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ENVIRONMENTAL ASSESSMENT REPORT AND FINDINGS POINT PLEASANT WATER SUPPLY PROJECT

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF
ENVIRONMENTAL RESOURCES

Commonwealth of Pennsylvania
Department of Environmental Resources

ENVIRONMENTAL ASSESSMENT
REPORT AND FINDINGS
POINT PLEASANT WATER SUPPLY PROJECT

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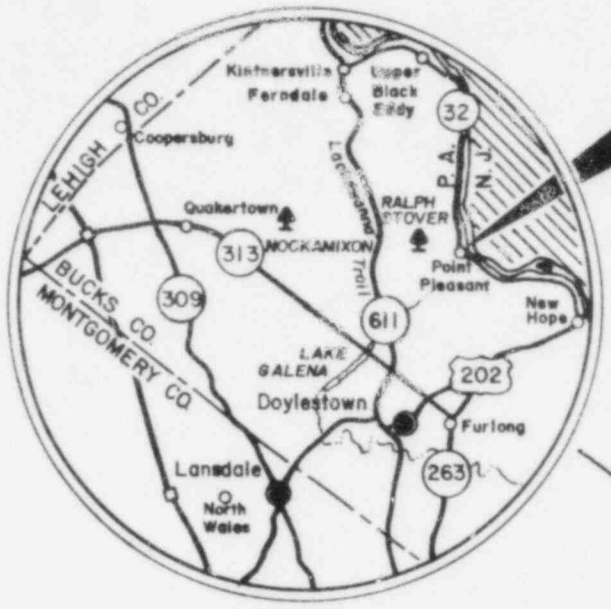

PROJECT

LOCATION MAP

Scale : 1 in. = 9 mi

NEW JERSEY

PERKIOMEN TRANSMISSION MAIN

BRADSHAW RESERVOIR AND PUMP STATION

POINT PLEASANT PUMP STATION

COMBINED TRANSMISSION MAIN

NORTH BRANCH TRANSMISSION MAIN

Perkiomen Creek

E. Br.

Delaware River

LAKE GALENA

N. Br. Neshaminy Creek

Pine Run

PENNSYLVANIA

Doylestown

NORTH BRANCH WATER TREATMENT PLANT

PHILADELPHIA ELECTRIC CO. TRANSMISSION MAIN

Pottstown

PHILADELPHIA ELECTRIC CO. PUMPING STATION

LIMERICK NUCLEAR GENERATING STATION

Schuylkill River

Perkiomen Creek

Neshaminy Creek

BUCKS COUNTY

MONTGOMERY COUNTY

N

4 3 2 1 0 4 8mi.

scale in miles

Introduction

This report has been prepared to review in a comprehensive fashion the environmental and resource management aspects of the Point Pleasant Project. The report constitutes an environmental assessment of the project and related facilities.

The Department of Environmental Resources currently has pending before it a series of applications, filed by the Neshaminy Water Resources Authority (NWRA) and the Philadelphia Electric Company (PECO), for permits to authorize the construction and operation of facilities to transfer water from the Delaware River near Point Pleasant, Bucks County, Pennsylvania to the North Branch Neshaminy Creek and East Branch Perkiomen Creek, to serve public water supply and electric generating cooling water purposes. Pending actions include (1) permit applications pursuant to the Pennsylvania Dam Safety and Encroachments Act; (2) a request for license to occupy State lands in the bed of the Delaware River, for the purpose of installing intake facilities; (3) a request for water quality certification of the project pursuant to Section 401 of the Federal Clean Water Act; and (4) requests for leases or licenses to install facilities through the State lands of the Roosevelt State Park and under the Delaware Division of the Pennsylvania Canal, and to obtain construction and maintenance access through the Park to lands owned by the NWRA. This report is intended to serve as a primary decision document for each of these applications, guiding the actions of all involved bureaus.

This review has been undertaken by the Department in view of its regulatory responsibilities relating to the project, and its proprietary and trustee responsibilities for managing the public navigable waters of the Delaware River Basin and Commonwealth lands of the Roosevelt State Park.

In considering the pending applications, the Commonwealth and Department are fundamentally governed by the responsibilities and obligations imposed by the Pennsylvania Constitution. Article 1, Section 27 of the Constitution states:

> "The people have a right to clean air, public water, and to the preservation of the natural, scenic, historic, and esthetic values of the environment. Pennsylvania's public natural resources are the common property of all the people, including generations yet to come. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people."

The courts of this State have found these Constitutional provisions to be self-executing,[1] imposing duties shared by all State and local agencies in the conduct of their official duties.[2] In applying Article 1, Section 27, the courts have enunciated a basic threefold standard for testing compliance with the Constitution:[3]

> "(1) Was there compliance with all applicable statutes and regulations relevant to the protection of the Commonwealth's public natural resources? (2) Does the record demonstrate a reasonable effort to reduce the environmental incursion to a minimum? (3) Does the environmental harm which will result from the challenged decision or action so clearly outweigh the benefits to be derived therefrom that to proceed further would be an abuse of discretion?"

In this context, the three part Payne v. Kassab test requires the Department to conduct a careful review of the pending applications.

Specific guidance for this review is provided by the Department's Dam Safety and Waterway Management regulations, 25 Pa. Code Sections 105.14 - 105.16. In conducting this environmental assessment pursuant to the provisions of Chapter 105, the Department must not only ascertain compliance with relevant statutes and regulations, but also assure that any adverse effects associated with the project are reduced to a minimum and mitigated to the maximum extent possible. Further, if after consideration of mitigation measures, the Department finds that significant environmental harm will occur, the Department must evaluate the public social and economic benefits of the project to determine whether the harm outweighs the benefits.[4]

In conducting this assessment, in order to reach a reasonable and responsive decision, the Department will consider the following primary issues:

(1) Need for the Project
(2) Impacts on Delaware River
(3) Impacts on North Branch Neshaminy Creek
(4) Impacts on East Branch Perkiomen Creek
(5) Impacts on Delaware Canal
(6) Water Quality Concerns

(7) Blasting Impact

(8) Archaeological/Historical Impacts

(9) Land Use Impacts

(10) Wetlands Impacts

(11) Alternatives to the Proposed Project

1. Project Description - General

The proposed Point Pleasant Project is an integral component of the Neshaminy Water Supply System that is being implemented by the Neshaminy Water Resources Authority of Bucks County. This system would divert water from the Delaware River mainstem at Point Pleasant to (1) supplement public water supplies in Bucks and Montgomery Counties, and (2) provide water, when needed, to the Limerick Nuclear Generating Station in Montgomery County.

The Point Pleasant Pump Station would have an ultimate capacity to divert 95 million gallons per day (mgd) and lift the water via a transmission main some 2.4 miles to the proposed Bradshaw Reservoir. The Bradshaw Reservoir would serve as a holding and control structure. This first segment, from the Point Pleasant Pump Station to the Bradshaw Reservoir and Pump Station, would serve as a joint facility for Philadelphia Electric Company (PECO) and Neshaminy Water Resources Authority (NWRA). It would be developed and operated by the NWRA on behalf of both project sponsors.

In the second segment, the water diverted from Bradshaw Reservoir to the Neshaminy Water Resources Authority water supply system would be released into a transmission main approximately one mile long to the North Branch Neshaminy Creek, and then flow by gravity into and through Lake Galena to the North Branch water treatment plant located in Chalfont, Pennsylvania. After appropriate treatment to meet Federal and State drinking water standards, finished water would be distributed through several transmission mains to serve retail public water supply systems in Bucks and Montgomery Counties serving over 50 municipalities. These transmission facilities would be constructed and operated by NWRA.

The maximum amount of water to be pumped from the Delaware River at Point Pleasant through Bradshaw Reservoir in the year 2010 for public water supply would be 49 mgd. Forty mgd ultimately would be picked up at the Chalfont Water Treatment Plant. Approximately 4 mgd would constitute evaporative and seepage losses, and 5 mgd would serve as stream flow augmentation in the Neshaminy Creek to enhance fish and wildlife, in accordance with release schedules requested by the Pennsylvania Fish Commission and imposed as conditions in the Water Allocation Permit No. WA-0978601 previously issued for the project by the Department of Environmental Resources.

The Chalfont Treatment Plant would be built in two phases. The first, with 20 mgd capacity, would serve immediate water supply needs. A second phase of 20 mgd would be added between 1990 and 2000, as projected demand requires.

In the third segment, a maximum of 46 mgd would be pumped from the Bradshaw Reservoir via a transmission main some 6.7 miles to the East Branch Perkiomen Creek. Water released to the upper reaches of the East Branch Perkiomen Creek would flow by gravity in the stream channel to a diversion point near Graterford on the Perkiomen Creek, and hence via a transmission main to the Limerick Nuclear Generating Station. This segment, including Bradshaw Reservoir, transfer facilities to Perkiomen Creek, and pumping facilities from Perkiomen Creek to Limerick, would be developed and operated by the Philadelphia Electric Company.

A. Point Pleasant Pump Station

The project site is located on the west bank of the Delaware River at a point near the southern limits of the Village of Point Pleasant in Plumstead Township, Bucks County, Pennsylvania. As noted in material[5] supplied by E.H. Bourquard Associates, Inc., and in the plans associated with Application No. 09-81, the station will be approximately 80 feet long by 45 feet wide above finished grade and is to be a reinforced concrete structure with architectural features such that the structure will resemble a barn. The station will house pumps having a total capacity of 95 mgd (147 cfs), together with related heating and ventilating, electrical, and instrumentation and control facilities.

The intake for the pump station is to consist of an assembly of wedge wire screens which will be located at a point approximately 245 feet streamward of the bank and which will have an approximate minimum submergence of 4 feet during low flow stages in the river. A total of twenty-four (24) screens will be installed in three groups of eight screers each. The screens will be 40 inches in diameter and maximum flow velocities through the screen slots will be approximately 0.5 feet per second. The screens will be cleaned by both hydraulic and air wash systems.

Each group of screens is to be connected by a 42 inch diameter reinforced concrete pipe to a gate well to be located along the shore line. From the gate well, a 72-inch diameter reinforced concrete pipe will pass under the Delaware Canal (Roosevelt State Park) carrying water from the well to the pump station.

B. Combined Transmission Main

The combined transmission main will deliver flow from the pump station to Bradshaw Reservoir and will extend through a reach of approximately 2.4 miles. Based on the use of reinforced concrete pipe, the first 1600 feet of main that will traverse the steep river valley slopes will be 66 inches in diameter with the remainder being a 60 inch diameter pipe.

C. Bradshaw Reservoir

The Bradshaw Reservoir (Application No. D09-181) will serve as the point of discharge for the water pumped through the combined transmission main. The reservoir will be structured on the drainage divide between the North Branch Neshaminy Creek and the South Branch Geddes Run. The embankment will consist of compacted earthen dikes formed from material excavated at the site. These dikes will vary in height from 5 feet to 23 feet and will form a square reservoir about 900 feet on a side. Operating capacity of the reservoir will be approximately 70 million gallons (215 acre-feet). The reservoir will have no drainage area feeding it except for the actual water surface of 18.8 acres.

D. North Branch Transmission Main

The North Branch Transmission Main will deliver a maximum of 49 mgd by gravity flow from Bradshaw Reservoir to the upper reaches of the North Branch Neshaminy Creek from which point the flow will be via the stream to Lake Galena and then on to the North Branch treatment plant. The main is to be a 42 inch diameter pipe based on the use of reinforced concrete pipe and will be approximately one mile in length. At the point of discharge on the North Branch, an energy dissipator and riprapped channel are to be installed to reduce flow velocities and guard against erosion as the flow is discharged into the stream. The maximum flow added to the channel will be 49 mgd or 76 cfs.

E. Perkiomen Transmission Main

The Perkiomen Transmission Main which connects Bradshaw Reservoir with the East Branch Perkiomen Creek will convey water via a 42 inch diameter pipe a distance of approximately 6.7 miles along an existing gas pipeline right-of-way to the upper reaches of the East Branch Perkiomen Creek. At the point of discharge, an energy dissipator would be constructed to reduce erosion of the stream bed and stream banks. A small connecting spur

channel dug perpendicular to the stream channel is also included in the energy dissipator design. The water would travel 22.2 stream miles via open channel conveyance to be picked up via withdrawal facilities located near Graterford, Pennsylvania, for eventual use at the Limerick Nuclear Generating Plant.

F. Operating Plan

This assessment is based on plans of operation for the various elements of the Point Pleasant project as outlined in the applications and in conditions imposed on project operations by regulatory decisions and permits issued by the Delaware River Basin Commission, the Department and the Army Corps of Engineers.[6]

Public Water Supply Operations

Public water supply withdrawals for the Neshaminy Water Supply System involve a sequence of diversions from a series of sources. The withdrawal plan approved by the Department as part of the Water Allocation Permit No. WA-0978601 involves the following order of operations, as needed, to serve public water supply demands in the service area:

(1) Withdrawals from the natural flows of Pine Run, up to 10 mgd (subject to minimum flow requirements in the North Branch Neshaminy Creek below the Chalfont Treatment Plant, described below).

(2) Withdrawals from the natural flows of the North Branch Neshaminy Creek, up to 15 mgd (subject to minimum flow requirements in the North Branch Neshaminy Creek below the Chalfont Treatment Plant, described below).

(3) Withdrawals from releases to the North Branch Neshaminy Creek from storage in Lake Galina (subject to the Lake Galena operating plan, described below).

(4) Withdrawals from the Delaware River up to 49.8 mgd (subject to conditions imposed in DRBC Docket No. D-65-76 CP (8)).

The total withdrawal at Chalfont, from natural or augmented flows, may not exceed 40 mgd. These withdrawals are conditioned upon maintaining a continuous minimum flow in the North Branch Neshaminy Creek below the Chalfont Treatment Plant of 5.3 mgd from March 1 to June 15 of each year, and 2.73 mgd from June 16 through February.

Cooling Water Operations

Withdrawals to serve consumptive cooling water requirements at the Limerick Nuclear Generating Station similarly involve a sequence of diversions. The average rates of consumptive use for cooling are 17.5 mgd for one power plant unit operating, and 35 mgd for two units. Maximum consumptive use rates are 21.3 mgd for one unit operating, and 42 mgd for two units.

Depending on actual cooling water demand at Limerick (based on electric generating demand and several technical factors), withdrawals will be made in the following order:

(1) Withdrawals from the Schuylkill River, (subject to conditions described below);

(2) Withdrawals from the natural flow of the Perkiomen Creek at Graterford (subject to conditions described below);

(3) Withdrawals from the Delaware River (subject to conditions described below).

Each of these withdrawals is subject to limitations designed to protect water quality, in-stream and downstream uses. Withdrawals from the Schuylkill River are limited by the following conditions: (i) flows (not including flow augmentations from DRBC-sponsored projects) measured at the Pottstown gage must exceed 342 mgd (530 cfs) with one power plant unit in operation and 362 mgd (560 cfs) with two units in operation; and (ii) no withdrawals may be made when water temperatures in the Schuylkill below Limerick exceed $15^{o}C$, except during April, May and June when the flow measured at the Pottstown gage is in excess of 1158 mgd (1791 cfs).

Natural flows of the Perkiomen Creek may be used for cooling water only when creek flows measured at the Graterford gage exceed 116 mgd (180 cfs) with one unit in operation and 136 mgd (210 cfs) with two units in operation. This condition assures that natural flows

below Graterford will not be reduced by withdrawals when flows fall below the long-term median flow of 97 mgd (150 cfs).

Conditions imposed by DRBC further require that a minimum flow of 27 cfs (17.4 mgd) be maintained in the East Branch Perkiomen Creek at a gage to be located at Bucks Road throughout the normal low flow period, beginning with the day each year that water is pumped from Bradshaw Reservoir to the East Branch and ending when pumping is no longer required for operation of the Limerick plant. For the remainder of the year, a minimum flow of 10 cfs (6.5 mgd) must be maintained in the East Branch.

Diversions from the Delaware River for cooling water purposes are prohibited when such withdrawals would reduce river flow measured at the Trenton gage below 3000 cfs (1940 mgd). When River flows fall below 3000 cfs at Trenton, cooling water diversions from the Delaware must be curtailed, or compensated by releases made from upstream storage for such purposes.

Lake Galena Operations

Lake Galena is a multiple purpose facility, serving water supply, flood control and recreation purposes. The operational plan for this facility was previously developed and approved at the time Lake Galena was designed and constructed. In so far as Lake Galena operations affect the operations of the Neshaminy Water Supply System, the following operating parameters and procedures apply.

Lake Galena is and will be operated to achieve and sustain a recreation pool at elevation 321.7 feet MSL throughout the recreation season, between Memorial Day and Labor Day. This recreation pool will be maintained, with minor fluctuations between elevations 320.7 and 321.7 feet through the recreation season. The zone of one foot at pool elevation 320.7-321.7 feet MSL involves approximately 60 million gallons of storage, which may be utilized to control reservoir inflow and releases for water supply and conservation purposes without affecting recreation uses.

During the recreation season, releases from the Lake to meet conservation release requirements and water supply needs, if not fully replaced by inflow to the Lake from natural flows of the North Branch Neshaminy Creek, will be made up by diversions of water from the Delaware River.

Following the conclusion of the recreation season, starting at pool elevation 321.7 feet MSL, Lake levels will be reduced by conservation releases and releases for water supply needs, on an "as needed" basis, drawing Lake levels down no further than the conservation pool elevation of 302.0 feet MSL. The total storage between the recreation and conservation pool elevations is 1.63 billion gallons. Because of this volume of storage, annual drawdowns during most years are not expected to lower storage to the conservation pool level.

Releases will be made, in any event, to drawdown Lake Galena by at least 10 feet below the recreation pool elevation (e.g., to elevation 311.7 feet MSL or below) each year, and to sustain such lower elevation through one or more freezing periods, as a means of retarding the growth of algae in the Lake.

Refilling of Lake Galena will commence in the period of mid-December through January (following the freeze periods described above). Refilling will rely to the maximum extent possible on natural inflows to the Lake from the North Branch. At each point through the winter-spring refilling process, natural inflows will be monitored and evaluated. If natural inflows are projected to be inadequate to reach the recreation pool elevation of 321.7 feet MSL by the start of the recreation season, natural flows of the North Branch Neshaminy will be supplemented by pumping from the Delaware River. If such supplemental withdrawals are required to refill Lake Galena, they will be projected as far in advance as possible and spread over the maximum number of days, in order to reduce the amount of the required daily withdrawal from the Delaware and minimize flow variations in the North Branch Neshaminy Creek above the Lake. (Consistent with condition(s) of DRBC Docket D-65-76 CP(8), NWRA as operator of Lake Galena will submit to DLR for review and approval a proposed initial protocol and plan for projecting inflow/refill requirements, to be refined on the basis of the first five years of experience with the system.)

Pennsylvania Dam Safety and Encroachments Permit No. 9-169 previously issued for Lake Galena requires a minimum conservation release of 1.5 mgd from the dam, or equal to the inflow to the Lake if less than 1.5 mgd. The conservation release is made by a fixed orifice set in the dam, providing an essentially uncontrolled release of 1.5 mgd at all times.

Bradshaw Reservoir Operations

Bradshaw Reservoir is designed to be operated essentially as a control structure, within the system, controlling the release and distribution of water diverted from the Delaware into the Perkiomen and Neshaminy watersheds. Of the reservoir's total operating capacity of 70 million gallons, 46 million gallons will be held in reserve for emergency storage (this storage is equivalent to one day's use or emergency shutdown requirements at Limerick). Six million gallons is assigned for silt buildup and counted as "dead storage". The remaining 18 million gallons, stored in the top three feet of the reservoir, will provide operating capacity.

Pumping rates at Point Pleasant will be triggered by storage elevation changes at Bradshaw. As releases are made to the North Branch Neshaminy for public water supply needs, or to the East Branch Perkiomen for cooling water requirements, elevations will lower in Bradshaw. As storage falls within the three foot operating range, 1, 2, 3 and 4 pumps at Point Pleasant will be triggered in sequence, and turned off in sequence as elevations in Bradshaw rise. This pattern moderates flow fluctuations in the Delaware River and provides more efficient utilization of the pumps. This type of sequenced operation is typical of water systems, and essentially the same as used by public water supplies which trigger well operations based on water levels in a storage tank.

Daily Operations

Unlike operating plans for large Federal multipurpose projects, or typical flood control projects (which follow operating curves in adjusting storage and release rates), the Point Pleasant operating plan is geared to daily operations and constant adjustments, based on the operating parameters and conditions described above. This form of operating plan is typical of water supply system operations. It is designed to make maximum efficient use of all sources, while conserving storage and flow and mitigating any potential environmental effects.

Operation of the Neshaminy Water Supply System, following the operating plan's parameters and conditions, will be conducted on a daily basis. There will be an instrumentation system connecting the Chalfont Treatment Plant with Lake Galena, Bradshaw Reservoir and Point Pleasant Pumping Station. Data will be immediately available to the Plant operators on flows from Lake Galena, the water level in Lake Galena,

flows from Bradshaw Reservoir, the water level in Bradshaw Reservoir and the operation of the pumps at Point Pleasant. Treatment Plant personnel will operate the control gates which release water from Lake Galena and from Bradshaw Reservoir. To eliminate any shock effect on North Branch aquatic biota, all releases will be started at a low rate and increased gradually to the scheduled rate, and any adjustments in daily releases will be done gradually.

The Plant production on a particular day will be scheduled on the prior day on the basis of the anticipated water needs of the service areas. As part of the procedure, natural flow takings from Pine Run and from the North Branch will be estimated on the basis of projected stream flows and climatic conditions, and any necessary releases from Lake Galena will be set up. If the estimates show that Delaware River water will be needed, this will also be scheduled.

During the day adjustments will be made in the release from Lake Galena to compensate for any change from anticipated water needs. The travel time for a release from Lake Galena to reach the Plant is about three hours. Releases from Bradshaw Reservoir take about five hours to reach Lake Galena.

Operations for cooling water will similarly be adjusted on a daily basis.

Delaware River Withdrawals

A computer program was developed to determine the amount of Delaware River water needed under the proposed operating plan. This program utilizes flow records of Neshaminy Creek at Langhorne, Pennsylvania to develop flows of Pine Run at the intake and of the North Branch into Lake Galena and at the intake. Account is then taken of Treatment Plant production, minimum flow releases at the intakes and from Lake Galena, water level elevation and water storage in Lake Galena, evaporation from Lake Galena and cooling water needs at Limerick, in order to determine the volume of water needed daily from the Delaware River. Three different sets of stream flow conditions were examined in this program: a wet year, an average year, and a dry year. The estimated monthly withdrawals, with average stream flow conditions, to provide for projected water needs of the years 1985, 1990, and 2000 are shown in Table 1, originally prepared by E. H. Bourquard Associates, Inc.

Table 1
PROJECTED DELAWARE RIVER WITHDRAWALS
(Average Stream Flow Year)

Month of Year	Water Supply Withdrawals in MG in: 1985	1990	2000	Cool. Water Withdrawal in MG	Total Withdrawals, MG from Delaware River 1985	1990	2000
January	0	0	0	220	220	220	220
February	0	0	0	199	199	199	199
March	0	0	10	220	220	220	230
April	0	30	90	213	213	243	303
May	101	205	370	220	321	425	590
June	203	400	740	1,205	1,408	1,605	1,945
July	289	470	685	1,265	1,554	1,735	1,950
August	277	455	670	1,258	1,535	1,713	1,928
September	0	0	0	1,178	1,178	1,178	1,178
October	0	0	25	1,149	1,149	1,149	1,174
November	0	0	30	213	213	213	243
December	0	0	20	220	220	220	240
Annual	870	1,560	2,640	7,560	8,430	9,120	10,200

NOTE: The above withdrawals provide for 5.3/2.73 mgd minimum flow releases in the North Branch and a 6.5 mgd minimum flow release in the East Branch, and include a 10% allowance for possible losses in transit.

The 10% allowance for possible losses in transit includes an allowance for channel storage, travel time, scheduling and evaporation. Because the natural streams being utilized during the pumping procedure are not uniform throughout the entire system, some of the "released" water will reach the water intake ahead of time and not be withdrawn; or some of the water will lag behind the withdrawal period and not be needed. In either case, the water is "lost" to the public water supply system and will become part of the stream flow downstream of the intake. Because of the expenses involved with pumping, the program will be refined once actual conditions have been observed to minimize these losses.

It should be noted that this program and the results itemized in Table No. 1 are a result of a simulated "typical" average stream flow year. If the entire Point Pleasant Project is approved, the program will be adjusted to reflect actual conditions - not simply typical ones.

The cooling water withdrawals shown in Table 1 are from an Environmental Report Operating License, prepared by Philadelphia Electric Company (PECO) for the Limerick Station. Again, these are estimated withdrawals based on weekly mean flows of (1) daily Perkiomen Creek flows at Graterford, (2) daily Schuylkill River flows and temperatures at Pottstown, and (3) hourly meterology from the LCS tower at the Station, during the period 1974-1977.

Emergency Operations

During drought and other water supply emergencies, withdrawals and operations for both public water supply and cooling water purposes are subject to modification or suspension, as directed by the Delaware River Basin Commission pursuant to Article 10 of the Delaware Compact, or by the Pennsylvania Department of Environmental Resources and Pennsylvania Emergency Management Agency pursuant to state statute.

2. History of Actions; Prior Reviews and Approvals

The Point Pleasant project has been the subject of numerous reviews, studies, and assessments over a period of nearly two decades.

DER and DRBC Reviews

The basic Point Pleasant-Neshaminy Water Supply Project resulted from the 1966 Water Resources Study - Neshaminy Creek Basin, Pennsylvania (Pennsylvania Water Resources Bulletin No. 2), a joint report prepared by the Pennsylvania Department of Forests and Waters (now Department of Environmental Resources), the Soil Conservation Service of the U.S. Department of Agriculture, and Bucks and Montgomery Counties.

The fundamental watershed project for Neshaminy Creek was approved by the Delaware River Basin Commission and added to the Delaware River Basin Comprehensive Plan on October 26, 1966, in Neshaminy Creek Watershed Project, Bucks and Montgomery

Counties, Pa. DRBC Docket No. D-65-76 CP. This decision was supplemented by Bucks and Montgomery County Commissioners, Neshaminy Creek Watershed Project, Bucks and Montgomery Counties, Pa., DRBC Docket No. D-65-76 CP(2) (January 25, 1967). The supplemental docket added the entire multipurpose project as described in the 1966 Water Resources Study to the DRBC Comprehensive Plan.

In 1970, Bucks County prepared and submitted the Feasibility Study of Delaware River Pumping Facilities at Point Pleasant, Pennsylvania, which assessed the proposed design of the Point Pleasant diversion facilities to provide public water supply in Bucks and Montgomery Counties, together with water quality augmentation for the Neshaminy Creek.

The Pennsylvania Water and Power Resources Board, on December 8, 1970, issued to Bucks County Water Allocation Permit No. WA-649, authorizing the withdrawal of Delaware River water for public water supply in the following amounts:

	To 1980	To 1990	To 1995
Average withdrawal, mgd	5	15	35
Maximum withdrawal, mgd	35	60	75

The permit recognized that the county had plans to pump additional quantities of water from the Delaware River at Point Pleasant for water quality augmentation in the Neshaminy Creek watershed and for industrial water supply in Montgomery County via Perkiomen Creek.

On March 17, 1971, DRBC approved Commissioners of Bucks County, Point Pleasant Pumping Station, Bucks County, Pa., DRBC Docket No. D-65-76 CP(3). This docket added the proposed project to DRBC's Comprehensive Plan, but deferred approval pursuant to Section 3.8 of the Compact until submission of final plans. The facilities included were a pumping station at Point Pleasant with the capacity and layout to handle all the required pumpage of the Delaware River water to the Neshaminy Basin, plus the proposed pumpage into the Perkiomen Creek Basin. A 66-inch transmission main, consisting of 14,000 feet of concrete pressure pipe and 5,300 feet of culvert pipe, would convey the total pumpage from the Point Pleasant Station to the terminus of this main, near Bradshaw Road, where the pumpage would be divided. The Neshaminy pumpage would flow by gravity through a 60-inch concrete culvert into the North Branch and on to Reservoir PA 617, Lake Galena. The Perkiomen pumpage would flow into a 35 mg open-storage reservoir, from where it

would be pumped by means of a 46 mgd capacity station through 30,300 feet of 42-inch concrete pressure pipe to the start of the Perkiomen watershed, from which point the water would flow by gravity in 6,300 feet of 36-inch concrete culvert pipe to the East Branch of Perkiomen Creek. As part of the 1971 docket review, DRBC prepared and processed an environmental statement for the project in accordance with the National Environmental Policy Act, entitled "Financial Statement - Environmental Impact of the Proposed Point Pleasant Diversion Plan, Bucks and Montgomery Counties, Pennsylvania".

In February 1973, DRBC prepared and submitted to the Council on Environmental Quality (CEQ) an expanded Final Environmental Impact Statement on the Point Pleasant Diversion Plan, Bucks and Montgomery Counties, Pennsylvania. The Final EIS concluded that the proposed project would be beneficial to the Neshaminy and Perkiomen watersheds and not detrimental to the Delaware River, provided that specific, listed mitigating measures were observed.

Meanwhile, due to the changes in growth patterns in Montgomery and Bucks Counties during the late sixties and continuing into the seventies, there was continued adjustment of the projected population to be served by the proposed public water supply facilities. The population projections and predicted supplementary surface water requirements of the Central Bucks County Service Area were updated in 1972, by a report entitled Master Plan for Water Supply - Bucks County, Pennsylvania - 1970. In 1975, further population projection adjustments were made resulting in amendments to the 1970 Master Plan for Water Supply. The adjustments were not of such magnitude to require change in the design capacities of the proposed plant. The final design of the plant started in 1975.

In early 1976, it was deemed necessary to review once again the projected population and resulting water needs. As a result, the final design of the treatment plant was halted to permit the completion of this review. During the period throughout 1976 and into early 1977, three additional studies of the Service Area were completed: The Central Bucks County Water Supply Study; the Water Supply Study for Montgomery County; and the Interim Projections Report for Bucks, Chester, Delaware, Montgomery, Philadelphia Counties, Pennsylvania. Based on these studies, the design capacity of the treatment plant was selected to remain at 20 mgd for the initial installation; however, the utlimate capacity was reduced from 80 to 40 mgd to meet the supplemental water needs of the service area.

In September of 1978, the Neshaminy Water Resources Authority filed with the Pennsylvania Department of Environmental Resources a water allocation permit application for the down-sized public water supply project. After an extensive evaluation, summarized in the Report on the Application of the Neshaminy Water Resources Authority for Water Allocation from Pine Run, North Branch Neshaminy Creek, and Delaware River, (November 1, 1978), ("DER Water Allocation Report"), the Department approved Water Allocation Permit No. WA-0978601, which superceded and replaced the permit No. WA-649 previously issued on December 8, 1970, by the Pennsylvania Water and Power Resources Board.

Concurrent with review of the basic Point Pleasant project and Neshaminy water supply system, a series of reviews were conducted regarding the Limerick Nuclear Generating Station.

In addition to providing treated water supply to Central Bucks and Montgomery Counties, the proposed Point Pleasant Project will withdraw Delaware River water for transfer via Perkiomen Creek to be used by the Philadelphia Electric Company (PECO) for cooling purposes at its Limerick Electric Generating Station located along the Schuylkill River near Pottstown, Pennsylvania.

DRBC Docket No. D-65-76 CP(3) (March 17, 1971) (referenced above), added the Perkiomen transfer element for Limerick to the overall Point Pleasant-Neshaminy project. As noted above, a Final Environmental Impact Statement on the Point Pleasant Diversion Plan, covering both the public water supply and Limerick transfers, was prepared by DRBC and filed with the Council on Environmental Quality in February 1973. The Final EIS of 1973, after considering various alternatives, concluded that a withdrawal from the Delaware River, subject to certain conditions, was necessary and proper to meet cooling water needs for the Limerick Station, and that such a withdrawal, if operated within the stated limitations, would not have a significant adverse effect on the environment.

The DRBC subsequently approved Philadelphia Electric Company, Limerick Nuclear Generating Station, Limerick Township, Montgomery County, Pennsylvania, DRBC Docket No. D-69-210 CP (March 29, 1973). This docket decision conditionally approved the water supply features of the project, subject to a specific list of conditions, particularly conditions relating to limits on diversions from the Schuylkill, Perkiomen and Delaware during low flow periods. One of the conditions for such withdrawal was that the DRBC, at its sole

discretion, would determine the adequacy of storage capacity in the basin necessary to provide sufficient water to meet PECO's consumptive water use at Limerick and to maintain a 3,000 cfs flow in the Delaware River at the Trenton gauge.

Approval of the water supply elements was based, at least in part, upon the previously approved Final EIS on the Point Pleasant Project. However, DRBC deferred a final decision on the Limerick Station per se until completion of a Final EIS by the Atomic Energy Commission (AEC) on the nuclear power plant and related facilities.

In November 1973, the U.S. Atomic Energy Commission's Directorate of Licensing completed the Final Environmental Statement related to the Proposed Limerick Generating Station, Units 1 and 2, Philadelphia Electric Company. Based on this EIS, the previous EIS prepared by DRBC, and the record compiled at hearings before the Atomic Safety and Licensing Board and the Appeal Board of the Nuclear Regulatory Commission (NRC), the NRC issued to Philadelphia Electric Company construction permits for the Limerick plant in March 1975. An extensive (96 pages) decision was rendered by the Atomic Safety and Licensing Appeal Board. See In the Matter of Philadelphia Electric Company (Limerick Generating Station, Units 1 and 2), Docket Nos. 50-352 and 50-353 (March 19, 1975). The decision addressed specifically numerous contentions made by intervenors in the AEC/NRC proceedings concerning the adequacy of the Final EIS prepared in 1973 by the Atomic Energy Commission.

The Atomic Safety and Licensing Appeal Board's decision, and NRC's issuance of construction permits for Limerick, were appealed to the Third Circuit Federal Court of Appeals by the project's opponents. The appellants challenged the adequacy of the environmental impact statements relied on by the NRC, both the EIS prepared by the Atomic Energy Commission and that prepared by DRBC in February 1973. In particular, appellants charged that the previous environmental impact statements had not properly assessed the impacts of water supply elements of the Limerick project, including the Point Pleasant diversion.

Based on the AEC's Final EIS and DRBC's own EIS of 1973, DRBC issued notice of intention to act upon Docket No. D-69-210 CP (Supplement No. 1) in July 1974. Proceedings to amend the Commission's earlier decision on the Limerick Station, however, were deferred while objections filed by the Environmental Coalition for Nuclear Power were heard by a hearing officer appointed by DRBC.

Following hearings and argument before the Commission, in November 1975, DRBC proceeded with final action on the docket concerning construction of Limerick and related water supply facilities. Philadelphia Electric Company, Limerick Nuclear Generating Station, Limerick Township, Montgomery County, Pennsylvania, DRBC Docket No. D-69-210 CP (Final) (November 5, 1975) included the Limerick project in the DRBC Comprehensive Plan. The docket further gave Compact Section 3.8 approval to construction of the Limerick Station, together with the Schuylkill River and Perkiomen Creek intake and diversion structures. The final docket imposed a series of conditions limiting the diversions and requiring specific measures to mitigate potential environmental impacts. Condition (c) required:

> "If . . . the storage will not be adequate for all protected needs of the Basin, the applicant will build or cause to be built, at its own expense, at a location approved by the Commission, a reservoir of sufficient storage capacity to assure the water supply needed for consumptive use by the Limerick plant, during periods when such use would reduce the flow in the Delaware River at the Trenton gage below 3,000 cfs. Storage and release of water in such facility will be under the Commission's regulation, at the expense of the applicant."

This DRBC docket decision was filed with the Third Circuit Court of Appeals prior to its decision on the then pending appeals of the Nuclear Regulatory Commission's action.

The Third Circuit's decision on the NRC appeals was rendered in Environmental Coalition of Nuclear Power, Limerick Ecology Action, and Delaware Valley Committee for Protection of the Environment v. Nuclear Regulatory Commisison and Philadelphia Electric Company, No. 75-1421 (November 12, 1975). The Court of Appeals rejected the challenges to the environmental impact statements and, in essence, found the previous environmental assessments prepared by DRBC and the NRC adequate to satisfy the purposes of NEPA. The Third Circuit's decision and order were not appealed to the U.S. Supreme Court.

A year later, on September 30, 1976, DRBC adopted Resolution No. 76-13, concerning provision of supplementary water supply storage for certain power projects, including both the Limerick and Hope Creek Nuclear Generating Stations. The Commission exercised its authority under conditions set forth in earlier DRBC approval of Docket Nos. D-69-210 CP (Limerick) and D-73-193 CP (Hope Creek), and ordered the involved utility companies "to

proceed to develop, or cause to be developed, an application under Section 3.8 of the Compact, supported by an environmental report in compliance with the Commission's rules and regulations, for the construction of the required supplement storage." The resolution further required that the application and accompanying environmental report be submitted by October 1, 1977.

The combined project once again came before DRBC in proceedings commencing in 1979, resulting in decisions rendered in early 1981. On January 27, 1979, PECO filed with DRBC application pursuant to Section 3.8 of the Compact for approval of the construction of its portions of the Point Pleasant pumping station, Bradshaw Reservoir, and transmission lines to the Perkiomen Creek. On July 5, 1979, NWRA filed application pursuant to Section 3.8 of the Compact for approval of constructon of its portions of the Point Pleasant pumping station, the water treatment plant at Chalfont and the various transmission lines. Both Section 3.8 applications were supported by detailed "environmental reports," prepared by the applicants as required by the then applicable DRBC regulations, 18 C.F.R. Sections 401.51 - 401.53 (1977).

DRBC had available to it three final environmental impact statements, together with all the supporting data, as of the time it received the present PECO and NWRA applications. They were: (1) "Point Pleasant Diversion Plan, Bucks and Montgomery Counties," submitted by DRBC in 1973; (2) "Limerick Generating Station, Units 1 and 2," submitted by the AEC in 1973; and (3) "Neshaminy Creek Watershed," submitted by U.S. Department of Agriculture, Soil Conservation Service in 1976. Each of these plans incorporated the concept of a withdrawal of a maximum of 150 mgd of water at Point Pleasant, a distribution of a maximum of 46 mgd to the Perkiomen Creek for use as additional cooling water at Limerick, and the balance of the water to flow into the headwaters of the Neshaminy watershed with a withdrawal of approximately an equal quantity of water at Chalfont for water treatment and distribution for public consumption in sections of Bucks and Montgomery Counties.

Pursuant to DRBC's regulations on processing Compact Section 3.8 applications, DRBC prepared an environmental assessment on the projects. The Executive Director of DRBC, on the basis of the environmental assessment, recommended a "negative declaration," based on his conclusion that the proposed projects would have no significant adverse impacts on the environment. Public notice of intent to issue a negative declaration and of the preparation

of the environmental assessment was given and a public hearing was held by DRBC on the Section 3.8 applications on November 18, 1980.

In August, 1980, DRBC prepared and published a "Final Environmental Assessment for the Neshaminy Water Supply System" project sponsored by NWRA and PECO. This document contained approximately 230 pages, with cross-references and references by incorporation to voluminous documents, studies, reports and comments by individuals and public and private organizations. On February 18, 1981, DRBC granted the Section 3.8 applications of both PECO and NWRA, subject to certain expressed conditions and limitations. The construction details of the project were added to the Comprehensive Plan to the extent that such details were contained in the applications and had not previously been approved and included in the prior actions of DRBC.

These actions by DRBC were the subject of appeals filed before the U.S. District Court, Eastern District of Pennsylvania, in the matter of Delaware Water Emergency Group, v. Gerald M. Hansler, 536 F. Supp. 26 (E.D.Pa., 1981) aff'd No. 81-2622 (3d Cir., March 19, 1982). The primary issue before the court was whether DRBC had fully and fairly considered the environmental impacts of the proposed project, with particular emphasis on impacts upon basin water resources.

In rendering its decision rejecting these challenges, the District Court concluded:

> "The record in this case makes four matters quite obvious. First, there have been at least three prior EIS's on the basic plan and concept, all of which were available and considered by DREC. With the Level B study, there have been at least four EIS's prepared. Second, the project has been under constant study and updating of factual information from the plan's inception to the present time and indeed is subject to ongoing studies. Third, the only substantial change from heretofore approved plans based on prior environmental impact statements and other studies, is a substantial reduction in the quantity of water to be withdrawn for NWRA's water treatment plant. Fourth, the environmental assessment prepared is detailed, up-to-date and adequately considers any changed circumstances."

By Compact signed by the four Basin States and the Federal Government, DRBC was created as the primary and lead agency of the parties to plan, coordinate and manage the water resources of this basin. It is DRBC's responsibility, recognized by Federal law, to equitably apportion the waters of the basin among the States and their respective political subdivisions, and to adopt and implement policies for the development, conservation and management of those resources.

This project and its operating conditions were made a part of the basin's Comprehensive Plan by unanimous action taken repeatedly over the past decade, and most recently in February 1981. Under the terms of the Compact, especially Compact Article 11 and Section 15.1(s) of Public Law 87-328, all Federal and State agencies are bound to recognize and act in a manner consistent with those water management policies and actions.

U.S. Army Corps of Engineers Review

In December 1980, the Neshaminy Water Resources Authority applied to the U.S. Army Corps of Engineers for a permit to (1) construct a water intake structure in the Delaware River and under the Pennsylvania Canal at Point Pleasant (Application No. NAPOP-R-80-0534-3); and (2) to relocate the channel of Pine Run and reshape the channel of North Branch Neshaminy Creek at Chalfont Borough (Application No. NAPOP-R-80-0813-3). On April 6, 1981, the Corps issued a Public Notice that NWRA had applied for the above-mentioned permits. On August 10, 1981, the Corps issued a Notice of Public Hearing concerning NWRA's applications and scheduled the hearing for September 15, 1981. The hearing was held as scheduled. A supplement to the original Public Notice for the intake structure application indicating some revisions to the project was issued February 9, 1982.

Since the original submission, the Corps has been evaluating these proposals. As of this date, the Corps has not taken any final action on these applications.

The Corps has undertaken its own environmental assessment of the proposed project, and pursued consultation procedures required under the Fish and Wildlife Coordination Act, the Endangered Species Act, and the National Historic and Preservation Act to assess potential impacts on historical resources, fish and wildlife, and endangered species.

Effect of Prior Reviews and Studies

The Department of Environmental Resources has obtained and reviewed the studies, reports, hearing transcripts, decisions and other records compiled by the Delaware River Basin Commission, U.S. Army Corps of Engineers and other agencies. Such materials are included in the Department's record for review of the pending applications, and are incorporated in the Department's assessment and consideration of the factors required by the Department's regulations (25 Pa. Code Sections 105.14 - 105.16)

3. **Project Need**

A. Public Water Supply

Bucks and Montgomery Counties face together a regional water supply problem. For the past three decades, the people of this region have relied on increasingly intense development of groundwater to provide both public and private water supplies. The Department's and the Delaware River Basin Commission's studies in recent years document growing problems created by over-reliance on groundwater in the region. The Pennsylvania State Water Plan, Comprehensive Water Quality Management Plan (COWAMP/208), and DRBC Level B Study, as well as several recent water supply cases in Montgomery and Bucks Counties, strongly indicate that intensive public and private groundwater withdrawals in substantial portions of Bucks and Montgomery Counties have oversubscribed or threaten to oversubscribe the resource.

The most recent study of groundwater conditions in the region was completed in 1982.[7] This report, prepared by R. E. Wright Associates, Inc. as part of DRBC's comprehensive groundwater study, refines and confirms the assessments of withdrawal rates and densities, compared to recharge rates, for the Triassic aquifers serving the populated areas of Montgomery and Bucks Counties.

Current groundwater withdrawals, especially in the Triassic rock formations, exceed, or threaten soon to exceed, the recharge and safe yield of the groundwater basins upon which a majority of the population relies for supply. Calculations by DER and DRBC indicate that in the Brunswick, Lockatong, and Stockton formations of the Triassic Lowlands, the normal year recharge rates average some 300,000 - 600,000 gallons per day per square mile. However, the region cannot count on every year being "normal". Yet,

public and private water supplies must be capable of providing reliable service in all kinds of years.

As noted by R. E. Wright Associates, like annual precipitation, the annual groundwater recharge for a watershed varies from year to year. Using a "normal" year recharge rate as a withdrawal limit for groundwater-management purposes may leave open the possibility that, in a fully developed area, annual groundwater production would exceed annual recharge 50 percent of the time. This could lead to the long-term depletion of the resource, with resulting conflicts among its users. Groundwater may justifiably be more conservatively managed using a lower rate of annual recharge as a guideline for withdrawal.[8]

From a water supply perspective, this area must be especially concerned with dry year recharge rates, rather than normal rates, because of the relatively quick reaction of Triassic formation groundwater to low precipitation. In 1976, for example, a short period of low recharge resulted in substantial drops in groundwater levels, diminishing public water well yields by 30 to 40 percent, while leaving some homeowner wells high and dry.

If previous dry periods were not enough, the drought of 1980-81 clearly dramatized to the people of Bucks and Montgomery Counties the insecurity and vulnerability of their water supply systems.

Rainfall deficiencies began in February and March of 1980 in many areas of eastern Pennsylvania. Problems mounted steadily throughout the year and by February of 1981, 85 public water systems faced severe shortages. Under Emergency Proclamations and Executive Orders issued by the Governor, 44 systems serving over 120 municipalities adopted full rationing plans - mandating cuts in water use by 25 percent or more, and reducing residential allotments to a mere 40 gallons per person per day. Other water systems were forced to turn to emergency supplies, such as quarries, strip mine pits and overland lines from distant streams and lakes, to meet essential needs.

Bucks and Montgomery Counties were amoung the most severely effected. Eleven public water suppliers in the two county region were forced to impose restrictions on all non-essential water use. Several municipalities lost wells because of TCE contamination and others faced greatly reduced water levels in their wells.

Dry periods of varying degrees of severity are not an infrequent occurrence in eastern Pennsylvania, and in an area serviced only by a highly subscribed groundwater table the result can be debilitating. In the Triassic formations dry year annual recharge rates are much lower than average year rates. For typical watersheds in the Triassic formations, based on the water budget for the dry year 1966, R. E. Wright Associates calculated annual baseflow/groundwater recharge rates of 146,000 - 331,000 gpd/sq. mi.[9] The R. E. Wright Associates study, confirming the observations of prior reports, found that groundwater production rates exceed 100,000 gpd/sq. mi. throughout much of the Montgomery and Bucks County Area. The Wright study further found that the 1-year-in-10 annual recharge rates to the affected aquifers is exceeded by current groundwater withdrawals over a relatively large portion of Montgomery County, and is generally pervasive throughout the DRBC designated Groundwater Protected Areas.[10]

These withdrawals in excess of recharge result in lowered water tables and groundwater mining, leading to periodic water supply crises, interference with private homeowner wells, and depleted stream flows. Indeed, the imbalanced conditions of groundwater use and reliable supply have led DRBC to designate major portions of Bucks, Montgomery, and Chester Counties as a Groundwater Protected Area, 29 C.F.R., Part 430. Under the Southeastern Pennsylvania Groundwater Protected Area regulations all new or expanded groundwater withdrawals exceeding an average of 10,000 gpd in any 30 day period is subject to permit approval. More careful review is imposed on all applications, requiring detailed pump tests to assess potential impacts on other uses, stream flows and the environment. Conservation programs are required of all groundwater uses. Most important, no new or expanded withdrawals will be permitted by DRBC if, as the result, the total of all withdrawals in a groundwater basin or subbasin would exceed the "withdrawal limit" of the basin or subbasin, based on the recharge rates available during drought years.

The Department in its State Water Plan has recommended that the water suppliers in Bucks and Montgomery Counties that show an existing or projected yield deficit encourage and support water conservation programs among their customers. Even with water conservation, however, supplemental and replacement supplies of water are needed to serve current and future demand in the service area of the Neshaminy Water Supply System.

As part of its evaluation of NWRA's water allocation permit application, DER conducted a detailed review of the public water supply needs in the project area.[11] In that assessment, the Department found that projections by the State Water Plan, the Delaware

Valley Regional Planning Commission, and NWRA all agreed that there is a clear and pressing need for additional and supplemental water in the project area.

Presently, the planned service area of the Neshaminy Water Supply System is served by twenty or more public water systems which depend almost completely on wells as their source of water supply. Many people still depend on private wells. The result of the development of the area is a growing demand for more water just at the time when the existing wells are drying up or losing yield because of declining groundwater tables caused by overpumping, paving over recharge areas, and the installation of storm and sanitary sewers.

Within the proposed NWRA service area, the State Water Plan projects a drought period yield deficiency by 1990 of 27.5 mgd, which will have to be made up with supplemental water developed from ground or surface water sources. NWRA's projections of yield deficiencies, submitted as part of its water allocation permit request in 1978, are actually slightly lower, projecting a 1990 supplemental water need of 23.1 mgd. By the year 2010, NWRA projects a supplemental or replacement water need of 39.1 mgd. State Water Plan projections indicate this estimate may be conservative.

The Department concurs with the DRBC forecast of supplemental water needs for the Neshaminy Water Supply System, included as part of DRBC Docket No. D-65-76 CP(8) (Figure B). DER finds that the supplemental water needs for the NWRA service area, shown in Table 2, are reasonable in light of current information and plans. The Department reconfirms its conclusion, made as part of the approval of Water Allocation Permit No. WA-0978601, that the allocation of 40 mgd for public water supply needs, for withdrawal at the Chalfont Treatment Plant, is reasonably necessary to provide supplemental and replacement supplies adequate to serve present purposes and future needs in the NWRA service area.

Table 2

Forecast Supplemental Water Needs
Neshaminy Water Supply System

Service Area or Agency	Average Daily, mgd				Maximum Daily, mgd			
	1981	1990	2000	2010	1981	1990	2000	2010
Central Bucks County	2.7	4.9	5.9	7.3	2.7	7.3	8.9	10.9
Central Montgomery County	7.3	10.5	15.7	18.8	7.3	15.8	23.5	28.2
Minimum Flow Releases[1]	3.5	3.5	3.5	3.5	5.3	5.3	5.3	5.3
Water Supply Needs	13.5	18.9	25.1	29.6	15.3	28.4	37.7	44.4
Water Supply Withdrawal[2]	14.9	20.8	27.6	32.6	16.8	31.2	41.5	48.8

(1) Minimum release of 5.3 mgd shall be maintained from 3/1 to 6/15 and 2.73 mgd shall be maintained during the remainder of the year in the Neshaminy Creek.
(2) Includes 10% for water losses in transit.

The Department is convinced that the citizens of Montgomery and Bucks Counties cannot continue to rely almost exclusively on groundwater for private and public water supplies. A balanced use of surface and ground water sources (otherwise known as "conjunctive management") is necessary to protect all water users in the region. After some 15 years of study by the counties, the Department and the Delaware River Basin Commission, DER has concluded that the Neshaminy Water Supply System including the Point Pleasant Diversion-Chalfont Water Treatment Plant Project is the most viable solution to provide conjunctive management of ground and surface waters capable of serving the citizens of the region.

More detailed information on these needs can be found in the report prepared in conjunction with NWRA's Water Allocation Permit WA-0978601 and the State Water Plan reports for this portion of the State.

B. Electric Generating Needs

The second purpose of the Point Pleasant facilities is to supply water to Philadelphia Electric Company's Limerick Nuclear Generating Station via Perkiomen Creek.

First, it should be noted that while NWRA is constructing the Point Pleasant Pumping Station and transmission lines westward to the North Branch Neshaminy Creek (with contributions from Philadelphia Electric Company), the facilities to divert water to Perkiomen Creek for provision to Limerick are to be built and operated by Philadelphia

Electric Company (PECO), not NWRA. The construction and operation of the transmission facilities from the headwaters of the North Branch to Perkiomen Creek, including the storage and release of water at the Bradshaw Reservoir, are solely the responsibility of PECO.

The Delaware River Basin Commission has reviewed and approved the Limerick Project, including the diversion of water from the Delaware River to Point Pleasant and the transfer via Perkiomen Creek, as part of the Comprehensive Plan, in DRBC Docket Nos. D-69-210-CP (March 29, 1973) and D-69-210-CP (Final) (November 5, 1975). DRBC's docket decisions and accompanying environmental statements addressed the impacts of the proposed diversion both with and without the then pending Tocks Island Lake Project. Conditions were attached to the Point Pleasant diversion approval specifically designed to protect instream uses (fish, wildlife, and recreation) and downstream interests during critical low flow periods. Subsequent challenges to the Limerick Project and its environmental impacts were prosecuted by objectors before the Nuclear Regulatory Commission and the Courts. These appeals were ultimately rejected by the Federal Courts, and it is our understanding that the issues thus litigated are now, as a matter of law, settled.

It must be emphasized that the construction and operation of the Limerick Station is not contingent upon NWRA, Bucks County, or Montgomery County proceeding with the Neshaminy Water Supply System public water supply project. The prime water sources for Limerick are the Schuylkill River and natural flows of Perkiomen Creek, which would supply sufficient flows to allow Limerick withdrawals under the conditions imposed by DRBC at least 60% of the time (that is, in all but low flow periods). Even if the NWRA or the Counties fail to construct the public water supply portion of the Point Pleasant Project, the Philadelphia Electric Company holds a valid allocation from the Delaware, and could proceed to implement a Point Pleasant Project on its own as solely an industrial diversion facility.

The need for additional or replacement electric generating capacity to serve the consumers of the Philadelphia Electric Company system and Pennsylvania-New Jersey-Maryland interconnection (PJM) is primarily a matter for determination by the Pennsylvania Public Utility Commission (PUC) and federal energy agencies. In a recent preliminary decision, the Pennsylvania PUC indicated that Limerick Unit I should proceed to completion of construction, but requested PECO for additional justification as to the public convenience and necessity of completing Unit 2 according to current schedules. Whether development of

Unit 2 will be completed on schedule, delayed, deferred or terminated remains an open issue.

Even if Unit 2 is delayed or cancelled, cooling water requirements for efficient operation of Limerick Unit 1 would still necessitate completion of the proposed Point Pleasant diversion. Under conditions imposed by DRBC, cooling water for Limerick may only be withdrawn from the Schuylkill River when river flows at the Pottstown gage exceed 530 cfs with one Limerick unit operating, or 560 cfs with both proposed Limerick units operating. The difference in the number of days in which Schuylkill River flows would be unavailable under these conditions for one versus two units is insignificant. In sample drought years of 1964, 1965 and 1981, Schuylkill River water could not be withdrawn for cooling water for both units at Limerick 133, 193 and 160 days respectively. If only one unit were operating at Limerick, Schuylkill flows would be available only 7 to 12 additional days of the year (or three percent more of the time).

Further, the ultimate fate of Limerick Unit 2 would have little effect on the engineering of the water supply facilities. If the possibility exists that a second unit will eventually be constructed over the life of the project, sizing of the Bradshaw Reservoir, conduits and transmission mains to accommodate the water requirements of both units would be prudent. Building in such capacity would avoid the need for later construction of such facilities, or the need to install duplicate facilities. (At the same time, some elements of the project, such as pump installation, could be developed in modules or phases.)

For purposes of this environmental assessment, the Department has assumed eventual operation of both Limerick units, in order to evaluate the maximum ("worst-case") impact of the project.

4. Impacts of the Project

A. Intake Structure on the Delaware River

(1) Installation

The installations of the River intake screens and the three reinforced concrete pipes are to be scheduled for a period during the months of November through March to avoid

disturbance of aquatic life during the spawning season.[12] This seasonal restriction will also avoid disruption of the anadromous fish run of American shad.

Foundations for the screen units are to consist of cylindrical reinforced concrete units which will be embedded in the River bottom. These will be placed by drilling or by use of caissons. Required excavation for the installation of the foundations will be by use of a barge mounted clamshell or dragline, with materials being temporarily stockpiled on a barge prior to selected use as a backfill for the installation. Most of the rock excavation can be performed by ripping, but at the site of the intake screens, the lower two feet of rock excavation is expected to require blasting. (Blasting and its impact will be considered as a separate issue.) Pre-assembled screen units will be set in place on the foundations and connected to the foundations by divers. The trench for the three intake pipes will also be excavated by barge mounted equipment, and barges will be used for temporary stockpiling of excavated materials. The trench excavation is expected to encounter no rock, except near the screens and between the shoreline and the gate well, and most of the rock from preliminary investigation appears to be rippable. The intake pipes, which will have subaqueous joints, will then be placed and connected by divers. Selected backfill will then be placed from temporary storage on barges.

(2) Operational Impacts

(a) Aquatic Ecology

The intake system proposed for the Point Pleasant Pumping Station represents the latest "state-of-the-art" technology in water intake structures. The report by P. L. Harman, Biological Evaluation of the Proposed Water Intake in the Delaware River at Point Pleasant Pennsylvania, (November 1980) indicates that this environmentally advanced screening system represents the best technology available for minimizing adverse impact to the aquatic life at this location.

Operation of a water intake generally has its greatest impact because of entrainment and impingement. Entrainment refers to the passage of small planktonic or nektonic organisms such as fish eggs and larvae through the intake screens and into the pumping facilities. Impingement is the capture of fish and other aquatic organisms on the screens. Some loss of aquatic organisms will occur because of these two factors. However, any adverse impacts will be greatly minimized by utilizing these new innovative screens. The

combination of 2mm slots in the screens, an intake velocity of less than 0.5 feet per second (fps) and a river velocity of at least 1.0 fps practically eliminates any impingement of organisms. Harman concludes that "the small percentage of water and organisms likely to be withdrawn from the river through this intake will not result in biologically significant impacts to the fish community".

Particular attention and study has been given to the potential impact of the project on shortnose sturgeon, an endangered species found in some reaches of the Delaware River. Detailed documentation and discussion can be found in the report entitled Assessment of the Impacts of the Proposed Point Pleasant Pumping Station and Intake on the Shortnose Sturgeon, Acipenser Brevirostrum by Harold M. Brundage III, Consulting Biologist (January 1982), and in the DRBC Final Environmental Assessment (August 1980). This species of fish comes under the jurisdiction and protection of the National Marine Fisheries Service (NMFS). NMFS has reviewed the impacts of the project under a consultation pursuant to Section 7 of the Endangered Species Act. Based on the "best available scientific and commercial data" NMFS has issued a biological opinion[12] concluding that:

(1) Project construction under conditions contemplated in the applications should cause no significant adverse effects on the shortnose sturgeon present in the area.

(2) The proposed state-of-the-art design of the water intake structure and projected schedule of withdrawals are adequate to ensure that juvenile and adult shortnose sturgeon as well as sturgeon eggs and larvae present in the project area will not be significantly affected.

(3) Construction and operation of the Point Pleasant Pumping Station is not likely to jeopardize the continued existence of the endangered shortnose sturgeon in the Delaware River.

The reduction in the amount of water in the Delaware River System because of the withdrawal would not result in biologically significant impacts to the aquatic community. The average daily flow of the Delaware River at Trenton (below Point Pleasant) is 11,430 cfs, (7384 mgd) and at the Riegelsville gage (above Point Pleasant) is 10,827 cfs (6994 mgd). Assuming the maximum allowable rate of withdrawal at Point Pleasant of 95 mgd, the reduction in Delaware River flows to sustain aquatic habitat would be

insignificant. A diversion of 95 mgd would represent less than 5 percent of the low flow of the Delaware, considering current upstream reservoir operations and drought emergency plans (see below), and such a withdrawal would result in a reduction in the river stage of six-tenths of one inch at the Trenton gage. Further, it should be noted that diversions at Point Pleasant for cooling water supply to PECO is restricted, and would be prohibited when flows in the Delaware River fall below 3000 cfs (1940 mgd) at Trenton.

As part of its role to monitor and safeguard Basin water resurces, DRBC has conditioned its approval of the intake and withdrawal operation, requiring NWRA to conduct a monitoring study of the operation of the intake facilities and, further, to take any mitigating steps that the study indicates are necessary to protect the River ecology.[14] Both DRBC and DER will monitor and review such studies, and require such corrective action as appropriate to mitigate any unforeseen aquatic impacts caused by the operation of the intake facilities.

(b) Low Flows

The key concern addressed in this section is whether the 95 mgd withdrawal at Point Pleasant will (1) substantially reduce low flows in the River, or (2) increase the frequency of such low flow occurrences?

The proposed withdrawal would not significantly change the frequency of low flow occurrences below the Point Pleasant intake structure. The flow of the Delaware River mainstem is essentially a "managed flow" according to the DRBC Final Environmental Assessment (August 1980). The level and incidence of low flow conditions is basically governed by the capacity and releases of the New York City Reservoirs (Pepacton, Neversink and Cannonsville), coupled with Beltzville Reservoir and several State and hydroelectric facilities, to maintain target flows at Montague and Trenton.

Management of Delaware River flow is a key function and role of the Delaware River Basin Commission. DRBC is responsible for development and implementation of plans to coordinate interstate actions concerning river flow, during both normal and drought periods. In cooperation with the parties to the 1954 Supreme Court Decree[15] and the Delaware River Master,[16] DRBC coordinates the storage and release of waters in all major basin reservoirs, and regulates water withdrawals, in augmenting and managing River flows to protect instream and downstream uses.

In recent years, several plans and studies have been developed to improve low flow management of the Delaware. In 1977, DRBC began work on the Level B Study, which was designed to provide a comprehensive review of plans, programs, operating arrangements and projects to manage Basin waters, especially with regard to flow maintenance. A "mixed-objective" plan for flow management was recommended as one of the products of the study.[17]

During this same period, DRBC, the Decree Parties and Army Corps of Engineers undertook a series of specialized studies. One study involved modeling of salinity behavior in the Delaware Estuary, as a function of River flow and other factors.[18] A second effort involved computer modeling and simulation of basinwide reservoir operations and natural flows to test the flow management impacts of various operating arrangements.[19]

In early 1979, at the request of the Delaware River Basin Commission,[20] the parties to the 1954 Supreme Court Decree entered into "serious good faith discussions to establish the arrangements, procedures and criteria for management of the waters of the Delaware Basin consistent with the Compact". The parties have recently submitted to DRBC the results of over three and a half years of Good Faith Negotiations, for publication and public comment.[21] The recommendations for future water management made by the Good Faith Parties involve an interrelated set of management actions, including salinity standards; management and planning criteria; plans for diversions, releases and reservoir management during drought; water storage, water supply and flow augmentation projects; conservation programs; and regulation of depletive water uses.

The plans and arrangements contained in the Level B Study and recommendations of the Good Faith Parties represent the most recent data and plans on the subject of Delaware flow management. As such, they form the basis for this environmental assessment of the low flow impacts of the Point Pleasant project.

Delaware flow management must be considered on the basis of arrangements for both "normal" operations and "drought" operations. The Good Faith Parties have developed criteria for differentiating between "normal", "drought warning" and drought" conditions as defined by the combined storage levels shown on a set of operating curves for New York City's Cannonsville, Neversink and Pepacton reservoirs.

During normal periods (in all but extended and severe drought conditions), upper and lower basin reservoirs will be operated to sustain a River flow objective at Trenton of no less than 3000 cfs (1940 mgd). This is, in essence, a continuation of DRBC's current minimum flow objective at Trenton of 3000 cfs. A withdrawal of 95 mgd (147 cfs) at Point Pleasant is equivalent to approximately 5% of this minimum flow objective at Trenton. It should be noted that the 95 mgd withdrawal is the maximum withdrawal requested by the applicants.

Under the proposed drought operating plan for the Basin (which was actually applied during the 1980-81 drought), if the combined storage in New York City's reservoirs fell to drought warning or drought levels, reductions would automatically be made in diversions, releases and flow objectives. During severe drought conditions, basin reservoirs would be operated to maintain a flow at Trenton of at least 2500 to 2900 cfs (1650 to 1873 mgd), depending on the location of the salt front in the Delaware Estuary.[22] (As seen by the experience in 1980-81, even during drought operations, flows in the Delaware at Trenton will exceed 3000 cfs much of the time.)

Pursuant to the limitations imposed upon cooling water withdrawals by DRBC Docket No. D-69-210 CP, if flows at Trenton fell below 3000 cfs, withdrawals from the Delaware for Limerick would be curtailed unless fully compensated by releases from upstream-storage. Thus, during drought conditions, if flows drop below 3000 cfs at Trenton and are maintained by DRBC operations in the range of 2500 to 3000 cfs, only public water supply withdrawals at Point Pleasant would be of concern. Under these conditions, even at minimum flows of 2500 cfs at Trenton, a maximum public water supply diversion of 48.8 mgd beyond the year 2000 would result in a reduction of Delaware River flows by less than 3 percent.

The water withdrawn for public water supply (DRBC August 1980) would be essentially a non-consumptive use, with almost total return to the Delaware River via the Neshaminy, Perkiomen, Pennypack, and Wissahickon Creeks. As noted in DER's State Water Plan, consumptive use is considered only 10% of total public water supply use. The Department's analysis of water use patterns in the NWRA Service Area and waste water facilities in the region, as summarized in the DER Water Allocation Report accompanying Permit No. WA-0978601, indicates that approximately one-half of the water taken at Chalfont will be returned to the Delaware River above Philadelphia, with the remaining half returned to the Schuylkill River. The maximum daily consumptive loss to the Delaware River Basin

resulting from public water supply withdrawals via Point Pleasant is expected to be less than 5 mgd (8 cfs), a quantity of flow within the river which is, for practical purposes, not measurable.

(c) Salinity

Another of the Department's considerations in this assessment is the effect of withdrawing 95 mgd from the mainstem Delaware upon salinity in the Delaware Estuary. This section ties in very closely with the previous section on low flows in the Delaware.

A key factor in Delaware Basin water management is the control of intrusion by saline waters in the tidal Estuary. As fresh water flows entering the Estuary diminish, as during droughts, saline water from the Delaware Bay tends to push further up the River, potentially affecting public drinking water supplies and industrial supplies.

Flow requirements, in turn, depend in large part upon salinity characteristics in the estuary and the degree of salinity concentration that can be tolerated at specified locations. Excessive salinity can increase sodium in drinking water supplies and cause adverse health effects for some people. Salinity can also increase operating costs for some industries.

The current salinity standard for the Basin, established by DRBC in the 1960's, calls for a maximum instantaneous salinity level of 250 mg/l chlorides at the mouth of the Schuylkill River. Following reassessment in the DRBC Level B and salinity studies, based on more recent data and more sophisticated evaluations of risks to Estuary supplies, the Good Faith Parties have recommended revised salinity objectives.

The Good Faith Recommendations include a set of interim and long-term salinity objectives. The interim operating objective would be to limit salinity to a maximum 30-day average of 180 mg/l of chlorides and a maximum 30-day average of 100 mg/l of sodium at River Mile 98 (i.e., one mile upstream from the Walt Whitman Bridge). Through a set of step-by-step actions a more protective objective would be established by the year 2000 to limit salinity to a maximum 30-day average of 150 mg/l of chlorides and a maximum 30-day average of 83 mg/l of sodium at River Mile 98. As additional reservoir facilities and storage capacity become available in the Basin, they would be used both to augment water supply, and to improve environmental conditions, water quality, and salinity protection.

The interim salinity objective of 180 mg/l chlorides at River Mile 98 can be met during a drought, equal to the record drought of the 1960's, with existing flow management capability at Trenton. Maintenance of this salinity objective requires a minimum flow at Trenton of approximately 2400 cfs. With currently available storage under Commission control (not counting Lake Nockamixon, or any new facilities now being planned), the current flow capability at Trenton is about 2500 cfs.

The percentage of the river flow at Trenton that will be ultimately lost to the Delaware Basin as a result of the Point Pleasant diversion is a maximum of approximately 2.5 percent. Roughly 90 percent of the water diverted at Point Pleasant for public water supply in Bucks and Montgomery Counties will be returned to the Delaware basin's hydrologic system. Most public water use is not consumptive, and the 10 percent of the water that will not be returned is mainly lost by evaporation. Most of the water will be returned to the Delaware from waste treatment plants in the Neshaminy and Pennypack Creeks watershed, and along the Schuylkill River, as well as the groundwater aquifers, recharged by treated sewage effluents and on-lot systems.

Although the control of salinity intrusion in the Estuary is a major issue confronting the basin, it does not present a substantial question regarding this project. The control of salinity in the Delaware Estuary is dependent on hydrologic boundaries, not the manmade political boundaries of counties or municipalities. Both historical experience and the Delaware River Basin Commission's salinity/flow model confirm that salinity control in the Estuary is directly dependent upon the combined flows entering the Estuary from the Delaware and Schuylkill Rivers and their tributaries. Salt water from the Delaware Bay is repelled by all flows which enter above River Mile 90, whether they enter via the Delaware River mainstem or the Schuylkill River. Since nearly 90 percent of the public water supply diversions via the Point Pleasant-Chalfont system are returned to the Delaware's tributaries above River Mile 90, all returned water will aid in the repulsion of sea salts. The consumptive use engendered by public water supply uses (approximately 4.5 to 5 mgd) is already covered by existing, in-place makeup storage.

Conditions imposed by DRBC on steam electric diversions require curtailment of consumptive uses when flows fall below 3,000 cfs at Trenton, unless fully compensated by releases from makeup storage constructed by the power companies. It is below this 3,000 cfs flow level that salinity control becomes a significant concern.

Hence, we foresee no measurable impact on Estuary salinity control resulting from the Point Pleasant withdrawals.

It should be noted that the Point Pleasant diversion will not be as large as New Jersey's diversion at the Raritan Canal authorized under the 1954 Supreme Court Decree to serve out of basin communities in northern New Jersey. For many years New Jersey has used the Delaware as a source for public water supply for the central part of the state. New Jersey's usage from the Raritan Canal totals 100 mgd. Unlike the Point Pleasant Project, New Jersey's diversion is not subject to conditions requiring development of storage to compensate for consumptive losses. Significantly, the New Jersey diversion is entirely lost to the basin, while only half of the water diverted at Point Pleasant is consumed.

B. North Branch Neshaminy Creek

(1) Installation - Outlet Structure

At the point of discharge from the transmission main from Bradshaw Reservoir on the North Branch Neshaminy Creek, an energy dissipator and riprapped channel are to be installed to prevent erosion as the flow is discharged into the stream. As noted previously, the maximum flow rate at the discharge point is 49 mgd or 76 cfs. Soil erosion and sedimentation control measures as approved by the Bucks County Conservation District will be adhered to during the actual installation of these permanent erosion control measures.

(2) Operational Impacts

(a) Aquatic Ecology

In order to evaluate the potential impact on the North Branch Neshaminy Creek (North Branch), an extensive review was made in DRBC's Final Environmental Assessment (August 1980) to gain an understanding of the existing fish, invertebrate and plant life.

Biota in the upper reaches of the North Branch are typical of small warmwater streams and are adapted to intermittent flow and eutrophication. No rare types of biota were found to be present. Nineteen species of fish inhabit the North Branch, including panfish (bluegill, pumpkinseed, redbreast sunfish) and a number of bass. Recreational fishing, which is limited, takes place primarily at pools and bridge crossings.

It is rather obvious that with the increase of an additional 76 cfs, the character of the existing biota will be altered. Organisms favoring higher water conditions would be on the increase; those favoring low or slow-moving water would decrease. In general, aquatic populations should benefit as a result of (1) an increase in the size of habitat allowing greater productivity and higher survival, and (2) a decrease in seasonal mortality caused by insufficient or no flow.

NWRA will be required to maintain year round minimum flows in the North Branch, below the Chalfont Treatment Plant. A minimum flow requirement of 5.3 mgd is established for March 1 through June 15, to enhance and protect fish spawning and recreational fishing habitat, and a continuous flow of 2.73 mgd is required for the remainder of the year. As noted previously, a conservation release of no less than 1.5 mgd is provided from Lake Galena to the North Branch, to protect and improve aquatic habitat.

The Department concludes that the net effect of proposed project operations upon aquatic habitat and ecology in the North Branch Neshaminy Creek would be beneficial.

(b) Increased Flows

This section will address the effects on stream flows of the North Branch with the addition of the 76 cfs. The major effects on the stream flows and the stream channel have been investigated in a report by E. H. Bourquard Associates, Inc.[23] At the time Bourquard's study was prepared, a maximum diversion from the Delaware River to the North Branch of approximately 160 cfs was being considered.

Four locations along the North Branch, from the upstream limits of the water supply pool of Lake Galena to PA Route 413, were investigated. Low, median and flood flows were established at each of these locations for both existing and proposed conditions. For purposes of comparison, the channel section closest to the point of the diversion will be discussed below. This most upstream section is considered the most critical since the cross-sectional area of the channel is the smallest at this point.

During low flow periods, only a small low flow channel (if the stream is not already dried up) is required to convey the stream, and velocities are almost non-existent, that is, the water is nearly stagnant. With the maximum pumping rate (160 cfs in Bourquard's report), depth of flow would increase approximately 1.5 feet and velocity would approach

3.0 feet per second (fps). Since this flow is contained within the channel banks, erosion should not be a problem.

During periods of median stream flow, existing conditions are such that depths range from 0.10 to 0.15 feet and flow velocities from 0.48 to 0.7 fps. With the increased flow, depth would increase to approximately 1.69 feet and velocity to 3.13 fps. Again, there should not be any erosion effects on the existing stream banks causing a sediment build-up downstream.

To analyze the effects on flood flows, the following table was prepared for Site 18, the most upstream section.

Table 3

	Q(cfs)	D(feet)	V(fps)
Median Flow	1.34	0.10	0.48
Median Flow + Point Pleasant Diversion	161.34	1.69	3.13
Mean Annual Flood	280.00	2.34	3.80
5-Year Flood	409.00	2.93	4.31
50-Year Flood	840.00	4.44	5.46

Q = Flow in cubic feet per second
D = Depth of water in feet
V = Velocity of stream in feet per second

As noted in Table 3, the addition of the 160 cfs to the median flows does not place the stream in a mean annual flood condition. The depths of flow are confined within the stream banks, and velocities are not considered to be erosive.

When one considers that the proposed diversion into the North Branch is only 76 cfs, the impacts will be much less. This 76 cfs diversion was discussed in DRBC's Final Environmental Assessment (August 1980), and Tables IV-8 and IV-9 were prepared for a channel section located approximately 150 feet upstream of PA Route 611, roughly midway between the outlet of the North Branch Transmission Main and Lake Galena. The analysis shows that under all conditions, the combined natural flow and proposed pumpage rates do not constitute a major flow and flow depths will be contained well within the channel. Because of the relatively low stream gradient, stream velocities in the upper North Branch resulting from combined natural flows and pumpage are expected to be less than 3 fps. For types of soils found in this portion of the watershed, such velocities are not considered erosive.

The assumption that NWRA would continue pumping during flood conditions is rather absurd and will not be addressed in the report. The operating plan for the Neshaminy Water Supply System requires NWRA to monitor stream flows and weather conditions, and to adjust operations as appropriate. Such monitoring will be conducted 24 hours a day, 7 days a week by operators located at the Chalfont Treatment Plant, who will be able to remotely adjust and control pumpage from Point Pleasant and releases to the North Branch as conditions warrant.

C. East Branch Perkiomen Creek

(1) Installation - Outlet Structure

As noted in the plans filed with Application No. 09-77 by Philadelphia Electric Company, an energy dissipator and outlet channel will be installed at the end of the 42-inch transmission main to provide a smooth transition of flow to the East Branch Perkiomen Creek. The dissipator will be a reinforced concrete box structure with a concrete baffle. The outlet channel spur and the East Branch channel will be riprapped on both sides and the bottom to further aid in dissipating the water energy and controlling any erosive affects. These measures were found to be adequate in controlling soil erosion and sedimentation by the Bucks County Conservation District.

(2) Operational Impacts

(a) Aquatic Ecology

As noted in the discussion on this topic on the North Branch Neshaminy Creek, there would be changes in the aquatic ecology as a result of increased flows in the East Branch. An increase in the size of habitat coupled with a decrease in seasonal mortality should result in an increased population in aquatic biota.

In order to protect and enhance aquatic habitat in the East Branch, conditions imposed by DRBC require PECO to maintain a minimum flow of 27 cfs (17.4 mgd) in the East Branch at Bucks Road during the normal low flow period, covering the season when pumpage may be required for cooling water at Limerick. A minimum flow of 10 cfs (6.5 mgd) is established for the remainder of the year.

From a review of DRBC's 1973 Environmental Impact Statement, the DRBC Final Environmental Assessment (August 1980), and Philadelphia Electric Company's Environmental Report (July 1979), the Department concludes that the overall effects of the project operations upon aquatic ecology in the East Branch would be beneficial.

(b) Increased Flows

The major effects on the stream flows and stream channel of the East Branch Perkiomen Creek resulting from the addition of waters diverted from the Delaware were investigated in the 1970 report by E. H. Bourquard Associates, Inc.[24] Because of proposed pumping rate changes, another review was made by Philadelphia Electric Company in its Environmental Report (July 1979).

To briefly summarize the findings of these studies, a total of 15 locations were investigated along the 117,000-foot reach between the mouth of the East Branch and the Elephant Road bridge. Low, median and flood flows were established at each of these locations for both existing and proposed conditions. In Bourquard's original report, the average rate of pumping Delaware River water into the East Branch was estimated to be 54 cfs. The average rate of pumping in PECO's updated calculations is estimated to be 34 cfs, not including water losses in transit. The maximum pumping rate used in both reports was 65 cfs.

For purposes of comparison, the channel section closest to the point of in-flow will be discussed. This section is considered the most critical since the cross-sectional area of the channel is the smallest at this point.

During low-flow periods, only a small low-flow channel is required to convey the entire stream flow of approximately 0.05 cfs. Depths of flow are calculated to be 0.02 feet and velocities are 0.17 fps.[25] During maximum pumpage, the flow increases to 65 cfs, depths to 1.28 feet and velocities approach 3.0 fps. This rate of flow is not considered to be erosive and flows should be contained within existing stream channels.

During periods of median stream flow, existing conditions are such that flows are 1.4 cfs, depths approach 0.15 feet and velocities are calculated at 0.61 fps. With the maximum increased flow of 65 cfs, the depths would increase to 1.3 feet and velocities to 3.02 fps. Again, there should not be any noticable erosion on existing stream banks.

To analyze the effects on flood flows, the following table was prepared for this inflow point utilizing data from Tables 2 and 3 in PECO's 1979 Environmental Report.

Table 4

	Q(cfs)	Depth (feet)	Velocity (fps)
Median Flow	1.4	0.15	0.61
Median Flow + Point Pleasant Diversion	66.4	1.30	3.02
Mean Annual Flood	320.0	2.6	5.1
5 - Year Flood	457.0	3.2	5.7
50 - Year Flood	960.0	4.1	6.6

As noted above, the addition of the 65 cfs to the median flows does not place the stream in a mean annual flood condition.

The operating plan for the project requires PECO to monitor stream flows of the East Branch and, with the advent of a flood on that stream, reduce or terminate pumpages from Bradshaw Reservoir. When the stream flow of the East Branch approaches potential flood levels (238 cfs at the Bucks Road Gaging Station which is the peak flow of a one-year flood), an alarm is automatically activated at the pumping control center and the Bradshaw pumps, if operating, shall be stopped.

Philadelphia Electric has prepared a "Simulation of Estimated Weekly Water Withdrawals During Two Unit, Full Power Generation, 1974-1977" contained in Table I of the Environmental Report (July 1979). This table indicates the periods in weeks that water will be withdrawn from the Schuylkill River, Perkiomen Creek, and the Delaware River and the estimated withdrawal from the Delaware in cfs.

PECO is not anticipating pumping from the Delaware on a year-round basis. Pumping will cease when adequate flows exist in the "natural flows" of the Schuylkill and Perkiomen to satisfy the operating conditions imposed by DRBC.

D. Delaware Canal

The Delaware Canal flows parallel to the Delaware River, and lies between the Point Pleasant withdrawal intakes, and the pump station and upland areas to be served by the project. As a result, water lines must be installed under the Canal.

The roughly 60 miles of the canal, from Easton to Bristol were built as part of the Delaware Division of the Pennsylvania Canal between 1830 and 1832. Following abandonment as a commercial transportation facility, the Delaware Canal was reacquired by the Commonwealth in 1939 and is administered as the Roosevelt State Park. The canal today primarily serves recreational purposes (canoeing, barge trips, and fishing), as well as providing a reminder of Pennsylvania's historical development.

The installation of conduits by NWRA under the canal would certainly not be unique or unusual. In order to gain access to water supply, or for sewage discharges, communities all along the canal's length must maintain crossings under or over the canal. Through the 60-mile long State Park, there are at least 127 water, sewer and other utility crossings, along with 135 public and private bridges and culverts providing access and transport.

(1) Installation Procedure

The installation of the intake conduit under the Delaware Canal will be accomplished in "dry" conditions. Lock No. 14 will be closed and the immediate upstream overflow weir will be set at a specific elevation to divert all flow to the Delaware River. To prevent leakage through the lock gates and the bypass gate, reinforced plastic liners will be placed on the upstream sides and held in place with sandbags or other suitable means. A small cofferdam, approximately 8 feet high, will be constructed across the canal just downstream of Lock No. 13.

Prior to closing off the canal section, temporary pumping facilities having a capacity of 25 cfs will be installed to deliver Delaware River water to the canal just downstream of the Lock No. 13 cofferdam to provide a continual water supply for downstream canal users. This water will also maintain the aquatic environment in the canal in its present state.

A temporary roadway and dike will be installed across the canal utilizing materials excavated from the site. There will be two 48-inch diameter drainage culverts in the dike

access roadway with slide gates on the downstream ends which will be open. The next step will be to remove any trapped water between Locks No. 13 and 14 and pump this water to a sedimentation basin prior to its release to the Delaware River. During the process, fish would be removed under the supervision of the Pennsylvania Fish Commission and returned to the downstream section of the canal or to the river.

The trench will then be excavated and the intake conduit installed. After installation, the surface of the excavated portion of the canal will be shaped to its original section and segregated impervious soils will be used, if deemed suitable by the Department, for replacement of the canal lining. This backfill shall be placed in 8-inch layers and compacted to a density of 95% per modified Proctor tests. Rock in backfill shall not exceed 12 inches and will be placed in 18-inch thick layers separated by 12-inch thick layers of overburden material.

During this period when the Canal towpath is excavated or non-usable, an accessway suitable for a pick-up truck usage shall be maintained on the River side of the Canal to Lock No. 14. Signs shall be placed upstream of Lock 14 and adjacent to Lock 13 prohibiting trespassing by the general public along the towpath during such time as work is in progress.

The culvert slide gates will then be closed and the section of the canal between Lock No. 14 and the access roadway will be filled with water to check for leakage and subsidence. After dewatering, inspection, and any necessary repairs, the culvert slide gates will be opened. Pumping to the canal will then be stopped for the time being. The bypass gate of Lock No. 14 and the upstream overflow weir will be adjusted to restore flow through the canal. After completion of earthmoving activities at the project site, the canal is to be dewatered between Locks 13 and 14 for a period of time to permit the removal of the access roadway and to inspect and restore the area of the canal occupied by the roadway. During this period pumping to the canal will be resumed. Upon complete restoration, the cofferdam below Lock No. 13 will be removed. Any disturbed area of the clay liner under the removed cofferdam will be repaired and restored as directed by DER's representative. Normal flow through the canal will then be resumed.

It is the Department's judgement that the environmental impacts on the canal itself will be minimal by utilizing the installation techniques described above. The erosion and sedimentation control techniques, properly implemented, are adequate and should prevent

materials from entering the canal or the river downstream of the construction site. Any impacts on the fish community or the aquatic environment would be short term.

Because of Departmental maintenance projects, sections of the canal are currently dewatered using similar procedures. Personnel from the Department's Bureau of State Parks will be available to inspect the project during all aspects of the construction phase.

(2) Aesthetic Considerations

In accordance with DRBC's 1973 Environmental Impact Statement, the proposed pumping station facility is isolated in an area of excellent visual quality. Temporarily, construction will adversely affect the immediate vicinity of the station with equipment, movement, noise, and exposed excavation. When construction is completed, however, the pumping station should blend reasonably well with the existing environment. For several years, the newness of the facility and the freshness of the landscaping will be apparent. In time the facility should not be noticeable. The loss of esthetic value therefore is considered to range from very slight to no impact over time.

In line with the above, DRBC Docket Decision No. D-65-76CP(8) requires that the above-ground facilities be designed and landscaped to compliment the surrounding environment. As demonstrated in the plans and drawings submitted to this Department, NWRA has complied with DRBC's requirement and designed the pumping station to closely resemble a barn in order to blend in with the existing environment. Landscaping utilizing flora indigenous to the area is included in the project plan to minimize any long-term adverse aesthetic impact. It should be noted that the station is not visually screened with flora from the canal users, but is designed to blend in with the existing surroundings.

(3) Operational Impacts

The major long-term operational impact that will result from the operation of the pumping station would be the increase in the noise level at the station site. This anticipated increase generated by the pumps in the pump station will be mitigated by sound insulating the pumphouse. The station structure also will help mute the pump noise because it completely encloses the pumps and is built into the ground.

The only other potential long term impact of the station to be considered is traffic. The only traffic generated by the project would be the small number of station personnel permanently needed at the station.[26] In the Department's opinion, vehicle movements and traffic generated by the project will have negligable impact.

E. Water Quality

(1) Delaware River

(a) Installation

The major effect on water quality experienced during installation is turbidity. A short-term exceedance of the stream standard of turbidity of 150 units maximum in the localized construction area may occur. However, this impact should not extend further than one-third of the river width, allowing fish passage through the area. It should be noted that during storm events, background turbidity in the River sometimes exceeds 150 turbidity units.

(b) Operation

(i) Pumping Effects on Sediments

The intake screens are designed to minimize surface water and channel bottom disturbances resulting from the withdrawals. Little or no scouring is expected. The structure is also designed such that no sedimentation is expected under the structure and no maintenance dredging is anticipated.

An issue has been raised regarding the potential effects of the Point Pleasant Project on water quality in the Delaware-Raritan Canal. The Delaware-Raritan Canal, operated by New Jersey, serves as the primary conduit conveying diversions from the River authorized by the 1954 U.S. Supreme Court Decree to serve out-of-basin water supply demands in central and northern New Jersey. The Delaware-Raritan Canal withdraws water from the Delaware at a point near Lumberville, at River Mile 156.1, approximately 0.9 miles downstream of Point Pleasant and on the opposite shore.

Two Rutgers University reports[27] indicated the quality of Delaware River water is good as it enters the Delaware-Raritan Canal, but found as the water moves along the Canal, its quality is degraded, although not to the extent to preclude its use for public water supply (near the terminus). The degradation is caused by inflow from three major and 200 small drainage basins, both urban and rural, along the length of the Canal. The Rutgers Studies conclude that operation of the Delware-Raritan Canal to get as much Delaware River water down the canal as possible is presently the only practical way for reducing the degradational effects. The temporary bottom disturbances and pump station operation at Point Pleasant will not compound the existing water quality problems in the Canal.

(ii) Upper Estuary

In the area of water quality in the upper estuary, reference is made to DRBC's Level B Study.[28]

The Level B Study indicates that dissolved oxygen standards in the central portion of the Delaware Estuary do not maximize the fisheries potential of the Delaware River; and there is an increasing concern about the possible threat of toxic substances in the surface and groundwaters of the basin. The new estuary model being developed by DRBC will explore the relationship between temperature and dissolved oxygen levels at critical periods; however, the model cannot evaluate the problem of contamination of the estuary waters with trace quantities of toxic substances. The report further states that in zone 2 (the upper portion of the estuary) more detailed investigations of water quality issues are needed regarding: (1) the effect of bottom deposits on water quality, and (2) the water quality characteristics of the river as it enters the estuary. (Previous studies demonstrated that the carbonaceous and nitrogenous loads entering the estuary from the non-tidal river are predominantly from non-point sources of pollution suggesting that a truly interstate impact is being thrust upon zone 2). The Level B Report was prepared at a time when the EPA toxics list was being expanded from the original 65 substances to the present 129 priority pollutants, and before detailed studies were made to examine and/or determine the presence of toxic substances in waters of the Delaware River Basin. Of the 65 original pollutants, 36 were noted as being detected in the ground or surface waters of the basin; however, in almost all cases the quantities involved were minute.

The impact of the Point Pleasant Project on dissolved oxygen (D.O.), trace organics and suspended solids will not be significant in zone 1 and 2, even during low flow and summertime conditions.

Reservoir releases from Lake Nockamixon during spring time from lower levels of reservoir storage may have a potential downstream water quality impact. The duration and magnitude of releases, assimilation distance and time will minimize any effect on the estuary, even if a diversion occurs simultaneously at Point Pleasant.

NWRA, in its Environmental Report, presents data showing that seven common metals exist in the Delaware River at levels far below those listed in DER's water quality objectives. It appears that the chemical make-up of waters of the various streams involved do not differ significantly to produce major changes after mixing.

One issue, raised in public comments, involves impacts of the project on so-called "flushing" flows during the spring. The question is raised whether high spring flows will be reduced, preventing the "flushing" of contaminants in the river or bottom sediments from the upper estuary downriver. (This issue is raised primarily by the Lower Bucks County Pollution Control Group, an organization representing citizens, industries and some municipalities in the Morrisville area.)

As a water quality management agency, the Department does not necessarily endorse the concept of flushing pollutants downstream. However, an analysis of the Delaware River's hydrology indicates the project will have no substantial effect on spring flows which "change over" water in the upper estuary, even during drought years.

The Department has examined River flow patterns in the spring (March 1 through June 15) in three critical drought years on record (1964, 1965 and 1981). In the worst year on record (1965), River flows at Trenton exceed 10,000 cfs for at least 23 days during the spring. As a result of snow melt and storm events, even during a drought period, River flows on a daily basis often exceed even 15,000 and 20,000 cfs. In each of the critical years studied, between February and June, there was at least one week in which the seven consecutive day average flow exceeded 25,000 cfs.

Even if the Point Pleasant Project operated at maximum authorized withdrawal rates of 95 mgd (147 cfs), it would have no measurable impact on such high spring flows.

Moreover, during spring flows, withdrawals at Point Pleasant are not likely to occur at anywhere near maximum rates. At the same time Delaware flows are high, the natural flows of the Schuylkill, Perkiomen, and North Branch Neshaminy Watersheds are increased. Even in drought years, the Schuylkill River's flow measured at Pottstown may be expected to exceed 560 cfs some 90-100% of the days during the spring, allowing withdrawals for cooling at Limerick to be taken directly from the Schuylkill.

During the record drought years of 1964 and 1965, natural flows of the North Branch Neshaminy Creek at Chalfont exceeded 5.3 mgd over 60 to 80 percent of the days during the spring. Under such conditions, at least part of the public water supply needs could be satisfied by withdrawals from natural flows on the Creek.

The Department also concludes that there will be no significant impact on assimilative capacity in the River and Estuary. Wasteload allocations and effluent criteria for discharges to the River and Estuary have been established to assure maintenance of water quality standards at a critical flow of 3000 cfs at Trenton, with an added margin of safety. The operations of the Point Pleasant Project under the proposed operating plan should have no significant effect on low flows at or below this design flow used in water quality management.

(iii) Lumberville Area

Water quality in the upper regions of the Delaware is presently very good. There are small dissolved oxygen depressions occurring in the upstream area such as Easton and Philipsburg. The Hydroscience Report[29] states that measured temperature, pH and alkalinity variability are considered normal for a river such as the Delaware; however, periodic violations of the maximum pH and minimum alkalinity set by DRBC do occur. Observed pH values above the standard indicate unfavorable trends in water quality directly related to the biological productivity. Nutrient concentrations are low or at background in the region north of Easton and a significant increase in nutrient concentration occurs in the Philipsburg-Easton area.

Municipal/industrial discharges to the river in the upper region are generally small and insignificant in terms of affecting dissolved oxygen water quality. Similarly, nutrient loadings from these sources do not contribute to significant phytoplankton and rooted

aquatics. The primary BOD and nutrient loadings to the river are from tributaries with the principal loading coming largely from uncontrolled, non-point sources.

DRBC's 1980 Upper Delaware River summer limnological program confirmed that primary productivity caused violations of the upper pH standard attributable to the removal of dissolved carbon dioxide during photosynthesis. However, the impact on fish is minor because of the brief duration of most occurrences. Violations of dissolved oxygen standards did not occur, although wide diurnal variations were observed.

Algal blooms in the River have caused decreased dissolved oxygen levels of about 2 to 5 mg/l which cause periodic summer morning minimum dissolved oxygen concentrations of less than 5.0 mg/l at two locations. Factors contributing to algae bloom (nutrients and retention periods) will not be significantly altered by the project such as to cause a decreased D.O. in summer months. During shad runs in May and June, D.O. values will be above minimum value for anadromous fish.

An evaluation of the water quality data in the Lumberville area below the Tohickon Creek confluence indicates the Lumberville information is based on very limited data. In comparison, averages reported at the Rieglesville or Trenton gaging stations are for much longer periods of record and show the supression of the peaks and valleys. The water quality, in general, is uniform through this area.

(2) Tohickon Creek

The Southeastern Pennsylvania COWAMP/208 Plan recognizes that Pennsylvania DER has established water quality criteria for each stream in the Study Area and notes the streams found to violate water quality criteria and the causes for violation. The report indicates that violation of water quality criteria does not necessarily imply gross pollution, but simply means that one of the criterion established by DER has been violated. Some violations, such as periodic high pH values resulting from geologic weathering, are of minor concern. For the Upper Bucks County Region, pH criteria for Tohickon Creek has been violated with geology and algae as the probable cause. Deep Run Creek has a dissolved oxygen violation caused by municipal treatment plant effluent.

Water quality in the intake area on the Delaware River below the Tohickon will not be changed significantly as a result of the project, and will not affect shad in the river, or quality in the Neshaminy and Perkiomen Creeks.

(3) Bradshaw Reservoir

Any impounded waters have the potential to cause eutrophication. Phosphorous levels in the Delaware are commensurate with that of the Perkiomen Watershed. Loadings of phosphorous will increase because of increased influent flows. DRBC reasons, however, and DER concurs, that the increased loadings may be wholly or partially offset by the small hydraulic retention times resulting from the proposed method of operation. Furthermore, the reservoir may act as a phosphorous sink due to the settling of suspended materials. This would reduce the phosphorous delivered to the East Branch Perkiomen and North Branch Neshaminy.

(4) North Branch Neshaminy Creek

Data shows water quality in the Delaware River in the vicinity of Point Pleasant to have equal or better quality than the North Branch[30].

The Department has compared test results from monthly samplings taken in the Delaware River at the Point Pleasant Pumping Station site, and in the North Branch Neshaminy Creek at Silo Hill Road (upstream of Lake Galena) and at the Chalfont Treatment Plant. Single samples or short-term samples were analyzed for additional parameters. The results of this comparison are displayed in Tables 5 and 6. Additional samples taken in the period from May 1980 to December 1981, were also examined by the Department and confirm the results of earlier analyses.

Concern has been expressed that trihalomethanes may be present in the Neshaminy Creek Basin because of operational problems at upstream sewage treatment plants. The trihalomethanes (THM's) found in drinking water are members of the family of organo-halogen compounds. These compounds result from the interaction of chemicals added for disinfection of waste water and drinking water with commonly present natural humic substances and other precursers. The actual levels of THM's will vary depending on the season, chlorine contact time, water temperature, pH, type and composition of raw water and treatment methodology. Chloroform is the most common THM found in drinking water.

Table 5

Water Quality Parameter Values

Average of Monthly Sampling
September 1971 through December 1975
(mg/l unless otherwise shown)

Parameter	Delaware River	North Branch	
		Silo Hill	Treatment Plant
Bacteriological			
Total Plate Count - No./ML@37°	2,855	2,626	2,358
Total Coliform - No./100 ML	5,977	4,174	6,003
Physical			
Turbidity	9.7	12.5	7.7
Odor	1.1	1.0	1.1
Color	15	17	19
Conductivity	187	313	—
Solids - Total	147	222	144
- Dissolved	149	214	145
- Suspended	28	19	19
- Volatile	58	79	—
- Fixed	104	120	—
Inorganic Chemicals			
pH	7.5	7.2	7.6
Alkalinity	44.4	72	52.7
Carbon Dioxide	5.5	9.9	—
Dissolved Oxygen	10.6	10.4	—
Nitrogen - Ammonia	0.26	0.22	0.35
- Albuminoid	0.10	0.08	0.14
- Nitrite	0.033	0.040	0.017
- Nitrate	0.94	1.61	1.25
Hardness	78	107	85
Phosphate - Ortho-Phosphate	0.8	1.3	—
Poly-Phosphate	< 0.1	0.8	—
Total-Phosphates	0.90	1.63	1.9
Chloride	13	23	15
Fluoride	0.25	0.21	0.14
Sulfate	25	41	25
Iron	0.71	0.48	0.57
Manganese	0.15	0.1	0.21
Phenol	0.020	0.010	0.047
Heavy Metals			
Mercury	< 0.001	< 0.001	< 0.001
Lead - Total	0.025	0.040	0.01
Suspended	0.01	0.01	0.01
Dissolved	0.01	0.01	< 0.01
Cadmium	< 0.01	< 0.01	< 0.01
Chromium (Hexavalent)	< 0.01	< 0.01	< 0.01

Table 6

Water Quality Parameter Values

Results of Single Sample, or Short Term Sampling Analyses
1971 - 1978
(mg/l unless otherwise shown)

Parameter	Delaware River	North Branch
Inorganic Chemicals		
Arsenic	0.001	0.001
Barium	<0.01	<0.01
Copper	0.005	0.004
Selenium	<0.001	<0.001
Silver	0.002	0.005
Zinc	0.006	0.006
Organic Chemicals		
Pesticides		
Chlordane	0.007	0.007
Endrin	0.005	0.005
Heptachlor	0.005	0.005
Heptachlor Epoxide	<0.0001	<0.0001
Lindane	<0.03	0.007
Methoxychlor	0.06	0.06
Toxaphene	0.008	0.008
Herbicides		
2,4-D	<0.001	0.005
2,4,5-TP (Silvex)	<0.01	<0.01
Cyanide	0.08	0.09
MBAS	0.0	0.0

EPA has extrapolated from the results of animal carcinogenic studies to assess the risk posed by THM to humans and has assigned a 100 parts per billion (ppb) limit in finished drinking water. All existing public water suppliers serving greater than 10,000 individuals are required to initially monitor for THM and must comply with the maximum contaminant levels one year later. The program is phased depending on population served, but compliance must be by November 29, 1983.

Philadelphia Suburban Water Company operates a water filtration plant at Janey downstream from all dischargers and significant tributary streams. Their monitoring reports for THM show the drinking water to be within the EPA requirements. DRBC indicates that in the Trenton water supply (using the Delaware River), THM concentration is non-detectable. Point Pleasant diversions will not alter these levels.

(5) Lake Galena

Existing background levels of nutrients entering Lake Galena are sufficient to induce eutrophication. Increased flows into and out of the Lake would provide benefit by maintaining a minimum flow with controlled releases. Increased loadings of phosphorous would occur, mitigated in part, by small hydraulic retention times resulting from operation of the water supply system.

Even if eutrophication in Lake Nockamixon continues at current rates, as reflected in water quality reported at the Tohickon gaging station, the water quality characteristics of Lake Galena with the Point Pleasant Project in operation should not vary significantly from existing conditions. Nutrients would be incorporated into lake sediments and D.O. would be controlled by outflow mixing. Coliform bacteria should die off.

(6) East Branch Perkiomen Creek

The Department has compared water quality data for the East Branch Perkiomen and the Delaware River, as displayed in Table 7.[31] This data reflects the results of monitoring from 1975 to 1978, and lists median results for each parameter. Low and peak results were also compared. During the period May 1980 to December 1981, additional monitoring of Delaware River water was conducted. The results of this monitoring confirm the results of earlier analyses.

Table 7

Summary of East Branch Perkiomen Creek and Delaware River Water Quality 1975 Through 1978

MEDIAN RESULTS

Parameter	Dec, Jan, Feb		Mar, Apr, May		Jun, Jul, Aug		Sep, Oct, Nov	
	E. Branch Perkiomen	Delaware	E. Branch Perkiomen	Delaware	E. Branch Perkiomen	Delaware	E. Branch Perkiomen	Delaware
Temperature (C)	0.0	1.0	9.0	9.5	21.5	23.0	12.0	13.0
Dissolved Oxygen (mg/l)	12.8	12.6	10.6	10.4	6.9	7.5	9.0	9.4
Biochemical Oxygen Demand (mg/l)	0.8	1.0	1.1	1.3	1.6	2.0	1.4	1.2
Total Organic Carbon (mg/l)	0.1	2.1	7.4	7.2	8.6	7.9	3.5	3.6
pH	7.25	7.58	7.47	7.53	7.63	7.85	7.46	7.52
Total Inorganic Carbon (mg/l)	40.4	40.6	34.3	27.6	71.1	49.3	61.7	41.4
Total Alkalinity (mg/l)	35.4	38.6	32.0	26.3	69.8	47.4	62.4	38.8
Free Carbon Dioxide (mg/l)	2.5	1.5	2.2	1.3	3.0	1.5	3.5	2.0
Total Hardness (mg/l)	80.1	58.9	67.8	49.4	97.4	70.1	92.7	50.9
Specific Conductance (USM/CM)	197	155	190	127	266	181	244	143
Turbidity (JTU)	6.3	3.4	6.5	4.8	5.3	4.2	4.7	3.5
Total Suspended Solids (mg/l)	5	4	6	9	7	7	5	8
Total Dissolved Solids (mg/l)	141	100	119	97	183	117	182	108
Chloride (mg/l)	20.66	11.34	17.01	9.07	25.50	11.70	24.88	11.62
Fluoride (mg/l)	0.01	0.01	0.02	0.03	0.10	0.10	0.10	0.07
Sulfate (mg/l)	35.8	21.1	31.0	20.0	32.3	27.3	34.8	21.8
Sodium (mg/l)	9.85	6.50	9.22	5.47	14.10	7.05	10.71	5.06
Potassium (mg/l)	2.16	1.44	1.89	1.26	2.86	1.63	2.99	1.71
Calcium (mg/l)	15.44	14.01	16.20	12.35	21.80	17.99	20.80	13.64
Magnesium (mg/l)	9.88	5.75	8.70	4.74	11.25	6.99	12.04	5.18
Ammonia-Nitrogen (mg/l)	0.00	0.26	0.01	0.10	0.00	0.03	0.00	0.06
Nitrite Nitrogen (mg/l)	0.01	0.02	0.01	0.02	0.01	0.04	0.01	0.04
Nitrate Nitrogen (mg/l)	1.82	0.89	1.20	0.64	0.15	0.96	0.42	0.75
Total Phosphate Phosphorus (mg/l)	0.04	0.09	0.04	0.07	0.04	0.12	0.04	0.13
Ortho Phosphate Phosphorus (mg/l)	0.02	0.06	0.03	0.04	0.02	0.06	0.02	0.07
Arsenic (mg/l)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Beryllium (mg/l)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Boron (mg/l)	0.11	0.11	0.10	0.08	0.09	0.08	0.12	0.08
Cadmium (mg/l)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chromium (mg/l)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002
Copper (mg/l)	0.007	0.006	0.007	0.006	0.006	0.008	0.005	0.007
Iron (mg/l)	0.240	0.218	0.224	0.261	0.250	0.267	0.234	0.259
Lead (mg/l)	0.001	0.001	0.002	0.002	0.003	0.004	0.001	0.002
Manganese (mg/l)	0.051	0.069	0.035	0.066	0.049	0.073	0.032	0.051
Nickel (mg/l)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Selenium (mg/l)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Zinc (mg/l)	0.012	0.060	0.010	0.034	0.008	0.028	0.008	0.032
Mercury (mg/l)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cobalt (mg/l)	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000

The Department concludes that the quality of the Delaware River water in the vicinity of Point Pleasant is equivalent to better than quality in the East Branch Perkiomen. Moreover, beneficial low or intermittent flow augmentation would be provided by the Point Pleasant Project, improving existing degraded water quality in the lower reaches of the Perkiomen Creek.

(7) Schuylkill River

Comments received by DER regarding water quality in the Schuylkill River as a result of PECO's operation of the Limerick Station indicate a major concern for chloride and its effect on downstream users. DER concludes that the impact of chlorides discharged from Limerick cooling towers will be insignificant. Delaware River chloride concentrations are equal to or less than that of the Schuylkill River. During cooling tower operation, when water is evaporated, the concentration of the constituents of the circulating water is increased. The evaporation rate is dependent on atmospheric conditions, consequently the concentration factor varies. PECO utilized a factor range of 2.9 to 3.4 at Limerick based on historic atmospheric conditions. Based on the design flow conditions and applying this concentrating factor to Delaware River waters (also Perkiomen and Schuylkill), the slight increase in chloride concentration at Schuylkill River critical flow conditions will not cause violations of water quality standards.

(8) Toxics

Assertions have been made by Del-Aware Unlimited, Inc., that the diversion of water from the Delaware will involve the transfer of "toxics" from the River to the North Branch Neshaminy and East Branch Perkiomen Creeks. Del-Aware has cited a study prepared by the U.S. Environmental Protection Agency, Water Quality Analysis Area Specific Dilution Studies Region III, as purported evidence that toxics are contained in the Delaware River at Point Pleasant.

As part of the national toxics consent decree of 1976, EPA performed "dilution studies" of potential toxic waste dischargers. This study used solely a desktop modeling process; no actual sampling was conducted. In this theoretical study (based on a series of assumptions), EPA estimated the amount of priority pollutants that might be discharged by various facilities after best available technology (BAT) controls are implemented. EPA then used these estimates to project the ambient concentrations of these pollutants based on

stream flow characteristics for each area under study. Through this modeling effort (again, with no sampling), EPA projected a potential "hot spot" on the Lehigh River in the area of Allentown. Four priority pollutants were noted to be of potential concern in the Allentown Area: copper, lead, flourene and benzene. (A fifth pollutant cited by Del-Aware, hexachloroacenapthylene, is not found in the EPA dilution study.)

EPA has subsequently advised the Department that the "dilution study" methodology is only a first step in identifying potential problem areas - to help focus monitoring and sampling efforts. The dilution study provides no evidence of the actual existence of toxics or priority pollutants in the Lehigh, let alone the Delaware.

Sampling was conducted over several years of Delaware River water quality at the site of the proposed Point Pleasant Pumping Station. The most recent sampling was conducted at Point Pleasant in the period May 1980 to December 1981. The analyses of both long-term and recent monitoring indicate water quality is within acceptable limits for all parameters. Moreover, most of the toxics and priority pollutants are at or below detectable limits.

The Department concludes there is no substantial evidence that Delaware River water in the vicinity of Point Pleasant contains significant levels of toxics or priority pollutants, or that the proposed project will engender the transfer of toxic substances causing contamination of the Neshaminy or Perkiomen watersheds.

F. Scenic Rivers and Recreation

The Delaware River in the vicinity of Point Pleasant is not presently included in either the National Wild and Scenic Rivers System or the State Scenic Rivers System. Under the Pennsylvania Scenic Rivers program, based on recommendations from an advisory task force, the lower Delaware River (from the Lehigh River to Yardley) has been identified as a potential candidate stream, with a 1A priority. The lower River has also been identified as a potentially eligible stream under the national program by inventories conducted by the Department of the Interior's Heritage Conservation and Recreation Service. To date, no detailed studies of the lower Delaware, preliminary to possible designation under the federal or state systems, have been conducted or scheduled.

If the lower Delaware River were considered for designation under the scenic rivers systems, current development along both the Pennsylvania and New Jersey shore in the

reach near Point Pleasant would make the River eligible only under the "recreation", or "modified recreation" categories. Under both categories, the type of shore development contemplated by the Point Pleasant Project would be more than compatable.

Waterways designated as "recreation" streams may combine free flowing and relatively short stretches of impounded water that can or is being restored to sustain appropriate water based recreation, aquatic and fish life. The shorelines may exhibit considerable manmade modification; however, such modification shall be compatible with the aesthetics of the river environment. The river shall be readily accessible.

"Modified recreation" streams may contain calm water that can or is being restored to support appropriate water-based recreation, aquatic and fish life. Shoreline development may be extensive, provided it does not inhibit public use or detract from enjoyment of the river. The river shall be readily accessible.

The intake structures at Point Pleasant would have no significant effect on river recreation. The design and landscaping of shore facilities would blend in with existing development along the River in the area.

Currently, the Schuylkill River in the vicinity of Limerick and the confluence of the Perkiomen is included in the Pennsylvania Scenic River System, under the "modified recreation" classification. The development and operation of the Point Pleasant Project would have no substantial effect on the Schuylkill River, and is consistent with its designation within the system.

The Pennsylvania Coastal Zone Management Report (CZM), in assessing recreational demands and needs of the Delaware Estuary, found that the River has not been developed to its full potential primarily because of the limited publicly owned access areas. Under DER water quality regulations, swimming, recreational boating and fishing are recognized and protected.

The Delaware River Basin Commission has prepared a series of recreation maps containing detailed information about the physical characteristics of the River and the associated recreational facilities available for public use.

Section I extends from Upper Black Eddy to New Hope, Pennsylvania and Lambertville, New Jersey with Point Pleasant being the approximate mid-point of the section. The topography of the area is gentle and undulating except for some deep cuts along the river. Throughout the section the river drop is more gradual than in upstream sections. Long quiet pools, fairly shallow and separated by gentle riffles, characterize this reach. The river bottom is composed almost entirely of gravel and rubble. Only occasionally is the bedrock exposed. While somewhat richer in nutrients than the northern sections, the water in this section is clean and well aerated, even though at times it may appear quite turbid as a result of microscopic plankton growth.

The Delaware Canal continues throughout this section and south to Bristol. On the New Jersey side a second canal, the Delaware and Raritan Canal Feeder, originates just above the Lumberville wing dams at Raven Rock. Like the Canal in Pennsylvania, the restful environment of the Delaware and Raritan Canal makes it particularly desirable for beginner fishermen and canoeists.

Of the five species of sea-run fish that migrate into this area, three attract thousands of anglers to the more heavily used spawning areas. These are the American shad, shortnose sturgeon, and the Americal eel. In addition to the migrant species, this section also supports an excellent panfish and smallmouth bass population that provides good fishing throughout the spring, summer and autumn months.

The long quiet pools of Section I are heavily used for speedboating and water skiing. Parts of this reach, however, are particularly well suited for canoeing and other small boat use. Public access areas are identified as Upper Black Eddy, Raven Rock (Lumberville Wing Dams) and Lambertville.

Development of the Point Pleasant Project should have no adverse effect on Delaware River recreation resources and opportunities. Even at flows as low as 3000 cfs, a minimum water depth of 4 feet above the intake structure would be maintained, allowing free passage of canoes and watercraft typically used in this area. As noted previously, the design of the intake structure and proposed operation of the project should have no significant effect upon Delaware River fish habitat.

On the other hand, required minimum releases in the East Branch Perkiomen and the North Branch Neshaminy Creeks will assist in protecting and improving the aquatic habitat,

and should enhance recreational fishing opportunities. As part of the discussions leading to the issuance of Water Allocation Permit No. WA-0978601, Bucks County and the Pennsylvania Fish Commission agreed upon a cooperative effort to provide increased stream flows during the spring, coupled with public access through county lands for fishing on the North Branch Neshaminy and a fish stocking program for the creek.

G. Blasting

From plans filed by NWRA in conjunction with Application 09-81, and other information available to this Department, it is apparent that some blasting will be required in order to construct the proposed Point Pleasant pumping facilities. Because of the potential problems associated with blasting, careful consideration by the Department's Bureaus of Topographic and Geologic Survey, Mining and Reclamation, Design, Dams and Waterway Management and State Parks has been given to this topic. Blasting, in the Department's opinion, is potentially most extensive and, therefore, the most critical in the Delaware Canal area.

Bedrock beneath the canal at the proposed conduit crossing is hard, blocky mudstone (argillite) close to a gradational contact with hard brittle hornfels (a fine grained metamorphic rock). The geologic intrusion of diabase altered the mudstone to hornfels. Bedrock in the area is characteristically hard, brittle, fine to medium grained and poorly bedded. The top of rock is between 27 and 32 feet below the surface at the Canal and approximately 27 feet below the surface at the pumping station site. Excavation of about 12 feet of rock, varying somewhat from place to place, under the Canal and approximately 22 feet under the adjacent pumping station is required according to design. Bedrock is fractured and broken in part with some clay seams, so that the upper few feet may be rippable. However, blasting will be necessary to reach final grade.

Because the rock to be blasted is hard and dense with a moderately well developed, blocky joint pattern, excavation can be satisfactorily done with a designated peak particle velocity not exceeding 0.5 inches per second. In the Department's opinion, this along with other blasting criteria outlined in Appendix B (prepared by DER) can be followed during rock excavation in the vicinity of the Delaware Canal at the subject site without incurring damage to nearby buildings, lock structures and retaining walls. It should be noted that the criteria set forth in Appendix B are in general agreement with the criteria outlined in the Specifications for Blasting by Robert H. Davis, May 9, 1980.

In DRBC's Final Environmental Assessment (August 1980), the section on rock blasting impacts concludes that the specifications proposed by NWRA's consultant (Mr. Robert H. Davis) are well within the criteria set by DRBC's consultant (Converse Ward Davis Dixon, Inc.) as outlined in the "Report on Evaluation of Rock Excavation and Impact of Blasting for the Proposed Point Pleasant Pumping Facilities, Point Pleasant, Pennsylvania" (May 20, 1980). Specifications recommended by Converse are similar to the New Swiss Standard, which is the most conservative of the references cited by Converse Ward Davis Dixon. Since both consultants agree that no significant damage would occur if blasting is performed according to the prescribed specifications, DRBC concluded that this part of the construction process would not impose an unacceptable adverse impact on the environment.

Revisions were made to the plans that Converse Ward Davis Dixon originally reviewed, thereby initiating an evaluation of the new data. In a letter to E. H. Bourquard Associates, Inc., dated August 28, 1981, Converse again concluded that their original conclusions and recommendations were still valid, provided that blasting criteria specified in the report are followed. Converse also indicated that the nearby structures mentioned in their May 20, 1980 report which would be adequately protected by the proposed blasting criteria include the Delaware Canal locks.

In a letter to Mr. Roy E. Denmark, Jr., U.S. Army Corps of Engineers, dated January 22, 1982, NWRA reiterated its commitment to conduct pre- and post-construction surveys of wells and residences in the vicinity of the combined transmission main in connection with blasting. In short, NWRA will perform all blasting in a controlled manner to assure that there is no damage to nearby structures. NWRA will take all necessary measures to protect sites of archeological or historical significance.

The Department, therefore, concludes that if NWRA follows the guidelines noted in Appendix B and submits a blasting report to the Department's Bureau of Mining and Reclamation that reflects adherence to these guidelines, the Department would have no reason to deny issuance of a blasting permit in conjunction with the Point Pleasant Project.

H. Archaeological/Historical

There are two major areas of concern of archaeological or historical interest associated with the Point Pleasant Project. These are (1) the Delaware Division of the Pennsylvania Canal and (2) the Point Pleasant Historic District.

The Delaware Division of the Pennsylvania Canal was listed in the National Register of Historic Places on October 29, 1974. In addition, the Canal was designated a National Historic Landmark on December 28, 1976. As part of its justification in being granted these "honors", it is indicated that the Canal was both an economic and convenient means of transporting coal along the eastern coast. It provides today's visitors with an accurate and an authentic "look back" at the past.

The Point Pleasant Historic District was determined to be eligible for the National Register of Historic Places on December 29, 1981. According to information supplied by the U.S. Army Corps of Engineers, the District represents an important example of a rural Pennsylvania village typifying settlements in the 18th and 19th Centuries.

Because of the importance of preserving the integrity of both of these areas of concern, it is imperative that any impacts engendered by the Point Pleasant Project be minimized. As such, there has been extensive correspondence between the State Historic Preservation Officer (SHPO) and the Neshaminy Water Resources Authority (NWRA) in regard to the proposed facilities. In addition, the U.S. Army Corps of Engineers has submitted to the Advisory Council on Historic Preservation (ACHP) a report entitled "Preliminary Case Report for Neshaminy Water Resources Authority, Point Pleasant Diversion Project, Point Pleasant, Bucks County, Pennsylvania, NAPOP-R-80-D534-3, prepared by Elizabeth R. Mintz".

Both the State Historic Preservation Officer and the Advisory Council reviewed the proposed project. Through consultations with NWRA and the Corps, appropriate mitigation measures have been outlined to assure compatability of project appearance with historical values of the area, to control construction and blasting in order to protect historical structures, and to conduct an archeological survey of the site and preserve any significant archeological resources found. As noted previously, the Department has carefully reviewed the aesthetics of the proposed project, to assure compatability with nearby historical structures. DER has further considered construction, blasting and related installation practices to insure protection of the Delaware Canal and other historic features. The Department finds that the project, designed and constructed with implementation of the mitigation measures outlined in the plans, will be developed in a manner consistent with adequate protection of Pennsylvania's historic resources.

I. Land Use

The question most often raised regarding land use involves whether the Point Pleasant Project will promote more land development or induce more growth in the project service area.

The initial subject of the need for more water has been addressed not only in this Environmental Assessment (Section 3) but in DER's 1978 Water Allocation Report, DRBC's Final Environmental Assessment (August 1980), and DER's Draft State Water Plan, Subbasin 3 Report covering this area.

In general, these reports were prepared with the basic assumption that the population growth predictions were a result of growth management plans and decisions developed by the concerned municipalities and counties in their efforts to guide or direct future growth and development. Under Pennsylvania state law and policy, as expressed in the Municipalities Planning Code and other acts, local governments - not the State - are assigned the right and power to determine the type and rate of growth to occur within their jurisdictions. Through its resource planning (such as the State Water Plan), technical assistance and advice, and environmental regulatory programs, the Department may encourage and support sound land use planning by county and local agencies. However, absent a clear legislative mandate, it would be improper for the Department to disregard or usurp the lead role of local governments in determining growth policy for their communities.

While the availability of water supplies may be a factor in development decisions, water is only one of many resources affecting the rate, siting and pattern of growth. The assumption cannot be made that once an area approaches the limits of locally available supplies, growth will cease automatically.

The Department views this project as a response to an existing water problem. In the early stages of planning for the Point Pleasant Project, over a decade ago, State, county and regional agencies projected and assessed development patterns in the Bucks and Montgomery County area. Studies predicted water supply shortage would occur in the next ten years - by 1980. Despite repeated warnings of the pending water crisis, these shortages became a reality as underscored by the experience in the 1980-81 drought.

To evaluate the land use implications of the Point Pleasant Project, consideration must be given to the current development pattern without the project. As evidenced in county and municipal land use reports, Act 537 sewage facility plan submissions, project review applications filed with DRBC, and other observations, a primary pattern of residential subdivision development in Bucks and Montgomery Counties emerges. Many developments, seeking open land at a reasonable cost, site residential developments on farm and pasture land, often beyond the distribution lines of existing water systems. Developers rely on installing individual wells for each home, or drilling a single well and creating a mini-utility to serve the subdivision. (This sytem may be retained by the developer as an investor-owned utility, or turned over to a homeowners association after the lots are sold.) Absent effective local regulations or incentives to develop within established communities, this pattern results in a spreading checkerboard of subdivisions, industrial parks and malls.

Checkerboard subdivision development and continued sprawl of low to moderate density residential uses engenders a wide range of adverse environmental impacts. More roads must be built, and longer sewer, water, and other utility lines must be laid to serve the population than if the same number of people lived in higher density core areas, such as Doylestown, Lansdale and Norristown. This development requires more material resources and disturbs more land. It results in greater impervious surfaces, and thus tends to increase stormwater runoff and flood potentials, while reducing groundwater infiltration.

Sprawling development makes it more difficult to provide mass transit, and reinforces reliance on the automobile for transportation. Longer travel distances (from homes to work or shopping) engender greater energy consumption and produce higher volumes of air pollutants.

There is a tendency in such sprawl development to clear out natural vegetation during construction, to be replaced by residential landscaping. Open space and relatively undisturbed areas necessary for wildlife habitat are reduced, if not eliminated. Prime agricultural land is removed from food production, and converted to residential lawns, roads and septic system tile fields.

From an aesthetic viewpoint, checkerboard development makes it much more difficult to plan for and protect environmentally sensitive resources, trails, scenic areas and corridors. It is also far more difficult to design new subdivision development in a manner

compatible with adjacent subdivisions if areas are developed on a case-by-case, haphazard arrangement.

Many of these environmental impacts are reflected in higher economic costs as well. More roads and longer utility lines impose higher costs on all taxpayers and consumers. Spread-out development imposes higher police and fire protection costs to cover a larger area within adequate response times. In these days of petroleum shortage, it is easy to see the cost implications of increasing reliance on cars and the higher energy demands created by sprawl. On a regional basis, sprawl is likely to leave empty classrooms in already developed core areas, while imposing tax burdens in newly developed neighborhoods to build more schools.

For these reasons, DER recognizes the need to foster a water supply system which encourages more efficient and environmentally responsible land use development. The Point Pleasant Project encourages achievement of such goals.

The NWRA regional public water supply project has been planned and designed in a manner to encourage the orderly provision of water supply services in a manner consistent with sound conservation practices and comprehensive planning in the region. By making water available in areas presently served by public systems, development in existing communities is encouraged and new, checkerboard-type development is discouraged.

The State Water Allocation Permit No. WA-0978601 granted to the NWRA includes conditions designed to foster the type of planned growth pattern favored by both Montgomery and Bucks Counties. Under Special Condition No. 9 of the Allocation Permit, NWRA may only sell water to retail public water supply systems after those systems apply to DER for "subsidiary allocations". The Policy and Guidelines for Review of Applications for Subsidiary Allocations, established by the Department, specify requirements for obtaining subsidiary allocations of water from the Point Pleasant Project. In order to obtain such a subsidiary allocation, the retail water supply system must indicate a need for supplemental water, substantiated by appropriate population and water demand projections. Those projections will be reviewed for consistency with local and county comprehensive land use plans, as well as consistency with the Delaware Valley Regional Planning Commission regional plans, the State Water Plan, and other water supply, wastewater management and environmental plans. The Policy and Guidelines establish a clear procedure for submission and review of subsidiary allocation requests, including notification of DRBC, the Delaware

Valley Regional Planning Commission, the respective county planning commissions, other retail water systems within NWRA's service area, and affected municipalities, with the opportunity to comment and consult on the applications.

Additionally, it should be noted that the Point Pleasant Project does not simply provide 40 mgd more water supply capacity to the NWRA service area, to be used in addition to current ground and surface water sources as the basis for attracting new development. The objective of the project is to relieve presently stressed supplies, while providing limited supplemental water for the "planned growth" contemplated by the Bucks and Montgomery County comprehensive plans.

Over the past four years, DRBC's approvals of all groundwater withdrawals in southeastern Pennsylvania have contained conditions limiting the approval to five years, and requiring groundwater users (especially public water supplies) to seek supplemental sources. Further, all of the NWRA service area has been included within the DRBC Southeastern Pennsylvania Ground Water Protected Area, subject to more intense scrutiny of groundwater development and use. As the Point Pleasant Project comes on line, withdrawal approvals within the service area will be carefully reviewed, in order to assure that the total withdrawal by each system - from ground and surface water - is consistent with the comprehensive plans for the area and the principles of conjunctive use and conservation of the total supply.

J. Wetlands

Although limited in area involved, there is a wetland area that will be affected by the Point Pleasant Project. According to information supplied by E. H. Bourquard Associates, Inc., the total area of affected wetlands is 0.30 acres which is about one-third of the 0.93 acres of wetlands available on the site. According to information made available to this Department from the Corps of Engineers, these wetlands are typical of many floodplain forests in south eastern Pennsylvania. The most abundant plants in the tree size class are green ash, silver maple, sycamore, box elder, and river birch. The shrub layer is dominated by spice bush, while the ground cover consists of Japanese honeysuckle and purple loosestrife and bur-cucumber in the wetter areas.

Based on a review of the facts in this case, the Department finds that the small wetland area involved is not an "important wetland" within the meaning of Section 105.17 of

the Department's regulations. Nevertheless, actions must and will be taken to minimize and mitigate any unavoidable impacts created by the project. Of the total 0.30 acres affected by the project, 0.22 acres of wetlands will be permanently destroyed by the placement of fill. This acreage has been reduced by NWRA to minimize wetlands lost to the smallest acreage practicable. The remaining 0.08 acres of disturbed wetlands will be restored to original grade and returned to pre-construction conditions. NWRA has noted that there will be no temporary stockpiling of excavated materials on any wetland areas.

K. Alternatives

In discussing the environmental impacts of the proposed NWRA facilities, the Department and DRBC have carefully considered the alternatives which might be pursued and the likely impacts of those alternatives. In this regard, the Department wishes to commend DRBC and the applicants for laying out in their reports the major options available for public consideration.

The Department wishes to address a few of the alternatives in particular, because of their important implications on State resources management and environmental policy in this region.

(1) No Action

If this alternative were selected, the people in Bucks and Montgomery Counties would be in the same position they are in today, the owners of an unreliable water supply. The recent experience of drought and water supply shortages in 1980-81, forcing virtually universal bans on some water uses and full water rationing programs in a number of communities, makes clear that no action is no option.

(2) Water Conservation

DER has gone on record many times in support of water conservation. Conservation is considered as the first priority alternative for satisfying an existing or projected water supply deficit for all water companies in its State Water Plan. However, the Department realizes that, at best, this alternative offers only a short-term partial solution to the problem.

Water Allocation Permit No. WA-0978601 and the Policy and Guidelines for subsidiary allocations require both NWRA and any retail water system receiving water from the Point Pleasant Project to implement conservation measures on a continuous basis. NWRA and the retail systems must submit and implement an adequate program to encourage water conservation by residential, commercial, and industrial customers; and further must implement an adequate, systematic program of monitoring, repair, and preventative maintenance to detect, correct, and where possible, prevent leakage in transmission and distribution lines.

In assessing the need for the project, both DER and DRBC have considered that reasonable water conservation measures and practices will be followed. Without a continuing conservation program, demand in the area to be served would be even higher.

Water conservation is a necessary part of the solution to problems in central Bucks and central Montgomery Counties, but it is not a panacea. The effectiveness of water conservation is limited by the type of residential and commercial uses served by the public water systems in the area. Compared to residential per capita uses in the western United States, which often exceed 300-400 gallons per day per person, total per capita use in the NWRA service area is relatively low (100-130 gpcd). Discretionary water uses, such as lawn watering, are not predominant.

In order to effect conservation savings, basic changes in water-using appliances, processes and habits must be evolved. Because of water pollution control costs and regulatory requirements, many businesses have already implemented changes in their processes to minimize water use, and further reductions are likely to be more difficult and expensive. Residential uses may be reduced by utilization of low-flow plumbing (toilets, shower heads and faucets). While such conservation plumbing may be implemented readily on new construction, retrofitting of existing homes will take many years. The net conservation effect will not be instantaneous, but will evolve over time.

Finally, the volume of water to be saved via conservation should not be overestimated. Even during severe drought conditions, such as occurred during 1980-81, when people are most sensitive to shortages and the need to conserve, a savings of only 10-15% in average total public water supply use may be achieved. This alone is not enough to solve the Bucks-Montgomery water supply problem.

(3) Further Development of Groundwater

In the absence of a concerted regional effort to develop and distribute surface water supplies, and to effect conjunctive water management, the most likely structural alternative to meet public water supply demands would involve further development of already stressed groundwater resources.

As already noted, DER — along with most of the other agencies responsible for water management in this region -- believes that this area is already overdependent on groundwater. Clearly, the problems associated with the recent drought illustrate the validity of these concerns. If groundwater is to be managed as a replenishable resource, withdrawals must be brought in line with groundwater recharge. We cannot continue to overdraw this region's groundwater basins without facing the inevitable consequences: lowered water tables, depletion of private residential wells, diminished stream flows (especially in summer), and, in turn, reduced assimilative capacity, higher wastewater treatment requirements and costs, and adverse impacts on aquatic ecosystems.

If anyone doubts the problems associated with overreliance upon, and competition in, development of groundwater, the experience of the past year of drought should be sobering. In 1980 and early 1981, the region endured a period of moderate to serious rainfall shortages, but far less than a record drought condition. Nevertheless, by March 1981, over 4,000 domestic wells in eastern Pennsylvania had gone dry as a result of this drought event. Four thousand families found themselves without water for essential drinking, sanitation and other domestic uses. The costs of replacing these supplies represented an economic loss of over $6.7 million, borne primarily by these homeowners. The area surely does not need a record drought to make the point more clearly.

Theoretically, it might be possible to serve the more developed portions of Bucks and Montgomery Counties by installing a wide ranging system of wells in the rural areas, with water lines conveying groundwater to the already overpumped communities. Even if economically feasible (which is open to some doubt), for environmental reasons the Department would express serious reservations regarding such a scheme.

In order to develop a well system, yielding 40 mgd public water supply capacity equivalent to the Point Pleasant Project, a large number of wells would have to be dispersed in a pattern which extracts water efficiently, but avoids exceeding the recharge rates of the

involved aquifers. Even assuming that normal year recharge rates of 300,000 - 600,000 gallons per day per square mile are the limiting factor, and that no other users were in the area, such a groundwater development project would involve a minimum of one or more wells in each of over 65-130 square miles. Based on water budgets in a dry year, as calculated by R. E. Wright Associates, some 120 to 274 square miles would be required. (To serve the cooling water needs of the Limerick plant, an equivalent well project would be involved.)

Unless such a well system were dispersed far from the existing areas of heavy groundwater use, it could lead merely to further exacerbation of the groundwater mining problem. Groundwater mining can occur whether the withdrawals are made by a few wells, or many dispersed wells; the problem arises whenever the total amount of groundwater withdrawals in an area exceeds the recharge in the area. In portions of the Montgomery and Bucks County region, groundwater withdrawals already approach or exceed recharge rates. The communities immediately adjacent to these areas are developed in large part, and also primarily rely on groundwater through homeowner or public water system wells. Placing additional wells in these nearby communities to serve the existing "groundwater mining" areas is likely to combine with local uses to simply spread the "mining" areas.

The R. E. Wright Associates groundwater study plotted the density of current groundwater uses in the area. Based on the use densities and recharge rates of local aquifers,[32] in order to avoid interference with neighboring uses, a supplemental well system to serve the needs of the Lansdale, Hatfield, Warrington and Warminster areas would have to be sited at least 6 to 10 miles from those communities, in undeveloped areas or in less developed portions of other municipalities and other water companies.

Placing a system of wells in more remote rural areas would naturally involve installing an extensive series of water transmission lines through now undeveloped lands. But placing a widespread network of water lines in rural areas would provide an attraction for suburban development in those rural areas, most likely leading to the same groundwater overuse problems now being experienced.

Even if a dispersed well system did not lead to groundwater mining, it is likely to create problems of local interference with homeowner wells. Most homeowner and farm wells in rural areas of this region are relatively shallow (from 50 to around 200 feet deep). New wells developed to serve subdivisions or community water supply systems are likely to

be deeper and more powerful than the typical homeowner well. As seen in a series of recent cases in Montgomery, Bucks, Chester and Lehigh Counties, such development may create cones of influence which draw down water tables in nearby shallow wells, causing interference and/or total depletion. The more groundwater is relied upon as the almost sole source of supply, the more prevalent these problems are likely to become.

The Department is equally disturbed by the prospect that dispersed well development would tend to attract and encourage a checkerboard of subdivision developments, with attendant adverse environmental, social and economic impacts. The most likely sites for supplemental well fields to serve central Bucks and Montgomery Counties fall within areas of prime farm lands. Both counties and the Commonwealth have expressed policies to protect and conserve these valuable soil and land resources. Encouraging more groundwater development in rural areas as a solution to water shortage problems would tend to undermine these prime farmland protection policies.

Thus, as an alternative solution, further development of the groundwater is unsatisfactory from many perspectives, and the Department finds it an unacceptable option for this region.

(4) Utilization of Lake Galena

Proposals have been made that the storage of Lake Galena (PA-617) alone be used to supply public water supply needs, without augmentation by waters diverted from the Delaware River.

Lake Galena was designed incorporating a long term water supply storage capacity of 5000 acre feet (1.63 billion gallons). The gross yield of this storage in a drought of record would be 9 mgd. Accounting for the minimum continuous conservation release of 1.5 mgd required to protect downstream areas on the North Branch Neshaminy, the net yield of Lake Galena is 7.5 mgd. It is assumed this water would be picked up at Chalfont, treated and distributed under arrangements and conditions similar to those contemplated by the proposed Point Pleasant-Chalfont project. Reservoir storage combined with the natural flow of Pine Run and the North Branch Neshaminy, would yield approximately 8.5 mgd at Chalfont.

As noted previously in part 3.A. of this report, the supplemental average daily water needs in Central Bucks and Central Montgomery Counties totalled 14.9 mgd in 1981, and are expected to rise to 20.8 mgd by 1990. Lake Galena alone could not serve the public water supply demands contemplated within the service area of the Neshaminy Water Supply System.

The storage yield of Lake Galena might serve a portion of the NWRA service area, or (as contemplated by the proposed project) serve a portion of needs in the entire service area. Considering the minimum flow requirements in the North Branch Neshaminy below Chalfont (averaging 3.5 mgd), Lake Galena alone would barely meet the 1981 needs of Central Bucks County (2.7 mgd + 3.5 mgd, or a total of 6.2 mgd). By 1990, the projected average daily supplemental water supply demand of 4.9 mgd in just Central Bucks County, coupled with the required flow rates below Chalfont - totalling 8.4 mgd - would exceed the net yield of Lake Galena and just barely be covered by the combined yield of the reservoir storage and natural stream flows. The combined yield of Pine Run and the North Branch Neshaminy watersheds (including Lake Galena storage) would clearly be inadequate to serve Central Bucks County needs beyond the year 2000.

Use of Lake Galena alone, without the Point Pleasant Project, would engender additional drawdowns of lake levels and fluctuations of pool elevations, especially through summer months. Certain recreation uses at Peace Valley Park would be sacrificed to meet water supply demands, and fish spawning areas in Lake Galena would be eliminated.

Because of the inadequacy of Lake Galena to meet the public water supply demands of the Neshaminy Water Supply System service area, the impacts and costs of this alternative must be considered in conjunction with one or more other projects required to address the entire regional water supply problem.

(5) Utilization of Lake Nockamixon

Suggestions have been made that a direct withdrawal from the State-owned Lake Nockamixon be used in lieu of a diversion at Point Pleasant, as the source for the NWRA water supply system. Since the Department of Environmental Resources constructed and operates this facility, it has some knowledge and views regarding this option.

When the Department constructed Nockamixon Reservoir, storage was included in the reservoir for long-term future water supply needs. However, DER developed the project with the understanding and plan that it would be operated as a single purpose recreation facility until at least the year 2000, before any water supply would be utilized. Under this assumption, the recreational facilities along the lake were designed to accommodate a five-foot drawdown, which is only slightly greater than the normal drawdown resulting from low flow releases and evaporation. Any water supply usage would cause much greater drawdowns, necessitating the redesign and modification of these facilities, in addition to substantially reducing the recreational usefulness of the lake. In light of the fact that Lake Nockamixon and the surrounding State park provide a major regional recreational resource, which is heavily used by citizens of the five-county metropolitan area, DER would be extremely reluctant to reduce its recreational capacity at this time in order to allow water supply usage, unless no other feasible, cost-effective alternative for public water supply were available.

Even if Lake Nockamixon were to be utilized for public water supply, a direct diversion from the reservoir would not be the most efficient mode of operation. It would be preferable to use Lake Nockamixon in conjunction with a downstream diversion on the Delaware, such as the proposed Point Pleasant withdrawal. In this mode, moderate to high flows on the Delaware could support public water supply for most of the year, while the available storage in Nockamixon is saved to augment available flows during dry periods. In contrast with a direct reservoir tap, which draws on storage all the time, a river withdrawal-reservoir augmentation arrangement would greatly enhance the yield from Lake Nockamixon and allow more water to be made available when it is most needed.

There is an additional disadvantage to a direct tap-off of Lake Nockamixon. Such a withdrawal would make the NWRA system heavily reliant on continuous operation of the Lake. However, it is probable that at several points over the life of the facility, the Lake will have to be drawndown for inspection and perhaps maintenance and repairs. It would be extremely hard to take the reservoir out of service for maintenance if it were to become the direct and sole, or primary, water source for the entire NWRA system.

In summary, DER cannot endorse the use of Nockamixon Reservoir for public water supply at this time. It is serving a large public demand for recreation, while providing some backup insurance for drought protection to the Delaware Estuary. In addition, the

Department notes that special legislative authority would be needed for DER to sell water from Nockamixon or any other State-owned reservoirs.

(6) Withdrawals From the Schuylkill River

Comments have been received suggesting that Montgomery County utilize withdrawals from the Schuylkill River for public water supply, rather than interconnect with the NWRA system.

It must be recognized that Montgomery County has made a good faith effort to develop the resources of the Schuylkill River. Several communities, including Norristown and environs, derive their water supplies directly from the Schuylkill, and others are now using groundwaters of the Schuylkill Basin. Philadelphia Suburban Water Company has intensively developed the Perkiomen Creek watershed, via its Green Lane Reservoir and intakes near the confluence with the Schuylkill River.

In fact, the Schuylkill River is the most intensively used watershed in the entire Commonwealth, and its resources are already used and reused to close to their practical limits. The City of Philadelphia now withdraws an average of 180 mgd from the Schuylkill for municipal water supply. However, the Schuylkill's record seven day average low flow is 200 mgd. The lower Schuylkill is heavily industrialized, while the upper reaches sustain considerable agricultural production. According to State Water Plan assessments, withdrawals in the Schuylkill River watershed today total over 950 mgd. During low flow periods, every drop of water flowing in the Schuylkill River is used five to six times over. Even with modest increases in use, the potential conflicts among agricultural, power, municipal, industrial, and other uses during drought conditions are obvious.

Unfortunately, opportunities for developing further storage in the Schuylkill watershed are extremely limited, due to geology, past mining activities in upper reaches, and the location of communities in several of the technically viable reservoir sites. Both the State Water Plan and the DRBC Level B Study indicate that technical, environmental, economic or social conditions virtually preclude development of significant new surface water storage facilities in the Schuylkill Basin in the foreseeable future.

Because of the already intensive use of the Schuylkill, we must conclude that further significant withdrawals for public water supply would not be the optimal choice to serve

regional needs. Such increased use on the Schuylkill would likely lead to further quantity conflicts, and because of the increasing factors of reuse, a further buildup of total dissolved solids and deteriorated water quality.

(7) Development of Evansburg Reservoir

Another alternative is the possiblity of utilizing Evansburg Reservoir, a potential reservoir to be developed by the Commonwealth of Pennsylvania in Evansburg State Park on Skippack Creek, Montgomery County. This facility has not been constructed, has not been authorized, and has not been funded. As conceived, if it were built, Evansburg Reservoir would provide only 20.2 million gallons a day for water supply at the site. Because of its location and relative elevation, Evansburg could not serve the Bucks County water supply service area covered by the Point Pleasant Project.

Evansburg Reservoir could potentially supply some portions of the Montgomery County service area. However, a 20.2 million gallons a day capacity could barely meet the average demand deficiencies of Central Montgomery County, with no reserve for peak day requirements.

In 1980, DER reexamined the potential for utilization of Evansburg to serve water supply needs, and reassessed the cost and benefits analysis for this project. The original cost and benefit analysis of the Evansburg facility did not lend itself to comparison with assessments of other potential water supply projects. Most critical to the prior analysis was the assumption that the reservoir would serve primarily a recreational purpose, with only limited water supply utilization scheduled in the near term. As a result, a large portion of project's direct and indirect costs (over 87%) were allocated to recreational purposes. The preliminary assessments were further based on construction and development cost estimates for the basic reservoir facilities at March 1978 material and labor price levels. No estimates were included for costs of water treatment and distribution facilities necessary to utilize a potential water supply storage in the project.

If Evansburg Reservoir is considered as a basic water supply source for central Montgomery County, rather than a supplement to other major sources, including Point Pleasant, the fundamental operating assumptions for the Evansburg Project must be modified. Because of the health and safety implications of major reliance upon Evansburg by public water supply agencies, water supply would become a dominent constraint in

operation of the facility. In the event of a precipitation shortfall, such as might occur in a moderate drought, it must be expected that recreational purposes would be sacrificed to meet the demands of public water supply service. Under these modified operational assumptions, water supply would be required to bear between 38 and 48% of the general project costs.

The Department also prepared preliminary cost estimates for the total water supply system, assuming Evansburg were chosen to provide up to 20.2 mgd in water supply yield for communities in Central Montgomery County. The total water supply system includes: (1) storage in Evansburg Reservoir and withdrawal facilities; (2) a water treatment plant, utilizing standard filtration and disinfection technologies, with 20.2 mgd capacity; and (3) two transmission lines between the reservoir and the existing public water supply distribution systems in the vicinity of Ambler-Hatboro and Lansdale. April 1979 price levels were utilized to facilitate comparison with similar estimates made for the Neshaminy Water Resources Authority Point Pleasant-Chalfont Project. The total costs of the Evansburg water supply system for Montgomery County, in 1979 dollars, was estimated to range between $27.9 to $30.9 million, nearly 50% more than the Montgomery County portion of the Point Pleasant water supply costs.

(8) Imports From the Susquehanna River

In correspondence received by the Department regarding the NWRA project, it was suggested that Montgomery County's needs might be served by diversions from the Susquehanna River.

The suggestion that Montgomery County utilize the Susquehanna River appears to reflect a misconception of geography. All of Montgomery County lies within the Delaware River Basin, and is nowhere near the Susquehanna River. The area in Montgomery County to be served by Point Pleasant-Chalfont Project is over 65 miles from the closest point of the Susquehanna River. Even if a feasible diversion project could be conceived, such a project would engender a significant transfer from the Susquehanna Basin (which flows into Chesapeake Bay) to the Delaware Basin (which flows into the Delaware Bay). No water would be returned to the Susquehanna, and such a transfer would have to be considered a totally "consumptive" use, requiring construction of makeup storage in the Susquehanna Basin to protect downstream flows into the Chesapeake. In contrast, the Point Pleasant Project would divert, use and return water entirely within the Delaware Basin, and would

not engender large-scale consumptive use. From the viewpoint of sound water management, as well as environmental and economic considerations, the use of Delaware Basin water in the Delaware Basin is by far preferable to construction of a Susquehanna to Delaware transfer project.

(9) Independent Water Supply Projects

As noted in DRBC's Environmental Assessment (August 1980), another alternative was assessed in the Central Montgomery County Water Supply Study prepared by Gannett Fleming Corddry and Carpenter, Inc. (January 1980) for the North Penn Water Authority and the North Wales Water Authority. This option would involve an independent Montgomery County water supply project. The Gannett Fleming study concluded that, if an independent project were pursued to serve Montgomery County, the most feasible option still involved a transfer from the Delaware River, either at Point Pleasant via the Perkiomen Creek, or at New Hope via a pipeline to the service area.

Whether the cooling water project is separated from the public water supply project, or Bucks and Montgomery Counties each pursue independent water supply projects, it appears each of the options being considered contemplates diversions from the Delaware. Under these conditions, a joint project is preferable from both an economic and environmental impact perspective.

The proposed Point Pleasant pipeline route is superior to any of the alternative pipeline options studied by PECO[33] or Gannett Flemming. A joint cooling water/public water supply project involves two less miles of pipeline right-of-way than the total of two individual facilities. A joint project avoids increased impacts engendered by multiple intakes on the river, multiple pumping stations, clearance of vegetation for multiple pipelines, and repeated disturbance of communities affected by construction activities. Joint facilities have further advantages in greater operating flexibility and reliability. By involving less materials and land, and sharing economies of scale in construction of joint pumping and transmission facilities, PECO and the public water supply systems will accrue a 10 to 20% or greater annual cost savings compared to separate, independent facilities.

(10) Using City of Philadelphia Water Supply

According to NWRA's Environmental Report (February 1979), the alternative of utilizing water from the City of Philadelphia system would require the extension of existing water distribution facilities from Lower Southampton through Warminster to Chalfont.

The following items are offered as reasons that the Department could not recommend this alternative:

(a) By supplying water to the area that would benefit from Point Pleasant water, the City of Philadelphia would utilize a substantial amount of its reserve capacity which would preclude the use of its water to urbanized areas located closer to the Torresdale intake. As noted in the DRBC Level B Study and the Good Faith Recommendations, serious consideration is being given to developing interconnections between Philadelphia and the Camden Metropolitan area water systems, in order to relieve overpumping of the Potomac-Raritan-Magothy aquifer system and attendant problems of potential salinity/sodium contamination of sensitive drinking water supplies. If this option is selected, the City of Philadelphia water supply will become a key element in a regional solution to a critical problem facing the Basin. That solution would likely require all or most of the reserve capacity now extant at the Torresdale plant to provide effective relief in neighboring communities across the River.

(b) The Department does not view this alternative as the most cost effective in light of the distances involved in transporting Philadelphia water to the potential users.

(c) The raw water quality at Point Pleasant will be better than at the Torresdale intake, and likely to involve less treatment and operating costs.

(d) Even if public water supply needs in Bucks and Montgomery Counties were met via interconnections with the Philadelphia system, PECO's cooling water demands would still require development of a project to transfer Delaware water via the Perkiomen. The most likely point of diversion would remain at or near Point Pleasant. The net environmental impacts of the total alternative project

(Philadelphia interconnection/separate PECO Delaware transfer) would not be significantly less than the proposed Point Pleasant Project.

This option must further be considered together with alternatives likely to be pursued by the Camden area and other communities who are thereby precluded from an interconnection with Philadelphia. Several of these alternatives, involving development of additional Delaware River diversion projects, when coupled with the Philadelphia interconnection to Bucks/Montgomery and the separate PECO Delaware transfer, may well engender greater environmental impacts than the Point Pleasant Project.

(11) Cooling Water Withdrawal at Philadelphia

Another alternative hypothesized in comments, involves diversion of Delaware River water at Philadelphia (rather than at Point Pleasant) for transfer to Limerick.

Cooling water does not require treatment to drinking water standards, and interconnection with a public water supply distribution system to serve the power plant would be a wasteful use of treatment capacity. Thus, this alternative contemplates a raw water withdrawal from the Delaware pumped to Limerick via a separate pipeline.

For these purposes, DER assessed the potential of a withdrawal from the Delaware, located approximately one mile upstream of the Ben Franklin Bridge. A 30 mile pipeline would be installed through 11 municipalities, including Philadelphia, Conshocken, Norristown, and Collegeville. Water would be pumped up an elevation differential of 450 feet.

The total estimated capital cost of this alternative just for cooling water exceeds $52 million, based on a conservative projected cost for the pipeline construction at $1.5 million per mile. This compares with a capital cost of the proposed Point Pleasant Project of approximately $43 million, for both cooling and public water supply services.

The pipeline contemplated would be three times the combined length of the Point Pleasant combined transmission main and Perkiomen transmission main. Installation would entail intensive construction activities, including excavation of public streets and relocation of numerous underground utilities, through heavily populated areas. This compares with relatively easy installation of the Point Pleasant mains along rights-of-way of country roads,

in largely rural areas with low population density and little dislocation. The Philadelphia-Limerick pipeline would involve numerous crossings, under or over natural streams, including mainstems of the Wissahickon and Stoney Creeks.

In terms of effects on the Delaware River flow and salinity, a withdrawal at Philadelphia would involve impacts similar to a withdrawal at Point Pleasant. As noted previously, salinity intrusion is controlled by total flows entering the River above the Schuylkill confluence, and flow/salinity management is affected by the rate of consumptive use, not the location of withdrawal.

Operation of the Philadelphia-Limerick pipeline transfer would involve substantially greater pumping of water, over a greater distance, entailing higher energy usage and costs than experienced at Point Pleasant. Because of the length of conduit structures, and routing through populated areas, maintenance and repair activities will be more difficult, and much more costly.

This alternative is neither cost-effective, nor preferable from the perspectives of social and environmental impact.

L. Special Topics

(1) Merrill Creek Reservoir Project

The Merrill Creek Reservoir Project is a project proposed to be constructed in Warren County, New Jersey, by the Merrill Creek Owner's Group (MCOG) to compensate for consumptive water use in the Delaware River. Since PECO is a member of this group and will need a source of make-up water if Delaware River water is used during low flow periods, interested parties have indicated that this Environmental Assessment will be incomplete if DER does not evaluate this project.

At the outset, it should be noted that water from the Merrill Creek Reservoir would (if constructed) service more than just the Limerick Nuclear Generating Station. This project was designed to supply the anticipated compensation requirements of all the member utility companies of MCOG, providing consumptive use make-up for a series of power plants in the Delaware Basin. Second, PECO's use of Delaware River water does not depend solely on the construction of the Merrill Creek Project. The prime source of water for Limerick is the

Schuylkill River which has sufficient flow most of the year (even in a drought) to supply Limerick's cooling needs. Under the "river follower" rule, PECO may suspend its withdrawals when flows drop below authorized levels, in the event make-up water is unavailable.

The Delaware River Basin Commission, which has jurisdiction over the project, has prepared a full draft environmental impact statement on the Merrill Creek Reservoir Project.[34] Although DER has no jurisdiction over the Merrill Creek project located in New Jersey, the Department has reviewed the draft EIS as it may relate to the impacts of the Point Pleasant project.

Based on detailed analysis contained in this 300 page EIS, DRBC has concluded that:

(a) The geotechnical attributes of the Merrill Creek site are suitable to design and construction of a safe reservoir.

(b) The Merrill Creek Reservoir, located at the site of an existing smaller reservoir, would not impose unacceptable changes in land form, land use, land value, physical or cultural attributes of the project area.

(c) The Merrill Creek Project will not have a significant adverse affect on the prevailing hydrology, water quality, and hydrogeology of the Merrill Creek watershed, Pohating Creek, the Delaware River or groundwater in the area.

(d) The project will not significantly affect the climate or air quality of the project area.

(e) The project will have a significant affect on terrestrial and aquatic ecology in the reservoir area, and downstream of the project on Merrill Creek. However, mitigation measures, including a fisheries management program and conservation release schedule, to reduce or compensate for adverse impacts are proposed.

(f) No significant adverse impacts would accrue to people, their sources of livelihood, culture or government as a result of the project.

(g) The Merrill Creek Project is the most desirable of the alternatives considered to provide a supplemental supply of cooling water for electric generating stations located in the Delaware River Basin.

DER has consulted with representatives of the New Jersey Department of Environmental Resources, who have indicated general concurrance with DRBC's assessment of the Merrill Creek Project. The State of New Jersey has previously indicated its support for the Merrill Creek Reservoir, and endorsed early action on the project as evidenced by the Good Faith Recommendations.

The Department of Environmental Resources finds that the environmental impacts of the Merrill Creek Project have been and will be adequately addressed in reviews by the State of New Jersey and DRBC.

(2) Hydraulics of Water Intake

Questions have been raised concerning the actual operation of the water intake assembly and what if any effects (such as funneling or whirlpooling) might result when this assembly is operating.

These issues were specifically addressed in a report prepared by E. H. Bourquard, dated April 30, 1982.

(a) Water Intake Assembly

The intake assembly will be located in the channel of the Delaware River, about 245 feet off the west bank. The screens are part of a Tee and are aligned in two rows parallel to the flow of the River. The screens will consist of stainless steel wedge wire wrapped around a cage with a clear opening between the wires of 2 mm. Each screen will have a diameter of 40 inches and a length of 40 inches. The overall length of the horizontal part of the Tee is 124 inches, and there will be a total of 12 such Tees, 6 in each row.

The lower portion of the intake assembly, primarily the support and connecting piping, will be below channel bottom and protected from possible scour during floods by a blanket of rock riprap. The upper portion of the assembly, the part above the channel bottom, will have a maximum cross-sectional area at intake centerline of 48.3 square feet. This portion

basically consists of two 40-inch diameter almost continuous cylinders about 70 feet long with nose cones at each end. These two cylinders are supported at six places by 24-inch pipes which connect at a 45 degree angle to a vertical 36-inch pipe. The top of the screens, at Minimum Water Surface (Elev. 70.0 feet MSL), will be covered by at least four (4) feet of water and the bottom of the screens will be at least two (2) feet above channel bottom.

(b) Effect on River Flow

The cross-sectional flow area of the Delaware River at the intake site is 3,610 square feet at Minimum Water Surface (Elev. 70.0), and 5,100 square feet at Normal Water Surface (Elev. 72.4). The upper portion of the intake assembly, with a cross-sectional area of 48.3 square feet, will occupy 1.3% of the channel at the minimum stage and less than 1% at normal stage. River flow velocities past the assembly at minimum stage will be about 1-2 feet per second, and at normal stage about 2-3 feet per second. With these low percentages and flow velocities, it is evident that the assembly will not create any appreciable disturbance of River flows. A field inspection of a similar intake in the Dan River at Eden, N.C., confirms this conclusion. This intake utilizes 30-inch diameter screens in a single row having a length of 30 feet. The Dan River is approximately 200 feet wide and 5-6 feet deep. A measurement of the surface flow velocity over the screens during the inspection indicated a flow velocity past the screens of about 3 feet per second. The water depth at the intake was about 5 feet and the screens were one foot off the bottom; thus, the submergence was approximately 1.5 feet. Although the screens took up 1/2 of the channel depth, there was no disturbance of the water surface; in fact, there was not even an indication of the intake's presence.

Hydraulic computations, based on the Yarnell equation, were completed to obtain the water surface change due to the Point Pleasant intake assembly and the calculated results were in the ten-thousandths of a foot, in other words, nil.

(c) Effect of Intake Withdrawals

The manufacturer of the screens, Johnson Division of UOP, recommends "a minimum distance of one screen diameter from the centerline of the screen assembly to both the surface and the bottom of the water body". This is based on an analytical analysis completed by the Johnson Division. According to Johnson Division, with these distances, there will be negligible effect on the flow fields entering the screens; a by-pass current,

which will be present at the intake, will further decrease any effects on these boundaries. As the distances between the screens of the Point Pleasant intake and the water surface and the channel bottom will be in excess of the suggested minimum distance (2.4 times larger for the surface and 1.2 times for the bottom), and River water will flow past the screens, there should be no measurable disturbance of either the water surface or the channel bottom as a result of the withdrawals. This is readily understandable, as the screens are designed for a maximum velocity of 0.5 feet per second through the slots in the screen when the withdrawal rate is at the maximum of 95 mgd. The velocity of flows approaching the screens will naturally be considerably less than 0.5 feet per second; rough flow net computations indicate the average flow velocity toward the screens would be only 0.1 feet per second at a distance of one foot from the screens when withdrawals are at the maximum rate.

Another confirming factor is that the maximum withdrawal rate of 95 mgd will only occur when the River flow is 3000 cfs, or greater, and such a withdrawal would constitute only 5% of the 3000 cfs flow. Additionally, the taking will occur along 70 feet of stream channel.

(d) Conclusions

As noted by the National Marine Fisheries Service and other studies, this intake constitutes the state-of-the-art from an environmental viewpoint. The intake will be a hydraulically efficient structure. The intake is streamlined and provides for withdrawals to take place over a wide area and along an extended length of stream channel. Furthermore, located out into the stream channel where higher flow velocities are observed and with the face of the screens parallel to the direction of flow, any possibilities of impinging water borne debris or aquatic life are drastically reduced.

In view of the streamlined nature of the intake assembly and the River flow velocities past the assembly, there should be no sedimentation under the structure and no maintenance dredging is anticipated. The effect of the intake structure on the flow of the River, even at very low flows, will be negligible, not even measureable. The same is true concerning the effect of the withdrawals. There should not even be an indication on the water surface that the intake exists, even when operating at the maximum rate.

(3) Bradshaw Reservoir

The Department's Division of Dam Safety has conducted a careful review of the safety and engineering of the Bradshaw Reservoir.[35]

(a) Geology

The bedrock underlying the site is Lockatong Argillite, characterized by dark grey color, fine texture and its bedded and fractured nature. The top surface of the bedrock is highest in elevation in the borrow area, southeast of the reservoir area and adjacent to the Point Pleasant Pike. The elevation of the rock falls off to the north toward the Delaware River and toward highway 413. The bedrock in the reservoir area rises and falls with the surface topography.

Overburden is uniformly an impermeable silty clay averaging 6.5 feet in depth. Zones of weathered shale frequently found on top of the bedrock are badly broken and thin bedded. These thin bedded zones belong to the parts of detrital cycles which are 14 to 20 feet thick and recur frequently and persist laterally. The badly broken parts are associated with fractures and will be linear and narrow and separated by wider areas of tough, massive rock. The geology of the site and design are adequate to provide a suitable dam foundation.

(b) Seepage

Although the solid argillite is impermeable, bedrock in the site is weathered and fractured, allowing secondary porosity and transmissivity of groundwater. Therefore, the entire reservoir floor will be covered with a 2-foot thick impermeable blanket liner composed predominantly of clays and fine silts.

The estimated permeability of the proposed clay liner is 1 to 5 x 10^{-6} cm/sec. For the area of the proposed reservoir, this would limit seepage from Bradshaw Reservoir to a rate in the range of 0.1-0.5 mgd. This rate would be further limited by the tight rock formations and low transmissivity of the Lockatong, and relatively high groundwater tables in the area.

Any "mounding" of groundwater in the Bradshaw Reservoir vicinity, due to seepage, is likely to be minor. Because of low transmissivity rates of the Lockatong, gradients of seepage flow to the groundwater table will be steep. Assuming the water table lies at

30 feet below ground surface (as evidenced by the elevation of nearby springs and streams), the seepage "mound" will most probably extend well within 100 feet of the reservoir edge. Even with greater transmissivity rates, the effects of a "mound" would reach out a maximum of no more than 1000 feet.

The elevation of groundwater could impact wells, septic systems, springs and basements if located within the zone of mounding. However, no wells, septic systems, structures, or significant springs are located within the maximum probable area of influence (100 to 1000 feet) from the reservoir.

As noted previously, sampling of the Delaware River water in the vicinity of Point Pleasant does not evidence the existence of significant levels of toxics or priority pollutants. Almost all priority pollutant parameters analyzed were at or below detectable limits. Even if some seepage of water transferred from the Delaware occurs at Bradshaw Reservoir, such seepage should have no measurable effect on the quality of groundwater in the area.

Under DER's dam classification system, Bradshaw has been determined to be small size with significant hazard potential (C-2). In accordance with current regulations, the spillway design flood for this dam is in the 100-year to 1/2 PMF frequency range.

Since the reservoir is off-stream, the uncontrolled drainage area behind the embankment is limited to the surface area at top of dam level (18.8 acres). Sources of inflow to the reservoir are (1) rainfall on the reservoir surface, and (2) water pumped from the Point Pleasant Pumping Station.

An emergency spillway, designed to pass the maximum inflow to the reservoir from the Point Pleasant Pumping Station, will be provided to prevent embankment overtopping in the event of pump control failure. Freeboard has been provided above the emergency spillway design high water level to store all of the rainfall from the 1/2 PMP event without overtopping the embankment.

The dam will be constructed as an earthfill embankment. A cutoff trench will be excavated to impervious material along the centerline of the dam, with a bottom width of 7.5 feet and 1 to 1 side slopes.

Embankment side slopes will be 3 to 1 upstream and 2.5 to 1 downstream, except at the pumping station intake. The upstream side slope at the intake will be 2 to 1. The top width of the dam will be 14 feet. The dam crest will be at elevation 438.0. Stone riprap and a filter blanket will be placed on the entire upstream slope for erosion protection. A toe drain will be incorporated into the entire length of the downstream slope.

Two 12-foot wide access ramps will be formed into the embankment. One will be located on the western portion of the downstream slope. The other will be located on the southeastern portion of the upstream slope.

A 20-foot wide roadway paved with asphaltic concrete will provide vehicular access to the pumping station. The roadway will run in a westerly direction from the Danboro-Point Pleasant Pike, onto the crest of the dam, and will terminate at a parking area adjacent to the pumping station.

Stability analyses of the dam were carried out utilizing soil parameters determined in laboratory tests on soil samples taken at the site.

The stability of the upstream and downstream slopes at the maximum section were evaluated by computer simulation. Corps of Engineers Program 741-11-F5030, "Slip Circle Slope Stability with Side Forces" was utilized to evaluate steady state seepage and sudden drawdown conditions. The minimum factor of safety found under the steady state seepage condition was 1.54. The minimum factor of safety found under the sudden drawdown condition was 1.77. These are greater than the minimum factors of safety recommended by the Corps of Engineers Manual, EM-1110-2-1902, "Stability of Earth and Rock-Fill Dams".

The Department has found the method and schedule of operation adequate to assure safe operation of the dam. As noted previously in this report, water level in Bradshaw Reservoir will be maintained within the range of 52 MG (at elevation 431.8) and 70 MG (at elevation 435.0) by controlling the operation of the Point Pleasant Pumping Station. Pumps at Point Pleasant will be automatically controlled to maintain water level in Bradshaw Reservoir as withdrawals are made. In the event of failure of the pump control system, causing continuous pump operation and resulting in above-normal pool levels in the reservoir, alarms would be sounded at two remote locations and the pumps would be manually shut down. If the pumps could not be shut down, the emergency spillway would overflow, thus protecting the dam from overtopping.

An Operation and Maintenance Manual for the reservoir and pumping station will be prepared by PECO's engineer during the construction phase of the project and will be subject to this D partment's review and approval prior to start-up of reservoir operation. An emergency warning system and evacuation plan will be submitted to and approved by the Division of Dam Safety and local emergency management officials prior to commencement of storage of water in the reservoir. PECO will be required to submit annual reports regarding the condition of the dam, certified by a registered professional engineer, to the Division of Dam Safety on or before October 1 of each year.

Findings

1. As a project to develop water supplies for public water supply and cooling water purposes, the Point Pleasant Project has a clear need to develop the proposed facilities in or adjacent to the waters of the Delaware River, North Branch Neshaminy Creek, East Branch Perkionen Creek and Pine Run. The development of the proposed withdrawals is reasonably necessary to serve present purposes and future needs in the service area of the Neshaminy Water Supply System within Bucks and Montgomery Counties, and to supply cooling water for operation of the Limerick Nuclear Generating Station.

2. The proposed Point Pleasant Project, properly constructed and operated, should present no significant threats to life or property.

    a. The proposed Bradshaw Reservoir complies with all design, operating and safety standards established under the Pennsylvania Dam Safety and Encroachments Act.

    b. The operation of both public water supply releases to the North Branch Neshaminy Creek and releases to the East Branch Perkiomen Creek will be adequately controlled during potential storms and high flows to avoid exacerbating flood events.

    c. Blasting during project construction will be carefully controlled, limited, and monitored, in accordance with a prescribed plan and procedures, in order to avoid damage to nearby structures, including facilities of the Delaware Canal.

3. The proposed water intake at Point Pleasant will be located in the Delaware River channel, with the top of the intake at Minimum Water Surface (Elevation 70.0 feet MSL) covered by at least four feet of water. The design and operation of the intake will allow free passage of canoes and watercraft typically used in the area, and will create no threat to safe navigation.

4. The primary potential effect of the Point Pleasant Project on riparian rights involves changes to flow regimes of the Delaware River, the East Branch Perkiomen Creek and North Branch Neshaminy Creek.

   a. Under the proposed operating plan and limits imposed by the Delaware River Basin Commission, the effect on Delaware River flows below Point Pleasant will be insignificant even during low flow periods, and the rights of downstream riparian land owners will not be adversely impacted.

   b. Flows in the East Branch Perkiomen Creek and North Branch Neshaminy Creek will be augmented by project releases, and minimum flows will be maintained under the project operating plan. The natural flow of the streams will not be diminished, but will be augmented and enhanced, especially during low flow periods. The rights of riparian landowners along the Perkiomen and Neshaminy Creeks will not be adversely affected.

5. The Point Pleasant Project, designed, installed and operated in accordance with the plans and conditions approved by the Department, will have no significant adverse effects on: the regimen and ecology of the Delaware River, Perkiomen Creek, Neshaminy Creek, Lake Galena or Pine Run; water quality; stream flow; fish and wildlife; aquatic habitat; instream and downstream uses; or other significant environmental factors.

6. The project will be designed, constructed and operated in a manner adequate to protect the historical and recreational values of the Roosevelt State Park, the Delaware Canal (a national historic landmark) and the Point Pleasant Historic District from substantial long-term impacts.

a. Limits and procedures for blasting conducted during construction should be adequate to avoid injury to the locks and channel of the Delaware Canal, or other nearby structures.

b. Following construction, and installation of pipelines under the canal, the Delaware Canal and Roosevelt State Park lands will be restored to their preexisting condition.

c. The Point Pleasant Pump Station is designed to resemble a barn structure, and will be landscaped with flora indigenous with the area so as to blend in with the existing environment.

d. Archeological resources which may be located on the project site will be protected and preserved, following monitoring and construction procedures agreed to between the Neshaminy Water Resources Authority and State and Federal historical preservation agencies.

7. The proposed Point Pleasant Project incorporates designs, construction practices, and operating procedures to minimize the potential adverse impact of the project upon the environment and to protect the public natural resources of the Commonwealth. No feasible, cost-effective alternatives to the project have been identified which would fulfill the needs for the project and offer significantly less affects on the environment or public natural resources.

8. The proposed Point Pleasant Project will comply with all applicable laws administered by the Department, the Pennsylvania Fish Commission and the Delaware River Basin Commission.

9. The construction and operation of the proposed Point Pleasant Project is consistent with the applicable State flood plain management program, the Pennsylvania State Water Plan, and the Coastal Zone Management Plan.

10. The design, construction, and operation of the project is consistent with the designation of the Schuylkill River as a recreation and modified recreation river under the Pennsylvania Scenic Rivers Act, and would be consistent with any potential

designation of the Delaware River as a recreation or modified recreation stream under the National Wild & Scenic Rivers Act of 1968, or the Pennsylvania Scenic Rivers Act.

11. The public benefits of the Point Pleasant Project, including provision of public utility services, protection of public health and safety, development of energy generating resources and improved management of ground and surface water resources in the region, substantially exceed and outweigh any adverse impacts on the environment and public natural resources engendered by the project.

Footnotes:

1. Payne v. Kassab, 11 Pa. Cmwlth. 14, 312 A. 2d 86 (1973), aff'd, 486 Pa. 226, 361 A. 2d 263 (1976).

2. Community College of Delaware County v. Fox, 20 Pa. Cmwlth. 335, 342 A. 2d 468, 481 (1975).

3. Payne v. Kassab, 11 Pa. Cmwlth. 14, 312 A. 2d 86 (1973) aff'd, 486 Pa. 226, 361 A. 2d 263 (1976); Mignatte Construction Co., Inc. v. Commonwealth Environmental Hearing Board, Pa. Cmwlth., 411 A. 2d 860 (1980); Concerned Citizens for Orderly Progress v. Commonwealth Department of Environmental Resources, Pa. Cmwlth., 387 A. 2d 989 (1978); Township of Middle Paxton v. Commonwealth Department of Environmental Resources, Environmental Hearing Board Docket No. 80-127-W (June 30, 1981) at 19-25.

4. 25 Pa. Code Section 105.16(a).

5. E. H. Bouquard Associates, Inc., Point Pleasant Pumping Station and Transmission Mains, Project Description and Soil Erosion and Sediment Control Narrative, Neshaminy Water Resources Authority, Bucks County, Pennsylvania (November 1981).

6. The basic parameters of the project operating plan are set forth in the following documents: E. H. Bouquard Associates, Inc., Neshaminy Water Supply System Plan of Operation (April 27, 1982); E. H. Bouquard Associates, Inc., Raw Water Operation North Branch Water Treatment Plant (1982); Neshaminy Water Resources Authority, Neshaminy Watershed Plan - Water Supply, Bucks and Montgomery Counties, Pennsylvania, DRBC Docket No. D-65-76 CP(8) (February 27, 1981); Philadelphia Electric Co. Bradshaw Reservoir, Pumping Station and Transmission Main, Bucks and Montgomery Counties, Pennsylvania, DRBC Docket No. D-79-52 CP (February 27, 1981); Philadelphia Electric Co. Limerick Nuclear Generating Station, Limerick Twp., Montgomery County, Pennsylvania, DRBC Dkt. No. D-69-210 CP (March 29, 1973); Department of Environmental Resources Water Allocation Permit No. WA-0978601 (November 1978); Department of Environmental Resources Dam Safety and Encroachments Permit No. 9-169 (May 1970).

7. R. E. Wright Associates, Inc., Special Groundwater Study of the Middle Delaware River Basin Study Area II (1982).

8. Id., Vol. 1, p. 6-17 to 6-18.

9. Id., Vol. 1, p. 6-27.

10. Id., Vol. 2, p. 11-13, and Vol. 4, Plate 22.

11. Department of Environmental Resources, Report on Application of Neshaminy Water Resources Authority for Water Allocation from Pine Run, North Branch Neshaminy Creek, and Delaware River, Water Allocation Permit No. WA-0978601 (November 1, 1978) (hereinafter "DER Water Allocation Report").

12. Neshaminy Water Resources Authority Neshaminy Watershed Plan - Water Supply, Bucks and Montgomery Counties, Pennsylvania, DRBC Docket D-65-76 CP(8) (February 27, 1981), Condition N.

13. Letter from William G. Gordon, Assistant Administrator for Fisheries, National Marine Fisheries Service to Lt. Col. Roger L. Baldwin, District Engineer, U.S. Army Corps of Engineers Philadelphia District (July 19, 1982) and attached Endangered Species Act Section 7 Consultation - Biological Opinion.

14. DRBC Docket D-65-76 CP(8) (February 27, 1981) Condition L.

15. New Jersey v. New York, 347 U.S. 995 (1954). The parties to the 1954 Supreme Court Decree, allocating waters of the Delaware, are the States of Delaware, New Jersey, New York and Pennsylvania and the City of New York.

16. The Delaware River Master is an officer of the U.S. Geological Survey designated by the U.S. Supreme Court under the 1954 Decree to supervise diversions, storage and release of waters under the terms of the Decree.

17. Delaware River Basin Commission, Delaware River Basin Comprehensive (Level B) Study (May 1981) (hereinafter "DRBC Level B Study").

18. C. H. J. Hull and R. Tortoiello, Delaware Salinity Modeling Study - Effects of Salinity - Period Duration on Maximum Salinity Levels Attained (July 1980). Note, the DRBC salinity model is a computer simulation model; numerous computer runs have been made by DRBC and reviewed by DER staff in the past several years.

19. Camp Dresser & McKee, Inc., Daily Flow Model of the Delaware River Basin (prepared for the U.S. Army Corps of Engineers) (September 1981). Note, the Delaware River flow model is a computer model, now programmed on DER's computers. Additional model runs have been made at various times testing different operating plans.

20. DRBC Resolution 78-20 (December 13, 1978).

21. Interstate Water Management Recommendations of the Parties to the U.S. Supreme Court Decree of 1954 to the Delaware River Basin Commission Pursuant to Commission Resolution 78-20 (June 25, 1982) ("Good Faith Recommendations"); and DRBC, Background Report Concerning Interstate Water Management Recommendations of the Parties to the U.S. Supreme Court Decree of 1954 to the Delaware River Basin Commission Pursuant to Resolution 78-20 (June 1982) ("Good Faith Background Report").

22. Good Faith Recommendations, Recommendation 3.

23. E. H. Bourquard Associates, Inc., Investigation of the Effect of Proposed Pumpages on Stream Flows in Each Branch Perkiomen Creek and North Branch Neshaminy Creek (July 1970).

24. E. H. Bourquard Associates, Inc., supra note 23.

25. Philadelphia Electric Co., Environmental Report (July 1979), Section IV, Table No. 1.

26. Neshaminy Water Resources Authority, Environmental Report (February 1979).

27. Rutgers University, Cook College, College of Engineers, Dredging the Delaware and Raritan Canal Program Plan and Programmatic Environmental Assessment Report (August 1981); Rutgers University, Delaware and Raritan Canal Hydrologic, Hydraulic, Structural, Water Quality and Institutional Report (June 1980).

28. It is important to note what a "level B study" is, and to put it in perspective with the other two types of studies. A "level A study" is a general assessment of resource concerns in a large area usually comprised of several states. In "level B studies", a detailed examination of resource problems and issues is performed for a region or a river basin, like the Delaware. A "level C study" then involves the design feasibility and implementation of management projects and programs dealing with the level B or level A concerns.

29. Hydroscience, Inc., Time Variable Water Quality Analyses and Related Studies of the Upper Delaware River - Port Jervis to Trenton (January 1975).

30. DRBC Final Environmental Assessment (August 1980) at IV-50 to IV-54.

31. Philadelphia Electric Co., Environmental Report - Bradshaw Reservoir, Transmission Main, East Branch Perkiomen, and Perkiomen Creeks. (July 1979) at Section V.

32. R. E. Wright Associates, Inc., supra note 7, Vol. 4, Plates 21 and 22.

33. Philadelphia Electric Co., Environmental Report - Alternatives to Proposed Plan, July 1979, at Section III.

34. Delaware River Basin Commission, Draft Environmental Impact Statement for the Proposed Merrill Creek Reservoir Project (July 1982).

35. Report Upon the Application of Philadelphia Electric Company, DO9-181 (July 1982)

APPENDIX A

References Used by DER in Preparing this Environmental Assessment

I. References submitted by the Neshaminy Water Resources Authority as part of their Permit Application

NWRA-1. Chronology of Actions on the Point Pleasant Project.

NWRA-2. DRBC Final Environmental Impact Statement on the Point Pleasant Diversion Plan, Bucks and Montgomery Counties, Pa., February 1973.

NWRA-3. United States Department of Agriculture, Soil Conservation Service. Final Environmental Statement, Neshaminy Creek Watershed, Bucks and Montgomery Counties, Pennsylvania, April 1976.

NWRA-4. Neshaminy Water Supply System, Delaware River at Point Pleasant and North Branch Neshaminy Creek, Environmental Report Water Quality - Aquatic Biota, November, 1978 (Harmon 1978 Report).

NWRA-5. Letter from Delaware River Basin Commission to Neshaminy Water Resources Authority, May 24, 1979. (Responding to questions raised by Robert Flowers re, e.g., pooled water concept.)

NWRA-6. Transcript of Neshaminy Water Resources Authority Public Hearing, May, 1979.

NWRA-7. Responses by Neshaminy Water Resources Authority to Comments at Public Hearing.

NWRA-9. Letter from Pennsylvania Department of Environmental Resources to Delaware River Basin Commission, with attachment, September 13, 1979. (DER statement of regional water supply approach.)

NWRA-10. Letter from Pennsylvania Historical and Museum Commission to Delaware River Basin Commission, October 10, 1979.

NWRA-11. Memorandum from Hansler to Delaware River Basin Commissioners, February 14, 1980. ("Executive Director's Evaluation of the Environmental Assessment for the Proposed North Branch Water Treatment Plan (sic) sponsored by the Neshaminy Water Resources Authority and a Review of Related Components to the Point Pleasant Project".)

NWRA-12. DRBC, Notice of Intent to issue a Negative Declaration on North Branch Water Treatment Plant and Related Components, February 15, 1980.

NWRA-13. A. DRBC, Negative Declaration on North Branch Water Treatment Plant and Related Components, August 25, 1980.

B. DRBC, Summary Description of Environmental Assessment, August 25, 1980.

NWRA-14. Letter from Delaware River Basin Commission to Army Corps of Engineers, August 28, 1980. (Corps to comply with National Historic Preservation Act of 1966.)

NWRA-15. Neshaminy Water Supply System and PECO Water Supply System, Data and Information for Permit Application to Philadelphia District, U.S. Army Corps of Engineers, September 1980.

NWRA-16. Letter of October 8, 1980 from E. H. Bourquard to the United States Fish and Wildlife Service, with attachments. (Data and information on proposed water intakes for Point Pleasant, North Branch and Pine Run.)

NWRA-17. DRBC, Notice of Public Hearing, October 15, 1980.

NWRA-18. Record of public hearing held by DRBC on November 18, 1980.

NWRA-19. Certificate of the Delaware River Basin Commission (certifies record before DRBC).

NWRA-20. Internal memorandum from Dr. C. H. J. Hull to Messrs. Herbert A. Howlett and Gerald M. Hansler, December 4, 1980. (Responding to the salinity intrusion issue.)

NWRA-21. Letter from Gerald M. Hansler to Ralph W. Abele, Executive Director, Pennsylvania Fish Commission, April 15, 1980.

NWRA-22. Letter from Army Corps of Engineers to Delaware River Basin Commission, January 27, 1981. (Corps will comply with National Historical Policy Act of 1966 (sic).)

NWRA-23. Letter from Delaware River Basin Commission to U.S. Environmental Protection Agency - Region III, February 2, 1982. (Response to concerns raised by EPA.)

NWRA-24. DRBC, Staff Summary of the Applications of Neshaminy Water Resources Authority D-65-76 CP(8) and Philadelphia Electric Company.

NWRA-25. DRBC, Memorandum Responding to the Comments Received at the Public Hearing on November 18, 1980 Concerning NWRA Docket C-65-76 CP(8) and PECO Docket D-79-62 CP, February 4, 1981.

NWRA-26. Letter from Delaware River Basin Commission to Governor Tribbitt, February 4, 1981. (Transmitted DRBC staff response to concerns raised by Norman R. Chupp of the U.S. Fish and Wildlife Service.)

NWRA-27. U.S. Army Corps of Engineers Notice of Public Hearing on Applications NAPOP-R-80-0534-3-HRG and NAPOP-R-80-0813-3HRG.

NWRA-28. DRBC, The Final Report and Environmental Impact Statement of the Level B. Study, The Delaware River Basin Comprehensive (Level B) Study, May 1981.

NWRA-29. Letter from David J. Goldberg to Judge VanArtsdalen, June 3, 1981. (Re: EPA letter as part of certified record; Scenic River status; public comment on EPA letter.)

NWRA-30. Delaware Water Emergency Group v. Hansler, Memorandum Opinion and Order, U.S. District Ct., Eastern District of Pennsylvania Civil Action No. 80-4372, August 17, 1981.

NWRA-31. Letter from E. H. Bourquard to Colonel Baldwin, September 9, 1981. (Transmitting construction procedures for the installation of stream intake facilities and channel modifications at the North Branch Water Treatment Plant site, and for the installation of the intake facilities at the Point Pleasant Pumping Station site.)

NWRA-32. Record of Army Corps of Engineers Public Hearing held on September 15, 1981.

NWRA-33. Delaware Water Emergency Group v. Hansler, Judgment Order, United States Court of Appeals for the Third Circuit, March 19, 1982.

NWRA-34. Letter from Hershel J. Richman to Roy Denmark, Jr., U.S. Army Corps of Engineers, (with appendix), January 22, 1982. (Response to miscellaneous public comment.)

NWRA-35. Letters from Warrington Township to DRBC, Army Corps of Engineers, and Bucks County, August 19, 1980, September 18, 1981, and March 17, 1982.

NWRA-36. U.S. Army Corps of Engineers, Environmental Assessment for Permit Application 80-0534-3. (Initial - prior to public hearing.)

NWRA-37. Plans showing design of Point Pleasant Pump Station, landscape design, staged plan for construction under Pennsylvania Canal, etc.

NWRA-38. Converse Ward Davis Dixon, Inc., Report on Evaluation of Rock Excavation and Impact of Blasting for the Proposed Point Pleasant Pumping Facilities, Point Pleasant, Pennsylvania, May 20, 1980.

NWRA-39. Letter from Robert A. Flowers to Roy E. Denmark, Jr., U.S. Army Corps of Engineers, transmitting application to construct Point Pleasant Pumping Station, July 18, 1980.

NWRA-40. Revisions to Neshaminy Water Resources Authority 3.8 Application to Delaware River Basin Commission, with letter of transmittal, September 23, 1980. (Re: Revised intake structure.)

NWRA-41. P. L. Harmon, Biological Evaluation of the Proposed Water Intake in the Delaware River at Point Pleasant, Pennsylvania, November, 1980.

NWRA-42. R. W. Blye and P. L. Harmon, Vegetation of the Point Pleasant Intake Site, November, 1980.

NWRA-43. Letter December 30, 1980 from Neshaminy Water Resources Authority to Delaware River Basin Commission, December 30, 1980. (Transmitting Harmon 1980 Report.)

NWRA-44. U.S. Army Corps of Engineers Public Notice of NWRA's Application #NAPOP-R-80-0534-3 (Point Pleasant), April 6, 1981.

NWRA-45. Letter from Delaware River Basin Commission to Neshaminy Water Resources Authority, April 13, 1981. (NWRA has complied with condition "L" of DRBC docket decision D-65-76 CP(8) re: approval of design of intake structure.)

NWRA-46. Letter from Hershel J. Richman to Judge VanArtsdale, U.S. District Court, June 2, 1981. (Re: Wild and Scenic Rivers.)

NWRA-47. U.S. Army Corps of Engineers Public Notice of revision to NWRA's Application #NAPOP-R-80-0534-3, February 9, 1982.

NWRA-48. Letter from PA Historical and Museum Commission to U.S. Army Corps of Engineers, September 28, 1981.

NWRA-49. H. M. Brundage, Assessment of the Impacts of the Proposed Point Pleasant Pumping Station and Intake on the Shortnose Sturgeon, Acipenser Brevirostrum, January 1982.

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NWRA-56. Letter from U.S. Army Corps of Engineers to PA Historical & Museum Commission, April 2, 1982.

NWRA-57. U.S. Army Corps of Engineers Determination: Adverse Effect - The Pennsylvania Canal, April 2, 1982.

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NWRA-59. Letter from Pennsylvania Historical and Museum Commission to E. H. Bourquard Associates, Inc., October 20, 1978.

NWRA-60. Letter from Pennsylvania Department of Environmental Resources to Neshaminy Water Resources Authority, October 30, 1978. (Re: the use of Nockamixon Reservoir to meet water supply needs.)

NWRA-61. Letter from State Historic Preservation Officer to Delaware River Basin Commission, August 7, 1979.

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NWRA-64. Letter from Delaware River Basin Commission to Neshaminy Water Resources Authority, November 20, 1980. (Re: questions raised by Chalfont Borough representatives at DRBC public hearing.)

NWRA-65. Letter from Robert A. Flowers to Roy E. Denmark, Jr., U.S. Army Corps of Engineers, December 2, 1980. (Transmitting application to perform channel improvements along the North Branch Neshaminy Creek and Pine Run.)

NWRA-66. Letter from Neshaminy Water Resources Authority to Delaware River Basin Commission, December 31, 1980. (Re: response to questions raised by Chalfont Borough representatives at the DRBC public hearing.)

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COE-2. Letter from Kathryn Ann Auerbach, Bucks County Conservancy, to Mrs. Charlene Diven, Advisory Council on Historic Preservation, April 26, 1982.

COE-3. Letter from Peter S. Duncan, DER, to U.S. Army Corps of Engineers, September 23, 1981. (Re: pending NWRA applications.)

COE-4. Letter/Opinion from William G. Gordon, National Marine Fisheries Service, to Lt. Colonel Roger L. Baldwin, U.S. Army Corps of Engineers, July 19, 1982. (Re: shortnose sturgeon.)

COE-5. Letter from Hershel J. Richman to Lt. Colonel Roger L. Baldwin, U.S. Army Corps of Engineers, June 14, 1982. (Re: alternatives to the Point Pleasant Project.)

COE-6. Letter from Norman R. Chupp, Fish and Wildlife Service, to Lt. Colonel Roger L. Baldwin, U.S. Army Corps of Engineers, July 12, 1982. (Re: the Point Pleasant Project.)

V. References supplied by Del-Aware Unlimited, Inc.

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D-A-3. Letter from Dr. Richard H. Jordan and Glenn W. Sheehan to Cathy Auerbach, Bucks County Conservancy, April 8, 1982. (Re: the archaeological investigations by Shortman and Urban.)

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D-A-7. Norman T. Torkelson, Water Quality Effects of the Receiving Streams from the Proposed Point Pleasant Pumping Station, March 4, 1982.

D-A-8. U.S. Army Corps of Engineers, Executive Summary of the Report "Economic Study of Salinity Costs in the Delaware Estuary", February 1980.

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D-A-10. Letter/Report from J. T. Phillippe (GKY & Associates, Inc.) to Colleen Wells, May 10, 1982. (Re: the Point Pleasant Pumping Station.)

D-A-11. E. H. Bourquard Associates, Inc., Report on Status of Neshaminy Projects, Neshaminy Creek Water Resources Development Plan, February 1977.

D-A-12. Letter from Robert J. Sugarman to Timothy Weston,June 23, 1982. (Re: Neshaminy Water Supply System; Plan of Operation, and Description and Purpose of the Bradshaw Reservoir.)

D-A-13. Letter from James M. Neill, Del-Aware, to DER,May 10, 1982, submitting letters from other agencies pointing out the major failings of some of the environmental statements compiled by NWRA, PECO, and DRBC.

D-A-14. Letter/Report from Robert J. Sugarman to DER, May 24, 1982. (Re: Memorandum Regarding Environmental Impacts of Proposed Water Transport Pumpage in the Each Branch of Perkiomen Creek.)

NOTE: Numerous letters not individually documented here between the Department and Del-Aware were also considered in this Assessment.

VI. Letters and general comments were received from the following:

1. State Representative James C. Greenwood
2. Daniel H. Smith
3. Erma W. Martin
4. Phyllis Zitzer - Limerick Ecology Action
5. James Dillon - Township Manager - Middletown Township
6. John M. Mankelwicz - Bucks County Audubon Society
7. State Representative James J. A. Gallagher
8. Kathryn Ann Auerbach - Bucks County Conservancy
9. Paul J. Corr
10. Virginia and Lefferts Hutton

11. Marian S. Concannon
12. Mr. and Mrs. Robert B. Wallace
13. Clarence Wells
14. Mr. and Mrs. Robert Hansen
15. John M. Mankelwicz, Bucks County Audubon Society
16. J. William Inslee
17. Virginia R. Forrest
18. Freda W. Sampson, Susanna W. Hewitt, and Denis L. Hewitt

APPENDIX B

POINT PLEASANT PROJECT
BLASTING REQUIREMENTS FROM DELAWARE RIVER TO PUMPING STATION

PRE-BLASTING SURVEY

1. The services of an independent company shall be engaged to perform pre-blasting surveys.

2. All structures located within 1,000 feet of blasting operations shall be surveyed to accomplish the following:

   a. Determine the physical condition of each structure.

   b. Document existing damage and other factors inside and outside which could reasonably be affected by blasting.

   c. Assess the condition of appurtenances such as pipes, cables, transmission lines, wells and other water systems. The quantity and quality of water wells and other water systems used for human, animal, or agricultural purposes shall be documented.

3. Persons who conduct the pre-blast surveys shall submit written reports which shall include but are not limited to the following:

   a. Diagrams or photographs of rooms or structures indicating size and location of cracks or separations in foundations, walls, ceilings, floors, etc.

   b. Provide a copy of the pre-blast survey report to the resident or owner of the structure and to the Department.

BLASTING PLAN

1. After bedrock is exposed in the excavation, the attitude of naturally occuring fractures in the rock shall be measured and that data shall be utilized to plan the blasting procedure.

2. Blasting shall not begin until a blasting plan is approved in writing by the Department.

3. The blasting plan shall include but not be limited to the following:

   a. Diameter of holes.

   b. Depth of holes.

   c. Centerline to centerline spacing of holes.

   d. Weight of explosives per delay period of 8ms or greater.

   e. Decking if applicable.

f. Height of top stemming.

g. Scaled distance (Ds) based on distance to the nearest structure (minimum Ds = 60).

h. Public alert and warning system.

i. Location of seismographs.

j. Anticipated blasting schedule.

k. Maximum peak particle velocity (0.5 in./second monitored at each seismograph location).

l. Maximum sound pressure level (120 dB flat response).

m. Use of blasting mats.

BLASTING RECORDS

1. Engage the services of a seismic survey company to monitor and record vibration and noise levels of each blast with instruments located at the nearest structure whether that structure be the canal (including retaining wall and locks) or a dwelling that is neither owned nor leased by the operating contractor. When blasting is done under the Delaware Canal, seismic instruments will monitor at a distance of 50 ft. from each blast. Loading of boreholes will be at a scaled distance of 60 based on the 50 ft. actual distance location of each seismograph.

2. Submit a record of each blast to include all information required by Section 211.46 of Title 25 Rules and Regulations, seismograph analyses and noise level reports of each blast.

GENERAL

1. No blasting shall occur during normal mealtimes nor when children congregate for travel to and from school.

2. Written evidence of notification to the Pennsylvania Fish Commission shall be submitted to the Department if blasting occurs in any waters within or on the boundaries of the Commonwealth.

3. Before blasting is conducted on the Delaware Canal property, blasting first shall be conducted on the proposed route of the pipeline on either side of the Delaware Canal property.

FOR THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES:

Approved:

William B. Middendorf
Deputy Secretary for
Environmental Protection

Approved:

R. Timothy Weston
Associate Deputy Secretary
for Resources Management

Approved:

Peter S. Duncan III
Secretary
Department of Environmental Resources

Date: August 16, 1982