E. H. ' JURQUARD ASSOCIATES, IC.
WATER RESOURCES ENGINEERING
1400 RANDOLPH STREET
(EXIT NO. 24 E. INTERSTATE 83)
HARRISBURG, PA.
17104

TELEPHONE (717) 238-9505

A. Ex. 2

TER SUPPLY
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January 22, 1982

Mr. Roy E. Denmark, Jr.,
Chief, Permits Branch,
U. S. Corps of Engineers,
Custom House,
Second & Chestnut Streets,
Philadelphia, Pa. 19106

Re: Application No. NAPOP-R-80-0534-3
Point Pleasant Pumping Station

Dear Mr. Denmark:

Since submission of the referenced application on July 18, 1980, we have determined that certain revisions should be made in the plans for the project to improve the efficiency of the facility and to reduce to a minimum any environmental impact. These revisions are described in the following paragraphs and the reasons for each are given.

1. Further Extension of Intake into River Channel. The initial plans for the Point Pleasant Pumping Station called for a shoreline water intake with vertical travelling screens. In 1980 and prior to submission of the referenced Application, the intake was changed to one utilizing cylindrical Johnson wedge wire well screens located approximately 200 feet out into the River channel. The 200 foot distance was selected as it placed the intake beyond a back eddy in the River which extended out 150-160 feet from the west bank and, also, put the intake in a position where it would always be subject to positive, or downstream flow velocities. This was verified by RMC Ecological Division during field investigations for a report titled "Biological Evaluation of the Proposed Water Intake in the Delaware River at Point Pleasant, Pennsylvania" (copy furnished by letter of January 28, 1981 to R. E. Denmark), and by River flow velocities measured by RMC on July 23, 1981; which measurements are tabulated on Table No. 1 and discussed later herein. It should be reiterated that, at this location, the intake would not be in the backwater eddy portion of the River and, also, River flows past the screens would be in a downstream direction.

In connection with the above biological evaluation, the slots in the wedge wire screens were reduced from 1/4 inch to 2 mm which increased the diameter and length of the individual screens from 36 inches to 40 inches, in order to maintain a maximum inflow velocity of 0.5 feet per second (fps). This 2 mm slot provided assurance that no shad eggs would be entrained by the screens.

The River flow velocity measurements mentioned above showed that further extension of the intake into the River would increase the flow velocities past the screens, which should, in turn, lessen the likelihood of debris and aquatic life being impinged on or entrained in the intake screens. The small screen opening of 2 mm, combined with a definite River flow past the screens, precludes the entrainment of the vast majority of fish eggs and larvae and essentially eliminates impingement. It was felt, however, that consideration should be given to utilizing higher flow velocities to reduce even further the possibilities of entrainment. In this connection, reference is made to a paper* titled "Studies of Three Cylindrical Profile-Wire Screens Mounted Parallel to Flow Direction" by Brian N. Hanson, a Research Biologist with RMC Delmarva Ecological Lab., Middletown, Del. This paper presents the results of actual flow tests on cylindrical wedge wire screens with 2 mm slots, which tests measure the entrainment and impingement of fish eggs for three flow velocities. The test results indicated that as flow velocities increase from 0.5 to 1 foot per second (fps), the percentage of eggs entrained or impinged is drastically reduced, but higher velocities do not appreciably lessen this percentage. To provide for a flow velocity of 1 fps past the screens, the intake location is changed from Station 8+17 to Station 8+62, which positions the intake 45 feet further into the River, or about 245 feet from the west bank. The flow velocities at the new location, Station 8+62, may be noted by examination of Exhibits Nos. 1, 2 and 3 attached. Exhibit No. 1 is a plot of flow velocities measured in the River at the intake site on November 7, 1980 when the River flow was about 3,000 cfs and the water surface was at Elevation 70.8. Exhibit No. 2 shows flow velocity measurements on July 23, 1981, when the River flow was approximately 4,500 cfs and the water surface elevation was 71.4. The horizontal stationing used on the exhibits is that of the centerline of the River intake facilities, with the 0+00 Station located at the intersection of this centerline and a line connecting two permanent monuments on the Project site along State Route No. 32. (The stationing and the monuments are shown on Exhibit No. 5.) The transverse position of the intake assembly, both where originally proposed and where now planned, has been indicated on these exhibits by marking each with its centerline stationing, 8+17 and 8+62, respectively. Exhibit No. 3 is a plot of flow velocity measurements on November 7, 1980 and July 23, 1981, at the proposed intake site (Station 8+62) and at the elevations at which they were taken. There will be two rows of screens, as can be seen on Exhibit No. 5, and the velocities at the centerline of both rows are shown on Exhibit No. 3. The west screens are those in the row nearest the Pa. shore and the east screens are in the row furtherest away. Also shown on Exhibit No. 3 are the top and bottom elevations of the intake screens; thus indicating the range of flow velocities which will pass the screens. The Exhibit reveals that even with a low flow of 3,000 cfs, the flow velocities past the screen will range from 1.0 to 1.3 fps which is twice, or more, the maximum screen inflow velocity of 0.5 fps. In this connection, it should be noted that low flows do not normally occur during the major

* A copy of this paper has been furnished Richard Hassel, District Biologist.

fish spawning period of March thru June and, during that period, greater flows can be anticipated with even higher River flow velocities. In fact, flow velocities during the spawning period should be higher than those plotted on Exhibit No. 3 for a flow of 4,500 cfs which velocities are indicated by the lines marked "7-23-81" at the top.

The velocity measurements plotted on Exhibits Nos. 1, 2 and 3 were made by the Environmental Services Division - RMC on the days indicated.

Exhibit No. 4 is a cross section of the River channel at the intake and the various components of the intake are shown thereon, together with the approximate rock line.

2. Shift of Building Location and Intake Alignment. The pump station building was moved about 18 feet further away from State Route No. 32 and will be extended about 15 feet to the southeast. This provides more working space for placement of the Combined Transmission Main under the highway, reduces the amounts of earth and rock excavation required for the building installation, and provides a larger setback from the highway, permitting more landscaping at the front of the building to improve the general appearance of the facility. The building was lengthened to provide for a stairway and for additional equipment related to the River intake. The intake alignment was shifted as a result of the building movement and, also, to provide a straight run of pipe before entering the transition section of the pump sump. The straight run will give improved flow conditions in the pump sump, resulting in better pump operation and higher pumping efficiencies.

In conformity with suggestions of representatives of the Pennsylvania Historical and Museum Commission, the roof of the pumping station building was changed from a gambrel to a ridge roof, and some exterior architectural features were changed.

The original intake plans provided for the 42-inch intake pipes to be spaced 22.5 feet apart. In order to reduce the amount of earth and rock excavation in the channel and on shore for the installation, the pipes are now spaced 6 feet apart and will be installed in a single ditch. This will reduce the area of channel bottom that will be disturbed by the installation. With this closer pipe spacing, the size of the gate well was reduced. Also, the fill around the gate well was shifted landward lessening the volume and areal coverage. With the reduced fill and landward movement, the stone riprap on the fill has been eliminated and erosion-resistant vegetation will be utilized.

Exhibit No. 5 shows a general plan and profile of the pumping station and the water intake with the above revisions. The revisions will reduce the areas of wetlands affected to less than an acre and improve the appearance of the facilities when viewed from River Road and from the Delaware River. The

Pennsylvania Canal crossing will be shifted about 18 feet northward but the construction procedure will be the same as originally planned and the crossing, when complete, will restore the Canal to prior conditions.

3. Revised Water Level Elevations. A very preliminary stage-discharge curve was developed in 1969 on the basis of selected (2 consecutive days of about same flow) recorded flows at Reigelsville and recorded gage heights (gage washed out in 1955 Flood, and never replaced) at the Point Pleasant-Byram Bridge. Extrapolation of this data indicated that the water level at Point Pleasant might go as low as Elevation 68, and this was utilized in the preliminary studies as the minimum water level. However, actual water level readings at the intake site in 1980 and 1981, when related to recorded River flows at Trenton showed that even with low flows of less than 3,000 cfs, the water level at the site is above Elevation 70. A new stage-discharge relationship was developed in 1981 using recorded flows at Trenton and water level readings at the intake site. To confirm this relationship, the U.S.G.S. was requested and did make flow measurements of the Delaware River and the Raritan Canal at the Lumberville Bridge, and of Paunnacussing Creek at State Route No. 32. Attached as Exhibit No. 6 is a copy of the data provided by the U.S.G.S. Exhibit No. 7 tabulates and gives the sources of the discharge-water level relationship data for the Delaware River at the Intake site and includes a rating curve plotted from the data. Exhibit No. 8 is a sample of the computations which developed this data. On Sheet No. 3 of this exhibit, it will be noted that the drainage area of the Delaware River at the River intake is 97% of that at the Trenton gage.

Sheet No. 3 of Exhibit No. 7 explains how the minimum, normal, and maximum water levels were derived for the Delaware River at the PPPS site. The term minimum water level, as used herein, refers to a design condition; that is, this is the lowest water level when the withdrawal rate would be at the maximum.

4. Revisions to Pump Sump and Intake Conduit. As mentioned previously, the initial plans for the PPPS called for a shoreline intake having vertical travelling screens with 3/8-inch wire spacing. The change to a channel intake with circular wedge wire screens with 2 mm slots was made in order to provide the most environmentally advanced type of water intake. However, the new installation involved additional waterway structures: the gate well, three 42-inch pipes, the screen assembly piping, and the screens. All of these result in additional hydraulic losses over those of the shoreline intake and, to compensate for these losses and to provide for necessary submergence of the pumps, the pump sump was lowered and the conduit between the gate well and the transition was increased from 5-foot diameter to 6-foot diameter.

Exhibit No. 9, attached, are computations which calculate the hydraulic losses through the intake system and establish the floor elevation of

the pump sump. Developed below is the invert elevation of the 42-inch pipes at the connection to the screen assembly piping. Exhibit No. 10, attached, is a drawing showing the intake screen assembly in plan and section. Refer to Sheet No. 2 of Exhibit No. 9 when reviewing the tabulations below.

Minimum Water Surface Elevation			70.00
Minimum Water Cover over Screens			4.00
Elevation of Top of Screens			66.00
One-half Screen Diameter			1.67
Elevation of Screen Centerline			64.33
Piping Assembly -	To ℄ 36" Vert. Pipe	5.50'	
	To Flange of 36-Inch Tee	1.00	
	To ℄ of 36-Inch Tee	2.33	
	Total		8.83
Elevation of Centerline of 36-Inch Tee			55.50
One-half Diameter 42-Inch Pipe			1.75
Invert Elevation of 42-Inch Pipe at Intake Assembly			53.75

The above invert elevation of 53.75 may be noted on Exhibits Nos. 4 and 5.

In 1980, Converse Ward Davis Dixon, a firm of geotechnical consultants, made an investigation relating to the impact of using explosives in the construction of the proposed Point Pleasant Pumping Facilities and submitted a report to DRBC thereon dated 20 May 1980. In essence, the firm found that required blasting to install the pumping station and the pipe lines can reasonably be controlled so as to result in no noticeable damage to nearby structures or water wells. The installation of the channel intake and lowering of the pump sump constituted changes in plan so the firm was requested to make a new evaluation taking the changes into account. Also, additional subsurface information had been obtained and the data was provided the firm. Attached hereto, as Exhibit No. 11, is a letter report on this evaluation wherein it is stated that the conclusions and recommendations of their 20 May 1980 report are still valid. Also, attached as Exhibits Nos. 12, 13 and 14 are letters from the firm which provide additional information or clarify questions asked concerning their report. As may be noted, the firm has changed its name to Converse Consultants.

The previously described revisions will make no change in the construction procedures which were submitted to the District Engineer by letter dated

September 9, 1981. In fact, all except the further extension of the intake into the River were taken into account when the procedures were developed and this further extension does not alter the procedures.

In conjunction with discussions with DER regarding the construction activities within the Canal, DER has indicated it believes it would be convenient to perform repairs to Lock No. 13 at the same time as NWRA constructs the intake conduit under the Canal. These repairs are part of DER's continual routine maintenance program for the Canal and are not at all related to or caused by NWRA's proposed construction activities. To enable DER to accomplish these repairs, DER has indicated a desire to have a cofferdam constructed below Lock No. 13 with water delivered below the dam by NWRA. This cofferdam has been shown in plans submitted to the Bucks County Conservation District. It is, however, NWRA's intention for DER to obtain all necessary reviews, approvals and/or permits incident to the construction of the cofferdam. Only if DER obtains these approvals will the cofferdam be constructed.

The design of the Project, as shown on Exhibit Nos. 5 and 15, minimizes the impact on the wetlands at the Project site. In November 1980, RMC performed a field vegetation survey of the site and, based on the survey, prepared a report entitled "Vegetation of the Point Pleasant Intake Site" which was submitted both to DRBC and the Corps of Engineers. The report concluded that the wetland vegetation at the site is "typical" and "widely distributed throughout the Northeastern United States". According to RMC's description, the wetland habitat at the Point Pleasant Pumping Station appears to fall within Resource Category No. 4 of the United States Fish and Wildlife Service's mitigation policy guidelines for habitats that may be affected by Federally permitted land and water resource developments (The guidelines were published in the Federal Register of January 23, 1981). Category No. 4 habitats are characterized as of "medium to low value", and the mitigation goal set for these habitats is the minimization of the loss of habitat value, rather than the creation of compensatory habitat.

In accordance with this goal, NWRA has made every effort to minimize the impact of construction on wetlands. In order to give full consideration to the effect of the installation on the wetlands, the actual limits of the wetlands on the Project site were staked out by a biologist and these limits were then surveyed and placed on the site plan. They are shown on Exhibit No. 5, and on Exhibit No. 15. Through judicious design and planning, the total area of affected wetlands is only 0.30 acre which is about 1/3 of the 0.93 acre of wetlands at the site. Of this, only 0.22 acre of wetlands will be permanently affected by placement of fill. The ground surface of the remaining 0.08 acre of affected wetland will be restored to original grade and should return to pre-construction conditions.

As shown on Exhibit No. 15, the alignment of the intake conduit passes between the two principal wetland areas, minimizing the amount of wetlands affected. The fill around the gate well and for the access road covers some of the wetland area but these facilities are essential for the operation of the Project. Also, some wetland area must be excavated for installation of the intake conduit. There will be a settling basin in the upper part of the property near the Canal towpath, during the construction period. The settling basin will affect only 0.01 acre of wetlands and is an essential structure for sediment control. There will be no temporary stockpiling of excavated materials on wetland area.

Notwithstanding the successful efforts to minimize impacts of the Project on wetlands, NWRA is willing to provide compensatory wetlands if the Corps believes this is necessary. It should be noted that DRBC, after taking into account the marginal value of these wetlands and the small amount affected, did not consider this necessary.

It should be stressed that none of the above described revisions increase the pumping capacity of the Project. Attached as Exhibit No. 16 is a chart which shows the pumping capacity of the Station with one, two, three and four pumping units operating. These pumping units will be operating within the limits of the two relatively horizontal lines marked "Maximum Head" and "Minimum Head". The "Maximum" line is based on pumping against the highest operating pool level in Bradshaw Reservoir and the minimum low water level in the Delaware River. The "Minimum" line is based on the lowest operating pool level in Bradshaw Reservoir and an above normal water level (Elev. 75) in the River. With all four pumping units operating, the total production of the Station will range from 3.95 to 4.00 million gallons per hour and the maximum possible pumpage in a 24-hour day will be 94.8 to 96.0 million gallons. These amounts of pumpage are based on factory pumping tests which may be high and, also, the amounts are expected to decrease with wear on the pumps.

If additional information is desired, please advise.

Sincerely yours,

E. H. Bourquard

E. H. Bourquard

EHB/bs
Encl.

LIST OF EXHIBITS

Exhibit No.	Title
1	PPPS - Delaware River Flow Velocities at Intake Site - November 7, 1980.
2	PPPS - Delaware River Flow Velocities at Intake Site - July 23, 1981.
3	PPPS - Delaware River Flow Velocities with Intake at Station 8+62.
4	PPPS - Delaware River Channel Section at Water Intake.
5	PPPS - Location and Layout Plan, General Profile, Dec. 22, 1981, Rev. Jan. 13, 1982.
6	Forwarding Memo and Discharge Measurement Notes - Pennsylvania District, USGS, U. S. Dept. of the Interior.
7	Development of Relationship between Water Discharge and Water Surface Elevation, Delaware River at PPPS Site, Point Pleasant, Pennsylvania, January 4, 1981
8	PPPS - Preliminary Design, Discharge-Stage Data at Intake Site, RES, 6-10-81, 4 Sheets.
9	Point Pleasant Pumping Station - Preliminary Design, Intake Screens, JJP Jr., 1-9-81, 10 Sheets.
10	Point Pleasant Pumping Station, Intake Screen Assembly and Piping Details, Sept. 1, 1981, Rev. Jan. 13, 1982.
11	Converse Ward Davis Dixon Letter of 28 August, 1981, to E. H. Bourquard Associates, Inc.
12	Converse Ward Davis Dixon Letter of October 13, 1981 to E. H. Bourquard Associates, Inc.
13	Converse Consultants Letter of October 27, 1981 to E. H. Bourquard Associates, Inc.
14	Converse Consultants Letter of November 27, 1981 to E. H. Bourquard Associates, Inc.
15	PPPS Site, Limits of Wetlands and Effected Areas.
16	PPPS - Head vs. Capacity Curves with 66/60 CTM and Peerless 28 HXB

Table No.	Title
1	Velocity Measurements of Delaware River Flow along PPPS River Intake Centerline.

TABLE NO. 1

Velocity Measurements of Delaware River Flow along PPPS River Intake Centerline

November 7, 1980

Water Depth in Feet	River Flow Velocity in Feet Per Second, at Centerline Station: 7+05	7+85	8+60	9+30	9+95	10+53	11+03
1	0.0	0.1	1.4	1.7	1.1	0.5	Slack, to
4	0.0	0.1	1.3	1.7	0.7	0.6	Slightly
7		0.0	1.1	1.6	0.8	0.5	Upstream
10			0.9	1.4			

W. S. Elev. - 70.8 Flow - 3000± cfs

July 23, 1981

	River Flow Velocities in Feet Per Second, at Centerline Station: 6+49	6+74	6+99	7+24	7+49	7+74	7+99
1	0.1	0.1	-0.2	-0.2	0.05	±0.25	0.25
4			-0.2	-0.3	-0.1	±0.3	0.3
7				-0.15	-0.2	±0.2	0.4
10					-0.1	±0.15	0.2

	8+24	8+49	8+74	8+99	9+24	9+49	9+74
1	1.3	2.2	3.0	3.0	3.5	3.0	2.3
4	1.2	2.0	2.8	2.5	2.6	3.1	2.0
7	0.9	1.6	2.6	2.5	2.7	2.4	2.1
10	0.75	0.7	1.5	2.1	2.2	1.6	1.1

W. S. Elev. - 71.4 Flow - 4500± cfs

THIS IS NOT A PAID ADVERTISEMENT

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2d & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

FEB 22 1982

NAPOP-R-80-0314-1
Supplement Number 1

9 February 19

PUBLIC NOTICE

This is a supplement to the public notice bearing the above number issued 6 April 1981 concerning the application by Neshaminy Water Resources Authority, 2875 Old York Road, P.O. Box 378, Jamison, Pennsylvania 18929, for a Department of the Army permit to build a water intake structure in the Delaware River, at Point Pleasant, Bucks County, Pennsylvania, as more fully described in the basic notice. Notice of a public hearing was issued on 10 August 1981, and the hearing took place on 15 September 1981.

The applicant has made engineering revisions in its plans, as shown on the attached drawings numbered E-1 and E-2 dated January 1982. The revisions in brief are:

1. Relocate the intake structure 45 feet further channelward in the Delaware River.

2. Place three intake pipes (42 inch diameter) under the Delaware River 6 feet apart instead of 22.5 feet apart.

3. Relocate the intake pipe crossing under the Pennsylvania Canal approximately 13 feet northward, and increase the diameter of this pipe from 60 inches to 72 inches.

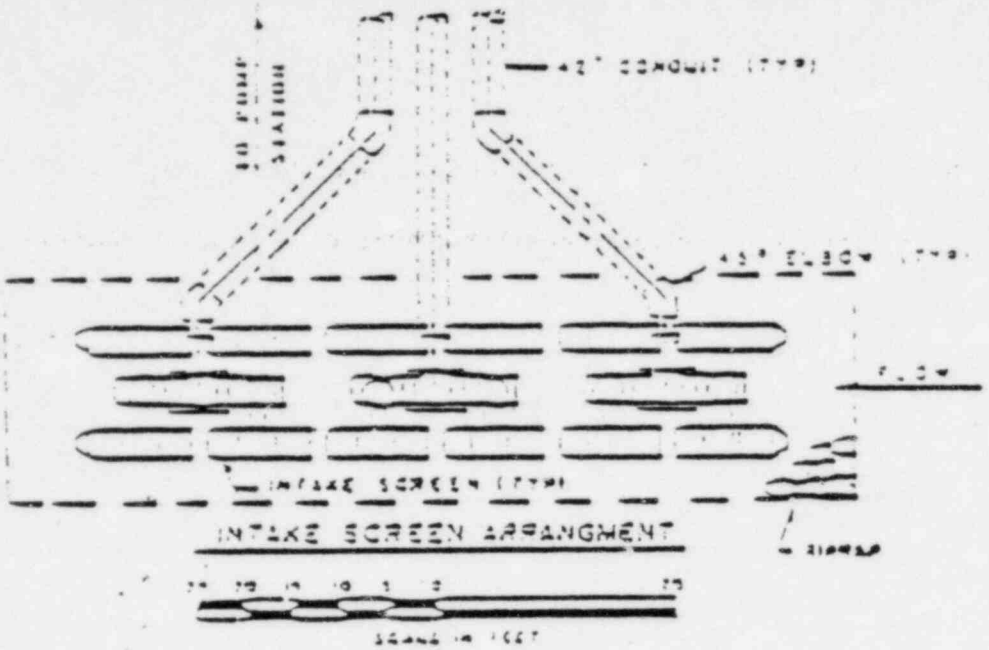
4. Lower the pump sump and the entire length of intake pipes from invert elevation 58.00 feet to invert elevation 53.75 feet.

5. Change the designation of the minimum water level elevation of the Delaware River from 68.0 feet to 70.0 feet.

The stated purpose for revisions 1 through 4 is to increase the operating efficiency of the water intake facility and to lessen any environmental impact. Revision number 5 reflects up to date hydrologic information and data. The purpose of the intake structure and its capacity are unchanged.

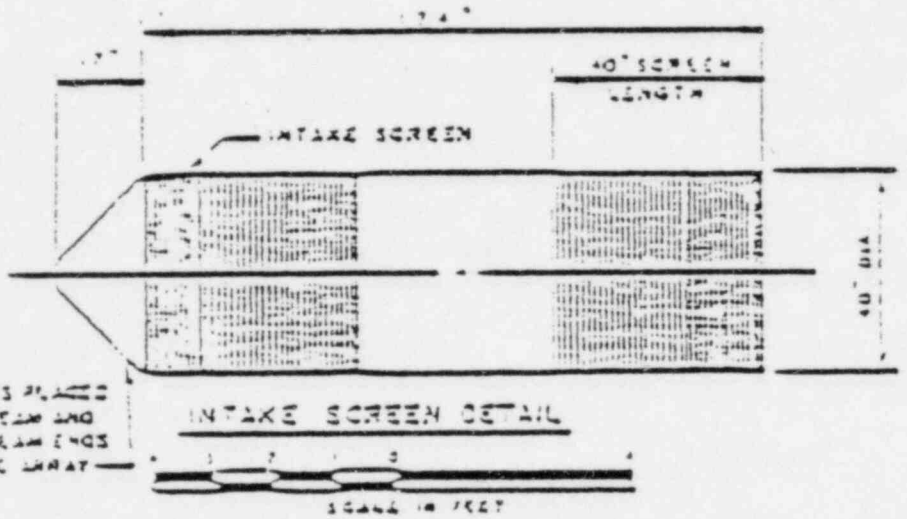
ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
District Engineer

CFT To: V. S. BAYER
J. S. KEMPER
E. C. KUSTNER



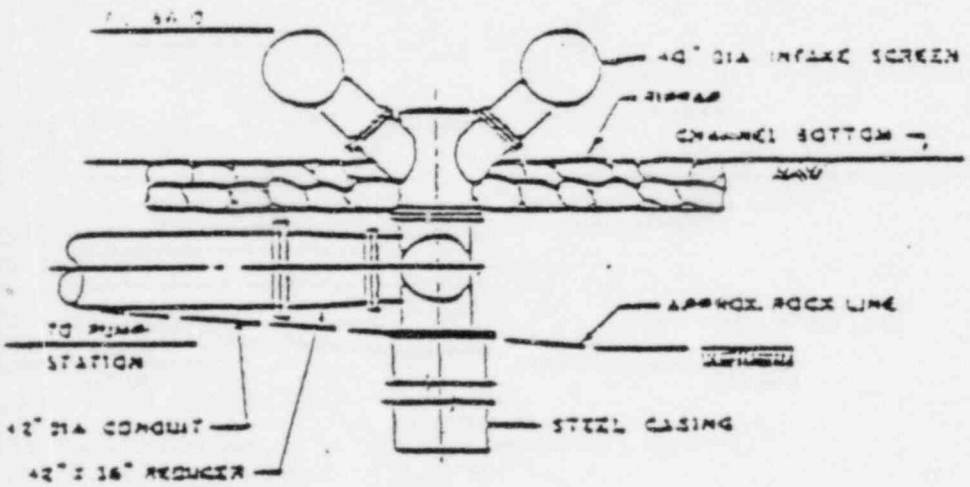
INTAKE SCREEN ARRANGEMENT

SCALE IN FEET



INTAKE SCREEN DETAIL

SCALE IN FEET



ENLARGED INTAKE DETAIL

SCALE IN FEET

E 2-(1)

NESHAMINY WATER SUPPLY SYST

POINT PLEASANT

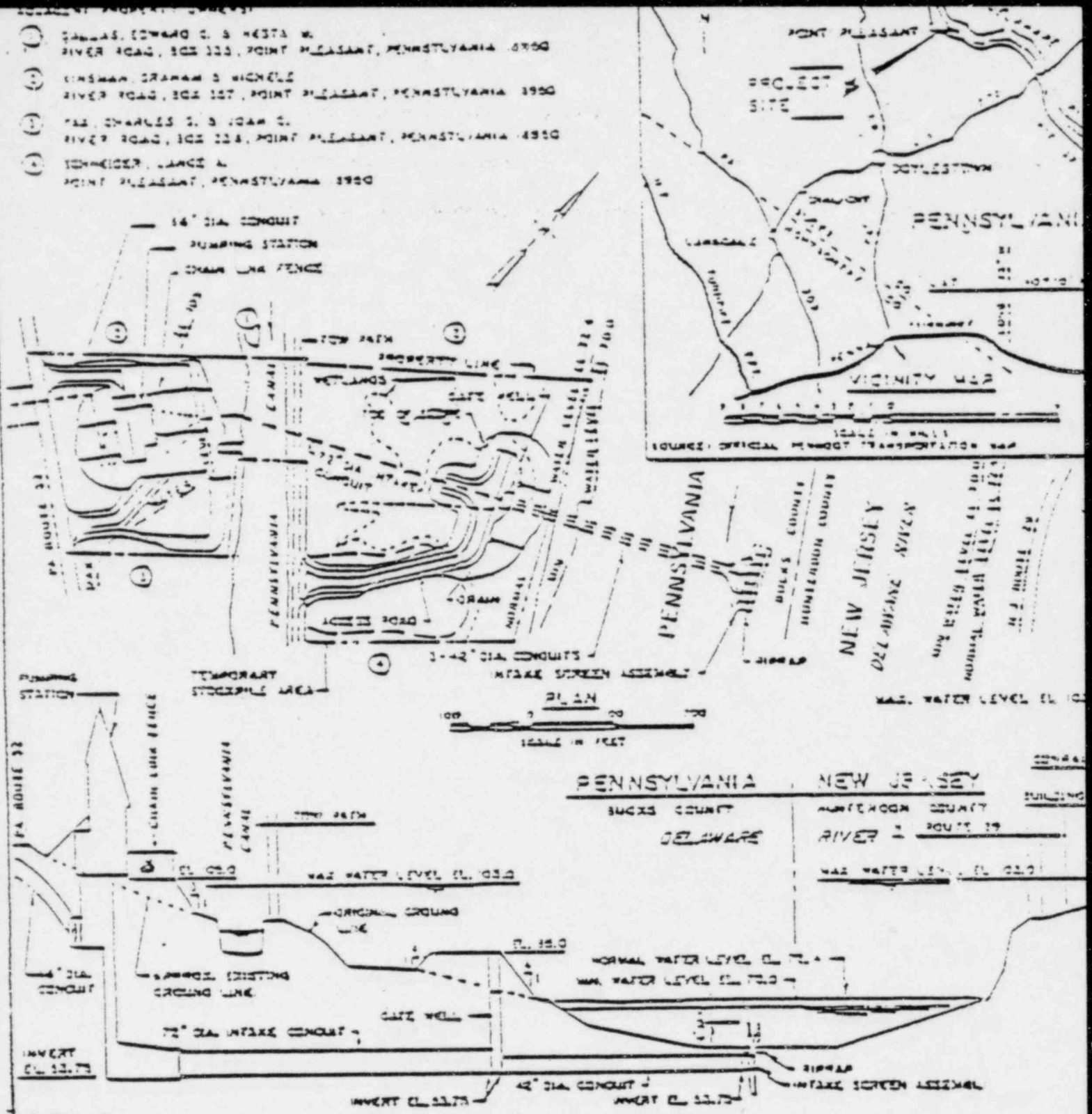
PUMPING STATION

INTAKE SCREENS

PLUMSTEAD TOWNSHIP

BUCKS COUNTY, PENNSYLVANI

JAN. 1963


PROJECT SITE
VICINITY MAP
PENNSYLVANIA
NEW JERSEY
DELAWARE RIVER
BUCKS COUNTY
PLAN
PROFILE
HORIZONTAL
VERTICAL
DATUM MG
POINT PLEASANT PUMPING STATION
WATER INTAKE
PUMSTEAD TOWNSHIP
BUCKS COUNTY, PENNSYLVANIA

E-10(2)