ENVIRONMENTAL REPORT

CHAPTER 4

ENVIRONMENTAL IMPACTS OF CONSTRUCTION

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4.0 ENVIRONMENTAL IMPACTS OF CONSTRUCTION

4.1 LAND USE IMPACTS

This section describes the impacts of site preparation and construction to the {BBNPP} site and the surrounding area. Section 4.1.1 describes impacts to the site and vicinity. Section 4.1.2 describes impacts that could occur along transmission lines. Section 4.1.3 describes impacts to historic and cultural resources at the site.

4.1.1 THE SITE AND VICINITY

The {BBNPP} site land use is presented in Table 2.2-1 and shown on Figure 2.2-1. The land use categories are consistent with USGS, 1997, land use/cover categories. Land use/cover within the {6 mi (10 km)} site vicinity is presented in Table 2.2-2 and shown on Figure 2.2-2. Highways and utility rights-of-way that cross the site and vicinity are shown on Figure 2.2-4 and Figure 2.2-5.

4.1.1.1 The Site

{BBNPP and supporting facilities will be located on 424 ac (172 ha) within the 882 ac (357 ha) BBNPP Owner Controlled Area (OCA), to the west of and adjacent to SSES Units 1 and 2. The SSES site use activities will not change as the result of the proposed action to construct and operate BBNPP. The BBNPP site will conform to applicable local, state, and federal land use requirements and restrictions as they pertain to the proposed action. The BBNPP site is not located in a coastal area and, therefore, is not subject to requirements of the Coastal Zone Management Act. Figure 2.2-4 shows the current Salem Township zoning categories for the BBNPP site.

Through regulation, the federal, state, county, and local governments attempt to limit potential environmental impacts to land. The BBNPP site will follow local, state, and federal requirements, including those that pertain to Water Quality Standards (PA, 2007). During construction, site activities are required to be authorized by the agencies and programs listed in Table 1.3-1. There are no recognized Native American Tribal Land use plans that would have jurisdiction over, or within the vicinity of, the BBNPP site that could impact the site.

Table 4.1-1 provides an estimate of the land areas that would be disturbed during construction of BBNPP and supporting facilities, including temporary features such as laydown areas, stormwater retention ponds, and borrow areas. Approximately 630 ac (255 ha) of the BBNPP site would be disturbed by site preparation and construction. Approximately 365 ac (148 ha) would be permanently dedicated to BBNPP and its supporting facilities, and lost to other uses until after decommissioning. Approximately 265 ac (107 ha) would be temporarily impacted. Acreage not containing permanent structures would be reclaimed to the maximum extent possible.

From Figure 4.1-1, an estimate was made regarding the amount of land currently zoned as Agricultural and Conservation District within the BBNPP site boundary that would be affected by the proposed construction activities. Approximately 568 ac (230 ha) of land currently zoned Agricultural and Conservation District will be permanently (349 ac (141 ha)) or temporarily (220 ac (89 ha)) impacted by the construction activities.

The proposed location of BBNPP and supporting facilities is partially farmland, and the site contains three types of soil rated as Prime Farmland by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS). Also present on the BBNPP site are five types of soil rated as Farmland of Statewide Importance.

As discussed in Section 4.3.1.1, an estimated 174 ac (70 ha) of mixed deciduous forest would be lost during construction activities. Additional information is provided on Table 4.1-1.

Section 2.2.1 describes the land areas that are devoted to major uses within the BBNPP site boundary and the BBNPP site vicinity. These areas are depicted on Figure 2.2-1 and Figure 2.2-2, respectively. In addition, Section 2.2.1 describes the highways and utility rights-of-way that cross the BBNPP site and vicinity. PPL Bell Bend, LLC is not aware of any federal action in the area that would have cumulatively significant land use impacts.

Heavy equipment and reactor components would be transported by rail and highway to the new construction site and lay down areas. A new access road, approximately 0.8 mi (1.3 km) long, would be constructed from U.S Highway 11 to the construction site providing access to the construction areas without impeding traffic to the existing units. A site perimeter road system and access road around the cooling towers area and the power block would be built. An access driveway would be constructed to connect the proposed water intake structure to an existing road.

The new intake and discharge would be located in the 100-year floodplain. A small portion of the BBNPP site to the west along Walker Run would also be within the 100-year and 500-year floodplain. With those exceptions, construction activities would be outside the 500-year floodplain in areas designated as areas of minimal flooding.

The only known mineral deposits having a potential of being extracted at the BBNPP site are sand, gravel, and siltstone as described in Section 2.2.1. The siltstone could not be mined economically due to its depth and only a small portion of the sand and gravel deposits along the Susquehanna River are under the flood plain at the site.

The proposed construction activities would result in the permanent loss, through filling, of approximately 36 ac (14.6 ha) of wetland habitat. Section 4.3.1.3 provides a detailed discussion of construction impacts to wetlands.

It is concluded that the land use impacts to the BBNPP site and vicinity of the BBNPP site from construction of the new unit would be MODERATE.}

4.1.1.2 The Vicinity

{Land in the vicinity of the BBNPP site is rural with development generally occurring in town centers per current Luzerne County planning requirements. Land use within 6 mi (10 km) of the site is predominantly forest and agriculture as described in Table 2.2-2.

The construction activities that would degrade the visual aesthetics of the land would be limited to those activities potentially seen from the new construction access road and sections of North Market Street, Confers Lane, and Beach Grove Road, which transect the perimeter of the site. Because of the forested nature of the area surrounding the proposed site, it is unlikely that construction activities for the proposed facilities could be seen directly from the adjacent highway

(US Route 11), with the exception of the activities to build or upgrade the BBNPP site access road and install the cooling water intake and discharge lines from BBNPP to the Susquehanna River, and multiple site cranes. Once the proposed facility construction extends above the tree line, some construction could be seen from roadways or other areas in the vicinity of the site depending on the area's topography and the immediate land cover. However, because a portion of the land adjoining the BBNPP site is currently zoned as industrial and already contains SSES Units 1 and 2, visual impacts from the proposed project would be similar to existing site conditions.

Section 4.4.2.4 provides the details on potential population impacts due to construction activities. The majority of the temporary construction workforce would probably live outside of Luzerne County and Columbia County. These workers would commute or find temporary housing in Luzerne County or Columbia County. No other land use changes in the vicinity would likely occur as a result of construction workforce related population changes.

Thus, it is concluded that impacts to land use in the vicinity of BBNPP would be SMALL, and not require mitigation.}

4.1.2 TRANSMISSION CORRIDORS AND OFFSITE AREAS

{The electricity generated from BBNPP will be transmitted through both existing transmission corridors, including the planned Susquehanna-Roseland line, and will not require the addition of any new offsite rights-of-way. As discussed in Section 2.2.2.2, the proposed BBNPP construction activities within the BBNPP Owner Controlled Area (OCA) would include the following transmission system changes:

- One new 500 kV switchyard to transmit power from BBNPP.
- Two new 500 kV, 4260 MVA circuits connecting the BBNPP switchyard to the existing Susquehanna 500 kV Yard and the proposed Susquehanna 500 kV Yard 2.
- One new 500 kV transmission system switchyard (Susquehanna 500 kV Yard 2)
- Expansion of the existing Susquehanna 500 kV Yard

Additionally, the 230 kV transmission lines currently passing through the BBNPP site will be relocated to run along the northern boundary of the OCA in order to provide a buffer from the BBNPP CWS cooling towers and provide additional areas for the location of plant-related structures.

In its generation interconnection Impact Study Restudy (PJM, 2008), PJM identified that BBNPP contributes to two previously identified upgrades for overloads initially caused by prior Queue position generation additions. Any related offsite modifications are due to prior Queue position generation additions.

The two 500 kV transmission lines that currently connect the existing Susquehanna 500 kV Yard with the regional grid, are located in 350 to 400 ft (100 to 125 m) wide corridors, totaling approximately 150 mi (241 km) in length, within the PJM Regional Transmission Organization. The corridors pass through land that is primarily agricultural and forest. Additionally, SSES and BBNPP will both be connected to the planned Susquehanna-Roseland transmission line.

The transmission line work to support the BBNPP project will require the construction of new towers and transmission lines to connect the BBNPP switchyard to the existing Susquehanna 500 kV Yard and the new Susquehanna 500 kV Yard 2. Line routing would be conducted to avoid or minimize impact on the existing wetlands and threatened and endangered species identified in the local area. However, lines routed through forested wetlands will cause a permanent disturbance due to corridor vegetation management. No new offsite corridors or widening of existing offsite corridors are required. The new onsite connector corridor would be located on the BBNPP OCA or on land already in use to generate electric power. Some of the new facility locations associated with the project are located on land currently zoned and used as heavy industrial. The remainder is zoned as Agricultural and Conservation District. As discussed in Section 1.3, federal, state, and local regulations and requirements including those that deal with construction impacts will be followed.

There are no federal actions that would have cumulatively significant land use impacts within the vicinity and region of the BBNPP site activity and offsite areas as described in Section 2.8.

Because there are no new offsite transmission corridors, it is concluded that there will be no additional impacts to the offsite transmission corridor lands associated with the construction of BBNPP. The new onsite transmission line connector corridor would be located on the BBNPP OCA or on land already in use to generate electric power. No new access roads or modifications to existing roads associated with offsite transmission corridors are currently anticipated.}

4.1.3 HISTORIC PROPERTIES

{This section discusses the potential impact of BBNPP construction on cultural and historical resources within the project area. The assessment focuses on historic resources that are either listed in, or potentially eligible for listing, on the National Register of Historic Places (NRHP). These resources typically include districts, sites, buildings, structures and objects of historical, archaeological or traditional cultural significance.

Section 2.5.3 describes the significant cultural resources associated with BBNPP. The information presented was derived from a Phase Ia reconnaissance and a Phase Ib survey. The Phase Ia project study area included lands east and west of the Susquehanna River. Phase Ib focused exclusively on PPL Susquehanna, LLC lands west of the Susquehanna River and more specifically on lands selected for the BBNPP project.

A total of 24 previously-recorded archaeological sites were identified within a 1 mi (1.6 km) radius of the Phase Ia project Area of Potential Effect (APE). As presented in Table 2.5-33, six of these previously-recorded archaeological sites are located within the Phase Ia project APE-all along the west bank of the Susquehanna River. Of these, four are recommended as eligible for listing on the National Register of Historic Places (NRHP). Because of the subsequent exclusion of those portions of the initial Phase Ia project area on the eastern side of the Susquehanna River, only one of the Phase Ia sites (36LU51) is mapped within the Phase Ib project APE.

Table 2.5-34 lists previously-recorded architectural and historical resources within the proposed Phase Ia project viewshed, including those eligible for listing on the NRHP (NPS, 2008). One previously-recorded resource, the NRHP-eligible North Branch Pennsylvania Canal, lies within the project footprint west of the river. (NPS, 2008)

Table 2.5-35 summarizes 52 surveyed architectural and historical resources identified within the project viewshed during the project's architectural survey, ten of which are recommended as eligible for listing on the NRHP. Five of these 52 surveyed resources are located within the project footprint west of the river, including three recommended as NRHP-eligible (Table 2.5-34). The Pennsylvania SHPO (PHMC/BHP) has requested additional information (i.e. Pennsylvania Historic Resource Forms) on 22 of the 52 resources, including the three NRHP-eligible resources located within the project footprint (PHMC/BHP, 2008). An assessment of potential adverse effects to architectural and historic resources will be necessary following Pennsylvania SHPO (PHMC/BHP) concurrence on recommendations of NRHP eligibility.

The Phase Ib archaeological survey was conducted on the 630 ac (255 ha) BBNPP project APE west of the Susquehanna River. The survey included a pedestrian ground survey, subsurface shovel testing, and deep testing (i.e., trenching and column samples). A total of 2,049 artifacts were found. Based on field results, this study identified eleven archaeological sites (three prehistoric and eight historic) and 26 prehistoric isolated finds, as well as dispersed historic/modern surface artifacts representing field scatters. Figure 2.5-9 illustrates the location of identified archaeological sites. Table 2.5-33 and Table 2.5-34 summarize the eleven sites. Both tables provide recommendations on potential NRHP eligibility for these resources. Based on these field results, seven sites (Sites 2, 3, 4, 5, 7, 9 and 10) are recommended as potentially eligible for listing in the NRHP. Of these, six historic sites (Sites 2, 3, 4, 7, 9 and 10) are located in upland settings west of the existing SSES facility (West Alternative) and one prehistoric site (Site 5) lies on a low terrace/floodplain setting in Area 7. An assessment of potential adverse effects to archaeological sites will be necessary following Pennsylvania SHPO (PHMC/BHP) concurrence on recommendations of NRHP eligibility.

Additional Phase IB cultural resource investigations were proposed for a 235 ac (95 ha) upland project area, located adjacent to Area 6 and the Western Alternative. Of these 235 ac (95 ha), 197 ac (80 ha) are considered to have moderate to high archaeological potential, 30 ac (12 ha) have low archaeological potential (slopes in excess of 15%) and 8 ac (3 ha) are characterized by disturbance/no archaeological potential. Of the 197 ac (80 ha), approximately 124 ac (50 ha) are in corn fields and 73 ac (29 ha) are typified by grass fields and woodlands. Supplemental Phase IB investigations have commenced and are anticipated to be completed in early September, 2008. Subsequent laboratory analysis will take up to two weeks, with some of the analysis being done concurrently with field investigations. Sampling and reporting methodologies for supplemental Phase IB investigations will be the same as for previous Phase IB investigations as described above.

As with any new project area, this supplemental investigation will identify resources in this location and assess their potential National Register eligibility. Upon completion of any Phase II investigations (if necessary) and assessment of effects, in consultation with the SHPO, BBNPP will identify measures to avoid, minimize, or mitigate and adverse effects, per Section 106 of the National Historic Preservation Act (USC, 2007).

SHPO consultation on the Phase IB study is pending. This consultation could result in changes to recommendations regarding the National Register of Historic Places eligibility of onsite resources.

Based on Phase IB assessments conducted to date, in conjunction with review of applicable state and federal guidelines, adverse impacts may occur to historic resources from construction. Measures will be developed to limit impacts to historic resources during construction activities.

As described in Section 2.5.3, research identified 723 previously-recorded cultural resources within a 10 mi (16 km) radius of the project area. This number includes historic districts, buildings, sites, bridges, and other structures. Resource types range from historic districts with numerous contributing resources to archaeological sites and individual architectural features. Of these, seven were NRHP-listed and 51 were eligible for listing on the NRHP.

In addition, within Luzerne County there were 32 cultural resources listed on the NRHP and 30 cultural resources were listed on the NRHP within Columbia County (NPS, 2008) (Table 2.5-41 and Table 2.5-42).

The amount of acreage potentially affected by site construction is given in Section 3.1. Construction support facilities such as laydown, the batch plant and parking are expected to occupy approximately 266 ac (108 ha). The power block, cooling tower and switchyard collectively are expected to occupy approximately 100 ac (40 ha). Total area occupied will be approximately 364 ac (147 ha).

BBNPP construction would require installation of a new intake structure, located east of the BBNPP power block on the west bank of the North Branch Susquehanna River near the terminus of the North Branch Pennsylvania Canal (North Canal). The new intake structure is necessary to support cooling water system makeup. Area 6, the area most likely to be affected by the new intake structure, contains one previously-recorded architectural resource, the NRHP-eligible North Canal. In addition, Area 6 contains two resources identified by the project's architectural and historical survey-the Delaware Lackawanna & Western Railway and the Susquehanna and Tioga Turnpike, both of which are recommended as eligible for listing in the NRHP (Table 2.5-35). It is probable that construction activities, including the use of sheet-piling coupled with directional drilling, excavation and eventual de-watering, may impact the North Canal. It is also predicted that excess sediments, resulting from construction activities, may be introduced to the North Canal and subsequently the Susquehanna River. Area 7 (proposed construction lay down area) includes the mapped locations of two previously-recorded NRHP-eligible resources-archaeological Site 36LU51 and portions of the North Branch Pennsylvania Canal. In addition, one potentially-eligible archaeological site (Site 5) was identified in Area 7 during Phase Ib survey; this site may represent or be associated with previously-recorded Site 36LU51. The project's proposed West Alternative, located west of the existing SSES facility, contains six archaeological sites identified by Phase Ib survey and recommended potentially eligible for listing in the NRHP (Sites 2, 3, 4, 7, 9 and 10).

Pennsylvania SHPO provided a review of Phase Ia investigations in a letter dated June 5, 2008 (PHMC/BHP, 2008). SHPO consultation on results of the Phase Ib investigations is pending. Following completion of the Phase Ib study, the SHPO will be consulted to obtain concurrence on recommendations of NRHP eligibility for resources identified within the proposed project area and to comment on proposed plans for further investigations of those potentially-eligible resources that cannot be avoided by proposed project construction. This consultation could result in changes to the recommended potential NRHP-eligibility of identified resources located within the proposed project area. Subsequent Phase II archaeological investigations, along with continued SHPO consultation, would be conducted on potentially-eligible archaeological resources that are located within the proposed project area and cannot be avoided, to determine their NRHP-eligibility (PHMC, 2008)

Upon completion of Phase II (if necessary) investigations and an assessment of effects, consultation with the SHPO will be conducted to identify measures to avoid, minimize, or mitigate any adverse effects, per section 106 National Historic Preservation Act (USC, 2007) to protect historic resources. Based on the results of cultural resource investigations conducted to date it is likely that there will be SMALL impacts to cultural resources from construction.}

4.1.4 REFERENCES

{**NPS, 2008**. National Park Service, National Register of Historic Places, Pennsylvania - Luzerne County and Columbia County, http://nationregisterofhistoricplaces.com. Accessed April 2008.

PA, 2007. Pennsylvania Code, Title 25, Chapter 93, Water Quality Standards. 2007.

PHMC, 2008. Letter from Doug McLearen to John Price (UniStar), ER 81-0658-079-H, NRC: Proposed Bell Bend Nuclear Power Plant, Salem Township, Luzerne County, Pennsylvania, Phase Ia Cultural Resources Survey, June 5, 2008.

PJM, 2008. PJM Generator Interconnection R01/R02 Susquehanna 1600 MW Impact Study Re-study, DMS #500623, September 2008.

USC, 2007. Title 16, United States Code, art 470, National Historic Preservation Act of 1966, as amended, 2007.}

Table 4.1-1 {Construction Areas Acreage and Operations Area Acreage, Land Use and Zoning}

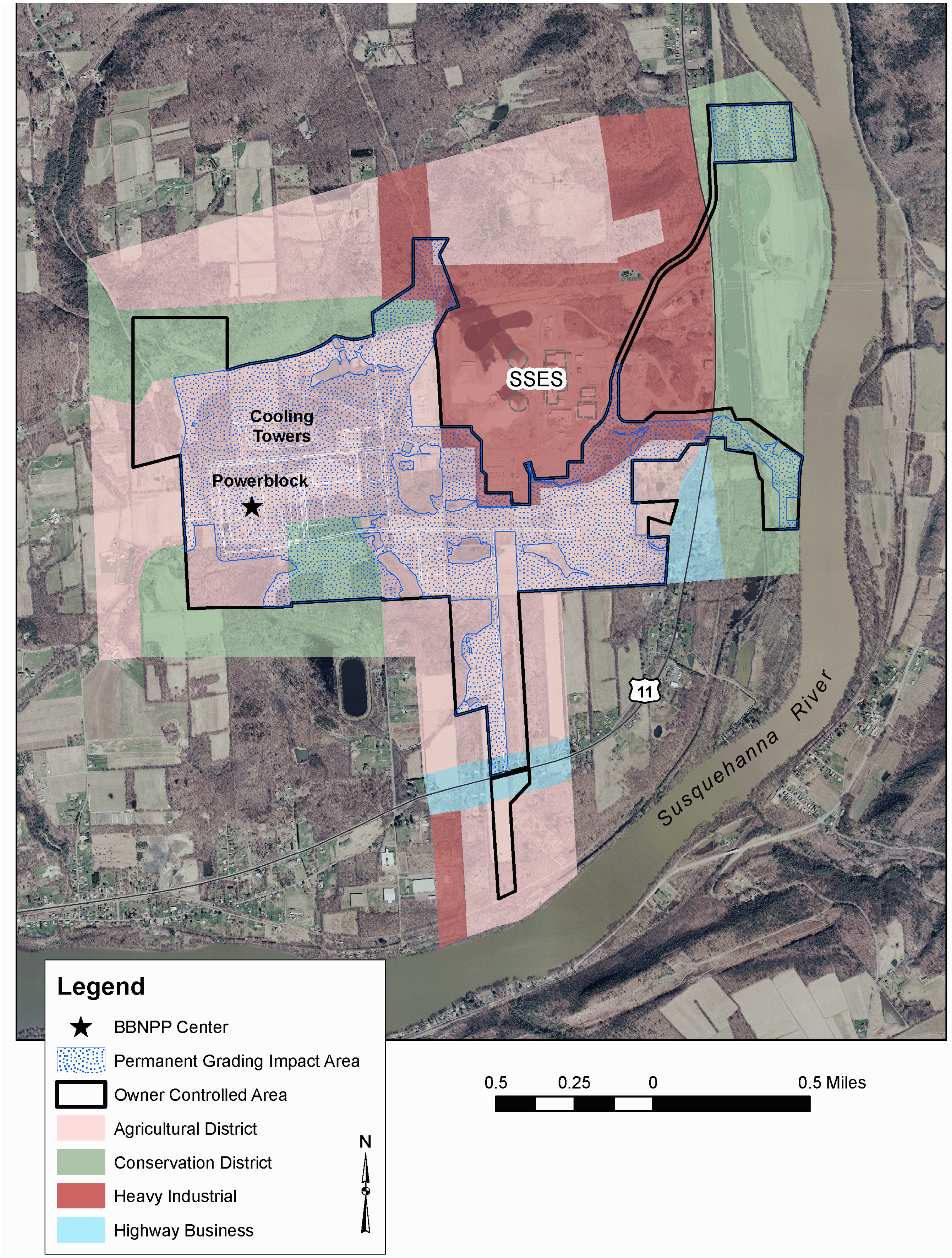
Construction Area	Construction Acreage (hectares)	Current Land Use	Current Zoning
BBNPP Power Block	61.2 (24.8)	B, F, A, U/B, W, WL	AD, CD
ESWEMS Retention (UHS) Pond and Pumphouse	9.9 (4.0)	F, A	AD
Intake Structure	0.7 (0.3)	F, W, WL	CD
BBNPP Switchyard	7.5 (3.0)	F, A, WL	AD, CD
SSES Units 1 and 2 Switchyard (expansion)	11.0 (4.5)	B, F, A, U/B, W, WL	AD, HI
Cooling Towers Area	21.1 (8.5)	F, A	AD
Water Treatment	9.2 (3.7)	B, F, A	AD
Roads	16.9 (6.8)	B, F, A, U/B, WL	AD, CD, HB
Rail Roads	28.3 (11.4)	B, F, A, U/B, WL	AD, HI
Storm Water Ponds	29.7 (12.0)	F, A, U/B	AD, HI
Permanent Laydown Areas	76.3 (30.9)	F, A	AD, CD
Permanent Offices	0.9 (0.4)	F	AD
Permanent Parking	23.6 (9.6)	F, A	AD, CD
Onsite Transmission Line R/W	68.6 (27.8)	B, F, A, U/B, WL	AD, CD, HI
Total Acreage of Disturbed Area for Permanent Construction Features	**364.9 (147.7)**	**--**	**--**
Batch Plant	25.5 (10.3)	B, F, A	AD
Temporary Laydown Areas	119.9 (48.5)	B, F, A, U/B	AD, CD, HI
Temporary Offices	5.6 (2.3)	B, F, A	AD, HB, HI
Temporary Parking	90.0 (36.4)	B, F, A, U/B	AD, HB, HI
Onsite Transmission Line R/W	25.1 (10.2)	B, F, A	AD, CD, HI
Total Acreage of Disturbed Area for Temporary Construction Features	**265.4 (107.4)**	**--**	**--**

Notes:

Land Use categories
B = Barren
F = Forest
A = Agricultural
U/B = Urban or Built Up
W = Water
WL = Wetlands

Zoning categories
AD = Agricultural District
CD = Conservation District
HI = Heavy Industrial
HB = Highway Business

Figure 4.1-1 BBNPP Site Zoning and Grading Layout



4.2 WATER-RELATED IMPACTS

The following sections describe the hydrologic alterations and water use impacts that result from the construction of the {BBNPP}. Section 4.2.1 describes the hydrologic alterations resulting from construction activities including the physical effects of these alterations on other users, the best management practices to minimize any adverse impacts and how the project will comply with the applicable federal, state and local standards and regulations. Section 4.2.2 describes the potential changes in water quality and an evaluation of the impacts resulting from construction activities on water quality, availability and use.

4.2.1 HYDROLOGIC ALTERATIONS

This section discusses the proposed construction activities including site preparation, the resulting hydrologic alterations and physical effects of these activities on other water users, best management practices to minimize adverse impacts, and compliance with applicable federal, state and local environmental regulations.

4.2.1.1 Description of Surface Water Bodies and Groundwater Aquifiers

{The BBNPP site covers an area of 424 ac (172 ha) within the 882 ac (357 ha) OCA and is located on a flat upland terrace adjacent to the Susquehanna Steam Electric Station in Salem Township, Luzerne County, Pennsylvania near U.S. Highway 11 as shown in Figure 2.1-2. Additional details on the BBNPP site location and surrounding area are provided in Section 2.1.

The topography at the BBNPP site is gently rolling with steeper slopes in the northern half of the site. Local relief ranges from approximately 485 ft (148 m) above mean sea level at the Susquehanna River to an elevation of 650 ft (198 m) along Walker Run in the southwest corner of the site up to approximately 800 ft (244 m) on the hilltop just north of the power block. The BBNPP site is drained by Walker Run toward the southwest, while the pipeline corridor to the east of the power block drains eastward toward the North Branch Canal and Susquehanna River. Five existing surface water impoundments are present on the site.

Surface Water Bodies

The surface water bodies (Figure 2.3-33) within the hydrologic system that may be affected by the construction and operation of BBNPP are:

- East fork of Walker Run;
- Main stem of Walker Run;
- Johnson's Pond;
- Beaver Pond;
- West Building Pond;
- Unnamed Pond;
- Farm Pond;
- North Branch Division of the Pennsylvania Canal System; and
- Susquehanna River.

Walker Run is perennial and typically fed by springs and seeps.

Four of the small onsite ponds are present on the eastern half of the BBNPP site while Farm Pond is in the vicinity of the power block. These man-made impoundments drain to the East Fork of Walker Run and Walker Run. Water levels in Walker Run appear to be heavily influenced by surface runoff from the site and from upstream drainages to the north and northwest of the site.

A USGS gauging station is located upriver on the Susquehanna River at Wilkes-Barre and these records are presented in Section 2.3.1. Additional details on the surface water drainage and hydrology are also presented in Section 2.3.1.

Groundwater Aquifers

The BBNPP site lies in the northeastern end of the Ridge and Valley Province in northeastern Pennsylvania. In the vicinity of the BBNPP site, the total thickness of the Paleozoic sedimentary rocks overlying the Precambrian crystalline basement is approximately 33,000 ft (10,058 m). The sedimentary rocks include sandstone, siltstone, shale, and limestone units. In the Ridge and Valley province of Pennsylvania, groundwater is found in and produced from almost all the rock formations, including shales and clay shales. This is partly due to the fact that they have been folded, faulted, and fractured. As a result, there are no areally extensive aquitards in the vicinity of BBNPP.

In the northeastern corner of Pennsylvania, the bedrock is overlain by a variable thickness of glacial till, outwash, colluviums, kame, and kame terrace deposits of Pleistocene age. A large percentage of these surficial glacial materials were deposited during the last major glacial advance of the Wisconsin stage. The BBNPP site lies at the edge of where the Wisconsin glacier made its farthest advance and, as a result, end moraine deposits are present at the BBNPP site.

The surficial glacial overburden aquifer includes all of the glacial outwash, kame, and kame terrace, till, colluviums, alluvium, and other unconsolidated surficial deposits that overlie the bedrock, are saturated, and transmit groundwater. It is the main aquifer that could be impacted by project construction activities at the BBNPP site, and is more fully described in Section 2.3.1. The hydrostratigraphic column for the BBNPP site and surrounding area, identifying geologic units, confining units, and aquifers are shown in Figure 2.3-19 through Figure 2.3-22. The physical characteristics of the groundwater aquifers are provided in Section 2.3.1 and Section 2.3.2.}

4.2.1.2 Construction Activities

The following construction activities will take place that may alter site hydrology:

Clearing, Grubbing, and Grading

{Spoils, backfill borrow, and topsoil storage areas will be established on parts of the BBNPP property. Clearing and grubbing of the site begins with harvesting trees, vegetation removal, and disposal of tree stumps. Topsoil will be moved to a storage area (for later use) in preparation for excavation. The general plant area including the cooling tower areas will be brought to plant grade in preparation for foundation excavation and installation. As described in Section 4.1, approximately 630 ac (255 ha) of land will be cleared for road, facility construction, laydown and parking uses.

Road Construction

As described in Section 4.1.1.1, a new three-lane access road, approximately 0.8 mi (1.3 km) long, would be constructed from U.S. Highway 11 to the construction site providing access to the construction areas without impeding traffic to the existing units. A new rail road spur will connect to the existing line on the eastern boundary of SSES and provide access to the laydown area located near the northwestern boundary of the BBNPP site. A site perimeter road system will be installed, including an access road from the cooling tower area to the power block area.

Temporary Utilities

Temporary utilities include above-ground and underground infrastructure for power, communications, potable water, wastewater, and fire protection.

Temporary Construction Facilities

Temporary construction facilities include offices, warehouses, sanitary toilets, a changing area, a training area, and personnel access facilities. The site of the concrete batch plant includes the cement storage silos, the batch plant and areas for aggregate unloading and storage.

Parking, Laydown, Fabrication, and Shop Preparation Areas

The parking, laydown, fabrication and shop areas include preparation of the parking and laydown areas by grading and stabilizing the surface with gravel. The shop and fabrication areas include the concrete slabs for formwork, laydown, module assembly, equipment parking and maintenance, and fuel and lubricant storage. Concrete pads for cranes and crane assembly will be installed.

Underground Installations

Concurrent with the power block earthworks, the initial non-safety-related underground fire protection, water supply, and sanitary piping, and electrical power and lighting duct banks will be installed and backfilled. These installations will continue as construction progresses.

Intake/Pumphouse Cofferdams

A sheet pile cofferdam and dewatering system will be installed downstream of the Susquehanna Steam Electric Station (SSES) Units 1 and 2 intake structure to facilitate the construction of the BBNPP Circulating Water System (CWS) Makeup Water Intake Structure. Pilings will also be driven to facilitate construction of new discharge system piping.

Excavation of the intake structure, erection of the pump house, and installation of mechanical, piping, and electrical systems follow the piling operations and continue through plant construction. Excavated material will be transported to a spoils area located outside the boundaries of designated wetlands.

Power Block Earthwork (Excavation)

The deepest excavations in the power block area are for the BBNPP reactor and auxiliary building foundations that extend to approximately 64 ft (19.5 m) below the existing ground surface. The excavations will take place concurrent with the installation of any required dewatering systems, slope protection and retaining wall systems. At a minimum, drainage sumps will be installed at the bottom of the excavations from which surface drainage and groundwater infiltration will be pumped to a stormwater discharge point. Monitoring of construction effluents and stormwater runoff would be performed as required in the stormwater pollution prevention plan, the National Pollutant Discharge Elimination System (NPDES) permit, and other applicable permits obtained for construction. Excavated material will be transferred to the spoils and backfill borrow storage areas. Acceptable material from the excavations will be stored and reused as structural backfill.

Power Block Earthwork (Backfill)

The installation of suitable backfill to support structures or systems occurs as part of the site preparation activities. Backfill material will come from the concrete batch plant, onsite borrow pit and storage areas, or offsite sources. Excavated areas will be backfilled to reach the initial level of the building foundation grade. Backfill will continue to be placed around the foundation as the building rises from the excavation until final plant grade is reached.

Nuclear Island Base Mat Foundations

The deepest foundations in the power block are installed early in the construction sequence. Detailed steps include: installation of the grounding grid, mud-mat concrete work surface, reinforcing steel and civil, electrical, mechanical/piping embedded items, forming, and concrete placement and curing.

Transmission Corridors

New onsite transmission corridors will be installed from the BBNPP switchyard to an expansion of the existing Susquehanna 500 kV yard and the new Susquehanna 500 kV yard. Tower foundations will be installed as well as access roads running along, or intersecting with, the corridors. Additionally, an existing onsite 230 kV transmission line will be relocated to accommodate plant structures associated with the BBNPP site.

Offsite Areas

As stated in Section 2.2.2, BBNPP will use existing offsite transmission corridors along with the independently planned Susquehanna-Roseland 500 kV line to connect to the electrical grid. No additional transmission corridors or other offsite land use would be required to connect the BBNPP to the existing electrical grid.}

4.2.1.3 Water Sources and Amounts Needed for Construction

{Water demand during construction of BBNPP is estimated on work days to average from 77,800 gpd (294,000 lpd) to 138,000 gpd (522,000 lpd) during the approximately 68-month construction phase, as described in Section 5.2.1 and Table 5.2-1. Limited amounts of groundwater pumped from the excavations will be used for manufacture of concrete in the concrete batch plant, dust control and other construction purposes. None will be used as a source of drinking water.

Initially, water for construction will be transported on site by trucks and stored onsite in temporary tanks. Once a potable water line is brought to the site, local municipal water will be the primary source of water for construction. Table 4.2-1 shows the estimated amounts of fresh water needed by construction year. It is currently estimated that a peak water demand of up to approximately 1,200 gpm (4,500 lpm) will be required for BBNPP construction activities (demands include those for construction personnel, concrete manufacturing, dust control, hydro testing and flushing, and filling tanks and piping). Based on the water demand figures presented in Table 4.2-1 average construction water usage would be less and is estimated at 250 gpm (950 lpm). The potential sources of water for construction include local municipal water, Susquehanna River water, and offsite water trucked to the construction site.}

4.2.1.4 Surface Water Bodies Receiving Construction Effluents that Could Affect Water Quality

{The surface water bodies within the hydrologic system at the BBNPP site that could receive effluents during BBNPP construction are listed in Section 4.2.1.1.

Two impoundments are planned to catch stormwater and sediment runoff from the various construction areas. Modeling of the runoff from the probable maximum flood (PMF) during plant operation bounds the possible runoff amounts, characteristics, and impacts that might occur during construction due to unpaved surfaces allowing for greater stormwater infiltration into the ground. The impoundments will be sized so as to prevent fast flowing, sediment laden stormwater from reaching Walker Run or the Susquehanna River by allowing the sediments to settle out. The flow velocities will be minimized to prevent erosion of the stream banks. The allowable flow rates and physical characteristics of stormwater runoff will be specified in the state discharge permits.

Maximum runoff for the entire basin (comprised of three sub-basins) during the PMF is estimated at 24,569 cfs (696 m^3/s). The maximum high water level elevation in Walker Run is 670.96 ft (204.51 m) NGVD 29, which is below the approximate 674 ft (205 m) NGVD 29 elevation of the final site grade in the power block, switchyard, and cooling tower area.}

4.2.1.5 Construction Impacts

{Construction of BBNPP with its associated cooling towers will impact the glacial overburden aquifer, current Walker Run drainages and impoundments at the BBNPP site. In order to build the power block and other safety-related structures on bedrock, the glacial overburden aquifer must first be excavated and removed. Temporary dewatering will be required for groundwater management during excavation and construction on the BBNPP power block foundations. Temporary dewatering is also required for the excavation of the Essential Service Water System Emergency Makeup System (ESWEMS) pumphouse.

As described in Section 2.3.2, the area of the proposed nuclear island and safety-related structures has saturated glacial overburden deposits that range up to approximately 64 ft (20 m) thick. The hydraulic conductivity of the glacial overburden materials is relatively large (10 to 200 ft/day) (3.1 to 61 m/day), so relatively large rates of groundwater seepage into excavations could be encountered.

In order to excavate down to bedrock surface and construct the foundations in the power block area and the ESWEMS Pumphouse, the sand and gravel aquifer needs first to be dewatered in the entire excavation area in order to achieve stable sidewalls and to minimize the area that is disturbed during excavation. Prior to excavation a concrete diaphragm wall, slurry wall, or other type of groundwater flow barrier will be constructed around the excavation area. This step will be performed in order to minimize the amount of groundwater that flows into the excavation and minimize the potential impacts to the shallow glacial aquifer during construction activities. Once construction of the power block foundations nears completion, the dewatering wells will be turned off and converted to monitoring wells, if deemed necessary. Otherwise, they will be pressure-grouted shut and abandoned in accordance with Pennsylvania Department of Environmental Protection (PADEP) well abandonment requirements.

A permanent groundwater barrier will be constructed around the power block which will limit groundwater flow into the area. Large sections of the site will have buildings and pavement over the land surface which will significantly reduce groundwater recharge from the surface.

Surface drainage modifications will also affect groundwater recharge and groundwater elevations in the glacial overburden aquifer. A large portion of the wetland areas will be drained and filled. The east fork of Walker Run which originates north of the BBNPP site, and currently flows along the eastern side of the site then westward through the power block area to join Walker Run, will be diverted so it flows eastward into Storm Water Pond No. 2

Runoff from the finished grade of the BBNPP power block, switchyard, cooling towers, parking areas and permanent laydown areas will be directed by sloping towards a series of bio-retention ditches around most of the periphery of these permanent features. Any excess runoff from the bio-retention ditches will in turn flow into stormwater impoundments. The bio-retention ditches will be constructed of base materials that promote infiltration of runoff from low intensity rainfall events. However, for large storms the infiltration capacity of the base materials will be exceeded and overflow pipes will direct the excess runoff to the stormwater impoundments. The final site grading plan is shown in Figure 4.2-1

The planned storm water impoundments will include a piping system that will direct any discharge to the adjacent watercourses. One impoundment, Storm Water Pond No. 1, is northwest of the power block and will discharge into Walker Run. The small ponds will be filled in by the construction of the BBNPP power block, adjacent permanent laydown area, and other site features. Excess runoff from the eastern section of the site and adjacent areas will flow easterly into Storm Water Pond No. 2 just south of the SSES site and in turn discharge to the Susquehanna River.

Grading of the excavation spoils pile for a temporary laydown area, concrete batch plant, access road, and construction parking areas could increase runoff into the constructed impoundments downstream of the spoils pile and into temporary impoundments along the southern edge of the new access road as shown in Figure 4.2-1.

Construction impacts to the existing surface water bodies are summarized as follows:

- Increasing runoff from the approximately 87 ac (35 ha) of impervious and relatively impervious surfaces for the BBNPP power block pad, cooling tower pads, switchyard, laydown, and parking areas;
- Infilling and eliminating the Farm Pond;

- Re-routing a section of east fork Walker Run through a culvert that will pass under the site and then discharge to the wetlands area at the southwestern corner of the site;
- Creating a new stream channel and relocating the section of the main stem of Walker Run at the western boundary of the site along Market Street;
- Construction of cofferdams that will temporarily de-water a section of the canal;
- Creating a new channel and then re-routing a drainage ditch that drains the canal into the rver;
- Wetlands removal, fill and hydrologic disruptions; and
- Possibly increasing sediment loads and channel erosion rates in the downstream reaches of Walker Run and Unnamed Tributary 2.

The site drainage basin areas are not expected to drastically change as a result of the site grading plan.

These impacts to surface water bodies are MODERATE, primarily due to the loss of wetlands and require mitigation. The mitigation measures associated with the wetlands are described in Section 4.3.1.6. The permanent loss of affected wetlands, 36 ac (14.6 ha), compared to 83,797 ac (33,911 ha) of wetlands in the region is SMALL.}

4.2.1.6 Identification of Surface Water and Groundwater Users

{There are no users of onsite surface water. Walker Run flows into the Susquehanna River where there is recreational boating and fishing. There is no commercial fishing on the Susquehanna River in the vicinity of BBNPP.

Groundwater users in the vicinity of the BBNPP site are identified in Section 2.3.2. As described in Section 2.3.2, the nearest permitted PADEP groundwater well(s) (beyond the boundary of the BBNPP property boundary and downgradient from the site), is permitted as Industrial Use and is located approximately 1.7 mi (2.7 km) from the center of the BBNPP site as shown in Figure 2.3-73.}

4.2.1.7 Proposed Practices to Limit or Minimize Hydrologic Alterations

{The following actions will be used to limit or minimize expected hydrologic alterations:

- Groundwater flow barriers will be installed during construction of the power block and ESWEMS pumphouse.
- Implementation of best management practices (BMPs) such as;
    - Maintaining clean working areas;
    - Removing excess debris and trash from construction areas;
    - Properly containing and cleaning up all fuel and chemical spills;
    - Installing erosion prevention devices in areas with exposed soils;
    - Utilizing percolating pavement where feasible;
    - Installing sediment control devices at the edges of construction areas; and

- Retaining and controlling stormwater and wash-down water onsite.

- Implementation of a Storm Water Pollution Prevention Plan (SWPPP).

The bio-retention ditches are designed to allow runoff to infiltrate. They will shift, slightly, the recharge areas for the glacial overburden aquifer. The amount of recharge may increase since there is less opportunity for evaporation and evapotranspiration. Monitoring of construction effluents and stormwater runoff will be performed as required in the stormwater pollution prevention plan, NPDES permit, and other applicable permits obtained for construction.}

4.2.1.8 Compliance with Applicable Hydrological Standards and Regulations

{The regulations guiding the implementation of BMPs for erosion and sediment control are provided in 25 PA Code, Chapter 102 (PA, 2000). These regulations contain BMP installation instructions and typical construction activities which require BMPs. Monitoring of construction effluents and stormwater runoff will be performed as required by the PADEP, Pennsylvania Stormwater Best Management Practices Manual (PADEP, 2006), NPDES permit, and other applicable permits obtained for the construction.}

4.2.1.9 Best Management Practices

{The following BMPs will be implemented:

- Controlling site runoff;
- Monitoring runoff, groundwater, and surface water bodies for contaminants;
- Implementing controls, such as a spill prevention program, to protect against accidental discharge of contaminants (fuel spills, other fluids and solids that could degrade groundwater).

The bio-retention ditches are designed to allow runoff to infiltrate. They will shift the recharge areas for the glacial overburden aquifer. Monitoring of construction effluents and stormwater runoff would be performed as required in the stormwater management plan, NPDES permit, and other applicable permits obtained for the construction.

In addition, BBNPP will comply with the requirements and conditions of the various permits issued to support construction. Environmental compliance personnel will monitor construction activities and provide direction to add, modify or replace site practices to ensure compliance with hydrological standards and regulations.}

4.2.1.10 References

{**PA, 2000.** 25 PA Code, Chapter 102, Erosion and Sediment Control, Januaary 2000, Website: http://www.pacode.com/secure/data/025/chapter102/chap102toc.html, Date accessed: June 3, 2008.

PADEP, 2006. PA Department of Environmental Protection, Bureau of Watershed Management, *Pennsylvania Stormwater Best Management Practices Manual*, Website: http://164.156.74.80/VWRQ.asp?docid=2087d8407c0e00000000071b0000071b&context=2&backlink=WXOD.aspx%3ffs%3d2087d8407c0e0000800071900000719%26ft%3d1, Date accessed: April 11, 2008.}

4.2.2 WATER USE IMPACTS

This section discusses the proposed construction activities and resulting hydrologic alterations that could impact water use, an evaluation of potential changes in water quality resulting from construction activities and hydrologic changes, an evaluation of proposed practices to minimize adverse impacts, and compliance with applicable federal, state and local environmental regulations.

4.2.2.1 Description of the Site and Vicinity Water Bodies

{The BBNPP site covers an area of approximately 882 ac (357 ha) and is located to the northwest of the Susquehanna River in Luzerne County, Pennsylvania near US Route 11 as shown in Figure 2.2-1. Additional details on the BBNPP site location and surrounding area are provided in Section 2.1.

The surface water bodies, as shown in Figure Figure 2.3-33, within the hydrologic system at the BBNPP site that may be affected by the construction and operation of BBNPP are discussed in Section 4.2.1.1.

Additional details on the surface water drainage and hydrology are presented in Section 2.3.1 and the Final Wetland Delineation Report.

The glacial overburden aquifer could be impacted by project construction activities at the BBNPP site. This, and the other aquifers in the regional groundwater system, are described in Section 2.3.1 and Section 2.3.2. Site-specific hydrogeologic cross-sections are provided in Figure 2.3-34 through Figure 2.3-36}.

4.2.2.2 Hydrologic Alterations and Related Construction Activities

{Construction impacts to the existing surface water bodies are summarized as follows:

- Increasing runoff from the approximately 87 ac (35 ha) of impervious and relatively impervious surfaces for the BBNPP power block pad, cooling tower pad, switchyard, permanent laydown, and parking areas;
- Infilling the Farm Pond due to construction of the BBNPP powerblock;
- Disruption and possible relocation of Walker Run and other unnamed tributaries;
- Wetlands removal and disruptions; and
- Possibly increasing the sediment loads into the downstream reaches of Walker Run.

The hydrologic alterations to groundwater that could result from the project related construction activities are:

- Creation of a local and temporary depression in the glacial overburden aquifer due to dewatering for foundation excavations;
- Disruption of current glacial overburden aquifer recharge and discharge areas by plant construction. Hilly, vegetated areas would be cleared and graded; the unnamed tributary to Walker Run may be redirected to the east toward the Susquehanna River and construction areas would be covered by less permeable materials and graded to increase runoff into bio-retention ditches and sedimentation ponds. The locations of, or quantity of,

water produced at springs and seeps could change downgradient of the construction areas; and

- Stormwater runoff from the flat, non-vegetated foundation pads, switchyard and laydown areas would be directed and concentrated into bio-retention ditches and new impoundments that could affect recharge to the glacial overburden aquifer. Since the ditches and impoundments are unlined, they could act as smaller, focused recharge areas and might increase the amount of water recharging the glacial overburden aquifer.

A further discussion of related construction activities is provided in Section 4.2.1.2.}

4.2.2.3 Physical Effects of Hydrologic Alterations

{Impacts from the construction of BBNPP are similar to those associated with any large construction project. The construction activities that could produce hydrologic alterations to surface water bodies and groundwater aquifers are presented in Section 4.2.1.2. The potentially affected surface water bodies and groundwater aquifers are described in Section 4.2.1.4. The potential construction effects on surface water bodies and groundwater aquifers are presented in Section 4.2.1.5.

Surface Water Impacts

Because of the potential for impacting surface water resources, a number of environmental permits are needed prior to initiating construction. Table 1.3-1 provides a list of construction-related consultations and permits that have to be obtained prior to initiating construction activities.

The construction activities expected to produce the greatest impacts on the surface water bodies occur from:

- Reducing the available infiltration area;
- Grading and the subsequent covering of the 71.1 ac (28.8 ha) for the BBNPP power block foundation;
- Grading and covering of the 21.1 ac (8.5 ha) for the BBNPP cooling tower pads;
- Grading and covering of the 7.5 ac (3.0 ha) for the BBNPP switchyard/substation;
- Vegetation removal and grading of 266.1 ac (107.7 ha) for temporary construction laydown areas, concrete batch plant, offices, parking, and transmission line corridors;
- Creation of impoundments;
- Elimination of the existing Farm Pond; and
- Relocation of a small section of Walker Run and elimination or redirection of the existing branches of Walker Run.

Additional information on construction related land-use is provided in Section 4.1.1.

Site grading and new building foundations will cover and reduce existing infiltration and recharge areas. Runoff will be directed into bio-retention ditches that could discharge to new impoundments, altering the glacial overburden aquifer recharge areas. Possible increases in runoff volume and velocity in the downstream creeks may cause erosion and adversely affect riparian habitat if not controlled.

Dewatering for the proposed foundation excavations could also impact surface water bodies. Effluent from the dewatering system, and any stormwater accumulating during the excavation, would be pumped to a stormwater discharge point or into onsite impoundments. If pollutants (e.g., oil, hydraulic fluid, concrete slurry) exist in these effluents from construction activities, they could enter the impoundments, downstream channel sections, or other surface water bodies. Monitoring of construction effluents and stormwater runoff would be performed as required in the Erosion and Sediment Control Plan, NPDES permit, and other applicable permits obtained for construction. Depending on the design of the stormwater impoundments and discharge systems, outflow rates into the surface streams could be altered.

All water bodies within the BBNPP site boundary could have the potential to indirectly receive untreated construction effluents. The water bodies listed in Section 4.2.1.1 are potentially subject to receiving untreated construction effluents directly. It will be necessary to implement proper BMPs under state regulations such as an Erosion and Sediment Control Plan and an NPDES Permit. Table 1.3-1 lists and presents additional information on the federal, state and Local Authorizations associated with this project.

If proper BMPs are implemented under these permits, treated construction effluents could be released to the site water bodies without adverse impacts. Flow rates for untreated construction effluents will depend upon the usage of water during site construction activities and the amount of precipitation contacting construction debris during construction activities. Flow rates and physical characteristics of the construction effluents are discussed in Section 4.2.1.4. A quantitative calculation and evaluation of the construction effluents and runoff will be done as part of the state construction permit process. BMPs would be implemented to control runoff, soil erosion, and sediment transport. Good housekeeping practices and engineering controls will be implemented to prevent and contain accidental spills of fuels, lubricants, oily wastes, sanitary wastes, etc.

BMPs are implemented under an Erosion and Sediment Control Plan, as described in Section 4.2.1.7 and Section 4.2.2.10. Environmental control systems installed to minimize impacts related to construction activities will comply with all federal, state and local environmental regulations and requirements. Once the initial controls are in place, they are maintained through the completion of construction and during plant operation, as needed.

Surface water impacts are moderate, primarily due to the loss of wetlands and wetland buffers, and will require mitigation. The mitigation measures associated with the wetlands and wetland buffers are described in Section 4.3.1.6.

Groundwater Impacts

Depending on the design of the stormwater impoundments and discharge systems, outflow velocity and volume in the surface streams could change, and change the volume of water available to infiltrate and recharge the glacial overburden aquifer.

No groundwater withdrawals will be made for the construction of BBNPP.

The hydrologic alterations that could be produced in the groundwater aquifers are expected to be localized and possibly temporary. Most of the effects are expected to occur in the uppermost or glacial overburden aquifer. Any effects in the deeper aquifers are expected to be minor, due to remaining within the existing permit withdrawal limits, and dependent to a large extent on groundwater travel time, thickness and physical properties of the intervening stratigraphic units, and the nature of the hydraulic connection between aquifers.

The construction activities listed in Section 4.2.1.2 that are expected to produce the greatest impacts on the glacial overburden aquifer are related to:

- Changing the existing recharge and discharge areas;
- Possibly changing the amount of runoff available for infiltration; and
- Dewatering of foundation excavations during construction.

Site grading and leveling for the building foundations and laydown areas will cover and possibly eliminate existing recharge areas. Runoff from the graded areas will be directed into bioretention ditches and several proposed impoundments, possibly creating new "focused" recharge areas. Runoff velocity may be increased in the channels downstream of the impoundments, which could decrease the amount of runoff available for infiltration and recharge. Fine-grained sediments could settle out in the impoundments and channels and create less-permeable areas for infiltration and recharge. These changes affect local recharge to the glacial overburden aquifer. Impacts on the deeper aquifers are likely to be small.

Dewatering foundation excavations also produce localized impacts on the glacial overburden aquifer. The deepest excavations anticipated are for the proposed reactor and auxiliary building foundations, and extend approximately 64 ft (20 m) below plant grade in order to reach bedrock. The dewatering system and activities are not expected to have any significant impact on the deeper aquifers. Hence, it is insensitive to perturbances of the glacial overburden aquifer. Effluent from the dewatering system will be pumped to a stormwater discharge point. Monitoring of construction effluents and stormwater runoff will be performed as required in the stormwater pollution prevention plan, NPDES permit, and other applicable permits obtained for the construction.

The locally lowered glacial overburden aquifer water level would be expected to eventually recover after the dewatering and other subsurface construction activities are complete. Although it would be altered by buildings and paved areas, rainwater is still allowed to infiltrate in other plant areas to recharge the aquifier.

The impact to groundwater is SMALL and localized, changes to the glacial overburden aquifer water level are expected to eventual recover once construction is complete.}

4.2.2.4 Water Quantities Available to Other Users

{As described in Section 2.3.2.1.2, at present no surface water withdrawals from the Susquehanna River are made in Luzerne County for public potable water supply. The population projection for Act 220 State Water Plan estimates a 7% decline in the Luzerne County population between 2000 and 2030 (PADEP, 2008). Thus, future additional use of surface water is projected to be extremely limited, except for the increase due to BBNPP needs.

Groundwater use and trends in the region of and at the BBNPP site are presented in Section 2.3.2.2 and in Section 2.4.12 of the Final Safety Analysis Report.

Water required for BBNPP construction is estimated at 250 gpm (946 lpm). This water is expected to come from the local public water supply once the line is brought to the site. Prior to the availability of the public water supply, water will be trucked in and stored onsite in temporary tanks.

The glacial overburden aquifer is used as a potable water source in the vicinity of the BBNPP site. The SMALL impacts expected from foundation dewatering or other construction activities will not impact any local users.}

4.2.2.5 Water Bodies Receiving Construction Effluents

{The surface water bodies directly downstream of the proposed construction activities could be impacted during clearing, grubbing, and grading. Locations of surface water and its users that could be impacted by construction activities are provided in Section 4.2.1.4.

Since most of the water for construction would be used for consumptive uses such as grading, soil compaction, dust control, and concrete mixing, little infiltration would be expected. Any effluents that might infiltrate would recharge the glacial overburden aquifer, and, potentially, any underlying aquifer.

If contaminants enter the surface water bodies unchecked, there would be a potential for infiltration and subsequent groundwater contamination. If contaminants do enter groundwater, they may impact the quality of water withdrawn for industrial and commercial applications.

Any construction effluents infiltrating into the subsurface could potentially reach the glacial overburden aquifer if they are of sufficient volume and concentration. The plume migration would be downgradient and, depending on location, flow either south-southwest into Walker Run or south-southeast to the Susquehanna River. As described in Section 2.3.2, the horizontal groundwater flow in the glacial overburden aquifer is generally north to south. As discussed in Section 2.3.1.2.3.2, in the southern trough (where the BBNPP power block is located), ground water in the glacial overburden aquifer flows from east to west and then southwest. The glacial overburden aquifer in this area discharges as springs and seeps into the Farm Pond, the wetlands along the southern border of the BBNPP site, and into Walker Run.

It is also possible that this groundwater could discharge locally at seeps or springs. Any possible impacts on deeper aquifers would also depend on the infiltrating volume and the hydrologic connection with the glacial overburden aquifer.

The composition of possible construction effluents that could infiltrate into the glacial overburden aquifer would depend on several factors related to the physical nature of the effluent material, i.e., solids versus liquids, solubility, vapor pressure, mobility, compound stability, reactivity in the surface and subsurface environments, dilution, and migration distance to groundwater. It is expected that proper housekeeping and spill management practices would minimize potential releases and volumes and physically contain any releases. Pesticides and herbicides are expected to be applied in limited site areas for insect and weed/brush control.

Several impoundments are planned to catch stormwater and sediment runoff from the various construction areas. Bio-retention ditches are planned to drain the proposed BBNPP power block, cooling tower pads, switchyard, and laydown areas. Modeling of the runoff from the probable maximum flood (PMF) during plant operation bounds the possible runoff amounts, characteristics, and impacts that might occur during construction due to unpaved surfaces during construction allowing for greater stormwater infiltration to ground. The retention ditches will discharge excess runoff into impoundments. The impoundments will be sized so as to prevent fast flowing, sediment laden stormwater from reaching the creeks or the Susquehanna River prior to allowing the sediments to settle out. The flow velocities will be minimized to prevent erosion of stream banks. The allowable flow rates and physical characteristics of stormwater runoff will be specified in state discharge permits.

Maximum runoff for the Walker Run basin during the PMF is estimated at 13,033 cfs (369 m^3/s). The maximum high water level elevation in Walker Run at the BBNPP site is 670.96 ft (204.51 m) NGVD 29, which is below the approximate 674 ft (205 m) msl elevation of the final site grade in the power block, switchyard, and cooling tower area.}

4.2.2.6 Baseline Water Quality Data

{Baseline water quality data for surface water bodies is provided and discussed in Section 2.3.3. A summary of the water quality data for the onsite surface water bodies is presented in Table 2.3-43. Baseline water quality data for groundwater is provided in Section 2.3.3.}

4.2.2.7 Potential Changes to Surface Water and Groundwater Quality

{The following section describes the potential water quality impacts resulting from the construction of BBNPP.

The BBNPP site will be provided with water expected to come from the local public water supply once the line is brought to the site. Prior to the availability of the public water supply, water will be trucked in and stored onsite in temporary tanks.

<u>Potential Changes to Surface Water Quality</u>

Potential surface water quality impacts are associated with the site clearing and grading activities.

The addition of sediment and organic debris to the local streams resulting from clearing, grubbing, and grading could decrease water quality. Organic debris could dam or clog existing streams, increase sediment deposition, and increase potential for future flooding. Organic debris decomposing in streams can cause dissolved oxygen and pH imbalances and subsequent releases of other organic and inorganic compounds from the stream sediments. Sediment laden waters are prone to reduced oxygen levels, algal growth, and increases in pathogens. If heavy metals or chemical compounds spill and/or wash into surface waters, there could be a direct toxicity to aquatic organisms. These potential pollutant releases could impact aquatic species and in turn affect the recreational aspects associated with fishing.

The water bodies downstream of the proposed construction areas could be directly and indirectly affected by construction activities onsite. Construction debris residing on the pads and temporary staging areas could mix with construction wash-down water or stormwater, exit the site via untreated runoff and produce chemical reactions adverse to downstream ecology. Possible contaminants include: sediment, alkaline byproducts from concrete production, concrete sealants, acidic byproducts, heavy metals, nutrients, solvents, and hydrocarbons (fuels, oils, and greases). There could be a high potential for contaminants to mix with site wash-down water or rainwater/precipitation runoff and be washed downstream into surface water bodies existing on the BBNPP site due to the persistent nature of local precipitation. There could also be the potential for spills within the construction areas consisting of fuels, solvents, sealants, paints, or glues. Construction dusts not suppressed could drift outside of the construction zones and contaminate nearby water supplies. If these contaminants enter the surface water bodies unchecked there could be a potential for infiltration and subsequent groundwater contamination.

The impacts to surface water quality downstream of the construction site are small due to the use of BMPs to control dust, runoff, and spills.

Potential Changes to Groundwater Quality

Dewatering for the foundation excavations may increase the oxidation of some sedimentary constituents by placing them in direct contact with the atmosphere. The oxides might have an increased solubility and could migrate down gradient when the potentiometric head is reestablished following construction completion. Possible impacts to the glacial overburden aquifer water quality would be small and decrease with migration and dilution.}

4.2.2.8 Surface Water and Groundwater Users

{Surface water users downstream of the site may experience impacts from potential water quality changes if construction effluent concentrations and volumes are large enough and the release enters directly into a surface water body bypassing the overflow catch basins and retention ponds. The surface water users that could be impacted in the event of a release are those downstream of the BBNPP site along the tributaries flowing to the Susquehanna River. Any impacts to the Susquehanna River receiving the discharge are expected to be small.}

Groundwater users in vicinity of the {BBNPP} site are identified in Section 2.3.2.

4.2.2.9 Predicted Impacts on Water Users

{The impact of potential increased sediment loads in site runoff during construction would result in small or no impacts to surface water users and affected areas.

Potential construction effluent impacts on aquifer groundwater quality would first be manifested in the glacial overburden aquifer. Construction activities are only expected to produce limited and temporary impacts in the Surficial aquifer. As described in Section 2.3.1, the glacial overburden aquifer is not used as a potable water source in the vicinity of the BBNPP site. Therefore, potential groundwater quality changes would not be expected to have any impact on possible users. Potential impacts to the deeper aquifers are dependant on the nature of the hydraulic connection between aquifers described in Section 4.2.1.1. Groundwater quality impacts on users of the deeper aquifer users are small due to dilution and other contaminant attenuation effects that could occur along any effluent plume migration path.

The BBNPP site is located in U.S. EPA Region 3 (the District of Columbia, Delaware, Maryland, Pennsylvania, Virginia, and West Virginia). Six sole-source aquifers are identified in U.S. EPA

Region 3 (Figure 2.3-70). None of these are located in the region of BBNPP (USEPA, 1996). Thus, the addition of BBNPP is not an impact to any sole source aquifer.}

4.2.2.10 Measures to Control Construction Related Impacts

{The following measures will be taken to avoid runoff from the construction areas entering and potentially impacting downstream surface water bodies and groundwater, as applicable:

- Implementation of a Erosion and Sediment control Plan;
- Controlling runoff and potential spills using dikes, earthen berms, seeded ditches, and impoundments;
- Monitoring for contaminants within construction area impoundments and impoundments downstream of disturbed areas;
- Implementation of BMPs to protect against accidental discharge of contaminants (fuel spills, other fluids and solids that could degrade groundwater and surface water resources); and
- Performing additional onsite surface and groundwater monitoring compared to established water quality benchmarks and historical site data.

Bio-retention ditches are planned for the periphery of the power block, laydown, cooling tower and switchyard areas. The ditches are constructed of base materials that promote infiltration of runoff from low intensity rainfall events. However, for large storms the infiltration capacity of the base materials would be exceeded and the overflow pipes are provided to direct the runoff to the stormwater basins. The stormwater basins are unlined impoundments with simple earth-fill closure on the down stream end and include discharge piping to the adjacent watercourses.

As discussed in Section 2.3.2.2.9, during construction, dewatering of the glacial overburden aquifer will be required in the power block and the ESWEMS pumphouse areas in order to excavate down to bedrock. Groundwater flow barriers will be installed around these areas in order to minimize impacts to the aquifer. Because a groundwater barrier will be installed prior to excavation, the amount of groundwater that needs to be pumped and resulting impacts to the shallow aquifer will be minimal.

During operation of the BBNPP, groundwater will not be pumped and will not be used in the plant. Therefore, the long term impacts on groundwater levels, flow direction, and resources resulting from construction and operation of the BBNPP will be localized and will be minimal.

Following the acquisition of the required permits and authorizations, site preparation activities include the installation or establishment of environmental controls to assist in controlling construction impacts to groundwater. These environmental controls include:

- Coffer Dams;
- Stormwater management systems;
- Spill containment controls;
- Silt screens;
- Settling basins; and

- Dust suppression systems.

These controls assist in protecting the glacial aquifer by minimizing the potential for construction effluents to infiltrate directly into the subsurface or to carry possible contaminants to aquifer recharge areas.

Mitigation measures for construction activities in the area of the CWS Intake Structure and discharge outfall include:

- Installing a sheet pile cofferdam and dewatering system to facilitate construction of the BBNPP CWS Intake Structure and discharge outfall structure; and
- Carrying out water-quality monitoring in accordance with any permit requirements.

Additional measures to minimize or contain accidental releases of contaminants will be the establishment, maintenance, and monitoring of:

- Solid waste storage areas;
- Backfill borrow, spoils, and topsoil storage areas; and
- Site drainage patterns.

Groundwater monitor wells will be installed to assess gradient changes toward the excavation dewatering areas and potential groundwater quantity and quality changes.

As explained in Section 4.2.2.7, any contamination that might be introduced into the glacial overburden aquifer would be attenuated by the time it might reach deeper aquifers.}

4.2.2.11 Consultation with Federal, State and Local Environmental Organizations

{The regulations guiding the implementation of Best Management Practices (BMPs) are provided by the Pennsylvania Department of Environmental Protection (PADEP) for water quality, and the Susquehanna River Basin Commission (SRBC) for water use. (PADEP, 2006). These regulations contain BMP installation instructions and typical construction activities which require BMPs. Monitoring of construction effluents and stormwater runoff would be performed as required in the stormwater management plan, NPDES permit, and other applicable permits obtained for the construction. The integrated permitting process for the applicable environmental permits will proceed concurrently with NRC review of the combined license application.}

4.2.2.12 Compliance with Water Quality and Water Use Standards and Regulations

{The regulations guiding the implementation of water quality and water use standards and regulations are provided by the Pennsylvania Department of Environmental Protection (PADEP, 2006). These regulations contain water quality and water use standards that must be adhered to during construction. In addition, site specific permits for various construction activities will contain conditions that must be complied with for the duration of the permitted activity.}

4.2.2.13 Water Quality Requirements for Aquatic Ecosystems and Domestic Users

Section 4.3.2 discusses information pertaining to water quality requirements for aquatic ecosystems.

Domestic users of groundwater need to meet the state water quality standards for potable water systems.

4.2.2.14 References

{**PADEP, 2006**. PA Department of Environmental Protection, Bureau of Watershed Management, Pennsylvania Stormwater Best Management Practices Manual, Website: http://164.156.71.80/VWRQ.asp?docid=2087d8407c0e00000000071b0000071b&context=2&backlink=WXOD.aspx%3ffs%3d2087d8407c0e000080000719000007719%26ft%3d1, Date accessed: April 11, 2008.

PADEP, 2008. PA Department of Environmental Protection, Pennsylvania State Water Plan, Population Projections 2000, Website: http://www.depweb.state.pa.us/watershedmgmt/lib/watershedmgmt/stat_water_plan/data/population_projections2000/flatcounty2.pdf, Date accessed: April 27, 2008.

USEPA, 1996. The Sole Source Aquifer (SSA) Program, Section 1424(e) of Safe Drinking Water Act (SDWA), 1996, U.S. Environmental Protection Agency, Website: http://www.epa.gov/reg3wapd/presentations/ssa/index.htm, Date accessed: April 21, 2008.}

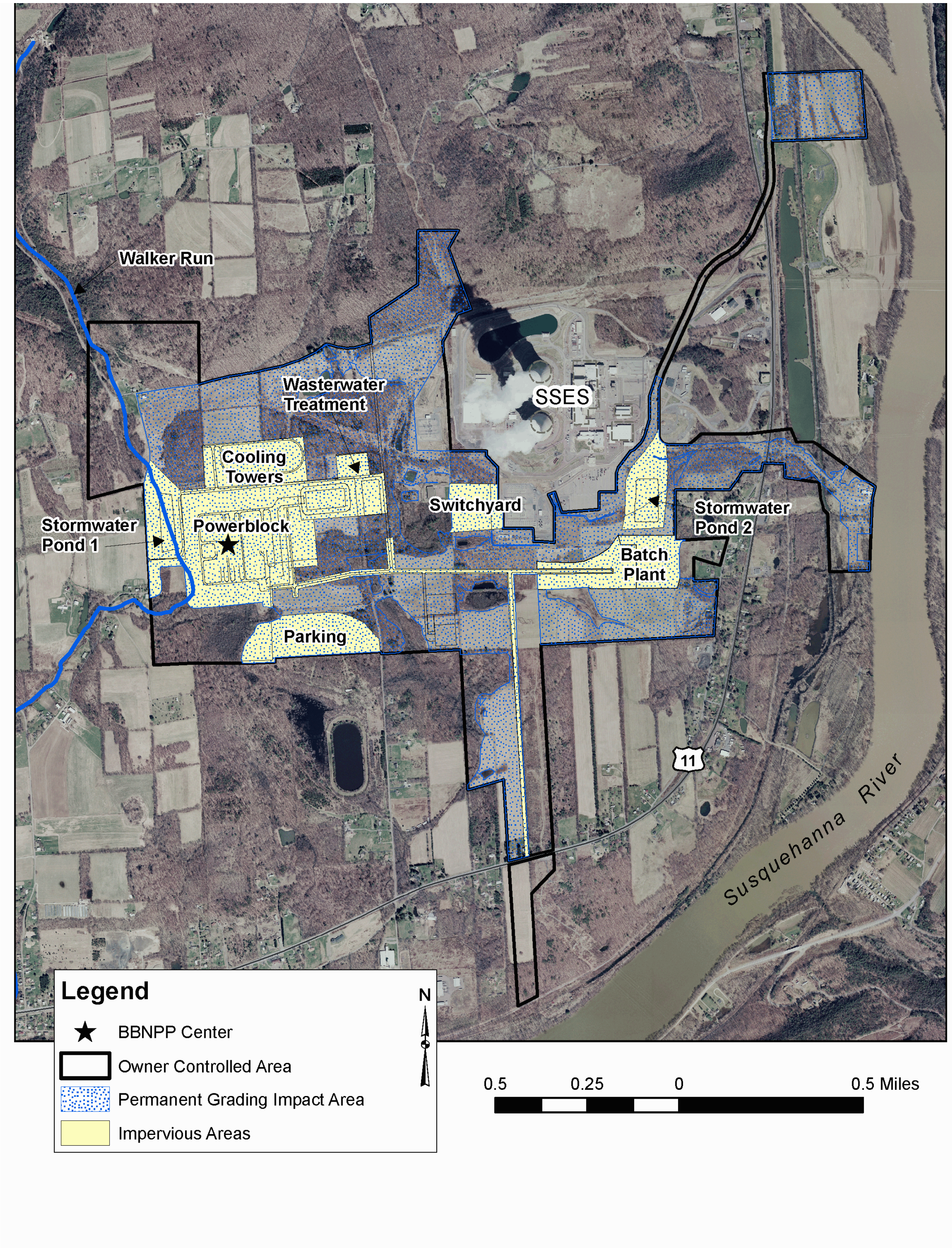
Table 4.2-1 {Estimated Fresh Water Demand During BBNPP Construction}

Construction Year	Year 1 gal (l)	Year 2 gal (l)	Year 3 gal (l)	Year 4 gal (l)	Year 5 gal (l)	Year 6 gal (l)
Potable and Sanitary	8,550,000[a] (32,361,750)	25,650,000[b] (97,085,250)	25,650,000[b] (97,085,250)	25,650,000[b] (97,085,250)	25,650,000[b] (97,085,250)	-
Concrete Mixing and Curing[c]	2,219,844 (8,402,110)	2,219,844 (8,402,110)	2,219,844 (8,402,110)	2,219,844 (8,402,110)	2,219,844 (8,402,110)	-
Dust Control[d]	11,400,000 (43,149,000)	11,400,000 (43,149,000)	11,400,000 (43,149,000)	11,400,000 (43,149,000)	11,400,000 (43,149,000)	-
Total	22,169,844 (83,912,860)	39,269,844 (148,636,360)	39,269,844 (148,636,360)	39,269,844 (148,636,360)	39,269,844 (148,636,360)	26,179,896[e] (99,090,906)

Notes:

(a) Estimated at 1,000 persons using 30 gallons per day for 285 days per year.
(b) Estimated at 3,000 persons using 30 gallons per day for 285 days per year.
(c) Estimated at 6,700 cubic yards per month using 27.61 gallons per cubic yard and 12 months per year.
(d) Estimated at 40,000 gallons per day for 285 days per year.
(e) Estimated at two-thirds of the amount used in years 2 through 5.

Figure 4.2-1 {BBNPP Site Grading Plan}



4.3 ECOLOGICAL IMPACT

4.3.1 TERRESTRIAL ECOSYSTEMS

{This section describes the impacts of construction on the terrestrial ecosystem. The BBNPP Owner Controlled Area (OCA) is equivalent to the construction zone and is shown in Figure 4.3-1. An estimate of all land areas, including both developed lands and undeveloped terrestrial habitats, that would be temporarily or permanently disturbed during construction of BBNPP and supporting facilities is provided in Table 4.1-1. Approximately 630 ac (255 ha) of the BBNPP OCA would be disturbed by site preparation and construction. This area is assumed to be the maximum area of soil to be exposed at any time.

Approximately 365 ac (148 ha) (developed and undeveloped) would be permanently converted to structures, pavement, or other intensively-maintained exterior grounds. These facilities will include the proposed power block, switchyards, CWS and ESWS cooling towers, ESWEMS Retention Pond, combined wastewater retention pond, water treatment plant, permanent parking and laydown areas, roads, railroad, stormwater ponds, soil stockpile and CWS Makeup Water Intake Structure. Temporary disturbance of forest cover would also be considered effectively permanent due to the time needed to recreate forest cover of similar maturity.

Approximately 265 ac (107 ha) (developed and undeveloped) would be temporarily disturbed, only, to accommodate the batch plant, modular assembly area, and temporary offices, warehouses, parking and laydown areas. Acreage not containing permanent structures would be restored by grading and revegating to the extent practicable.

Construction impacts to terrestrial habitats, only, will entail a permanent loss of 351 ac (142 ha), and temporary disturbance of 213 ac (86 ha) as shown in Figure 4.3-2 and Table 4.3-1. Permanent terrestrial habitat losses are small compared to the 4,390,530 ac (1,776,784 ha) of terrestrial habitat in the region as shown in Table 2.2-5. Wetlands comprise approximately 36 ac (14.6 ha) of the permanently lost terrestrial habitat, as shown in Figure 4.3-2 Permanent wetland losses are also small compared to the 83,797 ac (33,911 ha) of wetlands in the region (Eastern Pennsylvania).

Additionally, construction of the surface water CWS Makeup Water Intake Structure and blowdown diffuser structure will involve very minor impacts of 0.7 acres (0.3 hectares) within the Susquehanna River as shown in Figure 2.2-1. Wherever possible, the construction footprint has been designed to minimize impacts to the river channel and terrestrial ecosystems, specifically potential habitat for species of special concern; wetlands; and forest cover, especially large blocks of contiguous forest that provide habitat for forest interior dwelling species.

Construction activities will start upon receipt of all federal, state, county and local permits necessary to start clearing and grading of the site. Start and end dates of construction activities for non safety-related systems and structures are discussed in Section 1.0.}

4.3.1.1 Vegetation

{**Plant Communities and Habitats:**

Clearing and grubbing will result in the vegetation losses shown in Figure 4.3-1 and summarized in Table 4.3-1. The losses will include approximately 174 ac (70 ha) of upland deciduous forest cover and approximately 22 ac (9 ha) of palustrine forested wetland cover. The majority of both the upland and wetland forest covers is composed of well-developed overstory and understory strata. Many canopy trees are over 12 in (30 cm) in diameter at breast height. Other vegetation losses from both permanent and temporary disturbances will include approximately:

- 174 ac (70 ha) of upland scrub/shrub vegetation,
- 179.8 ac (72.6 ha) of old field vegetation,
- 134.4 ac (54.3 ha) of agricultural land including an abandoned orchard,
- 14.0 ac (5.7 ha) of palustrine emergent (herbaceous marsh) vegetation,
- 0.7 ac (0.3 ha) of scrub/shrub vegetation,

Each of the affected types of vegetation is common throughout the region.

The boundaries of vegetated areas subject to clearing and grubbing will be prominently marked prior to site preparation. Merchantable timber within marked areas may be harvested prior to site preparation. Merchantable timber occurs almost entirely in areas of upland deciduous forest and palustrine forested wetland cover. Stumps, shrubs, and saplings will be grubbed, and groundcover and leaf litter will be cleared to prepare the land surface for grading. Felled trees, stumps, and other woody material will be disposed of by chipping and spreading the wood chips, and/or sent to an offsite composting facility or landfill.

Opportunities to recycle woody material for use elsewhere on the BBNPP site or for sale to the public may be considered. Recycling opportunities could include cutting logs into firewood, using wood chips to mulch landscaped areas, using logs to line pathways, piling logs and brush in open fields to improve terrestrial wildlife habitat, and placing stumps (root wads) in stream channels to prevent bank erosion and enhance aquatic habitat.

Practicable opportunities to preserve individual trees are not available within the broad contiguous areas of land that must be graded to construct the power block, switchyard, cooling tower and other large permanent structures. However, a biologist will examine forested areas subject to clearing for the temporary construction parking areas, construction office and warehouse area, and construction laydown areas for aesthetically outstanding trees or clusters of trees that might be capable of preservation without interfering with construction activities.

Silt fences will be erected around the perimeter of the construction footprint to reduce the potential for sedimentation of adjoining vegetated areas. Detailed specifications for the silt fences and vegetative stabilization will be presented in a soil erosion and sediment control plan (E&S plan) approved by the Luzerne County Conservation District prior to site disturbance. As required by state regulations, stockpiles for soil and other excavated material will be located outside of the 100-year floodplains for the Susquehanna River and other watercourses. Stockpiled materials will be covered with plastic, enclosed within a berm, or stabilized with hay mulch and a grass cover until removed during backfill and final grading activities. Monitoring of construction effluents and storm water runoff will be performed as required by the E&S plan, NPDES permit, and other applicable permits obtained for construction.

<u>Important Habitats:</u>

To the extent practicable, the construction footprint has been designed to limit impacts to the river channel and terrestrial ecosystems, specifically potential habitat for species of special concern;

wetlands; and forest cover, especially large blocks of contiguous forest that provide habitat for forest interior dwelling species. Site preparation will result in the permanent loss (filling) of approximately 37 ac (15 ha) of wetland habitats, including approximately 14 ac (5.7 ha) of palustrine emergent wetlands, approximately 0.7 ac (0.3 ha) of palustrine scrub/shrub wetlands and approximately 22.2 ac (9.0 ha) of palustrine forested wetlands. Wetland impacts are discussed in more detail in Section 4.3.1.3.

The 1,200 ac (486 ha) Susquehanna Riverlands Environmental Preserve was also identified as an important habitat as this area encompasses a wide variety of upland and wetlands habitats along both sides of the Susquehanna River, and includes a 400 ac (162 ha) public recreation area. Site development within this area will consist of surface water intake and blowdown related facilities. Earth disturbance will be limited and will largely take place in upland cover types that are common throughout the region. Permanent loss (filling) of wetlands associated with these structures will be minimal and are included with wetland losses discussed in the above paragraph.

Important Plant Species:

As noted below in Section 4.3.1.5, the Pennsylvania Department of Conservation and Natural Resources (PDCNR) was consulted concerning plants, natural communities, terrestrial invertebrates, and geologic features of special concern within a 0.5 mi (0.8 km) radius of an area encompassing the BBNPP OCA, PPL Susquehanna, LLC owned lands to the east and the Susquehanna Riverlands (PDCNR, 2008a). PDCNR's response indicated that no state or federal rare, threatened or endangered plants are known to occur within the designated search area. (PDCNR, 2008a)

Important plant species were identified and discussed in Section 2.4.1, and encompass red maple, river birch, black cherry, spicebush, skunk cabbage and Canada goldenrod. These plants were designated as important species because they are key contributors to the overall structure and ecological function of vegetation communities on the BBNPP site. Red maple is a dominant tree in both upland and wetland forests throughout the project area, and river birch is a dominant overstory species in wetland forests of the Susquehanna Riverlands. Black cherry was designated as important since it is both commercially valuable and plentiful in upland forests onsite.

Spicebush is a dominant shrub in the understories of upland and wetland forests throughout the BBNPP site. Skunk cabbage is very abundant in wetland forests onsite and is the principal herbaceous groundcover in this habitat during the early part of the growing season. Canada goldenrod is a prominent herbaceous species in much of the old-field vegetation cover.

Any losses of important tree cover or other forest cover, including areas of temporary disturbance, must be considered effectively permanent. Deciduous forest can be replanted; however, at least a hundred years will be necessary to recreate forest cover of similar maturity. Shrub and herbaceous cover lost to permanent structures must also be considered permanent. However, following temporary disturbance, these cover types can generally be restored to a pre-disturbance state in a few years through a combination of replanting, reemergence from the seed bank and recolonization from similar habitats on nearby lands.}

4.3.1.2 Fauna

{Proposed construction will convert a portion of the forests, abandoned orchards, old fields, wetlands, agricultural and other terrestrial habitats to paved parking lots, cooling towers, power block, switchyards, roadways, and retention basins. These permanent habitat conversions will constitute an ecological loss and will reduce populations of and use by terrestrial fauna. However, in portions of the BBNPP site where only temporary disturbance will occur (batch plant, construction laydown areas, construction offices, warehouses and temporary parking lots), these habitats have the potential to recover, if allowed or encouraged, to be valuable again for terrestrial fauna.

Vegetation losses summarized in Table 4.3-1 will reduce the habitat available to mammals, birds, and other terrestrial fauna that inhabit the BBNPP site and surrounding regions. Some smaller, less mobile fauna such as mice, shrews, voles, frogs and toads, salamanders and snakes may be impacted by heavy equipment used in clearing, grubbing, and grading. Larger, more mobile fauna will be displaced to adjoining terrestrial habitats, which could experience temporary increases in population density of certain species. If the increases exceed the carrying capacity of those habitats, the habitats could experience degradation and the displaced fauna could compete with other fauna for food and cover, resulting in a die-off of some individuals until populations decline to below the carrying capacity. Potential impacts to specific fauna species identified as important at the BBNPP site are discussed below in three major categories: (1) rare important species, (2) commercially or recreationally important species, and (3) ecologically important species.

<u>Rare Important Species:</u>

As noted in Table 2.4-1, sixteen species of terrestrial fauna were identified as potentially "important" at the BBNPP site according to rarity criteria defined in NUREG-1555 (NRC, 1999). They include four mammals (Indiana bat (*Myotis sodalis*), eastern small-footed myotis (*Myotis leibii*), northern myotis (*Myotis septemtrionalis*), and Allegheny woodrat (Neotoma magister)); three birds, (bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (Falco peregrinus), and osprey (Pandion haliaetus)); three reptiles (redbelly turtle (*Pseudemys rubiventris*), timber rattlesnake (*Crotalus horridus*), and eastern hognose snake (*Heterodon platyrhinos*)), one amphibian (eastern spadefoot (*Scaphiopus holbrookii)*); and five insects (northern Pearly-eye (*Enodia anthedon*), long dash (*Polites mystic*), mulberry wing (*Poanes massasoit*), Baltimore checkerspot (*Euphydryas phoeton*), and black dash (*Euphyes conspicua*). (NRC, 1999)

Five of these species have ranges that include Luzerne County, Pennsylvania, but have not been observed at or in the immediate area of the BBNPP site during the 2007-2008 terrestrial faunal surveys or reported in previous studies. Further discussion will be restricted only to the ten species that have been documented to actually occur at or near the BBNPP site.

Three rare bat species are known to occupy hibernacula within 5 mi (8 km) of the BBNPP site : the Indiana bat, which is federally and state-listed as endangered (PPL, 2006); the eastern small-footed myotis, which is state-listed as threatened; and the northern myotis, which is state-listed as candidate rare. Eastern small-footed myotis have been encountered rarely during the non-hibernating periods so very little is known about the habitat requirements or food habits of this rare bat. Unlike most other bats, the eastern small-footed myotis does not appear to hibernate in large colonies. In Pennsylvania, the largest known hibernating population consisted of less than fifty individuals and in a majority of caves where they were found, less than five individuals were found in each cave.

During non-hibernating periods (April through mid-November) the Indiana bat typically favors sites under the exfoliating bark of large, often dead, trees as roosting sites and maternity dens. Northern myotis, like the Indiana bat, also uses exfoliating bark of large trees as roosting sites and maternity dens.

No bat hibernacula of any type have been identified at the BBNPP site, nor have any of these bat species been documented to occur at the BBNPP site. However, to further document the presence or absence of bat species, especially Indiana bat, at the BBNPP site, a mist-net capture survey and habitat evaluation by an expert bat biologist was completed in the summer of 2008. No Indiana bats were captured, seen or heard, no small-footed myotis were captured, but 4 adult male northern myotis were captured. However, the capture of only adult male northern myotis, and no females or young, provides evidence for the existence of roost sites in the area surveyed, but not maternity colonies of females and young, at least for that species.

Potential suitable roosting and maternity den habitat included most of the forested areas where loose bark of shagbark hickory (Carya ovata), wild black cherry (Prunus serotina), red maple (Acer rubrum) and dead snags > 5 in (13 cm) diameter at breast height (dbh) were present. (PPL, 2006)

The clearing of forest habitat for construction could have a negative impact on the Indiana bat, the only federally and state- listed endangered species likely to occur at the BBNPP site. To avoid possible negative impacts on the Indiana bat, the USFWS advised that all tree cutting activities should occur only during the period November 16 through March 31, while the Indiana bat is hibernating (usually in caves or mines), so that removal of trees does not inadvertently injure or kill roosting individuals or families in maternity dens (USFWS, 2008). If cutting is necessary from April 1 through November 15, no trees > 5 in (13 cm) diameter at breast height should be cut during non-hibernating periods (USFWS, 2008). At the BBNPP site, this would be particularly true for shagbark hickory trees which are suspected to be one of the most likely to provide roosting habitat for bats. Increase of old-growth forest acreage and forest contiguity, especially within several miles of hibernation sites, is recommended to improve prospects for this species (PDCNR, 2008b).

The bald eagle, peregrine falcon, and osprey (all state threatened) have been observed with increasing frequency during migration along the Susquehanna River in recent years but no nesting or intensive use have ever been documented on the BBNPP site, so it is unlikely that construction will have any significant impact on any of these bird species. A peregrine falcon nest site is located approximately 2 mi (3.2 km) east of proposed location of the intake and discharge structures. It is unlikely that construction will have any impact on the peregrine falcons since they often nest in urban locations where considerable human presence and construction activity are common events. For example, the first recovered nesting in Pennsylvania was documented in 1987 on a bridge in Philadelphia (Brauning, 2007), and peregrine falcons have been routinely nesting at the Rachel Carson State Office Building in downtown Harrisburg and at the Gulf Tower and University of Pittsburgh Cathedral of Learning in Pittsburgh (PGC, 2008a). A possible mitigating effect for negative impacts of construction would be to erect nesting structures in suitable locations near or in the BBNPP OCA for bald eagles, peregrine falcon and/or osprey. (Brauning, 2007)

None of the potentially important rare reptiles or amphibians with ranges that include Luzerne County (eastern spadefoot, redbelly turtle, timber rattlesnake, and eastern hognose snake) listed in Section 2.4.1 has been documented to occur at the BBNPP OCA and were deemed unlikely to occur due to lack of suitable habitat and range limitations. Accordingly, it is unlikely that the proposed construction will have any significant impact on any of these rare reptile or amphibian species.

Correspondence with the Pennsylvania Department of Conservation and Natural Resources (PDCNR) indicated that four species of butterflies (northern pearly eye, long dash, mulberry wing, and Baltimore checkerspot), each state-listed as species of special concern, were known to occur in the immediate area of BBNPP site (PDCNR, 2008b). The entomologist that conducted the butterfly survey indicated that two of the four original butterfly species of concern, northern pearly-eye and long dash, are no longer PNDI tracked species due to a recent revision of the state ranks. However, the entomologist indicated that a new species, black dash was added to the list of butterfly species of special concern for Luzerne County.

A butterfly survey was conducted by an experienced entomologist as part of the terrestrial fauna studies during June and July of 2008. No northern pearly-eye, mulberry wing, or Baltimore checkerspot butterflies were located during the butterfly survey. One long dash butterfly and a pair of black dash butterflies were collected. In addition, at least 8-10 more black dash butterflies were observed at the BBNPP OCA during the butterfly survey. Accordingly, the black dash butterfly and its host plants are addressed in Table 2.4-1. (PDCNR, 2008b)

The project area potentially provides suitable habitat for these butterflies based on habitat descriptions provided by PDCNR and information collected concerning life histories and breeding/foraging preferences of these species. Table 2.4-32 provides information on the occurrence of host plant species on the BBNPP site for each of the butterfly species listed. PDCNR requested that attempts be made to minimize impacts to potential habitat for these butterflies within the project area. Accordingly, care will be taken to prevent loss of plant species listed in Table 2.4-32.

Commercially or Recreationally Important Species:

White-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*) and wild turkey (*Meleagris gallopovo*) are identified as commercially or recreationally important species on the BBNPP site. Hundreds of thousands of hunters hunt for these game animals each year throughout Pennsylvania, generating large economic impacts, particularly in rural areas like Luzerne County.

White-tailed deer are currently abundant on the BBNPP site based on terrestrial vertebrate surveys of 2007-2008. With the proposed construction and development of the power plant facility much of the suitable habitat, especially forested wetlands, will be lost and resident deer will be forced to emigrate to adjacent suitable habitat which is similar to BBNPP OCA. This may temporarily increase competition for limited resources in adjacent areas initially.

However, the long-term impact of this construction project on the deer herd is unlikely to be significant on a larger landscape scale. For example, in Pennsylvania deer populations average about 25 deer per 1 mi^2 (2.6 km^2). At this density, Luzerne County, which is 907 mi^2 (2,322 km^2) should support approximately 2,250 deer, of which only about 50 (less than 0.3%) would live in the BBNPP OCA. The lack of impact significance is particularly true because in the absence of major natural predators, a decline in the numbers of hunters, and land use changes that create abundant browse (abandonment of farmland and forest fragmentation due to development), deer populations in much of Pennsylvania have increased dramatically. Because none of these conditions is likely to change in the near future, white-tailed deer populations are expected to remain high in the region, even if deer leave the BBNPP OCA.

Black bear sign (tracks and scat) have been located on the OCA and several bears have been observed but the 196 ac (79 ha) of forest habitat expected to be lost is very small when compared to the average home range of even a single bear. In northeastern Pennsylvania, male home ranges averaged 63 mi^2 (173 km^2) and were 8 to 16 mi (13 to 26 km) across, while female home ranges averaged 15 mi^2 (41 km^2) and were 3 to 8 mi (5 to 13 km) wide (Alt, 1980) and rivers and developed areas of several square miles, such as BBNPP OCA, are not much of a barrier for bears. They will simply swim across rivers or walk around highly developed areas. Due to the very large area requirements of bears and their preferential selection for larger blocks of forest habitat than is found in the BBNPP OCA, the impacts of construction on the local black bear population should be minimal. In addition, black bear populations throughout Pennsylvania, including the Luzerne County area, have increased dramatically in the past few decades (PGC, 2008b).

Wild turkeys were frequently observed on the BBNPP site during terrestrial vertebrate surveys of 2007-2008. The current mix of forested, actively farmed and reverting farmland habitat types found at the BBNPP site is ideal for wild turkeys (PGC, 2008) but the carrying capacity will decline considerably with the loss of much of this habitat to construction. Like the white-tailed deer, the resident wild turkey population will likely emigrate to adjacent suitable habitat after construction begins. Also, like the deer, wild turkey populations have increased dramatically in recent decades throughout Pennsylvania and the impacts of construction will likely be minimal at the landscape level. (PGC, 2008b)

<u>Ecologically Important Species:</u>

The meadow vole (*Microtus pennsylvanicus*), deer mouse (*Peromyscus maniculatus*) and white-footed mouse (*Peromyscus leucopus*) are three mammalian species identified as being ecologically important due to their value as a major prey base for predators at the BBNPP site. Because of their ubiquitous distribution across nearly all habitats, these species form an essential link in the complex food web. They represent the major herbivore component bridging the gap between plants (producers) and carnivorous animals (consumers). (Merritt, 1987)

Proposed construction at the BBNPP OCA will convert a significant portion of the forests, abandoned orchards, old fields, wetlands, agricultural and other terrestrial habitats heavily used by these prey species to paved parking lots, cooling towers, power block, switchyards, roadways, and retention basins. These permanent habitat conversions will constitute an ecological loss and will significantly reduce populations of prey species and utilization of their predators. However, in portions of the BBNPP site where only temporary disturbance will occur, these habitats have the potential to recover, if allowed or encouraged, to be valuable again for small mammal prey species and their predators.

The scarlet tanager (Piranga olivacea) was also identified as an ecologically important species at the BBNPP OCA as a forest interior bird and biological indicator of effects related to forest fragmentation. The loss of nearly 200 ac (80 ha) of forested habitat is expected, primarily in the western portion of the project area, which will negatively impact scarlet tanagers and other forest interior birds. However, extensive forested regions remain in adjacent and nearby areas, (especially directly north and south) of the BBNPP OCA, that scarlet tanagers and other forest interior birds could use, though this may temporarily increase competition with resident populations for limited habitat resources.

Bird Collisions: The proposed cooling towers are not expected to cause substantial bird mortality due to collisions. Although infrequent bird collisions with the proposed cooling towers are likely, the overall mortality potentially resulting from bird collisions with cooling towers is reported to have only minor impacts on bird species populations (NRC, 1996).

In a review of the literature for avian collision mortality associated with all types of man-made objects as well as the monitoring studies conducted at six nuclear power plants, (including the Susquehanna Steam Electric Station (SSES) Units 1 and 2 adjacent to the proposed BBNPP (Ecology III, 1995), it was concluded that (1) avian mortality associated with cooling towers is a very small part of the total mortality and (2) local bird populations are not being significantly reduced (NRC, 1996). A majority of the avian mortality caused by collision with cooling towers occurred during nocturnal periods of spring and fall migration by songbirds. (Ecology III, 1995)

The proposed cooling towers for the BBNPP site are similar to the 540 ft (165 m) tall natural draft towers already existing on the adjacent property at SSES. Accordingly, expected bird-collision impacts should be comparable. At SSES, surveys conducted on weekdays during spring and fall migration from 1978 through 1986 yielded an average of about 170 dead birds per survey year, consisting primarily of songbirds (NRC, 1996). Songbird population studies done in the vicinity of SSES prior to and after operation of the plant did not detect population declines associated with the plant operation (Ecology III, 1995).

The scarlet tanager and other forest interior bird species should be even less impacted by collisions with the cooling towers, at least during non-migrating periods, because they would not find suitable habitat close to the cooling towers, which will be constructed on a cleared, treeless pad. Measures such as reducing the lighting on the cooling tower to the minimum required by the Federal Aviation Administration and using flashing lights instead of floodlights have been shown to be effective in reducing the incidence of bird collisions (Ogden, 1996). No other mitigation appears to be necessary to prevent substantial adverse impacts to bird species populations caused by collisions with the cooling towers. (Ogden, 1996)}

4.3.1.3 Wetlands

{The construction footprint for the proposed facilities has been designed, wherever possible, to minimize encroachment into state and federally regulated wetlands, other waters of the U.S., and "Regulated Waters of the Commonwealth of Pennsylvania." However, construction of the proposed facilities will not be possible without permanently filling approximately 36 ac (14.6 ha) of wetlands and approximately 340 linear feet (104 m) of stream channel outside of the wetlands area. The project will therefore require an Individual Permit from the Baltimore District of the U.S. Army Corps of Engineers (USACE) under Section 404 of the Federal Water Pollution Control Act, and Section 10 of the Rivers and Harbors Act. The project does not qualify for approval under the USACE's Pennsylvania State Programmatic General Permit-3 (PASPGP-3) due to the extent of impacts to federally regulated areas.

At the state level, the project will require the following permits from the Pennsylvania Department of Environmental Protection (PADEP) under its Chapter 105 Dam Safety and Waterway Management Regulations (Chapter 105) for proposed development activities in "Regulated Waters of the Commonwealth":

- Water Obstruction and Encroachment Permit,
- Dam Permits for stormwater ponds 1 and 2,
- Submerged Lands License Agreement,

Both the USACE and PADEP permitting processes include a detailed analysis of environmental impacts and alternative measures for avoiding and/or minimizing impacts. All impacts to wetlands and other regulated waters must be unavoidable, and will require mitigation through techniques such as the construction of new wetlands habitat as discussed below in Section 4.3.1.6. Permits and other regulatory authorizations required for the project are presented in Section 1.3.}

4.3.1.4 Other Projects Within the Area with Potential Impacts

{Preliminary siting studies have been conducted for an electric power transmission line extending from the vicinity of Berwick, Pennsylvania to Roseland, New Jersey. In addition, the U.S Department of Energy has tentatively designated a corridor in Pennsylvania, including Luzerne County, as part of the Mid-Atlantic Area National Corridor that will serve as potential routes for future electric power transmission lines (DOE, 2008a) (DOE, 2008b). The only other known project that may impact natural resources in the region is a new 42 in (107 cm) natural gas pipeline, part of which is located in Luzerne County (FERC, 2006). Transco proposes to expand its existing Leidy gas pipeline to allow additional transport of gas to southern New York. (DOE, 2008) (USFWS, 2008).

4.3.1.5 Regulatory Consultation

Affected federal, state and Regional agencies will be contacted regarding the potential impacts to the terrestrial ecosystem resulting from plant construction. {The U. S. Fish and Wildlife Service was consulted for information on known occurrences of federally-listed threatened, endangered, or special status species and critical habitats (USFWS, 2008). For state-listed threatened, endangered, or special status species and critical habitats, the Pennsylvania Game Commission was consulted concerning mammals and birds (PGC, 2008); the Pennsylvania Fish and Boat Commission was consulted concerning reptiles and amphibians (PFBC, 2008), and the Pennsylvania Department of Conservation and Natural Resources (PDCNR) was consulted concerning plants, natural communities, terrestrial invertebrates, and geologic features (PDCNR, 2008a). Wetlands regulatory officials with the USACE and PADEP were consulted regarding wetlands issues. Identification of the important species discussed above was based in part on information provided by consultation with the state and federal agencies listed above.}

4.3.1.6 Mitigation Measures

Opportunities for mitigating unavoidable impacts to terrestrial ecosystems involve restoration of natural habitats temporarily disturbed by construction creation of new habitat types in formerly disturbed areas, as well as enhancement of undisturbed natural habitats. Mitigation plans will be developed in consultation with the applicable state and local resource agencies and will be implemented on the {BBNPP} site to the extent practicable. The description of mitigation measures is addressed below for upland areas (flora and fauna) and wetland areas.

{Flora:

Mitigation to replace temporary and permanent impacts to upland areas is not required by federal, state or local regulations, but will be considered for the BBNPP project. Upland mitigation would take place largely on nearby PPL or other-owned property, as needed, and may involve restoration of natural vegetation cover to farmland and other disturbed uplands, as well as enhancement of existing natural vegetation communities.   Restoration/enhancement techniques may include reforestation or the creation of other appropriate naturally vegetated areas such as meadows, old field habitat and shrub/scrub communities.

Reforested areas would be designed to ultimately yield a cover of mature deciduous forest. An optimal mix of trees for planting would include species present in the existing deciduous forest that are tolerant of full sunlight, relatively fast growing, easily transplanted and widely available as nursery stock. Shade tolerant trees, as well as understory and groundcover vegetation typical of local deciduous forests would likely become established over time via natural recolonization processes. The floristic composition of the stands will gradually approach that of the existing deciduous forest on the BBNPP site, a process that could require more than 100 years.

A field survey of nearby PPL-owned lands will be needed to determine the appropriate areas for reforestation and creation of other plant communities (old field, meadows, shrub/scrub). Therefore, the exact locations and habitat type will be determined at a later date. As stated previously, mitigation plans will be developed in consultation with the federal, state and local resource agencies.

Fauna:

With the current understanding that mitigation for loss of upland habitat is strictly voluntary, except potentially in circumstances related to impacts to state or federal listed species, the following could be done to reduce negative impacts on terrestrial fauna:

- Maintain and/or plant host plants listed in Table 2.4-32 for the five butterfly species of special concern that occur at the BBNPP site (northern pearly-eye, long dash, mulberry wing, Baltimore checkerspot, and black dash).
- Maintain and/or plant shagbark hickory trees to provide potential roosting and maternity dens for three rare species of bats that are known to occur nearby (Indiana bat, eastern small-footed myotis, and northern myotis).
- Erect potential nesting sites for bald eagle, osprey, and peregrine falcon.
- Maintain and/or plant oaks and black cherry to provide mast for wildlife species, especially wild turkey, black bear, and the small-mammal prey base.

Wetlands:

Wetland mitigation in Pennsylvania is driven primarily by conditions established by the USACE and PADEP in permits issued under Section 404 of the Federal Water Pollution Control Act and Chapter 105 Dam Safety and Waterway Management Regulations. Wetland mitigation follows a sequencing process beginning with avoidance of wetland impacts, then minimization of wetland impacts, and lastly compensatory mitigation to offset impacts. The proposed facilities have been sited and the proposed construction has been configured to avoid encroaching into wetlands to the extent possible. Therefore, the wetland impacts detailed above must be considered unavoidable.

Several measures will be taken to minimize the unavoidable adverse effects to wetlands. The use of silt fences, temporary and permanent vegetative stabilization, and other soil erosion and sediment control practices would reduce the risk of sediment runoff into intact wetlands adjoining the areas of fill, as well as wetlands located downstream of the project area. Bio-retention ditches will be constructed around the periphery of the power block, construction laydown area, cooling tower, and switchyard areas to help catch surface runoff and prevent degradation of adjoining terrestrial and aquatic habitats. The ditches would be constructed of base materials that promote infiltration of runoff from low intensity rainfall events. However, for large storms the infiltration capacity of the base materials would be exceeded and the overflow pipes would direct the runoff to the stormwater retention basins. A typical stormwater retention basin would consist of an unlined impoundment vegetated with regionally indigenous wetland grasses and herbs, and a simple earth-fill closure on the down stream end that could include a discharge pipe to an adjacent watercourse.

Commonly used forms of compensatory wetland mitigation include restoration or enhancement of degraded wetlands, creating (constructing) wetlands in areas that are not wetland, and preserving areas of intact wetlands. The proposed wetland impacts would be permanent; hence, restoring the filled wetlands after completion of construction activities would not be possible.

Opportunities exist to construct new wetlands on PPL or other-owned property, as needed, near the BBNPP site. The soils and surface hydrology of any candidate area for wetland creation would have to be evaluated in detail to quantitatively determine that wetland construction is feasible. There are also opportunities to enhance existing wetlands on PPL-owned lands near the BBNPP site. At least one wetland in the Susquehanna Riverlands has become infested with a near-monoculture of the invasive grass Phragmites australis. Eradicating Phragmites from this wetland and restoring it with a cover of regionally indigenous wetland vegetation is an applicable form of wetland mitigation. In addition, several stream channels in the vicinity of the BBNPP site have become scoured by runoff. Stabilization of eroding channel banks using environmentally sensitive techniques (bio-engineering) and a reduction in stormwater runoff through Best Management Practices (BMPs) that increase groundwater recharge could be accepted by regulatory agencies toward fulfillment of wetland mitigation requirements.

In summary, the following mitigation measures may be implemented for wetlands:

- The use of silt fences, temporary and permanent vegetative stabilization, and other soil erosion and sediment control practices will be implemented to reduce the risk of sediment runoff into intact wetlands adjoining the areas of fill, as well as wetlands located downstream of the areas of fill;
- Bio-retention ditches will be constructed around the periphery of the power block, construction laydown area, cooling tower, and switchyard areas to help catch surface runoff and prevent degradation of adjoining terrestrial and aquatic habitats;

- Eradication of Phragmites from at least one infested onsite wetland and the restoration of a regionally indigenous wetland vegetation cover in its place;
- Stabilization of eroding stream channels in the vicinity of the BBNPP project using environmentally sensitive techniques coupled with the reduction of strormwater runoff through BMPs that enhance groundwater recharge;
- Restoration of wetlands temporarily disturbed during construction; and
- If practicable, construction of new wetlands on nearby PPL or other-owned properties.

The exact location and size of areas to be constructed for wetlands would be determined at a later date. As stated previously, mitigation plans will be developed in consultation with the state, federal, and local resource agencies.}

4.3.2 AQUATIC ECOSYSTEMS

{This section provides an assessment of the potential impact construction activities will have on aquatic ecosystems in the onsite ponds, Walker Run, and North Branch Canal and offsite in the Susquehanna River and Unnamed Tributaries 1 and 3, as shown on Figure 2.3-3. Any new transmission lines and access corridors associated with the project are limited to the BBNPP Owner Controlled Area (OCA).

Thirty-six (36) acres (14.6 hectares) of the affected aquatic habitat will be permanently converted to structures, pavement, or other intensively-maintained exterior grounds to accommodate the proposed power block, cooling towers, switchyard, roadways, permanent construction laydown area, retention basins, and permanent parking lots. The permanent loss of affected aquatic habitat of 36 ac (14.6 ha) is SMALL compared to the 83,797 ac (33,911 ha) in the region as shown in Table 2.2-5. Figure 4.3-1 shows the BBNPP site boundary, the major buildings to be constructed, the land to be cleared, the waste disposal area and the construction zone. The location of biological assessment stations for the water bodies is given in Figure 2.4-3 to Figure 2.4-6. A topographic map is provided as Figure 2.4-1 showing the aquatic habitats. A similar analysis is discussed for wetlands in Section 4.3.1.

Section 4.2 includes a description of the footprint of the construction area and construction methods. Activities to construct non-safety-related systems and structures will begin after the Commonwealth of Pennsylvania issue applicable permits to start clearing and grading the BBNPP site. Other permits may be required from other regulatory agencies. The expected date for the NRC combined license, which will allow construction of safety-related systems and structures is discussed in Section 1.2. The expected date for completion of construction is also available in Section 1.2.}

4.3.2.1 Impacts to Impoundments and Streams

{The construction footprint of BBNPP covers 630 ac (255 ha) including many separate wetland and surface water areas. The effects of construction to onsite wetlands are described in Section 4.3.1. Construction effects to aquatic habitats in the immediate area range from temporary disturbance to complete elimination. The following surface water bodies may be affected by construction activities:

- East fork of Walker Run;
- Main stem Walker Run;

- Johnson's Pond;
- Beaver Pond;
- West Building Pond;
- Unnamed Pond;
- Farm Pond; and
- North Branch of the Pennsylvania Canal.

As described in Section 4.2.2.2, construction of BBNPP will permanently displace some of the existing surface water bodies. Construction impacts to the existing surface water bodies are summarized as follows:

- Increasing runoff from the approximately 87 ac (35 ha) of impervious and relatively impervious surfaces for the BBNPP power block pad, cooling tower pad, switchyard, laydown, and parking areas;
- Infilling and eliminating Farm Pond;
- Rerouting a section of east fork of Walker Run through a culvert that will pass under the site and then discharge to the wetlands area at the southwestern corner of the site;
- Creating a new stream channel and re-locating the section of the main stem of Walker Run at the western boundary of the site along Market Street;
- Construction of cofferdams that will temporarily de-water a section of the canal;
- Creating a new channel and then rerouting a drainage ditch that drains the canal into the river;
- Possibly increasing the sediment loads into the proposed impoundments; and
- Possibly increasing the sediment loads into the proposed impoundments and downstream reaches of Walker Run and Unnamed Tributary 2.

The site drainage basin areas are not expected to change substantially as a result of the site grading plan.

When a surface water body is removed by construction activities, impacts to aquatic life are expected. If the water body has an outlet, and the disturbance is gradual rather than abrupt, some fish may relocate. However, construction impacts to small impoundments or stream reaches may also result in total loss of the fish and macroinvertebrates.

As discussed in Section 2.4.2, surveys of the onsite streams and impoundments documented that no rare or unique aquatic species occur in the construction zone. The aquatic species that occur on site are ubiquitous, common, and easily located in nearby waters. Typical and abundant fish species in the onsite ponds include green sunfish, bluegill, and brown bullhead. Common and abundant fish species on site in Walker Run include creek chub, white sucker, and blacknose dace. The most important aquatic macroinvertebrate species in the impoundments and streams are the larval stages of aquatic insects. These species readily recolonize available surface waters, and so would not be permanently lost to the area. No important aquatic habitats were identified in Walker Run within the project vicinity. The ponds and Canal are all man-made impoundments in which no unique habitat exists.

Infilling of Farm Pond would most likely result in loss of most of the invertebrates and fish in the pond, however, some fish may utilize the overflow and migrate into Walker Run. The fish in the main stem of Walker Run and east fork Walker Run would most likely swim away from the affected areas to other parts of these water bodies, outside of the construction footprint. Those that do not move from the section to be relocated could be rescued and transported downstream into unaffected sections of the stream during the channel dewatering process. Fish in the Canal would most likely swim away from the affected area.

Re-construction of a small section of Walker Run (approximately 1,000 ft (305 m)) along the western boundary of the BBNPP site may result in temporary disruption of both benthic and fish community habitat in this section. After re-construction, it is expected that the former community will recolonize the created stream section within a fairly short time frame. The section of stream to be relocated was previously channelized for agricultural purposes and does not follow a natural course. The banks are incised and show signs of extensive erosion. The relocated channel will be west of the existing channel, closer to Market St. The relocated stream channel will be constructed to incorporate natural features of the stream similar to a reference section of Walker Run. The method called Natural Channel Design will be used for the new channel construction. Construction of the new channel will strictly adhere to the PADEP Chapter 105 regulations (PA, 1978). The new channel will be constructed, habitat features added, and bank vegetation will be established prior to diverting stream flow into the new channel. The new channel will be constructed with both riffle and pool habitats. Meanders will be created to mimic the reference channel. Rock substrate will be added to the channel to create habitat for benthic macroinvertebrates and fish. The banks will be constructed to minimize erosion and will be stabilized with native vegetation and the riparian area will be planted with native vegetation. (PA, 1978)

Monitoring will be undertaken for fish and benthic macroinvertebrates once new channel construction is completed. Monitoring will start a minimum of 30 days after watering the new channel. This will allow for sufficient time for colonization by fish and benthic macroinvertebrates. Sampling should be completed upstream of the new channel, within the new channel, and downstream of the new channel. Fish sampling will be completed at each location assuring that similar stream lengths and equal effort are employed at each location. Benthic macroinvertebrates will be collected from riffle habitats.

The restoration goal for the relocated portion of Walker Run is to create habitat in the constructed channel that is similar to the reference condition. Success shall be measured in terms of establishment of fish and benthic macroinvertebrate communities similar to reference sections of Walker Run. These will be measured by comparison with the reference community through the use of biological metrics. The benthic macroinvertebrate community will be evaluated using the PADEP index of biotic integrity (IBI) for freestone streams in Pennsylvania (PADEP, 2008). This IBI consists of a suite of six metrics including Modified Beck's Index, Ephemeroptera, Plecoptera, Trichoptera Taxa Richness, Total Taxa Richness, Shannon Diversity Index, Hilsenhoff Biotic Index, and Percent Intolerant Individuals. The fish community will be evaluated with several metrics that are commonly used in biomonitoring (Barbour, 1999). Potential metrics to be evaluated include total number of fish, number of individuals (density), relative percent composition of species, and proportion of individuals with disease, tumors, fin damage and skeletal anomalies. Additionally, the U.S. Environmental Protection Agency (USEPA) Rapid Bioassessment Protocol (RPB) for habitat assessment will be utilized to assess the created habitats in the new channel. This protocol scores 10 parameters that are effective in evaluating habitat quality in streams. (Barbour, 1999) (PADEP, 2008)

Another long-term impact to streams with watersheds that will be developed on the BBNPP OCA relates to impervious surfaces. Impervious surfaces (e.g. parking lots, sidewalks, buildings) prevent precipitation from infiltrating the soil. Increases in the amount of impervious surface in a watershed can lead to increases in the rate of channel erosion, changes in stream flow (larger and more frequent flood events, decrease in base flow), and changes in water quality. The affect of increasing impervious surface can potentially alter aquatic biota habitat and alter fish (Wang, 2003) and macroinvertebrate communities (Lieb, 2000). These impacts may be evaluated using the aforementioned USEPA RBP for habitat assessment. (Lieb, 2000) (Wang, 2003)

The aquatic community present in the OCA of the abandoned Canal was not sampled, however, it is assumed to be similar to that of Lake Took-a-While since it is connected to the Lake. A warm water fish community is present in Lake Took-a-While that is dominated by stunted bluegill (Ecology III, 2000). Other species include typical lentic species found in many Pennsylvania ponds including black crappie, carp, and largemouth bass. It is unlikely that any rare species occur in the canal. The main impact to the canal will be construction of cofferdams that will be used to temporarily de-water a section of it for placement of the intake and discharge lines. Most likely additional sediments would be transported by runoff into the canal during and after construction. (Ecology III, 2000)

The ditch that drains the canal into the river will be relocated as a part of the construction of the intake structure. The existing channel is essentially a straight, channelized ditch that offers little habitat or natural stream features. The process of relocating the ditch will be similar to the procedure for the aforermentioned Walker Run relocation. The new channel will be created to mimic a natural stream channel with habitat features added for use by aquatic organisms. Once the new channel is stabilized water flow will be diverted into it.

Onsite streams and ponds were described as typical surface water habitats in the area. Headwater streams in general are considered important; however, there is nothing of regional significance about Walker Run. All of the onsite aquatic species mentioned in this section are common in the area. No loss of critical habitat is anticipated.

Although the wetland areas themselves are considered a sensitive and valuable resource, the particular wetlands that will be impacted on site are not substantively distinguishable from other wetland acreage in the vicinity. Discussion of wetlands impacts are treated extensively in Section 4.3.1. Additional details of the specific plants that will be lost in each area are presented in Section 4.3.1. The impact to the wetlands that remain at the BBNPP site may be MODERATE.

Proposed construction activities that will potentially affect onsite water bodies are described in Section 4.2. Due to construction, effects to aquatic ecosystems may result from sedimentation (due to erosion of surface soil) and, to a lesser extent, spills of petroleum products. A report on anthropogenic impacts to stream water quality listed siltation as the primary cause of stream degradation by a wide margin (Waters, 1995). In a 1982 nationwide survey by the U.S. Fish and Wildlife Service on impacts to stream fisheries, sedimentation was named the most important factor (Waters, 1995).

Several groups of aquatic organisms are typically affected by the deposition of sediment in streams: (1) aquatic plants, (2) benthic macroinvertebrates, (3) fish, and (4) periphyton. The effects of excess sediment in streams and rivers, including sediment generated by construction activities, are influenced by particle size. Finer particles may remain suspended, blocking the light needed for primary producer photosynthesis, which could initiate a cascade of subsequent effects (Waters, 1995). Turbidity associated with suspended sediments may reduce photosynthetic activity in both periphyton and rooted aquatic plants. Suspended particles may also interfere with respiration in macroinvertebrates and newly hatched fish, or reduce their feeding efficiency by lowering visibility. Suspended particles may also clog feeding structures for filter-feeding macroinvertebrates (Newcombe 1991). Slightly larger particles fall out of suspension to the stream bed, where they can smother eggs and developing fry, fill interstitial gaps, or degrade the quality of spawning grounds. Larger particles in combination with high flow events can also scour periphyton from substrate and thereby reduce peripyton biomass (Newcombe 1991). As the interstitial spaces in the substrate are filled, habitat quality is decreased for intolerant benthic macroinvertebrates forms such as Ephemeroptera, Plecoptera, and Trichoptera, and more tolerant forms such as oligochaetes and chironomids become dominant (Waters, 1995) (Lemly 1982). Such changes in the benthic community assemblage result in a loss of fish forage, and a subsequent change in fish community functional feeding groups and reduction in fish populations. (Lemly, 1982) (Newcombe, 1991) (Rabeni, 1995) (Waters, 1995)

Construction sites contribute to erosion, which can lead to sedimentation in streams and rivers. Construction-related activities such as excavation, grading for drainage during and after construction, temporary storage of soil piles, and use of heavy machinery all disturb vegetation and expose soil to erosive forces. Reducing the length of time that disturbed soil is exposed to the weather is an effective way of controlling excess erosion and sedimentation.

Preventing onsite erosion by covering disturbed areas with straw or matting is also a preferred method of controlling sedimentation. When erosion cannot be prevented entirely, intercepting and retaining sediment before it reaches a stream is a high priority.

Several measures will be taken to minimize the unavoidable adverse effects to the aquatic ecology. The use of silt fences, temporary and permanent vegetative stabilization, and other soil erosion and sediment control practices will reduce the risk of sediment runoff into intact wetlands adjoining the areas of fill. Bio-retention ditches will be constructed around the periphery of the power block, construction laydown area, cooling tower and switchyard areas to help catch surface runoff and prevent degradation of adjoining terrestrial and aquatic habitats. The ditches will be constructed of base materials that promote infiltration of runoff from low intensity rainfall events. However, for large storms the infiltration capacity of the base materials will be exceeded and the overflow pipes will direct the runoff to the stormwater retention basins. The stormwater retention basins will be unlined impoundments, vegetated with regionally indigenous wetland grasses and herbs, with simple earth-fill closure on the downstream end and will include discharge piping to the adjacent watercourses.

Construction impacts to water resources will be avoided or minimized through best management practices and compliance with NPDES Construction Permit requirements. An Erosion and Sedimentation Control (E&S) Plan which provides explicit specifications to control soil erosion and sediment intrusion into wetlands, streams and waterways will be followed (Pa Code Chapter 102). Applicable Pennsylvania state regulations found at 25 Pa. Code include Chapter 92, National Pollutant Discharge Elimination System; Chapter 93, Water Quality Standards; and Chapter 102, Erosion and Sediment Control. These chapters provide the primary regulatory authority for implementing the federal NPDES requirements within the Commonwealth. Chapter 92 regulations provide for the development and use of individual and general NPDES permits, applications, and Notice of Intent (NOI), and describes the public participation and other requirements. Chapter 93 regulations identify the water quality standards that must be met, including those for special protection waters. Chapter 102 regulations provide the requirements for the development and implementation of Erosion and Sedimentation Control (E&S) Plans for earth disturbance activities. A Preparedness, Prevention, and Contingency (PPC) Plan will be developed to reduce the potential for causing accidental pollution of air, land, and water through accidental release of toxic, hazardous, or other polluting materials.}

4.3.2.2 Impacts to the {Susquehanna River and Offsite Streams}

{The construction footprint in the Susquehanna River will be limited to construction of the CWS Makeup Water Intake Structure and discharge structure, located as shown on Figure 4.3-1. These construction activities are expected to have limited impact to the river. Temporary disturbance to both the river bank and bottom substrate will occur due to construction. Construction may lead to sediment additions to the river from bank disturbance and soil erosion. Other indirect impacts may result from increased sediment loads from Walker Run and Unnamed Tributaries 1, 2, and 3. The impacts of sediment on aquatic communities were discussed in detail in Section 4.3.2.1.

Extensive surveys of the Susquehanna River did not document any important fish species (Section 2.4.2). Fish species observed in the river are year-round residents and common in Pennsylvania. Recreationally important fishes that are abundant in the river include smallmouth bass, walleye, and channel catfish. Construction impacts to recreational fish species will be minimal based on the fact that the areas of impact are not unique to this segment of the river. That is, the areas do not serve a special ecological purpose for fish within this river segment. Two important species of mussels classified as species of special concern by the Pennsylvania Fish and Boat Commission (PFBC) , green floater (Lasmigona subviridis) and yellow lampmussel (Lampsilis cariosa), were collected within the vicinity of the proposed location of the BBNPP intake/discharge structures.

Freshwater mussels, in general, are sensitive to sedimentation effects and proper erosion controls should be employed when working in and along the river. Similar to other filter-feeding macroinvertebrates, excess sediments can lead to disrupted feeding and subsequent decline in health. Large amounts of sediment can also lead to deposition and alteration of the bottom substrate. Mussels within the footprint of disturbance for the intake structure and the diffuser pipe will also be impacted by the physical disturbance of bottom substrate. The exact location of the intake and discharge structures was not surveyed because their locations were not known at the time that the surveys were completed. Instead, sampling was completed in the vicinity (both upstream and downstream) of the approximate BBNPP intake and discharge structures. Renewed coordination with the PFBC will be undertaken prior to initiation of construction of the intake and discharge structures. No unique habitats were identified in the Susquehanna River (Section 2.4.2.2), thus no loss of important habitat will occur as a result of construction of the intake/discharge structures.

Turbidity and sedimentation in the river will be minimized during construction of the intake structure by placement of a cofferdam around the work area. Intake construction will require excavation into the bedrock below streambed elevation. A seepage cutoff structure will be built to allow the construction of the intake structure to occur in dry conditions. The cutoff wall will consist of a circular cofferdam consisting of interlocking sheetpile sections. The cofferdam will be anchored into the bedrock to minimize any under seepage into the excavation and to provide stability against sliding. The diameter of the cofferdams will be designed to provide adequate stability from overturning due to the water load from the river.

The area of the river disturbed by the installation of the cofferdam will be approximately 200 ft (61 m) into the river channel, by 100 ft (30 m) parallel to the shoreline, for a total area of 20,000 ft^2 (1,858 m^2). When the cofferdam is removed some additional area will be disturbed. This total area after construction will be approximately 120 ft (37 m) into the river channel, by 220 ft (67 m) for a total disturbed area of 26,400 ft^2 (2,453 m^2).

After completion of the intake structure, the cofferdams and fill material will be removed to allow the river to flow into the structure. After removal of the cofferdams a temporary increase in sediment in the water column is expected. The cofferdams will not inhibit aquatic organism movement within the river due to the small area affected by construction activity (see Figure 3.4-11).

A similar process will be employed during diffuser pipe installation. The diffuser begins 203 ft (62 m) perpendicularly from the shoreline, and extends 119.5 ft (36 m) into the river channel. The axial distance along the discharge pipeline to the diffuser is approximately 210 ft (64 m). Thus the trench for the pipeline and the diffuser will extend approximately 329.5 ft (100 m), i.e., 210 ft (64 m) plus (+) 119.5 ft (36 m), into the river, and will be approximately 50 ft (15 m) wide. The total disturbed area during construction will be approximately 16,500 ft^2 (1,533 m^2). After installation of the pipe and the riprap protection, the final disturbed area will be slightly narrower, with a disturbed area of approximately 329.5 ft (100 m) by 20 ft (6 m) for a total of 6,600 ft^2 (613 m^2). Construction will result in removal and disruption of river substrate in the immediate vicinity of the diffuser pipe. Temporary increases in suspended sediments in the water column will result during cofferdam installation. After removal of the cofferdams a temporary increase in sediment in the water column is also expected. The cofferdams will not inhibit migration of aquatic organisms within the river due to the small area affected by construction activity.

The river bed in the vicinity of BBNPP site is composed of a coarse sand and gravel mixture which is not expected to produce any significant turbidity during removal of the cofferdams. Blasting should not be necessary since both the intake and discharge structures will be constructed in locations in which only the river bed overburden, not the bedrock, will need to be penetrated. Any disturbed material should settle within a short distance downstream of the intake structure or diffuser pipe.}

4.3.2.3 Impacts on the Transmission Corridor and Offsite Areas

{The new transmission lines at the east side of the site will cross over Beaver Pond, West Building Pond, and the east fork of Walker Run. No new transmission towers will be constructed in any onsite water bodies. No important aquatic species or habitat will be impacted by the transmission corridor.

Transmission line construction will be limited to the onsite construction area. The BBNPP plant switchyard will be electrically interconnected to the 500 kV transmission system via two independent circuits. One circuit will connect the BBNPP plant switchyard to the existing Susquehanna 500 kV switchyard, and a separate circuit to a new substation. Two approximately 1 mi (1.6 km), 500 kV, 4,260 MVA lines on individual towers will be constructed. The transmission lines are needed to convey electric power generated by the BBNPP power block to existing or proposed transmission lines that connect to the regional power grid. Additionally, an existing 230 kV transmission line will be relocated on the site to make way for other plant structures.

The onsite transmission corridors for the BBNPP are within the construction area. The information provided above pertaining to control of erosion and sedimentation applies to streams and wetlands within the transmission corridor.

No incremental effect on aquatic resources beyond what currently occurs within the transmission corridor is expected for the construction of BBNPP.

Only existing or proposed offsite transmission corridors that are unrelated to the project's construction will be used for BBNPP. No existing or proposed transmission corridors in offsite areas will be impacted, since no changes are required that would be related to the project.}

4.3.2.4 Summary

{Construction activities that may cause erosion that could lead to harmful deposition in aquatic water bodies would be (1) of relatively short duration, (2) permitted and overseen by state and federal regulators, and (3) guided by an approved NPDES Construction Permit. Any small spills of construction-related hazardous fluids, such as petroleum products, would be mitigated according to a Preparedness, Prevention, and Contingency Plan. Wetland and stream habitats occur within the area expected to be affected by construction activities; however, no important aquatic species are expected to be affected. Impacts to aquatic communities within the stream, canal, and river from construction will be limited and temporary.

No incremental effect on aquatic resources beyond what currently occurs within the transmission corridor is expected.}

4.3.3 REFERENCES

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Table 4.3-1 {Impacts to Plant Communities and Other Habitats in Acres (Hectares) for Construction of Proposed BBNPP}

Plant Community	Permanent Losses		Temporary Losses		Total Losses	
	Acres	Hectares	Acres	Hectares	Acres	Hectares
Upland Forest	135.1	54.6	38.6	15.6	173.7	70.2
Upland Scrub/Shrub	23.7	9.6	15.0	6.1	38.7	15.6
Old Field/Former Agricultural	112.6	45.5	67.2	27.1	179.8	72.6
Agricultural	43.8	17.7	90.6	36.6	134.4	54.3
Palustrine Forested Wetlands	20.9	8.4	1.3	0.5	22.2	9.0
Palustrine Scrub-Shrub Wetlands	0.7	0.3	0	0.0	0.7	0.3
Palustrine Emergent Wetlands	14	5.7	0	0.0	14	5.7
Total Losses =	351	142	213	86	564	228

Permanent and temporary impacts to wetlands and other regulated waters for construction of transmission line corridors within the OCA, as well as the corridor emcompassing the electrical ducts, raw water, blowdown and deicing lines are currently unknown.

Figure 4.3-1 {BBNPP Owner Controlled Area (OCA) Vegetation Impacts}

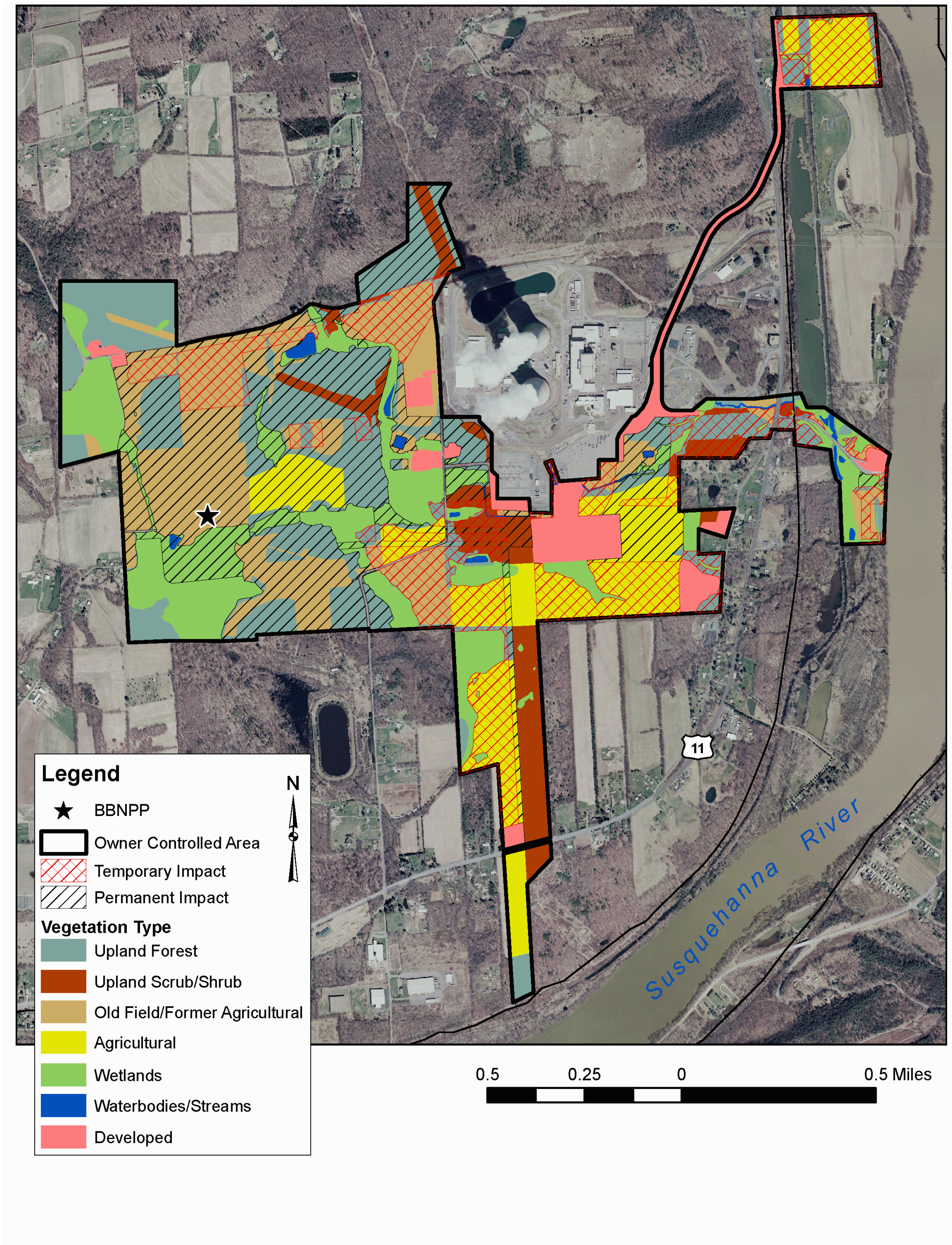
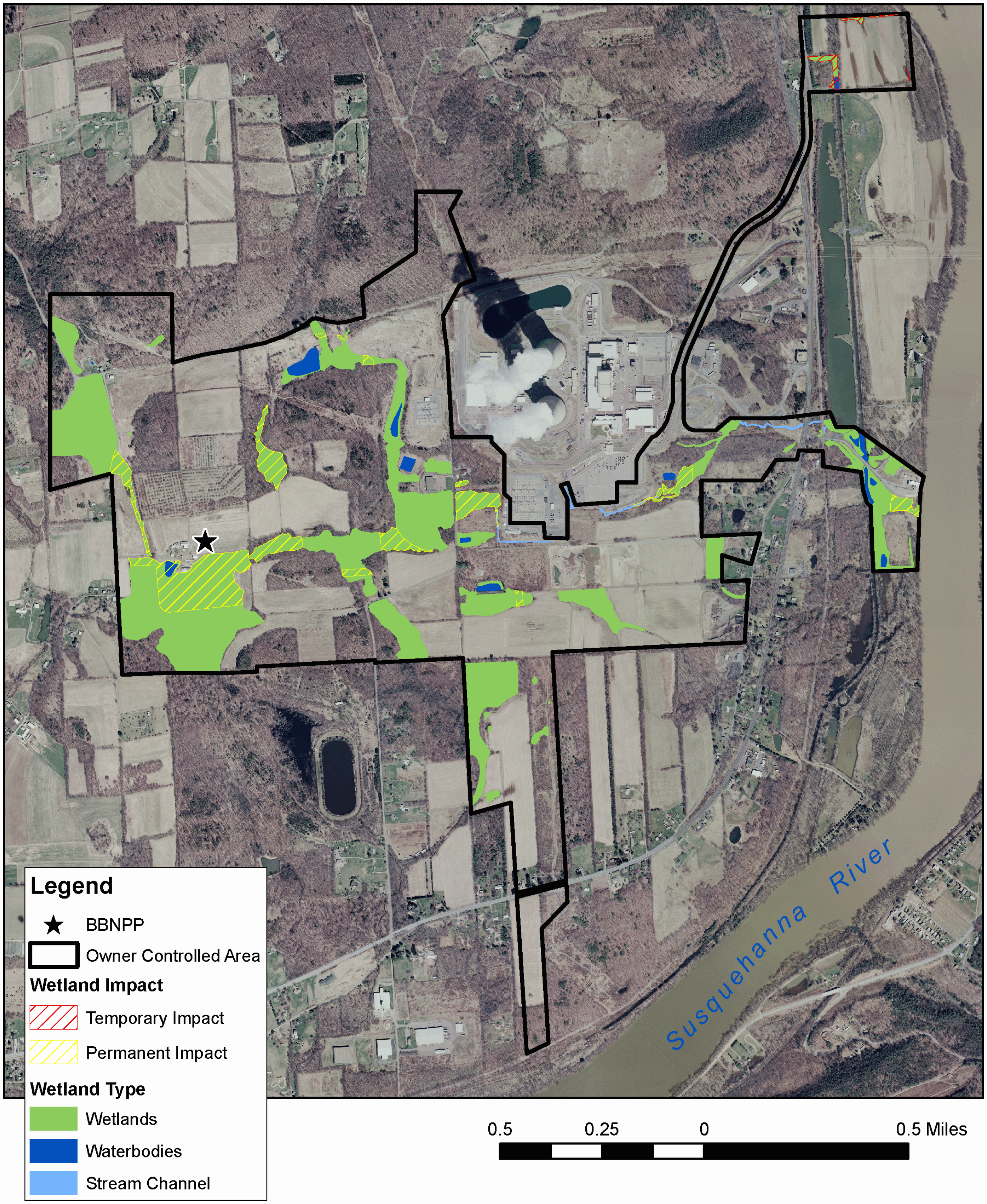


Figure 4.3-2 {BBNPP Wetland Impacts}



4.4 SOCIOECONOMIC IMPACTS

4.4.1 PHYSICAL IMPACTS

Construction activities at the {BBNPP} site will cause temporary and generally localized physical impacts such as increased noise, vehicle exhaust, and dust. This section addresses these potential impacts as they might affect people (the local public and workers), buildings, transportation routes, and the aesthetics of areas located near the plant site.

A description of the {BBNPP} site, location and surrounding community characteristics is provided in Section 2.1, Section 2.2, and Section 2.5. Chapter 3 describes the proposed facility including its external appearance.

{As discussed below, the BBNPP site is located in a rural area, relatively remote from nearby population centers and communities. As a result, the potential for direct physical impacts to the surrounding communities from plant construction is expected to be SMALL.}

4.4.1.1 The Public and Workers

People who work at or live near the {BBNPP} site will be subject to physical impacts resulting from construction activities. Onsite construction workers will be impacted the most, with workers at the existing adjacent operating units subject to slightly reduced, similar impacts. People living or working adjacent to the site will be impacted significantly less due to site access controls and distance from the construction site where most activities will occur. Transient populations and recreational visitors will be impacted the least for similar reasons and the limited exposure to any impacts of construction.

4.4.1.2 Noise

Section 2.7 provides information and data related to the background noise levels that exist at the construction site.

Noise levels in the site area will increase during construction primarily due to the operation of vehicles; earth moving, materials-handling, and impact equipment; and other tools.

Typical noise levels from equipment that is likely to be used during construction are provided in Table 4.4-1 (Beranek, 1971). Onsite noise levels that workers will be exposed to are controlled through appropriate training, personnel protective equipment, periodic health and safety monitoring, and industry good practices. Good practices such as maintenance of noise limiting devices on vehicles and equipment, and controlling access to high noise areas, duration of emission, or shielding high noise sources near their origin will limit the adverse effects of noise on workers. Non-routine activities with potential to adversely impact noise levels such as blasting will be conducted during weekday business hours and utilize good industry practices that further limit adverse effects.

The exposure of the public to adverse effects of noise from construction activities will be reduced at the source by many of the same measures described above and the additional distance, interposing terrain, and vegetation which provide noise attenuation. Pile driving will occur during some construction activities. {Typically, noise generated by construction equipment decreases by approximately 6 dBA for each doubling of distance (Harris, 1979). So, if the maximum noise levels produced by construction are 90 dBA at a reference distance of 50 ft (15 m), then at 100 ft (30 m) that noise level will be reduced to 84 dBA. Because the nearest residence is 1,400 ft

(427 m) away, the noise effects from construction are expected to be at levels that produce a SMALL impact.}

Traffic noise in the local area will increase as additional workers commute, and materials and waste are transported to and from the construction site. Noise impacts will occur primarily during shift changes and will not be extraordinary given the source and nature of vehicle noise and the normally varying nature of transient vehicle noise levels. Additionally, localized impacts will be reduced as distance from the construction site increases and traffic diverges outward.

In summary, good noise control practices on the construction site, and the additional attenuation provided by the distance between the public and the site, will limit noise effects to the public and workers during construction so that its impact will be small and temporary. Construction noise generation is directly linked with the conduct of construction activities which will end as the facility enters operation.

4.4.1.3 Dust and Other Air Emissions

Construction activities will result in increased air emissions. Fugitive dust and fine particulate matter will be generated during earth moving and material handling activities. Vehicles and engine-driven equipment (e.g., generators and compressors) will generate combustion product emissions such as carbon monoxide, oxides of nitrogen, and to a lesser extent, sulfur dioxides. Painting, coating and similar operations will also generate emissions from the use of volatile organic compounds (VOCs).

To limit and mitigate releases, emission-specific strategies, plans and measures will be developed and implemented to ensure compliance within the applicable regulatory limits defined by the primary and secondary National Ambient Air Quality Standards in 40 CFR 50 (CFR, 2007a) and the National Emission Standards for Hazardous Air Pollutants in 40 CFR 61 (CFR, 2007b). Air quality and release permits and operating certificates will be secured where required.

For example, a dust control program will be incorporated into the Storm Water Pollution Prevention Plan. A routine vehicle and equipment inspection and maintenance program will be established to minimize air pollution emissions. {Emissions will be monitored in locations where air emissions could exceed limits (e.g. the concrete batch plant).

The Pennsylvania Department of Labor and Industry (PADOLI) implements occupational health and safety regulations that set limits to protect workers from adverse conditions including emissions of airborne contaminants (PADOLI, 1953). If localized emissions result in limits being exceeded, corrective and protective measures will be implemented to reduce emissions (or otherwise protect workers in some cases) in accordance with the applicable regulations.}

Implementation of controls and limits at the source of emissions on the construction site will result in reduction of impacts offsite. For example, the dust control program will limit dust due to construction activities to the extent that it is not expected to reach site boundaries.

Transportation and other offsite activities will result in emissions due largely to use of vehicles. Activities will generally be conducted on improved surfaces and any related fugitive dust emissions will be minimized. As with noise, impacts will be reduced as distance from the site increases.

In summary, air emission impacts from construction are expected to be SMALL because emissions will be controlled at the sources where practicable, maintained within established regulatory limits that were designed to minimize impacts, and distance between the construction site and the public will limit offsite exposures. Construction air emissions impacts are temporary because they will only occur during the actual use of the specific construction equipment or conduct of specific construction activities, and surfaces will be stabilized upon completion of construction activities.

4.4.1.4 Buildings

{The primary buildings in the immediate area with the potential for impact from construction are the residences located 1,400 ft (427 m) or more to the west and south of the site and those associated with SSES, which is located approximately 5,000 ft (1,524 m) to the east. Related information about historic properties and the impacts of construction on them is provided in Section 2.5.3 and Section 4.1.3.

Many existing SSES onsite buildings related to safety of the existing facility were constructed to meet seismic qualification criteria which make them resistant to the effects of vibration and shock similar to that which could occur during construction. Other SSES onsite facilities were constructed to the appropriate building codes and standards which include consideration of seismic loads. Regardless of the applicable design standard, construction activities will be planned, reviewed, and conducted in a manner that ensures no adverse effect on the operating nuclear units and that SSES buildings are adequately protected from adverse impact.

Construction activities are not expected to affect other offsite buildings due to their distance from the construction site.}

The impact of construction activities on nearby buildings will be SMALL and temporary because of the design of SSES buildings and the administrative programs that will ensure no adverse interaction with the operating units, while offsite buildings are located at distances that isolate them from potential interaction.

4.4.1.5 Transportation Routes

The major transportation routes in the area are described in Section 2.5.1.

{The current Luzerne County highway system contains the major Interstates 80 and 81. Interstate 80, the closest to the proposed plant, runs east-west along the southern end of Luzerne County and is a four-lane divided road built to accommodate large volumes of passenger vehicles and freight transport. These highways provide access to traffic and shipping routes for BBNPP via their intersection with U.S. Highway 11. U.S. Highway 11 is a well maintained two-lane paved road oriented northeast-southwest. Traffic will increase substantially on U.S. Highway 11 during peak construction periods and will be at its greatest during shift changes. Construction workers will use U.S. Highway 11 and Interstates 80 and 81 in the area around the site to commute to work. Additionally, public roadways will be used to transport construction materials and equipment to the site, although most heavy equipment and plant components will be brought in by rail. Impact on area transportation resources will generally decrease with increased distance from the site as various routes are taken by individual vehicles.

A transportation study was performed to identify potential routes, both highway and rail, that could support the shipment of materials for the BBNPP. This study found that significant improvements made to the rail and roadway networks since the 1970's and early 80's are sufficient to ship the necessary construction material(s) to the site. An access road will be built to connect BBNPP with U.S. Highway 11. The existing rail spur will be extended from the existing SSES plant to BBNPP. Use of rail spur during construction is not expected to directly impact traffic flow on U.S. Highway 11 as there are no at-grade rail crossings along this route in the vicinity of BBNPP and SSES. However, rail deliveries would have the potential to create temporary congestion during SSES shift changes because the rail spur crosses access ways that serve SSES. Measures suggested to avoid these impacts included scheduling shipments over the rail spur to avoid shift changes.

An additional study of traffic related to construction activities (KLD, 2008) was performed to assess the impacts on capacity and level of service (LOS) and to identify potential mitigation actions, if needed. The study found that mitigation will be required to maintain an acceptable level of service on U.S. Highway 11 and at nearby intersections. Table 4.4-2 provides the projected levels of service at key intersections (Figure 4.4-1) during construction of BBNPP as compared to the future no-build traffic condition. Measures suggested to mitigate excess construction traffic impacts included installation of signals at the entrance to the BBNPP access road and nearby cross roads, realignment of lanes on U.S. Highway 11 to facilitate entrance to the site, and the provision of additional entrance and exit lanes on the access road at the intersection of U.S. Highway 11.

A water intake pump house along with discharge piping will be constructed for BBNPP. The Circulating Water System (CWS) Makeup Water Intake Structure will be located south of the existing SSES plant intake on the west bank of the Susquehanna River. Construction of the intake and discharge will occupy a portion of the river due to construction of sheetpile cofferdams, but these structures are sufficiently small such that access to upstream and downstream areas by boaters should not be impeded. Furthermore, the cofferdams will be removed prior to operations.

Thus, the potential impacts to the surrounding communities from construction related traffic are expected to be SMALL.}

4.4.1.6 Aesthetics

{The BBNPP will be separated from the currently operating SSES facilities by a distance of approximately 5,000 ft (1,524 m). Construction activities that might affect visual aesthetics will largely be limited to those seen from the new construction access road and from Market Street and Beach Grove Road, which pass to the west and north along the perimeter of the site. Some residential properties located west of the site are expected to experience the most direct aesthetic impacts.

As detailed and illustrated in Section 3.1, the proposed building structures that might impact the aesthetic qualities of the area as they reach the tree line during construction are the reactor building, turbine hall, and the two natural draft cooling towers. Of the buildings listed, the two cooling towers, at approximately 475 ft (145 m) above grade, and the reactor building at 204 ft (62 m) above grade, will be the highest structures. Most other new buildings will not be visible because they will be obscured by the taller structures and will generally exist below the tree line.

Visual impacts of construction are expected to be SMALL, because of the topography that includes forests and rolling terrain, and since the BBNPP site is about a 1 mi (1.6 km) from U.S.

Highway 11 to the east and south. However, to limit and mitigate aesthetic impacts, the following design and layout concepts will be included:

- Locating the new intake structure, pump house, and discharge piping near the existing facilities on the river shoreline.
- Minimizing tree or natural vegetation removal by placing concrete and grassy areas in already cleared areas of the site.
- Minimizing the amount of new road construction.
- Creating an exterior for new structures that is compatible with the color and texture of the surrounding area.
- Where feasible, replanting and reseeding of cleared areas with native trees and vegetation.

The existing 500 kV transmission system and the PJM Interconnection, LLC, planned upgrades being installed independent of BBNPP construction will serve the offsite needs of BBNPP, requiring no new construction of offsite transmission towers. New transmission towers and transmission lines will be constructed onsite to connect BBNPP to the existing SSES 500 kV switchyard and a new 500 kV switchyard to the north of the site. These new lines will be built on land currently owned by SSES and will be consistent with existing onsite facilities.

In summary, aesthetic impacts are expected to be SMALL and temporary, because the BBNPP site is set back from, and only limited portions of the construction will be visible from, publicly accessible areas. Most construction activities will be shielded from public view and construction activities are by nature temporary.}

4.4.1.7 Reference

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PADOLI, 1953. General Safety Law, Act Number 174 (May 18, 1937), P.L. 654, Pennsylvania Department of Labor and Industry, as amended June 28, 1951 and July 13, 1953.}

4.4.2 SOCIAL AND ECONOMIC IMPACTS

{This analysis presents information about the potential impacts to key social and economic characteristics that could arise from the construction of the power plant at the BBNPP site. The analysis was conducted for the 50 mi (80 km) comparative geographic area and for the region of influence (ROI), Luzerne County and Columbia County, Pennsylvania, where appropriate and as described in Section 2.5.2.} The discussion focuses on potential impacts to population settlement patterns, housing, employment and income, tax revenue generation, and public services and facilities.

4.4.2.1 Study Methods

{Changes in regional employment can result in impacts to the region's social and economic systems. An estimate of direct full-time equivalent (FTE) personnel that would be needed to construct the new unit was determined and is provided in Table 4.4-3. "Direct" jobs are those new construction employment positions that would be located on the BBNPP site. "Indirect jobs" are positions created off of the BBNPP site as a result of the purchases of construction materials and equipment, and the new direct workers' spending patterns in the ROI. Examples of indirect jobs that could be generated include carpenters and other construction jobs, barbers, restaurant personnel, gas station and auto repairs jobs, convenience store cashiers, dry cleaning and laundry jobs, and so forth.

To estimate indirect employment that would be generated by construction of the power plant, a regional multiplier was generated by the RIMS II software and provided by the Regional Economic Analysis Division of the U. S. Bureau of Economic Analysis (BEA, 2008). This model, based upon the construction industry in the ROI, generated a multiplier of 1.3866 indirect jobs created for each direct job. This multiplier was then applied to the estimated peak number of new direct FTE workers to estimate the peak number of indirect jobs that will be created in the ROI.

This analysis evaluates two potential in-migration impact scenarios for the construction workforce: an assumed 20% of the peak construction workforce moving into the ROI with their families for the duration of construction; and a second scenario with 35% moving into the ROI. These scenarios were selected because they are representative of the range of in-migration levels that the NRC found in studies they conducted in 1981 of nuclear power plant construction workforces. The NRC (NRC, 1981) conducted a study of 28 surveys of construction workforce characteristics for 13 nuclear power plants. They found that 17% to 34% of the total construction workforces at most of these nuclear power plants (the 75th percentile) had moved their families into the study areas for each power plant.

They then conducted a more detailed analysis of in-migrants and found that the most common in-migration levels (again for the 75th percentile) for the construction/labor portion of the workforce ranged from 11% to 29%. Additionally, an analysis of the craft labor portion of the workforce showed that pipefitters, electricians, iron workers, boilermakers, and operating engineers were the most likely non-managerial staff to in-migrate into an area, and general laborers, carpenters, and other types of construction workers were the least likely to in-migrate (NRC, 1981).

For managerial and clerical staff the in-migration levels ranged from 40% to 58%. Of the managerial staff alone (i.e., excluding clerical staff), most sites had in-migration rates of 58% to 76% (NRC, 1981).

The potential demographic, housing, and public services and facilities impacts are only discussed for the two-county region of influence, because those impacts are an integral part of, and derive from the impacts of, the in-migrating construction workforce. Impacts to employment and tax revenues are discussed for the 50 mi (80 km) comparative geographic area and the ROI, because of the construction labor pool that would be drawn from, and the collection and distribution of income and sales tax revenues throughout, the state.}

4.4.2.2 Construction Labor Force Needs, Composition and Estimates

4.4.2.2.1 Labor Force Availability and Potential Composition

{There would be an estimated maximum 3,950-FTE person workforce constructing the BBNPP power plant from 2012 to 2018, representing a significant increase in the overall employment opportunities for construction workers. In comparison, Luzerne County had 8,164 construction jobs in 2006 and Columbia County had 2,134 construction jobs (USCB, 2006). As shown in Table 4.4-3, this peak is estimated to last for about 12 months, from about the third quarter of the fourth year of construction through about the second quarter of the fifth year. Over the course of the entire construction period, staffing needs are estimated to increase relatively steadily from the third quarter of the first year until the peak is reached. Once the peak has passed, the staff levels again would drop steadily until the last 5 months of construction, when employment levels would drop significantly.

Relatively recent studies have shown that the availability of qualified workers to construct the power plant might be an issue, particularly if several nuclear power plants are built concurrently nationwide. Competition for this labor could increase the size of the geographic area, beyond the middle eastern seaboard, from which the direct construction labor force would have to be drawn for BBNPP. In its study of the construction labor pool for nuclear power plants, the U.S. Department of Energy (DOE, 2004a) stated that, "A shortage of qualified labor appears to be a looming problem…The availability of labor for new nuclear power plant construction in the U.S. is a significant concern."

These workforce restrictions are most likely to occur with "managers, who tend to be older and close to retirement, and skilled workers in high-demand, high-tech jobs." The Department of Energy (DOE, 2005) anticipates that qualified boilermakers, pipefitters, electricians, and ironworkers might be in short supply in some local labor markets. Labor force restrictions can be exacerbated by the fact that portions of the labor force might have to have special certifications for the type of work that they are doing, and because they might have to pass NRC background checks (DOE, 2004a). DOE also found that, "recruiting for some nuclear specialists (e.g., health physicists, radiation protection technicians, nuclear QA engineers/technicians, welders with nuclear certification, etc.) may be more difficult due to the limited number of qualified people within these fields" (DOE, 2004b). However, meeting these needs can be accomplished by hiring traveling crafts workers from other jurisdictions or regions of the country, which is a typical practice in the construction industry.

Estimates about the composition of the BBNPP construction workforce (i.e., types of personnel needed) have not been developed for the power plant. However, existing studies of other nuclear power plant construction sites provide an indication about the potential composition of the BBNPP construction workforce. As shown in Table 4.4-4 (DOE, 2005), during the peak construction period an estimated 67% (2,635) of the construction workforce could be craft labor. Other less prevalent construction personnel could include about 8% (328) of BBNPP's operation and maintenance staff, 7% (265) site indirect labor, and 6% (229) Nuclear Steam Supply System vendor and subcontractor personnel.

In reviewing only the potential craft labor force component of the entire construction workforce as provided in Table 4.4-5 (DOE, 2005), the greatest levels of employment during the peak of construction could be about 18% (474) electricians and instrument fitters, 18% (474) iron workers, 17% (448) pipefitters, 10% (264) carpenters, and 10% (264) of general laborers.

Table 4.4-6 shows the percentage of each of these craft labor categories that would be needed during seven phases of construction. Carpenters, general laborers, and iron workers would comprise the greatest proportions of the workforce during the concrete formwork, rebar installation, and concrete pouring phase of construction. Iron workers would continue to constitute the greatest portion of the workforce during the installation of structural steel and miscellaneous iron work. General laborers and operating engineers would be most needed during the earthwork and clearing of the site, including excavation and backfilling. The installation of mechanical equipment would primarily require pipefitters and millwrights. Pipefitters would also be the primary craft labor category working during installation of piping. Electricians would be the most prevalent during installation of the power plant instrumentation and the electrical systems (GIF, 2005).}

4.4.2.3 Demography

{As state above, it is estimated that a peak of 3,950 FTE employees would be required to construct BBNPP. As shown in Table 4.4-7 under the 20% in-migration scenario, an estimated peak of 688 construction workers would migrate into the ROI along with about 1,018 family members, for a total of 1,706. Of these, the total estimated direct in-migration would be about 829 people (48.6%) into Luzerne County and 878 people (51.4%) into Columbia County. As shown in Table 4.4-8 under the 35% in-migration scenario, an estimated peak of 1,204 direct workers would migrate into the ROI along with about 1,782 family members, for a total of 2,986 people. Of these, the total estimated direct peak in-migration would be about 1,450 people (48.6%) into Luzerne County and 1,536 people (51.4%) into Columbia County.

In addition, it is estimated that a maximum of 954 indirect jobs would be created within the ROI under the 20% scenario and 1,670 indirect workforce jobs would be created under the 35% scenario (multiplying 3,440 ROI peak direct workers by the BEA indirect employment/economic multiplier of 1.3866, (BEA, 2008)). An estimated 532 to 930 indirect jobs located within the ROI could be filled by the spouses and other family members of the direct workforce. The remaining 423 to 739 indirect jobs likely would be filled by existing unemployed residents, a maximum of 7.0% of the 10,491 unemployed within the ROI in 2006, underemployed area residents, or new in-migrants. If all of these remaining indirect jobs were filled by new in-migrants, it would only represent 278 to 486 households with 688 to 1,205 people.

A maximum potential in-migration, assuming all indirect workers in-migrate, of up to 2,395 people into the ROI under the 20% scenario, or up to 4,191 people under the 35% scenario, would only represent a 0.6% to 1.1% increase in the total ROI population of 378,034 people in 2006. Table 4.4-9 shows the cumulative workforces that would be accessing the BBNPP site on a daily basis as well as the surrounding ROI during normal SSES operations, planned outages, and construction of the BBNPP facility. Because these percentage changes are small, it is concluded that the impacts to population levels in the ROI would be SMALL, and would not require mitigation.

A search was conducted for the presence of other nuclear power plants within 100 mi (160 km) of the BBNPP site. Figure 4.4-2 shows the resulting locations. The figure contains four overlapping zones each with 50 mi (80 km) radii. The zones include as their centers the surrounding nuclear power plant sites. The other power plants include SSES Units 1 and 2 to the east, Limerick Units 1 and 2 to the southeast, Peach Bottom Units 2 and 3 to the south, and Three Mile Island Unit 1 to the southwest. As can be seen in the figure, the BBNPP site's 50 mi (80 km) radius overlaps slightly with the 50 mi (80 km) zones of each of these facilities. The cumulative effect of a proportion of the construction workforce originating from within 50 mi (80 km) of BBNPP and potentially drawing employees from these other four power plants, or adding significantly to the total employment levels for these types of facilities in these areas, would be SMALL, and would not require mitigation.}

4.4.2.4 Housing

{The in-migrating construction workforce would likely either rent or purchase existing homes, or would rent apartments and townhouses. Non-migrating (i.e., weekly or monthly) workers would likely stay in area hotels, motels, bed and breakfasts (B&Bs), or at area campgrounds and recreational vehicle (RV) parks. Of the estimated maximum 966 direct and indirect households migrating into the ROI to construct BBNPP under the 20% scenario, and the 1,690 households in the 35% scenario, it is estimated that 429 to 821 households (42%) would reside in Luzerne County and 497 to 869 (45%) would reside in Columbia County. This would represent a maximum of 5.7% to 10.0% of the 16,817 total housing units vacant in the ROI in 2000. It would represent 4.6% to 8.1% of the 20,796 units vacant in 2006. Thus, the ROI, and each county within it, have enough housing units available to meet the needs of the workforce, based upon 2000 and 2006 housing information.

An example of what housing impacts could occur is provided by the construction of the original SSES units. Construction of the original SSES units resulted in the modular home developments along Route 93 toward Orangeville, in Salem Township, and in Berwick. Additional development occurred in the Hazleton/Conyngham Valley and the Wilkes-Barre/Scranton areas. Much of the management and engineering teams moved to the area for relatively long periods of time. More temporary housing that was utilized by some of the construction workforce included motels, located from Benton to Bloomsburg, and camping. In some cases, such as with the members of the electricians union, workers commuted in groups of 12 or more people to the site each day. Many of the pipefitters likely originated and commuted from the Philadelphia area on a weekly basis.

In addition to the above housing units, there are a total of 68 apartment and townhouse complexes providing one to three bedroom rental units in the ROI. Most of these facilities are located in Luzerne County, including 50 apartment and townhouse complexes. These rental complexes could be used to house part of the in-migrating workforce and might be a viable option to purchasing more costly single-family homes.

Weekly or monthly commuters might elect to stay at one of the 96 hotels/motels/B&Bs facilities, providing about 3,674 rooms for rent in the ROI. Luzerne County has 49 hotel/motel facilities with 2,353 rooms and Columbia County has 47 facilities with 1,321 rooms. Because the hotels and motels are operating at or near capacity during the summer vacation season, from about April through August (see Section 2.5.2), the portions of the workforce that might want to stay on a weekly or monthly basis and then commute home might compete with existing users. During the remainder of the year, enough units would likely be available to meet the needs of the weekly or monthly commuters.

Because significantly more housing units are available than would be needed, the in-migrating workforce alone should not result in an increase in the demand for housing, or in increases in housing prices or rental rates. Also, construction is not scheduled to begin until 2012, providing adequate time for private developers to construct additional new homes and apartment complexes if the economy in the ROI expands, in general, and demand warrants it. In addition, for about seven months out of the year there are noticeable quantities of vacant motel and hotel units that could be used by weekly and monthly commuters. Thus, because of the available housing, it is concluded that the impacts to area housing would be SMALL, and would not require mitigation.}

4.4.2.5 Employment and Income

4.4.2.5.1 50 mi (80 km) Comparative Geographic Area

{As stated above, it is estimated that a peak of 3,950 direct construction employees would build BBNPP. Under the 20% peak in-migration scenario described above, it is implicit that the remaining 80% (3,160) either would be commuting from a reasonable distance on a daily basis or would stay at area hotels/motels and would be weekly/monthly commuters to the job site. Under the 35% in-migration scenario, an estimated 65% (2,570) of the peak direct construction workers would be daily or weekly/monthly commuters. The greatest proportion of these workers would likely commute from within or near the Scranton, Pittsburgh, and Philadelphia, Pennsylvania areas; New York, New York metropolitan area; Baltimore, Maryland, and Washington D.C. metropolitan areas. However, a portion of these workers also would likely originate from throughout the northeastern and the remainder of the U.S. The greater the distance that they would commute, and the longer that they are employed on the construction site, the more likely they would be to commute from home on a weekly or monthly basis and stay in area motels, or become in-migrants into the ROI, as described in the housing section above. Because the employment opportunities and income would be spread over the 50 mi (80 km) radius, and an even larger geographic area and basis of comparison outside of the region, the beneficial impacts would be SMALL and would not require mitigation.}

4.4.2.5.2 {Two-County} Region of Influence

{Direct construction workforce employment is already discussed in the demography section above. In addition to the 3,950 direct workforce, a peak of 954 indirect workforce jobs would be created in the ROI under the 20% scenario and 1,670 indirect jobs would be created under the 35% scenario (Table 4.4-7 and Table 4.4-8). This would result in a peak increase of 1,642 to 2,874 employed people in the ROI, depending upon the scenario selected. The peak increase in employment would range from 797 to 1,396 people in Luzerne County and 845 to 1,478 people in Columbia County. Unemployed or underemployed members of the labor force could benefit from these increased employment opportunities, to the extent that they have the craft skills required (e.g., laborers, carpenters, electricians, plumbers, welders) and are hired as part of the construction workforce. These increases would result in a noticeable but small impact to the area economy, representing a maximum 0.9% increase in the 151,869 total labor force in Luzerne County in 2000 and 4.6% in the 32,403 total labor force in Columbia County (USCB, 2000).

It is estimated that the direct construction workforce would receive average salaries of $34.00/hour/worker (two-thirds of the estimated $50 per hour, including benefits), or about $70,720 annually. This would result in an annual salary expenditure, for the peak construction workforce of 3,950 people, of $279.3 million. The average annual salary for the direct workforce would be significantly more than the $52,370 mean earnings in Luzerne County in 2006 and the $48,437 mean earnings in Columbia County. Based upon the peak 35% scenario in-migration levels, Luzerne County would experience an estimated $41.4 million increase in annual income during peak construction and Columbia County would receive an estimated $43.8 million annually. In addition, the working spouses of the direct construction workers, who filled indirect jobs created by the power plant, would contribute substantially to individual household incomes. Assuming that the average indirect worker earned $52,370 annually, the average earnings in Luzerne County in 2006, the 954 indirect workers under the 20% scenario would generate $50 million in additional annual salaries within the ROI, and the 1,670 indirect workers under the 35% scenario would generate $87.4 million in additional annual salaries. The additional direct and indirect workforce income would result in additional expenditures and economic activity in the ROI. Construction of SSES was noted to have benefitted restaurants; car dealerships; golf courses/ clubs; sand, gravel, and aggregate businesses; firms providing nitrogen and oxygen gases; lumber suppliers; and other similar businesses. Because of the overall significant number of construction and indirect jobs that would be created, existing lower income levels found in the ROI, and the general out-migration occurring (an indicator of lower economic opportunity), the beneficial impacts to employment and income from construction of the BBNPP facility would be MODERATE, and would not require mitigation.}

4.4.2.6 Tax Revenue Generation

4.4.2.6.1 50 mi (80 km) Comparative Geographic Area

{State income taxes would be generated by the in-migrating residents, although the amount cannot be estimated because of the variability of investment income, retirement contributions, tax deductions taken, applicable tax brackets, and other factors. It is estimated that the 50 mi (80 km) radius and the state, excluding the two county ROI, would experience a $230.7 million increase in annual wages from the direct workforce under the 20% scenario (i.e., 80% of the construction workforce in the 50 mi (80 km) area) and $194.2 million under the 35% scenario (i.e., 65% of the construction workforce in the 50 mi (80 km) area). Relative to the existing total wages for the region and the 50 mi (80 km) radius, it is concluded that the potential increase in state income taxes represent a SMALL economic benefit.

Additional sales taxes also would be generated by the power plant and the in-migrating residents. PPL Bell Bend, LLC, would directly purchase materials, equipment, and outside services, which would generate additional state sales taxes. Also, in-migrating residents would generate additional sales tax revenues from their daily purchases. The amount of increased sales tax revenues generated by the in-migrating residents would depend upon their retail purchasing patterns, but would only represent a SMALL benefit to this revenue stream for the region and the 50 mi (80 km) radius.

Overall, although all tax revenues generated by the BBNPP and the related workforce would be substantial in absolute dollars, as described above, they would be relatively small compared to the overall tax base in the region and the Commonwealth of Pennsylvania. Thus, it is concluded that the overall beneficial impacts to state tax revenues would be SMALL.}

4.4.2.6.2 {Two-County} Region of Influence

{In 2008, PPL Susquehanna, LLC, paid approximately $1.2 million in real estate taxes to Luzerne County for SSES Units 1 and 2 and surrounding properties. PPL Susquehanna, LLC, also paid approximately $2.7 million in real estate taxes to the Berwick School District. In 2008, PPL Bell Bend, LLC, will generate approximately $30,000 in total property taxes in its current, substantially undeveloped state. Based on a countywide property reassessment in 2008, the 2009 real estate taxes are expected to increase significantly on these properties. Additional real estate tax increases are expected once BBNPP secures the approvals for the required rezoning for the properties that will make up the BBNPP site. Taxes will also escalate during the time frame between the commencement of construction and commercial operation of the plant in 2018. Those increases will be based on the reassessed value determined by the County Assessor based on the percentage of work completed. It is anticipated that these reassessments will occur annually until construction is complete, at which time a final assessment will be determined. This total property tax paid during construction will represent a significant increase in revenues for Salem Township, the Berwick Area School District, and Luzerne Country.

These increased property tax revenues would either provide additional revenues for existing public facility and service needs or for new needs generated by the power plant and associated workforce. The increased revenues could also help to maintain or reduce future taxes paid by existing non-project related businesses and residents, to the extent that project-related payments provide tax revenues that exceed the public facility and service needs created by BBNPP. However, the payment of those taxes often lags behind the actual impacts to public facilities and services, or the time needed to plan for and provide the additional facilities or services. Thus, it is concluded that these increased power plant property tax revenues would be a LARGE economic benefit to Luzerne County.

Additional state and local income taxes would be generated by the in-migrating residents, although the amount cannot be estimated because of the variability of investment income, retirement contributions, tax deductions taken, applicable tax brackets, and other factors. It is estimated that Luzerne County would experience a $41.4 million increase in annual wages from the direct workforce. Columbia County would experience an estimated annual increase of $43.8 million from the direct workforce. Relative to the existing total wages for the ROI, it is concluded that the potential increase in income taxes represent a SMALL economic benefit to the jurisdictions.

As with the 50 mi (80 km) comparative geographic area, additional sales taxes also would be generated within the ROI by the power plant and the in-migrating residents. However, these purchases would be much smaller within the ROI. The amount of increased sales tax revenues generated by the in-migrating residents would depend upon their retail purchasing patterns, but would only represent a small benefit to this revenue stream for the Commonwealth of Pennsylvania.

Overall, although all tax revenues generated by the BBNPP and the related workforce would be substantial, as described above, they would be relatively small compared to the overall tax base in the ROI. Thus, it is concluded that the overall beneficial impacts to tax revenues would be SMALL.}

4.4.2.7 Land Values

{Studies have found varying impacts to residential and commercial land values for facilities that are visible and have greater perceived risks such as nuclear power plant sites, potentially less visible but also greater perceived risks of contaminated and brownfield sites, highly visible but lower perceived risk sites such as transmission lines, and for highly visible but low perceived human risk sites such as windfarm energy facilities.

Other studies of potential impacts to property values have had varied results, depending on the type of facility being studied, including facilities that are more visible and could have greater risks such as nuclear power plants, facilities that are potentially less visible but also have greater risks such as landfills and hazardous waste sites, and highly visible facilities but with potentially less perceived risk such as electrical transmission lines and windfarm facilities. For instance, a Maryland Department of Natural Resources (MDNR, 2006) study of the effects of large industrial facilities showed that residential property values were not adversely affected by their proximity to the Calvert Cliffs Nuclear Power Plant site. Overall, Maryland power plants have not been observed to have negative impacts on surrounding property values (MDNR, 2006). Similarly, studies of the property value impacts of the Three Mile Island nuclear power plant accident showed that nearby residences were not significantly affected by the accident.

However, studies of the impacts to residential property values from low-level radioactive waste landfills in Ohio, from leaks at a nuclear facility in Ohio, and along potential nuclear shipment routes in Nevada show that these facilities and activities have a negative impact on housing values within a limited distance from the facility, typically within 3 miles. Even within this limited distance, the impacts on property values decrease rather quickly as one gets farther from the facility.

Evaluations of potentially less visible but also perceived greater risk facilities such as hazardous waste and Superfund sites (e.g., underground storage tanks, existing and former manufacturing facilities, and so forth) generally show similar results. A study of underground storage tanks in Ohio showed that proximity to non-leaking or unregistered leaking tanks did not affect property values, but registered leaking tanks affected property values within 300 feet of the sites. Studies of Superfund sites in Ohio, Texas, Pennsylvania, and the southeastern U.S. showed that property values were negatively affected by the facilities. The negative impacts were particularly noticeable during periods with significant media coverage and public concern, with the properties close to the facilities most affected. Again, the greater the distance from the facilities, the less the impacts on property values. Also, once there was a reduction in media attention and public concern, or after site cleanup, property values sometimes recovered from their losses. Similar results were found for landfills in Ohio and Maryland.

Electrical transmission lines and windfarm facilities can be highly visible but might have a smaller perceived risk to area residents than nuclear and hazardous waste facilities. Although three early studies found that tall electrical transmission lines did not affect nearby residential or agricultural property values, later studies showed that they did have a negative effect on property values. The most common reason given by one study was the visual impact of the transmission line, followed by the perceived health risk (Blinder, 1979) (Delaney and Timmons, 1992). One study (Colwell, 1990) showed that over time the negative impacts to property values decreased, indicating a reduced concern about the facilities.

Studies of potential impacts to property values from windfarm facilities have had mixed results. A study of an existing windfarm in New York and a potential windfarm facility in Illinois showed that there was no impact to nearby residential property values. However, another study of impacts at existing facilities showed that property values increased faster near the facilities than in control areas, likely because of the perception that they represented "green" benefits to the environment.

Overall, these studies show that the impacts of various types of facilities can have a negative impact on residential property values, typically within 1 to 3 miles (1.6 to 5 km) of a facility. However, they also show that the impacts might be less where other facilities already exist, and over time these negative impacts could decrease. The three property owners that live within as little as 1,400 feet (426 m) from the proposed BBNPP facility would likely see reduced property values. However, because there is an existing nuclear power plant next to the BBNPP site, it has been there for a number of years, and most residents and recreational users are located 1 mi

(1.6 km) or more away from the site, the overall impacts to land values likely would be minimal and not require mitigation. Thus, overall, it is concluded that the impacts to land values would be SMALL, and would not require mitigation.}

4.4.2.8 Public Services

{Although an increase in population levels from the BBNPP construction workforces could place additional demands on area doctors and hospitals, with nine hospitals in Luzerne County and another two hospitals in Columbia County (Section 2.5.2) it appears that the two county ROI has enough capacity to accommodate the increased demand, and impacts from construction of the BBNPP facility would likely be SMALL. No impacts would occur to area political and social structures. However, the increased population levels could place some additional daily demands on constrained police services, fire suppression and EMS services, and schools. Impacts to these services are discussed below. As shown in Section 2.5.1, population levels in the ROI without the BBNPP project are estimated to decline by 11,928 people from 2000 to 2010, and another 6,727 people from 2010 to 2020, thus somewhat reducing the need for public services. This loss of population would be offset somewhat by the potential total direct and indirect in-migration of 2,395 people into the ROI for the 20% scenario and 4,191 people into the ROI for the 35% scenario for construction of BBNPP. Also, because the addition of BBNPP-related population is so much less than the general projected out-migration of population, there should still be an overall reduced need for public services. Thus, these services should have enough capacity to accommodate the increased demand and impacts would likely be SMALL.

<u>Police</u>

The Luzerne County Sheriffs Office and 37 other police departments in the county may not have sufficient staff levels to simultaneously respond to a potential emergency and offsite evacuation in the event of an emergency. The departments might need additional funding, staff, facilities, and equipment. For instance, a representative of the Salem Township Police Department suggested that the construction of the BBNPP would require the addition of equipment and response materials particular to the facility. Additional staff may be required, particularly to address traffic concerns.

<u>EMS and Fire Suppression Services</u>

Luzerne County has 68 career and volunteer fire departments with 87 fire stations and 2,391 active firefighters, and Columbia County has 23 fire departments with 27 stations and 967 active firefighters. Thus, both jurisdictions appear to be doing an excellent job of meeting the needs of their residents. For instance, a representative from the Salem Township Volunteer Fire Company suggested that the department is able to serve the needs of their residents, but felt that additional volunteers are always needed, regardless of the introduction of new facilities. He also felt that improvements to ensure that the building is capable of handling new types of equipment also are necessary. A representative of the Berwick Fire Department, however, expressed some concerns regarding truck traffic carrying hazardous substances to the site because of an incident that occurred in July of 2008. Construction of the power plant generally would create additional needs beyond those that already exist. In addition, Emergency Management office staff would be affected by having to conduct emergency planning activities for the new power plant.

These fire and emergency response departments would be supplemented by a BBNPP onsite emergency response team, which would include a fire brigade. The BBNPP staff will also include an onsite emergency response team and emergency medical technician (EMT) responders. An emergency management plan will be developed for BBNPP, similar to that which already exists for SSES Units 1 and 2, that would address PPL Bell Bend, LLC and agency responsibilities, reporting procedures, actions to be taken, and other items should an emergency occur at BBNPP.

Existing fire and law enforcement services in Luzerne County and Columbia County appear to be adequate to meet current daily needs within their jurisdictions. As described in Section 4.4.2.6 above, the significant new tax revenues generated in Luzerne County by construction of BBNPP would provide additional funding to expand or improve services and equipment to meet the additional daily demands created by the plant. Columbia County would also experience increased revenues from construction of the power plant, but to a much lesser extent. However, some departments still might not have enough staff and equipment to respond to an emergency situation, including offsite evacuation. Although the BBNPP facility would somewhat increase the need for these services, additional tax funds would be available to pay for these needs. Thus, it is concluded that there would be a SMALL impact on the fire and law enforcement departments and additional mitigation would not be required.

Educational System

As described above, an estimated 469 to 821 new households would in-migrate into Luzerne County for construction of BBNPP. It is estimated that these new households would have a maximum of 259 to 453 children, assuming in-migration of the entire indirect workforce, with most of them likely to be school aged (assuming 0.48 children per household). This would represent an increase of 1.1% to 2.0% in the 42,000 students enrolled in the county during 2005-2006. The increased annual real estate taxes (Section 4.4.2.6.2) that would be paid to Luzerne County and the Berwick Area School district during construction of BBNPP would provide additional funds to meet the educational needs of children for the in-migrating construction workforce. If enrollment levels were to increase as a result of constructing the power plant, the district might seek assistance in recruiting additional teachers and could install modular classrooms. A representative of the Berwick Area School District confirmed that capital investments related to infrastructure might not be needed. Because the percentage increase is not great and additional tax revenues would provide funding to meet new project-related impacts to the school system and the Berwick Area School District, it is estimated that the impacts would be SMALL, and would not require additional mitigation.

The in-migration of an estimated 497 to 869 new households into the Columbia County from construction of the BBNPP could place greater demands on the Columbia County public school system. It is estimated that these new households would have a maximum of 274 to 480 children, assuming in-migration of the entire indirect workforce, with most of them likely to be school aged (assuming 0.48 children per household). This would represent an increase of 4.6% to 8.0% in the 10,800 students enrolled in the county during 2005-2006. Although the school district would receive some additional funding from real estate taxes generated by these new households (likely to be minimal because adequate housing units are already available in the county and those units are already being taxed), it would not receive additional funding directly from the power plant because BBNPP does not pay property taxes to Columbia County. Because there would be some additional demands placed on the Columbia County Public School System, the impacts of the power plant would be MODERATE and some additional mitigation might be required.}

4.4.2.9 Public Facilities

{As discussed above, there is a sufficient quantity of vacant housing units in Luzerne County and Columbia County to meet the housing needs of the in-migrating direct construction workforce for BBNPP, so no new housing units would likely be required. The excess capacity in the water and sewage services and the lack of new construction resulting from the power plant would result in no effects to those services. Although an increase in the population would likely place additional demands on area recreational facilities, the facilities appear to have enough capacity to accommodate the increased demand and impacts would likely be SMALL. Area highways, roads, and schools would have increased use levels resulting in MODERATE impacts. These impacts are described in Section 4.4.1.}

4.4.2.10 References

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4.4.3 ENVIRONMENTAL JUSTICE IMPACTS

This section describes the potential disproportionate adverse socioeconomic, cultural, environmental, and other impacts that construction of {BBNPP} could have on low income and minority populations within two geographic areas. The first geographic areas is a 50 mi (80 km) radius of the {BBNPP} power plant, where there is a potential for disproportionate employment, income, and radiological impacts, compared to the general population (NRC, 1999). This analysis also evaluates potential impacts within the region of influence (ROI), most of which is encompassed within a 20 mi (32 km) radius of the power plant site, where more localized potential additional impacts could occur to transportation/traffic, aesthetics, recreation, and other resources, compared to the general population. It also highlights the degree to which each of these populations would disproportionately benefit from construction of the proposed power plant, again compared to the entire population is also discussed.

Section 2.5.1 provides details about the general population characteristics of the study area. Section 2.5.4 provides details about the number and locations of minority and low income populations within a 50 mi (80 km) radius of the {BBNPP} site, and {their related reliance on subsistence uses.}

4.4.3.1 Minority and Low Income Populations and Activities

{Luzerne County and Columbia County have been defined as the ROI because 87% of the current SSES Units 1 and 2 operational workforce resides there, and it is assumed that the in-migration construction workforce for BBNPP would also primarily reside in and impact this geographic area.

Because the power plant site is currently located on lands owned by SSES, and onsite access to these lands is restricted, no minority or low income residences would be removed or relocated within the ROI. Additionally, the distance of the plant from area residents, in general, is great enough so that these populations would only be affected minimally by construction of the power plant (i.e., noise, air quality, and other disturbances from the footprint of the facility)}

4.4.3.1.1 50 Mile (80 km) Comparative Geographic Area

<u>Employment and Income</u>

{There would be an estimated maximum 3,950 person workforce constructing the BBNPP power plant from 2012 to 2018, representing a minor increase in the overall employment opportunities for construction workers in: the 50 mi (80 km) comparative geographic area, in which there are a total of 79,804 construction workers in the 22 county area in 2000 (USCB, 2000a); and the state, where a total of 339,363 construction workers were employed in 2000 (USCB, 2000a). Unemployed or underemployed members of minority and low income groups could benefit from increased employment opportunities, to the extent that they have the craft skills required (e.g., laborers, carpenters, electricians, plumbers, welders), are hired as part of the construction workforce, and have adequate transportation to access the construction site.

The greatest concentrations of minority populations within the comparative geographic area, but outside of the ROI, primarily reside toward the edges of the 50 mi (80 km) radius in: Lehigh County (located southeast of the BBNPP site with 54 aggregate minority census blocks); Lycoming County (located west-northwest of the BBNPP site with 8 aggregate groups); and Monroe County (located east of the BBNPP site with 6 aggregate groups). Similarly, the greatest concentrations of low income populations are located in: Lehigh County (13 census block groups); Lycoming County (9 census block groups); Monroe County (9 census block groups); Lackawanna County (located toward the edge of the 50 mi (80 km) radius northeast of the BBNPP site with 6 census block groups); and Northumberland County (located southwest of the BBNPP site with 5 census block groups) (Section 2.5.4). Given that the peak construction workforce would represent only about 4.9% of the construction workforce in the 50 mi (80 km) radius in 2000, and 1.2% of the construction workforce in the Commonwealth of Pennsylvania, the beneficial impacts of these potential new employment opportunities likely would be SMALL.

In addition, because of the demand for such skills, low income and minority construction workers from the comparative geographic area that are currently employed could realize increased income levels, to the extent that they leave lower paying jobs to work on the BBNPP. As discussed in Section 2.5.2 and Section 4.4.2, the BBNPP construction workforce average annual salary would be about $70,720, compared to the mean earnings of $64,352 in the Commonwealth of Pennsylvania in 2006 (USCB, 2006c). The beneficial impacts of these increased income levels for low income and minority populations likely would be SMALL.

There are no unique minority or low income populations within the comparative geographic area that would likely be disproportionately adversely impacted by the construction of the proposed power plant because they are located more than 20 mi (32 km, or outside of the ROI) from the BBNPP site where no environmental impacts (e.g., noise, air quality, water quality, changes in habitat, aesthetic, etc.) would likely occur.}

4.4.3.1.2 {Two-County} Region of Influence

<u>Employment and Income</u>

{Unemployed or underemployed members of minority and low income groups within the ROI also could benefit from increased employment opportunities, to the extent that they have the craft skills required (e.g., laborers, carpenters, electricians, plumbers, welders) and are hired as part of the construction workforce. The beneficial impacts of increased employment opportunities are likely to be more noticeable for minority and low income populations within the ROI, because of the potential hiring levels relative to the smaller existing ROI construction workforce, which would represent 39.0% of the 10,139 construction workforce and 2.1% of the total workforce base of 184,124 employed civilians in the ROI in 2000 (USCB, 2000b) (USCB, 2000c). The minority populations located within the ROI primarily reside in: Wilkes-Barre, which is about 26 mi (42 km) from the BBNPP site; Nanticoke, which is about 16 mi (26 km) from BBNPP site; and Dallas, which is about 24 mi (39 km) from the BBNPP site; and the area located northeast of the BBNPP site on, or just off of, U.S. Highway 11. The low income populations are scattered throughout the Berwick, Bloomsburg, Wilkes-Barre, Nanticoke, and Hazleton areas. Because of the overall significant number of construction jobs that would be created and the general out-migration currently occurring, which is an indicator of lower economic opportunity, the beneficial impacts of these potential new employment opportunities likely would be MODERATE.

In addition, impacts on area businesses, and potentially related increased opportunities to obtain higher paying indirect jobs, could be realized from increased economic activity resulting from BBNPP's purchase of materials from businesses within the ROI. The beneficial impacts of these potential new indirect employment opportunities likely would be SMALL.

As stated in Section 2.5.2 and Section 4.4.2 the BBNPP Construction workforce average annual salary would be about $70,720 compared to the mean earnings of $52,370 in Luzerne County and $48,437 in Columbia County in 2006 (USCB, 2006a) (USCB, 2006b) and both were significantly less than that for the state or the U.S. Because of the demand for such skills, the proportion of low income and minority construction workers from the ROI that are currently employed could realize increased income levels, to the extent that they leave lower paying jobs to work on the BBNPP. Because of the overall significant number of construction jobs that would be created, lower income levels found in the ROI, and the general out-migration currently occurring, the beneficial impacts of these potential new employment opportunities likely would be MODERATE.}

4.4.3.2 Subsistence Activities

{The types and levels of subsistence activities occurring in the two-county ROI (i.e., Luzerne County and Columbia County) are described in Section 2.5.4. As discussed in this section, wildlife and fish harvesting are important parts of the food gathering activities for minority and low income residents. Susquehanna River sediments would be disturbed and turbidity would likely increase during construction of the water intake and outfall for the BBNPP. These activities could disturb current subsistence catch rates of resident finfish (e.g., muskellunge, northern pike, walleye, yellow perch, largemouth and smallmouth bass, native brook trout, and other species) to the extent that they are occurring near the BBNPP site. Although these activities could disturb traditional subsistence catch rates of finfish, to the extent that they are occurring on the Susquehanna River near the BBNPP intake and outfall sites, the impacts would likely be SMALL for all members of the general public and, thus, would not represent a disproportionate impact to minority or low income populations.

As stated in Section 4.3.1, white-tail deer, turkey, rabbit, squirrel, waterfowl, and other wildlife populations are abundant throughout Pennsylvania, including those areas in the vicinity of the BBNPP site. These populations represent a valuable resource for hunters. Construction of the BBNPP project might affect habitat for some of these species, but adequate similar habitat should be available in the surrounding area, so that overall population and harvest levels would not be affected.

In addition, it is assumed that collection of plants for ceremonial purposes and as a food source (i.e., culturally significant plants, berries, or other vegetation) could be occurring in the two county region of influence. Again, minority and low income populations might be conducting these collection activities in the vicinity of the BBNPP site, or could be harvesting greater quantities of plants, than the general population.

For safety and security reasons the general public is not allowed uncontrolled access to the BBNPP site. Thus, no ceremonial or subsistence gathering of culturally significant plants, berries, or other vegetation occurs on the site and no impacts would occur.}

4.4.3.3 {References

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USCB, 2000a. Table DP-3, Profile of Selected Economic Characteristics: 2000, Census 2000 Summary File 1 (SF 1) 100-Percent Data, Pennsylvania, U.S. Census Bureau, Website: http://factfinder.census.gov/servlet/QTTable?_bm=y&-geo_id=04000US42&-qr_name=DEC_2000_SF3_U_DP3&-ds_name=DEC_2000_SF3_U&-redoLog=false, Date accessed: April 9, 2008.

USCB, 2000b. U.S. Census 2000 Demographic Profiles: 100-Percent and Sample Data. Table DP-3, Profile of Selected Economic Characteristics: 2000, Geographic area: Luzerne County, Pennsylvania, U.S. Census Bureau, Website: http://censtats.census.gov/pub/Profiles.shtml, Date accessed: April 9, 2008.

USCB, 2000c. U.S. Census 2000 Demographic Profiles: 100-Percent and Sample Data, Table DP-3, Profile of Selected Economic Characteristics: 2000, Geographic area: Columbia County, Pennsylvania, U.S. Census Bureau, Website: http://censtats.census.gov/pub/Profiles.shtml, Date accessed: April 9, 2008.}

Table 4.4-1 Typical Noise Levels of Construction Equipment

(Page 1 of 1)

Equipment Type	Noise Level, db(A)		
	Peak	at 50 ft (15.2 m)	at 3000 ft (914.4 m)
Earthmoving			
Loaders	104	73-86	38-51
Dozer	107	87-102	52-67
Scraper	93	80-89	45-54
Graders	108	88-91	53-56
Dump trucks	108	88	53
Heavy trucks	95	84-89	49-54
Materials Handling			
Concrete mixer	105	85	50
Crane	104	75-88	40-53
Forklift	100	95	60
Stationary			
Generator	96	76	41
Impact			
Pile driver	105	95	60
Jack hammer	108	88	53

Table 4.4-2 {Projected Levels of Service at Key Intersections During Construction of BBNPP as Compared to Future No-Build Condition}

Intersection	Type	Future No-Build		Construction	
		AM	PM	AM	PM
RT11 & Union St.	Signalized	B	B	C	C
RT11 & Main St.	Signalized	A	A	C	F
RT11 & PPL Entrance	Unsignalized	B	B	C	B
RT11 & Bell Bend Entrance	Unsignalized			F	F
2nd Street & Market St.	Unsignalized	B	B	B	F
Front St. & Market St.	Signalized	B	B	C	E
RT11 & LaSalle St.	Signalized	A	A	A	A
RT11 & Orange St.	Signalized	B	B	D	F
RT11 & Poplar Ave.	Signalized	B	B	F	E

A = Free flow
B = Reasonable free flow
C = Stable flow
D = Approaching unstable flow
E = Unstable flow
F = Forced or breakdown flow

Table 4.4-3 Estimated Average FTE Construction Workers, by Construction Year/Quarter at the {BBNPP}

Year / Quarter of Construction	Average FTE Construction Workforce
Year 1:	
1	350
2	800
3	1,250
4	1,600
Year 2:	
1	1,900
2	2,200
3	2,500
4	2,800
Year 3:	
1	3,050
2	3,200
3	3,350
4	3,500
Year 4:	
1	3,683
2	3,867
3	3,950
4	3,950
Year 5:	
1	3,950
2	3,917
3	3,700
4	3,400
Year 6:	
1	3,050
2	1,967
3*	768*

Note: The third "quarter" of construction year 6 has only two months; the length of the total construction period is estimated to be 68 months.

Table 4.4-4 Total Peak Onsite Nuclear Plant Construction Labor Force Requirements (based on an average of single power plants)

Personnel Description	DOE Percent of Total Peak Personnel, Average Single Unit	DOE Peak Total Personnel, Average Single Unit	Estimated BBNPP Total Peak Workforce Composition
Craft Labor	66.7%	1,600	2,635
Craft Supervision	3.3	80	130
Site Indirect Labor	6.7	160	265
Quality Control Inspectors	1.7	40	67
NSSS Vendor and Subcontractor Staffs	5.8	140	229
EPC Contractor's Managers, Engineers, and Schedulers	4.2	100	166
Owner's O&M Staff	8.3	200	328
Start-Up Personnel	2.5	60	99
NRC Inspectors	0.8	20	32
Total Peak Construction Labor Force	100.0 %	2,400	3,950

Notes:
EPC = Engineering, Procurement, and Construction
O&M = operation and maintenance
NRC = Nuclear Regulatory Commission
NSSS = Nuclear Steam Supply System
Percentages and numbers may total slightly more or less than the total due to rounding.

Table 4.4-5 Peak Onsite Nuclear Power Plant Construction Craft Force Requirements (based on an average of single power plants)

Craft Personnel Description	DOE Percent of Peak Craft Labor Personnel, Average Single Unit	DOE Peak Craft Labor Personnel, Average Single Unit	Estimated BBNPP Peak Craft Workforce Composition
Boilermakers	4.0 %	60	105
Carpenters	10.0	160	264
Electricians/Instrument Fitters	18.0	290	474
Iron Workers	18.0	290	474
Insulators	2.0	30	53
Laborers	10.0	160	264
Masons	2.0	30	53
Millwrights	3.0	50	79
Operating Engineers	8.0	130	211
Painters	2.0	30	53
Pipefitters	17.0	270	448
Sheetmetal Workers	3.0	50	79
Teamsters	3.0	50	79
Total Craft Labor Force	100.0 %	1,600	2,635
Notes: Percentages and numbers may total slightly more or less than the total due to rounding.			

Table 4.4-6 Nuclear Power Plant Craft Labor Force Composition by Phases of Construction (in percent)

Craft Labor	Percentage of Craft Labor Force by Construction Phase						
	Concrete Formwork, Rebar, Embeds, Concrete	**Structural Strength Steel, Misc. Iron & Architectural**	**Earthwork Clearing, Excavation, Backfill**	**Mechanical Equipment Installation**	**Piping Installation**	**Instrument Installation**	**Electrical Installation**
Boilermakers				15			
Carpenters	40	5					2
Electricians/Instrument Fitters						70	96
Iron Workers	20	75		10			
Laborers	30	5	60				1
Millwrights				25			
Operating Engineers	5	15	35	12	15	2	1
Pipefitters				35	80	28	
Teamsters			5	3	5		
Others	5						
Total Percentage of Craft Labor Force	100	100	100	100	100	100	100

Table 4.4-7 {Estimates of In-Migrating Construction Workforces in Luzerne County and Columbia County, 20% In-Migration Scenario, from 2012-2017}

In-migration Characteristics	Luzerne County	Columbia County	Total ROI
Direct Workforce:			
Maximum Direct Workforce			3,950
Percent of Current SSES Units 1 & 2 Workforce Distribution	42.3%	44.8%	87.1%
Estimated In-migrating Direct Workforce (@ 20% assumption)	334	354	688
In-migrating Direct Workforce Population (@2.48 people/ household)	829	878	1,706
Indirect Workforce:			
Estimated Distribution of Peak Direct Workforce	334	354	688
Peak Indirect Workforce (@1.3866 BEA multiplier)	463	491	954
Indirect Workforce Needs That Could Be Met by Direct Workforce Spouses (@52.2% working females 16 years old and older)	258	273	532
Remaining, Unmet Indirect Workforce Need	205	217	423
Number of Indirect Households Meeting Unmet Need (@1.522 Workers/Households)	135	143	278
In-migrating Indirect Workforce Population (@2.48 people / household)	334	354	688
Total In-migrating Direct and Indirect Workforce People:	1,163	1,232	2,395

Notes:

1. Estimated construction employment multiplier of 1.3866 for the two county ROI. (BEA, 2008)
2. U.S. Census Bureau 2000 census data indicates that the Commonwealth of Pennsylvania had 2.48 people per household.
3. U.S. Census Bureau 2000 census data indicates that, within the Commonwealth of Pennsylvania, 52.2% of households had a working female 16 years old or older (assumed to be a spouse).

Table 4.4-8 {Estimates of In-Migrating Construction Workforces in Luzerne County and Columbia County, 35% In-Migration Scenario, from 2012-2017}

In-migration Characteristics	Luzerne County	Columbia County	Total ROI
Direct Workforce:			
Maximum Direct Workforce			3,950
Percent of Current SSES Units 1 & 2 Workforce Distribution	42.3%	44.8%	87.1%
Estimated In-migrating Direct Workforce (@ 35% assumption)	585	619	1,204
In-migrating Direct Workforce Population (@2.48 people/ household)	1,450	1,536	2,986
Indirect Workforce:			
Estimated Distribution of Peak Direct Workforce	585	619	1,204
Peak Indirect Workforce (@1.3866 multiplier)	811	859	1,670
Indirect Workforce Needs That Could Be Met by Direct Workforce Spouses (@52.2% working females 16 years old and older)	452	478	930
Remaining, Unmet Indirect Workforce Need	359	380	739
Number of Indirect Households Meeting Unmet Need (@1.522 Workers/Household)	236	250	486
In-migrating Indirect Workforce Population (@2.48 people / household)	585	620	1,205
Total In-migrating Direct and Indirect Workforce People:	2,035	2,156	4,191

Notes:
1. Estimated construction employment multiplier of 1.3866 for the two county ROI. (BEA, 2008)
2. U.S. Census Bureau 2000 census data indicates that the Commonwealth of Pennsylvania had 2.48 people per household.
3. U.S. Census Bureau 2000 census data indicates that, within the Commonwealth of Pennsylvania, 52.2% of households had a working female 16 years old or older (assumed to be a spouse for this analysis).

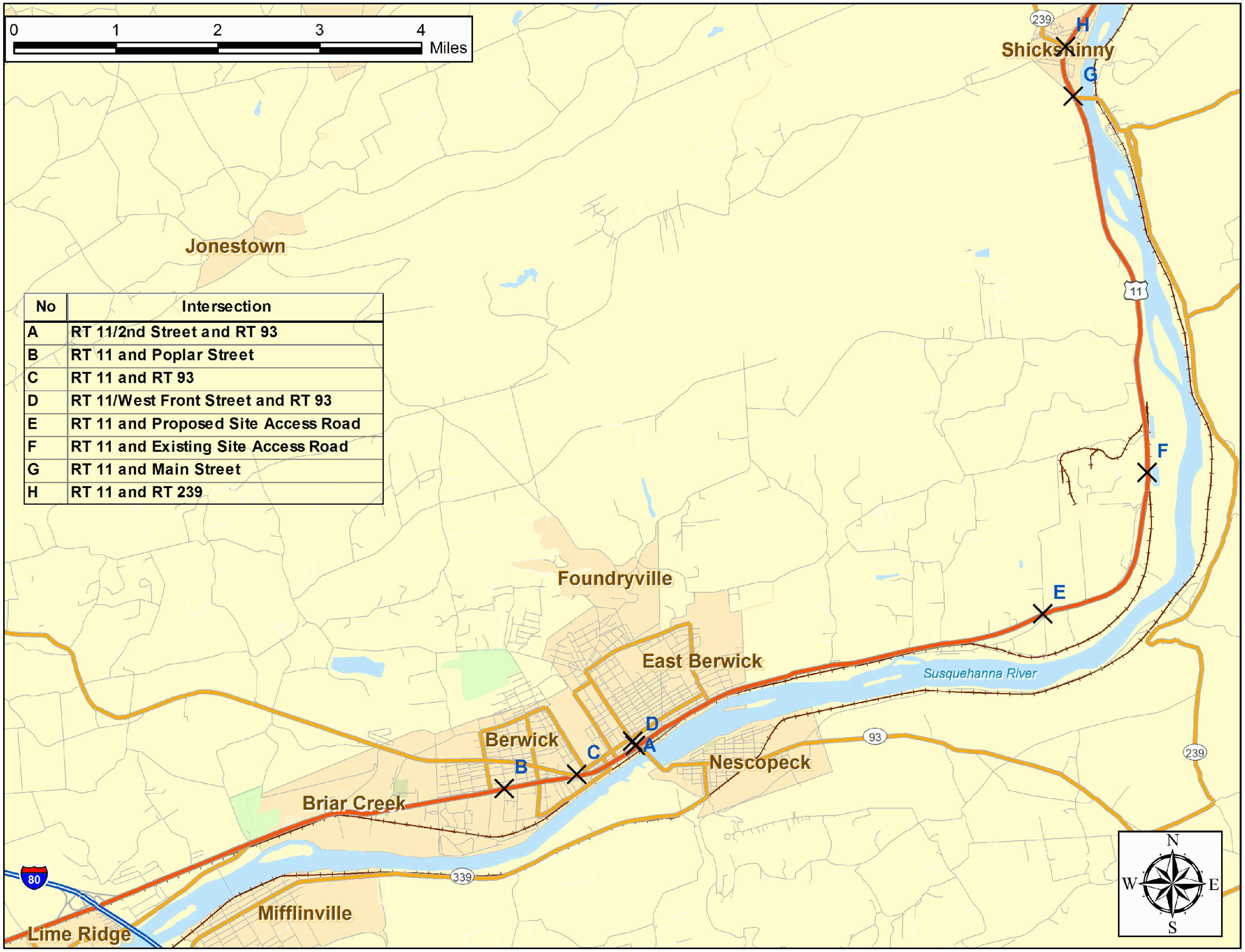
Table 4.4-9 {Total Work Force Potential During BBNPP Construction, SSES Units 1 and 2 Operations, and SSES Outage Periods}

Workforce Groups	Workforce Potential	Total
SSES Units 1 and 2 Operations and Outage		
Units 1 & 2 Operations	1,247	
Units 1 & 2 Outage Workers	1,400 [1]	
Maximum Existing Operational Workforce		2,647
BBNPP Construction		
Peak BBNPP Direct Construction Workforce Accessing Site Daily	3,950 [2]	
Cumulative SSES Units 1 & 2, Outage, plus Peak Direct Construction Workforce		6,597
Indirect In-Migration (35% scenario)	2,987 [3]	
Cumulative Peak Operations, Construction & Outage Workforce		9,584

Notes:

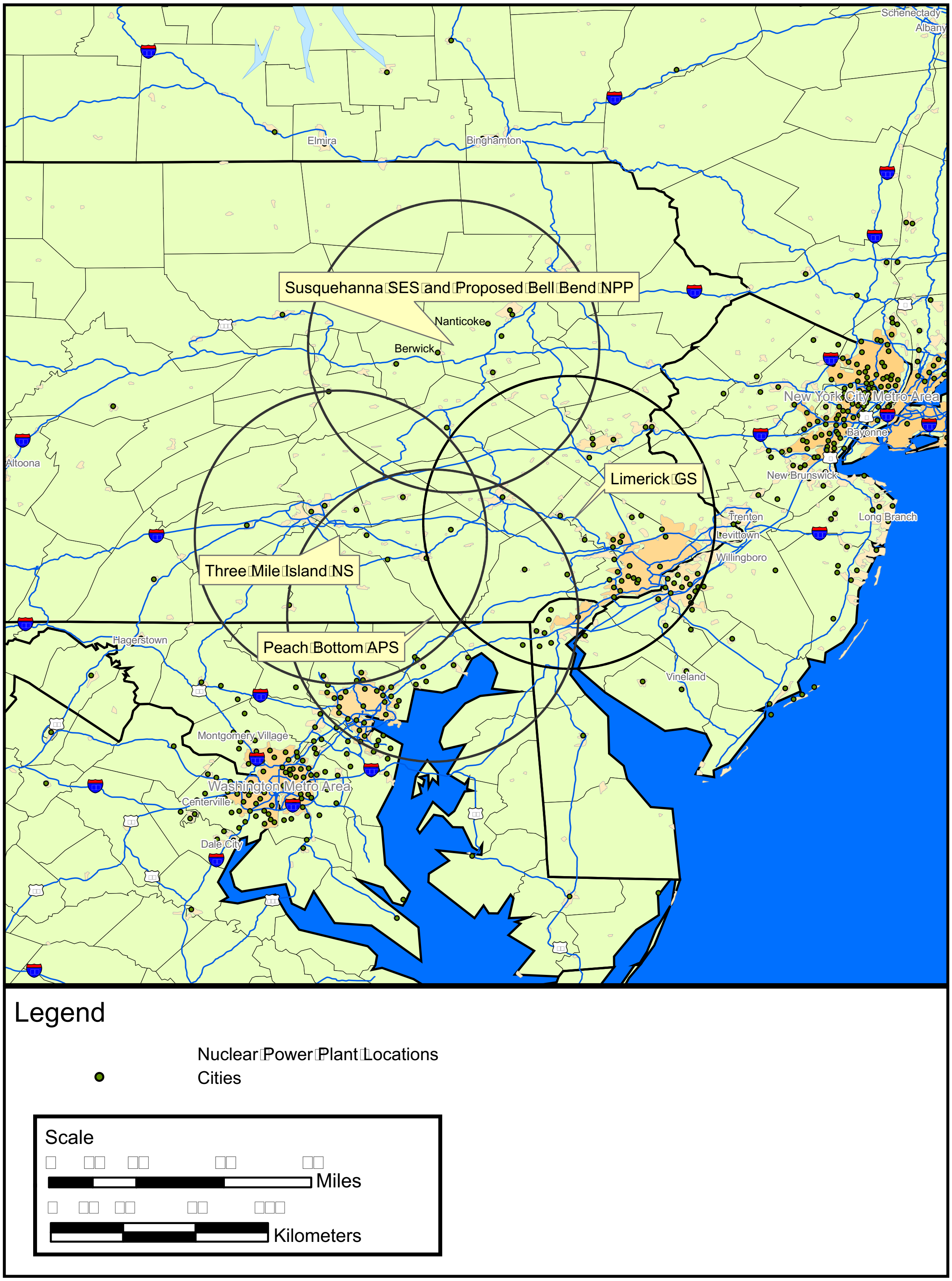
1. Outage workforces would be rotated across years so that an outage would occur for only one unit at a time, usually scheduled for each March.
2. This is the estimated peak construction workforce that would access the BBNPP site on a daily basis.
3. Under the 35% scenario, a maximum of 1,204 of the peak construction workers, 1,670 indirect workers (assumed to be spouses), and 1,317 other family members would in-migrate into the ROI.

Figure 4.4-1 {BBNPP Traffic Impact Assessment Study Area}



No	Intersection
A	RT 11/2nd Street and RT 93
B	RT 11 and Poplar Street
C	RT 11 and RT 93
D	RT 11/West Front Street and RT 93
E	RT 11 and Proposed Site Access Road
F	RT 11 and Existing Site Access Road
G	RT 11 and Main Street
H	RT 11 and RT 239

Figure 4.4-2 {Cumulative Overlapping 50 mi (80 km) Zones for Nuclear Power Plants Surrounding BBNPP}



4.5 RADIATION EXPOSURE TO CONSTRUCTION WORKERS

{This section discusses the exposure from the normal operation of Susquehanna Steam Electric Station (SSES) Units 1 and 2 to construction workers building the Bell Bend Nuclear Power Plant (BBNPP).}

4.5.1 SITE LAYOUT

{The physical location of BBNPP relative to the existing SESS Units 1 and 2 is presented in Figure 4.5-1. BBNPP will be located approximately 5000 ft (1524 m) west of SSES. BBNPP and SSES will have separate protected areas (See Section 3.1).}

4.5.2 RADIATION SOURCES AT {BBNPP}

{During the construction of BBNPP, the construction workers will be exposed to radiation sources from the routine operation of SSES Units 1 and 2. Sources that have the potential to expose construction workers are listed in Table 4.5-1. They are characterized as to location, inventory, shielding, and typical local dose rates. They are also characterized in terms of potential to expose BBNPP construction workers. Only those with significant potential are analyzed in detail. Interior, shielded sources are not included. Figure 4.5-2 shows the locations of these sources.

These sources are discussed in the Offsite Dose Calculation Manual (ODCM), the annual Radiological Effluent Release Report, the Radiological Environmental Operating Report, and the Final Safety Analysis Report. The eight main sources of radiation to BBNPP construction workers are gaseous effluents, liquid effluents, the Independent Spent Fuel Storage Installation (ISFSI), the Condensate Storage Tanks (CSTs), the Low Level Radioactive Waste handling Facility (LLRWHF), the SEALANDS, the Steam Dryer Storage Vault, and the Turbine Building. These are discussed below.

Airborne effluents are release via four rooftop vents on the reactor building. The releases are reported annually to the NRC. Doses to the general population are also reported annually.

Effluents from the liquid waste disposal system produce small amounts of radioactivity in the discharge to the Susquehanna River. All waterborne effluents are released in batch mode and are sampled and analyzed prior to release. Waterborne effluents from the site are released into the cooling tower blowdown line for dilution prior to release in the Susquehanna River.

There are five sources of direct radiation that could contribute to construction workers dose: the Independent Spent Fuel Storage Facility (ISFSI), the Low Level Radioactive Waste Handling Facility (LLRWHRF), SEALAND containers, the Steam Dryer Storage Vault, and the Turbine Building. There are three sources identified that are not significant contributors to construction worker dose. These are listed in Table 4.5-1 along with a brief discussion.

There are five sources of skyshine radiation that could contribute to construction workers dose: the Condensate Storage Tanks ()CSTs), the Low Level Radioactive Waste Handling Facility (LLRWHRF), SEALAND containers, the Steam Dryer Storage Vault, and the Turbine Building. They are also listed in Table 4.5-1.

4.5.3 HISTORICAL DOSE RATES

The historical annual dose rates reported to the NRC are summarized in Table 4.5-2.

4.5.4 {PROJECTED DOSE RATES AT BBNPP

Annual doses from all sources combined were calculated for each 104 ft (32 m) by 97 ft (30 m) foot square on the plant grid. For purposes of dose calculation, a 100% occupancy is assumed. (For purposes of collective dose calculations, the occupancy for construction workers is 2,200 hours per year.) The doses are the sum of the dose rates from the eight main sources; gaseous effluents, liquid effluents, the independent Spent Fuel Storage Facility (ISRSI), the Condensate Storage Tanks (CSTs), the Low Level Radioactive Waste handling Facility (LLRWHF), SEALAND containers, the Steam Dryer Storage Vault, and the Turbine Building. The annual doses are shown in Figure 4.5-4 for the year 2017, the last year of construction. It is this year that the dose rate will be greatest, primarily because the ISFSI will have the largest number of spent fuel storage casks.

The collective dose is the sum of all doses received by all workers. It is a measure of population risk. The number of workers (in terms of Full Time Equivalents) and their location by zone are given in Table 4.5-3. The zone locations are shown by squares in Figure 4.5-5. The details of the collective dose calculations are given in the following discussion.Dose rates from all sources combined were calculated for each square on the plant grid. The dose rates were the sum of the dose rate from the eight main sources and assume 100% occupancy.

The equation for dose rate during year t at location x,y on the plant grid is:

$$\dot{D}_{x,y} = \dot{D}_{gas} + \dot{D}_{liq} + \dot{D}_{ISFSI,t} + \dot{D}_{CST} + \dot{D}_{LLRWHF} + \dot{D}_{SEA} + \dot{D}_{SD} + \dot{D}_{TB}$$

where the terms are explained in the ER Sections.

The equation for the average dose rate in a zone is:

$$\overline{\dot{D}}_z = \frac{1}{N_z} \sum_{(\text{all } x,y \text{ in } z)} \dot{D}_{x,y}$$

where N_Z is the number of squares in the zone.

The equation for collective dose for the construction period is:

$$D = \frac{2200}{8760} \sum_t \sum_z \overline{\dot{D}}_z FTE_{z,t}$$

where $\frac{2200}{8760} = \text{fraction of work hours per year}$, $\overline{\dot{D}}_z$ is defined as above, and $FTE_{z,t}$ is the full time equivalent in zone z during year t, or

$$FTE_{z,t} = P_Z C_t$$

The probability of a worker in each zone, P_Z, reflects the average construction worker and is based on an approximation of how much time the average worker spends in each zone. The probability of a worker in each zone, $P_{Z,}$ results the average construction worker and is based on a rough idea of how much time the average worker spends in each zone, as shown in Table 4.5-

16. The spatial distribution of zones on the site is shown (gold letters indicating a zone code in each square) in Figure 4.5-5. There are many locations where construction workers are not expected to perform work activities, so they are not marked in the figure. These squares that are marked are chosen because of planned activities at those locations.

4.5.4.1 Gaseous Dose Rates

The construction worker dose due to SSES gaseous effluents depends upon the airborne effluents release and the atmospheric transport to the worker. The releases, which flow out of the SSES Units 1 and 2 plant vents, are reported annually to the NRC. Doses to the general population are also reported annually. The releases are modeled as ground level releases, which is conservative as it does not take credit for the height of the releases. Although there are two reactor building and two turbine building vents, the Radioactive Effluent Release Reports only give a total release. The releases were conservatively modeled assuming the vent closes to the workers.

The annual dose rate from gaseous effluents to construction workers on the BBNPP site is bounded by the following equation:

$$\dot{D}_{(j),\ gas} = c_{(j)}\ r^{b} \quad \text{(mrem/year)}$$

where,

c(j) = dose type coefficient,

j = dose type (TEDE, total body, organ, or thyroid),

r = distance from the release point to the target = $\sqrt{(N - N_s)^2 - (E - E_s)^2}$

N,E = location of receptor on plant grid in feet,

Ns,Es = location of source on plant grid in feet, and

b = fitting parameter for atmospheric dispersion model = -1.6925.

The c(j) are documented in Table 4.5-4. The equation is based on annual average, undecayed, undepleted ground level χ/Qs without credit for building wake from Susquehanna Steam Electric Station site meteorology for the years 2001 to 2006 (see Table 2.7-157) which are modeled as

$$\frac{X}{Q}(r) = 38.603r^{-1.6925}$$

where r is defined as above. The equation also assumes the most limiting gaseous effluent releases from the period 2001 to 2006. The model is based upon 100% occupancy.

The dose rates were calculated for an onsite location with a known χ/Q for the years 2001 through 2006 according to the Regulatory Guide 1.109 (NRC, 1977) method with Total Effective Dose Equivalent (TEDE) calculations according to Federal Guidance Reports 11 (EPA, 1988) and 12 (EPA, 1993). The gaseous releases are shown in Table 4.5-7. The 2006 releases gave the highest dose rates.

4.5.4.2 Liquid Dose Rates

The projected dose at the shoreline to a construction worker with a 2,200 hours/year occupancy rate is 0.407 mrem/yr; for a person with a full-time occupancy (8,760 hr/yr) the dose rate is 1.62 mrem/yr. This is based on releases and dilutions in Table 4.5-6 and Table 4.5-9. Table 4.5-8 lists the dose contributions by year.

4.5.4.3 ISFSI Dose Rates

For the purposes of this calculation the ISFSI is broken into north and south pieces. The north piece is assumed filled in 2010. Loading of the south piece is assumed to begin in 2009. The dose rate from the ISFSI is::

$$D_{ISFSI,t} = k[f_N(t)\varpi_N e^{-\mu r_N} + f_s(t)\varpi_s e^{-\mu r_s}]$$

where, D = annual dose,

ϖ_I = the solid angle between the ISFSI and receptor in steradians = $\pi\left(1- \frac{r_i}{\sqrt{R^2 + r_i^2}}\right)$

k = fitting parameter = 1500 ft,

$f_i(t)$ = function describing loading with time dependence = $a_i + b_i t$,

μ = effective removal coefficient in air in ft^{-1} = 0.002056 ft^{-1},

r_i = distance from ISFSI piece i to receptor in ft = $\sqrt{(N - N_i)^2 + (E - E_i)^2}$

t = time in years (i.e., 2007),

a_i = fitting parameter.

a_N = -233.88

a_S = -253.79

b_i = fitting parameter,

b_N = 0.177 yr^{-1}

b_S = 0.126 yr^{-1}

R = effective source radius = 116.52 ft, and

N_i, E_i = State plane coordinates of source and receptor

N_N = 341550 ft

N_S = 341450 ft

$E_N = E_s$ = 2,440,600 ft.

The equation is based upon TLD measurements in the vicinity of the ISFSI combined with historic loading data and a projected loading schedule. The incremental loading of the ISFSI is modeled as a linear function.

Figure 4.5-6 shows the effect of distance on dose and compares this to TLD measurements. Figure 4.5-7 shows a satellite image of the ISFSI, Figure 4.5-8 shows the locations of the TLDs. The effect of time on dose is shown in Figure 4.5-9. And the basic input data to the time equation (the load history and projections) is shown in Table 4.5-10.

4.5.4.4 Condensate Storage Tank Dose Rate

The Unit 1 Condensate Storage Tank (CST) is shielded on the west side by the Unit 1 Turbine Building, on the east by the Diesel Generator Building wall, on the north by the Refueling Water Storage Tank, and on the south by the Unit 1 Reactor Building (see Figure 4.5-2 and Figure 4.5-3). The Unit 2 CST is shielded on the west by the Unit 2 Turbine Building and on the north by the Unit 2 reactor Building. It is partially shielded on the east and south by an overflow berm which extends 10.5 ft (3.2 m) above grade, which means that 21.5 ft (6.6 m) is exposed above the berm height. When a line is projected from the top of the Unit 2 CST over the berm wall, it converges with grade 575 ft (175 m) from the CST, which means direct radiation is absorbed by the ground beyond that point. since construction workers will spend the majority of their time on site west of SSES and the remaining time further than 575 ft (175 m) east or south of the SCTs, additional analysis for the direct dose from the CSTs is not required. The skyshine dose from the Condensate Storage Tank is represented by the equation

$$\dot{D}_{CST} = 2E\text{-}05e^{-0.0018r}$$

Where $\dot{D}_{CST}$ is in mrem/yr (based on 8760 hr/yr occupancy) and r is in ft. This equation is based on the source terms listed in Table 4.5-10 and a source material of water with a density of 62 lb/ft^3 (1 g/cm^3). The effect of distance on dose is shown in Figure 4.5-10.

4.5.4.5 LLRWHF Dose Rate

The Low Level Radioactive Waste Handling Facility (LLRWHF) provides temporary storage for low level radioactive waste materials produced at SSES. It stores dry active waste, dewatered waste, and solidified waste. It is also used to temporarily store pieces of contaminated plant equipment and radioactive material. The LLRWHF source term, shown in Table 4.5-11, was conservatively developed based on 10,000 sq ft (283 m^2) of storage in containers with a maximum dose rate of 100 µGy/hr (10 mR/hr) at 6.56 ft (2 m), the maximum allowable per 49 CFR 173.411, (CFR, 2008.) The storage containers are condensate demineralizer radwaste containers in linear storage modules. The facility has a 23 x 2 square meter orientation to the east and a 7 x 2 square meter orientation to the south. The more conservative 23 x 2 was used in calculating the direct dose to construction workers.

The direct dose from the LLRWHF is

$$\dot{D}_{LLRWHF} = 15068653r^{-2.3}$$

where $\dot{D}_{LLRWHF}$ is in mrem/yr (based on 8760 hr/yr occupancy) and r is in feet. The effect of distance on dose is shown in Figure 4.5-11.

4.5.4.6 Sealand Container Dose Rate

The area due west of the Unit 2 cooling tower was selected as an area to store actual or potentially contaminated material in containers such as SEALAND containers. The area is surrounded by dirt embankments to the west, north, and south. The Unit 2 cooling tower lies to the east. It is estimated that 80 SEALAND containers can be stored in the area. The direct dose from the SEALAND Containers is

$$\dot{D}_{SEA} = 5.7055e^{-0.0006r}$$

where $\dot{D}_{SEA}$ is in mrem/yr (based on 8760 hr/yr occupancy) and r is in feet. The source term used to develop the equation is given in Table 4.5-12. It is based on the restriction that the dose rate on the exterior of each SEALAND container shall not exceed 20 µGy/hr (2 mR/hr). The dirt embankment is assumed to provide 3 ft (0.91 m) of shielding with a density of that for dry packed earth (i.e., 93.6 lb/ft^3 (1.5 g/cm^3)). The effect of distance on dose is shown in Figure 4.5-12.

4.5.4.7 Steam Dryer Storage Vault Dose Rate

The original SSES Units 1 and 2 steam dryers, which have been replaced, are stored on site in a concrete storage facility located east of the LLRWHF. Prior to placement in storage, the steam dryers were cut into halves. Each half was placed inside its own steel box with one inch (2.54 cm) thick walls. The direct dose from the steam dryer storage vault is

$$\dot{D}_{SD} = 14.37e^{-0.003r}$$

where $\dot{D}_{SD}$ is in mrem/yr (based on 8760 hr/yr occupancy) and r is in ft. This is based on 708.3 Ci of Co-60 which is based on surveys performed by SSES. The effect of distance on dose is shown in Figure 4.5-13 .

4.5.4.8 Turbine Building Dose Rate

The N-16 present in the reactor steam in the primary steam lines, turbines, and moisture separators provides a dose contribution to locations outside the plant structure as a result of the high energy gamma rays which it emits as is decays. The following equipment components, located on or above the Turbine Building Operating Floor are considered in this analysis:

- High pressure turbine inlet piping
- High pressure turbines
- Moisture separators

- Low pressure turbines
- 42 inch cross-around piping from the moisture separators to the CIVs
- Combined intermediate valves and piping to low pressure turbines

Sources below the operating floor are not considered. Typically, these sources are pipes of smaller volume than the equipment above the Operating Floor, and hence, of smaller N-16 inventory. Their dose rate contributions are bounded by the equipment above the Operating Floor because the floor provides additional shielding to limit their contribution.

The dose from the turbine building is

$$\dot{D}_{TB} = 0.8744e^{-0.0009r}$$

where $\dot{D}_{TB}$ is in mrem/yr (based on 8760 hr/yr occupancy) and r is in ft. This was developed using source terms based upon component volume, the density of the source within the volume (i.e., water or steam), and the N-16 concentration listed in Table 12.2-11 of the Susquehanna Steam Electric Station Final Safety Analysis Report. The effect of distance on dose for both direct and skyshine sources is shown in Figure 4.5-11.}

4.5.5 COMPLIANCE WITH DOSE RATE REGULATIONS

{BBNPP} construction workers are, for the purposes of radiation protection, members of the general public. This means that the dose rate limits are considerably lower (i.e., 5 mrem/yr (50 μSv/yr)) than the 100 mrem/year (1 mSv/yr) limit to be considered a radiation worker. The construction workers (with the exception of certain specialty contractors loading fuel or using industrial radiation sources for radiography) do not deal with radiation sources.

There are three regulations that govern dose rates to members of the general public. Dose rate limits to the public are provided in 10 CFR 20.1301 (CFR, 2007a) and 10 CFR 20.1302 (CFR, 2007b) and 10 CFR 50, Appendix I. Compliance with 10 CFR 20.1302 is discussed in Section 4.5.7. The design objectives of 10 CFR 50, Appendix I (CFR, 2007c) apply relative to maintaining dose as low as reasonably achievable (ALARA) for construction workers. Also, 40 CFR 190 (CFR, 2007d) applies because it is referred to in 10 CFR 20.1301. Note that 10 CFR 20.1001, 20.1201, 20.1203, 20.1204 and 20.1205 do not apply to the general public, but only to radiation workers. Thus, they will not be considered here.

4.5.5.1 10 CFR 20.1301

{The 10 CFR 20.1301 regulations limit annual doses from licensed operations to individual members of the public to 100 mrem (1 mSv) total effective dose equivalent (TEDE). In addition, the dose rate from external sources to unrestricted areas must be less than 2 mrem (20 μSv) in any one hour. This applies to the public both outside and within controlled areas. Given that the relevant sources are relatively constant in time, the hourly limit is met if the annual limit is met.

Dose rates in each 104 ft (32 m) by 97 ft (30 m) block of the plant grid are calculated and the array of dose rates searched for the maximum in the construction zones. The maximum dose rates by zone are give in Table 4.5-13. for an occupational year, i.e., 2200 hours on site, the maximum dose would be on Confers Lane west of SSES Unit 1 cooling tower where the dose is 14.2 mrem (142 μSv). This assumes the worker stood on Confers Lane for all working hours in one year. This is less than 100 mrem (1 mSv), thus, it meets the criterion and therefore construction workers can be considered to be members of te general public, for the purpose of radiation protection.

4.5.5.2 10 CFR 50, Appendix I

The 10 CFR 50, Appendix I criteria (CFR, 2007c) apply only to effluents. The purpose of the criteria are to assure adequate design of effluent controls (in this case at SSES Units 1 and 2). The annual limits for liquid effluents are 3 mrem (30 μSv) to the total body and 10 mrem (100 μSv) to any organ. Table 4.5-14 shows that these criteria are met for liquid effluents with regard to BBNPP construction workers.

For gaseous effluents, the pertinent limits are 10 mrad (100 μGy) to air gamma and 20 mrad (200 μGy) to air beta without credit for occupancy. If the air dose limits are not met then the limits become doses to real people (with occupancy credit allowed) of 5 mrem (50 μSv) to the total body and 15 mrem (150 μSv) to organs including skin.

Table 5.4-13 shows the TEDE dose limit for whole body assuming full-time occupancy. There is no dose rate to a construction worker that exceeds the limits. Therefore, the criteria have been met. Note that BBNPP occupational zones, during construction, are treated, for purposes of these criteria, as unrestricted areas.

4.5.5.3 40 CFR 190

The 40 CFR 190 (CFR, 2007d) criteria apply to annual doses, called dose rate here because the units are in mrem per year, received by members of the general public exposed to nuclear fuel cycle operations, i.e., nuclear power plants. Therefore, these regulations apply to BBNPP construction workers on the plant site just as they apply to members of the general public who live offsite. The most limiting part of the regulations states, "The annual dose equivalent (shall) not exceed 25 millirem (per year) to the whole body." In the case of SSES effluent releases, if this regulation is met for the whole body, then the thyroid and organ components will also be met.

Table 4.5-13 shows that the average dose rate in any of the construction zones is less than 25mrem/2,200 hours (250 μSv/2,200 hours). The units are expressed to be clear that an occupancy of 2,200 hours is assumed. The use of 2,200 hours assumes the worker works 40 hours per week for 50 weeks per year and works 10% overtime per year. Note, that this dose rate is for the maximum dose rate locations. The actual dose is expected to be considerably smaller. Therefore, the requirements of 40 CFR 190 will be met for all construction workers.}

4.5.6 {COLLECTIVE DOSES TO BBNPP WORKERS

The collective dose is the sum of all doses received by all workers. It is a measure of population risk. The total worker collective dose for the combined years of construction is 6.944 person-rem (6.944E-02 person-Sieverts). This is a best estimate based upon the worker census and occupancy projections shown in Table 4.5-15 , and Table 4.5-16 . The breakdown of collective dose by construction year and occupancy zone is given in Table 4.5-17 . This assumes 2200 hours per year occupancy for each worker.}

4.5.7 RADIATION PROTECTION AND ALARA PROGRAM

{Due to the exposure from SSES normal operations, there will be a radiation protection and ALARA program for BBNPP construction workers. This program will meet the guidance of

Regulatory Guide 8.8 to maintain individual and collective radiation exposures ALARA. This program will also meet the requirements of 10 CFR 20.1302.

Since the construction workers are not radiation workers, but, for the purposes of radiation protection, are members of the general public, individual monitoring and training of construction workers on BBNPP is not required. Construction workers will be treated, for the purposes of radiation protection, as if they were members of the general public in unrestricted areas. However, they are exposed to effluent radioactivity and direct radiation sources from SSES Units 1 and 2. The most important reason for the ALARA program is that these source levels may vary over time from the projections made here. There may also be additional sources, unaccounted for by the above projections.

Some features of the BBNPP Construction ALARA Program will be:

- The BBNPP ALARA Committee will operate in parallel with the SSES Units 1 and 2 ALARA Committee. The Committee will meet quarterly, will review monitoring, and review worker does rate and dose projections. The Committee will be empowered to stop work if the "general public" status of any construction worker(s) is jeopardized. The Committee will publish a dose and dose rate report for construction workers.
- BBNPP radiation protection personnel will report to the Committee. The Radiation Protection Department will be in charge of radiation monitoring, worker census and source census. It will use this data to project worker doses and dose rates on a monthly basis into the next quarter and will report to the Committee.
- The SSES ODCM and other SSES processes such as the ISFSI projected loading process, will be updated to link dose-important SSES activities to the projected BBNPP construction worker ALARA dose.
- The Committee will periodically identify and direct construction management to control the occupancy of areas where dose rates can be high enough that workers might exceed 40 CFR 190 limitations.
- The Committee will establish a radiation monitoring program to assure 40 CFR 190 regulations are met for BBNPP construction workers. It is expected that monitoring will require either special instruments and/or measurements closer to sources and projected by calculation further out to where workers will be.
- The Committee will require, before any high dose rate evolutions, such as the transport of fuel to the ISFSI or transport of highly radioactive components, that the BBNPP ALARA evaluation be revised.
- Consumption of onsite agricultural products such as plants and fish will be prohibited.
- The program will survey the radiation levels in construction areas and will survey radioactive materials in effluents released to construction areas to demonstrate compliance with dose limits for BBNPP workers.
- The program will comply with the annual dose limit in 10 CFR 20.1301 by measurement or calculation to verify that the total effective dose equivalent to the individual worker likely to receive the highest dose from any onsite operation does not exceed the annual dose limit.}

4.5.8 REFERENCES

{**CFR, 2007a**. Title 10, Code of Federal Regulations, Part 20.1301, Dose Limits for Individual Members of the Public, 2007.

CFR, 2007b. Title 10, Code of Federal Regulations, Part 20.1302, Compliance with Dose Limits for Individual Members of the Public, 2007.

CFR, 2007c. Code of Federal Regulations, Title 10 CFR 50, Appendix I, Numerical Guides for Design Objectives and Limiting Condition for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light Water Cooled Nuclear Power Reactor Effluents, 2007.

CFR, 2007d. Title 40, Code of Federal Regulations, Part 190, Environmental Radiation Protection Standards for Nuclear Power Operations, 2007.

CFR, 2008. Title 49, Code of Federal Regulations, Transportation, Part 173, Shippers-General Requirements for Shipments and Packaging, 2008.

EPA, 1988. Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion, Federal Guidance Report No. 11, Document Number EPA-52012-88-020, U.S. Environmental Protection Agency, September 1988.

EPA, 1993. External Exposure to Radionuclides in Air, Water, and Soil, Federal Guidance Report No. 12, Document Number EPA-402-R-93-08 1, U.S. Environmental Protection Agency, September 1993.

NRC, 1978. Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations will be as Low As is Reasonably Achievable, Regulatory Guide 8.8, Revision 3, Nuclear Regulatory Commission, June 1978.

NRC, 1977. Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I, Regulatory Guide 1.109, Revision 1, Nuclear Regulatory Commission, October 1977.

NRC, 1986. LADTAP II - Technical Reference and User Guide, NUREG/CR-4013, Nuclear Regulatory Commission, April 1986.

SSES, 2007, Susquehanna Steam Electric Station Units 1 & 2, Radioactive Effluent Release Report, 2006 Annual Report, PPL Susquehanna, LLC, April 2007.}

Table 4.5-1 {Radiation Sources at SSES Units 1 and 2}

Source	Location on Plant Grid	Radioactive Inventory	Shielding	Dose Rate	Significance to BBNPP Workers
Unit 1 and Unit 2 Reactor Building Vents	U1 N341,185, E2,442,025 U2 N341,165, E2,442,025	Gaseous effluents characterized in RETS	N/A (Airborne)	150 µSv/yr/unit (15 mrem/yr/unit)	The gaseous effluents from reactor building and turbine building vents are contributors to the dose to construction workers.
Unit 1 and Unit 2 Turbine Building Vents	N 341, 175 E 2,441,833	Gaseous effluents characterized in RETS	N/A (Airborne)	150 µSv/yr/unit (15 mrem/yr/unit)	
Liquid Waste Management System	N/A	Liquid Effluents characterized in RETS	N/A (waterborne)	<30 µSv/yr (3 mrem/yr/unit) total body <100 µSv/yr (10 mrem/yr) organ	No impact because BBNPP is a substantial distance (i.e., over 3000 ft) from the body of water into which the SSES liquid effluents are released.
Refueling Water Storage Tank (RWST)	N341,424, E2,442,000.5	Liquid Waste	Shielded by neighboring buildings	<15 µGy/hr (1.5 mR/hr) contact	No impact because shielded by Turbine building
Condensate Storage Tanks (CSTs)	U1 N341,371, E2,442,007.5 U2 N340,979.0, E2,442,007.5	Liquid Waste	Shielded by neighboring buildings	Turbine Building shields direct dose to construction workers from the CSTs	No impact because Turbine Building shields any dose to construction workers from the CSTs.
Low Level Radwaste Handling Facility	N341,400. E2,440,500	Temporary storage for low level radioactive waste and radioactive material	Concrete walls	<100 µSv/yr (10 mR/hr) at 6.6 ft (2 m)	Direct source.
Temporary Laundry Facility	Southwest of Unit 2 Turbine Building	Contaminated laundry	Shielded by neighboring buildings	79.4 µGy/hr (7.94 mR/hr) at 1 ft (0.305 m) perimeter	No impact.
ISFSI	N341,500 E2,440,600	Spent fuel	Concrete walls	<70 mrem/hr on surface	Time dependent source.
Turbine shine due to N-16 in the reactor steam	N 341,175 E 2,441,833	N-16	Shielding around each turbine train and a roof slab over each moisture separator	< 0.5 mrem/hr	Direct and skyshine source.
SEALAND Containers	N340,750, E2,441,050	LSA boxes, barrels, shield blocks, turbine rotor stands, etc.	Shielded by dirt embankment	< 20 µGy/hr (2 mR/hr) at exterior surface	Direct and skyshine source.

Table 4.5-1 {Radiation Sources at SSES Units 1 and 2}

Source	Location on Plant Grid	Radioactive Inventory	Shielding	Dose Rate	Significance to BBNPP Workers
Steam Dryers	N341,060.3, E 2,440,653.5	Original steam dryers	Concrete walls	< 5 μSv/yr (0.5 mrem/hr)	Direct and skyshine source.
Dry Active Waste Reduction System Facility	N341,700, E2,441,900	Equivalent of 30 mCi (1.11E+09 Bq)Co-60 max.	None	Negligible	No impact because of low activity.

NOTE A - For example, the annual gaseous releases from BBNPP Units 1 and 2 for 2007 were reported as of fission and activation gases, of I-131, of particulates with half-lives greater than eight days, and of tritium.
NOTE B - The annual liquid radioactivity releases for 2007 were reported as of fission and activation products, of tritium, and of dissolved and entrained gases (SSES, 2008).

Table 4.5-2 {Historical All-Source Compliance for Offsite General Public }

Maximum Offsite Doses for 40CFR190 Compliance from Gas and Liquid Releases as Reported to the NRC in Annual REMP Reports						
	Dose in mrem/year (µSv/yr) from REMP Reports)			Dose as Percent of 40CFR190 Limit		
Year	Thyroid	WB	Limiting Organs	WB	Thyroid	Limiting Organs
2006	5.27E-01 (5.27E+00)	5.27E-01 (5.27E+00)	5.27E-01 (5.27E+00)	2.11E-02	7.03E-03	2.11E-02
2005	8.38E-01 (8.38E+00)	8.38E-01 (8.38E+00)	8.38E-01 (8.38E+00)	3.35E-02	1.12E-02	3.35E-02
2004	1.22E+00 (1.22E+01)	1.22E+00 (1.22E+01)	1.22E+00 (1.22E+01)	4.88E-02	1.63E-02	4.88E-02
2003	1.21E+00 (1.21E+01)	1.21E+00 (1.21E+01)	1.21E+00 (1.21E+01)	4.84E-02	1.61E-02	4.84E-02
2002	1.31E+00 (1.31E+01)	1.31E+00 (1.31E+01)	1.31E+00 (1.31E+01)	5.24E-02	1.75E-02	5.24E-02
2001	2.20E-01 (2.20E+00)	2.20E-01 (2.20E+00)	2.20E-01 (2.20E+00)	8.80E-03	2.93E-03	8.80E-03
2000	1.73E-01 (1.73E+00)	1.73E-01 (1.73E+00)	1.73E-01 (1.73E+00)	6.92E-03	2.31E-03	6.92E-03
1999	9.82E-02 (9.82E-01)	9.82E-02 (9.82E-01)	9.82E-02 (9.82E-01)	3.93E-03	1.31E-03	3.93E-03
1998	1.38E-01 (1.38E+00)	1.38E-01 (1.38E+00)	1.38E-01 (1.38E+00)	5.52E-03	1.84E-03	5.52E-03
1997	1.63E-01 (1.63E+00)	1.63-01 (1.63E+00)	1.63E-01 (1.63E+00)	6.52E-03	2.17E-03	6.52E-03
1996	5.64E-01 (5.64E+00	5.64E-01 (5.64E+00)	5.64E-01 (5.64E+00)	2.26E-02	7.52E-03	2.26E-02
1995	2.31E-01 (2.31E+00)	2.31E-01 (2.31E+00)	2.31E-01 (2.31E+00)	9.24E-03	3.08E-03	9.24E-03
1994	1.41E-01 (1.41E+00)	1.41E-01 (1.41E+00)	1.41E-01 (1.41E+00)	5.64E-03	1.88E-03	5.64E-03
Maximum	1.31+00 (1.31+01)	1.31E+00 (1.31E+01)	1.31E+00 (1.31E+01)	5.24E-02	1.75E-02	5.24E-02

Table 4.5-3 {FTE for BBNPP Construction Workers}

Zone	2012	2013	2014	2015	2016	2017
B	0.5	2.3	4.0	4.0	4.0	3.2
C	353.1	1516.9	2660.0	2660.0	2660.0	2138.0
L	10.6	45.6	80.0	80.0	80.0	64.3
O	85.0	365.0	640.0	640.0	640.0	514.4
P	10.6	45.6	80.0	80.0	80.0	64.3
R	10.6	45.6	80.0	80.0	80.0	64.3
S	35.0	150.5	264.0	264.0	264.0	212.2
T	35.0	150.5	264.0	264.0	264.0	212.2
W	1.6	6.8	12.0	12.0	12.0	9.6
By Year	542.2	2328.9	4084.0	4084.0	4084.0	3282.5

Table 4.5-4 {Gaseous Dose Rate Type and Coefficients}

Dose Type	Pathway	Methodology	c(j)
TEDE	All	ICRP26	1259244
Total Body	External	ICRP2	692594.5
Skin	External	ICRP2	845547.4
Organ I & P	I & P	ICRP2	721931
Total Body	All	ICRP2	813007.5
Thyroid	All	ICRP2	812811.5
Organ	All	ICRP2	826407

Table 4.5-5 {Historic Gaseous Releases For 2001 Through 2006}

Nuclide	2001 Ci (Bq)	2002 Ci (Bq)	2003 Ci (Bq)	2004 Ci (Bq)	2005 Ci (Bq)	2006 Ci (Bq)
H 3	1.29E+02 (4.77E+12)	1.37E+02 (5.07E+12)	1.56E+02 (5.77E+12)	1.60E+02 (5.92E+12)	8.61E+01 (3.19E+12)	5.87E+01 (2.17E+12)
Ar 41		9.68E+00 (3.58E+11)	3.37E-03 (1.25E+08)	8.07E+00 (2.99E+11)		
Cr 51	6.48E-03 (2.40E+08)	3.31E-03 (1.22E+08)	1.09E-03 (4.03E+07)	2.52E-04 (9.32E+06)	2.22E-04 (8.21E+06)	2.07E-04 (7.66E+06)
Mn 54	5.96E-04 (2.21E+07)	1.21E-03 (4.48E+07)	2.61E-04 (9.66E+06)	2.74E-04 (1.01E+07)	2.33E-04 (8.62E+06)	1.93E-04 (7.14E+06)
Co 57					3.11E-06 (1.15E+05)	
Co 58	4.43E-05 (1.64E+06)	5.62E-05 (2.08E+06)	9.42E-06 (3.49E+05)	9.93E-06 (3.67E+05)	2.43E-05 (8.99E+05)	1.09E-05 (4.03E+05)
Co 60	2.27E-04 (8.40E+06)	1.48E-03 (5.48E+07)	8.83E-05 (3.27E+06)	1.79E-04 (6.62E+06)	2.54E-04 (9.40E+06)	3.82E-04 (1.41E+07)
Fe 59	6.40E-05 (2.37E+06)	2.32E-04 (8.58E+06)			1.69E-05 (6.25E+05)	
Kr 85m			7.68E-04 (2.84E+07)	6.02E-01 (2.23E+10)		
Kr 87			5.44E-03 (2.01E+08)			
Kr 88			3.01E-01 (1.11E+08)	2.48E-01 (9.18E+09)		6.94E-01 (2.57E+10)
Kr 89			6.03E-02 (2.23E+09)			
Sr 90		2.95E-05 (1.09E+06)				
Nb 95	5.39E-06 (1.99E+05)			4.11E-06 (1.52E+05)	6.43E-06 (2.38E05)	
Ag 110m	1.18E-05 (4.37E+05)	2.32E-06 (8.58E+04)				
I 131					9.71E-06 (3.59E+05)	1.41E+05 (5.22E+05)
I 133					1.28E-05 (4.74E+05)	
Xe 133			2.36E+04 (8.73E+06)	6.04E-01 (2.23E+10)		
Xe 133m	1.27E-01 (4.70E+09)					
Xe 135	6.65E+00 (2.46E+11)		2.84E-03 (1.05E+08)			4.13E-02 (1.53E+09)
Xe 135m			1.52E-02 (5.62E+08)			
Xe 137			1.52E-01 (5.62E+09)			
Xe 138			6.73E-02 (2.49E+09)			
Cs 137		3.23E-06 (1.20E+05)				
Ce 141	1.76E-06 (6.51E+04)					
Ce 144	6.97E-06 (2.58E+05)				1.48E-05 (5.48E+05)	
Ba-La 140					8.73E-06 (3.23E+05)	
As 76	6.26E-03 (2.32E+08)	1.86E-03 (6.88E+07)				
Na 24	2.52E-04 (9.32E+06)	8.08E-05 (2.99E+06)				
Tc 99m	1.05E-03 (3.89E+07)	1.78E-04 (6.59E+06)				

Table 4.5-6 {Historical Liquid Releases for Input to LADTAPII}

Isotope	2001 Ci (Bq)	2002 Ci (Bq)	2003 Ci (Bq)	2004 Ci (Bq)	2005 Ci (Bq)	2006 Ci (Bq)
Co-58	4.28E-04 (1.58E+07)	2.92E-04 (1.08E+07)	3.426E-04 (1.26E+07)	2.03E-04 (7.51E+06)	5.33E-05 (1.97E+06)	3.25E-05 (1.20E+06)
Co-60	3.90E-03 (1.44E+08)	3.27E-03 (1.21E+08)	5.14E-03 (1.90E+08)	1.32E-03 (4.88E+07)	9.01E-04 (3.33E+07)	2.67E-04 (9.89E+06)
Cr 51	1.25E-02 (4.61E+08)	1.15E-02 (4.27E+08)	8.16E-03 (3.02E+08)	2.67E-03 (9.86E+07)	8.43E-04 (3.12E+07)	7.08E-04 (2.62E+07)
Cs 137				6.57E-07 (2.43E+04)		4.45E-05 (1.64E+06)
F 18	1.82E-07 (6.72E+03)			1.96E-07 (7.25E+03)		
Fe 55	3.89E-03 (1.44E+08)	6.45E-03 (2.39E+08)	9.07E-03 (3.36E+08)	1.95E-02 (7.22E+08)		
Fe 59	3.03E-05 (1.12E+06)	6.12E-04 (2.26E+07)	1.29E-04 (4.77E+06)	4.90E-05 (1.81E+06)	4.63E-06 (1.71E+05)	1.24E-05 (4.58E+05)
H 3	2.44E+01 (9.04E+11)	6.61E+01 (2.45E+12	7.75E+01 (2.87E+12)	6.21E+01 (2.30E+12)	7.40E+01 (2.47E+12)	8.29E+01 (3.30E+12)
I 33					2.45E-07 (9.07E+03)	
Mn 54	3.44E-03 (1.27E+08)	7.68E-03 (2.84E+08)	5.34E-03 (1.98E+08)	1.29E-03 (4.77E+07)	2.95E-04 (1.09E+07)	1.40E-04 (5.17E+06)
Na 24	2.48E-06 (9.18E+04)					
Nb 95			6.81E-07 (2.52E+04)	2.66E-06 (9.84E+04)		
P 32	1.18E-05 (4.36E+05)	3.06E-05 (1.13E+06)				
Sb 124	9.07E-07 (3.36E+04)		2.96E-06 (1.10E+05)	9.12E-07 (3.37E+04)	3.32E-06 (1.23E+05)	1.22E-05 (4.51E+05)
Tc 99m						1.17E-06 (4.33E+04)
Zn 65	1.20E-04 (4.42E+06)	4.28E-06 (1.58E+05)	4.63E-05 (1.71E+05)	3.61E-06 (1.34E+05)	1.88E-04 (6.96E+06)	9.77E-05 (3.61E+06)
Xe 133m	1.27E-01 (4.70E+09)					
Xe 135	6.65E+00 (2.46E+11)		2.84E-03 (1.05E+08)			4.13E-02 (1.53E+09)

Table 4.5-7 {Historical Dilutions for Input to LADTAPII}

Year	1st Quarter L (ft^3)	2nd Quarter L (ft^3)	3rd Quarter L (ft^3)	4th Quarter L (ft^3)	Total L (ft^3)	Release Duration min	Flow Rate L/min (ft^3/sec)
2001	6.84E+07 (2.42E+06)	6.39E+07 (2.26E+06)	3.36E+07 (1.19E+06)	2.20E+07 (7.77E+05)	1.88E+08 (6.64E+06)	6.28E+03	2.99E+04 (1.76E+01)
2002	7.70E+07 (2.72E+06)	2.07E+08 (7.31E+06)	1.58E+08 (5.58E+06)	1.33E+08 (4.70E+06)	5.75E+08 (2.03E+07)	1.90E+04	3.03E+04 (1.78E+01)
2003	9.05E+07 (3.20E+06)	6.54E+07 (2.31E+06)	2.13E+08 (7.52E+06)	1.38E+08 (4.87E+06)	5.07E+08 (1.76E+07	1.49E+04	3.40E+04 (2.00E+01)
2004	1.04E+08 (3.67E+06)	1.54E+08 (5.44E+06)	1.17E+08 (4.13E+06)	2.18E+07 (7.07E+05)	3.97E+08 (1.40E+07)	1.15E+04	3.45E+04 (2.03E+01)
2005	8.91E+07 (3.15E+06)	2.43E+08 (8.58E+06)	1.63E+08 (5.76E+06)	7.86E+07 (2.78E+06)	5.74E+08 (2.03E+07)	1.81E+04	3.17E+04 (1.87E+01)
2006	1.43E+08 (5.05E+06)	1.03E+08 (3.64E+06)	9.69E+07 (3.42E+06)	2.63E+08 (9.29E+06)	6.06E+08 (2.14E+07)	1.88E+04	3.22E+04 (1.90E+01)

Table 4.5-8 {Historical Shoreline Dose}

Year	LADTAPII mrem/yr (µSv/yr) with 12 hr/yr occupancy)	Worker mrem/yr (µSv/yr) with 2200 hr/yr occupancy)	Full mrem/yr (µSv/yr) with 8760 hr/yr occupancy)
2001	1.95E-03 (1.95E-02)	0.358 (3.58)	1.424 (14.24)
2002	1.71E-03 (1.71E-02)	0.314 (3.14)	1.248 (12.48)
2003	2.22E-03 (2.22E-02)	0.407 (4.07)	1.621 (16.21)
2004	5.61E-04 (5.61E-03)	0.103 (1.03)	4.10 (0.410)
2005	4.04E-04 (4.04E-03)	0.074 (0.74)	0.295 (2.95)
2006	1.31E-04 (1.31E-03)	0.024 (0.24)	0.096 (0.96)

Table 4.5-9 {Historic and Projected Loading of SSES ISFSI}

Year	Bundles Added	# of Bundles Total
1999	208	208
2000	208	416
2001	468	884
2002	416	1300
2003	0	1300
2004	409	1709
2005	244	1953
2006	305	2258
2007	305	2563
2008	427	2990
2009	366	3356
2010	732	4088
2012	0	4088
2012	488	4576
2013	488	5064
2014	0	5064
2015	488	5552
2016	488	6040
2017	122	6162

Table 4.5-10 {Condensate Storage Tank Source Terms}

((Page 1 of 2)

Isotope	Curies (Bq)
Br 83	2.75E-02 (1.02E+09)
Br 84	2.42E-02 (8.95E+08)
I 131	3.80E-02 (1.41E+09)
I 132	2.18E-01 (8.07E+09)
I 133	2.39E-01 (8.84E+09)
I 134	2.90E-01 (1.07E+10)
I 135	3.07E-01 (1.14E+10)
Cr 51	5.66E-05 (2.09E+06)
Mc 56	2.97E-03 (1.10E+08)
Co 58	5.67E-04 (2.10E+07)
CO 60	5.68E-05 (2.10E+07)
Sr 89	3.78E-04 (1.40E+07)
Sr 91	9.45E-03 (3.50E+08)
Sr 92	8.54E-03 (3.16E+08)
Mo 99	2.41E-03 (8.92E+07)
Tc 99m	2.35E-02 (8.70E+08)
Te 132	5.40E-03 (2.00E+08)
Cs 138	2.87E-02 (1.06E+09)
Ba 139	2.56E-02 (9.47E-08)
Ba 140	1.12E-03 (4.14E+07)
Ba 141	4.72E-03 (1.75E+08)
Ba 142	1.78E-03 (6.59E+07)
Np 239	2.62E-02 (9.69E+08)
Cs 140	9.75E-03 (3.61E+08)
Y 92	3.44E-03 (1.27E+08)
Cs 139	2.91E-02 (1.08E+09)
Sr 93	7.89E-04 (2.92E+07)
Y 93	1.71E-04 (6.33E+06)
La 141	1.89E-03 (6.99E+07)
Br 85	1.77E-03 (6.55E+07)
Tc 101	1.32E-03 (4.88E+07)
Cs 134	9.08E-05 (3.36E+06)
Cs 136	6.20E-05 (2.29E+06)
Cs 137	1.36E-04 (5.03E+06)
Na 24	1.97E-04 (7.29E+06)
Ni 65	1.77E-05 (6.55E+05)
W 187	3.11E-04 (1.15E+07)
Cs 141	4.44E-04 (1.64E+07)
Sr 94	1.09E-05 (4.03E+05)
Y 94	2.85E-05 (1.05E+06)
Y 95	1.06E-05 (3.92E+05)
Rb 91	1.05E-02 (3.89E+08)
Rb 90	2.03E-02 (7.51E+08)
Rb 89	1.42E-02 (5.25E+08)
Rb 88	2.13E-03 (7.88E+07)
La 142	1.23E-03 (4.55E+07)

Table 4.5-10 {Condensate Storage Tank Source Terms}

((Page 2 of 2)

Isotope	Curies (Bq)
Y 91m	5.11E-03 (1.89E+08)
Y 91	1.46E-05 (5.40E+05)
Sr 90	2.61E-05 (9.66E+05)
La 140	6.12E-05 (2.26E+06)

Table 4.5-11 {LLRWHF Source Term}

Isotope	Activity in Ci (Bq)
Ba 137m	2.59E-02 (9.58E+08)
Cr 51	3.17E-04 (1.17E+07)
Fe 59	9.49E-04 (3.51E+07)
Mn 54	1.66E-01 (6.14E+09)
Co 58	3.49E-03 (1.29E+08)
Cs 134	9.88E-03 (3.66E+08)
I 129	1.09E-03 (4.03E+07)
Sb 124	2.32E-05 (8.58E+05)
Co 60	1.12E+00 (4.14E+10)
Fe 55	1.40E+00 (5.18E+10
I 131	8.45E-06 (3.13E+05)
Zn 65	5.67E-02 (2.10E+09)

Table 4.5-12 {SEALAND Container Source Term}

Isotope	Activity in Ci (Bq)
Ba 137m	3.15E-04 (1.17E+07)
Co 58	2.95E-03 (1.09E+08)
Co 60	1.51E-01 (5.59E+09)
Cs137	3.33E-04 (1.23E+07)
Fe 55	4.00E+00 (1.48E+11)
Fe 59	5.35E-03 (1.98E+08)
I 129	1.30E-05 (4.81E+05)
Mn 54	2.26E-01 (8.36E+09)
Nb 95	3.10E-04 (1.15E+07)
Ni 59	2.21E-04 (8.18E+06)
Ni 63	1.33E-02 (4.92E+08)
Sb 125	5.62E-04 (2.08E+07)
Sr 89	4.74E-06 (1.75E+05)
Sr 90	2.42E-06 (8.95E+04)
Tc 99	7.07E-06 (2.62E+05)
Y 90	2.42E-06 (8.95E+04)

Table 4.5-13 {Maximum Dose by Zone for 2200 Hours}

Zone	Zone Description	**Maximum Dose Rate** µSv/2200 hours (mrem/2200 hours)
B	Batch Plant	12.0 (1.20)
C	Construction on main structures	3.6 (0.36)
L	Laydown	10.4 (1.04)
O	Office/Trailer	6.1 (0.61)
P	Parking	8.2 (0.82)
R	Roads	141.5 (14.15)
S	Shoreline	7.2 (0.72)
T	Tower/Basin	4.9 (0.49)
W	Warehouse	5.5 (0.55)

Table 4.5-14 {Effluent Dose Rates by Zone}

Maximum Dose Rate (mrem/year) Assuming Full Time Occupancy - Effluents Only				
Zone	**Zone Description**	**Gaseous Effluents** µSv/hr (mrem/yr)	**Gaseous Effluents Organ** µSv/hr (mrem/yr)	**Liquid Effluents TEDE** µSv/hr (mrem/yr)
B	Batch Plant	15.8 (1.58)	16.5 (1.65)	0.0 (0.00)
C	Construction on main structures	4.1 (0.41)	4.3 (0.43)	0.0 (0.00)
L	Laydown	8.5 (0.85)	8.9 (0.89)	0.0 (0.00)
O	Office/Trailer	6.6 (0.66)	6.9 (0.69)	0.0 (0.00)
P	Parking	10.4 (1.04)	10.8 (1.08)	0.0 (0.00)
R	Roads	17.9 (1.79)	18.6 (1.86)	0.0 (0.00)
S	Shoreline	5.0 (0.05)	5.2 (0.52)	16.2 (1.62)
T	Tower/Basin	5.1 (0.51)	5.3 (0.53)	0.0 (0.00)
W	Warehouse	6.1 (0.61)	6.3 (0.63)	0.0 (0.00)

Table 4.5-15 {Projected Construction Worker Census 2010 to 2015}

Year	Construction Workers On Site
2012	531
2013	2281
2014	4000
2015	4000
2016	4000
2017	3215

Table 4.5-16 {Occupancy by Construction Zone}

Zone Description	Zone Code	Conservative Occupancy Fractions Used in Calculation
Batch Plant	B	0.001
Construction on main structures	C	0.665
Laydown	L	0.020
Office/Trailer	O	0.160
Parking	P	0.020
Roads	R	0.020
Shoreline	S	0.066
Tower/Basin	T	0.066
Warehouse	W	0.003
	TOTAL	1.021

Table 4.5-17 {Collective Dose to BBNPP Construction Workers}

Zone	Collective Dose by Zone person-Sievert (person-rem)						Zone
	2012	2013	2014	2015	2016	2017	
B	4.82E-06 (4.82E-04)	2.07E-05 (2.07E-03)	3.63E-05 (3.63E-03)	3.63E-05 (3.63E-03)	3.64E-05 (3.64E-03)	2.92E-05 (2.92E-03)	1.64E-04 (1.64E-02)
C	9.71E-04 (9.71E-02)	4.17E-03 (4.17E-01)	7.32E-03 (7.32E-01)	7.32E-03 (7.32E-01)	7.32E-03 (7.32E-01)	5.88E-03 (5.88E-01)	3.30E-02 (3.30E+00)
L	4.31E-05 (4.31E-03)	1.85E-04 (1.85E-02)	3.26E-04 (3.26E-02)	3.26E-04 (3.26E-02)	3.27E-04 (3.27E-02)	2.63E-04 (2.63E-02)	1.47E-03 (1.47E-01)
O	4.85E-04 (4.85E-02)	2.08E-03 (2.08E-01)	3.65E-03 (3.65-01)	3.65E-03 (3.65-01)	3.65E-03 (3.65-01)	2.94E-03 (2.94E-01)	1.65E-02 (1.65E+00)
P	5.29E-05 (5.29E-03)	2.27E-04 (2.27E-02)	3.98E-04 (3.98E-02)	3.98E-04 (3.98E-02)	3.98E-04 (3.98E-02)	3.20E-04 (3.20E-02)	1.80E-03 (1.80E-01)
R	9.18E-05 (9.18E-03)	4.11E-04 (4.11E-02)	7.84E-04 (7.84E-02)	7.77E-04 (7.77E-02)	8.05E-04 (8.05E-02)	6.70E-04 (6.70E-02)	3.50E-03 (3.50E-01)
S	2.47E-04 (2.47E-02)	1.06E-03 (1.06E-01)	1.86E-03 (1.86E-01)	1.86E-03 (1.86E-01)	1.86E-03 (1.86E-01)	1.50E-03 (1.50E-01)	8.40E-03 (8.40E-01)
T	1.29E-04 (1.29E-02)	5.56E-04 (5.56E-02)	9.76E-04 (9.96E-02)	9.76E-04 (9.76E-02)	9.77E-04 (9.77E-02)	7.85E-04 (7.85E-02)	4.40E-03 (4.40E-01)
W	8.12E-06 (8.12E-04)	3.49E-05 (3.49E-03)	6.12E-05 (6.12E-03)	6.12E-05 (6.12E-03)	6.12E-05 (6.12E-03)	4.92E-05 (4.29E-03)	2.76E-04 (2.76E-02)
By Year	2.03E-03 (2.03E-01)	8.75E-03 (8.75E-01)	1.54E-02 (1.54E+00)	1.54E-02 (1.54E+00)	1.54E-02 (1.54E+00)	1.24E-02 (1.24E+00)	6.94E-02 (6.94E+00)

Figure 4.5-1 {Site Layout}

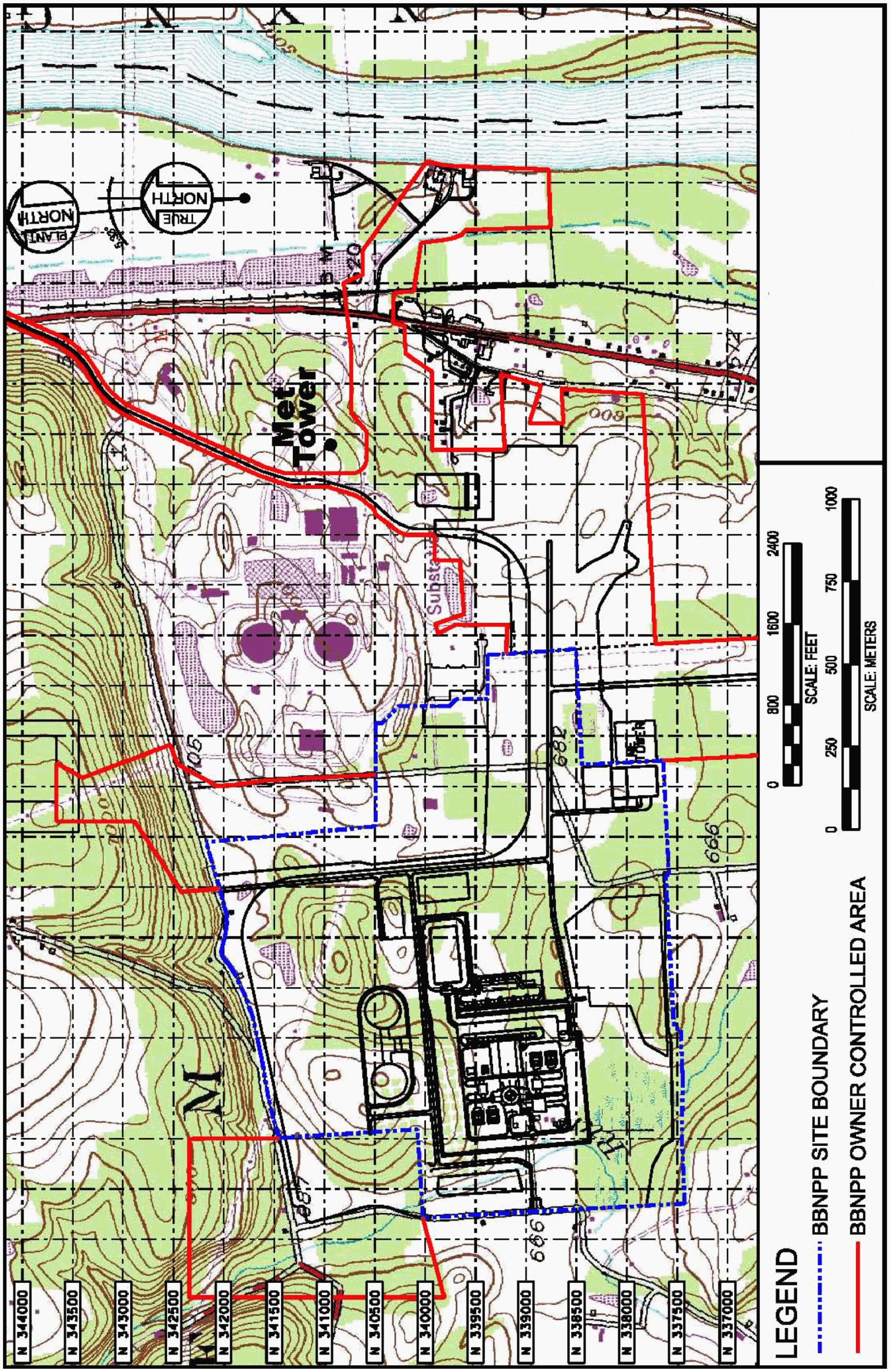


Figure 4.5-2 {CST and RWST Locations on Plant Grid}

(Background image for illustration purposes only. Pertinent information is labeled in red)

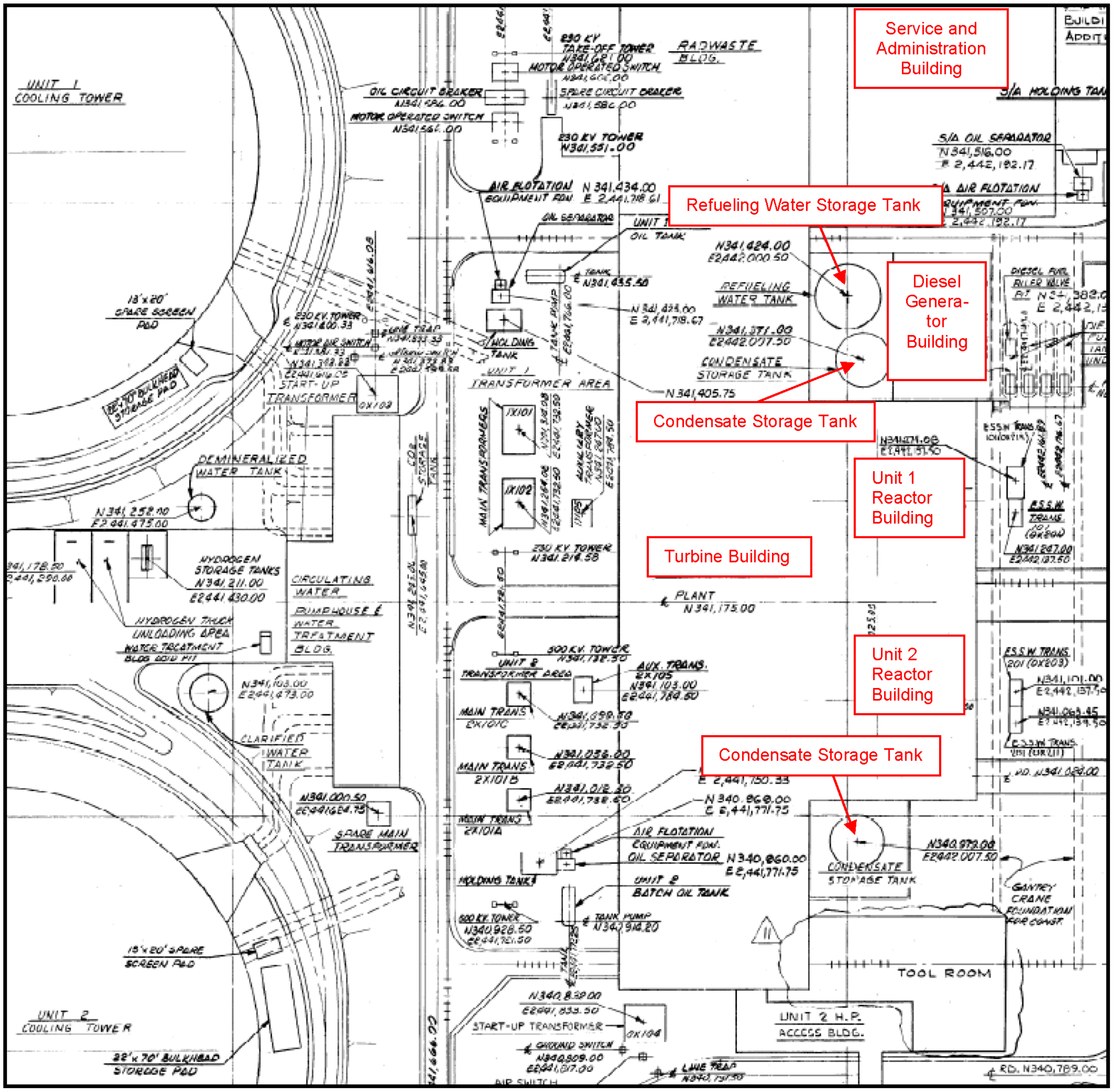


Figure 4.5-3 {Source Locations}

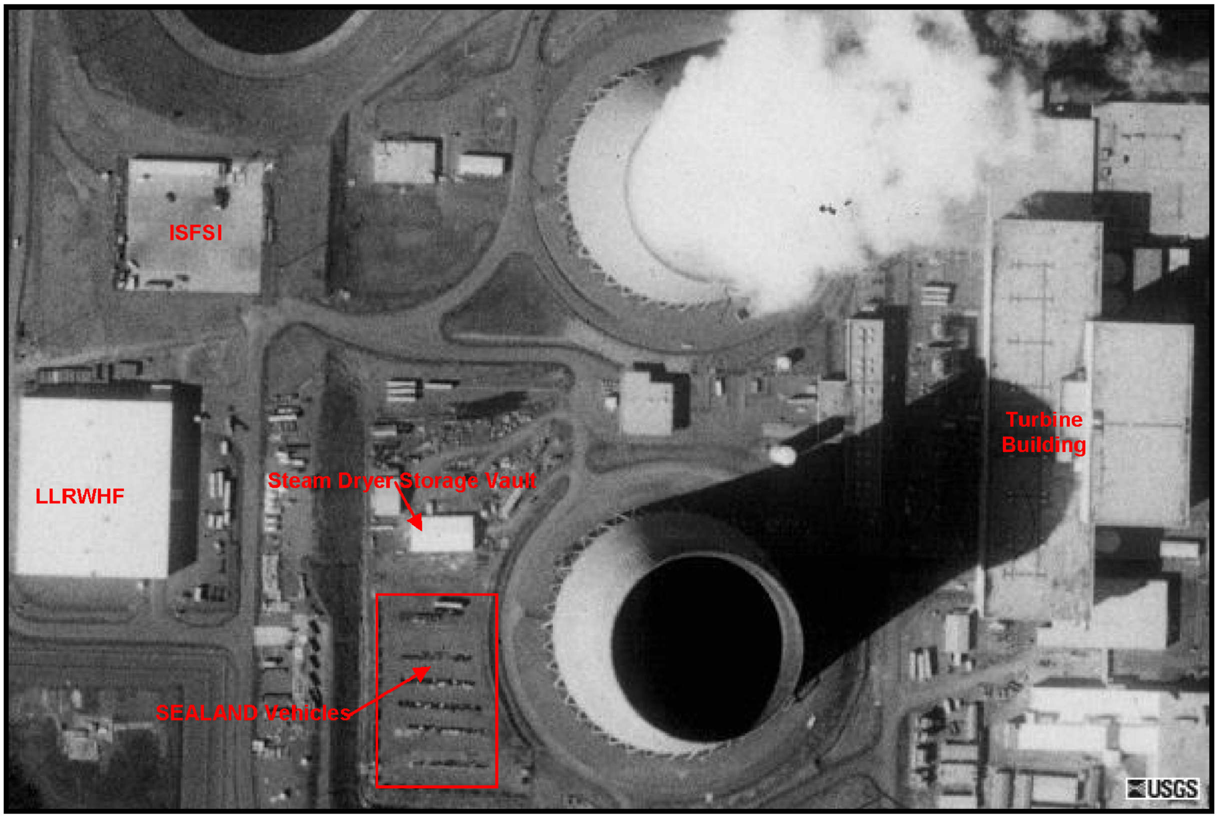


Figure 4.5-4 {Annual Dose Rate in 2017 in Units of mrem 8760 hours}
Background image for illustration purposes only. Illegible data is not pertinent.

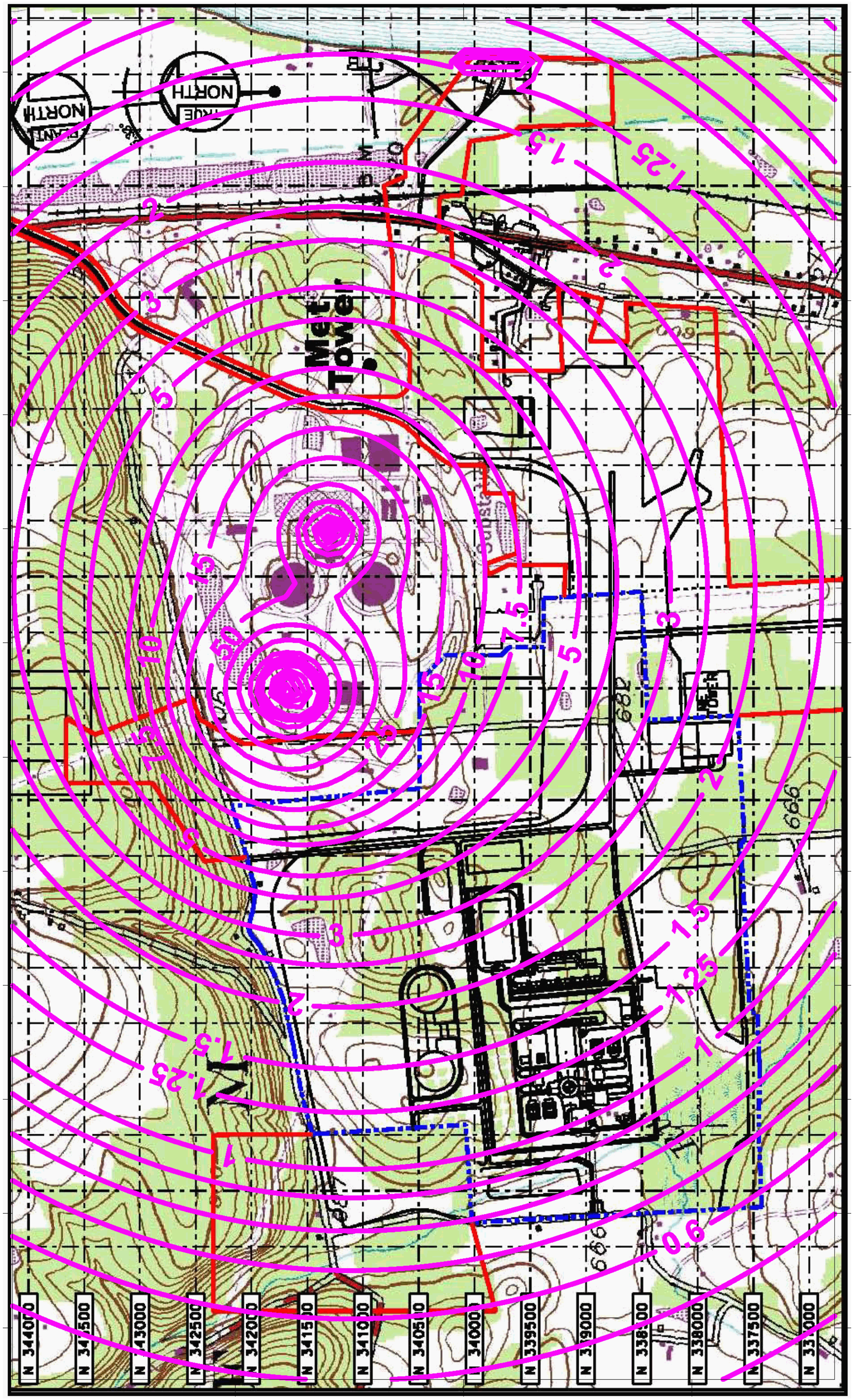
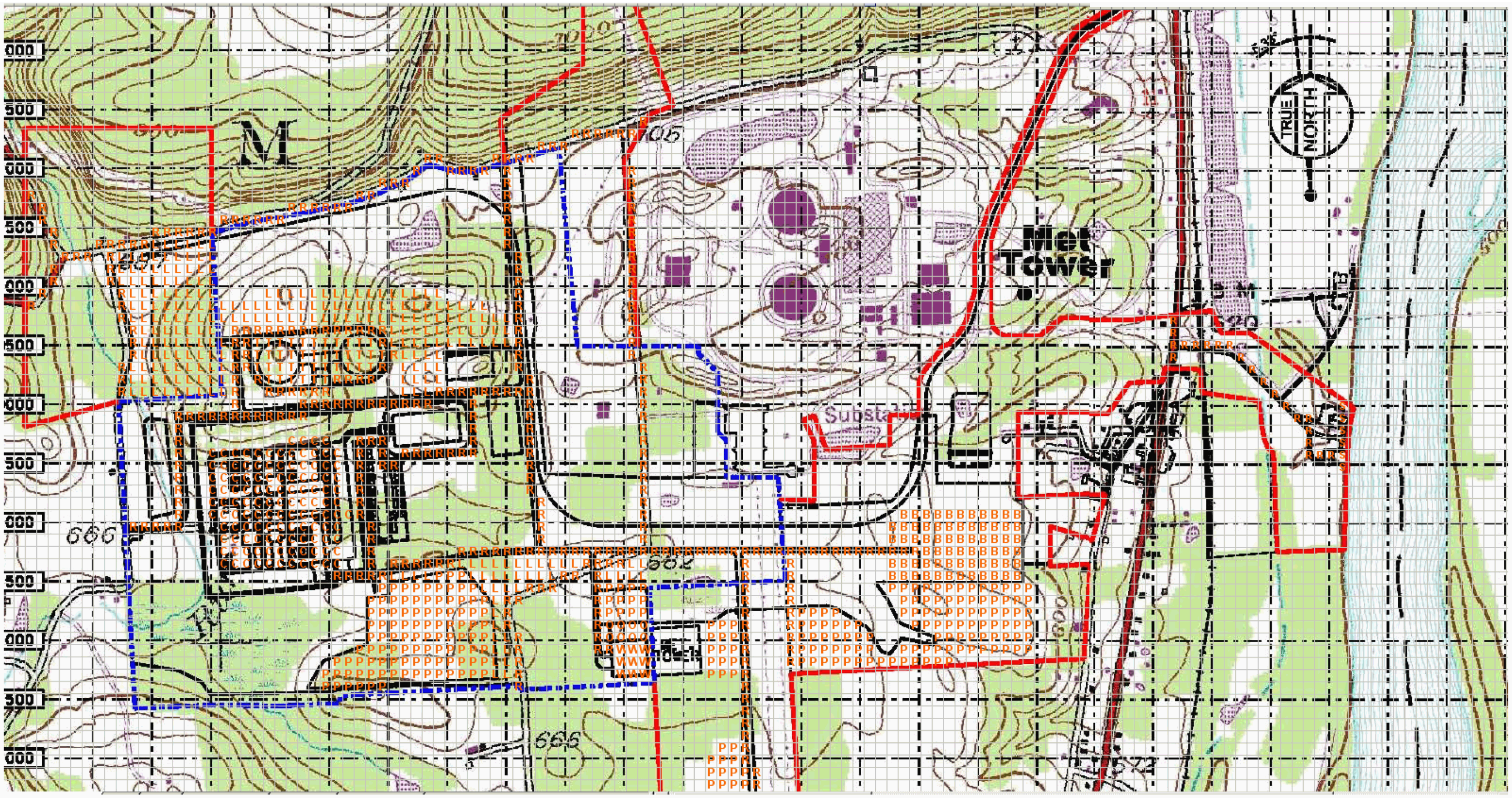


Figure 4.5-5 {Worker Zone Locations}



Notes:
Note 1 – the plant grid is in feet, there is a line every 500 feet and every other line is labeled at 1000 feet.
Note 2 – the following provides a key to the zones indicated in the figure:

Zone	Description	Zone	Description	Zone	Description
B	Batch Plant	O	Office/Trailer	S	Shoreline, tunnel, barge, in/out flow
C	Construction on main structures	P	Parking	T	Tower/Basin/De-salinization
L	Laydown	R	Roads	W	Warehouse

Figure 4.5-6 {ISFSI Distance Equation}

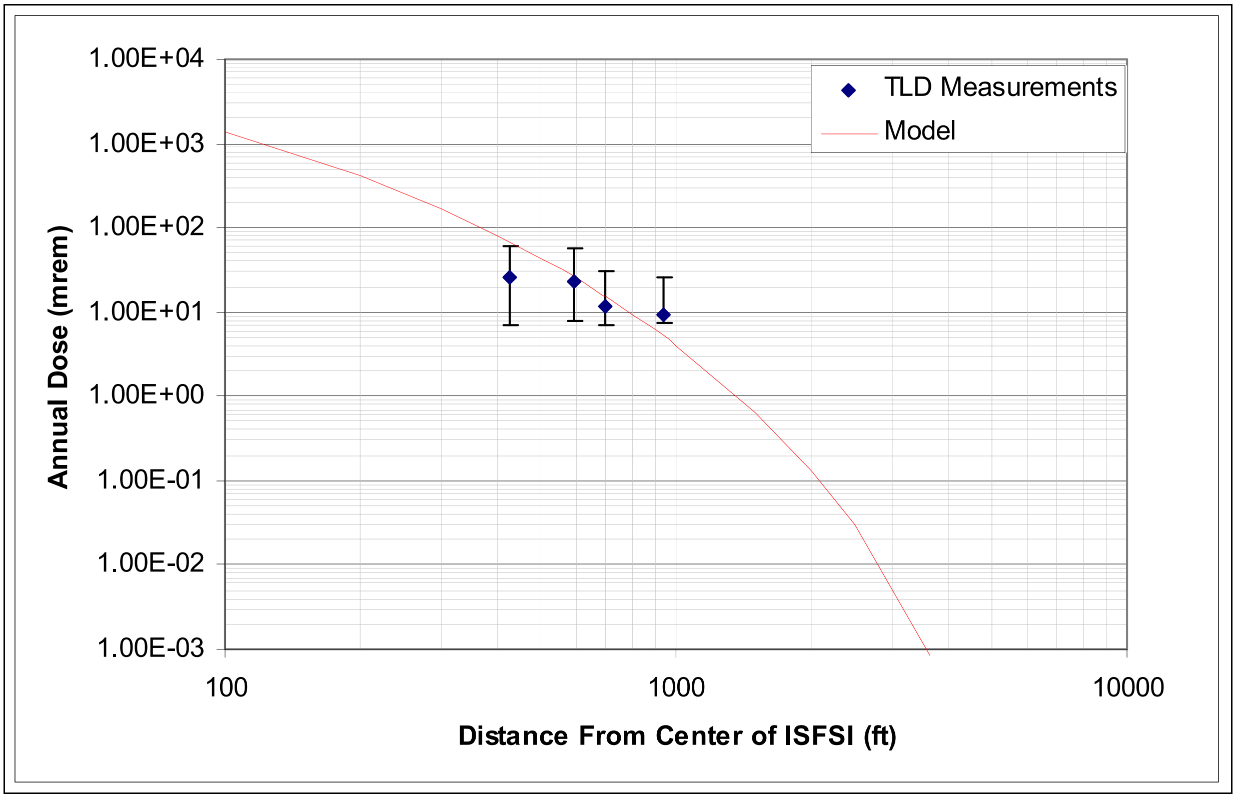


Figure 4.5-7 {ISFSI Satellite Image}

Figure 4.5-8 {SSES ISFSI (blue border) with TLDs and Grid}

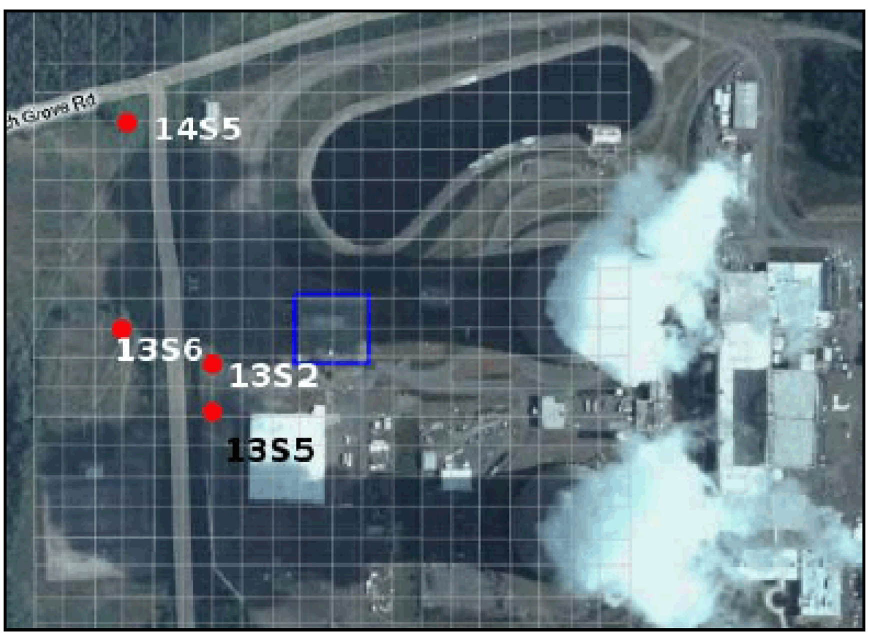


Figure 4.5-9 {TLD (ID 13S2) Data Verifying Time Correlation Function}

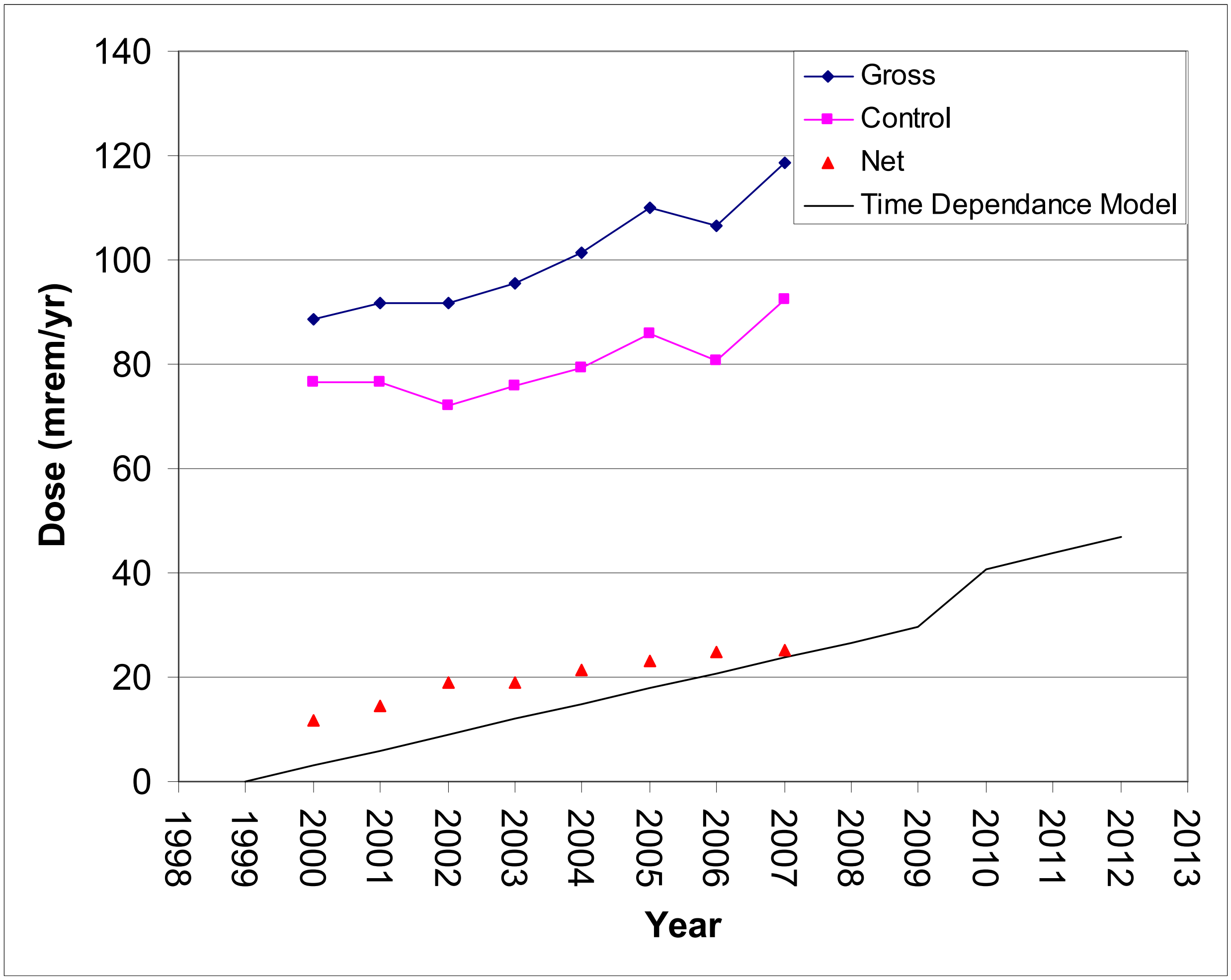


Figure 4.5-10 {Dose vs Distance for CSTs}

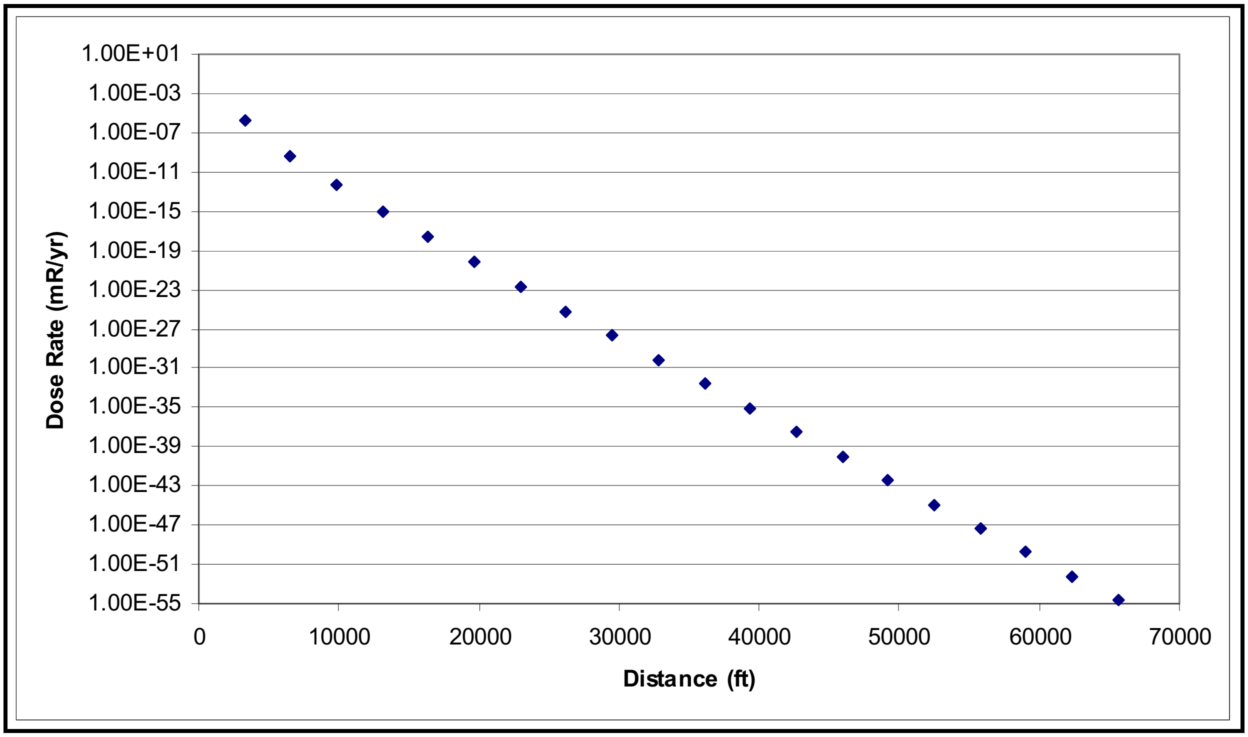


Figure 4.5-11 {Dose vs Distance for LLRWHF}

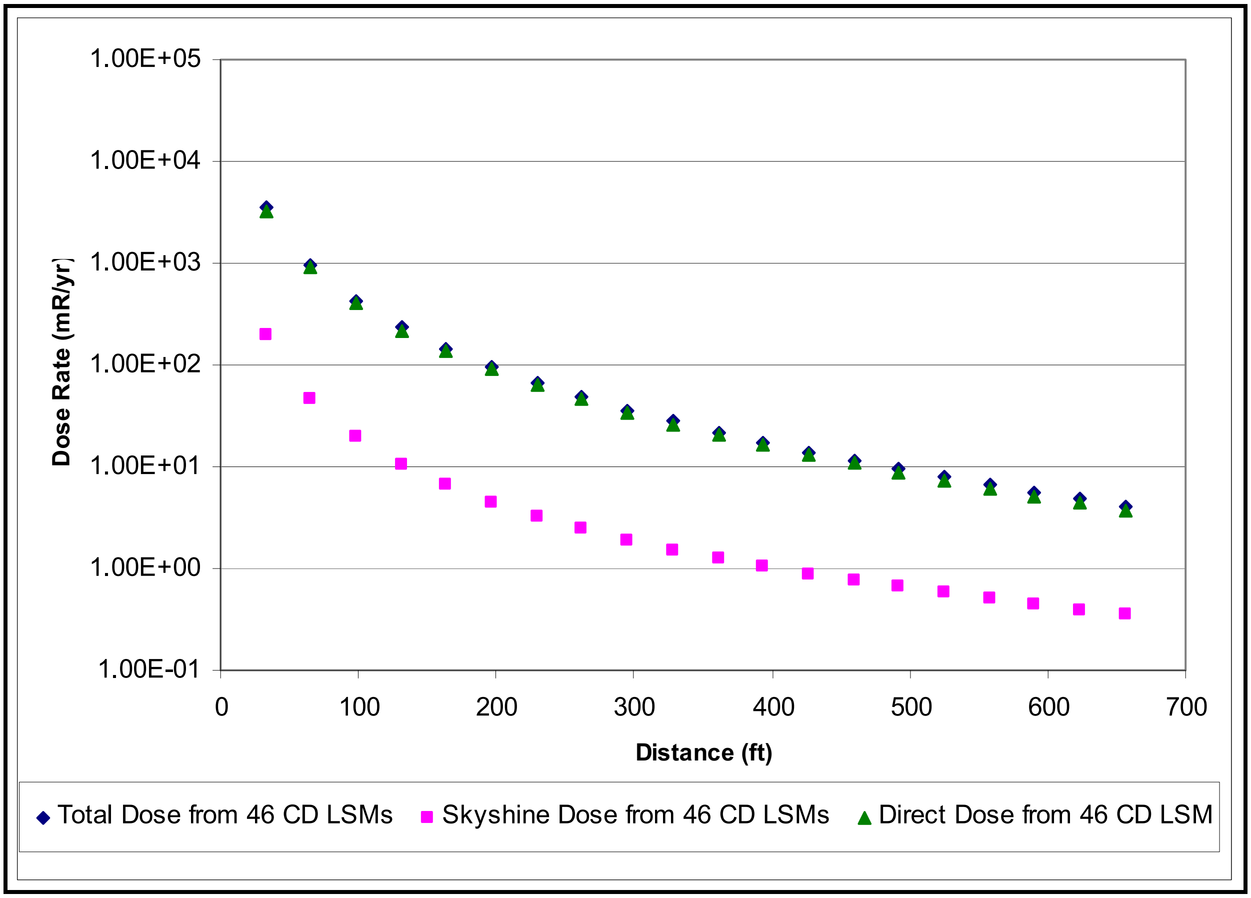


Figure 4.5-12 {Dose vs Distance for SEALAND Containers}

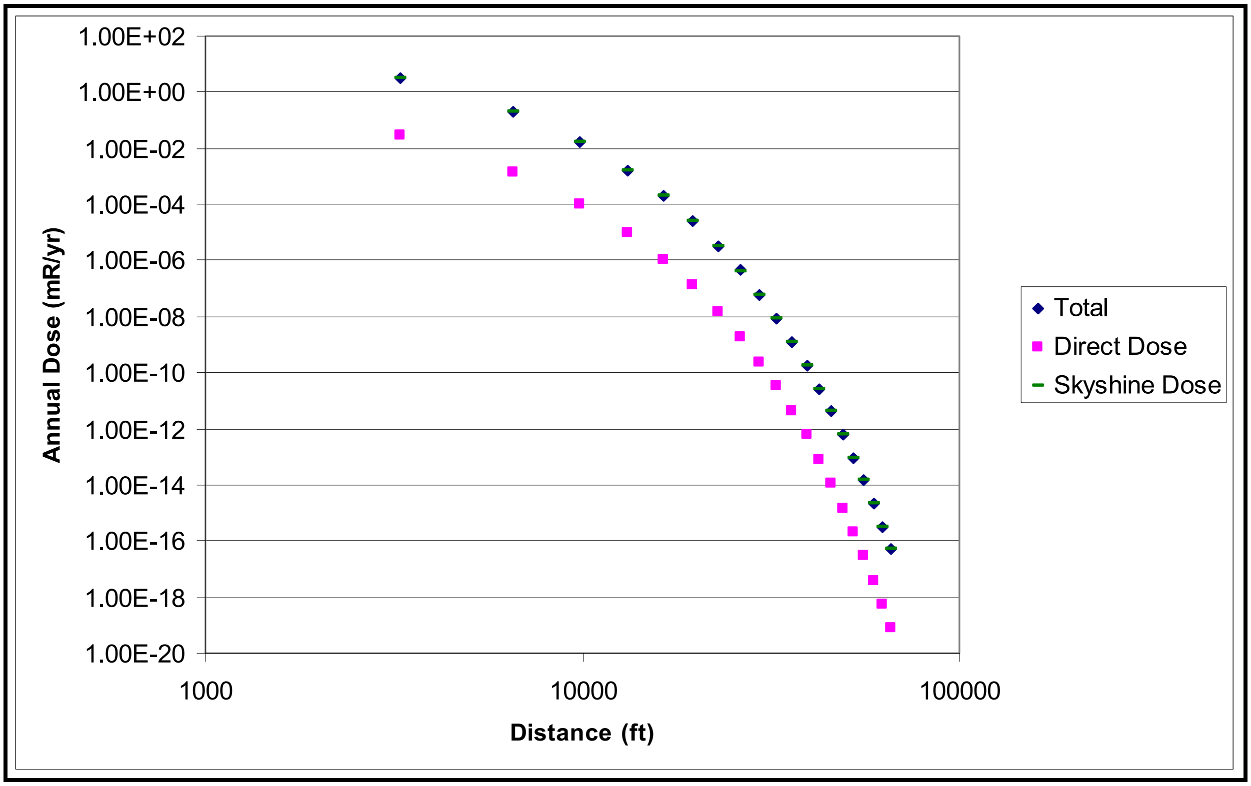


Figure 4.5-13 {Dose vs Distance for Steam Dryer Storage Vault}

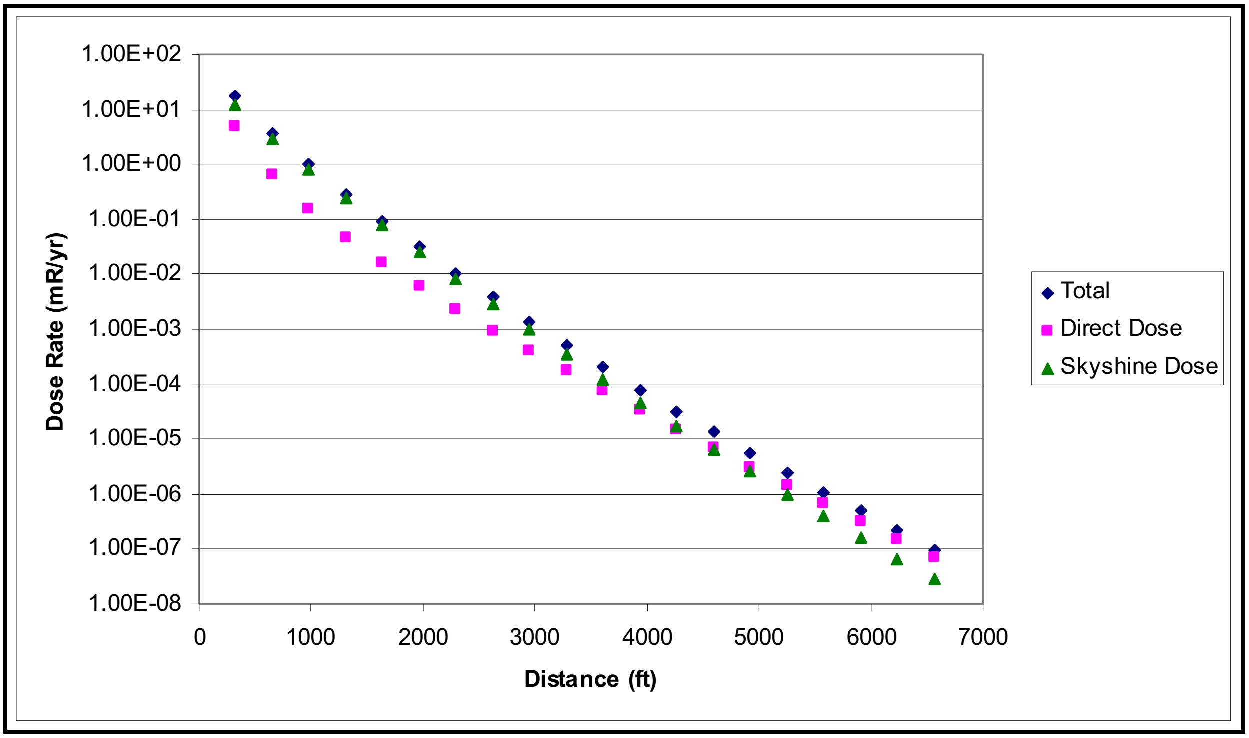
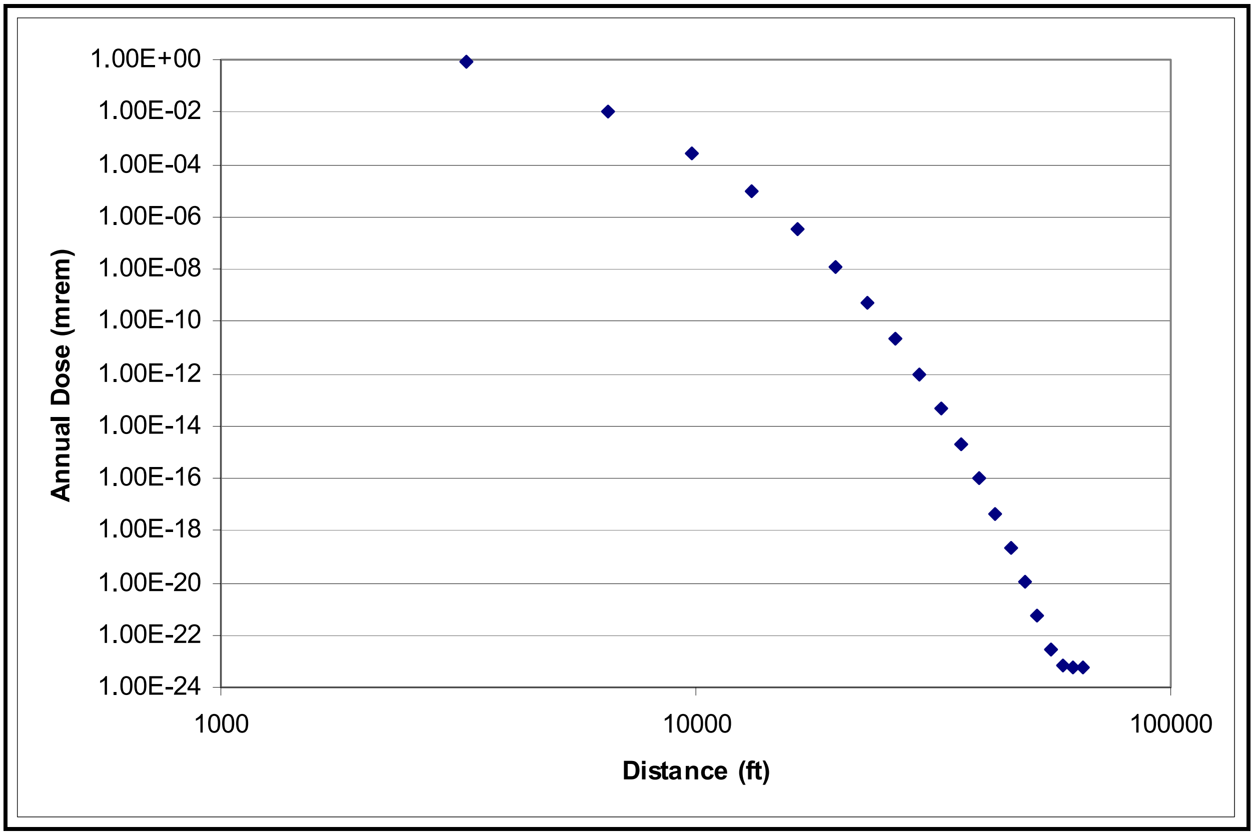


Figure 4.5-14 {Dose vs Distance for Turbine Building}



4.6 MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING CONSTRUCTION

In general, potential impacts will be mitigated through compliance with applicable federal, {Pennsylvania}, and local laws and regulations enacted to prevent or minimize adverse environmental impacts that may be encountered such as air emissions, noise, storm water pollutants, and spills. Principal among these will be the National Pollutant Discharge Elimination System (NPDES) Construction General Permit and the Corps of Engineers 404 Permit to minimize sediment erosion and protect water quality. The Site Resource Management Plan will address affected site lands and waters. Also included will be required plans such as a Storm Water Pollution Prevention Plan (SWPPP) and associated Best Management Practices (BMPs) as well as administrative actions {such as a Traffic Management Plan.}

Table 4.6-1 lists the potential impacts associated with the construction activities described in Section 4.1 through 4.5 and 4.7. The table identifies, from the categories listed below, which adverse impact may occur as a result of construction activities and its relative significance rating (i.e., [S]mall, [M]oderate, or [L]arge) following implementation of associated measures and controls. Table 4.6-1 also includes a brief description, by ER Section, of each potential impact and the measures and controls to mitigate the impact, if needed.

- Erosion and Sedimentation
- Air Quality (dust, air pollutants)
- Wastes (effluents, spills, material handling)
- Surface Water
- Groundwater
- Land Use
- Water Use and Quality
- Terrestrial Ecosystems
- Aquatic Ecosystems
- Socioeconomic
- Aesthetics
- Noise
- Traffic
- Radiation Exposure
- Other (site specific (i.e., non-radiological health impacts))

Based on existing site conditions, {Susquehanna Steam Electric Station programs and procedures}, as well as the measures and controls proposed, the potential adverse impacts identified from the construction of {BBNPP} are anticipated to be SMALL, if any, {for all categories evaluated except traffic, which is expected to be MODERATE, but manageable with mitigation, and wetlands and surface water, which are expected to be MODERATE, but manageable with mitigation.

Table 4.6-2 provides estimates of the percentage of impacts attributable to "construction" and to "preconstruction," as well as a summary of the basis for the estimates. The estimated construction related impacts presented in the table were based primarily on two factors, namely the area associated with the construction of SSCs and the labor hours associated with the construction of SSCs. Information related to these two factors is provided as follows:

- Construction Area - The area that will be developed for BBNPP is estimated to be approximately 630 ac (255 ha.) Of these developed areas, approximately 66 ac (26.7 ha) will be occupied by SSCs (11.5 ac (4.7 ha) each for UHS Pump House and UHS Pond, 11.5 ac (4.7 ha) for the 500 kV GIS Switchyard, and 43 ac (17.4 ha) for the Power Block). It is assumed that Pre-construction activities of clearing/grubbing/site preparation will impact land area to be occupied by both SSCs and non SSC structures/activities; therefore, this results in an allocation of a 95% (597 ac) land area impact due to preconstruction and a 5% (33 ac) land area impact during construction.
- Labor Hours - Based on construction estimates for all phases of development of the BBNPP, the estimated labor hours associated with the construction of SSCs is approximately 50% of the total labor hours associated with the development of the entire BBNPP plant site.

Other factors that were considered where applicable include the following:

- Construction Duration - Estimates of impacts generally associated with construction activities were estimated to be related to construction of SSEs 50% of the time and to preconstruction activities 50% of the time.
- Water Usage - The quantity of water to be used for preconstruction is estimated to be 45% of the total water requirements in Table 4.2-1. Preconstruction activities were assumed to begin at the start of Year 1and extend ten months into Year 3 to align with the assumption that preconstruction activities comprise 50% of time of construction. The water usage predicted for the first 34 months of the 68 month BBNPP construction period is allocated to preconstruction activities. That usage totals 45% of the total volume in Table 4.2-1.}

Table 4.6-1 A Summary of Measures and Controls to Limit Adverse Impacts During Construction

(Page 1 of 10)

ER Reference Section	Potential Impact Category and Description															Proposed Measures and Controls or Mitigating Circumstances
	Erosion/Sediment (ES)	Air Quality (AQ)	Wastes (WS)	Surface Water (SW)	Groundwater(GW)	Land Use (L)	Water Use & Quality (W)	Terrestrial Ecosystems (TE)	Aquatic Ecosystems (AE)	Socioeconomic (S)	Aesthetics (A)	Noise (N)	Traffic (T)	Radiation Exposure (R)	Other (site specific) (O)	
4.1 Land Use Impacts						M										
4.1.1 The Site and Vicinity	Clearing, grading, excavation, and re-contouring. (ES) (AQ) (L) (A)															Comply with NPDES Construction General Permit, including U.S. Environmental Protection Agency (USEPA) effluent limitations.
																Obtain and comply with required agency programs listed in Table 1.3-1.
	Disturbance (temporary and permanent) of wetlands and surface water systems in vicinity. (ES) (SW) (W) (AE)															Use site Resource Management Plan and Best Management Practices (BMPs) to protect and mitigate resources such as wetlands and surface water systems in vicinity.
																Obtain Chapter 105 Water Obstruction and Encroachment permits; comply with BMP requirements.
																Obtain individual Corps of Engineers 404 Permit.
	Soil stockpiling and disturbance to natural drainage channels. (ES) (SW) (L) (AE)															Implement Storm Water Pollution Prevention Plan (SWPPP), including erosion and sediment plan, as part of the NPDES Construction General Permit requirements.
	Removal of existing trees and vegetation. (L) (TE) (A)															Use site Resource Management Plan and comply with BMP requirements.
																Chip unmerchantable trees and spread as wood chips, and/or disposed of at an offsite landfill.
																Restore acreage following construction to the maximum extent possible.
	Construction of temporary and permanent structures. (L) (TE) (A)															Place construction footprint wholly within a dedicated nuclear power plant site.

Table 4.6-1 A Summary of Measures and Controls to Limit Adverse Impacts During Construction

(Page 2 of 10)

ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
	Release of fuel, oils, or other chemicals. (SW) (GW) (W) (TE) (AE)	Implement Spill Prevention, Control, and Countermeasures (SPCC) Plan.
	Heavy equipment transported to the site. (A) (N) (T)	Construct new site access, perimeter roads, and a rail spur will be constructed.
4.1.2 Transmission Corridors and Offsite Areas	-The existing transmission lines have sufficient capacity to carry the total output of the existing Susquehanna Steam Electric Station, as well as BBNPP; as a result, there will be no new offsite transmission lines or rights-of-way disturbance. (L)	Continue existing transmission corridor maintenance policies and practices to protect terrestrial and aquatic ecosystems.
4.1.3 Historic Properties (and Cultural Resources)	Disturbance of potentially eligible archaeological resources. (L)	Complete Phase Ib Cultural Resource Survey Report and receive State Historic Preservation Office (SHPO) consutation in order to identify measures to avoid, minimize, or mitigate any adverse effects. Implement procedures and take appropriate actions (e.g., stop work) following discovery of potential historic/cultural resource.
4.2 Water-Related Impacts	Erosion/Sediment (ES): S Air Quality (AQ): Wastes (WS): Surface Water (SW): M Groundwater(GW): S Land Use (L): Water Use & Quality (W): S Terrestrial Ecosystems (TE): Aquatic Ecosystems (AE): Socioeconomic (S): Aesthetics (A): S Noise (N): Traffic (T): Radiation Exposure (R): Other (site specific) (O):	
4.2.1 Hydrologic Alterations	Erosion, sediment, and storm water runoff (from onsite building, utilities, and road construction activities). (ES) (SW) (W) (AE)	Implement SWPPP, including erosion and sediment plan, as part of the NPDES Construction General Permit requirements.

Table 4.6-1 A Summary of Measures and Controls to Limit Adverse Impacts During Construction

(Page 3 of 10)

ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
	Susquehanna River turbidity/sediment effects (from dredging, refurbishment of the shoreline unloading facility, and installation of the Intake and Discharge Structures). (ES) (SW) (W) (AE)	Comply with Corps of Engineers 404 Permit requirements.
	Temporary use of groundwater. (GW)	Use groundwater flow barriers.
		Use offsite water supply, as needed.
	Temporary dewatering activities. (W) (AE)	Comply with 25 PA Code, Chapter 102 for dewatering activities.
		Obtain individual Corps of Engineers 404 Permit; comply with BMP requirements.
		Monitor perched water and groundwater levels.
	Disturbance (temporary and permanent) of wetlands and surface water systems in vicinity. (ES) (SW) (AE)	Use site Resource Management Plan and BMPs to protect resources such as wetlands and surface water systems in vicinity.
		Obtain Chapter 105 Water Obstruction and Encroachment permits; comply with BMP requirements.
		Obtain individual Corps of Engineers 404 Permit; comply with BMP requirements.
	Shift of the Surficial aquifer recharge area(s). (ES) (SW) (GW) (W)	Monitor construction effluents and storm water runoff.
	Release of fuel, oils, or other chemicals. (SW) (GW) (W) (TE) (AE)	Implement SPCC Plan.
4.2.2 Water Use Impacts	Erosion, sediment, and storm water runoff (from onsite building, utilities, and road construction activities). (ES) (SW) (W) (AE)	Implement SWPPP, including erosion and sediment plan, as part of the NPDES Construction General Permit requirements.
	Temporary use of groundwater. (GW)	Use groundwater flow barriers.
		Use offsite water supply, as needed.
	Reduction and/or increase in available pervious (infiltration) areas. (ES) (SW) (L)	Use site Resource Management Plan and BMPs to protect resources such as wetlands and surface water systems in vicinity.
		Direct runoff into bio-retention ditches.
		Use offsite water supply, as needed.

Table 4.6-1 A Summary of Measures and Controls to Limit Adverse Impacts During Construction

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ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
	Temporary dewatering activities. (W) (AE)	Comply with 25 PA Code, Chapter 102 for dewatering activities.
		Obtain individual Corps of Engineers 404 Permit; comply with BMP requirements.
		Monitor perched water and groundwater levels.
	Disturbance (temporary and permanent) of wetlands and surface water systems in vicinity. (ES) (SW) (AE)	Use site Resource Management Plan and BMPs to protect resources such as wetlands and surface water systems in vicinity.
		Obtain Chapter 105 Water Obstruction and Encroachment permits; comply with BMP requirements.
		Obtain individual Corps of Engineers 404 Permit; comply with BMP requirements.
	Increasing sediment loads into Walker Run. (ES) (SW) (W) (AE)	Implement SWPPP, including erosion and sediment plan, as part of the NPDES Construction General Permit requirements.
	Shift of the Surficial aquifer recharge area(s). (ES) (SW) (GW) (W)	Monitor construction effluents and storm water runoff.
	Creating a local and temporary Surficial aquifer depression. (L) (TE) (A)	Changes to the glacial overburden aquifer water level are expected to eventually recover once construction is complete.
	Release of fuel, oils, or other chemicals. (SW) (GW) (W) (TE) (AE)	Implement SPCC Plan.

ER Reference Section	Erosion/Sediment (ES)	Air Quality (AQ)	Wastes (WS)	Surface Water (SW)	Groundwater(GW)	Land Use (L)	Water Use & Quality (W)	Terrestrial Ecosystems (TE)	Aquatic Ecosystems (AE)	Socioeconomic (S)	Aesthetics (A)	Noise (N)	Traffic (T)	Radiation Exposure (R)	Other (site specific) (O)	Proposed Measures and Controls or Mitigating Circumstances
4.3 Ecological Impacts				S		S			M		S					

Table 4.6-1 A Summary of Measures and Controls to Limit Adverse Impacts During Construction

(Page 5 of 10)

ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
4.3.1 Terrestrial Ecosystems	Loss of vegetation (i.e., red maple, river birch, black cherry, spice bush, skunk cabbage and Canada goldenrod) and some of the existing habitat for important fauna (i.e., Indiana bat, eastern small-footed myotis, northern myotis, Allegheny woodrat, bald eagle, peregrine falcon, osprey, redbelly turtle, timber rattlesnake, eastern hognose snake, eastern spadefoot, northern Pearly-eye, long dash, mulberry wing, Baltimore checkerspot, white-tailed deer, black bear, wild turkey, etc.), as well as forest cover. (ES) (L) (TE) (A)	Implement SWPPP, including erosion and sediment plan (silt fences, vegetative stabilization, bio-retention ditches and other controls) as part of the NPDES Construction General Permit requirements.
		Review BBNPP historic survey database to identify important terrestrial species; conduct new surveys, as needed.
		Use site Resource Management Plan and BMPs (may include restoration), to protect resources.
		Design construction footprint to account for important habitat.
		Minimize lighting, as practicable and allowed by regulation.
		Limit tree cutting activities, if needed, to times and sizes that will not affect fauna habitat.
		Restore acreage or mitigate, if needed, following construction to the extent practicable.
	Disturbance (temporary and permanent) of trees. (L) (TE) (A)	May preserve aesthetically outstanding tree clusters, as practical; harvest merchantable timber; use or recycle other woody material, as appropriate; and develop reforestation plan.
	Disturbance (temporary and permanent) of wetlands and surface water systems in vicinity. (ES) (SW) (AE)	Use site Resource Management Plan and BMPs (silt fences, bio-retention ditches, and vegetative stabilization) to protect resources such as wetlands and surface water systems in vicinity.
		Conduct wetland mitigation, if needed, and/or wetland enhancement at this or another site.

Table 4.6-1 A Summary of Measures and Controls to Limit Adverse Impacts During Construction

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ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
		Obtain Chapter 105 Water Obstruction and Encroachment permits (including dam permits for storm water ponds and a submerged lands license agreement); comply with BMP requirements.
		Obtain individual Corps of Engineers 404 Permit; comply with BMP requirements.
	Disturbance (temporary and permanent) of the Susquehanna Riverlands Environmental Preserve in vicinity. (ES) (SW) (AE)	Use site Resource Management Plan and BMPs (silt fences, bio-retention ditches, and vegetative stabilization) to protect resources such as wetlands and surface water systems in vicinity.
		Conduct wetland mitigation, if needed, and/or wetland enhancement at another site.
	Limited mortality of wildlife (e.g., avian collisions with man-made structures). (TE)	Use site Resource Management Plan and BMPs to protect resources. Monitor and maintain records of environmental data, as needed, per 10 CFR 50.36b.
		Reduce cooling tower lighting, as practicable, and use flashing lights instead of flood lights.
4.3.2 Aquatic Ecosystems	Disturbance (temporary and permanent) of wetlands and surface water systems (pond infilling, elimination and/or creation of ponds or streams, dewatering Canal Susquehanna River bank and bottom substrate, etc.) in vicinity; however, onsite wetlands are not substantively distinguishable from other wetlands in the site vicinity and streams within the construction zone contain no rare or unique aquatic species. (ES) (SW) (L) (W) (AE) (A) Susquehanna River bank may contain rare or unique mussel species.	Review BBNPP historic survey database to identify important aquatic species; conduct new surveys, as needed.
		Implement SPCC Plan.
		Use site Resource Management Plan and BMPs to protect resources.
		Possible relocation of rare or unique mussel species from the construction footprint per PA Fish and Boat Commission requirements.
		Obtain Chapter 105 Water Obstruction and Encroachment permits (including dam permits for storm water ponds and a submerged lands license agreement); comply with BMP requirements.
		Obtain individual Corps of Engineers 404 Permit; comply with BMP requirements.

Table 4.6-1 A Summary of Measures and Controls to Limit Adverse Impacts During Construction

ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
	Temporary sediment and silt increases in surface water systems. (ES) (SW) (W)	Implement SWPPP, including erosion and sediment plan (silt fences, vegetative stabilization, bio-retention ditches, dust suppression, the construction of new impoundments, and other controls), as part of the NPDES Construction General Permit requirements.
	Temporary turbidity increase. (SW) (W)	Comply with Corps of Engineers 404 Permit requirements.
		Construction of cofferdams around work areas where appropriate.
	Release of fuel, oils, or other chemicals. (SW) (GW) (W) (TE) (AE)	Implement SPCC Plan.
	Limited mortality of fish and insects (i.e., resulting from sedimentation and surface water modifications). (AE)	Implement SWPPP, including erosion and sediment plan (silt fences, vegetative stabilization, bio-retention ditches, dust suppression, the construction of new impoundments, and other controls), as part of the NPDES Construction General Permit requirements; comply with BMP requirements.
4.4 Socioeconomic Impacts	(see category ratings below)	
4.4.1 Physical Impacts	Equipment and non-routine noise. (N)	Comply with applicable PA Department of Environmental Protection (DEP) and Salem Township noise restrictions.
		Comply with applicable Occupational Safety and Health Administration (OSHA) noise-exposure limits.

4.4 Socioeconomic Impacts

Erosion/Sediment (ES)	Air Quality (AQ)	Wastes (WS)	Surface Water (SW)	Groundwater(GW)	Land Use (L)	Water Use & Quality (W)	Terrestrial Ecosystems (TE)	Aquatic Ecosystems (AE)	Socioeconomic (S)	Aesthetics (A)	Noise (N)	Traffic (T)	Radiation Exposure (R)	Other (site specific) (O)
	S	S			S				L	S	S	S		

Table 4.6-1 A Summary of Measures and Controls to Limit Adverse Impacts During Construction

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ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
		Implement appropriate training, personal protective equipment, health and safety monitoring and other good industry noise control practices.
	Air emissions (dust and volatiles) increase. (AQ)	Comply with applicable USEPA and PA DEP air quality regulations.
		Implement routine vehicle/equipment inspection and maintenance program.
		Implement measures to comply with Ambient Air Quality Standards (NAAQS) and National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulatory limits.
		Obtain required permits and/or operating certificates.
	Local and regional temporary traffic increase. (AQ) (T)	Heavy plant equipment will be brought to the site on rail when possible.
		Install new site perimeter and access road.
		Signal retiming and/or additions combined with removing street parking and/or re-designation of movements of lanes.
	Site aesthetically altered due to plant construction; construction activities visible, but temporary. (L) (A)	Use low points in topography to create lowest visual profile practicable.
		Minimize tree and vegetation removal and post-construction restoration.
		Minimize new road construction.
		Paint exteriors of structures, where practicable, with a compatible color of the surrounding area.
4.4.2 Social and Economic Impacts	Influx of large construction work force. (W) (S) (T)	Small aggregate socioeconomic impacts anticipated; mitigation not required.
	Public services need (employment, housing, emergency services, schools, land use) increase. (S) (T)	Small aggregate socioeconomic impacts anticipated; mitigation not required. Low income housing not affected due to sufficient vacant housing inside ROI to meet the need.
	Traffic volume increase. (T)	Signal retiming and/or additions combined with removing street parking and/or re-designation of movements of lanes.

Table 4.6-1 A Summary of Measures and Controls to Limit Adverse Impacts During Construction

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<table>
<tr><th>ER Reference Section</th><th colspan="15">Potential Impact Category and Description</th><th>Proposed Measures and Controls or Mitigating Circumstances</th></tr>
<tr><td></td><td colspan="15">Spending and tax revenue increase.
(S)</td><td>Large beneficial impact to property tax revenues; small beneficial impact for other types of tax revenues. No mitigating measures or controls required.</td></tr>
<tr><td>4.4.3 Environmental Justice Impacts</td><td colspan="15">No disproportionate adverse impacts to minority or low-income populations.
(S)</td><td>None necessary.</td></tr>
<tr><td rowspan="8">4.5 Radiation Exposure to Construction Workers</td><td>Erosion/Sediment (ES)</td><td>Air Quality (AQ)</td><td>Wastes (WS)</td><td>Surface Water (SW)</td><td>Groundwater(GW)</td><td>Land Use (L)</td><td>Water Use & Quality (W)</td><td>Terrestrial Ecosystems (TE)</td><td>Aquatic Ecosystems (AE)</td><td>Socioeconomic (S)</td><td>Aesthetics (A)</td><td>Noise (N)</td><td>Traffic (T)</td><td>Radiation Exposure (R)</td><td>Other (site specific) (O)</td><td rowspan="2"></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>S</td><td></td></tr>
<tr><td colspan="15" rowspan="2">SSES Units 1 and 2 gaseous effluents exposure.
(AQ) (SW) (TE) (AE) (R)</td><td>Implement a radiation protection and/or monitoring program and/or as low as is reasonably achievable (ALARA) practices at construction site per 10 CFR 20.1301.</td></tr>
<tr><td>Prohibit consumption of onsite agricultural products.</td></tr>
<tr><td colspan="15" rowspan="2">Independent Spent Fuel Storage Installation (ISFSI) direct radiation exposure.
(TE) (R)</td><td>Implement a radiation protection and/or monitoring program and/or as low as is reasonably achievable (ALARA) practices at construction site per 10 CFR 20.1301.</td></tr>
<tr><td>Prohibit consumption of onsite agricultural products.</td></tr>
<tr><td colspan="15" rowspan="2">Low Level Radioactive Waste Handling Facility (LLRWHF) direct radiation exposure.
(TE) (R)</td><td>Implement a radiation protection and/or monitoring program and/or as low as is reasonably achievable (ALARA) practices at construction site per 10 CFR 20.1301.</td></tr>
<tr><td>Prohibit consumption of onsite agricultural products.</td></tr>
</table>

Table 4.6-1 A Summary of Measures and Controls to Limit Adverse Impacts During Construction

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ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
	SEALAND containers direct radiation exposure. (TE) (R)	Implement a radiation protection and/or monitoring program and/or as low as is reasonably achievable (ALARA) practices at construction site per 10 CFR 20.1301.
		Prohibit consumption of onsite agricultural products.
	Steam dryer storage vault direct radiation exposure. (TE) (R)	Implement a radiation protection and/or monitoring program and/or as low as is reasonably achievable (ALARA) practices at construction site per 10 CFR 20.1301.
		Prohibit consumption of onsite agricultural products.
	Turbine building direct radiation exposure. (TE) (R)	Implement a radiation protection and/or monitoring program and/or as low as is reasonably achievable (ALARA) practices at construction site per 10 CFR 20.1301.
		Prohibit consumption of onsite agricultural products.

ER Reference Section	Erosion/Sediment (ES)	Air Quality (AQ)	Wastes (WS)	Surface Water (SW)	Groundwater(GW)	Land Use (L)	Water Use & Quality (W)	Terrestrial Ecosystems (TE)	Aquatic Ecosystems (AE)	Socioeconomic (S)	Aesthetics (A)	Noise (N)	Traffic (T)	Radiation Exposure (R)	Other (site specific) (O)
4.7 Non-Radiological Health Impacts															S

ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
	Risk to workers from accidents and occupational illnesses. (O)	Implement site-wide Safety and Medical Program, including safety policies, safe work practices, as well as general and topic-specific training.

Table 4.6-2 {Summary of Construction and Preconstruction Related Impacts}

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Section Reference	Potential Impacts and Significance[(a)]	Estimated Impacts (%)		Basis of Estimate
		Construction[(b)]	Preconstruction	
Section 4.1 Land Use Impacts				
Section 4.1.1 The Site and Vicinity				
Section 4.1.1.1 The Site	S - Land Use	5	95	The percentage of the Construction Area impacted during Pre-construction is estimated to be 95% as described previously..
Section 4.1.1.2 The Vicinity	S - Land Use	95	5	Estimates are based on the activities for the construction of BBNPP and supporting facilities that will take place above the tree line and will thus be visible from nearby roadways.
Section 4.1.2 Transmission Corridors and Offsite Areas	S - Land Use	0	100	Transmission corridors are not included in the definition of construction of SSC's. There are no offsite areas associated with the project that are included in the definition of construction of SSC's.
Section 4.1.3 Historic Properties	S-M - Land Use	5	95	The impact of historic properties will apply primarily to preconstruction activities since they will be identified and mitigation plans established prior to land clearing, grading, installation of drainage, erosion and other environmental mitigation measures, construction of temporary roads and laydown areas, etc. There is some small potential for discovery of historic properties during the construction-related excavations.
Section 4.2 WaterRelated Impacts				
Section 4.2.1 Hydrologic Alterations				
Section 4.2.1.1 Description of Surface Water Bodies and Groundwater Aquifers				N/A
Section 4.2.1.2 Construction Activities	S - Erosion and Sediment S - Surface Water S - Groundwater	5	95	The percentage of the Construction Area impacted during Pre-construction is estimated to be 95% as described previously.
Section 4.2.1.3 Water Sources and Amounts Needed for Construction	S - Surface Water	55	45	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction. Estimates are based on the quantity of water to be used during the initial 50% time (assumed for preconstruction) and the remaining years for construction as shown in Table 4.2-1.

Table 4.6-2 {Summary of Construction and Preconstruction Related Impacts}

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Section Reference	Potential Impacts and Significance[a]	Estimated Impacts (%)		Basis of Estimate
		Construction[b]	Preconstruction	
Section 4.2.1.4 Surface Water Bodies Receiving Construction Effluents that Could Affect Water Quality	S - Erosion and Sediment M - Surface Water	5	95	The percentage of the Construction Area impacted during Pre-construction is estimated to be 95% as described previously.
Section 4.2.1.5 Construction Impacts	S - Erosion and Sediment M - Surface Water S - Groundwater	55	45	These estimates are based on the land area that will be impacted by the construction of BBNPP and related facilities and on water usage over the time period of construction. A significant contributor to construction impacts will be de-watering of the deep excavations, with water routed in accordance with a required NPDES permit.
Section 4.2.1.6 Identification of Surface Water and Groundwater Users				N/A
Section 4.2.1.7 Proposed Practices to Limit or Minimize Hydrologic Alterations				N/A
Section 4.2.1.8 Compliance with Applicable Hydrological Standards and Regulations				N/A
Section 4.2.1.9 Best Management Practices				N/A
Section 4.2.2 Water Use Impacts				
Section 4.2.2.1 Description of the Site and Vicinity Water Bodies				N/A
Section 4.2.2.2 Hydrologic Alterations and Related Construction Activities	S - Erosion and Sediment M - Surface Water S - Groundwater	50	50	These estimates are based on the land area that will be impacted by the construction of BBNPP and related facilities and on water usage over the time period of construction. A significant contributor to construction impacts will be de-watering of the deep excavations, with water routed in accordance with a required NPDES permit.

Table 4.6-2 {Summary of Construction and Preconstruction Related Impacts}

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Section Reference	Potential Impacts and Significance[a]	Estimated Impacts (%)		Basis of Estimate
		Construction[b]	Preconstruction	
Section 4.2.2.3 Physical Effects of Hydrologic Alterations	S - Erosion and Sediment M - Surface Water S - Groundwater	50	50	These estimates are based on the land area that will be impacted by the construction of BBNPP and related facilities and on water usage over the time period of construction. A significant contributor to construction impacts will be de-watering of the deep excavations, with water routed in accordance with a required NPDES permit.
Section 4.2.2.4 Water Quantities Available to Other Users	S - Surface Water S - Water Use S - Groundwater	55	45	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction. Estimates are based on the quantity of water to be used during the initial 50% time (assumed for preconstruction) and the remaining years for construction as shown in Table 4.2-1.
Section 4.2.2.5 Water Bodies Receiving Construction Effluents	S - Surface water S - Groundwater	55	45	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction. Estimates are based on the quantity of water to be used during the initial 50% time (assumed for preconstruction) and the remaining years for construction as shown in Table 4.2-1.
Section 4.2.2.6 Baseline Water Quality Data				N/A
Section 4.2.2.7 Potential Changes to Surface Water and Groundwater Quality	S - Surface water S - Groundwater	55	45	These estimates are based on the water usage over the time period of construction. The assumption is made that the disturbed land will be stabilized so as to prevent erosion and that potential changes to water quality will be associated with water usage and consequent runoff potential during active preconstruction and construction. A significant contributor to construction impacts will be de-watering of the deep excavations, with water routed in accordance with a required NPDES permit.
Section 4.2.2.8 Surface Water and Groundwater Users				N/A

Table 4.6-2 {Summary of Construction and Preconstruction Related Impacts}

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Section Reference	Potential Impacts and Significance[a]	Estimated Impacts (%)		Basis of Estimate
		Construction[b]	Preconstruction	
Section 4.2.2.9 Predicted Impacts on Water Users	S - Water Use S - Surface water S - Groundwater	55	45	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction. Estimates are based on the quantity of water to be used during the initial 50% time (assumed for preconstruction) and the remaining years for construction as shown in Table 4.2-1.
Section 4.2.2.10 Measures to Control Construction Related Impacts	S - Erosion and Sediment S - Surface water S - Water Use S - Groundwater	5	95	The percentage of the Construction Area impacted during Pre-construction is estimated to be 95% as described previously.
Section 4.2.2.11 Consultation with federal, state, and local environmental organizations				N/A
Section 4.2.2.12 Compliance with Water Quality and Water Use Standards and Regulations				N/A
Section 4.2.2.13 Water Quality Requirements for Aquatic Ecosystems and Domestic Users				N/A
Section 4.3 Ecological Impact				
Section 4.3.1 Terrestrial Ecosystems				
Section 4.3.1.1 Vegetation	S - Terrestrial Ecosystems	5	95	The percentage of the Construction Area impacted during Pre-construction is estimated to be 95% as described previously.
Section 4.3.1.2 Fauna	S - Terrestrial Ecosystems	5	95	The percentage of the Construction Area impacted during Pre-construction is estimated to be 95% as described previously.
Section 4.3.1.3 Wetlands	M - Aquatic Ecosystem	5	95	Estimates are based on the land area of wetlands that will be permanently filled (36 acres of total 196 acres of wetlands, or 18%) due to the construction of the BBNPP site. Most wetlands work is preconstruction; minor wetlands work may be required during construction.

Table 4.6-2 {Summary of Construction and Preconstruction Related Impacts}
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Section Reference	Potential Impacts and Significance[a]	Estimated Impacts (%)		Basis of Estimate
		Construction[b]	Preconstruction	
Section 4.3.1.4 Other Projects Within the Area with Potential Impacts				N/A
Section 4.3.1.5 Consultation				N/A
Section 4.3.1.6 Mitigation Measures				N/A
Section 4.3.2 Aquatic Ecosystems				
Section 4.3.2.1 Impacts to Impoundments and Streams	S - Surface Water S to M - Aquatic Ecosystem	5	95	The percentage of the Construction Area impacted during Pre-construction is estimated to be 95% as described previously.
Section 4.3.2.2 Impacts to Surface Water Bodies	S to M - Aquatic Ecosystem	5	95	These estimates are based on the land area that will be impacted by the construction of BBNPP and related facilities and on water usage over the time period of construction. A significant contributor to construction impacts will be de-watering of the deep excavations, with water routed in accordance with a required NPDES permit. The majority of these construction impacts are temporary. No important fish species or unique habitats are present in the river and thus none will be affected by the construction of BBNPP.
Section 4.3.2.3 Impacts on the Transmission Corridor and Offsite Areas	S - Aquatic Ecosystem	0	100	Transmission corridors are not included in the definition of construction of SSC's. There are no offsite areas associated with the project that are included in the definition of construction of SSC's
Section 4.3.2.4 Summary				N/A
Section 4.4 Socioeconomic Impacts				
Section 4.4.1 Physical Impacts				
Section 4.4.1.1 The Public and Workers				N/A
Section 4.4.1.2 Noise	S - Noise	50	50	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.4.1.3 Dust and Other Air Emissions	S - Air Quality	50	50	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.

Table 4.6-2 {Summary of Construction and Preconstruction Related Impacts}

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Section Reference	Potential Impacts and Significance[a]	Estimated Impacts (%)		Basis of Estimate
		Construction[b]	Preconstruction	
Section 4.4.1.4 Buildings	S - Other (Site Specific)	50	50	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.4.1.5 Transportation Routes	S - Transportation and roads	50	50	Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.4.1.6 Aesthetics	S - Other (Site Specific)	50	50	Estimates are based on the visual aesthetic impact from construction of the BBNPP. The reactor building, turbine hall, and two natural draft cooling towers are expected to affect the aesthetics around the site. However, effects will be limited due to the topography that includes forests and rolling terrain. Additionally, mitigation measures will be implemented.
Section 4.4.2 Social and Economic Impacts				
Section 4.4.2.1 Study Methods				N/A
Section 4.4.2.2 Construction Labor Force Needs, Composition and Estimates				N/A
Section 4.4.2.3 Demography				N/A
Section 4.4.2.4 Housing	S - Socioeconomic	50	50	Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3. Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.4.2.5 Employment and Income	S - Socioeconomic	50	50	Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3. Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.4.2.6 Tax Revenue Generation	L - Socioeconomic	50	50	Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3.

Table 4.6-2 {Summary of Construction and Preconstruction Related Impacts}

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Section Reference	Potential Impacts and Significance[a]	Estimated Impacts (%)		Basis of Estimate
		Construction[b]	Preconstruction	
Section 4.4.2.7 Land Values	S - Socioeconomic	100	0	Estimates are based on the presumption that preconstruction activities have no impact on land values; only permanent structures as will be developed during construction may be perceived to impact land values.
Section 4.4.2.8 Public Services	S - Socioeconomic	50	50	Public services availability is based on the ability of the emergency services to respond simultaneously to an emergency as well as offsite evacuation. For the educational system, estimates are based on the workforce estimated to be necessary for each phase of construction. Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3.
Section 4.4.2.9 Public Facilities	S-M - Socioeconomic	50	50	Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3.
Section 4.4.3 Environmental Justice Impacts				
Section 4.4.3.1 Minority and Low Income Populations and Activities	S - Socioeconomic	50	50	Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3. Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.4.3.2 Subsistence Activities	S - Socioeconomic	5	95	The percentage of the Construction Area impacted during Pre-construction is estimated to be 95% as described previously.
Section 4.5 Radiation Exposure to Construction Workers				
Section 4.5.1 Site Layout				N/A
Section 4.5.2 Radiation Sources at BBNPP	S - Rad Exp to Constr Wkrs	50	50	Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3. Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.5.3 Historical Dose Rates				N/A

Table 4.6-2 {Summary of Construction and Preconstruction Related Impacts}

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Section Reference	Potential Impacts and Significance[a]	Estimated Impacts (%)		Basis of Estimate
		Construction[b]	Preconstruction	
Section 4.5.4 Projected Dose Rates at BBNPP				N/A
Section 4.5.5 Compliance with Dose Rate Regulations				N/A
Section 4.5.6 Collective Doses to BBNPP Workers	S - Effluent and Wastes S - Rad Exp to Constr Wkrs	50	50	Estimates are based on the workforce estimated to be necessary for each phase of construction as shown in Table 4.4-3. Estimates are based on a planned 68 months of construction, of which 50% is preconstruction.
Section 4.5.7 Radiation Protection and ALARA Program				N/A

Notes:
a) The qualitative significance levels of (S)MALL, (M)ODERATE, or (L)ARGE have been assigned based on deployment and effective implementation of mitigation measures and controls required by local, state and federal regulations.
b) "Construction," as defined in 10 CFR 50.2 "Definitions" refers to the construction of "safety-related structures, systems, or components (SSCs) of a facility"

4.7 NONRADIOLOGICAL HEALTH IMPACTS

4.7.1 PUBLIC HEALTH

Members of the public can potentially be put at risk by construction of a new power generation unit. Nonradiological air emissions and dust can migrate offsite through the atmosphere to nearby residences or businesses. {BBNPP non-radiological air emmissions will meet required PaDEP air permit limits.} Noise can also propagate offsite. The increase in traffic from commuting construction workers and deliveries can result in additional air emissions and traffic accidents. Section 4.4.1, "Physical Impacts, addresses these potential impacts to the public from construction activities.

4.7.2 OCCUPATIONAL HEALTH

Construction of a new power generation unit and associated transmission lines would involve risk to workers from accidents or occupational illnesses. These risks could result from construction accidents (e.g., falls and burns), exposure to toxic or oxygen-replacing gases, and other causes.

During construction of {BBNPP, PPL Bell Bend, LLC} will provide a safety and medical program with associated personnel to promote safe work practices and respond to occupational injuries and illnesses. The safety and medical program will utilize an industrial safety manual providing a set of work practices with the objective of preventing accidents due to unsafe conditions and unsafe acts. These safe work practices address hearing protection, confined space entry, personal protective equipment, respiratory protection, heat stress, electrical safety, excavation and trenching, scaffolds and ladders, fall protection, chemical handling, storage, and use, and other industrial hazards. The safety and medical program provides for employee training on safety procedures. Site safety and medical personnel are provided to handle construction accidents and occupational illnesses.

Contractors, including construction contractors, will be required to review all safety policies/safe work practices applicable to their work with site personnel. The contractors will be required to comply with site safety, fire, radiation, security polices, procedures, safe work practices, and federal and state regulations.

The Bureau of Labor Statistics maintains records of a statistic known as total recordable cases (TRC), which are a measure of annual work-related injuries or illnesses that include death, days away from work, restricted work activity, medical treatment beyond first aid, and other criteria. The {2006} nationwide TRC rate published by the Bureau of Labor Statistics for utility system construction is {5.4} per 100 workers {(BLS, 2008)}. A similar statistic for the {Commonwealth of Pennsylvania is 4.1} per 100 workers {(PLDI, 2007). PPL Bell Bend, LLC has} calculated the TRC incidence for the proposed construction site.

{The number of injuries or illnesses that might occur during construction of BBNPP can be calculated as the product of the incidence rate and the number of full time workers divided by 100. The calcuated annual average numbers of injuries and illnesses that could be expected each year of construction, using both the nationwide and Pennsylvania TRC values, are as follows:}

	TRC Incidence Based on US Rate	TRC Incidence Based on {PA} Rate
Average Annual	{162}	{124}

The Bureau of Labor Statistics published {2006} statistics for fatal occupational injuries {(BLS, 2008b)} and average employment {(BLS, 2008a)} that were used to calculate the nationwide annual rate of fatal occupational injuries for utility system construction. Using monthly construction employment predictions and the calculated rate {0.025%}, it is estimated that {5} construction deaths could occur over the pre-construction and construction period of 68 months. {PPL Bell Bend, LLC} will require all construction contractors and subcontractors working at the construction site to comply with all safety procedures in order to prevent and/or minimize the number of deaths, injuries, and illness during the construction of {BBNPP}. Even with effective safety procedures, construction work carries the risk or injury, illness, and death. However, it is not expected that the construction of a new nuclear power generation facility will result in more construction deaths than other similarly sized non-nuclear heavy construction projects.

4.7.3 REFERENCES

{**BLS, 2008a**. Table 1, Incidence rates of nonfatal occupational injuries and illnesses by industry and case types, 2006, Bureau of Labor Statistics, Website: http://www.bls.gov/iif/oshwc/osh/os/ostb1765.pdf, Date accessed: March 25, 2008.

BLS, 2008b. Table A-1, Fatal occupational injuries and even or exposure, All United States, 2006, Bureau of Labor Statistics, Website: http://www.bls.gov/iif/oshwc/cfoi/cftb0216.pdf, Date accessed: March 25, 2008.

PDLI, 2007. 2006 Pennsylvania Worker's Compensation and Workplace Safety Annual Report, Website: http://www.dli.state.pa.us/landi/lib/landi/bwc/publications/2006_annual_report.pdf, Date accessed: March 25, 2008.}