traffic impact assessment
TLD	thermoluminescent dosimeter
USACE	U.S. Army Corps of Engineers
US-APWR	U.S. Advanced Pressurized Water Reactor
USEPA	United States Environmental Protection Agency
U.S. EPR	U.S. Evolutionary Power Reactor
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WMA	Wildlife Management Area
yr	year
χ/Q	atmospheric dispersion factor

CHAPTER 4

INTRODUCTION

4.0 INTRODUCTION

Chapter 4 presents the potential impacts of construction of the new plant at the PSEG Site. In accordance with 10 CFR 51, *Environmental Protection Regulations For Domestic Licensing And Related Regulatory Functions,* impacts are analyzed, and a single significance level of potential impact to each resource (i.e., SMALL, MODERATE, or LARGE) is assigned consistent with the criteria the U.S. Nuclear Regulatory Commission (NRC or Commission) established in 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3 as follows:

- SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.

- MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

- LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

This chapter is divided into six sections:

- Land Use Impacts (Section 4.1)
- Water-Related Impacts (Section 4.2)
- Ecological Impacts (Section 4.3)
- Socioeconomic Impacts (Section 4.4)
- Radiation Exposure to Construction Workers (Section 4.5)
- Measures and Controls to Limit Adverse Impacts During Construction (Section 4.6)

4.1 LAND USE IMPACTS

This section assesses the impacts to land use and land cover (LULC) for the PSEG Site, vicinity, and region due to construction of the new plant. The impacts of constructing the proposed site access road causeway and potential off-site transmission lines also are assessed. The land use for the site and proposed causeway is analyzed using the New Jersey (NJ) LULC database. In contrast, the U.S. Geological Survey (USGS) LULC database is used to analyze land use for the vicinity and region to provide a more unified database for the multiple jurisdictions within the larger region, which includes parts of NJ, Delaware (DE), Pennsylvania (PA), and Maryland (MD).

4.1.1 THE SITE AND VICINITY

As described in Section 2.1, the PSEG Site is defined as the land area owned (819 acres [ac.].) and/or controlled by PSEG when the combined license is issued. All but 45 ac. of the lands used for new plant construction will be within the PSEG Site property boundaries. The vicinity of the PSEG Site is defined as the area within a 6-mile (mi.) radius of the new plant centerpoint. The changes to site land use as a result of the construction of the new plant relate to the construction of the power block, cooling towers, switchyards, offices and warehouses, intake and discharge structures, parking areas, on-site roads and transmission lines, and construction support/laydown areas. The changes to vicinity and regional land use relate primarily to the construction of the proposed causeway, any potential off-site transmission lines, related construction support facilities, and a temporary concrete batch plant.

4.1.1.1 The Site

As indicated in Section 2.2, Hope Creek Generating Station (HCGS) and Salem Generating Station (SGS) occupy 373 ac. of land on the PSEG Site. This 373 ac. includes the power block and supporting facilities, on-site rights-of-way (upland developed and wetlands), transportation (roads), temporary materials and equipment storage areas, and security facilities. Based on the Site Utilization Plan shown in Figure 3.1-2, construction of the new plant at the PSEG Site impacts 380 ac. (permanent and temporary uses) of the site. Additional construction phase disturbance will occur to 45 ac. of land owned by the U.S. Army Corps of Engineers (USACE) adjacent to the northern boundary of the PSEG Site. This land currently is used by the USACE as a confined disposal facility (CDF) for disposal of dredged materials from the Delaware River. During construction of the new plant, this land is used for a concrete batch plant, heavy haul road, and construction laydown area.

Table 4.1-1 lists the existing land uses within the PSEG Site and the adjacent 45 ac. owned by the USACE (Figure 2.2-1). As noted in Table 4.1-1, the land uses on 349 ac. of the 819 ac. PSEG Site are considered to be developed uses as classified by the New Jersey Department of Environmental Protection (NJDEP). Industrial land uses account for the majority of this acreage (235 ac.) and correspond to the areas occupied by the HCGS and SGS plants and associated support facilities (the power block, switchyards, parking areas, administrative building, cooling tower, intake structures, materials building, maintenance and other support facilities). The remaining area used by HCGS and SGS that are not classified as industrial include altered lands, rights-of-way (including wetlands rights-of-way) roads, prior construction support/laydown and bulk material storage areas, and security facilities. Wetland areas of various types account for the second most prevalent land use category. The PSEG Site contains 322 ac. of lands with a

wetland cover type. Much of this acreage consists of disturbed wetlands dominated by *Phragmites (*common reed*)*. Undeveloped lands consisting of predominantly disturbed old field cover types comprise 107 ac. of lands. On-site water, consisting of the artificial ponds within the USACE CDF and the PSEG desilt basin in the northwestern portion of the PSEG Site, account for 40 ac. of land on-site.

The Site Utilization Plan (Figure 3.1-2) shows the land areas altered due to new plant construction. Land alteration activities associated with the construction phase include excavation of the power block, site grading, and construction of plant facilities. A barge facility north of the power block area provides for the delivery of materials for construction and large system components. A heavy haul road to be constructed along the Delaware River shoreline supports the movement of materials from the temporary laydown/batch plant area within the USACE CDF to other areas of the construction site.

All site preparation and construction activities are conducted in accordance with federal, state and local regulations, as appropriate. All necessary permits and authorizations will be obtained and appropriate environmental controls implemented (e.g., stormwater management systems, groundwater monitoring wells, and spill containment controls) prior to commencement of earth disturbing activities. Site preparation and construction activities affecting land use include clearing, grubbing, grading, excavating, and stockpiling of soils. Soil management is an important element of construction sequencing. Materials excavated from the power block area will be stockpiled and/or disposed of on-site, or otherwise evaluated for reuse/disposal, potentially under a beneficial use determination (BUD), per NJDEP requirements as appropriate.

Permanently disturbed locations will be stabilized and contoured in accordance with design specifications. Methods to stabilize the area and prevent erosion or sedimentation comply with applicable safety requirements, laws, regulations, permit requirements, and good engineering and construction practices. Construction debris is disposed of in an appropriate on-site location or transported off-site to a permitted disposal facility. The impact of erosion and sedimentation on receiving surface water is therefore, SMALL.

Construction of the new plant at the PSEG Site will result in permanent changes in NJDEP-mapped land uses for 225 ac. as follows: 50 ac. of developed land uses, 9 ac. of old field and shrubland, 127 ac. of lands mapped as wetland cover type, and 40 ac. of lands mapped as water. Within the latter two land use categories (wetlands and water), construction activities primarily result in impacts to disturbed and artificial wetlands and water bodies. *Phragmites*-dominated coastal and interior wetlands account for 102 ac. of the wetland land cover within permanent site utilization areas (Figure 3.1-2). Actual disturbance of these wetland areas will be further minimized during the design phase subsequent to the selection of a reactor technology. Subsection 4.3.1.1.2 provides additional discussion regarding the impacts to wetlands.

In addition to permanent changes in land use within the PSEG Site, construction also results in temporary changes in land use to 160 ac. within the PSEG Site and 45 ac. in adjacent off-site areas. Lands impacted by these temporary use areas include 39 ac. of developed lands, 80 ac. of disturbed old fields or *Phragmites*-dominated old field, and 41 ac. of lands mapped by NJDEP land use as wetland. *Phragmites*-dominated interior wetlands (24 ac.) account for the majority of wetland impacts in these temporary use areas.

The 45 ac. in the adjacent off-site USACE CDF area is also used temporarily to support construction activities. A total of 42 ac. of lands mapped as wetlands by NJDEP land use are used to support the batch plant and other temporary uses. The primary land uses impacted in this area include *Phragmites*-dominated wetlands (coastal and interior, 29 ac.) and disturbed wetlands (modified)(12 ac.).

The PSEG property is zoned for industrial use by Lower Alloways Creek Township. The additional land that PSEG will acquire from the USACE is currently a CDF site used for disposal of dredged materials from the Delaware River, and is also zoned for industrial use. Construction of a new plant at the PSEG Site is consistent with current Salem County land use zoning for this area. Use of part of the CDF during construction is not expected to adversely impact USACE use of the remaining portion of the CDF. Based on the relatively minor acreage that is converted from non-industrial to industrial use, and the compatibility of future uses with existing zoning, impacts to site land use are SMALL.

PSEG submitted a concurrent application to the NJDEP to obtain a coastal zone consistency determination. PSEG is also requesting that the New Jersey State Planning Commission revise the Coastal Area Facility Review Act Energy Facility Node and State Master Plan to be consistent with the new plant Site Utilization Plan. Upon a NJDEP determination that development of the new plant at the PSEG Site is consistent with the Coastal Zone Management Act, potential impacts of the new plant on coastal zones are therefore SMALL.

4.1.1.2 The Vicinity

The vicinity of the PSEG Site is defined as the area within a 6-mi. radius of the new plant centerpoint. Table 2.2-2 provides a breakdown of the land use for the vicinity using USGS LULC data, and Figure 2.2-2 shows the distribution of the various land uses within the vicinity. Construction of the proposed site access road causeway and a potential new 500-kilovolt (kV) off-site transmission line will result in changes to the land uses within the project vicinity, as discussed in the following subsections.

4.1.1.2.1 Proposed Causeway

The proposed causeway provides vehicular access to the PSEG Site and extends towards the north-northeast to the intersection of Money Island Road and Mason Point Road. The conceptual design specifies a 200-foot (ft.) wide rights-of-way in upland areas at the north and south termini, and a 48-ft. wide structure for the elevated portions of the causeway within lowland areas. For impact assessment purposes, a 50-ft. wide rights-of-way is assumed to be permanently impacted by the elevated causeway. It is also assumed that an additional 50-ft. wide area along the elevated portion of the causeway is temporarily impacted during the construction period.

Table 4.1-2 presents the potential acreage affected by construction of the proposed causeway, by LULC category. A total of 69 ac. is impacted by the construction of this causeway, 45.5 ac. permanently and 23.5 ac. temporarily. Permanent impacts result from the placement of structures (piers, pilings or other support structures) in the wetlands, and shading from the 50-ft. wide causeway. Temporary impacts result from the temporary placement of work mats on the wetlands to support equipment, materials, and personnel. The majority of the land use impacts are to open water and wetlands. A total of 45.3 ac. of wetlands may be permanently (25.2 ac.)

or temporarily (20.1 ac.) affected. Impacts to lands mapped as agricultural lands account for 11.5 ac. of the 69 ac., while open water, forest and urban land use account for the remaining acreage. The impacted agricultural and wetlands areas represent less than 0.2 percent of those available within the vicinity of the PSEG Site.

As is discussed in Section 2.2, some of the lands along the proposed causeway area are designated as prime and unique farmlands or farmlands of unique importance (based on soil type). Of these lands, 34 ac. are impacted. However, land to be converted is relatively minor as compared to the abundance of prime farmlands within Salem County. Furthermore, some of the lands along the proposed causeway are prime farmland soils that are limited by wetness (e.g., coastal marsh that was prime farmland when historically drained and used for salt hay production). Consequently, potential impact to prime farmland and agricultural and uses is SMALL.

While the open water and wetland areas impacted by causeway construction retain some normal wetland functions, it is likely that there will be some reduction in or loss of their existing functions and values due to the effects of shading and the resultant reduction in primary productivity within the system. In the context of the abundance of the coastal wetlands in the vicinity, however, the potential impact of this loss in function is SMALL. The agricultural land used by the new roadway is no longer available for farming. Therefore, for purposes of this land use impact assessment, all of the permanently impacted lands are reclassified as developed lands. Land uses affected temporarily are likely to return to their former uses.

Approximately 1 ac. of residential and 1 ac. of recreational land is permanently and temporarily impacted. The residential land is owned by PSEG and contains a structure used as a PSEG environmental project office. The 1 ac. of impacted recreational land consists of several small areas located within the Abbott's Meadow Wildlife Management Area (WMA) and Mad Horse Creek WMA. As noted in Section 2.2, these two WMAs are 1000 and 9500 ac. in size, respectively, and the impacted land represents less than 0.01 percent of these areas combined.

As shown in Table 4.1-2, the total land use impacts (permanent and temporary) for each of the four land use categories listed are minor in the context of the available lands of similar uses in the vicinity. PSEG also addresses the proposed causeway in the coastal consistency determination application discussed in Subsection 4.1.1.1. Impacts to land use in the vicinity of the plant as a result of the construction of the proposed causeway are SMALL.

4.1.1.2.2 Transmission Line Corridor

PSEG has identified two off-site transmission corridor alternatives that may be considered in future transmission routing studies in the event a new transmission line is necessary to accommodate grid stability requirement (Subsection 9.4.3). A particular corridor has not been selected, as this is dependent on a variety of factors including the selection of a reactor technology, formal transmission impact studies, and regional transmission planning efforts.

To evaluate potential impacts of an off-site transmission corridor, PSEG performed a geographic information system (GIS) analysis of two macro-corridors to estimate potential land use effects. A tabulation of the existing land use of the two macro-corridor areas (5-mi. wide corridors) within each of the potentially affected counties is provided in Section 2.2. In this section, the potential

impact of the longest corridor is presented based on an assumed transmission line rights-of-way width of 200 feet.

Table 4.1-3 lists the acreage for each of the USGS LULC categories within the hypothetical rights-of-way for the portion of the transmission corridor located within the 6-mi. vicinity of the PSEG Site. Values presented in Table 4.1-3 bound the potential impact to land use for future off-site transmission. Cultivated cropland is the largest land cover type affected within the vicinity by the hypothetical off-site transmission corridor. An estimated 101 ac. is potentially affected based on a 200-ft wide adjusted hypothetical rights-of-way (Subsection 9.4.3). Potential impacts to this land cover type are small as the development of transmission does not preclude continued use of these lands for agricultural production. Other major land uses potentially affected within the vicinity include emergent herbaceous wetlands (100 ac.), woody wetlands (67 ac.), open water (39 ac.), pasture (29 ac.) and deciduous forest (19 ac.). As presented in Table 2.2-2, large land areas are dedicated to these uses within the vicinity (cultivated cropland — 12,808 ac., emergent herbaceous wetlands — 16,379 ac., woody wetlands — 8870 ac., open water (26,733 ac.), pasture — 3533 ac., and deciduous forests — 2455 ac.). Based on the large area of similar lands within the vicinity and the small acreage of land uses affected by transmission, impacts to land use within the vicinity are SMALL.

4.1.2 TRANSMISSION LINES AND OTHER OFF-SITE AREAS

A new transmission line, if required, and off-site soil borrow pits primarily impact regional LULC. Table 2.2-2 lists the LULC in the region, by USGS category. Figure 2.2-4 shows the distribution of LULC in the region. The transmission line and off-site borrow pit impacts to regional LULC are discussed in Subsections 4.1.2.1 and 4.1.2.2.

4.1.2.1 Transmission Corridors

As described in Subsection 4.1.1.2.2, potential effects of transmission on lands within the region (beyond the vicinity) are provided in Table 4.1-3. These values bound the potential impact to land use for future off-site transmission within the region. Regional land use impacts associated with the development of the hypothetical off-site transmission rights-of-way bears similarity to those impacts within the vicinity (Table 4.1-3). As was the case with the land use in the vicinity, cultivated cropland is the largest land cover type affected within the region. An estimated 950 ac. is potentially crossed within the region. Potential impacts to this land use, however, are limited as the development of transmission does not preclude continued use of these lands for agricultural production. Similarly, 277 ac. of pasture hay lands are crossed within the region, but as with cultivated cropland, use of these lands is not expected to be altered by transmission line development. Forested lands (deciduous, evergreen, mixed) collectively account for the second largest land cover type affected (388 ac.). Alteration of these lands results in a permanent impact and change in land use to herbaceous communities. There are 187 ac. of open water crossed by the potential off-site transmission line, which are primarily associated with the crossing of the Delaware River and other large water bodies. Alterations associated with crossing the Delaware River include the placement of transmission tower support structures within the river. New structures are co-located with existing transmission towers in and adjacent to the Delaware River. In addition to potential effects to the above referenced land uses, the potential transmission line may affect 139 ac. of lands currently identified as developed uses (residential, commercial, etc.). Potential effects to all land uses will be reduced and minimized to the extent possible, during route development by locating potential off-site transmission along

existing rights-of-way. However, based on the area of lands potentially affected that were identified in this bounding evaluation, the potential impacts of off-site transmission are MODERATE. Mitigation is not required as the majority of the land uses are not physically affected by the transmission towers, except where towers are directly located.

4.1.2.2 Other Off-Site Areas

Fill materials are required to elevate the site for the new plant. These fill materials come from on-site sources, USACE CDF, and the dredge materials from excavation of the intake and barge facility areas. If additional fill materials are required from off-site sources, it is anticipated that these would come from existing borrow pits. Therefore, no new borrow pits are anticipated, and land-use impacts associated with use of existing borrow pits are SMALL.

4.1.3 HISTORIC PROPERTIES

The Area of Potential Effect (APE) for historic properties related to on-site and near off-site areas is considered to be the permanent and temporary use areas identified in the Site Utilization Plan (Figure 3.1-2) and the right-of-way for the proposed causeway. Additionally, the APE for potential off-site transmission lines corresponds to the 200-ft. right-of-way of the hypothetical off-site corridor.

The following subsections consider this APE as the basis for potential impacts to historic properties for this ESPA. However, the APE will be further refined in consultation with NJ HPO during the design phase to evaluate needs for further investigation and consultation as described below.

4.1.3.1 On-Site Historic Properties

As is described in Subsection 2.5.3, no on-site historic properties are associated with the PSEG Site. The highly disturbed composition of the hydraulic fill that forms Artificial Island coupled with the developed and disturbed historical and current uses of the site preclude the existence of on-site historic properties.

Underwater remote scanning surveys performed at the request of the New Jersey Historic Preservation Office (HPO) have identified several anomalies that may represent potential archaeological sites (possibly boat hulls or other debris) within the vicinity of the area to be dredged for the proposed intake and barge facility. At this time it is not know if these anomalies are archaeological sites or if they are eligible for listing on the National Register of Historic Places (NRHP). As part of ongoing design for the new plant, PSEG will avoid these anomalies and will consult with HPO as appropriate to investigate and assess any unavoidable potential effects to historic resources, as appropriate.

4.1.3.2 Proposed Causeway

Six archaeological sites are identified in the Phase I survey of the proposed causeway corridor (Section 2.5.3). All six sites are recommended as potentially eligible for the NRHP. These sites are multi-component sites containing both prehistoric and historic artifacts. Three of the sites are clearly avoidable. When the specific design for the proposed causeway is completed, Phase II testing and consultation with the HPO will be required for any that cannot be avoided. Impacts

to these archaeological sites are MODERATE, but can be mitigated. A final assessment and any required mitigation are dependent on the outcome of the Phase II testing and HPO consultation.

Additionally, PSEG will consult with HPO regarding the need for additional investigative work during the design phase to evaluate the potential for undiscovered sites that may be associated with buried soils that may underlie the coastal marsh.

4.1.3.3 Transmission Corridors

Based on the results of the transmission macro-corridor analysis described in Subsection 9.4.3, there are a small number of NRHP-listed architectural sites potentially impacted by the 200-ft. wide corridor. PSEG expects that detailed routing studies performed for off-site transmission would successfully avoid listed NRHP sites. As part of normal transmission routing development studies, PSEG conducts Phase I archaeological studies that will identify and evaluate the potential effects of transmission to historic properties. PSEG will investigate historic properties and consult with State Historic Preservation Offices (SHPOs) as appropriate, to avoid and minimize potential impacts to historic properties. Therefore, potential impacts to historic and archaeological resources are SMALL.

4.1.4 REFERENCES

4.1-1 New Jersey Department of Environmental Protection, New Jersey Land Use/Land Cover Update: 2002, Website, http://www.state.nj.us/dep/gis/lulc02cshp.html#top, Trenton, New Jersey, 2004, accessed October 5, 2009.

4.1-2 U.S. Geological Survey (USGS), Land Use/Land Cover, 2001, Website, http://www.mrlc.gov/nlcd.php, accessed October 5, 2009.

Table 4.1-1
Construction-Related Changes in Land Use Within the PSEG Site Property Boundary and Adjacent Off-Site Areas

New Jersey Land Use Category	Total On-Site Area (ac.)	PSEG Site Property		Adjacent Off-Site Areas[a]
		Permanent Use (ac.)	Temporary Use (ac.)	Temporary Use (ac.)
Developed Land Uses				
Altered Lands	14.8	14.8	0	0.7
Industrial	234.5	26.4	5.1	0.0
Other Urban or Built-Up Land	55.8	8.1	9.5	2.4
Phragmites-Dominated Urban Area	0.5	0.5	0.0	0.0
Transportation/Communication/ Utilities	8.5	0.0	0.0	0.0
Upland Rights-of-Way Developed	0.5	0.0	0.2	0.0
Recreation Land	4.9	0.0	4.4	0.0
Upland Rights-of-Way Undeveloped[b]	29.5	0.0	19.6	0.0
Subtotal	**349.0**	**49.8**	**38.8**	**3.1**
Forest/Old Field				
Deciduous Brush/Shrubland	6.0	6.0	0.0	0.0
Old Field (<25 percent Brush Covered)	69.4	2.6	54.3	0.0
Phragmites-Dominated Old Field	31.9	0.1	26.0	0.0
Subtotal	**107.3**	**8.7**	**80.3**	**0.0**
Water				
Artificial Lakes	40.3	40.3	0.0	0.0
Subtotal	**40.3**	**40.3**	**0.0**	**0.0**
Wetland Areas				
Deciduous Scrub/Shrub Wetlands	4.6	4.6	0.0	0.0
Disturbed Wetlands (Modified)	4.3	4.0	0.1	11.8
Herbaceous Wetlands	5.8	0.9	2.5	0.0
Managed Wetland in Maintained Lawn Greenspace	3.8	0.0	2.7	0.0
Phragmites-Dominated Coastal Wetlands	155.6	58.3	5.1[c]	2.1
Phragmites-Dominated Interior Wetlands	118.7	44.1	24.2	27.3
Saline Marsh	0.2	0.1	0.0	0.8
Tidal Rivers, Inland Bays, and Other Tidal Waters	5.6	2.9	0.3	0.1
Wetlands Rights-of-Way	23.8	11.7	5.9	0.0
Subtotal	**322.4**	**126.6**	**40.8**	**42.1**
Total	**819.0**	**225.4**	**159.9**	**45.2**

a) Located in the USACE CDF and includes batch plant, heavy haul road, and construction laydown area.
b) These on-site lands are subject to periodic disturbance by plant activities and are therefore listed as developed lands for the purposes of impact assessment. Note that they are classified as Rights-of-Way Undeveloped in Table 2.2-1 as that is the LULC category nomenclature.
c) Temporary construction impact due to installation of transmission towers.

Reference 4.1-1

Table 4.1-2
Construction-Related Changes in Land Use for the Site Access Road Causeway

New Jersey Land Use Category	Vicinity Total Acres	Total Area Affected: Acres	Total Area Affected: Percent of Total	Percent of Total Vicinity (ac.)	Permanent Use (ac.)	Temporary Use (ac.)
Agriculture						
Cropland and Pastureland		10.9	15.82%	0.07	10.7	0.2
Other Agriculture		0.6	0.87%	0.00	0.6	0.0
Subtotal	*16,341*	*11.5*	*16.69%*	*0.07*	*11.3*	*0.2*
Forest/Old Field						
Deciduous Forest (10-50% Crown Closure)		0.1	0.15%	0.00	0.1	0.0
Old Field (<25% Brush Covered)		3.5	5.08%	0.14	3.4	0.1
Subtotal	*2532*	*3.6*	*5.23%*	*0.14*	*3.5*	*0.1*
Developed Land Uses						
Recreational Land		1.0	1.45%	0.07	0.4	0.6
Residential, Rural, Single Unit		1.0	1.45%	0.07	0.7	0.3
Upland Rights-Of-Way Undeveloped		2.0	2.90%	0.13	2.0	0.0
Subtotal	*1526*	*4.0*	*5.80%*	*0.26*	*3.1*	*0.9*
Water						
Tidal Rivers, Inland Bays, and Other Tidal Waters		4.6	6.68%	0.02	2.4	2.2
Subtotal	*26,732*	*4.6*	*6.68%*	*0.02*	*2.4*	*2.2*
Wetlands						
Agricultural Wetlands (Modified)		0.9	1.31%	0.00	0.9	0.0
Former Agricultural Wetland (Becoming Shrubby, Not Built-Up)		0.2	0.29%	0.00	0.2	0.0
Freshwater Tidal Marshes		12.7	18.43%	0.05	6.1	6.6
Herbaceous Wetlands		1.2	1.74%	0.00	1.2	0.0
Mixed Scrub/Shrub Wetlands (Coniferous Dominated)		0.1	0.15%	0.00	0.1	0.0
Phragmites-Dominated Coastal Wetlands		22.3	32.37%	0.09	11.2	11.1
Phragmites-Dominated Interior Wetlands		6.3	8.99%	0.02	4.4	1.9
Wetlands Rights-Of-Way		1.6	2.32%	0.01	1.1	0.5
Subtotal	*25,249*	*45.3*	*65.61%*	*0.18*	*25.2*	*20.1*
Total	**72,380**	**69.0**	**100.00%**	**0.10**	**45.5**	**23.5**

References 4.1-1 and 4.1-2

Table 4.1-3
Land Use Impacts Associated with Hypothetical Off-Site Transmission Rights-of-Way[b]

Land Use Category[a]	6-Mile Vicinity	6-50+ Mile Region	Total	Percent
Open Water	39	187	226	8.3
Developed - Open Space	2	55	57	2.1
Developed - Low Intensity	2	49	51	1.9
Developed - Medium Intensity	1	23	24	0.9
Developed - High Intensity	2	12	14	0.5
Barren Land	4	27	31	1.1
Deciduous Forest	19	337	356	13.0
Evergreen Forest	1	35	36	1.3
Mixed Forest	0	16	16	0.6
Pasture Hay	29	277	306	11.2
Cultivated Crops	101	950	1051	38.5
Woody Wetlands	67	161	228	8.4
Emergent Herbaceous Wetlands	100	232	332	12.2
Total	**367**	**2361**	**2728**	**100.0**

a) Reference 4.1-2

b) Values are based on a 107-mi. long 200-ft. wide hypothetical rights-of-way as described in Subsection 9.4.3.

4.2 WATER-RELATED IMPACTS

Water-related impacts from the construction of the new plant are similar to those of any other large construction project. Due to the scale of the excavations and extent of land disturbance, large construction projects can impact surface and groundwater systems. These impacts may include:

- Direct physical alteration of local streams and wetlands
- Indirect physical alteration of receiving surface water bodies, especially streams, due to increased runoff volumes and rates during construction or diversions of runoff
- Alteration of surface water quality as a result of erosion and sedimentation or inadvertent discharges of pollutants associated with construction activities
- Changes in groundwater flow patterns from dewatering and soil retention management practices
- Down-gradient groundwater quality changes from spills of fuels and lubricants used in construction equipment
- Increased groundwater use during construction

Because of this potential for affecting surface and groundwater resources, applicants are required to address the potential impacts and obtain a number of permits prior to initiating construction. Section 1.3 provides a list of construction-related consultations and permits that may be required prior to initiating construction activities.

Construction of the new plant at the PSEG Site permanently changes land use in a manner that has the potential to affect hydrology. As described in Section 4.1, 225 ac. of the PSEG Site is permanently converted to developed areas. Based on the Site Utilization Plan (Figure 3.1-2), this includes, 127 ac. of lands mapped as wetland cover type, and 40 ac. of open water areas associated with artificial ponds (Table 4.1-1). *Phragmites*-dominated coastal and interior (non-tidal) wetlands account for 102 ac. of the 127 ac. of wetlands within permanent use areas.. Actual disturbance of these wetland areas will be further refined and minimized during the detailed design phase subsequent to the selection of a reactor technology (Subsection 4.3.1.1.2 for further discussion regarding the impacts to wetlands).

In addition to permanent changes in land use within the PSEG site boundary, construction will also result in temporary changes in land use to 160 ac. within the PSEG property boundary and 45 ac. in adjacent off-site areas (Table 4.1-1).

A summary of land areas potentially impacted by construction of the proposed causeway is provided in Table 4.1-2. A total of 69 ac. of mostly undeveloped land is directly impacted along the access road alignment, including 23.5 ac. that are affected temporarily during construction of the proposed causeway.

The following subsections describe the anticipated construction-related impacts to both surface water and groundwater resources.

4.2.1 HYDROLOGICAL ALTERATIONS

The following construction activities have the potential to impact the hydrology at the PSEG Site:

- Clearing land at the project site and constructing infrastructure such as roads and stormwater conveyance and retention systems
- Raising the plant grade to the 36.9 ft. North American Vertical Datum of 1988 (NAVD) elevation, including filling of 40 ac. of artificial ponds in the PSEG desilting basin and the USACE CDF
- Construction of new buildings and structures (reactor containment structure, turbine building, cooling towers, electrical substation, sub-grade piping and systems), road/rails, parking lots
- Constructing transmission towers
- Constructing cooling water intake and discharge structures on the Delaware River shoreline
- Dredging near-shore areas of the Delaware River for water intake, water discharge, and barge access areas
- Modifying the existing HCGS barge slip
- Temporary disturbance of currently vegetated areas and wetlands for construction lay-down areas, concrete batch plants, sands/gravel stockpiles and construction-phase parking areas
- Dewatering foundation excavations during construction
- Constructing the proposed causeway

4.2.1.1 Surface Water

Surface water is influenced by building and infrastructure construction activities (on-land construction) as well as the dredging required within the Delaware River during construction of the intake and discharge structures. The impacts of these alterations to surface waters are described below.

4.2.1.1.1 Artificial Ponds

The 40 ac. of shallow artificial ponds within the desilting basin and USACE CDF will be filled during construction. Within the proposed power block and cooling tower areas, these existing ponds provide localized retention of rainfall and stormwater runoff. Elimination of these ponds would, therefore, result in an alteration in local surface water flow and retention. However, as described in Section 2.3, under normal conditions these ponds are hydrologically isolated (i.e.,

having no surface water flow connection to surrounding areas). Water losses from the ponds appear to be almost exclusively through lateral groundwater seepage and evaporation. Notably, surface water evident within the USACE CDF is artificially retained within the disposal basin by a water control structure and infrequently released to the receiving marsh creek system during USACE dredge disposal operations. Development of these areas resulting in the loss of the artificial ponds will result in localized runoff that is collected in engineered detention basins, and conveyed to the Delaware River. The Delaware River is extremely large in area. It includes 758.7 sq. mi. of open water and 246.8 sq mi. of adjacent marsh plain area (Table 2.3-8). At River Mile 52, flow capacity is comprised of tidal flow (400,000 to 472,000 cfs) and freshwater inflow (20,240 cfs average)(Table 2.3-8). Therefore, the impact of the loss of stormwater retention within the artificial ponds and the resultant additional runoff to the Delaware River is SMALL. (Reference 4.2-4)

4.2.1.1.2 Land Construction

Site preparation and construction activities will be conducted in accordance with federal, state and local regulations, as appropriate. Necessary permits and authorizations will be obtained and appropriate environmental controls implemented (e.g., stormwater management systems, groundwater monitoring wells, and spill containment controls) prior to commencement of earth disturbing activities. Site preparation, preconstruction, and construction activities affecting land use will include clearing, grubbing, grading, excavating and stockpiling of soils. Soil management is an important element of construction sequencing. Materials excavated from the power block area will be stockpiled and/or disposed of on-site, or otherwise evaluated for reuse / disposal under a beneficial use determination if required under NJDEP regulations. Stockpile areas or dewatering basins constructed on-site will be properly designed and monitored to ensure that runoff from such facilities is managed and controlled.

Permanently disturbed locations will be stabilized and contoured in accordance with design specifications. Revegetation per soil erosion and sediment control and other permit requirements will comply with site maintenance and safety requirements. Methods to stabilize the area and prevent erosion or sedimentation will comply with applicable laws, regulations, permit requirements and good engineering and construction practices. Construction debris will be recycled, reused, or transported off-site to a permitted disposal facility.

The NJDEP requires a New Jersey Pollution Discharge Elimination System (NJPDES) permit for stormwater discharges associated with the construction of the new plant. In addition to the application for a NJPDES permit, a Storm Water Pollution Prevention Plan (SWPPP) will also be prepared following United States Environmental Protection Agency (USEPA) guidance documents (Reference 4.2-6) and the current version of the *New Jersey Stormwater Best Management Practices Manual* (Reference 4.2-2) as necessary.

The construction SWPPP defines best management practices (BMPs) that are employed for erosion and sediment control and prevention of pollutant releases during construction, and details training requirements for the construction workforce. In addition, the SWPPP contains an inspection and monitoring plan for verifying the effectiveness of the implemented BMPs following rainfall events during construction. Construction activities include the development of features that function as permanent stormwater management systems. Such features will be developed in the detailed site design and include permanent grading and drainage features to

manage stormwater runoff from impervious surfaces and undeveloped lands prior to their release to the Delaware River.

To manage surface water discharges from the site, sediment traps and sedimentation basins provide suspended solids removal prior to discharge to surface water bodies. An appropriate set of BMPs, including both structural and non-structural BMPs, will be implemented as required in NJDPES construction activity permits and regulations to reduce erosion and minimize risk of discharges of all pollutants.

For the proposed elevated causeway construction, use of a structure-type roadway reduces both construction impacts and long term impacts. The import and placement of fill soil for a roadway embankment, a principal source of potential sediment, is significantly reduced.

For disturbed areas along the perimeter of the plant construction area, perimeter sediment controls will be used as appropriate. BMPs for perimeter controls include stormwater diversion berms and swales, sediment fences, vegetated filter strips, and other practices for use with small drainage areas. Based on the proper design of soil stockpile areas or dewatering basins constructed on-site, installation and management of stormwater detention systems, and use and maintenance of BMPs, potential impacts to hydrology due to land construction activities is SMALL.

4.2.1.1.3 Coastal Wetland and Marsh Creeks

This subsection provides an assessment of impacts to the hydrology of coastal wetlands and marsh creeks. Additional discussion regarding overall impacts to wetlands is provided in Subsection 4.3.1.1.2.

Surface water features shown in Figure 4.2-1 include tidally influenced stream channels that are part of the coastal marsh that surrounds the developed areas of the PSEG Site. On-site, these hydrographic features have been classified by USGS as “stream” and “canal ditch” based on their size and degree of channelization. Collectively, these features are referred to here as “marsh creeks.” Table 4.2-1 summarizes the lengths of each marsh creek feature impacted by construction activities. Based on the Site Utilization Plan, included on Figure 4.2-1, construction impacts to the existing surface waters include:

- Infilling and eliminating portions of the marsh creeks, including permanent loss of 7265 ft. of creek channels
- Isolation of 2320 ft. of marsh creek channels from their tidal connection
  Crossing of 2123 ft. of marsh creek channels by the proposed causeway

The marsh creek system within the coastal wetlands surrounding the PSEG Site is characterized by a high channel density. Within PSEG’s nearby Alloway Creek Watershed Wetland Restoration Site of 2000 ac., the coastal marsh was inventoried as part of PSEG’s Estuary Enhancement Program (EEP) and was documented to contain a total of 16,343 channels having a total length of 1,105,485 ft. In this context, the permanent loss of marsh creeks due to construction is equivalent to 0.7 percent of the total creek density within the adjacent restoration site alone. Additionally, as described in Section 4.3, wetland mitigation includes the restoration and enhancement of coastal wetlands, which will include the

development of marsh creek channels. Accordingly, the impact of the loss of marsh creek channels due to plant construction is SMALL.

Existing drainage to most of these small systems is cut off by the construction activities to prevent discharge of sediment. Final site design will also permanently remove small contributing drainage areas to these systems. This loss of small headwater area to these channels, and storage area for tidal ebb and flow, will result in a gradual physical change in these open water channels for a short distance from the boundary of the plant area, as runoff and tidal ebb and flow is reduced in the most upstream segments of these channels. This hydrologic alteration will cause localized siltation and physical alteration of these limited stream segments.

Site grading and use of BMPs will control runoff from the construction site. Consequently, potential effects of the discharge of runoff from impervious surfaces and potential fuel or hydraulic fluid spills from construction vehicles are SMALL.

The proposed causeway will be constructed in nearby off-site areas to provide access to the PSEG Site. The proposed causeway’s route extends in a northeasterly direction from the site and connects the new plant site to local roads in Elsinboro Township. The proposed causeway is conceptually designed as an elevated structure, and as such preserves many of the hydrologic connections between the braided creek channels in the wetland system. Consequently, while the proposed causeway alignment crosses additional stream features (Figure 4.2-1), these systems will be subject to impacts from pier placement. Temporary impacts will include sediment runoff. Construction of the causeway uses temporary work mats that typically result in some soil compaction and localized alteration of hydrologic patterns within the coastal wetland. Removal of the mats following construction coupled with restoration of the work area will enhance reestablishment of local hydrologic flow.

The environmental protection measures for the on-site and off-site marsh creeks will be developed and implemented over the timeframe covering causeway construction. Construction BMPs used during the construction of the proposed causeway will minimize impacts to these stream segments. Thus, impacts to surface water hydrology within and along the access causeway corridor are SMALL and temporary.

4.2.1.1.4 Delaware River

Alteration of surface waters within the Delaware River include those associated with the development of shoreline features (intake structure, barge facility, heavy haul road), and dredging (Figure 3.1-2). Constructed features along the Delaware River shoreline require the filling of 9.5 ac. of coastal wetlands and shallow open water areas (Subsection 4.3.2.3). Construction of these facilities includes the installation of sheet piling, bulkheads, and backfilling to create the constructed project utilization area. Shorelines will be stabilized and protected from erosion by the use of hardened bank applications (concrete, riprap, etc.). Consequently, in consideration of the small area of river to be modified relative to the size of the Delaware River, and based on the use of hardened bank treatments that minimize shoreline erosion, potential construction related impacts to the Delaware River are SMALL, but warrant mitigation in accordance with the NJDEP and USACE requirements.

Sediments from the near-shore area of the Delaware River Estuary will be dredged to provide for water intake and discharge and to provide adequate draft for barge access during

construction. Construction of the new barge unloading facility and mooring area will require lowering of the river bottom an average of 4.5 ft. over an area of 61 ac. (dredging of 440,000 cubic yards of sediment). Barge mooring caissons will be constructed. Each caisson is 20 ft. in diameter resulting in the loss of 0.05 ac. of river bottom habitat for seven caissons. Construction of the new intake structure requires lowering the river bottom an average of 4.5 ft. over an area of 31-ac. (dredging of 150,000 cubic yards of sediment).

The total area to be dredged is 92 ac., extending riverward 1700 ft. from the shoreline, or 13 percent of the 2.5-mi. river width at this location. Dredging may include both mechanical and hydraulic dredging methods. Dredged material removed as part of this construction activity will be transported to and placed in an on-site or other approved upland disposal facility. The potential impacts of the dredging activities on water quality are described in Subsection 4.2.3.1. Potential impacts to benthic organisms are discussed in Section 4.3. BMPs for dredging implemented during this activity will comply with requirements of the USACE Section 10/404 and NJDEP permits. Hydrologic alterations associated with this activity include localized changes in flow patterns along the river bottom due to differences in bottom contours at the edges of the dredge zone. From a river flow cross section perspective, the dredged area for barge access would add a total of 7500 square feet (sq. ft.) to an existing cross section of 220,000 sq. ft. (low water) to 270,000 sq. ft. (high water), or a localized increase in flow area that is in the range of 2.5 to 3.5 percent. Accordingly, the average velocity within the dredged area is reduced in proportion to the increase in cross sectional area. However, these small scale alterations in river flow are minimal in the context of the large size of the Delaware River and regular tidal flows. In consideration of the magnitude of the tidal flow and the size of the Delaware River, potential impacts associated with dredging are SMALL.

The Delaware River is brackish to well upstream of the PSEG Site, and therefore, surface water use is limited as described in Section 2.3. There are no other water users in close proximity to the PSEG Site. Construction activities associated with the new plant are not expected to withdraw surface water from either the Delaware River or other local surface waters that would impact any other potential water withdrawals. Any water-borne pollutants released from the surface water runoff controls for the construction site or resulting from aquatic dredging activities are expected to be minor and temporary with regard to any potential users.

4.2.1.1.5 Floodplains

As is described in Subsection 2.3.1, riverine flood conditions are not a primary flooding concern at the PSEG Site because the flow conveyance capacity of the estuary at this location is large compared to riverine generated flow rates. Tidal storm surges generate higher water levels at the PSEG Site than do rainfall runoff events from the watershed. In accordance with the requirements of Executive Order 11988 (Floodplain Management) the potential impact to the area inundated by the 1 percent annual risk flood (100-year [yr] flood) was evaluated. Based on the site utilization areas and as illustrated in Figure 4.2-2, the total on-site and adjacent off-site floodplain area to be potentially altered by the placement of fill material is 152 ac. Lands subject to the placement of fill material will result in a minor reduction in the available flood storage in the vicinity. A grading plan for the site has not been developed. As the volume of storage displaced is minimal, and the primary flooding concern is generated by tidal storm surge (i.e., water pushed upstream from the coast) there is no adverse impact or loss of storage and floodplain conveyance. Finally, because of the availability of large areas within the vicinity that

are low-lying and functional as floodplains, the potential impact of such alteration is SMALL and does not warrant mitigation.

4.2.1.2 Groundwater

Potential construction phase hydraulic alterations to groundwater include those associated with dewatering and the increase in groundwater withdrawal to support construction activities. Potential impacts from dewatering are discussed below, whereas effects of potential increases in groundwater withdrawal are discussed in Subsection 4.2.2. The use of groundwater for the new plant operations is discussed in Section 5.2.

4.2.1.2.1 General Hydrogeological Setting

A description of the shallow hydrogeology below the new plant location is provided in Section 2.3. In general, the site is underlain by four primary water bearing zones beneath the hydraulic fill. Each water bearing zone is listed below in order of shallow to deeper:

- Alluvium
- Vincentown Aquifer
- Mount Laurel-Wenonah Aquifer
- Potomac-Raritan-Magothy (PRM) Aquifer

The two upper most aquifers, the Alluvium and Vincentown aquifer, are both saline and are of generally poor water quality (for drinking water) at the PSEG Site. The Alluvium is encountered at 30 to 40 ft. below ground surface (bgs), directly below the hydraulic fill that comprises most of Artificial Island shallow soils and have an average thickness of 13 feet. The Vincentown Formation, the next encountered aquifer, is 70 to 100 ft. thick. The Alluvium and the Vincentown Formation are generally separated by the Kirkwood aquitard; however, based on the borings that were completed to support the early site permit application (ESPA), the Kirkwood aquitard is not consistently encountered at the new plant location. Groundwater data from observations wells installed in both the Alluvium and the Vincentown Aquifer are presented in Subsection 2.3.3.

The two lower aquifers are of better water quality and have been used to support potable water withdrawals. The Mount Laurel-Wenonah aquifer is separated from the Vincentown aquifer by the Navesink-Hornerstown confining unit. The Mount Laurel-Wenonah aquifer has been used to supply water to the HCGS and SGS.

The PRM is of high quality and currently supplies the freshwater demand for HCGS and SGS. Additional discussions on previous modeling efforts as well as permitted allotments are discussed below.

4.2.1.2.2 Hydrogeological Alterations to Support Construction

Dewatering is required to support construction of the nuclear island, as well as other safety-related structures. Dewatering activities in the Alluvium, Kirkwood, and Vincentown Formations are not expected to impact local water well users. Most local wells are installed in the underlying Mount Laurel-Wenonah and PRM aquifers, and as discussed in Section 2.3, nearby wells are

located at a distance from the new plant that are beyond the zone of influence of the dewatering system.

To better understand the potential impacts from dewatering on adjacent surface waters and nearby wells, a shallow groundwater model was constructed using site-specific data. The MODFLOW computer model is used to simulate impacts from dewatering in the shallow water bearing zones. The model simulated the potential impacts to the hydraulic fills, Alluvium, Kirkwood Formation, and Vincentown Formation as well as allowing for vertical upwelling or flow from the underlying Navesink-Hornerstown Aquitard. The dewatering of the power block area occurs within a limited area (70 ac.) and for a reasonably short time period. The model was calibrated to assess steady state conditions after 365 days of dewatering as additional dewatering durations after one year do not significantly change the zone of influence. Based on groundwater modeling of the dewatering activity, the shallow water bearing zones will be depressed approximately 30 ft. at the excavation site perimeter, and approximately 0.5 ft. at the PSEG Site boundary. Zones that are slightly affected by dewatering include the alluvial deposits that underlie the hydraulic fills, as well as the deeper lower Hornerstown and Vincentown aquifers. A more detailed discussion of the MODFLOW model and the application to the dewatering simulation is provided in the SSAR Subsection 2.4.12.

As discussed in Subsection 2.3.1, the shallow hydraulic fills act as an aquitard. Consequently, the surface waters (surrounding coastal wetlands) in the vicinity of the PSEG Site are perched and not in direct hydraulic communication with the more transmissive underlying units. Accordingly, localized dewatering of the adjoining area of coastal wetlands is not anticipated. Furthermore, should some influence of dewatering be expressed in hydrologic drawdown within wetlands, it is expected that the effect would be minor and offset by recharging of these systems by twice daily tidal recharge.

Other potential effects associated with the dewatering of the power block area pertain to the release of the excess water to adjoining water bodies. Groundwater pumped from dewatering wells installed within the construction areas is discharged directly to surface water (Delaware River). Water withdrawn from open surface excavations is pumped to an on-site settling basin before discharge through a permitted NJPDES outfall. PSEG will develop BMPs for soil and erosion control as required by applicable federal and state permits and regulations.

Once dewatering is no longer needed, the water table is expected to return to static conditions. Dewatering is not anticipated to create subsidence in adjoining areas. Impacts from the dewatering of the excavation are SMALL.

4.2.1.3 Transmission Corridors

4.2.1.3.1 Surface Water

PSEG identified two off-site transmission corridor alternatives that may be considered in future transmission routing studies in the event an additional transmission line is needed for grid stability (Subsection 9.4.3). A particular corridor has not been selected, as this is dependent on a variety of factors including the selection of a reactor technology, formal transmission impact analyses, and regional transmission planning efforts.

To evaluate potential impacts of an off-site transmission corridor, PSEG performed a GIS analysis of two macro-corridors to estimate potential environmental effects. In this subsection, the potential impact of the longest corridor is presented based on an assumed transmission line rights-of-way width of 200 ft. With regard to the streams crossed by the potential macro-corridors, the stream classifications are represented as channelized waterway, intermittent stream, and perennial stream. Based on a 200-ft. wide hypothetical rights-of-way, the macro-corridor will cross a total of 14.6 mi. of streams. Of that total, 5.4 mi. are channelized waterways, 1.1 mi. are intermittent streams, and 8.1 mi. are perennial streams. Most surface water features (streams, channels, ponds, etc.) are avoided or spanned during route development and design. Consequently, potential impacts to these aquatic habitats are SMALL.

The potential new off-site transmission line will cross the Delaware River, parallel to the existing 500 kV transmission line (Figure 2.2-6). Work in the Delaware River associated with construction of the footings for the transmission towers will employ many of the same BMPs that will be used to protect the aquatic ecosystem during construction of the barge and circulating water intake (CWIS) structures. The footings for the towers result in some loss of river bottom habitat, but this loss is small compared to the available habitat in the river. Agency coordination to consider potential impacts to listed species in the Delaware River will be initiated when the exact route for a new transmission corridor is determined. Any aquatic impacts associated with the construction of the tower footings in the Delaware River are SMALL.

The macro-corridor studied by PSEG crosses several intermittent and perennial streams. Because the off-site transmission of electricity is anticipated to consist of elevated lines, impacts will occur only within the footprint required for support structures and where access roads may be necessary for construction or maintenance. It is anticipated that most support structures will be sited in upland areas outside of stream channels thus avoiding stream impacts. Furthermore, access roads will be located to avoid and/or minimize impacts to streams. Construction impacts associated with these potential transmission line crossings are associated with clearing activities and potential runoff and sedimentation. PSEG has developed procedures and BMPs to protect aquatic communities and prevent degradation of water quality as part of its program to maintain existing transmission corridors. Additionally, construction permits specific to any new transmission line, will include ecological protection provisions. With the implementation of these measures, impacts to aquatic ecosystems associated with construction of the new transmission line are SMALL and of short duration. Subsection 4.3.2.6 provides further discussion of the potential effects of off-site transmission on aquatic ecosystems.

4.2.1.3.2 Floodplains

Based on the results of the transmission macro-corridor analysis, the hypothetical rights-of-way cross up to 1026 ac. of floodplains. However, most floodplains will be unaffected by the transmission line except in the limited footprints of transmission towers and any necessary access points. Therefore, impacts to floodplains from off-site transmission are SMALL.

4.2.2 WATER USE

This subsection presents an evaluation of the use of surface water from the Delaware River and groundwater during the construction phase of the project. Water use impacts are assessed with respect to the additional water needs, as well as the potential impacts from proposed dewatering.

4.2.2.1 Surface Water

Because of the brackish nature of the water within the Delaware River at the PSEG Site, there are no current plans to use surface water during the construction phase of the project. Relatively small amounts of water from the stormwater retention ponds may be used for dust suppression. Potential effects of water use from these retention ponds are SMALL.

4.2.2.2 Groundwater

There are six production wells (including two backup wells) at HCGS and SGS that provide sufficient volumes for sanitary and potable water, as well as makeup water for the demineralization system (Reference 4.2-3). The installation details, as well as the maximum permitted pumping rates for these existing HCGS and SGS wells, are described further in Section 2.3. Two additional groundwater withdrawal wells have been conceptually designed for the PSEG Site.

Potential effects of groundwater withdrawal during construction can be evaluated by considering two primary causative activities: (1) water removed for dewatering to facilitate power block construction, and (2) water needed for typical construction support (including concrete batch plant supply and dust suppression).

4.2.2.2.1 Dewatering

Excavation for the nuclear island foundation will extend to approximate elevation -67 ft. NAVD (into the top of the Vincentown Formation). Dewatering systems will be used to remove groundwater from the shallow water bearing zones in the alluvial riverbed deposits, the Kirkwood aquitard and the Vincentown Aquifer.

Groundwater modeling was completed to evaluate the zone of influence caused by dewatering during construction. This effort was conducted using site-specific data collected as part of this ESPA project. As discussed above in Subsection 4.2.1.2.2, the modeling efforts were completed to assess the potential impacts of dewatering on existing safety related structures, and also to assess potential impacts to the adjacent wetlands and surface waters.

Projected groundwater flow and piezometric contours for the hydraulic fill and Alluvium are shown on Figures 4.2-3 and 4.2-4, respectively. Based on the existing information on hydrologic conditions in the vicinity of the PSEG Site, and as predicted in the groundwater model, water use impacts from construction dewatering are SMALL and not warrant mitigation. Construction of the new plant will take several years to complete. The model was run for a projected 365 days to show the impact of sustained pumping. Based on these simulations, there is little to no impact on the adjacent surface waters as they are perched on top of the hydraulic fills and are also tidally recharged. The dewatering systems have no impact on the deeper Mount Laurel-Wenonah and PRM aquifers.

As discussed in Subsection 2.3.1, the shallow hydraulic fills act as an aquitard. Consequently, the surface waters (surrounding coastal wetlands) in the vicinity of the PSEG Site are perched and not in direct hydraulic communication with the more transmissive underlying units. Accordingly, localized dewatering of the adjoining area of coastal wetlands is not anticipated. Furthermore, should some influence of dewatering be expressed in hydrologic drawdown within

wetlands, the impact is SMALL and offset by recharging of these systems by twice daily tidal recharge.

While any modeling exercise is subject to some uncertainty, estimates of dewatering and construction effects are examined using a sensitivity analysis. As anticipated, higher initial dewatering pumping rates could be sustained from aquifer storage. As dewatering proceeds, sustainable pumping rates may decline and less water is derived from storage. The extent of the dewatering influence reaches a near steady-state condition, especially in the Vincentown aquifer where it becomes unconfined (water level or pressure drops below the upper confining layer). During the simulation of dewatering, estimates of water provided by storage in the Vincentown had dropped below 7 percent of pumpage at one year simulation time, indicating an approach to the extent of the dewatering influence, and validating the conclusion that impacts to the aquifer beyond that time frame are small. As indicated above, should some concern exist for dewatering based on the selected technology and the revised model, dewatering schemes developed during the COLA stage, such as injection to create hydraulic barriers, could be implemented to further reduce any potential adverse effects.

4.2.2.2.2 Construction Support

Water use requirements for construction of a nuclear plant are similar to those for other large industrial construction projects. Water is required for typical construction uses such as dust suppression and concrete mixing. As noted in Section 2.3, there are four production wells that draw water from the PRM aquifer. The two backup wells are screened within the Mount Laurel-Wenonah aquifer.

The amount of water needed to support new plant construction was estimated using the historical water use during the construction of the existing plants. The new plant will use 119 gallons per minute (gpm) of groundwater to support concrete batch plant operations, dust suppression, and potable use. The existing water supply system currently provides 379 gpm to support HCGS and SGS operations. The existing water allocation permits allow for an additional withdrawal of sufficient capacity to provide the groundwater needed to support the new plant construction.

For longer term impacts from extended construction periods, additional data to assess if the deeper aquifers can support the additional withdrawal was taken from the previous modeling efforts conducted by Dames & Moore (Reference 4.2-1). To support the water allocation permits, as well as to understand the potential impacts of saline intrusion on the Mount Laurel-Wenonah and PRM aquifers, the Princeton Transport Code model was used to run simulations at different rates.

Dames and Moore simulated continued water withdrawals (at the 1987 rates [i.e., a total of 736 gpm average]) for the period of 1987 – 2007. The Dames & Moore model results are pertinent to the evaluation of future use of potential groundwater supplies and the risk of salt-water intrusion into the aquifers. In additional simulations, the withdrawals from the Mount Laurel-Wenonah wells and from PW-6 in the Middle PRM were discontinued and a hypothetical well, PW-7 in the Magothy Sand, was added in conjunction with increases at wells HC-1 and HC-2, for a total increase in flow rate to 875 gpm. The final simulation held the same withdrawal rate with a different well configuration. The final simulation configuration (PW-5 at 200 gpm, HC-1 and HC-2 at 268 gpm each, and hypothetical PW-7 at 139 gpm) provided adequate supply

with appropriately limited drawdown and without any significant increases in chloride level at the production wells. Note that the total withdrawal simulated in the increased demand scenario (875 gpm) is considerably more than the current total of 369 gpm (average demand of HC-1, HC-2 and PW-5 over 2002 to 2009), although the distribution of rates among wells is different than currently used. Pumping rates in this simulation were greater than the total groundwater use projected during construction (498 gpm).

Based on the maximum permitted withdrawal, the sufficiency of the excess capacity, and the historic modeling efforts conducted in support of water allocation permits, the groundwater use impacts to support the construction activities (and long term operation) are SMALL (References 4.2-1 and 4.2-3).

4.2.3 WATER QUALITY IMPACTS

Impacts to water quality may occur as the result of construction activities. These include:

- Soil erosion and sediment transport due to land disturbance during construction
- Increase in stormwater discharge, or modification to stormwater flow paths
- Increases in suspended sediment within the Delaware River
- Changes in physical parameters such as dissolved oxygen, temperature, or pH

Water quality of surface water and groundwater at the PSEG Site is presented in Subsection 2.3.3. The following subsections discuss the potential effects to surface water and groundwater quality from the construction of the new plant.

4.2.3.1 Surface Water Quality

Potential impacts to the quality of stormwater runoff, and therefore receiving waters, can occur as the result of soil erosion due to vegetative clearing and land disturbance during construction. Additionally, inadvertent discharges of materials present on construction sites, such as petroleum products associated with construction equipment, and other construction materials stored and used on the site, may occur. Finally, changes in runoff volumes may alter the transport capacity of and potential pollutant loading.

The total area affected by construction of the new plant and the proposed causeway are summarized in Tables 4.1-1 and 4.1-2. Surface water impacts are regulated by NJDEP, Delaware River Basin Commission (DRBC), and the USACE. Land disturbance activities will require permitting by the NJDEP. Because the area anticipated to be disturbed by construction of the new plant and supporting infrastructure is more than 1 ac., PSEG is required to:

- Obtain an NJPDES permit for stormwater discharges from construction activity

- Develop a SWPPP that defines BMPs, including structural measures (e.g. erosion control practices and sedimentation basins) and non-structural measures to minimize discharge of pollutants, including sediment, from the site in stormwater runoff

- Obtain wetland permits from NJDEP

Additionally, Section 10/404 permits will be required from the USACE and Section 401 water quality certifications from NJDEP for dredging and filling activities in wetlands and other jurisdictional waters. Forty acres of shallow artificial ponds will be filled as they are located within the footprint of the new plant. Mapped and unmapped coastal wetlands are also subject to permitting by the USACE and NJDEP. Mitigation is described in Section 4.3. Storage volume for stormwater runoff retention from the construction area will be designed to minimize impacts and potential effects on water quality. The Delaware River and adjoining coastal marsh systems are the most significant natural water bodies potentially affected by construction activities at the PSEG Site. The tidal marsh area north of the site, which includes several small open water channels at the northern site boundary, is also impacted during construction.

As discussed in Subsection 4.1.1, the proposed causeway extends from the new plant north to Money Island and Mason Point Roads in Elsinboro Township, NJ. Construction of the elevated roadway will cross segments of tidal marsh and tidal streams. Construction activities within the tidal marsh segments include placement of support pilings, fill placement, and grading. A total of 54 ac. of wetlands east of the new plant are impacted by construction of the two required switchyards for the new plant (Table 4.3-3).

Dredging will be required within the Delaware River during construction of the water intake, discharge structures, and barge facilities. In addition, improvements to the existing barge slip will also require dredging to provide adequate water depth for access by barges during construction. Dredge materials are hydraulically or mechanically removed and transported to an on-site, or licensed upland location for disposal. Based on the findings of the USACE's Delaware River main channel deepening project Environmental Assessment, dredging is not expected to result in degradation of water quality (Reference 4.2-5).

There will be construction activities along the river shoreline for the barge facilities and heavy haul paths. Excavation and other construction activities may disturb shoreline sediments and soils, which could increase turbidity in the immediate area. Appropriate silt curtains or coffer dams to limit the mixing and transport of suspended sediments will be used in accordance with applicable permits. Dredging and shoreline construction activities require Section 10/404 permits from the USACE and NJDEP.

In summary, construction activities are permitted and regulated by NJDEP, USACE, and other regulatory agencies (Table 1.3-2). BMPs and engineering controls will be developed to control pollutant loading and minimize impacts to jurisdictional waters. Drainage from the construction site will be managed using detention basins, and site grading to avoid discharge of stormwater to the adjacent coastal marsh. As described in Subsection 2.3.2, other than the HCGS and SGS, there are no other water users near the PSEG Site that may be adversely affected by alterations in water quality. Therefore, potential impacts to surface water during the construction phase are SMALL and do not warrant additional protective measures or mitigation beyond the BMPs required by state and federal permits.

4.2.3.2 Groundwater Quality

As noted above, the construction phase hydraulic alterations to groundwater include dewatering, potential pollutant releases, and the discharge of groundwater to adjacent surface water bodies. Potential impacts on water quality from dewatering and construction are discussed below.

Dewatering of the power block area occurs within a limited area and during the duration of the construction of the below grade nuclear island structures and foundations. Based on groundwater modeling of the dewatering, it is projected that the shallow water bearing zones are depressed approximately 30 ft. near the excavation site perimeter, and approximately 0.5 ft. at the PSEG Site boundary. Zones that are slightly affected by dewatering include the alluvial river bed deposits that underlie the hydraulic fills, as well as the deeper lower Hornerstown and Vincentown aquifers. This dewatering will alter the groundwater flow patterns but it is not anticipated to alter groundwater quality, as the two upper water bearing zones, the Alluvium and the Vincentown Formation, are in hydraulic communication with the Delaware River and are too saline to be used as a potable water source in the vicinity of the PSEG Site.

Other potential effects associated with the dewatering of the power block area pertain to the release of the excess water to adjoining water bodies. Groundwater pumped from dewatering wells installed within the construction areas will be discharged directly to surface water (Delaware River). Water withdrawn from an open excavation is planned to be pumped to an on-site settling basin before discharge through a permitted NJPDES outfall. PSEG will implement BMPs for soil and erosion control as required by applicable federal and state laws and regulations.

Once dewatering is no longer needed, the water table is expected to return to static conditions. Dewatering is not anticipated to create subsidence for adjoining structures or areas. Water quality impacts from the dewatering of the excavation are SMALL.

During construction, gasoline, diesel fuel, hydraulic lubricants, and other similar products are used for construction equipment. BMPs will be employed during construction to minimize potential discharges to the environment. NJDEP requires that chemical discharges to the soils and groundwater be reported and subsequently remediated to prevent impacts to groundwater quality. Based on NJDEP reporting and remediation requirements and BMPs, chemical impacts to groundwater quality are SMALL.

4.2.4 REFERENCES

4.2-1 Dames & Moore, Final Report Study of Groundwater Conditions and Future Water-Supply Alternatives Salem/Hope Creek Generating Station, Artificial Island, Salem County, New Jersey, PSEG, July 15, 1988.

4.2-2 New Jersey Department of Environmental Protection, Division of Watershed Management, *New Jersey Stormwater Best Management Practices Manual*, Available at www.njstormwater.org, April 2004, Revised September 2009.

4.2-3 New Jersey Department of Environmental Protection, *Water Allocation Permit WAP040001*, Program Interest ID 2216P, 2001.

4.2-4 U.S. Army Corps of Engineers, *Delaware River Main Channel Deepening Project Design Memorandum*, Philadelphia District, Philadelphia, Pennsylvania, p. 55 – 60, 1996.

4.2-5 U.S. Army Corps of Engineers, *Delaware River Main Stem and Channel Deepening Project*, *Environmental Assessment.* Philadelphia, PA., 2009.

4.2-6 U.S. Environmental Protection Agency, *Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices*, Office of Water, Washington, DC, September, 1992,

Table 4.2-1
Impacted Length of Surface Water Channels

	Flowline Type[a]	Length Impacted (ft.)	Duration of Impact
On-site Areas (Direct)			
Cooling Tower (CT01)	Canal Ditch	1280	Permanent
Cooling Tower (CT01)	Stream	1187	Permanent
Power Block (PB01)	Canal Ditch	1335	Permanent
Switchyard 1 (SY01)	Canal Ditch	901	Permanent
Switchyard 2 (SY02)	Canal Ditch	1396	Permanent
Switchyard 2 (SY02)	Stream	848	Permanent
Causeway Area 1 (CW01)	Stream	30	Permanent
Temporary Laydown Area 4 (TL04)	Canal Ditch	288	Permanent
Subtotal		**7265**	
On-site Areas (Indirect) [b]	Canal Ditch	2320	Permanent
Off-Site Areas			
Proposed Causeway	Stream/Artificial Path	2123	Permanent[c]

a) Flowline type designations from the USGS GeoDatabase. Canal Ditch and Stream are considered marsh creeks, which are included in the NJDEP-mapped coastal wetlands. As such, impacts to marsh creeks are included in the coastal wetland impacts in Table 4.3-3.
b) Indirect effects associated with isolation of stream channels and loss of connectivity to tidal exchange
c) Actual impacts will be substantially reduced and limited to pier placement only. Stream channels will be avoided during final design.

4.3 ECOLOGICAL IMPACTS

Preconstruction activities at the PSEG Site begin with site mobilization, including the construction of the causeway, barge facility, laydown areas, heavy haul road, and temporary utility supply systems. This preconstruction/site mobilization phase continues for 1 to 3 yr. During this time period, most of the impacts to the on-site terrestrial habitats, wetlands, marsh creeks, and artificial ponds occur, as described below. Construction phase impacts occur over approximately 5 yr. and include site excavation and the construction of safety-related structures.

4.3.1 TERRESTRIAL ECOSYSTEMS

This subsection describes the impacts of preconstruction and construction on the terrestrial ecosystem. The terrestrial ecology of the PSEG Site and 6-mi. vicinity, including the proposed causeway, is characterized using historical data collected by PSEG, recorded information from resource agencies, and supplemental field survey conducted in 2009-2010 (Subsection 2.4.1).

This subsection describes the potential terrestrial impacts to the PSEG Site and off-site areas and is based on the Site Utilization Plan (Figure 3.1-2). Areas identified in Figure 3.1-2 include the power block, cooling tower, concrete batch plant, intake structure, switchyard, heavy haul road, temporary laydown areas, parking areas, and proposed causeway. As described in Subsection 3.1.2, these areas were developed using information for each of the four reactor technologies considered for the PSEG Site. As such, the limits of the site utilization areas represent a bounded configuration of the lands potentially affected by construction of the new plant. Actual limits of disturbance of these utilization areas (particularly wetlands and jurisdictional streams) are further minimized during the design phase, subsequent to the selection of a reactor technology.

The majority of the PSEG Site was developed to support the construction of HCGS and SGS beginning in 1968. The prior disturbances have resulted in the various land forms presently on the site. There are limited areas where prior construction activities did not alter the landforms, primarily in the northeastern portions of the site.

Construction requires permanent or temporary disturbance to 431 ac. on the PSEG Site and adjacent off-site areas as presented in Figure 4.3-1 and Table 4.3-1. As stated above, most of the areas on the PSEG Site have been previously disturbed from the construction of HCGS and SGS. Construction activities that impact terrestrial ecosystems include clearing and grubbing activities, site grading of upland areas, excavation, and filling of various site areas to achieve design grades.

A total of 225 ac. of the affected terrestrial habitat are permanently converted to structures, pavement, or other intensively maintained exterior grounds. Notably, a portion of the PSEG Site and vicinity are located in active land disposal areas. This includes the CDF that is used by the USACE for placement of dredge material from the Delaware River. In addition, the permitted disposal facility on the PSEG Site is used for disposal of materials dredged from the intake structures of HCGS and SGS.

As indicated in Table 4.3-1, a total of 205 ac. of impacts are considered temporary. A total of 160 ac. of the lands subject to temporary impacts are associated with on-site areas, whereas 45 ac. of lands temporarily affected during construction are associated with adjacent off-site areas.

The site utilization footprint is designed to minimize impacts to terrestrial and wetland ecosystems and any important species as described in Subsection 2.4.1. Preconstruction activities commence after the appropriate permits are acquired to start clearing and grading the site. Other projects in the region that potentially affect important species are discussed in Section 2.8, and the cumulative impacts of the new plant are discussed in Section 10.5.

4.3.1.1 Plant Communities

Figure 2.4-2 establishes the baseline of plant communities potentially affected by construction. Land cover data from the NJDEP was used to identify land cover types at the PSEG Site and within the off-site areas potentially affected by the proposed causeway. In contrast, USGS LULC was used to assess potential effects of any off-site transmission corridor construction in the 6-mi vicinity and the region (Subsection 4.3.1.7).

Potential impacts to land cover and the associated plant communities were assessed by evaluating the effects of site construction as presented in the Site Utilization Plan (Figure 3.1-2). Figure 4.3-1 presents the site utilization areas overlaid on the LULC map for the site and nearby off-site areas. Table 4.3-1 presents a tabulation of the land cover types that are affected by site development.

Erosion control devices are installed around the perimeter of the construction footprint to reduce the potential for sediment mobilization and transport into surrounding wetlands. Detailed specifications for erosion control and soil conservation measures are defined in a soil erosion and sediment control plan developed in association with the site-specific construction plan. Monitoring of stormwater effluents during construction is performed in accordance with the land use permits, NJPDES permit or other applicable permits obtained for construction.

Plant communities within this area represent terrestrial habitat types and are grouped into the four general habitat categories (Developed Land Uses, Wetlands, Forest/Old Field, and Agriculture) that are discussed below. Water is a LULC category that is described further in Subsection 4.3.2.

4.3.1.1.1 Developed Land Uses

Land cover types that are generally maintained to support human activities may be collectively grouped as developed land uses. NJDEP LULC cover types that may be included in this category include the following:

- Altered lands
- Industrial
- Other urban or built-up land
- *Phragmites*-dominated urban area
- Recreational land
- Transportation/communication/utilities
- Upland rights-of-way developed
- Residential, rural, single unit
- Upland rights-of way undeveloped

Developed lands occupy 349 ac. within the PSEG Site (Table 4.3-1). Industrial land cover attributable to the operational uses of SGS and HCGS represents a majority (235 ac.) of the developed land uses on-site. These land cover types are concentrated in the western portion of the site and include paved roads, parking lots, buildings, and an unused recreational area that is an abandoned ball field. A total of 50 ac. of this habitat type are permanently impacted and 39

ac. are temporarily impacted by construction related activities (Table 4.3-1). An additional 3.1 ac. of developed lands are permanently impacted by construction of the causeway bridge and site access areas (Table 4.3-2).

These developed land areas are highly disturbed and degraded, the potential impacts to this land cover type are SMALL.

4.3.1.1.2 Wetlands

Wetlands plant communities on-site and in the vicinity are variably represented by artificial wetlands within CDFs, disturbed wetlands, degraded coastal marsh communities, freshwater tidal wetlands, and coastal salt marsh. As described in Section 2.4.1.3, jurisdictional wetlands are often more narrowly defined relative to wetlands identified as part of NJDEP's LULC classification system. Subsection 4.3.1.4 provides a discussion of impacts to jurisdictional wetlands. Wetlands and waters include the following land cover types as depicted in Figure 4.3-1:

- Deciduous scrub/shrub wetlands
- Mixed Scrub/shrub wetlands (coniferous dominated)
- Disturbed wetlands (modified)
- Herbaceous wetlands
- Managed wetlands in maintained lawn greenspace
- *Phragmites*-dominated interior wetlands
- *Phragmites*-dominated coastal wetlands
- Saline marsh
- Freshwater tidal marshes
- Wetland rights-of-way
- Agricultural wetlands (modified)
- Former agricultural wetlands
- Tidal rivers, inland bays, and other tidal waters
- Artificial lakes

Wetlands and other aquatic habitats are principally found in the extreme eastern and northern portions of the PSEG Site. A total of 127.4 ac. of this habitat type are permanently impacted by on-site construction activities and 83 ac. are temporarily impacted by construction related activities within on-site areas and in adjacent off-site areas (USACE CDF lands, Table 4.3-1). Most wetlands are represented by *Phragmites*-dominated plant communities consisting of near-monocultures of common reed (*Phragmites australis*). As described in Subsection 2.4.1, *Phragmites* is an aggressive wetland invader forming dense monotypic plant communities that reduce wetland diversity and habitat quality for resident wildlife. Conversely, *Phragmites*-dominated areas may provide marginal habitat when its stands are interspersed with open water or other vegetation, which is generally not the case for the PSEG Site.

A network of marsh creeks, *Phragmites*-dominated coastal wetlands, and restored coastal salt marsh comprise the majority of the proposed causeway route (Subsection 2.4.1). A total of 25.1 ac. of off-site wetland habitat are permanently impacted by construction of the causeway bridge and site access areas (Table 4.3-2). Potential impacts to plant communities due to causeway construction will be minimized as this access road is designed as an elevated structure.

Permanent impacts to these plant communities are therefore limited to placement of piers within wetlands and direct shading. Direct shading potentially results in some alteration of plant communities under the bridge and a reduction in primary productivity. The construction methodology for the proposed causeway has not yet been determined, but construction work mats are expected to be used within a 50-ft. wide easement. Therefore, additional temporary impacts to 20.1 ac. of similar wetland plant communities occur during construction (Table 4.3-2). Impacts to wetland plant communities consist of plant damage, compaction of wetland soils and short-term reductions in productivity. Such reductions in primary productivity are small considering the large area of adjacent coastal wetlands within the project vicinity. Subsection 4.3.1.4 provides additional discussion regarding potential impact to wetlands.

A total of 229 ac. of jurisdictional wetlands are impacted by construction (Table 4.3-3). However, due to the abundance of wetland land cover types within the vicinity (25,249 ac.) (Table 4.3-2), and the quality of the affected resource (i.e., dominance by invasive *Phragmites* and high amount of on-site acreage represented in CDFs), the impacts to this land cover type are MODERATE and warrant mitigation (see additional wetland discussion in Subsection 4.3.1.4).

4.3.1.1.3 Forest/Old Field

A number of NJDEP LULC cover types may be collectively grouped as forest/old field habitat. The communities consist of an assemblage of habitats dominated by trees and other occasional woody vegetation on previously disturbed uplands that have become naturalized by plant communities in varying stages of succession. This land cover category includes the following land cover types:

- Deciduous brush/shrubland
- Deciduous Forest (10 to 50 percent crown closure)
- Old field (less than 25 percent brush covered)
- *Phragmites*-dominated old field

Forest/old field habitat occupies 107 ac. within the PSEG Site (Table 4.3-1). This land cover type is mainly represented in the southeast portion of the PSEG Site and corresponds to lands used in support of the construction of SGS and HCGS. Scattered old field communities consisting of one or more land cover types also occur sporadically in the north and west portions of the PSEG Site. Almost 32 ac. of this LULC category is represented by *Phragmites*-dominated old field. A small section of old field habitat is present at the northern end of the proposed causeway (Figure 2.4-2).

Of this habitat type, 9 ac. are in permanent use areas, and 80 ac. are in temporary use areas (Table 4.3-1). Three and a half acres of this habitat is likely to be permanently impacted by construction of the proposed causeway bridge and site access areas. A temporary impact of 0.1 ac. of forest/old field habitat is also likely within the causeway construction area (Table 4.3-2). Due to the abundance of forest/old field land cover types within the vicinity (2532 ac.) (Table 4.3-2), the potential impacts to this land cover type are SMALL.

4.3.1.1.4 Agriculture

The agricultural lands potentially impacted by construction include those in the near off-site areas along the proposed causeway route. Agricultural land cover types are located at the north end of the proposed causeway in Elsinboro Township. Plant communities of this land cover type consist of cultivated crops and adventitious weedy species. No permanent or temporary agricultural lands are impacted by on-site construction activities at the PSEG Site. Agricultural land impacts resulting from construction of the proposed causeway include 11.3 ac. of permanent impacts and an additional 0.2 ac. of temporary impacts (Table 4.3-2). Due to the abundance of agricultural land within the vicinity (16,341 ac.), the potential impacts to this land cover type are SMALL (Table 4.3-2).

4.3.1.2 Terrestrial Fauna

Wildlife of the PSEG Site and 6-mi. vicinity was characterized using historical data collected by PSEG, recorded information from resource agencies, and supplemental field surveys conducted in 2009. As described in Subsection 2.4.1, field studies completed in 2009 included general site reconnaissance and observation, waterfowl spot counts, roadside bird surveys (similar to those conducted by the USGS), anuran listening surveys, and transect surveys.

Impacts to terrestrial wildlife result from the conversion of available habitats used by mammals, birds, and other fauna that inhabit the PSEG Site and potentially affected off-site areas. Displacement of larger, more mobile fauna to adjoining terrestrial habitats is anticipated. These adjoining habitats, therefore, may experience temporary increases in population density potentially resulting in localized competition for shared resources. Smaller, less mobile fauna such as small rodents, frogs, and turtles may be permanently displaced during construction.

The proposed causeway, constructed on piers instead of embankment, is an elevated roadway structure that minimizes impacts to wildlife. Due to its elevated nature, the proposed causeway will not prevent the movement of wildlife in the manner that a roadway built on embankment does. For terrestrial wildlife species, typical roadways built on embankment become crossing hazards for wildlife. As such, the proposed causeway allows for wildlife movement under the elevated roadway and eliminates or greatly reduces the number of wildlife/vehicle incidents.

Wildlife species potentially impacted from construction activities are generally common in the region as described in Subsection 2.4.1. Suitable replacement habitat is readily available for most on-site wildlife species in lands surrounding the PSEG Site and proposed causeway. Furthermore, any losses of individual animals in the project study area during construction activities are not expected to substantially alter local populations and the impacts are SMALL.

Green treefrogs were observed on-site within small isolated impounded areas within the PSEG desilt basin. This species has not been reported previously in NJ and is not listed in NJ as threatened or endangered, but may be in the process of extending its range. Based on the overlay of the Site Utilization Plan shown in Figure 4.3-1, habitats in which green treefrog were observed will be altered or eliminated as part of construction activities.

Typical noise levels from equipment commonly used during construction range from 80 to 90 A-weighted decibels (dBA) at 50 feet. High noise levels within this range may be expected to exhibit varying responses from nearby wildlife. For example, breeding wading birds responded

to low level flights of military aircraft with noise levels ranging from 55 to 100 dBA by exhibiting no response, looking up, or changing position (usually to an alert posture) (Reference 4.3-1). Noise levels attenuate with distance such that noise levels within coastal wetlands and other nearby terrestrial habitats are anticipated to be near 50 dBA level that is similar to ambient noise levels measured near the boundary of the PSEG Site. For example, a source with a noise level of 50 dBA at 1000 ft. has a noise level of 44 dBA at 2000 ft. from the source, and a source with a noise level of 60 dBA at 1000 ft. has a noise level of 54 dBA at 2000 feet. NUREG-1555, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan,* requires a description of the distance from the source of construction noise to locations of any federally threatened or endangered species. However, there are no federally listed threatened or endangered terrestrial species within the vicinity of the PSEG Site. Thus, the impacts of noise from construction of the new plant on wildlife in adjacent coastal marsh are SMALL.

Avian collisions with man-made structures are the result of numerous factors related to species characteristics such as flight behavior, age, habitat use, seasonal and diurnal habitats; and environmental characteristics such as weather, topography, land use, and orientation of the structures. The number of bird collisions with construction equipment, such as cranes, or new structures has not been quantitatively assessed. However, based on surveys conducted over several years at the existing natural draft cooling tower at HCGS, which showed few instances of bird collisions (Subsection 5.3.3.3.5), and the findings of NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, which demonstrated that the effects of avian collisions with existing structures at nuclear power plants is SMALL, the impacts of such collisions during the construction phase are SMALL.

Wildlife species have the potential to be affected by the use of artificial lighting at nighttime during construction of the new plant. For example, frogs have been found to inhibit their mating calls when exposed to excessive light at night, and the feeding behavior of some bat species may be altered by artificial lighting (Reference 4.3-2). In addition, artificial lighting could create or exacerbate an avian-collision hazard if tall cranes are illuminated for work during nighttime construction of the new plant. According to Ogden (Reference 4.3-3), a large proportion of migrating birds affected by human-built structures are songbirds, apparently because of their propensity to migrate at night, their low flight altitudes, and their tendency to be trapped and disoriented by artificial light, making them vulnerable to collision with obstructions. During nighttime construction for the new plant and/or proposed causeway, BMPs will be used to mitigate the hazards to wildlife associated with artificial nighttime illumination. Based on the background nighttime illumination levels of HCGS and SGS, and the BMPs to mitigate effects to wildlife, the impacts of artificial illumination at nighttime during the construction phase are SMALL.

4.3.1.3 Impacts to Important Terrestrial Species

Twenty bird species have been identified as important terrestrial species at or in the vicinity of the PSEG Site as described in Subsection 2.4.1. This includes five birds of prey, 13 waterfowl species, and two additional important bird species.

4.3.1.3.1 Impacts to Important Bird Species

4.3.1.3.1.1 Birds of Prey

The five birds of prey identified as important species include the Cooper's hawk, red shouldered hawk, northern harrier, bald eagle, and osprey. Construction-related impacts to these important bird species are SMALL as discussed below.

As stated in Subsection 2.4.1, Cooper's hawks prefer large tracts of forested land where they nest in large mature trees. Cooper's hawk is listed as threatened in NJ, and one was observed in a small tree on-site in the fall of 2009 (Subsection 2.4.1). Because preferred habitat is not present on-site, Cooper's hawks are more likely residents of forested habitat in the vicinity of the PSEG Site. Construction-related impacts to Cooper's hawks are SMALL.

Although the red shouldered hawk, a NJ-listed endangered species, has been identified in recent years near the PSEG Site in the Audubon Christmas Bird Count (Table 2.4-6), no red shouldered hawks were observed on-site during the 2009-2010 field survey as discussed in Subsection 2.4.1. Preferred habitat, deciduous and mixed forest communities adjacent to water, is absent on-site but available in the vicinity. Construction-related impacts to red shouldered hawks are SMALL.

The northern harrier, a state-listed endangered species in NJ and DE, was commonly observed foraging in the coastal wetlands on-site and near the site. Nests were not observed on-site during the 2009-2010 field survey but nesting habitat in the coastal marsh is present on-site and in the vicinity. Construction-related impacts to on-site habitat potentially used by the northern harrier includes 26 ac. of *Phragmites*-dominated old field, 63 ac. of *Phragmites*-dominated coastal wetlands, 68 ac. of *Phragmites*-dominated interior wetlands, 57 ac. of old field, and 0.1 ac. of saline marsh (Table 4.3-1). Permanent impacts to northern harrier habitat within the proposed causeway include 11.3 ac. of agricultural lands, 3.4 ac. of old field habitats, and 25.1 ac. of wetlands (Table 4.3-2). The vast majority of these construction-related impacts are incurred in areas consisting of near monocultures of the invasive reed, *Phragmites australis*, which offers poor-quality habitat because it forms dense, impenetrable stands. Abundant foraging and nesting habitat will remain in the vicinity of the existing plant site after project completion. The impacts are incurred in poor-quality habitat and ample northern harrier habitat will remain post-construction, therefore construction-related impacts to the northern harrier are SMALL.

Due to its successful recovery, the bald eagle is no longer a federally listed species by the U.S. Fish and Wildlife Service (USFWS). The bald eagle was identified as important because of its status as a federally protected species (Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act) and state listed threatened species. Although bald eagles were occasionally observed during the 2009-2010 field survey on-site, there are no known bald eagle nests or suitable roosting habitat at the PSEG Site, primarily due to the absence of large trees or suitable structures that support nesting activities. Therefore, the proposed construction footprint of the plant and proposed causeway is not anticipated to impact bald eagle nesting or roosting habitat. However, as indicated in Subsection 4.3.1.7, the new plant may require a new off-site transmission line. If active bald eagle nests are discovered as a result of routing studies, the appropriate state regulatory agency and the USFWS will be consulted regarding avoidance and

appropriate mitigation measures. As such, construction-related impacts to the bald eagle are SMALL.

Osprey, a threatened species in NJ, were occasionally observed both on-site and in the vicinity of the PSEG Site during the 2009-2010 field survey (Table 2.4-6). Active osprey nests were observed on transmission towers along the current access road, on the transmission towers that run from the plant north towards Money Island Road, and on man-made nesting platforms constructed by PSEG along Alloway Creek. Natural osprey nesting sites such as large trees are not present on-site. Impacts to osprey, if any, are SMALL because nesting platforms are not expected to be impacted by construction. Although there may be some short-term displacement during construction, nesting structures in the form of additional transmission towers may be more plentiful after construction. Furthermore, food and foraging habitat (fish in the Delaware River) will remain abundant during and after construction. Consequently, impacts of construction on osprey are SMALL.

4.3.1.3.1.2 Waterfowl

The northern pintail, green-winged teal, mallard, American black duck, ring-necked duck, greater scaup, Canada goose, bufflehead, snow goose, American coot, hooded merganser, common merganser, and red-breasted merganser are all waterfowl that have been identified as important species at or near the PSEG Site. These thirteen species of waterfowl are considered important species based on their recreational value as game species that are hunted in the vicinity of the PSEG Site. Although protected by the Migratory Bird Treaty Act, hunting provisions allow for sport harvest.

Waterfowl habitat is relatively abundant throughout the PSEG Site and vicinity. The invasion of *Phragmites australis,* however, has altered the structure and function of the historically diverse marsh ecosystems by changing species composition, nutrient cycles and hydrological regimes. Dense stands of *Phragmites* decrease native biodiversity and quality of wetland habitat, particularly for migrating waterfowl species. Although a few of these waterfowl species may occasionally nest, most migrate through the Atlantic Flyway stopping to rest and feed. Therefore, they primarily use open water areas such as the CDF/disposal basins and tidal creeks. Construction-related impacts will include 90 ac. of unmapped coastal–CDF/disposal basin wetlands (Table 4.3-3). These basins are mostly surrounded by nearly impenetrable monotypic stands of *Phragmites* and are generally shallow, containing minimal assemblages of aquatic vegetation and benthic macroinvertebrate communities. As such, the basins offer resting habitat but provide generally poor foraging and nesting habitat for waterfowl. Construction activities may result in waterfowl displacement, but tidal creeks will remain abundant in the vicinity of the PSEG Site after construction, as well as 25,000 ac. of wetland habitat (Table 4.3-2). Construction-related impacts to these 13 important species are SMALL.

4.3.1.3.1.3 Other Birds

Wild turkey is considered an important species due to its status as a game bird and its presence on-site and in the vicinity. Wild turkeys were observed at the PSEG Site and vicinity during the 2009-2010 field survey conducted for this environmental report. A total of 9 ac. of suitable turkey habitat (i.e., deciduous brush/shrubland, old field, and upland right-of-way undeveloped) as indicated in Table 4.3-1, are permanently converted to developed land cover types on the PSEG Site as a result of construction activities. A total of 100 ac. is temporarily converted on the

PSEG Site as a result of construction activities. A total of 17 ac. of turkey habitat (i.e., cropland, pastureland or other agriculture, forest/old field, and upland right-of-way undeveloped) as indicated in Table 4.3-2, are permanently converted by construction of the proposed causeway. Wild turkeys are mobile birds that will disperse to appropriate and abundant available habitat in the vicinity of the PSEG Site. Over 16,000 ac. of agricultural land and over 2500 ac. of forest/old field will remain in the vicinity post construction (Table 4.3-2). For these reasons, construction-related impacts to the wild turkey are SMALL.

The red-headed woodpecker is not a federally listed species, but its breeding and non-breeding populations are listed by the NJ as threatened. No red-headed woodpeckers were observed during the 2009-2010 field survey nor have they been reported in the USGS Breeding Bird Survey or the Audubon Society's Christmas Bird count. Due to the lack of appropriate habitat (i.e., open woods, deciduous forests, forest edges, river bottoms, orchards, grasslands with scattered trees and clearings, dead or dying trees) (Subsection 2.4.1) within the PSEG Site and vicinity, construction-related impacts, if any, are SMALL.

4.3.1.3.2 Impacts to Important Mammal Species

The river otter is considered an important species because it is commercially harvested for its pelt. River otters inhabit both freshwater and coastal environments and were observed in the Delaware River at the PSEG Site during the 2009-2010 field survey. Although some temporary displacement may occur during construction, appropriate habitat will remain abundant in the Delaware River, Alloway Creek, Hope Creek, and various unnamed tidal creeks in the vicinity of the PSEG Site after construction. Construction-related impacts to the river otter and its preferred habitat are SMALL.

The muskrat is considered an important species at the PSEG Site because it is commercially harvested for its fur. Muskrats are abundant in the coastal wetlands and freshwater wetlands surrounding the PSEG Site and were observed during the 2009-2010 field survey. Permanent impacts to wetland land cover potentially used by muskrat include 127 ac. on-site (Table 4.3-1) and 25 ac. off-site (Table 4.3-2). Although construction impacts result in temporary displacement and some permanent impacts to muskrat habitat on the PSEG Site and proposed causeway, 25,000 ac. of wetland remain in the vicinity after construction (Table 4.3-2). Construction-related impacts to muskrat are SMALL.

White-tail deer are considered an important species due to their game species status and recreational value to hunters. This important species is abundant in the upland agricultural areas within the vicinity where they were commonly observed during the 2009 ecological field studies. On-site, white-tail deer were occasionally observed in the upland old field habitat east of the existing HCGS and SGS. Impacts to potential white-tail deer habitat on-site in upland rights-of-way undeveloped and forest/old field land cover types includes 9 ac. of permanent impacts and 100 ac. of temporary impacts as indicated in Table 4.3-1. Impacts to potential white-tail deer habitat within the proposed causeway (agriculture, forest/old field, upland rights-of-way undeveloped, agricultural wetlands, and former agricultural wetlands) include 18 ac. of permanent impacts and 0.3 ac. of temporary impacts as indicated in Table 4.3-2. Portions of the impacted area are located near the existing facility where buildings, pavement, and the noise of operations provide unsuitable or marginal wildlife habitat. Construction activities may also increase the potential for additional temporary white-tail deer mortality due to vehicle collisions related to displacement and movement toward appropriate upland habitat east of the site in the

vicinity. Over 16,000 ac. of agriculture habitat and over 2500 ac. of forest/old field habitat remain in the vicinity post construction (Table 4.3-2). Due to the abundance of available habitat in the vicinity and the temporary impacts associated with displacement during construction, impacts to the white-tailed deer are SMALL.

4.3.1.3.3 Impacts to Important Plant Species

The only important plant species of note on the PSEG Site is saltmarsh cordgrass, *Spartina* spp. Saltmarsh cordgrass appears as individual plants or in small clumps throughout the site but, in general, this vegetative cover type has been replaced by *Phragmites*. A total of 1 ac. of saline marsh habitat is impacted by construction on-site and in adjacent off-site areas (Table 4.3-1). Within the proposed causeway, 22.3 ac. of mapped *Phragmites*-dominated coastal wetlands are impacted during construction. However, much of the *Phragmites-d*ominated coastal wetlands mapped within the proposed causeway north of Alloway Creek has been restored to saltmarsh cordgrass through the PSEG EEP. As shown in Table 4.3-2, 25,000 ac. of wetlands will remain after construction. In addition, construction-related impacts to salt marsh wetlands will require mitigation as stated in Subsection 4.3.1.6; therefore, construction-related impacts to saltmarsh cordgrass are SMALL.

4.3.1.4 Impacts to Important Terrestrial Habitat – Jurisdictional Wetlands

As described in Subsection 2.4.1.3 jurisdictional wetlands are often more narrowly defined relative to wetlands identified as part of NJDEP’s LULC classification system. Because jurisdictional wetlands represent lands that are subject to permitting requirements they are evaluated here separately from the LULC analysis provided in Subsection 4.3.1.1.

The proposed new plant and associated development results in unavoidable impacts to waters of the United States and state waters. Impacts to wetland resources at the new plant site and the proposed causeway are comprised of both direct and indirect effects. Anticipated direct impacts are those relating to direct habitat alteration associated with fill placement, shading, and construction activities. Potential indirect impacts result from disturbances occurring in areas outside of wetlands. These include pollutant loading (oil and grease) from cars on the proposed causeway and erosion/sedimentation resulting from increased runoff due to an increase in impervious surfaces.

Direct wetland impacts from construction of the new plant and proposed causeway occur within the various site utilization areas including, but not limited to, the power block, cooling tower, switchyard, batch plant, heavy haul road, parking, intake structure, and temporary laydown areas as illustrated in Table 4.3-3 and Figure 4.3-2. Direct impacts generally consist of the placement of fill material in support of construction activities. As discussed in Subsection 4.3.1, the limits of the site utilization areas represent a bounded configuration of the lands potentially affected by construction of the new plant. Actual limits of disturbance of these utilization areas and resultant impacts to wetlands and jurisdictional streams will be minimized during the design phase, subsequent to the selection of a reactor technology.

A total of 65.2 ac. of coastal wetlands and 122.5 ac. of unmapped coastal wetlands are impacted by on-site construction activities (Table 4.3-3). Of the 122.5 ac. of unmapped coastal wetland impacts on-site, 90 ac. are located in active land disposal areas (i.e., USACE CDF and PSEG desilt basin). A total of 151 ac. of wetlands are located in on-site permanent use areas

and 37 ac. are located in on-site and adjacent off-site areas (USACE CDF) within temporary use areas. Impacts to all use areas are considered to be permanent, as mitigation for these losses will occur in other areas of the site or in off-site areas (Subsection 4.3.1.6.2).

Off-site impacts associated with the proposed causeway are minimized through the use of an elevated road and bridge design that reduces the width and magnitude of impact when compared to construction on fill. Within a 50-ft. width of impact, wetland impacts resulting from construction fill are limited to the areas directly affected by pier placement. Some plant community alteration is expected due to shading effects as described in Subsection 4.3.1.1.2. As such, the 50-ft. wide corridor is assumed to be permanently impacted. It is also assumed that construction methods include the use of low ground-pressure equipment and work mats to support heavy equipment (e.g., pile drivers). Work mats are used within a 50-ft. wide construction easement and removed after construction. Temporary impacts within these areas are therefore minimized, but result in limited compaction and disturbance to wetland soils and substrates. Consequently, only temporary disturbance in these areas is anticipated and recovery following the construction phase is expected to be rapid. An additional 39.6 ac. of coastal wetlands and 1.4 ac. of unmapped coastal/freshwater wetlands are impacted off-site for proposed causeway construction.

Indirect impacts include localized siltation and sedimentation within adjacent wetlands and surface waters. The use of BMPs minimizes and controls construction-related secondary impacts to site wetlands. The use of silt fences, temporary and permanent vegetative stabilization, mulching, erosion control blankets, stormwater detention basins, and other soil erosion and sediment control practices, as appropriate, reduces the risk of sediment runoff into wetlands adjoining construction zones. Grading plans also control site runoff from developed lands and prevent discharge of stormwater into adjacent wetlands.

Altogether, 104.8 ac. of coastal, 122.5 ac. of unmapped coastal, and 1.4 ac. of freshwater wetlands are impacted by the new plant and proposed causeway construction, totaling 228.7 ac. of wetland impacts (Table 4.3-3). In consideration of the abundance of wetland land cover types within the vicinity (25,249 ac.) (Table 4.3-2), and the quality of the affected resource (i.e., dominance of *Phragmites* and high amount of on-site acreage represented in CDFs), the potential impacts to this land cover type are MODERATE and warrant mitigation (additional discussion in Subsection 4.3.1.6 regarding mitigation).

4.3.1.5 Consultation

As described in Section 2.4, consultation with various federal, state and regional agencies has been on-going throughout the development of the ESPA. This consultation process will continue throughout the licensing process to communicate PSEG’s continuing efforts toward impact minimization.

4.3.1.6 Mitigation Measures

Opportunities for mitigating unavoidable impacts to terrestrial and wetland ecosystems include restoration of natural habitats temporarily disturbed by construction, creation of new habitat types in previously disturbed areas, and enhancement of undisturbed natural habitats. Mitigation plans will be developed in consultation with the applicable federal, state and local resource agencies and will be implemented on and in the immediate area of the PSEG Site to the extent

practicable. The description of mitigation measures is addressed below for upland areas (flora and fauna) and wetland areas.

4.3.1.6.1 Upland Terrestrial Habitats

Mitigation of temporary impacts to upland areas and associated wildlife consists of restoration activities to restore temporary use areas to natural cover types. As is indicated in Figure 4.3-1, many of the areas identified for temporary use are existing previously disturbed habitats that have become naturalized. Mitigative measures for these areas may include grading and planting with native vegetation to stabilize disturbed soils. Adjacent lands temporarily leased from the USACE will be restored to an appropriate use and land cover type as agreed to by the USACE. Together these measures provide a restored habitat of value to resident wildlife.

4.3.1.6.2 Wetlands

Wetlands have been identified as important terrestrial habitat at the PSEG Site and are regulated under the authority and jurisdiction of the USACE and NJDEP (Subsection 2.4.1). Section 404 of the Clean Water Act authorizes the Secretary of the Army, acting through the Chief of Engineers, to regulate (via a permit system) the discharge of dredged or fill material into the waters of the United States, including wetlands. In the State of NJ, coastal wetlands are regulated under the Wetlands Act of 1970 whereas freshwater wetlands are regulated under the New Jersey Freshwater Wetlands Protection Act. Development in coastal or freshwater wetlands requires authorization in the form of permits from the NJDEP.

Guidelines under Section 404(b)(1) of the Clean Water Act require that actions proposed within "waters of the United States," especially those that are not water-dependent, are required to demonstrate that they have considered all appropriate reasonable and prudent measures to avoid and minimize impacts to waters. If all measures to avoid and minimize wetland impacts have been considered and employed to the extent practicable and result in unavoidable impacts, a compensatory mitigation plan should be considered.

PSEG will seek to avoid and minimize impacts to jurisdictional wetlands to the extent practicable. The new plant is located adjacent to the existing HCGS and SGS which are constructed on Artificial Island, a man-made landform created through the deposition of Delaware River dredged spoils behind a naturally occurring sandbar and bulkhead. Much of the PSEG Site is surrounded by degraded tidal marsh dominated by the invasive common reed, *Phragmites australis*. Measures taken during development of the Site Utilization Plan and off-site features to avoid and minimize adverse impacts to "waters of the United States" included the following considerations:

- Minimization of encroachment on coastal wetlands
- Minimization of encroachment on NJDEP regulated freshwater wetlands
- Use of previously developed sediment disposal basins for plant development (both PSEG's permitted disposal facility and the USACE's CDF)
- Refinement of the Site Utilization Plan to avoid various wetland areas throughout the PSEG Site

- Causeway construction on piers or bridges to span tidal wetlands instead of construction on fill. This measure significantly reduces impacts to wetlands and avoids impacts to tidal creeks

Additional measures to avoid and minimize potential impacts to wetlands will be implemented after the selection of a reactor technology and throughout the design phase as detailed site layouts are developed. For example, based on technology selection and future decisions regarding soil management and use, additional reductions in the limit of construction (i.e., fill areas) may be achieved to reduce the impact footprint from that shown in the Site Utilization Plan. This process of optimization of site use will continue during the permitting process to develop the most environmentally preferable practicable alternative.

After reasonable measures have been explored to avoid and minimize impacts to wetlands, PSEG will compensate for unavoidable adverse impacts to wetlands by implementing approved wetland restoration and/or rehabilitation measures. PSEG, through their EEP, has extensive experience and demonstrated success implementing coastal saltmarsh and freshwater wetland restoration and rehabilitation programs. This familiarity with local wetland systems was used to identify appropriate candidate mitigation sites and will be used in developing and implementing the final approved mitigation plan.

Factors typically considered when selecting a site for wetland mitigation include existing land use (historic and current), property ownership or potential for acquisition, hydrologic potential, proximity to other wetland sites, site topography, connectivity to adjacent natural habitats, site accessibility and the presence of or potential to develop hydric soils.

Opportunities for mitigation exist in various locations throughout the PSEG Site and vicinity. Factors that may influence site selection for wetland creation include topography, soil types, watershed size, and the presence of adjacent streams as a source of additional hydrology. Once a candidate mitigation site has been selected, wetland mitigation will be achieved through a series of rehabilitation and/or restoration methods as outlined below. Methods are tailored to the selected site and may include the control of *Phragmites*, restoration of hydrology (levee removal, channel design, and reestablishing a connection of upland areas to tidal influences), and wetland enhancement including restoration of desirable and native vegetation.

Wetland mitigation plan details are primarily driven by conditions established within Clean Water Act Section 404 permits issued by the USACE or NJDEP Land Use Regulation Program, and Section 401 Water Quality Certifications issued by the NJDEP. Accordingly, specific wetland mitigation efforts will be determined as part of such authorizations.

Several candidate mitigation areas have been identified during the ESPA process that have the potential to meet some or all of PSEG's wetland mitigation needs. Candidate mitigation areas include portions of the existing PSEG Site, Mannington Meadow, Mason's Point, and additional areas of the PSEG Alloway Creek Watershed restoration site.

Wetland mitigation concepts for each of these areas are described below and include the enhancement and/or development of coastal and freshwater wetland systems. A network of marsh creeks are intrinsic to the restoration of coastal marsh and will address the loss of marsh creeks within the existing marsh as described in Subsection 4.3.2.

4.3.1.6.2.1 On-Site

Although much of the PSEG Site is either developed or is proposed to be developed, 149 ac. of *Phragmites*-dominated wetlands on-site could be used for wetland mitigation activities (Figure 4.3-3). PSEG is currently in the process of acquiring additional acreage to the north of the site, a significant portion of which is degraded, *Phragmites*-dominated, mapped coastal wetlands. Upon completion of the acquisition, this area will be considered for on-site mitigation. Most of the wetlands on-site are tidally influenced coastal wetlands where *Phragmites* control may allow *Spartina* and other desirable marsh species to revegetate.

4.3.1.6.2.2 Mannington Meadow

Mannington Meadow is a brackish estuary located on the Salem River in Salem County, NJ (Figure 4.3-3). Mannington Meadow is a significant migrating, wintering and breeding site for numerous species of birds including but not limited to waterfowl, shorebirds, and raptors. A brackish and freshwater-based fishery also exists in the area. Mannington Meadow includes open water, emergent wetland, and adjacent farmland. The potential exists to restore this degraded marsh to a functional tidal brackish ecosystem. Keys to this restoration include increasing the incoming freshwater flow from the Salem River and reducing the coverage of *Phragmites* in the degraded wetlands to allow *Spartina* and other desirable marsh species to revegetate. Mannington Meadow is large enough (3800 ac.) to provide mitigation opportunities for the PSEG project, but much of it is under private, state or federal ownership.

4.3.1.6.2.3 Mason’s Point

Mason’s Point is located in Elsinboro Township near Alloway Creek, 2.5-mi. upstream from the creek’s confluence with the Delaware River (Figure 4.3-3). In the mid-1990s, Mason’s Point existed as an impounded coastal marsh with near monotypic stands of *Phragmites*. Since that time, levee failure has opened the system to limited and inefficient tidal flow from Alloway Creek into portions of the site. The potential for full salt marsh restoration exists through levee removal and channel installation to restore the natural daily tidal exchange. Additionally, *Phragmites* control promotes the revegetation of the site by *Spartina* and other desirable marsh species. Mason’s Point is owned by NJ and is 1000 ac. in area.

4.3.1.6.2.4 Alloway Creek Watershed

The western portion of PSEG’s Alloway Creek Watershed site is not included in the EEP restoration area. It is located in Elsinboro and Lower Alloways Creek townships in Salem County, NJ. This site, as depicted in Figure 4.3-3, was originally part of the over 2800 ac. Alloway Creek site in PSEG’s EEP. As such, herbicide control was applied at the beginning of the program. Subsequently, the Alloway Creek EEP site was reduced in size leaving over 1400 ac. unrestored outside the restoration area as identified in Figure 4.3-3. As it exists today, this site is a non-impounded coastal marsh with monotypic stands of *Phragmites*. The key restoration component consists of *Phragmites* control to allow *Spartina* and other desirable marsh species to revegetate.

4.3.1.7 Impacts of Transmission Corridors on Terrestrial Ecosystem

PSEG has identified two off-site transmission corridor alternatives that may be considered in future transmission routing studies in the event a new transmission line is necessary to accommodate grid stability requirement (Subsection 9.4.3). A particular corridor has not been selected, as this is dependent on a variety of factors including the selection of a reactor technology, formal transmission impact studies, and regional transmission planning efforts.

To evaluate potential impacts of an off-site transmission corridor, PSEG performed a GIS analysis of two macro-corridors to estimate potential environmental effects. In this subsection, the potential impact of the longest corridor is presented based on an assumed transmission line rights-of-way width of 200 feet. Values presented in this subsection and in Tables 4.3-4 and 4.3-5 are considered to represent the bounded value of impact for potential new off-site transmission line.

Potential land cover impacts associated with the hypothetical 200-ft. wide rights-of-way are presented in Table 4.3-4 for the 6-mi. vicinity and the 6 to 50+ mi. region (i.e., lands beyond the 6-mi vicinity). Cultivated cropland is the largest land cover type affected with a total of 1051-ac. potentially impacted. Potential impacts to this land cover type are small as the development of transmission does not preclude continued use of these lands for agricultural production. Potential forested land impacts consist of 356 ac. of deciduous forest, 36 ac. of evergreen forest, and 16 ac. of mixed forest (Table 4.3-4). Alteration of these lands results in a permanent impact and change in land use to herbaceous communities. Potential effects to all land uses are reduced and minimized to the extent possible, during route development by locating new off-site transmission along existing rights-of-way. However, based on the area of lands potentially affected and the intent to site potential new transmission along existing rights-of-way to the extent practicable, the impacts of off-site transmission are MODERATE.

Potential impacts to wetlands based on the National Wetlands Inventory (NWI) associated with the proposed off-site transmission corridor are presented in Table 4.3-5. The potential impact to wetlands is 814 ac. The largest contributors to that total are estuarine and marine wetlands (52 percent, 425 ac.) and freshwater forested/shrub wetlands (26 percent, 210 ac.). Because the off-site transmission of electricity is anticipated to consist of elevated lines, impacts will occur only within the footprint required for support structures and where access roads are necessary for construction to occur. As such, actual wetland impacts may be less than Table 4.3-5. In some cases, elevated transmission lines may result in a conversion of wetland types (i.e., from forested wetlands to emergent wetlands). Support structures and access roads are sited, to the extent practicable, to avoid and minimize impacts to wetlands. BMPs, such as silt fences and other sediment and erosion control practices, are implemented to further minimize impacts to wetlands and others waters. Actual losses of wetlands due to fill activities are limited. Potential construction related impacts to wetlands are MODERATE, and require mitigation (see additional discussion of wetland mitigation in Subsection 4.3.1.4).

Important species and habitats (other than wetlands) are not identified by the macro-corridor analysis. Agency coordination to consider potential impacts to listed species and sensitive habitats along the selected transmission corridor will be initiated when the need for a new transmission line is determined by PJM and the exact route for a new transmission corridor is determined. Once this coordination is completed and important species and habitats are

selected, efforts will be made to minimize and avoid any impacts to important species and habitats.

4.3.2 AQUATIC ECOSYSTEMS

Construction activities that could affect on-site and off-site aquatic ecosystems include construction of the intake and discharge structures, and the barge facility on the Delaware River shoreline, impacts to marsh creeks due to the development of site utilization areas, construction of the proposed causeway, and construction of any proposed transmission lines. Aquatic habitats in the project vicinity, as depicted in Figure 2.4-7, consist mostly of marsh creeks and the Delaware River. Construction phase impacts to aquatic ecosystems could be caused by physical alteration of habitat (e.g. in-filling, coffer dam placement, dredging, pile driving, etc.), sedimentation, accidental spills, and changes in water quality.

4.3.2.1 Impacts to the On-Site Marsh Creeks

Tidally-influenced stream channels that are part of the coastal marsh surrounding the developed areas of the PSEG Site are referred to as marsh creeks. These hydrographic features are classified by the USGS as stream and canal ditch based on their size and degree of channelization. Table 4.3-6 summarizes the lengths of each marsh creek feature impacted by construction activities. Based on the site utilization plan, included on Figure 4.3-4, construction impacts to the existing surface waters include:

- Infilling and eliminating portions of the marsh creeks, including permanent loss of 7265 ft. of creek channels
- Isolation of 2320 ft. of marsh creek channels from their tidal connection due to placement of fill from the switchyard, power block and cooling tower areas
- Crossing of 2123 ft. of marsh creek channels by the proposed causeway

Because the marsh creeks are included in the mapped coastal wetlands (Figure 4.3-2), the tabulation of impacts to marsh creeks, for the purposes of permitting, is included in the coastal wetland impacts in Table 4.3-3. Marsh creek features are linear features in the GIS database, and do not have dimensions of width. Thus, they are characterized in this section in terms of linear feet. The amount of marsh creek habitats that are eliminated relative to the total amount present within the 6-mi. vicinity is small; 1.8 and 0.08 percent for canal ditch and stream (excluding the Delaware River), respectively. Moreover, the marsh creek system within the coastal wetlands surrounding the PSEG Site is characterized by a high channel density (Subsection 4.2.1.1.3). For example, within PSEG's nearby Alloway Creek Watershed Wetland Restoration Site, the coastal marsh was inventoried. A total of 16,343 channels with a total length of 1,105,485 ft. was obtained in this estimate. Therefore, the permanent loss of marsh creeks is equivalent to 0.7 percent of the total marsh creek density within this one wetland restoration area.

The aquatic organisms most likely affected by construction activities include primary producers, benthic macroinvertebrates, fish, and resident semi-aquatic mammals (e.g., muskrat, river otter). Although small, localized areas of habitat are lost, large amounts of similar habitat remain available for these species. Additionally, mammals and fish are mobile species and can move downstream to non-affected areas. Consequently, they are not likely to be impacted by construction activities.

The impacted marsh creek segments are the extreme upper portions of a few of the small anastamosed creeks described in Subsection 2.4.2.1.1. The fish and macroinvertebrate communities in these creeks have relatively low diversity and productivity, likely due to the large fluctuations in both water level and salinity. The creek and ditch segments that will be impacted by project construction are not known to support any listed species nor do they provide essential fish habitat for species of concern. As discussed in Subsection 2.4.2, surveys of the on-site streams document that the aquatic species that occur on-site are ubiquitous, common, and readily distributed in nearby waters. Substantial quantities of similar habitat are located immediately adjacent to the PSEG Site, so the projected losses comprise a small fraction of similar habitat available in the project vicinity. Fish inhabiting the marsh creeks immediately adjacent to the construction areas will likely move downstream during construction activities. Therefore, they are not likely to be permanently impacted. After construction is complete, it is likely that fish will repopulate those areas that were temporarily disturbed by construction activities.

Some segments of marsh creek areas are isolated and cut off from downstream tidal creeks due to the placement of fill. Impacts may occur within coastal wetlands for the two switchyards. This isolation causes the physical habitat to become degraded and overgrown with vegetation. Additionally, aquatic biota is isolated from downstream/connecting creek channels under most tidal conditions, which may result in reduced population vigor. Detailed site development engineering and design will address potential connecting channels to prevent isolation of these marsh creek segments. For example, as discussed in Subsection 4.3.1.6, one of the mitigation options to address wetland impacts is the restoration of coastal wetlands on-site. Reconnection of these potentially isolated marsh creek segments will be considered as part of this restoration effort.

While there is a potential for sedimentation to nearby wetlands and stream channels from rainfall runoff during and immediately following construction, BMPs will be used to minimize the potential for erosion and sedimentation within marsh creeks. A stormwater management plan will be in place for collection and control of construction site runoff in accordance with state and federal regulations and permit requirements. Conceptual construction planning for this project includes timely development and implementation of a variety of relevant environmental protection measures, including:

- Environmentally sensitive area controls
- Environmental compliance
- Water management (construction)
- Basins, dikes and settling basin management
- Soil erosion and settlement control
- Stormwater management
- Silt management
- Fugitive dust and dust suppression control
- Spill response and containment/cleanup

Construction impacts to the fragments of marsh creek habitats on the PSEG Site are SMALL, and mitigated as part of overall wetlands restoration activities.

Regarding off-site impacts, a new causeway is proposed to provide access to the PSEG Site. The proposed causeway's route runs in a northeasterly direction from the site along or adjacent to the existing Red Lion 500 kV transmission circuit and will connect the new plant to local roads in Elsinboro Township. The causeway traverses the adjoining saltmarsh wetland system. It is designed to be an elevated causeway which preserves the hydrologic connections between the braided creek channels in the wetland system. Consequently, while the proposed causeway crosses additional stream features (Table 4.3-6), these systems are only subject to impacts from pier placement and shading. Temporary impacts may include sediment runoff. No discernable disruption of normal movement/migration patterns for fish or other aquatic biota is anticipated. Localized, limited impacts to primary producers, macroinvertebrates, and fish, are expected during roadway construction. Even so, the communities in the marsh creeks consist of a fish and aquatic vertebrate species that are typically mobile enough to avoid the immediate construction zone.

The environmental protection measures for the on-site marsh creeks will be developed and implemented over a timeframe covering causeway construction. Construction BMPs are used during the construction of the proposed causeway to minimize impacts to these stream segments. Impacts to aquatic ecosystems within and along the access causeway corridor are SMALL and temporary.

4.3.2.2 Impacts to the On-Site Artificial Ponds

There are several freshwater ponds located on the PSEG Site that have a combined surface area of 40 ac. (Figure 4.3.4 [Sheet 1] and Table 4.3-1). These artificial ponds consist of perched water bodies that are within the actively permitted CDF facilities (USACE CDF and PSEG's on-site desilt basin). These ponds are generally shallow and have no connection to the Delaware River or adjacent marsh creeks. The NJ LULC classification system identifies these as artificial lakes (Table 4.3-1 and Figure 4.3-1). Surveys of these ponds indicate that they are warmwater systems mainly supporting centrarchids (e.g., pumpkinseed and bluegill sunfish) and small forage fish (sheepshead minnow, mummichog, and banded killifish) (Subsection 2.4.2.1.1). These ponds have demonstrated the ability to provide resting and marginal foraging habitat for waterfowl and other waterbirds, but do not support populations of important aquatic species, nor do they represent essential fish habitat. Construction activities for the new plant result in complete conversion of these artificial pond habitats to industrial land use. In consideration of the shallow nature of these habitats, their location in approved and active CDFs, and the abundance of other shallow water habitats within the vicinity, the loss of these artificial ponds does not have an adverse impact on aquatic resources in the vicinity or region and therefore, associated impacts are SMALL.

4.3.2.3 Impacts to the Delaware River

Construction of the barge facility and intake and discharge structures will occur along the eastern shore of the Delaware River in the northern part of the PSEG Site. Development along the Delaware River also includes the construction of a heavy haul road along the site boundary to support the movement of materials during construction. The intake and discharge structures are located adjacent to the power block area, and the barge facility is located adjacent to the cooling tower area. Barge mooring caissons will be constructed along the shoreline upstream of the cooling tower area. The new barge unloading area is 300 ft. long and 58 ft. wide, and the barge mooring area is up to 1250 ft. long (Figure 3.1-2). The new intake structure area is 600 ft.

long and 300 ft. wide, housing the trash racks, traveling screens, and intake pumps (Figures 3.4-2 and 3.4-3). Development of the features along the Delaware River shoreline, as illustrated in Figure 3.1-2, results in the conversion of 9.5 ac. or riparian zone and shallow water area to industrial uses.

Construction of the new barge unloading facility and mooring area will require lowering of the river bottom an average of 4.5 ft. over an area of 61 ac. (dredging of 440,000 cubic yards of sediment). Barge mooring caissons will be constructed. Each caisson is 20 ft. in diameter resulting in the loss of 0.05 ac. of river bottom habitat for seven caissons. Construction of the new intake structure requires lowering the river bottom an average of 4.5 ft. over an area of 31-ac. (dredging of 225,000 cubic yards of sediment).

The maximum areal extent of the Delaware River bottom to be dredged for this project is 92 ac., which accounts for 0.4 percent of the total Delaware River bottom within a 6-mi. vicinity. Technology used for dredging of this area will likely use a combination of suction and bucket dredges. Dredged material will be disposed of on-site or other approved upland disposal facility.

The ecological effects associated with suspended sediments depends on a variety of factors. This includes the type of dredge used, the timing and duration of the dredging, the particle size of the suspended sediment, the presence of contaminants in the sediments, the control measures to contain the suspended sediments, and the life stage of the species present. Dredging for the barge and intake structure facilities results in a temporary increase in suspended sediment in the immediate vicinity of the dredge operation. Drift of suspended material is expected to occur beyond the immediate dredge site based on sediment composition. However, results of surficial sediment grain size analysis in these areas suggests that most sediments are comprised of coarser sandy material (Subsection 2.3.1).

Dredging and other in-stream construction activities will comply with applicable NJDEP and USACE permits for controls and timing. They will result in the permanent loss of some aquatic habitat and temporary alteration of additional habitat. However, no aquatic habitats in the Delaware River adjacent to the PSEG Site are known to be rare, unique, or essential. Fish and other mobile organisms will likely avoid these areas during construction activities, and impacts would be mostly limited to temporary displacement. The more immobile benthic organisms will be displaced, but will recolonize the dredged areas. Impacts associated with limited dredging required to construct the barge slip and intake structures at the PSEG Site are SMALL.

4.3.2.4 Impacts to Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation Management Act (16 United States Code 1801 to 1883), as amended by the Sustainable Fisheries Act of 1996, directs the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service to protect and conserve the habitat of marine, estuarine, and anadromous finfish, as well as mollusks and crustaceans. Additionally, all diadromous species are under management by the Atlantic States Marine Fisheries Commission and its member states, which include both NJ and DE.

Essential fish habitat (EFH) is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” As discussed in Subsection 2.4.2, federal agencies are required to consult with the National Marine Fisheries Service (using existing consultation processes of the National Environmental Policy Act, the Endangered Species Act,

or the Fish and Wildlife Coordination Act) on any action that they authorize, fund or undertake that may adversely affect EFH. This requirement is applicable to the NRC in connection with issuing a permit for a new nuclear plant. The regional fisheries management council responsible for EFH protection in Delaware Bay is the Mid-Atlantic Fishery Management Council.

The reach of the Delaware River in the vicinity of the PSEG Site is considered important estuarine habitat for many species (Subsection 2.4.2). However, none of the important species in the vicinity of the PSEG Site are endemic to the Delaware River. All of the species range widely throughout the mid-Atlantic coast. Many of the important species that use the Delaware River system as nursery grounds need submerged aquatic vegetation and tidal marsh creeks for cover and forage areas. The eastern bank of the Delaware River near the PSEG Site has no submerged aquatic vegetation (Subsection 2.4.2.2.4.1) and is not likely to provide important habitat for any of these species.

The EFH within the project area that will be affected by construction activities in the Delaware River include muddy bottom habitat, pelagic waters, estuarine bottom habitat, and bottom waters (Subsection 2.4.2.3.2). Direct impacts may occur from loss of habitat, exposure to fine sediments, or scour from the propellers. Most of the impacts are to immobile benthic organisms. However, once these areas have been dredged, some of the benthic organisms will recolonize the dredged area. Fish and other mobile organism will likely avoid these areas during construction activities and impacts are mostly limited to temporary displacement. However, compared with the expanse of EFH in Delaware Bay, the impacts to aquatic habitats and species in this area are SMALL.

The construction of the intake and discharge structures and barge facility results in the permanent loss of some aquatic habitat and temporary alteration of additional habitat. However no aquatic habitats in the Delaware River adjacent to the PSEG Site are known to be rare, unique, or essential. Mobile organisms like fish are temporarily displaced by the habitat changes, while individuals of non-mobile species like benthic invertebrates are lost. These species will likely compensate for these losses by emigration back to the areas after disturbances have ceased. Any impacts associated with this loss or alteration of aquatic habitat are SMALL.

4.3.2.5 Impacts to Important Aquatic Species

Important species in small marsh creeks and ponds on-site are limited to American eel, Atlantic menhaden, striped bass and white perch. American eel and white perch were collected from both creeks and ponds, whereas Atlantic menhaden and striped bass were collected only from creeks. No threatened or endangered aquatic turtles or commercially important invertebrates were encountered in surveys of these habitats near the PSEG Site. A single American eel was found in pond habitat (AS-09) in July and marsh creek habitat (AS-05) in winter (Subsection 2.4.2). White perch and striped bass were not common in creek or pond surveys, and the individuals collected were juvenile specimens (Subsection 2.4.2). Atlantic menhaden, an important forage species, was common in marsh creek samples in both May and July (Table 2.4-14). All of these species are common in the Delaware River, and individuals found in ponds or marsh creeks are likely strays from the riverine habitat. For each of the four species, construction impacts are SMALL as they are mobile enough to avoid direct impact. In the unlikely case that individuals of these species are affected by construction activities, the impact on their populations in the area are SMALL and temporary.

The threatened and endangered aquatic species known to occur in the project area are two species of sturgeon (shortnose and Atlantic) and five species of sea turtles (loggerhead, Atlantic green, leatherback, hawksbill, and Kemp’s ridley). The sea turtles in the Delaware Bay system are summer foraging populations and do not nest in the area (Subsections 2.4.2.2.1.3 through 2.4.2.2.1.7). Spawning habitat for the shortnose sturgeon in the Delaware River system is located substantially upstream of the PSEG Site. Consequently, the benthic eggs and larvae are unlikely to be affected by project dredging operations distant from the spawning area. Larger individuals are known to occur in this reach of the river (Subsection 2.4.2.2.1.1) but are likely to be capable of swimming away from any suspended sediments or from dredging equipment. It is not likely that Atlantic sturgeon spawn in the project vicinity in the Delaware River (Subsection 2.4.2.2.1.2). However, appropriate habitat for juveniles does exist in the project area. Direct impacts to Atlantic sturgeon are limited to exposure to fine sediments, or collisions with propellers or water borne equipment that may occur. However, such impacts are unlikely as the impacted areas are minimal compared with the expanse of similar suitable habitat in the Delaware River in the vicinity and region. Additionally, dredging activities will likely displace this and other fish from the immediate dredge zone, thereby minimizing impact potential. Therefore, any impacts are SMALL and temporary.

Other important species in the project area that are most likely to be temporarily affected by dredging and in-stream construction activities are the commercially or recreationally important species that are abundant in the construction area as inferred from their abundance in impingement and entrainment samples at SGS (Subsection 2.4.2). These include white perch, Atlantic croaker, weakfish, bay anchovy, striped bass, blueback herring and Atlantic silverside, as well as blue crab. The fish species listed above are mobile and will most likely avoid the areas being dredged. They are also abundant in the Delaware River system (Subsection 2.4.2). With regard to blue crab, their mobility is not as great as finfish and some individuals may be impacted due to construction activities. However, these numbers are likely minimal as compared to the standing stock in this segment of the Delaware estuary (Subsection 2.4.2). Therefore, impacts to these species are SMALL and temporary.

4.3.2.6 Impacts of Transmission Corridors on Aquatic Ecosystems

PSEG has identified two off-site transmission corridor alternatives that may be considered in future transmission routing studies in the event a new transmission line is necessary to accommodate grid stability requirement (Subsection 9.4.3). A particular corridor has not been selected, as this is dependent on a variety of factors including the selection of a reactor technology, formal transmission impact studies, and regional transmission planning efforts.

To evaluate potential impacts of an off-site transmission corridor, PSEG performed a GIS analysis of two macro-corridors to estimate potential environmental effects. In this subsection, the potential impact of the longest corridor is presented based on an assumed transmission line rights-of-way width of 200 feet. Values presented in this subsection and in Table 4.3-7 are considered to represent the bounded value of impact for potential new off-site transmission line.

Table 4.3-7 presents the length of the streams for each of the USGS categories crossed by the hypothetical 200-ft. wide rights-of-way. Similarly, Table 4.3-4 presents the area of open water crossed by the rights-of-way. These values are considered to represent the bounding value of potential impact to streams for a potential new off-site transmission line. With regard to the streams crossed by the hypothetical rights-of-way, the stream classifications are represented as

channelized waterway, intermittent stream, and perennial stream. The rights-of-way crosses a total of 14.6 mi. of streams. Of that, 5.4 mi. are channelized waterways, 1.1 mi. are intermittent streams, and 8.1 mi. are perennial streams. Most surface water features (streams, channels, ponds, etc.) are avoided or spanned during route development and design. Consequently, potential impacts to these aquatic habitats are SMALL.

The potential new off-site transmission line crosses the Delaware River, adjacent to the existing 500 kV transmission line. In-stream work in the Delaware River will be required to install the footings for the towers for the elevated lines. In-stream work in the Delaware River associated with construction of the footings for the transmission towers will employ many of the same BMPs that will be used to protect the aquatic ecosystem during construction of the barge and CWIS structures. The footings for the towers result in some loss of river bottom habitat, but this loss is small compared to the available habitat in the river. Agency coordination to consider potential impacts to listed species in the Delaware River will be initiated when the need for a new transmission line is determined by PJM and the exact route for a new transmission corridor is determined. Any aquatic impacts associated with the construction of the tower footings in the Delaware River are SMALL. Both of the macro-corridors studied by PSEG cross several intermittent and perennial streams. Because the off-site transmission of electricity is anticipated to consist of elevated lines, impacts will occur only within the footprint required for support structures and where access roads may be necessary for construction to occur. It is anticipated that most support structures will be sited in upland areas outside of stream channels thus avoiding stream impacts. Furthermore, access roads will be strategically located to avoid and/or minimize impacts to streams. Construction impacts associated with these potential transmission line crossings are associated with clearing activities and potential runoff and sedimentation. PSEG has developed procedures and BMPs to protect aquatic communities and prevent degradation of water quality as part of its program to maintain existing transmission corridors. Additional procedures will be written into construction permits specific to this new transmission line. With the implementation of these measures, impacts to aquatic ecosystems associated with construction of the potential new transmission line are SMALL and of short duration.

4.3.3 REFERENCES

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4.3-2 Chepesiuk, Ron, *Missing the Dark, Health Effects of Light Pollution,* Environmental Health Perspectives, Volume 117, Number 1, January 2009.

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Table 4.3-1
Construction-Related Changes in Land Cover[a] within the PSEG Plant Site Property Boundary and Adjacent Off-Site Areas

New Jersey Land Use Category		Total On-Site Area (ac.)	PSEG Site Property		Adjacent Off-Site Areas[b]
			Permanent Use (ac.)	Temporary Use (ac.)	Temporary Use Only (ac.)
Developed Land Uses					
Altered Lands		14.8	14.8	0	0.7
Industrial		234.5	26.4	5.1	0
Other Urban or Built-Up Land		55.8	8.1	9.5	2.4
Phragmites-Dominated Urban Area		0.5	0.5	0.0	0
Transportation/Communication/Utilities		8.5	0.0	0.0	0
Upland Rights-of-Way Developed		0.5	0.0	0.2	0
Recreation Land		4.9	0.0	4.4	0
Upland Rights-of-Way Undeveloped[c]		29.5	0.0	19.6	0
	Subtotal	**349.0**	**49.8**	**38.8**	**3.1**
Forest/Old Field					
Deciduous Brush/Shrubland		6.0	6.0	0.0	0
Old Field (<25 percent Brush Covered)		69.4	2.6	54.3	0
Phragmites-Dominated Old Field		31.9	0.1	26.0	0
	Subtotal	**107.3**	**8.7**	**80.3**	**0**
Water					
Artificial Lakes		40.3	40.3	0.0	0
	Subtotal	**40.3**	**40.3**	**0.0**	**0**
Wetland Areas					
Deciduous Scrub/Shrub Wetlands		4.6	4.6	0.0	0
Disturbed Wetlands (Modified)		4.3	4.0	0.1	11.8
Herbaceous Wetlands		5.8	0.9	2.5	0
Managed Wetland in Maintained Lawn Greenspace		3.8	0.0	2.7	0
Phragmites-Dominated Coastal Wetlands		155.6	58.3	5.1[d]	2.1
Phragmites-Dominated Interior Wetlands		118.7	44.1	24.2	27.3
Saline Marsh		0.2	0.1	0.0	0.8
Tidal Rivers, Inland Bays, and Other Tidal Waters		5.6	2.9	0.3	0.1
Wetlands Rights-of-Way		23.8	11.7	5.9	0
	Subtotal	**322.4**	**126.6**	**40.8**	**42.1**
	Total	**819.0**	**225.4**	**159.9**	**45.2**

a) Based on NJDEP Land Use/Land Cover Data
b) Located in the USACE CDF and includes batch plant, heavy haul road, and construction laydown area.
c) These on-site lands are subject to periodic disturbance by plant activities and are therefore listed as developed lands for the purposes of impact assessment. Note that they are classified as Rights-of-Way Undeveloped in Table 2.2-1 as that is the LULC category nomenclature.
d) Temporary construction impact due to installation of transmission towers.

Table 4.3-2
Construction-Related Changes in Land Cover[(a)] for the Proposed Causeway

New Jersey Land Use Category	Vicinity Total ac.	Total Area Affected ac.	Total Area Affected Percent of Total	Percent of Total Vicinity	Permanent Use (ac.)	Temporary Use (ac.)
Agriculture						
Cropland and Pastureland		10.9	15.82%	0.07%	10.7	0.2
Other Agriculture		0.6	0.87%	0.00%	0.6	0
Subtotal	**16,341**	**11.5**	**16.69%**	**0.07%**	**11.3**	**0.2**
Forest/Old Field						
Deciduous Forest (10-50% Crown Closure)		0.1	0.15%	0.00%	0.1	0
Old Field (<25% Brush Covered)		3.5	5.08%	0.14%	3.4	0.1
Subtotal	**2532**	**3.6**	**5.23%**	**0.14%**	**3.5**	**0.1**
Developed Land Uses						
Recreational Land		1	1.45%	0.07%	0.4	0.6
Residential, Rural, Single Unit		1	1.45%	0.07%	0.7	0.3
Upland Rights-of-Way Undeveloped		2	2.90%	0.13%	2	0
Subtotal	**1526**	**4**	**5.80%**	**0.26%**	**3.1**	**0.9**
Water						
Tidal Rivers, Inland Bays, and Other Tidal Waters		4.6	6.68%	0.02%	2.4	2.2
Subtotal	**26,732**	**4.6**	**6.68%**	**0.02%**	**2.4**	**2.2**
Wetlands						
Agricultural Wetlands (Modified)		0.9	1.31%	0.00%	0.9	0
Former Agricultural Wetland (Becoming Shrubby, Not Built-Up)		0.2	0.29%	0.00%	0.2	0
Freshwater Tidal Marshes		12.7	18.43%	0.05%	6.1	6.6
Herbaceous Wetlands		1.2	1.74%	0.00%	1.2	0
Mixed Scrub/Shrub Wetlands (Coniferous Dom.)		0.1	0.15%	0.00%	0.1	0
Phragmites-Dominated Coastal Wetlands		22.3	32.37%	0.09%	11.2	11.1
Phragmites-Dominated Interior Wetlands		6.2	8.99%	0.02%	4.3	1.9
Wetlands Rights-Of-Way		1.6	2.32%	0.01%	1.1	0.5
Subtotal	**25,249**	**45.2**	**65.61%**	**0.18%**	**25.1**	**20.1**
Total	**72,380**	**68.9**	**100.00%**	**0.10%**	**45.4**	**23.5**

a) Based on NJDEP Land Use/Land Cover Data

Table 4.3-3
Summary of Wetland Impacts

Impact Area	Wetland Impacts (ac.)[a, b]				Total Wetland Impacts (ac.)
	Coastal	Unmapped Coastal-CDF/Disposal Basin	Unmapped Coastal-Other	Freshwater	
Batch Plant[c]	0	19.1	0		19.1
Construction Parking[d]	0	0	0.1		0.1
Cooling Tower	11.7	36.3	0		48.0
Heavy Haul Road[e]	8.6	0.9	0.1		10.0
Intake Structure	0.9	0.6	0		1.5
Power Block	8.9	30.5	0		39.4
Switchyard	29.9	0	23.8		53.7
Temporary Laydown	0	2.6	6.5		9.1
Transmission Towers[d]	5	0	0		5.0
Causeway (Site)[e]	0.2	0	1.6		1.8
Subtotal Site	**65.2**	**90**	**32.5**		**187.7**
Causeway (Off-Site)[e]	39.6	0		1.4	41.0
Total Impacts	**104.8**	**90**	**32.5**	**1.4**	**228.7**

Impact Summary	ac.
Permanent Use Area	
On-Site	151.2
Off-Site (causeway)	20.9
Subtotal	**172.1**
Temporary Use Area	
On-Site[d]	17.4
Adjacent Off-Site[c]	19.1
Off-Site (causeway)	20.1
Subtotal	**56.6**
Total	**228.7**

a) Wetland impacts may be reduced by 90 ac. if the wetland areas in the CDF/Disposal Basins are deemed non-jurisdictional via the JD/LOI process
b) Wetlands as defined by NJDEP and PSEG field delineations
c) Includes adjacent off-site areas (batch plant)
d) Temporary impact area
e) Includes the following temporary impact: haul road (on-site) – 2.3 ac. ; causeway (on-site) – 0.9 ac.; causeway off-site – 20.1 ac.

Table 4.3-4
Land Cover Associated with Hypothetical Off-Site Transmission Right-of-Way

Land Use Category[(a)]	6-Mile Vicinity (acres)	6 to 50+ Mile Region (acres)	Total (acres)	Percent
Open Water	39	187	226	8.2
Developed - Open Space	2	55	57	2.1
Developed - Low Intensity	2	49	51	1.9
Developed - Medium Intensity	1	23	24	0.9
Developed - High Intensity	2	12	14	0.5
Barren Land	4	27	31	1.1
Deciduous Forest	19	337	356	13.1
Evergreen Forest	1	35	36	1.3
Mixed Forest	0	16	16	0.6
Pasture Hay	29	277	306	11.2
Cultivated Crops	101	950	1051	38.5
Woody Wetlands	67	161	228	8.4
Emergent Herbaceous Wetlands	100	232	332	12.2
Total	**367**	**2361**	**2728**	**100.0**

a) Based on USGS Land Use / Land Cover

Table 4.3-5
Wetlands Associated with Hypothetical Off-Site Transmission Right-of-Way

Type[(a)]	6-Mile Vicinity (acres)	6 to 50+ Mile Region (acres)	Total (acres)	Percent
Estuarine and Marine Deepwater[(c)]	33	75	109	13.4
Estuarine and Marine Wetland	143	282	425	52.2
Freshwater Emergent Wetland	13	34	47	5.8
Freshwater Forested/Shrub Wetland	14	196	210	25.9
Freshwater Pond	2	9	11	1.4
Lake	0	7	7	0.8
Riverine	0	3	3	0.4
Other[(b)]	1	2	2	0.3
Total	**207**	**607**	**814**	**100.0**

a) Based on USFWS National Wetlands Inventory
b) Other wetlands include those classified as farmed wetlands, excavated/disturbed wetlands, and seasonal wetlands.
c) Delaware River and other major crossings

Table 4.3-6
Impacted Lengths of Creek Channels

	Flowline Type[(a)]	Length Impacted (ft.)	Duration of Impact
On-site Areas (Direct)			
Cooling Tower (CT01)	Canal Ditch	1280	Permanent
Cooling Tower (CT01)	Stream	1187	Permanent
Power Block (PB01)	Canal Ditch	1335	Permanent
Switchyard 1 (SY01)	Canal Ditch	901	Permanent
Switchyard 2 (SY02)	Canal Ditch	1396	Permanent
Switchyard 2 (SY02)	Stream	848	Permanent
Causeway Area 1 (CW01)	Stream	30	Permanent
Temporary Laydown Area 4 (TL04)	Canal Ditch	288	Permanent
Subtotal		**7265**	
On-site Areas (Indirect) [(b)]	Canal Ditch	2320	Permanent
Off-site Areas			
Proposed Causeway	Stream/Artificial Path	2123	Permanent[(c)]

a) Flowline type designations from the USGS GeoDatabase. Canal Ditch and Stream are considered marsh creeks which are included in the NJDEP-mapped coastal wetlands. As such, impacts to marsh creeks are included in the coastal wetland impacts in Table 4.3-3.
b) Indirect effects associated with isolation of stream channels and loss of connectivity to tidal exchange
c) Actual impacts will be substantially reduced and limited to pier placement only. Stream channels will be avoided during final design.

Table 4.3-7
Stream Lengths (Miles) Associated with Hypothetical Off-Site Transmission Right-of-Way

Type[(a)]	6-Mile Vicinity	6 to 50+ Mile Region	Total	Percent
Channelized Waterway	1.7	3.7	5.4	37.0
Intermittent Stream	0.0	1.1	1.1	7.7
Perennial Stream	2.8	5.3	8.1	55.3
Total	**4.5**	**10.2**	**14.6**	**100.0**

a) Based on USGS Hydrography Dataset

4.4 SOCIOECONOMIC IMPACTS

4.4.1 PHYSICAL IMPACTS

Potential physical impacts associated with construction activities at the PSEG Site and off-site areas include increased noise, vehicle exhaust, dust, and vibration. Physical impacts from construction of the new plant and associated facilities are limited primarily to the previously disturbed areas of the PSEG Site. Off-site physical impacts result from the construction of the proposed causeway, possible new transmission line, operation of a concrete batch plant (adjacent to the northern site boundary), construction traffic to and from the site over local roadways, and possible excavation of fill materials from off-site borrow pits. This subsection addresses how these potential impacts may affect people (the local public and workers), buildings, transportation routes, and the aesthetics of areas located near the PSEG Site. PSEG is committed to meeting applicable environmental requirements and following good construction practices to minimize physical impacts. This subsection also addresses how these commitments are met.

4.4.1.1 The Public and Workers

People living near or working at or near construction sites may be subject to the physical impacts of construction activities. Earthmoving, excavation, clearing, pile driving, erection, batch plant operation, and construction-related traffic may create physical impacts. Activities associated with the use of construction equipment may result in varying amounts of dust, air emissions, noise, and vibration. Increases in traffic due to construction activities can result in local increases in noise and emissions. The magnitude of these potential impacts is typically related to the specific construction activities that occur at a given site, the nature and effectiveness of implemented environmental controls, and the proximity of the site to populated areas.

The PSEG Site, proposed causeway, and borrow pits (if required) are located in or, in the case of the causeway, pass through areas of low population density. A small portion of the population is subject to the potential impact of increases in dust, emissions, noise, and vibrations caused by these construction activities. Workers are subject to the greatest potential physical impacts. This is due to the size of the construction workforce at the PSEG Site and the size of the current operational workforce at HCGS and SGS.

Although the need for a new off-site transmission line has not been formally determined by the RTO via formal transmission impact studies, portions of any potential new transmission right-of-way could pass through populated areas (Section 4.1). Individuals in these areas may experience some impacts of construction as described in Subsection 4.4.1.1.1.

4.4.1.1.1 Impact to the Public

On-site and off-site construction could expose some members of the public to physical impacts from these activities. Potential direct physical impacts are associated with the construction of off-site features (proposed causeway and potential new transmission line). Members of the public may experience indirect physical impacts from on-site activities resulting from increased traffic along local roadways. This subsection describes potential impacts to the public.

4.4.1.1.1.1 On-Site Construction Activities

As noted in Section 2.1, the nearest residences to the center point of the new plant are located 2.8 mi. west in DE, and 3.4 mi. east-northeast near Hancocks Bridge, NJ. As there are no communities or residences in the immediate proximity of the new plant location, noise, dust, and vibration from on-site construction activities are unlikely to have any direct physical impacts on the public.

An increase in daily traffic (up to 3150 construction worker vehicles and 50 trucks) is expected during peak construction along roads passing through Elsinboro and Lower Alloways Creek Townships, and Salem City. The composition of this traffic includes passenger cars and light-duty trucks of the construction workforce, as well as truck traffic for delivery of construction materials and heavy equipment used to support facility construction (e.g. excavators, bulldozers, heavy haul trucks, cranes, etc.). Potential effects of this daily traffic are considered as indirect impacts associated with on-site construction activities. Workers may carpool or shuttle to the construction site, thereby minimizing the number of workers using the causeway and other roadways. Additionally, the existing Hope Creek barge slip and the proposed parallel barge facility are used to deliver larger components (constructed at off-site facilities) and construction materials to the site. Construction-related traffic could expose people living or working along these roads to additional emissions and noise. Because the construction workforce is divided into three shifts, the increased traffic is distributed over the day with only periodic and short-term increases at shift changes. As a result, increases in emission and noise levels are minimal and temporary. Therefore, the indirect physical impacts of on-site construction to the public are SMALL.

Construction activities generate recyclable and non-recyclable wastes. All waste materials will be recycled or properly disposed of in existing permitted landfills. Impacts associated with the generation of construction wastes are SMALL.

4.4.1.1.1.2 Off-Site Construction Activities

The proposed causeway and potential new transmission line are the major off-site new plant elements. The proposed causeway, including at-grade roadways at the northern and southern terminus points, is 4.8 mi. in length. PSEG has determined that a new off-site transmission line may be needed to enhance overall stability of the transmission system; however, no corridor or routing has yet been determined. If off-site borrow pits are required for fill materials at the PSEG Site, some localized increases in dust, emissions, and noise may result at the borrow pit sites. Each of these potential project elements is discussed in the following sections.

4.4.1.1.1.2.1 Proposed Causeway

The proposed causeway extends to the northeast of the PSEG Site, passing over tidal marshland areas. The only nearby residences are located at the extreme northern end of the proposed causeway. A single residence is located just to the west of the intersection of the proposed causeway and Mason Point Road. Construction of the proposed causeway and any improvements of connecting roadways may expose residents of this and other nearby buildings to temporary and intermittent increases in noise, dust, and air pollution emissions associated with these activities. Another structure, owned by PSEG and used intermittently as a field office is located south of the Mason Point Road intersection. Construction practices and controls will be used to minimize fugitive dust. All construction equipment will meet appropriate emissions

standards. The majority of construction activities are during day shift, thereby reducing nighttime noise levels.

Most of the proposed causeway will be built on support structures elevating the roadway above the marsh to minimize impacts to the wetlands. Related construction work includes pile driving, form construction, and steel and concrete work. Because the work is in wetland areas, impacts associated with fugitive dust are not anticipated. Emissions, noise, and vibrations are the primary potential physical impacts. No impacts to the public are anticipated, as there are no homes near the proposed elevated portions of the causeway. Impacts to the public near the northern at-grade portions of the proposed causeway from emissions, noise and vibration are SMALL and temporary.

The construction of the proposed causeway results in an increase in traffic on local roadways in Elsinboro Township and Salem City that lead to the construction site (Figure 2.5-7). Workers may carpool or shuttle to the construction site. Traffic associated with the construction of the causeway has similar potential physical impacts as described for the new plant construction in Subsection 4.4.1.1.1.1. However, because the proposed causeway construction period is limited and the peak workforce is less than 10 percent of the peak construction workforce for the new plant, impacts are lower.

In summary, physical impacts to the public from construction of the proposed causeway, associated parking lots, and increased construction traffic on local roadways in Elsinboro Township and Salem City, are SMALL.

4.4.1.1.1.2.2 Potential Off-Site Transmission Line

Despite adequate thermal capacity of the existing plant transmission lines, a new off-site transmission line may be needed to accommodate the new plant relative to grid stability. Technology selection and formal transmission impact studies (performed by the RTO) are required to determine the need for a new line, PSEG identified two off-site transmission corridor alternatives that may be considered in future transmission routing studies (Subsection 9.4.3).To evaluate potential impacts of these corridors on land use, PSEG performed a geographic information system (GIS) analysis. A tabulation of the existing land use of the two macro-corridor areas (5-mi. wide corridors) within each of the potentially affected counties is provided in Section 2.2.

Need for off-site transmission is dependent on many factors including the type of reactor technology selected, formal transmission impact studies and regional planning efforts by PJM Interconnection, LLC (PJM) external to PSEG. No corridor selection or routing has been determined for off-site transmission. However, construction of any potential transmission line will include excavation, clearing, drilling, and tower erection activities. If PJM determines that a new transmission line is required for stability and reliability of the regional grid, the line would traverse a combination of wooded and open areas. Excavation and pile driving / drilling are required for transmission tower foundations within the cleared and open areas. After foundation placement, the towers are erected and the power lines attached. The potential physical impacts associated with these construction activities include fugitive dust from clearing, grading and drilling operations, and noise and emissions from construction equipment., Physical impacts to the public are minimal, as most of these activities take place in remote areas. Whenever possible, the new transmission towers will be constructed within or along existing transmission corridors to minimize potential environmental impacts.

Portions of the potential off-site transmission line may pass through developed areas. Although route selection for any new off-site transmission line will attempt to avoid residential and other developed land to the extent feasible, some developed properties may have to be purchased along the transmission right-of-way. Because of the proximity of these developed land uses, a higher potential exists for fugitive dust, emissions, and noise impacts during construction. In un-forested areas, noise and emission impacts are minimal and confined to small areas near the towers. By comparison, emissions and noise levels may be greater in areas that require clearing due to the increased use of equipment and the workforce needed to clear wooded areas, remove woody debris, and grade. Appropriate construction management practices are employed to reduce equipment and noise emissions in these areas. Any increases in fugitive dust, emissions, and noise are short-term and impacts to the public are SMALL.

4.4.1.1.1.2.3 Borrow Pits

Fill material is required to elevate the new plant facilities and structures to final grade. To the extent possible, this fill material comes from within the PSEG Site boundaries. If additional off-site fill material is required, it is expected to come from existing permitted borrow areas such as those used in the construction of HCGS. For existing borrow areas, physical impacts are limited to emissions and noise from trucks traveling to and from the borrow pits and the construction site. These borrow pits are generally located in remote areas, and given Salem County's low population density, a small portion of the public have the potential to be exposed to these physical impacts for short durations. Therefore, impacts are SMALL.

4.4.1.1.2 Impacts to Workers On-Site and Off-Site

Due to the large scale of the construction project, the large number of on-site workers, and the large requirement for equipment and materials, on-site construction workers have the highest potential for exposure to physical impacts. Because of their proximity to the construction site, the operational workforce of the HCGS and SGS may be impacted, but to a lesser extent. Heavy equipment operation such as that related to batch plant operations, excavation, drilling, and pile driving results in elevated noise, fugitive dust, emissions, and vibrations on-site and immediately adjacent to the construction site. Contractors, vendors, and other members of the workforce are required to employ BMPs to minimize and control dust; use personal protective equipment and masks in areas of high dust; properly maintain equipment to minimize harmful emissions; and implement safety measures to reduce noise impacts to the workers (e.g., protective earplugs and other hearing protection). Most of the operational workforce at HCGS and SGS work indoors. These workers are expected to only be intermittently exposed to increased fugitive dust, emissions, and noise from the construction of the new plant.

The potential for physical impacts to workers constructing the proposed causeway and potential off-site transmission line is low, due to the much smaller workforce and reduced demand for equipment and materials. Additionally, the associated construction activities are dispersed over a larger, linear geographic area, further reducing the relative impact. Although the potential for impacts may be less, BMPs are implemented to minimize worker exposure to fugitive dust, emissions, and noise. Therefore, impacts are SMALL.

4.4.1.2 Noise

Subsection 2.5.5 provides information and data related to the background noise levels at the PSEG Site. Noise levels at the PSEG Site are expected to increase due to the operation of vehicles and construction equipment.

Table 4.4-1 provides typical noise levels from equipment commonly used during construction. On-site noise level exposure is controlled through appropriate training, personnel protective equipment, periodic health and safety monitoring, and industry good practices. Practices such as maintenance of noise limiting devices on vehicles and equipment, controlling access to high noise areas, duration of emissions, and/or shielding high noise sources near their origin limit the adverse effects of noise on workers. Non-routine activities with potential adverse impacts on noise levels are limited and use good industry practices that further limit adverse effects.

New Jersey has established protective noise levels. New Jersey Administrative Code (NJAC) 7:29 includes regulatory limits on continuous noise levels at the residential property line from industrial, commercial, public service, or community service facilities. For continuous noise sources, the protective level is 65 dBA during the day and 50 dBA during the night at the residential property line (Reference 4.4-3). The similar DE limits (Part VII, Title 7, Chapter 71 of the Delaware Code) provide for a protective level of 65 dBA during the day and 55 dBA during the night for residential receptors.

As shown in Table 4.4-1, noise levels for construction equipment range from 80 to 88 dBA at 50 ft to 50 to 58 dBA at 1500 ft. These data indicate that noise levels attenuate rapidly with distance (30 dBA over a distance of 1450 ft). The bounding condition for construction noise levels is 102 dBA at 50 ft. (Site Safety Analysis Report [SSAR] Table 1.3-1 Item 18.3.1). Based on the natural attenuation of noise levels over distance, the bounding condition construction noise level is below the NJ daytime standard between 3000 and 4000 ft. from its source. The closest residences and recreation areas are more than 2 mi. from the construction site. Thus, the impact of noise from construction of the new plant on nearby residences and recreational areas is SMALL.

Traffic associated with the plant workforce traveling to and from the PSEG Site also generates noise. The increase in noise relative to background conditions is most noticeable during the shift changes in the morning and late afternoon. The 4100 additional employees work in shifts, with the largest shift working during the day. Smaller shifts work in the evening and night. Additionally, posted speed limits, traffic control and administrative measures, such as staggered shift hours, will be employed that reduce traffic noise during the weekday business hours. Therefore, potential noise impacts to the community are intermittent and limited primarily to shift changes. The impact from noise from construction-related traffic to nearby residences and recreational areas is SMALL.

Potential indirect impacts may be anticipated to off-site areas associated with the roadway network and adjacent lands beyond the terminus of the causeway. Noise related impacts may result from an increased traffic volume and resultant increases in traffic generated noise as discussed above. Noise levels during shift changes in these off-site areas are notable as these residences are currently located within a roadway network that is characterized by low traffic volumes and low traffic noise levels. Within off-site areas, distances of residential receptors to existing roadways range from 25 ft. within the urban areas of Salem and Hancocks Bridge to 990 ft. in the rural areas of Elsinboro and Lower Alloways Creek townships, with a mean of 396

ft. Based on the greater distances evident within rural areas, the intermittent increase in traffic volume associated with shift changes, and the natural tendency for noise to attenuate over distance (as discussed above), noise levels attenuate to acceptable levels and do not adversely impact the public.

In summary, noise control practices at the construction site and the additional attenuation provided by the distance between the public and the site, limits noise effects to the public and workers during construction so that its impact is SMALL and temporary.

4.4.1.3 Dust and Other Air Emissions

Construction activities result in increased air emissions. Earthmoving and material handling activities may generate fugitive dust and fine particulate matter. Vehicles and engine-driven equipment (e.g., generators and compressors) generate combustion product emissions such as carbon monoxide, nitrogen oxides and, to a lesser extent, sulfur dioxides. Painting, coating and similar operations also generate emissions from the use of volatile organic compounds. Table 4.4-1 includes typical emission levels for major equipment that is used during construction and for light vehicles (passenger cars and trucks) used by construction workers.

Emission-specific strategies and measures will be developed and implemented to ensure compliance within the applicable regulatory limits defined by the *National Primary and Secondary Ambient Air Quality Standards* (40 CFR Part 50) and *National Emission Standards for Hazardous Air Pollutants* (40 CFR Part 61). Additionally, a dust control program will be implemented.

Contractors, vendors, and subcontractors are required to adhere to appropriate federal and state occupational health and safety regulations. These regulations set limits to protect workers from adverse conditions, including air emissions.

Implementation of controls and limits at the source of emissions on the construction site result in reduction of impacts off-site. For example, the dust control program reduces dust due to construction activities to minimize dust reaching site boundaries. Transportation and other off-site activities result in emissions from vehicle usage. Off-site transportation activities generally occur on improved surfaces, limiting fugitive dust emissions.

Specific mitigation measures to control fugitive dust may include any or all of the following:

- Stabilizing construction roads and spoil piles
- Limiting speeds on unpaved construction roads
- Periodically watering unpaved construction roads
- Performing housekeeping (e.g., remove dirt spilled onto paved roads)
- Covering haul trucks when loaded or unloaded
- Minimizing material handling (e.g., drop heights, double-handling)
- Phased grading to minimize the area of disturbed soils
- Re-vegetating road medians and slopes

While emissions from construction activities and equipment are unavoidable, implementation of mitigation measures minimize impacts to local ambient air quality and the nuisance impacts to the public in proximity to the project. The mitigation includes:

- Implementing controls to minimize daily emissions
- Performing proper maintenance of construction vehicles to maximize efficiency and minimize emissions

In summary, air emission impacts from construction are SMALL because emissions are controlled at the source where practicable; maintained within established regulatory limits designed to minimize impacts; and located a significant distance from the public.

4.4.1.4 Buildings

The only buildings in the immediate area of the construction site that may be impacted by construction activities are those associated with the HCGS and SGS. There are no other buildings located near the PSEG Site. The proposed causeway and potential off-site transmission line pass by existing homes and other buildings, but none of these structures are expected to be removed. Related information about historic properties and the potential impacts of construction to these structures is provided in Subsections 2.5.3 and 4.1.3.

The greatest potential impact is to buildings located on the PSEG Site. These buildings could be affected by vibration associated with pile driving activities. Construction activities will be planned, reviewed, and conducted in a manner that ensures no adverse effect on existing plant operations.

Construction activities are not expected to affect off-site buildings due to their distance from the construction areas. As previously stated, the nearest residence is located 2.8 mi. to the west of the site across the Delaware River.

Construction activities along the proposed causeway are not expected to have an adverse impact on buildings. While pile driving is required for construction of the support structures over the marshlands and other areas of lower bearing capacity, no buildings have been identified in areas where pile driving activities occur. A residence located at the intersection of Money Island Road and Mason Point Road is immediately adjacent to the at-grade terminus of the proposed causeway. However, the required widening and upgrading of the road in this location is not expected to involve any major vibration generating activities such as pile driving or blasting. The impact on buildings associated with the potential off-site transmission line will be determined during routing studies and at the time of detailed design. However, routing is anticipated to avoid buildings and therefore impacts will be minimized.

Potential physical effects on buildings on-site and adjacent to the proposed causeway and potential new transmission line are SMALL.

4.4.1.5 Transportation Routes

A number of major highways are located north and north-northeast of the PSEG Site. The major interstates are 76, 95, 276, 295, 476, 495 and 676 (Figure 2.2-5). The major NJ highways providing access between the site and these interstates are NJ Route 45 and NJ Route 49, which pass through Salem City.

To avoid disruptions to the HCGS and SGS operational workforces, construction-related traffic will primarily use the proposed causeway. The anticipated transportation routes to and from the PSEG Site via the proposed causeway are shown on Figure 2.5-7. As shown in this figure, there are multiple routes from the terminus of the proposed causeway to NJ Route 45 and NJ Route 49 in Salem City. PSEG conducted a traffic impact assessment (TIA) study to determine the impact of construction traffic. This study indicates that construction traffic on these roads is greatest during shift changes, when construction activities reach their peak. During shift changes, 2200 vehicles are estimated to use these local roads during peak construction. Delivery of construction materials, equipment and supplies adds another 50 vehicles per day to the local highways over the 68-month construction period.

Additional traffic on receiving roadways results in a deterioration in the level of service (LOS) at five key intersections near Salem. LOS is a measure of time delays at signalized and unsignalized intersections, and is ranked from A to F based on the delay times. LOS A reflects the optimum conditions with delay times of less than 10 seconds for both signalized and unsignalized intersections. Delay times of 10 to 20 seconds, 15 to 35 seconds, 25 to 55 seconds, 35 to 80 seconds, and greater than 50 – 80 seconds are classified as LOS B through F, respectively. The lower value of each noted LOS range is for the unsignalized intersections and the higher value for the signalized intersections. Three of these intersections are unsignalized and are located along Grieves Parkway at Chestnut, Oak, and Walnut streets. Grieves Parkway is located on the south side of Salem City and extends between Yorke Street to the east, and Front Street to the west. The fourth intersection, Front Street and NJ Route 49 (also known as South Broadway) is signalized and is located on the west / north side of Salem City. The fifth intersection, NJ Route 49 and Market Street is signalized and located at the center of Salem City. The projected LOS levels at these locations are presented in Table 4.4-2. The "Future No-Build" column depicts the traffic conditions in year 2021 if the new plant at the PSEG Site is not built. The "Future with Causeway" column depicts the traffic conditions with the causeway in service and construction activities taking place at the PSEG Site, but without any mitigation to alleviate the traffic impacts. These data indicate that the LOS deteriorates more under the future with construction traffic scenario, particularly for the morning shift change. The morning LOS deteriorates from C to F at the Chestnut and Oak Street intersections with Grieves Parkway (southeast approaches), and deteriorates to F during peak hours (AM and PM) at the Walnut Street and Grieves Parkway, and the Front Street and NJ Route 49 intersections. The "With Mitigation" column depicts the traffic conditions with the causeway in service and construction activities taking place at the PSEG Site, and considers the mitigation measures noted in the far right hand column of the table.

Based on this deterioration in LOS, the TIA evaluated various mitigation measures at four of the five intersections. The mitigation measures found to be the most effective and their associated affect on the future LOS levels with construction traffic are shown in the "With Mitigation" column in Table 4.4-2. Potential mitigation measures include:

- Changing the three Grieves Parkway intersections at Chestnut, Oak and Walnut streets from two-way stop sign control to traffic light control
- Constructing turn bays at the Grieves Parkway/Oak Street intersection
- Adding another turn bay at the Front Street/NJ Route 49 intersection

These mitigation measures markedly improve the LOS at these intersections. In addition to the recommended intersection improvements, the TIA study indicated that some additional widening of Amwellbury Road may be necessary to increase its capacity. No specific plans or designs regarding this potential improvement have been developed. PSEG will continue to work with the Salem County Public Works Department regarding the need for improvements.

Large components and equipment will be transported by barge and delivered to a barge unloading facility constructed at the PSEG Site. The barge facility will comply with applicable regulatory requirements. Construction of this unloading facility does not result in impacts to the public as its location is in an access-restricted area of the PSEG Site.

While the additional construction traffic creates adverse impacts to local roadway traffic usage, these are short-term and limited to the morning and late afternoon. Therefore, these impacts are MODERATE and can be mitigated.

4.4.1.6 Aesthetics

NUREG-1437 presents criteria for the assessment of visual impacts for relicensing of existing nuclear power units. However, these criteria are also appropriate for construction of new units. These criteria are based on complaints from the public concerning a sense of change or diminution of enjoyment of the affected physical environment, and impacts to socioeconomic institutions and processes. These criteria are:

SMALL	No complaints from public and no measurable impacts to socioeconomic institutions and processes.
MODERATE	Some complaints from the affected public, and measurable impacts that do not alter the continued functioning of socioeconomic institutions and processes.
LARGE	Continuing and widely shared opposition from the public and measurable social impacts that perturb the continued functioning of community institutions and processes.

Visual and aesthetic impacts associated with a particular project may occur as a result of the introduction of a structure or facility that is not consistent with the existing viewshed. Consequently, the character of an existing site is an important factor in evaluating potential visual effects of construction on the visual resource. The PSEG Site is a developed site containing a number of structures including the 512-ft. tall HCGS natural draft cooling tower, three containment buildings, transmission towers, and several other buildings. Additional buildings adjacent to existing structures should not appreciably change the visual character of the area. The site is remote and not readily accessible to the public. The closest public road is Alloway Creek Neck Road, 3 mi. to the east. Money Island Road is the closest public road to the north and is 4 mi. away. The terrain and distance between these roads and the site reduce the

visibility of most of the construction activities. As stated in Subsection 4.4.1.1.1.1, the nearest residences to the new plant site are located 2.8 mi. west in Bay View Beach, DE, and 3.4 mi. east-northeast of the proposed site near Hancocks Bridge, NJ. Close-up views of the construction site are limited to those from boat traffic on the Delaware River. The proposed construction site is located adjacent to the Delaware River and the terrain is low, making it visible to recreational users on the Delaware River and bay.

While most of the construction activities are not expected to be visible to the general public, natural draft cooling towers may be as high as 590 ft. (SSAR Table 1.3-1, Item 2.5.20) and are visible from local public roads. These natural draft cooling towers are visible in DE, because the river provides an open and unobstructed view of the site. Lights will be placed on these towers to meet Federal Aviation Administration requirements. These lights are visible at night from local public roads and elevated structures such as the Delaware Memorial Bridge.

A potential off-site transmission line may be needed to accommodate the new plant relative to grid stability. Need for off-site transmission is dependent on a variety of factors, including the type of reactor technology selected, formal transmission impact studies, and regional planning efforts by PJM external to PSEG. Transmission towers and supporting lines can impact on the viewscape for some members of the public. To minimize visual impacts, the corridor routing and siting process will attempt to locate new transmission lines in or adjacent to existing transmission corridors to the extent practicable.

Construction of the proposed elevated causeway will be visible to recreational users on the Delaware River and bay, and recreational visitors to Abbot Meadows near the north terminus of the proposed causeway. While this impact is somewhat diminished due to its alignment along an existing transmission line, it still results in viewshed alteration due to its visual inconsistency with the existing viewscape, highway safety lighting, and its elevated position. However, this potential visual alteration does not adversely impact recreational use of these areas.

The consistency of the proposed land use with the existing industrial land use, and the commitment to use existing transmission corridors to the extent practicable for construction of the new transmission lines reduce incremental aesthetic impacts. Public issues are expected to be minor because of the remoteness of the PSEG Site and no measurable impacts to socioeconomic institutions and processes are anticipated. Therefore, visual impacts are SMALL.

4.4.2 SOCIAL AND ECONOMIC IMPACTS

This section evaluates the demographic, economic, infrastructure, and community impacts to the region as a result of constructing a new plant at the PSEG Site. Potential impacts of constructing a new plant on regional and local socioeconomic conditions is attributable to the size of the construction workforce, the expenditures needed to support the construction program, and the tax payments made to political jurisdictions. The analysis presented in this section is based on the plant parameter envelope (Section 3.1), for the largest construction work force of the four reactor technologies. As noted in Table 2.5-22, the maximum on-site workforce is approximately 4100 workers (SSAR Table 1.3-1, Item 18.4.1). This analysis assumes 2016 as the construction start date and assumes a 68-month schedule of construction, ending in 2021.

As discussed in Subsection 4.4.1.1.1.2.1, PSEG plans to construct a new 4.8 mi. causeway that connects the new plant site to the local road network 3.5 mi. southwest of Salem City, NJ. The

causeway provides access to the construction site for workers and for land-delivered materials. Construction of the proposed causeway results in minor social and economic impacts in comparison to construction of the new plant. The causeway project is expected to be completed in less time and require fewer workers than construction of the new plant. Work will be initiated at approximately the start of plant pre-construction work.

As discussed in Subsections 4.4.1.1.1.2.2 and 4.4.1.1.1.2.3, additional off-site features associated with the new plant construction include the development of a potential off-site transmission line and use of off-site borrow pits. No formal determination for the need of the new transmission line has been made and no decision has been made as to the location of the off-site transmission corridor or the specific route within the selected corridor, but two corridor alternatives have been preliminarily considered and are discussed in Chapter 9. PSEG expects that the potential future transmission line will be constructed within or along existing transmission corridors wherever possible. Construction activity consists of foundations for individual transmission towers and clearing activities where required in new transmission rights-of-way.

Fill material is needed to construct the new plant. If sufficient fill material is not available on-site, PSEG will supplement the supply with material from existing off-site borrow pits. As a result, these additional off-site activities contribute minor social and economic impacts as components of the overall site construction effort.

4.4.2.1 Demography and Distribution of New Workforce

In 2000, the population within the 50-mi. radius of the PSEG Site was 5 million and is projected to grow to 6 million by 2021 (Table 2.5-7). The four-county Region of Influence (Cumberland, Gloucester and Salem counties in NJ and New Castle County, DE) had a population of 966,000 in 2000 and 1 million in 2008. A total of 82.6 percent of the current HCGS and SGS workforce resides in the Region of Influence (Table 2.5-1).

The peak construction workforce is 4100 on-site workers (SSAR Table 1.3-1, Item 18.4.1). A 1981 NRC study (Reference 4.4-11) of construction workforce migration and relocation at 13 operating nuclear power plants indicated that a variety of factors contributed to the number of workers that relocate from outside the region. This study found that 15 to 35 percent of the trade and non-trade workforce come from outside the 50-mi. radius of the new plant. Also, trades that were represented by a large workforce within the region generally had lower rates of relocation. In contrast, the rates of relocation were greater for non-trade workforce and for trades that were less well represented in the region.

A characterization of the workforce needed for construction of a two-unit AP1000 plant is given in Table 2.5-22. Overall construction of the new plant is estimated to take 5 to 7 yr. Based on information supplied by the reactor vendors, a 68-month construction period has been assumed for this ER, with construction commencing in 2016 and a 2021 commercial operation date. To meet this 68-month schedule, the workforce is divided into three shifts; with approximately 60 percent working on the first shift (days); 35 percent on the second shift (evenings); and 5 percent on the third shift (overnight) (Table 2.5-23).

Based on PSEG’s previous experience with the construction of HCGS and SGS, most of the construction workforce reside within 50-mi. of the new plant and commute to work from their homes. As shown in Tables 2.5-20 and 2.5-26, a large construction trade workforce is available

in the region and four-county Region of Influence, respectively. Therefore, it can be assumed that the number of trade workers moving into the region is at the low end of the overall range noted in the 1981 NRC study. Given that the construction trades are abundant relative to construction workforce requirements (except for Boilermakers and Iron Workers), it is assumed that the required workforce for these trades will come from within the region. For Boilermakers and Iron Workers, the construction workforce requirement is high relative to the available workforce. Demand is assumed to be high for these trades and therefore, it is conservatively assumed that 10 percent of these specific workforces are available from within the region for the construction of a new plant.

No workforce data are available for the non-trade labor in the 50 mi. radius of the PSEG Site or four-county Region of Influence. However, given that a major economic center (Philadelphia-Camden-Wilmington) is located within the region, a large pool of non-trade labor is available. The NRC 1981 study found that a higher percentage of the required non-trade workforce came from outside the 50-mi. region. Therefore, the mid-point of the range (25 percent) noted in the 1981 NRC study is a reasonable estimate of the number of required non-trade workers likely to relocate from outside the 50-mi. region, which is reflected in Table 4.4-3.

Based on the above trade and non-trade workforce assumption, the construction workforce requirements, and the available workforce within the 50-mi. radius of the new plant, the numbers of trade and non-trade workers that are available locally and that relocate to the region are shown in Table 4.4-3. It is estimated that 3466 of the required workers already reside within the 50-mi. radius of the new plant and 634 workers, or 15.5 percent of the workforce, are to relocate from outside the 50-mi. radius of the new plant. This estimate of trade and non-trade worker relocations is representative of the lower end of the range noted in the NRC study. The lower value is considered reasonable based on the large construction workforce (over 233,000 as noted in Table 2.5-20) projected to be available within the 50-mi. region.

Most workers relocating from outside the 50-mi. radius of the PSEG Site are expected to select localities in which to reside that provide convenient access to the PSEG Site. It is conservatively assumed that 100 percent of the non-residential workforce and their families relocate within the Region of Influence.

The growth of jobs associated with the non-residential workforce is likely to occur later compared to workers currently living within the 50-mi. region. However, for the purposes of assessing potential impact, it is conservatively assumed that the number of non-resident workers is a constant 15.5 percent of the total workforce, based on the peak ratio of 634 non-resident workers out of 4100 total workers. A timeline of growth and decline in the construction workforce is illustrated in Table 2.5-23.

PSEG further assumes that each construction worker that relocates into the Region of Influence brings a family. The average household size in NJ and DE are 2.70 and 2.57, respectively (Table 2.5-10). To be conservative, the NJ household size of 2.7 is used to estimate the population increase in the Region of Influence during construction. Therefore, a non-residential workforce of 634 increases the population in the Region of Influence by 1712 people.

Of the 1300 PSEG employees who currently reside within the Region of Influence, 12.1 percent reside in Cumberland County, 17.7 percent in Gloucester, 49.6 percent in Salem and 20.6 percent in New Castle. Assuming a similar distribution, the resulting numbers of non-resident

workers and net population growth within the Region of Influence are summarized in Table 4.4-4.

The estimated population increase constitutes 0.13 percent, 0.10 percent, 1.28 percent, and 0.07 percent of the 2008 estimated population of Cumberland, Gloucester, Salem and New Castle counties, respectively.

4.4.2.2 Impacts to the Community

4.4.2.2.1 Economy

The employment of the construction workforce over the period of construction has economic and social impacts on the surrounding region. Salem County is the most affected county within the 50-mi. radius of the new plant because it is the site of the construction activity and receives the largest number of relocated employees. Salem County also has the smallest population of the four counties in the Region of Influence (Table 2.5-9). Other counties in the Region of Influence and the 50-mi. region experience the remaining economic and social impacts, which are more diffuse within the larger populations of these counties.

NUREG-1437 presents criteria for the assessment of economic impacts based on the construction-related employment as a percentage of total employment for the relevant study area. These criteria are:

SMALL	If construction-related employment is less than 5 percent of total study area employment.
MODERATE	If construction-related employment is 5 to 10 percent of total study area employment.
LARGE	If construction-related employment is greater than 10 percent of total study area employment.

Capital expenditures, purchases of goods and services, and payment of wages and salaries to the construction workforce has multiplier effects during the construction phase that result in an increase in business activity, particularly in the retail and service industries. In the multiplier effect, each dollar paid to construction workers are either saved or expended for personal goods and services. Similarly, goods and services purchased as part of the construction effort represent income to the recipient who likewise expends monies as part of payroll and goods and services. The number of times the final increase in consumption exceeds the initial dollar spent is called the multiplier (Reference 4.4-1). Based on a 2006 Nuclear Energy Institute (NEI) report (Reference 4.4-12), the multiplier effect from the purchase of goods and services for HCGS and SGS operation and maintenance was an additional $0.88 of economic output for the Region of Influence and additional $1.07 for the three-state area (DE, NJ, and PA) for each dollar spent.

Additional jobs in the Region of Influence and three-state area (DE, NJ, and PA) result from the multiplier effect attributable to the new plant construction expenditures. An additional 586 indirect jobs in the Region of Influence and 4000 indirect jobs in the three-state area may be created as a result of the purchases of goods and services in support of the new plant construction. Most indirect jobs are service-related and the indirect jobs are assumed to be filled

by the existing community workforces within the 50-mi. radius of the PSEG Site. Some of these indirect jobs benefit unemployed or underemployed workers within the four-county Region of Influence. It is also assumed that distribution of indirect jobs by county is the same as the distribution of direct jobs. In year 2000, there were 18,588 unemployed workers in the four-county Region of Influence, with 1216 in Salem County. Due to the recession era volatility reflected in 2008/2009 data, the average for year 2000 is used as a more conservative basis of comparison in this analysis.

A total of 314 construction workers are assumed to relocate to Salem County. These workers spend part of their incomes on housing, food, clothing, fuel and related expenses within Salem County and additional income on sales taxes for most of these expenditures. Additional expenditures will be realized from other construction workers commuting into the county. This has a positive impact on the economy by providing new business and job opportunities for local residents. In addition, these businesses and employees generate additional profits, wages, and salaries, upon which taxes are paid. Because the number of construction workers relocating to the Region of Influence will be lower than five percent of the available workforce (634 relocations as compared to a 2007 workforce of almost 600,000), the economic impacts of constructing the proposed new plant are beneficial and SMALL.

4.4.2.2.2 Taxes

NUREG-1437 presents an assessment of off-site land use impacts that is based on (1) the size of plant-related population growth compared to the area's total population, (2) the size of the plant's tax payments relative to the community's total revenue, (3) the nature of the community's existing land-use pattern, and (4) the extent to which the community already has public services in place to support and guide development. In the same document, NRC presents an analysis of off-site land use during refurbishment (i.e. large construction activities) that is based on population changes caused by refurbishment activities.

Based on the case-study analysis of refurbishment, in NUREG-1437 NRC defined the magnitude of license renewal-related tax impacts as:

SMALL	If the payments are less than 10 percent of revenue.
MODERATE	If the payments are between 10 and 20 percent of revenue.
LARGE	If the payments are greater than 20 percent of revenue.

Finally, NRC determined that, if the plant's tax payments are projected to be a dominant source of the community's total revenue, new tax-driven land-use changes are LARGE. This is especially true where the community has no pre-established pattern of development or has not provided adequate public services to support and guide development in the past.

Tax revenues associated with construction of a new plant include payroll taxes on wages and salaries of the construction work force, sales and use taxes on purchases made by PSEG and the construction workforce, property taxes related to the building of new nuclear plants, and property taxes on owned real property. Additional tax revenues generated by economic activity result from the multiplier effect. Increased taxes collected are a benefit to the states and the local jurisdictions in the region.

Personal and Corporate Income Taxes

Taxes generated by construction activities and purchases and by workforce expenditures include construction workforce payroll taxes (federal and state). State tax payments are distributed throughout the 50-mi. region, based on the current residential location of most construction employees. The non-resident workers within the Region of Influence results in an increase in payroll taxes paid to NJ and DE.

New or expanded businesses benefiting from the multiplier effect pay additional corporate income taxes, and hire workers who are taxed on wages and salaries. Thus, the tax base in the region expands, particularly in the four counties most affected by the influx of construction workers.

Sales Taxes

Workers commuting to the construction site from within the 50-mi. region contribute sales tax revenues in a pattern generally representative of where they live within the region. NJ counties within the Region of Influence experience an increase in the amount of sales taxes collected, reflecting the concentration of re-located workers. Additional sales taxes generated by retail expenditures of businesses and their employees result from the multiplier effect. DE does not currently collect sales tax.

Sales tax revenues also result from direct purchases by PSEG for materials, equipment and services supporting the construction project. The distribution of these tax revenues is determined by the business locations of the material and service providers and likely reflects a broader distribution throughout the 50-mi. region and beyond. The amount of sales taxes collected over a potential 60-yr operating period for the new plant is significant, but is relatively minor when compared to the total amount of taxes collected throughout the 50-mi region.

Property Taxes

PSEG pays property taxes to Lower Alloways Creek Township and Salem City in Salem County, NJ. A portion of the property taxes collected are provided to Salem County, which in turn provides services to residents of the municipality. From 2005 through 2009 these property taxes averaged 3.4 percent of total property tax revenue in Salem County (Table 2.5-37). PSEG owns portions of several EEP mitigation sites and paid property taxes on these to the townships in where they are located. Property taxes to Lower Alloways Creek Township, Elsinboro Township, Salem City, and Salem County from the construction project may increase if additional property is acquired.

The effect of property taxes paid by the construction workforce is dispersed throughout the 50-mi. radius of the new plant. Construction workers commuting to the job from their homes continue to pay existing property taxes. Workers relocating to the Region of Influence also indirectly contribute to increased property tax revenues.

Summary of Tax Impacts

Although overall tax revenues generated by construction of the new plant will be substantial in absolute dollars, they are relatively small in comparison to the established tax base of the Region of Influence and the 50-mi. radius of the PSEG Site. The effect of tax revenues will be most noticeable in Salem County, NJ. However, the maximum increase in property tax revenues at completion of new plant construction is less than half the existing revenue, which accounts for 3.3 percent of county revenue. Therefore, total tax revenues from plant construction are less than 10 percent of total revenue for Salem County, resulting in SMALL positive impacts.

4.4.2.2.3 Land Use

NUREG-1437 presents an assessment of off-site land use impacts of license renewal that is based on the following:

- The size of plant-related population growth compared to the area's total population
- The nature of the community's existing land-use pattern
- The extent to which the community already has public services in place to support and guide development

The NRC presents an analysis of off-site land use during refurbishment that is based on population changes caused by refurbishment activities. The NRC's criteria and methodology are appropriate to evaluate socioeconomic impacts of construction of the new plant.

In NUREG-1437, the NRC concluded that land-use changes during refurbishment at nuclear plants would be:

SMALL	If population growth results in very little new residential or commercial development compared with existing conditions and if the limited development results only in minimal changes in the area's basic land use pattern.
MODERATE	If plant-related population growth results in considerable new residential and commercial development and the development results in some changes to an area's basic land use pattern.
LARGE	If population growth results in large-scale new residential or commercial development and the development results in major changes in an area's basic land-use pattern.

Further, NRC defined the magnitude of population changes as follows:

SMALL	If plant-related population growth is less than 5 percent of the study area's total population, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons per square mi., and at least one urban area with a population of 100,000 or more within 50 mi.

MODERATE — If plant-related growth is between 5 and 20 percent of the study area's total population, especially if the study area has established patterns of residential and commercial development, a population density of 30 to 60 persons per square mi., and one urban area within 50 mi.

LARGE — If plant-related population growth is greater than 20 percent of the area's total population and density is less than 30 persons per square mile.

Land Use in the Region of Influence and Salem County

All of the counties in the Region of Influence have planning departments that maintain land use plans, zoning ordinances and related documents that are primarily implemented at the municipal level. Population data for the Region of Influence counties and municipalities are presented in Table 2.5-9. In NJ, the counties provide resources and services to municipalities and townships and participate in regional planning organizations. NJ is developing a statewide land use plan and has established a cross-acceptance procedure for certifying county and local plans under the state plan. All three NJ counties in the Region of Influence participate in the statewide Farmland Preservation Program, which receives policy and funding support through the state plan. Additional discussion of county land use practices is presented in Subsection 2.5.2.8.

Salem County is the primary focus of the land use analysis because it is the county where the new plant is constructed and receives the largest percentage of the non-resident construction workforce. Salem County, Salem City, Lower Alloways Creek Township and Elsinboro Township may receive property tax benefits from PSEG. Other counties in the Region of Influence are more heavily populated and receive smaller shares of the non-resident construction workforce. Land use changes in those counties are influenced by a variety of other socioeconomic forces (e.g., closer proximity to major population centers or employers). Those forces significantly dilute potential land use impacts created by the temporary residency of non-resident construction workers.

Salem County has several measures in place to provide sustainable economic development while protecting its rural character. These are organized in a Smart Growth Plan (Reference 4.4-4) that focuses on directing future commercial and industrial growth toward the western side of the county (including Salem City), where existing infrastructure and major roadways exist to support development. Residential growth is encouraged in existing communities and an Open Space and Farmland Preservation Plan (References 4.4-5 and 4.4-6) focuses on controlling growth in the eastern and central portions of the county to protect the traditional agrarian economy of the area. Many of the non-residential workers are expected to find temporary housing in the more developed western corridor, which includes the communities of Pennsville, Penns Grove and Carneys Point. The population of Salem County in 2008[a] is estimated at 66,141 (Table 2.5-9), and the land area of the county is 338 sq. mi.

Salem City is the county seat of Salem County with a population of 5678 in 2007 (Table 2.5-9). In 1999, "Salem Main Street" was formed to stimulate business opportunities, historic preservation, and community growth. Salem Main Street created the Main Street Revitalization

a. Note that population estimates at the state and county level are available for 2008, whereas the most recent data for township and municipalities is for 2007.

Master Plan (Master Plan) which acts as a road map for future land use for Salem City. The Master Plan focuses on creating a cohesive town core and encourages coordination with Salem County to reduce competition between the city and the county (Reference 4.4-7). Salem City is 7-1/2 mi. from the PSEG plant site. The extent of temporary housing available in or near Salem City influences the number of non-resident workers that locate here.

Lower Alloways Creek Township occupies 47 sq. mi. (30,080 ac.) in the southwest corner of Salem County and had a population of 1883 in 2007 (Table 2.5-9). The PSEG Site, along with the SGS and HCGS, is located in the western edge of the township. Lower Alloways Creek Township's land use plan focuses on preserving farmland and open spaces and directing growth toward areas of the community most capable of providing necessary services. The 2005 Master Plan Reexamination Report for Lower Alloways Creek Township states that there has been little change in the Township's land use patterns since the last Master Plan review in 1999. The township has little temporary housing capacity and few non-resident workers are likely to find housing there.

Cumberland County, NJ has a land area of 500 sq. mi. and an estimated population of 156,830 in 2008 (Subsection 2.5.2, Table 2.5-9). Existing land use patterns in Cumberland County are similar to those of Salem County, and consist of extensive wetlands along the Delaware Bay coastline, an inland agricultural landscape, and population centers in the central and northeastern portions of the county. Temporary housing is most likely to be available in Bridgeton or Vineland.

Gloucester County, NJ, is located north of Salem County and is almost the same size at 337 sq. mi. The estimated population of 287,860 (Table 2.5-9) people in 2008 is primarily concentrated in suburban communities in the north part of the county, which is adjacent to major population centers in Philadelphia and Delaware counties, PA and Camden County, NJ. Another concentration of population is clustered around Glassboro, in the center of the county. South and southeast portions of the county are predominantly rural and more closely resemble the agricultural character of Salem and Cumberland counties.

New Castle County, DE is located to the west of Salem County and has a land area of 426 sq. mi. In New Castle County, DE, zoning ordinances at the municipal and county level set forth the permitted land uses and intensities. State-certified comprehensive plans adopted by the county and municipalities establish future land uses for these jurisdictions and guide development patterns. Zoning must reflect the future land-use designation in the comprehensive plan. New Castle County's Comprehensive Plan 2007 Update generally calls for medium to high density residential and commercial development along major roadways and within existing developments in northern New Castle County. This part of the county is most accessible to PSEG employees via the bridge from Wilmington, DE to Pennsville, NJ. The 2008 estimated population of New Castle County was 529,641 (Table 2.5-9).

Population growth from the new plant construction workforce results in limited new residential and commercial development compared with existing conditions and minimal changes in the area's basic land use pattern. Therefore impacts are SMALL.

Construction-Related Population Growth

The analysis performed for construction-related population growth assumes that 49.5 percent of the non-resident construction workforce relocates to Salem County. The 2008 estimated

population of Salem County was 66,141 with a population density of 196 persons per square mi. Salem County could gain 314 workers and up to 848 people if all of those workers were accompanied by their families. A temporary population growth of 848 people represents 1.28 percent of the total 2008 population of Salem County (Subsection 4.4.2.1).

According to NUREG-1437, construction-related population changes are considered SMALL if plant-related population growth is less than 5 percent of the study area's total population, the area has an established pattern of residential and commercial development, a population density of at least 60 persons per square mi., and at least one urban area with a population of 100,000 or more within 50 miles. Salem County meets the NUREG-1437 criteria, and therefore changes to the population of Salem County due to construction activities are SMALL.

With respect to other counties in the four-county Region of Influence, anticipated population increases attributable to the non-resident workforce represents 0.13 percent of the 2008 Cumberland County population, 0.10 percent of Gloucester County and 0.07 percent of New Castle County (Subsection 4.4.2.1). Impacts of population change in the four county Region of Influence are SMALL.

<u>Tax Revenue-Related Impacts</u>

NRC determined in NUREG-1437 that, if the plant's tax payments are projected to be a dominant source of the community's total revenue, the potential impact of new tax-driven land-use changes are LARGE. This is especially true where the community has no pre-established pattern of development or has not provided adequate public services to support and guide development in the past. Property tax payments from the SGS and HCGS represent 3.4 percent of the total property taxes received by Salem County (Table 2.5-37). As described in Subsection 4.4.2.2.2, the new plant is expected to generate similar property tax revenue for Salem County. Additionally, Salem County has a well established pattern of development and established public services to support and guide development. Therefore, the effect of tax-driven land-use changes is SMALL.

4.4.2.2.4 Housing

Subsection 2.5.2.4.2 and Table 2.5-32 reviews the years 1990, 2000, and 2005 to 2007 availability of housing in the Region of Influence and is used as a basis for estimating the number of housing units that may be available during the construction phase.

NUREG-1437 presents criteria for the assessment of housing impacts based on the discernible changes in housing availability, prices, and changes in housing construction or conversions. These criteria are:

SMALL — Small and not easily discernible change in housing availability; increases in rental rates or housing values equal or slightly exceed the statewide inflation rate; and no extraordinary construction or conversion of housing.

MODERATE	Discernible but short-lived change in housing availability; rental rates or housing values increase slightly faster than state inflation rate with rates realigning as new housing added; and minor and temporary conversions of non-living space to living space.
LARGE	Very limited housing availability; rental rates or housing values increase well above normal inflation rate for state; and substantial conversions of housing units and overbuilding of new housing units.

In 2000, there were 1863 vacant housing units in Salem County, NJ and a total of 20,506 vacant housing units in the four-county Region of Influence (Table 2.5-32). For 2005 to 2007, vacant housing units increased to 2240 in Salem County and 30,181 in the Region of Influence. It is likely adequate housing is available within the Region of Influence at the time the nonresident construction workforce moves into the area. If 49.5 percent of the new nonresident workforce moves to Salem County, 314 construction workers and their families will seek temporary housing in the county. While there is currently enough housing to accommodate all the new families expected in Salem County alone, not all housing may be the type sought by the construction workforce. Therefore, a percentage of the nonresident workforce that might otherwise prefer to reside temporarily in Salem County may choose to rent housing elsewhere in the four-county Region of Influence.

Refueling outages create a periodic demand for temporary housing. During construction of the new plant, planned refueling outages occur at SGS and HCGS once every 18 months per unit (3 units), equating to twice per year for the existing SGS and HCGS site. PSEG schedules refueling to avoid overlapping outages. The maximum temporary increase in workforce is 1000 outage workers per refueling outage. These workers need temporary housing for an average of 3 to 4 weeks per refueling outage. Most of the outage workers stay in local extended stay hotels, rent rooms in local homes, or bring travel trailers. These refueling outage workers compete for temporary housing with the non-residential construction workforce. Such competition could limit the availability of temporary housing within Salem County and some workers may seek housing elsewhere in the Region of Influence. However, as noted in Subsection 2.5.2, with more than 20,000 vacant units within the four-county Region of Influence, there appears to be sufficient capacity to absorb this demand.

The potential impacts on housing are SMALL due to the large number of available vacant housing units in the Region of Influence and the relatively small requirements for the construction workforce.

4.4.2.2.5 Public Services

The following conclusions regarding police, fire and related safety services are based in part on an analysis NRC performed of impacts sustained during original plant construction (NUREG-1437). NRC selected seven case study plants whose characteristics resembled the spectrum of nuclear plants in the United States today. NRC reported that, “(n)o serious disruption of public safety services occurred as a result of original construction at the seven case study sites.” Most communities showed a steady increase in expenditures connected with public safety departments. Tax contributions from the plant often enabled expansion of public safety services in the purchase of new buildings and equipment and the acquisition of additional staff.”

Water Supply Facilities

Construction of the new PSEG plant requires quantities of potable water to support the needs of the construction work force. As noted in Subsection 4.2.2.2.2, the fresh water aquifer that currently supplies HCGS and SGS will also supply the construction site for general purposes including the potable and sanitary water, fire protection, and other miscellaneous construction uses such as batch plant supply and dust suppression. The total anticipated construction water use for the new plant from the fresh water aquifer is 119 gpm (171,360 gallons per day [gpd]). The average per capita water usage in the United States is 90 gpd per person. Of that, 26 gallons are used for personal use (Reference 4.4-10). At a conservatively assumed 30 gpd, an on-site workforce of 4100 needs 123,000 gpd for potable and sanitary use. The balance is for dust suppression, concrete batch plant operation, and other miscellaneous uses. A workforce that is on-site for 8 to 12 hours per day requires proportionately less water for personal use. As discussed in Section 4.2, use of groundwater by the new plant does not adversely affect off-site water uses. Therefore, impacts of groundwater use by the on-site construction workforce on off-site water sources is SMALL

The impact to the local water supply systems from construction-related population growth can be estimated by calculating the amount of water that is required by these individuals. Subsection 2.5.2.9.1 and Table 2.5-38 describe the public water supply systems in the area, their permitted capacities, and current demands. The average per capita water usage in the United States is 90 gpd per person including personal use, bathing, laundry and other household uses (Reference 4.4-10). The total construction-related population increase within the four-county Region of Influence of 1712 people (construction workforce and their families) increases consumption by 154,080 gpd. The excess public water supply capacity in Salem County is 2,860,000 gpd. The total for the four-county Region of Influence is 64,100,000 gpd (Table 2.5-38). Therefore, impacts to municipal water suppliers from the construction related population increase are SMALL.

Wastewater Treatment Facilities

PSEG has an on-site wastewater treatment facility sized for the three existing units at HCGS and SGS. The proposed new plant wastewater demand exceeds the capacity of the existing treatment facility. As described in Subsection 3.6.2, a new sewage treatment system will be installed, or current capacity increased, to treat the daily flow from the new plant. The new system is sized to meet needs during construction of the new plant as well as long term operational needs. No wastewater from the new plant is treated at off-site facilities.

Subsection 2.5.2.9.1 and Table 2.5-39 describe the public wastewater treatment systems in the four-county Region of Influence, their permitted capacities, and current demands. The impact to local wastewater treatment systems from construction-related population increases can be determined by calculating the amount of water that is used and disposed of by these individuals. The average person in the United States uses 90 gpd (Reference 4.4-10). PSEG conservatively estimates that 100 percent of this water is disposed of through the wastewater treatment facilities. The construction-related population increase of 1712 people could require 154,080 gpd of additional wastewater treatment capacity. The excess treatment capacity in Salem County is 1.78 million gpd (Table 2.5-39). The total for the four-county Region of Influence is 50.2 million gpd. Therefore, based on this excess treatment capacity, impacts to wastewater treatment facilities are SMALL.

Police Services

Police services within the four-county Region of Influence are addressed in Subsection 2.5.2.9.2 and summarized in Table 2.5-40. Services at the county level are compared to average service levels throughout the 25 counties within the 50-mi region. Additional detail is provided for localities within Salem County, including Salem City and Lower Alloways Creek Township. On a per capita basis, Salem County has the highest level of police service in the four-county Region of Influence, with one police officer per 241 residents. Gloucester County has the lowest level of police service, with one officer per 832 residents. The overall average for counties within the 50-mi radius of the PSEG Site ranged from 424 residents per officer in MD to 566 in NJ. The four-county Region of Influence averages one officer per 485 residents.

As previously discussed in Subsection 4.4.2.1, a peak non-resident workforce results in 207 new residents living temporarily in Cumberland County, 303 in Gloucester County, 849 in Salem County, and 353 in New Castle County. These numbers constitute 0.13 percent, 0.10 percent, 1.28 percent, and 0.07 percent of the 2008 estimated populations of Cumberland, Gloucester, Salem and New Castle counties, respectively. Salem County is estimated to experience the largest influx of temporary new residents, which changes the service level from 241 residents per officer to 244 residents per officer.

Based on the net increase in police service needs, construction-related population increases will not adversely affect existing police services in the four-county Region of Influence. The potential impacts of new plant construction on police services in the Region of Influence and in the 50-mi. radius of the PSEG Site are SMALL.

Fire Protection Services

Subsection 2.5.2.9.2.2 and Table 2.5-40 cover the provision of fire protection services in the four-county Region of Influence and the 50-mi. region of the PSEG Site. For purposes of comparison, county level staffing of this service class is presented as residents per service provider. Fire protection services typically include ambulance, emergency medical response, accident scene, and specialty rescue in addition to traditional firefighting response. A large percentage of these services are provided by volunteer personnel. Within the Region of Influence, and throughout the 50-mi. region, staffing levels ranged from 109 to 319 per fire protection provider.

During construction of the new plant, Salem County is estimated to experience a temporary influx of 849 construction related residents, while the four-county Region of Influence is to experience an increase of 1712. In order to maintain the current service level (number of residents to staff) only a negligible increase in fire protection personnel will be required. To provide a similar level of service to the additional Region of Influence population of 1712, only a negligible increase in personnel will be necessary. Based on the limited increase in need, construction-related population increases do not have a significant impact on existing fire protection services in the four-county Region of Influence or within the 50-mi. radius of the PSEG Site. Therefore, the potential impacts of the new workforce on fire protection services are SMALL.

4.4.2.2.6 Medical and Social Services

Medical Services

Information on medical services in the four-county Region of Influence is provided in Subsection 2.5.2.9.2.3. Table 2.5 41 lists the number of licensed beds and number of physicians per county. Salem County, NJ is among the counties with the lowest number of licensed beds and the lowest number of physicians. The same data indicates that the NJ seven-county average of 2.2 beds per 1000 residents falls between the minimum (1.5 in MD) and maximum (3.0 in PA) average values for counties within the 50-mi. region. The small population and rural character of Salem County suggests that residents rely on the larger supply of physicians and beds available in the adjacent counties of Gloucester and New Castle. Many of the counties participate in a mutual-aid program for emergency medical care services and this may result in Salem County residents receiving hospital services in other counties.

Medical facilities in the four-county Region of Influence provide complete medical care services to the local population. Any specialized services not fully available locally can be found within the 50-mi radius of the PSEG Site. The construction workforce increases the population in Salem County by 1.28 percent and the population of the four-county Region of Influence by 0.1 percent. Therefore, the potential impacts of construction on medical services are SMALL.

Social Services

The Salem County Department of Public Health and Safety provides services including communicable disease response; environmental investigations, monitoring and enforcement; nursing; public health preparedness and response; sexually transmitted disease clinic and immunizations; counseling; health screening and special child. Some services are consolidated through a coalition between Salem and Cumberland County. Similar services are provided through county agencies elsewhere in the 50 mi. region.
The population growth associated with construction of the new PSEG units economically benefits Salem County, NJ and other counties in the four-county Region of Influence. The new direct jobs correspondingly cause an increase in indirect jobs within the Region of Influence, some of which will be filled by currently unemployed or underemployed workers, thus reducing the social services burden. Many of these benefits accrue to Salem County, where, because of the smaller economic base, they might have a more noticeable impact. Impacts are SMALL and positive.

4.4.2.2.7 Education

Schools and student populations are discussed in Subsection 2.5.2.5. Regional school resources are summarized in Table 2.5-33 and Region of Influence schools are addressed in Table 2.5-34. As shown in Table 2.5-10, 18.1 percent of the population of NJ and 18.2 percent of DE was 5 to 17 yrs old in 2000. In the 2005 to 2007 USCB estimates, students account for 17.3 to 17.9 percent of total county populations in the four-county Region of Influence. Using the highest figure of 17.9 percent, an estimated non-resident construction workforce resulting in a population increase of 1712 contributes 306 school-aged children within the Region of Influence.

Based on estimated population increases due to construction workers moving into the four-county Region of Influence (Subsection 4.4.2.1), Salem County experiences the largest

increase in school-age population of 152 students or less than 1.3 percent of current school populations. An increase of 152 students in a school system with a teacher to student ratio of 1:30 requires an additional 5 teachers. Cumberland, Gloucester, and New Castle Counties experiences much smaller increases in school-age populations of 37, 54, and 63 students, respectively.

Increased property and sales tax revenues as a result of the increased population, and, in the case of Salem County, property taxes on construction of the new plant, may fund additional teachers and facilities. The number of additional staff needed to maintain the current teacher to student ratio is minor. Therefore, impacts to the four-county Region of Influence county school systems and school systems within the 50-mi region are SMALL.

4.4.2.2.8 Recreational Facilities

As shown in Table 2.5-36, a number of private (land trusts) and public (federal and state parks) recreational facilities are located within a 50 mi. radius of the PSEG Site. Modest increased usage of these recreational facilities is likely as a result of population increases due to the construction workforce. Transient population data for recreation facilities within 10 mi. of the PSEG Site (Table 2.5-6) suggest that usage of these facilities is low (3100 visitors per day). The estimated increase in the population of the region, due to construction workers, is 1712. Given the low usage and small population increase, sufficient recreational facilities are available to accommodate any increase in visitors. Therefore, impacts to recreational facilities are SMALL.

4.4.3 ENVIRONMENTAL JUSTICE IMPACTS

The potential for disproportionate adverse environmental impacts on low income and minority populations (environmental justice populations) associated with construction of a new plant at the PSEG Site are addressed in this section. Potential impacts include the physical, socioeconomic and other factors addressed in Subsections 4.4.1 and 4.4.2. The discussion includes potential impacts at three geographic scales: the 50-mi. region, the four-county Region of Influence and Salem County, NJ. Following NRC guidance in NUREG-1555, the 50-mi. region encompasses the population most broadly influenced by physical and socioeconomic effects of construction and related activities. The Region of Influence includes those areas where the majority of the non-resident construction workforce is expected to seek temporary housing. Salem County, NJ is addressed individually because it is the county where the new plant is located, and therefore has the greatest potential for construction impacts.

4.4.3.1 Distribution of Environmental Justice Populations

The distribution of environmental justice populations, as defined by NRC criteria, is presented in Subsection 2.5.4. As illustrated in Table 2.5-47 and Figures 2.5-10 through 2.5-16, the majority of all classifications of environmental justice populations are concentrated within Philadelphia County, PA, at a distance of 30 to 50 mi. from the PSEG Site. Other counties in the 20 to 50 mi. range with notable concentrations of environmental justice populations include Delaware and Montgomery counties, PA and Camden County, NJ.

Within the Region of Influence, the majority of environmental justice populations are located in New Castle County, DE at a distance of 10 to 20 mi. from the PSEG Site. Several smaller concentrations occur in Cumberland and Gloucester counties between 20 and 40 mi. from the

PSEG Site. No other populations or groups (e.g., subsistence populations) were identified that represent environmental justice populations.

Within 10 mi of the PSEG Site, all three of the Census block groups that encompass Salem City record minority populations of Black and Aggregate categories. One of the Salem City block groups meets the NRC criterion for low-income households. In Middletown, DE, one block group meets the NRC criteria for Black and Aggregate minority populations. No other block groups within the 10-mi. radius of the PSEG Site meet any of the NRC criteria for minority, ethnic or low-income household classification. There are no populations meeting NRC criteria within 5 mi. of the PSEG Site; the closest populations are between 7 and 9 mi. in Salem City.

Also in Salem County, Pennsville is the site of several Black and Aggregate block groups, one Hispanic block group and one low-income block group. A single minority block group meeting NRC criteria for Black populations is located in rural Pilesgrove Township, also in Salem County.

4.4.3.2 Potentially Adverse Disproportionate Impacts in Region and Region of Influence

Subsections 4.4.1 and 4.4.2 have analyzed construction related impacts as they affect the general population. The result of this analysis indicates that most of the impacts to the environment and public are SMALL. The MODERATE impact related to traffic can be mitigated to SMALL. Except for any potential transmission line, the MODERATE impacts are within the four-county Region of Influence and do not extend to the 50-mi. region. In general, construction related impacts within the 50-mi. region and the Region of Influence are diluted by the size of the population, the developed nature of community infrastructure and the receipt of tax revenues with which to address the impacts. Additionally, no potential adverse impacts are disproportionately concentrated in such a manner as to impact environmental justice populations within the 50-mi. region or the four-county Region of Influence.

4.4.3.3 Potentially Disproportionate Impacts in Salem County

As discussed in Subsection 4.4.2, Salem County, NJ is the place of residence for more construction workers of the new plant than any other county. Although most potential impacts at the scale of the county are SMALL, the concentration of environmental justice populations in Salem City and in Pennsville or Pilesgrove townships introduce the possibility that some populations may be vulnerable with respect to construction-related impacts.

On-site construction impacts, as described in Subsection 4.4.1 are concentrated in close proximity to the project construction site. Other potential impacts associated with close proximity to the plant include water transportation, aesthetic and recreational impacts. Due to the remote location, low population within 5 mi., and buffering effect of wetlands, woodlots and agriculture surrounding the project site, potential impacts to all populations are SMALL. Potential effects to the cultural, economic, or human health characteristics of these populations are also SMALL, because of the large distances between the PSEG Site and identified environmental justice populations. Similarly, potential environmental justice populations in Salem City, Pennsville and Pilesgrove are not disproportionately or adversely affected in comparison to the general population.

Off-site construction impacts associated with construction of the proposed causeway and potential transmission line are not disproportionately close to existing environmental justice populations.

Economic impacts associated with construction activities and tax revenues associated with construction of the new plant produce generally beneficial effects to local communities including Lower Alloways Creek, Salem City and elsewhere through Salem County and the four-county Region of Influence. These benefits are proportionately spread across the general and environmental justice populations.

The potential effect of land use impacts on residential or commercial development patterns results in SMALL impacts to the general population. The distribution of such effects does not result in disproportionate impacts to environmental justice communities. As discussed in Subsection 4.4.2, population growth associated with construction activity is a SMALL impact on the general population.

Under the category of public services, the existing level of service was found to be generally adequate to the needs of the existing community populations. Excess capacity of existing water and sewer services was found to be adequate to meet the service demands of the projected population increase (Tables 2.5-38 and 2.5-39). Indices of police, fire and emergency response services showed Salem County in the mid-range of equivalent services in neighboring counties (Table 2.5-40). Medical (Table 2.5-41), social services and public education (Table 2.5-34) meet local needs with capacity for some additional growth. Finally, the proposed construction activity generates income, including property and sales tax revenues that can be applied to upgrade public services in response to needs of an expanded population. Therefore, the level of impact for these categories, is SMALL for the general population, and is also SMALL for environmental justice populations.

4.4.3.4 Housing and Transportation Impacts

Transportation Impacts

The discussion of road transportation issues in Subsection 4.4.1 identified potential impacts associated with the concentration of commuting workers in the proximity of Salem City that are MODERATE and require mitigation. Portions of the affected transportation routes are located within or closely proximate to Salem City. Because of the possibility that these transportation impacts may disproportionately affect environmental justice populations or that mitigation measures may fail to meet specific needs of the minority or low-income groups these impacts are assessed.

Traffic congestion associated with construction traffic impacts all users of transportation resources in the congested areas in Salem City. This includes people traveling to or from work or shopping, school buses, school children walking or biking, and emergency response vehicles. Environmental justice populations may be disproportionately affected if the concentration of traffic occurs where such populations are disproportionately concentrated.

As described in Subsection 4.4.1, preliminary traffic studies have indicated that mitigation is needed in several locations in order to maintain an acceptable LOS. Recommended mitigation measures include:

- Changing the three Grieves Parkway intersections at Chestnut, Oak and Walnut streets from two-way stop sign control to traffic light control
- Constructing turn bays at the Grieves Parkway/Oak Street intersection
- Adding another turn bay at the Front Street/NJ Route 49 intersection

Installation of these mitigation measures at the beginning of new plant construction improves traffic operations such that the potential for impacts to environmental justice populations are SMALL and do not warrant additional mitigation. After construction is completed, leaving the improvements in place results in a LOS that is as good as or better than the existing LOS.

Housing

The potential that environmental justice populations may be disadvantaged in their ability to find or keep housing in competition with a non-resident workforce was assessed. Factors affecting the degree of disadvantage include the amount of vacant housing available and the size of the work force relocating into the area. The concern is that competition from non-resident workers for a limited supply of housing could increase rental costs and possibly force some low-income families to relocate.

As discussed in Subsection 4.4.2.1, 314 non-resident workers relocate into Salem County, NJ and 634 relocate into the four-county Region of Influence. Salem County reported 1863 vacant housing units in the 2000 Census and 2240 vacant units as of 2005 to 2007 (Table 2.5-32). These numbers suggest the availability of several vacancies for each non-resident worker that relocates into Salem County. Even if only one third of the available housing was suitable to the needs of the relocated workforce, there are enough vacancies to meet demand without creating a competitive shortage of housing.

Total housing vacancies within the Region of Influence ranged from 20,506 to 30,181 between 2000 and 2005 to 2007 (Table 2.5-32), with the majority of this housing in New Castle County. If larger than expected numbers of workers were to create a shortage of housing within Salem County, there is sufficient availability of housing in other portions of the Region of Influence to meet this demand. The availability of this alternative housing reduces the degree of competition for housing within Salem County and therefore the potential impacts to environmental justice populations are SMALL.

4.4.3.5 Conclusion

Subsections 4.4.1 and 4.4.2 conclude that physical and socioeconomic effects of new plant construction have SMALL impacts on communities and general populations within the 50-mi. region of the PSEG Site and the four-county Region of Influence, after application of appropriate controls and mitigation measures. Additionally, no potential adverse impacts are disproportionately concentrated in such a manner as to impact environmental justice populations within the 50-mi. region of the new plant or the four-county Region of Influence.

The environmental justice populations within Salem County (in Salem City and Pennsville), and the new plant construction within the county, introduce a potential for disproportionate impacts to these populations. With the exception of transportation impacts, all of the potentially adverse impacts of construction affecting the general population are SMALL. Completion of transportation improvements concurrent with the onset of construction mitigates the

transportation related impacts. Based on the rural location of the construction site, the established adequacy of community infrastructure and public services, effective planning procedures, and sufficient tax revenues generated by the construction activity, potential impacts to environmental justice populations within Salem County are SMALL and not disproportionate.

4.4.4 REFERENCES

4.4-1 Bureau of Economic Analysis, BEA, 2009, *Regional Input-Output Modeling System (RIMS II)*, Website, http://www.bea.gov/regional/rims/index.cfm, 2009, accessed August 24, 2009.

4.4-2 California Energy Commission, Orange Grove Energy, L.P., Orange Grove Project, Application for Certification (08-AFC-4), San Diego County, Volume 3, Appendix 6.12 B, April 2009.

4.4-3 New Jersey Administrative Code, 2007, “N.J.A.C. 7:29, Noise Control, Statutory Authority N.J.S.A. 13-1G-1 et seq., Date Last Amended August 6, 2007, Trenton, New Jersey.

4.4-4 Rukenstein and Associates, *Smart Growth Plan: Delaware River and I-295/NJ Turnpike Planned Growth Corridor,* Salem County, New Jersey, January, 2004.

4.4-5 Salem County, *Open Space and Farmland Preservation Plan, Volume 1: Open Space and Recreation,* Salem County, New Jersey, December, 2008.

4.4-6 Salem County, *Open Space and Farmland Preservation Plan, Volume 2: Farmland Preservation Plan,* Salem County, New Jersey, August, 2008.

4.4-7 Salem Main Street, *The City of Salem, New Jersey: Main Street Revitalization Master Plan,* Salem City, New Jersey, September, 2003.

4.4-8 U.S. Border Patrol, *Final Environmental Stewardship Plan for the Construction, Operation, and Maintenance of Tactical Infrastructure: U.S. Border Patrol Yuma Sector, Arizona and California,* Washington DC, May 2008.

4.4-9 U.S. Environmental Protection Agency, *Emission Facts: Average Annual Emissions and Fuel Consumption for Passenger Cars and Light Trucks,* April 2000, Website: http://www.epa.gov/oms/consumer/f00013.htm, accessed on 2/12/2010.

4.4-10 U.S. Environmental Protection Agency, *Water on Tap: What you need to know,* EPA-815-03-007, Office of Water, Washington DC, October 2003.

4.4-11 Nuclear Regulatory Commission, 1981, NUREG/CR-2002, PNL-3757, Volume 2, *Migration and Residential Location of Workers at Nuclear Power Plant Construction Sites, Profile Analysis of Worker Surveys.* Prepared by S. Malhotra and D. Manninen, Pacific Northwest Laboratory, 2009, April, 2007.

4.4-12 Nuclear Energy Institute, *Economic Benefits of Salem and Hope Creek Nuclear Generating Stations: An Economic Impact Study by the Nuclear Energy Institute,* Washington, DC, September 2006.

Table 4.4-1
Typical Noise and Emissions from Construction Equipment and Light Vehicles Used in Major Construction Projects

Equipment Type	Noise Level in dBA			Emissions(grams/horsepower-hour)					
	At 50 feet	At 500 feet	At 1500 feet	VOC	CO	NO_x	$PM_{2.5\&10}$	SO_2	CO_2
Earthmoving									
Loaders	88	68	58	0.38	1.55	5.00	0.69	0.74	536.2
Dozer	88	68	58	0.36	1.38	4.76	0.65	0.74	536.3
Tractor	80	60	50	1.85	8.21	7.22	2.70	0.95	691.1
Grader	85	65	55	0.35	1.36	4.73	0.65	0.74	536.3
Trucks	86	66	56	0.44	2.07	5.49	0.81	0.74	536.0
Shovels	84	64	54	0.34	1.30	4.60	0.63	0.74	536.3
Materials Handling									
Concrete pumps/mixers	81	61	51	0.61	2.32	7.28	0.95	0.73	529.7
Derrick and mobile cranes	83	63	53	0.44	1.30	5.72	0.67	0.73	530.2
Stationary									
Portable Generator	84	64	54	1.23	3.76	5.97	1.44	0.81	587.3
Impact									
Paving breaker	80	60	50	NA	NA	NA	NA	NA	NA
				Emissions (grams/mile)					
				HC	CO	NO_x	CO_2		
Light Duty Vehicles[a]	NA	NA	NA	2.8-3.5	20.9-27.7	1.39-1.81	416-522		

Reference 4.4-2 for noise; References 4.4-8 and 4.4-9 for emissions.
a) Includes cars and light trucks. Lower values for cars.
NA – Not available

Table 4.4-2
Level of Service Impacts at Key Intersections with and without Causeway Construction

Intersection	Level of Service (LOS)[a]						Mitigation Measures
	Future No-Build		Future With Causeway		With Mitigation		
	AM	PM	AM	PM	AM	PM	
Grieves Parkway and Walnut Street[b]					D	A	Traffic Signal
Northwest Approach	F	F	F	E			
Southeast Approach	F	F	F	C			
Grieves Parkway and Chestnut Street[b]					B	D	Traffic Signal
Northwest Approach	C	E	D	E			
Southeast Approach	C	C	F	C			
Grieves Parkway and Oak Street[b]					A	C	Traffic Signal
Northwest Approach	B	C	B	F			Extra eastbound right turn bay
Southeast Approach	C	B	F	F			Extra northbound left turn bay
Broadway (Route 49) and Front Street	B	B	F	F	D	D	Extra southbound left turn bay
Broadway (Route 49) and Market Street	B	C	C	D	C	E	None

a) LOS is a reflection of delays at intersections with A being the optimum with minimum delays, and F being the worst with unacceptable delays
b) Future No-Build and Future With Causeway have two-way stop sign control; With Mitigation has traffic signal control

Table 4.4-3
Projected Construction Labor Availability and On-Site Labor Requirements

	Workforce in 50-mi. Region	Locally[b,c] Available Labor	Construction Labor[a] Requirement	Deficiency
Trade Labor				
Boilermakers	385	38	103	65
Carpenters	41,795	274	274	0
Electricians/Instrument Fitters	21,450	495	495	0
Iron Workers	2340	234	495	261
Insulators	2700	51	51	0
Laborers	33,190	274	274	0
Cement Masons	5000	51	51	0
Millwrights	1215	85	85	0
Operating Engineers	11,780	222	222	0
Painters	11,535	51	51	0
Pipefitters	18,220	462	462	0
Sheetmetal Workers	6755	85	85	0
Teamsters	51,805	85	85	0
Trade Supervision	19,690	137	137	0
Subtotal	227,860	2544	2870	326
Non-Trade Labor				
Site Indirect Labor	ND	205	273	68
Quality Control Inspectors	ND	51	68	17
Vendors and Subcontractors	ND	179	239	60
EPC Contractor Staff	ND	128	171	43
Owner's O&M Staff	ND	256	342	85
Start-up Personnel	ND	77	103	26
NRC Inspectors	ND	26	34	9
Subtotal		922	1230	308
Total Labor		3466	4100	634

a) From Table 2.5-22
b) Assumes 100 percent of required trade labor is available in the region except for Boilermakers and Iron Workers which are limited relative to need and it is further assumed that 10 percent of these two trades are available from within the 50 mile region.
c) Assumes 75 percent of the required non-trade workforce will be available within the 50-mi. region

ND = no data available.

Table 4.4-4
Estimated Number of New Construction Workers and Associated Population Increase for the Region of Influence

County	Number of Construction Workers	Estimated Population Increase
Cumberland County	77	207
Gloucester County	112	303
Salem County	314	849
New Castle County	131	353
Total	634	1712

4.5 RADIATION EXPOSURE TO CONSTRUCTION WORKERS

This section evaluates the potential radiological dose impacts to construction workers at the PSEG Site resulting from the operation of HCGS and SGS. Construction workers are exposed to gaseous radioactive effluents and direct radiation from the operation of HCGS and SGS during construction. There are four different reactor technologies being considered for the site. Doses to the construction workforce building the Advanced Boiling Water Reactor (ABWR), U.S. Advanced Pressurized Water Reactor (US-APWR), or U.S. Evolutionary Power Reactor (U.S. EPR) reactors are similar because they are single-unit plants. However, doses received from the building of dual unit Advanced Passive 1000 (AP1000) reactors are different. Releases from the first AP1000 unit placed in service during construction of the second AP1000 unit have to be factored into the dose to construction workers.

As discussed in Chapter 1, the anticipated construction start date is 2016. Construction of a new plant would take approximately 5 yr. If PSEG makes a decision to perform site preparation activities, such activities will take 12 to 36 months to complete, prior to the start of NRC-regulated construction activities.

4.5.1 SITE LAYOUT

The PSEG Site is located on the east bank of the Delaware River in the southwest portion of Salem County, in southern NJ. The new plant is located north of HCGS, as shown in Figure 3.1-2. The current PSEG Site layout and locations of existing thermoluminescent dosimeter (TLD) stations inside the site boundary are depicted in Figure 4.5-1.

4.5.2 RADIATION SOURCES FROM THE EXISTING PSEG SITE

Construction workers building additional units at the PSEG Site are exposed to direct radiation and gaseous and liquid effluents released during the routine operation of HCGS and SGS.

4.5.2.1 Direct Radiation

Direct radiation doses from sources present on the HCGS and SGS-site are measured using environmental TLD. The existing on-site independent spent fuel storage installation (ISFSI) has a small cask load, and is not considered a significant contributor of direct radiation (based on TLD station data). It is conservatively assumed that current direct radiation doses measured by the TLD stations are from sources on-site, such as normal operations of SGS and HCGS, and that ISFSI doses are not included in this data. Future doses from the ISFSI are calculated separately, and added into the total direct dose from the existing PSEG Site.

Cask loading in the ISFSI prior to and over the duration of the construction period must be considered. As casks are loaded into the ISFSI, it may become the primary source of direct radiation to construction workers at the PSEG Site. For the purposes of this analysis, it is conservatively assumed that the ISFSI is fully loaded with 200 HI-STORM 100S Version B (Model 100S-218) storage casks. Doses are calculated using the MCNP Monte Carlo computer code (Reference 4.5-6), which calculates the effects of both skyshine and direct shine. Assuming a fully loaded ISFSI is a conservative approach that removes the need to reevaluate potential doses to workers if construction is delayed and the cask load in the ISFSI changes.

4.5.2.2 Gaseous Effluents

At SGS, the plant vent for each respective unit is the final release point for gaseous effluents. Each plant vent receives discharges from the waste gas hold-up system, condenser evacuation system, containment purge and pressure/vacuum relief vents and the auxiliary building ventilation. The vents are continuously monitored by installed radiation monitors, and continuously sampled for iodine and particulates with charcoal cartridges and filter papers. The charcoal and filter papers are analyzed and changed periodically. Sampling is performed on gas decay tanks and the containment atmospheres prior to release to the environment. The plant vents are also sampled periodically for noble gases, particulates, radioiodine, and tritium. More information can be found in the SGS Offsite Dose Calculation Manual (ODCM) (Reference 4.5-2).

At HCGS, the north plant vent (NPV) and south plant vent (SPV) are the final release points for most of the planned gaseous effluent releases. These vents are continuously monitored for iodine, particulates, and noble gases. Monitoring includes the use of moving particulate and fixed charcoal filters. The filter papers and charcoal cartridges are replaced and analyzed periodically. The NPV and SPV are also sampled periodically for noble gases and tritium. A small amount of gaseous effluent is also released from the filtration, recirculation, and ventilation system (FRVS) vent during testing periods. The FRVS vent is continuously monitored for noble gases when in service and also uses fixed particulate and charcoal filters. Samples are taken periodically during extended runs, but during shorter runs samples are collected at the end of the release period. More information can be found in the HCGS ODCM (Reference 4.5-1).

4.5.2.3 Liquid Effluents

Construction workers, since they are members of the general public, may be exposed to liquid effluents released from SGS and HCGS into the Delaware River. Pathways include fish ingestion, boating, swimming, and shoreline use on and near the Delaware River. In the region of the PSEG Site, the Delaware River is brackish water, and is not potable. Water from the Delaware River at the PSEG Site is not used as drinking water or as an irrigation source. Thus, there are no dose contributions from the drinking water and irrigation pathway, as stated in the SGS ODCM (Reference 4.5-2).

4.5.3 RADIATION SOURCES FROM A SINGLE UNIT AP1000

During the construction of dual unit AP1000s, one unit begins operation before the second unit is completed. In this event, construction workers are exposed to radiation from the first AP1000 in addition to radiation from HCGS and SGS and ISFSI. This condition, while conservative, bounds the worst case radiation exposure for construction workers.

4.5.3.1 Direct Radiation

Construction workers building a second AP1000 are exposed to direct radiation from the first AP1000 built. Direct radiation is considered to originate from the approximate center of the containment building. The two AP1000 containment centerlines are located at least 800 ft. apart, as stated in the Westinghouse siting guide (Reference 4.5-5). The radius of the containment building is 72.5 ft., as stated in Table 3.3-5 of the AP1000 design control document

(DCD) (Reference 4.5-4). Under these conditions, direction radiation is modeled as a point source for dose calculations to construction workers. Radiation from the condensate storage tank was not considered. As stated in Subsection 11.2.1.2.3.3 of the DCD (Reference 4.5-4) the condensate storage tank may become contaminated in the event of a steam generator tube rupture. In this event the condensate storage tank would be cleaned of radioactive contamination.

4.5.3.2 Gaseous Effluents

Gaseous effluents are normally released from the plant vent or the turbine building vents. Contributors to plant vent effluent releases include containment venting releases, auxiliary building ventilation releases, annex building releases, radwaste building releases, and gaseous radwaste system discharge. Systems and components that contribute to the turbine building vents include the condenser air removal system, gland seal condenser exhaust, and turbine building ventilation releases.

4.5.3.3 Liquid Effluents

Construction workers are exposed to liquid effluents released from the operating AP1000 unit into the Delaware River. Pathways include fish ingestion, boating, swimming, and shoreline use on and near the Delaware River. In the region of the PSEG Site, the Delaware River is brackish water, and is not potable. Water from the Delaware River at the PSEG Site is not used as drinking water or as an irrigation source. Thus, there are no dose contributions from the drinking water and irrigation pathways, as stated in the SGS ODCM (Reference 4.5-2).

4.5.4 MEASURED AND CALCULATED DOSE RATES

The dose limits in 10 CFR 20 are given as a total effective dose equivalent (TEDE). The doses considered in this section are given for different types of exposure and in different units. To compare construction worker doses to the 10 CFR 20 limits, all doses are converted to doses that approximate a TEDE. A TEDE is defined as the sum of the deep dose equivalent (DDE) and the committed effective dose equivalent (CEDE). For the purposes of this analysis, either the whole body dose or the sum of the gamma and beta doses is used to approximate the DDE. This approach is conservative, because a weighting factor (less than 1) is often used on the beta dose when converting to a DDE, but is not used in this analysis. The organ dose multiplied by a weighting factor is the CEDE. In this case, the limiting potential pathway (critical organ) is the thyroid, which has a weighting factor of 0.03 per 10 CFR 20.1003. For sources that do not result in an organ dose, the CEDE is zero. Conversion of the doses used in this section to TEDE is shown in Table 4.5-11.

The doses from some of the sources are given in units of rads, and are converted to rems in order to compare with the limits in 10 CFR 20. One rem is defined as one rad multiplied by a quality factor. All doses in this section are given for either gamma or beta radiation, so the quality factor is always one for this section, therefore one rad is equivalent to one rem.

4.5.4.1 Existing PSEG Site

Doses from gaseous effluent releases from HCGS and SGS are listed in Table 4.5-7. These doses are obtained from the 2008 Annual Radioactive Effluent Release Report (RERR)

(Reference 4.5-3). Doses are calculated in accordance with the HCGS and SGS ODCMs (References 4.5-1 and 4.5-2). These ODCMs use Canberra Effluent Management System Software, which is consistent with Regulatory Guide (RG) 1.109, *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purposes of Evaluating Compliance with 10 CFR Part 50*, Appendix I, Revision 1, 1977 and NUREG-0133, *Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants*. Doses are given at the site boundary. However, construction workers will spend time inside the site boundary. The exact dispersion factors inside the site boundary are not known. To be conservative, RERR doses have been multiplied by ten to account for workers inside the site boundary.

Doses from direct radiation from the ISFSI are calculated using the Monte Carlo N-Particle (MCNP) computer code (Reference 4.5-6) considering a worst-case, bounding scenario that assumes the ISFSI is fully loaded with fresh spent fuel casks in the least desirable cask arrangement. To reflect probable conditions at the ISFSI, doses are scaled down because existing administrative controls will prevent doses from exceeding 100 millirems per year (mrem/yr) at the ISFSI fence, 10 meters (m) (32.81 ft.) north of the ISFSI pad. A distance of 25 m (82.02 ft.) corresponds to the approximate distance between the ISFSI pad and the closest point to the north a worker might be positioned for an extended period. Doses from direct radiation 25 m (82.02 ft.) north of the ISFSI are found by taking the calculated, bounding dose and scaling it by the ratio of the administrative control dose at 10 m (32.81 ft.) to the bounding, calculated dose at 10 m (32.81 ft.). These doses are listed in Table 4.5-8.

Doses from direct radiation from SGS and HCGS are measured at the north TLD station. The average monthly reading here is 4.77 mrem per month, which is equivalent to a 57.2 mrem annual dose. This annual dose can be compared to the preoperational dose (55 mrem annually) measured before SGS and HCGS were built. This means the annual net dose is 2.2 mrem. This annual dose is for continuous occupancy (8760 hours per year [hr/yr]), it is scaled down to 6.03E-01 mrem annual dose to account for worker occupancy (2400 hr/yr).

All input doses are given for continuous occupancy (8760 hr/yr), and have been scaled down to account for a 2400-hr/yr occupancy of a construction worker. This is based on a 2000–hr. work year plus 20 percent overtime.

Doses from liquid effluents are obtained from the 2008 Annual RERR for the HCGS and SGS (Reference 4.5-3), and are listed in Table 4.5-10. Doses are calculated in accordance with the HCGS and SGS ODCMs (References 4.5-1 and 4.5-2). These ODCMs use Canberra Effluent Management System Software, which is consistent with RG 1.109 and NUREG-0133. Unlike the gaseous and direct doses, the liquid doses are not scaled down to account for occupancy. This approach is conservative because it assumes construction workers are engaging in the same activities that lead to the calculated liquid effluent doses to members of the public (i.e., fish consumption and recreation on the Delaware River).

Gaseous, liquid, and direct dose data are obtained from the 2008 Annual RERR for the HCGS and SGS (Reference 4.5-3). The doses from 2008 are considered to be an acceptable basis for predicting releases during construction of new units. The HCGS and SGS units operated normally, at or near rated power for most of 2008. SGS Unit 2 was shut down for a scheduled 57-day outage in the spring and SGS Unit 1 was shut down for a scheduled 29-day outage in the fall. Based on PSEG outage scheduling, two of the three HCGS and SGS units commonly have a scheduled outage in any given year. In addition, a 15 percent power uprate was

implemented for HCGS in mid-2008, which increased the total power generation for the year and increased power dependent radiation levels.

4.5.4.2 Single Unit AP1000

Direct radiation doses to construction workers at the second AP1000 unit are calculated at 800 ft. from the first AP1000 containment centerline. This is the expected minimum distance between containment building centerlines for a dual unit AP1000. The maximum dose rate at 72.5 ft. from the first AP1000 containment building centerline is less than 0.25 mrem/hr, as specified in the AP1000 DCD. To determine the dose 800 ft. from the first AP1000 containment building centerline, an inverse distance squared model is applied using the known (0.25 mrem/hr) dose rate at 72.5 feet. The annual calculated dose at 800 ft. is 4.9 mrem. This dose includes a 2400 hr/yr occupancy factor.

The annual air doses at ground level at the DCD postulated site boundary are listed in Table 4.5-9. Doses are based on a postulated DCD atmospheric dispersion factor (χ/Q). These doses are adjusted for site-specific conditions by multiplying them by the ratio of the site-specific χ/Q to the DCD χ/Q. The site-specific χ/Q value is calculated for the new plant location. The maximum, bounding χ/Q value at the site boundary is 1.6E-05 sec/m^3, as stated in the AP1000 DCD (Reference 4.5-4). This corresponds to a distance of 0.17 mi. (897.6 ft.) from the postulated release point at the new plant site center defined in Figure 3.1-2. The distance between containment building center lines for a dual unit AP1000 plant is comparable to the distance associated with the above χ/Q value. Therefore, use of the minimum distance between the postulated release point and the nearest site boundary (i.e., the maximum χ/Q) provides a reasonable estimate of the effect on the construction workforce from the operating AP1000. Additionally, all input doses are given for continuous occupancy, and are adjusted to account for a maximum 2400 hr/yr occupancy of a construction worker.

The doses to construction workers from liquid effluents are the same as those to members of the public. Recreational usage of the Delaware River and fish/invertebrate consumption patterns do not change as a result of working at the PSEG Site. Doses to members of the public, and thus construction workers, are calculated in Section 5.4, using the LADTAP II computer code. These doses are listed in Table 4.5-10. Information regarding specific calculation inputs and parameters is in Section 5.4.

4.5.5 CONSTRUCTION WORKER DOSES

Doses to construction workers are summarized in Table 4.5-1. Doses are given annually for each construction worker (in mrem TEDE), and to the collective construction workforce (in person-rem TEDE). The construction workforce is 4100 at its maximum (SSAR Table 1.3-1, Item 18.4.1). For the purposes of comparison to the limits in 10 CFR 20, doses are converted to TEDEs. These dose conversions are shown in Table 4.5-11, and discussed in Subsection 4.5.4. The organ dose from SGS and HCGS is converted to a thyroid (critical organ) CEDE by multiplying by a weighting factor of 0.03.

4.5.5.1 Compliance with 10 CFR 20

To comply with 10 CFR 20, a construction worker must not be exposed to an annual dose of more than 100 mrem TEDE or more than 2 mrem TEDE in any one hour. Table 4.5-2 shows

that construction workers are exposed to a dose considerably less than the annual limit. The radiation sources are relatively constant in time, the hourly limit is met if the annual limit is met. These results show that the construction workers do not need to be treated as monitored radiation workers. Normal variations in overtime scheduling do not lead to annual doses or hourly doses exceeding the 10 CFR 20 limits.

4.5.6 REFERENCES

4.5-1 "Offsite Dose Calculation Manual for PSEG Nuclear LLC - Hope Creek Generating Station," Revision 23, 2009.

4.5-2 "Offsite Dose Calculation Manual for PSEG Nuclear LLC - Salem Generating Station," Revision 21, 2008.

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4.5-4 Westinghouse, Design Control Document (DCD) for the Advanced Passive 1000 (AP1000) Reactor, Revision 17.

4.5-5 Westinghouse, "AP1000 Dual Unit Siting (TR99)," APP-GW-GLR-099, Revision 0.

4.5-6 U.S. Department of Energy, Radiation Safety Information Computational Center, CCC-701, MCNP4C2: Monte Carlo N-Particle Transport Code System, June 2001.

Table 4.5-1
Summary of Annual Construction Worker Doses

Source	Annual Worker TEDE (mrem)	Annual Collective TEDE to Workforce (person-rem)
SGS and HCGS Gaseous	< 0.01	0.01
AP1000 Gaseous	2.67	10.95
SGS and HCGS Direct	0.60	2.46
ISFSI Direct	10.3	42.23
AP1000 Direct	4.90	20.09
SGS and HCGS Liquid	<0.01	<0.01
AP1000 Liquid	0.19	0.78
Total All Sources	18.66	76.51

Table 4.5-2
Total Annual Dose Comparison to 10 CFR 20

Source	Annual Worker TEDE (mrem)	10 CFR 20 Annual Limit (mrem TEDE)
Gaseous SGS and HCGS	< 0.01	
Gaseous AP1000	2.67	
SGS and HCGS Direct	0.60	
ISFSI Direct	10.3	
AP1000 Direct	4.90	
SGS and HCGS Liquid	< 0.01	
AP1000 Liquid	0.19	
Total All Sources	18.66	100

Table 4.5-3
Not Used

Table 4.5-4
Not Used

Table 4.5-5
Not Used

Table 4.5-6
Not Used

Table 4.5-7
Gaseous Effluent Doses from SGS and HCGS

Gaseous Effluent Parameter	Annual Dose(a)	Annual Dose x10	Annual Worker Dose(b)
Maximum Gamma Air Dose (mrad)	2.01E-04	2.01E-03	5.51E-04
Maximum Beta Air Dose (mrad)	1.94E-04	1.94E-03	5.32E-04
Organ Dose from I-131, I-133, Tritium, and particulate nuclides (>8 days half-life) - Site Boundary (N Sector) (mrem)	2.04E-02	2.04E-01	5.59E-02

a) Annual dose is for continuous occupancy (8760 hr/yr).
b) Annual worker dose is for 2400 hr/yr occupancy.

Table 4.5-8
Direct Radiation Doses from the ISFSI

Dist (m)	Bounding Dose Rate (mrem/hr)	Bounding Annual Dose[(a)] (mrem)	Annual Dose[(b)] (mrem)	Annual Worker Dose[(c)] (mrem)
10	5.67E+00	4.97E+04	1.00E+02	2.74E+01
25	2.14E+00	1.87E+04	3.76E+01	1.03E+01

a) Annual dose is for continuous occupancy (8760 hr/yr).
b) The maximum annual dose at 10 m, considering administrative controls, is 100 mrem/yr. To calculate the annual dose at 25 m, the bounding dose at 25 m is scaled by a factor of 1.00E+02/4.97E+04.
c) Annual worker dose is for 2400 hr/yr occupancy.

Table 4.5-9
Gaseous Effluent Doses from a Single Unit AP1000

Gaseous Effluent Parameter	DCD Annual Dose (mrad)	DCD χ/Q (sec/m^3)	Site χ/Q (sec/m^3)	χ/Q Ratio (Site/DCD)	Annual Dose[(a)] (mrad)	Annual Worker Dose[(b)] (mrad)
Gamma Air Dose	2.1	2.00E-05	1.60E-05	8.00E-01	1.68E+00	4.60E-01
Beta Air Dose	10.1	2.00E-05	1.60E-05	8.00E-01	8.08E+00	2.21E+00

a) Annual dose is for continuous occupancy (8760 hr/yr).
b) Annual worker dose is for 2400 hr/yr occupancy.

Table 4.5-10
Liquid Effluent Doses

Liquid Effluent Parameter	Dose[a] (mrem)
AP1000	
Whole Body Dose	1.57E-02
Limiting Organ Dose	1.77E-01
SGS and HCGS	
Whole Body Dose	6.69E-05
Organ Dose	1.58E-04

a) Liquid effluent doses do not consider an occupancy factor, since the fish/invertebrate annual consumption and Delaware River annual recreational usage values (which are used to calculate the liquid effluent doses) are independent of the amount of time a construction worker is on-site.

Table 4.5-11
Conversion of Construction Worker Doses to TEDE

Source	Annual Worker Gamma Dose (mrad)	Annual Worker Beta Dose (mrad)	Annual Worker Organ CEDE (mrem)	Annual Worker Whole Body Dose (mrem)	Annual Worker TEDE (mrem)
SGS & HCGS Gaseous[(a)]	5.51E-04	5.32E-04	1.68E-03[(b)]		2.76E-03
AP1000 Gaseous[(c)]	4.60E-01	2.21E+00			2.67E+00
SGS and HCGS Direct[(d)]			0.00E+00	6.03E-01	6.03E-01
ISFSI Direct[(e)]				1.03E+01	1.03E+01
AP1000 Direct[(f)]				4.90E+00	4.90E+00
SGS and HCGS Liquid[(g)]			4.74E-06[(b)]	6.69E-05	7.16E-05
AP1000 Liquid[(g)]			1.77E-01	1.57E-02	1.93E-01

a) From Table 4.5-7
b) The CEDE was calculated by adjusting the annual worker organ dose to the limiting potential pathway (thyroid). This was done by multiplying the annual worker organ dose by a factor of 0.03.
c) From Table 4.5-9
d) From Section 4.5.4.1
e) From Table 4.5-8
f) From Section 4.5.4.2
g) From Table 4.5-10

4.6 MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING CONSTRUCTION

This section summarizes potential adverse environmental impacts from site preparation and construction activities discussed in previous sections of this chapter, along with associated measures and controls to limit those impacts.

4.6.1 REGULATORY CRITERIA

In accordance with NUREG-1555, potential adverse environmental impacts from construction activities are identified and addressed in this section, as well as the specific measures and controls to limit those adverse impacts.

4.6.2 ADVERSE ENVIRONMENTAL IMPACTS

PSEG will avoid, minimize, and reduce adverse environmental impacts during construction activities where feasible and practical. Construction activities at the PSEG Site will result in some adverse environmental impacts that are unavoidable.

Table 4.6-1 provides a summary of the impacts attributable to the construction of a new plant at the PSEG Site. The “Potential Impact Significance” columns in Table 4.6-1 list the elements identified in NUREG-1555 that relate to construction activities. Table 4.6-1 summarizes the measures and controls to limit potential adverse environmental impacts during construction activities. The following list identifies elements with potential adverse environmental impacts that may be encountered during construction activities:

- Air quality
- Aquatic ecosystems
- Erosion and sediments
- Effluents and wastes
- Groundwater
- Land use protection/restoration
- Noise
- Surface water
- Terrestrial ecosystems
- Traffic
- Water use protection/restoration
- Socioeconomic
- Radiation exposure to construction workers

Table 4.6-1 uses the NRC’s significance levels (SMALL, MODERATE, or LARGE) for each element. These significance levels are determined by evaluating the potential effects after any controls or mitigation measures had been implemented. The significance levels used in the evaluation are developed using Council on Environmental Quality (CEQ) guidelines set forth in the footnotes to Table B-1 of Title 10 of the CFR Part 51, Subpart A, Appendix B:

- SMALL — Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.

- MODERATE — Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

- LARGE — Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The impact categories evaluated in this chapter are the same as those used in NUREG-1437 *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, Volumes 1 and 2.

Upon receipt of an ESP permit, PSEG may choose to obtain a Limited Work Authorization (LWA) to carry out site preparation and preconstruction activities. Additionally, site preparation activities, some excavation work, and construction of support buildings, roads, fences, parking lots, potable water systems, and other nonsafety-related facilities may be initiated prior to receipt of a COL. These activities are referred to as preconstruction activities. These preconstruction activities can be carried out prior to issuance of a COL and are separated from NRC-regulated construction activities. The cumulative impacts attributable to new plant construction at the PSEG Site are summarized in Table 4.6-1.

Table 4.6-2 includes a separation of construction and preconstruction environmental impacts. Estimates of the percentage of impacts attributable to construction and preconstruction, and a summary of the basis for the estimates are provided. The construction-related activities were determined using the criteria in 10 CFR 50.10(a)(1). Activities constituting construction are the driving of sheeting and piles for a retaining/cut-off wall, subsurface preparation, placement of backfill, concrete or permanent retaining walls within the excavation, installation of foundations, or in-place assembly, erection, fabrication, or testing for:

- Safety-related Structures, Systems, and Components (SSC) of the facility, as defined in 10 CFR 50.2
- SSCs relied upon to mitigate accidents or transients or used in plant emergency operating procedures
- SSCs whose failure could prevent safety-related SSC from fulfilling their safety-related function
- SSCs whose failure could cause a reactor scram or actuation of a safety-related system
- SSCs necessary to comply with 10 CFR 73
- SSCs necessary to comply with 10 CFR 50.48 and criterion 3 of 10 CFR 50, Appendix A
- On-site emergency facilities, such as technical support and operations support centers, necessary to comply with 10 CFR 50.47 and 10 CFR 50, Appendix E

The following rationale is used to separate the construction and preconstruction impacts shown in Table 4.6-2:

- The area associated with SSC construction, for land use impacts
- Estimated labor hour percentages associated with SSC construction
- Activities associated with the potential off-site transmission line and the proposed causeway are considered preconstruction impacts
- On-site transmission activities are considered construction
- Excavation at the PSEG Site is considered construction, because sheet pile walls or other foundation cut-off walls are required to support excavation, and these walls will remain in place
- Activities performed prior to COL and/or LWA issuance are preconstruction activities. These include construction support facilities, preparation of barge facilities, parking construction and laydown development, and site preparation work such as clearing, grubbing and preparation of the USACE CDF.

The construction-related impacts in the table are based primarily on two factors: the area associated with the construction of SSC and the labor hours associated with the construction of SSCs.

- Land Use Factors — The PSEG Site consists of 819 contiguous acres, exclusive of the proposed off-site causeway and potential off-site transmission line. There are 45 ac. of adjacent land that will be used for temporary construction support, which is referred to as adjacent off-site. The total area that will be permanently and temporarily developed for the PSEG Site and adjacent off-site (45-ac. construction support area) is 430 ac. (Table 4.1-1), exclusive of the off-site proposed causeway and potential off-site electric transmission line. Of these developed areas, 129 ac. will be developed for SSCs (70 ac. for the power block, 50 ac. for the cooling tower area, 5 ac. for on-site transmission, and 4 ac. for the intake structure). In addition, on-site transmission switchyards total 63 ac., bringing the total land developed for SSCs to 192 acres. The area that will be developed for the construction of SSCs represents approximately 45 percent of the total area that will ultimately be developed (excluding the proposed causeway and potential off-site electric transmission line). The balance of the impacts on the PSEG Site and the adjacent off-site support area are considered to be preconstruction (55 percent). For other off-site areas (proposed causeway and potential off-site transmission line) the impacts are considered to be 100 percent preconstruction, as they are not SSCs per 10 CFR 50.2.

- Labor Factors — Labor data provided by potential reactor technology vendors for the phases of new plant development is analyzed and applied to the PSEG Site. The estimated labor hours directly associated with the construction of SSCs are 80 percent of the total labor hours for the new plant development. Construction labor versus preconstruction labor serves as a reasonable basis for the analysis necessary to separate impacts, as the quantity of emissions, labor socioeconomic impacts, water use, etc. is proportional to the labor percentage assigned to construction and preconstruction activities.

In addition to the factors described above, estimating the division of preconstruction and construction impacts for some resources requires consideration of resource-specific and/or activity-specific attributes (e.g., construction water use). In such cases, the justification for estimating the division of impacts is provided in Table 4.6-2 Basis of Estimates.

4.6.3 MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS

Table 4.6-1 lists and describes facility construction impacts that require mitigation along with corresponding measures and controls that may be committed to limit potential adverse environmental impacts. The listed measures and controls have been designed to achieve a practical level of mitigation that can be achieved through implementation. Further, the listed measures and controls are reasonable, specific, and unambiguous; and involve methods and techniques that are appropriate, achievable, and can be verified through subsequent field reviews and inspections. Finally, the environmental, economic, and social costs of implementing the measures and controls have been balanced against the expected benefits.

Examples of PSEG's measures to minimize impacts and protect the environment include:

- Using BMPs for construction activities
- Implementing plans to manage stormwater and to prevent and appropriately address accidental spills
- Managing and/or restoring wetlands and marsh creek channels
- Adhering to federal, state and local permitting requirements

In addition to the general measures discussed above, the following specific factors limit potential adverse environmental impacts related to construction activities at the PSEG Site:

- Compliance with federal, state, and local laws, ordinances, and regulations intended to prevent or minimize adverse environmental effects (for example, solid waste management, erosion and sediment control, air emissions, noise control, stormwater management, discharge prevention and response, and hazardous waste management)

- Compliance with applicable requirements, permits and licenses required for construction of a new plant at the PSEG Site (for example, any subsequent application to the NRC for approval to conduct certain LWA construction activities, USACE Section 404 and Section 10 Permits, and NJPDES permit(s), Prevention of Significant Deterioration air operating permit(s), Clean Water Act Section 316 (a) and (b) requirements for the proposed intake structure, and others as necessary)

- Compliance with existing PSEG Site processes and/or procedures applicable to construction environmental compliance activities for the new plant including solid waste management, hazardous waste management, and discharge prevention and response

- Incorporation of environmental requirements into construction contracts
- Identification of environmental resources and potential effects during the development of this Environmental Report

The potential mitigation measures and controls will be reviewed and revised as appropriate after PSEG selects a reactor technology for the new facility.

Table 4.6-1 (Sheet 1 of 10)
Summary of Measures and Controls to Limit Adverse Impacts During Construction

ER Section Reference	Potential Impact Significance[a,b] Elements													Impact Description or Activity	Specific Measures and Controls
	Air Quality	Aquatic Ecosystems	Erosion and Sediment	Groundwater	Land Use	Noise	Radiation Exposure	Socioeconomic	Surface Water	Terrestrial Ecosystems	Traffic	Wastes	Water Use		
4.1 Land-Use Impacts															
4.1.1 The Site and Vicinity			S		S				S					1. Permanent conversion of disturbed or degraded non-industrial land to industrial land. 2. Temporary conversion of disturbed or degraded non-industrial lands to industrial land. 3. Permanent loss of wetlands (primarily *Phragmites*-dominated). 4. Conversion of artificial ponds to industrial land. 5. Temporary change of wetlands to industrial land.	1. Stormwater management plans to control erosion and runoff. 2. Lands returned to former use upon completion of construction. 3. Loss of wetland use and function offset by mitigation. 4. Artificial pond losses do not require mitigation. 5. Wetlands areas allowed to return to former use upon completion of construction.
4.1.2 Transmission Corridors and Off-Site Areas					M									1. Impacts to lands from construction of on-site, adjacent off-site areas, proposed causeway and off-site transmission lines. 2. Permanent impacts (lack of access for farming) to prime and unique farmlands and NJ State farmlands of unique importance.	1. Use Best Management Practices (BMPs), stormwater management plans to control erosion and runoff, minimize clearing, minimize effects on human populations, wetlands, water bodies, archaeological and historic sites, vegetation, and wildlife. 2. Specific measures and controls are not necessary for impacts that are minor.

Table 4.6-1 (Sheet 2 of 10)
Summary of Measures and Controls to Limit Adverse Impacts During Construction

ER Section Reference	Potential Impact Significance[a,b] Elements													Impact Description or Activity	Specific Measures and Controls
	Air Quality	Aquatic Ecosystems	Erosion and Sediment	Groundwater	Land Use	Noise	Radiation Exposure	Socioeconomic	Surface Water	Terrestrial Ecosystems	Traffic	Wastes	Water Use		
4.1.3 Historic Properties								M S						1. Impacts to lands along proposed causeway containing archaeological resources. 2. Potential impacts to lands along transmission lines that may contain archaeological resources and other historic properties.	1. Phase II survey and consultation with the New Jersey Historic Preservation Office to define mitigation requirements, as appropriate 2. Phase I survey to identify archaeological sites during route development. Avoidance where possible. Consultation with State Historic Preservation Offices to define mitigation requirements for unavoidable impacts, as appropriate.
4.2 Water-Related Impacts															
4.2.1 Hydrologic Alterations			S	S					S					1. Limited impacts to Delaware River flow / velocities and volumes due to shoreline modifications and intake channel dredging. 2. Changes in tidal access to limited marsh areas due to loss of marsh creek channels. 3. Loss of on-site water retention and potential for increased runoff to Delaware River by filling on-site artificial ponds and wetland areas, and increase in impervious surfaces.	1. Shoreline Modifications and Dredging – Use of BMPs and design features to minimize and stabilize affected areas. 2. Reconnection of isolated marsh creek channels and restoration of marsh creek channels as part of wetland mitigation program implementation. 3. Stormwater management plan to control erosion and runoff; grading design to manage runoff for controlled discharge to Delaware River.

Table 4.6-1 (Sheet 3 of 10)
Summary of Measures and Controls to Limit Adverse Impacts During Construction

	Potential Impact Significance[a,b]														
	Elements														
ER Section Reference	Air Quality	Aquatic Ecosystems	Erosion and Sediment	Groundwater	Land Use	Noise	Radiation Exposure	Socioeconomic	Surface Water	Terrestrial Ecosystems	Traffic	Wastes	Water Use	Impact Description or Activity	Specific Measures and Controls
4.2.1 Hydrologic Alterations, continued														4. Potential increase in local flood levels due to filling floodplain to elevate the site for flood protection of the plant. 5. Disruption of off-site creek flows and marsh tidal flows due to proposed causeway. 6. Potential impacts to Delaware River and other streams for transmission line towers.	4. No mitigation required for floodplain loss; no changes in local flood levels. 5. Construct causeway as elevated structure. 6. Towers to be co-located along existing transmission line to minimize alteration.
4.2.2 Water Use													S	Use of groundwater supplied from wells that provide water for HCGS and SGS. Additional needs are less than the 200 gallons per minute (gpm) available under existing water use permits.	Specific measures and controls are not needed; impacts are minor.
4.2.3 Water Quality Impacts			S	S					S					1. Increased suspended solids and potential for pollutant loading due to land disturbance activities; filling of site utilization areas to raise elevation for plant buildings and support facilities; construction of cooling water intake and discharge structures in the Delaware River; dredging of water intake, discharge, and barge access areas; and proposed causeway construction.	1. Use of BMPs, stormwater management plans to control erosion and runoff, grading design to manage runoff for controlled discharge to Delaware River; use of cofferdams and/or silt curtains to limit mixing and transport of suspended sediments; disposal of dredged materials in approved upland areas.

Table 4.6-1 (Sheet 4 of 10)
Summary of Measures and Controls to Limit Adverse Impacts During Construction

ER Section Reference	Potential Impact Significance[a,b]													Impact Description or Activity	Specific Measures and Controls
	Elements														
	Air Quality	Aquatic Ecosystems	Erosion and Sediment	Groundwater	Land Use	Noise	Radiation Exposure	Socioeconomic	Surface Water	Terrestrial Ecosystems	Traffic	Wastes	Water Use		
4.2.3 Water Quality Impacts, continued														2. Increase in potential for chemical discharges from accidental spills to surface and groundwater.	2. Implementation of spill prevention control plans, construction limited to shallow aquifers avoid adverse effects on deeper aquifers used for potable water; use of secondary containments to prevent and control spills.
4.3 Ecological Impacts															
4.3.1 Terrestrial Ecosystems						S				S				<u>Non-wetland flora and fauna</u>: 1. Displacement of fauna, particularly birds and mammals. Habitat for flora and some less mobile fauna will be eliminated. 2. Construction-related noise may temporarily displace wildlife. 3. Potential bird collisions with man-made structures such as cranes and buildings during construction. 4. Construction lighting during night time hours may interfere with wildlife.	Specific measures and controls are not needed; impacts are minor.

Table 4.6-1 (Sheet 5 of 10)
Summary of Measures and Controls to Limit Adverse Impacts During Construction

ER Section Reference	Potential Impact Significance[a,b]													Impact Description or Activity	Specific Measures and Controls
	Elements														
	Air Quality	Aquatic Ecosystems	Erosion and Sediment	Groundwater	Land Use	Noise	Radiation Exposure	Socioeconomic	Surface Water	Terrestrial Ecosystems	Traffic	Wastes	Water Use		
4.3.1 Terrestrial Ecosystems. continued										M				Wetland Areas: 1. Permanent loss of on-site jurisdictional wetlands (includes areas on-site and within USACE confined disposal facility (CDF) that are currently assumed to be non-jurisdictional), mostly *Phragmites*-dominated wetlands; impact to jurisdictional wetlands (primarily shading impacts associated with the proposed causeway). 2. Temporary loss of function for on-site wetlands, adjacent areas, and off-site jurisdictional wetlands (causeway).	Wetland Areas: 1. Mitigation of impacts to coastal wetlands and unmapped coastal wetlands to include restoration and enhancement. 2. No mitigation needed for artificial ponds within desilting basin and USACE CDF as these are active, permitted disposal basins that have limited and temporary biological value. 3. On-going effort to avoid and minimize impacts to wetlands as part of design and permitting process. 4. Mitigation of impacts to coastal wetlands and unmapped coastal wetlands to include restoration and enhancement.
										S				Important Species: 1. Habitat alternation and elimination, noise, human activity, and new structures. 2. Potential habitat alteration due to future off-site transmission line development.	Important Species: 1. No mitigation required for on-site and near off-site impacts as impacts to birds of prey, waterfowl, other bird species, mammals and salt marsh cordgrass will be small. 2. Consultations with state and federal agencies to minimize potential unavoidable impacts to listed species as part of off-site transmission line and proposed causeway development.

Table 4.6-1 (Sheet 6 of 10)
Summary of Measures and Controls to Limit Adverse Impacts During Construction

ER Section Reference	Potential Impact Significance[(a,b)] Elements: Air Quality	Aquatic Ecosystems	Erosion and Sediment	Groundwater	Land Use	Noise	Radiation Exposure	Socioeconomic	Surface Water	Terrestrial Ecosystems	Traffic	Wastes	Water Use	Impact Description or Activity	Specific Measures and Controls
4.3.1 Terrestrial Ecosystems. continued										M				<u>Potential Off-Site Transmission:</u> 1. Alteration of forested land. 2. Crosses wetlands, including alteration of freshwater forested/shrub wetland to herbaceous wetland community; limited filling activity in wetlands. 3. Potential impact to important species that may be present.	<u>Potential Off-Site Transmission:</u> 1. Avoid forested tracts of lands to extent practicable. 2. On-going effort to avoid and minimize impacts to wetlands as part of design and permitting process. 3. Consultations with state and federal agencies to minimize potential unavoidable impacts to listed species as part of off-site transmission line development.
4.3.2 Aquatic Ecosystems		S							S					<u>On-site and Near-Off-site</u> 1. Impacts to shoreline of Delaware River from construction of cooling water intake and discharge structures, heavy haul road and barge facility; impact to Delaware River benthic community by dredging; impact to small amount of essential fish habitat. 2. Impact to marsh creek headwater channels from switchyard and cooling tower construction. 3. Temporary displacement of important aquatic species.	<u>On-Site and Near-Off-Site</u> 1. Stormwater discharges compliance to applicable NJPDES permit requirements, BMPs to minimize erosion and sedimentation based on New Jersey Storm Water Pollution Prevention Plan (SWPPP) requirements, use of cofferdams and/or silt curtains to limit mixing and transport of suspended sediments.

Table 4.6-1 (Sheet 7 of 10)
Summary of Measures and Controls to Limit Adverse Impacts During Construction

ER Section Reference	Potential Impact Significance[a,b]													Impact Description or Activity	Specific Measures and Controls
	Elements														
	Air Quality	Aquatic Ecosystems	Erosion and Sediment	Groundwater	Land Use	Noise	Radiation Exposure	Socioeconomic	Surface Water	Terrestrial Ecosystems	Traffic	Wastes	Water Use		
4.3.2 Aquatic Ecosystems, continued														4. Impact to artificial ponds due to power block construction.	2. On-going efforts to avoid and minimize impacts to aquatic ecosystems as part of design and permitting process; restoration of marsh creeks as integrated part of coastal wetland restoration (Subsection 4.3.1); Re-connection of isolated marsh creek channels by development of supplemental connecting channels. 3. No measures or controls required for important species since impacts are small. 4. No measures or controls required for artificial ponds as they are currently assumed to be non-jurisdictional and impacts are small.
		S	S						S					<u>Off-Site Transmission:</u> 1. Impacts to Delaware River from tower construction. 2. Potential impact to other surface water resources by land clearing/tower construction. 3. Potential impact to sensitive species.	<u>Off-Site Transmission:</u> 1. Ongoing efforts to avoid and minimize impacts to aquatic ecosystems as part of design and permitting process. 2. Consultations with state and federal agencies to minimize potential unavoidable impacts to listed species as part of off-site transmission line development.

Table 4.6-1 (Sheet 8 of 10)
Summary of Measures and Controls to Limit Adverse Impacts During Construction

ER Section Reference	Potential Impact Significance[(a,b)] Elements													Impact Description or Activity	Specific Measures and Controls
	Air Quality	Aquatic Ecosystems	Erosion and Sediment	Groundwater	Land Use	Noise	Radiation Exposure	Socioeconomic	Surface Water	Terrestrial Ecosystems	Traffic	Wastes	Water Use		
4.4 Socioeconomic Impacts															
4.4.1 Physical Impacts	S				S	S					M	S		1. Exposure to noise. 2. Exposure to fugitive dust, exhaust emissions, and vibrations. 3. Generation of construction wastes. 4. Visual alteration of site. 5. Increases in traffic on local highways due to construction worker vehicles and equipment, deterioration of level of service of local roads.	1. Major high noise construction activities will be managed to limit and minimize noise impacts to residences in the vicinity, construction workers will be required to wear noise protection equipment in areas with high noise levels. 2. Best management practices for controlling fugitive dust and proper maintenance of construction equipment for controlling emissions. 3. To the extent possible construction wastes will be recycled with remaining waste disposed in approved landfills. 4. Stabilize cleared areas, minimize disturbance and visual intrusion, removal of construction debris in timely manner. 5. Installation of traffic controls and turning capacity to mitigate traffic delays, construction workforce will work in three shifts to spread additional construction traffic volume over a 24-hour period.

Table 4.6-1 (Sheet 9 of 10)
Summary of Measures and Controls to Limit Adverse Impacts During Construction

ER Section Reference	Potential Impact Significance[a,b]													Impact Description or Activity	Specific Measures and Controls
	Elements														
	Air Quality	Aquatic Ecosystems	Erosion and Sediment	Groundwater	Land Use	Noise	Radiation Exposure	Socioeconomic	Surface Water	Terrestrial Ecosystems	Traffic	Wastes	Water Use		
4.4.2 Social and Economic Impacts					S			S						1. Changes in regional and local population. 2. Increase in demand for public services and school enrollments in region and vicinity. 3. Increase in demand for homes and apartments in region and vicinity. 4. Additional tax revenues and purchases in Salem County will be beneficial given declining populations and need for revenues to maintain existing public services and social programs. 5. Small increase in regional sales, payroll, and property tax revenues associated with hiring of construction workforce and purchase of construction equipment and materials.	1. No measures or controls required as impacts are small. 2. No measures or controls required as impacts are small. 3. No measures or controls required as impacts are small. 4. No measures or controls required as impacts are small. 5. No measures or controls required as impacts are small.

Table 4.6-1 (Sheet 10 of 10)
Summary of Measures and Controls to Limit Adverse Impacts During Construction

ER Section Reference	Potential Impact Significance[(a,b)] Elements: Air Quality			Groundwater	Land Use	Noise	Radiation Exposure	Socioeconomic	Surface Water	Terrestrial Ecosystems	Traffic	Wastes	Water Use	Impact Description or Activity	Specific Measures and Controls
4.4.3 Environmental Justice Impacts								S			S			1. Increases in traffic may have a disproportionate effect on the low income and minority population in Salem City. 2. Deterioration of level of service of local roads.	1. Installation of traffic controls and turning capacity to mitigate traffic delays in and around Salem City. 2. Construction workforce will work in three shifts to spread additional construction traffic volume over a 24-hour period.
4.5 Radiation Exposure to Construction Workers															
							S							Radiation exposures will be within established standards.	Specific measures and controls are not needed; impacts are minor.

a) The assigned significance levels are based on the assumption that the associated proposed mitigation measures and controls will be implemented.
b) Blanks in columns denote “no impact” for that specific element due to assessed impacts.

Table 4.6-2 (Sheet 1 of 8)
Summary of Construction and Preconstruction-Related Impacts for Safety-Related Structures, Systems, or Components

ER Section Reference	Potential Impacts and Significance[(a)]	Construction Impacts (%)[(b)]	Preconstruction Impacts (%)	Basis of Estimate
4.1 Land Use Impacts				
4.1.1 Site and Vicinity[(c)]	Erosion and Sediment – SMALL Land Use – SMALL Surface Water - SMALL	45 45 45	55 55 55	Impact percentage estimates for construction and preconstruction are based on the land area that will be dedicated to SSCs and the Site Utilization Plan showing that the construction of SSCs will occur on approximately 192 ac. (70 ac. for power block, 50 ac. for cooling tower, 63 ac. for on-site transmission switchyards, 5 ac. for on-site transmission, and 4 ac. for the intake structure) of the 430 ac. area impacted by on-site and adjacent off-site construction activities (Table 4.3-1). The area related to SSCs represents 45% of the total area affected by construction.
4.1.2 Transmission Corridors and Off-Site Areas	Land Use – MODERATE	0	100	Proposed off-site causeway (Subsection 4.1.1) and potential off-site transmission corridor are 100 percent preconstruction scope.
4.1.3 Historic Properties	<u>PSEG Site Activities</u> Socioeconomic – SMALL <u>Off-site Activities</u> Causeway - MODERATE Transmission - SMALL	0 0	100 100	No impact to historic properties is anticipated on the PSEG Site. Impacts are associated with proposed off-site causeway and potential off-site transmission. Unidentified impacts on historic properties applies only to preconstruction activities and off-site improvements. Potential impacts will be assessed prior to land clearing, grading, installation of drainage, erosion and other environmental mitigation measures, and construction of temporary roads and laydown areas.

Table 4.6-2 (Sheet 2 of 8)
Summary of Construction and Preconstruction-Related Impacts for Safety-Related Structures, Systems, or Components

ER Section Reference	Potential Impacts and Significance[a]	Construction Impacts (%)[b]	Preconstruction Impacts (%)	Basis of Estimate
4.2 Water-Related Impacts				
4.2.1 Hydrologic Alterations	PSEG Site Activities			Impact percentage estimates for construction and preconstruction are based on the land area that will be dedicated to SSCs and the Site Utilization Plan showing that the construction of SSCs will occur on approximately 192 ac. (70 ac. for power block, 50 ac. for cooling tower, 63 ac. for on-site transmission switchyards, 5 ac. for on-site transmission, and 4 ac. for the intake structure) of the 430 ac. area impacted by on-site and adjacent off-site construction activities (Table 4.3-1). The area related to SSCs represents 45% of the total area affected by construction.
	Erosion and Sediment – SMALL	45	55	
	Groundwater – SMALL	45	55	
	Surface Water – SMALL	45	55	
	Surface Water Dredging – SMALL	30	70	Dredging activities are 70% preconstruction (barge unloading) and 30% construction (intake structure) based on areas to be dredged for each.
	Off-Site Activities (Causeway and Transmission)			Proposed off-site causeway and potential off-site transmission corridor are 100 percent preconstruction scope.
	Erosion and Sediment – SMALL	0	100	
	Groundwater – SMALL	0	100	
	Surface Water -SMALL	0	100	

Table 4.6-2 (Sheet 3 of 8)
Summary of Construction and Preconstruction-Related Impacts for Safety-Related Structures, Systems, or Components

ER Section Reference	Potential Impacts and Significance[(a)]	Construction Impacts (%)[(b)]	Preconstruction Impacts (%)	Basis of Estimate
4.2.2 Water Use	Water Use Surface Water – SMALL Groundwater – Dewatering - SMALL Groundwater – Construction Support - SMALL	 0 0 80	 100 100 20	There is limited surface water use for dust suppression, which is considered preconstruction. Impacts from groundwater (dewatering) are 100% preconstruction, as dewatering is necessary for the excavation. Plant labor is used to perform both preconstruction and construction scope. The percentage of total labor associated with construction scope (i.e., SSC construction) is 80% and therefore the labor associated with preconstruction scope is 20%. Groundwater use impacts are based on the labor split stated above for the withdrawal, which is for potable/sanitary use, and construction support (e.g., concrete batch plant supply and dust suppression.
4.2.3 Water Quality	Erosion and Sediment – SMALL Groundwater – SMALL Surface Water – SMALL Surface Water Dredging - SMALL	45 80 45 30	55 20 55 70	Impacts to water quality occur as a result of soil erosion and sediment transfer, stormwater discharge, suspended sediment within the Delaware River, and changes in physical parameters such as oxygen, temperature or pH. The labor and land use construction and preconstruction splits were used. Land clearing, grubbing and grading are preconstruction. Dredging activities are 70% preconstruction (barge unloading) and 30% construction (intake structure).

Table 4.6-2 (Sheet 4 of 8)
Summary of Construction and Preconstruction-Related Impacts for Safety-Related Structures, Systems, or Components

ER Section Reference	Potential Impacts and Significance(a)	Construction Impacts (%)(b)	Preconstruction Impacts (%)	Basis of Estimate
4.3 Ecological Impacts				
4.3.1 Terrestrial Ecosystems – On-Site and Adjacent On-Site (CDF)	*Non-wetland flora and fauna* Noise – SMALL Terrestrial Ecosystem – SMALL *Wetlands* Terrestrial Ecosystems – MODERATE *Important Species* Terrestrial Ecosystems - SMALL	 45 45 45 45	 55 55 55 55	Impact percentage estimates for construction and preconstruction are based on the land area that will be dedicated to SSCs and the Site Utilization Plan showing that the construction of SSCs will occur on approximately 192 ac. (70 ac. for power block, 50 ac. for cooling tower, 63 ac. for on-site transmission switchyards, 5 ac. for on-site transmission, and 4 ac. for the intake structure) of the 430 ac. area impacted by on-site and adjacent off-site construction activities (Table 4.3-1). The area related to SSCs represents 45% of the total area affected by construction. Impacts to the terrestrial ecosystems include clearing, grubbing, grading, excavation, filling, barge unloading construction, heavy haul road construction and other support facilities.
4.3.1 Terrestrial Ecosystems – Transmission and Off-Site	Terrestrial Ecosystems - MODERATE	0	100	Proposed off-site causeway and potential off-site transmission corridor are 100 percent preconstruction scope

Table 4.6-2 (Sheet 5 of 8)
Summary of Construction and Preconstruction-Related Impacts for Safety-Related Structures, Systems, or Components

ER Section Reference	Potential Impacts and Significance[(a)]	Construction Impacts (%)[(b)]	Preconstruction Impacts (%)	Basis of Estimate
4.3.2 Aquatic Ecosystems – On-Site and Adjacent Off-Site (CDF)	Aquatic Ecosystems – SMALL Surface Water - SMALL	45 45	55 55	Impact percentage estimates for construction and preconstruction are based on the land area that will be dedicated to SSCs and the Site Utilization Plan showing that the construction of SSCs will occur on approximately 192 ac. (70 ac. for power block, 50 ac. for cooling tower, 63 ac. for on-site transmission switchyards, 5 ac. for on-site transmission, and 4 ac. for the intake structure) of the 430 ac. area impacted by on-site and adjacent off-site construction activities (Table 4.3-1). The area related to SSCs represents 45% of the total area affected by construction. Aquatic habitats consist mostly of marsh creeks and the Delaware River. Impacts include construction of the barge facility, intake and discharge structures, and development of site utilization areas (e.g., infilling and isolation from tidal connection). The labor and land use construction and preconstruction splits were used.
4.3.2 Aquatic Ecosystems – Transmission and Off-Site	Aquatic Ecosystems – SMALL Surface Water – SMALL Erosion and Sediment – SMALL	0 0 0	100 100 100	Proposed off-site causeway and potential off-site transmission corridor are 100 percent preconstruction scope

Table 4.6-2 (Sheet 6 of 8)
Summary of Construction and Preconstruction-Related Impacts for Safety-Related Structures, Systems, or Components

ER Section Reference	Potential Impacts and Significance[(a)]	Construction Impacts (%)[(b)]	Preconstruction Impacts (%)	Basis of Estimate
4.4 Socioeconomic Impacts				
4.4.1 Physical – On-Site and Adjacent Off-Site (CDF)	Air Quality – SMALL Land Use – SMALL Noise – SMALL Traffic - MODERATE Wastes - SMALL	80 45 80 80 80	20 55 20 20 20	Impact percentage estimates for construction and preconstruction are based on the land area that will be dedicated to SSCs and the Site Utilization Plan showing that the construction of SSCs will occur on approximately 192 ac. (70 ac. for power block, 50 ac. for cooling tower, 63 ac. for on-site transmission switchyards, 5 ac. for on-site transmission, and 4 ac. for the intake structure) of the 430 ac. area impacted by on-site and adjacent off-site construction activities (Table 4.3-1). The area related to SSCs represents 45% of the total area affected by construction. Most perceptible noise and air quality impacts at off-site locations will occur during the most intense operations in the power block and cooling tower areas. Plant labor is used to perform both preconstruction and construction scope. The percentage of total labor associated with construction scope (i.e., SSC construction) is 80% and therefore the labor associated with preconstruction scope is 20%. Estimates are based on the average of the percent of labor hours dedicated to SSCs (80%) and the land dedicated to SSCs (45%). Air quality, noise, traffic and wastes construction and preconstruction splits are consistent with the labor splits (80% and 20% respectively). Land use construction and preconstruction splits were used (45% and 55%, respectively).

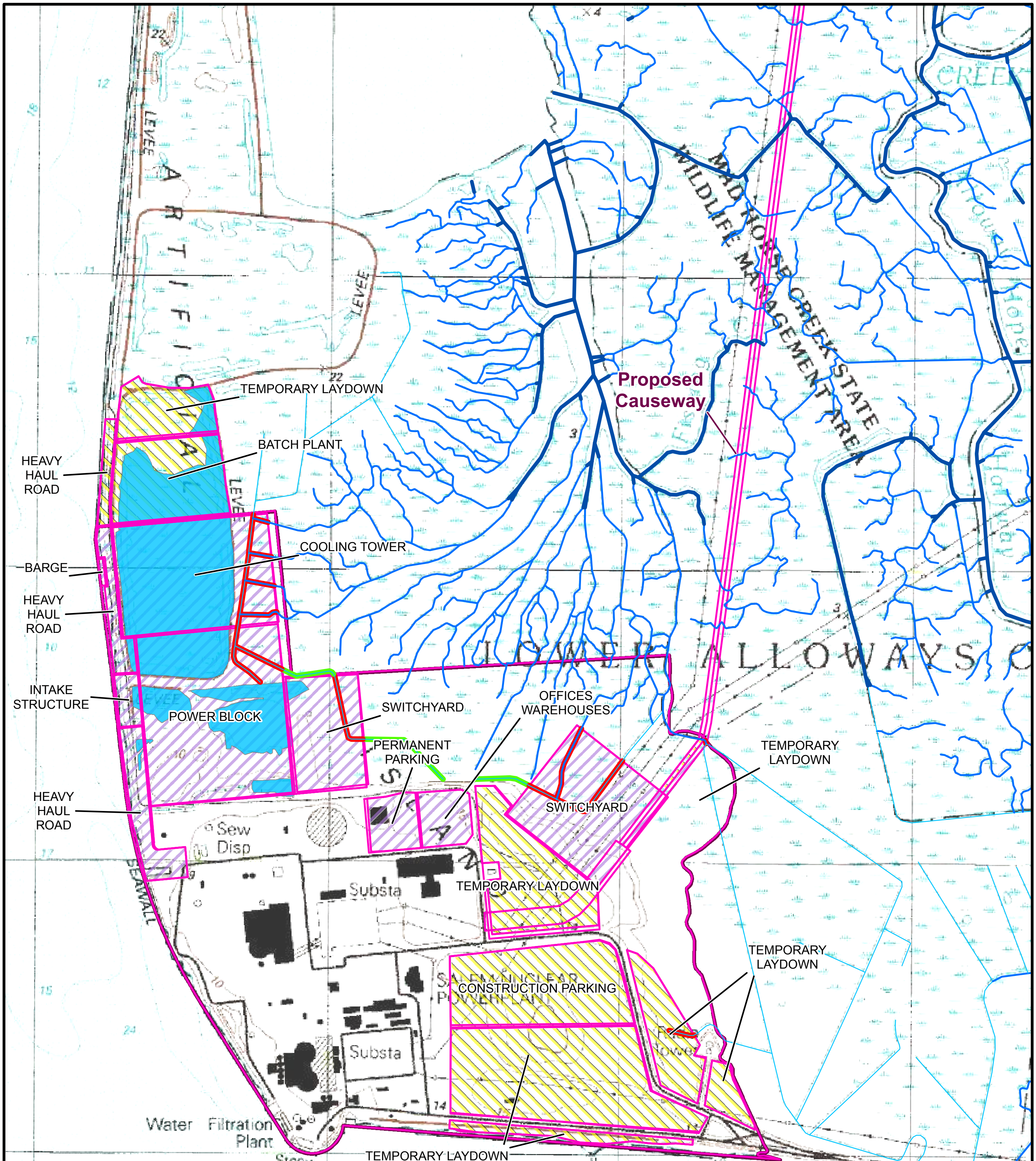
Table 4.6-2 (Sheet 7 of 8)
Summary of Construction and Preconstruction-Related Impacts for Safety-Related Structures, Systems, or Components

ER Section Reference	Potential Impacts and Significance[(a)]	Construction Impacts (%)[(b)]	Preconstruction Impacts (%)	Basis of Estimate
4.4.1 Physical – Transmission and Off-Site	Air Quality – SMALL	0	100	Proposed off-site causeway and potential off-site transmission corridor are 100 percent preconstruction scope
	Land Use - SMALL	0	100	
	Noise – SMALL	0	100	
	Traffic - SMALL	0	100	
	Wastes - SMALL	0	100	
4.4.2 Social and Economic	*Population Increase*			Plant labor is used to perform both preconstruction and construction scope. The percentage of total labor associated with construction scope (i.e., SSC construction) is 80% and therefore the labor associated with preconstruction scope is 20%. Estimated construction and preconstruction splits are consistent with the labor splits (80% and 20% respectively).
	Land Use – SMALL	80	20	
	Socioeconomic – SMALL	80	20	
	Additional Tax Revenues			
	Land Use – SMALL	80	20	
	Socioeconomic – SMALL	80	20	
	Demand For Public Services			
	Socioeconomic – SMALL	80	20	
	Demand of Housing			
	Socioeconomic-SMALL	80	20	
	Demand for Education			
	Socioeconomic – SMALL	80	20	

Table 4.6-2 (Sheet 8 of 8)
Summary of Construction and Preconstruction-Related Impacts for Safety-Related Structures, Systems, or Components

ER Section Reference	Potential Impacts and Significance[a]	Construction Impacts (%)[b]	Preconstruction Impacts (%)	Basis of Estimate
4.4.3 Environmental Justice	*Population Increase* Land Use – SMALL Socioeconomic – SMALL *Additional Tax Revenues* Land Use – SMALL Socioeconomic – SMALL *Demand For Public Services* Socioeconomic – SMALL *Demand of Housing* Socioeconomic-SMALL *Demand for Education* Socioeconomic – SMALL *Increased Traffic Volume* Socioeconomic - SMALL	 80 80 80 80 80 80 80 80	 20 20 20 20 20 20 20 20	Plant labor is used to perform both preconstruction and construction scope. The percentage of total labor associated with construction scope (i.e., SSC construction) is 80% and therefore the labor associated with preconstruction scope is 20%. Estimated construction and preconstruction splits are consistent with the labor splits (80% and 20% respectively).
4.5 Radiation Exposure to Construction Workers				
4.5 Radiation Exposure to Construction Workers	Radiation Exposure - SMALL	80	20	Plant labor is used to perform both preconstruction and construction scope. The percentage of total labor associated with construction scope (i.e., SSC construction) is 80% and therefore the labor associated with preconstruction scope is 20%. Estimated construction and preconstruction splits are consistent with the labor splits (80% and 20% respectively).

a) The assigned potential impact significance levels of SMALL, MODERATE, or LARGE are based on the assumption that mitigation measures and controls would be implemented.
b) Construction, as defined in 10 CFR 50.2, *Definitions*, refers to the construction of structures, systems, or components (SSCs) of a facility. These SSCs are primarily located within the power block, cooling tower, and intake structure areas.
c) Table entry refers to PSEG Site only and is exclusive of off-site activities (Subsection 4.1.3)



Legend

- Pond
- Site Boundary

Type

- Permanent Disturbance
- Temporary Disturbance

Stream Impact

- Isolated Impact
- Permanent Impact

Stream/River Type

- Canal/Ditch
- Stream/River
- Artificial Path

N / W / E / S

0 200 400 Meters

0 400 800 Feet

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Surface Water Resources
Impacted by Construction
(Sheet 1 of 2)

FIGURE 4.2-1

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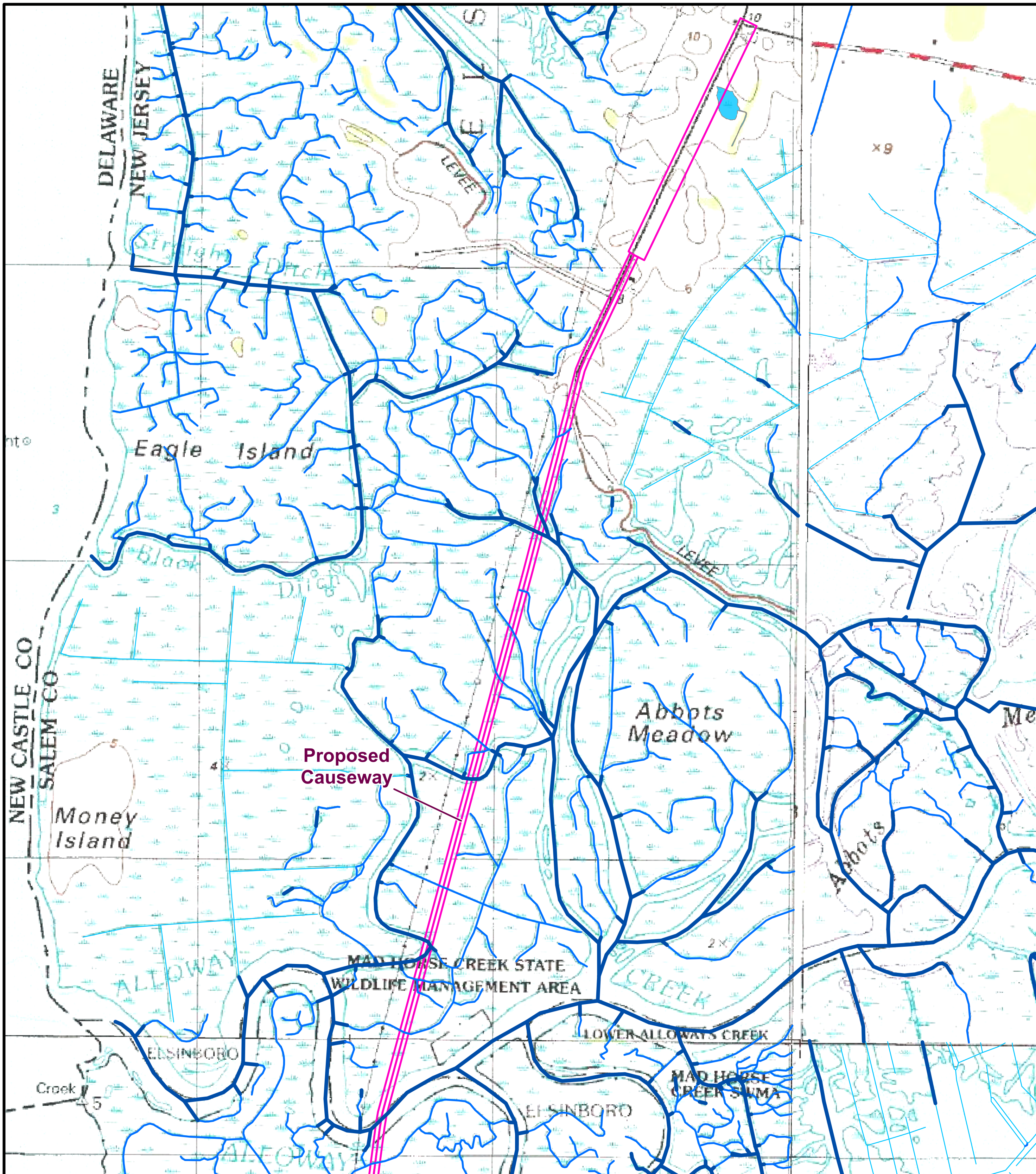

Legend

- Pond
- Site Boundary

Type

- Permanent Disturbance
- Temporary Disturbance

Stream Impact

- Isolated Impact
- Permanent Impact

Stream/River Type

- Canal/Ditch
- Stream/River
- Artificial Path

N / W / E / S

0 200 400 Meters

0 400 800 Feet

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Surface Water Resources Impacted by Construction (Sheet 2 of 2)

FIGURE 4.2-1

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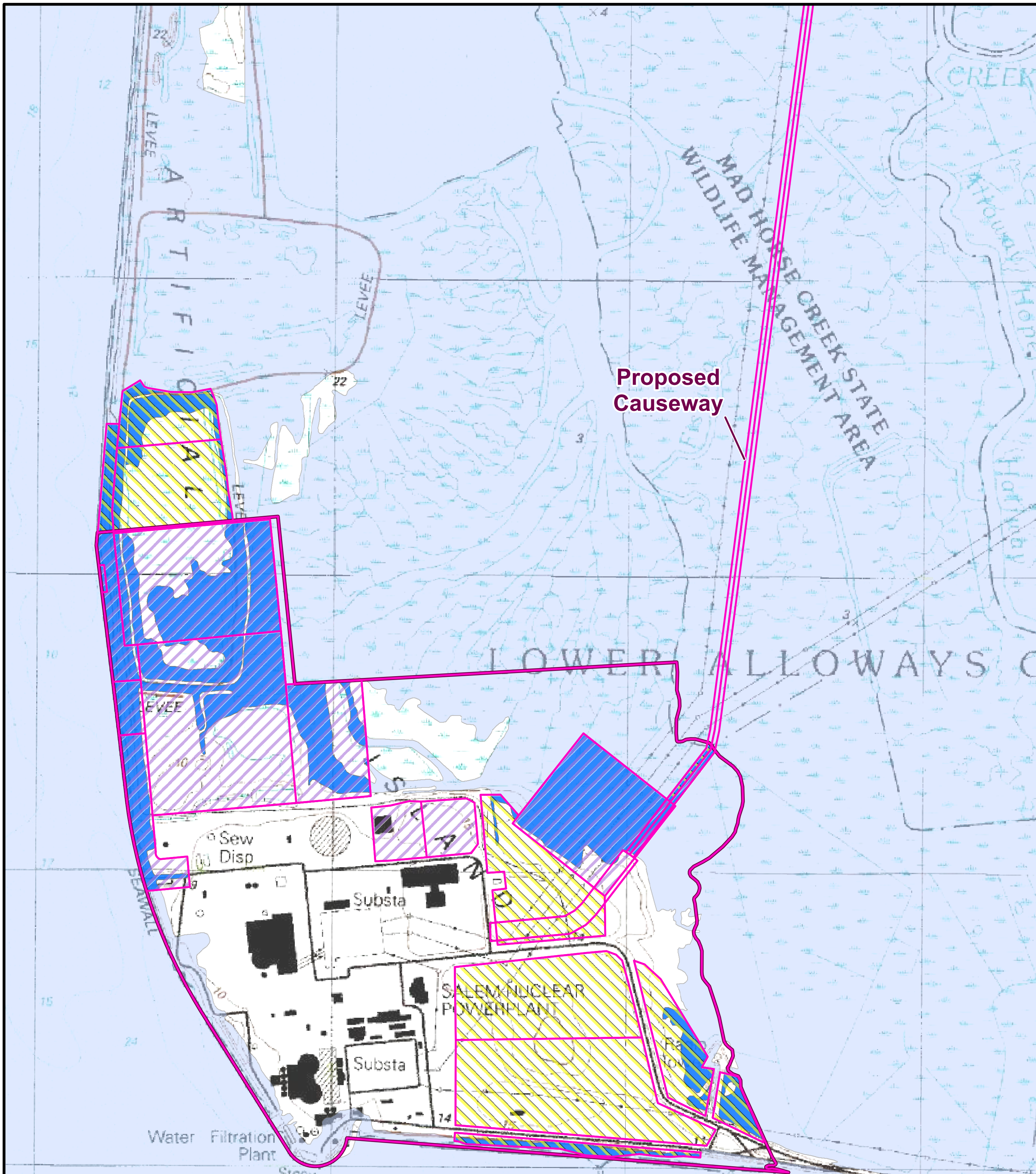

Legend

Site Boundary

Type

Permanent Disturbance

Temporary Disturbance

Floodplains

Impacted Floodplains

N
W E
S

0 200 400
Meters

0 400 800
Feet

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FEMA 100 Year Floodplains
Impacted by Construction

FIGURE 4.2-2

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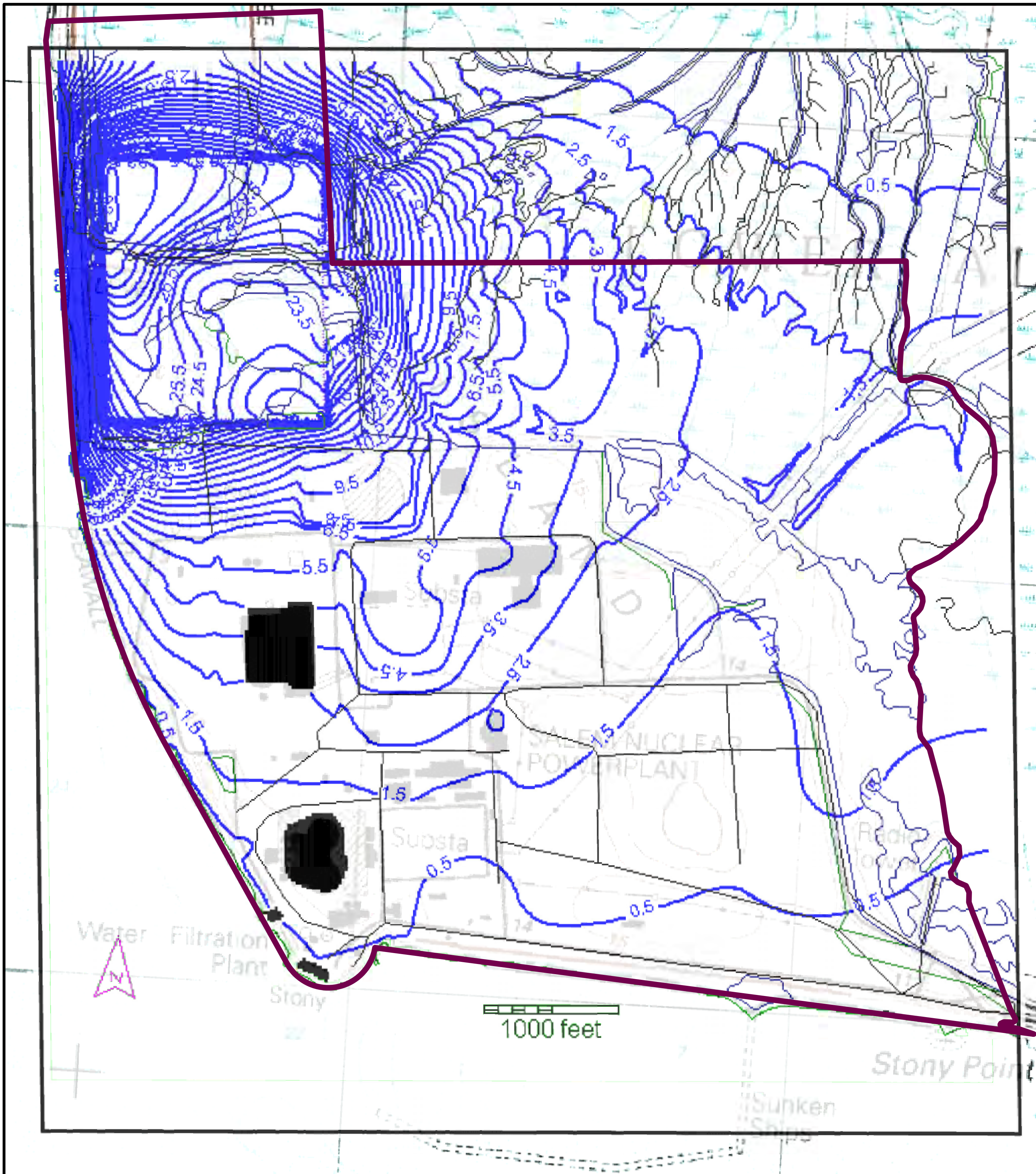

Legend

Site Boundary

0 200 400
Meters

0 400 800
Feet

Notes:
Simulation depicts groundwater drawdown contours after one year of dewatering
Contours estimated using MODFlow
Black areas show areas of no groundwater flow (i.e. deep structures)

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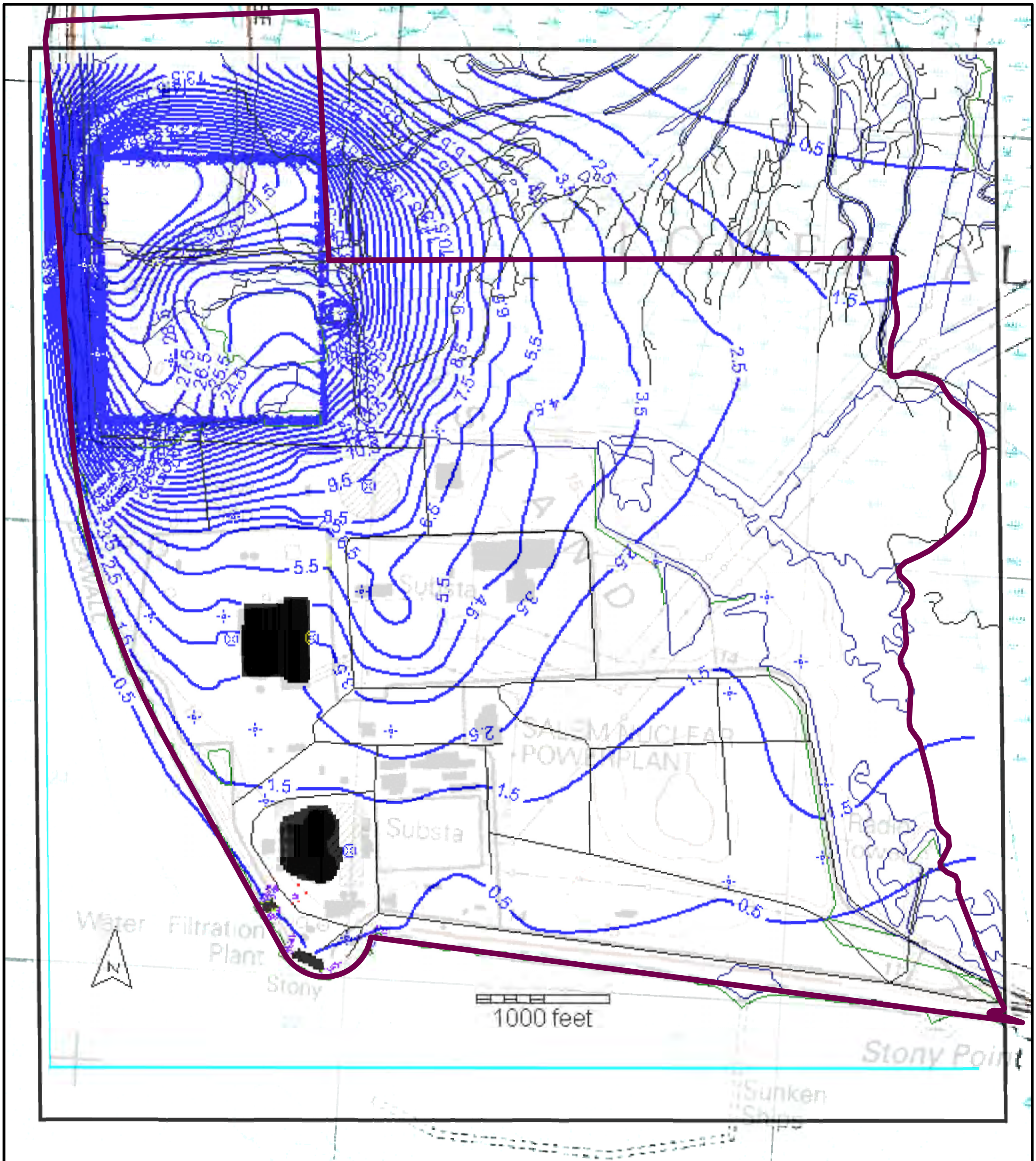
Drawdown Contours in Hydraulic Fill During Dewatering Activities

FIGURE 4.2-3

Rev 0



Legend

Site Boundary

Notes:
Simulation depicts groundwater drawdown contours after one year of dewatering
Contours estimated using MODFlow
Black areas show areas of no groundwater flow (i.e. deep structures)

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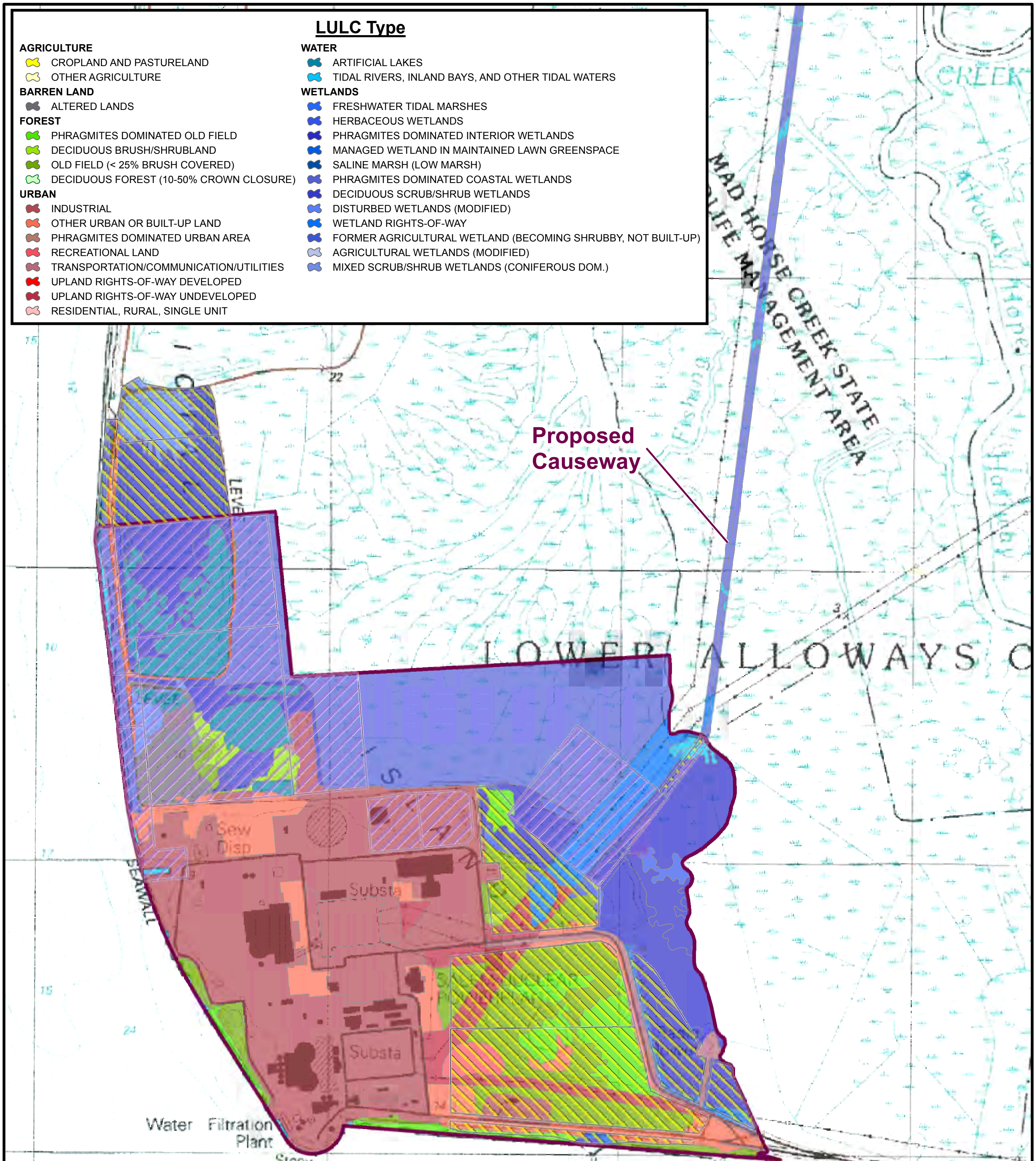
Drawdown Contours in the Alluvium During Dewatering Activities

FIGURE 4.2-4

Rev 0



Legend

Site Boundary **Type**

Permanent Disturbance

Temporary Disturbance

N W E S

0 200 400
Meters

0 400 800
Feet

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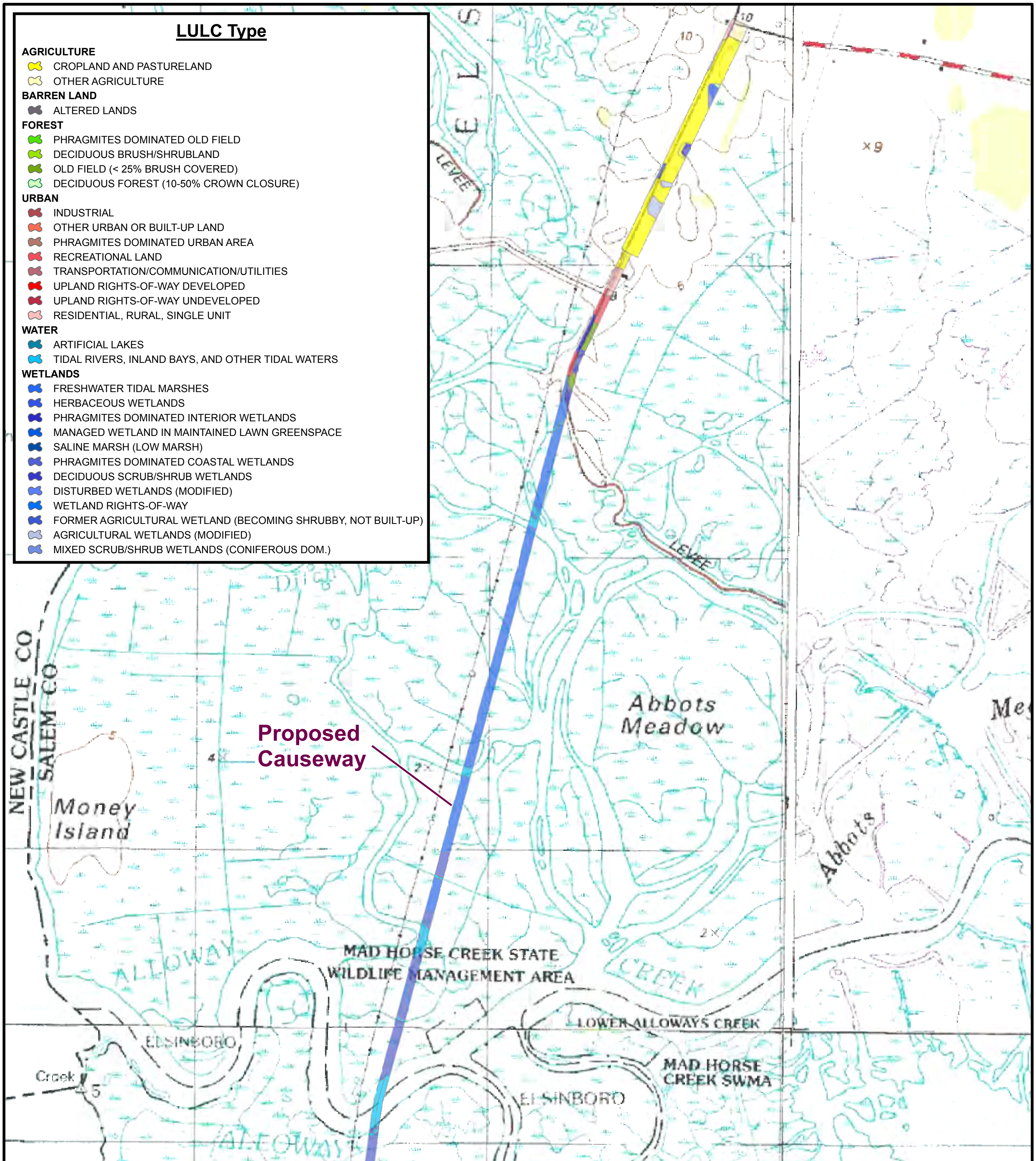
LULC
Impacted by Construction
(Sheet 1 of 2)

FIGURE 4.3-1

Rev 0



Legend

Site Boundary **Type**

Permanent Disturbance

Temporary Disturbance

N W E S

0 200 400 Meters

0 400 800 Feet

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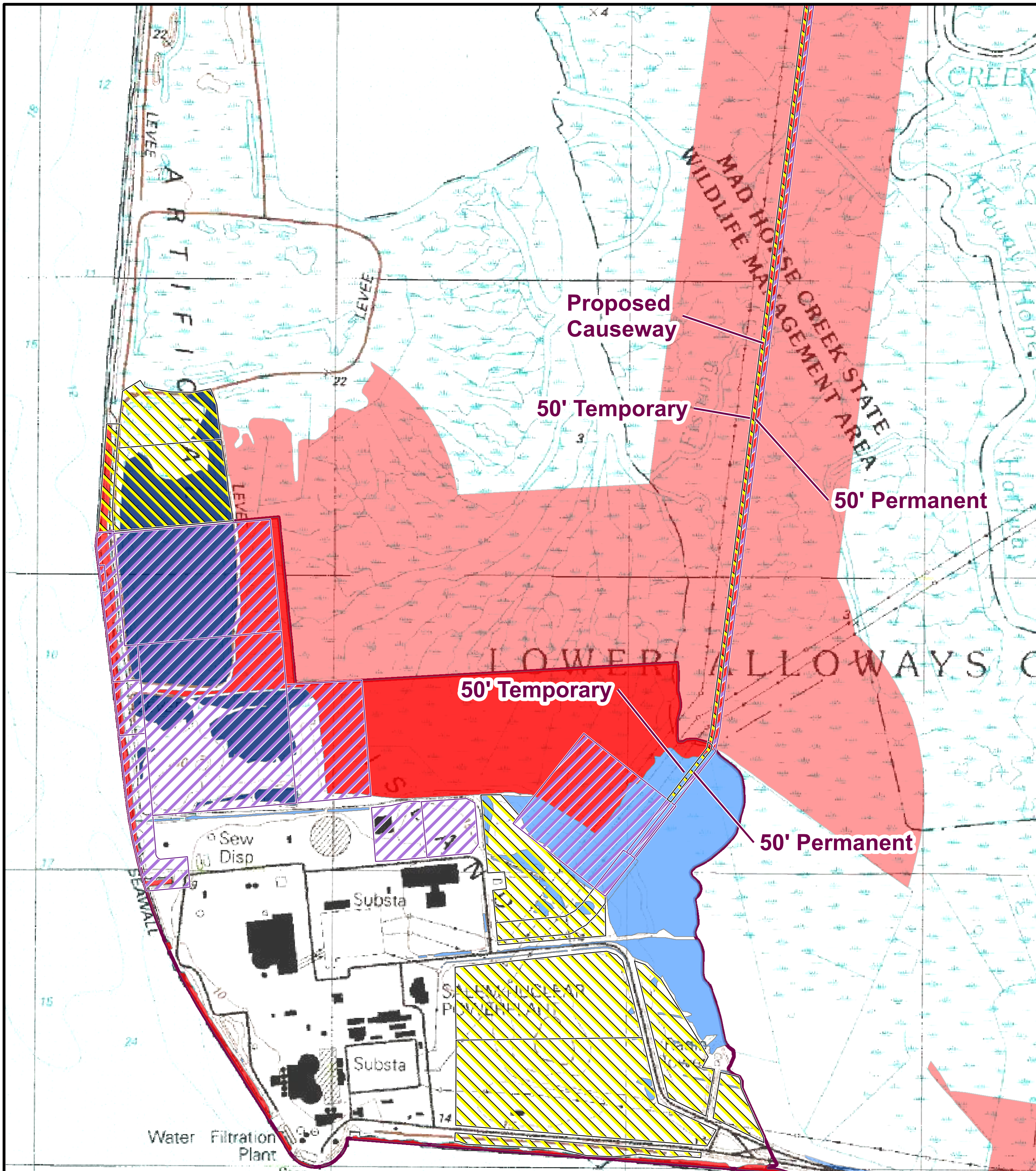
Part 3, Environmental Report

LULC
Impacted by Construction
(Sheet 2 of 2)

FIGURE 4.3-1

Rev 0



Legend

Site Boundary
Permanent Disturbance
Temporary Disturbance

Potentially Impacted Wetland

CDF/De-Silt Basin
Coastal
Coastal (Adjacent Area)
Unmapped Coastal
Freshwater

N
W E
S

0 200 400
Meters

0 400 800
Feet

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Wetlands
Impacted by Construction
(Sheet 1 of 2)

FIGURE 4.3-2

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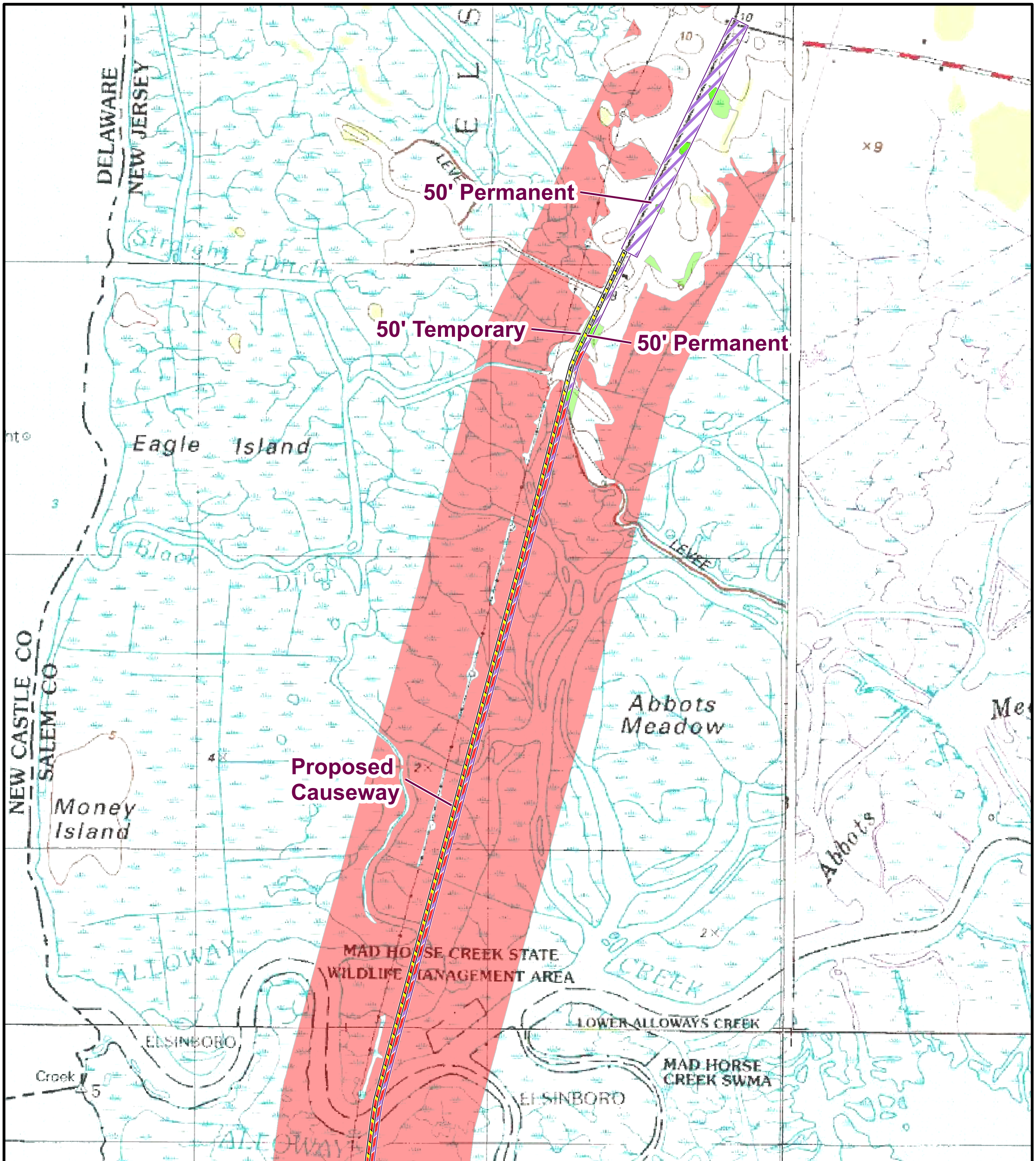

Legend

- Site Boundary
- Permanent Disturbance
- Temporary Disturbance

Potentially Impacted Wetland

- CDF/De-Silt Basin
- Coastal
- Coastal (Adjacent Area)
- Unmapped Coastal
- Freshwater

N
W E
S

0 200 400
Meters

0 400 800
Feet

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Wetlands
Impacted by Construction
(Sheet 2 of 2)

FIGURE 4.3-2

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Candidate Wetland
Mitigation Sites

FIGURE 4.3-3

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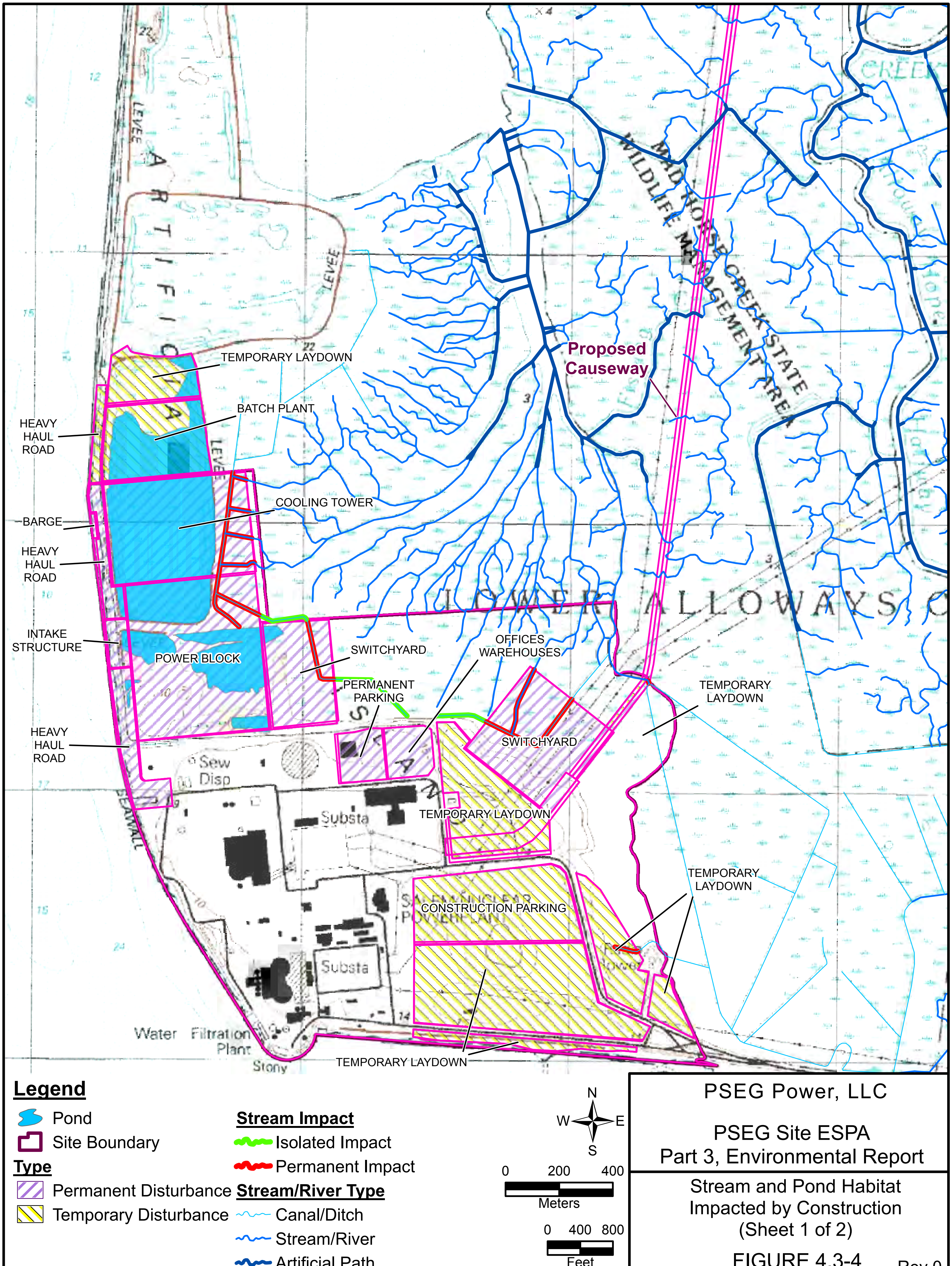

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Stream and Pond Habitat Impacted by Construction (Sheet 1 of 2)

FIGURE 4.3-4

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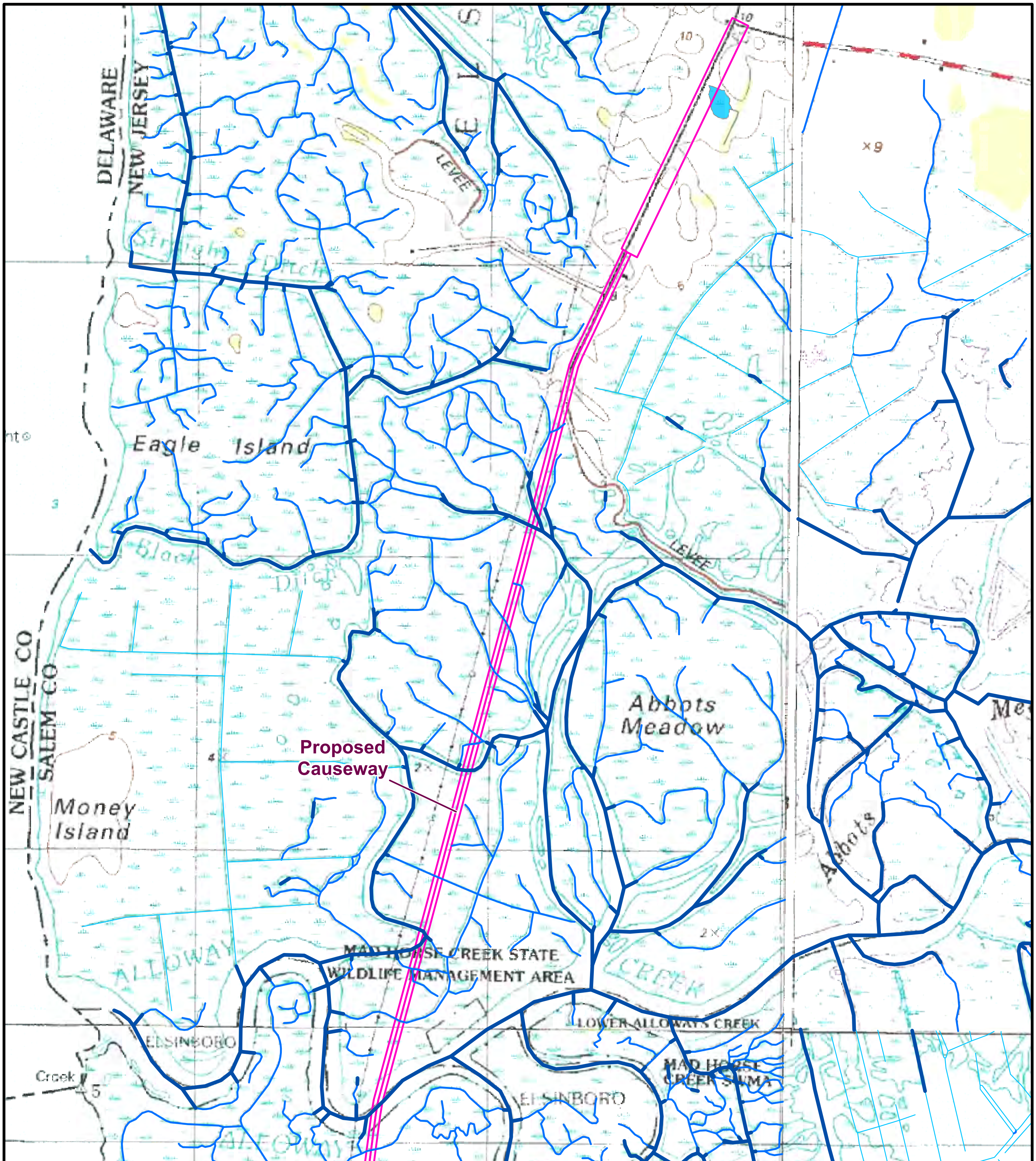

Legend

- Pond
- Site Boundary

Type

- Permanent Disturbance
- Temporary Disturbance

Stream Impact

- Isolated Impact
- Permanent Impact

Stream/River Type

- Canal/Ditch
- Stream/River
- Artificial Path

N / W / E / S

0 200 400 Meters

0 400 800 Feet

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Stream and Pond Habitat Impacted by Construction (Sheet 2 of 2)

FIGURE 4.3-4

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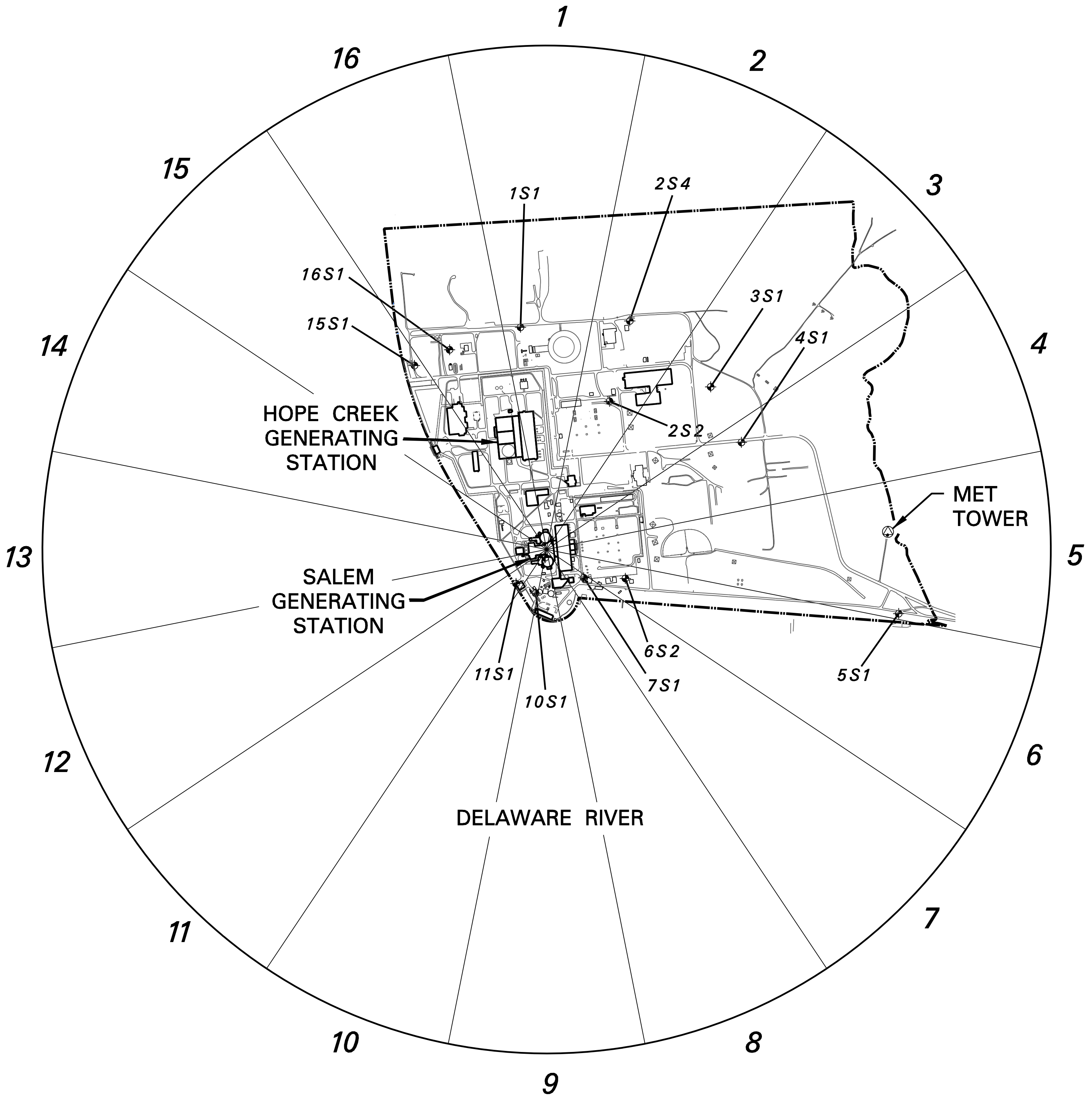

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TLD Layout and PSEG Site Map

Figure 4.5-1

Rev. 0