2.3 WATER

2.3.1 Hydrology

This section describes surface water bodies and ground water aquifers that could affect or be affected by the construction and operation of CCNPP Unit 3. The site-specific and regional data on the physical and hydrologic characteristics of these water resources are summarized to provide the basic data for an evaluation of impacts on water bodies, aquifers, human social and economic structures, and aquatic eco-systems of the area.

The CCNPP site covers an area of approximately 2.070 acres (838 hectares) and is located on the western shore of the Chesapeake Bay in Calvert County, MD near Maryland Route 2/4. The climate of the site area is primarily humid subtropical, with hot, humid summers and mild, rainy winters. The topography at the site is gently rolling with steeper slopes along stream banks. Local relief ranges from the sea level up to about 130 ft (40 m) NGVD 29 with an average relief of approximately 100 ft (30 m) NGVD 29. The Chesapeake Bay shoreline near the site, which constitutes the northeastern perimeter, consists mostly of steep cliffs with a narrow beach area.

2.3.1.1 Surface Water Resources

The CCNPP site is located on a high bluff on the Calvert peninsula within the Chesapeake Bay watershed with the bay influencing the siting of the CCNPP Unit 3. The Chesapeake Bay, with a watershed area in excess of 64,000 mi^2 (165,759, km^2), is the largest estuary in the U.S.

The Calvert peninsula is formed by the Chesapeake Bay to the east and the Patuxent River to the west. It has a width of approximately 5 mi (8.0 km) near the CCNPP site. The Patuxent River flows near the CCNPP site from the northwest to the southeast direction, and it discharges into the Chesapeake Bay approximately 8 mi (12.9 km) south of the CCNPP site. Drainage in the vicinity of the CCNPP site includes several small streams and creeks, which fall within two sub-watersheds of the Chesapeake Bay with the drainage divide running nearly parallel to the shoreline. These sub-watersheds include the Patuxent River watershed and the Chesapeake Bay Sub-watershed. Figure 2.3-1 (USGS, 2005e) shows the Chesapeake Bay watershed and sub-watersheds along with the CCNPP site location.

2.3.1.1.1 Freshwater Streams

2.3.1.1.1.1 Local Drainage

The CCNPP site is well drained by a natural network of short, ephemeral streams and creeks within the two sub-watersheds. Approximately 80% of the the CCNPP site is drained through the St. Leonard Creek drainage basin of the Lower Patuxent River watershed. The remaining 20% drains through the Maryland Western Shore watershed discharging northeastward and directly into the Chesapeake Bay by two unnamed creeks, identified as Branch 1 and Branch 2 in Figure 2.3-2. All the streams that drain the CCNPP site that are located east of Maryland Route 2/4 are non-tidal.

Runoff from the CCNPP site that lies within the St. Leonard Creek watershed mainly drains through Johns Creek, a tributary to St. Leonard Creek. The tributaries located upstream of Maryland Route 2/4 that contribute to Johns Creek are the Goldstein Branch, Laveel Branch, and two unnamed branches identified as Branch 3 and Branch 4 in Figure 2.3-2. Approximate lengths and average gradients of these streams are presented in Table 2.3-1.

The St. Leonard Creek watershed has a drainage area of approximately 35.6 mi^2 (92.2 km^2) (CWP, 2004) and mainly includes St. Leonard Creek and its tributaries, including the Perrin

Branch, Woodland Branch, Planters Wharf Creek, Johns Creek and its tributaries, Grovers Creek, Rollins Cove, and Grapevine Cove as shown in Figure 2.3-3. The combined flow from these streams discharge into the Patuxent River through St. Leonard Creek. St. Leonard Creek is tidally influenced at the confluence with Johns Creek.

The CCNPP Unit 3 power block will be located in the Maryland Western Shore Watershed as shown in Figure 2.3-2. The circulating water system (CWS) cooling towers and switchyard will be located in the St. Leonard Creek watershed. Power transmission lines from the CCNPP Unit 3 substation will use the CCNPP Units 1 and 2 transmission corridor. From the CCNPP Unit 3 substation, the transmission lines will proceed in a northwestward direction as shown in Figure 2.3-4. Site grading for CCNPP Unit 3 will affect the headwaters of the unnamed creek, Branch 1, in the Maryland Western Shore watershed. In the St. Leonard Creek watershed, the unnamed creek, Branch 3, will be affected by the switchyard. Post-construction drainage from the CCNPP Unit 3 power block area will be directed towards the Chesapeake Bay, while drainage from the CWS cooling tower and switchyard will be directed to Johns Creek.

The design basis flood elevation at the power block area is 81.5 ft (24.8 m) NGVD 29. However, the maximum water level associated with a safety-related structure is 81.4 ft (24.8 m) NGVD 29, which is 3.2 ft (1.0 m) below the reactor complex grade slab at elevation 84.6 ft (25.8 m) NGVD 29. The design basis flood elevation at the safety-related UHS makeup water intake structure is not expected to exceed 33.2 ft (10.11 m) NGVD 29.

Wetlands near the CCNPP Unit 3 construction area consist of small headwater streams with narrow floodplains and associated riparian forest in the St. Leonard watershed; and minor Chesapeake Bay watershed, minor tributary streams and associated small impoundments. Major impoundments within the site include the Lake Davies stormwater impoundment, sequential perennial water bodies that drain the dredge spoil disposal area, and the Camp Conoy fishing pond, The Camp Conoy pond is located at the headwaters of unnamed creek Branch 1 as shown in Figure 2.3-2. Runoff from Lake Davis discharges west to Goldstein Branch, which then discharges to Johns Creek. The sequential ponds discharge directly to Johns Creek upstream of Goldstein Branch. Both the Camp Conoy fishing pond and Lake Davies are man-made. The U.S. Fish and Wildlife Services (USFWS, 2007) have designated the water bodies within the CCNPP site as palustrine wetlands. Camp Conoy pond and Lake Davies are further sub-classified as unconsolidated bottom permanently flooded and emergent semi-permanently flooded wetlands, respectively. Wetlands along the streams and creeks are mostly classified as forested or scrub-shrub wetlands that are seasonally or temporarily flooded.

2.3.1.1.1.2 Patuxent River Watershed

The Patuxent River is the largest river that is completely contained in Maryland. It drains an area of about 932 mi^2 (2,414 km^2) as shown in Figure 2.3-1, which includes portions of St. Mary's, Calvert, Charles, Anne Arundel, Prince George's, Howard, and Montgomery Counties (MDNR, 2006). The Patuxent River contributes slightly over 1% of the total streamflow delivered annually from the catchment of the Chesapeake Bay Basin (USGS, 1968). The river basin is situated between two large metropolitan areas, which are Baltimore, Maryland and Washington, D.C. Consequently, the Patuxent River watershed has gone through significant suburban development in the past few decades. Present land use in the basin is approximately 44% forest, 30% urban, and 26% agriculture (MDNR, 2006).

The Patuxent River watershed is divided into four sub-watersheds:

- Upper Patuxent River watershed

- Western Branch Patuxent River watershed
- Middle Patuxent River watershed
- Lower Patuxent River watershed

The Lower Patuxent River watershed area within Calvert County is approximately 174 mi^2 (451 km^2) and covers over 50% of land in the county. The major rivers contributing to the watershed are the Patuxent River, Hunting, Hall, St. Leonard, and Battle Creeks. The main stem of the Patuxent River is influenced by tidal fluctuation in the Chesapeake Bay. The tidal influence is observed over nearly the entire length of the river in the lower watershed with the head of tide located south of Bowie, MD.

2.3.1.1.1.3 Streamflow Data and Flooding Intensity for Freshwater Streams

The U.S. Geological Survey (USGS) maintains a network of stream gauging stations on the rivers draining to the Chesapeake Bay, including the Patuxent River. The USGS gauging station on the Patuxent River that is closest to the CCNPP site is located at Bowie, MD (USGS Station No. 01594440), approximately 60 mi (97 km) upstream from the river mouth (USGS, 2006a). The drainage area at the gauging station is 348 mi^2 (901 km^2), approximately 37% of the total drainage area of the Patuxent River. The station is located in the non-tidal reach of the river. The nearest dam and reservoir, the Rocky Gorge Dam and Howard Duckett Reservoir, is located approximately 21 mi (34 km) upstream of the gauging station, and the streamflow may have been affected by this water control structure following the impoundment of the reservoir in 1953. A description of the reservoirs and associated dams is provided in Section 2.3.1.1.1.4.

The USGS records streamflow data on a water year basis, which starts on October 1 the preceding year and ends on September 30 of the water year. The gauge at Bowie, MD has recorded streamflow data from June 1977 to date. Table 2.3-2 (USGS, 2006a) shows the annual maximum streamflow data for the period of data records from 1978 to 2006. The table shows the highest peak flow at this station for the period of record as 12,700 cfs (359.6 cms) on June 26, 2006. However, before the official period of record, a higher peak flow rate was reported as 31,100 cfs (880.7 cms) on June 22, 1972. The maximum daily flow is reported to be 8,860 cfs (250.9 cms) on January 27, 1978. The minimum daily flow of 56 cfs (1.59 cms) was observed between September 17, 18, and 19, 1986. An instantaneous low flow of 32 cfs (0.9 cms) is reported at this location on August 9, 1966. The lowest recorded seven day flow is 57 cfs (1.6 cms) reported on September 15, 1986 (USGS, 2006c).

Monthly streamflows and mean, maximum and minimum daily streamflows at Bowie, MD are presented in Tables 2.3-3 through 2.3-6. Mean monthly streamflow discharges are also presented in Figure 2.3-5 along with the maximum and minimum of mean monthly values. While the mean monthly values show highest flow discharge in March, the maximum values indicate that highest mean monthly streamflows may occur in any month between December and June. The maximum of mean monthly streamflow shows an upper limit of approximately 1,350 cfs (38.2 cms) consistently for several months (Figure 2.3-5).

Because hydrologic conditions in the Patuxent River near the CCNPP site are estuarine as opposed to riverine, flood frequency distributions, maximum and minimum monthly streamflows, and the 10 year, 7 day low flow water level at the gauge location are not relevant for the CCNPP site. Also, water levels and streamflow characteristics of the Patuxent River near the site would have no affect on and would not be affected by the construction and operation of the CCNPP Unit 3.

The USGS operated a gauging station on St. Leonard Creek (USGS Station No. 01594800, St. Leonard Creek near St. Leonard, MD) from 1957 to 1968 and from 2000 to 2003 (USGS, 2006b). The gauging station has a drainage area of 6.73 mi^2 (17.43 km^2), which is approximately 19% of the total St. Leonard Creek watershed. Table 2.3-7 shows the annual maximum streamflow data for the period of data records. The table shows the highest peak flow at this station as 288 cfs (8.1 cms) on July 30, 1960. The maximum daily flow is reported to be 140 cfs (4.0 cms) on August 25, 1958. The station reported no flow several times during 1966, 2002, and 2003 with the minimum daily and instantaneous low flow of 0 cfs (0 cms) as noted in USGS, 2003a. The lowest recorded seven-day flow is 0 cfs (0 cms), as reported on August 24, 1966 as noted in USGS, 2003a.

Monthly streamflows and mean, maximum and minimum daily streamflows near St. Leonard, MD are presented in Tables 2.3-8 through 2.3-11. Mean monthly streamflow discharges are also presented in Figure 2.3-6 along with the maximum and minimum of mean monthly values. It shows that the maximum of mean monthly discharge at this location usually occurs in April and May.

Because the streamflow in St. Leonard Creek at the gauge location will not affect or be affected by the construction and operation of CCNPP Unit 3, flood frequency distributions, maximum and minimum monthly streamflows, and the 10 year, 7 day low flow water level at this gauge location have not been determined.

The U.S. Federal Emergency Management Agency Flood Insurance Rate Map for Calvert County shows that Zone A flood boundaries (flooding determined by approximate methods) extend up Johns Creek to a point upstream of the Maryland Route 2/4 (Solomon’s Island Road) crossing near the mouth of Goldstein Branch as shown in Figure 2.3-7 (FEMA, 1998). A similar extent of flooding is also shown by the Maryland Western Shore Hurricane Evacuation Study being performed by the US Army Corps of Engineers, Baltimore District (USACE, 2006a), as shown in Figure 2.3-8. The figures indicate that the CCNPP site, which is located further to the northeast of the flood extent boundary, would be free from any flooding in the freshwater streams. There are no flood control structures on Johns Creeks or its tributaries.

2.3.1.1.1.4 Dams and Reservoirs

There are no dams or reservoirs on St. Leonard Creek or its tributaries. There are two dams on the Patuxent River. The Rocky Gorge Dam is located approximately 75 mi (121 km) from the mouth of the Patuxent River. The Brighton Dam is located approximately 85 mi (137 km) from the mouth of the Patuxent River. Details of each of the dams are provided in Table 2.3-12 (USACE, 2006b). These impoundments would not affect or be affected by the construction or operation of CCNPP Unit 3.

2.3.1.1.2 The Chesapeake Bay Estuary

2.3.1.1.2.1 Physical Setting

The Chesapeake Bay is one of the largest and most productive estuarine systems in the world. The Chesapeake Bay main stem, defined by tidal zones, is approximately 195 mi (314 km) long (measured from its entrance at the Atlantic Ocean near Norfolk, VA to the mouth of the Susquehanna River near Havre de Grace, MD). At the northern end, the estuary is connected to the Atlantic Ocean through the Chesapeake and Delaware Canal. The estuary varies in width from about 3.5 mi (5.6 km) near Aberdeen, MD to 35 mi (56 km) near the mouth of the

Potomac River, with an approximate width of 6 mi (9.7 km) near the CCNPP site. It has an open surface area of nearly 4,480 mi^2 (11,603 km^2) and, including its tidal estuaries, has approximately 11,684 mi (18,804 km) of shoreline (USGS, 2003b) (CBP, 2006b).

On average, the Chesapeake Bay holds more than 18 trillion gallons (68 trillion liters) of water. Although the Chesapeake Bay's length and width are dramatic, the average depth of the bay, including tidal tributary channels, is only about 21 ft (6.4 m). The Chesapeake Bay is shaped like a shallow tray, except for a few deep troughs that are believed to be paleo channels of the Susquehanna River. The troughs form a deep channel along much of the length of the Chesapeake Bay. This deep channel allows passage of large commercial vessels. Because it is so shallow, the Chesapeake Bay is more sensitive to temperature fluctuations and wind than the open ocean. The Chesapeake Bay is irregular in shape and is long enough to accommodate one complete tidal wave cycle at all times (CBP, 2006b).

The main stem of the bay is entirely within Maryland and Virginia. Nearly 50 rivers, with thousands of tributary streams and creeks, drain an area in excess of 64,000 mi^2 (165,759, km^2) forming the Chesapeake Bay Basin (CBP, 2006b). The basin contains more than 150,000 stream mi (241,402 stream km) in the District of Columbia and parts of six states: New York, Pennsylvania, Maryland, Virginia, West Virginia, and Delaware as shown in Figure 2.3-1. Nine rivers, including the Susquehanna, Patuxent, Potomac, Rappahannock, York (including its Mattaponi and Pamunkey tributaries), James, Appomattox, and Choptank, contribute over 90% of the Chesapeake Bay's mean annual freshwater inflow. The Susquehanna River, the largest river that enters the bay, drains nearly 43% of the basin. It normally contributes about 50% of the freshwater reaching the Chesapeake Bay. Eighty percent to 90% of the freshwater entering the Chesapeake Bay comes from the northern and western portions of the basin. The remaining 10% to 20% is contributed by the eastern shore (CBP, 2004). Although the Chesapeake Bay lies totally within the Atlantic Coastal Plain, the watershed includes parts of the Piedmont Province and the Appalachian Province that provide a mixture of waters to the Chesapeake Bay with variable geochemical and sediment origins (USGS 2003b) (CBP, 2006b).

2.3.1.1.2.2 Chesapeake Bay Circulation and Freshwater Flow

Circulation in the Chesapeake Bay is mainly governed by astronomical tides entering the Chesapeake Bay through the Chesapeake Bay mouth near Norfolk, VA; gravitational flow due to freshwater inflow from the rivers; and wind-driven and atmospheric pressure-driven circulation. The effect of these physical processes is further impacted by the irregular Chesapeake Bay shape and bathymetry variation. The combined interaction of these physical processes also causes a varying degree of mixing of tidal water to produce different salinity zones over the Chesapeake Bay length.

The USGS provides estimates of mean monthly freshwater inflow to the Chesapeake Bay based on a methodology (USGS, 1968) that uses index stream gauging data from the Susquehanna, Potomac, and James Rivers (USGS, 2007). Mean annual (water year) freshwater inflow to the Chesapeake Bay for a period from 1938 to 2006 is shown in Figure 2.3-9 (USGS, 2007). The estimated mean monthly freshwater inflow to the Chesapeake Bay between 1951 and 2000 is provided in Table 2.3-13 (USGS, 1968). The maximum, average, and minimum of mean monthly freshwater flows for the same period are shown in Figure 2.3-10 (USGS, 1968). The figure shows that March and April are the wettest months in the Chesapeake Bay basin with mean freshwater inflows of nearly 152,000 cfs (4304 cms) and 145,000 cfs (4106 cms), respectively. The maximum mean monthly freshwater inflow to the Chesapeake Bay, reported as 380,700 cfs (10,780 cms), occurred in April, 1993. August is the driest month with an approximate mean freshwater inflow of 30,800 cfs (872 cfs) from the rivers. The minimum monthly inflow of 7,800 cfs (221 cms) occurred in September, 1964. The annual average freshwater inflow to the bay for the period of record is estimated to be approximately 77,500 cfs (2195 cms).

The USGS provides estimates of freshwater inflows to different reaches of the Chesapeake Bay (USGS, 1968) (USGS, 2007). The reach of the Chesapeake Bay that includes the CCNPP site extends from the mouth of the Susquehanna River to just above the mouth of the Potomac River, as shown in Figure 2.3-11, between Sections A and B (USGS, 2007). The southern boundary of the reach, which is Section B, is located south of the CCNPP site. The only major tributary to the Chesapeake Bay south of the CCNPP site that contributes freshwater flow to this reach is the Patuxent River. The USGS estimates indicate that the freshwater inflow available at Section B constitutes approximately 60% of the total freshwater inflow to the Chesapeake Bay (USGS, 1968) (USGS, 2007). Using this ratio of flow distribution, a mean annual freshwater inflow rate of approximately 46,500 cfs (1317 cms) is estimated for the reach including the CCNPP site. Because the Patuxent River contributes only about 1% of total freshwater inflow to the Chesapeake Bay, the estimated mean annual freshwater flow rate for this reach is assumed available at the CCNPP site.

Tides primarily enter the Chesapeake Bay through the southern entrance from the Atlantic Ocean and propagate upstream. Tides can also enter the Chesapeake Bay through the Chesapeake and Delaware Canal, but these tidal influences are limited to the upper Chesapeake Bay region. The modifications of tidal characteristics and tidal circulation within the Chesapeake Bay are dependent on the width, depth, and configuration of the estuarine basins and tributaries. In the Chesapeake Bay, the mean tidal range varies from approximately 2.55 ft (0.78 m) near the Atlantic Ocean entrance (Chesapeake Bay Bridge Tunnel, VA), decreasing to approximately 1.04 ft (0.32 m) at Cove Point, MD near the CCNPP site, and increasing to nearly 1.9 ft (0.58 m) close to the northern head waters (Havre De Grace, MD) (NOAA, 2007a). Additional National Oceanic and Atmospheric Administration (NOAA) tidal records near the site are also available at Long Beach, MD on the western shore; Cambridge, MD on the eastern shore of the Chesapeake Bay; and at Solomons Island on the Patuxent River. The mean tidal range at these locations is estimated as 1.01 ft (0.31 m), 1.62 ft (0.49 m), and 1.17 ft (0.36 m), respectively (NOAA, 2007a).

Due to the effect of Coriolis force, the tidal range is higher on the eastern shore than the western shore of the Chesapeake Bay. The tidal range generally increases as the tidal wave propagates through the tributary rivers. For example, this phenomenon can be observed in the Patuxent River and Potomac River from NOAA tide measurements. The mean tidal range near the entrance of the Patuxent River (Solomons Island, MD) is about 1.17 ft (0.36 m), while the range at the upstream station Lower Marlboro, MD is about 1.79 ft (0.55 m). Similarly, on the Potomac River, between the entrance (Tangier Island, VA) and Washington, D.C., the mean tidal range increases from about 1.51 ft (0.46 m) to 2.79 ft (0.85 m) (NOAA, 2007a). Tides in the Chesapeake Bay are mainly semidiurnal with two nearly-equal tide peaks and two troughs each a day. However, in the upper part of the Chesapeake Bay, mixed-type tides are also observed with unequal tide peaks and troughs. Also, freshwater flow from the Susquehanna River can considerably modify the tidal behavior in the upper reach of the Chesapeake Bay.

Tidal currents in the Chesapeake Bay follow a distribution similar to that of mean tidal ranges. The spring tidal current, as predicted by NOAA at the entrance of the Chesapeake Bay, is about 1.7 knots (3.1 km/hr). At the entrance of Baltimore Harbor, the current magnitude reduces to approximately 1.1 knots (2.0 km/hr), but increases in the Chesapeake and Delaware Canal near Chesapeake City to about 2.5 knots (4.6 km/hr) (NOAA, 2006a). The tides and tidal currents in the Chesapeake Bay can be significantly affected by local meteorological conditions, including wind storms and barometric pressure changes.

The maximum tidal flow into the Chesapeake Bay during spring tides can be estimated from the tidal prism, which is the volume of ocean water entering or exiting the Chesapeake Bay over the flood or ebb tide (one-half tide period) (USACE, 2006c). Using a maximum spring tidal current of 1.7 knots (3.1 km/hr), the average tidal flow rate during spring tide (over one-half tide period) at the Chesapeake Bay entrance is estimated to be about 3,900,000 cfs (110,436 cms) as shown in Table 2.3-14. Interaction of freshwater flow from the rivers with tidal inflow produces a two-layered flow system with the net surface water flow over a tidal period directed towards the ocean and the net bottom water moving up the Chesapeake Bay. Records of field data collected at various locations in the Chesapeake Bay between 1976 and 1983 showed that the magnitude of near-surface and near-bottom residual currents, the net currents averaged over one tidal period, range within 0.1-0.2 knots (5-10 cm/s) with nearly the same magnitudes for surface and bottom layers (Johnson, 1993). In the vicinity of the CCNPP site, the length of tidal excursion, which is the range of water particle movement over a tidal cycle, is estimated to be approximately 1.75 mi (2.82 km).

2.3.1.1.2.3 Water Temperature and Salinity Distribution

The Chesapeake Bay Program (CBP) records water temperature and salinity distributions once and twice every month during winter and summer months, respectively, at several locations in the Chesapeake Bay. The stations in the upper Chesapeake Bay located near the CCNPP site are CB4.2C and CB5.2. Station CB4.2C is located in the middle of the bay across from the mouth of the Choptank River, while CB5.2 is located just upstream of the mouth of the Potomac River, as shown in Figure 2.3-1 (CBP, 2007a). The CCNPP site is located nearly halfway between the two stations. Water temperature and salinity data have been recorded at these stations since 1984 and are available for the 1984-2006 period (CBP, 2007b).

Recorded data from the stations show a strong seasonal dependence on vertical temperature distribution. Water surface temperatures vary within a range from approximately 32°F to 85.5°F (0°C to 29.7°C). Water temperatures near the bottom vary within a range from approximately 32.5°F to 81.3°F (0.3°C to 27.4°C). Vertical water temperature distributions for the two stations during 2004 are shown in Figure 2.3-12 and Figure 2.3-13 (CBP, 2007b). The figures show that the typical thermocline at these stations is located at water depths ranging from 5 to 15 ft (1.5 to 4.6 m) from the surface. The surface temperatures respond more quickly to seasonal air temperature change than the bottom temperatures. As a result, the bottom temperatures lag the surface temperatures over the seasonal cycle of temperature change. At the end of the winter, the vertical temperature distribution is nearly uniform. Towards the end of the spring and early summer, the surface quickly heats up, causing a sharp drop in temperature over the thermocline. By the end of the summer and early fall, the surface temperature begins to fall and it attains a nearly uniform vertical distribution. By the end of the fall (late November) and early winter, the surface has cooled rapidly with the temperature lower than the bottom. The temperature cycle then continues at the end of the winter.

The variation of mean monthly water surface temperatures at CB5.2 is shown in Figure 2.3-14 along with the range of monthly minimum and maximum values (CBP, 2007a). The figure indicates that the mean monthly water surface temperature varies between approximately 36.5°F (2.5°C) in February and 80.6°F (27°C) in June.

The NOAA Chesapeake Bay Office produces three-dimensional temperature and salinity maps for the entire Chesapeake Bay based on interpolation of measured data from the Chesapeake

Bay and its tributaries (NOAA, 2007b). Maximum monthly water temperature distributions for February, May, and August in 2004 are shown in Figures 2.3-15 through 2.3-17. As Figure 2.3-12 and Figure 2.3-13 illustrate, the selected months represent the minimum monthly temperature condition, condition with the maximum temperature gradient across the thermocline, and a well mixed condition for the Chesapeake Bay.

Salinity concentrations in the Chesapeake Bay and its tributaries range from less than 0.5 parts per thousand (ppt) in non-tidal and tidal fresh water areas to about 30 ppt at the mouth of the Chesapeake Bay. Salinities are higher on the eastern side of the Chesapeake Bay than on the western side, due in part to the Coriolis effect of the earth's rotation and in part because more freshwater is discharged from rivers along the western shore of the Chesapeake Bay (CBP, 2004). Salinities are highest after dry weather periods and lowest after wet weather or snowmelt periods. Thus, salinities are usually lowest in April and May, after the spring rains, and increase in August and September after the drier summer months.

Vertical salinity distributions at the CBP stations CB4.2C and CB5.2 show that the typical halocline is located between 5 ft (1.5 m) and 15 ft (4.6 m) of water depth, which is similar to that for the thermocline. The surface salinity at the two stations over the period of record (1984-2006) varied between approximately 2.0 ppt and 21.8 ppt, while the salinity in the lower layer varied within a range of approximately 11.3 to 25.8 ppt (CBP, 2007b). Vertical salinity distributions at the two stations for 2004 are shown in Figure 2.3-18 and Figure 2.3-19. Although the salinity distribution shows a seasonal variation, the average salinity gradient across the halocline remains nearly unchanged throughout the year, unlike the water temperature. The maximum surface salinity recorded over the data period is considerably higher than the maximum surface salinity observed in 2004. This could be due to the fact that during 2004 the annual freshwater inflow to the bay was much higher than the freshwater inflow for an average year, as shown in Figure 2.3-9. The variation of mean monthly surface salinity along with the range of monthly minimum and maximum salinities at CBP station CB5.2 are shown in Figure 2.3-20 (CBP, 2007a). The mean monthly surface salinity at this location varies between approximately 11.6 ppt and 17.0 ppt.

Maps of the three-dimensional salinity field for the Chesapeake Bay and its tributaries for the months of February, May and August 2004 are shown in Figures 2.3-21 through 2.3-23 (NOAA, 2007b). Higher salinities along the eastern shore of the Chesapeake Bay can be observed in the figures.

2.3.1.1.2.4 Sediment Transport and Shoreline Erosion Characteristics

The major sources of sediment to the Chesapeake Bay estuary are from external and internal sources. The three major external sediment sources include a) the above-Fall Line watersheds, b) below-Fall Line watersheds, and c) oceanic inputs. The two main internal sources are a) tidal erosion and b) biogenic productivity (USGS, 2003b). It is estimated that 57% of the total sediment load into the Chesapeake Bay is from tidal erosion, which is the combination of both fastland erosion (shoreline erosion) and near-shore erosion (erosion at the shallow water areas close to the shoreline) (NOAA, 2007b). Approximately 35% of the total sediment load is the contribution from the watersheds above and below the Fall Line, and the remaining 8% of the estimated sediment load into the bay is from oceanic input. Sediment sources due to biogenic productivity are not included in this distribution. It has been assessed (USGS, 2003b) that nearly the entire volume of sediment supplied from the watersheds was fine grained silts and clays. Approximately 14% of the sediments from oceanic input and 67% of sediments from tidal erosion were also estimated to be fine grained silts and clays (USGS, 2003b). Combined annual suspended sediment loads and relation to annual flow for the Susquehanna, Potomac, and the James Rivers near the Fall Line are shown in Figure 2.3-24 for the 1985 to 2001 period (USGS, 2003b).

Both long-term and short-term processes are responsible for shore erosion of the Chesapeake Bay. The slow rise in sea level and wave action are the two primary long-term processes that cause the shoreline to recede. Over the past century, sea level rise in the estuary amounts to approximately 1.3 ft (0.4 m). It may rise by 2 to 3 ft (0.6 to 0.9 m) in the next 100 years, as suggested by some researchers (TSTF, 2005). Waves and surges due to occasional hurricane wind may considerably change coastal morphology. These short-term, high energy erosive waves often reach high, upland banks out of the range of normal tides and waves.

Near the middle reach of the Chesapeake Bay, sediment supply due to tidal erosion is much higher than the supply from the watersheds. In the Maryland Western Shore watershed, annual average fine grained sediment (silts and clays) loads from fluvial sources and from tidal erosion were estimated to be 0.2 and 0.4 million metric tons per year (USGS, 2003b), respectively. In a 433 mi (697 km) length of the shoreline in the Lower Maryland Western Shore watershed, where the CCNPP site is located, this erosion results in an annual average shoreline retreat of 0.47 ft (0.14 m) per year (TSTF, 2005). The local rate of shoreline change in the vicinity of CCNPP site, as estimated by the Maryland Department of Natural Resource (MDNR), is shown in Figure 2.3-25. The rate of shoreline erosion south of the existing barge jetty and near the CCNPP site has been estimated by MDNR to be between 2 and 4 ft (0.6 and 1.2 m) per year. North of the existing intake structure, MDNR has estimated the shoreline change to be between 2 ft (0.6 m) per year accretion and 4 ft (1.2 m) per year erosion. The shoreline near the CCNPP Units 1 and 2 intake structure is stabilized so that any shoreline retreat is precluded. Historic shoreline locations near the CCNPP site in 1848, 1942 and 1993 are shown in Figure 2.3-26 (MGS, 2001).

2.3.1.1.2.5 Chesapeake Bay Bathymetry

Near the CCNPP site, the Chesapeake Bay is approximately 6 mi (10 km) wide, and the bottom elevation of the Chesapeake Bay's deepest section is approximately 105 ft (32 m) NGVD 29, as shown in Figure 2.3-27. The bathymetry near the existing intake and the CCNPP Unit 3 discharge pipeline is also shown in Figure 2.3-27 as an inset map. The deepest portion of the Chesapeake Bay is located nearly at the middle of the bay. From the western shore near the site into the Chesapeake Bay, the bottom elevation decreases from about 0 to -52 ft (0 to -15.9 m) NGVD 29 over a distance of about 3.5 miles (5.6 km). Near the CCNPP site, an intake channel that is perpendicular to the shoreline and is approximately 4,830 ft (1,472 m) long was dredged for CCNPP Units 1 and 2. The design bottom elevation of the dredged channel varied between -51 ft (-15.5 m) NVGD 29 near the intake to -40 ft (-12.2 m) NGVD 29 away from the intake structure. CCNPP Unit 3 will use the same intake channel for the UHS makeup water intake and the CWS makeup water intake. A recent bathymetric survey in front of the CCNPP Units 1 and 2 intake structure indicates that the bottom elevation of the intake channel near the structure has silted-in since the intake channel was dredged. The current bottom elevation of the intake channel near the intake structure is approximately -28 ft (-8.5 m) NGVD 29, as shown in Figure 2.3-27. The figure also shows that the bottom elevation within the intake channel remained nearly uniform over a length of about 2,000 ft (610 m).

2.3.1.2 Groundwater Resources

This section contains a description of the hydrogeologic conditions present at, and in the vicinity of the CCNPP site. This section describes the regional and local groundwater resources that could be affected by the construction and operation of CCNPP Unit 3. The regional and site-specific data on the physical and hydrologic characteristics of these groundwater resources are summarized to provide the basic data for an evaluation of potential impacts on the aquifers of the area. The location of the site, including regional and local surface hydrologic features, is described in Section 2.3.1.1.

2.3.1.2.1 Hydrogeologic Setting

The location of the CCNPP site in reference to the Mid-Atlantic States is shown in Figure 2.3-28. The site is located in Calvert County, MD, and lies within the Coastal Plain Physiographic Province, at a distance of about 50 mi (80 km) east of the Fall Line. The Coastal Plain Physiographic Province is a lowland that is bordered by the Atlantic Ocean to the east and the Fall Line to the west. The Fall Line is a demarcation, separating the eastern, unconsolidated coastal plain sediments from the consolidated rocks of the western physiographic provinces associated with the Appalachian Mountains. Although the Coastal Plain is generally a flat, seaward-sloping lowland, this province has areas of moderately steep local relief that reach elevations of several hundred feet (USGS, 1997b).

The CCNPP site is underlain by approximately 2500 ft (762 m) of Coastal Plain sedimentary strata of Cretaceous and Tertiary age that dips southeast. Underlying these sediments are crystalline and metamorphic rocks of Precambrian and Early Paleozoic age. The Cretaceous and Tertiary strata are comprised primarily of sedimentary deposits of silt, clay, sand, and gravel, which exhibit considerable lateral and vertical variations in lithology and texture. The stratum forms a wedge-shaped mass, which thickens and deepens to the southeast from the Fall Line towards the Atlantic Ocean. Water-bearing units within the Coastal Plain sediments consist of unconsolidated to semi-consolidated sand aquifers separated by clay confining units. The sediments that compose the aquifer system were deposited in non-marine, marginal marine, and marine environments during a series of marine transgressions and regressions during Cretaceous and Tertiary times (USGS, 1997b).

Parts of five physiographic provinces are present in Maryland as shown in Figure 2.3-29 and Figure 2.3-30). These include (from west to east):

- Appalachian Plateau Province
- Valley and Ridge Province
- Blue Ridge Province
- Piedmont Province
- Coastal Plain Physiographic Province

The provinces are illustrated in Figure 2.3-29 (USGS, 1997b), which also illustrates the aquifer systems associated with these provinces. Figure 2.3-30 (USGS, 1997b) is a cross-section view of these provinces. The Fall Line identifies a topographical contrast between the western physiographic provinces and the eastern Costal Plain Physiographic Province.

Groundwater occurrence is only significant to the site within the Coastal Plain Physiographic Province, specifically, the regional area of southern Maryland. However, a brief discussion of groundwater within the other provinces is included below to provide a more complete picture of Maryland's hydrogeologic regimes.

2.3.1.2.1.1 Appalachian Plateau Physiographic Province

The Appalachian Plateau Province extends over most of West Virginia, more than one-half of Pennsylvania, and small parts of westernmost Virginia and Maryland. The province lies approximately 150 mi (241 km) west of the CCNPP site. It is bounded on the east and southeast by the Valley and Ridge Province. The Appalachian Plateau Province is underlain by rocks that are continuous with those of the Valley and Ridge Province, but in the Appalachian Plateau Province the sedimentary rocks are nearly flat-lying, rather than being intensively folded and faulted (USGS, 1997b).

The Appalachian Plateau aquifers are contained in Paleozoic sedimentary rocks consisting mostly of shale, sandstone, conglomerate, and limestone. Coal beds are found in rocks of Pennsylvanian age. The water-yielding characteristics of these aquifers vary significantly due to local variations in lithology, fracture density, and thickness of the geologic units. Most of the productive aquifers lie within sandstones or conglomerates, but local limestone formations yield significant volumes of water (USGS, 1997b).

2.3.1.2.1.2 Valley and Ridge Physiographic Province

The northeast-southwest trending Valley and Ridge Physiographic Province lies southeast of the Appalachian Plateau Province and lies approximately 100 mi (161 km) west of the CCNPP site. This province is characterized by layered, sedimentary Paleozoic rocks that have been complexly faulted and folded. These rocks range in age from Cambrian to Pennsylvanian. Elongated mountain ridges are formed by well-cemented sandstones and conglomerates that are resistant to weathering. The less resistant limestone, dolomite, and shale are more easily eroded and form the intervening valleys between the ridges (USGS, 1997b). Additional information is described in Section 2.6.

The principal aquifers in the Valley and Ridge Province are carbonate rocks (limestone and dolomite) and sandstones that range in age from early to late Paleozoic. Most of the more productive aquifers are in carbonate rocks, primarily limestone, and most are in the valleys. However, the water-yielding character of the carbonate rocks depends upon the degree of fracturing and development of solution cavities in the rock. Sandstone formations can also yield large volumes of water where these rocks are well fractured. Generally, the carbonate aquifers predominate in early Paleozoic rocks, whereas the sandstone aquifers are more often found in late Paleozoic rocks (USGS, 1997b).

2.3.1.2.1.3 Blue Ridge Physiographic Province

The Blue Ridge Physiographic Province lies east of the Valley and Ridge Province. It forms a thin (generally 5 to 20 mi (8 to 32 km) wide) and continuous band of mountains trending from the northeast to southwest, from Pennsylvania to Georgia. The province boundary lies approximately 90 mi (145 km) northwest of the CCNPP Site. The rocks comprising the Blue Ridge Province are geologically similar to those of the bordering Piedmont Province. Therefore, from a hydrogeological standpoint, the two provinces are often described together. The principal differences between the two provinces are relief, altitude, and geographical position. The Blue Ridge mountain belt primarily contains crystalline, igneous, and high-grade metamorphic rocks consisting of coarse-grained gneisses and schists. Minor amounts of low-grade metamorphic rocks (i.e., as phyllites and slates) and Early Cambrian sedimentary rocks occur along its western margin (USGS, 1997b).

The primary features for the storage and transmission of groundwater in the Blue Ridge Province occur in surficial regolith and bedrock fractures. Although the porosity of the regolith varies, it is one to three orders of magnitude greater than the porosity of the crystalline bedrock. Accordingly, the regolith has the capacity to store a larger volume of water than the bedrock, which contains water only in its fractures. Because the size, number, and interconnection of bedrock fractures decreases with depth, most of the groundwater is stored in the regolith. Therefore, well yields are greatest in the thickest regolith areas (USGS, 1997b).

2.3.1.2.1.4 Piedmont Physiographic Province

The Piedmont Physiographic Province lies east of the Blue Ridge Province, and its eastern boundary lies approximately 50 mi (80 km) northwest of the CCNPP site. The Piedmont Province is bounded on the east by the Fall Line. The Fall Line is a zone of stream rapids that marks the position where streams flow from the Piedmont Province's consolidated rocks to the Coastal Plain's unconsolidated sediments as shown in Figure 2.3-29 and Figure 2.3-30. The Piedmont Province is an area of varied topography ranging from lowlands to peaks and ridges of moderate relief and elevation. The metamorphic and igneous rock types seen in the Blue Ridge Province are also present in the Piedmont Province. Sedimentary basins that formed within early Mesozoic crustal rift zones are also included in this province. These basins contain shale, sandstone, carbonates, and conglomerate interbedded locally with basalt lava flows and minor coal beds. In some places, these rocks are intruded by diabase dikes and sills (USGS, 1997b).

Aquifers in the Piedmont Province lie predominantly in the shallow, fractured igneous and metamorphic rocks that underlie both the Blue Ridge and Piedmont Provinces. In some topographically low areas of the Piedmont Province, aquifers exist within the carbonate rocks and sandstones associated with the Mesozoic rift basins (USGS, 1997b).

2.3.1.2.1.5 Coastal Plain Physiographic Province

The Coastal Plain Physiographic Province is located east of the Piedmont Province and extends to the Atlantic coastline. The CCNPP site lies on the western shore of Chesapeake Bay in Maryland within the Coastal Plain. Semi-consolidated to unconsolidated sediments from ages as old as Cretaceous form a northeast trending band that narrows to the northeast and parallels the coast as shown in Figure 2.3-29. These sediments overlie igneous and metamorphic basement rocks equivalent to those exposed in the Piedmont. The Coastal Plain sediments form a southeasterly, thickening wedge-shaped mass ranging in thickness from 0 ft (0 m) at the Fall Line to as much as 8,000 ft (2,438 m) along the Atlantic coastline of Maryland (USGS, 1997b).

The sediments in this province consist of layers of sand, silt, and clay with minor amounts of gravel and calcareous sediments. Aquifers are found primarily in the sand, gravel, and calcareous sediments. They can be traced over long distances, although some occur in lenses and some are localized. The aquifers are separated vertically by confining units primarily consisting of clay with lesser amounts of silt and sand. Depending on the thickness and sand content of the confining units, they can act locally as either aquitards or aquicludes by retarding vertical groundwater flow to varying degrees (USGS, 1997b).

In the Mid-Atlantic States, the aquifers within the Coastal Plain Physiographic Province are referred to as the Northern Atlantic Coastal Plain aquifer system (MGS, 2001). This aquifer system extends from New Jersey to the Carolinas. Water-bearing units within the Coastal Plain sediments consist of unconsolidated to semi-consolidated sand aquifers separated by clay confining units. Although water moves more readily through the aquifers than the intervening confining units, water can leak through the confining units and, therefore, the aquifer systems are considered to be hydraulically interconnected to some degree (USGS, 1997b).

The principal aquifers within the system (from shallow to deep) are as follows (USGS, 1997b):

- Surficial aquifer
- Chesapeake aquifer
- Castle Hayne-Aquia aquifer
- Severn-Magothy aquifer
- Potomac aquifer

Closer to the CCNPP Unit 3 site in southern Maryland, this nomenclature changes and is described in Section 2.3.1.2.2. The aquifer units dip east to southeast from the Fall Line towards the Atlantic Ocean. Outcrop areas are identified as areas where the up-dip portion of the aquifer unit reaches ground surface. The deeper aquifers outdrop further west and closer to the Fall Line. Similarly, the more shallow aquifers crop out toward the east.

The Fall Line is considered to be the western most boundary of the outcrop areas for the Coastal Plain aquifer system. In southern Maryland, recharge areas for the shallow aquifer systems (Surficial and Chesapeake aquifers) are localized while the recharge areas for the deeper aquifer systems (Caste Hayne-Aquia, Severn-Magothy, and Potomac aquifers) are the outcrop areas west and northwest in Charles, Prince George's, and Anne Arundel counties as shown in Figure 2.3-29.

2.3.1.2.2 Regional Hydrogeologic Description

Regionally, the CCNPP site is located in southern Maryland. It is underlain by approximately 2500 ft (762 m) of southeasterly dipping Coastal Plain sedimentary strata of Cretaceous and Tertiary ages. The Cretaceous and Tertiary strata are comprised primarily of sedimentary deposits of silt, clay, sand, and gravel which exhibit considerable lateral and vertical variations in lithology and texture. The stratum forms a wedge-shaped mass that thickens to the southeast from the Fall Line towards the Atlantic Ocean.

For southern Maryland, hydrogeologists have refined the aquifer nomenclature system described in Section 2.3.1.2.1.5 based on local hydrostratigraphic conditions. From shallow to deep, the local aquifer systems are as follows: Surficial aquifer, Piney Point-Nanjemoy aquifer, Aquia aquifer, Magothy aquifer, and the Potomac Group of aquifers (MGS, 1996) (MGS, 1997). The main difference between the nomenclatures is that in southern Maryland the Chesapeake aquifer is treated as a confining unit and that the Castle Hayne - Aquia aquifer system has been subdivided into the Piney Point - Nanjemoy and Aquia aquifers.

The refined nomenclature will be used to describe the regional hydrogeologic conditions in the vicinity of CCNPP site. The hydrostratigraphic column for the CCNPP site and surrounding area, identifying geologic units, confining units, and aquifers is shown in Figure 2.3-31 (MGS, 1997). A schematic cross-section of the southern Maryland hydrostratigraphic units is shown in Figure 2.3-32. Geologic and stratigraphic unit descriptions are provided in Section 2.6.

2.3.1.2.2.1 Surficial Aquifer

In Calvert County, the unconfined Surficial aquifer consists of two informal stratigraphic units, the Lowland Deposits and the Upland Deposits. The units comprising the Lowland Deposits are Holocene to Pleistocene in age. They consist of sands and clays deposited in fluvial and estuarine environments. The Upland Deposits are Pliocene in age and consist primarily of sands and gravels deposited in fluvial environments. In Calvert County and St. Mary's County, the Lowland Deposits outcrop along the Patuxent and Potomac Rivers and the Chesapeake

Bay; however, these deposits appear to be absent in the immediate vicinity of the CCNPP site. The Upland Deposits are geographically more extensive in St. Mary's County than in Calvert County, but they are present at the CCNPP site and form the entirety of the Surficial aquifer at the site (MGS, 1996).

Recharge to the Surficial Aquifer is almost exclusively by infiltration from direct precipitation. Flow within the aquifer is localized with water moving from recharge areas (local land surface) along short flow paths to discharge areas (nearby streams or springs). Some of the water may percolate downwards to recharge underlying aquifers. The average annual precipitation in the region between 1951 and 1980 was estimated at 44 in (112 cm) with an average annual runoff estimated as 15 in (38 cm) or 34% (USGS, 1997b). The remaining 29 in (74 cm) of precipitation was available as recharge to the aquifer system, with the exception of that removed from the hydrologic cycle by direct evaporation and plant evapotranspiration.

Within the southern Maryland region, the Surficial aquifer (Upland Deposits) is not a reliable source of groundwater. This is due to its relative thinness, limited saturated thickness (particularly during prolonged drought) and topographic dissections, which causes local groundwater to discharge as small springs (USGS, 1997b). The Surficial aquifer is primarily tapped by irrigation wells and some old farm and domestic wells, but it is not widely used as a potable water supply because of its vulnerability to contamination and unreliability during droughts (MGS, 2005). Wells completed in this aquifer generally yield less than 50 gpm (189 lpm). The groundwater table is usually encountered within a depth of 50 ft (15 m) below ground surface (bgs).

2.3.1.2.2.2 Chesapeake Confining Unit

From youngest to oldest, the Miocene Chesapeake Group consists of the Saint Mary's, Choptank, and Calvert Formations. The Chesapeake Group is a significant aquifer east of the CCNPP site in the Delmarva Peninsula. However, beneath the western shore of Maryland, in the vicinity of the CCNPP site, the Chesapeake Group is described as a confining unit. With the exception of a relatively thin, sandy unit at its base (lower Calvert Formation), the silts and clays of the Chesapeake Group are hydrostratigraphically undifferentiated and define the Chesapeake Confining Unit. The overlying Surficial aquifer is separated from the underlying Piney Point-Nanjemoy aquifer by the Chesapeake Confining Unit (MGS, 1996), although thin and discontinuous sand units capable of producing small quantities of groundwater are present locally. These thin and discontinuous sand units beneath the western shore of Maryland may yield water but not of quantities sufficient for most uses. Within the region, localized sand units are recharged by direct precipitation and percolation through the Surficial aquifer, moving a few miles or less downgradient along the flow path, and discharging to the Chesapeake Bay, streams, or localized areas of pumping. The potentiometric surface of the localized sand aquifers in the Chesapeake Group is generally above mean sea level (USGS, 1997b).

In general, the Chesapeake Confining Unit thickens from northwest to southeast in Calvert County and ranges in thickness from approximately 115 to 300 ft (35 to 91 m). Boring logs from a production well at the CCNPP site indicate that the base of the Chesapeake Confining Unit is at an approximate elevation of –205 ft (-62 m) msl and its total thickness is approximately 250 ft (76 m) (MGS, 1996).

2.3.1.2.2.3 Piney Point-Nanjemoy Aqufier

The Piney Point - Nanjemoy aquifer is stratigraphically complex, consisting of several geologic units. From youngest to oldest, the aquifer includes: the basal sandy strata of the lower to middle Miocene Chesapeake Group (lower Calvert Formation): unnamed upper Oligocene beds: the middle Eocene Piney Point Formation: and the sandy, upper part of the lower Eocene Nanjemoy Formation. Recharge to this aquifer is interpreted to be from direct precipitation in northern Calvert County (lower Calvert Formation) and Anne Arundel County (Nanjemoy Formation) where these geologic units are exposed at the surface. Recharge also presumably occurs from leakage from overlying aquifers. Discharge of the Piney Point-Nanjemoy aquifer is primarily from subaqueous exposures of the aquifer that are presumed to occur along the Continental Shelf. However, the northern portion of the Chesapeake Bay is a discharge area where the aquifer system is eroded by ancestral Susquehanna River paleochannels. Additional discharge occurs at local pumping locations (MGS, 1996).

The basal beds of the Calvert Formation are hydraulically connected to the underlying Piney Point - Nanjemoy aquifer. This unit is generally 10 to 20 ft (3 to 6 m) thick and consists of green to gray, glauconitic fine to medium grained quartz sand. In places, this unit contains coarse shell fragments, phosphate nodules, and gravel (MGS, 1996). The underlying unnamed upper Oligocene beds are thin (less than 5 ft (1.5 m)) to locally absent and very difficult to map in the subsurface. Consequently, the basal Calvert Formation sands and the unnamed upper Oligocene beds are treated as a single subsurface mapping unit (MGS, 1997).

The middle Eocene Piney Point Formation underlies the unnamed upper Oligocene beds and consists of shelly, glauconitic, quartzose sands and carbonate cemented interbeds of sands up to 5 ft (1.5 m) in thickness. The Piney Point Formation thickens to the southeast and ranges from 0 ft (0 m) in central Calvert County to approximately 45 ft (14 m) thick in southern Calvert County at Solomons. Boring logs from a production well at the CCNPP site indicate that the base of the Piney Point Formation is at an approximate elevation of –225 ft (-69 m) msl and its total thickness is approximately 10 ft (3 m) (MGS, 1996).

The Piney Point Formation overlies lower Eocene beds of the Nanjemoy Formation. The Nanjemoy Formation coarsens upward overall from predominantly sandy silts and clays to dominantly clayey sands. This allows it to be subdivided into two hydrostratigraphic units. The sandy upper Nanjemoy Formation is hydraulically connected to the overlying Piney Point Formation and is assigned to the Piney Point-Nanjemoy aquifer. The more clayey sediments of the lower Nanjemoy Formation are placed in the Nanjemoy Confining Unit (MGS, 1996) (MGS, 1983). Boring logs from a production well at the CCNPP site indicate that the base of the coarser grained upper Nanjemoy Formation (bottom of the Piney Point - Nanjemoy aquifer) is at an approximate elevation of –315 ft (-96 m) msl and the total thickness of the Piney Point - Nanjemoy aquifer is approximately 115 ft (35 m) (MGS, 1996).

Results from six pumping tests conducted in the Piney Point - Nanjemoy aquifer in the late 1970s indicated transmissivity values ranging from 275 to 690 ft^2/day (26 to 64 m^2/day). Similar transmissivity values ranging from 125 to 740 ft^2/day (12 to 69 m^2/day) were estimated from well specific capacity data, derived from well completion reports (MGS, 1997). A storage coefficient of 3×10^{-4} was applied to this aquifer as part of a groundwater modeling effort by the State of Maryland (MGS, 1997).

Although a few major users in southern Calvert County and St. Mary's County pump from the Piney Point - Nanjemoy aquifer, it is primarily used for domestic water supply. Domestic well yields are generally less than 20 gpm (76 lpm) with maximum reported well yields of up to 200 gpm (757 lpm) in the Piney Point Formation and up to 60 gpm (227 lpm) in the Nanjemoy formation (MGS, 1996).

2.3.1.2.2.4 Nanjemoy Confining Unit

The Nanjemoy Confining Unit underlies the Piney Point - Nanjemoy aquifer and consists of the lower part of the early Eocene Nanjemoy Formation and the underlying late Paleocene Marlboro Clay. The lower Nanjemoy Formation consists of greenish-gray, glauconitic sandy clay. The underlying Marlboro Clay occurs at the base of the Nanjemoy Confining Unit and consists of a gray to pale red, plastic clay interbedded with reddish silt. Boring logs from a production well at the CCNPP site indicate that the base of the lower Nanjemoy is at an approximate elevation of -415 ft (-126 m) msl and attains a thickness of approximately 90 ft (27 m). These boring logs indicate that the base of the Marlboro Clay is at an approximate elevation of -440 ft (-134 m) msl and is approximately 25 ft (8 m) thick in the vicinity of the CCNPP site (MGS, 1997).

The Marlboro Clay is described as much "tighter" than the muddy sands of the Nanjemoy Formation. Vertical hydraulic conductivities from laboratory tests performed on Nanjemoy samples in Queen Anne's county range from 6.6 x 10^{-3} ft/day to 6.8 x10^{-2} ft/day (2.0 x 10^{-3} m/day to 2.1 x10^{-2} m/day). Similar tests on Marlboro clay samples generated lower results ranging from 9.5 x 10^{-5} ft/day to 4.5 x 10^{-4} ft/day (2.9 x 10^{-5} m/day to 1.4 x 10^{-4} m/day). Specific storage values assigned to the Nanjemoy Confining Unit in several groundwater models range from 1.0 x 10^{-5} ft^{-1} to 7.6 x 10^{-5} ft^{-1} (3.3 x 10^{-5} m^{-1} to 2.5 x 10^{-4} m^{-1}) Laboratory results of specific storage tests on the Marlboro Clay range from 1.0 x 10^{-5} ft^{-1} to 1.1 x 10^{-4} ft^{-1} (3.3 x 10^{-5} m^{-1} to 3.6 x 10^{-4} m^{-1}) (MGS, 1997).

2.3.1.2.2.5 Aquia Aquifier

In southern Maryland, the Aquia aquifer correlates with the late Paleocene Aquia Formation. The Aquia Formation is poorly to well sorted, shelly and glauconitic quartz sand with carbonate cemented sandstones and shell beds. The Aquia Formation (aquifer) dips to the southeast with its upper surface ranging in elevation from approximately -100 ft (-30 m) msl in northern Calvert County to approximately -500 ft (-152 m) msl just off Solomon in southern Calvert County. The aquifer's thickness varies considerably in Calvert County. It reaches a maximum thickness of approximately 200 ft (61 m) in east-central and northeastern Calvert County and thins to the northwest and southeast where it reaches a thickness of approximately 145 ft (44 m) at Solomons and 160 ft (49 m) at the boundary between Anne Arundel County and Calvert County. The Aquia aquifer thins progressively to the southeast where it grades into predominantly fine-grained sediments and hydraulically becomes a confining unit in southernmost St. Mary's County where it is no longer used for water supply. Boring logs from a production well at the CCNPP site indicate that the base of the Aquia aquifer is at elevation –560 ft (-171 m) msl and its total thickness is approximately 145 ft (44 m) (MGS, 1996).

Aquia aquifer transmissivity maps derived from pumping tests display a general correlation to Aquia aquifer thickness maps with highest transmissivity values in areas of greatest aquifer thickness. Reported transmissivities in northern Calvert County at Randle Cliff Beach are 1330 ft^2/day (124 m^2/day) where the Aquia reaches its maximum thickness of approximately 200 ft (61 m). Farther south, at Solomons, reported transmissivities are 755 ft^2/day (70 m^2/day) where the aquifer thins to approximately 145 ft (44 m). A transmissivity of 935 ft^2/day (87 m^2/day) is reported at the CCNPP site (MGS, 1997). Storage coefficient values of the Aquia aquifer determined from pumping tests in southern Maryland range from 4 x 10^{-4} to 1 x 10^{-4} (MGS, 1997).

The Aquia formation is a productive aquifer with reported yield of up to 300 gpm (1136 lpm). Recharge to the Aquia aquifer is from direct precipitation in central Anne Arundel and Prince

George's counties where these units outcrop at the surface. Natural discharge of the Aquia aquifer is to the southeast, primarily from subaqueous exposures of the aquifer that are presumed to occur along the Continental Shelf. Other discharge occurs at local pumping locations.

The Aquia aquifer is used extensively for domestic and major-user water supplies in southern Maryland. By the 1980s, a deep cone of depression (up to 100 ft (30 m)) had developed in the Solomons area of Calvert County and St. Mary's County where it is heavily pumped for public, commercial, and military supplies as shown in Figure 2.3-33 (USGS, 2005a). This has diverted the groundwater flow direction in Calvert County to the south and southeast toward these pumping centers. Because of these considerations, water supply managers in these counties are seeking to shift some groundwater usage from the Aquia aquifer to the deeper Patapsco aquifers (MGS, 2005).

2.3.1.2.2.6 Brightseat Confining Unit

The confining unit underlying the Aquia aquifer is composed of several geologic units. These include the lower Paleocene Brightseat Formation and several upper Cretaceous units including the Monmouth, Matawan, and Magothy Formations. The fine-grained sediments of these formations combine to form the hydraulically indistinguishable Brightseat Confining Unit. The Brightseat Confining Unit has a composite thickness ranging from approximately 20 to 105 ft (6 to 32 m). Boring logs from a production well at the CCNPP site indicate that the base of the Brightseat Confining Unit is at an approximate elevation of -590 ft (-180 m) msl and attains a thickness of approximately 30 ft (9 m) (MGS, 1996).

Most researchers model the Brightseat Confining Unit as a no-flow boundary; however, a few vertical hydraulic conductivity and specific storage values have been reported. Samples from Prince George's County yielded vertical hydraulic conductivity and specific storage values of 9.5×10^{-4} ft/day (2.9×10^{-4} m/day) and 7.4×10^{-5} ft^{-1} (2.4×10^{-4} m^{-1}) respectively. Vertical hydraulic conductivities for the Matawan Formation in the Annapolis area range from 5.7×10^{-5} ft/day to 3.1×10^{-4} ft/day (1.7×10^{-5} m/day to 9.4×10^{-5} m/day (MGS, 1997).

2.3.1.2.2.7 Magothy Aquifer

In central Calvert County, the Magothy aquifer is contained in the Upper Cretaceous Magothy Formation. This unit consists of interbedded red, brown, and gray sands and clays. The Magothy aquifer is present in the northern and central portions of Calvert County. It thins to the south and pinches out in southern Calvert County where it is not a significant aquifer. The southern extent of the aquifer is estimated to lie somewhere between the CCNPP site and Solomons. Boring logs from a production well at the CCNPP site indicate that the base of the Magothy aquifer is at an approximate elevation of -610 ft (-186 m) msl and appears to attain a thickness of less than 25 ft (8 m) (MGS, 1996).

Transmissivities of 450 to 4,570 ft^2/day (42 to 425 m^2/day) have been reported for the Magothy aquifer in southern Anne Arundel County (MGS, 2002). Reported transmissivity values for southern Maryland range from 1,000 to 12,000 ft^2/day (93 to 1,115 m^2/day) with primary use occurring in Anne Arundel County, Prince George's County, and Charles County (MDE, 2004).

Recharge to the Magothy aquifer is from direct precipitation in northern Anne Arundel County where the Magothy Formation outcrops at the surface. In central Calvert County, flow is east-southeast, towards the Atlantic Coast. Other discharge occurs at local pumping locations (MGS, 1997) (USGS, 2005b).

A 2003 southern Maryland potentiometric surface map of the Magothy aquifer is presented in Figure 2.3-34 (USGS, 2005b) to establish the elevation and horizontal direction of groundwater flow.

2.3.1.2.2.8 Potomac Group

The lower Cretaceous Potomac Group consists of, in descending order, the Patapsco, Arundel, and Patuxent Formations. These units form a thick (greater than 1,500 ft (457 m)) series of unconsolidated sediments which locally contain three confining units and three aquifers. Because of the significant depth of these formations and the abundance of exploitable groundwater supplies in shallower aquifers, these units are not currently used as a significant source of groundwater in the vicinity of the CCNPP site. Consequently, available hydrogeologic information for the Potomac Group of aquifers and confining units is limited.

The Upper Patapsco aquifer underlies the Magothy aquifer. It is separated from the Magothy aquifer by clayey units in the top of the Patapsco Formation and bottom of the Magothy Formation. Those clayey units are referred to as the Upper Patapsco confining unit. The Upper Patapsco aquifer includes sand units in the upper part of the Patapsco Formation. This aquifer is not continuous and is comprised of complexly stratified, sandy units separated locally by silts and clays. Individual sand units in the Upper Patapsco aquifer are difficult to correlate laterally, but they appear to be sufficiently interconnected at the regional scale to form a single aquifer (MGS, 2005). The aquifer extends to the northeast through Prince George's County and Anne Arundel County, and beneath Chesapeake Bay to the eastern shore of Maryland. The aquifer is recharged by direct precipitation at outcrops in western and northern Charles County, Prince George's County, and Anne Arundel County. It subcrops beneath the tidal part of the Potomac River where water intrusion has been documented in the Indian Head area near the Potomac River in Maryland (USGS, 1997a).

The Upper Patapsco aquifer is extensively used for public supply in central Charles County, where a cone of depression has formed at an approximate elevation of -136 ft (-41 m) msl. It is also pumped heavily by major users in Prince George's County and Anne Arundel County (MDE, 2004). A few major users pump the Upper Patapsco aquifer in northern St. Mary's County and Calvert County (MGS, 2005). Pumping tests performed in the Upper Patapsco aquifer in east-central Charles County yielded a transmissivity of 1110 ft^2/day (103 m^2/day) (MGS, 2007). Upper Patapsco transmissivities reported for southern Maryland range from 1,000 to 10,000 ft^2/day (93 to 929 m^2/day). Groundwater from this aquifer is primarily used in Charles County and Anne Arundel County.

The Lower Patapsco aquifer underlies the Upper Patapsco aquifer. The two aquifers are separated by clayey units that form the Middle Patapsco confining unit in the middle part of the Patapsco Formation. The Lower Patapsco aquifer comprises sandy units in the lower part of the Patapsco Formation. The aquifer extends northeast to northern Anne Arundel County, but its correlation to the west and southwest is uncertain. It extends across the Chesapeake Bay to the eastern shore of Maryland. The Lower Patapsco aquifer is pumped heavily by users in central and northwestern Charles County, but it is not currently used in St Mary's County or Calvert County (MGS, 2005). Pumping tests performed in the Lower Patapsco aquifer in western Charles County yielded a transmissivity of 1,130 ft^2/day (105 m^2/day). Specific capacity values for the wells used in these pump tests ranged from 1.8 to 7.1 gpm/ft (196 to 772 lpm/m)(MDE,2004) (MGS, 2004). Lower Patapsco aquifer transmissivities reported for southern Maryland range from 1,000 to 5,000 ft^2/day (93 to 465 m^2/day) and the groundwater from this aquifer is primary used in Charles County and Anne Arundel Count.

The Patuxent aquifer lies below the Lower Patapsco aquifer. The two are separated at some locations by the Arundel confining unit. The Arundel Formation consists of a thick series of dense clays and silts and probably does not allow much leakage. However, further research is needed to properly identify the Arundel Formation. Section 2.6 provides addition information.

The Patuxent aquifer is the deepest Coastal Plain aquifer in Maryland, and rests on the Piedmont bedrock surface. Patuxent aquifer transmissivities reported for Charles and Anne Arundel counties range from 200 to 8,000 ft^2/day (19 to 743 m^2/day) (MDE, 2004). Pumping tests performed in the Patuxent aquifer in western Charles County yielded a transmissivity of 937 ft^2/day (87 m^2/day). The specific capacity for the single Patuxent aquifer well used in this pumping test was 2.6 gpm/ft (283 lpm/m) (MGS, 2004). Pumping tests performed on Patuxent aquifer municipal wells in Bowie, Maryland (northern Prince George's County) yielded an average transmissivity of 1,468 ft^2/day (136 m^2/day) (Bowie, 2007). Because of its great depth and the known presence of brackish water in places, its potential for development is thought to be limited (MDE, 2004).

A 2003 southern Maryland potentiometric surface map of the Upper and Lower Patapsco aquifers are presented in Figure 2.3-35 and Figure 2.3-36 (USGS, 2005c) (USGS, 2005d) to establish the elevation and horizontal direction of ground water flow.

2.3.1.2.3 Local and Site-Specific Hydrogeologic Descriptions

The Chesapeake Bay and Patuxent River define the eastern, southern, and western boundaries of Calvert County. The creeks and streams within the area influence the shallow aquifer systems beneath the site. Deeper aquifers are less influenced by incisions of streams and rivers. Natural flow directions in the deeper aquifers are southeasterly from the Fall Line towards the Atlantic Ocean. Localized areas of increasing groundwater withdrawals in southern Maryland have affected both local and regional groundwater movement. With the exception of the Surficial aquifer and the Chesapeake Group, recharge areas are west and northwest of the CCNPP site, towards the Fall Line, in Charles County, Prince George's County, and Ann Arundel County.

The topography at the CCNPP site is gently rolling with steeper slopes along stream courses as shown in Figure 2.3-4. Local relief ranges from sea level up to approximately elevation 130 ft (40 m) msl with an average elevation of approximately 100 ft (30.5 m). The Chesapeake Bay shoreline consists mostly of steep cliffs with narrow beach areas. The CCNPP site is well drained by short, intermittent streams. A drainage divide, which is generally parallel to the coastline, extends across the CCNPP site. The area to the east of the divide drains into the Chesapeake Bay. The western area is drained by tributaries of Johns Creek and Goldstein Branch, which flow into St. Leonard Creek, located west of Maryland Highway 2/4, and subsequently into the Patuxent River. The Patuxent River empties into the Chesapeake Bay approximately 10 mi (16 km) southeast from the mouth of St. Leonard Creek.

The geotechnical and hydrogeological investigations provide information on the CCNPP site to depths of 400 ft (122 m) below ground surface. Subsurface information was collected from over 228 borings and cone penetrometer tests (CPTs). Forty-seven (47) groundwater observation wells were installed across the CCNPP site, completed in the Surficial aquifer and the water-bearing materials in the Chesapeake Group (Schnabel, 2007). The wells were located in order to provide adequate distribution with which to determine CCNPP site groundwater levels, subsurface flow directions, and hydraulic gradients beneath the CCNPP site. Well pairs were installed at selected locations to determine vertical gradients. Field hydraulic conductivity tests (slug tests) were conducted in each observation well. Groundwater levels in the wells installed in 2006 were monitored monthly from July 2006 through June 2007 and have been monitored quarterly thereafter. Groundwater levels in the wells installed in 2008 were monitored monthly from September 2008 through October 2009, and will be monitored on a quarterly basis henceforth. The hydrogeologic conditions interpreted from the information collected during the 2006 through 2007 subsurface CCNPP site field investigation are described in the following sections.

A detailed description of the geotechnical subsurface investigation, is provided in FSAR Section 2.5. The locations of the soil borings that are within the power block area are shown in Figure 2.3-37. Hydrogeologic cross sections for the strata penetrated by the soil borings in the vicinity of the CCNPP Unit 3 area are shown in Figure 2.3-38 and Figure 2.3-39.

2.3.1.2.3.1 Geohydrology

The elevations, thicknesses and geologic descriptions of the sediments comprising the shallow hydrogeologic units (depths to 400 ft (122 m) below ground surface) were determined from CCNPP Unit 3 geotechnical and hydrogeological borings. Geotechnical and geological descriptions of the material encountered are described in Section 2.6.

2.3.1.2.3.1.1 Surficial Aquifer

The elevations, thicknesses, and geologic descriptions of the sediments comprising the Surficial aquifer, as determined from the CCNPP Unit 3 geotechnical and hydrogeological borings, are summarized as follows.

- The unconsolidated sediments comprising the Surficial aquifer primarily consist of fine to medium grained sands and silty or clayey sands. At relatively few locations and intervals, coarse grained sands were observed to comprise the bulk of the interval sampled.

- The Surficial aquifer is present above an elevation of approximately 65 ft (20 m) msl at the CCNPP site as shown in Figure 2.3-38 and Figure 2.3-39. The thickness of the Upland deposits containing the Surficial aquifer ranges from 0 ft (0 m), where local drainages have dissected the unit, to approximately 55 ft (17 m) at the site's higher elevations.

2.3.1.2.3.1.2 Chesapeake Confining Unit

The Chesapeake Confining Unit thickens from northwest to southeast in Calvert County and ranges in thickness from approximately 115 to 300 ft (35 to 91 m). Boring logs from a production well at the CCNPP site indicate that the base of the Chesapeake Confining Unit is at an elevation of approximately -205 ft (-62 m) msl and its total thickness is approximately 250 ft (76 m) (MGS, 1996). The CCNPP Unit 3 soil borings advanced to this depth confirm this observation.

The elevations, thicknesses, and geologic descriptions of the sediments comprising the Chesapeake Confining Unit as determined from the CCNPP Unit 3 geotechnical and hydrogeological borings are summarized as follows.

- The unconsolidated sediments comprising the Chesapeake Confining Unit consist primarily of silty clays, silt, and silty fine grained sands. Thin, interbedded, fine to medium grained fossiliferous sands are common. Some of these sands are cemented with calcite.

- The base of the Chesapeake Confining Unit is observed at an elevation of approximately –205 ft (-62 m) msl in Boring B-401 and -215 ft (-66 m) msl in Boring B-301.
- The top of the Chesapeake Confining Unit ranges from an elevation of approximately 8 ft (2 m) msl in Boring B-701 at the Chesapeake Bay shore to approximately elevation 65 ft (20 m) msl in borings where the overlying Upland Deposits comprising the Surficial aquifer were encountered.
- The thickness of the Chesapeake Confining Unit, as observed in Borings B-301 and B-401, is approximately 278 ft (84.8 m).
- Two thin, semi-continuous, water-bearing sand units were encountered in the upper portion of the Chesapeake Confining Unit. These units are informally referred to as the "Upper Chesapeake unit and the Lower Chesapeake unit."
- The base of the Upper Chesapeake unit ranges in elevation from approximately 16 ft (4.9 m) msl to -17 ft (-5.2 m) msl and has a mean thickness of approximately 46 ft (14.9 m) and reaches a maximum thickness of approximately 63 ft (19.2 m) at boring B-331. The minimum observed thickness of the Upper Chesapeake unit is 17 ft (5.2 m) at borings B-701 and B-702. The elevation of the top of the Upper Chesapeake unit occurs at an average elevation of approximately 41 ft (12.5 m) msl.
- The Lower Chesapeake unit contains a higher silt and clay content than the Upper Chesapeake unit. The base of the Lower Chesapeake unit ranges from elevation -38 ft (-12 m) msl to -92 ft (-28 m) msl and has a mean thickness of approximately 36 ft (11 m) and reaches a maximum thickness of approximately 62 ft (19 m) at boring B-313. The minimum observed thickness of the Lower Chesapeake unit was 19 ft (6 m) at boring B-327.
- The Upper Chesapeake unit is separated from the overlying Surficial aquifer by the informally named relatively thin Upper Chesapeake aquitard. The thickness of the Upper Chesapeake aquitard ranges from approximately 4 to 36 ft (1.2 to 11 m) and averages approximately 20 ft (6.1 m). The Upper and Lower Chesapeake units are separated by the informally named Middle Chesapeake aquitard. The thickness of the Middle Chesapeake aquitard ranges from approximately 4 to 22 ft (1.2 to 6.7 m). The Lower Chesapeake unit is separated from the underlying Piney Point - Nanjemoy aquifer by the informally named and relatively thick Lower Chesapeake aquitard. Two CCNPP Unit 3 soil borings penetrated the Lower Chesapeake aquitard, which is approximately 170 ft (52 m) thick.

2.3.1.2.3.1.3 Piney Point-Nanjemoy Aquifer

The basal beds of the Calvert Formation are readily identified in the two CCNPP site borings (B-301 and B-401) that penetrate this unit. The top of the basal Calvert Formation sands is observed at an approximate elevation of –205 ft (-62.5 m) msl in Boring B-301 and elevation -215 ft (-66 m) msl in Boring B-401. The base of the Piney Point Formation was encountered at approximately elevation -230 ft (-70 m) msl and -234 ft (-71 m) msl, respectively. Borings B-301 and B-401 did extend into the Nanjemoy Formation but did not penetrate through the Nanjemoy Confining Unit.

2.3.1.2.3.2 Observation Well Data and Subsurface Pathways

Data collected from groundwater observation wells installed for the CCNPP site subsurface investigation were used to develop groundwater elevation contour maps and to present groundwater elevation trends. A total of 40 new observation wells with depths extending to 122 ft (37 m) below ground surface were installed from May to July 2006. Observation wells were installed in three distinct groundwater bearing intervals: the Surficial aquifer (17 wells), a deeper sand unit at the top of the Chesapeake Formation informally referred to as the Upper Chesapeake unit in this report (20 wells), and an even deeper sand unit in the Chesapeake Formation informally called the Lower Chesapeake unit in this report (3 wells). No wells were installed in the deeper Piney Point - Nanjemoy aquifer.

Seven additional observation wells were installed in 2008 as part of the Supplemental COL Investigation. Five of these wells were installed to provide additional geotechnical information regarding slope stability and soil stresses near the intake structure. Of these five wells, two were installed in the Surficial aquifer, one was installed in the Upper Chesapeake unit, and two were installed in the Lower Chesapeake unit. In addition, two wells were installed in the Power Block 3 area to provide additional water level information in the Upper Chesapeake Unit. All well screens are 10 feet in length.

The base of the well screens in the Surficial aquifer wells were placed at elevations ranging from approximately 81.6 ft (24.9 m) msl to 53.7 ft (16.4 m) msl. Elevations for the base of well screens in the Upper Chesapeake unit range from approximately 27.1 ft (8.3 m) msl to -10.3 ft (-3.1 m) msl, while the corresponding elevations for the Lower Chesapeake unit wells range from approximately -32.4 ft (-9.9 m) msl to -54.3 ft (-16.6 m) msl as shown in Table 2.3-15.

Three well series designations are assigned to the CCNPP Unit 3 observation wells.

- OW-300 Series wells are located in the proposed CCNPP Unit 3 power block area.
- OW-400 Series wells are located adjacent to the Unit 3 power block, generally to the southeast.
- The OW-700 Series wells include all of the wells located outside of the power block areas. The OW-700 Series wells are located in the proposed cooling tower, switchyard, and support facility areas.

Four wells screened in the Surficial aquifer water levels (OW-413A, OW-729, OW-770, and OW-778) are consistently dry, i.e. the depth to water is at or below the bottom of the well screens and exhibit minimal water level fluctuations and, therefore, are not included in the analysis. Observation well OW-779 appears to have been screened in the Chesapeake Confining unit between the Surficial aquifer and the Upper Chesapeake unit. This well is consistently dry and is also not included in the analysis. The data are not considered true indicators of aquifer conditions. Additionally, observation well OW-744 appears to have been screened in a discontinuous sand unit between the water bearing sand units of the Surficial aquifer and the Upper Chesapeake unit and could not be grouped into one of the water-bearing units described above. Accordingly, the groundwater elevation trends, flow directions, and rates presented below do not consider data from this well. Observation well locations are shown in Figure 2.3-40.

To evaluate vertical hydraulic gradients, several observation wells were installed as well clusters. Well clusters are a series of wells placed at the same location, with each well monitoring a distinct water bearing interval. Four well clusters were installed to evaluate the hydraulic gradient between the Surficial aquifer and the Upper Chesapeake unit, and four well clusters were installed to evaluate the gradient between the Upper Chesapeake and Lower Chesapeake units. Table 2.3-15 provides well construction details for the observation wells installed onsite. Table 2.3-16 provides the groundwater elevation from these wells over time, listed in numerical order, while Table 2.3-17 presents a summary of the observation wells data, segregated by aquifer, and used in the following evaluations.

Monthly water levels in the observation wells were measured to characterize seasonal trends in groundwater levels and flow directions for the CCNPP Unit 3 site. Upon completion of well installation and development activities, monthly monitoring of the 2006 COL observation wells began in July 2006 and continued through June 2007. Quarterly monitoring of this well series was then initiated, commencing in September 2007 and continuing to the present.

Installation and development activities for the 2008 Supplemental COL Investigation observation well series were completed in September 2008, at which time a monthly water level monitoring program was initiated for these wells. Monthly water level measurements for the 2008 Supplemental COL Investigation observation well series were taken from September 2008 through October 2009. Henceforth, ground water levels in this series will be monitored on a quarterly basis.

The following ground water potentiometric surface trend discussion is based the observation well data described above.

Surficial Aquifer

Groundwater data for the Surficial aquifer are shown in Figure 2.3-41. These data exhibit seasonal variability in groundwater elevations during the observation period (July 2006 to October 2009). A seasonal influence during this monitoring period was indicated by ground water elevation lows in the late fall through mid-winter, and ground water elevation highs in the spring and summer. For 12 of the 13 wells, maximum observed water levels for the observation period occurred in late spring to early summer of 2007. Generally, minimum observed water levels for the observation period occurred in the fall to winter of either 2007-2008 or 2008-2009. Ground water elevation fluctuations averaged approximately 4.7 ft (1.4 m), and the maximum observed fluctuation of 9.8 ft (3.0 m) was observed in OW-759A.

For the first year of monitoring, the groundwater elevation data summarized in Table 2.3-17 were used to develop groundwater surface elevation contour maps for the Surficial aquifer on a quarterly basis. These maps are presented in Figure 2.3-42 through Figure 2.3-45 for July 2006, September 2006, December 2006, and March 2007, and Figure 2.3-78 for June 2007. After the first year of monitoring, groundwater surface elevation contour maps were developed semi-annually to roughly coincide with observed maximum and minimum groundwater elevations in the Surficial aquifer. These contour maps are presented in Figure 2.3-79 through Figure 2.3-82 for December 2007, July 2008, January 2009, and July 2009. For each mapping period, the spatial trend of the water table surface and horizontal gradients are similar, with elevations ranging from a high of approximately 85.7 ft (26.1 m) msl at well OW-423 to a low of approximately 65.9 ft (20.1 m) msl at well OW-743.

The groundwater surface contour maps indicate that horizontal groundwater flow in the Surficial aquifer is generally bi-modal. A northwest trending groundwater divide roughly following a line extending through the southwestern boundary of the CCNPP Unit 3 power block area is present at the CCNPP site. Northeast of this divide, horizontal groundwater flow is northeast toward the Chesapeake Bay. Because the Surficial aquifer is not present below approximately elevation 65 ft (20 m) msl, groundwater flowing in the northeastern direction likely discharges to small seeps and springs before reaching the Chesapeake Bay or CCNPP site streams. Groundwater flowing from the divide toward the hydraulic boundary created by

John's Creek and Branch 3 presumably discharges from seeps and springs above the 65 ft (20 m) msl elevation level along these stream valleys.

In general, the horizontal hydraulic gradient for the Surficial aquifer decreases from north to south across the CCNPP site. In the northern portion of the CCNPP site, the hydraulic gradients associated with the southwesterly and northeasterly flow components are similar with values ranging from 0.0110 ft/ft and 0.0124 ft/ft, respectively. In the southern portion of the CCNPP site, the hydraulic gradient is lower (approximately 0.0086 ft/ft). In the northwest portion of the CCNPP site, where a small portion of the site's groundwater flow emanating from the groundwater divide is to the north and west, the hydraulic gradient is approximately 0.0150 ft/ft.

Groundwater elevations measured in the four well clusters that monitor head differences between the Surficial aquifer and the Upper Chesapeake unit indicated a downward vertical gradient between the Surficial aquifer and the Upper Chesapeake unit. Water table elevations in the Surficial aquifer range from approximately 32.8 to 43.0 ft (10.0 to 13.1 m) higher than the potentiometric surface of the Upper Chesapeake unit, as detailed in Table 2.3-17. This indicates that a less-permeable material separates the two water-bearing units.

Upper Chesapeake Unit

Groundwater elevation data for the Upper Chesapeake unit are shown in Figure 2.3-46. The data exhibit slightly more variability in groundwater elevations during the observation period (July 2006 to October 2009) than those for the Surficial aquifer. Seasonal trends for the Upper Chesapeake are very similar to those in the Surficial aquifer; however, they are slightly more pronounced. A seasonal influence during the monitoring period was indicated by ground water elevation lows in spring and summer, with ground water elevation highs in fall and early winter. Maximum observed water levels for the observation period were recorded in spring to early summer 2007 for the 2006 COL observation wells. Water levels for the 2008 Supplemental COL Investigation wells recorded maximum values in May or June 2009. Minimum observed water levels in 19 of the 23 wells installed in the Upper Chesapeake unit occurred in October 2008. Although they exhibit the same general water level trends during the observation period, two wells (OW-708A and OW-769) exhibit noticeably higher ranges (amplitude) of elevation changes. On average, ground water elevations fluctuated approximately 5.4 ft (1.7 m), and the maximum observed fluctuation of 12.8 ft (3.9 m) was observed in OW-769.

For the first year of monitoring, the groundwater potentiometric data summarized in Table 2.3-17 were used to develop groundwater surface elevation contour maps for the Upper Chesapeake unit on a quarterly basis. These maps are presented in Figure 2.3-47 through Figure 2.3-50 for July 2006, September 2006, December 2006, and March 2007, and 2.3-83 for June 2007. After the first year of monitoring, groundwater surface elevation contour maps were developed semi-annually to roughly coincide with observed maximum and minimum groundwater elevations in the Upper Chesapeake unit. These contour maps are presented in 2.3-84 through 2.3-88 for December 2007, July 2008, October 2008, April 2009, and October 2009. For each mapping period, the spatial trends of the potentiometric surface and the horizontal hydraulic gradient are similar, with elevations ranging from a high of approximately 42.1 ft (12.8 m) msl in observation well OW-401 to a low of approximately 1.8 ft (0.5 m) msl at well OW-774A.

The groundwater surface contour maps indicate that horizontal groundwater flow in the Upper Chesapeake unit ranges from north to east across most of the site. Groundwater flowing in this direction likely discharges to the lower reaches of Branch 1 and Branch 2 and to seeps and springs in topographically low areas where the Upper Chesapeake unit is presumably exposed at the surface, including at the face of the Calvert Cliffs. It is also possible that a component of the Upper Chesapeake unit flow discharges directly to the Chesapeake Bay. The south central portion of the CCNPP site exhibits a very flat horizontal hydraulic gradient over a large area centered over an area just south of the CCNPP Unit 3 power block area. It is possible that a groundwater hydraulic divide exists along the southwestern boundary of the CCNPP Unit 3 power block area, resulting in a flow direction beneath the western switchyard area towards St. John's Creek and Branch 3. A potential exists for localized Upper Chesapeake unit recharge associated with seepage from the small pond southeast of the CCNPP Unit 3 power block area at Camp Canoy (Figure 2.3-47 through Figure 2.3-50, and Figure 2.3-83 through Figure 2.3-88). In this area, the base of the pond is close to the top of the water bearing sands of the Upper Chesapeake unit.

In general, three different horizontal hydraulic gradients can be observed from the potentiometric surface data:

- The highest gradients, at approximately 0.0170 ft/ft are observed to the north and east of the CCNPP Unit 3 power block area.
- The horizontal hydraulic gradient southeast of the CCNPP Unit 3 power block area is slightly lower at approximately 0.0091 ft/ft.
- The lowest horizontal hydraulic gradient observed at the CCNPP site was in the southwestern corner of the site where the gradient approaches zero.

Lower Chesapeake Unit

Groundwater data for the Lower Chesapeake unit are shown in Figure 2.3-51. The data exhibit similar groundwater elevation trends to those observed in the Surficial aquifer and exhibit little variability in groundwater elevations during the observation period (July 2006 to October 2009). A slight seasonal influence during the monitoring period was indicated by ground water elevation lows in the fall and winter, and ground water elevation highs in the spring and summer. This seasonal variation is not very pronounced in the two wells located near the Chesapeake Bay shoreline (OW-774B and OW-781). Maximum observed water levels were recorded in April 2007 for the 2006 COL observation wells. Maximum observed water levels for the 2008 Supplemental COL Investigation wells were recorded in June 2009. Minimum observed water levels occurred in fall 2008 and winter 2009. In general, ground water elevation fluctuations averaged approximately 3.6 ft (1.1 m), and the maximum observed fluctuation of 7.0 ft (2.1 m) was observed in OW- 703B.

For the first year of monitoring, the groundwater elevation data summarized in Table 2.3-17 were used to develop groundwater surface elevation contour maps for the Lower Chesapeake unit on a quarterly basis. These maps are presented in Figure 2.3-52 through Figure 2.3-55 for July 2006, September 2006, December 2006, and March 2007, and Figure 2.3-89 for June 2007. After the first year of monitoring, groundwater surface elevation contour maps were developed semi-annually to roughly coincide with observed maximum and minimum groundwater elevations in the Lower Chesapeake unit. These contour maps are presented in Figure 2.3-90 through Figure 2.3-94 for December 2007, April 2008, October 2008, April 2009, and October 2009. It should be noted that only five observation wells penetrate the Lower Chesapeake unit, and the monitoring area is limited to the area within and immediately north of the CCNPP Unit 3 power block area, and near the UHS makeup water intake structure. For each mapping period, the spatial trend in the potentiometric surface shows very little change, with elevations ranging from a high of approximately 35.4 ft (10.8 m) msl in the vicinity of well OW-418B to a low of approximately 1.9 ft (0.6 m) msl at well OW-781.

The potentiometric surface contour maps suggest that horizontal groundwater flow in the Lower Chesapeake aquifer is to the north-northeast across the coverage area. Groundwater flowing in this direction likely discharges directly to the Chesapeake Bay since the silty sand unit containing the Lower Chesapeake unit is below sea level. Very little change in horizontal hydraulic gradient was observed during the monitoring period with values averaging approximately 0.0140 ft/ft.

Groundwater elevations collected from the four well clusters that monitored head differences between the Upper Chesapeake unit and the Lower Chesapeake unit indicated a slight downward vertical gradient. Potentiometric surface elevations in the Upper Chesapeake unit range approximately -0.6 to 5.4 ft (-0.2 to 1.7 m) higher than the ranges in the Lower Chesapeake unit. Potentiometric surface elevations in the two units are basically identical at the well clusters closest to the Chesapeake Bay, locations OW-703 and OW-774.

2.3.1.2.3.3 Hydrogeologic Properties

The 40 groundwater observation wells installed in connection with the 2006 CCNPP Unit 3 site subsurface evaluation were slug tested to determine in-situ hydraulic conductivity values for the Surficial aquifer and Upper and Lower Chesapeake units. Table 2.3-18 summarizes the test results.

Ten of the 17 Surficial aquifer wells tested were used to calculate hydraulic conductivity values. Three wells screened in the Surficial aquifer had measurable water but at or below the bottom of the well screen (OW-413A, OW-729, and OW-770); therefore, the slug test results from these wells are not included in this analysis. The slug test data from three additional Surficial aquifer wells (OW-714, OW-718, and OW-766) were not used in this evaluation because the static water levels were below the top of the solid slugs inserted into the well to displace the water level. Additionally, observation well OW-744 appears to have been screened in a discontinuous sand unit between the water bearing sand units of the Surficial aquifer and the Upper Chesapeake unit. Because the following slug test analyses are categorized by the three distinct water bearing units encountered onsite, the hydraulic conductivity evaluations presented below do not consider slug test data from this well. Slug test data from all the Upper and Lower Chesapeake unit wells were used in the hydraulic conductivity evaluations.

Soil samples collected from the Surficial aquifer, Upper Chesapeake and Lower Chesapeake units during the geotechnical investigation were submitted for laboratory tests to determine median grain size, moist unit weight, moisture content, and specific gravity. The results of these laboratory analyses were used to calculate bulk density and porosity values for the three water bearing units cited above. The following discussions on hydrogeological properties are derived from the CCNPP Unit 3 data evaluations for the Surficial aquifer, Upper Chesapeake unit, and Lower Chesapeake unit. Hydrogeological property discussions for the Chesapeake Group aquitards comprising the Chesapeake Confining Unit and all deeper units described in Section 2.3.1.2.2 were summarized from the literature, where available. A detailed description of the geotechnical subsurface site investigation is described in FSAR Section 2.5.

Surficial Aquifer

Hydraulic conductivities determined from slug test results for the Surficial aquifer range from 0.040 to 17.40 ft/day (0.01 to 5.30 m/day), with a geometric mean of 0.91 ft/day (0.28 m/day) as detailed in Table 2.3-18. The range in values is considered to be indicative of the variability of the subsurface material composition. This is additionally discussed in Section 2.6. A transmissivity of 10.9 ft^2/day (1.01 m^2/day) for the Surficial aquifer is calculated using the mean hydraulic conductivity value cited above and the average saturated thickness of approximately 12 ft (3.7 m).

An estimate of the effective porosity of the Surficial aquifer was developed based on the grain size distribution of soil samples collected during the geotechnical investigation. Using median grain size and Figure 2.17 in de Marsily (1986), an effective porosity value of 25.2% was estimated for the Surficial aquifer. However, Stephens et al. (1998) indicate that, based on the results of a field tracer test, effective porosities that are estimated from grain size data can over-estimate the actual effective porosities by approximately 45%. Therefore, the estimated effective porosity of the Surficial aquifer was reduced to 13.9% for transport calculations. Bulk density was estimated using moist unit weight and moisture content values from laboratory test results of the geotechnical samples. Bulk density in the Surficial aquifer was estimated to be 100.0 lb/ft^3 (1.60 g/cm^3).

Information on the vadose zone above the Surficial aquifer is limited. As described in the FSAR Section 2.5, measured moisture contents by weight range from approximately 2.5% to 19.1%. The majority of the values ranged between 5% and 15%. Hydraulic conductivity for the Upland Deposits was estimated from grain size analyses as part of the CCNPP Unit 1 and 2 FSAR investigation. A maximum hydraulic conductivity of 400 gpd/ft^2 (16,299 lpd/m^2)(53.6 ft/day (16.3 m/day)) was reported.

Chesapeake Group

The following discussion presents the evaluations of the hydrogeologic properties of the two water bearing units in the upper Chesapeake Group, informally named the Upper Chesapeake and Lower Chesapeake units. This is followed by a description of the intervening and underlying Chesapeake Clay and Silt units comprising the remainder of the Chesapeake Group.

Upper Chesapeake Unit

The top of the silty sand unit comprising the informally named Upper Chesapeake unit lies approximately 50 ft (15 m) below the base of the Surficial aquifer. Hydraulic conductivities determined from the slug test results for the Upper Chesapeake unit range from 0.12 to 13.70 ft/day (0.04 to 4.18 m/day), with a geometric mean of 0.740 ft/day (0.23 m/day) as detailed in Table 2.3-18. The range in values is indicative of the variability of the grain size and clay content of the material. A transmissivity of 31.8 ft^2/day (3.0 m^2/day) for the Upper Chesapeake unit is calculated using the mean hydraulic conductivity value cited above and an average saturated thickness of 43.0 ft (13.1 m).

An estimate of the effective porosity of the Upper Chesapeake unit was developed based on the grain size distribution of soil samples collected during the geotechnical investigation. Using median grain size and Figure 2.17 in de Marsily (1986), an effective porosity value of 26.4% was estimated for the Upper Chesapeake unit. However, Stephens et al. (1998) indicate that, based on the results of a field tracer test, effective porosities that are estimated from grain size data can over-estimate the actual effective porosities by approximately 45%. Therefore, the estimated effective porosity of the Upper Chesapeake unit was reduced to 14.5% for transport calculations. Bulk density was estimated using moist unit weight and moisture content values from laboratory test results of the geotechnical samples. Bulk density in the Upper Chesapeake unit was estimated to be 95.6 lb/ft^3 (1.53 g/cm^3).

Lower Chesapeake Unit

The top of the informally named Lower Chespeake unit generally lies approximately 15 ft (4.6 m) below the base of the Upper Chesapeake unit. Hydraulic conductivities determined from the slug test results for the three wells screened in the Lower Chesapeake unit range from 0.019 to 0.093 ft/day (0.006 to 0.028 m/day), with an arithmetic mean of 0.045 ft/day (0.014 m/day) as detailed in Table 2.3-18. The arithmetic mean for the hydraulic conductivity was used instead of the geometric mean due to the very small sample size. These values are lower than those observed in the Surficial aquifer and the Upper Chesapeake unit by more than one order of magnitude. A transmissivity of 1.6 ft^2/day (0.15 m^2/day) for the Lower Chesapeake unit is calculated using the mean hydraulic conductivity value cited above and an average approximate saturated thickness of 36.1 ft (11.0 m).

An estimate of the effective porosity of the Lower Chesapeake unit was developed based on the grain size distribution of soil samples collected during the geotechnical investigation. Using median grain size and Figure 2.17 in de Marsily (1986), an effective porosity value of 28.4% was estimated for the Lower Chesapeake unit. However, Stephens et al. (1998) indicate that, based on the results of a field tracer test, effective porosities that are estimated from grain size data can over-estimate the actual effective porosities by approximately 45%. Therefore, the estimated effective porosity of the Lower Chesapeake unit was reduced to 15.6% for transport calculations. Bulk density was estimated using moist unit weight and moisture content values from laboratory test results of the geotechnical samples. Bulk density in the Lower Chesapeake unit was estimated to be 83.6 lb/ft^3 (1.34 g/cm^3).

Chesapeake Clay and Silts

Clay and silt comprising the Upper Chesapeake aquitard separates the Surficial aquifer from the underlying Upper Chesapeake unit. It immediately underlies the Surficial aquifer below an elevation approximately 65 ft (20 m) msl. Laboratory tests performed on core samples in support of southern Maryland hydrogeologic studies reported vertical hydraulic conductivities ranging between 5.9×10^{-5} ft/day to 2.5×10^{-2} ft/day (1.8×10^{-5} m/day to 7.6×10^{-3} m/day (MGS, 1997). Vertical hydraulic conductivities established for groundwater model calibrations associated with these studies range from 8.6×10^{-6} ft/day to 8.6×10^{-5} ft/day (2.6×10^{-6} m/day to 2.6×10^{-5} m/day), except for channeled areas where higher values were assigned to accommodate infilled deposits of sand and gravel (MGS, 1997). These sand units presumably correlate to the Upper and Lower Chesapeake units described herein. Assigned specific storage values ranged between 6.0×10^{-6} ft^{-1} and 1×10^{-5} ft^{-1} (2.0×10^{-5} m^{-1} and 3.3×10^{-5} m^{-1}) for the Chesapeake Group aquitards in the Chesapeake Confining Unit (MGS, 1996).

2.3.1.2.3.4 Groundwater Flow and Transport

The following sections present the most probable groundwater flow direction and travel time from the CCNPP Unit 3 power block area to nearby surface water features. Based on the evaluation summarized in the above sections, only the shallow water bearing units (the Surficial aquifer and the Upper Chesapeake and the Lower Chesapeake water-bearing units) would be affected by construction and operation of the new units with the exception of groundwater use in support of facility operations, discussed in Section 2.3.2.2. Accidental release parameters and pathways for liquid effluents in groundwater and surface water are presented in FSAR Chapter 2.

The groundwater seepage velocity is defined as distance over time and is calculated as follows:

Velocity = [(hydraulic gradient) x (hydraulic conductivity)] / (effective porosity).

The travel time is defined as rate of groundwater movement for a set distance and is calculated as follows:

Travel Time = (distance) / (velocity).

Surficial Aquifer

In the vicinity of the CCNPP site, the Surficial aquifer is capable of transmitting groundwater but is of limited areal and vertical extent. The Surficial aquifer (Upland Deposits) is not a reliable source of groundwater because of its relative thinness, limited saturated thickness, and dissected topography that causes local groundwater to discharge as small seeps and springs.

The groundwater travel time in the Surficial aquifer was calculated from the center of the groundwater divide in the CCNPP Unit 3 power block to the projected discharge point in the headwater area of Branch 3. An average horizontal groundwater velocity of 0.072 ft/day (0.022 m/day) was calculated using a mean horizontal hydraulic gradient of 0.0110 ft/ft between the groundwater divide and Branch 3 (Figures 2.3-42 through 2.3-45, and Figures 2.3-86 through 2.3-90), a hydraulic conductivity of 0.910 ft/day (0.28 m/day), and an effective porosity of 13.9% (Section 2.3.1.2.3.3). Using a mean travel distance of approximately 1315 ft (400.8 m) from the groundwater divide in the CCNPP Unit 3 power block to the closest downgradient point above 65 ft (20 m) msl in Branch 3, the groundwater travel time from the power block area to Branch 3 is estimated to be about 50 years. East of the CCNPP Unit 3 reactor building, the flow paths to adjacent springs and seeps are presumed to be shorter, with shorter corresponding travel times for spring/seep discharge.

Upper Chesapeake Unit

Direct groundwater discharge to surface water from the Upper Chesapeake unit likely occurs along the lower reaches of Branch 1 and Branch 2 at elevations below approximately 45 ft (13.7 m) msl where the Upper Chesapeake unit presumably outcrops. The groundwater travel time in the Upper Chesapeake unit was calculated from the center of the CCNPP Unit 3 power block northward to the projected discharge point at an elevation of 45 ft (13.7 m) msl in Branch 2. An average horizontal groundwater velocity of 0.087 ft/day (0.026 m/day) was calculated using a mean horizontal hydraulic gradient of 0.017 ft/ft along the projected flowpaths between the center of the CCNPP Unit 3 power block and the discharge point in Branch 2 (Figure 2.3-47 through Figure 2.3-50, and Figure 2.3-83 through Figure 2.3-88), a hydraulic conductivity of 0.740 ft/day (0.226 m/day), and an effective porosity of 14.5% (Section 2.3.1.2.3.3). Using a mean travel distance of approximately 470 ft (143.3 m) from the center of the CCNPP Unit 3 power block to the projected downgradient discharge point at 45 ft (13.7 m) msl in Branch 2, the groundwater travel time from the power block area to Branch 2 is estimated to be about 15 years. Similarly, the groundwater travel times in the Upper Chesapeake unit were calculated from a point south of the CCNPP Unit 3 power block area northeastward to the projected discharge point at an elevation of 45 ft (13.7 m) msl in Branch 1 and farther downgradient to Chesapeake Bay. Using the same average horizontal groundwater velocity of 0.087 ft/day (0.026 m/day) and mean path distances of 1110 ft (338.3 m) and 1685 ft (514 m) to Branch 1 and the Chesapeake Bay, respectively, travel times of approximately 35 years and 53 years were calculated. It is possible that a groundwater hydraulic divide exists along the southwestern boundary of the CCNPP Unit 3 power block area resulting in a flow direction beneath the western switchyard area as towards St. John's Creek and Branch 3.

Lower Chesapeake Unit

Groundwater in the Lower Chesapeake unit likely discharges to the Chesapeake Bay because this unit is entirely below sea level. The groundwater travel time in the Lower Chesapeake unit was calculated from the center of the CCNPP Unit 3 power block northeastward to the downgradient location of the Chesapeake Bay shoreline. An average horizontal groundwater velocity of 0.0040 ft/day (0.0012 m/day) was calculated using a mean horizontal hydraulic gradient of 0.014 ft/ft along the projected flowpaths between the center of the CCNPP Unit 3 power block and the shoreline (Figure 2.3-52 through Figure 2.3-55, and Figure 2.3-89 through Figure 2.3-94), a hydraulic conductivity of 0.045 ft/day (0.014 m/day), and an effective porosity of 15.6%. The arithmetic mean (versus the geometric mean) for the hydraulic conductivity was applied to the Lower Chesapeake unit due to the very small sample size Using a distance of approximately 1,540 ft (469 m) from the center of the CCNPP Unit 3 power block area to a downgradient point on the shoreline of the Chesapeake Bay, the groundwater travel time from the power block to the Chesapeake Bay is estimated to be about 1054 years.

2.3.1.3 References

Bowie, 2007. Wellhead Protection Program, City of Bowie, Website: http://www.cityofbowie.org/water/hydrogeology.htm, Date accessed: January 22, 2007.

CBP, 2004. Chesapeake Bay: Introduction to an Ecosystem (EPA 903-R-04-003, CBP/TRS 230/00), Chesapeake Bay Program, 2004.

CBP, 2006a. The Chesapeake Bay Watershed, Chesapeake Bay Program, Website: http://www.chesapeakebay.net/wspv31/(ojtvye45vgw30j55kcanqc45)/WspAboutPrint.aspx?basno=1, Date accessed: August 31, 2006.

CBP, 2006b. Did You Know? Bay Factoids About the Bay, Chesapeake Bay Program, Website: http://www.chesapeakebay.net/info/factoids.cfm, Date accessed: November 30, 2006.

CBP, 2007a. Chesapeake Bay Water Quality— Current Conditions, Water Quality: Tidal River and Main Bay, Chesapeake Bay Program, Website: http://www.chesapeakebay.net/status/WQcrntcond.cfm?subjectarea=TIDAL, Date accessed: January 3, 2007.

CBP, 2007b. CBP Water Quality Database, 1984-Present, Chesapeake Bay Program, Website: http://www.chesapeakebay.net/data/WQ_query2.cfm, Date accessed: February 23, 2007.

CWP, 2004. Lower Patuxent River Watershed Restoration Action Strategy In Calvert County, MD (prepared for Calvert County, MD), Center for Watershed Protection, 2004.

FEMA, 1998. Flood Insurance Rate Map, Calvert County, Maryland (Community Panel Numbers: 240011 0026B and 240011 0027D), Federal Emergency Management Agency, 1984 and 1998.

Johnson, 1993. Validation of Three-Dimensional Hydrodynamic Model of Chesapeake Bay, Journal of Hydraulic Engineering, B. Johnson, K. Kim, R. Heath, B. Hsieh, and H. Butler, 1993.

de Marsily, 1986. Quantitative Hydrogeology,Groundwater Hydrology for Engineers, (p. 36), G. de Marsily, 1986.

MDE, 2004. Southern Maryland Pilot Study (Appendix E), Advisory Committee on the Management and Protection of the State's Water Resources: Final Report, Maryland

Department of the Environment, G. Wolman, May 2004, Website: http://www.mde.state.md.us/Programs/WaterPrograms/Water_Supply/WR_Advisory_Committee.asp

MDNR, 2006. Data in Maryland Tributary Strategy Patuxent River Basin Summary Report for 1985-2004, Maryland Department of Natural Resources, 2006.

MDNR, 2007. Maryland Shorelines Online, Maryland Department of Natural Resources. Website: http://shorelines.dnr.state.md.us/shoreMapper/standard/, Date accessed: February 7, 2007.

MGS, 1983. Hydrogeology, Digital Simulation, and Geochemistry of the Aquia and Piney Point-Nanjemoy Aquifer System in Southern Maryland, Maryland Geological Survey Report of Investigations No. 38, Maryland Geological Survey, F. Chappelle and D. Drummond, 1983.

MGS, 1996. Hydrostratigraphic Framework of the Piney Point-Nanjemoy Aquifer and Aquia Aquifer in Calvert and St. Mary's Counties, Maryland, Maryland Geological Survey Open File Report No. 96-02-8, Maryland Geological Survey, H. Hansen, 1996.

MGS, 1997. Hydrogeology, Model Simulation, and Water-Supply Potential of the Aquia and Piney Point-Nanjemoy Aquifers in Calvert and St. Mary's Counties, Maryland, Maryland Geological Survey Report of Investigations No. 64, Maryland Geological Survey, G. Achmad and H. Hansen, 1997.

MGS, 2001. Shoreline Change Maps, Shoreline Changes, Cove Point Quadrangle, MD, Maryland, 7.5 Minute Series: Orthophotoquad, Coastal and Estuarine Geology Program, Maryland Geological Survey, 2001, Website: http://www.mgs.md.gov/coastal/maps/schangepdf.html, Date accessed: January 4, 2007.

MGS, 2002. Future of Water Supply from the Aquia and Magothy Aquifers in Southern Anne Arundel County, Maryland, Maryland Geological Survey, D. Andreasen, 2002.

MGS, 2004. Optimization of Ground Water Withdrawals from the Lower Patapsco and Patuxent Aquifers in the Bryans Road Service Area, Charles County, Maryland, Maryland Geological Survey Administrative Report, Maryland Geological Survey, D. Andreasen, 2004.

MGS, 2005. Water Supply Potential of the Coastal Plain Aquifers in Calvert, Charles, and St. Mary's Counties, Maryland, with Emphasis on the Upper Patapsco and Lower Patapsco Aquifers, Maryland Geological Survey Administrative Report, Maryland Geological Survey, D. Drummond, June 2005.

MGS, 2007. Drill Site at Hughesville Community Park: Hughesville, Maryland, Southern Maryland Project, Maryland Geological Survey, Website: http://www.mgs.md.gov/hydro/somd/site3.html, Date accessed: January 22, 2007.

NOAA, 2006a. Tidal Currents (information extracted from the National Oceanic and Atmospheric Administration for tidal range at various locations along the Chesapeake Bay), National Oceanic and Atmospheric Administration, Website: http://tidesandcurrents.noaa.gov, Date accessed: November 29, 2006.

NOAA, 2006b. Chesapeake Bay, VA/MD (M130), National Ocean Serviced (NOS) Estuarine Bathymetry Data, Nation Oceanic and Atmospheric Administration, Website: http://

egisws01.nos.noaa.gov/servlet/BuildPage?template=bathy.txt&parm1=M130&B1=Submit, Date accessed: September 6, 2006.

NOAA, 2007a. Tidal Range, National Oceanic and Atmospheric Administration, Website: http://tidesandcurrents.noaa.gov, Date accessed: March 6, 2007.

NOAA, 2007b. Chesapeake Bay and Tidal Tributary Interpolator, NOAA Chesapeake Bay Office, Website: http://chesapeakebay.noaa.gov/interpolator.aspx, Date accessed: March 13, 2007.

Schnabel, 2007. Geotechnical Subsurface Investigation Data Report, Rev. 1, CGG Combined Operating License Application Project, Calvert Cliffs Nuclear Power Plant (CCNPP), Schnabel Engineering North, LLC, April 2007.

Stephens, et al., 1998. "A comparison of estimated and calculated effective porosity", Hydrogeology Journal, Volume 6, p. 156-165.

TSTF, 2005. Sediment in the Chesapeake Bay and Management Issues: Tidal Erosion Processes, CBP-TRS276-05, Tidal Sediment Task Force of the Sediment Workgroup under the Chesapeake Bay Program, Nutrient Subcommittee, May 2005.

USACE, 2006a. Maryland Western Shore Hurricane Evacuation Study: Draft Maps and Data (Calvert County, Baltimore District), U.S. Army Corps of Engineers, Website: http://www.nab.usace.army.mil/hes.htm, Date accessed: December 21, 2006.

USACE, 2006b. Detailed Information, Brighton and Rocky Gorge Dam, National Inventory of Dams, U.S. Army Corps of Engineers, Website: http://crunch.tec.army.mil/nid/webpages/niddetails.cfm?ID=26707&ACC=1, Date accessed: November 21, 2006.

USACE, 2006c. Coastal Engineering Manual, U.S. Army Corps of Engineers, Coastal Engineering Research Center, June 1, 2006.

USFWS, 2007. Wetlands Online Mapper, U.S. Fish and Wildlife Service, Website: http://wetlandsfws.er.usgs.gov/, Date accessed: March 2, 2007.

USGS, 1968. Monthly Surface-Water Inflow to Chesapeake Bay, (USGS Survey Open-File Report), U.S. Geological Survey, C. Bue, 1968. Website: http://md.water.usgs.gov/publications/ofr-68-Bue10/ofr-68-bue10.html, Date accessed: September 22, 2006.

USGS, 1997a. Geologic Framework, Hydrogeology, and Groundwater Quality of the Potomac Group Aquifer System, Northwestern Charles County, Maryland (USGS Water Resources Investigation Report 91-4059), U.S. Geological Survey, S. Hiortdahl, 1997.

USGS, 1997b. Delaware, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, West Virginia, In Ground Water Atlas of the United States (Hydrologic Investigations Atlas 730-L), U.S. Geological Survey, H. Trapp and M. Horn, 1997.

USGS, 2003a. "Surface-Water Data," (vol. 1). Water Resources Data: Maryland, Delaware, and Washington D.C.: Water Year 2003 (Water-Data Report MD-DE-DC-03-1), U.S. Geological Survey, R. James, R. Saffer, R. Pentz, and A. Tallman, 2003.

USGS, 2003b. A Summary Report of Sediment Processes in Chesapeake Bay and Watershed, (Water Resources Investigation Report 03-4123), U.S. Geological Survey, E. Langland and T. Cronin, 2003.

USGS, 2005a. Potentiometric Surface of the Aquia Aquifer in Southern Maryland: September 2003, (USGS Open-File Report 2005-1004), U.S. Geological Survey, S. Curtin, D. Andreasen, and J. Wheeler, 2005.

USGS, 2005b. Potentiometric Surface of the Magothy Aquifer in Southern Maryland: September 2003 (USGS Open-File Report 2005-1006), U.S. Geological Survey, S. Curtin, D. Andreasen, and J. Wheeler, 2005.

USGS, 2005c. Potentiometric Surface of the Upper Patapsco Aquifer in Southern Maryland: September 2003 (USGS Open-File Report 2005-1008), U.S. Geological Survey, S. Curtin, D. Andreasen, and J. Wheeler, 2005.

USGS, 2005d. Potentiometric Surface of the Lower Patapsco Aquifer in Southern Maryland, September 2003 (USGS Open-File Report 2005-1010), U.S. Geological Survey, S. Curtin, D. Andreasen, and J. Wheeler, 2005.

USGS, 2005e. Summary of Suspended-Sediment Data for Streams Draining the Chesapeake Bay Watershed, Water Years 1952–2002 (Scientific Investigation Report 2004-5056), U.S. Geological Survey, A. Gellis, W. Banks, M. Langland, and S. Martucci, 2005.

USGS, 2006a. Patuxent River near Bowie, MD, (USGS 01594440), U.S Geological Survey, National Water Information System: Web Interface, Website: http://waterdata.usgs.gov/md/nwis/nwisman/?site_no=01594440&agency_cd=USGS, Date accessed: November 27, 2006.

USGS, 2006b. St. Leonard Creek near St Leonard, MD, (USGS 01594800), U.S. Geological Survey, National Water Information System: Web Interface, Website: http://waterdata.usgs.gov/md/nwis/nwisman/?site_no=01594800&agency_cd=USGS, Date accessed: November 3, 2006.

USGS, 2006c. Surface-Water Data (Vol.1), Water Resources Data, Maryland, Delaware, and Washington D.C., Water Year 2005 (Water-Data Report MD-DE-DC-05-1), U.S. Geological Survey, R. Saffer, R. Pentz, and A. Tallman, 2006.

USGS, 2007. Estimated Streamflow Entering Chesapeake Bay, USGS Chesapeake Bay Activities, U.S. Geological Survey, Website: http://md.water.usgs.gov/monthly/bay.html, Date accessed: March 5, 2007.

2.3.2 Water Use

This section describes surface water and groundwater uses that could affect or be affected by the construction or operation of CCNPP Unit 3 and associated transmission corridor and offsite facilities. Consumptive and non-consumptive water uses are identified, and water diversions, withdrawals, consumption, and returns are quantified. In addition, this section describes statutory and legal restrictions on water use and provides the projected water use for CCNPP Unit 3.

2.3.2.1 Surface Water Use

2.3.2.1.1 Surface Water

The CCNPP site is situated on the boundary of two basins of the Chesapeake Bay watershed, which includes the Maryland Lower Western Shore Basin and the Lower Patuxent River Basin. The Maryland Lower Western Shore Basin drains directly into the Chesapeake Bay while drainage from the Lower Patuxent River Basin discharges to the Chesapeake Bay through the Patuxent River. The surface water bodies that are within the hydrologic system where the CCNPP site is located and that could affect or be affected by the construction and operation of the CCNPP Unit 3 include branches, creeks, lakes, and impoundments in the two basins and the Chesapeake Bay. Surface water features in the Lower Patuxent River Basin include the Patuxent River, St. Leonard Creek, Island Creek, Battle Creek, Hunting Creek, and Graham Creek. In the Maryland Lower Western Shore Basin, surface water features include Fishing Creek, Plum Point Creek, Parkers Creek, Grays Creek, Mill Creek, Cypress Swamp, Caney Creek, Johns Creek, Hoften Creek and Cove Point Marsh. Several small lakes and impoundments are also located within the two basins. Figure 2.3-56 shows the major streams and rivers in the vicinity of the CCNPP site, which could affect or be affected by CCNPP Unit 3. The impoundments on the CCNPP Unit 3 site are depicted on Figure 2.3-60.

2.3.2.1.2 Consumptive Surface Water Use

Surface water use data for Calvert County were obtained from the Maryland Department of the Environment (MDE). Any activity that withdraws water from Maryland's surface water bodies requires a water appropriation and use permit from the MDE (MDE, 2007). Certain water uses, however, are exempt from the water appropriation and use permit process. These include extinguishing a fire, agricultural use under 10,000 gpd (37,854 lpd), individual domestic use except withdrawals for heating and cooling, temporary dewatering during construction, and residential subdivisions of ten or fewer lots.

As of November 2006, nine intake facilities in Calvert County were permitted for surface water withdrawals. Figure 2.3-56 shows the locations of these surface water intakes. Table 2.3-19 identifies the surface water users, water bodies from which the withdrawals are made, and the permitted maximum withdrawal rates. Table 2.3-19 indicates that permitted withdrawals are for irrigation, institutional use, hydrostatic testing and fire protection, aquaculture, and power generation. None of the permitted withdrawals are for public water supply.

CCNPP Units 1 and 2 is the largest water user in Calvert County, which uses the Chesapeake Bay as a source of cooling water. The Dominion Cove Point LNG facility is the second largest user, using Chesapeake Bay water for hydrostatic testing and pipeline drilling. Other major surface water users include the Morgan State University Estuarine Research Center (ERC), Calvert County Commissioners for Calvert Marine Museum, and the Chesapeake Biological Laboratory of the University of Maryland, as indicated in Table 2.3-19. These facilities withdraw surface water from the Patuxent River for institutional use purposes.

The water-use permit for CCNPP Units 1 and 2 allows an annual average withdrawal of 3.5E+09 gpd (1.3E+10 lpd) with a maximum daily withdrawal of 3.6E+09 gpd (1.4E+10 lpd). Most of the water withdrawn for the CCNPP Units 1 and 2 is returned back to the bay after being circulated through the plant condensers. The monthly variation of cooling water discharge rate at the CCNPP Units 1 and 2 during calendar years 2002 through 2006 is shown in Table 2.3-20, which represents typical intra-annual water use pattern by CCNPP Units 1 and 2.

Surface water use in Calvert County is categorized in irrigational use, agricultural use, institutional use, fire protection use, and thermoelectric use. Irrigational and agricultural surface withdrawal mainly for farming and hydroseeding in the county will be conducted during spring and summer in the year. Yearly withdrawal rate for irrigational and agricultural use will be varied depending on dry and wet intervals of the year. Institutional withdrawal rate will be constant for the entire year. Thermoelectric withdrawal rate of the CCNPP Units 1 and 2 will depend on the water temperature of the Chesapeake Bay. Normally, the withdrawal rate of the CCNPP Units 1 and 2 reaches the peak during summer season and declines during the winter season, excluding the overhaul period. Maryland water use projections for 2030 do not anticipate surface water being used as a source for public water supply in southern Maryland counties, including Calvert County (MDE, 2004).

The water use projection is assessed based on the population trend in the county. Since the surface water is not used for the public water supply in Calvert County, the surface water use projection in the county is unavailable. The use rate of the CCNPP Units 1 and 2 is 99.9% of the total surface water use amount in the county. Excluding the plant water use of the CCNPP Unit 3, the future use of surface water will be extremely limited. The surface water use rate in the future will remain the same as the present level, because there are limited uses for the brackish water that principally comprises surface water in the county.

Table 2.3-21 summarizes surface discharge data for Calvert County. The MDE has issued seven surface discharge permits in the county, which include four facilities that hold both surface water withdrawal and discharge permits. Figure 2.3-56 shows the locations of the permitted surface discharges. Discharges from CCNPP Units 1 and 2, the Dominion Cove Point LNG facility, the Morgan State University ERC, and the Chesapeake Biological Laboratory are located near the CCNPP site.

2.3.2.1.3 Non-Consumptive Surface Water Use

The major non-consumptive surface water uses in the vicinity of the site are recreation, fishing, and navigation. Section 2.5 provides detailed descriptions of these uses and activities. Figure 2.3-57 shows locations for these activities and their proximity to the CCNPP site.

An intra-coastal waterway runs through the Chesapeake Bay from the bay's entrance to the Chesapeake and Delaware Canal. There are two major commercial ports in the Chesapeake Bay, the Port of Baltimore, approximately 60 mi (97 km) north of the CCNPP site, and the Port of Hampton Roads, near the entrance of the Chesapeake Bay. Commercial and non-commercial vessels pass through the waterway along the eastern side of the Chesapeake Bay in front of the CCNPP site. Section 2.2 provides additional detail regarding the use of the Chesapeake Bay for navigation.

2.3.2.1.4 Statutory and Legal Restrictions on Surface Water Use

The withdrawal of water for CCNPP Unit 3 from the Chesapeake Bay to use in the cooling systems and as a source for the desalination plant will be subject to the provisions of Title 5 of the Environment Article, Annotated Code of Maryland (1996 Replacement Volume).

The discharge of blowdown from cooling towers, effluent from a sewage treatment plant, brine from a desalination plant, and storm-water runoff will be subject to Title 9 of the Environment Article, Annotated Code of Maryland and regulations promulgated there under; the provisions of the Federal Water Pollution Control Act (USC, 2007); and implementing regulations of 40 CFR, parts 122, 123, 124, and 125.

In 1998, the EPA declared the Chesapeake Bay an impaired water body under provisions of the Federal Water Pollution Control Act (USC, 2007), because of excess nutrients and sediments. The Chesapeake Bay water is required to meet federal regulatory water quality standards by 2010 (CBPO, 2007).

2.3.2.1.5 Plant Water Use

Plant water use for CCNPP Unit 3 is described in Section 3.3. There are no other station water uses other than those described in Section 3.3.

2.3.2.2 Groundwater Use

This section provides a description of the groundwater use at, and in the vicinity of, the CCNPP site. This section also describes the regional and local groundwater resources that could be affected by the construction and operation of CCNPP Unit 3.

The objective of this section is to discuss the U.S. Environmental Protection Agency (EPA) sole source aquifers within the region and to describe groundwater use in southern Maryland, current users in Calvert County, current CCNPP Units 1 and 2 groundwater use, expected future groundwater demand for southern Maryland and Calvert County, and to identify and determine impacts to the groundwater aquifers due to the operation and construction of CCNPP Unit 3.

2.3.2.2.1 Physical Setting

The CCNPP site covers an area of approximately 2,057 acres (832 hectares), and it is located on the western shore of the Chesapeake Bay in Calvert County, Maryland. The CCNPP site is located on a high bluff on the Calvert peninsula. The climate of the CCNPP site area is primarily hot, humid summers and mild, rainy winters. The topography at the CCNPP site is gently rolling with steep slopes along stream courses. Local relief ranges from sea level up to an approximate elevation of 130 ft (40 m) with an average elevation of approximately 100 ft (30m).

Sections 2.2 and 2.5 provide a detailed description of the site vicinity and surrounding region, including nearby communities and major population centers.

The CCNPP site is located within a regional area informally referred to as "southern Maryland." This region is the area southeast of Washington, D.C. and includes Calvert County, Charles County, and St. Mary's County. The Chesapeake Bay defines the eastern boundary of the region whereas the Potomac River defines the southwestern boundary. Prince George's County and Anne Arundel County are located to the north. The Patuxent River separates the eastern Calvert County and Anne Arundel County from southern and western St. Mary's County, Charles County, and Prince George's County. The location of the CCNPP site within southern Maryland, including regional and local surface hydrologic features, is described in Section 2.3.1.1.

Groundwater is the primary source of water supply in southern Maryland. The area is dependent on groundwater for potable supplies, because the major surface-water bodies are brackish.

2.3.2.2.2 Hydrogeologic Setting

The regional and site-specific physical and hydrologic characteristics of these groundwater resources are presented in Section 2.3.1.2. The following sections provide a brief summary of hydrogeologic conditions in the vicinity of the CCNPP site.

The CCNPP site lies within the Coastal Plain Physiographic Province, at a distance of about 50 mi (80 km) east of the Fall Line. The Coastal Plain Physiographic Province is a lowland that is bordered by the Atlantic Ocean to the east and the Fall Line to the west. The Fall Line is a demarcation, which separates the eastern, unconsolidated coastal plain sediments from the rocks of the western physiographic provinces associated with the Appalachian Mountains. The Chesapeake Bay and Patuxent River define the eastern, southern, and western boundaries of Calvert County. The creeks and streams within the area influence the shallow aquifer systems beneath the CCNPP site. Deeper aquifers are less influenced by incisions of streams and rivers. Natural flow directions in the deeper aquifers are southeasterly from the Fall Line towards the Atlantic Ocean. Localized areas of increasing groundwater withdrawals in southern Maryland have affected both local and regional groundwater movement.

Only groundwater occurrence within the Coastal Plain Physiographic Province is of significance to the CCNPP site. Within the Coastal Plain, semi-consolidated to unconsolidated sediments form a southeasterly, thickening wedge-shaped mass, ranging in thickness from 0 ft (0 m) at the Fall Line to as much as 8,000 ft (2,438 m) along the Atlantic coastline of Maryland. The sediments consist of layers of sand, silt, and clay with minor amounts of gravel and calcareous sediments.

Aquifers are found primarily in the sand, gravel, and calcareous sediments. They can be traced over long distances, although some occur in lenses and some are localized. The aquifers are vertically separated by confining units that primarily consist of clay with lesser amounts of silt and sand. Depending on the thickness and sand content of the confining units, they can act locally as either aquitards or aquicludes by retarding vertical groundwater flow to varying degrees. Although water moves more readily through the aquifers than the intervening confining units, water can leak through the confining units and, therefore, the aquifer systems are considered to be hydraulically interconnected to some degree (USGS, 1997).

In the Mid-Atlantic States, the aquifers within the Coastal Plain Physiographic Province are referred to as the Northern Atlantic Coastal Plain aquifer system. This aquifer system extends from New Jersey to the Carolinas. The principal aquifers within the region (from shallow to deep) are as follows: Surficial aquifer, Chesapeake aquifer, Castle Hayne-Aquia aquifer, Severn-Magothy aquifer, and the Potomac aquifer. The aquifer units dip east to southeast from the Fall Line towards the Atlantic Ocean (USGS, 1997).

For southern Maryland, hydrogeologists have refined the aquifer nomenclature system described based on local hydrostratigraphic conditions. From shallow to deep, the local aquifer systems are as follows (MGS, 1996) (MGS, 1997):

- Surficial aquifer
- Piney Point-Nanjemoy aquifer
- Aquia aquifer
- Magothy aquifer

- Potomac Group of aquifers

The main differences between the nomenclatures are that a) the Chesapeake aquifer is treated as a confining unit in southern Maryland and b) the Castle Hayne - Aquia aquifer system has been subdivided into the Piney Point - Nanjemoy and Aquia aquifers. A schematic cross-section of the southern Maryland hydrostratigraphic units is presented in Figure 2.3-32. In addition to the hydrostratigraphic units utilized by hydrogeologists in southern Maryland, the Chesapeake confining unit is informally subdivided into the Upper Chesapeake aquitard, Upper Chesapeake unit, Lower Chesapeake unit, and the Lower Chesapeake aquitard as shown in Figure 2.3-38 and Figure 2.3-39.

Outcrop areas are identified as areas where the upward dip of the aquifer unit reaches ground surface. In southern Maryland, recharge areas for the shallow aquifer systems (Surficial and Chesapeake water-bearing units) are localized while the recharge areas for the deeper aquifer systems are the outcrop areas to the west and northwest in Charles County, Prince George's County, and Anne Arundel County. Precipitation recharge migrates downwards and laterally through the unconsolidated surficial materials, discharging to nearby streams and low lying areas, or percolates vertically downward into the deeper unconsolidated and semi-consolidated sediments.

Geotechnical and hydrogeological investigations have been performed that provide information on the CCNPP site to depths of 400 ft (122 m) below ground surface (bgs). Subsurface information was collected from over 228 borings and cone penetrometer tests (CPTs). Forty-seven groundwater observation wells were installed across the site. Observation wells were installed in three groundwater bearing intervals: the Surficial aquifer (19 wells), a deeper sand unit at the top of the Chesapeake Formation informally referred to as the Upper Chesapeake unit (23 wells), and an even deeper sand unit in the Chesapeake Formation informally called the Lower Chesapeake unit (5 wells).

The location of the CCNPP Unit 3 observation wells are shown in Figure 2.3-40. Specific well construction details, including locations and screen depths are provided in Section 2.3.1.2.3.2. Hydrogeologic cross sections for the strata penetrated by the CCNPP Unit 3 soil borings are shown in Figure 2.3-38 and Figure 2.3-39.

2.3.2.2.2.1 Surficial Aquifer

Within the Southern Maryland region, the Surficial aquifer is not a reliable source of groundwater. This is due to its relative thinness, limited saturated thickness (particularly during prolonged drought), and its topographic dissections that cause local groundwater to discharge as small springs (USGS, 1997).

The Surficial aquifer is primarily tapped by irrigation wells (and some old farm and domestic wells), but it is not widely used as a potable water supply because of its vulnerability to contamination and unreliability during droughts (MGS, 2005). Wells completed in this aquifer generally yield less than 50 gpm (189 Lpm). The groundwater table is usually encountered within a depth of 50 ft (15 m) bgs (USGS, 1997).

The Surficial aquifer is present above an elevation of approximately 65 ft (20 m) msl at the CCNPP site. Groundwater surface contour maps, as detailed in Section 2.3.1.2, indicate groundwater elevations between 65.9 to 85.7 ft (20.1 to 26.1 m) msl.

The horizontal groundwater flow in the Surficial aquifer is generally bi-modal. A northwest trending groundwater divide roughly follows a line extending through the southwestern boundary of the proposed power block area. Northeast of this divide, horizontal groundwater flow is northeast toward the Chesapeake Bay to small seeps and springs or site streams. Groundwater southwest of this divide flows to the southwest. The water table elevations in the Surficial aquifer are approximately 32.8 to 43.0 ft (10.0 to 13.1 m) higher than the potentiometric surface of the Upper Chesapeake unit, which indicates that a less-permeable material separates the two water-bearing units.

2.3.2.2.2.2 Chesapeake Confining Unit

The Chesapeake Group is a significant aquifer that is east of the CCNPP site in the Delmarva Peninsula. However, beneath the western shore of Maryland, in the vicinity of the CCNPP site, the Chesapeake Group is described as a confining unit. Thin and discontinuous sand units, capable of producing small quantities of groundwater, are present locally within the confining unit. These thin and discontinuous sand units may yield water but not quantities sufficient for most uses. Within the region, localized sand units are recharged by direct precipitation and percolation through the Surficial aquifer, moving a few miles or less downgradient along the flow path, and discharging to creeks and streams, the Chesapeake Bay, or localized areas of pumping. The potentiometric surface of the localized sand aquifers in the Chesapeake Group is generally above mean sea level (USGS, 1997).

A boring log from a production well at the CCNPP site indicates that the base of the Chesapeake Confining Unit is at an approximate elevation of -205 ft (-63 m) msl and its total thickness is approximately 250 ft (76 m) (MGS, 1996).

Two thin, semi-continuous, water-bearing sand units were encountered in the upper portion of the Chesapeake Confining Unit. These units are informally referred to as the Upper Chesapeake unit and the Lower Chesapeake unit.

2.3.2.2.2.2.1 Upper Chesapeake Unit

The Upper Chesapeake unit is separated from the overlying Surficial aquifer by the informally named relatively thin Upper Chesapeake aquitard. The thickness of the Upper Chesapeake aquitard ranges from approximately 4 to 36 ft (1.2 to 11 m) and averages approximately 20 ft (6.1 m). The Upper and Lower Chesapeake units are separated by the informally named Middle Chesapeake aquitard. The thickness of the Middle Chesapeake aquitard ranges from approximately 4 to 22 ft (1.2 to 6.7 m). The Lower Chesapeake unit is separated from the underlying Piney Point - Nanjemoy aquifer by the informally named and relatively thick Lower Chesapeake aquitard.

Potentiometric contour maps, as detailed in Section 2.3.1.2, indicate groundwater elevations from approximately 1.8 to 42.1 ft (0.5 to 12.8 m) msl. The horizontal groundwater flow across most of the site in the Upper Chesapeake unit ranges from north to east. Groundwater flowing in this direction likely discharges to the lower reaches of the site creeks flowing to the Chesapeake Bay. It is possible that a mound or hydraulic divide exists along the southwestern boundary of the power block area, resulting in a flow direction beneath the western switchyard area toward the tributaries of Johns Creek.

2.3.2.2.2.2.2 Lower Chesapeake Unit

The Lower Chesapeake unit contains a higher silt and clay content than the Upper Chesapeake unit. The base of the Lower Chesapeake unit ranges from elevation -38 to -92 ft (-11.6 to 28 m) msl and has a mean thickness of approximately 36 ft (11 m). Observed thickness is from 19 to 62 ft (5.8 to 18.9 m).

Approximate groundwater elevations range between 1.9 to 35.4 ft (0.6 to 10.8 m) msl. Potentiometric contour maps, as detailed in Section 2.3.1.2, suggest that horizontal groundwater flow in the Lower Chesapeake aquifer is to the north-northeast across the area covered by the Lower Chesapeake unit observation wells. Groundwater flowing in this direction likely discharges directly to the Chesapeake Bay.

The lower Chesapeake unit is separated from the underlying Piney Point-Nanjemoy aquifer by the informally named and relatively thick Lower Chesapeake aquitard. Two of the CCNPP Unit 3 soil borings penetrated the Lower Chesapeake aquitard which is approximately 170 ft (51.8 m) thick.

2.3.2.2.2.2.3 Piney Point-Nanjemoy Aquifer

The Piney Point - Nanjemoy aquifer is stratigraphically complex, consisting of several geologic units. Recharge to this aquifer is interpreted to be from precipitation in northern Calvert County and Anne Arundel County where these geologic units are exposed at the surface. Presumably, recharge also occurs from leakage of overlying aquifers. Discharge of the Piney Point-Nanjemoy aquifer is primarily from subaqueous exposures of the aquifer that are presumed to occur along the Continental Shelf. However, the northern portion of the Chesapeake Bay is a discharge area where the aquifer system is eroded by ancestral Susquehanna River paleochannels. Additional discharge occurs at local pumping locations (MGS, 1996).

The sandy upper Nanjemoy Formation is hydraulically connected to the overlying Piney Point Formation and is assigned to the Piney Point-Nanjemoy aquifer. Boring logs from a production well at the CCNPP site indicate that the base of the coarser grained upper Nanjemoy Formation (bottom of the Piney Point - Nanjemoy aquifer) is at an approximate elevation of –315 ft (-96 m) msl and the total thickness of the Piney Point - Nanjemoy aquifer is approximately 115 ft (35 m) (MGS, 1996).

Although a few major groundwater users in Calvert County and St. Mary’s County pump from the Piney Point-Nanjemoy aquifer, it is primarily used for domestic water supply. Domestic well yields are generally less than 20 gpm (76 Lpm) with reported well yields of up to 200 gpm (757 Lpm) in the Piney Point Formation and up to 60 gpm (227 Lpm) in the Nanjemoy formation (MGS, 1996).

The fine-grained lower Nanjemoy Formation comprises the Nanjemoy Confining Unit and underlies the Piney Point-Nanjemoy aquifer, separating the aquifer from the underlying Aquia Aquifer.

2.3.2.2.2.2.4 Aquia Aquifer

In southern Maryland, the Aquia aquifer correlates with the late Paleocene Aquia Formation. The Aquia Formation is poorly to well sorted, and consists of shelly, and glauconitic quartz sand with carbonate cemented sandstones and shell beds. The Aquia Formation (aquifer) dips to the southeast with its upper surface ranging in approximate elevation from -100 ft (-30.5 m) msl in northern Calvert County to -500 (-152 m) ft msl near Solomons in southern Calvert County. The aquifer thickness varies considerably in Calvert County. Boring logs from a production well at the CCNPP site indicate that the base of the Aquia aquifer is at elevation -560 ft (-171 m) msl and its total thickness is approximately 145 ft (44 m) (MGS, 1996).

The Aquia formation is a productive aquifer with a reported yield at the CCNPP site of up to 300 gpm (1,136 Lpm). Recharge to the Aquia aquifer is from precipitation in central Anne Arundel County and Prince George's County where these units outcrop. Natural discharge of the Aquia aquifer is to the southeast, primarily from subaqueous exposures of the aquifer that are presumed to occur along the Continental Shelf. Other discharge occurs at local pumping locations.

The Aquia aquifer is used extensively for domestic and major-user water supplies in southern Maryland. Since the 1980s, a deep cone of depression has developed in the Solomons area of Calvert County and St. Mary's County where it is heavily pumped for public, commercial, and military supplies. This has diverted the groundwater flow direction in Calvert County to the south and southeast toward these pumping centers. Because of these considerations, water supply managers in these counties are seeking to shift some groundwater usage from the Aquia aquifer to deeper aquifers (MGS, 2005). A 2003 southern Maryland potentiometric surface map of the Aquia aquifer is shown in Figure 2.3-33 (USGS, 2005a).

At the base of the Aquia aquifer, fine-grained sediments of the lower Paleocene Brightseat Formation and several upper Cretaceous units, including the Monmouth, Matawan, and Magothy Formations, combine to form the hydraulically indistinguishable Brightseat Confining Unit. This confining unit separates the Aquia aquifer from the underlying Magothy aquifer. Boring logs from a production well at the CCNPP indicate that the base of the Brightseat Confining Unit is at an approximate elevation of -590 ft (-180 m) msl and attains a thickness of approximately 30 ft (9 m) (MGS, 1996).

2.3.2.2.2.2.5 Magothy Aquifer

The Magothy aquifer is present in the northern and central portions of Calvert County. It thins to the south and pinches out in southern Calvert County where it is not a significant aquifer. The southern extent of the aquifer is estimated to lie somewhere between the CCNPP site and Solomons. Boring logs from a production well at the CCNPP site indicate that the base of the Magothy aquifer is at an approximate elevation of -610 ft (-186 m) msl and appears to attain a thickness of less than 25 ft (7.6 m) (MGS, 1996).

Recharge to the Magothy aquifer is from direct precipitation in northern Anne Arundel County where the Magothy Formation is exposed at the surface. Groundwater from this aquifer is primary used in Anne Arundel County, Prince George's County, and Charles County (MGS, 2005). A 2003 southern Maryland potentiometric surface map of the Magothy aquifer is shown in Figure 2.3-34 (USGS, 2005b).

2.3.2.2.2.2.6 Potomac Group

The Potomac Group consists of, in descending order, the Patapsco, Arundel, and Patuxent Formations. These units form a thick (greater than 1,500 ft (457 m)) series of unconsolidated sediments which locally contain three confining units and three aquifers. Because of the significant depth of these formations and the abundance of exploitable groundwater supplies in shallower aquifers, these units are not currently used as a significant source of groundwater in the vicinity of the CCNPP site. Consequently, available hydrogeologic information for the Potomac Group of aquifers and confining units is limited. The hydrogeologic units within the Potomac Group are defined as the: Upper Patapsco confining unit, Upper Patapsco aquifer, Middle Patapsco confining unit, Lower Patapsco aquifer, Arundel confining unit, and Patuxent aquifer.

The Upper Patapsco aquifer extends to the northeast through Prince George's County and Anne Arundel County and beneath Chesapeake Bay to the eastern shore of Maryland. The aquifer is recharged by direct precipitation at outcrops in western and northern Charles County, Prince George's County, and Anne Arundel County. Groundwater from this aquifer is extensively used for public supply in Charles County and Anne Arundel County (MGS, 2005).

The Lower Patapsco aquifer extends northeast to northern Anne Arundel County and across the Chesapeake Bay to the eastern shore of Maryland, but its correlation to the west and southwest is uncertain. Groundwater from this aquifer is primarily used in Charles County and Anne Arundel County (MGS, 2005).

The Patuxent aquifer is the deepest Coastal Plain aquifer in Maryland, and rests on the pre-Cretaceous basement surface. Because of its great depth and the presence of brackish water in coastal regions, its potential for development is thought to be limited (MGS, 2005).

Southern Maryland potentiometric surface maps of the Upper and Lower Patapsco aquifers for 2003 are shown in Figure 2.3-35 and Figure 2.3-36 (USGS, 2005c) (USGS, 2005d).

2.3.2.2.3 Sole Source Aquifiers

The Sole Source Aquifer (SSA) Program, which is authorized by the Safe Drinking Water Act, allows for groundwater protection when a community is dependent on a single source of drinking water and there is no possibility of a replacement water supply to be found. The U.S. EPA defines a sole or principal source aquifer as one which supplies at least 50% of the drinking water consumed in the area overlying the aquifer (USEPA, 2007a).

The CCNPP 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 as shown in Figure 2.3-66. None of the sole-source aquifers are located in southern Maryland. The construction and operation of CCNPP Unit 3 will not adversely impact the sole-source aquifers identified in U.S. EPA Region 3. The identified sole-source aquifers are beyond the boundaries of the local and regional hydrogeologic systems in southern Maryland.

2.3.2.2.4 Southern Maryland Regional Groundwater Use

The Piney Point-Nanjemoy aquifer and underlying Aquia aquifer are the chief sources of groundwater in Calvert County and St. Mary's County. The Piney Point - Nanjemoy aquifer is primarily used for domestic water supply. The Aquia aquifer is the primary source of groundwater for major groundwater appropriation in southern Maryland.

Early in the 20th century, few Aquia aquifer wells had been drilled in Calvert County and St. Mary's County. By mid-century, groundwater demands were increasing in the region due to growth in population, industry and military use. Groundwater usage was reported to have increased by 75% between 1940 (1.6E+06 gpd (6.1E+06 lpd)) and 1980 (2.8E+06 gpd (1.1E+07 lpd)). By the end of the 1980s, groundwater pumpage had increased to about 4.8E+06 gpd (1.8E+07 lpd). Domestic pumpage accounted for about 60.1% of usage in 1991 and was about 3.4E+06 gpd (1.3E+07 lpd) in 1994. Groundwater use was approximately evenly distributed between the Piney Point - Nanjemoy and the Aquia aquifers (MGS, 1997).

The underlying Magothy aquifer is present in the northern and central portions of Calvert County and farther north where it is used extensively for public and domestic supplies in northern Calvert County and Anne Arundel County. It thins to the south and pinches out in southern Calvert County where it is not a significant aquifer. The underlying Upper Patapsco aquifer is used extensively for public supply in central Charles County, where multiple cones of depression have formed. It is also pumped heavily by major users in Prince George's County and Anne Arundel County. A few users pump the Upper Patapsco aquifer in St. Mary's County and northern Calvert County. The Lower Patapsco aquifer is pumped heavily by users in central and northwestern Charles County, but it is not currently used as a major source of water in St Mary's County or Calvert County (MGS, 1997).

2.3.2.2.5 Calvert County Groundwater Use

The Aquia aquifer is currently the primary source of groundwater for the major appropriators in the county as the overlying Piney Point - Nanjemoy aquifer is increasingly being reserved for domestic users. The Calvert County Sanitary District operates major water-distribution systems as do numerous municipal and private water companies. In 1985, it was reported that major users withdrew approximately 73.4% from the Aquia aquifer, 19.4% from the Piney Point - Nanjemoy aquifer, and 7.2% from the deeper Magothy and Patapsco aquifers (MGS, 1997). By 1994, withdrawals from the Piney Point - Nanjemoy and the Aquia aquifers totaled about 1.9E+06 gpd (7.2E+06 lpd) and 3.6E+06 gpd (1.4E+07 lpd), respectively, for Calvert County.

A database obtained from the Water Supply Program of MDE in December 2006 for Calvert County lists 568 active Water Appropriations Permits for the county: 12 surface water permits and 556 groundwater permits. The appropriated amount of groundwater that was permitted in Calvert County in 2006 was approximately 5.3E+06 gpd (2.0E+07 lpd) for the daily average withdrawal rates (gallons withdrawn per year/365 days). The permitted daily average use during the month of maximum use is tabulated as approximately 9.3E+06 gpd (3.5E+07 lpd) (gallons withdrawn during the month of maximum use/number of days in that month). Permitted users, aquifer or stream withdrawal rates, and other pertinent information are provided in Table 2.3-22.

The locations of the groundwater users listed in Table 2.3-22 have a nominal mapping accuracy to the nearest 10,000 ft (3,048 ft). Due to this limited available accuracy, a figure depicting the locations of the groundwater permits within the county was not developed. Because the location of these wells can not be accurately plotted, the nearest permitted MDE groundwater well (beyond the boundary of the CCNPP site property), downgradient from the CCNPP site, is conservatively presumed to lie adjacent to the southeastern boundary of the CCNPP site. At this location, the distance between the boundary and the center of CCNPP Unit 3 power block is approximately 1.1 mi (1.8 km) as shown in Figure 2.3-59. The flow direction was based on the regional direction of flow within the Aquia aquifer as shown in Figure 2.3-33.

The Safe Drinking Water Information System (SDWIS) maintained by the U.S. EPA lists community, non-transient non-community, and transient non-community water systems that serve the public (USEPA, 2007b). Community water systems are defined as those that serve the same people year-round (e.g., in homes or businesses). Non-transient non-community water systems are those that serve the same people, but not year-round (e.g., schools that have their own water system). Transient non-community water systems are those that do not consistently serve the same people (e.g., rest stops, campground, and gas stations). Table 2.3-23 lists the community, non-transient non-community, and transient non-community water systems using groundwater as their primary water source in Calvert County (USEPA, 2007b). Many of these listings correlate to those provided by the MDE.

Coordinates for the locations of the water systems listed in the SDWIS database for Calvert County are not publicly released. In addition, many of the addresses provided are mail drop locations for the owners of water systems and, for some, addresses are not provided. Therefore, a figure depicting the locations of these systems was not developed. Because the location of these water systems can not be accurately plotted, the nearest water system (beyond the boundary of the CCNPP site property), is assumed to be near the community of Lusby, approximately 2.7 mi (4.3 km) to the south as shown in Figure 2.3-59.

2.3.2.2.6 CCNPP Units 1 and 2 Groundwater Use

Table 2.3-24 lists the MDE water appropriation permits and the groundwater production wells currently residing at the CCNPP site property, along with the approximate depths of the wells. There are a total of 13 wells at the CCNPP site. Five Maryland Water Appropriations Permits have been issued to CCNPP Units 1 and 2 for the operation of 12 groundwater withdrawal wells. Seven of the wells are completed in the Piney Point - Nanjemoy aquifer and the other 5 wells are completed in the Aquia aquifer. Table 2.3-25 also lists an historical Aquia well referred to as the Old Bay Farm location. At the CCNPP site, the Aquia aquifer ranges in elevation from approximately -560 ft to -415 ft (-171 to -126 m) msl. The Piney Point – Nanjemoy aquifer ranges in elevation from approximately -315 ft to -200 ft (-96 to -61 m) msl.

CCNPP Units 1 and 2 use groundwater for potable supply, sanitary facilities, fire protection, and makeup water. The groundwater is obtained from five Aquia aquifer wells listed as CCNPP Well Numbers 1 through 5 on Figure 2.3-68. First appropriated in July 1969, these wells are listed under permit number CA69G010 (05). The water appropriation permit issued for these wells requires semi-annually that monthly groundwater withdrawal rate reports be provided to the State of Maryland. Table 2.3-26 summarizes the water withdrawal rates for a five year interval (July 2001 through June 2006). Plant withdrawals from the Aquia aquifer average about 70.6E+06 gal (267E+06 liters) every six months or approximately 141E+06 gpy (533E+06 lpy).

Additional CCNPP groundwater appropriation permits have relatively low use limits compared to those for the existing power plant. These permits are summarized as follows. Well locations are shown in Figure 2.3-60:

- MDE water appropriation permit CA63G003 (07), first issued in May 1963, authorized groundwater use for potable supply, sanitary facilities, and filling a swimming pool at Camp Conoy (including the Eagle Den and Conference Center). Groundwater can be obtained from four wells (Camp Conoy wells) from the Piney Point aquifer as shown on Figure 2.3-60. Currently, three of the four wells are active. One well has since been taken out of service.
- MDE water appropriation permit CA83G008 (03), first issued in August 1983, authorized groundwater use for potable supply and sanitary facilities at the Visitor Center. Groundwater can be obtained from one well in the Piney Point aquifer.
- MDE water appropriation permit CA89G007 (02), first issued in April 1989, authorized groundwater use for potable supply, sanitary facilities, and lawn irrigation at the Rifle Range. Groundwater can be obtained from one well from the Piney Point aquifer.
- MDE water appropriation permit CA89G107 (01), first issued in July 1995, authorized groundwater use for non-potable supply at the Procedures Upgrade Project (PUP) Trailers. Groundwater can be obtained from one well in the Piney Point aquifer, northeast of the rifle range.

As shown on Figure 2.3-60, the only CCNPP Unit 1 and 2 wells within the CCNPP Unit 3 construction area are the three Camp Conoy Piney Point-Nanjemoy aquifer wells located east of the CCNPP Unit 3 power block. During construction of CCNPP Unit 3, the two active Camp Conoy wells immediately adjacent to the CCNPP Unit 3 construction area may need to be abandoned. The other active Camp Conoy well (at the Eagle's Den) is approximately 1,400 ft (427 m) northeast of the center of CCNPP Unit 3 on the Calvert Cliffs bluff. The nearest CCNPP Units 1 and 2 Aquia production well (CCNPP Well #5) is approximately 900 ft (274 m) north of the center of CCNPP Unit 3.

2.3.2.2.7 Southern Maryland Groundwater Demands

Withdrawals from Maryland Coastal Plain aquifers have caused groundwater levels in confined aquifers to decline by tens to hundreds of feet from their original levels (USGS, 2006). Beginning in the 1940s, with the development of the Patuxent River Naval Air Station, water levels within the Aquia aquifer began to decline significantly. Between 1960 and 1985, groundwater levels within the Aquia aquifer in Southern Maryland declined at a relatively constant rate as groundwater use increased over time. Since 1985, the decline in groundwater levels has sharply increased as the demand for water from the Aquia aquifer and, to a lesser extent, deeper aquifers (Magothy and Patapsco) has increased substantially. The current rate of decline in many of the confined aquifers has been estimated at about 2 ft (0.6 m) per year. Declines have been especially large in Southern Maryland and parts of the eastern shore where groundwater pumpage is projected to increase by more than 20% between 2000 and 2030 as population within the region is expected to grow by 37% (USGS, 2006).

Potentiometric surface maps developed on a regional scale by the U.S. Geological Survey (USGS) were used to evaluate the areal extent of groundwater elevation decreases through time as discussed in Section 2.3.2.2.2. The USGS potentiometric surface maps for the Aquia, Magothy, Upper Patapsco, and Lower Patapsco aquifers in Southern Maryland for 2003 are shown in Figure 2.3-33 through Figure 2.3-36. Two areas in Calvert County show cones of depression in the Aquia aquifer. A small depression north of the site is present in the North Beach and Chesapeake Beach area and a large depression south of the site in the Solomons area appears to be having a significant regional effect on the Aquia aquifer. This larger cone of depression is influencing regional groundwater flow out to a radius of at least 15 mi (24 km) from the pumping centers in the Solomons area as shown in Figure 2.3-33. This area of influence includes the CCNPP site. Similar cones of depression are present in the lower aquifers, although they are not as pronounced in Calvert County as shown in Figure 2.3-33 through Figure 2.3-36.

The USGS has also compiled historical water elevations for the Aquia, Magothy, Upper Patapsco, and Lower Patapsco aquifers in Southern Maryland to determine the magnitude of potentiometric surface declines through time. Potentiometric surface difference maps of these four southern Maryland aquifers are shown in Figure 2.3-61 through Figure 2.3-63, respectively, for various periods between 13 and 28 years (USGS, 2003a) (USGS, 2003b) (USGS, 2003c) (USGS, 2003d). As expected, the areas showing the largest cones of depression correlate with the largest historical declines in potentiometric surface elevations. From 1982 to 2003, the Aquia aquifer potentiometric surface has decreased over 100 ft (30 m) in elevation inside the center of the cone of depression at Solomons in southern Calvert County as shown in Figure 2.3-61. Decreases of over 70 ft (21 m) were observed in the Magothy aquifer in northeastern Charles County as shown in Figure 2.3-62, and smaller decreases were observed in the Upper and Lower Patapsco aquifers as shown in Figure 2.3-63 and Figure 2.3-64.

In 1943, the USGS and the Maryland Geological Survey (MGS) began a statewide cooperative groundwater monitoring network. Several private wells in the Solomons area of Calvert County were among the first to be monitored by what now is referred to as the Calvert County

Ground Water Level Monitoring Network, which is a cooperative program between the Calvert County Department of Public Works, Bureau of Utilities, the MGS, and the USGS (USGS, 2007). This network of approximately 42 wells is mainly focused on monitoring the deeper, confined aquifers that are affected by local and regional groundwater withdrawal. The major aquifers of interest are the Piney Point-Nanjemoy, Aquia, and Magothy aquifers. Recently, wells have been added to the system in order to study the availability of water in the deeper Upper and Lower Patapsco aquifers. Water table monitoring wells have also been added, which are used as climate response wells for indicating local groundwater recharge and drought conditions. A USGS web page provides water level trends for selected wells in the network (USGS, 2007). These wells are shown on Figure 2.3-65.

Selected well hydrographs from the Calvert County Ground Water Level Monitoring Network were reviewed to evaluate the temporal trends of the potentiometric surfaces of the aquifers underlying southern Calvert County. For each aquifer, the Calvert County Ground Water Level Monitoring Network well closest to the CCNPP site is evaluated in the following bullets:

- Well CA Fd 51 is screened in the Piney Point-Nanjemoy aquifer and is located approximately 2.5 mi (4 km) southeast of the CCNPP site at Calvert Cliffs State Park. Groundwater levels have been monitored since 1977 and show a nearly steady decrease in elevation from approximately 15.0 ft to -3.0 ft (4.6 to -0.9 m) msl. This rate of decline is approximately 0.6 ft/yr (0.2 m/yr). The rate of decline appears to have decreased slightly since 2000 as shown in Figure 2.3-66.

- Well CA Ed 42 is screened in the Aquia aquifer and is one of the production wells at the CCNPP site. Groundwater levels have been monitored since 1978 and show much higher rate of groundwater elevation decrease from approximately -19.0 ft to -92 ft (-5.8 to -28 m) msl. This corresponds to an overall rate of decline of approximately 2.6 ft/yr (0.8 ft/yr), although relatively stable elevations have been observed since 2003 as shown in Figure 2.3-67.

- Well CA Dc 35 monitors the Magothy aquifer and is located approximately 6 mi (10 km) northwest the CCNPP site at Scientists Cliffs. Groundwater levels have been monitored since 1975 and the data exhibit a very steady rate of groundwater elevation decrease from approximately 8 ft to -37 ft (2.4 to -11.3 m) msl. This rate of decline of approximately 1.6 ft/yr (0.5 m/yr) is less than that observed in the overlying Aquia aquifer as shown in Figure 2.3-68.

- Groundwater elevations in the Upper Patapsco aquifer were evaluated at well CA Db 96, located approximately 10 mi (16 km) northwest of the CCNPP site in Prince Frederick. Groundwater levels in this well have only been monitored since 2003, but groundwater level decreases in this aquifer are also observed. Groundwater elevation decreased at a rate of approximately 1.4 ft/yr (0.4 m/yr) from approximately -35.5 ft to -40.0 ft (-10.8 to -12.2 m) msl as shown in Figure 2.3-69.

- Groundwater elevations in the Lower Patapsco aquifer were evaluated at well CA Fd 85, located approximately 3.5 mi (5.6 km) southeast of the CCNPP site at Chesapeake Ranch Estates. Groundwater levels in this well have only been monitored since 2001, but groundwater level decreases in this aquifer are observed. Groundwater elevation decreased steadily from approximately -14.5 ft to -20.0 ft (-4.4 to -6.1 m) msl (Figure 2.3-70), a rate of approximately 1.1 ft/yr (0.34 m/yr).

Calvert County and St. Mary's County are rapidly growing areas. Between 1980 and 1990, the combined population of the two-county area increased significantly (as described in Section

2.5) and will continue to increase, putting additional demand on the groundwater resources for this area.

A 2004 report by an advisory committee on the management and protection of Maryland's water resources identified the need for a comprehensive assessment of groundwater resources of the Maryland Coastal Plain (MDE, 2004). The assessment will be conducted by the MGS and the USGS in three phases between 2006 and 2013. The goal of the assessment is to develop tools to facilitate scientifically sound management of the groundwater resources in the region.

MDE regulates major groundwater users (those users pumping an average of 10,000 gpd (37,854 lpd) or more) by requiring them to obtain Groundwater Appropriation Permits to prevent the regional potentiometric surface from declining below the 80% management level (80% of the aquifer's available drawdown). Because substantial population growth is anticipated in both Calvert County and St. Mary's County, the MGS developed a model to simulate water level trends through 2020 (MGS, 1997) and subsequently updated through 2025 (MGS, 2001) using several future alternative pumping scenarios for the Piney Point-Nanjemoy and the Aquia aquifers. The model was calibrated by matching simulated water levels against 1952, 1980, and 1982 data and verified by matching simulated data against 1991 through 1994 water levels in 198 observations wells. Future domestic pumpage for 1995 to 2025 simulations were based on estimated population increases and evaluated by comparing simulated drawdowns with the permitted 80% management levels. Major appropriated pumpage and domestic pumpage for the Piney Point-Nanjemoy and Aquia aquifers were simulated in the calibration and predictive scenarios for Anne Arundel County, Charles County, and Prince George's County. Major appropriated pumpage was also taken into account for the Maryland Eastern Shore counties. The Piney Point-Nanjemoy aquifer water levels remained substantially above the Aquia aquifer water levels, but it was suggested that in the future, large appropriators should be restricted from using this aquifer, leaving it to accommodate self-supplied domestic usage. In areas where Aquia domestic wells predominate, water levels could be stabilized by allocating major withdrawals to deeper, more productive aquifers such as the Magothy and Upper Patapsco.

The MGS recently developed a model to simulate and evaluate the potential for increasing groundwater withdrawals from the deeper Upper Patapsco and Lower Patapsco Aquifers in southern Maryland (Calvert County, Charles County, and St. Mary's County) (MGS, 2005). The results of this study projected that water demands within Calvert County and St. Mary's County through 2030 could be met without reducing water levels below the 80% management level by increasing pumpage in the Aquia aquifer. Shifting a portion of the public supply withdrawals from the Aquia to the Upper Patapsco aquifer would result in an increase in available drawdown in the Aquia aquifer in many areas with minimal effect on drawdown near the aquifer outcrop areas in Charles County.

The MGS continues to conduct studies, including modeling efforts, to understand and predict the effects of increasing groundwater demands of the Coastal Plain aquifers within the State of Maryland. New users (or existing user applying to increase its withdrawal) would not be granted a permit if the proposed withdrawal rate is predicted to cause the regional head to fall below the management level.

2.3.2.2.8 CCNPP Unit 3 Groundwater Use Projections

The sole source of fresh water for the operation of CCNPP Unit 3, except as noted below, will be a desalination plant drawing raw water from the Chesapeake Bay. However, other sources of fresh water will be required to support construction of CCNPP Unit 3 before the desalination plant is operational. Construction activities requiring fresh water include concrete mixing and curing, dust suppression, sanitary and potable use by the construction workforce, hydrostatic testing of pipes and tanks, and wash water. The water needed during the projected 21 months of pre-construction and 68 months (approximately 6 years) of construction of CCNPP Unit 3 will be supplied by new production wells drilled into the Aquia aquifer, the Upper Patapsco aquifer, or the Lower Patapsco aquifer. Other sources of fresh water that may be used to support construction are the groundwater pumped for construction dewatering and water trucked or barged from off site.

The Maryland Public Service Commission has issued a proposed Certificate of Public Convenience and Necessity (CPCN) to UniStar (MPSC, 2009). Condition 17 of the proposed CPCN authorizes UniStar to appropriate and use groundwater from up to two production wells in the Aquia aquifer to support the construction of CCNPP Unit 3. The groundwater allocation granted by this appropriation is limited to a daily average of 100,000 gallons on a yearly basis and a daily average of 180,000 gallons for the month of maximum use (MPSC, 2009). Condition 28 of the proposed CPCN limits construction dewatering withdrawals from the Surficial aquifer to a daily average of 75,000 gallons on an average annual basis and a daily average not to exceed 100,000 gallons during the highest withdrawal month.

Based on water use estimates for normal conditions during pre-construction, maximum monthly water use total is calculated to be a daily average of 287,333 gallons. This value exceeds the groundwater allocation allowed by the CPCN. Therefore, other sources of water will be needed during this period, or the CPCN will need to be revised. Utilizing the dewatering effluent as a supplement for construction water use is the most attractive option; but it will require a revision to the dewatering limit in the CPCN.

After CCNPP Unit 3 construction is complete, the desalination plant may be out of service occasionally for a period estimated to be no more than two weeks, to permit maintenance and repair. During this period, continued operation of CCNPP Unit 3 will require a back-up source of approximately 900 gpm of fresh water. The Aquia, Upper Patapsco, and Lower Patapsco aquifers are each capable of producing the fresh water supply required. However, three wells would be needed in the Aquia aquifer (one more than the maximum of two allowed by the CPCN) to reach the required 900 gpm flow, while only two wells would be necessary in either the Upper Patapsco or Lower Patapsco aquifers.

If properly managed, construction activities at CCNPP and any additional groundwater withdrawals for construction of CCNPP Unit 3 will not adversely affect the local or regional groundwater systems. There are currently no known or projected site discharges that do or could affect the local groundwater system. Construction activities will affect the shallower, non-utilized water-bearing units beneath the site including the Surficial aquifer and the upper water bearing units within the Chesapeake Group. However, these shallow units are not used locally for water supply and their relatively thin, discontinuous layers limit the extent to which construction impacts propagate off site.

2.3.2.2.9 CCNPP Unit 3 Aquia Aquifer Groundwater Impacts

MGS 2007 defines five groundwater management factors that require evaluation in connection with the increase in withdrawal at the CCNPP site. These factors are; first, the 80 percent water management level; second, impacts on other groundwater users; third, lowered water table; fourth, brackish-water and river-water intrusion; fifth, subsidence.

Several studies by both MGS and the applicant have been run to evaluate the foregoing factors. Not-withstanding the fact that CCNPP Unit 3 will have newly permitted construction wells, these studies have considered groundwater withdrawal rates associated with permitted quantities for CCNPP Units 1 & 2 as well as much larger withdrawal rates. These studies provide bounding impacts.

- **Existing studies of drawdown in coastal plain aquifers associated with increasing withdrawals to currently appropriated maximum permitted values from existing CCNPP wells.**

  One existing study evaluated the potential impacts associated with increasing current average groundwater withdrawal from the Aquia aquifer by approximately 60,000 gallons per day (227,400 lpd) up to the maximum currently permitted rate for CCNPP Units 1 & 2 of 450,000 gallons per day (1.7 million lpd) is by using the results of the groundwater flow model developed by MGS to evaluate the water supply potential of the coastal plain aquifers in Calvert and St. Mary's Counties (MGS 2005 and MGS 2007). This model was used to evaluate the effects of continued groundwater withdrawal at either current rates or at various projected rates until the year 2030. The model was calibrated to reproduce the potentiometric head measured in 2002. Figure 4b of MGS 2005 indicates a predicted water level in 2002 of about -80ft msl in the Aquia aquifer in the vicinity of CCNPP which closely approximates the observed -81.5ft msl.

  Results of the MGS model indicate that increasing the annual water withdrawal by domestic users and public supply wells to account for projected populations increases while maintaining all other major users (with withdrawal rates in excess of 10,000 gallons (37,900 liters) per day) at their actual 2002 measured withdrawal rates results in an additional drawdown in the Aquia aquifer in the vicinity of CCNPP of between 20 and 30 feet by 2030. Simulated drawdown in the Piney Point-Nanjemoy aquifer in 2030 is less than 10 ft.

  Increasing the withdrawal rates of domestic water users by the same amount as modeled in Scenario 1 and setting the water use of all major users at their average WAP rates instead of actual withdrawal rates measured in 2002 (Scenario 4 of MGS, 2005 and MGS, 2007) results in an additional drawdown in the Aquia aquifer of between 5 and 10 feet by 2010 (UniStar, 2008) and between 20 and 30 feet by 2030. This scenario corresponds to the increase in withdrawal from the CCNPP Unit 1 & 2 wells of approximately 60,000 gallons (227,400 liters) per day to the permitted maximum of 450,000 gallons (1.7 million liters) per day.

  Simulated drawdown of the Piney Point-Nanjemoy aquifer associated with this Scenario is less than 5 ft in 2010 and less than 10 feet in 2030. The increased drawdown is principally the result of increased withdrawal by domestic and other users not from leakage across the low vertical conductivity Middle Confining Bed due to increased pumping from the underlying Aquia aquifer.

  Based upon the foregoing results, withdrawal of an additional 60,000 gallons (227,400 liters) per day of water from the Aquia aquifer at the maximum CCNPP Unit 1 & 2 permitted flow rate for 8 years (construction period is 6 years) an additional drawdown in the vicinity of CCNPP is expected to be less than 10 feet. This additional drawdown includes the effects of increase withdrawal by domestic and other major users of the Aquia aquifer and other coastal plain aquifers. The drawdown from CCNPP alone would clearly be less.

- **Modeled effects of groundwater withdrawal rates at greatly exceeding the amounts in the CCNPP Unit 3 permit application.**

  In addition to the conditions modeled by the Maryland Geological Survey (MGS, 2005 and MGS, 2007) described in the foregoing discussion, an additional numerical model of the Aquia aquifer considering an area within a five mile radius of CCNPP based upon the MGS model was developed by the applicant. The model simulates the impact on the Aquia aquifer during the six year CCNPP Unit 3 construction period at a pumping rate of 738,000 gallons (2.8 million liters) per day. This conservative withdrawal rate represents the current CCNPP Unit 1 & 2 permitted flow plus an additional 200 gpm (757 lpm). (This rate is more than seven times the currently proposed CCNPP Unit 3 permit rate of 100,000 gallons (379,000 liters) per day. The model results predict a drawdown after six years of 52 feet at the CCNPP site and 13 feet at the closest off-site wells of major water users. These are at the Beaches Water Company approximately 2.75 miles northward and the Dominion Cove Point LNG Terminal approximately 3.85 southward. The model also predicts that following the six year construction period water levels will return to pre-construction withdrawal rate levels during a period of three years.

  In anaylzing potential impacts, using the most extreme parameters, it is concluded that the increase in drawdown in the vicinity of the CCNPP will not exceed 13 feet.

- **80 Percent Management Level**

  Currently, the primary criterion used by the MDE for evaluating water-appropriation permit applications in the confined aquifers of the Maryland Coastal Plain is the 80-percent management level. The 80-percent managment level is defined as 80-percent of the available drawdown in an aquifer. This level for the Aquia aquifer in the vicinity of CCNPP is at an elevation of about -350 ft msl. Increasing drawdown in the Aquia aquifer at CCNPP by 52 ft from the 2002 level of about -110 ft msl yields an estimated groundwater elevation at CCNPP of about -162 ft msl, well above the 80-percent management level.

- **Impacts on Other Ground-Water Users**

  Analysis of impacts to other users generally relates to the effect of lowering the groundwater level in other wells. Those wells most vulnerable to such impacts are small diameter "telescoping wells". Such wells are typically constructed with a 4-inch diameter casing near the surface that reduces to a 2 inch diameter in the deeper portion of the well. The submersible pump in these wells is typically installed near the bottom of the 4-inch part of the well (MGS 2007). Because the diameter of the pump is too large to be lowered below the depth where the well diameter is reduced. Its yield will be adversely affected if regional declines cause the groundwater level to be lowered to a depth near the well's "reduction point". This type of well construction is typically used in the region for domestic supplies and other wells of relatively low yield. Most of these wells, as well as those of some major users of groundwater in the vicinity of CCNPP, such as the White Sands subdivision to the west and the Calvert Cliffs State Park to the south, are completed in the Piney Point or Nanjemoy Formations and impacts from increased withdrawals from the deeper Aquia aquifer are negligible.

Major users of the Aquia aquifer in the vicinity of CCNPP, including the Beaches Water Company to the north and the Dominion Cove Point LNG Terminal to the south are several miles away from CCNPP. Wells for these major users are not small diameter "telescoping wells". The pumps in these wells are typiccally set much deeper, hence their yields are not significantly impacted by lowering water levels by about thirteen feet. Therefore, the likelihood of the additional drawdown in the Aquia aquifer affecting other users is small, given the lack of small diameter telescoping wells in the Aquia aquifer in the vicinity of CCNPP and the fact that other users of groundwater in the vicinity of CCNPP generally pump from the overlying Piney Point-Nanjemoy aquifer.

- **Lowered Water Table**

The outcrop of the Aquia Formation, where the aquifer is unconfined and under water-table conditions, is about 30 miles northwest of CCNPP. Regional groundwater withdrawals from the confined portion of an aquifer can affect the water table elevation. However, the additional withdrawal from the CCNPP wells would be a small fraction of the total groundwater withdrawal from the Aquia aquifer and would be unlikely to affect the water table surface 30 miles away.

In the vicinity of the CCNPP site, the Surficial aquifer is unconfined and under water table conditions. The level of the water table is controlled primarily by recharge and discharge in the Surficial aquifer rather than by the relatively small amount of leakage across the Upper Confining Bed beneath the Surficial aquifer that might be induced by increased pumping from the deeper Aquia aquifer. The thickness of the Upper Confining Bed in the vicinity of CCNPP is about 250 ft. MGS modeled results demonstrate that the potentiometric head in the underlying Piney Point-Nanjemoy aquifer changes by less than 5 ft after 8 years of increased withdrawals from the deeper Aquia aquifer. These results, in addition to the thickness and low vertical hydraulic conductivity of the Upper Confining Bed, suggest there will be no effect on the Surficial aquifer water table due to increased pumping from the CCNPP wells in the Aquia aquifer.

- **Brackish-Water and River-Water Intrusion**

Brackish-water and river-water intrusion is possible in the shallow aquifers in the area if they are hydraulically connected to surface water and the potentiometric heads in these aquifers are reduced below sea level. Increased withdrawal from the Aquia aquifer would not significantly affect the water level in the Surficial aquifer or the Piney Point-Nanjemoy aquifer, therefore, brackish or river-water intrusion would be negligible. In addition, brackish-water intrusion is not expected in the Aquia aquifer because the overlying confining units would prevent the downward migration of salty water. Although the top of the Piney Point-Nanjemoy aquifer is projected to subcrop in the Chesapeake Bay in areas where the formation is eroded by ancestral Susquehanna River channels, there remains over 100 ft of the Middle Confining Bed between the Piney Point-Nanjemoy and Aquia aquifers to prevent the downward migration of salty water to the Aquia aquifer.

- **Land Subsidence**

Land subsidence caused by large potentiometric head declines as a result of groundwater withdrawals has not been documented in Maryland, but is possible.

Considering a pre-consolidation stress equivalent of 65 ft below sea level and a maximum subsidence to water-level decline ratio of 0.0037, an additional 52 ft of drawdown at CCNPP after 6 years of increased withdrawals from the Aquia aquifer may yield about 0.192 ft of subsidence or a rate of about 0.032 ft/yr (about 0.384 in/yr).

Because of the length of time required for drainage of the thick confining units above the Aquia aquifer, the actual subsidence rate is likely to be less than this value and subsidence would continue after water levels in the aquifer have stabilized. This estimated subsidence rate is the maximum that could occur over the area of greatest drawdown. A lower average rate would apply over the area of the aquitard and subsidence would be distributed over a large area as the stresses are redistributed vertically.

- **Summary**

Based on the above analysis, there would be no significant impact from increasing groundwater withdrawal from the Aquia aquifer for the six years of construction of CCNPP Unit 3. Although the water level in the vicinity of CCNPP will be lowered, the results of numerical modeling indicate the projected drawdown (using extreme assumptions) in the closest wells of major water users to be approximately 13 ft even after 6 years of increased pumping from the CCNPP wells and from those of other domestic and major users of the Aquia aquifer. Drawdowns of this amount do not significantly impact the relevant water management factors.

It is important to note that the anticipated use of the additional groundwater is for construction purposes which are expected to last approximately 6 years. After that time, a desalination plant is planned to be on-line producing 1,225 gpm (1,764,000 gpd).

2.3.2.2.10 Groundwater Monitoring

The observation well network in the vicinity of CCNPP Unit 3 currently consists of 40 wells constructed in the summer of 2006, and seven supplemental wells constructed in 2008. Groundwater levels in the 40 wells installed in 2006 were monitored monthly from July 2006 through June 2007 and have been monitored quarterly thereafter. Groundwater levels in the seven wells installed in 2008 were monitored monthly from September 2008 through October 2009 and have been monitored quarterly thereafter. Quarterly groundwater level monitoring will continue until the onset of CCNPP Unit 3 construction, at which time most of the existing observation wells will be properly sealed and abandoned in accordance with MDE Regulation 26.04.04.11. Most of the wells are within the CCNPP Unit 3 power block area and adjacent areas that will be re-graded during construction. For this reason, all but nine of the existing wells will be properly abandoned to allow for construction and to eliminate the potential for the wells to become damaged during construction and potentially provide a pathway for contaminants to enter the local groundwater system.

Groundwater levels will continue to be monitored quarterly during the construction of CCNPP Unit 3 in the nine observation wells outside of the construction footprint that will remain: OW-768A, -769, -703A, -703B, -718, -725, -743, -759A and -759B. The objective of continued monitoring of water levels is to determine the long-term range of seasonal water-level fluctuation. The range of fluctuation during the construction period will be compared to that identified during monitoring before construction, to determine if groundwater gradients, flow directions and flow velocities are significantly affected by construction activities.

As soon as practical after construction is complete, but before CCNPP Unit 3 begins operation, approximately 29 new observation wells will be installed in the vicinity of CCNPP Unit 3. The locations of the proposed observation wells are shown on Figure 2.3-95. The total comprised of these 29 wells, together with the 9 existing wells, is comparable to the number of wells in the original observation network and will provide sufficient coverage to monitor groundwater levels in the three aquifers of primary interest beneath the site of CCNPP Unit 3. These are (in increasing depth) the Surficial aquifer, the Upper Chesapeake unit and the Lower Chesapeake unit. Other deeper regional aquifers exist beneath the CCNPP Unit 3 site but the shallowest of these (the Piney Point-Nanjemoy aquifer) is separated from the overlying Lower Chesapeake unit by an aquitard approximately 170 ft thick and it is unlikely that there is a significant flow path from the Lower Chesapeake unit to the deeper aquifers.

The proposed new wells are arrayed in 13 pairs and one well triplet. Eleven of these new well pairs, plus one well pair from the original nine wells, will monitor the vertical hydraulic gradient between the Surficial aquifer and the underlying Upper Chesapeake unit. Two of the new well pairs, plus one well pair from the original nine wells, will monitor the vertical gradient between the Upper Chesapeake unit and the underlying Lower Chesapeake unit. The well triplet will monitor the vertical hydraulic gradient between all three aquifers. Two of the original nine wells are single wells monitoring the Surficial aquifer and three of the original nine wells are single wells monitoring the Upper Chesapeake unit.

Groundwater levels in each of the 38 observation wells (9 existing and 29 new) in the post construction network will be measured quarterly. The data will be used to construct water table contour maps for the Surficial aquifer and potentiometric surface contour maps for both the Upper and Lower Chesapeake units. These maps will allow determination of groundwater flow gradients, flow directions and flow velocities after operation of CCNPP Unit 3 begins. In addition, some of these wells may be used during plant operation to monitor groundwater quality, including identifying the presence of plant related radionuclides in the vicinity of CCNPP Unit 3.

Safeguards will be used to minimize the potential for adverse impacts to the groundwater caused by construction and operation of CCNPP Unit 3. These safeguards will include the use of lined containment structures around storage tanks (where appropriate), hazardous materials storage areas, emergency cleanup procedures to capture and remove surface contaminants, and other measures deemed necessary to prevent or minimize adverse impacts to the groundwater beneath the CCNPP site.

2.3.2.2.11 Construction and Post-Construction Groundwater Environment

The completed surface grade for CCNPP Unit 3 is expected to range between elevations of 72 to 85 ft (21.9 to 25.9 m) msl, requiring cut and fill across the site area. The proposed maximum grade elevation of the nuclear island is approximately 83 ft (25.3 m) msl. The design depth for foundations of structures within the nuclear island is estimated to be at an approximate elevation of 40 ft (12.2 m) msl for the reactor containment structure.

Groundwater elevations within the Surficial aquifer range from approximately elevation 65.9 to 85.7 ft (20.1 to 26.1 m) msl with the highest observed elevations occurring in the CCNPP Unit 3 power block area. Since the current maximum observed Surficial aquifer groundwater elevation is 85.7 ft (26.1 m) msl in the nuclear island area, the water table currently lies approximately 45.7 ft (13.9 m) above the lowest subsurface portion of safety-related structures.

As indicated above, existing data indicates that the maximum groundwater level is currently at the proposed maximum grade level in the nuclear island area. Because the CCNPP Unit 3 cut and fill operations, site grading, and construction activities will alter the existing groundwater system, groundwater modeling using a three-dimensional, five-layer numerical model was employed to evaluate these effects. The groundwater model includes five layers, each of which describes one of the hydrostratigraphic units of the shallow groundwater system. Specifically, most of the top layer of the model (layer 1) represents the Surficial aquifer; most of the next lower layer (layer 2) represents the Upper Chesapeake aquitard; layer 3 represents the Upper Chesapeake unit, layer 4 the Middle Chesapeake aquitard, and layer 5, the lowermost layer of the model, describes the Lower Chesapeake unit. The two uppermost hydrostratigraphic units, the Surficial aquifer and the Upper Chesapeake aquitard, do not extend over the entire model domain.

The Lower Chesapeake aquitard, which separates the Lower Chesapeake unit from the Piney Point/Nanjemoy aquifer, was not included explicitly in the three-dimensional model. The Lower Chesapeake aquitard is below the bottom of the model, which was treated as a no-flow boundary. A sensitivity analysis was conducted to assess the effect of this assumption. The sensitivity analysis indicated that the leakance to the Piney Point Aquifer, which can be estimated by the flux through a general head boundary at the bottom of layer 5, is relatively negligible compared with the horizontal flux towards Chesapeake Bay.

The thickness of each of the five units included in the model was defined from borehole data collected as part of the geotechnical investigation at the site. The total areal extent of the model is about one and a quarter square mile [3.24 km^2], covering an area of 5180 ft [1579 m] by 6790 ft [2070 m]. The model domain extends southward approximately 0.25 mi [0.40 km] beyond the southern side of the CCNPP Unit 3 switchyard into the Johns Creek watershed. To the model north, the domain extends into Chesapeake Bay about 50 ft [15 m] beyond the tip of the barge dock. In the model east-west direction, the domain extends about 0.35 mi [0.56 km] to the east of the eastern side of the CCNPP Unit 3 power block and about 0.45 mi [0.72 km] to the west of the western side of the CCNPP Unit 3 cooling tower.

Because the exact location of groundwater discharge from the Surficial aquifer and the Upper Chesapeake unit into nearby streams and other low-lying areas is not known, a drain condition was applied over the entire top layer of the model, except over the part of the model that is in Chesapeake Bay. The elevation of each drain was set at 0.1 ft [0.03 m] below the ground surface. A high value for the conductance of these drains was used to allow the discharge of groundwater out of the aquifer system when the water table reaches the ground surface.

In the top layer of the model, a constant head boundary condition was used to represent the Chesapeake Bay, and no flow conditions were used along the other three sides of the model. In the layers of the model representing the Upper and the Lower Chesapeake units, a general boundary condition was used on their southern and northern boundaries and a no-flow condition on the eastern and western sides. Layer 2 and layer 4 in the model represent the two aquitards, with the exception of the north side of layer 2 where the Upper Chesapeake unit is present. The northern boundary of layer 2 used a general head boundary while all other boundaries in layers 2 and 4 were treated as no-flow boundaries.

Different zones of groundwater recharge were used in the model simulations. These zones include forested areas, open undeveloped areas (i.e., areas covered with grasses and low shrubs), and paved areas. Also, different recharge zones were defined for forested areas over the Surficial aquifer, over the outcrop of the Upper Chesapeake aquitard and over the outcrop of the Upper Chesapeake unit.

In most simulations, each of the five hydrostratigraphic units was represented with a single value of horizontal hydraulic conductivity and a single value of vertical hydraulic conductivity. One alternative, conceptual geologic scenario and corresponding model employed two zones of horizontal hydraulic conductivity for the Upper Chesapeake unit. The second value represented a zone of low horizontal hydraulic conductivity relative the major portion of the unit. The horizontal to vertical anisotropy of hydraulic conductivity for all aquifer units was assumed to be 10:1.

Calibration parameters included hydraulic conductivity values in all units and the rate of groundwater recharge at the top layer of the model. Piezometric level data from monitoring wells discussed in Section 2.3.1.2.3.2 were used as calibration targets. The model was calibrated for steady-state conditions. For this purpose, the average value of the monthly or quarterly observations at each well in 2007 was used as a calibration target representing long-term average conditions. The calibrated hydraulic conductivity values were within the range of measured values in the hydraulic tests conducted in each aquifer unit. The calibrated hydraulic conductivity values for the aquitards were within the range of values for the confining layers used by the Maryland Geological Survey in their regional model (MGS, 2007).

The simulated groundwater levels were found to agree well with the observed values and reproduce the salient features of the flow patterns shown in Figure 2.3-42 through Figure 2.3-45, and Figure 2.3-78 through Figure 2.3-82 for the Surficial aquifer, in Figure 2.3-47 through Figure 2.3-50, and Figure 2.3-83 through Figure 2.3-88 for the Upper Chesapeake unit, and in Figure 2.3-52 through Figure 2.3-55, and Figure 2.3-89 through Figure 2.3-94 for the Lower Chesapeake unit based on the interpretation of the measured water levels.

The model was used to predict groundwater levels and flow direction at the site under post-construction conditions. For this purpose, the model was modified by replacing the current topography with the post-construction topography. The post-construction model accounted for hydraulic properties of backfill and other fill material used to achieve the final grade plan and treated buildings with foundations that extend below elevation 80 ft [24 m] (NGVD 29) as barriers to shallow groundwater flow, incorporated stormwater treatment measures including surface sand filters, and considered changes in groundwater recharge resulting from the construction of CCNPP Unit 3 and supporting facilities and structures.

Model cells in areas where building foundations extend to or near the bottom of the Surficial aquifer were designated as inactive and excluded from the model to indicate that the foundations are barriers to groundwater flow. Recharge rates over the area of the proposed buildings in the CCNPP Unit 3 power block area were reduced to zero. The rate of recharge from the surface sand filters surrounding the power block area was estimated based on the amount of flow directed to the surface sand filters and the ability of the subsurface materials in these areas to accommodate these rates.

The post-construction model was used to estimate piezometric levels in the power block area. Modeled post-construction depth to the water table in the power block area is shown on Figure 2.3-71. The elevation of the water table across the power block area is shown on Figure 2.3-72.

In addition, the post-construction model was used to identify likely and other plausible pathways of postulated accidental effluent releases in the Nuclear Auxiliary Building (NAB) evaluated in the FSAR. The post-construction model was also used to quantify the impact of the construction of CCNPP Unit 3 on groundwater discharge in Johns Creek. A sensitivity analysis was conducted to assess the impact of different assumptions and input parameter values on the model predictions. The sensitivity analysis included simulations for different values of hydraulic conductivity of the fill material, different assumptions for the performance of the surface sand filters designed to enhance groundwater recharge, an alternative hydraulic conductivity distribution in the Upper Chesapeake unit assumptions, and an assumption of leakage through the bottom of the Lower Chesapeake unit.

The major conclusions from the post construction simulations are:

a. The water table in the power block area will be well below the site grade level. In all simulations, the water table in the power block area was more than 25 ft [7.6 m] below the site grade level of 85 ft [26 m] (NGVD 29).

b. The groundwater pathway for liquid effluent releases from the NAB depends on the hydraulic conductivity of the fill material.

- ♦ If the hydraulic conductivity of the fill is equal to the lower end of the range of expected values ($1x10^{-3}$ cm/s [2.8 ft/day]), then releases from the bottom of the NAB will move first downwards to the Upper Chesapeake unit and then horizontally through this unit towards Chesapeake Bay where they will eventually discharge. Even with a conservative assumption of 0.145 for the effective porosity for the Upper Chesapeake unit, the estimated travel time from the release point to Chesapeake Bay is over 22 years.

- ♦ If the hydraulic conductivity of the fill is equal to the upper end of the range of expected values ($1x10^{-2}$ cm/s [28 ft/day]), then releases from the bottom of the NAB will move horizontally through the fill material and discharge into Branch 2. The estimated travel time from the release point to discharge point is less than a year.

c. The impact of the construction of CCNPP Unit 3 on the volume of groundwater discharge in Johns Creek will be negligible.

The effect on local users of groundwater from cutting, filling and grading the CCNPP Unit 3 site will be negligible. The upland deposits of southern Calvert County are deeply incised by stream erosion, such that they are laterally discontinuous. This condition causes dissection of the Surficial aquifer into relatively small areas that are effectively isolated and have limited hydraulic connection. Furthermore, because of its thin and variable saturated thickness (typically less than 20 feet at CCNPP) and vulnerability to low yield during droughts, few water wells are completed in the Surficial aquifer in southern Calvert County. Deeper aquifers beneath the Surficial aquifer are effectively segregated from flow in the shallow aquifer, except for the Upper Chesapeake unit immediately below the main excavation. Results from the post-construction model indicate that the upper portion of the Upper Chesapeake unit will be hydraulically connected to the Surficial aquifer within the footprint of the excavation. The potentiometric surface of the Upper Chesapeake unit will rise slightly within the excavation, however water levels are expected to maintain their pre-construction elevations away from the excavation. For these reasons, users of groundwater near CCNPP are expected to experience no significant impacts to their water supplies due to construction or operation of CCNPP Unit 3.

Construction of CCNPP Unit 3 includes excavations for the power block and for the Ultimate Heat Sink (UHS) makeup water intake structure. Water within these excavations is typically derived from three sources: surface water from precipitation falling in the excavation, water stored within the materials being excavated, and ground water inflow to the excavation. Ground water inflow in the excavations is analyzed for a Representative case (most likely conditions) and an Upper Bound case (using maximum values). Precipitation into the excavations is estimated using the rational method (a mass balance method which relates discharge to inflow). The volume of water stored within the material to be excavated is estimated by multiplying the area of the excavation by the saturated thickness and the effective porosity of the materials. Ground water flow into the excavation is estimated by treating the excavation as a large diameter well. Variables used for the precipitation Representative case include a 2-year – 1-hour rainfall intensity of 1.75 inches, and a coefficient of runoff of 0.8. For the ground water inflow Representative case, the geometric mean hydraulic conductivity from slug tests of 0.91 ft/day for the Surficial aquifer and 0.74 ft/day for the Upper Chesapeake unit is used for calculations. For the precipitation Upper Bound case, variables used include a 2-year – 1-hour rainfall intensity of 2.5 inches, and a coefficient of runoff of 1.0. The maximum hydraulic conductivity from slug tests is used for the ground water inflow Upper Bound case, corresponding to 17.4 ft/day for the Surficial aquifer and 13.7 ft/day for the Upper Chesapeake unit.

The Power Block excavation is approximately 1,080 ft wide by 1,080 ft long. The bottom of the excavation is at elevation 32 ft msl, with the reactor tendon galleries extending to 30 ft msl. Plant grade is 85 ft msl. For the Surficial aquifer, the saturated thickness is estimated to be 20 ft, with an effective porosity of 25.2%. For the Upper Chesapeake unit, the saturated thickness is estimated to be 13.1 ft, with an effective porosity of 26.4%. The amount of water entering the excavation from precipitation is estimated to be 16,826 gpm for the Representative case, and 30,046 gpm for the Upper Bound case. The ground water stored in the excavation is estimated to be 74,147,852 gallons (43,972,347 gallons in the Surficial aquifer and 30,175,505 gallons in the Upper Chesapeake unit). Assuming a three month period for pumping, the equivalent pumping rate to remove the stored water would be 572 gpm. Ground water flow into the excavation is calculated to be 35 gpm (20 gpm from the Surficial aquifer and 15 gpm from the Upper Chesapeake unit) for the Representative case. The Upper Bound ground water flow into the excavation is calculated to be 250 gpm (140 gpm from the Surficial aquifer and 110 gpm from the Upper Chesapeake unit).

The UHS Makeup Water Structure/Electrical Building excavation is approximately 100 ft wide by 300 ft long by 37 ft deep. The grade in the area is approximately 10 ft msl. In this location, the Surficial aquifer is absent, and the Upper Chesapeake unit is estimated to have a saturated thickness of 30 ft and an effective porosity of 26.4%. Precipitation into the excavation is estimated to be 433 gpm for the Representative case and 773 gpm for the Upper Bound case. Ground water stored in the excavation is estimated to be 1,777,372 gallons. Assuming a three month period for pumping, the equivalent pumping rate to remove the stored water would be 14 gpm. The ground water flow into the excavation is calculated to be 20 gpm for the Representative case and 110 gpm for the Upper Bound case.

During construction activities at the CCNPP site, dewatering effluent from the Power Block excavation may be used for fugitive dust suppression, rough grade (common fill) compaction and structural (engineered) backfill requirements. This dewatering effluent will be stored on-site in an unlined pond which is sized to accommodate at least a week's worth of water to maintain both rough grade operations and the dewatering pumping rates to remove the stored volume. All dewatering effluent that is not used for construction activities will be discharged to surrounding surface water bodies under an NPDES permit.

Based on current groundwater conditions and the anticipated facility surface grade between elevations 72 to 85 ft (21.9 to 25.9 m), groundwater is expected to be encountered at pre-construction depths from grade level to 16 ft (4.9 m) below grade. Surface water controls to minimize precipitation infiltration and the redirection of surface runoff away from the excavation and temporary construction dewatering areas are expected. A permanent groundwater dewatering system is not anticipated to be a design feature for the CCNPP Unit 3 facility.

Electrical manholes within the facility area are expected to be at depths of 10 to 15 ft (3 to 4.6 m) below grade and, therefore, have the potential for encountering groundwater that may leak into these structures. Manhole sump pumps may be required to be operated periodically to remove the water seeping into these features.

Groundwater sampling and testing at the CCNPP Unit 3 site has been performed in eight separate sampling events. Samples were field tested for pH, and laboratory samples were tested for sulfate and chloride concentrations. Data from these sampling events were analyzed to determine the expected water quality of the groundwater in the excavations. For samples obtained from the Surficial aquifer, the mean pH was found to be 5.2, with a seasonal low mean of 4.9. Test results from the Surficial aquifer gave a pH range of 4.5 to 6.9. Mean sulfate and chloride concentrations in the Surficial aquifer were 14.9 and 13.2 mg/l, respectively. Seasonal high Surficial aquifer mean sulfate and chloride concentrations were 21.8 and 18.9 mg/l, respectively. In the Upper Chesapeake unit, the mean pH was found to be 7.4, with a seasonal low mean of 7.1. Test results from the Upper Chesapeake unit gave a pH range of 6.4 to 8.0. Mean sulfate and chloride concentrations in the Upper Chesapeake were 51.4 and 45.0 mg/l, respectively. In the Upper Chesapeake unit, seasonal high mean sulfate and chloride concentrations were 65.1 and 50.7 mg/l, respectively.

2.3.2.3 References

Bechtel, 2010. Groundwater Model for the Calvert Cliffs Nuclear Power Plant Unit 3 Site, 25237-000-30R-GEK-00002, Revision 000.

CBPO, 2007. Chesapeake Bay Program Office, Website: http://www.chesapeakebay.net/wqcchesapeake2000.htm, Date accessed: January 23, 2007.

CCDED, 2007a. Calvert County Department of Economic Development, Website: http://www.ecalvert.com/content/tourism/visitorsguide/beaches/index.asp, Date accessed: January 23, 2007.

CCDED, 2007b. Calvert County Department of Economic Development, Website: http://www.ecalvert.com/content/tourism/visitorsguide/boating/marinas.asp, Date accessed: January 23, 2007.

MDE, 2004. Southern Maryland Pilot Study (Appendix E). Advisory Committee on the Management and Protection of the State's Water Resources: Final Report, G. Wolman, May 2004.

MDE, 2007. Maryland Department of the Environment, Website: http://www.mde.state.md.us/Permits/WaterManagementPermits/index.asp, Date accessed: January 23, 2007.

MDNR, 2007. Maryland Department of Natural Resources, Website: http://mddnr.chesapeakebay.net/fish/Cntyramps/CA.html, Date accessed: January 19, 2007.

MDP, 2006. Maryland Department of Planning, Website: http://www.mdp.state.md.us/info/patuxpaddle/base.htm, Date accessed: December 13, 2006.

MGS, 1996. Hydrostratigraphic Framework of the Piney Point-Nanjemoy Aquifer and Aquia Aquifer in Calvert and St. Mary's Counties, Maryland, Maryland Geological Survey Open File Report No. 96-02-8, Maryland Geological Survey, H. Hansen, 1996.

MGS, 1997. Hydrogeology, Model Simulation, and Water-Supply Potential of the Aquia and Piney Point-Nanjemoy Aquifers in Calvert and St. Mary's Counties, Maryland, Maryland Geological Survey Report of Investigations No. 64, Maryland Geological Survey, G. Achmad and H. Hansen, 1997.

MGS, 2001. Simulated Changes in Water Levels of the Aquia Aquifer using Revised Water-Use Projections to 2025 for Calvert and St. Mary's Counties, Maryland, Supplemental Report No. S1/RI 64, Maryland Geological Survey, G. Achmad and H. Hansen, 2001.

MGS, 2005. Water Supply Potential of the Coastal Plain Aquifers in Calvert, Charles, and St. Mary's Counties, Maryland, with Emphasis on the Upper Patapsco and Lower Patapsco Aquifers, Maryland Geological Survey Administrative Report, Maryland Geological Survey, D. Drummond, June 2005.

MGS, 2007. Water Supply Potential of the Coastal Plain Aquifers in Calvert, Charles and St. Mary's Counties Maryland with Emphasis on the Upper Patapsco and Lower Patapsco Aquifers, Maryland Geological Survey Report of Investigation No 76 Maryland Geological Survey, D. Drummond, August 2007.

MPSC, 2009. Maryland Public Service Commission Case No. 9127, Appendix II, Proposed Order of Hearing Examiner, Final Licensing Conditions, Certificate of Public Convenience and Necessity to Construct a Nuclear Power Plant at Calvert Cliffs in Calvert County, Maryland, April 28, 2009.

Schlumberger, 2008. Modflow Professional v4.3, User's Manual, Schlumberger Water Services, 2008.

UniStar, 2008. Response to RFI 25237-000-GRI-GEKC-00016 Request for Maryland Geological Survey Results of Simulated Drawdowns 2002-2010, based on Scenario 4 of Report of Investigation No. 76 (25237-000-L8C-GAMU-00019).

USC, 2007. Title 33, United States Code, Part 1251, Federal Water Pollution Control Act, 2007.

USEPA, 2007a. U.S. EPA Region 3 Water Protection Division Sole Source Aquifer Program, U.S. Environmental Protection Agency, Website: http://www.epa.gov/reg3wapd/presentations/ssa/index.htm, Date accessed: January 9, 2007.

USEPA, 2007b. U.S. EPA Safe Drinking Water Information System (SDWIS), U.S. Environmental Protection Agency, Website: http://www.epa.gov/enviro/html/sdwis/sdwis_query.html#geography, Date accessed: May 31, 2007.

USGS, 1997. Delaware, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, West Virginia, Ground Water Atlas of the United States, Hydrologic Investigations Atlas 730-L, U.S. Geological Survey, H. Trapp and M. Horn, 1997.

USGS, 2003a. The Difference Between the Potentiometric Surfaces of the Aquia Aquifer: September 1982 and September 2003 in Southern Maryland, USGS Open-File Report 2005-1005, U.S. Geological Survey, S. Curtin, D. Andreasen, and J. Wheeler, 2003.

USGS, 2003b. The Difference Between the Potentiometric Surfaces of the Magothy Aquifer: September 1975 and September 2003 in Southern Maryland, USGS Open-File Report 2005-1007, U.S. Geological Survey, S. Curtin, D. Andreasen, and J. Wheeler, 2003.

USGS, 2003c. The Difference Between the Potentiometric Surfaces of the Upper Patapsco Aquifer: September 1990 and September 2003 in Southern Maryland, USGS Open-File Report 2005-1009, U.S Geological Survey, S. Curtin, D. Andreasen, and J. Wheeler, 2003.

USGS, 2003d. The Difference Between the Potentiometric Surfaces of the Lower Patapsco Aquifer, September 1990 and September 2003 in Southern Maryland, USGS Open-File Report 2005-1011, U.S. Geological Survey, S. Curtin, D. Andreasen, and J. Wheeler, 2003.

USGS, 2005a. Potentiometric Surface of the Aquia Aquifer in Southern Maryland: September 2003, USGS Open-File Report 2005-1004, U.S. Geological Survey, S. Curtin, D. Andreasen, and J. Wheeler, 2005.

USGS, 2005b. Potentiometric Surface of the Magothy Aquifer in Southern Maryland: September 2003, USGS Open-File Report 2005-1006, U.S. Geological Survey, S. Curtin, D. Andreasen, and J. Wheeler, 2005.

USGS, 2005c. Potentiometric Surface of the Upper Patapsco Aquifer in Southern Maryland: September 2003, USGS Open-File Report 2005-1008, U.S. Geological Survey, S. Curtin, D. Andreasen, and J. Wheeler, 2005.

USGS, 2005d. Potentiometric Surface of the Lower Patapsco Aquifer in Southern Maryland, September 2003, USGS Open-File Report 2005-10010, U.S. Geological Survey, S. Curtin, D. Andreasen, and J. Wheeler, 2005.

USGS, 2006. Sustainability of the Ground-Water Resources in the Atlantic Coastal Plain of Maryland, USGS Fact Sheet FS 2006-3009, U.S. Geological Survey, 2006.

USGS, 2007. USGS Water Resources of Maryland, Delaware, and D.C. Area, Ground-Water Level Monitoring in Calvert County, MD, U.S. Geological Survey, Website: http://md.water.usgs.gov/groundwater/calvert, Date accessed: March 31, 2007.

2.3.3 Water Quality

This section describes the site-specific surface water quality characteristics that could directly be affected by plant construction and operation or that could affect plant water use and effluent disposal within the vicinity of the CCNPP site. Site-specific water quality data was obtained through the Chesapeake Bay Program (CBP) databases, CCNPP, U.S. Geological Survey (USGS), site water body sampling, and other available sources.

The data available and collected for this report is believed to be adequate to characterize the water bodies in terms of suitability for aquatic organisms and to serve as a baseline for assessing if plant construction or operations have impacted water quality. All liquid effluent discharges during plant operation will be monitored and regulated by a NPDES permit.

Most of the data available and collected was to characterize Chesapeake Bay, the most significant water body in the vicinity of the CCNPP site. The most important parameters in terms of evaluating the Chesapeake Bay water quality are salinity, dissolved oxygen, temperature, sediments and chemical contaminants, and nutrients. Because nutrient loading is widely regarded as Chesapeake Bay's most critical water quality problem, this section examines trends in macronutrient concentrations (total nitrogen, nitrates, ammonia, phosphorus, orthophosphate) in Chesapeake Bay in the CCNPP vicinity. Many of these parameters were also measured in samples collected from the onsite water bodies. Groundwater samples were collected to monitor water quality parameters in the Surficial and Aquia aquifers in the area of the proposed project.

As described in Section 4.2.1.7, Best Management Practices will be used during plant construction to prevent pollutant discharges to the onsite water bodies or groundwater aquifers. The most probable pollutant expected during construction would be sediment or dust entering the air, streams, or groundwater. These particulates could also contain possible contaminants such as heavy metals. Steps will be taken to mitigate the generation and transport of these particulate materials. Sediment samples were collected and analyzed to establish a baseline indication of the pollution that is present in the bay floor sediments in the area near the CCNPP Unit 3 discharge structure.

2.3.3.1 Surface Water

The CCNPP site is located in Calvert County, Maryland on the western shore of the Chesapeake Bay, approximately 10 mi (16 km) to the north of the Patuxent River mouth. The CCNPP site lies within the Lower Maryland Western Shore watershed, which is characterized by freshwater flow from the Patuxent River, Fishing Creek, Parkers Creek, Plum Point Creek, Grays Creek and Grover Creek (CBP, 2006a). At the CCNPP site, the Chesapeake Bay is about 6 mi (10 km) wide. The bottom of the Chesapeake Bay slopes gradually to a depth of about 50 to 55 ft (15 to 117m) until it reaches the approximate center of Chesapeake Bay where the depth increases sharply to approximately 110 ft (34 m) (NOAA, 2007).

At the site, surface water within approximately 1,000 ft (300 m) of the Chesapeake Bay drains directly to the Bay. The portion of the site which will be used during the construction period, drains through Johns Creek watershed into the St. Leonard Creek, which then drains into the Patuxent River approximately 4 mi (7 km) from the plant (NRC, 1999a). The rest of the site drains into Goldstein Branch via unnamed drainage channels that also eventually discharge to the Patuxent River. The Patuxent River drains into the Chesapeake Bay at its mouth located approximately 10 mi (16 km) south of the plant (NRC, 1999a). Previous expansion and construction disturbed 220 acres (89 hectares) of the CCNPP site. Baltimore Gas and Electric Company concluded in its Environmental Report for license renewal of CCNPP Units 1 and 2 that surface water impacts remain small (BGE, 1998).

While no major impacts to surface water quality have been reported to date due to the construction and/or operation of CCNPP Units 1 and 2, these on-site surface water bodies, including the surface water channels, four on-site ponds, the Patuxent River, and the Chesapeake Bay, could potentially be impacted by the construction and operation of the new CCNPP Unit 3.

2.3.3.1.1 Freshwater Bodies

Surface water channels, including Johns Creek and Goldstein Branch, and four perennial ponds (Camp Conoy fishing pond, Lake Davies, and Ponds 1 and 2) are present within the boundary of CCNPP. Water quality data for the on-site surface water bodies was collected in September 2006 and March 2007 as part of a biological study. A summary of the water quality data collected during these studies are presented in Table 2.3-28 through Table 2.3-31. Based upon these data, the in situ water quality measurements are representative of a healthy aquatic environment in the streams and Camp Conoy fishing pond. Dissolved oxygen greater than 5 parts per million (ppm) and a neutral pH were recorded at Johns Creek, Goldstein Branch, and Camp Conoy fishing pond. Low dissolved oxygen concentrations were detected in Lake Davies and the two ponds during the September survey but were similar to the streams and Camp Conoy fishing pond during the March survey. Total organic carbon, alkalinity, and total dissolved solids are notably higher at Lake Davies and the downstream station on Johns Creek than the other site waters. Despite the low dissolved oxygen concentration at Lake Davies and the two ponds, and the elevated nutrients at Lake Davies, the general water quality of these systems does not indicate that any significant adverse conditions are the result of current operations at the CCNPP site. Additional water quality parameters were tested in the spring survey period to obtain a more complete baseline profile of conditions. The additional testing did not reveal any adverse water quality conditions. In particular, bacteria levels, chlorophyll a, and total petroleum hydrocarbons were low. Metals were largely at nondetected concentrations. However, in Lake Davies elevated levels of barium, calcium, magnesium, potassium and sodium were observed. These findings are consistent with the high conductivity, alkalinity and total dissolved solids measurements in Lake Davies and reflect past disposal of dredged material in adjacent upgradient areas.

To provide a representation of variability in these waters due to meteorological conditions, wet weather (rainfall within the previous 24 hours) and dry weather (no rainfall within the previous 72 hours) samples were taken at the downstream station on Johns Creek and at the Goldstein Branch station in the spring. The wet weather results show increases in BOD, COD, fecal coliform and fecal streptococci, phosphorus, and total suspended solids as would be expected. Wet and dry weather measurements of PAH were also made and none where detected. No petroleum hydrocarbons were detected.

2.3.3.1.2 Chesapeake Bay

The Chesapeake Bay is the largest estuary in the U.S., with over 64,000 square miles of watershed that spans six states (Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia) and the District of Columbia. The Susquehanna River provides about 50% of fresh water entering the Bay while other important tributaries include the Patapsco, Patuxent, Potomac, James, and Choptank. The Chesapeake Bay is nearly 200 mi (320 km) long and its width varies from 3.4 mi (5.5 km) near Aberdeen, Maryland, to 35 mi (56 km) across near the mouth of the Potomac River. The majority of the Chesapeake Bay is relatively shallow with an average water depth of approximately 21 ft (6 m); however, several deep trenches are found within the Chesapeake Bay with depths of over 100 ft (30 m).

The Chesapeake Bay estuary is a mixing zone of freshwater influx from rivers and streams and salt water from the Atlantic Ocean. Circulation of Bay waters transports sediment, dissolved oxygen, nutrients, chemical contaminants, and planktonic aquatic biota. Freshwater influx flows seaward, above the denser seawater intrusion, forming two wedges moving in opposite directions. The opposing movement of these two wedges, combined with seasonal weather patterns and tidal forces, drives the circulation of nutrients and sediments throughout the Chesapeake Bay.

CCNPP Units 1 and 2 use water from the Chesapeake Bay for condenser cooling, drawing bottom water through a 45 ft (15 m) deep, dredged channel that extends approximately 4,500 ft (1,400 m) offshore (NRC, 1999a). Water passes through the plant in approximately 4 minutes and is discharged from an outfall north of the plant that is approximately 850 ft (260 m) offshore in 10 ft (3 m) of water. A curtain wall that extends to a depth of 30 ft (9 m) across the intake channel limits the cooling water withdrawal to mostly bottom water, although there is evidence that mixing of surface and lower depth water occurs before entrance to the plant (NRC, 1999a). Proposed CCNPP Unit 3 will withdraw makeup water from the Chesapeake Bay through a two intake pipes located on a protected section of shoreline between the existing Units 1 and 2 intake structure and the barge slip. The intake pipes empty into a forebay that supplies CWS and UHS pumphouses, as discussed in Section 3.4. All cooling system discharges from the new unit, including the cooling tower blowdown, will be discharged to the Chesapeake Bay via a new discharge structure to be built south of the existing structure.

In the area of the CCNPP site, predominant physical characteristics of the Chesapeake Bay include silt and clay sediments, mesohaline salt concentrations (i.e., concentrations ranging from 5 to 18 parts per thousand), seasonal stratification, current patterns influenced by wind and tides, high levels of localized particulates, and moderate sedimentation and resuspension rates. The local aquatic ecosystem is driven by high spring nutrient influx, turbidity, high primary production and phytoplankton density with an intermediate benthic abundance, and a relatively low biological diversity. Throughout the Bay, contaminant distribution is largely influenced by physical processes, with the movement of water and sediment providing the principal mechanism for transport. Winds, waves, currents, tidal actions and episodic events, such as storms and hurricanes, can cause major resuspension of bottom sediments and associated contaminants, and the frequency and intensity of these physical events will have a fundamental effect on residence time of contaminants in any given area. Likewise, stratification and subsequent mixing will determine vertical, as well as horizontal, movement of contaminants, an important factor in a two-layered estuary like the Chesapeake Bay (MDSG, 2006).

The overall health of the Chesapeake Bay is considered degraded by nutrient, air, sediment, and chemical pollution (CBP, 2006c). High levels of nutrients, such as phosphorus and nitrogen, enter the bay system via stormwater, industrial/utility effluent, and atmospheric deposition. Sediments are washed into the Bay by natural processes including stream and shoreline erosion and stormwater runoff. The mass influx of nutrients and sediments decreases water clarity and stimulates algal production (which can reduce dissolved oxygen in the water column). Low freshwater flows lead to increased salinity and mixing between surface fresh water (higher oxygen levels) and the more saline water (where nutrients become available) below (CBP, 2007).

The Chesapeake Bay Program (CBP), formed in 1983 by the first Chesapeake Bay agreement, is a regional partnership that monitors the water quality and effective restoration of the Bay and its tributaries. Members of the program include the State of Maryland, Commonwealths of Pennsylvania and Virginia, the District of Columbia, the Chesapeake Bay Commission (a tri-state legislative body), the U.S. Environmental Protection Agency (EPA), and participating citizen advisory groups. The program was established to restore and protect the Chesapeake

Bay from natural and anthropogenic pollutants that have been widely distributed throughout the area impacting the Chesapeake Bay's overall water quality.

The following water quality databases, maintained by state agencies, federal agencies, and non-profit groups, were accessed to locate available and applicable water quality data relevant to the Chesapeake Bay water in the area of the CCNPP site:

- CBP Water Quality Database (1984 to present)
- Chesapeake Bay Institute (CBI) Water Quality Database (1949 to 1982)
- CBP Toxics Database
- Alliance Citizen Monitoring Database
- USGS River Input Monitoring Database
- USGS Monthly Stream Flow Data
- Susquehanna River Basin Commission (SRBC) Nutrient Assessment Program
- National Estuarine Research Reserve System (NERRS)
- CBP Nutrient Point Source Database

After examining these databases, the most available data was found within the CBP Water Quality Database (1984 to present). Using this database, the CBP manages water quality data recorded at monitoring stations throughout the Bay and its tributaries, including stations in the area of the CCNPP site. Data from three mainstem monitoring stations north of the CCNPP site (CB4.3W, CB4.3C, and CB4.3E) and three mainstem monitoring stations south of the CCNPP site (CB4.4, CB5.1, and CB5.1W) were used to characterize seasonal water quality trends for the Bay waters within the vicinity of the power plant. Water quality data presented in this report were obtained from these monitoring stations using the CBP database, unless otherwise noted.

Data reviewed for this environmental report was based on water year (WY) 2005 (i.e., the natural, annual water cycle from October 2004 through September 2005). Availability of water quality data varies by parameter and not all data were collected at the same collection events. However, where possible, trends in the available data sets were evaluated for discussion herein. Quality assurance/ quality control methodologies utilized can be found at the CBP website. Values with quality assurance/quality control issues noted by CBP were not included.

2.3.3.1.2.1 Freshwater Flow

Water quality of the Chesapeake Bay is directly influenced by the quantity and quality of freshwater inflow. The CCNPP site lies within the Lower Maryland Western Shore watershed, characterized by freshwater inflow from the Patuxent River, Fishing Creek, Parkers Creek, Plum Point Creek, Grays Creek, and Grover Creek (CBP, 2006a). The topography at the site is gently rolling with steeper slopes along stream courses. Local relief ranges up to about 130 ft (40 m). The site is well drained by short, intermittent streams. A drainage divide, which is generally parallel to the coastline, extends across the site as shown on Figure 2.3-2. The area to the east of the divide comprises about 20% of the site and includes CCNPP Units 1 and 2. This area drains to the Chesapeake Bay. The area west of the divide, which includes the CCNPP Unit 3 location, is drained by tributaries of Johns Creek and Woodland Branch, which flow into St.

Leonard Creek and subsequently into the Patuxent River. Grading during construction of the current operating units and support facilities did not substantially alter the drainage system (CCNPP, 2005). As shown in Figure 2.3-2, Johns Creek would drain the majority of the proposed project area. As described in Section 2.2.1.1.1.3, and shown on Figure 2.3-7, the CCNPP Unit 3 site is located further northeast of the predicted 100 year flood extent boundary for Johns Creek. Flooding for the 100 year and 500 year events could occur along portions of the CCNPP property that directly borders the Chesapeake Bay (FEMA, 1998). The intake forebay and CWS and UHS pumphouses are above the 100 year flood elevation.

The USGS calculates streamflow entering the Chesapeake Bay at five index stations including one, Segment B, located downstream of the Patuxent River mouth and north of the Potomac River mouth as described in Figure 2.3-74. Between 1937 and 2005, the monthly mean inflow between Segment A (at the mouth of the Susquehanna river) and Segment B was reported at 45,700 ft^3/s (1,294,000 L/s), and the average flow is 16% of the total flow to the Chesapeake Bay (USGS, 2007).

CCNPP is required by permit to monitor effluent discharge on an annual basis. Information on the average flow during periods of effluent discharge was reported in the Effluent and Waste Disposal 2005 Annual Report (CE, 2006), prepared by Constellation Energy. The 2005 flow data provided is as follows:

- 1.86 × 106 gals (7.05 × 106 L) of liquid waste were processed through the radwaste system (volume prior to dilution)
- 5.27 × 107 gals (2.00 × 108 L) of low activity liquid waste were processed through the secondary system (volume prior to dilution)
- 1.22 × 1012 gals (4.61 × 1012 L) of dilution water were discharged

The liquid effluent currently discharged from CCNPP Units 1 and 2 has relatively minimal impacts to the Chesapeake Bay (NRC, 1999a). Potential impacts include the distribution of water at higher or lower temperatures than the ambient waters and the discharge of toxic and/or radioactive materials to the receiving water body.

2.3.3.1.2.2 Pycnocline

Freshwater flow is less dense than the cooler, saline waters entering the Bay from the Atlantic Ocean creating vertical stratification of the water column and a zone (pycnocline) where the density changes rapidly due to temperature and salinity differences. The pycnocline plays an important role in determining seasonal changes in photosynthesis and nutrient distribution. Stratification and subsequent mixing will determine vertical, as well as horizontal, movement of contaminants, an important factor in a two-layered estuary such as the Chesapeake Bay. In some systems, stratification can represent a physical barrier to the mixing of the water column, thus minimizing the exchange of nutrients and oxygen through the pycnocline.

Sampling is conducted within the Chesapeake Bay to characterize the separate upper and lower water masses. Pycnocline data was obtained through the CBP to identify the depth and thickness of the pycnocline in the area of the CCNPP site. Four monitoring stations (CB4.3C, CB4.3E, CB4.4, and CB5.1) in the CCNPP site vicinity were found to have pycnocline data. A summary of the pycnocline data is provided in Table 2.3-34.

Based upon WY 2005 data, a pycnocline is established within the vicinity of the CCNPP site throughout the year; however, its depth and thickness fluctuate spatially throughout the seasons. The pycnocline fluctuated in thickness between < 3 ft (1 m) during the spring (at monitoring station CB4.3E) and 57.4 ft (17.5 m), observed during the winter (at monitoring station CB4.3C). In WY 2005, the pycnocline had the most variable thickness at monitoring station CB5.1, which was also the location of the greatest thickness.

2.3.3.1.2.2.1 Water Temperature

Seasonal variations in the thermal stratification of the Chesapeake Bay are observed with generally well-mixed conditions during winter and strong stratification during summer. During the winter, stratification is generally limited to ambient temperature and weather patterns that impact surface water temperature. WY 2005 water temperature data are provided in Table 2.3-35.

Water temperature affects chemical and biochemical reaction rates as well as physical processes such as current patterns and contaminant movement. With as little as an 18°F (10°C) water temperature increase, the speed of many chemical and physical reactions can double. Within the Bay, water temperature fluctuates throughout the year, ranging from 34 to 84°F (1 to 29°C) (CBP, 2006d).

Based upon the WY 2005 temperature data, presented above, the water temperature dropped quickly in the winter months, with the minimum temperature of 34.9°F (1.6°C) at monitoring station CB4.3C and average temperatures ranging from 42.7 to 43.2°F (6.0 to 6.2°C). The greatest variability in temperature was observed during the fall months with a maximum temperature of 80.6°F (27.0°C) and a minimum temperature of 53.2°F (11.8°C) recorded at monitoring stations CB4.4 and CB5.1W. Temperatures during the winter showed the lowest variation with a maximum high temperature of 54.5°F (12.5°C) at monitoring stations CB4.3C, CB4.4, and CB5.1, and a low temperature of 34.9°F (1.6°C) at monitoring station CB4.3C.

Evaluation of the water temperature data compared to the pycnocline data showed unusually high variations in stratification across the Chesapeake Bay. The surface water (above pycnocline) was found to have higher temperatures during the early spring through summer months that coincides with the establishment of the pycnocline. However, as the surface water temperatures dropped during late fall and winter the pycnocline began to decline, becoming less prominent within the water column.

2.3.3.1.2.2.2 Dissolved Oxygen

Dissolved oxygen (DO) concentrations in Chesapeake Bay waters fluctuate throughout the year in response to natural biological and physical processes. During the winter months, DO is relatively high throughout the water column in response to the increased solubility of DO in cooler water, reduced biologic activity and DO uptake, and a homogenizing of the water column produced by vertical mixing during turbulent seasonal weather (wind, storms). In the summer months, solubility decreases, biologic uptake increases, mixing becomes reduced, and the water column becomes stratified with the lowest DO concentrations typically observed below the pycnocline. Bacterial activity in organic material accumulating on the bay floor can produce DO-poor bottom water over large areas and the pycnocline can act as a barrier for bottom water exchange with DO-richer surface waters (CBP, 2006e).

A summary of WY 2005 DO data is provided as Table 2.3-36. The data indicate that annual DO concentrations decrease with depth. The greatest variation in DO concentrations was observed in the middle of the water column, or within the area of the pycnocline. DO concentrations within the upper portion of the water column, or above the pycnocline, remained the most constant over the year.

The lowest recorded DO concentration during the winter, at any depth, was 5.5 mg/L. Water below the pycnocline (benthic) fell into severe hypoxic and anoxic conditions during the summer months. During the summer, low concentrations of 0.1 mg/L occurred at four of the six monitoring stations, and a low concentration of 0.2 mg/L occurred at a fifth. According to the CBP, water quality data gathered between 2003 and 2005 also indicate that only about 29% of the Chesapeake Bay's waters met DO standards during the summer months.

State water quality standards have been developed to meet the DO needs of the Chesapeake Bay's aquatic life, and the standards vary with depth, season, and duration of exposure. The standards generally require 5.0 mg/l of DO for ideal aquatic conditions (CBP, 2006f). If the water column contains DO concentrations below 2.0 mg/L, the water is considered "severely hypoxic," and DO concentrations below 0.2 mg/l are considered "anoxic." Evidence suggests there has been an increase in the intensity and frequency of hypoxia and anoxia in the Chesapeake Bay waters over the past 100 to 150 years, most notably since the 1960s (USEPA, 2003).

Availability of DO is an important factor for biological and chemical processes within the Chesapeake Bay waters. Oxygen-rich shallow waters are most essential in the spring for spawning of aquatic species, and mortality rates for most aquatic species typically increase as DO concentrations decrease. DO additionally drives chemical processes such as the rate of flocculation, adsorption, and/or desorption of dissolved compounds (to organic or inorganic surfaces) within the Chesapeake Bay. Experiments have shown that the metals most strongly influenced by anoxia are manganese, zinc, nickel, and lead (MDSG, 2006). Dissolved oxygen levels can drive the release of metals from sediments within the Chesapeake Bay due to oxidative/reductive processes. Elevated DO concentrations cause the release of such metals as copper and zinc, therefore causing greater contaminant exposure to organisms in the water column (MDSG, 2006). On the other hand, decreased levels of oxygen (hypoxia or anoxia) cause metals to be bound in sediments, thus increasing exposure to bottom-dwelling organisms.

2.3.3.1.2.2.3 Salinity

Salinity levels are graduated vertically and horizontally within the Chesapeake Bay due to freshwater flows, and are generally higher along the Bay's eastern shore (CBP, 2006d). A summary of the WY 2005 seasonal salinity statistics is presented in Table 2.3-37.

Based upon the WY 2005 CBP monitoring data as described in Table 2.3-37, salinity concentrations ranged between 4.06 parts per thousand (ppt) in spring and 22.18 ppt in summer. Salinity concentrations showed the least uniformity in spring, likely due to the high freshwater inflow caused by seasonal rainfall and snow melt; winter and fall showed the most uniform salinities.

Salinity is a key factor in an estuarine ecosystem that affects distribution of living resources, circulation, and an integral fate and transport mechanism of chemical contaminants within the Chesapeake Bay. Aquatic species have varying degrees of tolerance for salinity. Since salinity affects various physiological mechanisms in an organism, such as movement across cell membranes, it can affect an organism's biological functioning; thus influencing how the organism may respond to the presence of contaminants (MDSG, 2006). Most aquatic organisms therefore move to areas within the Chesapeake Bay with suitable habitat conditions. Salinity affects movement of waters by influencing stratification in the water column and determines what form chemical contaminants are likely to take, making them less available for uptake by Chesapeake Bay organisms (MDSG, 2006).

2.3.3.1.2.2.4 Nutrients and Chemical Contaminants

Runoff within the Lower Maryland Western Shore watershed carries pollutants, such as nutrients and sediments, to rivers and streams that drain into the Chesapeake Bay. The entire watershed includes a land area of 83 mi^2 (215 km^2), with agricultural land uses comprising the second largest land use category at 14%; forested land made up 53% of the watershed area (CBP, 2006a). Fertilizers containing nitrogen and phosphorus that are applied to agricultural lands are predominant sources of nutrient pollutants in storm water.

Most of the Chesapeake Bay mainstem, all of the tidal tributaries, and numerous segments of non-tidal rivers and streams are listed as Federal Water Pollution Control Act (USC, 2006) Section 303(d) "impaired waters" largely because of low DO levels and other problems related to nutrient pollution (MDE, 2006a). The CCNPP site lies within the Lower Maryland Western Shore watershed, characterized by inflow from the Patuxent River, Fishing Creek, Parkers Creek, Plum Point Creek, Grays Creek and Grover Creek. According to the Maryland Department of Environment (MDE) listing of Section 303(d) waters, the Patuxent River is the only contributing water body within the watershed with Section 303(d) status. The discussion of Section 303(d) waters is limited to those in the watershed in the area of the CCNPP site. Although NUREG-1555 (NRC, 1999b) requests "State 303(d) lists of impaired waters", there are significant portions of state waters, including waters outside of Chesapeake Bay, that are well removed from the CCNPP site and could not possibly be affected by discharges from the CCNPP site.

The Patuxent River Lower Basin was identified on the 1996 Section 303(d) list submitted to U.S. EPA by the MDE as impaired by nutrients and sediments, with listings of bacteria for several specified tidal shellfish waters added in 1998, and listings of toxics, metals and evidence of biological impairments added in 2002 (USEPA, 2005). The Section 303(d) segments within the Patuxent River have been identified as having low priority (MDE, 2004). Only waters that may require the development of Total Maximum Daily Loads (TMDLs) or that require future monitoring need have a priority designation (MDE, 2004). Two approved TMDLs are already established within Calvert County, including TMDL of fecal coliform for restricted shellfish harvesting areas and a TMDL for mercury in Lake Lariat. While the current Section 303(d) list identifies the lower Patuxent River and greater Chesapeake Bay as low priority for TMDL development, it does not reflect the high level of effort underway to identify and document pollution loadings in the watersheds.

Pursuant to the Federal Water Pollution Control Act (USC, 2006), the water quality of effluent discharges to the Chesapeake Bay and its tributaries is regulated through the National Pollutant Discharge Elimination System (NPDES). CCNPP Units 1 and 2 maintain a current NPDES permit, State Discharge Permit 92-DP-0187; NPDES MD0002399. When the permit required renewal in June 1999, the MDE was unaware of any major issue that would prevent the permit renewal, and it was granted at that time. At the time, the MDE noted that any new regulations promulgated by U.S. EPA or the MDE would be included in future permits and those may include development and implementation of TMDLs (NRC, 1999a). NPDES data collected in 2005 was reviewed to determine the nature of effluent discharges from the CCNPP site. Discharge parameters including biologic oxygen demand, chlorine (total residual), chlorine (total residual, bromine), cyanuric acid, fecal coliform, oil and grease, pH, temperature, and total suspended solids, were reported. Based upon the data reviewed, all discharges were within the acceptable range and no discharge violations were reported (USEPA, 2006).

Water quality data on the parameters cited in NUREG-1555 (NRC, 1999b) was researched for evaluation and inclusion in this report. As noted previously, not all the parameters were available. A summary of the water quality data parameters obtained from the CBP database is provided in Table 2.3-38.

Based upon the data, the following water quality trends were evident.

- Seasonal fluctuations in ammonia concentrations were observed throughout the year; however the highest variability was observed during the summer months. A minimum concentration of 0.003 mg/L was recorded at nearly all six monitoring stations during all seasons, while a maximum concentration of 0.344 mg/L was recorded during the summer. The annual average concentration of ammonia was 0.074 mg/L.

- Nitrite concentrations reached their peaks in the fall at all six monitoring stations; the greatest absolute fluctuation was at monitoring station CB4.3C, also during the fall. The annual average concentration was 0.0134 mg/L. Nitrate concentrations fluctuated seasonally throughout the year, with peak concentrations reached in the spring at all six monitoring stations. The highest concentration was 0.971 mg/L at CB4.3W. The annual average concentration was 0.2014 mg/L.

- Concentrations of total organic nitrogen fluctuated, but did not show a defined seasonal trend. A minimum concentration, 0.2698 mg/L, was recorded at monitoring station CB4.4 during the summer, while a maximum concentration of total organic nitrogen, 1.2507 mg/L, was recorded at monitoring station CB4.3W, also during the summer. The annual average concentration of total organic nitrogen was 0.5066 mg/L.

- Orthophosphate and total phosphorus concentrations remained relatively stable throughout the year, with no notable spatial or temporal variations. The highest concentrations for both parameters was reached at CB4.3W during the summer, with concentrations of 0.0932 mg/L and 0.1223 mg/L for orthophosphate and total phosphorus, respectively. The annual average concentration of orthophosphate was 0.0103 mg/L. The annual average concentration of total phosphorus was 0.392 mg/L.

- Concentrations of Chlorophyll A varied substantially at five of the six monitoring stations during nearly all seasonal periods. Peak concentrations were generally reached in spring or summer. Monitoring station CB5.1W had the lowest peak concentrations and the lowest variability. A minimum concentration of 0.449 g/L was observed at monitoring station CB4.4 in the fall; while a maximum concentration 53.827 g/L was recorded at CB4.3W during the summer. This high concentration corresponds to a rise in total available organic nitrogen and orthophosphates within the surface waters. The annual mean concentration was 9.764 g/L.

- Total suspended solids concentrations fluctuated widely throughout the year, reaching peak concentrations at four of the six monitoring stations during the spring. Minimum concentrations of 2.4 mg/L were recorded at several monitoring stations. The maximum concentration of 53.827 mg/L was recorded during the summer at monitoring station CB4.3W. The lowest annual mean total suspended solids was 6.57 mg/L at Station CB5.1W. The average total suspended solids at Station CB4.4, nearest to CCNPP, range from 7.71 mg/L in the fall to 30.40 mg/L in the winter. The annual mean concentration for the six monitoring stations was 9.06 mg/L.

- Surface water pH fluctuated throughout the year from 7.0 to 8.6, averaging 7.764 standard units, with the lowest values generally reached during spring and summer.

The average low pH across the stations was 7.7 standard units; the average maximum was 8.4 standard units. No spatial variations are noted.

In response to concerns about nutrient pollution in 2003, the U.S. EPA developed Chesapeake Bay-specific water quality criteria for dissolved oxygen, water clarity, and Chlorophyll A. Chlorophyll A is an indicator parameter used to measure the abundance and variety of microscopic plants or algae that form the base of the food chain in the Chesapeake Bay (USEPA, 2003). Excessive nutrients can stimulate algae blooms, resulting in reduced water clarity, reduced amount of good quality food, and depleted oxygen levels in deeper water. Chlorophyll A is, therefore, used to evaluate attainment of various water quality criteria including DO and water clarity (USEPA, 2003). Based on the WY 2005 water quality data, as shown in Table 2.3-38, mesotrophic to eutrophic water conditions may have been present in the vicinity of CCNPP site during the spring and summer months, and indicated that water quality criteria for DO would not be attained for the spring months.

Radioactive effluent discharge data reported in the 2005 Effluent and Waste Disposal Report (CE, 2006) was additionally reviewed. The parameters measured included tritium, gross alpha, gamma emitting radionuclides, iron-55, nickel-63, strontium-89, and strontium-90. The effluent data presented was compared to the site's maximum permissible concentrations used for radioactive materials released in liquid effluents. Table 2.3-39 provides a summary of the 2005 liquid effluent data reported in the CCNPP Annual Report (CE, 2006). The reported releases were found to be within permissible limits; and no abnormal releases were reported during the year.

Beginning in February 2007, six water samples were collected at the CCNPP Units 1 and 2 cooling water intake structure. During each sampling event, water samples were collected towards the end of the incoming (flood) and the outgoing (ebb) tides. Sample results and analytical parameters are shown in Table 2.3-40. Because of differences in analytical suites, not all results are directly comparable to the water quality samples collected by the CBP as shown in Table 2.3-38. In general, the intake analyte concentrations and measurements are similar to the values measured in CBP water samples collected at the stations closest to the CCNPP (locations CB4.3W, CB4.3C, CB4.3E, and CB4.4) indicating that there are no significant pollutants in the influent cooling water for Units 1 and 2.

Water withdrawn from Chesapeake Bay for CCNPP Unit 3 and desalination plant operation could contain pollutants that might interact with the plant. However, any pollutants, unless from a large, local, or continuous source, probably would be dilute due to mixing by tides and currents in the large volume of Chesapeake Bay water. As shown on Figure 2.3-56 and listed in Table 2.3-38, the closest, large permitted, discharge sources to the proposed project intake structure are CCNPP Units 1 and 2, the Cove Point LNG plant 4 mi (6.4 km) south, and the Naval Research Laboratory; Chesapeake Bay detachment, 18.5 mi (30 km) to the north.

The largest discharges originate from CCNPP Unit 1 and 2 with an average volume of 3.2E+9 gallons per day (1.2E+7 cubic meters per day). This discharge consists mainly of warm water from the once-through cooling system and minor amounts of treated effluent from other waste streams. All CCNPP Unit 1 and 2 liquids are discharged to Chesapeake Bay through the submerged outfall located approximately 850 ft (260 m) offshore, northeast of the plant. The quantity and quality of the water discharged are regulated and permitted by the State of Maryland (NRC, 1999a). Given the approximate 1,500 ft (460 m) distance from CCNPP Units 1 and 2 outfall to the CCNPP Unit 3 plant shoreline intake pipes, and the Chesapeake Bay current patterns, any possible pollutants in the entrained bay water would be greatly diluted before reaching the new plant intake structure pipes.

The most likely pollutants that might be present in effluent discharged from CCNPP Units 1 and 2 operations would be treatment chemicals used to prevent scaling and rusting in the cooling system piping, those used in the waste water treatment plant operations, and diluted radioactive liquid waste. The volume of those effluents would be very minor compared to the total volume discharged.

Since the other surface water bodies on site are not used for any plant operations, no impact would be expected from any pollutants that might be present in them.

2.3.3.1.2.2.5 Sediments

The lands surrounding the Chesapeake Bay are mostly comprised of Pleistocene era deposits. Erosion of these deposits along the shoreline releases sediment that flows southward as littoral drift. The general flow of nearshore sediment transport is from north of Long Beach to a location just north of CCNPP (MDNR, 2003). The CCNPP site as shown on Figure 2.3-75 is situated in an area of net loss of sediment as the result of a circulating eddy in the Flag Pond area. The eddy influences the transport and deposition of sediments along the shoreline, most evidently to the south of the CCNPP site in the area of Cove Point. Cove Point is a littoral promontory that is slowly moving in a southerly direction, due to the transport and deposition of shoreline erosion sediments from beaches two to three miles to the north. A 2001 Maryland Department of Natural Resources orthophotograph as shown on Figure 2.3-26, which includes Long Beach to Cove Point, shows the progression of beach movement in the area from 1848 through 1993 (MDNR, 2001).

Turbulent weather conditions, prevailing wind patterns, currents, and tidal forces influence the spatial distribution of chemical contaminants in the Chesapeake Bay by driving resuspension of benthic sediments (MDSG, 2006). Resuspension rates are generally higher in well-mixed areas, while sediments become buried faster and incorporated into the bottom in less vigorously mixed environments. Stratification in the water column due to temperature or salinity gradients can additionally limit the height to which eroded sediments can be resuspended, keeping them low in the water column. Within the Chesapeake Bay, burial rates of heavy metals and movement of chemical pollutants out of sediments is moderate due to sedimentation and resuspension rates and low benthic cycling (CBP, 2006f). Based upon the localized flow rates and pycnocline data, presented in this section, resuspended bottom sediments are likely to settle rapidly within area of the CCNPP site.

The bottom of Chesapeake Bay in the CCNPP site area is characterized as having a hard substrate composed of compacted sand, mud, and calcareous shell fragments, overlain in some areas by scattered stones of various sizes. Sediment grabs were collected in September 2006 to assess the sediments and benthic biota. The samples were taken in the vicinity of the CCNPP Unit 3 discharge point (sample CCNPP-1) and at two locations within 500 ft (152 m) of this point (as shown in Figure 2.3-84) and were analyzed for the following physical/chemical parameters (EA, 2006):

- percent solids
- ammonia nitrogen
- total Kjeldahl nitrogen (TKN)
- total phosphorous

- metals (Cd, Cr, Cu, Hg, Pb, Zn, As)
- pesticides
- Polychlorinated Biphenyl (PCB) congeners
- volatile organic compounds (VOCs)
- semivolatile organic compounds (SVOCs) (including polyaromatic hydrocarbons)
- grain size
- total organic carbon
- specific gravity

A summary of sediment quality data is presented in Table 2.3-41. Concentrations of TKN, total organic carbon, total phosphorus, arsenic, chromium, lead, zinc, and PCB-18, were detected at levels that were above their respective method detection limits: however, based upon the relatively low concentrations of these analytes in samples, there is no evidence of sediment contamination (EA, 2006).

2.3.3.1.2.2.6 Chesapeake Bay Restoration Act

The Chesapeake Bay is considered Maryland's greatest economic and environmental treasure (MDE, 2006b). Over the past 100 years, the water quality of the Chesapeake Bay has become increasingly degraded due to over enrichment of unwanted nutrients such as phosphorus and nitrogen.

In 2004, the Chesapeake Bay Restoration Fund was proposed and signed into Maryland law to address Bay restoration. Administered by MDE, the law creates a dedicated fund for upgrading 66 of the largest wastewater treatment facilities to Enhanced Nutrient Reduction (ENR) standards. The ENR standards are stringent, and by enacting the legislation, the MDE expects results faster than many other nutrient programs. Once these plants are operating at ENR standards, conservatively 7.5×10^6 lb (3.4×10^6 kg) of nitrogen and 260,000 lb (118,000 kg) of phosphorus will stop going into the Chesapeake Bay each year, which represents over one-third of Maryland's commitment under the 2000 Chesapeake Bay Agreement (MDE, 2006b). In addition to effluent and non-point source pollutants, nearly one-third of the nitrogen delivered to the Chesapeake Bay comes from atmospheric deposition. Maryland's Clean Power Rule should have a significant benefit on public health, air quality and the health of the Chesapeake Bay by reducing air deposition of nitrogen by 900,000 lb (408,000 kg) a year to the Bay (MDE, 2006b).

2.3.3.1.3 Wastewater Treatment

The CCNPP Unit 3 Waste Water Treatment Plant (WWTP) will collect sewage and waste water generated from the portions of the plant outside the radiological control areas of the power block and will treat them using an extensive mechanical, chemical, and biological treatment processes. The treated effluent will be combined with the discharge stream from the onsite waste water retention basin and discharged to Chesapeake Bay. The discharge will be in accordance with local and state safety codes. The dewatered sludge will be hauled offsite for disposal at municipal facilities.

The CCNPP Unit 3 WWTP operation will be similar to the CCNPP Unit 1 and 2 treatment plant operation and will follow standard practices and use processes that are identical to wastewater treatment plants throughout the U.S. The CCNPP Unit 3 system will consist of a holding/debris tank, macerating pumps, oil/water separator, clarifiers, aeration blowers, diffusers, pre-treatment tanks, sludge holding tanks, and the associated piping, instrumentation, and controls necessary for proper operation. All of the WWTP piping, tanks, venting, and valving arrangements will be separated from all other plant chemical or radiological processes, and treatments by appropriate isolation devices.

The final stage of treatment will be disinfection of the wastewater to substantially reduce the number of microorganisms before discharge. Disinfection will either involve Ultraviolet (UV) or chlorination methods. If UV disinfection is used, discharge could be directly into the effluent stream from the retention basin. If chlorination disinfection is used, a de-chlorination step will be necessary before discharge in order to reduce the chlorine level below what is harmful to marine organisms.

The plant will be sized to have sufficient capacity to hold, process sewage or treated effluent under peak anticipated demand or operational transitional conditions. The treated wastewater will meet all applicable health standards, regulations, and total daily maximum loads (TMDLs) set by the Maryland Department of the Environment and the U.S. EPA.

2.3.3.2 Groundwater

Five groundwater production wells provide the process and domestic water for the operation of CCNPP Units 1 and 2. During the site characterization for CCNPP Unit 3, 145 borings were drilled and 40 observation wells were installed, primarily to monitor groundwater elevations. In May 2007, production Well No.5 and observation wells OW 752-A, OW 319-A and OW 319-B were sampled to collected groundwater quality data for the surficial and Aquia aquifers as shown in Figure 2.3-77. The well completion data for the wells sampled is presented in Table 2.3-42. The groundwater sample analytical results are presented in Table 2.3-43.

As shown in Table 2.3-43, there are differences in the Surficial aquifer groundwater across the site and between the Surficial aquifer and the deeper groundwater sampled beneath the site. For the Surficial aquifer samples, the metals concentrations are generally twice as high, the water is more alkaline and has elevated chloride, nitrate, phosphorus, pH, and total suspended solids concentrations in the groundwater sample from the eastern part of the site (well OW 319-A) than in the western sample (OW 752-A). Alkalinity, hardness, calcium, magnesium, and silicon are higher in the sample from the Upper Chesapeake Unit (well OW 319-B) than in samples from the other aquifers. The sample from the Aquia Aquifer (Well No. 5) has the highest sodium and potassium concentrations and most of the other parameters are intermediate in concentration between the Surficial and Upper Chesapeake Unit samples. The detections of bacteria in the samples is believed to be the result of contamination during sampling rather than contamination in the aquifer from a septic system source, especially since fecal colliforms were not detected.

While the groundwater wells provide the source of water for the site's domestic, plant service, and de-mineralized makeup water requirements, the Chesapeake Bay is the sole source of water for the once-through cooling system utilized at CCNPP Units 1 and 2. All CCNPP Units 1 and 2 liquid effluents are combined before being discharged to the Chesapeake Bay through a submerged outfall. Both the quantity of the water pumped (from the groundwater wells and the Chesapeake Bay) and quality of the water discharged to the Bay are regulated and permitted by the State of Maryland (NRC, 1999a).

In keeping with the requirements of 10 CFR 50.75(g) (CFR, 2006), CCNPP Units 1 and 2 reported detection of low-level tritium within a piezometer tube located within the CCNPP site (CE, 2006). According to the Calvert Cliffs Nuclear Power Plant Effluent and Waste Disposal 2005 Annual Report (CE, 2006), the detection was identified during routine annual samples collected in December 2005 from piezometers that were installed to access the shallow groundwater beneath the CCNPP site. Tritium was detected within the water from one piezometer at an activity of approximately 1,800 pCi/L (72 Bq/L), but no gamma activity was detected (CE, 2006). Tritium was not detected at the remaining three piezometers. Since the December 2005 detection, tritium has not been detected within any of the four piezometers.

2.3.3.3 References

BGE, 1998. Environmental Report – Operating License Renewal Stage, Calvert Cliffs Nuclear Power Plant Units 1 and 2, Baltimore Gas and Electric Company, April 1998.

CBP, 2005b. 2005 River Flow and Pollutant Loads Reaching the Bay, Chesapeake Bay Program, 2005.

CBP, 2006a. Watershed Profiles, Chesapeake Bay Program, Website: http://www.chesapeakebay.net/wspv31/, Date accessed: November 2006.

CBP, 2006d. Chesapeake Bay - An Introduction to the Ecosystem, Website: http://www.chesapeakebay.net/ecoint3a.htm, Date accessed: November 2006.

CBP, 2006e. Dissolved Oxygen: Supporting Life in the Bay, Website: http://www.chesapeakebay.net/do.htm, Date accessed: November 2006.

CBP, 2006f. Backgrounder, Website: http://www.chesapeakebay.net/pubs/doc-do_101_backgrounder.pdf, Date accessed: November 2006.

CBP, 2007. Monitoring, Website: http://www.chesapeakebay.net/Info/monprgms.cfm, Date accessed: January 2007.

CCNPP, 2005. Calvert Cliffs Nuclear Power Plant, Updated Final Safety Analysis Report, Constellation Generating Group, September 8, 2005.

CE, 2006. Calvert Cliffs Nuclear Power Plant Effluent and Waste Disposal, 2005 Annual Report, Constellation Generating Group, July 13, 2006.

CFR, 2006. Title 10 Code of Federal Regulations, Part 50.75, Reporting and recordkeeping for decommissioning planning, January 2006.

EA, 2006. Aquatic Field Studies for UniStar Calvert Cliffs Expansion Project Fall 2006, EA Engineering, Science, and Technology, October 2006.

FEMA, 1998. Federal Emergency Management Agency, Flood Insurance Rate Map for Calvert County, Maryland Revision for CCNPP Site, Community-Panel Number 240011 0027 D, July 20, 1998.

MDNR, 2001. Maryland Department of Natural Resources, Coastal and Estuarine Geology Program, Maryland Geological Survey, Shoreline Change Maps, Cove Point Quadrangle MD, Website: http://www.mgs.md.gov/coastal/maps/slmapdf/COVEP_PF.pdf, Date accessed: April 10, 2007.

MDNR, 2003. Maryland Department of Natural Resources, Flag Ponds Nature Park, A Beachcomber's Paradise, October 20, 2003, Website: http://www.dnr.state.md.us/baylinks/14.html, Date accessed: April 10, 2007.

MDE, 2004. Final 303(d) List and Integrated Assessment of Water Quality in Maryland, Maryland Department of Environment, 2004.

MDE, 2006a. Water Quality Standards in the Chesapeake Bay and Tributaries: Background & Implementation, Maryland Department of Environment, February 13, 2006, Website: http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/wqstandards, Date accessed: November 1, 2006.

MDE, 2006b. Chesapeake Bay Restoration, Website: http://www.mde.state.md.us/Water/bayrestoration.asp, Date accessed: November 2006.

MDSG, 2006. Chemical Contaminants in the Chesapeake Bay, Maryland Sea Grant, Website: http://www.mdsg.umd.edu/CBEEC/toxicsrpt/workshop.html, Date accessed: November 2006.

NRC, 1999a. Generic Environmental Impact Statement for license renewal of Nuclear Power Plants, Supplement 1 – Regarding the Calvert Cliffs Nuclear Power Plant, Nuclear Regulatory Commission, October 1999.

NRC, 1999b. Environmental Standard Review Plan, NUREG-1555, Section 2.3.3, Nuclear Regulatory Commission, October 1999.

USC, 2006. Title 33, United States Code, Part 1251, Federal Water Pollution Control Act, 2006.

USEPA, 2003. Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and Its Tidal Tributaries, U.S. Environmental Protection Agency, April 2003, Website: http://www.epa.gov/region3/chesapeake/baycriteria.htm, Date accessed: November 2006.

USEPA, 2005. Decision Rationale - Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in the Patuxent River Lower and Eastern Bay Basins in Calvert, St. Mary's and Queen Anne's Counties, Maryland, U.S. Environmental Protection Agency, September 27, 2005.

USEPA, 2006. Water Discharge Permits - Detailed Reports, U.S. Environmental Protection Agency, Website: http://oaspub.epa.gov/enviro/pcs_det_reports.detail_report?npdesid=MD000239, Date accessed: November 2006.

USGS, 2007. USGS Chesapeake Bay Activities, Estimated Streamflow Entering Chesapeake Bay, U.S. Geological Survey, Website: http://md.water.usgs.gov/monthly/bay.html, Date accessed: January 2007.

Table 2.3-1— Peak Annual Streamflow for the Patuxent River at Bowie, MD (USGS Station No. 01594440, Patuxent River near Bowie, MD)

#	River/Creek Name	Sub-watershed Name	Valley Length ft (m)	Average Slope %
1	Johns Creek Upper Reach (to the confluence with Branch 3)	Lower Patuxent River Watershed	4,200 (1280)	1.15
2	Johns Creek Lower Reach (from confluence with Branch 3 to river mouth)	Lower Patuxent River Watershed	14,600 (4450)	0.33
3	Branch 3 (unnamed branch)	Lower Patuxent River Watershed	2,200 (670)	2.59
4	Branch 4 (unnamed branch)	Lower Patuxent River Watershed	3,800 (1200)	1.29
5	Goldstein Branch	Lower Patuxent River Watershed	4,300 (1300)	1.02
6	Laveel Branch	Lower Patuxent River Watershed	4,700 (1400)	1.02
7	Branch 1 (unnamed branch)	Maryland Western Shore Watershed	1,500 (460)	3.33
8	Branch 2 (unnamed branch)	Maryland Western Shore Watershed	3,100 (950)	1.94

Table 2.3-2— Peak Annual Streamflow for the Patuxent River at Bowie, MD (USGS Station No. 01594440, Patuxent River near Bowie, MD)

Year	Date	Discharge (cubic feet per second)
1978	Jan. 27, 1978	10,600
1979	Sep. 06, 1979	11,500
1980	Oct. 11, 1979	3,940
1981	Feb. 24, 1981	1,640
1982	Feb. 04, 1982	3,380
1983	Jun. 21, 1983	5,750
1984	Mar. 30, 1984	4,340
1985	Feb. 13, 1985	4,730
1986	Apr. 16, 1986	1,520
1987	Dec. 25, 1986	4,060
1988	Nov. 30, 1987	3,510
1989	May 7, 1989	9,190
1990	May 30, 1990	3,140
1991	Mar. 24, 1991	4,750
1992	Mar. 27, 1992	3,200
1993	Mar. 05, 1993	5,550
1994	Nov. 29, 1993	6,960
1995	Mar. 09, 1995	4,100
1996	Jan. 20, 1996	8,280
1997	Jan. 20, 1997	6,900
1998	Mar. 10, 1998	4,840
1999	Sep. 17, 1999	8,200
2000	Mar. 22, 2000	3,640
2001	Jun. 08, 2001	3,800
2002	Mar. 21, 2002	957
2003	Feb. 23, 2003	6,990
2004	Dec. 12, 2003	5,790
2005	Apr. 03, 2005	5,210
2006	Jun. 26, 2006	12,700

Table 2.3-3— Monthly Streamflow for the Patuxent River at Bowie, MD (USGS Station No. 01594440, Patuxent River near Bowie, MD) (June 27, 1977 through September 30, 2005)

	Discharge (cubic feet per second)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1977							131.1	126.5	77.8	220.7	314.3	748.2
1978	1,316	358.6	854.2	372.7	884.0	233.8	298.5	293.2	130.0	109.6	201.8	347.9
1979	1,290	1,232	817.5	523.8	460.8	611.6	220.0	531.9	1,358	1,093	458.8	384.5
1980	496.6	262.8	693.9	806.0	670.3	308.5	210.3	157.3	106.7	201.1	181.9	135.7
1981	119.2	319.5	173.2	188.1	236.6	209.7	145.6	90.7	116.9	117.4	107.6	158.3
1982	211.9	507.8	328.0	344.8	206.2	439.0	124.5	111.8	147.2	130.5	177.5	204.8
1983	173.2	317.8	683.0	1,247	719.9	766.9	176.6	137.5	110.4	285.8	424.2	1,030
1984	407.0	658.3	843.1	843.2	657.5	262.1	371.6	343.3	182.8	155.7	225.5	306.1
1985	173.7	536.1	203.9	167.4	238.4	193.6	134.5	104.5	211.4	163.0	276.1	214.9
1986	218.4	379.5	294.3	328.9	153.8	116.4	102.3	121.5	65.2	80.4	251.6	489.1
1987	428.3	286.2	365.1	459.8	291.2	192.4	176.1	86.1	379.0	160.0	316.4	368.6
1988	453.2	566.2	364.2	351.9	730.1	190.7	189.8	130.4	119.0	114.1	278.6	180.0
1989	287.1	326.9	532.1	453.0	1,291	845.6	491.8	304.5	243.4	391.4	348.5	182.0
1990	462.1	424.5	374.8	581.8	578.4	324.7	209.9	306.3	125.6	332.6	305.6	459.4
1991	720.5	266.4	650.5	376.8	194.7	114.9	103.0	111.4	133.5	145.8	148.1	295.3
1992	217.8	251.6	399.5	260.9	221.2	234.6	248.4	153.7	188.0	167.7	350.5	537.5
1993	473.3	335.2	1,358	1,021	429.5	268.6	126.1	132.9	138.2	141.9	392.8	539.2
1994	657.6	930.1	1,318	648.5	347.4	182.9	239.7	319.0	202.3	153.4	193.9	237.6
1995	389.5	228.1	397.6	198.6	308.2	178.8	156.9	168.3	127.6	381.3	491.0	332.1
1996	1,035	549.5	566.6	598.3	575.9	654.4	579.2	474.8	701.6	614.1	747.2	1,357
1997	652.3	683.3	870.9	531.6	391.7	319.0	136.1	177.3	136.1	180.1	448.5	231.0
1998	605.6	890.7	1,124	648.5	669.1	361.7	163.3	124.8	111.2	114.6	123.4	128.1
1999	377.6	237.5	392.0	258.6	169.6	126.5	97.3	200.1	722.9	263.2	229.1	341.0
2000	269.0	420.7	511.9	581.3	271.0	318.9	293.9	225.3	362.9	166.1	171.1	312.5
2001	324.8	390.8	506.4	404.5	350.5	595.5	268.5	186.2	169.2	122.2	151.3	166.8
2002	177.4	141.6	244.2	291.5	269.9	135.1	116.5	98.6	124.4	239.7	371.2	477.7
2003	431.2	786.1	1,014	548.4	715.9	1,320	509.9	328.2	1,066	652.9	937.3	1,256
2004	449.5	919.2	507.0	697.3	437.5	347.3	364.4	336.8	254.7	178.3	343.5	372.1
2005	510.8	383.1	700.6	746.2	414.4	321.9	500.0	219.0	107.8			
Mean	476	485	610	517	460	363	237	210	273	253	320	421

Table 2.3-4— Mean Daily Streamflow for the Patuxent River at Bowie, MD (USGS Station No. 01594440, Patuxent River near Bowie, MD) (June 27, 1977 through September 30, 2005)

	Discharge (cubic feet per second)											
Day of Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	341	378	482	686	394	388	247	245	190	195	227	351
2	439	385	510	640	424	387	294	223	159	286	215	374
3	503	418	546	716	426	352	250	209	149	261	236	366
4	440	488	629	626	395	424	281	211	177	245	256	397
5	421	507	655	625	423	446	294	228	194	257	273	404
6	351	441	594	544	542	420	249	250	429	287	289	531
7	336	461	587	473	685	488	229	255	466	192	278	382
8	382	387	535	502	494	578	241	198	284	186	340	306
9	437	359	687	513	432	402	296	188	257	220	400	302
10	374	353	667	627	406	344	204	224	222	243	334	365
11	346	342	547	614	417	272	196	195	209	289	338	458
12	404	415	467	485	392	272	171	305	199	202	342	675
13	435	505	428	490	403	301	256	323	195	174	366	485
14	422	398	468	472	366	363	316	279	213	171	306	673
15	484	460	504	461	361	337	288	215	155	255	334	593
16	401	441	447	614	508	293	202	187	261	213	268	492
17	351	420	440	608	664	313	225	176	482	230	325	441
18	364	453	548	554	562	347	196	175	355	246	296	461
19	487	477	570	542	478	375	194	161	382	294	236	527
20	726	474	569	479	443	444	206	183	287	310	308	432
21	668	453	666	403	419	636	233	221	201	274	312	356
22	521	485	884	418	398	569	199	194	276	289	293	388
23	452	665	646	381	468	373	218	169	386	211	338	371
24	494	825	789	377	524	357	209	160	339	275	298	399
25	646	679	631	406	505	324	209	158	257	239	252	513
26	705	694	521	391	565	270	254	188	353	284	305	469
27	795	686	714	432	547	216	248	191	361	310	350	308
28	616	556	848	525	408	196	299	245	308	391	384	282
29	590	461	872	491	384	193	258	192	249	282	635	327
30	433		768	417	434	206	194	184	196	279	476	308
31	394		703		395		203	191		245		321

Table 2.3-5— Maximum Daily Streamflow for the Patuxent River at Bowie, MD (USGS Station No. 01594440, Patuxent River near Bowie, MD) (June 27, 1977 through September 30, 2005)

	Discharge (cubic feet per second)											
Day of Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1,140	1,040	2,210	2,040	1,130	1,000	991	1,060	615	940	1,280	1,250
2	2,460	1,100	2,270	1,680	1,320	1,570	1,680	986	575	2,960	837	2,730
3	3,160	959	3,090	4,510	1,400	1,220	1,250	744	557	2,170	778	2,290
4	1,360	2,790	3,330	2,780	1,190	2,940	1,810	917	785	2,480	936	2,000
5	995	3,320	4,480	1,850	1,260	2,930	1,450	1,070	900	2,370	997	1,930
6	1,170	2,550	2,290	1,520	2,350	1,120	1,020	646	7,350	2,470	1,430	4,430
7	932	4,390	2,120	1,000	8,400	1,790	1,050	1,520	7,500	1,430	1,480	1,850
8	1,400	2,700	1,660	1,220	4,020	3,950	896	642	2,780	1,430	2,650	1,820
9	1,920	1,400	3,170	1,160	1,620	2,520	2,750	499	1,800	1,690	4,190	1,660
10	1,650	1,260	3,780	2,320	1,040	1,650	660	1,240	1,460	1,740	3,360	1,310
11	777	1,400	2,490	3,430	1,460	1,160	899	817	1,180	3,350	1,730	2,240
12	2,180	1,310	1,330	1,600	1,240	1,110	599	1,880	1,490	1,220	1,200	5,240
13	2,310	3,750	1,270	1,700	2,010	1,270	1,210	1,360	938	815	1,590	2,670
14	1,560	1,440	1,640	1,500	1,250	2,070	3,800	1,940	1,520	632	934	5,220
15	3,960	2,140	1,490	1,220	1,580	1,610	1,230	722	602	1,560	2,470	2,800
16	1,270	2,270	1,130	3,730	3,630	1,220	631	638	2,740	881	1,360	1,900
17	1,080	1,300	1,030	3,180	4,560	1,280	1,460	654	7,110	1,140	1,700	1,680
18	1,500	1,620	3,350	1,890	2,940	1,480	741	495	1,840	1,190	1,630	2,360
19	1,910	1,370	1,870	1,660	1,550	2,210	534	334	4,940	2,030	593	5,700
20	6,350	1,600	1,750	1,220	1,010	3,000	901	568	3,240	2,860	3,010	3,470
21	4,170	1,600	3,190	1,310	1,640	4,280	1,510	1,300	1,040	1,840	2,180	1,410
22	3,920	1,300	3,440	1,450	1,200	3,630	742	932	1,870	2,300	1,330	1,380
23	2,850	5,600	2,140	1,220	3,000	1,480	975	572	3,450	575	1,200	1,780
24	2,610	4,540	3,770	964	2,170	2,110	768	526	4,890	1,410	1,630	1,460
25	4,650	4,500	2,450	1,880	1,830	1,370	1,350	488	1,900	900	845	2,500
26	4,430	8,000	1,350	974	2,690	826	1,560	1,030	2,110	980	1,390	2,600
27	8,860	8,470	3,720	931	2,580	614	1,260	1,560	1,400	1,220	1,290	830
28	4,430	4,430	3,420	1,830	1,310	432	1,940	1,830	2,330	3,020	1,720	768
29	4,110	918	3,440	1,980	893	396	1,850	1,000	1,520	2,000	5,190	1,380
30	1,340		3,620	1,390	2,530	479	718	833	664	2,600	2,720	964
31	1,080		2,010		1,500		638	800		1,490		1,550

Table 2.3-6— Minimum Daily Streamflow for the Patuxent River at Bowie, MD (USGS Station No. 01594440, Patuxent River near Bowie, MD) (June 27, 1977 through September 30, 2005)

	Discharge (cubic feet per second)											
Day of Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	113	105	132	183	122	121	79	69	67	59	82	98
2	115	158	136	182	122	118	88	68	71	64	107	119
3	123	151	169	171	176	115	85	66	71	66	107	118
4	114	148	165	159	173	112	82	66	70	63	105	117
5	121	140	180	152	157	109	79	65	74	63	106	115
6	118	136	175	155	150	110	77	73	75	60	107	110
7	118	128	166	153	143	111	76	70	72	57	106	105
8	119	145	161	140	135	111	76	70	72	57	107	105
9	117	145	157	147	126	108	78	70	69	58	108	107
10	115	136	169	158	120	105	81	73	66	57	105	103
11	107	133	160	157	128	105	81	73	65	57	104	98
12	104	134	150	158	128	105	79	73	64	58	102	99
13	105	141	161	156	115	108	79	74	62	63	98	101
14	104	133	156	154	110	102	85	73	61	76	99	103
15	106	132	147	153	106	99	81	73	59	76	99	124
16	111	134	151	153	102	99	80	71	58	77	101	126
17	112	136	151	149	100	98	78	75	56	77	100	123
18	112	134	149	143	98	94	79	74	56	73	99	120
19	111	132	143	143	105	92	74	70	56	71	97	118
20	112	130	143	140	149	94	73	70	57	71	97	120
21	122	135	139	136	144	105	79	69	60	70	98	106
22	130	135	142	134	139	96	80	66	59	70	95	109
23	130	133	138	131	135	86	79	67	59	71	117	116
24	130	133	137	130	132	87	76	67	57	71	102	115
25	120	134	134	138	120	87	81	66	59	70	96	115
26	120	132	130	127	114	86	78	65	60	84	96	114
27	110	139	131	124	108	81	77	65	60	105	96	114
28	110	132	131	127	119	80	75	64	59	108	94	120
29	100	222	129	127	133	90	73	62	59	106	95	124
30	100		159	123	127	88	77	68	58	96	94	118
31	100		164		123		72	70		86		111

Table 2.3-7— Peak Annual Streamflow for the St. Leonard Creek at St. Leonard, MD (USGS Station No. 01594800, St. Leonard Creek near St. Leonard, MD) (December 2, 1956 through September 30, 2003)

Year	Date	Discharge (cfs)
1958	Aug. 25, 1958	195
1959	Jul. 15, 1959	108
1960	Jul. 30, 1960	288
1961	Oct. 28, 1960	114
1962	Jan. 07, 1962	105
1963	Jun. 03, 1963	130
1964	Nov. 07, 1963	103
1965	Nov. 26, 1964	70
1966	Sep. 21, 1966	168
1967	Oct. 19, 1966	77
1968	Jan. 14, 1968	111
2001	May 26, 2001	48
2002	Sep. 01, 2002	33
2003	Sep. 19, 2003	68

Table 2.3-8— Monthly Streamflow for St. Leonard Creek at St. Leonard, MD (USGS Station No. 01594800, St. Leonard Creek near St. Leonard, MD) (December 1, 1956 through September 30, 2003)

	Discharge (cubic feet per second)											
YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1956												6.74
1957	6.02	8.99	12.5	7.7	4.11	2.46	1.57	4.7	7.04	4.15	4.96	11.9
1958	13.3	15.2	22.9	26.1	26.1	13.9	10.8	14.9	9.1	9.65	8.46	8.78
1959	9.2	7.59	8.63	10.1	5.93	4.26	7.81	4.73	2.44	4.18	8.12	7.61
1960	7.98	9.68	8.89	11.8	13.5	9.57	10.5	8.23	13.1	10.4	11	10.9
1961	12.9	24.8	22	20.3	16.5	9.88	6.53	4.63	2.84	3.76	4.37	6.79
1962	7.69	7.51	12.1	14	7.45	6.39	3.85	2.78	3.03	3.79	10.1	6.49
1963	7.16	6.31	12.3	7.46	5.67	8.91	2.3	1.14	2.64	2.31	7.65	5.58
1964	9.67	10.5	9.49	10.8	6.16	3.93	3.45	1.37	1.71	4.06	5.12	5.88
1965	6.58	7.33	9.26	8.59	4.49	4.88	3.56	3.12	2.44	2.69	3.06	3.23
1966	4.33	9.53	5.55	5.49	5.32	1.72	0.8	0.326	4.59	4.42	3.08	4.99
1967	5.19	5.91	6.43	4.29	5.82	2.5	2.14	3.45	1.31	1.73	2.41	7.23
1968	8.75	3.69	9.09	5.43	4.94	5.16	1.17	2.59	1.94			
2000										3.35	4.34	6.2
2001	8.94	11.2	11.4	8.65	9.58	9.82	6.91	5.43	2.44	1.91	2.92	3.11
2002	4.25	3.45	4.73	4.32	3.76	1.14	0.074	0.415	1.63	1.93	5.7	6.26
2003	4.89	8.14	11.3	8.21	9.35	9.92	5.49	4.8	8.73			
Mean	7.8	9.3	11	10	8.6	6.3	4.5	4.2	4.3	4.2	5.8	6.8

Table 2.3-9— Mean Daily Streamflow for St. Leonard Creek at St. Leonard, MD (USGS Station No. 01594800, St. Leonard Creek near St. Leonard, MD) (December 2, 1956 through September 30, 2003)
(Page 1 of 2)

	Discharge (cubic feet per second)											
Day of Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	10	8	13	12	9	7	3.5	4.1	3.8	5.3	5.1	4.8
2	8.3	7.1	9.8	11	9.1	9.6	3.6	3.1	3.5	4.1	5.7	4.5
3	7.1	6.4	9.7	10	8.4	14	4.3	3.4	3.6	3.6	6.3	5.9
4	6.7	8.5	8.9	9.8	8	7.9	3.9	3.9	3.4	3.6	4.9	6.6
5	5.9	9.3	11	10	9.6	7.2	3.7	4.8	2.9	3.5	4.6	5.5
6	8.1	8.9	12	9.9	8.5	6.2	4.2	4.5	2.6	4.6	6.7	6.2
7	9.6	9	10	11	11	7.4	3.4	3.3	6.7	4.4	11	5.6
8	7.1	10	11	12	9.9	7.7	4.3	5	2.9	3.6	5.2	5.5
9	7.6	9.6	11	11	9.1	5.8	4.3	2.9	2.7	3.9	4.7	7
10	7.6	8	8.6	9.8	7.5	6.5	4.3	3.1	3.9	3.2	8	6
11	6.6	8.2	8.4	13	9.3	5.2	4.9	3.8	6.2	2.9	4.9	6.7
12	6.4	8.7	13	11	8.5	5.3	5.4	3.8	10	2.8	4.9	9.5
13	6.6	9.9	10	13	7.5	5.8	5	4.8	4.6	2.8	5	7
14	15	8.7	10	11	7.3	7.6	5.8	3.9	4.4	3.7	4.6	7.6
15	10	8.2	8.9	9.3	7	5.5	7.4	2.9	3	3.7	4.7	6.3
16	7.7	9.9	9	9.4	7.4	5.4	5.6	3	3.6	3.4	4.5	8.2
17	6.5	9.3	11	9.2	6.5	5.6	3.4	3.5	4.4	4.4	5.3	8.5
18	6.1	8.8	12	9	7.3	5.2	3.3	2.5	4.1	3.7	5.4	7.8
19	6.5	14	12	9.1	7.8	5.7	3.2	3	5.5	6.1	5.6	5.7
20	9.7	9	17	9.8	8.1	6.3	3	4.8	4.9	5.5	5.2	5.9
21	8.9	8.6	16	9	6.9	6.8	3.4	3	8.4	4	4.7	7
22	8.4	9.3	15	9.4	8.2	5.4	3.1	3.5	3.9	6.1	5.9	5.2
23	8.3	11	13	12	8.5	5.2	3.6	3.2	4.1	4.1	5.2	6.3
24	7.8	9.1	11	9	6.7	6	4.5	4.8	3	4.3	7.2	6.6

Table 2.3-9— Mean Daily Streamflow for St. Leonard Creek at St. Leonard, MD (USGS Station No. 01594800, St. Leonard Creek near St. Leonard, MD) (December 2, 1956 through September 30, 2003)

(Page 2 of 2)

Day of Month	Discharge (cubic feet per second)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
25	8.9	10	10	9.1	7.3	6.2	3.5	17	3.1	3.5	7.3	6.7
26	6.7	11	11	8.4	11	5.1	3.9	6.5	2.9	4.1	8.3	7.4
27	6.7	12	11	8.8	9.1	5.5	5.4	4.6	4.8	3.6	5.3	6.8
28	7	11	9.5	11	11	4.1	3.4	3.3	3.4	5.6	5	7.6
29	6.6	8.4	9.1	9.3	13	4.1	4.5	3.4	4.6	6.2	6.5	9.9
30	6.6		11	10	7.8	3.6	12	2.8	4.6	4.5	6.2	9.9
31	6.3		11		8.9		4.1	3.3		4.1		6

Table 2.3-10— Maximum Daily Streamflow for St. Leonard Creek at St. Leonard, MD (USGS Station No. 01594800, St. Leonard Creek near St. Leonard, MD) (December 2, 1956 through September 30, 2003
(Page 1 of 2)

	Discharge (cubic feet per second)											
Day of Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	54	28	43	39	22	16	8.7	14	11	29	21	9.4
2	24	18	20	31	27	33	8.7	9.4	13	10	22	8.7
3	18	13	18	25	22	71	15	9.1	10	8.7	22	23
4	12	40	18	23	25	23	11	13	13	9.1	18	19
5	11	30	29	41	54	14	9.8	16	9.4	7.9	15	16
6	27	22	22	30	38	13	16	21	9.1	24	19	19
7	41	25	25	24	51	28	10	11	60	19	60	13
8	11	30	28	43	32	27	13	38	11	9.6	14	17
9	19	50	32	21	28	16	12	9.4	9.1	13	10	32
10	17	29	18	23	25	30	13	7.9	23	7.9	49	24
11	11	22	17	63	46	15	14	8.7	27	6.9	13	16
12	13	22	57	28	32	16	25	15	115	6.6	11	26
13	11	49	21	50	21	24	16	23	18	6.9	15	15
14	90	26	28	35	20	46	19	18	17	14	10	15
15	33	20	18	24	20	12	53	9.1	7.9	7.5	9.8	11
16	16	35	20	23	19	11	34	8.7	14	6.9	9.8	42
17	13	30	30	21	19	18	9.4	15	16	15	17	35
18	12	28	40	19	18	11	8.3	7.5	16	8.5	14	21
19	13	57	29	19	30	17	7.9	9.8	27	41	10	12
20	35	24	95	20	35	15	7.5	28	30	23	9.4	12
21	23	24	48	22	21	22	9.1	11	69	9.8	9.4	25
22	21	26	34	21	24	17	9.1	13	11	40	25	9.5
23	15	47	47	73	31	14	19	13	24	19	11	15
24	21	27	31	30	17	24	22	23	11	16	22	12

Table 2.3-10— Maximum Daily Streamflow for St. Leonard Creek at St. Leonard, MD (USGS Station No. 01594800, St. Leonard Creek near St. Leonard, MD) (December 2, 1956 through September 30, 2003

(Page 2 of 2)

	Discharge (cubic feet per second)											
Day of Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
25	40	26	27	24	30	16	12	140	8.8	8.3	26	16
26	20	22	29	22	45	18	9.8	32	7.2	8.3	36	26
27	13	46	33	24	35	28	20	18	23	7.9	11	16
28	12	41	26	40	44	11	11	16	11	39	9.8	28
29	13	11	22	26	53	10	18	14	17	47	15	33
30	14		27	27	21	9.1	124	12	19	14	20	36
31	14		33		37		16	12		13		12

Table 2.3-11— Minimum Daily Streamflow for St. Leonard Creek at St. Leonard, MD (USGS Station No. 01594800, St. Leonard Creek near St. Leonard, MD) (December 2, 1956 through September 30, 2003)
(Page 1 of 2)

	Discharge (cubic feet per second)											
Day of Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.1	3.5	2.1	4.4	3.5	1.4	0.18	0	0	0.2	1.1	2.4
2	1	3.7	2.8	3.9	3.3	1.1	0.13	0	0	0.15	1.2	2.4
3	1.4	3.4	3.7	3.7	3.5	0.64	0.13	0	0	0.1	1.2	2.6
4	2.1	3.4	4.4	3.7	3.5	0.64	0.13	0	0	0	1.3	2.7
5	2.5	2.8	4	3.7	3.3	0.76	0.1	0	0	0	2	2.8
6	4.2	3.2	3.9	3.5	3.3	1.4	0.08	0.06	0	0	2.1	2.8
7	3.8	3	3.9	3.5	3.1	1.6	0	0	0	0	2.1	2.8
8	3.6	3.5	3.9	3.3	2.9	1.8	0	0	0	0	2.1	2.9
9	3.4	3.6	3.8	3.3	2.9	1	0	0	0	0	2.1	2.9
10	3.7	3.4	4.1	3.3	2.9	1	0	0	0	0.1	2.1	2.8
11	3.3	3.2	4	3.3	2.7	0.64	0	0	0.01	0.2	2.1	2.9
12	3	3	3.9	3.6	3.1	0.64	0	0	0	1	2.1	2.9
13	3.3	2.8	4.4	3.6	3.1	0.9	0	0	0	1.1	2.1	2.6
14	3.3	2.8	4.2	3.4	2.7	1	0.13	0	0	0.5	2.1	3
15	3.2	3	4.1	3.4	2.7	1.1	0.13	0	0.13	0.39	2.3	2.6
16	3	3.2	3.9	2.6	2.9	1	0.06	0	0.4	1.5	2	2.1
17	2.9	3.8	4	2.3	2.6	0.9	0.06	0	0.2	1.5	2.1	2.3
18	2.6	3.6	4.1	1.9	2.3	0.76	0.01	0	0.2	1.5	2.1	3.1
19	2.8	3.5	4.1	2.4	2.6	0.52	0	0	0.23	1.5	2.3	2.7
20	3.1	2.9	3.9	3.4	3.1	0.64	0	0	0.13	0.62	2	2.6
21	3	2.9	3.9	2.9	2.7	0.77	0	0	0.13	0.48	2	2.1
22	3.5	2.8	3.9	4.1	2.7	0.65	0	0.01	0.06	0.35	2	1.9
23	3.5	2.3	3.9	3.7	2.4	0.46	0	0.06	0.06	0.35	2.4	2.1
24	3.1	2.2	4.1	3.7	3.2	0.46	0.13	0	0.01	0.35	2.4	3.3

Table 2.3-11— Minimum Daily Streamflow for St. Leonard Creek at St. Leonard, MD (USGS Station No. 01594800, St. Leonard Creek near St. Leonard, MD) (December 2, 1956 through September 30, 2003)
(Page 2 of 2)

	Discharge (cubic feet per second)											
Day of Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
25	3.4	2.3	3.9	3.3	2.8	0.2	0.01	0	0	0.62	2.6	3.5
26	3.7	2.5	4	3.9	2.7	0.2	0.1	0	0.34	1.8	2.6	2.9
27	3.8	2.9	4.4	4.4	2.5	0.23	0.2	0	0.4	1.7	2.4	2.3
28	3.6	1.8	3.9	4.6	2.1	0.2	0.3	0	0.4	1.6	2.3	1.9
29	3.5	5	3.9	3.9	2.1	0.67	0.23	0	0.52	1.3	2.3	2.1
30	3		3.9	3.7	1.8	0.47	0.01	0	0.32	1.2	1.7	1.5
31	2.5		4.5		1.7		0	0		1.2		1.2

Table 2.3-12— Details of Brighton and Rocky Gorge Dams

Information	Brighton Dam	Rocky Gorge Dam
Record Number	26707	26722
Dam Name	Brighton Dam	Rocky Gorge Dam
Other Dam Name	Tridelphia Lake Dam	Duckett Dam
State ID	5	20
NID ID	MD00005	MD00020
Longitude (decimal degree)	-77.005	-76.8767
Latitude (decimal degree)	39.1933	39.1167
County	Montgomery	Prince Georges
River	Patuxent River	Patuxent River
Owner Name	Washington Suburban Sanitary Commission	Washington Suburban Sanitary Commission
Year Completed	1943	1953
Year Modified	1999	1986
Dam Length (ft, top of the dam)	995	840
Dam Height (to the nearest ft)	80	134
Maximum Discharge (cfs)	83,000	65,200
Maximum Storage (ac-ft)	27,000	22,000
Normal Storage (ac-ft)	19,000	17,000
Surface Area (acres)	800	773
Drainage Area (mi^2)	77.3	132.0
Down Stream Hazard Potential	High	High
State Regulated Agency	MD Water Management Administration	MD Water Management Administration
Spillway Type	Controlled	Controlled
Spillway Width (to the nearest ft)	260	190

Table 2.3-13— Estimated Monthly Mean Inflow to the Chesapeake Bay (Based on Three Reference Stations) (1951-2000)
(Page 1 of 2)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1951	119,400	175,400	148,100	179,100	66,000	87,900	42,100	22,700	16,300	13,600	41,600	82,200	82,100
1952	173,500	123,300	182,100	180,100	142,100	47,000	33,500	30,400	38,800	16,800	68,300	97,100	94,400
1953	136,000	111,100	170,700	129,000	123,600	74,400	23,700	17,000	12,700	10,800	17,900	48,000	72,800
1954	39,700	71,800	135,100	95,200	99,900	45,400	19,100	14,000	13,600	41,600	51,100	78,300	58,700
1955	83,300	79,400	208,800	90,300	46,300	44,900	19,100	93,400	26,800	79,700	74,000	33,300	73,400
1956	27,400	107,900	161,400	161,500	82,800	45,000	49,900	39,500	30,700	36,400	69,400	101,900	76,000
1957	76,400	109,900	114,800	183,800	62,700	37,500	19,500	11,900	17,900	19,700	30,600	93,000	64,400
1958	89,100	72,900	160,900	238,900	154,400	51,500	43,000	40,400	24,900	25,400	37,400	37,500	81,400
1959	72,800	71,900	96,700	138,200	69,800	46,100	20,600	18,900	19,100	55,400	70,500	117,700	66,400
1960	95,500	118,100	84,000	230,700	145,700	92,900	32,100	26,100	42,600	22,100	24,300	20,100	77,400
1961	30,000	144,300	181,400	202,900	111,000	55,700	31,700	29,200	23,200	38,000	31,500	63,800	78,000
1962	78,500	71,800	207,200	195,300	61,000	38,800	21,900	16,800	13,700	31,500	60,500	41,700	69,800
1963	65,800	43,200	228,600	86,400	55,700	40,600	17,200	12,200	10,600	8,600	18,800	38,200	52,400
1964	103,400	80,600	222,700	127,300	88,700	23,600	16,300	11,400	7,800	13,000	14,000	33,200	61,900
1965	65,200	110,300	118,000	112,900	59,300	23,900	13,000	12,000	11,700	21,300	20,500	25,500	49,000
1966	29,600	110,200	130,100	66,500	105,800	30,700	10,500	9,300	23,600	35,000	30,500	61,400	53,300
1967	61,000	67,000	205,100	101,300	120,900	38,700	30,600	47,800	27,500	51,000	67,000	104,600	77,200
1968	62,800	86,600	129,100	64,800	81,200	86,000	31,500	16,900	23,700	19,700	67,900	52,600	60,100
1969	46,900	58,800	68,800	93,100	57,300	39,100	36,200	80,700	23,800	17,300	44,300	62,200	52,300
1970	66,200	132,000	95,800	218,500	73,500	38,200	39,100	24,400	17,300	29,000	111,800	80,200	76,500
1971	74,100	163,000	167,400	73,300	104,500	68,000	22,900	32,400	32,400	54,500	47,300	108,800	78,600
1972	82,300	107,700	183,500	159,600	145,300	324,600	117,100	42,400	19,900	58,600	131,800	209,000	131,700
1973	108,400	144,800	138,500	174,700	127,000	76,400	44,900	34,500	30,100	34,600	52,300	176,000	94,900
1974	153,900	88,600	109,000	156,000	81,000	56,500	40,100	27,400	46,800	25,200	38,500	99,400	76,800
1975	97,600	155,600	185,000	96,700	121,800	77,700	56,100	30,200	155,100	118,000	77,400	66,000	102,700
1976	118,200	155,400	104,400	85,900	59,400	74,400	41,900	33,600	22,900	173,900	73,400	68,300	84,100
1977	31,100	34,500	195,600	152,600	49,830	23,800	29,700	22,600	44,600	97,400	124,100	155,100	80,400

Table 2.3-13— Estimated Monthly Mean Inflow to the Chesapeake Bay (Based on Three Reference Stations) (1951-2000)
(Page 2 of 2)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1978	171,800	75,800	231,600	158,500	182,700	53,500	39,900	46,100	25,300	22,500	25,600	61,900	91,700
1979	188,700	131,200	253,400	122,200	94,600	81,500	32,600	34,300	98,800	132,600	107,800	87,200	113,700
1980	88,800	42,900	151,000	205,200	104,800	40,800	28,800	21,000	15,000	14,000	24,200	31,100	64,000
1981	17,800	151,900	58,600	69,600	78,900	68,900	36,100	20,600	23,200	31,100	50,000	44,200	53,500
1982	60,900	134,900	169,900	123,000	54,100	147,200	42,400	25,900	15,700	17,300	25,700	58,500	72,400
1983	39,500	100,800	128,500	264,000	149,000	64,400	33,300	16,900	13,000	26,800	55,100	167,000	88,000
1984	56,000	216,300	151,000	251,000	134,000	76,000	62,700	73,600	27,900	22,800	33,200	92,300	99,100
1985	62,100	97,000	95,100	86,000	58,800	40,800	25,700	36,600	21,100	28,700	164,000	104,300	68,000
1986	53,700	125,000	169,000	95,800	52,400	45,900	29,700	31,900	17,400	25,900	72,400	114,200	69,100
1987	68,200	69,500	121,100	226,000	76,500	38,600	36,200	15,400	73,600	33,100	47,600	82,100	73,800
1988	66,500	93,200	78,300	70,300	139,000	36,400	21,000	17,600	25,200	16,900	47,200	31,200	53,400
1989	49,100	54,100	97,300	104,900	223,900	117,800	87,000	39,800	47,700	76,600	71,800	37,500	84,200
1990	94,100	153,600	78,600	104,300	113,500	67,200	50,500	38,100	30,300	135,400	80,400	134,800	89,800
1991	167,200	94,600	156,500	110,400	58,800	24,600	24,400	21,700	13,200	14,700	21,900	51,900	63,300
1992	58,000	54,600	124,800	134,600	77,600	68,400	43,300	37,900	38,200	35,700	92,600	103,600	72,400
1993	125,300	58,500	230,700	380,700	89,000	35,800	20,900	18,000	20,400	24,000	78,600	125,200	100,600
1994	69,500	152,400	298,000	230,500	87,500	45,300	43,800	83,900	37,400	28,500	41,300	83,300	99,800
1995	128,600	55,000	88,100	58,400	61,700	77,000	60,500	20,700	13,200	63,500	80,100	69,800	64,900
1996	244,600	142,200	152,200	139,000	155,900	86,300	54,100	57,600	142,000	97,900	130,000	219,900	135,200
1997	77,500	109,700	160,300	80,500	61,300	62,200	25,000	19,000	20,300	18,600	81,400	55,800	64,000
1998	199,700	235,900	223,100	178,700	152,900	57,300	41,600	20,900	14,100	17,500	14,400	16,400	97,700
1999	80,200	70,500	108,000	98,800	45,000	17,400	13,100	13,600	47,300	48,700	33,200	66,400	53,500
2000	44,500	85,200	141,500	149,000	83,300	70,000	34,000	34,200					

Table 2.3-14— Estimated Tidal Inflow Rate at the Chesapeake Bay Entrance for Spring Tides and Tidal Excursion Length Near the CCNPP Unit 3 Site

Parameter	Assumptions	Forulation Used	Results	Comments
Tidal inflow rate during spring tide over flood or ebb tidal periods (one-half period)	Vm = Maximum cross-section average velocity over a tidal cycle at the mouth = 1.7 knots	Step 1: Calculate tidal prism, P P = (Ts. Vm.Aav)/$_{TT}$	8.691 x 10^{10} ft3	The tidal flow rate is assumed as the average flow rate over one-half tide period during spring tides.
	Ts = semi-diurnal tide period = 12.42 hrs	Step 2: Calculate corresponding tidal flow rate, qm, over Ts/2 qm = P/(Ts/2)	3.89 x 10^6 cfs Use 3,900,000 cfs	
	Aav = average area over channel length, assumed the same as the area of Chesapeake Bay entrance. = 2.214 x 106 ft^2	Step 1: Calculate wave celerity (Cs), long-wave approximation CS= (g.hav)0.5	26 ft.s-1	It is assumed that the average Chesapeake Bay water depth near the CCNPP site is the same as the average depth of the entire Chesapeake Bay. However, the average water depth near the CCNPP site could be higher, in which case the particle displacement range would be smaller. The higher range is considered as conservative.
Tidal excursion length near the CCNPP site	Hs = means tidal range at Cove Point = 1.04 ft	Step 2 Calculate tidel wave length, Ls Ls = Cs.Ts	220.12 mi	
	Hav = cross-section average water depth near the site, assumed the same as the average bay water depth = 21 ft	Step 3: Calculate horizontal particle displacement amplitude, a1, for shallow water waves a1 = Hs/2. Ls(2 $_{TT}$.hav)	0.87 mi	
	q = acceleration due to gravity = 32.17 ft.s-2	Step 4: Calculate horizontal particle displacement length (As) As = 2.a1	1.74 mi Use 1.75 mi	

Table 2.3-15— CCNPP Unit 3 Observation Wells Construction Details

(Page 1 of 2)

Well ID	Northing[1] (ft)	Easting[1] (ft)	Ground Surface Elevation (ft)	Well Pad Elevation (ft)	Top of Casing[2] Elevation (ft)	Boring Depth (ft)	Well Depth (ft)	Screen Diameter & Slot Size (in)	Screen Interval Depth		Screen Interval Elevation		Filterpack Interval Depth		CCNPP Hydrostratigraphic Unit
									Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft)	
OW-301	217048.02	960814.47	94.51	94.78	96.27	80.0	77.0	2 / 0.010	65.0	75.0	29.5	19.5	61.0	80.0	Upper Chesapeake Unit
OW-304	217158.10	960920.80	68.78	69.28	71.01	72.8	72.0	2 / 0.010	60.0	70.0	8.78	-1.22	57.5	72.8	Upper Chesapeake Unit
OW-308	216928.00	960750.00	111.45	111.95	113.62	103.0	102.0	2 / 0.010	90.0	100.0	21.45	11.45	88.0	103.0	Upper Chesapeake Unit
OW-313A	217367.31	960705.30	51.03	51.31	53.20	57.5	52.5	2 / 0.010	40.0	50.0	11.0	1.0	35.0	57.5	Upper Chesapeake Unit
OW-313B	217372.35	960713.67	50.73	51.16	53.54	110.0	107.5	2 / 0.010	95.0	105.0	-44.3	-54.3	91.0	110.0	Lower Chesapeake Unit
OW-319A	216962.56	961116.12	103.13	103.31	104.91	35.0	32.0	2 / 0.010	20.0	30.0	83.1	73.1	15.0	35.0	Surficial Aquifer
OW-319B	216957.32	961125.02	103.53	103.85	105.35	85.0	82.0	2 / 0.010	70.0	80.0	33.5	23.5	65.0	85.0	Upper Chesapeake Unit
OW-323	217034.46	960057.07	106.96	107.55	109.69	43.5	42.0	2 / 0.010	30.0	40.0	77.0	67.0	26.0	43.5	Surficial Aquifer
OW-328	216828.86	960493.21	76.29	76.55	77.85	72.0	72.0	2 / 0.010	60.0	70.0	16.3	6.3	56.5	72.0	Upper Chesapeake Unit
OW-336	216643.18	960746.61	97.11	97.50	99.07	74.0	72.0	2 / 0.010	60.0	70.0	37.1	27.1	53.0	74.0	Upper Chesapeake Unit
OW-401	216348.86	961530.99	71.38	71.91	73.49	77.5	75.3	2 / 0.010	63.0	73.0	8.4	-1.6	57.0	77.5	Upper Chesapeake Unit
OW-413A	216703.14	961418.81	123.15	123.51	125.04	50.0	47.0	2 / 0.010	35.0	45.0	88.2	78.2	30.0	50.0	Surficial Aquifer
OW-413B	216694.88	961413.25	122.90	123.25	124.85	125.0	122.0	2 / 0.010	110.0	120.0	12.9	2.9	105.0	125.0	Upper Chesapeake Unit
OW-418A	216340.41	961966.46	43.66	44.31	45.83	40.0	37.0	2 / 0.010	25.0	35.0	18.7	8.7	21.0	40.0	Upper Chesapeake Unit
OW-418B	216340.25	961976.71	43.67	44.13	45.77	92.0	87.0	2 / 0.010	75.0	85.0	-31.3	-41.3	72.0	92.0	Lower Chesapeake Unit
OW-423	216339.99	960882.24	111.12	111.67	113.16	43.0	40.3	2 / 0.010	28.0	38.0	83.1	73.1	23.0	43.0	Surficial Aquifer
OW-428	216105.21	961212.38	113.92	114.32	115.92	50.0	47.0	2 / 0.010	35.0	45.0	78.9	68.9	30.0	50.0	Surficial Aquifer
OW-436	215922.47	961446.87	108.13	108.53	110.39	50.0	41.0	2 / 0.010	29.0	39.0	79.1	69.1	24.0	50.0	Surficial Aquifer
OW-703A	218171.23	960967.72	44.02	44.44	45.65	49.0	47.0	2 / 0.010	35.0	45.0	9.0	-1.0	32.5	49.0	Upper Chesapeake Unit
OW-703B	218171.67	960958.91	45.57	45.97	47.53	80.0	80.0	2 / 0.010	68.0	78.0	-22.4	-32.4	65.0	80.0	Lower Chesapeake Unit
OW-705	217566.62	960917.18	47.71	47.77	50.22	52.0	52.0	2 / 0.010	40.0	50.0	7.7	-2.3	35.0	52.0	Upper Chesapeake Unit
OW-708A	217586.23	961803.52	37.44	37.82	39.61	34.0	34.0	2 / 0.010	22.0	32.0	15.4	5.4	19.0	34.0	Upper Chesapeake Unit
OW-711	216748.48	961741.61	52.92	53.26	55.31	50.0	47.0	2 / 0.010	35.0	45.0	17.9	7.9	30.0	50.0	Upper Chesapeake Unit
OW-714	215705.73	962034.37	116.02	116.32	117.98	50.0	50.0	2 / 0.010	38.0	48.0	78.0	68.0	36.0	50.0	Surficial Aquifer
OW-718	214133.58	961924.87	118.53	118.96	120.41	43.0	42.0	2 / 0.010	30.0	40.0	88.5	78.5	28.0	43.0	Surficial Aquifer
OW-725	214649.30	963212.73	58.04	58.38	59.94	60.0	60.0	2 / 0.010	48.0	58.0	10.0	0.0	46.0	60.0	Upper Chesapeake Unit
OW-729	214872.58	962445.93	118.88	119.44	121.11	42.0	42.0	2 / 0.010	30.0	40.0	88.9	78.9	28.0	42.0	Surficial Aquifer
OW-735	214805.48	961021.83	91.20	91.81	93.44	72.0	72.0	2 / 0.010	60.0	70.0	31.2	21.2	58.0	72.0	Upper Chesapeake Unit
OW-743	213320.62	961234.01	103.65	104.05	105.89	55.0	52.0	2 / 0.010	40.0	50.0	63.7	53.7	36.0	55.0	Surficial Aquifer
OW-744	216405.37	960089.41	97.50	97.96	99.81	50.0	50.0	2 / 0.010	38.0	48.0	59.5	49.5	36.0	50.0	Chesapeake Unit
OW-752A	215482.18	960250.12	95.30	95.73	97.00	37.0	37.0	2 / 0.010	25.0	35.0	70.3	60.3	19.0	37.0	Surficial Aquifer
OW-752B	215489.21	960257.57	95.79	96.09	97.41	97.0	97.0	2 / 0.010	85.0	95.0	10.8	0.8	83.0	97.0	Upper Chesapeake Unit
OW-754	217369.78	960290.37	67.00	67.21	68.85	44.0	44.0	2 / 0.010	32.0	42.0	35.0	25.0	30.0	44.0	Upper Chesapeake Unit

Table 2.3-15— CCNPP Unit 3 Observation Wells Construction Details

(Page 2 of 2)

Well ID	Northing[1] (ft)	Easting[1] (ft)	Ground Surface Elevation (ft)	Well Pad Elevation (ft)	Top of Casing[2] Elevation (ft)	Boring Depth (ft)	Well Depth (ft)	Screen Diameter & Slot Size (in)	Screen Interval Depth		Screen Interval Elevation		Filterpack Interval Depth		CCNPP Hydrostratigraphic Unit
									Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft)	
OW-756	215497.07	961212.39	106.56	107.07	108.77	42.0	42.0	2 / 0.010	30.0	40.0	76.6	66.6	28.0	42.0	Surficial Aquifer
OW-759A	214536.47	960055.02	97.78	98.05	99.69	35.0	32.0	2 / 0.010	20.0	30.0	77.8	67.8	17.0	35.0	Surficial Aquifer
OW-759B	214526.25	960056.32	98.35	98.72	100.14	90.0	87.0	2 / 0.010	75.0	85.0	23.4	13.4	70.0	90.0	Upper Chesapeake Unit
OW-765A	216424.51	959701.22	97.37	97.92	99.60	29.0	29.0	2 / 0.010	17.0	27.0	80.4	70.4	15.0	29.0	Surficial Aquifer
OW-765B	216420.42	959693.64	96.82	97.19	98.47	102.0	94.0	2 / 0.010	82.0	92.0	14.8	4.8	80.0	102.0	Upper Chesapeake Unit
OW-766	216932.89	959791.50	108.89	109.32	110.72	50.0	32.0	2 / 0.010	20.0	30.0	88.9	78.9	15.0	37.0	Surficial Aquifer
OW-768A	217106.06	962238.98	48.48	48.96	49.84	42.0	42.0	2 / 0.010	30.0	40.0	18.5	8.5	28.0	42.0	Upper Chesapeake Unit
OW-769	216589.75	962559.47	54.23	54.39	56.43	42.0	42.0	2 / 0.010	31.8	41.8	22.4	12.4	18.0	42.0	Upper Chesapeake Unit
OW-770	215466.60	962826.95	121.59	121.79	123.08	42.0	42.0	2 / 0.010	30.0	40.0	91.6	81.6	28.0	42.0	Surficial Aquifer
OW-774A	219187.30	961030.50	9.7	10.20	12.20	23.0	22.0	2 / 0.010	10.0	20.0	-0.3	-10.3	8.0	23.0	Upper Chesapeake Unit
OW-774B	219176.70	961020.20	10.1	10.50	12.55	52.8	52.0	2 /0.010	40.0	50.0	-29.9	-39.9	37.5	52.8	Lower Chesapeake Unit
OW-778	219100.60	960728.60	113.3	113.70	115.45	52.0	52.0	2 / 0.010	40.0	50.0	73.3	63.3	38.0	52.0	Surficial Aquifer
OW-779	218958.70	960587.30	100.9	101.30	102.94	52.5	52.0	2 / 0.010	40.0	50.0	60.9	50.9	37.9	52.5	Chesapeake Unit
OW-781	219421.30	960764.40	10.3	10.80	12.87	53.0	52.0	2 / 0.010	40.0	50.0	-29.7	-39.7	37.0	53.0	Lower Chesapeake Unit

Notes:

(1) Maryland State Plane (NAD 1927). The Maryland State Plane 1927 coordinate system is based on North American Datum of 1927 (NAD27). NAD27 is a surface (or plane) to which horizontal positions in the U.S., Canada and Mexico is surveyed and referenced.

(2) Elevation is top of PVC Well Casing. Reference Point for Groundwater Level Monitoring

Table 2.3-16— CCNPP Unit 3 Observation Well Water Level Elevations

(Page 1 of 8)

Well ID	Ground Surface Elevation	Water Level Monitoring Reference Point Elevation	Depth to Water										Water Level Elevation									
			July 2006	August 2006	September 2006	October 2006	November 2006	December 2006	January 2007	February 2007	March 2007	April 2007	July 2006	August 2006	September 2006	October 2006	November 2006	December 2006	January 2007	February 2007	March 2007	April 2007
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
2006 COLA Observation Wells																						
OW-301	94.51	96.27	58.85	59.45	59.37	58.34	58.00	58.04	57.33	57.00	56.78	56.46	37.42	36.82	36.90	37.93	38.27	38.23	38.94	39.27	39.49	39.81
OW-313A	51.03	53.20	19.80	20.40	20.08	19.57	18.80	18.90	17.93	18.25	17.12	16.77	33.40	32.80	33.12	33.63	34.40	34.30	35.27	34.95	36.08	36.43
OW-313B	50.73	53.54	23.05	23.65	23.47	23.17	22.76	22.52	21.89	21.80	21.44	20.97	30.49	29.89	30.07	30.37	30.78	31.02	31.65	31.74	32.10	32.57
OW-319A	103.13	104.91	26.48	26.58	26.25	26.08	26.28	26.22	26.25	26.44	26.25	26.18	78.43	78.33	78.66	78.83	78.63	78.69	78.66	78.47	78.66	78.73
OW-319B	103.53	105.35	67.49	67.97	67.95	67.53	66.57	66.49	65.74	65.52	65.27	64.84	37.86	37.38	37.40	37.82	38.78	38.86	39.61	39.83	40.08	40.51
OW-323	106.96	109.69	27.80	28.22	28.37	28.13	27.96	27.26	26.88	26.45	26.52	25.88	81.89	81.47	81.32	81.56	81.73	82.43	82.81	83.24	83.17	83.81
OW-328	76.29	77.85	40.77	41.40	41.35	40.68	40.33	40.13	39.63	39.42	39.32	38.72	37.08	36.45	36.50	37.17	37.52	37.72	38.22	38.43	38.53	39.13
OW-336	97.11	99.07	60.99	61.36	61.52	60.45	60.42	60.19	59.65	59.20	59.25	58.76	38.08	37.71	37.55	38.62	38.65	38.88	39.42	39.87	39.82	40.31
OW-401	71.38	73.49	34.13	34.95	34.73	33.72	32.95	33.37	32.33	32.45	31.76	31.38	39.36	38.54	38.76	39.77	40.54	40.12	41.16	41.04	41.73	42.11
OW-413A[1]	123.15	125.04	45.87	45.85	45.87	45.87	45.87	45.86	45.83	45.77	45.76	45.75	79.17	79.19	79.17	79.17	79.17	79.18	79.21	79.27	79.28	79.29
OW-413B	122.90	124.85	86.60	87.30	87.13	86.46	85.14	85.56	84.40	84.75	83.57	83.25	38.25	37.55	37.72	38.39	39.71	39.29	40.45	40.10	41.28	41.60
OW-418A	43.66	45.83	8.22	9.44	8.60	7.97	6.45	7.60	6.40	6.91	5.68	5.57	37.61	36.39	37.23	37.86	39.38	38.23	39.43	38.92	40.15	40.26
OW-418B	43.67	45.77	12.52	13.36	12.90	12.47	11.67	12.85	11.03	11.27	10.74	10.42	33.25	32.41	32.87	33.30	34.10	32.92	34.74	34.50	35.03	35.35
OW-423	111.12	113.16	29.77	30.04	30.03	29.93	29.78	29.54	29.02	28.76	28.38	27.62	83.39	83.12	83.13	83.23	83.38	83.62	84.14	84.40	84.78	85.54
OW-428	113.92	115.92	37.82	37.92	37.98	38.07	38.01	37.89	37.69	37.25	37.17	36.47	78.10	78.00	77.94	77.85	77.91	78.03	78.23	78.67	78.75	79.45
OW-436	108.13	110.39	31.68	32.06	31.85	31.55	31.08	31.40	30.60	31.05	30.28	30.19	78.71	78.33	78.54	78.84	79.31	78.99	79.79	79.34	80.11	80.20
OW-703A	44.02	45.65	27.33	27.84	28.05	27.93	27.60	27.12	25.16	25.60	22.15	21.95	18.32	17.81	17.60	17.72	18.05	18.53	20.49	20.05	23.50	23.70
OW-703B	45.57	47.53	29.34	29.85	29.95	29.73	29.40	29.10	27.45	27.72	24.74	24.47	18.19	17.68	17.58	17.80	18.13	18.43	20.08	19.81	22.79	23.06
OW-705	47.71	50.22	20.28	21.10	20.67	20.10	19.02	19.40	17.82	18.60	16.57	16.35	29.94	29.12	29.55	30.12	31.20	30.82	32.40	31.62	33.65	33.87
OW-708A	37.44	39.61	13.39	15.01	13.85	12.78	10.46	12.58	8.96	12.20	6.71	6.77	26.22	24.60	25.76	26.83	29.15	27.03	30.65	27.41	32.90	32.84
OW-711	52.92	55.31	19.26	20.64	19.50	18.43	16.14	18.33	15.94	17.70	14.33	14.36	36.05	34.67	35.81	36.88	39.17	36.98	39.37	37.61	40.98	40.95
OW-714	116.02	117.98	45.93	46.28	46.33	46.36	46.19	45.87	45.60	45.42	45.21	44.78	72.05	71.70	71.65	71.62	71.79	72.11	72.38	72.56	72.77	73.20
OW-718	118.53	120.41	40.47	40.56	40.80	41.07	41.29	41.37	41.18	40.40	40.22	39.28	79.94	79.85	79.61	79.34	79.12	79.04	79.23	80.01	80.19	81.13
OW-725	58.04	59.94	32.80	33.87	33.92	33.56	32.54	32.30	30.77	30.77	29.77	28.95	27.14	26.07	26.02	26.38	27.40	27.64	29.17	29.17	30.17	30.99

Table 2.3-16— CCNPP Unit 3 Observation Well Water Level Elevations
(Page 2 of 8)

Well ID	Ground Surface Elevation	Water Level Monitoring Reference Point Elevation	Depth to Water										Water Level Elevation									
			July 2006	August 2006	September 2006	October 2006	November 2006	December 2006	January 2007	February 2007	March 2007	April 2007	July 2006	August 2006	September 2006	October 2006	November 2006	December 2006	January 2007	February 2007	March 2007	April 2007
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
OW-729[1]	118.88	121.11	44.08	41.99	41.96	41.96	41.92	41.99	41.98	41.98	41.98	41.93	77.03	79.12	79.15	79.15	79.19	79.12	79.13	79.13	79.13	79.18
OW-735	91.20	93.44	54.18	55.17	55.14	54.57	53.31	53.24	52.36	52.13	52.16	51.40	39.26	38.27	38.30	38.87	40.13	40.20	41.08	41.31	41.28	42.04
OW-743	103.65	105.89	37.22	37.77	37.52	37.35	37.22	36.99	36.61	36.03	35.80	34.78	68.67	68.12	68.37	68.54	68.67	68.90	69.28	69.86	70.09	71.11
OW-744	97.50	99.81	32.97	33.52	33.15	32.96	32.47	32.52	32.06	31.97	31.73	31.33	66.84	66.29	66.66	66.85	67.34	67.29	67.75	67.84	68.08	68.48
OW-752A	95.30	97.00	24.76	25.18	25.35	25.36	25.23	24.08	23.34	22.77	22.68	21.57	72.24	71.82	71.65	71.64	71.77	72.92	73.66	74.23	74.32	75.43
OW-752B	95.79	97.41	59.55	60.25	60.05	59.75	59.38	59.16	58.77	58.60	58.58	58.01	37.86	37.16	37.36	37.66	38.03	38.25	38.64	38.81	38.83	39.40
OW-754	67.00	68.85	31.32	32.05	31.80	31.05	30.73	30.93	30.24	30.12	29.67	29.32	37.53	36.80	37.05	37.80	38.12	37.92	38.61	38.73	39.18	39.53
OW-756	106.56	108.77	29.98	30.17	30.42	30.55	30.59	30.46	30.04[2]	29.42	29.18	27.62	78.79	78.60	78.35	78.22	78.18	78.31	78.73	79.35	79.59	81.15
OW-759A	97.78	99.69	26.88	27.53	28.00	28.12	28.32	27.41	26.77	25.50	24.41	23.65	72.81	72.16	71.69	71.57	71.37	72.28	72.92	74.19	75.28	76.04
OW-759B	98.35	100.14	63.09	63.80	63.56	63.31	63.11	62.87	62.54	62.32	62.30	61.85	37.05	36.34	36.58	36.83	37.03	37.27	37.60	37.82	37.84	38.29
OW-765A	97.37	99.60	21.72	22.02	21.87	21.70	21.20	20.10	18.95	19.25	18.38	17.87	77.88	77.58	77.73	77.90	78.40	79.50	80.65	80.35	81.22	81.73
OW-765B	96.82	98.47	60.22	60.72	60.55	60.40	59.92	59.77	59.73	59.45	59.37	58.96	38.25	37.75	37.92	38.07	38.55	38.70	38.74	39.02	39.10	39.51
OW-766	108.89	110.72	28.88	29.36	29.42	29.20	29.20	28.76	28.11	27.60	27.30	26.77	81.84	81.36	81.30	81.52	81.52	81.96	82.61	83.12	83.42	83.95
OW-768A	48.48	49.84	24.05	24.88	24.04	23.67	23.12	23.65	23.10	23.26	22.53	22.62	25.79	24.96	25.80	26.17	26.72	26.19	26.74	26.58	27.31	27.22
OW-769	54.23	56.43	26.50	27.96	27.37	26.74	24.13	25.74	23.48	24.43	20.55	20.67	29.93	28.47	29.06	29.69	32.30	30.69	32.95	32.00	35.88	35.76
OW-770[1]	121.59	123.08	dry	42.10	42.09	42.08	42.09	42.11	42.10	42.10	42.10	42.10	dry	80.98	80.99	81.00	80.99	80.97	80.98	80.98	80.98	80.98
2008 COLA Supplemental Investigation Observation Wells																						
OW-304	68.78	71.01																				
OW-308	111.45	113.62																				
OW-774A	9.7	12.20																				
OW-774B	10.1	12.55																				
OW-778[1]	113.3	115.45																				

Table 2.3-16— CCNPP Unit 3 Observation Well Water Level Elevations

(Page 3 of 8)

Well ID	Ground Surface Elevation	Water Level Monitoring Reference Point Elevation	Depth to Water										Water Level Elevation									
			July 2006	August 2006	September 2006	October 2006	November 2006	December 2006	January 2007	February 2007	March 2007	April 2007	July 2006	August 2006	September 2006	October 2006	November 2006	December 2006	January 2007	February 2007	March 2007	April 2007
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
OW-779[1]	100.9	102.94																				
OW-781	10.3	12.87																				

Table 2.3-16— CCNPP Unit 3 Observation Well Water Level Elevations

(Page 4 of 8)

Well ID	Ground Surface Elevation	Water Level Monitoring Reference Point Elevation	Depth to Water										Water Level Elevation									
			May 2007	June 2007	September 2007	December 2007	April 2008	July 2008	September 2008	October 2008	November 2008	December 2008	May 2007	June 2007	September 2007	December 2007	April 2008	July 2008	September 2008	October 2008	November 2008	December 2008
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
2006 COLA Observation Wells																						
OW-301	94.51	96.27	57.32	58.67	59.92	60.75	59.62	59.58	60.57[3]	60.80			38.95	37.60	36.35	35.52	36.65	36.69	35.70	35.47		
OW-313A	51.03	53.20	18.23	19.56	21.05	21.52	20.32	23.80	21.51	21.71			34.97	33.64	32.15	31.68	32.88	29.40	31.69	31.49		
OW-313B	50.73	53.54	21.47	22.60	24.23	24.85	23.98	23.74	24.78	25.08			32.07	30.94	29.31	28.69	29.56	29.80	28.76	28.46		
OW-319A	103.13	104.91	26.26	26.57	26.95	27.25	26.20	26.28	26.68	26.08			78.65	78.34	77.96	77.66	78.71	78.63	78.23	78.83		
OW-319B	103.53	105.35	65.72	67.22	68.45	69.45	68.38	68.18	69.31	69.48			39.63	38.13	36.90	35.90	36.97	37.17	36.04	35.87		
OW-323	106.96	109.69	26.00	26.77	28.48	29.77	29.47	28.22	29.01	29.30			83.69	82.92	81.21	79.92	80.22	81.47	80.68	80.39		
OW-328	76.29	77.85	39.33	40.52	41.90	42.53	41.68	41.60	42.57	42.67			38.52	37.33	35.95	35.32	36.17	36.25	35.28	35.18		
OW-336	97.11	99.07	59.28	60.57	61.80	62.63	61.86	61.67	62.73	62.78			39.79	38.50	37.27	36.44	37.21	37.40	36.34	36.29		
OW-401	71.38	73.49	32.66	34.14	35.80	36.59	35.04	35.07	36.36	36.62			40.83	39.35	37.69	36.90	38.45	38.42	37.13	36.87		
OW-413 A[1]	123.15	125.04	45.68	45.72	45.82	45.93	45.97	45.87	45.90	45.92			79.36	79.32	79.22	79.11	79.07	79.17	79.14	79.12		
OW-413B	122.90	124.85	84.84	86.42	88.05	89.02	87.37	87.36	88.65	88.87			40.01	38.43	36.80	35.83	37.48	37.49	36.20	35.98		
OW-418A	43.66	45.83	7.32	8.65	10.67	10.62	8.38	8.95	10.70	11.17			38.51	37.18	35.16	35.21	37.45	36.88	35.13	34.66		
OW-418B	43.67	45.77	11.33	12.55	14.50	14.96	13.02	13.13	14.67	15.16			34.44	33.22	31.27	30.81	32.75	32.64	31.10	30.61		
OW-423	111.12	113.16	27.42	27.87	29.53	31.70	32.02	31.01	31.56	31.87			85.74	85.29	83.63	81.46	81.14	82.15	81.60	81.29		
OW-428	113.92	115.92	36.20	36.63	37.56	38.47	38.82	38.40	38.46	38.57			79.72	79.29	78.36	77.45	77.10	77.52	77.46	77.35		
OW-436	108.13	110.39	30.72	31.22	32.32	33.26	33.12	32.10	32.82	33.06			79.67	79.17	78.07	77.13	77.27	78.29	77.57	77.33		
OW-703A	44.02	45.65	25.68	24.08	28.42	28.83	28.17	28.14	29.15	29.54			19.97	21.57	17.23	16.82	17.48	17.51	16.50	16.11		
OW-703B	45.57	47.53	27.68	26.47	30.38	30.72	30.02	30.80	31.02	31.42			19.85	21.06	17.15	16.81	17.51	16.73	16.51	16.11		
OW-705	47.71	50.22	18.72	20.22	21.80	22.18	20.75	20.90	22.21	22.50			31.50	30.00	28.42	28.04	29.47	29.32	28.01	27.72		
OW-708A	37.44	39.61	11.70	14.50	16.26	17.36	13.46	13.18	15.67	16.28			27.91	25.11	23.35	22.25	26.15	26.43	23.94	23.33		
OW-711	52.92	55.31	18.18	19.85	21.88	19.50	19.42	20.03	14.67	22.37			37.13	35.46	33.43	35.81	35.89	35.28	40.64	32.94		
OW-714	116.02	117.98	44.93	43.25	46.05	47.57	47.32	46.48	48.11	48.53			73.05	74.73	71.93	70.41	70.66	71.50	69.87	69.45		
OW-718	118.53	120.41	38.72	38.93	39.85	41.50	41.70	43.90[4]	41.78	41.82			81.69	81.48	80.56	78.91	78.71	76.51	78.63	78.59		
OW-725	58.04	59.94	30.47	34.14	34.82	35.72	33.83	34.32	35.87	36.27			29.47	25.80	25.12	24.22	26.11	25.62	24.07	23.67		

Table 2.3-16— CCNPP Unit 3 Observation Well Water Level Elevations

(Page 5 of 8)

Well ID	Ground Surface Elevation	Water Level Monitoring Reference Point Elevation	Depth to Water										Water Level Elevation									
			May 2007	June 2007	September 2007	December 2007	April 2008	July 2008	September 2008	October 2008	November 2008	December 2008	May 2007	June 2007	September 2007	December 2007	April 2008	July 2008	September 2008	October 2008	November 2008	December 2008
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
OW-729[1]	118.8 8	121.11	42.00	42.00	42.00	41.96	41.98	41.98	42.00	42.00			79.11	79.11	79.11	79.15	79.13	79.13	79.11	79.11		
OW-735	91.20	93.44	52.37	53.74	55.98	56.72	55.09	55.32	56.80	57.01			41.07	39.70	37.46	36.72	38.35	38.12	36.64	36.43		
OW-743	103.65	105.89	34.57	34.14	37.17	38.35	38.26	38.65	39.82	39.97			71.32	71.75	68.72	67.54	67.63	67.24	66.07	65.92		
OW-744	97.5	99.81	31.73	32.47	33.7	33.83	33.34	33.47	34.07	34.22			68.08	67.34	66.11	65.98	66.47	66.34	65.74	65.59		
OW-752A	95.3	97	22.24	23.91	25.78	27.22	26.73	24.73	25.71	26.11			74.76	73.09	71.22	69.78	70.27	72.27	71.29	70.89		
OW-752B	95.79	97.41	58.5	59.32	60.68	61.05	60.43	60.47	61.46	61.57			38.91	38.09	36.73	36.36	36.98	36.94	35.95	35.84		
OW-754	67	68.85	30.33	31.33	32.5	32.98	31.86	32	32.87[3]	33.12			38.52	37.52	36.35	35.87	36.99	36.85	35.98	35.73		
OW-756	106.56	108.77	27.05	27.77	29.75	31.44	31.75	31.34	31.6	31.77			81.72	81	79.02	77.33	77.02	77.43	77.17	77		
OW-759A	97.78	99.69	23.73	21.08	28.27	30.58	29.86	30.92	29.52	29.84			75.96	78.61	71.42	69.11	69.83	68.77	70.17	69.85		
OW-759B	98.35	100.14	62.17	61.57	64.15	64.48	64.00	64.17	65.06	65.23			37.97	38.57	35.99	35.66	36.14	35.97	35.08	34.91		
OW-765A	97.37	99.6	18.28	20.12	22.12	22.57	21.73	21.55	22.25	22.42			81.32	79.48	77.48	77.03	77.87	78.05	77.35	77.18		
OW-765B	96.82	98.47	59.24	59.92	61.07	61.58	61.24	61.27	61.88	62			39.23	38.55	37.4	36.89	37.23	37.2	36.59	36.47		
OW-766	108.89	110.72	26.85	27.52	29.47	31.02	30.82	29.8	30.54	30.79			83.87	83.2	81.25	79.7	79.9	80.92	80.18	79.93		
OW-768A	48.48	49.84	23.55	24.15	26.17	26.75	23.84	24.42	26.34	26.81			26.29	25.69	23.67	23.09	26	25.42	23.5	23.03		
OW-769	54.23	56.43	24.68	26.4	26.37	30.27	27.7	28.07	29.88	33.33			31.75	30.03	30.06	26.16	28.73	28.36	26.55	23.1		
OW-770[1]	121.59	123.08	42.1	42.1	42.1	42.12	42.08	42.09	42.1	42.1			80.98	80.98	80.98	80.96	81	80.99	80.98	80.98		
2008 COLA Supplemental Investigation Observation Wells																						
OW-304	68.78	71.01							37.28	37.43	37.33	36.78							33.73	33.58	33.68	34.23
OW-308	111.45	113.62							78.33	78.41	78.29	78							35.29	35.21	35.33	35.62
OW-774A	9.7	12.2							10.13	10.21	10.15	9.98							2.07	1.99	2.05	2.22
OW-774B	10.1	12.55							10.15	10	10.15	10.04							2.4	2.55	2.4	2.51
OW-778[1]	113.3	115.45							dry	dry	dry	dry							dry	dry	dry	dry
OW-779[1]	100.9	102.94							dry	dry	dry	dry							dry	dry	dry	dry
OW-781	10.3	12.87							10.36	10.58	10.44	10.45							2.51	2.29	2.43	2.42

Table 2.3-16— CCNPP Unit 3 Observation Well Water Level Elevations

(Page 6 of 8)

Well ID	Ground Surface Elevation	Water Level Monitoring Reference Point Elevation	Depth to Water										Water Level Elevation									
			January 2008	February 2008	March 2008	April 2008	May 2008	June 2008	July 2008	August 2008	Septmeber 2008	October 2008	January 2008	February 2008	March 2008	April 2008	May 2008	June 2008	July 2008	August 2008	Septmeber 2008	October 2008
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
2006 COLA Observation Wells																						
OW-301	94.51	96.27	59.93			58.65			59.72			60.02	36.34			37.62			36.55			36.25
OW-313A	51.03	53.20	20.60			19.02			20.33			20.87	32.60			34.18			32.87			32.33
OW-313B	50.73	53.54	24.32			23.26			23.47			24.33	29.22			30.28			30.07			29.21
OW-319A	103.13	104.91	26.28			26.38			26.44			26.53	78.63			78.53			78.47			78.38
OW-319B	103.53	105.35	68.72			67.46			68.33			68.78	36.63			37.89			37.02			36.57
OW-323	106.96	109.69	29.57			29.08			27.55			28.72	80.12			80.61			82.14			80.97
OW-328	76.29	77.85	42.07			40.84			41.59			42.19	35.78			37.01			36.26			35.66
OW-336	97.11	99.07	62.24			60.97			61.80			62.28	36.83			38.10			37.27			36.79
OW-401	71.38	73.49	35.67			33.71			35.16			35.47	37.82			39.78			38.33			38.02
OW-413 A[1]	123.1 5	125.04	45.98			45.97			45.77			45.88	79.06			79.07			79.27			79.16
OW-413B	122.90	124.85	87.80			86.07			87.51			87.72	37.05			38.78			37.34			37.13
OW-418A	43.66	45.83	9.00			6.74			9.46			8.66	36.83			39.09			36.37			37.17
OW-418B	43.67	45.77	13.47			12.09			13.28			13.62	32.30			33.68			32.49			32.15
OW-423	111.12	113.16	32.07			31.97			29.77			30.43	81.09			81.19			83.39			82.73
OW-428	113.92	115.92	38.85			38.86			37.68			38.13	77.07			77.06			78.24			77.79
OW-436	108.13	110.39	33.31			33.27			31.66			32.10	77.08			77.12			78.73			78.29
OW-703A	44.02	45.65	28.52			27.68			27.48			28.80	17.13			17.97			18.17			16.85
OW-703B	45.57	47.53	30.30			29.36			29.51			30.56	17.23			18.17			18.02			16.97
OW-705	47.71	50.22	21.02			18.95			20.81			21.42	29.20			31.27			29.41			28.80
OW-708A	37.44	39.61	12.81			9.28			13.64			12.57	26.80			30.33			25.97			27.04
OW-711	52.92	55.31	19.62			16.27			20.45			18.32	35.69			39.04			34.86			36.99
OW-714	116.02	117.98	48.19			47.73			46.04			47.17	69.79			70.25			71.94			70.81
OW-718	118.53	120.41	42.12			42.03			42.08			42.08	78.29			78.38			78.33			78.33
OW-725	58.04	59.94	34.80			32.66			33.97			35.23	25.14			27.28			25.97			24.71

Table 2.3-16— CCNPP Unit 3 Observation Well Water Level Elevations
(Page 7 of 8)

Well ID	Ground Surface Elevation	Water Level Monitoring Reference Point Elevation	Depth to Water										Water Level Elevation									
			January 2008	February 2008	March 2008	April 2008	May 2008	June 2008	July 2008	August 2008	Septmeber 2008	October 2008	January 2008	February 2008	March 2008	April 2008	May 2008	June 2008	July 2008	August 2008	Septmeber 2008	October 2008
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
OW-729[1]	118.8 8	121.11	42.00			42.00			42.00			42.00	79.11			79.11			79.11			79.11
OW-735	91.20	93.44	55.77			53.88			55.25			55.80	37.67			39.56			38.19			37.64
OW-743	103.65	105.89	39.58			39.01			37.66			38.48	66.31			66.88			68.23			67.41
OW-744	97.50	99.81	33.47			32.98			33.16			33.37	66.34			66.83			66.65			66.44
OW-752A	95.30	97.00	26.43			26.04			23.72			25.66	70.57			70.96			73.28			71.34
OW-752B	95.79	97.41	60.78			59.89			60.39			60.75	36.63			37.52			37.02			36.66
OW-754	67.00	68.85	32.12			31.10			32.02			32.13	36.73			37.75			36.83			36.72
OW-756	106.56	108.77	31.99			32.04			30.13			30.77	76.78			76.73			78.64			78.00
OW-759A	97.78	99.69	30.23			30.18			27.28			28.76	69.46			69.51			72.41			70.93
OW-759B	98.35	100.14	64.45			63.61			63.95			64.14	35.69			36.53			36.19			36.00
OW-765A	97.37	99.60	22.27			21.05			20.97			22.17	77.33			78.55			78.63			77.43
OW-765B	96.82	98.47	61.50			60.94			60.91			61.33	36.97			37.53			37.56			37.14
OW-766	108.89	110.72	30.70			30.32			28.90			29.86	80.02			80.40			81.82			80.86
OW-768A	48.48	49.84	24.10			23.37			24.91			24.42	25.74			26.47			24.93			25.42
OW-769	54.23	56.43	28.57			24.74			28.03			28.66	27.86			31.69			28.40			27.77
OW-770 [1]	121.59	123.08	42.10			42.10			42.11			42.11	80.98			80.98			80.97			80.97
2008 COLA Supplemental Investigation Observation Wells													`									
OW-304	68.78	71.01	36.3	36.64	36.4	34.58	33.87	ZX	36.07	36.66	36.85	36.07	34.71	34.37	34.61	36.43	37.14	36.83	34.94	34.35	34.16	34.94
OW-308	111.45	113.62	77.62	77.77	77.71	76.41	75.57	75.43	77.18	77.64	77.73	77.18	36	35.85	35.91	37.21	38.05	38.19	36.44	35.98	35.89	36.44
OW-774A	9.7	12.2	10.34	10.45	10.01	9.37	9.53	9.14	9.7	9.82	10.01	9.7	1.86	1.75	2.19	2.83	2.67	3.06	2.5	2.38	2.19	2.5
OW-774B	10.1	12.55	10.52	10.48	10.17	9.78	9.76	9.48	9.92	9.91	10.06	9.92	2.03	2.07	2.38	2.77	2.79	3.07	2.63	2.64	2.49	2.63
OW-778[1]	113.3	115.45	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry
OW-779[1]	100.9	102.94	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry
OW-781	10.3	12.87	10.72	10.95	10.62	10.31	10.17	9.94	10.12	10.21	10.36	10.12	2.15	1.92	2.25	2.56	2.7	2.93	2.75	2.66	2.51	2.75

Table 2.3-16— CCNPP Unit 3 Observation Well Water Level Elevations

(Page 8 of 8)

Well ID	Ground Surface Elevation	Water Level Monitoring Reference Point Elevation	Depth to Water										Water Level Elevation									
			January 2008	February 2008	March 2008	April 2008	May 2008	June 2008	July 2008	August 2008	Septmeber 2008	October 2008	January 2008	February 2008	March 2008	April 2008	May 2008	June 2008	July 2008	August 2008	Septmeber 2008	October 2008
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)

Notes:

1. Questionable water level readings due to proximity of depth of water to bottom of well screen and/or minimal water level fluctuation with time.
2. Reading from water level round was 41.90. Review suggested questionable reading. Retaken five days later and reading was 30.04 ft.
3. Readings from September 2008 water level for OW-301 (67.2 ft) and OW-754 (21.51 ft) questioned by reviewer. Originator provided corrected readings on 10/8/08.
4. Reported as dry in remarks (water level measurement form).

Table 2.3-17— CCNPP Unit 3 Observation Wells used in the Hydrogeologic Evaluation
(Page 1 of 6)

Well ID	Aquifer Unit	Ground Surface Elevation	Water Level Monitoring Reference Point Elevation	Depth to Water										Water Level Elevation									
				July 2006	August 2006	September 2006	October 2006	November 2006	December 2006	January 2007	February 2007	March 2007	April 2007	July 2006	August 2006	September 2006	October 2006	November 2006	December 2006	January 2007	February 2007	March 2007	April 2007
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
Surficial Aquifer (SA)																							
OW-319A	SA	103.13	104.91	26.48	26.58	26.25	26.08	26.28	26.22	26.25	26.44	26.25	26.18	78.43	78.33	78.66	78.83	78.63	78.69	78.66	78.47	78.66	78.73
OW-323	SA	106.96	109.69	27.80	28.22	28.37	28.13	27.96	27.26	26.88	26.45	26.52	25.88	81.89	81.47	81.32	81.56	81.73	82.43	82.81	83.24	83.17	83.81
OW-423	SA	111.12	113.16	29.77	30.04	30.03	29.93	29.78	29.54	29.02	28.76	28.38	27.62	83.39	83.12	83.13	83.23	83.38	83.62	84.14	84.40	84.78	85.54
OW-428	SA	113.92	115.92	37.82	37.92	37.98	38.07	38.01	37.89	37.69	37.25	37.17	36.47	78.10	78.00	77.94	77.85	77.91	78.03	78.23	78.67	78.75	79.45
OW-436	SA	108.13	110.39	31.68	32.06	31.85	31.55	31.08	31.40	30.60	31.05	30.28	30.19	78.71	78.33	78.54	78.84	79.31	78.99	79.79	79.34	80.11	80.20
OW-714	SA	116.02	117.98	45.93	46.28	46.33	46.36	46.19	45.87	45.60	45.42	45.21	44.78	72.05	71.70	71.65	71.62	71.79	72.11	72.38	72.56	72.77	73.20
OW-718	SA	118.53	120.41	40.47	40.56	40.80	41.07	41.29	41.37	41.18	40.40	40.22	39.28	79.94	79.85	79.61	79.34	79.12	79.04	79.23	80.01	80.19	81.13
OW-743	SA	103.65	105.89	37.22	37.77	37.52	37.35	37.22	36.99	36.61	36.03	35.80	34.78	68.67	68.12	68.37	68.54	68.67	68.90	69.28	69.86	70.09	71.11
OW-752A	SA	95.30	97.00	24.76	25.18	25.35	25.36	25.23	24.08	23.34	22.77	22.68	21.57	72.24	71.82	71.65	71.64	71.77	72.92	73.66	74.23	74.32	75.43
OW-756	SA	106.56	108.77	29.98	30.17	30.42	30.55	30.59	30.46	30.04	29.42	29.18	27.62	78.79	78.60	78.35	78.22	78.18	78.31	78.73	79.35	79.59	81.15
OW-759A	SA	97.78	99.69	26.88	27.53	28.00	28.12	28.32	27.41	26.77	25.50	24.41	23.65	72.81	72.16	71.69	71.57	71.37	72.28	72.92	74.19	75.28	76.04
OW-765A	SA	97.37	99.60	21.72	22.02	21.87	21.70	21.20	20.10	18.95	19.25	18.38	17.87	77.88	77.58	77.73	77.90	78.40	79.50	80.65	80.35	81.22	81.73
OW-766	SA	108.89	110.72	28.88	29.36	29.42	29.20	29.20	28.76	28.11	27.60	27.30	26.77	81.84	81.36	81.30	81.52	81.52	81.96	82.61	83.12	83.42	83.95
Upper Chesapeake Unit (CU)																							
OW-301	CU	94.51	96.27	58.85	59.45	59.37	58.34	58.00	58.04	57.33	57.00	56.78	56.46	37.42	36.82	36.90	37.93	38.27	38.23	38.94	39.27	39.49	39.81
OW-304	CU	68.78	71.01																				
OW-308	CU	111.45	113.62																				
OW-313A	CU	51.03	53.20	19.80	20.40	20.08	19.57	18.80	18.90	17.93	18.25	17.12	16.77	33.40	32.80	33.12	33.63	34.40	34.30	35.27	34.95	36.08	36.43
OW-319B	CU	103.53	105.35	67.49	67.97	67.95	67.53	66.57	66.49	65.74	65.52	65.27	64.84	37.86	37.38	37.40	37.82	38.78	38.86	39.61	39.83	40.08	40.51
OW-328	CU	76.29	77.85	40.77	41.40	41.35	40.68	40.33	40.13	39.63	39.42	39.32	38.72	37.08	36.45	36.50	37.17	37.52	37.72	38.22	38.43	38.53	39.13
OW-336	CU	97.11	99.07	60.99	61.36	61.52	60.45	60.42	60.19	59.65	59.20	59.25	58.76	38.08	37.71	37.55	38.62	38.65	38.88	39.42	39.87	39.82	40.31
OW-401	CU	71.38	73.49	34.13	34.95	34.73	33.72	32.95	33.37	32.33	32.45	31.76	31.38	39.36	38.54	38.76	39.77	40.54	40.12	41.16	41.04	41.73	42.11
OW-413B	CU	122.90	124.85	86.60	87.30	87.13	86.46	85.14	85.56	84.40	84.75	83.57	83.25	38.25	37.55	37.72	38.39	39.71	39.29	40.45	40.10	41.28	41.60
OW-418A	CU	43.66	45.83	8.22	9.44	8.60	7.97	6.45	7.60	6.40	6.91	5.68	5.57	37.61	36.39	37.23	37.86	39.38	38.23	39.43	38.92	40.15	40.26
OW-703A	CU	44.02	45.65	27.33	27.84	28.05	27.93	27.60	27.12	25.16	25.60	22.15	21.95	18.32	17.81	17.60	17.72	18.05	18.53	20.49	20.05	23.50	23.70
OW-705	CU	47.71	50.22	20.28	21.10	20.67	20.10	19.02	19.40	17.82	18.60	16.57	16.35	29.94	29.12	29.55	30.12	31.20	30.82	32.40	31.62	33.65	33.87

Table 2.3-17— CCNPP Unit 3 Observation Wells used in the Hydrogeologic Evaluation

(Page 2 of 6)

				Depth to Water										Water Level Elevation									
Well ID	Aquifer Unit	Ground Surface Elevation	Water Level Monitoring Reference Point Elevation	July 2006	August 2006	September 2006	October 2006	November 2006	December 2006	January 2007	February 2007	March 2007	April 2007	July 2006	August 2006	September 2006	October 2006	November 2006	December 2006	January 2007	February 2007	March 2007	April 2007
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
OW-708A	CU	37.44	39.61	13.39	15.01	13.85	12.78	10.46	12.58	8.96	12.20	6.71	6.77	26.22	24.60	25.76	26.83	29.15	27.03	30.65	27.41	32.90	32.84
OW-711	CU	52.92	55.31	19.26	20.64	19.50	18.43	16.14	18.33	15.94	17.70	14.33	14.36	36.05	34.67	35.81	36.88	39.17	36.98	39.37	37.61	40.98	40.95
OW-725	CU	58.04	59.94	32.80	33.87	33.92	33.56	32.54	32.30	30.77	30.77	29.77	28.95	27.14	26.07	26.02	26.38	27.40	27.64	29.17	29.17	30.17	30.99
OW-735	CU	91.20	93.44	54.18	55.17	55.14	54.57	53.31	53.24	52.36	52.13	52.16	51.40	39.26	38.27	38.30	38.87	40.13	40.20	41.08	41.31	41.28	42.04
OW-752B	CU	95.79	97.41	59.55	60.25	60.05	59.75	59.38	59.16	58.77	58.60	58.58	58.01	37.86	37.16	37.36	37.66	38.03	38.25	38.64	38.81	38.83	39.40
OW-754	CU	67.00	68.85	31.32	32.05	31.80	31.05	30.73	30.93	30.24	30.12	29.67	29.32	37.53	36.80	37.05	37.80	38.12	37.92	38.61	38.73	39.18	39.53
OW-759B	CU	98.35	100.14	63.09	63.80	63.56	63.31	63.11	62.87	62.54	62.32	62.30	61.85	37.05	36.34	36.58	36.83	37.03	37.27	37.60	37.82	37.84	38.29
OW-765B	CU	96.82	98.47	60.22	60.72	60.55	60.40	59.92	59.77	59.73	59.45	59.37	58.96	38.25	37.75	37.92	38.07	38.55	38.70	38.74	39.02	39.10	39.51
OW-768A	CU	48.48	49.84	24.05	24.88	24.04	23.67	23.12	23.65	23.10	23.26	22.53	22.62	25.79	24.96	25.80	26.17	26.72	26.19	26.74	26.58	27.31	27.22
OW-769	CU	54.23	56.43	26.50	27.96	27.37	26.74	24.13	25.74	23.48	24.43	20.55	20.67	29.93	28.47	29.06	29.69	32.30	30.69	32.95	32.00	35.88	35.76
OW-774A	CU	9.7	12.20																				
Lower Chesapeake Unit																							
OW-313B	CL	50.73	53.54	23.05	23.65	23.47	23.17	22.76	22.52	21.89	21.80	21.44	20.97	30.49	29.89	30.07	30.37	30.78	31.02	31.65	31.74	32.10	32.57
OW-418B	CL	43.67	45.77	12.52	13.36	12.9	12.47	11.67	12.85	11.03	11.27	10.74	10.42	33.25	32.41	32.87	33.30	34.10	32.92	34.74	34.50	35.03	35.35
OW-703B	CL	45.57	47.53	29.34	29.85	29.95	29.73	29.40	29.10	27.45	27.72	24.74	24.47	18.19	17.68	17.58	17.80	18.13	18.43	20.08	19.81	22.79	23.06
OW-774B	CL	10.1	12.55																				
OW-781	CL	10.3	12.87																				

Table 2.3-17— CCNPP Unit 3 Observation Wells used in the Hydrogeologic Evaluation

(Page 3 of 6)

Well ID	Aquifer Unit	Ground Surface Elevation	Water Level Monitoring Reference Point Elevation	Depth to Water										Water Level Elevation									
				May 2007	June 2007	September 2007	December 2007	April 2008	July 2008	September 2008	October 2008	November 2008	December 2008	May 2007	June 2007	September 2007	December 2007	April 2008	July 2008	September 2008	October 2008	November 2008	December 2008
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
Surficial Aquifer (SA)																							
OW-319A	SA	103.13	104.91	26.26	26.57	26.95	27.25	26.2	26.28	26.68	26.08			78.65	78.34	77.96	77.66	78.71	78.63	78.23	78.83		
OW-323	SA	106.96	109.69	26	26.77	28.48	29.77	29.47	28.22	29.01	29.3			83.69	82.92	81.21	79.92	80.22	81.47	80.68	80.39		
OW-423	SA	111.12	113.16	27.42	27.87	29.53	31.7	32.02	31.01	31.56	31.87			85.74	85.29	83.63	81.46	81.14	82.15	81.6	81.29		
OW-428	SA	113.92	115.92	36.2	36.63	37.56	38.47	38.82	38.4	38.46	38.57			79.72	79.29	78.36	77.45	77.1	77.52	77.46	77.35		
OW-436	SA	108.13	110.39	30.72	31.22	32.32	33.26	33.12	32.1	32.82	33.06			79.67	79.17	78.07	77.13	77.27	78.29	77.57	77.33		
OW-714	SA	116.02	117.98	44.93	43.25	46.05	47.57	47.32	46.48	48.11	48.53			73.05	74.73	71.93	70.41	70.66	71.5	69.87	69.45		
OW-718	SA	118.53	120.41	38.72	38.93	39.85	41.5	41.7	43.9	41.78	41.82			81.69	81.48	80.56	78.91	78.71	76.51	78.63	78.59		
OW-743	SA	103.65	105.89	34.57	34.14	37.17	38.35	38.26	38.65	39.82	39.97			71.32	71.75	68.72	67.54	67.63	67.24	66.07	65.92		
OW-752A	SA	95.3	97	22.24	23.91	25.78	27.22	26.73	24.73	25.71	26.11			74.76	73.09	71.22	69.78	70.27	72.27	71.29	70.89		
OW-756	SA	106.56	108.77	27.05	27.77	29.75	31.44	31.75	31.34	31.6	31.77			81.72	81	79.02	77.33	77.02	77.43	77.17	77		
OW-759A	SA	97.78	99.69	23.73	21.08	28.27	30.58	29.86	30.92	29.52	29.84			75.96	78.61	71.42	69.11	69.83	68.77	70.17	69.85		
OW-765A	SA	97.37	99.6	18.28	20.12	22.12	22.57	21.73	21.55	22.25	22.42			81.32	79.48	77.48	77.03	77.87	78.05	77.35	77.18		
OW-766	SA	108.89	110.72	26.85	27.52	29.47	31.02	30.82	29.8	30.54	30.79			83.87	83.2	81.25	79.7	79.9	80.92	80.18	79.93		
Upper Chesapeake Unit (CU)																							
OW-301	CU	94.51	96.27	57.32	58.67	59.92	60.75	59.62	59.58	60.57	60.8			38.95	37.6	36.35	35.52	36.65	36.69	35.7	35.47		
OW-304	CU	68.78	71.01							37.28	37.43	37.33	36.78							33.73	33.58	33.68	34.23
OW-308	CU	111.45	113.62							78.33	78.41	78.29	78							35.29	35.21	35.33	35.62
OW-313A	CU	51.03	53.2	18.23	19.56	21.05	21.52	20.32	23.8	21.51	21.71			34.97	33.64	32.15	31.68	32.88	29.4	31.69	31.49		
OW-319B	CU	103.53	105.35	65.72	67.22	68.45	69.45	68.38	68.18	69.31	69.48			39.63	38.13	36.9	35.9	36.97	37.17	36.04	35.87		
OW-328	CU	76.29	77.85	39.33	40.52	41.9	42.53	41.68	41.6	42.57	42.67			38.52	37.33	35.95	35.32	36.17	36.25	35.28	35.18		
OW-336	CU	97.11	99.07	59.28	60.57	61.8	62.63	61.86	61.67	62.73	62.78			39.79	38.5	37.27	36.44	37.21	37.4	36.34	36.29		
OW-401	CU	71.38	73.49	32.66	34.14	35.8	36.59	35.04	35.07	36.36	36.62			40.83	39.35	37.69	36.9	38.45	38.42	37.13	36.87		
OW-413B	CU	122.9	124.85	84.84	86.42	88.05	89.02	87.37	87.36	88.65	88.87			40.01	38.43	36.8	35.83	37.48	37.49	36.2	35.98		
OW-418A	CU	43.66	45.83	7.32	8.65	10.67	10.62	8.38	8.95	10.7	11.17			38.51	37.18	35.16	35.21	37.45	36.88	35.13	34.66		
OW-703A	CU	44.02	45.65	25.68	24.08	28.42	28.83	28.17	28.14	29.15	29.54			19.97	21.57	17.23	16.82	17.48	17.51	16.5	16.11		
OW-705	CU	47.71	50.22	18.72	20.22	21.8	22.18	20.75	20.9	22.21	22.5			31.5	30	28.42	28.04	29.47	29.32	28.01	27.72		

Table 2.3-17— CCNPP Unit 3 Observation Wells used in the Hydrogeologic Evaluation

(Page 4 of 6)

Well ID	Aquifer Unit	Ground Surface Elevation	Water Level Monitoring Reference Point Elevation	Depth to Water										Water Level Elevation									
				May 2007	June 2007	September 2007	December 2007	April 2008	July 2008	September 2008	October 2008	November 2008	December 2008	May 2007	June 2007	September 2007	December 2007	April 2008	July 2008	September 2008	October 2008	November 2008	December 2008
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
OW-708A	CU	37.44	39.61	11.7	14.5	16.26	17.36	13.46	13.18	15.67	16.28			27.91	25.11	23.35	22.25	26.15	26.43	23.94	23.33		
OW-711	CU	52.92	55.31	18.18	19.85	21.88	19.5	19.42	20.03	14.67	22.37			37.13	35.46	33.43	35.81	35.89	35.28	40.64	32.94		
OW-725	CU	58.04	59.94	30.47	34.14	34.82	35.72	33.83	34.32	35.87	36.27			29.47	25.8	25.12	24.22	26.11	25.62	24.07	23.67		
OW-735	CU	91.2	93.44	52.37	53.74	55.98	56.72	55.09	55.32	56.8	57.01			41.07	39.7	37.46	36.72	38.35	38.12	36.64	36.43		
OW-752B	CU	95.79	97.41	58.5	59.32	60.68	61.05	60.43	60.47	61.46	61.57			38.91	38.09	36.73	36.36	36.98	36.94	35.95	35.84		
OW-754	CU	67	68.85	30.33	31.33	32.5	32.98	31.86	32	32.87	33.12			38.52	37.52	36.35	35.87	36.99	36.85	35.98	35.73		
OW-759B	CU	98.35	100.14	62.17	61.57	64.15	64.48	64	64.17	65.06	65.23			37.97	38.57	35.99	35.66	36.14	35.97	35.08	34.91		
OW-765B	CU	96.82	98.47	59.24	59.92	61.07	61.58	61.24	61.27	61.88	62			39.23	38.55	37.4	36.89	37.23	37.2	36.59	36.47		
OW-768A	CU	48.48	49.84	23.55	24.15	26.17	26.75	23.84	24.42	26.34	26.81			26.29	25.69	23.67	23.09	26	25.42	23.5	23.03		
OW-769	CU	54.23	56.43	24.68	26.4	26.37	30.27	27.7	28.07	29.88	33.33			31.75	30.03	30.06	26.16	28.73	28.36	26.55	23.1		
OW-774A	CU	9.7	12.2							10.13	10.21	10.15	9.98							2.07	1.99	2.05	2.22
Lower Chesapeake Unit (CL)																							
OW-313B	CL	50.73	53.54	21.47	22.6	24.23	24.85	23.98	23.74	24.78	25.08			32.07	30.94	29.31	28.69	29.56	29.8	28.76	28.46		
OW-418B	CL	43.67	45.77	11.33	12.55	14.5	14.96	13.02	13.13	14.67	15.16			34.44	33.22	31.27	30.81	32.75	32.64	31.1	30.61		
OW-703B	CL	45.57	47.53	27.68	26.47	30.38	30.72	30.02	30.8	31.02	31.42			19.85	21.06	17.15	16.81	17.51	16.73	16.51	16.11		
OW-774B	CL	10.1	12.55							10.15	10	10.15	10.04							2.4	2.55	2.4	2.51
OW-781	CL	10.3	12.87							10.36	10.58	10.44	10.45							2.51	2.29	2.43	2.42

Table 2.3-17— CCNPP Unit 3 Observation Wells used in the Hydrogeologic Evaluation
(Page 5 of 6)

Well ID	Aquifer Unit	Ground Surface Elevation	Water Level Monitoring Reference Point Elevation	Depth to Water										Water Level Elevation									
				January 2008	February 2008	March 2008	April 2008	May 2008	June 2008	July 2008	August 2008	Septmeber 2008	October 2008	January 2008	February 2008	March 2008	April 2008	May 2008	June 2008	July 2008	August 2008	Septmeber 2008	October 2008
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
Surficial Aquifer (SA)																							
OW-319A	SA	103.13	104.91	26.28			26.38			26.44			26.53	78.63			78.53			78.47			78.38
OW-323	SA	106.96	109.69	29.57			29.08			27.55			28.72	80.12			80.61			82.14			80.97
OW-423	SA	111.12	113.16	32.07			31.97			29.77			30.43	81.09			81.19			83.39			82.73
OW-428	SA	113.92	115.92	38.85			38.86			37.68			38.13	77.07			77.06			78.24			77.79
OW-436	SA	108.13	110.39	33.31			33.27			31.66			32.10	77.08			77.12			78.73			78.29
OW-714	SA	116.02	117.98	48.19			47.73			46.04			47.17	69.79			70.25			71.94			70.81
OW-718	SA	118.53	120.41	42.12			42.03			42.08			42.08	78.29			78.38			78.33			78.33
OW-743	SA	103.65	105.89	39.58			39.01			37.66			38.48	66.31			66.88			68.23			67.41
OW-752A	SA	95.30	97.00	26.43			26.04			23.72			25.66	70.57			70.96			73.28			71.34
OW-756	SA	106.56	108.77	31.99			32.04			30.13			30.77	76.78			76.73			78.64			78.00
OW-759A	SA	97.78	99.69	30.23			30.18			27.28			28.76	69.46			69.51			72.41			70.93
OW-765A	SA	97.37	99.60	22.27			21.05			20.97			22.17	77.33			78.55			78.63			77.43
OW-766	SA	108.89	110.72	30.70			30.32			28.90			29.86	80.02			80.40			81.82			80.86
Upper Chesapeake Unit (CU)																							
OW-301	CU	94.51	96.27	59.93			58.65			59.72			60.02	36.34			37.62			36.55			36.25
OW-304	CU	68.78	71.01	36.3	36.64	36.4	34.58	33.87	34.18	36.07	36.66	36.85	36.07	34.71	34.37	34.61	36.43	37.14	36.83	34.94	34.35	34.16	34.94
OW-308	CU	111.45	113.62	77.62	77.77	77.71	76.41	75.57	75.43	77.18	77.64	77.73	77.18	36	35.85	35.91	37.21	38.05	38.19	36.44	35.98	35.89	36.44
OW-313A	CU	51.03	53.2	20.6			19.02			20.33			20.87	32.6			34.18			32.87			32.33
OW-319B	CU	103.53	105.35	68.72			67.46			68.33			68.78	36.63			37.89			37.02			36.57
OW-328	CU	76.29	77.85	42.07			40.84			41.59			42.19	35.78			37.01			36.26			35.66
OW-336	CU	97.11	99.07	62.24			60.97			61.8			62.28	36.83			38.1			37.27			36.79
OW-401	CU	71.38	73.49	35.67			33.71			35.16			35.47	37.82			39.78			38.33			38.02
OW-413B	CU	122.9	124.85	87.8			86.07			87.51			87.72	37.05			38.78			37.34			37.13
OW-418A	CU	43.66	45.83	9.00			6.74			9.46			8.66	36.83			39.09			36.37			37.17
OW-703A	CU	44.02	45.65	28.52			27.68			27.48			28.80	17.13			17.97			18.17			16.85
OW-705	CU	47.71	50.22	21.02			18.95			20.81			21.42	29.20			31.27			29.41			28.80

Table 2.3-17— CCNPP Unit 3 Observation Wells used in the Hydrogeologic Evaluation

(Page 6 of 6)

				Depth to Water										Water Level Elevation									
Well ID	Aquifer Unit	Ground Surface Elevation	Water Level Monitoring Reference Point Elevation	January 2008	February 2008	March 2008	April 2008	May 2008	June 2008	July 2008	August 2008	Septmeber 2008	October 2008	January 2008	February 2008	March 2008	April 2008	May 2008	June 2008	July 2008	August 2008	Septmeber 2008	October 2008
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
OW-708A	CU	37.44	39.61	12.81			9.28			13.64			12.57	26.80			30.33			25.97			27.04
OW-711	CU	52.92	55.31	19.62			16.27			20.45			18.32	35.69			39.04			34.86			36.99
OW-725	CU	58.04	59.94	34.80			32.66			33.97			35.23	25.14			27.28			25.97			24.71
OW-735	CU	91.20	93.44	55.77			53.88			55.25			55.80	37.67			39.56			38.19			37.64
OW-752B	CU	95.79	97.41	60.78			59.89			60.39			60.75	36.63			37.52			37.02			36.66
OW-754	CU	67.00	68.85	32.12			31.10			32.02			32.13	36.73			37.75			36.83			36.72
OW-759B	CU	98.35	100.14	64.45			63.61			63.95			64.14	35.69			36.53			36.19			36.00
OW-765B	CU	96.82	98.47	61.50			60.94			60.91			61.33	36.97			37.53			37.56			37.14
OW-768A	CU	48.48	49.84	24.10			23.37			24.91			24.42	25.74			26.47			24.93			25.42
OW-769	CU	54.23	56.43	28.57			24.74			28.03			28.66	27.86			31.69			28.40			27.77
OW-774A	CU	9.7	12.20	10.34	10.45	10.01	9.37	9.53	9.14	9.70	9.82	10.01	9.70	1.86	1.75	2.19	2.83	2.67	3.06	2.50	2.38	2.19	2.50
Lower Chesapeake Unit (CL)																							
OW-313B	CL	50.73	53.54	24.32			23.26			23.47			24.33	29.22			30.28			30.07			29.21
OW-418B	CL	43.67	45.77	13.47			12.09			13.28			13.62	32.3			33.68			32.49			32.15
OW-703B	CL	45.57	47.53	30.3			29.36			29.51			30.56	17.23			18.17			18.02			16.97
OW-774B	CL	10.1	12.55	10.52	10.48	10.17	9.78	9.76	9.48	9.92	9.91	10.06	9.92	2.03	2.07	2.38	2.77	2.79	3.07	2.63	2.64	2.49	2.63
OW-781	CL	10.3	12.87	10.72	10.95	10.62	10.31	10.17	9.94	10.12	10.21	10.36	10.12	2.15	1.92	2.25	2.56	2.7	2.93	2.75	2.66	2.51	2.75

Table 2.3-18— CCNPP Unit 3 Observation Wells Hydraulic Conductivities from Slug Tests

Well ID	Surficial Aquifer	Kh	Kh	Kh	Well ID	Upper Chesapeake Unit	Kh	Kh	Kh	Well ID	Lower Chesapeake Unit	Kh	Kh	Kh
		(ft/sec)	(cm/sec)	(ft/day)			(ft/sec)	(cm/sec)	(ft/day)			(ft/sec)	(cm/sec)	(ft/day)
OW-319A	SA	2.89E-06	8.81E-05	2.50E-01	OW-301	CU	1.58E-04	4.82E-03	1.37E+01	OW-313B	CL	2.74E-07	8.35E-06	2.37E-02
OW-323	SA	6.24E-05	1.90E-03	5.39E+00	OW-313A	CU	7.50E-06	2.29E-04	6.48E-01	OW-418B	CL	2.16E-07	6.58E-06	1.87E-02
OW-423	SA	6.86E-05	2.09E-03	5.93E+00	OW-319B	CU	3.42E-05	1.04E-03	2.95E+00	OW-703B	CL	1.08E-06	3.29E-05	9.33E-02
OW-428	SA	1.19E-05	3.63E-04	1.03E+00	OW-328	CU	3.79E-06	1.16E-04	3.27E-01		**max**	**1.08E-06**	**3.29E-05**	**9.33E-02**
OW-436	SA	2.80E-06	8.53E-05	2.42E-01	OW-336	CU	2.10E-05	6.40E-04	1.81E+00		**min**	**2.16E-07**	**6.58E-06**	**1.87E-02**
OW-743	SA	6.23E-07	1.90E-05	5.38E-02	OW-401	CU	6.77E-06	2.06E-04	5.85E-01		**mean**	**5.23E-07**	**1.60E-05**	**4.52E-02**
OW-752A	SA	7.03E-05	2.14E-03	6.07E+00	OW-413B	CU	2.78E-06	8.47E-05	2.40E-01		**geo mean**	**4.00E-07**	**1.22E-05**	**3.45E-02**
OW-756	SA	2.01E-04	6.13E-03	1.74E+01	OW-418A	CU	4.41E-06	1.34E-04	3.81E-01					
OW-759A	SA	4.64E-07	1.41E-05	4.01E-02	OW-703A	CU	1.34E-05	4.08E-04	1.16E+00					
OW-765A	SA	1.00E-05	3.05E-04	8.64E-01	OW-705	CU	4.99E-06	1.52E-04	4.31E-01					
	max	**2.01E-04**	**6.13E-03**	**1.74E+01**	OW-708A	CU	2.56E-05	7.80E-04	2.21E+00					
	min	**4.64E-07**	**1.41E-05**	**4.01E-02**	OW-711	CU	6.04E-06	1.84E-04	5.22E-01					
	mean	**4.31E-05**	**1.31E-03**	**3.72E+00**	OW-725	CU	7.54E-06	2.30E-04	6.51E-01					
	geo mean	**1.05E-05**	**3.21E-04**	**9.10E-01**	OW-735	CU	5.48E-05	1.67E-03	4.73E+00					
					OW-752B	CU	3.35E-06	1.02E-04	2.89E-01					
					OW-754	CU	5.29E-06	1.61E-04	4.57E-01					
					OW-759B	CU	1.77E-06	5.39E-05	1.53E-01					
					OW-765B	CU	1.36E-06	4.15E-05	1.18E-01					
					OW-768A	CU	5.29E-06	1.61E-04	4.57E-01					
					OW-769	CU	1.74E-05	5.30E-04	1.50E+00					
						max	**1.58E-04**	**4.82E-03**	**1.37E+01**					
						min	**1.36E-06**	**4.15E-05**	**1.18E-01**					
						mean	**1.93E-05**	**5.87E-04**	**1.66E+00**					
						geo mean	**8.56E-06**	**2.61E-04**	**7.40E-01**					

Note:
Slug test results for 7 Surficial Aquifer wells (OW-413A, OW-714, OW-718, OW-729, OW-766, and OW-770) are not included because of invalid test conditions, questionable data, or the well was screened in a discontinuous sand unit.

Table 2.3-19— Permitted Surface Water Withdrawals in Calvert County

Owner	Max. Permitted Daily Withdrawal (gpd)	Permitted Quantity, Yearly Average (gpd)	Distance[1] (miles)	Intake Location[2]		Water Source	Use Category	Remarks
				North x 1,000 ft	East x 1,000 ft			
Swann, J. Allen	183,000	31,000	22	310	890	Patuxent River	Irrigation	Farming
Morgan State University ERC	250,000	150,000	4	210	940	Patuxent River	Institutional	Environmental research facility
Beckman, Inc.	3,000	400	20	310	900	Chesapeake Bay	Irrigation	Hydroseeding
Dominion Cove Point LNG, LP	7,200,000	64,000	4	200	970	Chesapeake Bay	Hydrostatic testing and fire protection	Hydrostatic testing
	15,000	3500	4	200	970	Chesapeake Bay	Hydrostatic testing and fire protection	Horizontal drilling for pipeline
	3,650,000	10,000	16	270	890	Patapsco River	Hydrostatic testing and fire protection	Hydrostatic testing
Calvert County Commissioners	5,000	150	8	180	950	Patuxent River	Institutional	Calvert Marine Museum
Cheseldine, Ronald W.	3,000	1,500	20	320	930	Chesapeake Bay	Aquaculture	Commercial crabbing operation
C&M Excavating Inc.	1,000	400	19	310	910	Chesapeake Bay	Irrigation	Hydroseeding
	2,000	400	19	310	910	Chesapeake Bay	Irrigation	Hydroseeding
Chesapeake Biological Laboratory	864,000	864,000	10	170	950	Patuxent River	Institutional	Laboratory use
Calvert Cliffs Nuclear Power Plant, LLC	3,600,000,000	3,500,000,000	-	220	960	Chesapeake Bay	Nuclear power generation	Cooling water

Notes:

1. Maryland State Plane 1927 coordinates system. The accuracy of the location is ±10,000 ft. The Maryland State Plane 1927 coordinate system is based on North American Datum of 1927 (NAD27). NAD27 is a surface (or plane) to which horizontal positions in the U.S., Canada and Mexico are surveyed and referenced.
2. Distance from the CCNPP Unit 3 site

Table 2.3-20— Monthly Average Cooling Water Discharge Rates for the CCNPP Units 1 and 2 in Million gallons per day

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MIllion Gallons Per Day												
2006	3448	2873	1726	3218	3460	3460	3440	3448	3425	3435	3458	3429
2005	3456	3037	2541	3432	3437	3429	3437	3453	3458	3456	3460	3442
2004	3363	3460	3434	2256	3135	3446	3460	3447	3439	3440	3457	3460
2003	3445	2667	1730	2724	3460	3442	3460	3454	3451	3460	3422	3435
2002	3459	2708	1730	1730	2047	3455	3405	3445	3445	3460	3404	3447
Million Liters Per Day												
2006	13,052	10,875	6,534	12,181	13,098	13,098	13,022	13,052	12,965	13,003	13,090	12,980
2005	13,082	11,496	9,619	12,992	13,010	12,980	13,010	13,071	13,090	13,082	13,098	13,029
2004	12,720	13,098	12,999	8,540	11,867	13,045	13,098	13,048	13,018	13,022	13,086	13,098
2003	12,662	10,096	6,549	10,311	13,098	13,029	13,098	13,075	13,063	13,098	12,954	13,003
2002	13,094	10,251	6,549	6,549	7,749	13,079	12,889	13,041	13,041	13,098	13,098	13,048

Table 2.3-21— Permitted Surface Water Discharges in the Calvert County

Owner	Average Discharge (gpd)	Location[1]		Distance[2] (miles)	Discharge Water Body
		Northing	Easting		
Naval Research Lab. – Chesapeake Bay Detachment	16,000	300,792	934,690	18.5	Chesapeake Bay
Morgan State University ERC	96,000	204,017	941,480	4	Patuxent River
Northern High School	40,000	309,735	898,326	22	Patuxent River
Dominion Cove Point LNG, LP	216,000	198,123	970,819	4	Chesapeake Bay
Chesapeake Beach Waste Water Treatment Plant	497,000	315,353	933,426	20.5	Chesapeake Bay
Chesapeake Biological Laboratory	648,000	177,095	956,849	10	Patuxent River
Calvert Cliffs Nuclear Power Plant, LLC.	3,200,000,000[3]	217,978	959,150	-	Chesapeake Bay

Notes:

1. Maryland State Plane 1927 coordinate system. The Maryland State Plane 1927 coordinate system is based on North American Datum of 1927 (NAD27). NAD27 is a surface (or plane) to which horizontal positions in the U.S., Canada and Mexico are surveyed and referenced.
2. Distance from the site
3. Shown in the Calvert Cliffs Nuclear Power Plant NPDES Permit Renewal Application issued on November 21, 2001

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 1 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1951G001	(04)	WARREN DENTON SEAFOOD, INC.	11/1992	N	2,000	3,000	200	930	125B	AQUIA FORMATION	02-13-11-01	OYSTER PROCESSING PLANT
CA	G	CA1952G001	(06)	CALVERT MEMORIAL HOSPITAL	09/1994	N	300	500	270	920	125B	AQUIA FORMATION	02-13-11-01	EMWEGENCY WATER SUPPLY
CA	G	CA1953G002	(05)	SCIENTISTS' CLIFFS ASSOCIATION, INC.,	04/1998	Y	33,000	56,000	250	940	124C	NANJEMOY FORMATION	02-13-10-05	COMMUNITY SUPPLY - SUPPLEMENTAL TO CA53G102
CA	G	CA1953G102	(03)	SCIENTISTS CLIFFS ASSOCIATION, INC.	04/1998	Y	17,000	29,000	250	940	125B	AQUIA FORMATION	02-13-10-05	COMMUNITY SUPPLY - SUPPLEMENTAL TO CA53G002
CA	G	CA1954G001	(04)	COLLINS, J. PATRICK AND, ANN	01/1998	N	500	800	270	910	124C	NANJEMOY FORMATION	02-13-11-01	AUTOMOBILE DEALERSHIP
CA	G	CA1955G001	(04)	CLIMATEMAKERS OF MARYLAND, INC.	09/1997	N	450	600	250	910	125B	AQUIA FORMATION	02-13-11-01	HEATING & AIR CONDITIONING
CA	G	CA1956G002	(05)	CALVERT COUNTY COMMISSIONERS	11/2004	N	8,000	13,000	220	950	124E	PINEY POINT FORMATION	02-13-11-01	WHITE SANDS SBDN - PDWIS# 004-0017
CA	G	CA1959G001	(06)	CALVERT COUNTY COMMISSIONERS	04/2004	Y	10,000	15,000	280	910	124C	NANJEMOY FORMATION	02-13-11-01	HUNTING HILLS ESTATES - NANJEMOY WELL - PDWIS #0040006
CA	G	CA1959G002	(04)	CALVERT COUNTY COMMISSIONERS	04/1994	Y	75,000	100,000	270	940	125B	AQUIA FORMATION	02-13-10-05	CHESAPEAKE HEIGHTS ON THE BAY SUBD - COMMUNITY SUPPLY
CA	G	CA1959G003	(06)	SHRI LIMITED PARTNERSHIP	07/1999	Y	20,000	30,000	330	900	125B	AQUIA FORMATION	02-13-11-01	REGENCY MANOR MOBILE HOME PARK
CA	G	CA1959G004	(01)	JOHN LORE'S LAUNDROMAT	12/1959	N	3,000	4,000	260	920	124C	NANJEMOY FORMATION	02-13-11-01	
CA	G	CA1959G101	(03)	CALVERT COUNTY COMMISSIONERS	04/2004	Y	10,000	15,000	280	910	125B	AQUIA FORMATION	02-13-11-01	HUNTING HILLS ESTATES - AQUIA WELL - PDWIS #0040006
CA	G	CA1960G002	(08)	CHESAPEAKE RANCH WATER COMPANY	08/1996	Y	900,000	1,500,000	190	970	125B	AQUIA FORMATION	02-13-10-05	CHESAPEAKE RANCH SBDN - 4 AQUIA WELLS
CA	G	CA1961G002	(04)	MARYLAND NATIONAL BANK	05/1994	N	300	500	320	910	125B	AQUIA FORMATION	02-13-11-01	OWINGS BRANCH OFFICE
CA	G	CA1961G004	(06)	MARYLAND STATE FOREST AND PARK SERVICE	03/2003	N	600	1,200	210	970	124C	NANJEMOY FORMATION	02-13-10-05	CALVERT CLIFFS STATE PARK - 2 WELLS BAY BREEZE & DAY USE AREAS

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 2 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1962G001	(08)	BEACHES WATER COMPANY, INC.	08/1990	Y	68,800	114,900	230	950	124C	NANJEMOY FORMATION	02-13-11-05	LONG BEACH AND CALVERT BEACH COMMUNITY SUPPLY
CA	G	CA1962G006	(01)	ROGERS, WILLIAM C.	07/1962	N	3,000	3,500	320	930	125B	AQUIA FORMATION	02-13-10-05	NORTH BEACH LAUNDROMAT
CA	G	CA1962G007	(05)	TPI GROUP, LLC.	03/2005	N	4,500	7,500	250	900	124C	NANJEMOY FORMATION	02-13-11-01	CALVERT MOBILE HOME PARK - PDWIS# 004-0206
CA	G	CA1962G103	(02)	CHESAPEAKE BIOLOGICAL LABORATORY	11/1997	N	8,000	10,000	180	960	125B	AQUIA FORMATION	02-13-11-01	UM CHESAPEAKE BIOLOGICAL LABORATORY
CA	G	CA1962G201	(03)	BEACHES WATER COMPANY, INC.	08/1990	Y	49,200	82,200	230	950	125B	AQUIA FORMATION	02-13-11-05	LONG BEACH AND CALVERT BEACH COMMUNITY SUPPLY
CA	G	CA1963G001	(04)	SHIELDS, SR., ROY, J.	09/1996	N	500	800	340	900	125B	AQUIA FORMATION	02-13-11-01	COMMERCIAL RENTAL PROPERTY - LEASED BY BEAUTY SHOP
CA	G	CA1963G003	(07)	CALVERT CLIFFS NUCLEAR POWER PLANT, LLC	07/2000	N	500	5000	220	960	124E	PINEY POINT FORMATION	02-13-10-05	CALVERT CLIFFS POWER PLANT - CAMP CANOY
CA	G	CA1963G005	(02)	SCOTT, JOHN, J.	05/1997	N	500	1,000	320	920	124C	NANJEMOY FORMATION	02-13-10-05	PREV.STRUCTURE BURNT APPROX.8 MOS. AGO - UNSURE WHEN REBUILDING
CA	G	CA1963G007	(05)	VERIZON MARYLAND INC.	03/2002	N	100	300	260	920	124C	NANJEMOY FORMATION	02-13-10-05	PRINCE FREDERICK FACILITY #34183
CA	G	CA1965G002	(04)	RAWLINGS, L. LOUISE	11/1997	N	6,300	10,000	250	920	124C	NANJEMOY FORMATION	02-13-11-01	PINE TRAILER PARK
CA	G	CA1965G003	(04)	BURKE, ALAN	03/2003	N	500	700	230	930	124C	NANJEMOY FORMATION	02-13-11-01	GATEWAY RESTAURANT
CA	G	CA1965G007	(05)	CALVERT COUNTY COMMISSIONERS	03/2005	N	100	1,000	260	920	124C	NANJEMOY FORMATION	02-13-10-05	PARKS & REC FACILITY (OLD FAIRGROUNDS SITE)
CA	G	CA1965G009	(04)	WATERS MEMORIAL UNITED METHODIST CHURCH	09/1997	N	300	800	230	930	124C	NANJEMOY FORMATION	02-13-11-01	CHURCH
CA	G	CA1966G001	(05)	CROOKS, EDWARD	08/2005	Y	25,000	40,000	240	940	124E	PINEY POINT FORMATION	02-13-10-05	WESTERN SHORES COMMUNITY SUPPLY - PDWIS# 004-0016
CA	G	CA1966G002	(01)	KNOTTY PINE BAR & GRILL	08/1965	N	500	1,000	220	950	122	MIOCENE	02-13-11-01	

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 3 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1966G005	(05)	CALVERT COUNTY COMMISSIONERS	04/2004	Y	16,000	25,000	330	900	125B	AQUIA FORMATION	02-13-11-01	LAKEWOOD SUBD COMMUNITY SUPPLY - PDWIS #0040008
CA	G	CA1966G006	(04)	MD STATE HIGHWAY ADMINISTRATION	03/1997	N	2,000	3,000	260	920	125B	AQUIA FORMATION	02-13-10-05	S.H.A. GARAGE
CA	G	CA1966G007	(02)	PATUXENT METHODIST CHURCH	08/1997	N	300	700	280	910	124C	NANJEMOY FORMATION	02-13-11-01	PATUXENT UNITED METHODIST CHURCH
CA	G	CA1966G008	(04)	WARD'S UNITED METHODIST CHURCH	07/1997	N	200	300	320	930	125B	AQUIA FORMATION	02-13-10-05	CHURCH
CA	G	CA1966G010	(05)	AMERICAN LEGION POST 206 INC.	05/1998	N	1,500	2,500	320	930	124C	NANJEMOY FORMATION	02-13-10-05	AMERICAN LEGION
CA	G	CA1966G011	(05)	CALVERT COUNTY COMMISSIONERS	09/2004	N	7,700	15,000	290	890	125B	AQUIA FORMATION	02-13-11-01	KING'S LANDING-POOL(1041140)/DIN HALL(1041053)/CHESPAX/ EQUES CTR
CA	G	CA1966G012	(04)	SPRING GROVE MARINA LTD.	07/1997	N	4,000	7,500	180	950	124E	PINEY POINT FORMATION	02-13-11-01	SPRING COVE MARINA
CA	G	CA1966G014	(04)	VICTOR STANLEY, INC.	03/1996	N	700	1,150	330	900	125B	AQUIA FORMATION	02-13-11-01	FURNITURE MANUFACTURER
CA	G	CA1967G003	(01)	SAINT ANTHONY'S CHURCH	11/1966	N	1,000	1,500	320	930	124C	NANJEMOY FORMATION	02-13-10-05	
CA	G	CA1967G005	(04)	AL BANNA, EDMAD	02/2002	N	300	500	250	910	125B	AQUIA FORMATION	02-13-11-01	CITGO GAS & GALLO'S DELI
CA	G	CA1967G006	(06)	CALVERT COUNTY DAY SCHOOL, INC.	08/2005	N	8,300	11,900	280	910	125B	AQUIA FORMATION	02-13-11-01	CALVERTON SCHOOL - PDWIS# 104-0022
CA	G	CA1968G001	(04)	PLUM POINT UNITED METHODIST CHURCH	08/2001	N	300	500	280	930	124C	NANJEMOY FORMATION	02-13-10-05	CHURCH
CA	G	CA1968G003	(02)	AMERICAN LEGION GRAY-RAY POST #220	05/1997	N	300	500	240	920	124C	NANJEMOY FORMATION	02-13-11-01	AMERICAN LEGION
CA	G	CA1968G004	(05)	MIDDLEHAM & ST PETER'S PARISH	02/1999	N	300	600	210	960	124E	PINEY POINT FORMATION	02-13-10-05	CHURCH, PARISH HALL, DAY SCHOOL, PROJECT SMILE(THRIFT SHOP/OFFICE
CA	G	CA1968G005	(04)	KING'S APOSTLE CHURCH OF GOD INC.	01/1998	N	300	500	310	930	124C	NANJEMOY FORMATION	02-13-10-05	CHURCH

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 4 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1968G008	(05)	PROUT, CLAIRE, EBY	07/2004	N	1,200	2,000	220	920	124C	NANJEMOY FORMATION	02-13-10-05	PATUXENT CAMPSITES
CA	G	CA1968G009	(05)	CALVERT COUNTY COMMISSIONERS	07/2000	Y	25,000	42,000	240	940	124E	PINEY POINT FORMATION	02-13-10-05	KENWOOD BEACH COMMUNITY SUPPLY
CA	G	CA1969G002	(04)	CALVARY BIBLE CHURCH	05/1996	N	300	500	220	950	124E	PINEY POINT FORMATION	02-13-11-01	SANITARY & POTABLE SUPPLY FOR CHURCH
CA	G	CA1969G003	(05)	BROOKS UNITED METHODIST CHURCH	03/2004	N	200	300	230	930	124E	PINEY POINT FORMATION	02-13-11-04	CHURCH - PDWIS #1041011
CA	G	CA1969G005	(05)	COX FAMILY LLLP	04/2006	N	500	900	260	920	125B	AQUIA FORMATION	02-13-11-01	WINEGARDNER PONTIAC-GMC
CA	G	CA1969G007	(04)	SMITH, SHERMAN & MABEL,	04/1998	N	300	500	310	910	124C	NANJEMOY FORMATION	02-13-11-01	BARBER SHOP/CARRY OUT
CA	G	CA1969G008	(04)	ASSOCIATION OF SEVENTH-DAY ADVENTISTS, CHESAPEAKE CONFERENCE	07/2000	N	300	500	240	930	124E	PINEY POINT FORMATION	02-13-11-01	CHURCH
CA	G	CA1969G009	(05)	FULL GOSPEL ASSEMBLY OF GOD	04/2006	N	600	800	250	920	124E	PINEY POINT FORMATION	02-13-10-05	CHURCH
CA	G	CA1969G010	(05)	CALVERT CLIFFS NUCLEAR POWER PLANT, LLC	07/2000	Y	450,000	865,000	220	960	125B	AQUIA FORMATION	02-13-10-05	CALVERT CLIFFS NUCLEAR POWER PLANT - FENCED AREA
CA	G	CA1969G013	(05)	BREEZY POINT MARINA, INC.	03/2004	N	2,400	5,000	290	940	124C	NANJEMOY FORMATION	02-13-10-05	MARINA - 230 SLIPS
CA	G	CA1969G014	(04)	PADILLA, JAIME, A.	11/1998	N	2,800	4,000	250	930	124C	NANJEMOY FORMATION	02-13-11-01	ADAM'S THE PLACE FOR RIBS RESTAURANT
CA	G	CA1969G015	(04)	R.S. LEITCH COMPANY	04/1994	N	100	200	190	960	124E	PINEY POINT FORMATION	02-13-11-01	SOUTHEND SEVICE CENTER, INC. - SERVICE STATION
CA	G	CA1970G002	(03)	DOWELL PLAZA, INC.	03/1986	N	300	500	190	960	124C	NANJEMOY FORMATION	02-13-11-01	TWO UNIT OFFICE BUILDING
CA	G	CA1970G003	(03)	KRICK PLUMBING & HEATING CO., INC.	04/1998	N	150	300	320	910	125B	AQUIA FORMATION	02-13-11-01	KRICK PLUMBING & HEATING SHOP
CA	G	CA1970G004	(07)	CALVERT COUNTY COMMISSIONERS	07/2004	Y	50,000	86,000	330	910	211D	MAGOTHY FORMATION	02-13-11-01	CAVALIER COUNTRY SUBD COMMUNITY SUPPLY - PDWIS# 0040002

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland

(Page 5 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1970G005	(06)	CALVERT COUNTY PUBLIC SCHOOLS	01/2003	Y	27,000	45,000	260	920	125B	AQUIA FORMATION	02-13-11-01	CALVERT HIGH SCHOOL & CALVERT CAREER CENTER
CA	G	CA1970G007	(06)	CALVERT COUNTY COMMISSIONERS	02/2004	Y	60,000	100,000	250	900	125B	AQUIA FORMATION	02-13-11-01	CALVERT COUNTY INDUSTRIAL PARK
CA	G	CA1971G001	(04)	HARBOR ISLAND MARINA, INC.	07/2002	N	900	1,800	180	960	124C	NANJEMOY FORMATION	02-13-11-01	
CA	G	CA1971G002	(02)	CALVERT COUNTY PUBLIC SCHOOLS	08/1996	N	2,000	3,300	290	910	125B	AQUIA FORMATION	02-13-11-01	HUNTINGTOWN ELEMENTARY SCHOOL
CA	G	CA1971G004	(04)	SOLOMONS BEACON INN LIMITED PARTNERSHIP	01/2004	N	3,000	6,000	180	950	124E	PINEY POINT FORMATION	02-13-11-01	SOLOMONS BEACON MARINA
CA	G	CA1972G001	(04)	CALVERT COUNTY PUBLIC SCHOOLS	09/2003	Y	18,000	23,000	310	900	211D	MAGOTHY FORMATION	02-13-11-01	NORTHERN HIGH SCHOOL & MIDDLE SCHOOL
CA	G	CA1972G002	(05)	CALVERT COUNTY COMMISSIONERS	12/2001	Y	35,000	60,000	330	890	211D	MAGOTHY FORMATION	02-13-11-01	SHORES OF CALVERT SUBDIVISION
CA	G	CA1972G003	(06)	TOWN OF CHESAPEAKE BEACH	12/2004	Y	630,000	1,100,000	310	930	125B	AQUIA FORMATION	02-13-10-05	CHESAPEAKE BEACH COMMUNITY SUPPLY - PDWIS# 004-0003
CA	G	CA1973G001	(03)	HOWLIN JR., EDWARD, B.	09/2000	N	5,500	8,000	320	900	124C	NANJEMOY FORMATION	02-13-11-01	DUNKIRK VILLAGE SHOP/BUS CENTER - COMBINE CA73G001 & CA85G004
CA	G	CA1973G002	(04)	CALVERT COUNTY COMMISSIONERS	07/2004	N	3,600	5,000	240	930	125B	AQUIA FORMATION	02-13-11-01	COLLEGE OF SOUTHERN MARYLAND CALVERT COUNTY - PDWIS# 1040049
CA	G	CA1973G003	(04)	CALVERT COUNTY PUBLIC SCHOOLS	06/2004	N	200	300	290	910	124C	NANJEMOY FORMATION	02-13-11-01	HUNTING CREEK ALTERNATIVE SCHOOL - PDWIS# 1040025
CA	G	CA1973G004	(04)	CALVERT COUNTY PUBLIC SCHOOLS	06/2004	N	2,000	3,000	260	920	125B	AQUIA FORMATION	02-13-10-05	BROOKS ADMINISTRATIVE CENTER - PDWIS# 1040006
CA	G	CA1973G005	(04)	CALVERT COUNTY PUBLIC SCHOOLS	06/2004	N	5,000	6,000	260	920	125B	AQUIA FORMATION	02-13-11-01	CALVERT COUNTRY & CALVERT ELEMENTARY SCHOOLS - PDWIS# 1040012
CA	G	CA1973G006	(04)	CALVERT COUNTY COMMISSIONERS	12/2001	N	500	800	310	900	125B	AQUIA FORMATION	02-13-11-01	CHANEYVILLE TOURIST CENTER & FAIRVIEW BRANCH LIBRARY

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 6 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1973G007	(02)	BD. OF CO. COMMISSIONERS OF CALVERT CO.	08/1996	N	800	1,300	310	920	125B	AQUIA FORMATION	02-13-10-05	MT. HOPE COMMUNITY CENTER
CA	G	CA1973G008	(04)	CALVERT COUNTY PUBLIC SCHOOLS	06/2004	N	5,000	10,000	260	920	125B	AQUIA FORMATION	02-13-11-01	CALVERT MIDDLE SCHOOL - PDWIS# 1040018
CA	G	CA1973G009	(04)	CALVERT COUNTY PUBLIC SCHOOLS	06/2004	N	5,000	7,000	320	910	125B	AQUIA FORMATION	02-13-11-01	MT. HARMONY ELEMENTARY SCHOOL - PDWIS# 1040030
CA	G	CA1973G010	(04)	CALVERT COUNTY PUBLIC SCHOOLS	07/1997	N	5,300	8,900	200	960	124E	PINEY POINT FORMATION	02-13-11-01	APPEAL ELEMENTARY - ONE WELL PRIMARY OTHER WELL FIRE SUPP/BACK-UP
CA	G	CA1973G011	(04)	CALVERT COUNTY COMMISSIONERS	06/1995	N	500	800	230	930	124C	NANJEMOY FORMATION	02-13-11-01	FAMILY RESOURCE CENTER/ HEAD START
CA	G	CA1973G012	(01)	GLASCOCK, BEDFORD C.	12/1972	N	2,600	3,500	180	950	124E	PINEY POINT FORMATION	02-13-11-01	
CA	G	CA1973G013	(05)	CALVERT COUNTY BOARD OF COMMISSIONERS	02/2002	Y	29,000	44,000	320	920	125B	AQUIA FORMATION	02-13-10-05	PARIS OAKS SUBDIVISION
CA	G	CA1973G014	(07)	DOMINION COVE POINT LNG, LP	03/2004	Y	32,000	50,000	200	970	125B	AQUIA FORMATION	02-13-10-05	LIQUEFIED NATURAL GAS TERMINAL
CA	G	CA1973G015	(04)	CALVERT COUNTY BOARD OF COMMISSIONERS	08/2003	N	700	1,000	260	920	124C	NANJEMOY FORMATION	02-13-10-05	PRINCE FREDERICK WASTEWATER TREATMENT PLANT
CA	G	CA1973G017	(04)	BRANDYWINE CORPOREX PLAZA II LP	02/2004	N	1,500	2,000	310	900	125B	AQUIA FORMATION	02-13-11-01	RETAIL CENTER
CA	G	CA1974G001	(03)	VAN DINE, PETER D.	10/1993	N	1,000	1,500	310	910	124C	NANJEMOY FORMATION	02-13-11-01	MERGANSER AIRCRAFT CORP.
CA	G	CA1974G002	(05)	CALVERT COUNTY COMMISSIONERS	07/2000	Y	25,000	37,500	270	940	124C	NANJEMOY FORMATION	02-13-10-05	DARES BEACH - NANJEMOY
CA	G	CA1974G003	(02)	GIBBONS, RICHARD, M.	05/1997	N	400	600	180	950	124E	PINEY POINT FORMATION	02-13-11-01	WATER FOR OFFICE
CA	G	CA1974G004	(03)	JESCHKE, CRAIG, A.	10/1993	N	1,000	1,500	320	910	125B	AQUIA FORMATION	02-13-11-01	MEDICAL CENTER
CA	G	CA1974G005	(06)	CALVERT COUNTY BOARD OF COMMISSIONERS, ,	05/1994	Y	245,000	370,000	260	920	125B	AQUIA FORMATION	02-13-11-01	PRINCE FREDERICK COMMUNITY WATER SUPPLY

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 7 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1974G007	(03)	T H B MANAGEMENT SERVICES, LLC	02/2004	N	5,000	8,800	310	900	125B	AQUIA FORMATION	02-13-11-01	
CA	G	CA1974G008	(03)	HUNTINGTOWN VOLUNTEER FIRE DEPARTMENT	05/1994	N	1,200	2,000	290	910	125B	AQUIA FORMATION	02-13-11-01	FIRE DEPT. & RESCUE SQUAD
CA	G	CA1974G009	(03)	CALVERT COUNTY PUBLIC SCHOOLS	03/1997	N	3,000	4,000	230	930	125B	AQUIA FORMATION	02-13-11-01	MUTUAL ELEMENTARY SCHOOL
CA	G	CA1974G102	(02)	CALVERT COUNTY COMMISSIONERS	07/2000	Y	25,000	37,500	270	940	125B	AQUIA FORMATION	02-13-10-05	DARES BEACH - AQUIA
CA	G	CA1975G001	(04)	VERIZON MARYLAND INC.	03/2002	N	200	300	320	920	125B	AQUIA FORMATION	02-13-11-01	NORTH BEACH FACILITY #35078
CA	G	CA1975G002	(03)	CALVERT COUNTY BOARD OF COMMISSIONERS	04/1998	N	1,000	5,000	260	910	125B	AQUIA FORMATION	02-13-11-01	OLD LANDFILL OFFICE BLDG
CA	G	CA1975G004	(01)	UNIVERSITY OF MARYLAND	03/1976	N	1,000	1,500	250	900	124C	NANJEMOY FORMATION	02-13-11-01	
CA	G	CA1975G005	(03)	COLLIER, CHARLES	04/1998	N	1,100	2,200	270	910	124C	NANJEMOY FORMATION	02-13-11-01	LORD CALVERT BOWLING ALLEY
CA	G	CA1976G005	(07)	CALVERT COUNTY COMMISSIONERS	07/2006	Y	6,300	23,800	250	910	125B	AQUIA FORMATION	02-13-11-01	HALLOWING POINT PARK - PDWIS# 1041185 (MAINT) & 1041015 (CONCESS)
CA	G	CA1976G006	(05)	HARVEST FELLOWSHIP PRESBYTERIAN CHURCH	04/2001	N	100	200	210	960	124C	NANJEMOY FORMATION	02-13-11-01	CHURCH
CA	G	CA1976G007	(02)	ALL SAINTS EPISCOPAL CHURCH	08/1996	N	200	300	300	910	124C	NANJEMOY FORMATION	02-13-11-01	CHURCH
CA	G	CA1976G010	(02)	HARBOUR COAST INC.	09/1997	N	1,500	2,000	180	960	124E	PINEY POINT FORMATION	02-13-11-01	RESTAURANT/LOUNGE
CA	G	CA1976G011	(03)	THE GOTT COMPANY	07/2000	N	200	300	200	960	124E	PINEY POINT FORMATION	02-13-11-01	NATIONS BANK - LUSBY BRANCH
CA	G	CA1977G001	(02)	MARYLAND TOBACCO GROWERS ASSOCIATION	07/1987	N	500	600	290	910	124C	NANJEMOY FORMATION	02-13-11-01	R.K. AGRI SERVICES, INC.
CA	G	CA1977G002	(03)	RAJA HAWIT, MD & RICHARD GHAFFAS, MD	02/1999	N	1,200	2,000	280	910	124C	NANJEMOY FORMATION	02-13-11-01	MEDICAL OFFICES

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 8 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1977G005	(03)	FERRENZ, BRIAN, F.	06/2000	N	300	500	310	910	125B	AQUIA FORMATION	02-13-11-01	MT. HARMONY AUTO SERVICE - AUTO REPAIR
CA	G	CA1977G006	(03)	DUNKIRK SUPPLY, INC.	06/1999	N	400	600	320	920	125B	AQUIA FORMATION	02-13-11-01	DUNKIRK SUPPLY - TRUSS PLANT
CA	G	CA1977G008	(03)	CALVERT COUNTY PUBLIC SCHOOLS	11/1999	N	7,500	10,000	210	960	125B	AQUIA FORMATION	02-13-11-01	SOUTHERN MIDDLE SCHOOL
CA	G	CA1977G009	(03)	GLASCOCK, BEDFORD, C.	09/1999	N	1,500	2,000	180	950	124E	PINEY POINT FORMATION	02-13-11-01	SHOPPING CENTER
CA	G	CA1977G011	(03)	MT. OLIVE UNITED METHODIST CHURCH	11/2004	N	200	300	260	920	124C	NANJEMOY FORMATION	02-13-10-05	CHURCH - PDWIS# 104-1062
CA	G	CA1977G016	(04)	CALVERT COUNTY COMMISSIONERS	03/2003	Y	33,000	45,000	260	910	125B	AQUIA FORMATION	02-13-11-01	CALVERT COUNTY DETENTION CENTER
CA	G	CA1977G017	(03)	AMERICAN LEGION POST 274	06/2000	N	800	1,200	200	960	124E	PINEY POINT FORMATION	02-13-11-01	ARICK L. LORE POST 274, THE AMERICAN LEGION INC.
CA	G	CA1977G018	(03)	DORAN, JOHN, T.	06/2000	N	1,000	1,500	250	910	124C	NANJEMOY FORMATION	02-13-11-01	R.T&E LAND - TRADE CENTER - OFFICE/WAREHOUSE BUILDING
CA	G	CA1977G019	(03)	SOUTHERN MARYLAND ELECTRIC COOPERATIVE	12/1999	N	2,000	3,000	260	920	125B	AQUIA FORMATION	02-13-10-05	ELECTRIC UTILITY AT 901 DARES BEACH ROAD
CA	G	CA1978G001	(03)	ST. PAUL UNITED METHODIST CHURCH	03/2001	N	600	800	200	960	124E	PINEY POINT FORMATION	02-13-10-05	CHURCH, PARSONAGE, DAY SCHOOL
CA	G	CA1978G003	(03)	PARKERS CREEK WATER COMPANY	08/2000	N	2,700	4,600	250	930	124E	PINEY POINT FORMATION	02-13-10-05	PARKERS CREEK KNOLLS SUBD COMMUNITY SUPPLY
CA	G	CA1978G004	(09)	BOARD OF COMMISSIONERS OF CALVERT COUNTY	12/1996	Y	128,600	214,700	320	930	125B	AQUIA FORMATION	02-13-10-05	SUMMIT, HIGHLANDS & CHESAPEAKE LIGHTHOUSE SBDNS.
CA	G	CA1978G006	(02)	HILL, THOMAS	05/1997	N	1,000	1,500	310	910	125B	AQUIA FORMATION	02-13-11-01	OPTIMIST CLUB
CA	G	CA1978G008	(04)	CALVERT COUNTY COMMISSIONERS	06/2003	Y	6,500	9,000	250	920	125B	AQUIA FORMATION	02-13-11-01	MASON ROAD/WOODRIDGE COMM. SUPPLY
CA	G	CA1978G009	(03)	COOPERS UNITED METHODIST CHURCH	06/2000	N	200	300	320	900	125B	AQUIA FORMATION	02-13-11-01	CHURCH
CA	G	CA1978G010	(02)	MC ALLUM, T., J.	03/2000	N	500	800	300	910	125B	AQUIA FORMATION	02-13-10-05	B & M MOBILE TUNE-UP

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 9 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1978G011	(04)	CALVERT BEACH WATER COMPANY INC.	05/1998	Y	40,000	70,000	230	950	124E	PINEY POINT FORMATION	02-13-10-05	CALVERT BEACH PARK WEST SUBDIVISION
CA	G	CA1978G012	(03)	FOWLER, GENEVIEVE, M.	09/2000	N	300	500	260	920	124C	NANJEMOY FORMATION	02-13-10-05	SEARS APPLIANCE STORE (FORMERLY A GROCERY STORE)
CA	G	CA1978G013	(02)	OLIVET UNITED METHODIST CHURCH	05/1997	N	100	300	180	960	122	MIOCENE	02-13-11-01	
CA	G	CA1978G015	(03)	THE CHRIST CHILD SOCIETY	04/2000	N	1,000	4,000	220	920	124C	NANJEMOY FORMATION	02-13-11-01	CHRIST CHILD SUMMER CAMP
CA	G	CA1979G001	(04)	J.H. GRIBBLE & SONS, INC.	09/2002	N	9,600	9,800	250	920	125B	AQUIA FORMATION	02-13-10-05	CALVERT WELL DRILLING COMPANY
CA	G	CA1979G002	(02)	ADAMS, R. SCOTT	10/2005	N	1,200	2,000	210	960	124E	PINEY POINT FORMATION	02-13-11-01	FRYING PAN RESTAURANT - PDWIS# 104-1036
CA	G	CA1979G003	(03)	SOLID GROUND FARM, INC.	06/2001	N	6,900	41,000	220	920	125B	AQUIA FORMATION	02-13-11-01	HORSE & ALFALFA FARM
CA	G	CA1979G004	(05)	CALVERT COUNTY COMMISSIONERS	07/2006	Y	6,000	29,400	320	900	211D	MAGOTHY FORMATION	02-13-11-01	DUNKIRK DISTRICT PARK - PDWIS# 104-1013
CA	G	CA1979G005	(03)	FRANKEL DMD, BENNETT, F.	01/2006	N	2,000	3,400	260	910	124C	NANJEMOY FORMATION	02-13-11-01	PRINCE FREDERICK PROFESSIONAL BLDG - PDWIS# 104-1095
CA	G	CA1979G006	(02)	RIDGEWAY, JON R. AND PEGGY JO	09/1996	N	2,000	3,400	340	900	125B	AQUIA FORMATION	02-13-11-01	MULTI FAMILY APARTMENT UNIT
CA	G	CA1979G008	(03)	CALVERT COUNTY BOARD OF COMMISSIONERS	06/2001	N	600	2,000	240	920	124C	NANJEMOY FORMATION	02-13-11-01	BATTLE CREEK CYPRESS SWAMP NATURE CENTER
CA	G	CA1979G009	(03)	RANDLE CLIFF COMMUNITY CHURCH	06/2001	N	100	300	300	930	124C	NANJEMOY FORMATION	02-13-10-05	
CA	G	CA1979G010	(02)	TOWN OF CHESAPEAKE BEACH	09/1996	N	1,000	1,500	320	930	124C	NANJEMOY FORMATION	02-13-10-05	TOWN ROADS BUILDING
CA	G	CA1979G011	(02)	DODSON, JOSEPH, S.	08/1996	N	400	600	250	920	124C	NANJEMOY FORMATION	02-13-10-05	KEN MAR LIQUORS
CA	G	CA1979G013	(02)	BETHEL WAY OF THE CROSS CHURCH	09/1996	N	500	2,500	300	910	124C	NANJEMOY FORMATION	02-13-10-05	CHURCH
CA	G	CA1980G001	(02)	HILL & JOHN PRINCIPE, ROBERT	07/1996	N	500	800	340	900	125B	AQUIA FORMATION	02-13-11-01	LIQUOR STORE & DELI

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 10 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1980G003	(03)	JOHNSON ACRES WATER COMPANY	05/2003	N	3,200	5,400	220	940	124C	NANJEMOY FORMATION	02-13-11-01	JOHNSON ACRES SUBD - COMMUNITY SUPPLY
CA	G	CA1980G004	(03)	CALVERT COUNTY SPORTSMEN'S CLUB, INC.	08/2002	N	300	500	250	920	124C	NANJEMOY FORMATION	02-13-11-01	CLUB
CA	G	CA1980G005	(03)	VERIZON MARYLAND INC.	03/2002	N	100	200	230	930	124E	PINEY POINT FORMATION	02-13-11-01	PORT REPUBLIC/MUTUAL FACILITY #34087
CA	G	CA1980G008	(02)	SHELDON, NANETTE	07/1990	N	1,200	2,000	300	930	124C	NANJEMOY FORMATION	02-13-10-05	RANDLE CLIFFS COMMUNITY SUPPLY
CA	G	CA1980G009	(01)	SKIP JACK, INC.	11/1980	N	500	800	180	960	124C	NANJEMOY FORMATION	02-13-11-01	
CA	G	CA1980G010	(02)	DRUM POINT YACHT CLUB, INC.	11/1990	N	600	1,000	190	960	124C	NANJEMOY FORMATION	02-13-11-01	
CA	G	CA1981G001	(06)	CALVERT COUNTY COMMISSIONERS	06/2006	Y	3,300	21,100	200	970	124E	PINEY POINT FORMATION	02-13-10-05	COVE POINT PARK-1041186(MAINT)/ 1041111(CONCESSION)/ 104-1255(POOL)
CA	G	CA1981G003	(03)	MT. HARMONY UNITED METHODIST CHURCH	12/2003	N	300	400	320	910	124C	NANJEMOY FORMATION	02-13-11-01	
CA	G	CA1981G006	(02)	EMMANUEL SEVENTH-DAY ADVENTIST CHURCH	07/1991	N	100	300	260	920	124C	NANJEMOY FORMATION	02-13-10-05	CHURCH
CA	G	CA1981G008	(01)	SOLID ROCK CHURCH OF OUR LORD JESUS CHRI	09/1981	N	400	600	250	930	124E	PINEY POINT FORMATION	02-13-10-05	
CA	G	CA1981G010	(02)	CHRISTIAN BIBLE CENTER, INCORPORATED	09/1991	N	300	500	280	920	124C	NANJEMOY FORMATION	02-13-11-01	
CA	G	CA1981G011	(03)	MC CARTNEY, LABEN, J.	11/2005	N	300	500	260	920	124C	NANJEMOY FORMATION	02-13-11-01	PENN AUTO
CA	G	CA1981G012	(03)	MERILLAT, STEPHEN M.	01/2004	N	300	500	320	900	125B	AQUIA FORMATION	02-13-11-01	AQUA MAINTENANCE SERVICES
CA	G	CA1981G014	(02)	HARBOR HILLS CITIZENS ASSOCIATION, INC.	09/1991	N	300	1,000	230	920	124C	NANJEMOY FORMATION	02-13-11-01	MARINA
CA	G	CA1981G015	(03)	ERSOY, OSMAN Z.	10/2003	N	300	500	270	910	124C	NANJEMOY FORMATION	02-13-11-01	O'BRIEN REALTY

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 11 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1981G016	(02)	CALVERT BANK & TRUST COMPANY	09/1996	N	300	500	310	900	125B	AQUIA FORMATION	02-13-11-01	BANK BRANCH OFFICE - CHANEYVILLE
CA	G	CA1982G001	(03)	FLAG HARBOR PARTNERSHIP	10/2004	N	1,000	4,000	230	950	124E	PINEY POINT FORMATION	02-13-10-05	MARINA - 165 SLIPS/2 EMPLOYEES/POOL - PDWIS# 104-1099
CA	G	CA1982G002	(03)	PADGETT, BASCOMBE, G.	05/2004	N	6,800	10,200	270	900	125B	AQUIA FORMATION	02-13-11-01	RESIDENTIAL GWHP W/ RECHARGE WELL
CA	G	CA1982G003	(04)	THOMPSON, PAUL	07/2005	N	3,000	5,000	290	930	124C	NANJEMOY FORMATION	02-13-10-05	RESIDENTIAL GWHP W/ RECHARGE WELL
CA	G	CA1982G004	(03)	PRINCE FREDERICK MOTOR COMPANY, INC.	03/2004	N	900	1,500	260	920	124E	PINEY POINT FORMATION	02-13-10-05	AUTO SALES & SERVICE
CA	G	CA1982G006	(03)	FIRST LUTHERAN CHURCH	09/2001	N	300	500	300	910	125B	AQUIA FORMATION	02-13-11-01	CHURCH
CA	G	CA1982G007	(04)	M & D PARTNERS, LLC.	12/2004	N	7,500	12,500	250	900	125B	AQUIA FORMATION	02-13-11-01	HALLOWING POINT MOBILE HOME PARK - PDWIS# 004-0208
CA	G	CA1982G008	(03)	CALVERT SKATING ASSOCIATES, INC.	01/2006	N	1,000	1,500	310	900	125B	AQUIA FORMATION	02-13-11-01	CALVERT ROLLER SKATING CENTER - PDWIS# 104-1018
CA	G	CA1982G010	(03)	SOUTHERN MARYLAND OIL, INC.	10/2005	N	200	300	320	910	125B	AQUIA FORMATION	02-13-11-01	PETROLEUM PRODUCTS DISTRIBUTOR
CA	G	CA1983G002	(02)	THE FIRST NATIONAL BANK OF MARYLAND	09/1996	N	300	500	260	920	124C	NANJEMOY FORMATION	02-13-11-01	BANK
CA	G	CA1983G005	(03)	WEBER, KARL & DEBORAH	04/2005	N	300	500	270	920	124C	NANJEMOY FORMATION	02-13-11-01	CHARLES F. WEBER CO., INC
CA	G	CA1983G006	(03)	CHRIST EPISCOPAL CHURCH	07/2005	N	800	1,500	240	930	124E	PINEY POINT FORMATION	02-13-11-01	CHURCH/PARISH HOUSE/ RESIDENCE - PDWIS# 104-1115
CA	G	CA1983G007	(02)	CHURCH OF CHRIST AT PRINCE FREDERICK	12/2000	N	500	800	290	910	124C	NANJEMOY FORMATION	02-13-11-01	CHURCH
CA	G	CA1983G008	(03)	CALVERT CLIFFS NUCLEAR POWER PLANT, LLC	07/2000	N	300	500	220	960	124E	PINEY POINT FORMATION	02-13-10-05	CALVERT CLIFFS POWER PLANT - VISTORS CENTER
CA	G	CA1983G009	(03)	DUNKIRK SUPPLY INC.	08/1997	N	1,400	2,300	310	910	125B	AQUIA FORMATION	02-13-11-01	RETAIL LUMBER YARD

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland

(Page 12 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1983G011	(03)	RICKER, MICHAEL	01/2006	N	5,000	9,000	200	960	124E	PINEY POINT FORMATION	02-13-11-01	POTABLE/SANITARY & COMMERCIAL GWHP - PDWIS# 104-1023
CA	G	CA1983G013	(03)	CALVERT COUNTY PUBLIC SCHOOLS	11/1999	N	100	200	310	900	125B	AQUIA FORMATION	02-13-11-01	WELL-NORTHERN HS WWTP & WELL-CONCESSION STAND/ FIELD IRRIGATION
CA	G	CA1983G014	(03)	MATTHEWS, GAYLE B. & STELLA J.	06/2001	N	3,000	6,000	220	950	124E	PINEY POINT FORMATION	02-13-11-01	RESIDENTIAL GWHP - NO RETURN
CA	G	CA1984G001	(02)	BUCKINGHAM, MICHAEL, H.	02/1994	N	300	500	310	910	124C	NANJEMOY FORMATION	02-13-11-01	BAY METAL WORKS
CA	G	CA1984G002	(02)	MCLELLAND, SLATEN, A.	08/1996	N	3,000	3,500	340	900	125B	AQUIA FORMATION	02-13-11-01	GROUNDWATER HEAT PUMP
CA	G	CA1984G003	(03)	BOARD OF COMMISSIONERS OF CALVERT CO.	03/2006	Y	550,000	825,000	190	960	125B	AQUIA FORMATION	02-13-11-01	SOLOMONS ISLAND/LUSBY COMMUNITY WATER SUPPLY
CA	G	CA1984G005	(01)	ASBURY COMMUNITY CHURCH, INC.	06/1984	N	100	300	250	910	124C	NANJEMOY FORMATION	02-13-11-01	
CA	G	CA1984G007	(02)	DASH IN FOOD STORES, INC.	05/1996	N	500	1,000	320	910	125B	AQUIA FORMATION	02-13-11-01	CONVENIENCE STORE
CA	G	CA1984G008	(02)	KING, ESTATE OF BOYD	08/1996	N	500	800	260	920	124C	NANJEMOY FORMATION	02-13-11-01	RADIO SHACK - CALVERT VILLAGE SHOPPING CENTER
CA	G	CA1984G010	(02)	EASTERN & ST. JOHN U.M.C.	07/1996	N	400	700	200	960	124E	PINEY POINT FORMATION	02-13-11-01	EAST JOHN YOUTH CENTER
CA	G	CA1984G012	(02)	FIRST BAPTIST CHURCH, ,	08/1996	N	300	1,000	250	920	124C	NANJEMOY FORMATION	02-13-10-05	CHURCH
CA	G	CA1984G013	(02)	CHURCH OF JESUS CHRIST OF LDS, CALVERT BRANCH	08/1997	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-10-05	CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS
CA	G	CA1984G015	(02)	MORRIS, MICHAEL F., AND SHARON	09/1999	N	4,000	7,000	320	900	125B	AQUIA FORMATION	02-13-11-01	GWHP - RECHARGE WELL
CA	G	CA1984G016	(04)	STROCON, INC.	07/2002	N	1,300	1,800	310	910	125B	AQUIA FORMATION		02-13-11-01
CA	G	CA1984G017	(02)	MULLER, KENNETH, M.	08/1996	N	300	500	320	900	125B	AQUIA FORMATION	02-13-11-01	MT. HARMONY PROFESSIONAL CENTER

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 13 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1985G001	(03)	MARYLAND HISTORICAL TRUST	10/2004	N	5,700	7,300	210	940	124E	PINEY POINT FORMATION	02-13-11-01	JEFFERSON PATTERSON PARK & MUSEUM - PDWIS# 104-1131
CA	G	CA1985G002	(03)	TALPALAR ET AL, JAY, & BEVERLY	12/2005	N	800	1,200	290	910	125B	AQUIA FORMATION	02-13-11-01	7-11 & PIZZA SHOP/CARPET STORE/VIDEO RENTAL - NEW WELL AQUIA
CA	G	CA1985G003	(02)	SOUTHERN MARYLAND ISLAMIC CENTER	08/2000	N	300	500	270	910	124C	NANJEMOY FORMATION	02-13-11-01	CHURCH
CA	G	CA1985G005	(02)	DEPARTMENT OF NATURAL RESOURCES	01/1999	N	500	600	250	900	125B	AQUIA FORMATION	02-13-11-01	SOUTHERN SERVICE CENTER
CA	G	CA1985G006	(02)	HOWLIN, EDWARD, B.	08/1997	N	1,400	2,000	320	900	125B	AQUIA FORMATION	02-13-11-01	PROFESSIONAL BUILDING - PDWIS# 104-1201
CA	G	CA1985G008	(02)	THOMAS DEVENNEY	08/1997	N	700	1,200	320	900	125B	AQUIA FORMATION	02-13-11-01	PEACHTREE COURT CENTER
CA	G	CA1985G009	(02)	LAKE, WILLIAM, B.	11/2001	N	2,000	4,000	220	950	124E	PINEY POINT FORMATION	02-13-11-01	RESIDENTIAL GWHP - OVERBOARD DISCHARGE
CA	G	CA1985G010	(02)	BOWLES, JOHN	06/1998	N	300	450	330	890	125B	AQUIA FORMATION	02-13-11-01	BUILDING CONTRACTOR
CA	G	CA1985G011	(02)	MILLER, JAMES, A.	11/2001	N	2,500	4,000	220	950	124E	PINEY POINT FORMATION	02-13-11-01	RESIDENTIAL GWHP
CA	G	CA1985G012	(03)	EDWARD B. HOWLIN, INC.	03/2003	N	9,800	16,000	320	920	124C	NANJEMOY FORMATION	02-13-11-01	CONCRETE BATCH PLANT - PROCESS WATER AND POTABLE
CA	G	CA1985G014	(02)	CALVERT LIGHTHOUSE TABERNACLE	07/2002	N	300	500	260	930	124C	NANJEMOY FORMATION	02-13-11-01	CHURCH
CA	G	CA1985G015	(02)	CALVERT COUNTY PUBLIC SCHOOLS	11/1997	N	2,200	3,500	310	910	125B	AQUIA FORMATION	02-13-10-05	SUNDERLAND ELEMENTARY SCHOOL
CA	G	CA1985G016	(02)	ZION HILL CHURCH OF GOD IN CHRIST	07/2000	N	300	500	190	960	124E	PINEY POINT FORMATION	02-13-11-01	CHURCH
CA	G	CA1985G017	(02)	CONNOR, ROBERT & DARLENE	11/1998	N	300	500	240	910	124C	NANJEMOY FORMATION	02-13-11-01	RAY GROCERY STORE
CA	G	CA1985G018	(02)	GROVER, JUNE, L.	04/1998	N	300	500	240	940	124E	PINEY POINT FORMATION	02-13-10-05	PLUMBING SHOP

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 14 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1986G001	(02)	CLEARY & CARL G. BROWN, FRANK, J.	04/1998	N	1,100	1,900	310	910	124C	NANJEMOY FORMATION	02-13-11-01	BROWN-CLEARY OFFICE BLDG-CUSTOM HOME BUILDER & ANIMAL HOSPITAL
CA	G	CA1986G002	(02)	BESCHE OIL COMPANY, INC.	04/1998	N	300	500	200	960	124E	PINEY POINT FORMATION	02-13-11-01	LUSBY SUNOCO GAS STATION AND REPAIR GARAGE
CA	G	CA1986G005	(02)	CALVERT COUNTY BOARD OF COMMISSIONERS	05/1998	N	350	500	230	940	124E	PINEY POINT FORMATION	02-13-11-01	TRASH COMPACTOR
CA	G	CA1986G006	(02)	HUNTINGTOWN UNITED METHODIST CHURCH	06/2000	N	300	500	290	910	124C	NANJEMOY FORMATION	02-13-11-01	CHURCH
CA	G	CA1986G007	(04)	CALVERT COUNTY COMMISSIONERS	03/2006	Y	30,000	45,000	230	940	125B	AQUIA FORMATION	02-13-11-01	ST. LEONARD MUNICIPAL SUPPLY - PDWIS# 004-0013
CA	G	CA1986G008	(02)	ELLIS, JOHN	12/1998	N	2,500	4,000	330	900	125B	AQUIA FORMATION	02-13-11-01	GWHP
CA	G	CA1986G009	(02)	TAYLOR, WILLIAM, R.	11/1998	N	3,000	5,000	270	920	124C	NANJEMOY FORMATION	02-13-11-01	GWHP AND SOME LIVESTOCK WATERING (CHANGE IN TYPE)
CA	G	CA1986G010	(02)	PRINCE FREDERICK CONGREGATION OF JEHOVAH	08/2000	N	200	300	280	910	124C	NANJEMOY FORMATION	02-13-11-01	CHURCH
CA	G	CA1986G011	(02)	BENNETT, CHARLES & GAIL	03/1999	N	300	500	200	960	124E	PINEY POINT FORMATION	02-13-11-01	MEDICAL SERVICES
CA	G	CA1986G012	(02)	CALVERT COUNTY GOVERNMENT	03/2001	N	900	1,500	200	980	124E	PINEY POINT FORMATION	02-13-10-05	COVE POINT LIGHT RESIDENCES
CA	G	CA1986G013	(03)	SILPASUVAN, SUWAT	02/2006	N	500	800	270	910	124C	NANJEMOY FORMATION	02-13-11-01	CALVERT PROFESSIONAL PARK - DOCTORS OFFICES - PDWIS# 104-1204
CA	G	CA1986G014	(02)	SHERIDAN ET AL, DANIEL, P.	10/1998	N	1,000	1,500	320	920	124C	NANJEMOY FORMATION	02-13-11-01	LAZY J'S TAVERN
CA	G	CA1986G015	(02)	BOARD OF COMMISSIONERS CALVERT COUNTY	06/2000	N	100	1,500	260	920	125B	AQUIA FORMATION	02-13-10-05	COURTHOUSE STANDBY WELL - PDWIS #104-0083
CA	G	CA1986G016	(02)	BURKE, ALAN,	10/1998	N	500	800	200	960	124E	PINEY POINT FORMATION	02-13-11-01	GUIDO'S RESTAURANT

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 15 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1986G017	(02)	WENTWORTH NURSERY, INC.	08/2004	N	1,500	4,500	250	920	124C	NANJEMOY FORMATION	02-13-10-05	POTABLE/SANITARY & NURSERY IRRIGATION - 1 AC
CA	G	CA1987G001	(01)	STOKES, PAUL	03/1987	N	300	500	310	910	124C	NANJEMOY FORMATION	02-13-11-01	PAUL STOKES & SONS, INC. (PLUMBING)
CA	G	CA1987G004	(02)	FIRE DEPARTMENT & RESCUE SQUAD INC., HUNTINGTOWN VOLUNTEER	08/2000	N	100	150	290	910	124C	NANJEMOY FORMATION	02-13-11-01	HUNTINGTOWN POST OFFICE
CA	G	CA1987G005	(02)	DUNKIRK ASSOCIATES, LLC,	06/2002	N	3,000	4,500	320	900	125B	AQUIA FORMATION	02-13-11-01	DUNKIRK TOWN SQUARE SHOPPING CENTER
CA	G	CA1987G006	(02)	CALVERT COUNTY BOARD OF COMMISSIONERS	04/2000	N	500	1,000	230	950	124E	PINEY POINT FORMATION	02-13-99-98	FLAG PONDS PARK
CA	G	CA1987G007	(01)	MARYLAND TOBACCO GROWERS ASSOCIATION	07/1987	N	350	500	290	910	124C	NANJEMOY FORMATION	02-13-11-01	JOHN'S OPEN PIT BAR-B-QUE
CA	G	CA1987G008	(02)	EDSINGER, ROBERT	11/2004	N	2,000	4,000	230	920	124E	PINEY POINT FORMATION	02-13-11-01	RESIDENTIAL GWHP W/ RECHARGE WELL
CA	G	CA1987G009	(01)	STEVENSON, DOUGLAS	08/1987	N	300	500	310	910	125B	AQUIA FORMATION	02-13-11-01	STEVENSON POOLS OFFICE
CA	G	CA1987G010	(02)	CALVERT COUNTY BOARD OF COMMISSIONERS	05/1998	N	1,000	5,000	290	930	124C	NANJEMOY FORMATION	02-13-10-05	PLUM POINT TRASH COMPACTOR SITE
CA	G	CA1987G011	(03)	SINGH, RAGHUVIR	11/2004	N	100	300	290	910	124C	NANJEMOY FORMATION	02-13-11-01	LIQUOR STORE
CA	G	CA1987G012	(02)	SUNTRUST BANK	11/2001	N	300	400	320	900	125B	AQUIA FORMATION	02-13-11-01	SUNTRUST BANK
CA	G	CA1987G014	(01)	MOORE, SEWELL	10/1987	N	7,000	14,500	220	940	124E	PINEY POINT FORMATION	02-13-11-01	GROUND WATER HEAT PUMP
CA	G	CA1987G015	(02)	WILLIS, MICHAEL & LORI	01/2000	N	3,000	5,000	260	940	124C	NANJEMOY FORMATION	02-13-10-05	GROUND WATER HEAT PUMP
CA	G	CA1987G016	(01)	BEVERLY, LINWOOD	01/1988	N	3,000	5,000	240	930	124E	PINEY POINT FORMATION	02-13-11-01	GROUND WATER HEAT PUMP
CA	G	CA1987G017	(02)	GOLLUB, MELVIN	11/1999	N	100	200	250	910	124C	NANJEMOY FORMATION	02-13-11-01	RADIO STATION - WMJS

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 16 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1987G018	(02)	MOORE, SEWELL, T.	01/2000	N	3,000	5,000	220	940	124E	PINEY POINT FORMATION	02-13-11-01	GWHP - RECHARGE WELL
CA	G	CA1987G019	(02)	BOWEN, EDWARD, L.	03/2000	N	500	800	250	930	124E	PINEY POINT FORMATION	02-13-10-05	JACK & JILL DAY CARE CENTER
CA	G	CA1987G020	(01)	ABNER, ROBERT	03/1988	N	100	200	310	930	125B	AQUIA FORMATION	02-13-10-05	MARINA
CA	G	CA1988G001	(02)	HEGARTY KOPICKI INCORPORATED	06/2000	N	300	500	290	910	124C	NANJEMOY FORMATION	02-13-11-01	OFFICE
CA	G	CA1988G002	(02)	GRIBBLE, JOSEPH, H.	06/2002	N	4,000	6,000	180	970	124E	PINEY POINT FORMATION	02-13-10-05	GROUND WATER HEAT PUMP
CA	G	CA1988G003	(02)	GRACE BRETHREN CHURCH	12/1996	N	600	1,000	320	910	124C	NANJEMOY FORMATION	02-13-11-01	CHURCH & PARSONAGE
CA	G	CA1988G004	(02)	BAY STATE INSULATION INC.	06/2000	N	200	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	INSULATION CONTRACTOR
CA	G	CA1988G005	(01)	CARROLL WESTERN CHURCH	04/1988	N	300	500	240	910	124C	NANJEMOY FORMATION	02-13-11-01	CHURCH
CA	G	CA1988G006	(02)	T. AND T. LUMBER COMPANY, INC.	03/2001	N	800	1,200	240	930	124E	PINEY POINT FORMATION	02-13-11-01	?
CA	G	CA1988G007	(01)	SPARROW, DOUG	10/1988	N	3,000	6,000	260	910	124C	NANJEMOY FORMATION	02-13-11-01	GROUND WATER HEAT PUMP
CA	G	CA1988G008	(03)	MYCHALUS, IHOR & ANNE	11/2001	N	3,000	5,000	180	960	124E	PINEY POINT FORMATION	02-13-11-01	RESIDENTIAL GROUND WATER HEAT PUMP SYSTEM
CA	G	CA1988G009	(03)	THE TOWN OF NORTH BEACH,	09/2006	Y	185,000	300,000	320	930	125B	AQUIA FORMATION	02-13-10-05	MUNICIPAL SUPPLY - PDWIS# 004-0030
CA	G	CA1988G010	(01)	PENN, JAMES & PATRICIA	12/1988	N	300	500	250	910	124C	NANJEMOY FORMATION	02-13-11-01	PATTI'S QUICK SHOP
CA	G	CA1989G002	(03)	KUNST, MARY ANN AND JAMES W.	11/2005	N	3,000	6,000	180	960	124E	PINEY POINT FORMATION	02-13-11-01	RESIDENTIAL GWHP W/ RECHARGE WELL
CA	G	CA1989G003	(03)	SELECT PRODUCTS, INC.	07/2001	N	100	200	180	960	124E	PINEY POINT FORMATION	02-13-11-01	MARINA
CA	G	CA1989G004	(02)	SELECT PRODUCTS, INC.	07/2001	N	6,000	12,000	180	960	122H	MIOCENE SERIES	02-13-11-01	CATAMARANS RESTAURANT - GWHP

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 17 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1989G005	(01)	FLORIA, JOSEPH	04/1989	N	3,000	6,000	300	910	124C	NANJEMOY FORMATION	02-13-11-01	GROUND WATER HEAT PUMP
CA	G	CA1989G007	(02)	CALVERT CLIFFS NUCLEAR POWER PLANT, LLC	07/2000	N	500	1,000	220	960	124E	PINEY POINT FORMATION	02-13-11-01	RIFLE RANGE -DRINKING FOUNTAIN, SINK, LAWN IRRIGATION
CA	G	CA1989G008	(03)	HOWLIN, JR., EDWARD, B.	01/2005	N	21,000	33,200	320	900	211D	MAGOTHY FORMATION	02-13-11-01	SHOPPES @ APPLE GREEN - PDWIS # 104-0076
CA	G	CA1989G009	(02)	HUDSON JR., JOHN, W.	06/2001	N	300	500	270	910	125B	AQUIA FORMATION	02-13-11-01	HUDSON'S SUNOCO & MINI MART INC.
CA	G	CA1989G010	(02)	COLUMBIA INVESTMENTS, LLC	10/2003	N	500	800	270	910	124C	NANJEMOY FORMATION	02-13-11-01	AUTO BODY REPAIR
CA	G	CA1989G011	(02)	CERRITO FAMILY PROPERTIES LLC	07/2001	N	1,000	1,500	340	900	125B	AQUIA FORMATION	02-13-11-01	RETAIL, OFFICE AND SERVICES
CA	G	CA1989G012	(02)	SNEADE, WILLIAM, D.	06/2001	N	500	700	320	920	125B	AQUIA FORMATION	02-13-10-05	HARDWARE STORE
CA	G	CA1989G013	(02)	WILLIAMS, JENNIFER	11/2005	N	1,000	1,600	270	910	124C	NANJEMOY FORMATION	02-13-11-01	FIRST IMPRESSIONS DAYCARE - PDWIS# 104-0054
CA	G	CA1989G015	(01)	RICHARD & PHYLLIS HORSMON	09/2001	N	3,000	12,000	220	940	112	PLEISTOCENE	02-13-11-01	NURSERY
CA	G	CA1989G016	(02)	CALVERT ELKS LODGE #2620	07/2001	N	500	800	260	920	124C	NANJEMOY FORMATION	02-13-10-05	MEETING HALL
CA	G	CA1989G017	(03)	CHESAPEAKE CHURCH	11/2005	N	1,100	2,200	300	910	124C	NANJEMOY FORMATION	02-13-11-01	CHURCH & SHILOH CHRISTIAN ACADEMY PDWIS# 104-1176
CA	G	CA1989G018	(02)	CALVERT COUNTY BOARD OF COMMISSIONERS	06/1998	N	1,000	5,000	200	960	124E	PINEY POINT FORMATION	02-13-11-01	APPEAL/LUSBY COMPACTOR SITE
CA	G	CA1989G019	(03)	JEFFERSON, AGNES	12/2004	N	100	300	210	960	124E	PINEY POINT FORMATION	02-13-11-01	D.J.'S MARKET-PDWIS# 104-1029 (INACTIVE) - PROP FOR SALE
CA	G	CA1989G020	(03)	CALVERT COUNTY PUBLIC SCHOOLS	12/2002	N	6,000	9,000	280	920	125B	AQUIA FORMATION	02-13-11-01	PLUM POINT ELEMENTARY SCHOOL
CA	G	CA1989G021	(02)	RAYMOND-WOOD FUNERAL HOME, P.A.	10/2005	N	500	700	320	900	125B	AQUIA FORMATION	02-13-11-01	FUNERAL HOME AND FLORIST SHOP - PDWIS# 104-1190
CA	G	CA1989G022	(02)	J & K INVESTMENT ASSOCIATES, L.L.C.	12/2001	N	900	1,500	320	900	125B	AQUIA FORMATION	02-13-11-01	OFFICE BLDG - 10020 SOUTHERN MARYLAND BLVD

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 18 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1989G023	(02)	WAYSON, MORGAN	09/2002	N	6,100	10,000	310	910	125B	AQUIA FORMATION	02-13-11-01	OFFICE/WAREHOUSE SPACE/ SAMES INDUSTRIAL CENTER
CA	G	CA1989G107	(01)	CALVERT CLIFFS NUCLEAR POWER PLANT, LLC	07/2000	N	300	500	220	960	124E	PINEY POINT FORMATION	02-13-11-01	PUP TRAILERS - NON-POTABLE SUPPLY ONLY
CA	G	CA1990G001	(02)	QUALITY BUILT HOMES, INC.	10/2003	N	600	1,200	220	950	112	PLEISTOCENE	02-13-11-01	
CA	G	CA1990G004	(03)	GIGLIOTTI, FELIX	09/2003	N	2,500	5,000	180	960	124E	PINEY POINT FORMATION	02-13-11-01	GWHP
CA	G	CA1990G005	(02)	CALVERT COUNTY PUBLIC SCHOOLS	12/2002	N	5,000	7,000	280	920	125B	AQUIA FORMATION	02-13-11-01	PLUM POINT MIDDLE SCHOOL
CA	G	CA1990G006	(02)	GRAY, BRUCE	05/1997	N	1,000	2,800	280	930	124C	NANJEMOY FORMATION	02-13-10-05	GWHP - RETURN WELL
CA	G	CA1990G008	(04)	DUNKIRK MARKET PLACE LLC,	07/2004	Y	15,000	30,000	320	900	125B	AQUIA FORMATION	02-13-11-01	DUNKIRK MARKET PLACE - 1 WELL - PDWIS# 1040064
CA	G	CA1990G009	(02)	BOWEN, DOUGLAS R.	11/2002	N	200	300	270	910	124C	NANJEMOY FORMATION	02-13-11-01	WASHING FARM EQUIPMENT.
CA	G	CA1990G010	(02)	CALVERT COUNTY COMMISSIONERS	12/2002	N	300	500	250	910	124C	NANJEMOY FORMATION	02-13-11-01	WASTE WATER TREATMENT PLANT.
CA	G	CA1990G011	(02)	RIVERA III, MODESTO S.	12/2002	N	300	500	260	920	124C	NANJEMOY FORMATION	02-13-11-01	MEDICAL OFFICE BUILDING.
CA	G	CA1990G012	(02)	KATZENBERGER, FRANK & KATHI	01/2003	N	300	500	220	960	124E	PINEY POINT FORMATION	02-13-11-01	FRANK'S GARAGE INC.
CA	G	CA1990G013	(02)	CRANE JR., JOHN, T.	01/2003	N	300	500	210	960	124E	PINEY POINT FORMATION	02-13-11-01	GROCERY STORE
CA	G	CA1990G014	(04)	DONALDSON, STEVEN, E.	09/2005	N	3,000	6,000	180	160	124E	PINEY POINT FORMATION	02-13-11-01	RESIDENTIAL GWHP W/RETURN WELL
CA	G	CA1990G015	(03)	MURRAY, JR., RAYMOND, W.	09/2005	N	3,000	6,000	180	960	124E	PINEY POINT FORMATION	02-13-11-01	RESIDENTIAL GWHP W/ RECHARGE WELL
CA	G	CA1990G016	(02)	RADEACKAR, RANDY,	10/1996	N	3,000	6,000	180	960	122	MIOCENE	02-13-11-01	GWHP.
CA	G	CA1990G017	(02)	EASTERN UNITED METHODIST CHURCH	11/2002	N	300	500	190	960	124E	PINEY POINT FORMATION	02-13-11-01	CHURCH
CA	G	CA1991G005	(02)	CROSSROAD CHRISTIAN CHURCH, INC.	07/2003	N	1,200	1,800	230	940	125B	AQUIA FORMATION	02-13-11-01	CHURCH & SCHOOL

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 19 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1991G006	(02)	MT. GETHSEMANE BAPTIST CHURCH	09/2006	N	100	200	290	920	124C	NANJEMOY FORMATION	02-13-10-05	CHURCH - PDWIS# 104-1129
CA	G	CA1991G008	(02)	MOUNT HOPE METHODIST CHURCH	07/2004	N	100	300	300	910	125B	AQUIA FORMATION	02-13-10-05	
CA	G	CA1991G023	(02)	AMERICAN LEGION POST #85	04/2004	N	100	300	290	910	125B	AQUIA FORMATION	02-13-11-01	AMERICAN LEGION
CA	G	CA1991G024	(02)	COLLINS CONTROLS, INC.	11/2003	N	500	1,000	210	960	124E	PINEY POINT FORMATION	02-13-11-01	WAREHOUSE-ELECTRICAL AND MASONRY CONTRACTORS
CA	G	CA1991G028	(02)	CALVERT COUNTY PUBLIC SCHOOLS	01/2004	N	4,400	6,600	200	960	124C	NANJEMOY FORMATION	02-13-11-01	PATUXENT ELEMENTARY SCHOOL
CA	G	CA1992G002	(02)	CHOICE HOME CENTER, INC.	01/2006	N	300	500	310	900	125B	AQUIA FORMATION	02-13-11-01	FLOORING CENTER
CA	G	CA1992G010	(02)	BECKER BROTHERS ENTERPRISES	07/1996	N	13,100	21,800	290	940	124C	NANJEMOY FORMATION	02-13-10-05	55-LOT BREEZY POINT ESTATES SUBDIVISION
CA	G	CA1992G024	(02)	SAFEWAY INC.	07/2004	N	8500	11,800	320	900	125B	AQUIA FORMATION	02-13-11-01	DUNKIRK MARKET PLACE SAFEWAY - PDWIS# 1040069
CA	G	CA1992G027	(02)	CALVERT COUNTY COMMISSIONERS	06/2004	N	400	700	200	970	124C	NANJEMOY FORMATION	02-13-11-01	FIRE SUBSTATION NO. 3A
CA	G	CA1992G029	(02)	ABDALLA, ET AL, NAJAH,	03/1996	N	10,700	17,800	230	930	124E	PINEY POINT FORMATION	02-13-11-01	MILLS POND SUBDIVISION
CA	G	CA1992G035	(03)	QUALITY BUILT HOMES, INC.	04/1997	N	14,700	24,600	280	930	124C	NANJEMOY FORMATION	02-13-10-05	WILBURN ESTATES SUBD - ADD 20 LOTS TO PLATTED 42
CA	G	CA1992G037	(02)	RAY ENTERPRISES, INC., ,	08/1995	N	7,200	12,100	220	920	124C	NANJEMOY FORMATION	02-13-11-01	WILLIAMS WHARF PLANTATION - 30 LOT SBDN
CA	G	CA1992G039	(02)	STONE, LOUIS, P.	01/2005	N	600	900	210	930	124E	PINEY POINT FORMATION	02-13-11-01	2 APARTMENTS
CA	G	CA1993G007	(02)	SOUTHERN CALVERT BAPTIST CHURCH	07/2005	N	1,000	2,000	190	960	124E	PINEY POINT FORMATION	02-13-11-01	CHURCH - PDWIS# 1041161
CA	G	CA1993G008	(02)	MORGAN STATE UNIVERSITY	03/2005	N	2,000	3,000	210	940	124E	PINEY POINT FORMATION	02-13-11-01	ENVIRONMENTAL RESEARCH FACILITY
CA	G	CA1993G010	(02)	STALLINGS, LARRY R. & JUDY C.	12/2005	N	400	700	290	920	124C	NANJEMOY FORMATION	02-13-10-05	THE ANOINTED HANDS HAIR SALON/STALLING NAT'L ENTER/ TRAILER

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 20 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1993G011	(03)	FDI POSTAL PROPERTIES II, INC.	03/2006	N	300	500	320	910	124C	NANJEMOY FORMATION	02-13-11-01	OWINGS POST OFFICE
CA	G	CA1993G020	(02)	TYRRELL, BRENDA	11/2005	N	1,800	3,000	320	920	125B	AQUIA FORMATION	02-13-11-01	PRIMETIME CHILDRENS CENTER
CA	G	CA1993G033	(02)	BOWEN, GORDON, F.	08/2005	N	300	400	290	910	124C	NANJEMOY FORMATION	02-13-11-01	BOWEN'S GROCERY - PDWIS# 104-1008
CA	G	CA1993G035	(01)	GRANADOS, MICHAEL & ROBERT	08/1993	N	8700	70,000	270	900	125B	AQUIA FORMATION	02-13-11-01	GRANADOS FARMS
CA	G	CA1993G038	(03)	BAYLINE BUILDERS & DEVELOPERS, INC.	03/2004	N	8,800	14,700	290	930	125B	AQUIA FORMATION	02-13-10-05	37-LOT HOLBROOK ESTATES SECT II SUBD
CA	G	CA1993G039	(04)	JLH GROUP, LLC	09/2004	N	1,000	1,900	260	910	124C	NANJEMOY FORMATION	02-13-11-01	DUPONT BLDG - PARK PLACE LOT 7RR - OFFICE & SUITES
CA	G	CA1993G040	(02)	BUCKLER, GORMAN, A.	08/2005	N	4,800	7,900	270	910	124C	NANJEMOY FORMATION	02-13-11-01	BUCKLER MOBILE HOME PARK - PDWIS# 004-0209
CA	G	CA1993G041	(01)	GRANADOS, MICHAEL & ROBERT	08/1993	N	8700	70,000	270	900	122	MIOCENE	02-13-11-01	GRANADOS FARMS
CA	G	CA1993G044	(02)	EVELYN NESTOR	05/1997	N	8,800	14,800	230	930	124E	PINEY POINT FORMATION	02-13-11-01	LOST MILL SBDN.
CA	G	CA1993G045	(02)	MATHEW, MD, SCARIA	10/2005	N	300	500	200	960	124E	PINEY POINT FORMATION	02-13-11-01	MEDICAL OFFICE
CA	G	CA1993G048	(04)	NAVAL AIR STATION	04/2006	Y	80,000	150,000	180	950	125B	AQUIA FORMATION	02-13-11-01	CENTRAL SUPPLY FOR PATUXENT NAVAL AIR STATION
CA	G	CA1994G004	(02)	NRL - CHESAPEAKE BAY DETACHMENT	02/2006	Y	25,000	51,000	300	930	125B	AQUIA FORMATION	02-13-10-05	CHESAPEAKE BY DETACHMENT - CHESAPEAKE BEACH - PDWIS# 004-0019
CA	G	CA1994G008	(02)	THE GOTT COMPANY	03/2006	N	500	700	200	960	124E	PINEY POINT FORMATION	02-13-11-01	"FASTOP" MINI-MART #54 - PDWIS# 104-1180
CA	G	CA1994G009	(02)	MARYLAND DEPARTMENT OF TRANSPORTATION	08/1994	N	300	500	260	910	124C	NANJEMOY FORMATION	02-13-11-01	PRINCE FREDERICK VEHICLE EMISSION TESTING FACILITY
CA	G	CA1994G011	(02)	CRAIG, JANET, L.	03/2006	N	1,500	3,000	290	910	125B	AQUIA FORMATION	02-13-11-01	DAYCARE FACILITY - PDWIS# 104-0084
CA	G	CA1994G023	(01)	MATHEWS, SCARIA	06/1994	N	300	500	200	960	122	MIOCENE	02-13-11-01	MEDICAL BUILDING

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 21 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1994G025	(02)	WLHSPE, LLC	11/2005	N	100	300	320	920	125B	AQUIA FORMATION	02-13-11-01	FRIENDLY SELF STORAGE
CA	G	CA1994G026	(03)	CALVERT COUNTY FAIR, INCORPORATED	05/2006	N	2,200	8,000	250	910	124C	NANJEMOY FORMATION	02-13-11-01	CALVERT COUNTY FAIR GROUNDS (104-1110)
CA	G	CA1994G028	(03)	CALVERT COUNTY COMMISSIONERS	03/2006	Y	6,000	9,500	290	910	125B	AQUIA FORMATION	02-13-11-01	COMMUNITY SUPPLY - TARA SUBD - 25 HOMES - PDWIS# 004-0034
CA	G	CA1994G033	(02)	HENNON, JR., JAMES, F.	07/1995	N	3,400	5,600	270	930	124C	NANJEMOY FORMATION	02-13-11-01	14L GARRETT ACRES SUBDIVISION
CA	G	CA1994G039	(01)	CEDAR BEACH HOMEOWNERS ASSOC., INC.	08/1994	N	100	300	250	900	124C	NANJEMOY FORMATION	02-13-11-01	CEDAR BEACH COMMUNITY PIER
CA	G	CA1994G044	(01)	CALVERT COUNTY COMMISSIONERS	10/1994	N	300	500	210	930	124C	NANJEMOY FORMATION	02-13-11-01	BROOMES ISLAND COMMUNITY CENTER
CA	G	CA1994G052	(02)	SCHMEISER, HAROLD R. & LAURIE T.	07/2006	N	600	1,000	230	900	125B	AQUIA FORMATION	02-13-11-01	DUNKIRK ANIMAL HOSPITAL - PDWIS# 104-1239
CA	G	CA1994G057	(01)	WILLOWS DEVELOPMENT COMPANY	12/1994	N	6,400	10,700	290	940	124C	NANJEMOY FORMATION	02-13-10-05	WILLOWS BEACH HOME SBDN
CA	G	CA1995G003	(01)	WALKER, DONALD, C.	02/1995	N	250	300	310	910	125B	AQUIA FORMATION	02-13-11-01	YESTERYEAR FURNISHINGS, INC.
CA	G	CA1995G004	(01)	PERRY, THOMAS, C.	02/1995	N	6,000	10,000	340	900	125B	AQUIA FORMATION	02-13-11-01	HARNISHAN SBDN
CA	G	CA1995G005	(02)	THE SHOPPES AT DUNKIRK, LLC	07/2005	N	5,600	8,100	320	900	125B	AQUIA FORMATION	02-13-11-01	COUNTRY PLAZA SHOPPING CENTER - PDWIS# 104-1152
CA	G	CA1995G006	(02)	GRACE, MARK & PEGGY	08/1998	N	2,500	10,000	300	890	125B	AQUIA FORMATION	02-13-11-01	PITCH & PUT GOLF COURSE T & GREENS ONLY 9 HOLES
CA	G	CA1995G010	(01)	PENWICK VILLAGE LIMITED PARTNERSHIP	03/1995	N	2,000	2,500	330	900	125B	AQUIA FORMATION	02-13-11-01	CALVERT GATEWAY CITGO
CA	G	CA1995G011	(01)	GREEN, SR., GEORGE	03/1995	N	2,900	4,900	290	930	124C	NANJEMOY FORMATION	02-13-10-05	THE ESTATE OF LEROY GREEN
CA	G	CA1995G019	(02)	BOARD OF COMMISSIONERS OF CALVERT COUNTY	07/2005	Y	10,000	15,000	200	960	125B	AQUIA FORMATION	02-13-11-01	SOUTHERN PINES SENIOR - TIED TO SOLOMONS/LUSBY PDWIS# 004-0002

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland

(Page 22 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1995G026	(01)	PAINTER, WILLIE	01/1996	N	10,000	16,700	300	920	125B	AQUIA FORMATION	02-13-10-05	SUNDERLEIGH SBDN (42 LOTS)
CA	G	CA1995G030	(03)	CALVERT COUNTY COMMISSIONERS	11/2000	Y	14,700	24,600	290	910	125B	AQUIA FORMATION	02-13-11-01	WALNUT CREEK COMMUNITY SUPPLY (PHASE III)
CA	G	CA1995G031	(01)	SOUTHERN MARYLAND OIL, INCORPORATED	07/1995	N	300	500	200	960	124E	PINEY POINT FORMATION	02-13-11-01	LUSBY TEXACO
CA	G	CA1995G032	(01)	CHAFFEE, CHRIS	07/1995	N	3,400	5,600	260	910	124C	NANJEMOY FORMATION	02-13-11-01	14L CHAFFEE PROPERTY SBDN
CA	G	CA1995G035	(01)	DUNLAP, STEVEN, H.	07/1995	N	2,700	4,400	230	930	124E	PINEY POINT FORMATION	02-13-11-01	STRATHEMOOR 11L SBDN
CA	G	CA1995G040	(01)	DINARDO, BRIAN	07/1995	N	1,000	4,000	220	930	124E	PINEY POINT FORMATION	02-13-11-01	SOUTHERN MD GREENHOUSE - NURSERY (PLANTS)
CA	G	CA1995G047	(01)	PRALEY, EDWARD	09/1995	N	3,400	5,600	270	910	124C	NANJEMOY FORMATION	02-13-11-01	14 LOT HUNTINGTOWN SOUTH SBDN
CA	G	CA1995G048	(01)	LEE FUNERAL HOME, INC.	09/1995	N	500	800	310	900	125B	AQUIA FORMATION	02-13-11-01	LEE FUNERAL HOME
CA	G	CA1995G049	(02)	MURRAY, J., D.	11/1996	N	11,500	19,200	320	910	125B	AQUIA FORMATION	02-13-11-01	48-LOT CABIN BRANCH SBDN
CA	G	CA1995G051	(01)	CLEARY, SR., FRANK,	11/1995	N	2,700	4,400	310	900	125B	AQUIA FORMATION	02-13-11-01	11L WILLIAMS PROPERTY SUBDIVISION
CA	G	CA1995G055	(01)	GATES, JR., ANDREW G.,	10/1995	N	300	500	300	910	124C	NANJEMOY FORMATION	02-13-11-01	GATES GREENHOUSE
CA	G	CA1995G057	(03)	CASTLETON COMMUNITY ASSOCIATION INC.	10/2002	N	300	500	280	920	124C	NANJEMOY FORMATION	02-13-11-01	CASTLETON SBDN - LAWN IRRIGATION & MAKE-UP WATER FOR FOUNTAIN
CA	G	CA1995G059	(01)	COX, MAURICE,	12/1995	N	300	500	260	910	124C	NANJEMOY FORMATION	02-13-11-01	OFFICE
CA	G	CA1995G060	(01)	BROWN, THOMAS PARRAN III/MELVIN,	12/1995	N	5,000	8,000	240	940	124E	PINEY POINT FORMATION	02-13-11-01	20- LOT SUBDIVISION
CA	G	CA1995G062	(01)	WOOD, FRANK	12/1995	N	500	800	320	910	125B	AQUIA FORMATION	02-13-11-01	SISK AUTO BODY
CA	G	CA1996G005	(01)	VENTURE UPHOLSTERY, INC.	02/1996	N	400	700	310	910	124C	NANJEMOY FORMATION	02-13-11-01	COMMERCIAL TRUCK SEAT SALES/UPHOLSTERY

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 23 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1996G008	(01)	ALEXANDER, R. BROOKE KAINE AND RICHA	02/1997	N	27,500	45,800	270	930	124C	NANJEMOY FORMATION	02-13-11-01	RESUBDIVISION OF 71 PLATTED LOTS INTO 115 LOTS
CA	G	CA1996G009	(01)	MILL BRANCH LLC, C/O MORGAN RUSSELL	02/1996	N	6,200	10,300	300	900	124C	NANJEMOY FORMATION	02-13-11-01	26 LOT SUBDIVISION
CA	G	CA1996G015	(01)	HOMES AMERICA CORPORATION	03/1996	N	400	700	300	910	124C	NANJEMOY FORMATION	02-13-10-05	CHIPS TOWING SERVICE
CA	G	CA1996G016	(01)	DOUBLE D FITNESS CENTER	04/1996	N	800	1,300	260	910	124C	NANJEMOY FORMATION	02-13-11-01	HEALTH AND FITNESS CENTER
CA	G	CA1996G018	(02)	HOWLIN, EDWARD, B.	06/1996	N	8,800	14,700	310	920	124C	NANJEMOY FORMATION	02-13-10-05	37 LOT ASPEN WOODS SUBD
CA	G	CA1996G019	(01)	WATHEN, KENNETH, L.	04/1996	N	500	800	230	940	124E	PINEY POINT FORMATION	02-13-11-01	SELF-STORAGE FACILITY AND APARTMENT
CA	G	CA1996G020	(01)	CALVERT MEMORIAL HOSPITAL	04/1996	N	2,600	4,000	330	900	125B	AQUIA FORMATION	02-13-11-01	PHYSICIAN'S OFFICE BUILDING
CA	G	CA1996G021	(04)	WELLONS, III & DIANE L. WELLONS, L. THOMAS	07/2005	N	500	800	260	910	124C	NANJEMOY FORMATION	02-13-11-01	LOT #2 - FUTURE COMMERCIAL ESTABLISHMENT
CA	G	CA1996G022	(04)	WELLONS, III & DIANE WELLONS, L. THOMAS	07/2005	N	500	800	260	910	124C	NANJEMOY FORMATION	02-13-11-01	LOT #3 - FUTURE COMMERCIAL ESTABLISHMENT
CA	G	CA1996G023	(04)	WELLONS, III & DIANE L. WELLONS, L. THOMAS	07/2005	N	500	800	260	910	124C	NANJEMOY FORMATION	02-13-11-01	LOT #4 - FUTURE COMMERCIAL ESTABLISHMENT
CA	G	CA1996G025	(02)	TROTT, RAYMOND, G.	04/1998	N	2,600	4,300	280	900	124C	NANJEMOY FORMATION	02-13-11-01	11-LOT SUBD
CA	G	CA1996G026	(03)	CALVERT COUNTY BOARD OF COMMISSIONERS	03/2000	Y	37,000	61,000	320	910	125B	AQUIA FORMATION	02-13-11-01	CROSS POINT COMMUNITY SUPPLY - CHANGE OF OWNER
CA	G	CA1996G036	(02)	GODSGRACE 1652, LLC	12/2004	N	500	800	310	900	125B	AQUIA FORMATION	02-13-11-01	OFFICE BUILDING PDWIS# 104-1209
CA	G	CA1996G039	(01)	THE CARROLL INDEPENDENT FUEL COMPANY	07/1996	N	300	500	320	900	125B	AQUIA FORMATION	02-13-11-01	CITGO GAS/SERVICE STATION
CA	G	CA1996G044	(01)	GROVER, RUTH	09/1996	N	7100	11,900	320	910	124C	NANJEMOY FORMATION	02-13-11-01	30 LOT SUBD
CA	G	CA1996G045	(01)	MARQUESS, ELINOR, J.	09/1996	N	6,700	11,200	300	910	124C	NANJEMOY FORMATION	02-13-11-01	28 LOT SUBD

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 24 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1996G046	(01)	WARD, DOROTHY, T.	09/1996	N	3,300	5,500	280	920	124C	NANJEMOY FORMATION	02-13-11-01	14 LOT SUBD
CA	G	CA1996G049	(01)	APPLE CREEK DEVELOPMENT CORPORATION	09/1996	N	4,000	6,700	240	910	124E	PINEY POINT FORMATION	02-13-11-01	17L APPLE CREEK SUBD
CA	G	CA1996G050	(01)	BUTTON, LELIA, M.	09/1996	N	8,800	14,700	230	930	124E	PINEY POINT FORMATION	02-13-11-01	37 LOT AUGUST RUN SUBD
CA	G	CA1996G052	(02)	TYRRELL, BRENDA	11/2005	N	2,000	3,300	320	920	125B	AQUIA FORMATION	02-13-11-01	PRIMETIME YOUTH ACTIVITY CENTER
CA	G	CA1996G055	(02)	CALVERT ANIMAL WELFARE LEAGUE	05/2004	N	1,000	2,500	260	910	125B	AQUIA FORMATION	02-13-11-01	CALVERT ANIMAL WELFARE LEAGUE
CA	G	CA1996G058	(01)	IRN, INC.	11/1996	N	300	500	190	960	124E	PINEY POINT FORMATION	02-13-11-01	DOWELL STORAGE
CA	G	CA1996G241	(01)	TWIN SHIELDS GOLF CLUB, INC.	07/2005	N	300	600	340	900	125B	AQUIA FORMATION	02-13-11-01	CONCESSION(CLUB HOUSE) & BATHROOMS - PDWIS# 1041096
CA	G	CA1997G001	(01)	KING, EUNICE	09/1997	N	11,200	18,600	300	900	125B	AQUIA FORMATION	02-13-11-01	OAKMOUNT MANOR RES SUBD
CA	G	CA1997G002	(01)	MCINTYRE, DONALD	01/1997	N	1,000	1,600	270	910	124C	NANJEMOY FORMATION	02-13-11-01	NURSERY
CA	G	CA1997G010	(02)	GEORGE MATHEWS & ASSOCIATES	04/1998	N	2,100	3,500	200	960	124E	PINEY POINT FORMATION	02-13-11-01	3-LOT COMMERCIAL SUBD "LUSBY TOWN SQUARE"
CA	G	CA1997G014	(01)	LEWIS, DAVID, R	04/1997	N	2,900	4,800	320	890	125B	AQUIA FORMATION	02-13-11-01	12 LOT SUBD
CA	G	CA1997G017	(01)	HARDESTY, MAURICE	05/1997	N	2,800	4,700	300	910	125B	AQUIA FORMATION	02-13-11-01	13-LOT CHANCELLORS RUN SUBD
CA	G	CA1997G019	(01)	LEWIS, DAVID, R.	05/1997	N	2,900	4,700	320	890	125B	AQUIA FORMATION	02-13-11-01	12-LOT LOVING FARM SUBD
CA	G	CA1997G020	(01)	MELVIN BROWN - EUGENE SMITH	06/1997	N	5,200	8,800	200	950	124E	PINEY POINT FORMATION	02-13-11-01	SUBDIVISION
CA	G	CA1997G023	(01)	GLENN BOWEN, ROBERT FOWLER, &	08/1997	N	8,100	13,500	270	920	124C	NANJEMOY FORMATION	02-13-11-01	34 LOT SUBDIVISION - LOTTIES REST
CA	G	CA1997G026	(01)	TANAVAGE, LEE, C.	07/1997	N	8,400	12,000	200	960	124E	PINEY POINT FORMATION	02-13-11-01	GENERIC SHOPPING, TAVERN, OFFICE BUILDING, BANK

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 25 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1997G027	(01)	COLLINSON, RICHARD	08/1997	N	8,300	14,000	240	910	124E	PINEY POINT FORMATION	02-13-11-01	35-LOT FOX FIELD SUBDIVISION
CA	G	CA1997G028	(01)	APOSTOLIC FAITH CHURCH	08/1997	N	300	500	320	910	125B	AQUIA FORMATION	02-13-11-01	CHURCH
CA	G	CA1997G029	(01)	FAI-MAR CORPORATION	08/1997	N	1,200	1,600	270	910	124C	NANJEMOY FORMATION	02-13-11-01	FULL SERVICE CAR WASH
CA	G	CA1997G030	(01)	ISLAND BAY L.L.C.	09/1997	N	2,900	4,800	220	940	124E	PINEY POINT FORMATION	02-13-11-01	ISLAND CREEK SUBD
CA	G	CA1997G031	(01)	QUALITY BUILT HOMES, INC.	09/1997	N	1,200	2,000	230	930	124E	PINEY POINT FORMATION	02-13-11-01	ADDITION TO PREV. RECORDED 38-LOT SUBD THAT WAS NEVER PERMITTED
CA	G	CA1997G032	(01)	GOLDSTEIN, LOUIS, L.	09/1997	N	200	300	240	930	124C	NANJEMOY FORMATION	02-13-11-01	FLOWER STAND
CA	G	CA1997G034	(01)	MULFORD SR. & WILLIAM FOWLER, RICHAR	09/1997	N	300	500	250	910	124C	NANJEMOY FORMATION	02-13-11-01	BARSTOW POST OFFICE
CA	G	CA1997G035	(02)	KOPICKI & MICHAEL HEGARTY, CHESTER	02/2002	N	6,000	10,000	290	910	125B	AQUIA FORMATION	02-13-11-01	FARM VALLEY NURSERY -
CA	G	CA1997G036	(01)	FOWBOWLSTONE L.L.P.	10/1997	N	8,100	13,500	270	930	124C	NANJEMOY FORMATION	02-13-11-01	35-LOT RES. SUBD
CA	G	CA1997G038	(01)	WARD, S., CHESTER	01/1998	N	4,600	7,700	320	920	124C	NANJEMOY FORMATION	02-13-10-05	20-LOT SUBD OF L.E. WARD PROPERTY
CA	G	CA1997G039	(01)	FINLEY, ELLIOTT, C.	01/1998	N	3,000	5,000	300	910	124C	NANJEMOY FORMATION	02-13-11-01	13-LOT SUBD
CA	G	CA1997G040	(01)	JOY, WAYNE, H.	01/1998	N	5,000	8,100	190	970	124E	PINEY POINT FORMATION	02-13-11-01	21-LOT SUBD
CA	G	CA1998G001	(01)	EASTERN PETROLEUM CORPORATION	02/1998	N	300	500	340	900	125B	AQUIA FORMATION	02-13-11-01	AMOCO GAS STATION (EP5)
CA	G	CA1998G002	(01)	MCKAY MANAGEMENT AND INVESTMENT COMPANY	02/1998	N	9,000	15,000	200	960	124E	PINEY POINT FORMATION	02-13-11-01	SOUTH CALVERT MARKETPLACE - GROCERY STORE AND RETAIL STORES
CA	G	CA1998G003	(01)	VAN HOY, DAVID	04/1998	N	300	500	320	900	125B	AQUIA FORMATION	02-13-11-01	CENTURY 21 REAL ESTATE OFFICE

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 26 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1998G004	(01)	SMITHVILLE UNITED METHODIST CHURCH	05/1998	N	300	500	320	900	125B	AQUIA FORMATION	02-13-11-01	REPLACEMENT WELL- NO PREVIOUS PERMIT LOCATED
CA	G	CA1998G006	(01)	CALVERT COUNTY BOARD OF COMMISSIONERS	05/1998	N	1,000	5,000	280	910	124C	NANJEMOY FORMATION	02-13-11-01	HUNTINGTOWN COMPACTOR SITE
CA	G	CA1998G009	(01)	PARRAN, JR., THOMAS	05/1998	N	9,500	15,800	230	950	124E	PINEY POINT FORMATION	02-13-11-01	PARRAN'S GRANT SECTION II - 41 LOT SUBD
CA	G	CA1998G010	(01)	EMMANUEL BAPTIST CHURCH	06/1998	N	300	500	280	910	125B	AQUIA FORMATION	02-13-11-01	CHURCH
CA	G	CA1998G011	(01)	JOHNSON, LANKFORD	06/1998	N	500	800	230	930	124E	PINEY POINT FORMATION	02-13-11-01	BROTHERS JOHNSON INC.
CA	G	CA1998G013	(01)	WAYSON JR., MORGAN	07/1998	N	500	800	310	910	125B	AQUIA FORMATION	02-13-11-01	SELF STORAGE RENTAL
CA	G	CA1998G014	(01)	HENNIG FAMILY LIMITED PARTNERSHIP	09/1998	N	13,700	22,900	230	940	124E	PINEY POINT FORMATION	02-13-11-01	59-LOT ORIOLE LANDING SBDN
CA	G	CA1998G015	(02)	LOGAN, RICHARD, EDWARD	08/1998	N	2,600	4,300	230	930	124E	PINEY POINT FORMATION	02-13-11-01	11-LOT RES. SUBD. - CHANGE IN LAND OWNERSHIP
CA	G	CA1998G016	(01)	SUNDERLAND LTD PARTNERSHIP	08/1998	N	500	2,000	300	910	124C	NANJEMOY FORMATION	02-13-11-01	CONTRACTING OFFICE & WAREHOUSE
CA	G	CA1998G017	(01)	MARRICK PROPERTIES,INC.	02/2000	N	27,000	44,000	330	900	125B	AQUIA FORMATION	02-13-11-01	113-LOT SBDN
CA	G	CA1998G018	(01)	BLANCADO, RICHARD	08/1998	N	7,100	42,000	230	910	124C	NANJEMOY FORMATION	02-13-11-01	IRRIGATION AND POND FILLING
CA	G	CA1998G019	(01)	CARTER, SR., ROBERT	09/1998	N	2,300	3,900	300	900	124C	NANJEMOY FORMATION	02-13-11-01	PRESENTLY 10 LOT RES. SUBD., 6 FORMER LOTS ALREADY SOLD,MORE LAND
CA	G	CA1998G022	(01)	HORSMON, RICHARD, A.	09/1998	N	3,500	5,900	220	940	122	MIOCENE	02-13-11-01	HORSMON, R., BELLE GROVE SUBD LOTS 6 -20/ CA92G012 LOT1-5 INACT.
CA	G	CA1998G023	(01)	HOWSARE, WILLIAM	09/1998	N	300	500	310	910	124C	NANJEMOY FORMATION	02-13-11-01	6 EMPLOYEES
CA	G	CA1998G025	(01)	GOTT COMPANY	09/1998	N	500	700	230	940	124E	PINEY POINT FORMATION	02-13-11-01	FAST STOP GAS AND CONVENIENCE STORE

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 27 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1998G026	(01)	PITCHER, CARL, L.	11/1998	N	4,000	20,000	230	930	124E	PINEY POINT FORMATION	02-13-11-01	RESIDENCE/IRRIGATION
CA	G	CA1998G028	(02)	BUCKINGHAM, MICHAEL, H.	07/2001	N	300	500	310	910	124C	NANJEMOY FORMATION	02-13-11-01	BAY METAL WORKS INC.
CA	G	CA1998G030	(01)	BEE'S AUTO SUPPLY INCORPORATED OF PRINCE	11/1998	N	300	500	250	920	124C	NANJEMOY FORMATION	02-13-10-05	BEE'S AUTO SUPPLY - NEW WELL - CANNOT LOCATE EXISTING PERMIT
CA	G	CA1998G031	(01)	DUNKIRK BAPTIST CHURCH	11/1998	N	300	500	330	900	125B	AQUIA FORMATION	02-13-11-01	DUNKIRK BAPTIST CHURCH
CA	G	CA1998G124	(01)	J. ALLEN SWANN	08/1999	Y	45,000	272,000	310	890	211D	MAGOTHY FORMATION	02-13-11-01	IRRIGATION MAGOTHY AQUIFER
CA	G	CA1999G002	(01)	WEEMS, CLAUDE, RONALD	02/1999	N	300	500	230	940	124E	PINEY POINT FORMATION	02-13-11-01	DICKSON'S EMPORIUM (FLOWER & GIFT SHOP)
CA	G	CA1999G004	(01)	TOCHTERMANN, WILLIAM	02/1999	N	500	800	210	930	124E	PINEY POINT FORMATION	02-13-11-01	BILL'S MARINA
CA	G	CA1999G005	(01)	RUSSELL, MORGAN	03/1999	N	1,500	2,500	300	910	124C	NANJEMOY FORMATION	02-13-10-05	EXCAVATING COMPANY
CA	G	CA1999G007	(01)	WOOD, GARY	03/1999	N	9,500	16,000	200	970	124E	PINEY POINT FORMATION	02-13-11-01	41-LOT FOXHOLE RESIDENTIAL SUBDIVISION
CA	G	CA1999G011	(01)	SWANN, HAZEL, M.	07/1999	N	4,200	7,000	310	890	124C	NANJEMOY FORMATION	02-13-11-01	PATUXENT SUNSET SUBDIVISION (18-LOT)
CA	G	CA1999G012	(01)	RAUSCH, MYRTLE, M.	07/1999	N	300	500	320	910	124C	NANJEMOY FORMATION	02-13-11-01	RAUSCH FUNERAL HOME
CA	G	CA1999G013	(01)	YANNONE, JOHN, J.	07/1999	N	1,000	1,500	320	920	124C	NANJEMOY FORMATION	02-13-11-01	CAR WASH AND AUTOMOTIVE CENTER
CA	G	CA1999G014	(01)	OGLE, CLARISSA	07/1999	N	6,500	10,800	280	920	124C	NANJEMOY FORMATION	02-13-11-01	SINGLE FAMILY DWELLING
CA	G	CA1999G015	(01)	TEDDER, RICHARD, C.	07/1999	N	300	500	320	920	124C	NANJEMOY FORMATION	02-13-11-01	RICH'S QUICK LUBE LLC
CA	G	CA1999G016	(01)	GOLDSTEIN, PHILIP, T.	08/1999	N	9,300	15,500	230	940	124E	PINEY POINT FORMATION	02-13-11-01	OLD GLORY 40-L RES. SUBD

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 28 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA1999G017	(02)	US POSTAL SERVICE	10/1999	N	200	300	240	940	124E	PINEY POINT FORMATION	02-13-10-05	US POST OFFICE, 4 EMPL, WELL REPLACE-NEW BLDG-PREV NOT PERMITTED
CA	G	CA1999G018	(02)	CALVERT COUNTY COMMISSIONERS	02/2002	Y	38,200	64,000	280	920	125B	AQUIA FORMATION	02-13-11-01	COMMUNITY SUPPLY - MARLEY RUN SUBD
CA	G	CA1999G021	(01)	VAN HOY, DAVID	12/1999	N	5,800	9,700	280	900	124C	NANJEMOY FORMATION	02-13-11-01	OAKWOOD MANOR 25-L RESIDENTIAL SUBDIVISION
CA	G	CA1999G022	(01)	EL-DAMALOUJI, ISSAM, F.	12/1999	N	4,000	6,600	280	920	124C	NANJEMOY FORMATION	02-13-11-01	20-LOT BARAKAT RESIDENTIAL SUBD - 17 WELLS
CA	G	CA2000G001	(01)	GOTT JR, JOHN, M.	02/2000	N	4,600	7,700	230	920	124C	NANJEMOY FORMATION	02-13-11-01	20-L DEER RUN SUBD (RESIDENTIAL)
CA	G	CA2000G002	(01)	NORFOLK, DALE & ANN	02/2000	N	3,900	6,600	320	920	124C	NANJEMOY FORMATION	02-13-10-05	17-L NORFOLK PLACE SUBD (RESIDENTIAL)
CA	G	CA2000G004	(01)	KENT, SARAH	04/2000	N	4,400	7,400	280	910	124C	NANJEMOY FORMATION	02-13-11-01	CHANCE POINT RESIDENTIAL SUBD
CA	G	CA2000G005	(01)	THOMPSON, SHIRLEY, E.	04/2000	N	4,900	8,100	280	920	124C	NANJEMOY FORMATION	02-13-11-01	21-LOT HUNTING CREEEK HILLS RESIDENTIAL SUBD
CA	G	CA2000G006	(01)	MC CONKEY, KELLY, D.	05/2000	N	4,500	20,000	330	900	125B	AQUIA FORMATION	02-13-11-01	MC CONKEY - VOLUNTARY AGRICULTURE
CA	G	CA2000G007	(01)	KAINE, BROOKE	11/2000	N	11,000	18,500	320	910	125B	AQUIA FORMATION	02-13-11-01	47-LOT RESIDENTIAL COVENANT CREEK SUBD
CA	G	CA2000G008	(01)	SUSAN CHAN	06/2000	N	300	500	300	910	124C	NANJEMOY FORMATION	02-13-11-01	ROUTES 2 & 4 LIQUORS
CA	G	CA2000G009	(02)	MURPHY DEVELOPMENT LLC	07/2003	N	2,000	3,500	300	910	124C	NANJEMOY FORMATION	02-13-11-01	RETAIL CENTER FOR 5 BUSINESSES - ONE TO BE FLOOR SYSTEMS
CA	G	CA2000G010	(01)	JLH GROUP LLC	06/2000	N	900	1,500	260	910	124C	NANJEMOY FORMATION	02-13-11-01	RETAIL WAREHOUSES - TO BE LEASED
CA	G	CA2000G011	(02)	POUNSBERRY, RONALD & SHEREE	03/2004	N	1,500	2,500	290	910	125B	AQUIA FORMATION	02-13-11-01	SLEEPY HOLLOW DAYCARES AND RESIDENCE
CA	G	CA2000G014	(02)	DUNKIRK VOLUNTEER FIRE DEPARTMENT, INC.	09/2002	N	1,000	2,500	320	900	125B	AQUIA FORMATION	02-13-11-01	3170 WEST WARD RD - DUNKIRK VFD NEW SITE

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland

(Page 29 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA2000G015	(02)	OSBORNE PROPERTIES LLC	09/2002	N	1,500	3,000	320	900	125B	AQUIA FORMATION	02-13-11-01	10200 SOUTHERN MD BLVD - ARBYS
CA	G	CA2000G016	(01)	BECKMAN, INC.	07/2000	N	2,000	5,000	310	900	124C	NANJEMOY FORMATION	02-13-11-01	LANDSCAPING BUSINESS/ COMMERCIAL NURSERY/ HYDROSEEDING
CA	G	CA2000G018	(02)	CHIARAMONTE, FRANCIS, P.	09/2002	N	300	500	320	900	125B	AQUIA FORMATION	02-13-11-01	3180 WEST WARD RD - LOT 4 DUNKIRK COMMERCIAL PARK
CA	G	CA2000G019	(03)	HOPEWELL PROPERTIES, LLC.	11/2006	N	900	1,700	320	900	125B	AQUIA FORMATION	02-13-11-01	10000 FT*2 OFFICE BUILDING
CA	G	CA2000G020	(03)	CALVERT INVESTMENT PROPERTIES, L.L.C.	07/2005	N	300	500	320	900	125B	AQUIA FORMATION	02-13-11-01	3185 WEST WARD RD - LOT 2 DUNKIRK COMMERCIAL PARK
CA	G	CA2000G021	(02)	CHIARAMONTE, FRANCIS, P.	09/2002	N	300	500	320	900	125B	AQUIA FORMATION	02-13-11-01	3195 WEST WARD RD - LOT 1 DUNKIRK COMMERCIAL PARK
CA	G	CA2000G024	(01)	BRISCOE, CROFTON	10/2000	N	200	300	210	940	124C	NANJEMOY FORMATION	02-13-11-01	LIVESTOCK & POTABLE
CA	G	CA2000G027	(01)	JONES SR., PHILLIP	11/2000	N	200	300	280	910	124C	NANJEMOY FORMATION	02-13-11-01	LIVESTOCK WATERING
CA	G	CA2000G028	(01)	CALVERT COUNTY COMMISSIONERS	12/2000	N	100	200	280	920	124C	NANJEMOY FORMATION	02-13-11-01	MARLEY RUN REC. AREA-SNACK STAND
CA	G	CA2001G001	(01)	SNEADE, DAVE	01/2001	N	400	700	200	960	124E	PINEY POINT FORMATION	02-13-11-01	SNEADES ACE HARDWARE
CA	G	CA2001G002	(01)	KELLY, PATRICK	01/2001	N	100	200	280	930	124C	NANJEMOY FORMATION	02-13-10-05	LIVESTOCK WATERING
CA	G	CA2001G003	(01)	HUMM, ET.AL., JOSEPH	03/2001	N	9300	15,300	310	900	124C	NANJEMOY FORMATION	02-13-11-01	SINGLE FAMILY RESIDENTIAL SUBDIVISION
CA	G	CA2001G004	(01)	MORRIS, JR., JAMES, S.	03/2001	N	8,100	13,600	300	990	125B	AQUIA FORMATION	02-13-11-01	CLAIREMONT-SINGLE FAMILY RESIDENTIAL
CA	G	CA2001G005	(01)	MORGAN WAYSON, JR.	05/2001	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	MORGAN WAYSON, JR. DUNKIRK BUS.CENT LOT1
CA	G	CA2001G006	(01)	MORGAN WAYSON, JR.	05/2001	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	MORGAN WAYSON, JR. DUNKIRK BUS.CENT. LOT 2
CA	G	CA2001G007	(02)	NSM REALTY, LLC	12/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	DUNKIRK BUSINESS CENTER, LOT 3

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 30 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA2001G008	(02)	J & J DEVELOPMENT CORPORATION	05/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	FUTURE DEVELOPMENT
CA	G	CA2001G009	(02)	WAYSON,JR., MORGAN	09/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	FUTURE - DUNKIRK BUS.CENT. LOT 5
CA	G	CA2001G010	(02)	QUALITY INVESTORS, LLC	06/2004	N	100	300	310	910				DUNKIRK BUSINESS CTR LOT 6
CA	G	CA2001G011	(02)	BCJJ, LLC	06/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	DUNKIRK BUS CTR - LOT #7 - 635 KEITH LANE
CA	G	CA2001G012	(02)	BCJJ, LLC	06/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	DUNKIRK BUSINESS CENTER - LOT #8 - 615 KEITH LANED
CA	G	CA2001G013	(02)	WAYSON,JR., MORGAN	09/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	FUTURE - DUNKIRK BUS.CENT. LOT 9
CA	G	CA2001G014	(02)	WAYSON,JR., MORGAN	09/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	FUTURE - DUNKIRK BUS.CENT. LOT 10
CA	G	CA2001G015	(02)	WAYSON,JR., MORGAN	09/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	FUTURE - DUNKIRK BUS.CENT. LOT 11
CA	G	CA2001G016	(02)	WAYSON,JR., MORGAN	09/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	FUTURE - DUNKIRK BUS.CENT. LOT 12
CA	G	CA2001G017	(02)	WAYSON,JR., MORGAN	09/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	FUTURE - DUNKIRK BUS.CENT. LOT 13
CA	G	CA2001G018	(04)	WAYSON LAND HOLDINGS LIMITED PARTNERSHIP	12/2005	N	1,400	2,500	310	910	125B	AQUIA FORMATION	02-13-11-01	LOT 14, DUNKIRK BUS. CTR - 7 UNITS - WELL DRILLED TO AQUIA
CA	G	CA2001G021	(01)	ARMIGER, MILTON, W.	07/2001	N	9,100	15,100	280	910	124C	NANJEMOY FORMATION	02-13-11-01	ARMIGER
CA	G	CA2001G022	(02)	TAYLOR BUSINESS CENTER, LLC	11/2004	N	300	500	310	910	124C	NANJEMOY FORMATION	02-13-11-01	7640 INVESTMENT CT, LOT #8
CA	G	CA2001G024	(01)	MORGAN WAYSON, JR.	09/2001	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	MORGAN WAYSON, JR. 7656 INVESTMENT CT, LOT #10
CA	G	CA2001G025	(02)	DRURY, ROBERT & MICHELLE	10/2002	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	
CA	G	CA2001G026	(03)	PHIPPS, W., SCOTT	05/2006	N	200	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	CHESAPEAKE INDUSTRIES - 7672 INVESTMENT CT LOT #12R

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 31 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA2001G028	(03)	WAYSON LAND HOLDINGS LIMITED PARTNERSHIP	09/2004	N	100	300	310	910	125B	AQUIA FORMATION	02-13-11-01	AUTO REPAIR BUSINESS/7665 INVESTMENT CT/N CAL IND PK LOT 15
CA	G	CA2001G029	(02)	TRUMPY PROPERTIES, LLC	12/2002	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	
CA	G	CA2001G031	(03)	WAYSON LAND HOLDINGS LIMITED PARTNERSHIP	12/2005	N	3,000	4,500	310	910	125B	AQUIA FORMATION	02-13-11-01	7632 INVESTMENT CT, LOT 4RR - WELL DRILLED TO AQUIA
CA	G	CA2001G032	(02)	WAYSON LAND HOLDINGS LIMITED PARTNERSHIP	09/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	FUTURE BUSINESS, JR. 7673 INVESTMENT CT, LOT #14R
CA	G	CA2001G033	(02)	MICHAEL H. BUCKINGHAM	07/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	MICHAEL BUCKINGHAM 7600 INVESTMENT CT, LOT #1
CA	G	CA2001G034	(01)	MICHAEL H. BUCKINGHAM	07/2001	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	MICHAEL H. BUCKINGHAM INVESTMENT COURT, LOT #5
CA	G	CA2001G035	(01)	VAN WIE BUILDERS, INC.	10/2001	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	VAN WIE BULDERS, INC. 7601 INVESTMENT CT, LOT #22R
CA	G	CA2001G036	(01)	CONSTANTINE, CHRIS	07/2001	N	3,700	6,200	300	930	124C	NANJEMOY FORMATION	02-13-01-05	CONSTANTINE
CA	G	CA2001G038	(01)	KEIR, KENNETH, G.	09/2001	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	KEN KEIR RACE CARS
CA	G	CA2001G039	(02)	KEIR, KENNETH, G.	10/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	AUTO REPAIR - N. CALVERT IND PARK LOT 2
CA	G	CA2001G040	(02)	SCHWENK, JOHN, P.	10/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	FUTURE BUSINESS @ 7615 GINGER LANE
CA	G	CA2001G041	(02)	SCHWENK, JOHN, P.	10/2004	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	FUTURE BUSINESS @ 7625 GINGER LANE
CA	G	CA2001G042	(01)	COLLEGE OF SOUTHERN MARYLAND	09/2001	N	1300	3,000	260	910	124C	NANJEMOY FORMATION	02-13-11-01	PRINCE FREDERICK
CA	G	CA2001G043	(01)	CONSTANTINE, CHRIS, G.	09/2001	N	3,700	6,200	300	930	124C	NANJEMOY FORMATION	02-13-10-05	SINGLE FAMILY RESIDENCE SUBDIVISION
CA	G	CA2001G044	(01)	HANCE, TOM	10/2001	N	600	800	240	930	124E	PINEY POINT FORMATION	02-13-11-01	FARM AND GREENHOUSE
CA	G	CA2001G047	(01)	RAUSH FUNERAL HOME	11/2001	N	350	500	230	930	124E	PINEY POINT FORMATION	02-13-11-01	RAUSH FUNERAL HOME

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 32 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA2001G048	(01)	SELLERS, PAUL	10/2001	N	600	900	240	940	124E	PINEY POINT FORMATION	02-13-11-01	LIVESTOCK WATERING
CA	G	CA2001G049	(01)	YANNONE, JOHN, J.	12/2001	N	1,000	1,500	200	960	124E	PINEY POINT FORMATION	02-13-11-01	AUTOMOTIVE SERVICE
CA	G	CA2002G001	(01)	CALVERT COUNTY PUBLIC SCHOOLS	10/2003	Y	15,500	38,000	290	910	125B	AQUIA FORMATION	02-13-11-01	HUNTINGTON HIGH SCHOOL
CA	G	CA2002G002	(02)	LITTEN, CURTIS & VIALONDA	08/2005	N	1,200	2,000	290	910	125B	AQUIA FORMATION	02-13-11-01	VET&ANIMAL HOSPITAL/DANCE INSTRUCT/PAINT CONTR
CA	G	CA2002G003	(01)	RODBELL, LARRY	02/2002	N	400	500	260	930	125B	AQUIA FORMATION	02-13-11-01	DOG KENNEL
CA	G	CA2002G006	(01)	GERTZ, RODNEY	04/2002	N	1,000	1,500	220	950	124E	PINEY POINT FORMATION	02-13-11-01	RODNEY GERTZ - SAW MILL DUST CONTROL
CA	G	CA2002G007	(01)	PETRALIAE, SALVATORE	04/2002	N	300	900	300	920	125B	AQUIA FORMATION	02-13-11-01	SALVATORE
CA	G	CA2002G009	(02)	BAYSIDE LAND DEVELOPMENT, LLC	05/2006	N	500	900	270	910	125B	AQUIA FORMATION	02-13-11-01	BAYSIDE TOYOTA-CHEVROLET - PDWIS #104-1230
CA	G	CA2002G010	(01)	PENWICK VILLAGE, L.L.C.	10/2003	Y	32,000	48,000	320	900	211D	MAGOTHY FORMATION	02-13-11-01	COMMERCIAL DEVELOPMENT - CALVERT GATEWAY
CA	G	CA2002G013	(02)	CALVERT COUNTY BOARD OF COMMISSIONERS	03/2004	N	500	600	290	940	125B	AQUIA FORMATION	02-13-10-05	BREEZY PT BEACH BATHHOUSE & SNACK BAR - PDWIS #1041154
CA	G	CA2002G016	(02)	WAWA, INC.	10/2005	N	800	1,700	320	900	125B	AQUIA FORMATION	02-13-11-01	WAWA CONVENIENCE STORE-PDWIS# 104-1248
CA	G	CA2002G017	(01)	CHIARAMONTE, FRANCIS, P.	09/2002	N	300	500	320	900	125B	AQUIA FORMATION	02-13-11-01	CHIARAMONTE - 3180 FERRY LANDING RD
CA	G	CA2002G018	(01)	7 ELEVEN, INC.	09/2002	N	500	800	300	910	124C	NANJEMOY FORMATION	02-13-10-05	7-ELEVEN STORE #2543-33340
CA	G	CA2002G020	(01)	WOOD, CHARLES	11/2002	N	2,600	4,300	300	910	124C	NANJEMOY FORMATION	02-13-11-01	COXCOMBE ESTATES SUBDIVISION
CA	G	CA2002G021	(01)	SAFEWAYM INC.	12/2002	N	200	300	320	900	125B	AQUIA FORMATION	02-13-11-01	GASOLINE SERVICE STATION

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 33 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA2002G113	(01)	CALVERT COUNTY BOARD OF COMMISSIONERS	03/2004	N	1,000	2,000	290	940	124C	NANJEMOY FORMATION	02-13-10-05	BREEZY PT CAMPGROUND BATHHOUSE & LOWER CAMPGROUNDS PDWIS #1040072
CA	G	CA2003G001	(01)	MASK, CRAIG	02/2003	N	2,600	15,700	230	920	124E	PINEY POINT FORMATION	02-13-11-01	VEG IRRIGATION
CA	G	CA2003G004	(01)	CVS DUNKIRK MARKETPLACE, L.L.C.	03/2003	N	300	500	320	900	124C	NANJEMOY FORMATION	02-13-11-02	CVS STORE # 1881 - 10095 WARD ROAD
CA	G	CA2003G005	(01)	BRIGHT, WYLMA AND ELDON	03/2003	N	100	200	320	920	125B	AQUIA FORMATION	02-13-10-05	BRIGHT PROPERTY INDUSTRIAL SUBDIVISION
CA	G	CA2003G006	(01)	BRIGHT, WYLMA & ELDON	03/2003	N	100	200	320	920	125B	AQUIA FORMATION	02-13-10-05	BRIGHT PROPERTY INDUSTRIAL SUBDIVISION
CA	G	CA2003G007	(01)	BRIGHT, WYLMA & ELDON	03/2003	N	100	200	320	920	125B	AQUIA FORMATION	02-13-10-05	LOT 3 - BRIGHT PROPERTY INDUSTRIAL SUBDIVISION
CA	G	CA2003G008	(01)	BRIGHT, WYLMA & ELDON	03/2003	N	100	200	320	920	125B	AQUIA FORMATION	02-13-10-05	BRIGHT PROPERTY INDUSTRIAL SUBDIVISION LOT 4
CA	G	CA2003G009	(01)	BRIGHT, WYLMA & ELDON	03/2003	N	100	200	320	920	125B	AQUIA FORMATION	02-13-10-05	BRIGHT PROPERTY INDUSTRIAL SUBDIVISION LOT 5
CA	G	CA2003G010	(01)	BRIGHT, WYLMA & ELDON	03/2003	N	100	200	320	920	125B	AQUIA FORMATION	02-13-10-05	BRIGHT PROPERTY INDUSTRIAL SUBDIVISION
CA	G	CA2003G011	(01)	BRIGHT, WYLMA & ELDON	03/2003	N	100	200	320	920	125B	AQUIA FORMATION	02-13-10-05	BRIGHT PROPERTY INDUSTRIAL SUBDIVISION LOT 7
CA	G	CA2003G012	(01)	BRIGHT, WYLMA & ELDON	03/2003	N	100	200	320	920	125B	AQUIA FORMATION	02-13-10-05	BRIGHT PROPERTY INDUSTRIAL SUBDIVISION LOT 8
CA	G	CA2003G014	(01)	CALVERT CO. BD OF COMMISSIONERS	04/2003	N	300	500	180	950	124E	PINEY POINT FORMATION	02-13-11-01	SOLOMONS WWTP - HEADWORKS SITE
CA	G	CA2003G015	(01)	CALVERT CO. BD OF COMMISSIONERS	04/2003	N	600	1,200	200	960	124C	NANJEMOY FORMATION	02-13-11-01	SOLOMONS WWTP-APPEAL SITE
CA	G	CA2003G016	(01)	EDWARD B. HOWLIN, INC.	06/2003	N	4,300	7,900	320	920	125B	AQUIA FORMATION	02-13-11-01	EDWARD B. HOWLIN INC. - OFFICES/WAREHOUSES
CA	G	CA2003G017	(01)	CHESAPEAKE HIGHLANDS MEMORIAL GARDENS	08/2003	N	8,000	16,000	240	930	125B	AQUIA FORMATION	02-13-11-01	CHESAPEAKE HIGHLANDS MEMORIAL GARDEN

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 34 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA2003G018	(02)	WAYSON, MORGAN	04/2006	N	1,000	1,500	310	910	125B	AQUIA FORMATION	02-13-11-01	SOLID WASTE RECYCLING/ TRUCKING/MILLWRIGHT/ CONTRACTORS
CA	G	CA2003G019	(01)	WOOD, SR., CHARLES	11/2003	N	2,600	4,200	300	910	124C	NANJEMOY FORMATION	02-13-11-01	11 LOT SINGLE FAMILY RESIDENTIAL SUBDIV.
CA	G	CA2003G021	(02)	HAMPSHIRE, ANTHONY	03/2004	N	500	800	290	910	125B	AQUIA FORMATION	02-13-11-01	CHESAPEAKE MONTESSORI - HAMPSHIRE
CA	G	CA2004G005	(01)	CHARLOTTE RUSSELL & WINDMILL. L.L.C.	02/2004	N	800	1,600	300	910	125B	AQUIA FORMATION	02-13-10-05	RETAIL CENTER
CA	G	CA2004G006	(01)	TOWNE, KAREN	02/2004	N	100	300	320	920	125B	AQUIA FORMATION	02-13-11-01	KAREN TOWNE
CA	G	CA2004G007	(01)	CALVERT COUNTY BOARD OF COMMISSIONERS	03/2004	N	2,000	4,000	210	960	124E	PINEY POINT FORMATION	02-13-11-05	BGE FIELD FACILITY - PARKS & REC
CA	G	CA2004G008	(01)	MATTESON, JOHN	05/2004	N	300	500	250	920	124C	NANJEMOY FORMATION	02-13-10-05	MATTESON SUPPLY - GAS/ MOTOR REPAIR/SUPPLY
CA	G	CA2004G009	(01)	FISHER/TOM LANTZ, MARK	07/2004	N	3,100	12,200	320	910	125B	AQUIA FORMATION	02-13-11-01	GRAYS FIELD FOUNDATION - RECREATION FIELD IRRIGATION
CA	G	CA2004G010	(01)	CALVERT TRASH SERVICE, INCORPORATED	08/2004	N	200	400	310	910	124C	NANJEMOY FORMATION	02-13-11-01	CALVERT TRASH
CA	G	CA2004G012	(01)	LAVERENZ, TERRY	10/2004	N	200	2,500	240	920	124C	NANJEMOY FORMATION	02-13-11-01	LIVESTOCK WATERING - 17 HORSES
CA	G	CA2004G013	(01)	EWALT FAMILY, LLC	11/2004	N	100	200	230	920	124C	NANJEMOY FORMATION	02-13-11-01	EWALT FAMILY LLC PRIVATE PIER
CA	G	CA2004G014	(01)	WAYSON LAND HOLDINGS LIMITED PARTNERSHIP	11/2004	N	300	500	290	910	124C	NANJEMOY FORMATION	02-13-11-01	BANK & VACANT RETAIL SLOT
CA	G	CA2004G015	(01)	CALVERT COUNTY COMMISSIONERS	02/2005	N	100	200	240	920	124E	PINEY POINT FORMATION	02-13-11-01	GRAYS ROAD RECREATION AREA - DOG EXERCISE AREA
CA	G	CA2005G001	(01)	LYSNE, MARK, A.	02/2005	N	100	200	240	920	124C	NANJEMOY FORMATION	02-13-11-01	RESIDENTIAL GREENHOUSE IRRIGATION
CA	G	CA2005G002	(01)	CHURCH BY THE CHESAPEAKE, INC.	02/2005	N	600	1,200	240	930	124E	PINEY POINT FORMATION	02-13-11-01	CHURCH
CA	G	CA2005G003	(01)	RUSSELL, MARY	03/2005	N	200	500	280	930	124C	NANJEMOY FORMATION	02-13-10-05	LUCKY CRICKET FARM - HORSES

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 35 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA2005G004	(01)	WILLIAMS ROAD DEVELOPMENT, L.L.C.	10/2006	N	34,800	58,200	260	910	125B	AQUIA FORMATION	02-13-11-01	152-L COLLEGE STATION SUBD
CA	G	CA2005G005	(01)	HEALEY, PAT & TONI	04/2005	N	900	1,500	290	910	125B	AQUIA FORMATION	02-13-11-01	NOAH'S ARK LEARNING CENTER - PDWIS# 104-0080
CA	G	CA2005G006	(01)	THE TIDEWATER SCHOOL, INC.	04/2005	N	800	1,300	290	910	124C	NANJEMOY FORMATION	02-13-11-01	THE TIDEWATER SCHOOL - PDWIS# 104-0067
CA	G	CA2005G010	(01)	HARMS DEVELOPMENT, LLC	09/2006	N	8,900	14,900	270	930	124C	NANJEMOY FORMATION	02-13-11-01	39-L FARMS @ HUNTING CREEK SUBD (#LOTS REDUCED FROM 179 APF ORD)
CA	G	CA2005G011	(02)	SMTCCAC, INC.	11/2005	N	900	1,500	280	910	125B	AQUIA FORMATION	02-13-11-02	CARROLL VICTORIA LODGE (PDWIS #104-0071)
CA	G	CA2005G016	(01)	FAIRVIEW CENTRE, INC.	08/2005	N	3,400	5,000	310	900	125B	AQUIA FORMATION	02-13-11-01	FAIRVIEW SOUTH - 7 UNIT SHOPPING CENTER
CA	G	CA2005G017	(01)	CLEARY, FRANK	08/2005	N	300	6,000	310	890	125B	AQUIA FORMATION	02-13-11-01	FRIDAY'S CREEK VINEYARD/ WINERY - 400 VINES
CA	G	CA2005G018	(01)	MARKETPLACE PROFESSIONAL CENTER, L.L.C.	08/2005	N	2,500	3,700	320	900	125B	AQUIA FORMATION	02-13-11-01	OFFICES - PDWIS# 1041210
CA	G	CA2005G019	(01)	BRINSON, JENNIFER	10/2005	N	1,100	2,000	320	910	124C	NANJEMOY FORMATION	02-13-11-01	IMAGINE NATIONS EARLY LEARNING CENTER - PDWIS# 104-0081
CA	G	CA2005G020	(01)	MS. BEV'S PLACE LLC	10/2005	N	1,400	2,300	330	900	125B	AQUIA FORMATION	02-13-11-01	MS. BEVS PLACE DAYCARE - PDWIS# 104-0004
CA	G	CA2005G021	(01)	ALLEN, DOUG & SUSAN	11/2005	N	1,000	2,000	220	940	124E	PINEY POINT FORMATION	02-13-11-01	LIVESTOCK WATERING - VARIETY
CA	G	CA2005G022	(02)	JESUS THE GOOD SHEPHERD,	10/2006	N	2,000	3,000	320	900	125B	AQUIA FORMATION	02-13-11-01	CHURCH & SCHOOL - PDWIS# 104-1184 ADDING A 3RD WELL
CA	G	CA2005G023	(01)	BIGSBY, TINA	11/2005	N	700	1100	270	920	124C	NANJEMOY FORMATION	02-13-11-01	MISS TINA'S DAY CARE - PDWIS# 104-0052
CA	G	CA2005G024	(01)	WAYSON LAND HOLDINGS LTD. PARTNERSHIP	11/2005	N	100	300	310	910	124C	NANJEMOY FORMATION	02-13-11-01	COMMERCIAL FLEX SPACE
CA	G	CA2005G025	(01)	WAYSON LAND HOLDINGS LIMITED PARTNERSHIP	04/2006	N	1,600	2,900	310	910	124C	NANJEMOY FORMATION	02-13-11-01	ANNAPOLIS SOUTH MARINE LOT 1

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 36 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA2005G026	(01)	WAYSON LAND HOLDINGS LIMITED PARTNERSHIP	11/2005	N	800	1,300	320	920	125B	AQUIA FORMATION	02-13-10-05	PARIS OAKS CENTER - PDWIS# 104-1070
CA	G	CA2005G028	(01)	BROTHERS' JOHNSON, INC.	12/2005	N	300	600	230	930	124E	PINEY POINT FORMATION	02-13-11-01	LIVESTOCK WATERING - CATTLE
CA	G	CA2005G029	(01)	WHITE SANDS CORPORATION	12/2005	N	1,500	2,500	210	950	124E	PINEY POINT FORMATION	02-13-11-01	WHITE SANDS RESTAURANT/ VERA FREEMAN - PDWIS# 1041150
CA	G	CA2005G030	(01)	WAYSON LAND HOLDINGS LIMITED PARTNERSHIP	04/2006	N	3,500	5,000	220	950	124E	PINEY POINT FORMATION	02-13-11-01	CALVERT CLIFFS BUSINESS CENTER-FLEX SPACE-PDWIS# 104-0089
CA	G	CA2006G001	(01)	WELLS, WALTER AND SUSAN HANCE-	03/2006	N	500	900	220	910	124C	NANJEMOY FORMATION	02-13-11-01	LIVESTOCK WATERING - 70 TOTAL CATTLE/HORSES
CA	G	CA2006G002	(01)	CALVERT LLC.	04/2006	N	5,300	8,800	310	920	124C	NANJEMOY FORMATION	02-13-10-05	23-L EAGLE'S TRACE SUBD
CA	G	CA2006G006	(01)	GREATER MOUNT ZION, INCORPORATED	05/2006	N	2,500	4,000	250	910	124C	NANJEMOY FORMATION	02-13-11-01	GREATER MT. ZION BAPTIST CHURCH - PDWIS# 104-0090
CA	G	CA2006G007	(01)	LOWER MARLBORO UNITED METHODIST CHURCH	05/2006	N	100	300	300	890	125B	AQUIA FORMATION	02-13-11-04	CHURCH
CA	G	CA2006G012	(01)	BTIP, LLC	07/2006	N	300	500	320	920	124C	NANJEMOY FORMATION	02-13-11-01	BRIGHT PROPERTY INDUSTRIAL SUBD LOT 1
CA	G	CA2006G013	(01)	BTIP, LLC	07/2006	N	300	500	320	920	124C	NANJEMOY FORMATION	02-13-11-01	BRIGHT PROPERTY INDUSTRIAL SUBD LOT 2
CA	G	CA2006G014	(01)	BTIP, LLC	07/2006	N	300	500	320	920	124C	NANJEMOY FORMATION	02-13-11-01	BRIGHT PROPERTY INDUSTRIAL SUBD LOT 3
CA	G	CA2006G015	(01)	BTIP, LLC	07/2006	N	300	500	320	920	124C	NANJEMOY FORMATION	02-13-11-01	BRIGHT PROPERTY INDUSTRIAL SUBD LOT 4
CA	G	CA2006G016	(01)	BTIP, LLC	07/2006	N	300	500	320	920	124C	NANJEMOY FORMATION	02-13-11-01	BRIGHT PROPERTY INDUSTRIAL SUBD LOT 5
CA	G	CA2006G017	(01)	BTIP, LLC	07/2006	N	300	500	320	920	124C	NANJEMOY FORMATION	02-13-11-01	BRIGHT PROPERTY INDUSTRIAL SUBD LOT 6
CA	G	CA2006G018	(01)	RIDDLE, RITA	09/2006	N	100	300	210	940	124E	PINEY POINT FORMATION	02-13-11-01	HORSE FARM WATERING

Table 2.3-22— Listing of MDE Water Appropriation Permits for Calvert County, Maryland
(Page 37 of 37)

County	GorS	WAPID	Rev-t4	Owner	EffDate-t7	ReptCode	AGPD	MGPD	North-thouFt27	East-thouFt27	AquiCd	AquiNam	Basin	Remarks
CA	G	CA2006G019	(01)	ACCIPITER, COURTNEY	09/2006	N	200	400	290	910	124C	NANJEMOY FORMATION	02-13-11-01	OLD TOWN AUTOMOBILE - CAR SALES
CA	G	CA2006G021	(01)	GALLAHAN, WILLIAM, ALTON	09/2006	N	6,000	9900	250	920	125B	AQUIA FORMATION	02-13-10-05	26-LOT GALLAHAN'S CHOICE RES SUBDD
CA	G	CA2006G023	(01)	MILLER, LAWRENCE	11/2006	N	2,000	4,000	180	960	124E	PINEY POINT FORMATION	02-13-11-01	RESIDENTIAL GWHP W/ RECHARGE WELL
CA	S	CA1962S103	(01)	CHESAPEAKE BIOLOGICAL LABORATORY	08/2006	Y	864,000	864,000	170	950	PXT	PATUXENT RIVER	02-13-11-01	SURFACE INTAKE - LABORATORY USE
CA	S	CA1971S001	(03)	CALVERT CLIFFS NUCLEAR POWER PLANT, LLC	07/2000	Y	3,500,000,000	3,600,000,000	220	960	CBA	CHESAPEAKE BAY	02-13-10-05	CALVERT CLIFFS NUCLEAR POWER PLANT - COOLING WATER
CA	S	CA1985S002	(01)	CHESELDINE, RONALD W.	01/1986	N	1500	3,000	320	930	CBA	CHESAPEAKE BAY	02-13-99-98	COMMERCIAL CRABBING OPERATION
CA	S	CA1989S014	(01)	CALVERT COUNTY COMMISSIONERS	06/1994	N	150	5,000	180	950	BAB	BACK CREEK	02-13-11-01	CALVERT MARINE MUSEUM
CA	S	CA1993S008	(02)	MORGAN STATE UNIVERSITY	03/2005	Y	150,000	250,000	210	940	PXT	PATUXENT RIVER	02-13-11-01	ENVIRONMENTAL RESEARCH FACILITY
CA	S	CA1998S024	(01)	SWANN, J. ALLEN	03/1999	Y	31,000	183,000	310	890	PXT	PATUXENT RIVER	02-13-11-01	IRRIGATION
CA	S	CA2000S016	(01)	BECKMAN, INC.	05/2001	N	400	3,000	310	900	CBA	CHESAPEAKE BAY	02-13-99-00	HYDROSEEDING
CA	S	CA2002S011	(01)	C&M EXCAVATING, INC.	08/2002	N	400	1,000	310	910	CBA	CHESAPEAKE BAY	02-13-99-00	HYDROSEEDING
CA	S	CA2003S013	(01)	C & M EXCAVATING, INC.	03/2003	N	400	2,000	310	910	CBA	CHESAPEAKE BAY	02-13-99-00	C & M EXCAVATING, INC.,HYDROSEEDING,ORIG.LOGGED IN BA CO-MISTAKE
CA	S	CA2004S003	(02)	DOMINION COVE POINT LNG, LP	07/2005	Y	64,000	7,200,000	200	970			02-13-10-05	HYDROSTATIOC TESTING
CA	S	CA2006S004	(01)	DOMINION COVE POINT LNG, L.P.	03/2006	N	3,500	15,000	200	970	CBA	CHESAPEAKE BAY	02-13-99-00	WATER FOR HORIZ. DRILLING FOR PIPELINE
CA	S	CA2006S005	(01)	DOMINION COVE POINT LNG, L.P.	04/2006	Y	10,000	3,650,000	270	890	PAT	PATAPSCO RIVER	02-13-11-01	WATER FOR HYDROSTATIC TESTING PATUX RIVER

Table 2.3-23— Listing of US EPA SDWIS Community, Non-Transient Non-Community, and Transient Non-Community Water Systems in Calvert County, Maryland

Water System Name	Population Served	Primary Water Source Type	System Status	Date Closed	Water System ID
Listing of US EPA SDWIS Community Water Systems in Calvert County, Maryland					
BEACHES WATER COMPANY	1,800	Groundwater	Active		MD0040009
BUCKLER MOBILE HOME PARK	65	Groundwater	Active		MD0040209
CALVERT BEACH - DECATUR STREET	350	Groundwater	Active		MD0040024
CALVERT BEACH / FOREST TRAIL	100	Groundwater	Active		MD0040020
CALVERT MOBILE HOME PARK	80	Groundwater	Active		MD0040206
CAVALIER COUNTRY	400	Groundwater	Active		MD0040002
CHESAPEAKE BEACH	3,000	Groundwater	Active		MD0040003
CHESAPEAKE HEIGHTS (BAYSIDE FOREST)	850	Groundwater	Active		MD0040018
CHESAPEAKE RANCH ESTATES	9,750	Groundwater	Active		MD0040004
CROSS POINT SUBDIVISION	462	Groundwater	Active		MD0040052
DARES BEACH	600	Groundwater	Active		MD0040005
HALLOWING POINT TRAILER PARK	100	Groundwater	Active		MD0040208
HUNTING HILLS	150	Groundwater	Active		MD0040006
JOHNSON ACRES WATER CO	50	Groundwater	Active		MD0040032
KENWOOD BEACH	350	Groundwater	Active		MD0040007
LAKEWOOD	200	Groundwater	Active		MD0040008
MARLEY RUN	171	Groundwater	Active		MD0040053
NORTH BEACH	3,000	Groundwater	Active		MD0040030
PARIS OAKS / DAYS END	275	Groundwater	Active		MD0040010
PARKERS CREEK KNOLLS	60	Groundwater	Active		MD0040031
PINE TRAILER PARK	65	Groundwater	Active		MD0040210
PRINCE FREDERICK	3,150	Groundwater	Active		MD0040011
REGENCY MANOR MOBILE HOME PARK	224	Groundwater	Active		MD0040202
SCIENTISTS CLIFFS	425	Groundwater	Active		MD0040014
SHORES OF CALVERT	400	Groundwater	Active		MD0040015

Table 2.3-24— Maryland Department of the Environment (MDE) Water Appropriation Permits for the Calvert Cliffs Nuclear Power Plant
(Page 1 of 8)

Water System Name	Population Served	Primary Water Source Type	System Status	Date Closed	Water System ID
SOLOMONS	2,700	Groundwater	Active		MD0040027
SOLOMONS RECREATION CENTER	1,200	Groundwater	Active		MD0040023
SOUTHERN PINES ELDERLY HOUSING	93	Groundwater	Active		MD0040033
ST. LEONARD	200	Groundwater	Active		MD0040013
SUMMIT/HIGHLANDS	800	Groundwater	Active		MD0040026
TAPESTRY NORTH	60	Groundwater	Active		MD0040205
TARA SUBDIVISION	75	Groundwater	Active		MD0040034
WALNUT CREEK	168	Groundwater	Active		MD0040035
WESTERN SHORES	155	Groundwater	Active		MD0040016
WHITE SANDS	100	Groundwater	Active		MD0040017
WOODBRIDGE - MASON ROAD	100	Groundwater	Active		MD0040025
ACCENT MOBILE HOME PARK	25	Groundwater	Closed	9/1/1981	MD0000069
ALL SAINTS DAY CARE CENTER	38	Groundwater	Closed	9/1/1981	MD0000875
ANCHORAGE TRAILER PARK	32	Groundwater	Closed	2/1/1988	MD0040203
ANCHORAGE TRAILER PARK	32	Groundwater	Closed	9/1/1981	MD0002691
BAY VIEW MANOR TRAILER PARK	142	Groundwater	Closed	9/1/1981	MD0002483
BAY VIEW MOBILE MANOR	100	Groundwater	Closed	1/1/2006	MD0040204
BEACHES WATER CO	400	Groundwater	Closed	10/1/1990	MD0040029
BROOKS DAY CARE CENTER	30	Groundwater	Closed	9/1/1981	MD0000892
CALVERT CHRISTIAN SCHOOL AND	200	Groundwater	Closed	9/1/1981	MD0000895
CALVERT CO NURSING CENTER	50	Groundwater	Closed	9/1/1981	MD0002688
CALVERT COUNTY NURSING CENTER	100	Groundwater	Closed	7/1/1993	MD0040201
CALVERT COUNTY NURSING CENTER	41	Groundwater	Closed	9/1/1981	MD0000898
CALVERT MEMORIAL HOSPITAL	78	Groundwater	Closed	9/1/1981	MD0000903
CALVERT MOBILE HOMES PARK	60	Groundwater	Closed	9/1/1981	MD0002693
CAVALIER COUNTRY WATER ASSOC I	436	Groundwater	Closed	9/1/1981	MD0002686
CHESAPEAKE BEACH	640	Groundwater	Closed	9/1/1981	MD0002270
CHESAPEAKE RANCH WATER CO INC	1,448	Groundwater	Closed	9/1/1981	MD0002551
CIRCLE S TRAILER PARK	28	Groundwater	Closed	6/1/1981	MD0002639
DARES BEACH WATER COMPANY	644	Groundwater	Closed	9/1/1981	MD0002687
FRISCOE TRAILER PARK	84	Groundwater	Closed	9/1/1981	MD0002692
GRAY-RAY CENTER	30	Groundwater	Closed	9/1/1981	MD0000935
HUNTING HILLS ESTATES	124	Groundwater	Closed	9/1/1981	MD0002325
KENWOOD BEACH WATER SYSTEM	320	Groundwater	Closed	9/1/1981	MD0002719
LAKEWOOD	60	Groundwater	Closed	9/1/1981	MD0002326
LONG BEACH WATER CO	1,244	Groundwater	Closed	9/1/1981	MD0002720
PINE TRAILER PARK	84	Groundwater	Closed	9/1/1981	MD0002690
PRNC FRED-CALV CO SAN DIST INC	500	Groundwater	Closed	9/1/1981	MD0002685
RANDLE CLIFF HEAD START CENTER	30	Groundwater	Closed	9/1/1981	MD0000969
REGENCY MANOR MOBILE PARK	108	Groundwater	Closed	2/1/1988	MD0002327
SAINT LEONARD DEV CORP INC	160	Groundwater	Closed	9/1/1981	MD0002755
SCIENTISTS CLIFFS SERVICE CO I	651	Groundwater	Closed	9/1/1981	MD0002677
SHORES OF CALVERT WAT ASSC INC	260	Groundwater	Closed	9/1/1981	MD0002678
WESTERN SHORES	120	Groundwater	Closed	9/1/1981	MD0002721
WHITE SANDS CORPORATION	56	Groundwater	Closed	9/1/1981	MD0002552
Listing of US EPA SDWIS Non-Transient Non-Community Water Systems in Calvert County, Maryland					
APPEAL ELEMENTARY SCHOOL	569	Groundwater	Active		MD1040001
BAYSIDE CHEVROLET BUICK INC.	34	Groundwater	Active		MD1041230
BREEZY POINT SNACKBAR	25	Groundwater	Active		MD1040092
BROOKS ADMINISTRATION BUILDING	106	Groundwater	Active		MD1040006
CALVERT CAREER CENTER	800	Groundwater	Active		MD1040011

Table 2.3-24— Maryland Department of the Environment (MDE) Water Appropriation Permits for the Calvert Cliffs Nuclear Power Plant

(Page 2 of 8)

Water System Name	Population Served	Primary Water Source Type	System Status	Date Closed	Water System ID
CALVERT CLIFFS NUCLEAR - OFFICE BUILDING	362	Groundwater	Active		MD1040055
CALVERT CLIFFS NUCLEAR - PROTECTED AREA	482	Groundwater	Active		MD1040002
CALVERT CO. INDUSTRIAL PARK	100	Groundwater	Active		MD1040051
CALVERT COUNTRY & CALVERT ELEMENTARY	900	Groundwater	Active		MD1040012
CALVERT COUNTY EMERGENCY CENTER	30	Groundwater	Active		MD1040083
CALVERT COUNTY JAIL	150	Groundwater	Active		MD1040013
CALVERT GATEWAY + MCDONALD # 16243	25	Groundwater	Active		MD1040079
CALVERT HIGH SCHOOL	1,450	Groundwater	Active		MD1040016
CALVERT MIDDLE SCHOOL	675	Groundwater	Active		MD1040018
CALVERTON SCHOOL	500	Groundwater	Active		MD1040022
CARDINAL HICKEY ACADEMY/JESUS THE GOOD	380	Groundwater	Active		MD1041184
CARROLL VICTORIA LODGE - HUNTINGTOWN	87	Groundwater	Active		MD1040071
CHESAPEAKE MONTESSORI LIMITED	77	Groundwater	Active		MD1040053
CROSSROAD CHRISTIAN CHURCH & DAYCARE	133	Groundwater	Active		MD1041163
DOMINION COVE POINT LNG, LP	55	Groundwater	Active		MD1040077
DUNKIRK BUSINESS CENTER I	250	Groundwater	Active		MD1041027
DUNKIRK MARKET PLACE	50	Groundwater	Active		MD1040064
DUNKIRK MEDICAL CENTER	200	Groundwater	Active		MD1040070
DUNKIRK SAFEWAY STORE #1129	25	Groundwater	Active		MD1040069
DUNKIRK TOWN SQUARE SHOPPING CENTER	40	Groundwater	Active		MD1041094
DUNKIRK VILLAGE SHOPPING CENTER	25	Groundwater	Active		MD1041077
FAIRVIEW CENTRE, INC.	30	Groundwater	Active		MD1040086
FIRST IMPRESSIONS DAYCARE CENTER	40	Groundwater	Active		MD1040054
HUNTING CREEK ALTERNATIVE SCHOOL	60	Groundwater	Active		MD1040025
HUNTINGTOWN ELEMENTARY SCHOOL	609	Groundwater	Active		MD1040027
HUNTINGTOWN HIGH SCHOOL	1,540	Groundwater	Active		MD1040075
IMAGINE NATIONS EARLY LEARNING CENTER	60	Groundwater	Active		MD1040081
JEFFERSON PATTERSON PARK & MUSEUM	35	Groundwater	Active		MD1041131
KID'S FARM, INC.	105	Groundwater	Active		MD1040084
LAURIAN BUILDING	30	Groundwater	Active		MD1040088
LYONS CREEK SHOPPING CENTER	95	Groundwater	Active		MD1041151
MARKETPLACE PROFESSIONAL CENTER, LLC	110	Groundwater	Active		MD1041210
MISS TINA DAY CARE	40	Groundwater	Active		MD1040052
MS. BEV'S PLACE	75	Groundwater	Active		MD1040004
MT. HARMONY ELEMENTARY SCHOOL	706	Groundwater	Active		MD1040030
MUTUAL ELEMENTARY SCHOOL	894	Groundwater	Active		MD1040032
NAVAL RESEARCH LAB., CHESAPEAKE BAY DIV.	200	Groundwater	Active		MD0040019
NOAH'S ARK LEARNING CENTER	63	Groundwater	Active		MD1040080
NORTHERN MIDDLE & HIGH SCHOOLS	2,470	Groundwater	Active		MD1040034
PATUXENT ELEMENTARY SCHOOL	637	Groundwater	Active		MD1040066

Table 2.3-24— Maryland Department of the Environment (MDE) Water Appropriation Permits for the Calvert Cliffs Nuclear Power Plant
(Page 3 of 8)

Water System Name	Population Served	Primary Water Source Type	System Status	Date Closed	Water System ID
PLUM POINT ELEMENTARY SCHOOL	615	Groundwater	Active		MD1040063
PLUM POINT MIDDLE SCHOOL	881	Groundwater	Active		MD1040065
PRIME TIME YOUTH ACTIVITY CENTER	99	Groundwater	Active		MD1040091
SHILOH CHRISTIAN ACADEMY	74	Groundwater	Active		MD1041176
SLEEPY HOLLOW DAYCARE	65	Groundwater	Active		MD1040074
SNEADE'S ACE HARDWARE (LUSBY)-DAVLYN LLC	40	Groundwater	Active		MD1040085
SNEADES HARDWARE (OWINGS) - DAVLYN LLC	40	Groundwater	Active		MD1041134
SOLOMONS WASTEWATER TREATMENT PLANT	27	Groundwater	Active		MD1040078
SOUTHERN MIDDLE SCHOOL	745	Groundwater	Active		MD1040038
SUNDERLAND ELEMENTARY SCHOOL	481	Groundwater	Active		MD1040041
THE SHOPPES AT DUNKIRK LLC -COUNTRY PLZ	60	Groundwater	Active		MD1041152
THE TIDEWATER SCHOOL	61	Groundwater	Active		MD1040067
BEACH ELEMENTARY (0040003)	25	Groundwater	Closed	7/1/1992	MD1040003
BEAVERS NURSERY 2	22	Groundwater	Closed	5/1/1994	MD1040005
BROOKS CHILD DEVELOPMENT CT.	62	Groundwater	Closed	7/1/1995	MD1040007
BUSY BEE NURSERY INC.	45	Groundwater	Closed	2/1/2003	MD1040009
BUSY LITTLE BEAVERS	25	Groundwater	Closed	12/1/1989	MD1040010
CALVERT CO. BOE	25	Groundwater	Closed	3/1/1991	MD1040042
CALVERT ELEMENTARY (1040012)	25	Groundwater	Closed	7/1/1992	MD1040015
CALVERT MEMORIAL HOSPITAL	25	Groundwater	Closed	7/1/1993	MD1040017
CALVERT NURSING CENTER	130	Groundwater	Closed	12/1/1989	MD1040019
CALVERT SR. HIGH/VO TECH.	25	Groundwater	Closed	3/1/1991	MD1040021
COLLEGE OF SOUTHERN MD - CALVERT CAMPUS	501	Groundwater	Closed	5/1/2005	MD1040049
CROSS POINT	25	Groundwater	Closed	8/1/1999	MD1040073
GRACE BRETHERN SCHOOL	25	Groundwater	Closed	9/1/1990	MD1040024
ISLAND CREEK COMMUNITY CENTER	85	Groundwater	Closed	1/1/2006	MD1040068
KIDDIE CORRAL	22	Groundwater	Closed	12/1/1994	MD1040028
LITTLE FLOCK DAY CARE	25	Groundwater	Closed	5/1/1994	MD1040029
NORTHERN HIGH (1040034)	25	Groundwater	Closed	6/1/1991	MD1040033
RAGGEDY ANN & ANDYS	25	Groundwater	Closed	3/1/1991	MD1040035
RANDLE CLIFF HEAD START CENTER	25	Groundwater	Closed	12/1/1989	MD1040036
ST PAULS UM PRESCHOOL	25	Groundwater	Closed	3/1/1991	MD1040039
STATE HIGHWAY ADMINISTRATION	50	Groundwater	Closed	12/1/1993	MD1040062
TOPAZ MARINE CORP	25	Groundwater	Closed	6/1/1991	MD1040040
Listing of US EPA SDWIS Transient Non-Community Water Systems in Calvert County, Maryland					
7-11 SUNDERLAND	25	Groundwater	Active		MD1041236
7TH DAY ADVENTIST CHURCH OF PR. FRED.	25	Groundwater	Active		MD1041177
ADAMS RIBS	195	Groundwater	Active		MD1041076
ALL SAINTS EPISCOPAL CHURCH	502	Groundwater	Active		MD1041160
AMERICAN LEGION POST 206	25	Groundwater	Active		MD1041080
AMERICAN LEGION POST 274	25	Groundwater	Active		MD1041002
APOSTOLIC FAITH CHURCH	25	Groundwater	Active		MD1041144
BAY BREEZE STATE PARK	25	Groundwater	Active		MD1041235
BENNETT & BATONG MEDICAL	25	Groundwater	Active		MD1041198
BETHEL WAY CHURCH	25	Groundwater	Active		MD1041005

Table 2.3-24— Maryland Department of the Environment (MDE) Water Appropriation Permits for the Calvert Cliffs Nuclear Power Plant
(Page 4 of 8)

Water System Name	Population Served	Primary Water Source Type	System Status	Date Closed	Water System ID
BILL'S BOAT RENTAL	25	Groundwater	Active		MD1041004
BOWENS GROCERY	25	Groundwater	Active		MD1041008
BREEZY POINT BATHHOUSE	56	Groundwater	Active		MD1040072
BREEZY POINT BEACH/CAMP	25	Groundwater	Active		MD1041154
BREEZY POINT GRILL WINE & SPIRITS	0	Groundwater	Active		MD1041181
BREEZY PT BEACH CLUB MARINA	25	Groundwater	Active		MD1041009
BRIDGE DINER	25	Groundwater	Active		MD1041010
BRIGHT CENTER EAST	25	Groundwater	Active		MD1041237
BRIGHT CENTER WEST	250	Groundwater	Active		MD1041028
BROWN CLEARY BUILDING (CALVERT ANIMAL)	25	Groundwater	Active		MD1041238
BURNOUTS BAR & GRILL / STETSONS	0	Groundwater	Active		MD1041055
CALVARY BIBLE CHURCH	25	Groundwater	Active		MD1041164
CALVARY UNITED APOSTOLIC CHURCH	25	Groundwater	Active		MD1041113
CALVERT ARUNDEL MEDICAL	25	Groundwater	Active		MD1041197
CALVERT CLIFFS NUCLEAR - BALLFIELD	25	Groundwater	Active		MD1040058
CALVERT CLIFFS NUCLEAR - CAMP CONOY POOL	200	Groundwater	Active		MD1040059
CALVERT CLIFFS STATE PARK	25	Groundwater	Active		MD1041012
CALVERT DENTAL ASSOCIATES	25	Groundwater	Active		MD1041199
CALVERT ELKS LODGE	25	Groundwater	Active		MD1041215
CALVERT LIGHTHOUSE TABERNACLE	25	Groundwater	Active		MD1041165
CALVERT MEDICAL CENTER	25	Groundwater	Active		MD1041228
CALVERT PROFESSIONAL BUILDING	212	Groundwater	Active		MD1041204
CALVERT SKATING CENTER	25	Groundwater	Active		MD1041018
CAMP CONOY EAGLES DEN	25	Groundwater	Active		MD1041019
CHINA KING RESTAURANT	25	Groundwater	Active		MD1041145
CHRIST CHURCH PARISH HOUSE	25	Groundwater	Active		MD1041115
CHURCH OF CHRIST	25	Groundwater	Active		MD1041116
CHURCH OF LATTER DAY SAINTS	25	Groundwater	Active		MD1041117
CJ'S FOOD STORE	25	Groundwater	Active		MD1041023
COOPER UM CHURCH	25	Groundwater	Active		MD1041025
COVE POINT PARK MAINTENANCE BLDG	25	Groundwater	Active		MD1041186
COVE POINT PARK SNACK BAR	25	Groundwater	Active		MD1041111
CURTIS LITTEN - RIDGEWAY BUILDING	45	Groundwater	Active		MD1041254
CVS DUNKIRK	25	Groundwater	Active		MD1041222
CYPRESS SWAMP NATURE CENTER	25	Groundwater	Active		MD1041221
DASH IN OWINGS	25	Groundwater	Active		MD1041026
DOMINOS PIZZA-HUNTINGTOWN	25	Groundwater	Active		MD1041223
DON'S GENERAL STORE	25	Groundwater	Active		MD1041065
DOUBLE D'S SPORTS	42	Groundwater	Active		MD1041200
DUNKIRK ANIMAL HOSPITAL	25	Groundwater	Active		MD1041239
DUNKIRK BAPTIST CHURCH	303	Groundwater	Active		MD1041226
DUNKIRK CITGO	704	Groundwater	Active		MD1041167
DUNKIRK DISTRICT PARK	25	Groundwater	Active		MD1041013
DUNKIRK SUPPLY - LUSBY	25	Groundwater	Active		MD1041240
DUNKIRK SUPPLY - TRUSS PLANT	25	Groundwater	Active		MD1041242
DUNKIRK SUPPLY OWINGS	25	Groundwater	Active		MD1041241
DUNKIRK VOL FIRE DEPT	25	Groundwater	Active		MD1041031
EAST JOHN YOUTH CENTER	25	Groundwater	Active		MD1041034
EMMANUAL BAPTIST CHURCH	310	Groundwater	Active		MD1041120

Table 2.3-24— Maryland Department of the Environment (MDE) Water Appropriation Permits for the Calvert Cliffs Nuclear Power Plant
(Page 5 of 8)

Water System Name	Population Served	Primary Water Source Type	System Status	Date Closed	Water System ID
EMMANUEL SEVENTH DAY ADVENTIST CHURCH	25	Groundwater	Active		MD1041168
EMMANUEL U M CHURCH	25	Groundwater	Active		MD1041033
ETERNAL BUZZ TATTOO PARLOR	25	Groundwater	Active		MD1041250
FAIRVIEW CENTER	25	Groundwater	Active		MD1041098
FASTOP #54	225	Groundwater	Active		MD1041180
FASTOP #56	1,207	Groundwater	Active		MD1041170
FIRST BAPTIST CHURCH	25	Groundwater	Active		MD1041218
FIRST LUTHERAN CHURCH	25	Groundwater	Active		MD1041121
FLAG HARBOR POOL	167	Groundwater	Active		MD1041099
FLAVOR OF THE SOUTH CAFE	69	Groundwater	Active		MD1041052
FRYING PAN	25	Groundwater	Active		MD1041036
GATEWAY CENTER	25	Groundwater	Active		MD1041213
GATEWAY NORTH	25	Groundwater	Active		MD1041037
GENTLE FAMILY DENTISTRY	25	Groundwater	Active		MD1041214
GRACE BRETHREN CHURCH - EAST WING	608	Groundwater	Active		MD1041101
GRACE BRETHREN CHURCH - WEST WING	25	Groundwater	Active		MD1041219
GRAY-RAY AMER LEGION POST #220	25	Groundwater	Active		MD1041039
GREATER BIBLE WAY CHURCH	19	Groundwater	Active		MD1041040
GUIDOS RESTAURANT	25	Groundwater	Active		MD1041125
HALLOWING POINT PARK	25	Groundwater	Active		MD1041015
HALLOWING POINT PARK MAINTENANCE BLDG	25	Groundwater	Active		MD1041185
HARVEST FELLOWSHIP	25	Groundwater	Active		MD1041232
HEGARTY AND KOPICKI BUILDING	25	Groundwater	Active		MD1041243
HOPKINS & WAYSON / EXPRESSIONS CATERING	25	Groundwater	Active		MD1040087
HOWLIN BUILDING	25	Groundwater	Active		MD1041201
HUDSON'S SUNOCO	25	Groundwater	Active		MD1041046
HUNTINGTOWN MEDICAL BUILDING	90	Groundwater	Active		MD1041227
HUNTINGTOWN NORTH/FLOOR SYSTEMS	125	Groundwater	Active		MD1041234
HUNTINGTOWN PLAZA SHOPPING CENTER	25	Groundwater	Active		MD1041093
HUNTINGTOWN UM CHURCH	25	Groundwater	Active		MD1041049
HUNTINGTOWN VOL FIRE DEPT	25	Groundwater	Active		MD1041050
ISLAND CREEK PROPERTIES	25	Groundwater	Active		MD1041127
J & J PHYSICAL THERAPY	25	Groundwater	Active		MD1041211
JEHOVAHS WITNESS OF PRINCE FREDERICK	25	Groundwater	Active		MD1041123
JLH BUILDING	25	Groundwater	Active		MD1041244
KINGS LANDING CAMP	25	Groundwater	Active		MD1041053
KINGS LANDING POOL	25	Groundwater	Active		MD1041140
LEE FUNERAL HOME	303	Groundwater	Active		MD1041187
LEN'S MARKET/MARINA	25	Groundwater	Active		MD1041056
LORD CALVERT BOWL	25	Groundwater	Active		MD1041059
LUSBY SUNOCO	25	Groundwater	Active		MD1041195
MARLEY RUN RECREATION AREA	25	Groundwater	Active		MD1041158
MATTESON SUPPLY COMPANY	2	Groundwater	Active		MD1041252
MIDDLEHAM & ST PETERS PARISH	25	Groundwater	Active		MD1041162
MT GETHSEMANE BAPTIST CHURCH	25	Groundwater	Active		MD1041129
MT HARMONY UMC	54	Groundwater	Active		MD1041231

Table 2.3-24— Maryland Department of the Environment (MDE) Water Appropriation Permits for the Calvert Cliffs Nuclear Power Plant
(Page 6 of 8)

Water System Name	Population Served	Primary Water Source Type	System Status	Date Closed	Water System ID
MT HOPE CENTER	25	Groundwater	Active		MD1041103
MT OLIVE UM CHURCH	25	Groundwater	Active		MD1041062
NEW CALVERT CO FAIRGROUND	25	Groundwater	Active		MD1041202
OPTIMISTS CLUB BINGO	25	Groundwater	Active		MD1041229
PARIS CENTER (FKA GRIFFITHS)	25	Groundwater	Active		MD1041070
PATUXENT CAMPSITES	37	Groundwater	Active		MD1041066
PETERS UM CHURCH	25	Groundwater	Active		MD1041069
PRINCE FREDERICK PROFESSIONAL BLDG	120	Groundwater	Active		MD1041095
RAUSCH FUNERAL HOME OWINGS	20	Groundwater	Active		MD1041188
RAUSCH FUNERAL HOME PORT REPUBLIC	55	Groundwater	Active		MD1041189
RAYMOND FUNERAL HOME	25	Groundwater	Active		MD1041190
REID BUILDING	25	Groundwater	Active		MD1041182
ROUTE 231 CITGO	25	Groundwater	Active		MD1041174
ROUTE 260 AMOCO	25	Groundwater	Active		MD1041166
SAFEWAY GAS STATION	25	Groundwater	Active		MD1041247
SCHEIBELS CONSTRUCTION	43	Groundwater	Active		MD1041245
SEWELL FUNERAL HOME	25	Groundwater	Active		MD1041191
SMECO BUILDING	193	Groundwater	Active		MD1041203
SMITHVILLE U M CHURCH	25	Groundwater	Active		MD1041133
SOLID ROCK CHURCH	25	Groundwater	Active		MD1041079
SOUTHERN CALVERT BAPTIST CHURCH	86	Groundwater	Active		MD1041161
ST EDMONDS UM CHURCH	25	Groundwater	Active		MD1041081
ST NICHOLAS LUTHERAN	25	Groundwater	Active		MD1041233
ST PAUL UM CHURCH	25	Groundwater	Active		MD1041137
STONEYS CRAB HOUSE	25	Groundwater	Active		MD1041148
TASTY KWIK	25	Groundwater	Active		MD1041074
THE PAVILLION AT GODSGRACE	25	Groundwater	Active		MD1041209
THE QUILTING ROOM (FRMLY ISLAMIC CENTER)	25	Groundwater	Active		MD1041172
TOWN & COUNTRY LIQUORS/BARBER SHOP	2	Groundwater	Active		MD1041251
TOWN CENTER AMOCO	25	Groundwater	Active		MD1041175
TWIN SHIELDS GOLF CLUB	25	Groundwater	Active		MD1041086
WATERS MEMORIAL UM CHURCH	25	Groundwater	Active		MD1041089
WAWA #573	10	Groundwater	Active		MD1041248
WHITE SANDS RESTAURANT	25	Groundwater	Active		MD1041150
WINDSORS EZ STOP	25	Groundwater	Active		MD1041171
WORLD GYM	10	Groundwater	Active		MD1041253
7-ELEVEN DUNKIRK	25	Groundwater	Closed	8/1/1999	MD1041043
AMER LEGION POST 206	25	Groundwater	Closed	2/1/1999	MD1041157
ANDREA'S CATERING	25	Groundwater	Closed	3/1/1993	MD1041001
B G & E (FIRING RANGE)	25	Groundwater	Closed	8/1/1999	MD1040057
BARSTOW PROFESSIONAL BUILDING	25	Groundwater	Closed	1/1/2002	MD1041216
BAYSIDE MARKET	25	Groundwater	Closed	3/1/1993	MD1021297
BETTY SUE'S CONFECTIONARY	25	Groundwater	Closed	2/1/1999	MD1041107
BG&E VISITOR CENTER	200	Groundwater	Closed	5/1/2002	MD1040056
BISHOPS STAND	25	Groundwater	Closed	5/1/2005	MD1041006
BJ'S BAKERY	25	Groundwater	Closed	12/1/1996	MD1041007
BROOKS UM CHURCH	25	Groundwater	Closed	5/1/2005	MD1041011
C & B TEXACO	25	Groundwater	Closed	3/31/2006	MD1041192
CALVARY BAPTIST CHURCH	25	Groundwater	Closed	11/1/1999	MD1041108

Table 2.3-24— Maryland Department of the Environment (MDE) Water Appropriation Permits for the Calvert Cliffs Nuclear Power Plant
(Page 7 of 8)

Water System Name	Population Served	Primary Water Source Type	System Status	Date Closed	Water System ID
CALVERT CAFE	25	Groundwater	Closed	2/1/1999	MD1041109
CALVERT CLIFFS NUCLEAR CONFERENCE CENTER	100	Groundwater	Closed	10/1/2004	MD1040060
CALVERT COUNTY FAIRGROUND	25	Groundwater	Closed	1/1/2002	MD1041110
CALVERT MARINA	25	Groundwater	Closed	2/1/1999	MD1041112
CALVERT MEATS	25	Groundwater	Closed	8/1/1999	MD1041017
CARROLL WESTERN UM CHURCH	25	Groundwater	Closed	5/1/2005	MD1041022
CHESAPEAKE HILLS COUNTRY CLUB	25	Groundwater	Closed	8/1/1999	MD1041183
CHESSIES HUNTINGTOWN	25	Groundwater	Closed	8/1/1999	MD1041048
CHRIST CHILD CAMP	25	Groundwater	Closed	5/1/2005	MD1041020
CHRIST CHILD CAMP POOL	25	Groundwater	Closed	5/1/2005	MD1041153
CHRISTIAN BIBLE CENTER	25	Groundwater	Closed	11/1/1999	MD1041114
CHURCH OF GOD	25	Groundwater	Closed	5/1/2005	MD1041173
CORNER STONE BAPTIST CHURCH	25	Groundwater	Closed	11/1/1999	MD1041159
COUNTRY CUTS	25	Groundwater	Closed	3/1/1993	MD1041097
COUNTRY DOCKS	25	Groundwater	Closed	5/1/2005	MD1041073
DJ'S MINI MART	25	Groundwater	Closed	1/1/2002	MD1041029
DODSONS GROCERY	25	Groundwater	Closed	8/1/2000	MD1041030
DUNKIRK AMOCO	25	Groundwater	Closed	8/1/2000	MD1041194
DUNKIRK COMMUNITY CHAPEL	25	Groundwater	Closed	11/1/1999	MD1041118
DUNKIRK MARKET PLACE (SEE 104-0064)	25	Groundwater	Closed	3/31/2006	MD1041178
DUNKIRK SEAFOOD MARKET	25	Groundwater	Closed	11/1/1999	MD1041143
DUNKIRK URGENT CARE CENTER	25	Groundwater	Closed	3/31/2006	MD1041196
EASTERN U M CHURCH	25	Groundwater	Closed	5/1/2005	MD1041032
FAMILY MEDICINE	25	Groundwater	Closed	12/1/2000	MD1041225
FRANCHI'S RESTAURANT	25	Groundwater	Closed	12/1/1996	MD1041035
GASHOP 2	25	Groundwater	Closed	5/1/2005	MD1041100
GATSBY DOCKSIDE GALLERY	25	Groundwater	Closed	9/1/1988	MD1041038
HAWKINS GROCERY DUNKIRK	25	Groundwater	Closed	12/1/1996	MD1041042
HIGH'S-PARIS SHOPPING CENTER	25	Groundwater	Closed	2/1/1999	MD1041045
HULIO'S CHUCKWAGON	25	Groundwater	Closed	2/1/1999	MD1041047
IGA FOODLINER	25	Groundwater	Closed	12/1/1996	MD1041102
IGA NORTH BEACH	25	Groundwater	Closed	12/1/1996	MD1041051
ISLAND CREEK HEADSTART	25	Groundwater	Closed	3/31/2006	MD1041217
J & J FOODS	25	Groundwater	Closed	6/1/2001	MD1041024
J & J RESTAURANT	100	Groundwater	Closed	3/1/1993	MD1041146
JENEVAS CAKES	25	Groundwater	Closed	2/1/2006	MD1041224
JOE & THELMA CATERING	25	Groundwater	Closed	5/1/2005	MD1041155
KNOTTY PINE BAR & GRILL	25	Groundwater	Closed	12/1/1996	MD1041054
LAKE SNACK BAR	25	Groundwater	Closed	2/1/1999	MD1041156
LICKEDY SPLITS	25	Groundwater	Closed	2/1/1999	MD1041141
LILLIE'S CATERING SERVICE	25	Groundwater	Closed	9/1/1988	MD1041057
LITTLE PONDEROSA OWINGS	25	Groundwater	Closed	9/1/1988	MD1041058
MARKETPLACE PROFESSIONAL BUILDING	25	Groundwater	Closed	3/1/2001	MD1041212
MARYLAND TOBACCO GROWERS ASSOC	25	Groundwater	Closed	9/1/1988	MD1041126
MOTHER BROWN'S GROCERY	25	Groundwater	Closed	12/1/1996	MD1041060
MS. LIZZIES	25	Groundwater	Closed	3/1/1993	MD1041128
MT HOPE UM CHURCH	25	Groundwater	Closed	2/1/2006	MD1041061
N. BEACH STORE & OFFICES	25	Groundwater	Closed	12/1/1996	MD1041064
NEPTUNE'S	25	Groundwater	Closed	12/1/1996	MD1041063
NORTH BEACH POST OFFICE	25	Groundwater	Closed	12/1/1996	MD1041104

Table 2.3-24— Maryland Department of the Environment (MDE) Water Appropriation Permits for the Calvert Cliffs Nuclear Power Plant
(Page 8 of 8)

Water System Name	Population Served	Primary Water Source Type	System Status	Date Closed	Water System ID
NORTH BEACH TOWN OFFICES	25	Groundwater	Closed	12/1/1996	MD1041147
OASIS SNACK BAR	25	Groundwater	Closed	3/1/1993	MD1041130
OHALLORANS BAR & GRILL	25	Groundwater	Closed	8/1/1999	MD1041096
OLIVET UNITED METHODIST CHURCH	25	Groundwater	Closed	5/1/2005	MD1041169
PATUXENT UM CHURCH	25	Groundwater	Closed	5/1/2005	MD1041067
PENWICK HOUSE	25	Groundwater	Closed	1/1/2002	MD1041068
PIZZA OVEN	25	Groundwater	Closed	2/1/1999	MD1041071
PLATER'S TAVERN	25	Groundwater	Closed	1/1/1998	MD1081071
PLUM POINT UM CHURCH	25	Groundwater	Closed	5/1/2005	MD1041072
R & J LIQUORS	25	Groundwater	Closed	1/1/2002	MD1041078
R & W MARKET	25	Groundwater	Closed	3/1/1993	MD1041132
R/K AGRICULTURAL CENTER	25	Groundwater	Closed	11/1/1999	MD1041142
RANDLE CLIFF MARKET	25	Groundwater	Closed	8/1/2000	MD1041075
S & S SEAFOOD	25	Groundwater	Closed	11/1/2000	MD1041149
SNELLS FEED STORE	25	Groundwater	Closed	11/1/1999	MD1041135
SOLOMONS CHARGE UNITED METHODIST	25	Groundwater	Closed	11/1/1999	MD1041179
SOUTHERN COMMUNITY CENTER	25	Groundwater	Closed	3/31/2006	MD1041220
ST ANTHONYS CHURCH	25	Groundwater	Closed	8/1/1999	MD1041136
ST JOHNS UM CHURCH	25	Groundwater	Closed	5/1/2005	MD1041082
SURREY INN	25	Groundwater	Closed	9/1/2000	MD1041205
TRUEMAN H.B. LUMBER CO.	25	Groundwater	Closed	12/1/1996	MD1041138
TWIN BEACH COMM. CENTER	25	Groundwater	Closed	12/1/1996	MD1041085
WARDS MEMORIAL METHODIST CHURCH	25	Groundwater	Closed	5/1/2005	MD1041139
WARREN DENTON SEAFOOD	25	Groundwater	Closed	1/1/2002	MD1041088
WEEMS BUILDING	25	Groundwater	Closed	3/1/1993	MD1041090
WEEMS TAVERN	25	Groundwater	Closed	2/1/1999	MD1041091
WHITE SANDS POOL	25	Groundwater	Closed	3/31/2006	MD1041206
ZION HILL CHURCH OF CHRIST	25	Groundwater	Closed	5/1/2005	MD1041106

Note:
County(s) Served - Calvert

Table 2.3-25— CCNPP Units 1 and 2 State of Maryland Water Appropriation Permits

Permit Number	Location	Limit (gpd (lpd))	Expires	Report	Aquifer	Wells	Well Depth (ft)
CA69G010 (05)	CCNPP	450,000/865,000 (1,073,425/3,374,381)	7/1/2012	Yes	Aquia	5	600
CA63G003 (07)	Camp Conoy	500/5,000 (1,892/18,927)	7/1/2012	No	Piney Point	4	350
CA83G008 (03)	Visitor's Center	300/500 (1,135/1,892)	7/1/2012	No	Piney Point	1	350
CA89G007 (02)	Firing Range	500/1,000 (1,892/3,785)	7/1/2012	No	Piney Point	1	350
CA89G107(01)	PUP Trailers	300/500 (1,351/1,892)	7/1/2012	N/A	Piney Point	1	350
None	Old Bay Farm	None	N/A	N/A	Aquia	1	600

Field Explanations

- Permit Number: MD Water Appropriation and Use Permit
- Location: Location of permitted site well(s) in CCNPP
- Limit: Daily average of gallons on a yearly basis / daily average of gallons for the month of maximum use
- Expires: Permit Expiration Date
- Report: Requirements to report semi-annual groundwater withdrawals
- Aquifer: Aquifer source
- Wells: Number of permitted site wells

Table 2.3-26— CCNPP Units 1 and 2 Water Use Report, State of Maryland Water Appropriation Permit CA69G010 (05)

	2001 gallons (liters)	2002 gallons (liters)	2003 gallons (liters)	2004 gallons (liters)	2005 gallons (liters)	2006 gallons (liters)
January		14,495,320 (54,870,755)	11,392,300 (43,124,546)	14,992,760 (56,753,770)	11,148,840 (42,202,950)	10,041,320 (38,010,531)
February		10,342,670 (39,151,264)	10,857,000 (41,098,215)	12,414,190 (64,992,821)	11,607,670 (43,939,810)	10,346,610 (39,166,179)
March		9,481,760 (35,892,366)	10,165,800 (38,481,739)	11,692,830 (44,262,176)	12,870,800 (48,721,277)	10,012,940 (37,903,101)
April		9.742,450 (36,879,185)	11,195,700 (42,380,334)	10,572,530 (40,021,379)	8,977,320 (33,982,852)	14,271,134 (54,022,118)
May		10,653,390 (40,327,468)	15,828,550 (59,917,579)	12,288,900 (52,343,689)	13,827,740 (52,343,689)	11,781,229 (44,596,803)
June		11,305,160 (42,794,685)	14,877,230 (56,316,441)	15,858,200 (60,029,817)	11,987,770 (45,378,645)	10,936,940 (41,400,821)
July	12,106,107 (45,826,600)	15,271,750 (57,809,862)	12,902,030 (48,839,496)	13,892,440 (52,588,606)	8,336,940 (31,558,750)	
August	13,012,084 (49,256,096)	13,006,370 (49,234,466)	12,537,070 (47,457,972)	13,045,600 (49,382,967)	8,786,380 (33,260,066)	
September	12,573,675 (47,596,537)	13,707,430 (51,888,267)	11,507,340 (43,560,020)	11,817,990 (44,735,958)	8,343,530 (31,583,696)	
October	11,603,068 (43,922,390)	11,100,240 (42,018,979)	10,885,500 (41,206,099)	13,004,910 (49,228,939)	9,394,250 (35,561,104)	
November	12,220,342 (46,259,026)	13,171,740 (49,860,459)	12,553,100 (47,518,652)	10,932,310 (41,383,295)	7,566,650 (28,642,886)	
December	11,051,880 (41,835,916)	10,740,610 (40,657,631)	14,021,400 (53,076,772)	11,456,340 (43,366,964)	9,629,400 (36,451,244)	
Annual Totals	**72,567,156 (274,696,567)**	**143,018,890 (541,385,391)**	**148,723,020 (562,977,872)**	**151,969,000 (575,265,243)**	**122,477,290 (463,626,976)**	**67,390,173 (255,099,555)**

Table 2.3-27— Maryland Department of the Environment (MDE) Water Appropriation Permits for the Calvert Cliffs Nuclear Power Plant

Permit Number	Location	Limit gpd (lpd)	Expires	Report	Aquifer	Wells
CA69G010 (05)	CCNPP	450,000/865,000 (1,073,435/3,274,381)	7/1/2012	yes	Aquia	5
CA63G003 (07)	Camp Conoy	500/5,000 (1,892/18,297)	7/1/2012	no	Piney Point	4
CA83G008 (03)	Visitor's Center	300/500 (1,135/1,892)	7/1/2012	no	Piney Point	1
CA89G007 (02)	Rifle Range	500/1,000 (1,892/3,785)	7/1/2012	no	Piney Point	1
CA89G107(01)	PUP Trailers	300/500 (1,135/1,892)	7/1/2012	n/a	Piney Point	1
None	Old Bay Farm	None	n/a	n/a	Aquia	1

Field Explanations:

Permit Number: MD Water Appropriation and Use Permit
Location: Area within CCNPP
Limit: Daily average of gallons on a yearly basis/daily average of gallons for the month of maximum use
Expires: Permit Expiration Date
Report: Requirements to report semi-annual groundwater withdrawals
Aquifier: Aquifier source
Wells: Permitted site wells

Table 2.3-28— Summary of Fall 2006 Water Quality Analytical Data and In-situ Measurements for CCNPP Streams and Ponds

Water Body		Johns Creek		Goldstein Branch	Lake Conoy[a]				Pond 1[a]	Pond 2[a]	Lake Davies		
Parameter	Units	JCUS-01	JCDS-01	GB-01	LC-01	LC-02	LC-02 DUP	LC-03	P-01	P-02	LD-01	LD-02	LD-03
Temperature[b]	°F (°C)	64 (18)	59 (15.5)	62 (16.9)	76 (24.9)	70 (21.3)	NA	70 (21.7)	65 (18.4)	63 (17.3)	68 (20)	70 (20.5)	71 (20.7)
Dissolved Oxygen[b]	ppm	6.4	6	6.7	7.6	6.1	NA	6.16	3.21	0.99	3.4	3.4	4
pH[b]	SU	6.4	7.63	7.4	7.8	7.72	NA	7.3	6.7	6.39	7.5	7.7	7.7
Conductivity[b]	µmhos/cm	50	484	737	66	63	NA	62	109	135	1566	1592	1591
Alkalinity	mg/L	3.5	76	100	14	8.5	4.5	4.5	30	56	330	280	270
Biological Oxygen Demand (BOD)	mg/L	<2.0	3.2	5.9	6.3	6.9	<2.0	4.5	18	14	9.8	7.2	9.1
Ammonia	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nitrate plus Nitrite-N	mg/L	<0.05	<0.05	0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phosphorus Dissolved-P	mg/L	0.021	0.018	0.011	<0.01	0.021	<0.01	0.011	0.011	<0.01	0.22	0.19	0.21
Phosphorus Total-P	mg/L	0.029	0.032	0.079	0.17	0.038	0.067	0.035	0.18	0.095	0.36	0.31	0.29
Total Dissolved Solids	mg/L	30	280	440	35	67	20	48	41	51	980	950	980
Total Kjeldahl Nitrogen	mg/L	2	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	3.1	1.4	2.2	1.8	1.7
Total Organic Carbon	mg/L	5.5	4	3.9	6.1	5.8	5.6	5.7	6.3	6.4	15	16	16
Total Suspended Solids	mg/L	4	5	62 (16.9)	27	<5.0	<5.0	150	56	11	6	6.5	8

Notes:
See footnotes at end of table.
[a]Lake Conoy is also known as the Camp Conoy Fishing Pond. Pond 1 and Pond 2 are the first and second impoundments downstream of the Camp Conoy Fishing Pond.
[b]Insitu measurements for Temperature, Dissolved Oxygen, pH, and Conductivity are for surface readings. Additional data collected at various depths in the two lakes are provided in Table 2.3-29.

Table 2.3-29— Summary of Fall 2006 Water Quality Analytical Data and In-situ Measurements for CCNPP Streams and Ponds

Water Body	Units	Lake Conoy			Lake Davies		
		LC-01	LC-02	LC-03	LD-01	LD-02	LD-03
Parameter - Surface							
Temperature	°F (°C)	76 (24.9)	70 (21.3)	70 (21.7)	68 (20)	70 (20.5)	71 (20.7)
Dissolved Oxygen	ppm	7.6	6.1	6.16	3.4	3.4	4
pH	SU	7.8	7.72	7.3	7.5	7.7	7.7
Conductivity	µ mhos/cm	66	63	62	1566	1592	1591
Parameter – Mid-Depth							
Temperature	°F (°C)	NA	NA	70.6 (21.2)	68 (20)	68.4 (20.2)	68.5 (20.3)
Dissolved Oxygen	ppm	NA	NA	5.68	3.1	2.5	2.5
pH	SU	NA	NA	7.06	7.6	7.6	7.7
Conductivity	µ mhos/cm	NA	NA	63	1581	1612	1581
Parameter - Bottom							
Temperature	°F (°C)	77.5 (25.3)	70.4 (21.34)	70.2 (21.2)	67.8 (19.9)	68.4 (20.2)	67.8 (19.9)
Dissolved Oxygen	ppm	6.7	5.88	5.06	2.2	2.6	2.2
pH	SU	7.5	7.44	6.77	7.5	7.6	7.7
Conductivity	µ mhos/cm	65	62	62	1563	1608	1576

Notes:

NA = Not applicable. There is no duplicate sampling for in-situ measurements.
SU = Standard Units (pH)

Table 2.3-30— Summary of Spring 2007 Water Quality Analytical Data for CCNPP Streams and Ponds
(Page 1 of 2)

Water Body		Johns Creek			Goldstein Branch		Lake Canoy			Lake Davies			Pond 1	Pond 2
Parameter	**Units**	**JCUS-01**	**JCDS-01 (Dry)**	**JCDS-01 (Wet)**	**GB-01(Dry)**	**GB-01 (Wet)**	**LC-01**	**LC-02**	**LC-03**	**LD-01**	**LD-02**	**LD-03**	**P-01**	**P-02**
Conductivity	ìS/cm	37	297	---	460	---	61	56	57	1209	1197	1202	79	89
Dissolved Oxygen	mg/L	11.1	12.1	---	13.4	---	11.6	12.8	13.4	18.8	18.6	17.4	11.8	11.5
Odor (Observation)	NA	None	None	None	None	None	None	None	None	None	None	None	None	None
pH	units	6.6	7.5	---	7.3	---	8.1	8.1	7.9	8.3	8.3	8.3	7.5	7.5
Temperature	Centigrade	6.6	13	---	11.1	---	14.2	11.8	12.4	11	10.9	10.6	9	9.9
Turbidity	NTU	4.1	9.9	---	8.1	---	2.4	3.3	3	3.1	3.3	2.8	18.3	10.3
Water Depth	feet	1	---	---	1	1	2	2	3.5	3	4	3	3	1.5
Alkalinity	mg/L	8.5	43	33	62	42	6.5	12	9.5	180	190	190	25	24
BOD	mg/L	<3.0	<3.0	5.6	<3.0	7.3	<3.0	<3.0	<3.0	4.1	4.1	9.1	<3.0	<3.0
Carbon, Total	mg/L	3.4	13.3	12.6	21.7	15.1	5	4.1	2.8	8.3	8.4	6.6	9.9	3.8
Carbon, Total Organic	mg/L	2.6	5	5.8	3.7	6.8	2.4	4.2	5.6	8.8	9.7	9.8	4.9	3.3
Chemical Oxygen Demand	mg/L	<10	21	32	<10	35	<10	23	25	37	33	23	28	28
Chloride (Titrimetric, Mercuric Nitrate)	mg/L	6.5	46	46	50	29	7.5	7	7.5	120	120	120	7	7
Chlorophyll-A	mg/M_3	2.9	1.8	2.4	5.4	6.5	2.3	0.89	0.91	4.8	1.4	5.4	4.2	0.89
Color, True	color units	20	25	30	15	35	10	15	25	25	20	15	30	25
Fecal Coliform	MPN/100ml	<2.0*	<2.0*	1600	8*	500*	<2.0*	<2.0*	<2.0*	<2.0*	<2.0*	<2.0*	<2.0*	80*
Fecal Streptococcus	MPN/100ml	<2.0*	12*	90	4*	140*	<2.0*	<2.0*	<2.0*	<2.0*	<2.0*	<2.0*	33*	6.0*
Hardness, Total	mg/L	160	250	190	310	220	180	130	160	580	620	640	180	190
Nitrogen-Ammonia	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nitrogen, Total Kjeldahl	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nitrogen, Nitrate-Nitrite	mg/L	0.053	0.15	0.21	0.33	0.26	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.062	<0.050
Petroleum Hydrocarbons, Total	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Phosphorus, Dissolved	mg/L	<0.010	<0.010	0.013	<0.010	0.02	<0.010	<0.010	0.023	0.043	<0.010	<0.010	<0.010	0.013
Phosphorus, Ortho	mg/L	<0.010	<0.010	0.067	<0.010	0.024	0.01	0.01	0.03	0.031	0.04	0.077	<0.010	0.015

Table 2.3-30— Summary of Spring 2007 Water Quality Analytical Data for CCNPP Streams and Ponds
(Page 2 of 2)

Water Body		Johns Creek			Goldstein Branch		Lake Canoy			Lake Davies			Pond 1	Pond 2
Parameter	**Units**	**JCUS-01**	**JCDS-01 (Dry)**	**JCDS-01 (Wet)**	**GB-01(Dry)**	**GB-01 (Wet)**	**LC-01**	**LC-02**	**LC-03**	**LD-01**	**LD-02**	**LD-03**	**P-01**	**P-02**
Phosphorus, Total	mg/L	0.044	0.034	0.19	0.077	0.21	0.024	0.054	0.086	0.07	0.063	0.014	0.073	0.037
Solids, Total Dissolved	mg/L	49	180	120	320	180	47	61	46	860	900	980	32	63
Solids, Total Suspended	mg/L	<5.0	<5.0	20	<5.0	120	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.5	11
Sulfate	mg/L	11	45	30	130	73	13	15	14	360	520	520	13	14

* Sample analyzed past recommended holding time. Data are relevant for intra-study comparison but should not be used as the basis of management decisions for water use for primary contact recreation.

Table 2.3-31— Summary of Spring 2007 Surface, Mid-Depth and Bottom in Situ Water Quality Data for CCNPP Lake Conoy and Lake Davies

Water Body		Lake Canoy			Lake Davies		
Parameter	**Units**	**LC-01**	**LC-02**	**LC-03**	**LD-01**	**LD-02**	**LD-03**
Water Body		**Lake Canoy**			**Lake Davies**		
Parameter	**Units**	**LC-01**	**LC-02**	**LC-03**	**LD-01**	**LD-02**	**LD-03**
Surface							
Temperature	Centigrade	NA	NA	12.4	11.0	10.9	10.6
Dissolved Oxygen	ppm	NA	NA	13.4	18.8	18.6	17.4
pH	units	NA	NA	7.9	8.3	8.3	8.3
Conductivity	µS/cm	NA	NA	57.0	1209.0	1197.0	1202.0
Turbidity	NTU	NA	NA	3.0	3.1	3.3	2.8
MidDepth							
Temperature	Centigrade	14.2	11.8	NA	11.0	11.0	10.6
Dissolved Oxygen	ppm	11.6	12.8	NA	19.3	18.8	17.5
pH	units	8.1	8.1	NA	8.3	8.3	8.3
Conductivity	µS/cm	61.0	56.0	NA	1208.0	1197.0	1201.0
Turbidity	NTU	2.4	3.3	NA	3.0	3.1	3.0
Bottom							
Temperature	Centigrade	NA	NA	10.3	11.0	10.9	10.2
Dissolved Oxygen	ppm	NA	NA	14.1	19.3	18.8	17.6
pH	units	NA	NA	7.8	8.3	8.3	8.3
Conductivity	µS/cm	NA	NA	54.0	1206.0	1194.0	1195.0
Turbidity	NTU	NA	NA	3.9	3.2	3.2	3.3

Table 2.3-32— Summary of Spring 2007 Metals in CCNPP Streams and Ponds

Water Body		Johns Creek			Goldstein Branch		Lake Canoy			Lake Davies			Pond 1	Pond 2
Parameter	Units	JCUS-01	JCDS-01 (Dry)	JCDS-01 (Wet)	GB-01(Dry)	GB-01(Wet)	LC-01	LC-02	LC-03	LD-01	LD-02	LD-03	P-01	P-02
Arsenic	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0028	0.0024	0.0027	<0.0020	<0.0020
Barium	mg/L	0.023	0.027	0.066	0.030	0.04	0.016	0.016	0.016	0.015	0.014	0.015	0.012	0.0088
Cadmium	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Calcium	mg/L	0.98	22	14	52	33	1.9	1.8	1.8	84	84	85	8.7	11
Chromium	mg/L	<0.0025	<0.0025	<0.0025	<0.0025	0.0027	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Lead	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	0.003	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Magnesium	mg/L	1.5	7.1	4.7	16	10	2.6	2.5	2.5	62	62	62	2.7	2.7
Mercury	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Potassium	mg/L	0.83	1.8	1.9	2.8	2.5	1.0	1.0	0.99	17	17	17	0.78	0.87
Selenium	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Sodium	mg/L	4.1	30	30	31	20	5.3	5.3	5.4	170	170	170	5.2	5.3

Table 2.3-33— Summary of Spring 2007 Polynuclear Aromatic Hydrocarbons (PAHs) in CCNPP Streams

Water Body		Johns Creek		Goldstein Branch	
Parameter	**Units**	**JCDS-01(Dry)**	**JCDS-01 (Wet)**	**GB-01 (Dry)**	**GB-01 (Wet)**
Acenaphthene	µg/L	<10	<10	<10	<10
Acenaphthylene	µg/L	<10	<10	<10	<10
Anthracene	µg/L	<10	<10	<10	<10
Benz(a)anthracene	µg/L	<10	<10	<10	<10
Benzo(a)pyrene	µg/L	<10	<10	<10	<10
Benzo(b)fluoranthene	µg/L	<10	<10	<10	<10
Benzo(g,h,i)perylene	µg/L	<10	<10	<10	<10
Benzo(k)fluoranthene	µg/L	<10	<10	<10	<10
Chrysene	µg/L	<10	<10	<10	<10
Dibenz(a,h)anthracene	µg/L	<10	<10	<10	<10
Florene	µg/L	<10	<10	<10	<10
Fluoranthene	µg/L	<10	<10	<10	<10
Indeno(1,2,3-cd)pyrene	µg/L	<10	<10	<10	<10
Naphthalene	µg/L	<10	<10	<10	<10
Phenanthrene	µg/L	<10	<10	<10	<10
Pyrene	µg/L	<10	<10	<10	<10

Table 2.3-34— Summary of Pycnocline Data for Selected Chesapeake Bay Monitoring Stations, Water Year 2005

Station ID	Fall		Winter		Spring		Summer		Yearly Average
	Max	Min	Max	Min	Max	Min	Max	Min	
Depth to Pycnocline in feet (meters)									
CB4.3C	37.7 (11.5)	27.9 (8.5)	57.4 (17.5)	11.5 (3.5)	41 (12.5)	11.5 (3.5)	41 (12.5)	14.8 (4.5)	29.2 (8.9)
CB4.3E	34.4 (10.5)	11.5 (3.5)	--	--	44.3 (13.5)	14.8 (4.5)	27.9 (8.5)	14.8 (4.5)	25.7 (7.8)
CB4.4	44.3 (13.5)	18 (5.5)	44.3 (13.5)	27.9 (8.5)	34.4 (10.5)	8.2 (2.5)	41 (12.5)	27.9 (8.5)	31.4 (9.6)
CB5.1	47.6 (14.5)	8.2 (2.5)	54.1 (16.5)	18 (5.5)	41 (12.5)	11.5 (3.5)	37.7 (11.5)	14.8 (4.5)	27.9 (8.5)
Thickness of Pycnocline in feet (meters)									
CB4.3C	16.4 (5)	9.8 (3)	29.5 (9)	3.3 (1)	29.5 (9)	9.8 (3)	23 (7)	3.3 (1)	16.2 (4.9)
CB4.3E	19.7 (6)	16.4 (5)	--	--	6.6 (2)	<3 (<1)	26.2 (8)	9.8 (3)	13.1 (4)
CB4.4	49.2 (15)	9.8 (3)	19.7 (6)	9.8 (3)	32.8 (10)	19.7 (6)	23 (7)	6.6 (2)	19.9 (6.1)
CB5.1	52.5 (16)	6.6 (2)	32.8 (10)	9.8 (3)	49.2 (15)	23 (7)	49.2 (15)	9.8 (3)	23.6 (7.2)

Note:
-- = No data

Table 2.3-35— Summary of Tempature Statistics (F[C]) for Selected Chesapeake Bay Monitoring Stations, Water Year 2005

Seasonal Statistics	CB4.3W	CB4.3C	CB4.3E	CB4.4	CB5.1W	CB5.1
Fall – September, October, November						
Max	78.3 (25.7)	79.7 (26.5)	79.5 (26.4)	80.6 (27.0)	80.2 (26.8)	79.9 (26.6)
Min	66.6 (19.2)	56.7 (13.7)	66.4 (19.1)	58.1 (14.5)	53.2 (11.8)	58.3 (14.6)
Average	71.9 (22.2)	69.9 (21.1)	73.4 (23.0)	69.7 (21.0)	70.7 (21.5)	69.9 (21.1)
N	15	66	37	74	22	78
Winter – December, January, February						
Max	--	54.5 (12.5)	--	54.5 (12.5)	47.7 (8.7)	54.5 (12.5)
Min	--	34.9 (1.6)	--	35.1 (1.7)	35.6 (2.0)	35.1 (1.7)
Average	--	42.8 (6.0)	--	42.7 (6.0)	43.0 (6.1)	43.2 (6.2)
N	0	69	0	75	10	75
Spring – March, April, May						
Max	61.7 (16.5)	61.5 (16.4)	61.3 (16.3)	61.9 (16.6)	62.8 (17.1)	62.2 (16.8)
Min	38.7 (3.7)	38.3 (3.5)	38.1 (3.4)	38.1 (3.4)	36.9 (2.7)	38.1 (3.4)
Average	51.0 (10.6)	49.0 (9.4)	50.0 (10.0)	49.8 (9.9)	51.2 (10.7)	49.2 (9.6)
N	41	105	93	123	26	131
Summer – June, July, August						
Max	82.9 (28.3)	83.5 (28.6)	83.1 (28.4)	85.3 (29.6)	83.5 (28.6)	84.4 (29.1)
Min	71.6 (22.0)	60.6 (15.9)	60.8 (16.0)	60.6 (15.9)	61.0 (16.1)	61.0 (16.1)
Average	79.0 (26.1)	74.9 (23.9)	75.0 (23.9)	75.4 (24.1)	77.6 (25.3)	74.8 (23.8)
N	50	126	108	135	24	148

Notes:

N = Number of measurements
-- = No data

Table 2.3-36— Summary of Dissolved Oxygen Concentrations (mg/L) for Selected Chesapeake Bay Monitoring Stations, Water Year 2005

Seasonal Statistics	CB4.3W	CB4.3C	CB4.3E	CB4.4	CB5.1W	CB5.1
Fall – September, October, November						
Max	9.1	9.2	8.1	8.6	10.1	8.3
Min	4.6	0.2	0.2	0.2	5.1	0.2
Average	7.6	4.5	4.4	4.8	7.1	4.7
N	15	66	37	74	22	78
Winter – December, January, February						
Max	--	13.6	--	13.2	13.8	13.3
Min	--	5.5	--	5.7	10.6	5.8
Average	--	10.1	--	9.9	12.0	9.9
N	0	69	0	75	10	75
Spring – March, April, May						
Max	13.2	12.6	12.5	12.8	13	12.3
Min	3.1	1.2	1.4	1.3	7.9	0.9
Average	9.3	7.1	7.7	7.0	10.7	7.1
N	41	105	93	123	26	131
Summer – June, July, August						
Max	10.2	10.4	9.2	9.8	9.7	8.6
Min	0.2	0.1	0.1	0.1	3.0	0.1
Average	5.7	2.7	2.8	2.7	6.4	2.1
N	50	126	108	135	24	148

Notes:

N = Number of measurements
-- = No data

Table 2.3-37— Summary of Salinity Statistics (parts per thousand) for Selected Chesapeake Bay Monitoring Stations, Water Year 2005

Seasonal Statistics	CB4.3W	CB4.3C	CB4.3E	CB4.4	CB5.1W	CB5.1
Fall – September, October, November						
Max	14.87	20.78	20.29	21.55	15.41	21.83
Min	7.93	7.93	8.89	9.98	8.44	10.69
Average	11.13	15.59	14.50	16.03	12.60	16.60
N	15	66	37	74	22	78
Winter – December, January, February						
Max	--	18.83	--	19.87	10.24	20.08
Min	--	5.82	--	7.12	8.69	8.38
Average	--	13.17	--	14.73	9.66	15.32
N	0	69	0	75	10	75
Spring – March, April, May						
Max	11.8	19.11	18.14	19.52	10.69	20.01
Min	4.6	4.06	4.3	4.42	5.39	4.18
Average	8.37	12.42	11.78	13.30	8.78	14.15
N	41	105	93	123	25	131
Summer – June, July, August						
Max	15.07	21.48	20.64	22.18	15	21.9
Min	10.5	10.56	10.63	10.95	9.33	10.95
Average	11.98	15.83	15.45	16.38	12.46	17.38
N	50	126	108	135	24	148

Notes:

N = Number of measurements
-- = No data

Table 2.3-38— Summary of Water Quality Data for Selected Chesapeake Bay Monitoring Stations, Water Year 2005
(Page 1 of 7)

Monitoring Station ID	Seasonal Statistics	Water Quality Parameters									
		Ammonia (Filtered)	Filtered Nitrite	Filtered Nitrate	Total Organic Nitrogen	Ortho-phosphate	Total Phosphorus	pH	Specific Conductivity	Chlorophyll A	Total Suspended Solids
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	Mmhos/cm	µg/L	mg/L
CB4.3W	**Fall – September, October, November**										
	Max	0.014	0.0434	0.3727	0.5434	0.0117	0.063	8.3	24700	17.942	14.6
	Min	0.003	0.001	0.001	0.465	0.0027	0.034	7.7	14100	8.373	6.6
	Average	0.008	0.0219	0.1830	0.5180	0.0058	0.0439	8.127	18993	13.606	9.45
	N	4	4	4	5	4	4	15	15	4	4
	Winter – December, January, February										
	Max	--	--	--	--	--	--	--	--	--	--
	Min	--	--	--	--	--	--	--	--	--	--
	Average	--	--	--	--	--	--	--	--	--	--
	N	--	--	--	--	--	--	--	--	--	--
	Spring – March, April, May										
	Max	0.277	0.0197	0.971	0.679	0.0139	0.0792	8.4	20100	42.165	31.7
	Min	0.003	0.0058	0.376	0.398	0.002	0.0214	7.1	8700	3.289	3.3
	Average	0.086	0.0104	0.5766	0.5070	0.0042	0.0365	7.868	14744	16.293	11.26
	N	10	10	10	12	10	10	41	41	10	9
	Summer – June, July, August										
	Max	0.302	0.0091	0.1769	1.2507	0.0932	0.1223	8.5	25000	53.827	16.8
	Min	0.003	0.0002	0.0008	0.3551	0.0023	0.0257	7.2	18100	1.096	3.7
	Average	0.059	0.0025	0.0329	0.7025	0.0139	0.0597	8.018	20356	17.367	9.29
	N	12	12	13	17	12	12	50	50	12	12

Table 2.3-38— Summary of Water Quality Data for Selected Chesapeake Bay Monitoring Stations, Water Year 2005
(Page 2 of 7)

Monitoring Station ID	Seasonal Statistics	Water Quality Parameters									
		Ammonia (Filtered)	Filtered Nitrite	Filtered Nitrate	Total Organic Nitrogen	Ortho-phosphate	Total Phosphorus	pH	Specific Conductivity	Chlorophyll A	Total Suspended Solids
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	Mmhos/cm	µg/L	mg/L
CB4.3C	**Fall – September, October, November**										
	Max	0.185	0.2045	0.374	0.5364	0.067	0.085	8.2	33300	17.942	11.2
	Min	0.003	0.0192	0.0033	0.3418	0.0016	0.023	7.4	14100	0.897	2.8
	Average	0.036	0.0478	0.1679	0.4389	0.0163	0.0396	7.791	25676	6.205	6.31
	N	15	13	13	15	15	15	66	66	14	12
	Winter – December, January, February										
	Max	0.129	0.0196	0.7785	1.104	0.0107	0.062	8.3	30500	26.615	28.2
	Min	0.003	0.0041	0.0532	0.348	0.002	0.0172	7.6	10700	2.563	2.4
	Average	0.048	0.0105	0.3375	0.5908	0.0053	0.0322	7.893	22084	11.758	9.43
	N	15	15	15	16	15	15	69	69	15	12
	Spring – March, April, May										
	Max	0.281	0.0143	0.7953	0.817	0.0061	0.0475	8.5	30900	42.464	15.5
	Min	0.003	0.0058	0.0895	0.27	0.002	0.0195	7.1	7800	2.243	2.9
	Average	0.091	0.0095	0.4111	0.5362	0.0034	0.0312	7.639	20932	16.689	7.76
	N	25	25	25	28	25	25	105	105	25	23
	Summer – June, July, August										
	Max	0.326	0.0107	0.1977	0.664	0.0697	0.1008	8.6	34300	14.952	31.2
	Min	0.003	0.0002	0.0011	0.2938	0.0016	0.0208	7.1	18200	0.498	2.4
	Average	0.119	0.0029	0.0282	0.4795	0.0172	0.0467	7.630	26066	6.065	6.34
	N	30	29	32	35	30	29	126	126	30	24

Table 2.3-38— Summary of Water Quality Data for Selected Chesapeake Bay Monitoring Stations, Water Year 2005
(Page 3 of 7)

Monitoring Station ID	Seasonal Statistics	Water Quality Parameters									
		Ammonia (Filtered)	Filtered Nitrite	Filtered Nitrate	Total Organic Nitrogen	Ortho-phosphate	Total Phosphorus	pH	Specific Conductivity	Chlorophyll A	Total Suspended Solids
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	Mmhos/cm	µg/L	mg/L
CB4.3E	**Fall – September, October, November**										
	Max	0.094	0.0792	0.3495	0.558	0.0647	0.0961	8.2	32600	14.204	9.8
	Min	0.003	0.0002	0.0008	0.3609	0.0016	0.0207	7.4	15600	1.196	3.4
	Average	0.025	0.0277	0.1264	0.4470	0.0213	0.0484	7.746	24092	5.490	6.32
	N	8	8	9	10	8	8	37	37	8	5
	Winter – December, January, February										
	Max	--	--	--	--	--	--	--	--	--	--
	Min	--	--	--	--	--	--	--	--	--	--
	Average	--	--	--	--	--	--	--	--	--	--
	N	--	--	--	--	--	--	--	--	--	--
	Spring – March, April, May										
	Max	0.278	0.0145	0.77	0.793	0.008	0.0826	8.4	29500	41.866	51
	Min	0.003	0.0053	0.0975	0.389	0.0018	0.0173	7.1	8200	3.551	2.8
	Average	0.104	0.0090	0.3713	0.5088	0.0034	0.0338	7.714	19981	15.564	14.02
	N	20	20	20	21	20	19	93	93	20	14
	Summer – June, July, August										
	Max	0.344	0.0157	0.1648	0.6342	0.0725	0.1002	8.5	33100	17.045	15.9
	Min	0.003	0.0002	0.0006	0.2864	0.0019	0.0267	7	18300	0.797	2.4
	Average	0.143	0.0039	0.0220	0.4560	0.0221	0.0521	7.609	25519	6.509	6.58
	N	24	24	31	28	24	24	108	108	24	19

Table 2.3-38— Summary of Water Quality Data for Selected Chesapeake Bay Monitoring Stations, Water Year 2005
(Page 4 of 7)

Monitoring Station ID	Seasonal Statistics	Water Quality Parameters									
		Ammonia (Filtered)	Filtered Nitrite	Filtered Nitrate	Total Organic Nitrogen	Ortho-phosphate	Total Phosphorus	pH	Specific Conductivity	Chlorophyll A	Total Suspended Solids
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	Mmhos/cm	µg/L	mg/L
CB4.4	**Fall – September, October, November**										
	Max	0.167	0.1775	0.2951	0.597	0.0567	0.0752	8.2	34400	19.139	14.6
	Min	0.003	0.0003	0.0022	0.3156	0.0019	0.0236	7.4	17300	0.449	2.6
	Average	0.045	0.0596	0.0969	0.4291	0.0190	0.0430	7.839	26350	4.604	7.71
	N	15	14	14	17	15	15	74	74	15	10
	Winter – December, January, February										
	Max	0.12	0.0219	0.6152	1.0337	0.0149	0.1171	8.4	32000	34.39	98.3
	Min	0.003	0.0035	0.0386	0.3288	0.0006	0.0131	7.7	12800	2.392	4
	Average	0.043	0.0096	0.2136	0.5667	0.0050	0.0448	7.972	24407	14.113	30.40
	N	15	15	15	16	15	15	75	75	15	11
	Spring – March, April, May										
	Max	0.259	0.0203	0.8034	0.8573	0.0072	0.0694	8.6	31500	34.39	40.5
	Min	0.003	0.0045	0.0479	0.341	0.0015	0.0156	7.2	8400	5.607	2.6
	Average	0.106	0.0089	0.3094	0.5117	0.0034	0.0328	7.698	22265	16.387	11.09
	N	25	25	25	27	25	24	123	123	25	22
	Summer – June, July, August										
	Max	0.291	0.0131	0.1799	0.6933	0.0719	0.0986	8.5	35300	26.316	30.6
	Min	0.003	0.0002	0.001	0.2698	0.0017	0.0254	7	18800	0.748	2.4
	Average	0.145	0.0032	0.0225	0.4409	0.0225	0.0509	7.632	26868	5.239	8.78
	N	30	28	32	30	30	30	135	135	30	25

Table 2.3-38— Summary of Water Quality Data for Selected Chesapeake Bay Monitoring Stations, Water Year 2005
(Page 5 of 7)

Monitoring Station ID	Seasonal Statistics	Ammonia (Filtered)	Filtered Nitrite	Filtered Nitrate	Total Organic Nitrogen	Ortho-phosphate	Total Phosphorus	pH	Specific Conductivity	Chlorophyll A	Total Suspended Solids
		Water Quality Parameters									
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	Mmhos/cm	µg/L	mg/L
CB5.1	**Fall – September, October, November**										
	Max	0.145	0.1775	0.263	0.462	0.0545	0.0778	8.2	34800	11.214	28.8
	Min	0.003	0.0002	0.0012	0.3379	0.0028	0.0249	7.5	18400	0.897	3.2
	Average	0.041	0.0524	0.0856	0.4115	0.0150	0.0404	7.849	27200	5.177	7.46
	N	12	12	13	15	12	12	78	78	12	9
	Winter – December, January, February										
	Max	0.122	0.0196	0.4916	0.6394	0.0162	0.0579	8.4	32300	22.054	34.3
	Min	0.003	0.0032	0.0334	0.341	0.0006	0.0139	7.7	14800	2.35	3.1
	Average	0.034	0.0088	0.2247	0.4416	0.0043	0.0290	7.999	25295	10.527	8.55
	N	12	12	12	13	12	12	75	75	12	12
	Spring – March, April, May										
	Max	0.249	0.0152	0.8126	0.808	0.0067	0.0792	8.4	32200	27.412	59
	Min	0.003	0.0042	0.0464	0.316	0.0014	0.013	7.2	8000	5.981	2.4
	Average	0.084	0.0079	0.3169	0.4958	0.0033	0.0318	7.777	23550	15.697	10.91
	N	20	19	19	22	20	20	131	131	20	18
	Summer – June, July, August										
	Max	0.29	0.011	0.1768	0.6651	0.0689	0.1038	8.5	34900	16.148	23
	Min	0.003	0.0002	0.001	0.3094	0.0019	0.0229	7.1	18800	0.498	2.4
	Average	0.110	0.0025	0.0215	0.4504	0.0178	0.0464	7.593	28340	5.419	6.23
	N	24	23	28	28	24	24	148	148	24	18

Table 2.3-38— Summary of Water Quality Data for Selected Chesapeake Bay Monitoring Stations, Water Year 2005
(Page 6 of 7)

Monitoring Station ID	Seasonal Statistics	Water Quality Parameters									
		Ammonia (Filtered)	Filtered Nitrite	Filtered Nitrate	Total Organic Nitrogen	Ortho-phosphate	Total Phosphorus	pH	Specific Conductivity	Chlorophyll A	Total Suspended Solids
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	Mmhos/cm	µg/L	mg/L
CB5.1W	**Fall – September, October, November**										
	Max	0.055	0.1032	0.4085	0.9713	0.0159	0.0551	8.2	25500	8.22	12.4
	Min	0.003	0.0023	0.0021	0.357	0.0033	0.0239	7.6	14900	2.06	2.9
	Average	0.017	0.0349	0.1762	0.5540	0.0080	0.0358	7.968	21259	5.618	5.50
	N	25	25	25	32	25	25	22	22	25	24
	Winter – December, January, February										
	Max	0.024	0.0103	0.5711	0.583	0.0072	0.0314	8	17700	9.42	7.5
	Min	0.003	0.007	0.3857	0.35	0.0014	0.0134	7.9	15300	3.44	2.4
	Average	0.012	0.0091	0.4790	0.4710	0.0036	0.0228	7.990	16810	6.413	5.27
	N	10	10	10	13	10	10	10	10	9	7
	Spring – March, April, May										
	Max	0.107	0.0259	0.8964	0.684	0.0057	0.0639	8.4	18400	14.52	34.3
	Min	0.006	0.0063	0.3081	0.2881	0.0009	0.0121	7.7	10000	3.44	2.4
	Average	0.032	0.0100	0.5475	0.4773	0.0028	0.0229	8.042	15412	8.509	8.03
	N	30	30	30	30	30	30	26	25	30	24
	Summer – June, July, August										
	Max	0.209	0.0088	0.3435	0.9183	0.014	0.0637	8.5	24900	16.02	25.8
	Min	0.003	0.0002	0.0007	0.428	0.0023	0.0215	7.3	16300	3.29	5.2
	Average	0.031	0.0031	0.0644	0.6508	0.0047	0.0406	8.121	21075	8.606	9.37
	N	30	29	30	31	30	30	24	24	28	20

Table 2.3-38— Summary of Water Quality Data for Selected Chesapeake Bay Monitoring Stations, Water Year 2005

(Page 7 of 7)

Monitoring Station ID	Seasonal Statistics	Water Quality Parameters									
		Ammonia (Filtered)	Filtered Nitrite	Filtered Nitrate	Total Organic Nitrogen	Ortho-phosphate	Total Phosphorus	pH	Specific Conductivity	Chlorophyll A	Total Suspended Solids
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	Mmhos/cm	µg/L	mg/L
	Annual										
	Max	0.344	0.2045	0.971	1.2507	0.0932	0.1223	8.6	35300	53.827	98.3
	Min	0.003	0.0002	0.0006	0.2698	0.0006	0.0121	7	7800	0.449	2.4
	Average	0.074	0.0162	0.2014	0.5066	0.0103	0.0392	7.764	23978	9.764	9.06
All Stations	N	411	402	425	461	411	408	1631	1630	407	334

Notes:

µg/L = micrograms/liter
Mmhos/cm = micromhos per centimeter
mg/L = milligrams/liter
N = Number of measurements
SU = Standard units (pH)
-- = No data

Table 2.3-39— Summary of 2005 Radiological Liquid Effluent Calvert Cliffs Nuclear Power Plant Units 1 and 2

(Page 1 of 3)

	Continuous Mode		Batch Mode		Continuous Mode		Batch Mode	
Nuclide Reported	**1st QTR**	**2nd QTR**	**1st QTR Ci (Bq)**	**2nd QTR Ci (Bq)**	**3rd QTR**	**4th QTR**	**1st QTR Ci (Bq)**	**2nd QTR Ci (Bq)**
Beryllium - 7	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Sodium - 24	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Chromium - 51	(1)	(1)	1.22E-04 (4.51E+06)	2.67E-04 (9.88E+06)	(1)	(1)	(1)	(1)
Manganese - 54	(1)	(1)	1.14E-05 (4.22E+05)	2.01E-05 (7.44E+05)	(1)	(1)	5.39E-06 (1.99E+05)	4.22E-06 (1.56E+05)
Iron - 55	(2)	(2)	7.88E-04 (2.92E+07)	6.51E-02 (2.41E+09)	(2)	(2)	1.81E-02 (6.70E+08)	2.71E-03 (1.00E+08)
Cobalt - 57	(1)	(1)	(1)	1.39E-06 (5.14E+04)	(1)	(1)	(1)	(1)
Cobalt - 58	(1)	(1)	1.23E-03 (4.55E+07)	1.00E-03 (3.70E+07)	(1)	(1)	1.21E-04 (4.48E+06)	3.97E-05 (1.47E+06)
Iron - 59	(1)	(1)	4.08E-06 (1.51E+05)	1.25E-05 (4.63E+05)	(1)	(1)	(1)	(1)
Cobalt - 60	(1)	(1)	2.57E-04 (9.51E+06)	1.21E-04 (4.48E+06)	(1)	(1)	1.99E-04 (7.36E+06)	1.67E-05 (6.18E+06)
Nickel - 63	(1)	(1)	3.17E-04 (1.17E+07)	4.92E-03 (1.82E+08)	(1)	(1)	7.82E-04 (2.89E+07)	1.40E-04 (5.18E+06)
Zinc - 65	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Strontium - 89	(1)	(1)	2.75E-04 (1.02E+07)	7.54E-05 (2.79E+06)	(1)	(1)	3.25E-05 (1.20E+06)	(1)
Strontium - 90	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Strontium - 92	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Niobium - 95	(1)	(1)	2.81E-05 (1.04E+06)	1.24E-04 (4.59E+06)	(1)	(1)	4.41E-06 (1.63E+05)	3.88E-06 (1.44E+05)
Zirconium - 95	(1)	(1)	2.30E-05 (8.51E+05)	8.81E-05 (3.26E+06)	(1)	(1)	4.38E-06 (1.62E+05)	1.95E-06 (7.22E+04)
Niobium - 97	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Zirconium - 97	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Molybdenum - 99	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Technetium - 99m	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Ruthenium - 103	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Rhodium - 105	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Ruthenium - 105	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Silver - 110m	(1)	(1)	(1)	(1)	(1)	(1)	9.78E-06 (3.62E+05)	(1)
Tin - 113	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Tin - 117m	(1)	(1)	6.10E-05 (2.26E+06)	6.72E-05 (2.49E+06)	(1)	(1)	(1)	(1)
Antimony - 122	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)

Table 2.3-39— Summary of 2005 Radiological Liquid Effluent Calvert Cliffs Nuclear Power Plant Units 1 and 2
(Page 2 of 3)

	Continuous Mode		Batch Mode		Continuous Mode		Batch Mode	
Nuclide Reported	**1st QTR**	**2nd QTR**	**1st QTR Ci (Bq)**	**2nd QTR Ci (Bq)**	**3rd QTR**	**4th QTR**	**1st QTR Ci (Bq)**	**2nd QTR Ci (Bq)**
Antimony - 124	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Antimony - 125	(1)	(1)	8.57E-06 (3.17E+05)	(1)	(1)	(1)	(1)	(1)
Tellurium - 125m	(1)	(1)	5.68E-03 (2.10+08)	7.02E-03 (2.60E+08)	(1)	(1)	(1)	(1)
Tellurium - 132	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Iodine - 131	(1)	(1)	1.45E-04 (5.37E+06)	2.59E-06 (9.58E+04)	(1)	(1)	4.39E-06 (1.62E+05)	6.35E-06 (2.35E+05)
Iodine - 132	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Iodine - 133	(1)	(1)	2.32E-06 (8.58E+04)	4.38E-06 (1.62E+05)	(1)	(1)	4.91E-06 (1.82E+05)	4.24E-06 (1.57E+05)
Iodine - 135	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Cesium - 134	(1)	(1)	2.25E-05 (8.33E+05)	3.02E-05 (1.12E+06)	(1)	(1)	1.48E-05 (5.48E+05)	8.03E-06 (2.97E+05)
Cesium - 136	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Cesium - 137	(1)	(1)	4.58E-05 (1.69E+06)	3.49E-05 (1.29E+06)	(1)	(1)	1.97E-05 (7.29E+05)	3.17E-05 (1.17E+06)
Barium - 140	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Lanthanum - 140	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Cerium - 144	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Europium - 154	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Europium - 155	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Tungsten - 187	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Total for Period	(1)	(1)	9.02E-03 (3.34E+08)	7.89E-02 (2.92E+09)	(1)	(1)	1.93E-02 (7.14E+08)	2.97E-03 (1.10E+08)
Krypton - 85	(1)	(1)	(1)	(1)	(1)	(1)	(1)	6.42E-03 (2.38E+08)
Xenon - 131m	(1)	(1)	1.92E-03 (7.10E+07)	(1)	(1)	(1)	(1)	(1)
Xenon - 133	(1)	(1)	1.13E-01 (4.18E+09)	2.03E-03 (7.51E+07)	(1)	(1)	2.63E-03 (9.73E+07)	1.52E-02 (5.62E+08)
Xenon - 133m	(1)	(1)	6.99E-04 (2.59E+07)	(1)	(1)	(1)	(1)	(1)
Xenon - 135	(1)	(1)	5.28E-05 (1.95E+06)	(1)	(1)	(1)	(1)	(1)
Total for Period	(1)	(1)	1.15E-01 (4.26E+09)	2.03E-03 (7.51E+07)	(1)	(1)	2.63E-03 (9.73E+07)	2.17E-02 (8.03E+08)

Table 2.3-39— Summary of 2005 Radiological Liquid Effluent Calvert Cliffs Nuclear Power Plant Units 1 and 2
(Page 3 of 3)

	Continuous Mode		Batch Mode		Continuous Mode		Batch Mode	
Nuclide Reported	1st QTR	2nd QTR	1st QTR Ci (Bq)	2nd QTR Ci (Bq)	3rd QTR	4th QTR	1st QTR Ci (Bq)	2nd QTR Ci (Bq)

Notes:

From: Calvert Cliffs Nuclear Power Plant – Effluent and Waste Disposal, Annual Report, July 13, 2006.
(1) = Less than minimal detectable activity which meets the LLD requirement of ODCM Surveillance Requirement 4.11.1.1.1.
(2) = Continuous mode effluents are not analyzed for Iron-55.
Bq = Becquerel;
1 Bq = 3.7E+10 Curies
Ci = Curies
M = Metastable isotope.

Table 2.3-40— Summary of Analytical Results for Chesapeake Bay Water Samples Collected during Ebb and Flood Tides at the Unit 1 and 2 intake Structure, February - May 2007
(Page 1 of 3)

Parameter	EPA Test Method	Method Detection Limit	Ebb Tide 2/19/07	Flood Tide 2/20/07	Ebb Tide 3/05/07	Flood Tide 3/06/07	Ebb Tide 3/20/07	Flood Tide 3/20/07	Ebb Tide 4/17/07	Flood Tide 4/17/07	Ebb Tide 5/22/07	Flood Tide 5/22/07
Metals												
Aluminum	200.7	0.1 mg/L	0.26	0.19	ND (0.5)	ND (0.5)	ND (0.10)	0.12	0.4	0.33	ND (0.1)	ND (0.1)
Arsenic	200.8	0.0004 mg/L	0.035	0.041	0.03	0.028	0.02	0.022	0.02	0.02	ND (0.002)	ND (0.002)
Barium	200.8	0.001 mg/L	0.03	0.033	0.024	0.023	0.029	0.029	0.03	0.03	0.027	0.027
Calcium	200.7	0.5 mg/L	160	170	180	170	180	170	130	130	170	160
Copper	200.8	0.0004 mg/L	0.025	0.024	0.026	0.026	0.019	0.021	0.026	0.027	0.029	0.031
Iron, dissolved	200.7	0.01 mg/L	ND (0.01)	ND (0.01)	ND (0.05)	ND (0.05)	ND (0.10)	ND (0.10)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)
Iron, total	200.7	0.01 mg/L	0.22	0.12	2.7	0.36	0.042	0.082	0.55	0.46	0.041	0.1
Lead	200.8	0.0004 mg/L	0.0017	0.0018	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)
Manganese, dissolved	200.7	0.01 mg/L	ND (0.01)	ND (0.10)	ND (0.05)	ND (0.05)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)
Manganese, total	200.7	0.01 mg/L	ND (0.01)	ND (0.10)	ND (0.05)	ND (0.05)	ND (0.01)	ND (0.01)	0.021	0.015	0.069	0.064
Magnesium	200.7	0.1 mg/L	460	490	490	480	480	500	360	360	450	430
Potassium	200.7	0.1 mg/L	160	170	150	150	150	150	120	120	140	130
Sodium	200.7	1 mg/L	3,700	3,800	4,000	3,900	3,600	3,800	3,000	3,100	3,600	3,400
Strontium	200.7	0.005 mg/L	2.8	2.9	2.9	2.8	2.6	2.7	2	2.1	2.5	2.4
Vanadium	200.7	0.01 mg/L	ND (0.01)	ND (0.01)	ND (0.05)	ND (0.05)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)
Zinc	200.7	0.02 mg/L	ND (0.02)	ND (0.020)	ND (0.10)	ND (0.10)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	0.09
Non-Metals												
M alkalinity, as $CaCO_3$	310.1	1 mg/L	72	75	69	72	74	40	60	60	70	70
Ammonia as NH_3	350.2	1 mg/L	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1.0)	ND (1.0)
Biological Oxygen Demand (BOD_5)	405.1	2 mg/L	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (3)	3.7	ND (2.0)	ND (2.0)
Bromides	320.1_R3_83	1 mg/L	17	15	11	11	15	16	8.8	8.9	NR	NR
Chlorides	325.3	1 mg/L	6,500	6,700	7,200	6,500	6,600	7,000	4,900	5,000	6,600	6,500

Table 2.3-40— Summary of Analytical Results for Chesapeake Bay Water Samples Collected during Ebb and Flood Tides at the Unit 1 and 2 intake Structure, February - May 2007
(Page 2 of 3)

Parameter	EPA Test Method	Method Detection Limit	Ebb Tide 2/19/07	Flood Tide 2/20/07	Ebb Tide 3/05/07	Flood Tide 3/06/07	Ebb Tide 3/20/07	Flood Tide 3/20/07	Ebb Tide 4/17/07	Flood Tide 4/17/07	Ebb Tide 5/22/07	Flood Tide 5/22/07
Color (Color Units)	110.2	5 Color Units	10	5	15	10	5	5	ND (5)	ND (5)	15	10
Conductivity, (µmho/cm)	120.1	NA	28,000	29,000	20,000	20,000	19,000	20,000	15,000	15,000	21,000	23,000
Fluorides	340.2	0.1 mg/L	0.37	0.36	0.42	0.43	0.42	0.43	0.44	0.48	0.41	0.41
Hardness as $CaCO_3$	130.2	1 mg/L	3,400	4,000	3,600	3,200	4,500	3,300	2,400	2,200	4,300	3,100
Nitrates, as NO_3	353.2	0.05 mg/L	0.3	0.29	0.22	0.22	0.26	0.25	0.51	0.51	0.19	0.19
Nitrites, as NO_2	SM 4500	0.005 mg/L	0.0063	0.006	ND (0.005)	ND (0.005)	0.05	ND (0.005)	ND (0.005)	0.0057	0.011	0.012
Oil & grease (O&G)	1664	5 mg/L	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
pH (standard units)	150.1	1	7.7	7.8	7.8	7.8	7.5	7.2	7.6	7.2	8.5	8.4
Phosphorus, Total as P	SM 4500	0.01 mg/L	0.04	0.043	0.052	0.061	0.036	0.056	0.054	0.057	0.04	0.043
PO_4	SM 4500PE	0.01 mg/L	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	0.023	ND (0.01)	ND (0.01)
Silica, dissolved	200.7	0.5 mg/L	1.1	0.99	ND (2.5)	ND (2.5)	0.62	0.58	0.82	0.85	ND (0.5)	ND (0.5)
Silica, total	200.7	0.5 mg/L	2	1.8	ND (2.5)	ND (2.5)	1.1	1.2	2	1.8	0.61	0.69
Sulfates	375.4	1 mg/L	1,000	940	950	980	980	1,100	580	1,100	1,000	1,100
Total Organic Carbon (TOC)	415.1	1 mg/L	2.6	2.1	1.2	1.2	2.7	4.3	2.6	3.6	NR	NR
Total Dissolved Solids (TDS)	160.1	1 mg/L	12,000	12,000	14,000	11,000	12,000	11,000	15,000	14,000	18,000	13,000
Total Suspended Solids (TSS)	160.2	1 mg/L	12	11	21	23	17	18	28	25	7	8.5
Turbidity (NTU)	180.1	0.1 NTU	ND (0.1)	ND (0.1)	4	5.5	3.7	5.1	8.5	7.7	4.7	3.3

Table 2.3-40— Summary of Analytical Results for Chesapeake Bay Water Samples Collected during Ebb and Flood Tides at the Unit 1 and 2 intake Structure, February - May 2007
(Page 3 of 3)

Parameter	EPA Test Method	Method Detection Limit	Ebb Tide 2/19/07	Flood Tide 2/20/07	Ebb Tide 3/05/07	Flood Tide 3/06/07	Ebb Tide 3/20/07	Flood Tide 3/20/07	Ebb Tide 4/17/07	Flood Tide 4/17/07	Ebb Tide 5/22/07	Flood Tide 5/22/07

Notes:

BOD_5 = Biological Oxygen Demand, corrected for dilution
M Alkalinity = Total alkalinity expressed as $CaCo_3$
NA = Not analyzed
ND ( ) = Not detected at the concentration reported inside the parentheses
NR = Not Reported as of June 14, 2007
NTU = Nephelometric Turbidity Unit
SM = Standard Method

Table 2.3-41— Summary of Analytical Results for Sediment Samples Collected in Chesapeake Bay Near the CCNPP Barge Slip - September 2006

(Page 1 of 5)

Analyte	Theshold Effects Level	Probable Effects Level	Units	Average Reporting Limit	CCNPP Unit 1	CCNPP Unit 2	CCNPP Unit 3
General Chemistry Parameters							
Ammonia	--	--	mg/kg	7.0	**6.1 J**	**6.8 J**	**4.9 J**
Total Kjeldahl Nitrogen	--	--	mg/kg	210	**186 J**	**316**	ND
Total Organic Carbon	--	--	mg/kg	752	**23600**	**30700**	**24100**
Total Phosphorus	--	--	mg/kg	140	**1080**	**1110**	**615**
Metals							
Arsenic	7.240	41.600	mg/kg	0.98	**1.2**	**1.1**	**0.95 J**
Cadmium	0.676	4.210	mg/kg	0.49	**0.17 J**	**0.20 J**	**0.18 J**
Chromium	52.300	160.400	mg/kg	0.49	**3.7**	**4.3**	**3.4**
Copper	18.700	108.200	mg/kg	2.40	**1.2 J**	**1.2 J**	**1.3J**
Lead	30.240	112.180	mg/kg	0.29	**1.1**	**1.4**	**1.2**
Mercury	0.130	0.696	mg/kg	0.33	ND	ND	ND
Zinc	124.000	271.000	mg/kg	2.00	**7.5**	**9.4**	**9.3**
Polyaromatic Hydrocarbons							
Acenaphthene	6.71	88.9	µ g/kg	640	ND	ND	ND
Acenaphthylene	5.87	127.87	µ g/kg	640	ND	ND	ND
Anthracene	46.85	245	µ g/kg	640	ND	ND	ND
Benzo(a)anthracene	74.83	692.53	µ g/kg	640	ND	ND	ND
Benzo(a)pyrene	88.81	763.22	µ g/kg	640	ND	ND	ND
Benzo(b)fluoranthene	--	--	µ g/kg	640	ND	ND	ND
Benzo(ghi)perylene	--	--	µ g/kg	640	ND	ND	ND
Benzo(k)fluoranthene	--	--	µ g/kg	640	ND	ND	ND
Chrysene	107.77	845.98	µ g/kg	640	ND	ND	ND
Dibenzo(a,h)anthracene	6.22	134.61	µ g/kg	640	ND	ND	ND
Fluoranthene	112.82	1493.54	µ g/kg	640	ND	ND	ND
Fluorene	21.17	144.35	µ g/kg	640	ND	ND	ND
Naphthalene	34.57	390.64	µ g/kg	640	ND	ND	ND
Phenanthrene	86.68	543.53	µ g/kg	640	ND	ND	ND
Pyrene	152.66	1397.6	µ g/kg	640	ND	ND	ND
PCB Congeners *							
PCB 90	--	--	µ g/kg	0.24	ND	ND	ND
PCB 8	--	--	µ g/kg	0.24	ND	ND	ND
PCB 18	--	--	µ g/kg	0.24	**0.18 J**	**0.2 J, PG**	**0.27, PG**
PCB 28	--	--	µ g/kg	0.24	ND	ND	ND
PCB 44	--	--	µ g/kg	0.24	ND	ND	ND
PCB 49	--	--	µ g/kg	0.24	ND	ND	ND
PCB 52	--	--	µ g/kg	0.24	ND	ND	ND

Table 2.3-41— Summary of Analytical Results for Sediment Samples Collected in Chesapeake Bay Near the CCNPP Barge Slip - September 2006
(Page 2 of 5)

Analyte	Theshold Effects Level	Probable Effects Level	Units	Average Reporting Limit	CCNPP Unit 1	CCNPP Unit 2	CCNPP Unit 3
PCB 66	--	--	µ g/kg	0.24	ND	ND	ND
PCB 77	--	--	µ g/kg	0.24	ND	ND	ND
PCB 87	--	--	µ g/kg	0.24	ND	ND	ND
PCB 101	--	--	µ g/kg	0.24	ND	ND	**0.058 J, PG**
PCB 105	--	--	µ g/kg	0.24	ND	ND	ND
PCB 118	--	--	µ g/kg	0.24	ND	ND	ND
PCB 126	--	--	µ g/kg	0.24	ND	ND	ND
PCB 128	--	--	µ g/kg	0.24	ND	ND	ND
PCB 138	--	--	µ g/kg	0.24	ND	ND	ND
PCB 153	--	--	µ g/kg	0.24	ND	ND	ND
PCB 156	--	--	µ g/kg	0.24	ND	ND	ND
PCB 169	--	--	µ g/kg	0.24	ND	ND	ND
PCB 170	--	--	µ g/kg	0.24	ND	ND	ND
PCB 180	--	--	µ g/kg	0.24	ND	ND	ND
PCB 183	--	--	µ g/kg	0.24	ND	ND	ND
PCB 184	--	--	µ g/kg	0.24	ND	ND	ND
PCB 187	--	--	µ g/kg	0.24	ND	ND	ND
PCB 195	--	--	µ g/kg	0.24	ND	ND	ND
PCB 206	--	--	µ g/kg	0.24	ND	ND	ND
PCB 209	--	--	µ g/kg	0.24	ND	ND	ND
Chlorinated Pesticides							
4,4'-DDD	1.22	7.81	µ g/kg	1.7	ND	ND	ND
4,4'-DDE	2.07	374.17	µ g/kg	1.7	ND	ND	**0.18 J, PG**
4,4'-DDT	1.19	4.77	µ g/kg	1.7	ND	ND	ND
Aldrin	--	--	µ g/kg	1.7	**0.15 J, PG**	**0.17 J, PG**	**0.17 J, PG**
Alpha-BHC	--	--	µ g/kg	1.7	ND	ND	ND
Alpha-Chlordane	--	--	µ g/kg	1.7	ND	ND	ND
Beta-BHC	--	--	µ g/kg	1.7	ND	ND	ND
Delta-BHC	--	--	µ g/kg	1.7	ND	ND	ND
Dieldrin	0.715	4.3	µ g/kg	1.7	ND	ND	ND
Endosulfan I	--	--	µ g/kg	1.7	ND	ND	ND
Endosulfan II	--	--	µ g/kg	1.7	ND	ND	ND
Endosulfan Sulfate	--	--	µ g/kg	1.7	ND	ND	ND
Endrin	--	--	µ g/kg	1.7	ND	ND	ND
Endrin Aldehyde	--	--	µ g/kg	1.7	ND	**0.41 J, PG**	ND
Endrin Ketone	--	--	µ g/kg	1.7	ND	ND	ND
Gamma-BHC (Lindane)	0.32	0.99	µ g/kg	1.7	ND	ND	ND

Table 2.3-41— Summary of Analytical Results for Sediment Samples Collected in Chesapeake Bay Near the CCNPP Barge Slip - September 2006
(Page 3 of 5)

Analyte	Theshold Effects Level	Probable Effects Level	Units	Average Reporting Limit	CCNPP Unit 1	CCNPP Unit 2	CCNPP Unit 3
Gamma-Chlordane	--	--	µ g/kg	1.7	ND	ND	ND
Heptachlor	--	--	µ g/kg	1.7	**0.29 J, PG**	**0.52 J**	**0.63 J**
Heptachlor Epoxide	0.6	2.74	µ g/kg	1.7	ND	ND	ND
Methoxychlor	--	--	µ g/kg	3.2	ND	ND	ND
Toxaphene	--	--	µ g/kg	66	ND	ND	ND
Semi-Volatile Organic Compounds							
1,2,4-Trichlorobenzene	--	--	µ g/kg	640	ND	ND	ND
1,2-Dichlorobenzene	--	--	µ g/kg	640	ND	ND	ND
1,2-Diphenylhydrazine	--	--	µ g/kg	640	ND	ND	ND
1,3-Dichlorobenzene	--	--	µ g/kg	640	ND	ND	ND
1,4-Dichlorobenzene	--	--	µ g/kg	640	ND	ND	ND
2,4,6-Trichlorophenol	--	--	µ g/kg	640	ND	ND	ND
2,4-Dichlorophenol	--	--	µ g/kg	640	ND	ND	ND
2,4-Dimethylphenol	--	--	µ g/kg	640	ND	ND	ND
2,4-Dinitrophenol	--	--	µ g/kg	3100	ND	ND	ND
2,4-Dinitrotoluene	--	--	µ g/kg	640	ND	ND	ND
2,6-Dinitrotoluene	--	--	µ g/kg	640	ND	ND	ND
2-Chloronaphthalene	--	--	µ g/kg	640	ND	ND	ND
2-Chlorophenol	--	--	µ g/kg	640	ND	ND	ND
2-Methyl-4,6-Dinitrophenol	--	--	µ g/kg	3100	ND	ND	ND
2-Nitrophenol	--	--	µ g/kg	640	ND	ND	ND
3,3'-Dichlorobenzidine	--	--	µ g/kg	3100	ND	ND	ND
4-Bromophenyl phenyl ether	--	--	µ g/kg	640	ND	ND	ND
4-Chloro-3-methylphenol	--	--	µ g/kg	640	ND	ND	ND
4-Chlorophenyl phenyl ether	--	--	µ g/kg	640	ND	ND	ND
4-Nitrophenol	--	--	µ g/kg	3100	ND	ND	ND
Benzidine	--	--	µ g/kg	640	ND	ND	ND
Bis(2-Chloroethoxy)methane	--	--	µ g/kg	640	ND	ND	ND
Bis(2-Chloroethyl) ether	--	--	µ g/kg	640	ND	ND	ND
Bis(2-Chloroisopropyl) ether	--	--	µ g/kg	640	ND	ND	ND
Bis(2-Ethylhexyl) phthalate	--	--	µ g/kg	640	ND	ND	ND
Butyl benzyl phthalate	--	--	µ g/kg	640	ND	ND	ND
Diethyl phthalate	--	--	µ g/kg	640	ND	ND	ND
Dimethyl phthalate	--	--	µ g/kg	640	ND	ND	ND
Di-n-butyl phthalate	--	--	µ g/kg	640	ND	ND	ND
Di-n-octyl phthalate	--	--	µ g/kg	640	ND	ND	ND
Hexachlorobenzene	--	--	µ g/kg	640	ND	ND	ND

Table 2.3-41— Summary of Analytical Results for Sediment Samples Collected in Chesapeake Bay Near the CCNPP Barge Slip - September 2006

(Page 4 of 5)

Analyte	Theshold Effects Level	Probable Effects Level	Units	Average Reporting Limit	CCNPP Unit 1	CCNPP Unit 2	CCNPP Unit 3
Hexachlorobutadiene	--	--	µ g/kg	640	ND	ND	ND
Hexachlorocyclopentadiene	--	--	µ g/kg	3100	ND	ND	ND
Hexachloroethane	--	--	µ g/kg	640	ND	ND	ND
Indeno(1,2,3-cd)pyrene	--	--	µ g/kg	640	ND	ND	ND
Isophorone	--	--	µ g/kg	640	ND	ND	ND
Nitrobenzene	--	--	µ g/kg	640	ND	ND	ND
N-Nitrosodimethylamine	--	--	µ g/kg	640	ND	ND	ND
N-Nitrosodi-n-propylamine	--	--	µ g/kg	640	ND	ND	ND
N-Nitrosodiphenylamine	--	--	µ g/kg	640	ND	ND	ND
Pentachlorophenol	--	--	µ g/kg	3100	ND	ND	ND
Phenol	--	--	µ g/kg	640	ND	ND	ND
Volatile Organic Compounds							
1,1,1-Trichloroethane	--	--	µ g/kg	7	ND	ND	ND
1,1,2,2-Tetrachloroethane	--	--	µ g/kg	7	ND	ND	ND
1,1,2-Trichloroethane	--	--	µ g/kg	7	ND	ND	ND
1,1-Dichloroethane	--	--	µ g/kg	7	ND	ND	ND
1,1-Dichloroethene	--	--	µ g/kg	7	ND	ND	ND
1,2-Dichloroethane	--	--	µ g/kg	7	ND	ND	ND
1,2-Dichloropropane	--	--	µ g/kg	7	ND	ND	ND
2-Chloroethyl vinyl ether	--	--	µ g/kg	14	ND	ND	ND
Acrolein	--	--	µ g/kg	140	ND	ND	ND
Acrylonitrile	--	--	µ g/kg	140	ND	ND	ND
Benzene	--	--	µ g/kg	7	ND	ND	ND
Bromodichloromethane	--	--	µ g/kg	7	ND	ND	ND
Bromoform	--	--	µ g/kg	7	ND	ND	ND
Bromomethane	--	--	µ g/kg	7	ND	ND	ND
Carbon Tetrachloride	--	--	µ g/kg	7	ND	ND	ND
Chlorobenzene	--	--	µ g/kg	7	ND	ND	ND
Chloroethane	--	--	µ g/kg	7	ND	ND	ND
Chloroform	--	--	µ g/kg	7	ND	ND	ND
Chloromethane	--	--	µ g/kg	7	ND	ND	ND
cis-1,3-Dichloropropene	--	--	µ g/kg	7	ND	ND	ND
Dibromochloromethane	--	--	µ g/kg	7	ND	ND	ND
Ethylbenzene	--	--	µ g/kg	7	ND	ND	ND
Methylene Chloride	--	--	µ g/kg	7	**4.5 J**	**5.0 J**	**4.5 J**
Tetrachloroethene	--	--	µ g/kg	7	ND	ND	ND
Toluene	--	--	µ g/kg	7	ND	ND	ND

Table 2.3-41— Summary of Analytical Results for Sediment Samples Collected in Chesapeake Bay Near the CCNPP Barge Slip - September 2006
(Page 5 of 5)

Analyte	Theshold Effects Level	Probable Effects Level	Units	Average Reporting Limit	CCNPP Unit 1	CCNPP Unit 2	CCNPP Unit 3
Trans-1,2-Dichloroethene	--	--	μ g/kg	7	ND	ND	ND
Trans-1,3-Dichloropropene	--	--	μ g/kg	7	ND	ND	ND
Trichloroethene	--	--	μ g/kg	7	ND	ND	ND
Vinyl Chloride	--	--	μ g/kg	7	ND	ND	ND
Physical Properties							
Clay Percent	--	--	%	--	2.7	2.1	2.3
Gravel Percent	--	--	%	--	5.1	4.6	1.5
Sand Percent	--	--	%	--	93.9	93.5	96
Silt Percent	--	--	%	--	–	–	0.2
Specific Gravity	--	--	%	--	2.681	2.667	2.679
Percent Solids	--	--	%	--	**71.6**	**67.3**	**73.4**

Notes:

Bolded values represent detected concentrations.
PCB congeners used for Total PCB summation, as per Table 9-3 of the Inland Testing Manual (USEPA/USACE 1998)
J = compound was detected, but below the reporting limit (value is estimated)
ND = Not detected
PG = the percent difference between the original and confirmation second column analysis is greater than 40%– = <1%

Table 2.3-42— Well Construction Data for Wells Sampled at CCNPP May 31, 2007

Well	Ground Surface Elevation ft (m)	Well Pad Elevation ft (m)	Top of Casing Elevation ft (m)	Boring Depth ft (m)	Well Depth ft (m)	Screen Interval Depth ft (m)		Screen Interval Elevation ft (m)		Filterpack Interval Depth ft (m)		CCNPP Hydrostratigraphic Unit
						Top ft (m)	Bottom ft (m)	Top ft (m)	Bottom ft (m)	Top ft (m)	Bottom ft (m)	
OW 319A	103.13 (31.4)	103.31 (31.5)	104.91 (32)	35.0 (10.7)	32.0 (9.8)	20.0 (6.1)	30.0 (9.1)	83.1 (25.3)	73.1 (22.3)	15.0 (4.6)	35.0 (10.7)	Surficial Aquifer
OW 319B	103.53 (31.6)	103.85 (31.6)	105.35 (32.1)	85.0 (25.9)	82.0 (25)	70.0 (21.3)	80.0 (24.4)	33.5 (10.2)	23.5 (7.2)	65.0 (19.8)	85.0 (25.9)	Upper Chesapeake Unit
OW 752A	95.3 (29.0)	95.73 (29.2)	97.0 (29.6)	37.0 (11.3)	37.0 (11.3)	25.0 (7.6)	35.0 (10.7)	70.3 (21.4)	60.3 (18.4)	19.0 (5.6)	37.0 (11.3)	Surficial Aquifer
CCNPP Well No. 5	Not Available	Not Available	Not Available	Not Available	621 (190)	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Aquia

Notes:

All elevations are in feet (m) above the North American Vertical Datum of 1927 (NAVD 27).

Table 2.3-43— Summary of Analytical Results for Groundwater Well Sampling at CCNPP May 31, 2007

(Page 1 of 2)

Parameter	Units	OW 752A Surficial Aquifer	OW 319A Surficial Aquifer	OW 319B Upper Chesapeake Unit	OW 319B Duplicate Upper Chesapeake Unit	CCNPP Well No. 5 Aquia Aquifer	Rinse Blank
Metals							
Arsenic	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Barium	mg/l	0.027	0.055	0.044	0.044	0.025	<0.010
Cadmium	mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Calcium	mg/l	1.5	9.2	85	85	7.0	0.62
Chromium	mg/l	<0.0049	0.025	<0.0031	<0.0030	<0.0025	<0.0025
Iron	mg/l	1.8	23	8.0	8.0	3.2	<0.10
Lead	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Magnesium	mg/l	1.4	3.2	3.1	3.1	2.3	<0.10
Mercury	mg/l	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Potassium	mg/l	1.5	3.7	2.4	2.4	10.0	<0.10
Selenium	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Silicon	mg/l	6.3	13	16	16	5.3	2.3
Silver	mg/l	<0.012	<0.012	<0.001	<0.001	<0.012	<0.001
Sodium	mg/l	4.9	8.3	9.9	9.8	29	1.5
Non-metals							
Alkalinity, Bicarbonate	mg/l	<5	24.6	190	187	101	<5
Alkalinity, Total as $CaCO_3$	mg/l	<2.2	24.6	190	187	101	<2.2
Carbon Dioxide	mg/l	**	85.4	21.3	21	20	<5
Biologic Oxygen Demand	mg/l	<2	<3	<3	<3	<2	<2
Chemical Oxygen Demand	mg/l	21	24	26	28	26	<10
Chloride (Titrimetric, Mercuric Nitrate)	mg/l	4	10	10	12	2	<1
Color, True	color units	5	10	5	5	<5	<5
Enterococci	MPN/ 100ml	<1	410.6	2	<1	387.3	<1
Total Coliform	MPN/ 100ml	<1	17.1	<1	<1	1,299.70	<1
Fecal Coliform	MPN/ 100ml	<1	<1	<1	<1	<1	<1
Hardness, Total	mg/L	29	190	300	300	120	9
Nitrogen, Ammonia	mg/L	<1	<1	<1	<1	<1	<1
Nitrogen, Organic	mg/L	<1	<1	<1	<1	<1	<1
Nitrogen, Total Kjeldahl	mg/L	<1	<1	<1	<1	<1	<1
Nitrogen, Nitrite	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrogen, Nitrate	mg/L	<0.050	2.9	<0.050	<0.050	<0.050	<0.050
Odor, Threshold	TON	<1	16	8	16	<1	<1

Table 2.3-43— Summary of Analytical Results for Groundwater Well Sampling at CCNPP May 31, 2007

(Page 2 of 2)

Parameter	Units	OW 752A Surficial Aquifer	OW 319A Surficial Aquifer	OW 319B Upper Chesapeake Unit	OW 319B Duplicate Upper Chesapeake Unit	CCNPP Well No. 5 Aquia Aquifer	Rinse Blank
Ph*	SU	3.93	5.76	7.25	7.25	7.01	7.4
Phosphorus, Ortho	mg/L	<0.010	<0.010	<0.010	<0.010	0.010	<0.010
Phosphorus, Total	mg/L	0.031	0.064	0.081	0.034	0.041	<0.010
Total Dissolved Solids (TDS)	mg/L	92	110	230	310	210	<10
Total Suspended Solids (TSS)	mg/L	21	210	50	43	12	<2
Sulfate	mg/L	22	20	20	22	7.5	<1
Temperature	ºF (ºC)	65.2 (18.4)	69.3 (20.7)	63.2 (17.3)	63.2 (17.3)	68.0 (20.0)	69.1 (20.6)
Turbidity	NTU	7	60	49	37	4.1	<0.10

Notes:

SU = Standard Units (pH)
mg/L = Milligrams per liter
TON = Threshold odor number
MPN = Most probable number per 100
NTU = Nephelometric turbidity unit
* = Field Measurement
** = Carbon Dioxide could not be determined due to nondetected alkalinity and low pH

Figure 2.3-1— Chesapeake Bay Sub-Watersheds and CCNPP Unit 3 Site Locations

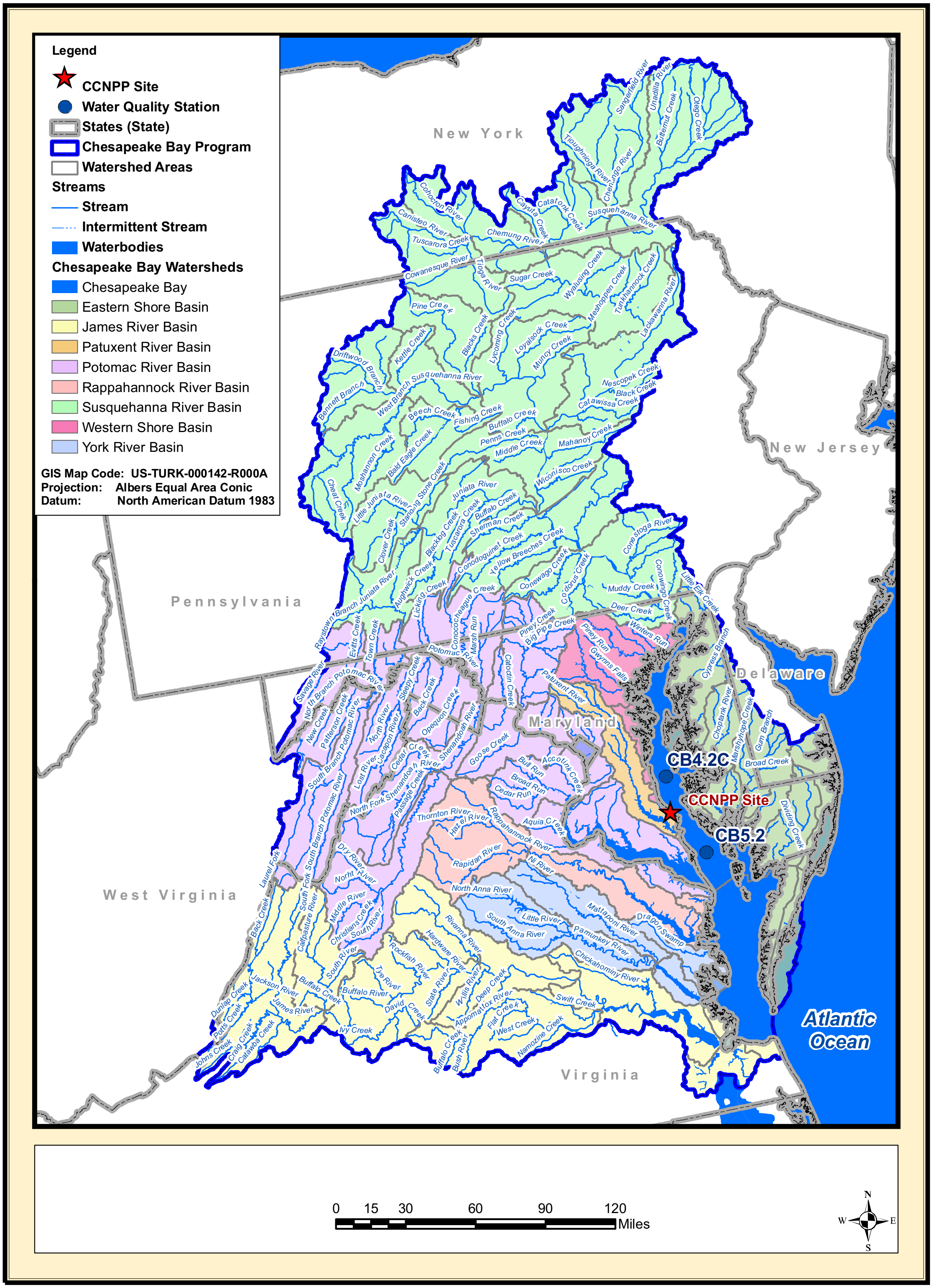
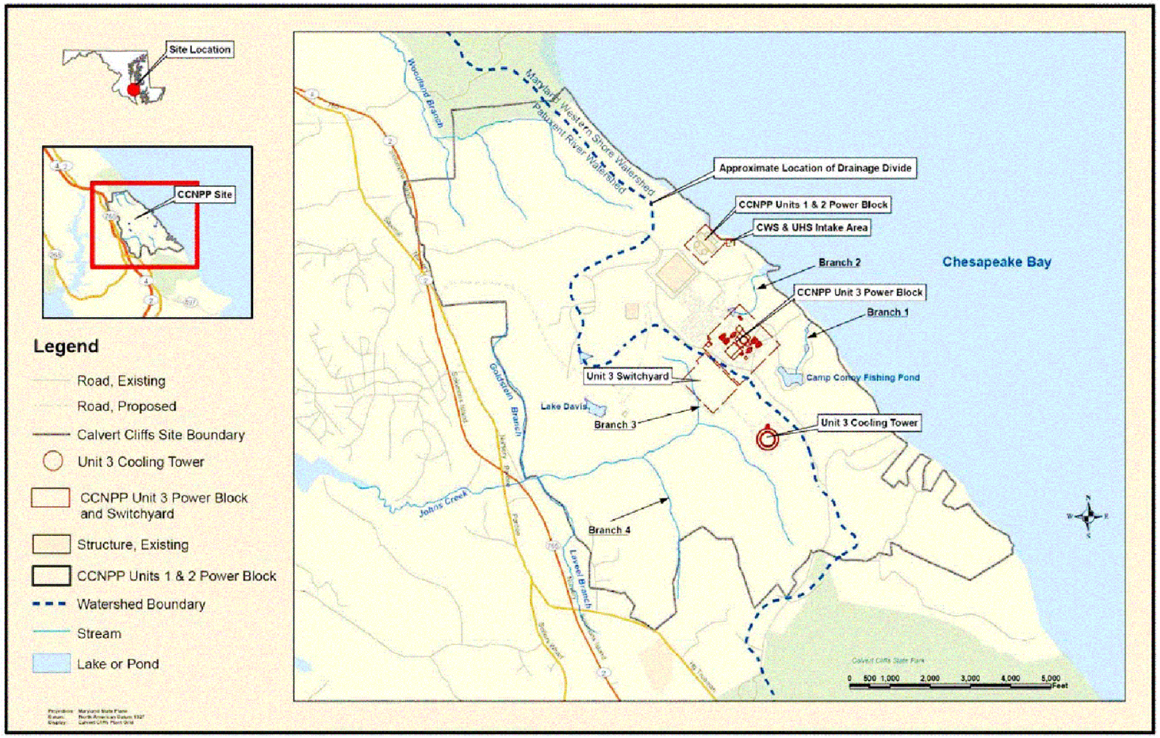


Figure 2.3-2— CCNPP Site Area Topography and Drainage



See Figure 2.1-1 and Figure 3.1-2 for Site and Powerblock layout

Figure 2.3-3— CCNPP Site and Major Drainage Routes

Figure 2.3-4— CCNPP Unit 3 Utilization Plot Plan

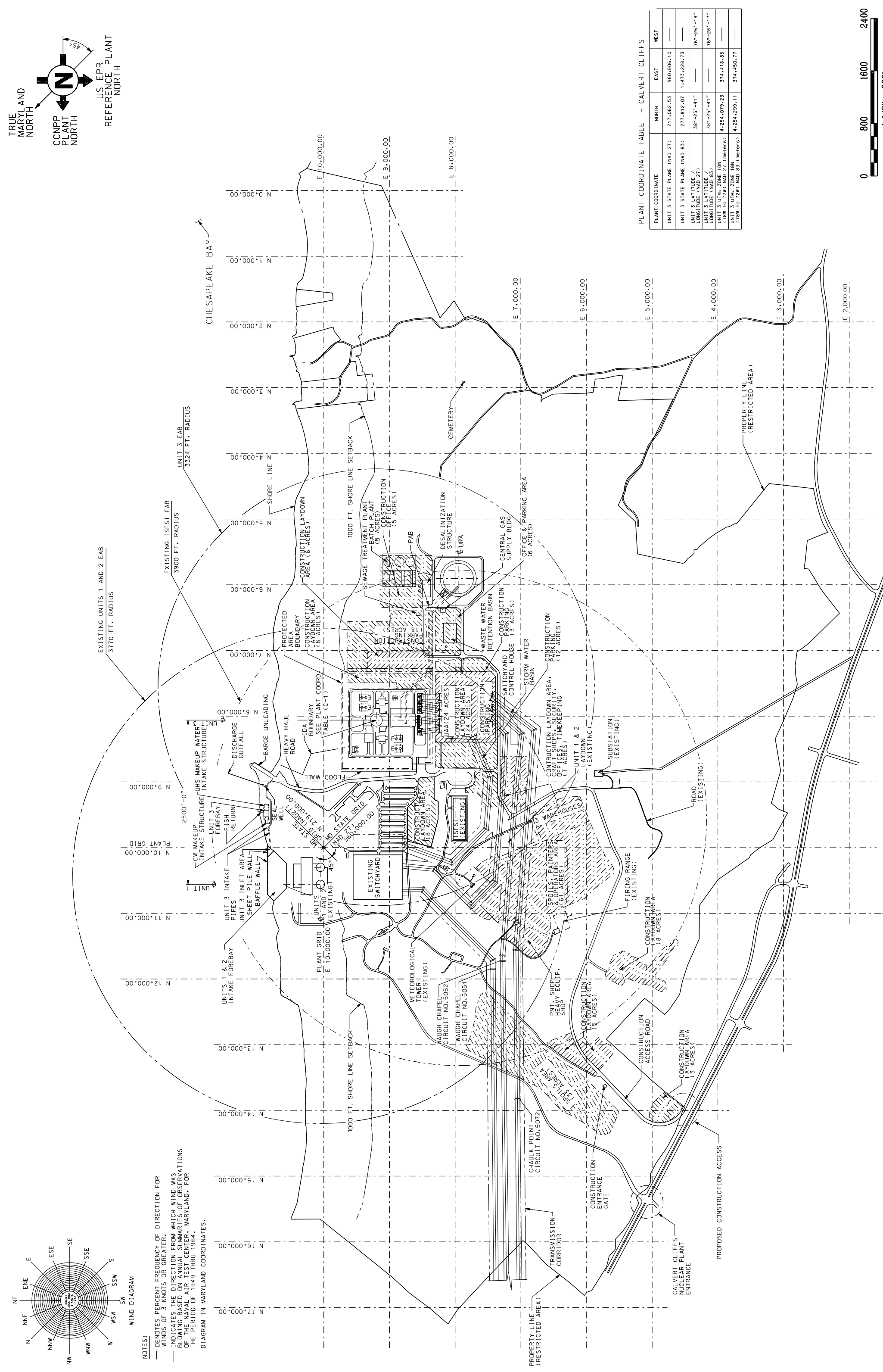


Figure 2.3-5— Mean, Average Maximum and Average Minimum Monthly Streamflows in the Patuent River at Bowie, MD USGS Station No. 01594440, Patuxent River near Bowie, MA (1977-06-01 through 2005-09-30)

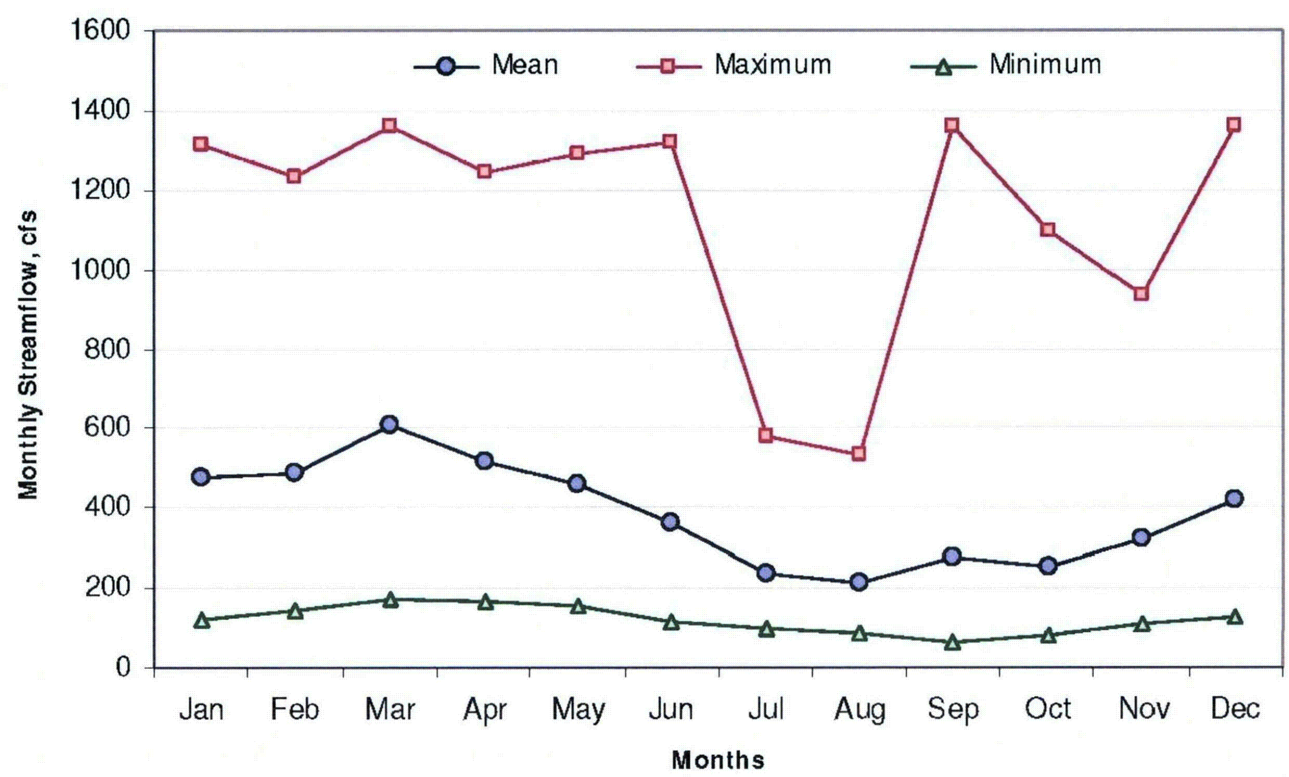


Figure 2.3-6— Mean, Average Maximum and Average Minimum Monthly Streamflows in the St. Leonard Creek at St. Leonard, MD USGS Station No. 01594800, St. Leonard Creek near St. Leonard, MA (1956-12-01 through 2003-09-30)

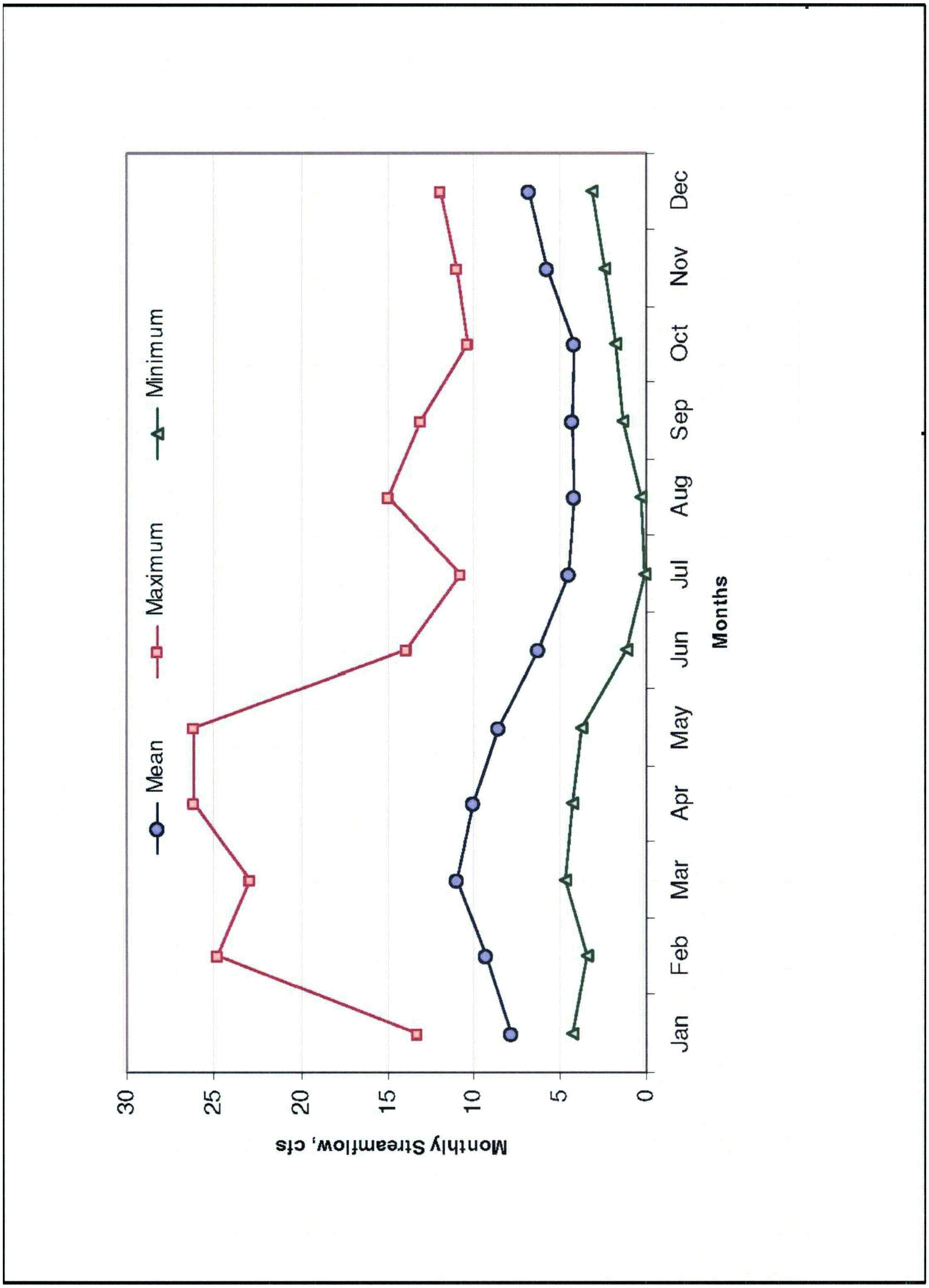


Figure 2.3-7— Flood Insurance Map of Calvert County, Maryland for Portions of Johns Creek

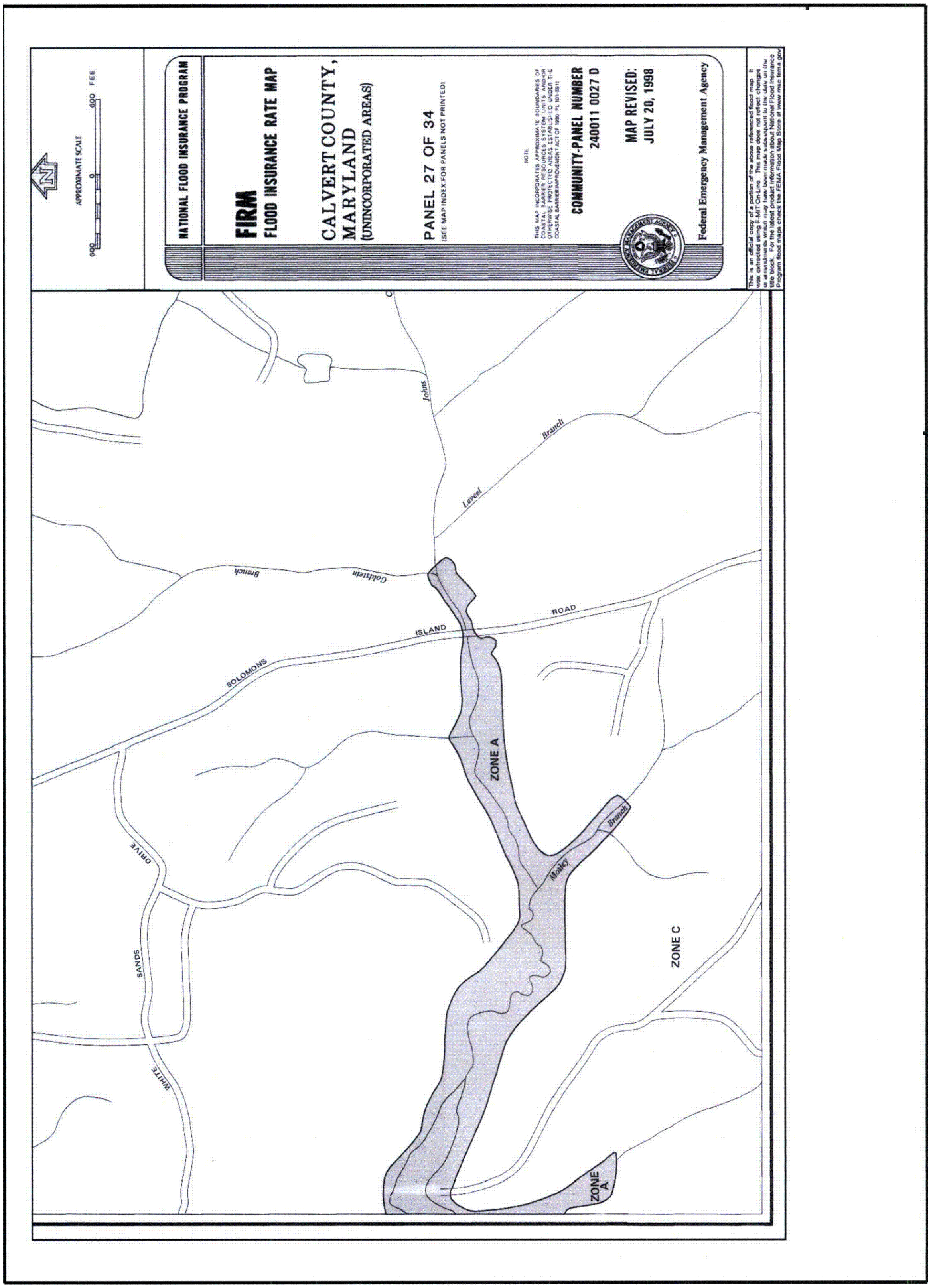


Figure 2.3-8— Storm Surge Map of Calvert County, Maryland

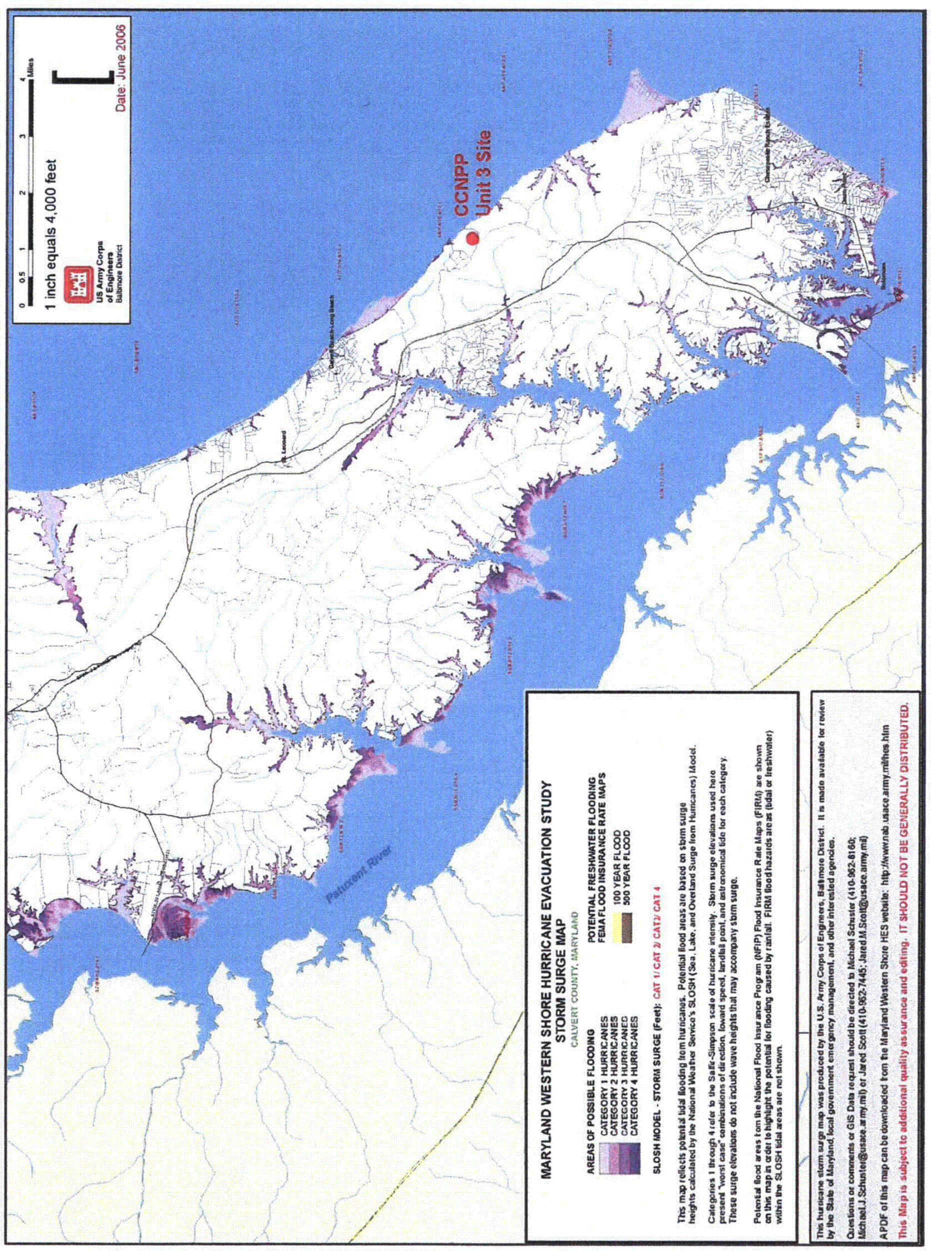


Figure 2.3-9— Mean Annual Freshwater Inflow in the Chesapeake Bay

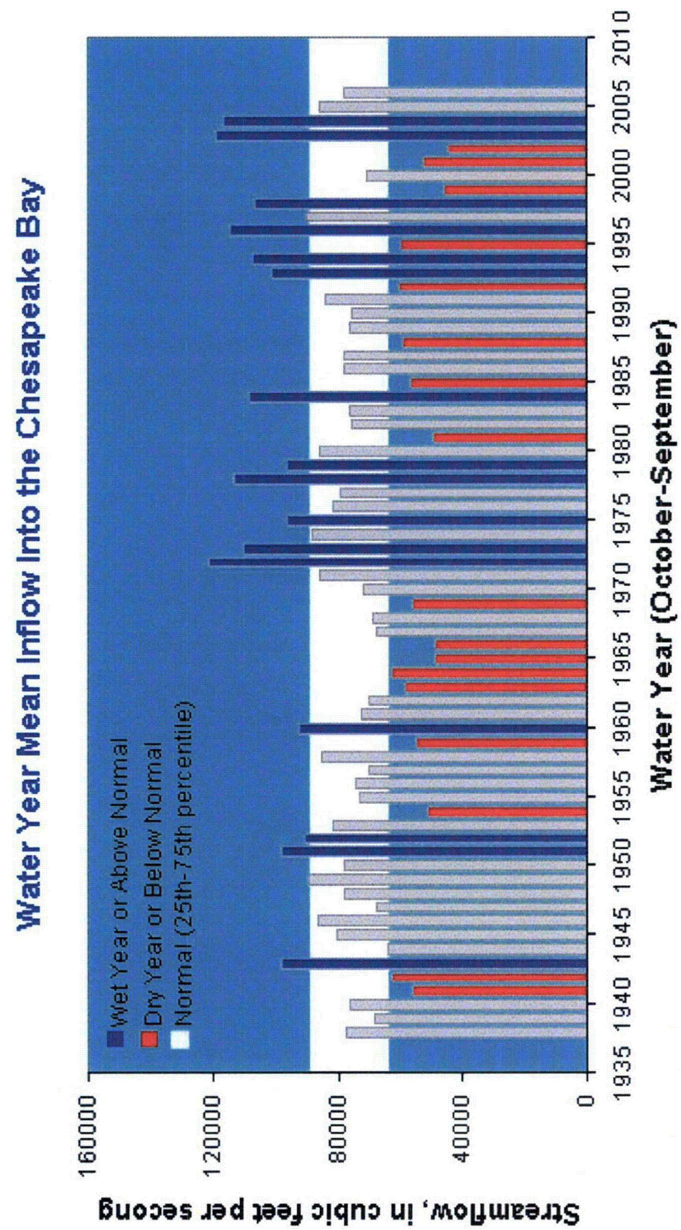


Figure 2.3-10— Maximum Average and Minimum Mean Monthly Freshwater Inflow in the Chesapeake Bay for the Period from 1951 to 2000 Including Average Annual Freshwater Inflow

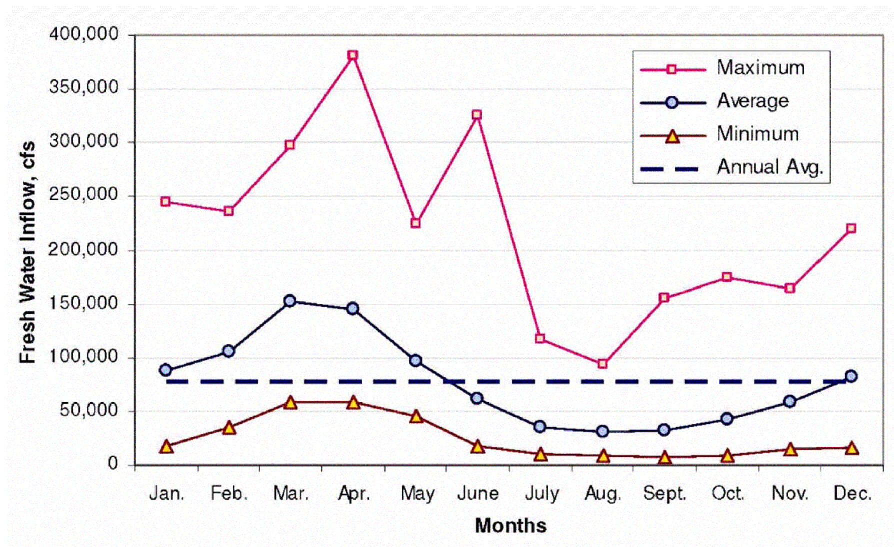


Figure 2.3-11— Chesapeake Bay Reaches for Freshwater Inflow Estimates as Identified by USGS

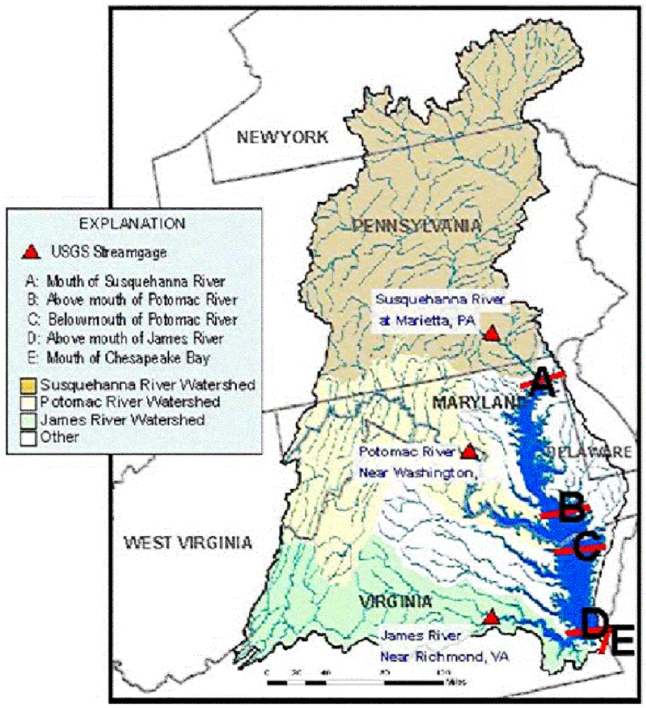
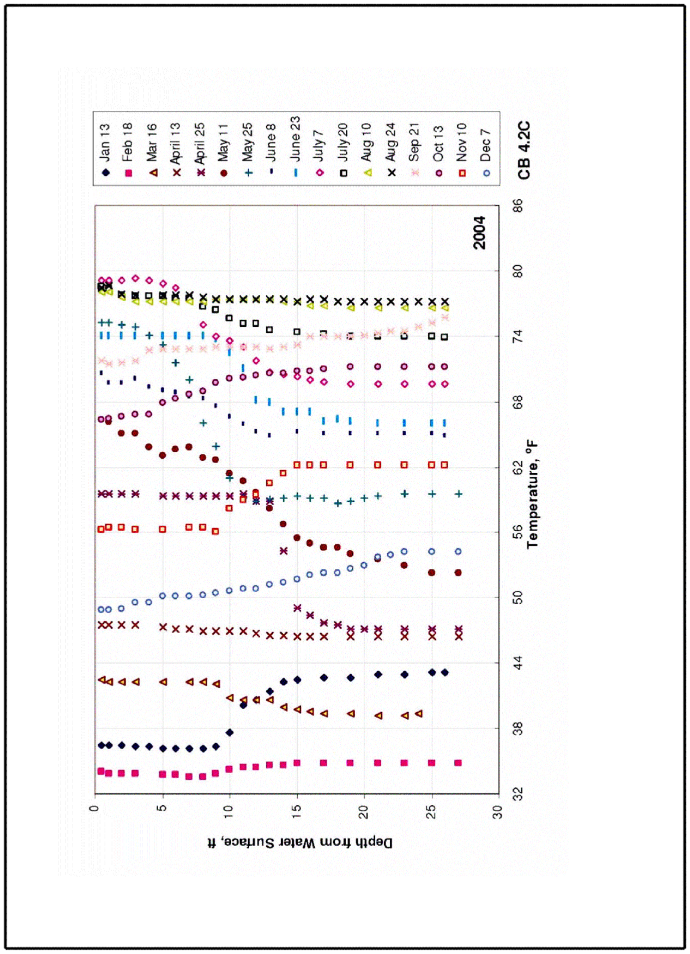


Figure 2.3-12— Water Temperature Vertical Variation, Chesapeake Bay Program Monitoring Station CB4.2C for 2004



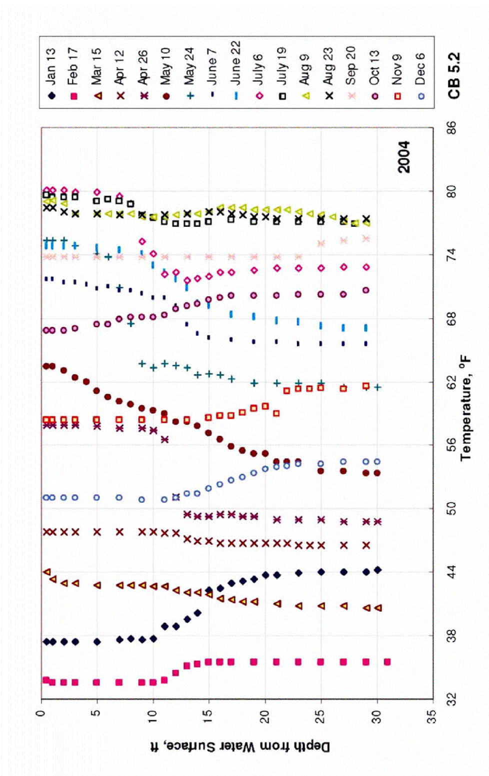


Figure 2.3-13— Water Temperature Vertical Variation, Chesapeake Bay Program Monitoring Station CB5.2 for 2004

Figure 2.3-14— Mean Monthly Water Surface Temperature, Chesapeake Bay Program Station CB5.2

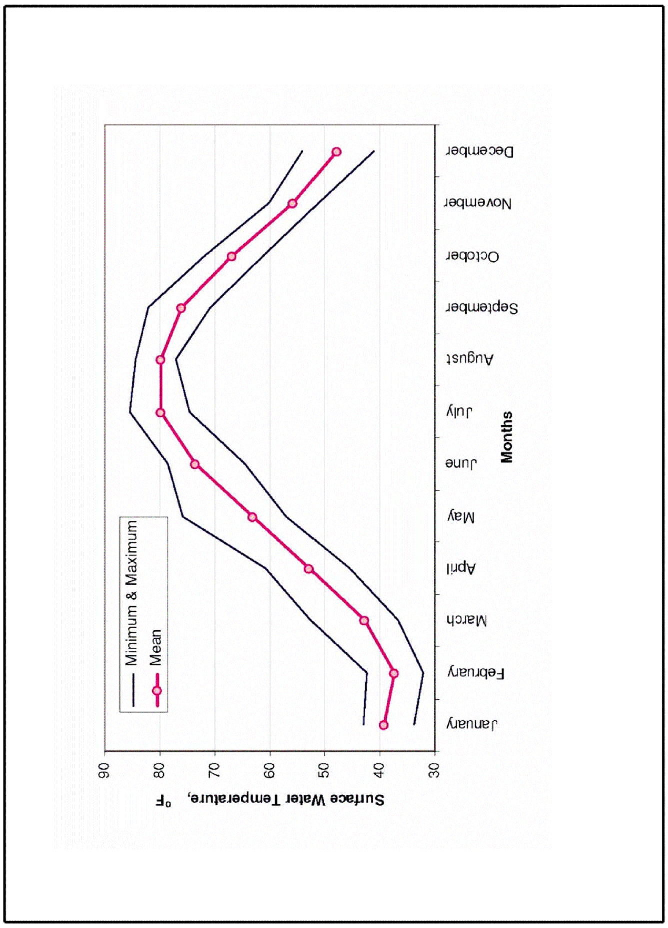


Figure 2.3-15— Chesapeake Bay Temperature Variation, Plan and Section Views, February 2004 (Maximum Condition)

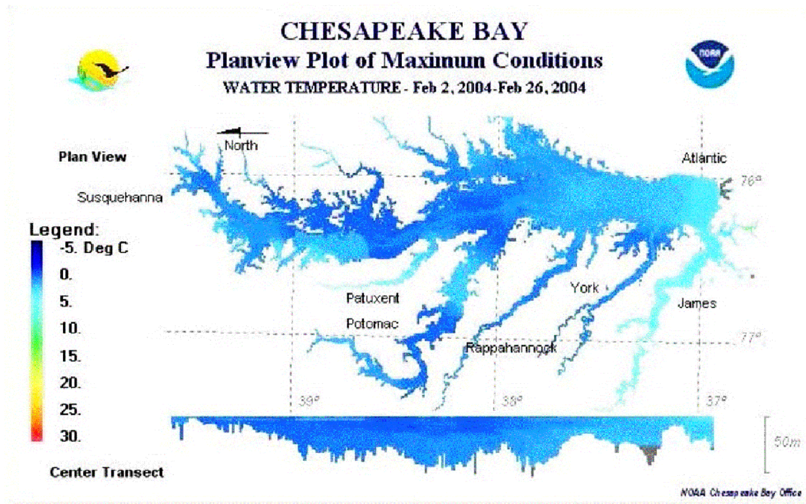


Figure 2.3-16— Chesapeake Bay Temperature Variation, Plan and Section Views, May 2004

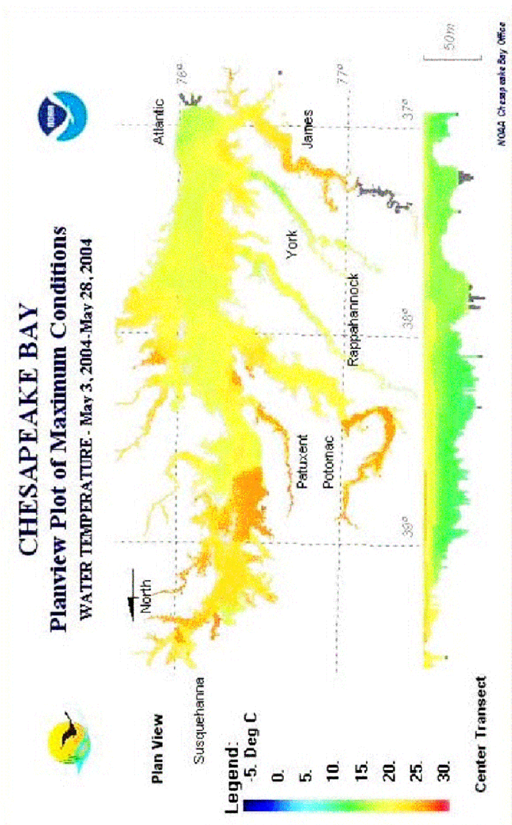


Figure 2.3-17— Chesapeake Bay Temperature Variation, Plan and Section Views, August 2004 (Maximum Condition)

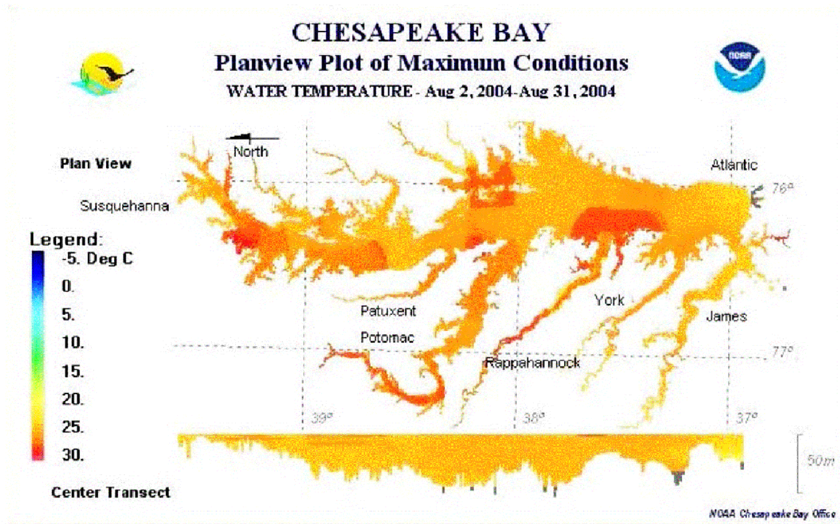


Figure 2.3-18— Salinity Vertical Variation, Chesapeake Bay Program Monitoring Station CB4.2C for 2004

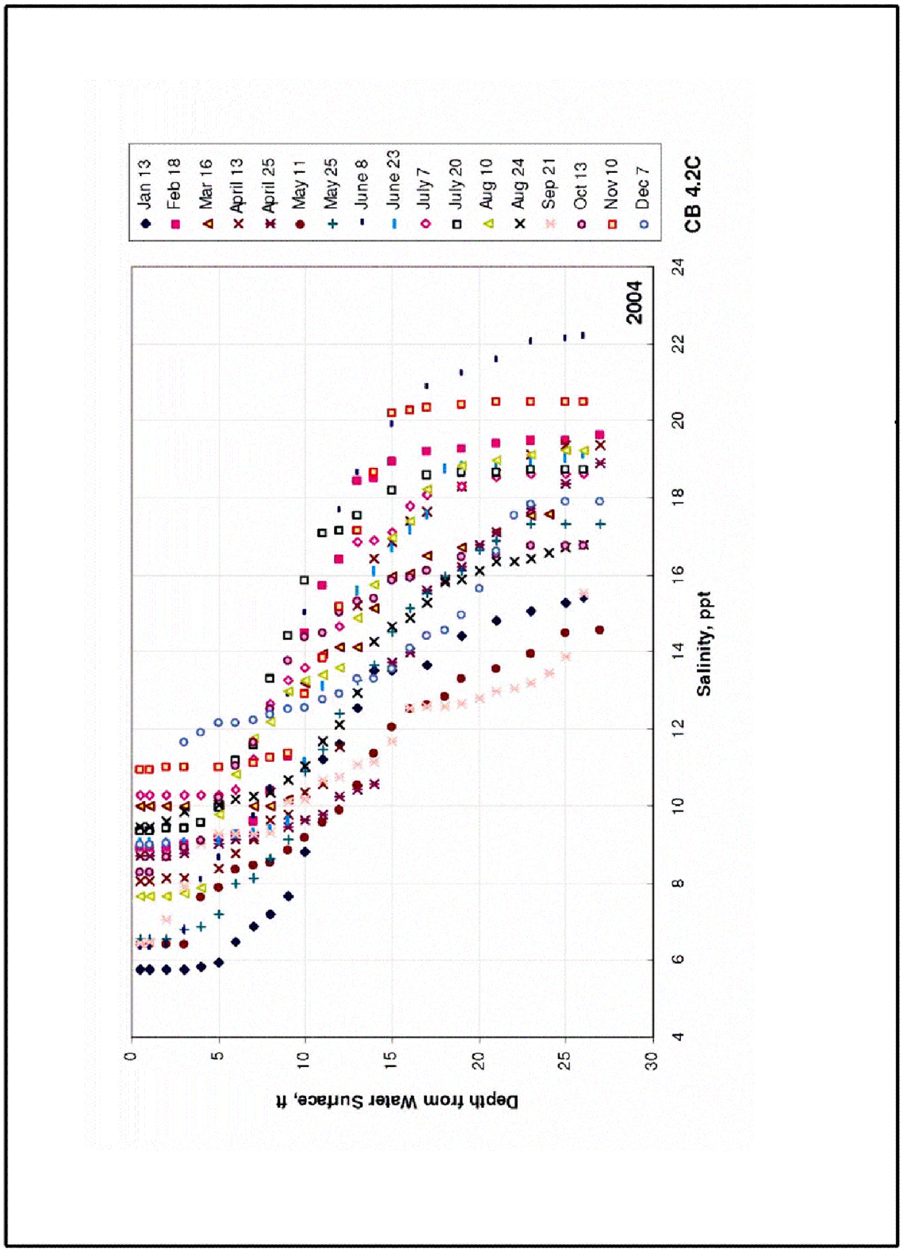


Figure 2.3-19— Salinity Vertical Variation, Chesapeake Bay Program Monitoring Station CB5.2C for 2004

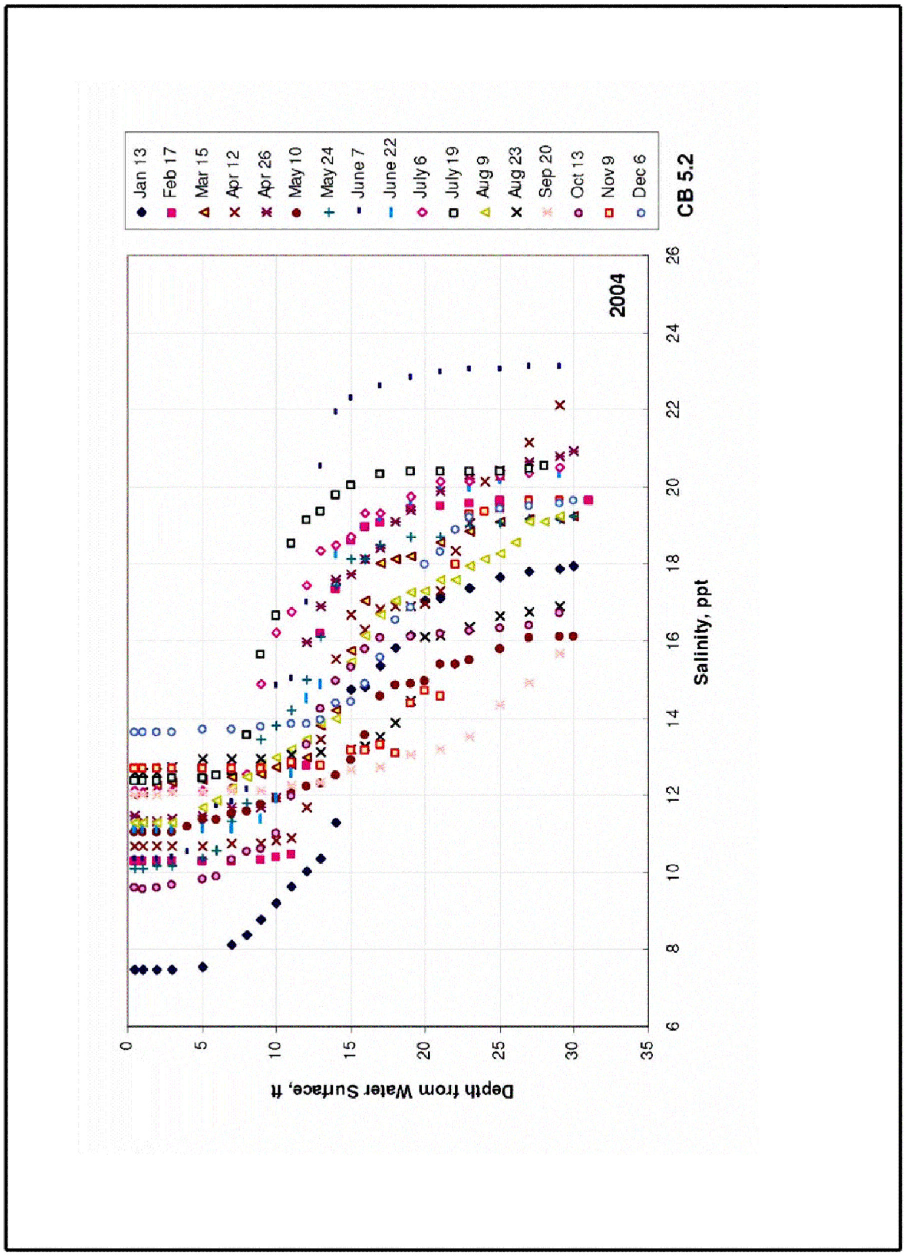


Figure 2.3-20— Mean Monthly Water Surface Salinity, Chesapeake Bay Program Monitoring Station CB5.2

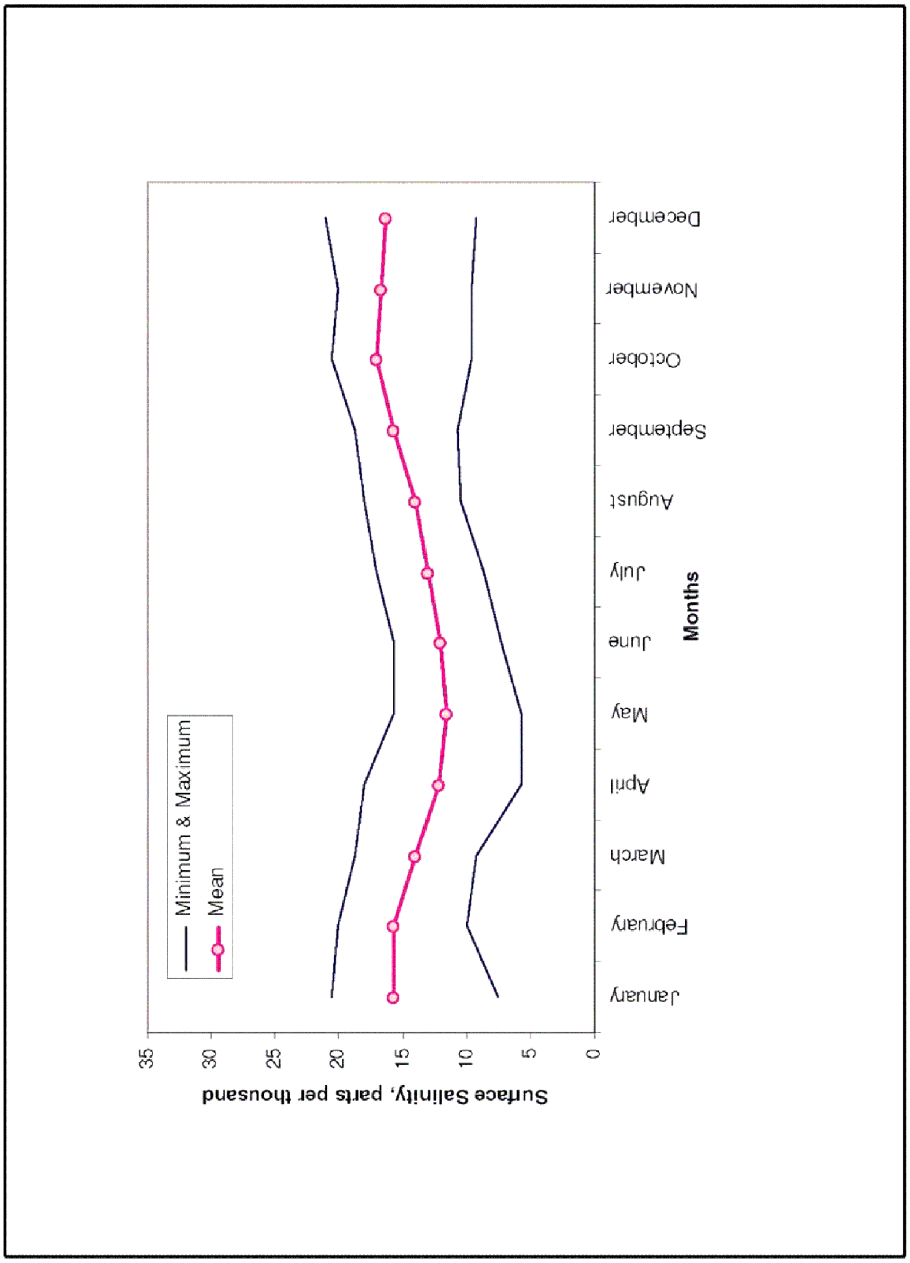


Figure 2.3-21— Chesapeake Bay Salinity Variation, Plan and Section Views, February 2004 (Minimum Condition)

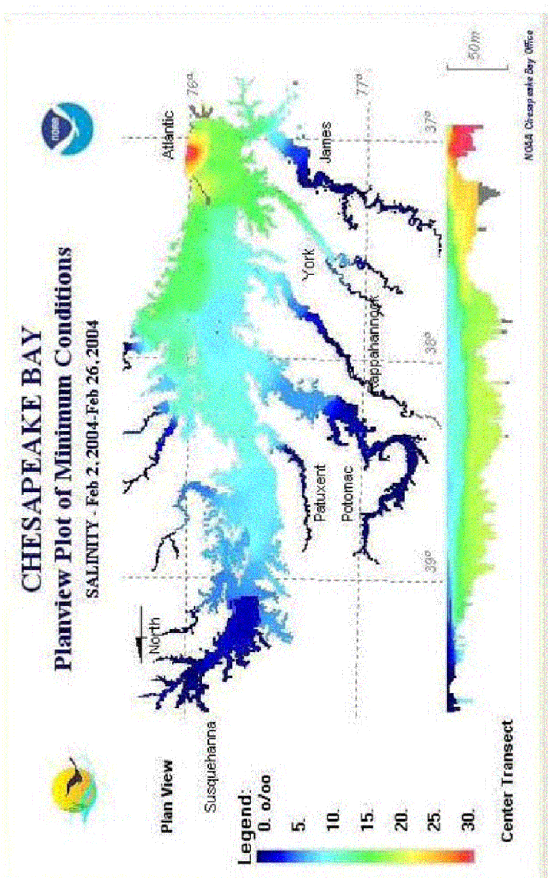


Figure 2.3-22— Chesapeake Bay Salinity Variation, Plan and Section Views, May 2004 (Minimum Condition)

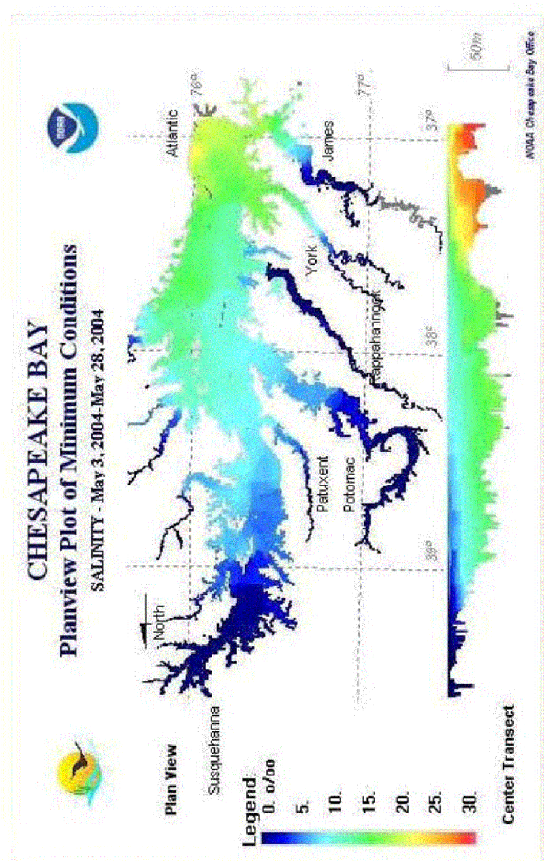
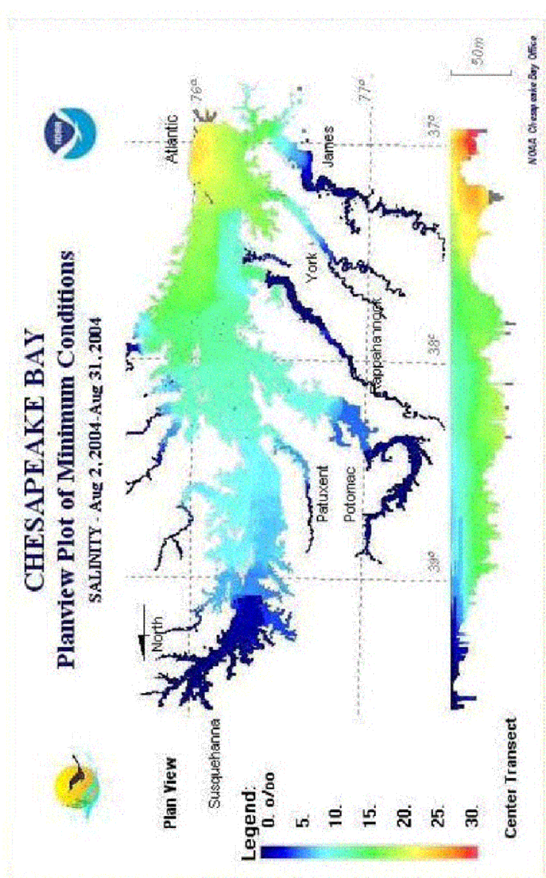


Figure 2.3-23— Chesapeake Bay Salinity Variation, Plan and Section Views, August 2004 (Minimum Condition)



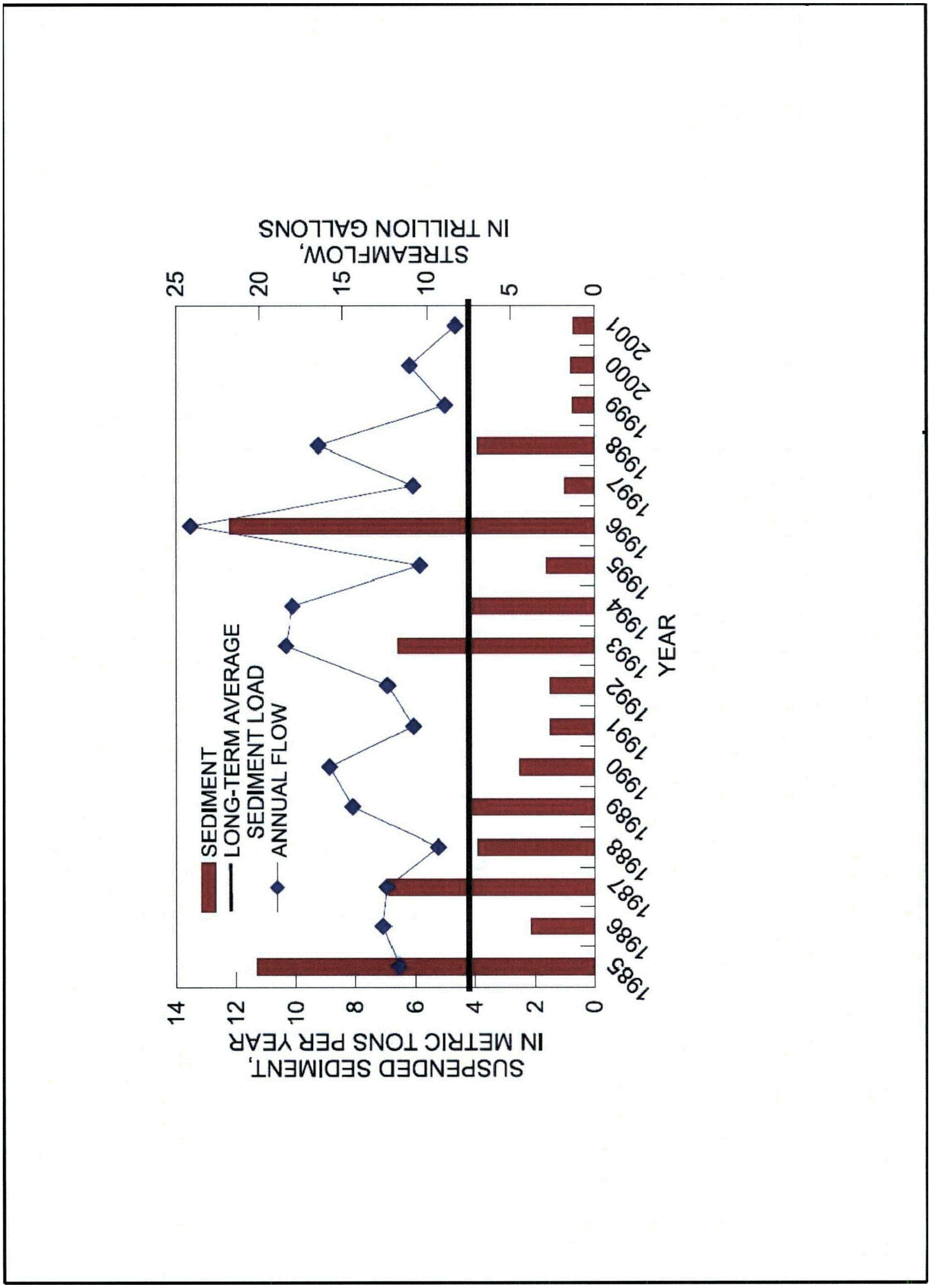


Figure 2.3-24— Combined Annual Suspended Loads and Relation to Annual Flow from the Susquehanna, Potomac and James Rivers near the Fall Line

Figure 2.3-25— Estimated Chesapeake Bay Shoreline Erosion Rates near the CCNPP Unit 3 Site

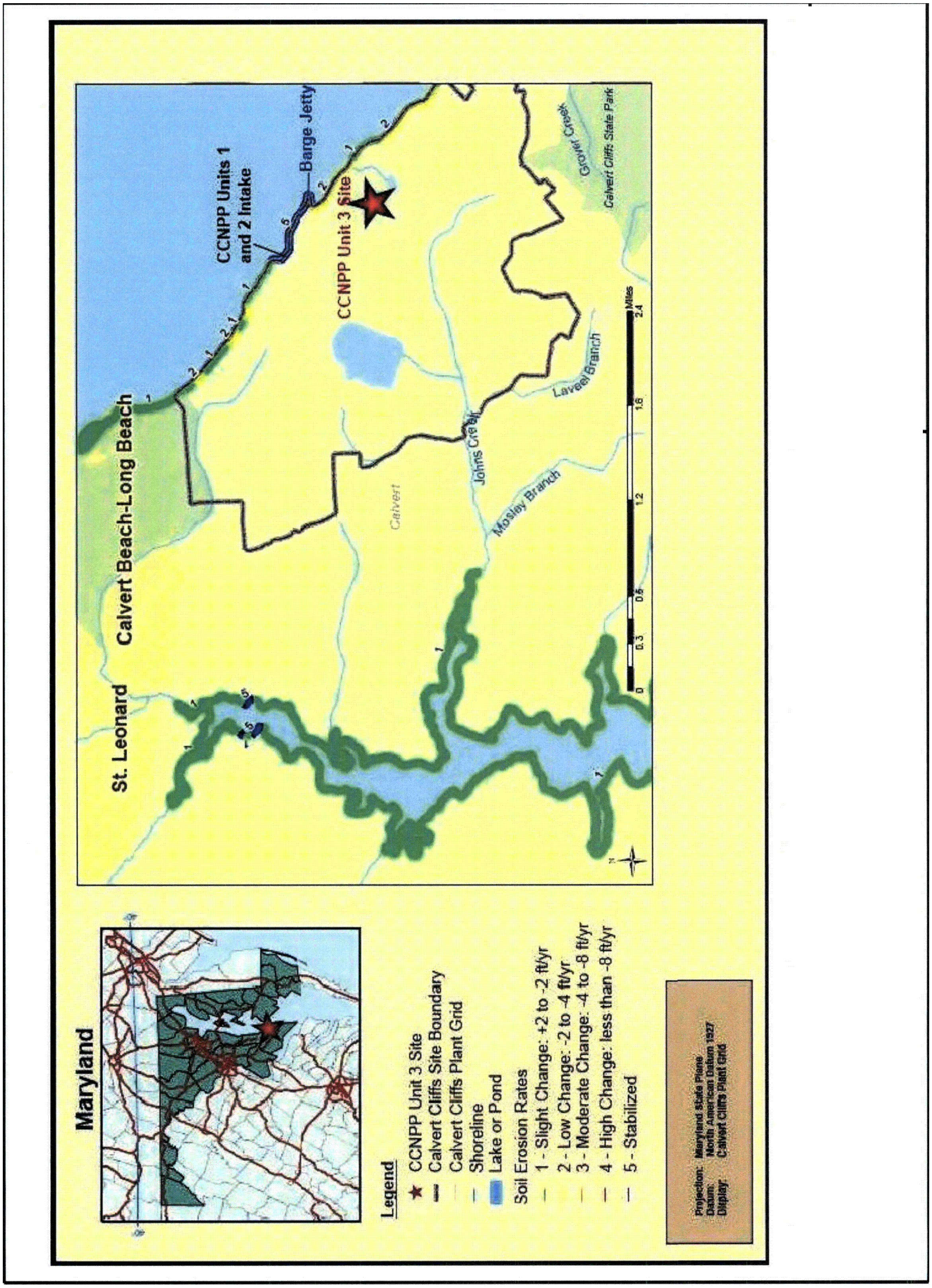


Figure 2.3-26— Change in the Chesapeake Bay Shoreline Position near the CCNPP Site Between 1848, 1942 and 1993

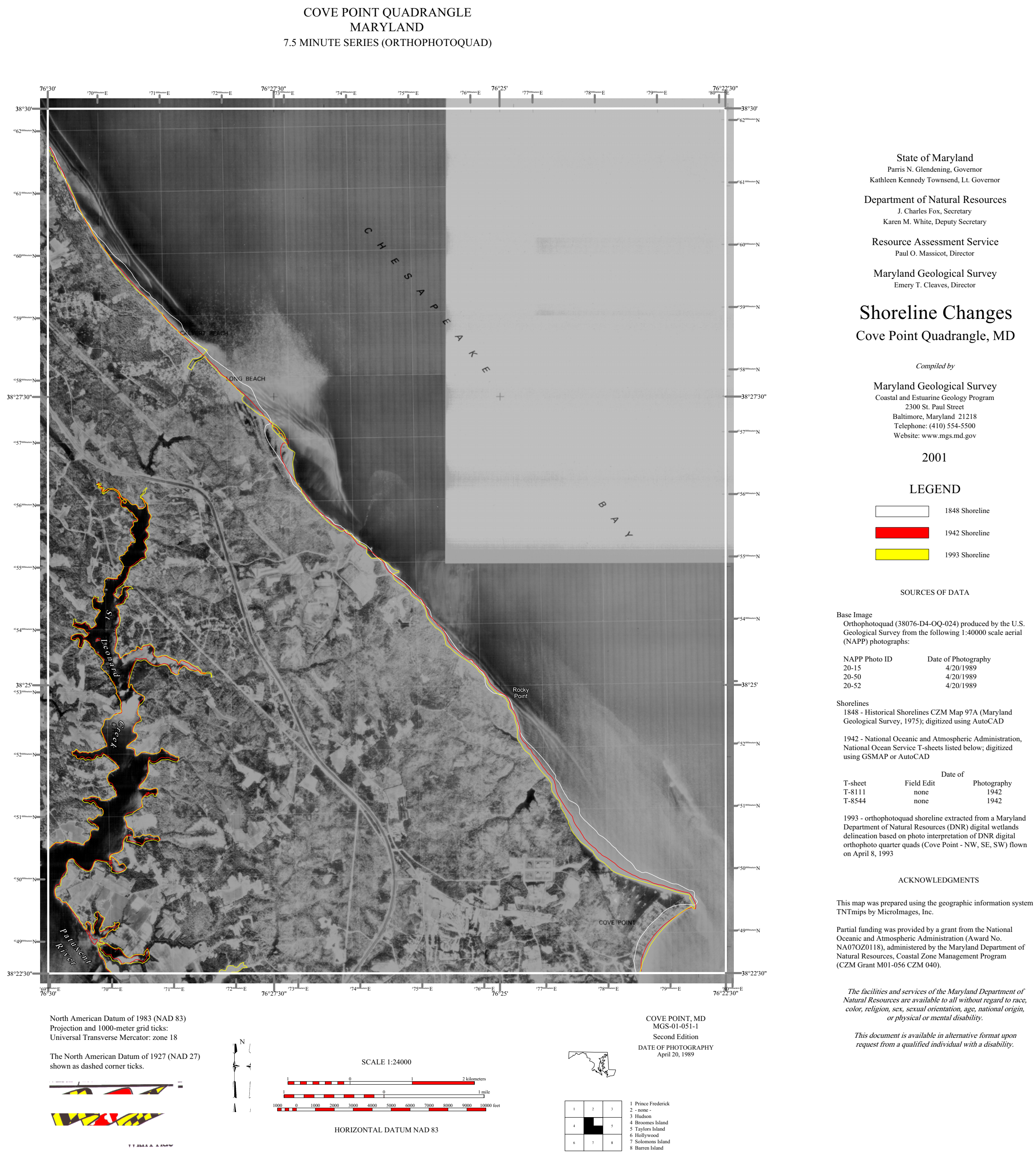
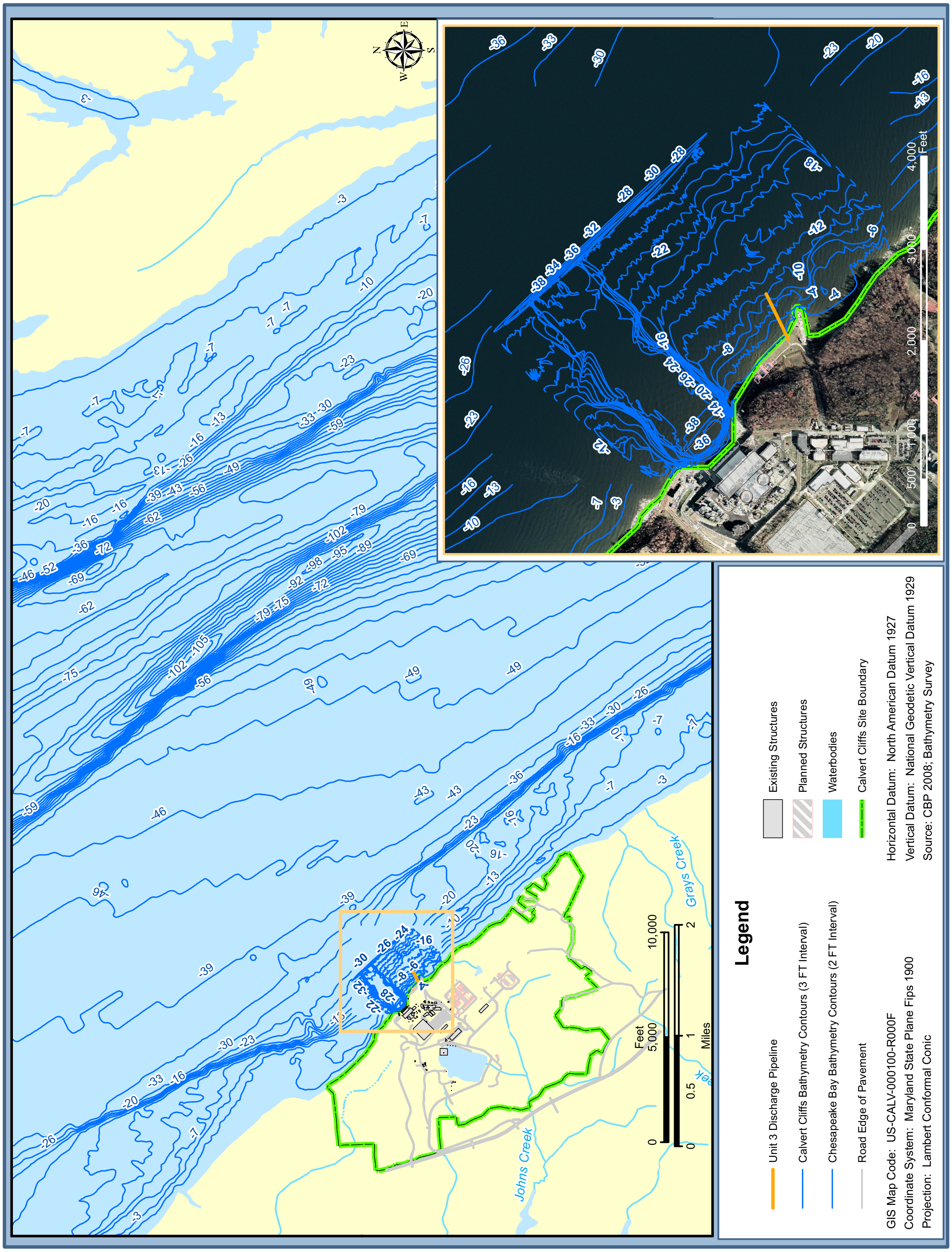


Figure 2.3-27— Chesapeake Bay Bathymetry Including the Existing CCNPP Units 1 and 2 Intake Channel



See Figure 2.1-1 and Figure 3.1-2 for Site and Powerblock layout

Figure 2.3-28— Location of CCNPP and 200 Mile Radius from the Plant Site

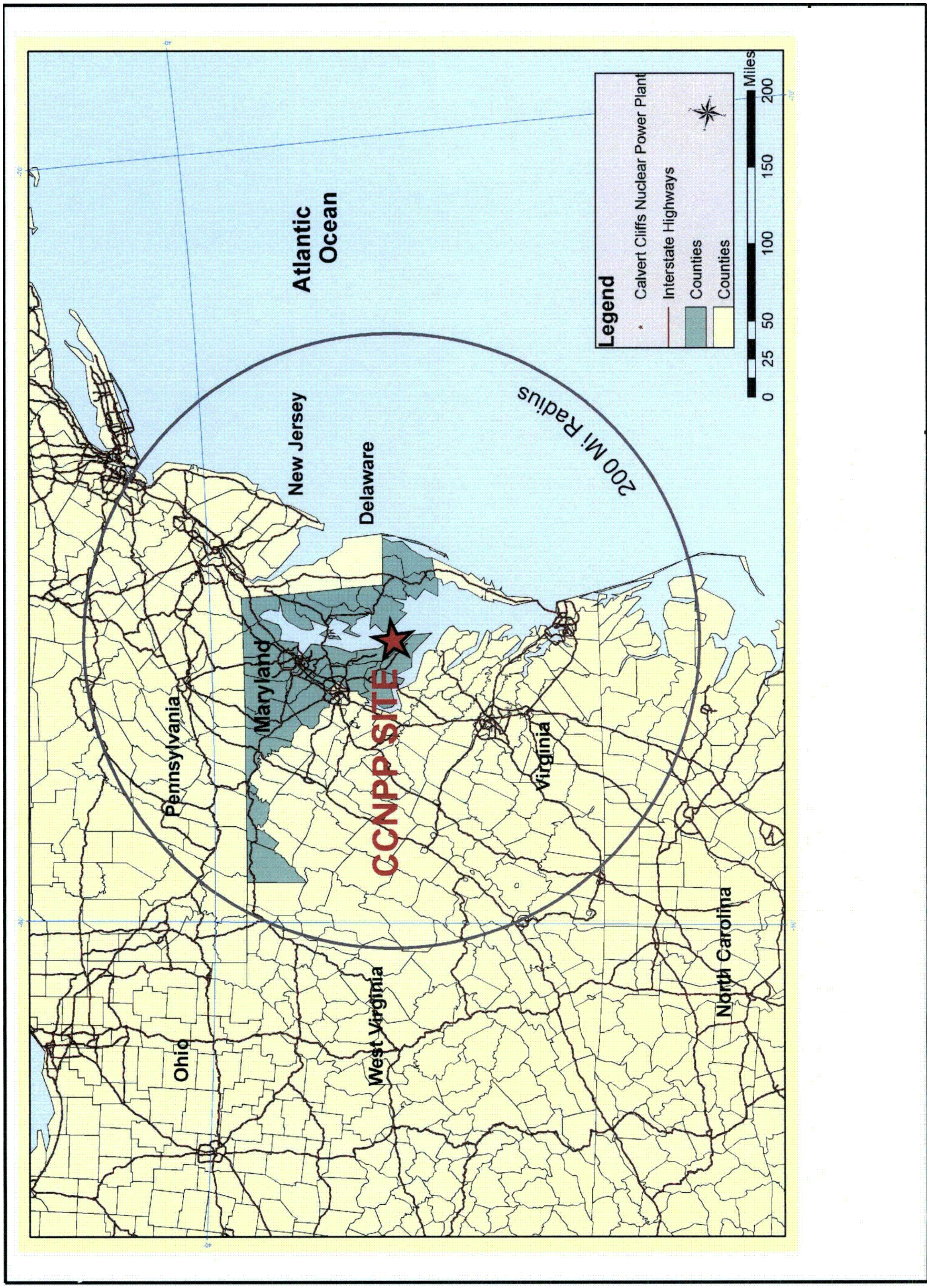


Figure 2.3-29— Mid-Atlantic Regional Physiographic Provinces and Hydrostratigraphic Units

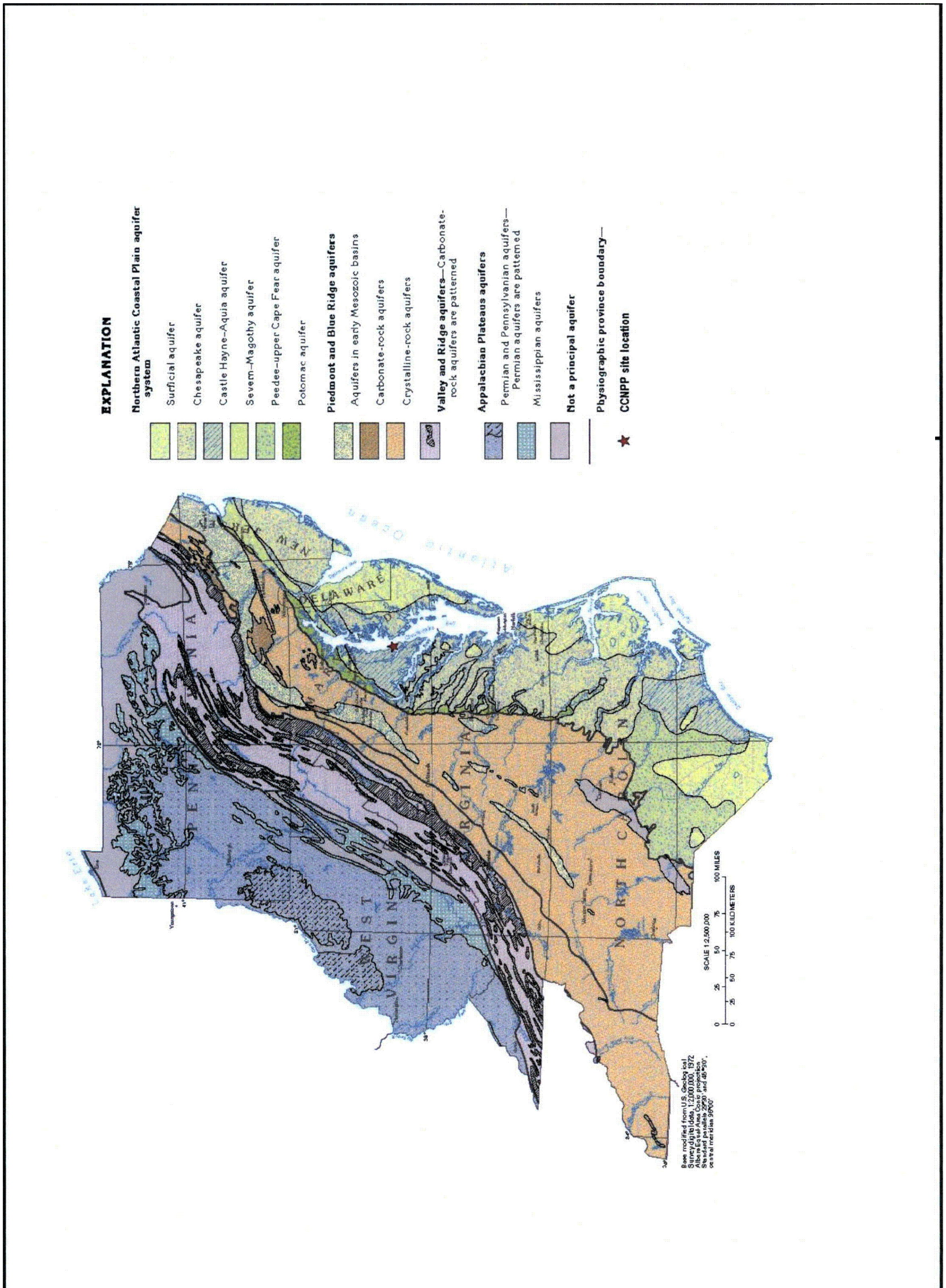


Figure 2.3-30— Schematic Geologic Cross Section through the Mid-Atlantic Region

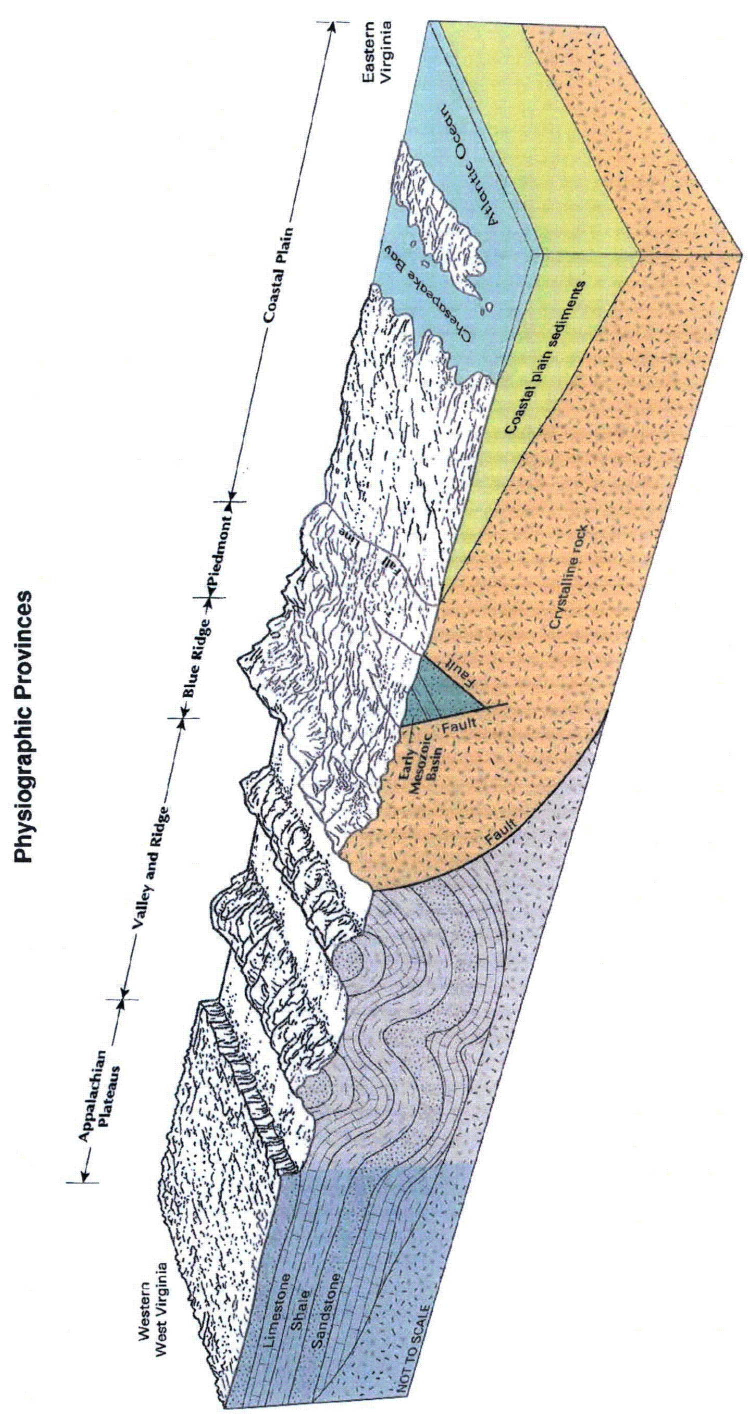


Figure 2.3-31— Southern Maryland Schematic Hydrostratigraphic Section

ERATHEM	SYSTEM	SERIES	FORMATION	THICKNESS (feet)	LITHOLOGY	HYDROSTRATIGRAPHIC UNIT
CENOZOIC	QUATERNARY	Holocene & Pleistocene	Lowland deposits	0-150	Sand, gravel, sandy clay, and clay.	SURFICIAL AQUIFER
CENOZOIC	NEOGENE	Pliocene	Upland deposits	0-85	Irregularly stratified cobbles, gravel, sand, and clay lenses.	SURFICIAL AQUIFER
CENOZOIC	NEOGENE	Pliocene	Chesapeake Group: St. Mary's Fm.	0-335	Sand, clayey sand, and sandy clay; fossiliferous and diatomaceous.	CHESAPEAKE CONFINING UNIT
CENOZOIC	NEOGENE	Miocene	Chesapeake Group: Choptank Fm.	0-335	Sand, clayey sand, and sandy clay; fossiliferous and diatomaceous.	CHESAPEAKE CONFINING UNIT
CENOZOIC	NEOGENE	Miocene	Chesapeake Group: Calvert Fm.	0-335	Sand, clayey sand, and sandy clay; fossiliferous and diatomaceous.	CHESAPEAKE CONFINING UNIT
CENOZOIC	PALEOGENE	Oligocene	Chesapeake Group: Unnamed Oligocene Beds	0-5	Patchy distribution; clayey, glauconitic sand.	PINEY POINT-NANJEMOY AQUIFER
CENOZOIC	PALEOGENE	Eocene	Pamunkey Group: Piney Point Fm.	0-90	Sand, slightly glauconitic, with intercalated indurated layers; fossiliferous.	PINEY POINT-NANJEMOY AQUIFER
CENOZOIC	PALEOGENE	Eocene	Pamunkey Group: Nanjemoy Fm.	0-240	Glauconitic sand with clayey layers.	PINEY POINT-NANJEMOY AQUIFER
CENOZOIC	PALEOGENE	Paleocene	Pamunkey Group: Marlboro Clay	0-30	Pink and gray clay.	NANJEMOY CONFINING UNIT
CENOZOIC	PALEOGENE	Paleocene	Pamunkey Group: Aquia Fm.	30-205	Glauconitic, greenish to brown sand with indurated layers; fossiliferous.	AQUIA AQUIFER
CENOZOIC	PALEOGENE	Paleocene	Brightseat Fm.	0-40	Gray to dark-gray micaceous silty and sandy clay.	BRIGHTSEAT CONFINING UNIT
MESOZOIC	CRETACEOUS	Upper	Monmouth Group / Matawan Group: Formations undifferentiated	20-105	Sandy clay and sand, dark gray to black, with minor glauconitic; fossiliferous.	BRIGHTSEAT CONFINING UNIT
MESOZOIC	CRETACEOUS	Upper	Magothy Fm.	0-230	Light gray to white sand and fine gravel with interbedded clay layers; contains pyrite and lignite. Includes two sand units in southern Anne Arundel County where the formation is the thickest.	MAGOTHY AQUIFER
MESOZOIC	CRETACEOUS	Lower	Potomac Group: Patapsco Fm.	0-1,200	Interbedded sand, clay, and sandy clay; color variegated, but chiefly hues of red, brown and gray; consists of several sandy intervals that function as separate aquifers.	Patapsco aquifer system: UPPER PATAPSCO CONFINING UNIT
						Patapsco aquifer system: UPPER PATAPSCO AQUIFER
						Patapsco aquifer system: MIDDLE PATAPSCO CONFINING UNIT
						Patapsco aquifer system: LOWER PATAPSCO AQUIFER
MESOZOIC	CRETACEOUS	Lower	Potomac Group: Arundel Fm.	0-400	Red, brown, and gray clay; in places contains ironstone nodules, carbonaceous remains, and lignite.	ARUNDEL CONFINING UNIT
MESOZOIC	CRETACEOUS	Lower	Potomac Group: Patuxent Fm.	100-600	Interbedded gray and yellow sand and clay; kaolinized feldspar and lignite common. Locally clay layers predominate.	PATUXENT AQUIFER
PALEOZOIC / PRECAMBRIAN	Undifferentiated pre-Cretaceous consolidated-rock basement			Unknown	Igneous and metamorphic rocks; sandstone and shale.	NOT RECOGNIZED

Figure 2.3-32— Schematic Cross Section of Southern Maryland Hydrostratigraphic Units

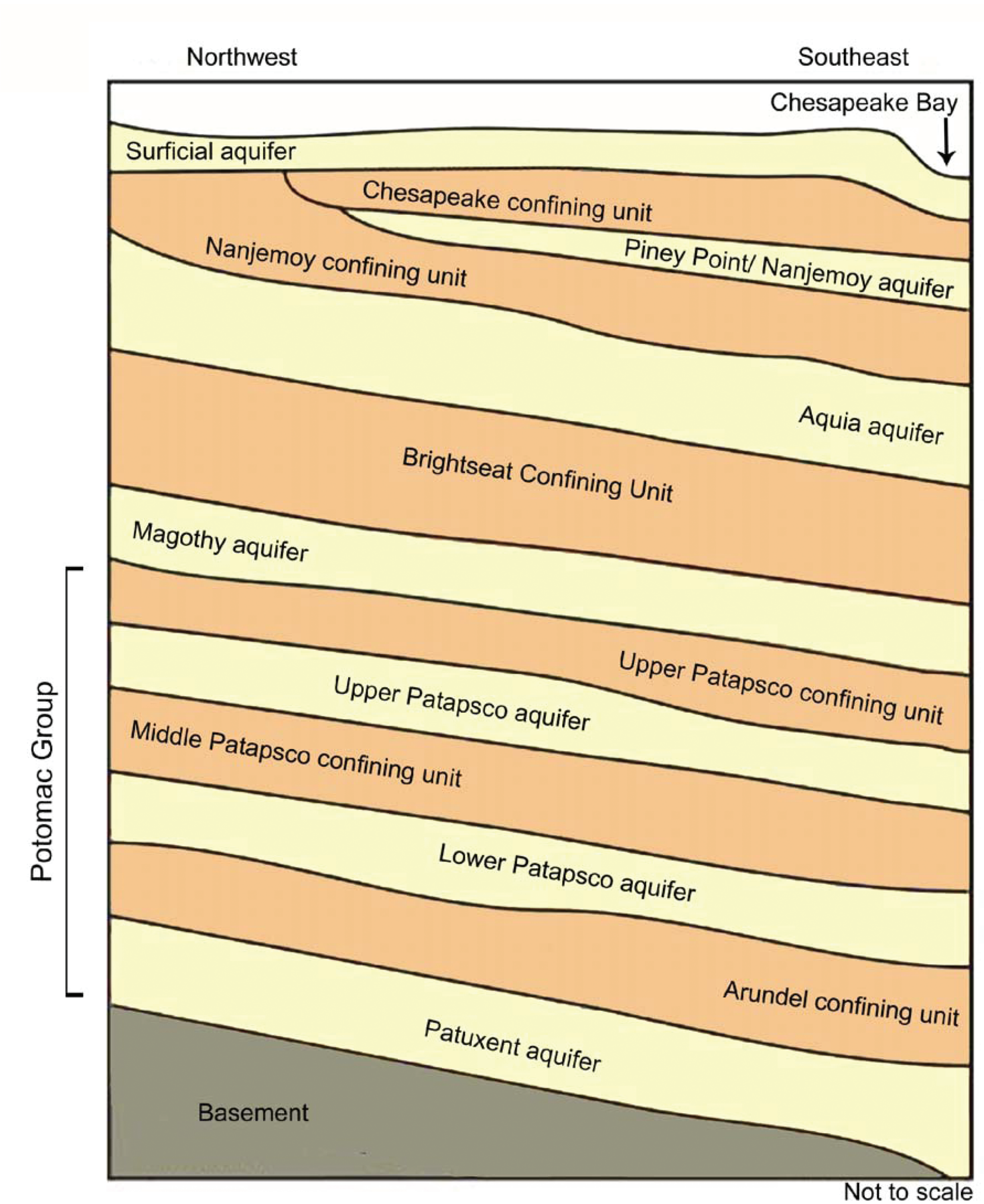


Figure 2.3-33— Potentiometric Surface of the Aquia Aquifer in Southern Maryland, September 2003

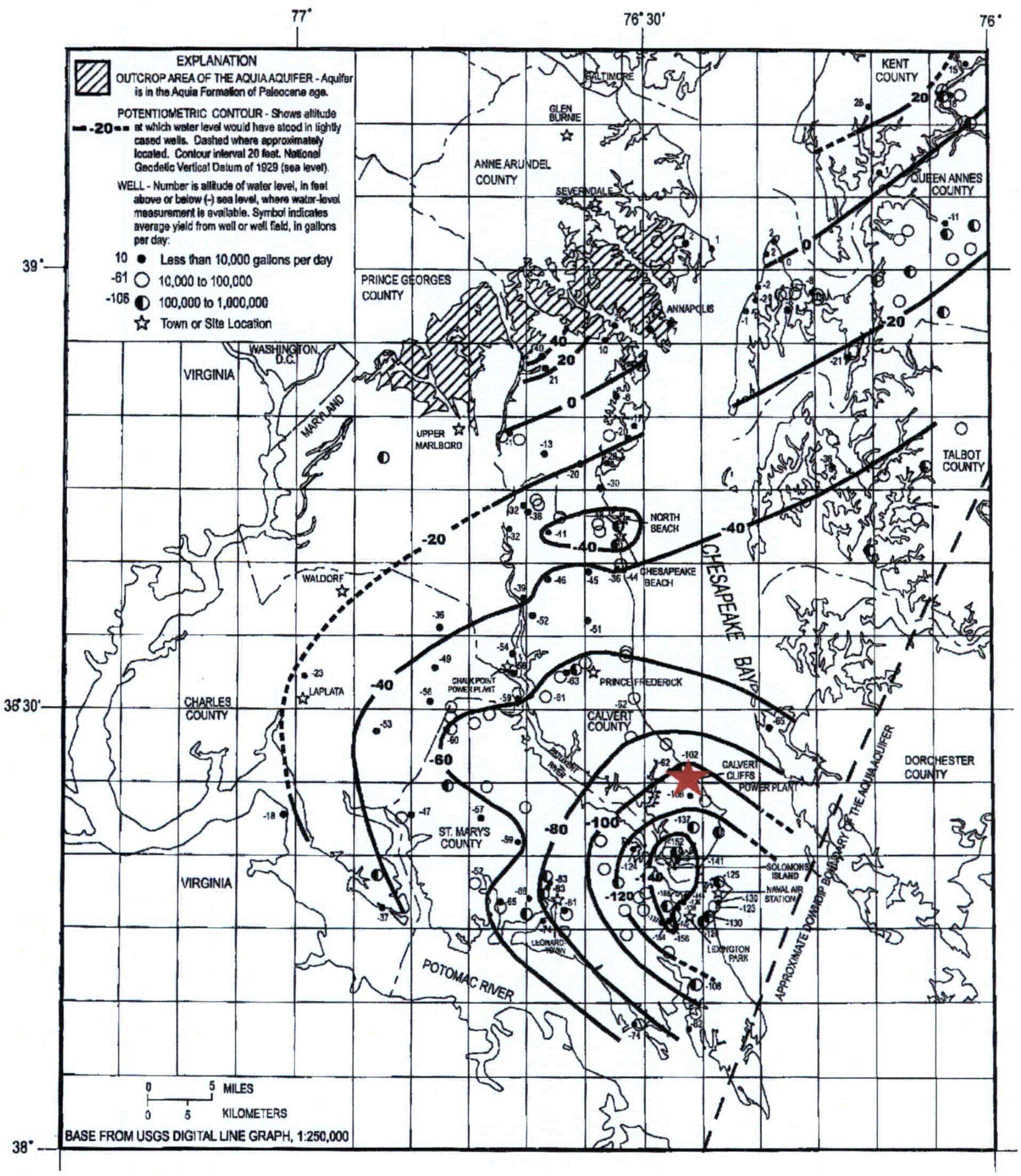


Figure 2.3-34— Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 2003

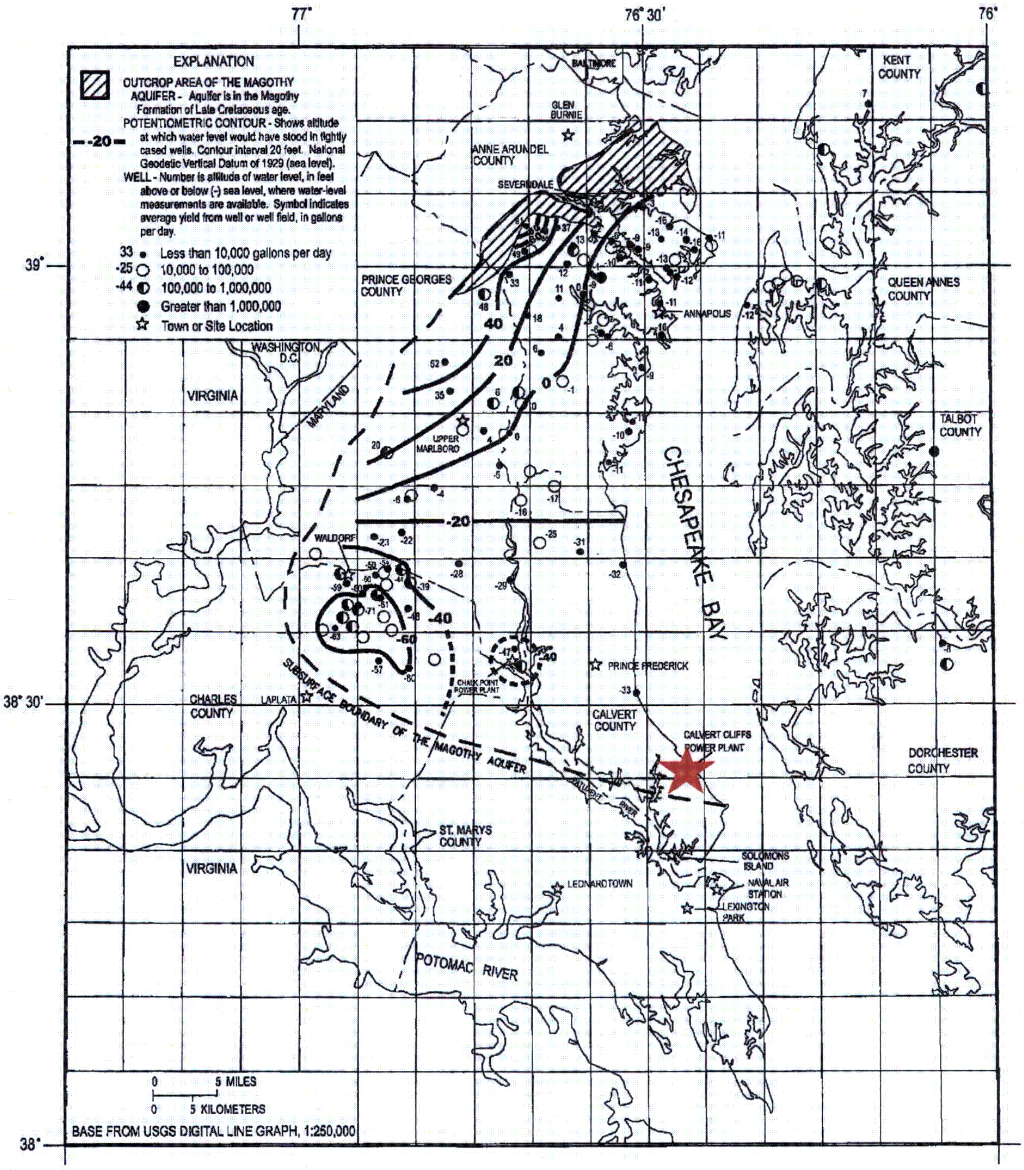


Figure 2.3-35— Potentiometric Surface of the Upper Patapsco Aquifer in Southern Maryland, September 2003

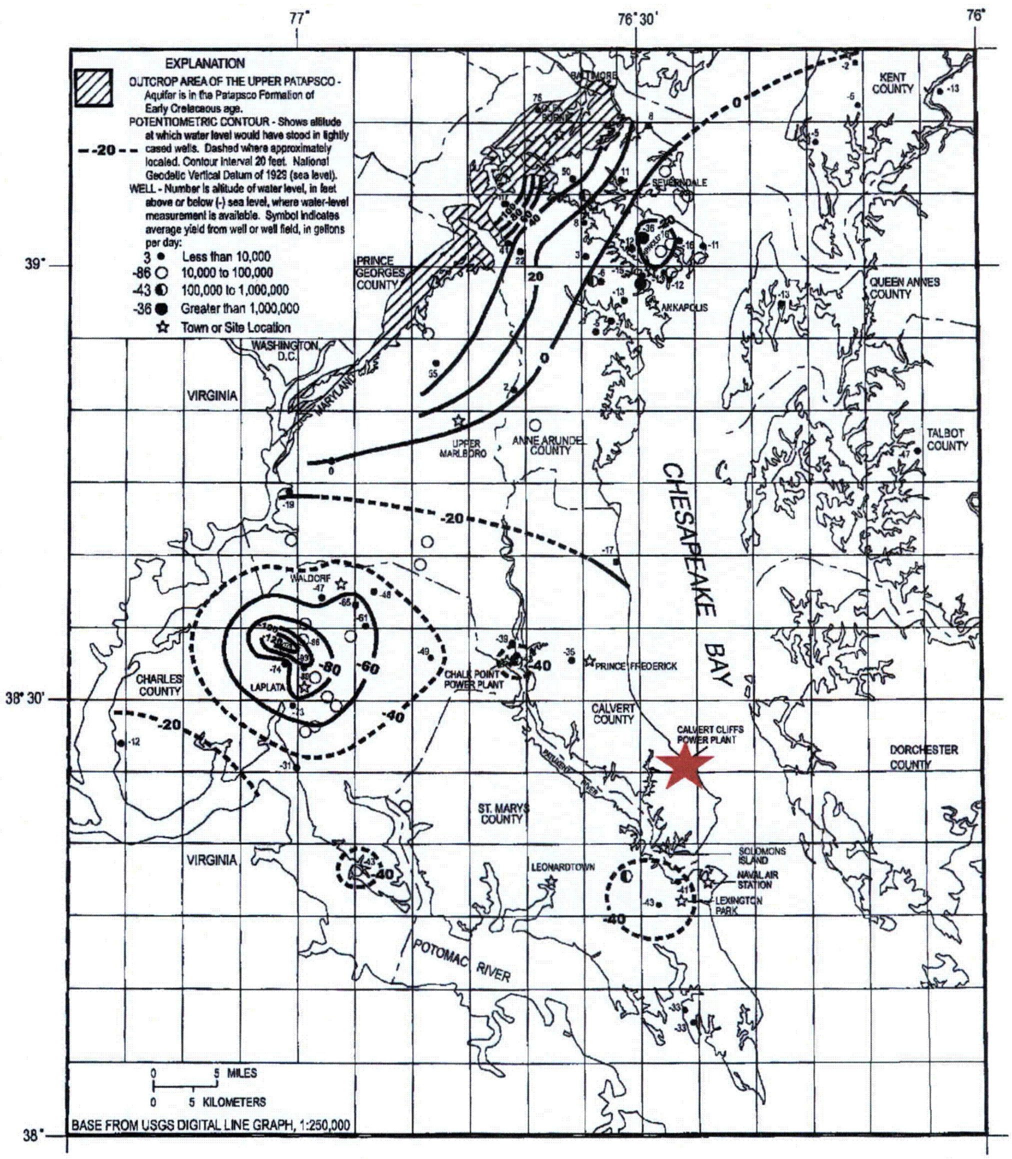


Figure 2.3-36— Potentiometric Surface of the Lower Patapsco Aquifer in Southern Maryland, September 2003

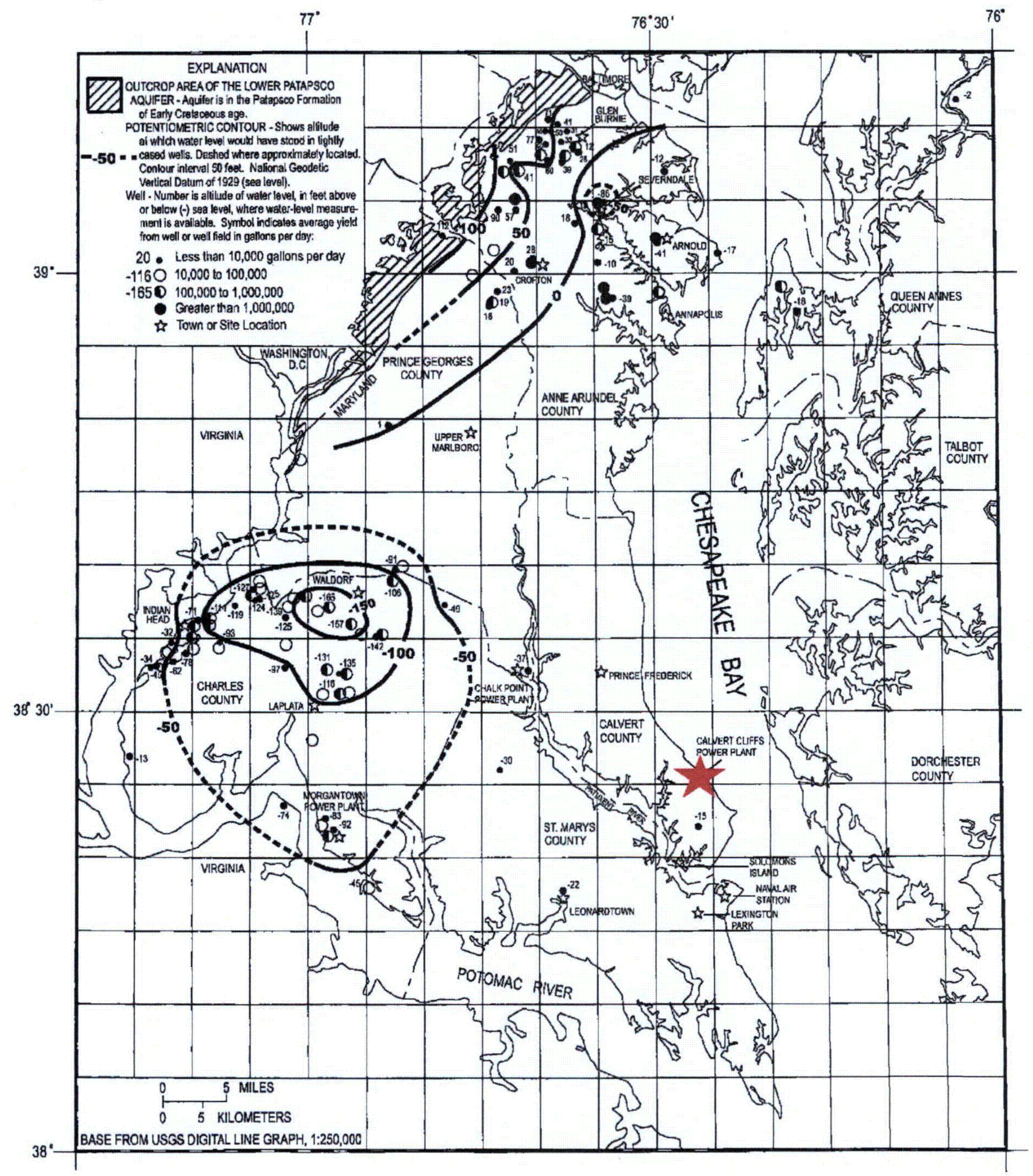
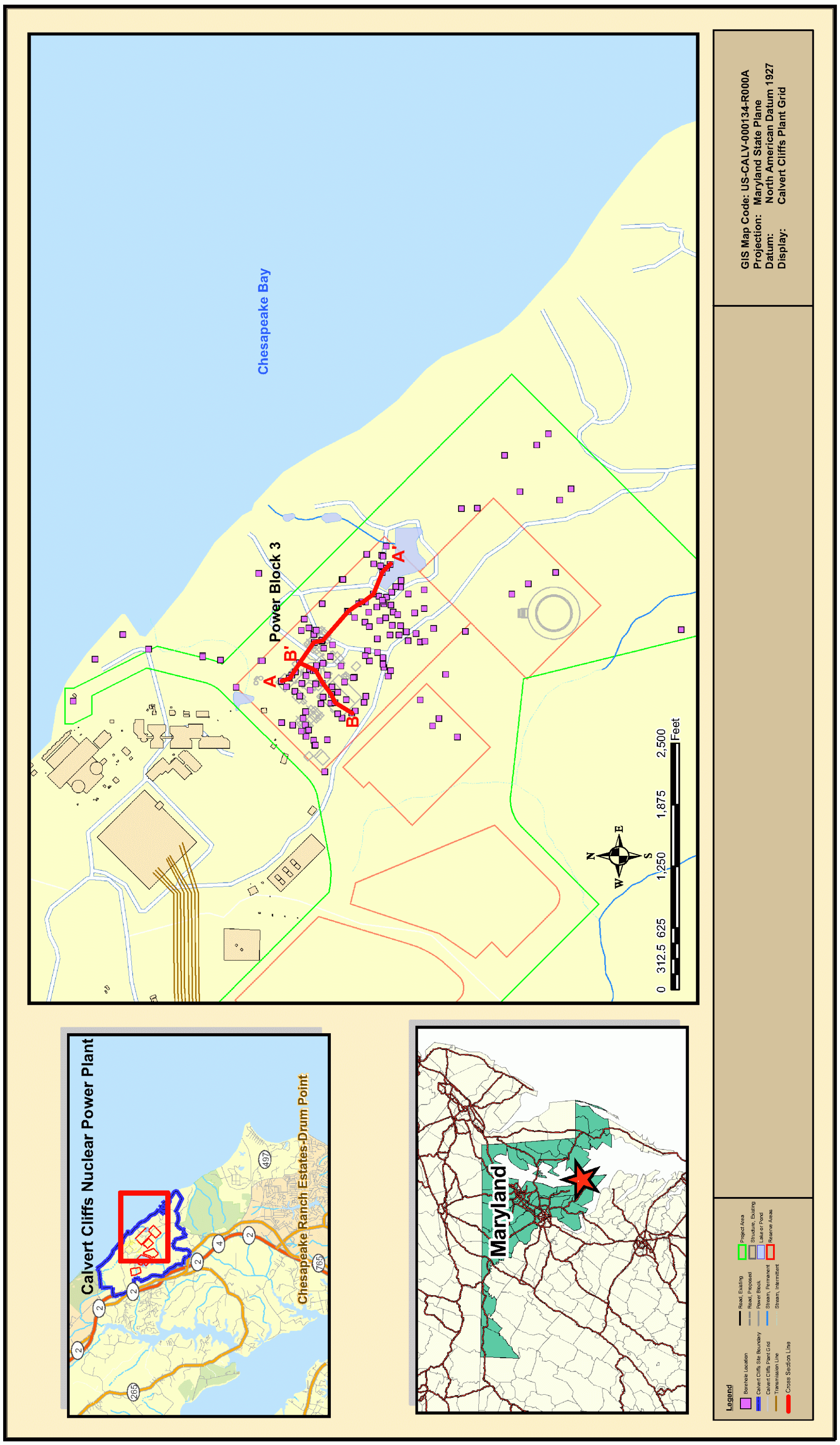


Figure 2.3-37— Cross Section and Soil Boring Locations in the Vicinity of CCNPP Unit 3



See Figure 2.1-1 and Figure 3.1-2 for Site and Powerblock layout

Figure 2.3-38— Cross Section A-A' through Proposed Unit 3 Power Block Area

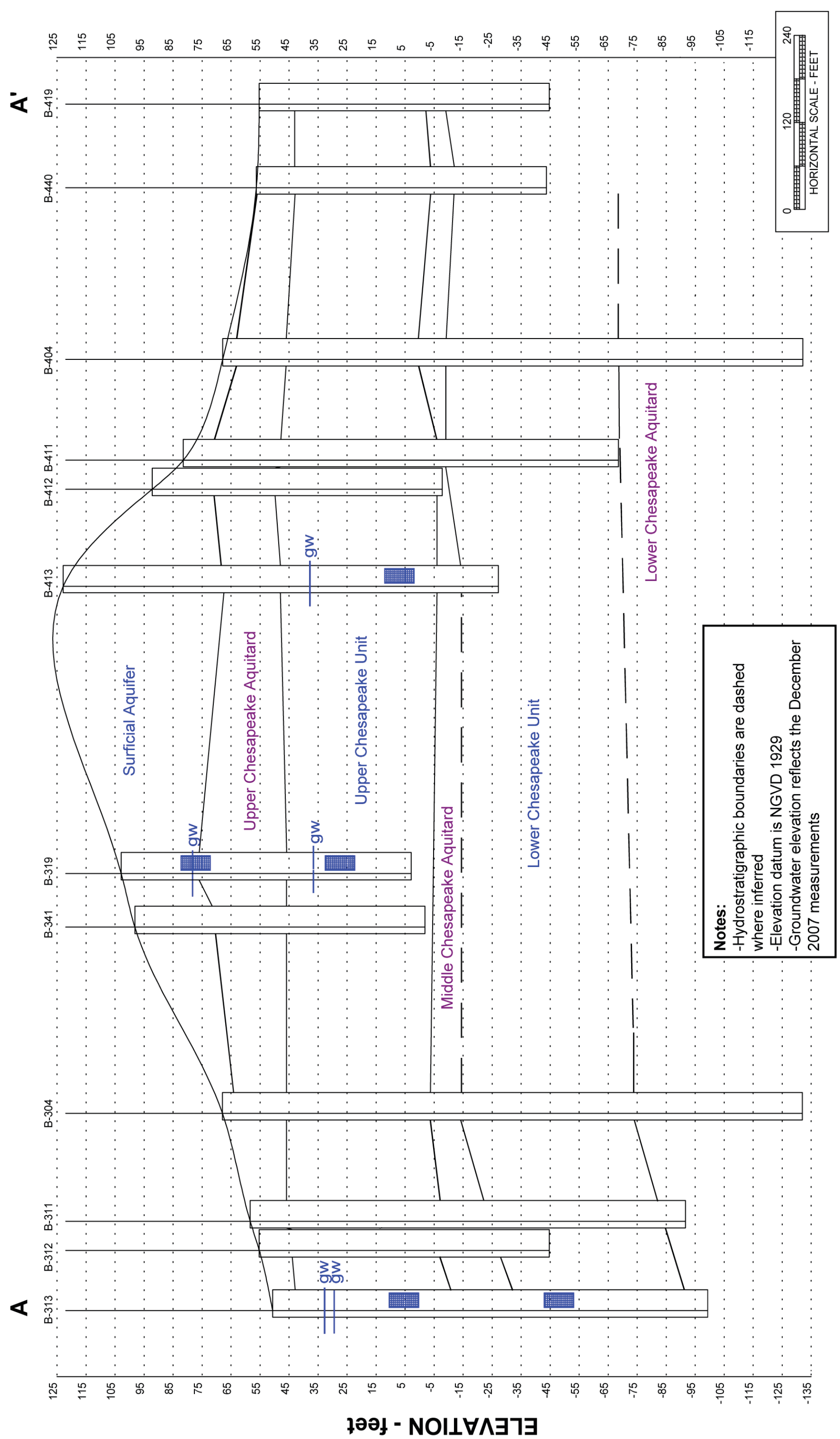


Figure 2.3-39— Cross Section B-B′ through Proposed Unit 3 Power Block Area

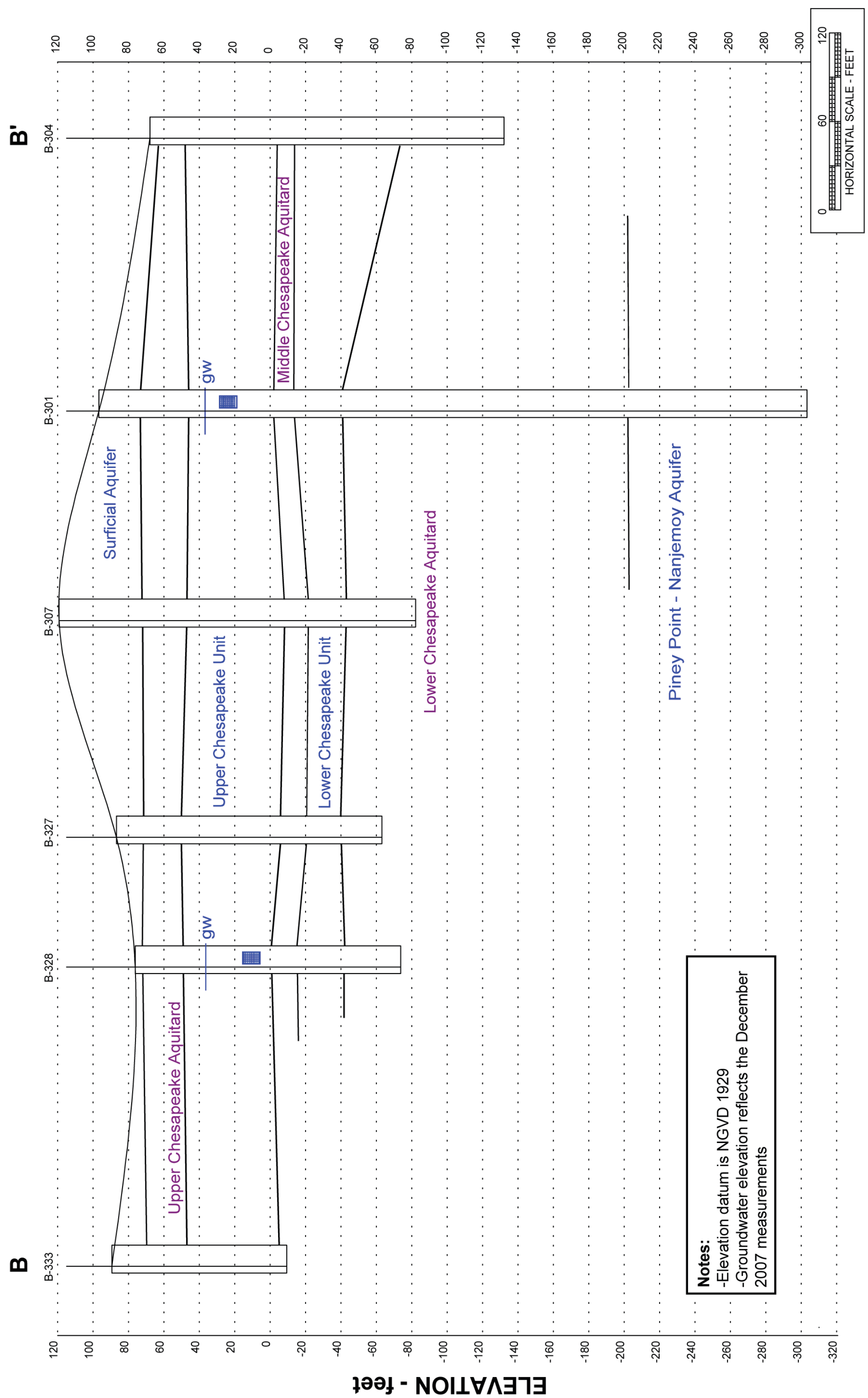
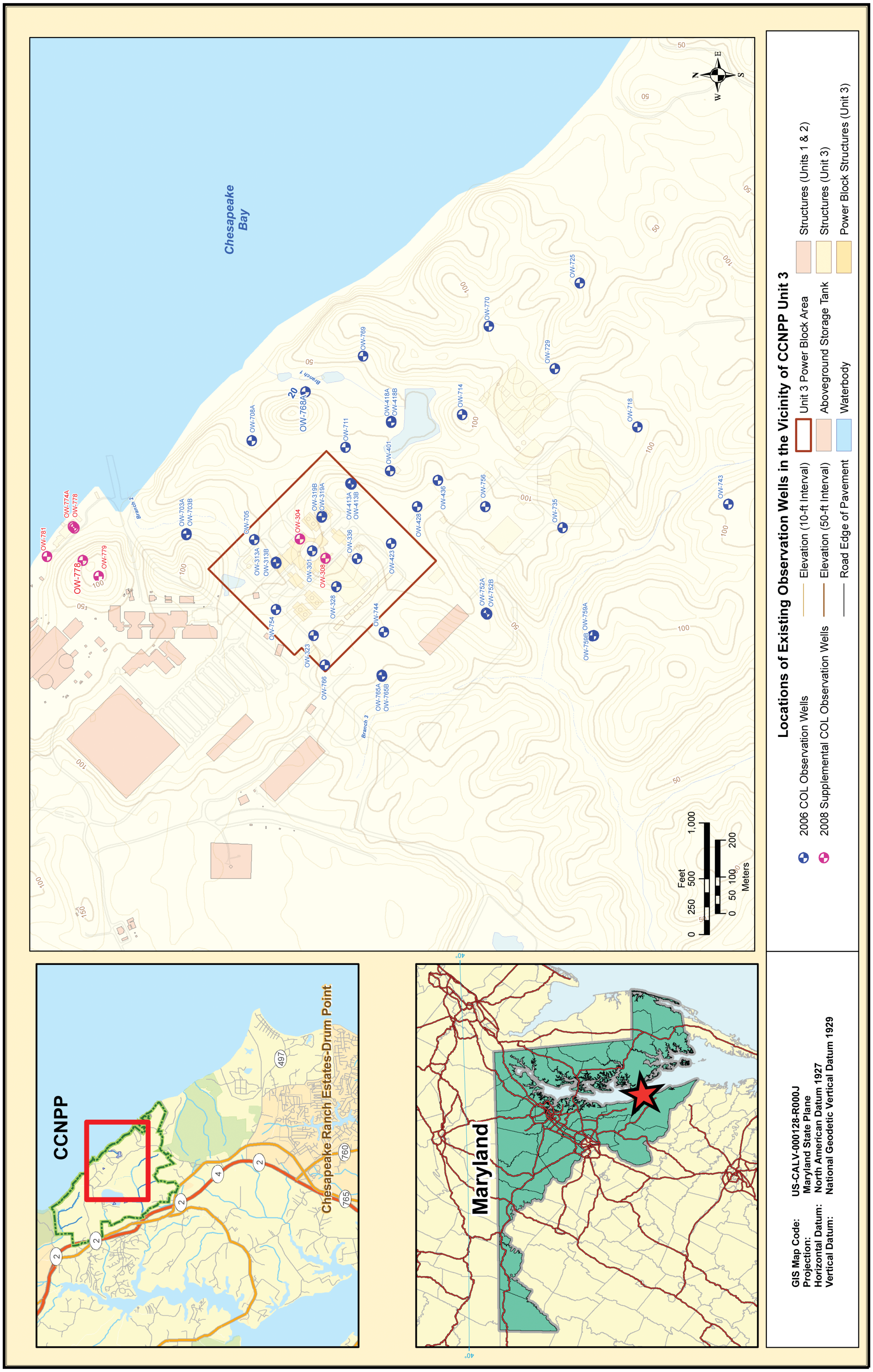


Figure 2.3-40— Groundwater Observation Wells in the Vicinity of CCNPP Unit 3



See Figure 2.1-1 and Figure 3.1-2 for Site and Powerblock layout

Figure 2.3-41— Groundwater Elevations for the Surficial Aquifer, July 2006 through October 2009

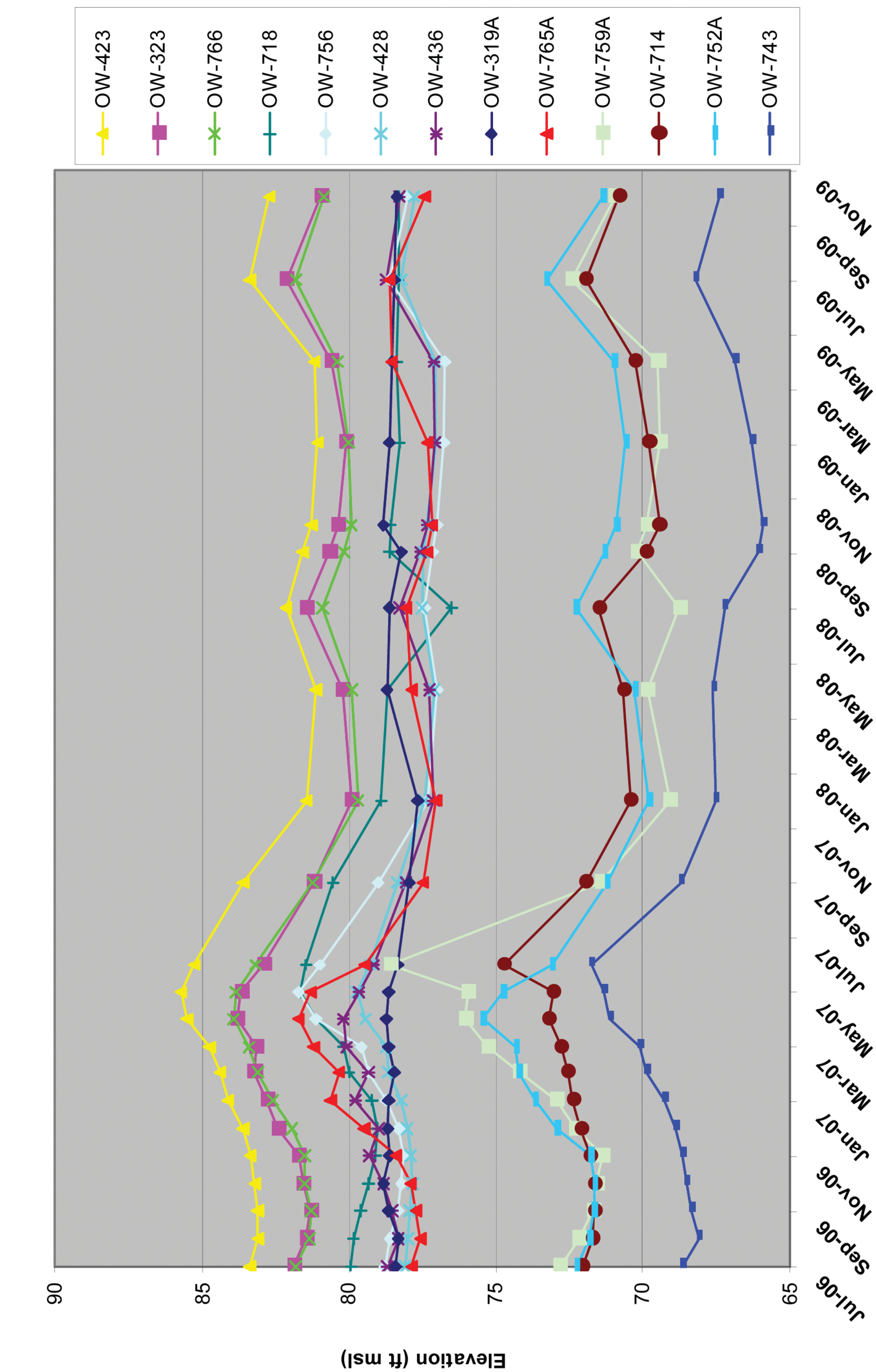
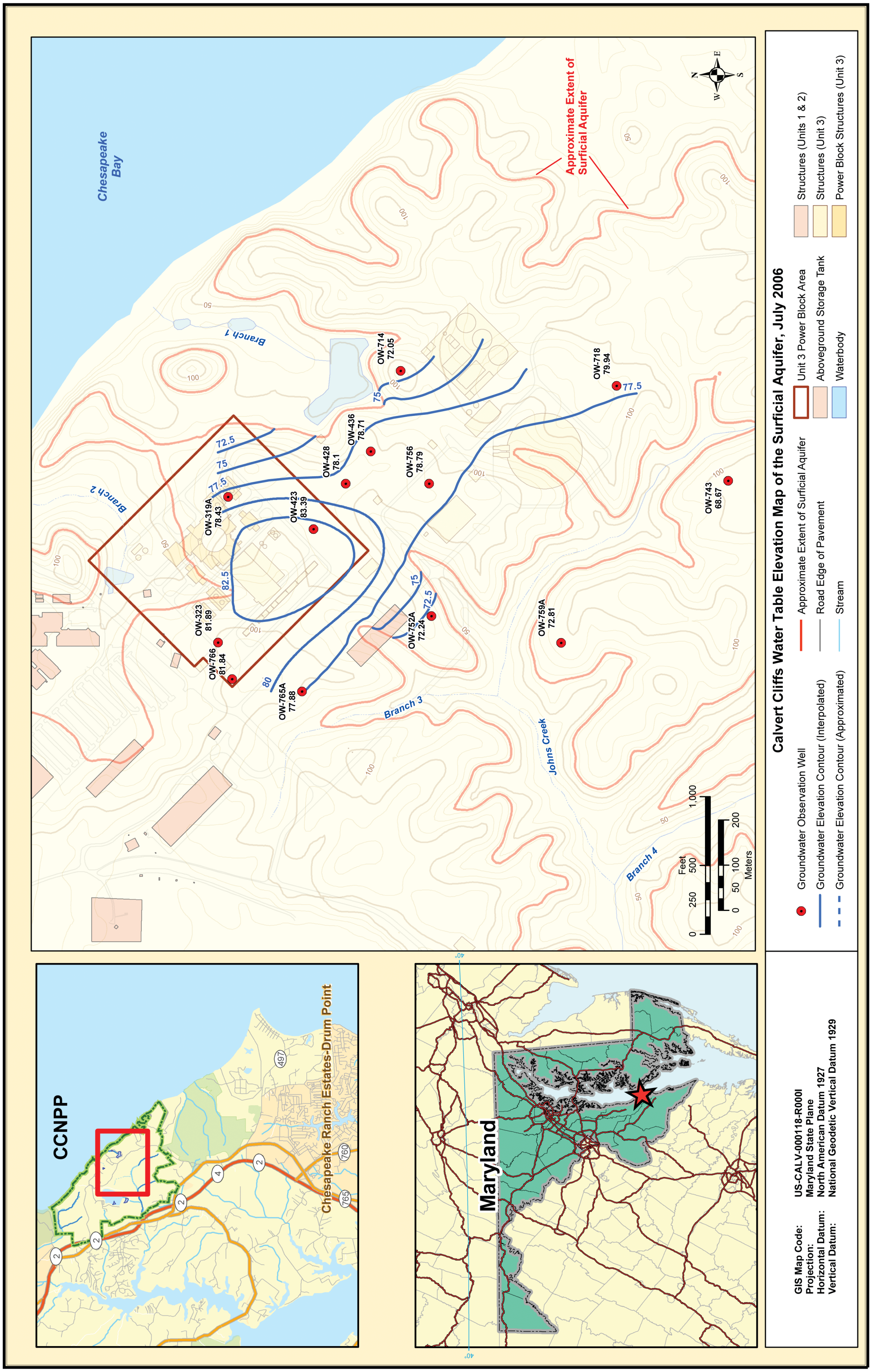
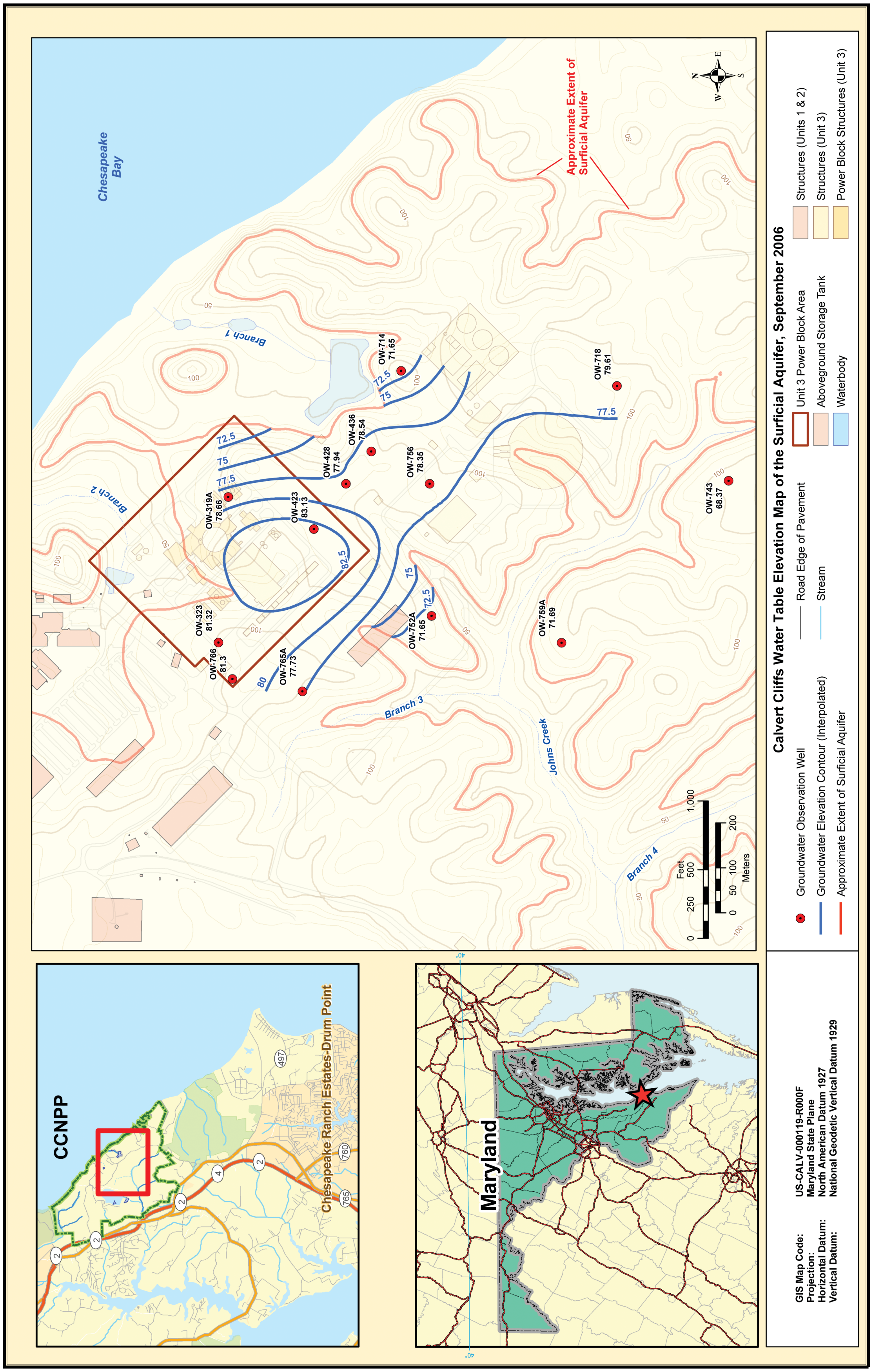


Figure 2.3-42— Water Table Elevation Map and Groundwater Flow Direction for the Surficial Aquifer, July 2006



See Figure 2.1-1 and Figure 3.1-2 for Site and Powerblock layout

Figure 2.3-43— Water Table Elevation Map and Groundwater Flow Direction for the Surficial Aquifer, September 2006



See Figure 2.1-1 and Figure 3.1-2 for Site and Powerblock layout