September 20, 1982

QUESTIONS CONCERNING J.T. PHILLIPPE
LETTER OF MAY 10, 1982

Q. What was the purpose of the letter addressed to Del-AWARE, May 10, 1982?

A. The purpose of the letter was to summarize findings and suggestions concerning issues regarding the hydrology and hydraulics of the Point Pleasant Pumping Station for the use of the citizens of Del-AWARE Unlimited and their counsel.

Q. Was the letter the result of a lengthy review of project documents?

A. No. The letter was the result of a brief review of very limited project documentation and river flow records in the public domain. The letter reflected the concerns of an engineer looking at possible environmental consequences of a very complicated project.

Q. What kinds of environmental consequences were of concern?

A. Of concern are the effects of diversion of water from the freshwater portion of the Delaware River, transfer of that water to a sub-basin of the Delaware (the Perkiomen Creek-Schuylkill River), and return to the Delaware Estuary by-passing the upper Delaware Estuary. Also of concern is the effect of operation of the Point Pleasant Pumping Station on aquatic life in the immediate vicinity of the Pumping Station. Other concerns relate to the public safety with respect to the operation of the various components of the conveyance and storage system.

Q. What was the purpose of the reference to fire department pumper trucks?

A. Since the letter was addressed to the citizen's group, Del-AWARE Unlimited, the use of the visualization of fire department pumper trucks was one to which I felt most citizens can relate. The number of equivalent pumper trucks provided a point of reference to which a layman could relate the magnitude of pumping.

Q. Why did you suggest the use of mathematical models for characterization of the Point Pleasant Pumping Station pumping environment?

A. The flow, velocity and eddy patterns at the Point Pleasant site are at present ill defined. The NWRA and PECO have provided very limited flow, velocity and eddy pattern field measurements. They have provided none at the low flow levels at which disruptions to the existing low flow velocity and eddy patterns may become significant. That is low flows substantially below 3000 cfs. Mathematical models allow incorporation of geomorphologic factors into a computerized calculating and "bookkeeping" scheme that can keep track of changes to velocity and eddy patterns under a variety of flow conditions. Such models, for which the physics of the situation are properly represented would allow the engineer to examine the sensitivity of the velocity and eddy patterns to various river flow flow and pumping operation variations. At the present time, only qualitative judgments can be made. Decisions for, or against a project, should not be made on the basis of qualitative judgments when better tools are available from which to make quantitative assessments.

Q. In your letter, you analyzed flow records at Trenton for the period 1963-1979. The Merrill Creek Owners' Group used flow records beginning in 1920 through 1979. Which set of flow records is more appropriate to use?

A. The historic flow record for the entire period of record is more appropriate to use.

Q. With reference to Exhibit 2 of your letter of May 10, 1982, what are the corresponding low flow expectations when the period of record through 1979 is used for the Trenton flow gage?

A. The attached exhibit gives the low flow expectations for the historic period of record through 1979.

Q. How do the low flow expectations for the historic period of record differ from those presented in your letter of May 10, 1982 for the more recent 17 years of record?

A. The low flow expectations produced from the complete period of record (as released by the USGS) are much lower than those calculated from the more recent 17 years of record.

Q. Why were the flow flow expectations produced from the more recent 17 years of published record biased on the high side when compared to the entire, published, historic record? Wasn't the severe drought of the 1960's included in the 17 years of recent record that was analyzed?

A. Although the extreme drought of 1966 was included, the very "wet" years of the 1970's were also included. Hurricane Agnes occurred in 1972. Review of the entire published period of record shows several other significant drought periods on the Delaware. Relatively severe droughts were observed in 1915, 1923-24, 1931-33, 1942, 1955, as well as the 1960's drought.

EXHIBIT

TRENTON GAGE (USGS No. 01463500)

SUMMARY OF LOW FLOW EXPECTATIONS*
(Log Pearson Type III Analysis)

Flow Period	Flow Values, cfs, for Recurrence Interval		
	2-year	5-year	10-year
1-day low flow	2184	1632	1411
3-day low flow	2311	1717	1480
7-day low flow	2460	1821	1566
14-day low flow	2605	1916	1647
30-day low flow	2893	2106	1799
60-day low flow	3342	2393	2041
90-day low flow	3832	2686	2255
120-day low flow**	4425	3047	2527

*Flow record, 1913-1979.

**Maximum sustained Merrill Creek Reservoir Release purported to be 200 cfs for 115 days.

Q. In your letter of May 10, 1982, Exhibit 3 showed the percent of time that the flow in the Delaware at Trenton was less than 3000 cfs for the 17 years of recent record analyzed on a monthly basis. How do those percentages compare using the entire published historic flow record for the Trenton gage?

A. The data used in Exhibit 3 was partitioned in 500 cfs increments. The percentage shown as less than 3000 cfs should have been shown as less than 3500 cfs. However, using the entire published historic period of daily flow values and partitioning in 100 cfs increments, flows less than 3050 cfs for Trenton can be expected for each of the twelve months as follows:

Month	Percent of flow less than 3050 cfs
January	3.1
February	1.5
March	0.2
April	0.0
May	0.0
June	2.9
July	19.4
August	29.5
September	34.3
October	30.3
November	14.7
December	5.1

Q. Can you provide similar monthly estimates of low flows less than 2500 cfs and 2000 cfs, respectively?

A. Using the same partitioning scheme for historic published daily flow values at the Trenton gage, the following estimates can be provided:

Month	Percent of Flow Less Than 2550 cfs	Percent of Flow Less Than 2000 cfs
January	1.4	0.1
February	0.5	0.0
March	0.0	0.0
April	0.0	0.0
May	0.0	0.0
June	1.0	0.5
July	10.2	3.9
August	19.2	8.3
September	24.2	10.4
October	18.9	11.4
November	9.6	5.2
December	2.8	0.9

Q. Given that the Merrill Creek Reservoir is built and is fully operational for low flow augmentation, and that the Point Pleasant Pumping Station benefit from such low flow augmentation using a "river-following" approach, do you anticipate pumping to be permitted at flows below 2500 cfs?

A. Yes.

Q. At flows less than 2000 cfs?

A. Yes.

Q. Questions have been raised concerning the water surface elevation at the propsoed Point Pleasant Pumping Station intake. Are you aware of water surface elevation measurements in the low flow vicinity of 2000 cfs?

A. Yes. Pickering, Corts & Summerson, Inc. obtained a water surface elevation of 69.4 feet above sea level for Channel Section 22.0 in a study of the proposed Tocks Island Dam and Reservoir. This cross-section is located approximately 1/3 mile below the proposed intake and is in the pool created by the Lumberville weir and dam. The elevation was obtained on September 26, 1964 at which time the flows observed at the Trenton gage were approximately 2000 cfs.

Q. What effect does the Lumberville dam have on flows below 3000 cfs?

A. With incomplete data available, only a qualitative answer should be given at this time. The Lumberville weir and dam, built, in part, to provide a pool from which water could be drawn into the Delaware-Raritan Canal, also creates a pool extending back to Channel Section 22.0 and back to the proposed intake location. At 2000 cfs, given the cross-sectional areas surveyed on September 26, 1964, an average velocity of less than 0.6 fps could be calculated. However, the exact velocity distribution cannot be given based on data presently available. Qualitatively, one can expect the instream velocities to drop as the flow drops below 3000 cfs because of the effects of the pooling occurring behind the Lumberville dam.

Q. What do you know about the channel in the Delaware River in the vicinity of the proposed Point Pleasant Pumping Station?

A. My knowledge is limited to the general nature of the bar at the mouth of the Tohickon Creek, the bend of the river at Point Pleasant, the cross-sections obtained for the Corps of Engineers once proposed Tocks Island Dam and Reservoir and information provided in E.H. Bourquard documents or from observations reported by divers and surveyors hired by Del-AWARE Unlimited or its counsel. In summary, as the river is traversed in an upstream to downstream direction, the main channel is found closer to the New Jersey shore in the vicinity of Tohickon Creek approximately two-tenths of a mile above the proposed intake. The principal channel continues past the proposed intake with the main channel apparently further toward the New Jersey shore than the proposed intake location. Approximately, one-third mile below the proposed intake the main channel is found approximately mid-river with the Pennsylvania side of the river generally deeper than the New Jersey side. Generally, the stronger currents can be found in the main channel with the "eddy" primarily located toward the Pennsylvania side of the main channel and below Tohickon Creek.

Q. Will Point Pleasant intake water be derived primarily from the main channel of the Delaware River or from the "eddy" area under low flow (less than 3000 cfs) conditions?

A. I don't know. Data for such low flow conditions is extremely meager. If the intake is, in fact, located in the main channel, then one might assume a larger proportion of the intake water to be drawn from the main channel. If, in fact, the intake is to be located at some distance from the main channel, one might anticipate a larger proportion of the water to be taken from the "eddy" area. Again, the data is extremely meager, and there exist no models of the situation, to my knowledge, either physical or mathematical.

OTHER QUESTIONS

Q. Are you familar with the details of the proposed Bradshaw Reservoir?

A. I have briefly reviewed documents concerning the Bradshaw Reservoir prepared by E.H. Bourquard and Associates, Inc.

Q. Do you agree that the plans and analyses are acceptable?

A. In general, I found the work to be thorough.

Q. The question has been raised concerning the stability of embankments under proposed operating conditions. Do you consider the stability analyses and the embankment designs to be adequate?

A. Given the type of soils to be used (although plasticity indices are generally low), the engineer has specified within reservoir slopes of one vertical to three horizontal and downstream slopes of one vertical to two and one-half horizontal. For the materials proposed, these embankments and slopes correspond to recommended practice by the Bureau of Reclamation, the Corps of Engineers and others. Stability analyses have been performed for these embankment situations including sudden-draw down. One section of the embankment within the reservoir is proposed to have slopes of one vertical to two horizontal. A stability analysis under sudden-drawdown conditions was not found in materials available for review. No reason was found for such an omission.

Q. Materials available for review often indicate a general plan of operations under average conditions. What does "average" mean and what effect might significant deviations from "average" entail?

A. I cannot answer the question. In many planning projects, a sensitivity analysis is performed in which the significant deviations from the "average" are analysed in order to anticipate effort on the project, or public safety, or economic losses resulting from such deviations from "average" conditions. Those type of analyses are generally lacking in documents available for review for this project.

RESUME - JONATHAN T. PHILLIPPE, P.E.

Education:

B.S. - Civil Engineering (Cum Laude), Virginia Polytechnic Institute and State University, 1962
M.S. - Civil Engineering (hydraulics and hydrology), Virginia Polytechnic Institute and State University, 1968

Continuing Education:

Course work has been completed and language requirements fulfilled toward a Ph.D. degree in Civil Engineering at Virginia Polytechnic Institute and State University. (Course work included the equivalent of a Master's degree in Environmental Engineering and additional work in soils and geology).

GKY and Associates (1975 to present):

Mr. Phillippe is chief engineer of GKY and Associates. He serves as Vice President of the corporation. His philosophy is to tailor the tools used to the requirements of the client. To the extent possible, his philosophy includes drawing these tools from the public domain in order to maximize the supporting user community and to minimize the cost to the client. Projects have been performed using client mainframe computers; down-loading mainframe run programs to minicomputers in order to hold costs constant; and specification and procurement of sophisticated microcomputer based systems to enable cost-effective management and development of major data bases.

Project manager experience has covered a wide range of activities. These activities have included responsibility for a PL92-500, Section 303(e) basin planning effort in the State of West Virginia, resulting in a basin plan for the principal river basin in the state and in the development of procedures for the orderly accomplishment of basin planning for the remaining river systems in the state. Mr. Phillippe also organized a field sampling program and performed wasteload allocation modeling in three southern Alabama basins in support of PL92-500, Section 303(e) planning. Nonpoint source questions were addressed and available water quality data was assessed.

Mr. Phillippe was a lead participant in water quality reviews of Advanced Wastewater Treatment project reviews for EPA in its first round of advanced treatment project reviews. As well as performing water quality reviews, Mr. Phillippe also participated in screening incoming projects for adequacy of materials submitted for review. This screening included facilities, population, economic as well as the water quality considerations of water quality data and attempted water quality simulations. Mr. Phillippe coordinated individual reviews with both EPA and the prime contractor, who was in charge of facilities reviews. More than 60 reviews were made in less than one year with the bulk of the review occuring within a six-month period.

He has served as principal investigator for: a two-year EPA project on "Nonpoint Source Guidance for 201 Facilities", and for Bridgewater Commons EIS, heading a multidisciplinary team which assessed water quality impacts and hydrologic modifications to the environment induced by a shopping center in Bridgewater, New Jersey. The Bridgewater Commons project was supported directly by shopping center developer, Ernest W. Hahn, Inc. for Bridgewater Township.

Project manager experience also included the generation of reports and position papers for the Council on Environmental Quality, the U.S. Environmental Protection Agency and the U.S. Water Resources Council. These papers included assessments of national data bases of water quality and quantity. Included in this area of experience are papers relating to the 1975 National Water Assessment. Mr. Phillippe provided water quality sampling and analysis and hydraulic and hydrologic analyses with regard to an Environmental Impact Statement for a major expressway proposed through tidal wetlands. Expert testimony was provided in support of litigation both for the defendents and for the plaintiffs in several cases. Testimony was provided in the areas of water quality, hydraulics and hydrology. Project manager experience also included the application of the computer programs, HEC-1 and HEC-2 to urban or urbanizing watersheds adjacent to major eastern cities. Mr. Phillippe has also engaged in hydrologic research efforts for the National Weather Service.

As a member of GKY study teams, Mr. Phillippe has engaged in the review of and application of mathematical stream modeling including nonpoint source pollution simulation in both riverine and estuarine modeling efforts. He has been involved with the development of economic and statistical methodologies for use in the assessment of stream gaging networks of national scope. He has participated in the development of simplified methodologies to assess urban stormwater impacts. He participated in the development of a raw water interconnection optimization model for a major metropolitan area. He also participated in a series of projects evaluating the applicability of airborne lasers in hydrographic applications.

Private Practice 1974 - 1975):

Mr. Phillippe engaged in general civil engineering consulting in Southwestern Virginia.

Wytheville Community College (1968-1974):

While teaching at the community college, Mr. Phillippe served as Chairman of the Division of Engineering Technology and Business Sciences. He was responsible for the administration of a teaching program involving fourteen full-time professionals and additional part-time professionals and the requisite support staff. In his

capacity as Division Chairman, he also chaired a statewide community college committee reviewing and recommending content of engineering technology curricula. He also served on a committee to establish a Master Plan for data processing for the community college system in Virginia. Teaching responsibilities as an associate professor of Civil Technology included a broad range of courses in mathematics, statistics, environmental engineering design and operation, a full range of surveying, soils, and engineering materials and structures. During this time, Mr. Phillippe also worked with the Appalachian Power Company on its "Blue Ridge Project". This work included a surveying program of shoreline control and a soils sampling, testing and evaluation program with Drs. A. and L. Casagrande of Harvard University. Mr. Phillippe also developed and taught several short courses and training programs in the environmental technology field.

Other Experience (1956 - 1962):

Mr. Phillippe attended Virginia Polytechnic Institute and State University as a co-op student. He co-oped with the U.S. Coast and Geodetic Survey in the areas of hydrographic surveying, photogrammetric interpretation, geodetic surveying and cartography. Upon graduation, Mr. Phillippe worked as a junior engineer for the State of California on the southern terminus of the California Aqueduct. Other work included thorough exposure to all aspects of residential construction. Mr. Phillippe's extensive travels have resulted in familiarity with most areas of the continental United States and also of the subcontinent of India and other areas of southeast Asia.

Licenses and Professional Affiliations:

Registered Land Surveyor - Virginia
Registered Professional Engineer - Virginia
Member, National Society of Professional Engineers
Member, Virginia Society of Professional Engineers
(has held elective offices in a local chapter)
Member, American Society of Civil Engineers
Member, American Geophysical Union
Tau Beta Pi, Phi Kappa Phi, Chi Epsilon, Sigma Xi
Private Pilot

Other Skills:

Accomplished semi-professional photographer.

Representative Publications:

Instantaneous Unit Hydrograph Response by Harmonic Analysis, Bullet 15, Water Resources Research Center, Virginia Polytechnic Institute, March 1969.

The Optimization of Raw Water Interconnections for the Washington, D.C. Metropolitan Area: Phase III, Final Report; Report to Baltimore District, Corps of Engineers, with G. K. Young, R. A. Aspinwall and S. A. Daley, January, 1979.

The Optimization of Raw Water Interconnections for the Washington, D.C. Metropolitan Area: Phase I, Hydrologic and Hydraulic Data; Report to Baltimore District, Corps of Engineers, with R. Aspinwall and S. A. Daley, April, 1979.