ALTERNATIVE WATER SUPPLY RESERVOIRS

in the

DELAWARE RIVER BASIN

Report of the Delaware River Basin Electric Utility Group
Reservoir Contingency Study Subcommittee

May 1975

TABLE OF CONTENTS

SUMMARY AND CONCLUSIONS

****

As a result of the August 16, 1974 meeting of DRBEUG with the DRBC, a subcommittee was formed to conduct reservoir contingency studies. The objective of these studies was to identify and evaluate reservoir sites that could be developed to supply the freshwater consumptive requirements for Limerick, Hope Creek, Summit and other generating stations in the event that the Tocks Island project is either further delayed or cancelled. The subcommittee was to assess the feasibility of developing reservoir sites to supply the water requirements of various proposed units listed in the Delaware River Basin, Master Siting Study. The total water requirement was identified to be at least 70 cfs, the expected average demand for those generating stations named above, since DRBC requires the completion of a reservoir by the time of commercial operation for each.

The subcommittee consists of Messrs. E. L. Brown of P.S.E.&G., R. D. Ley of GPU, and J. B. Mochel of PECo. The Civil Section of the PECo Mechanical Engineering Division was assigned, by PECo, the responsibility of implementing the study under the direction of said subcommittee, utilizing the firm of TAMS for technical support.

Meetings of the subcommittee have been held as follows:

8/27/74 ---- Preliminary Mtg. (PECo, TAMS)
9/ 4/74 ---- Subcommittee Mtg.
9/12/74 ---- Subcommittee & TAMS Mtg.
10/25/74 ---- Subcommittee & TAMS Mtg.
3/ 3/75 ---- Subcommittee & TAMS Mtg.

The most immediate job of the subcommittee was to coordinate the consumptive requirements of DRBEUG with PECo's need to satisfy a condition of the Limerick Generating Station's construction permit which requires the submittal of a "schedule identifying milestone dates ...." for development of a reservoir by the time of Limerick Generating Station initial power operation (scheduled for 1981). This schedule has been prepared, was reviewed by the DRBC, and with their concurrence was submitted to the (AEC) Director of Licensing on December 19, 1974.

To provide the necessary degree of detail for the preparation of this schedule, reservoir sites throughout the Delaware River Basin previously identified by TAMS* were reevaluated for 70 cfs and maximum practical yields. The attached reports present the findings of this DRBEUG Reservoir Subcommittee. The document entitled "Timetable for Development of a Water Supply Reservoir in the Delaware River Basin" (Attachment 1) briefly describes the status of each site evaluated and presents a schedule suitable for the development of any of the alternative projects. The report entitled "Discussion of Alternatives,

* Tippetts, Abbett, McCarthy, Stratton

Water Supply Reservoirs -- Delaware River Basin" (Attachment 2) is a more in depth presentation of the site investigations, hydologic criteria used and alternatives available. These are intended for the use of DRBEUG as working documents.

During the conduct of the study, GPU informed the subcommittee of key project data concerning their proposed Mill Creek Reservoir development, adjacent to the proposed Berne Generating Station, and the GPU position regarding its availability (see attached letter dated November 12, 1974, Attachment 3. It has been evaluated by TAMS as an alternative site in the attached supplementary report entitled "Investigation of Mill Creek Reservoir", Attachment 4. GPU presently owns a large portion of the property required for this project and would be willing to have it developed before their requirement date (presently in the 1990's) for the use of other utilities. There would be a water use charge related to the annual cost of the project and the yield would have to be reassigned to the GPU units as they come on line. GPU has had some preliminary correspondence with the DRBC regarding pump-in criteria.

As a result of these most recent evaluations the following reservoirs have been identified as the most viable alternatives for development. Their location is indicated on the attached map.

Name	Yield	Type	Tributary of
Equinunk	70 cfs	Conventional	Delaware
(max.)	420 cfs	Pump-in	Delaware
Milanville Sites	70 cfs	Conventional	Delaware
(max.)	420 cfs	Pump-in	Delaware
L. Martins Cr.	70 cfs	Pump-in	Delaware
(max.)	279 cfs	Pump-in	Delaware
Blacks Cr.	70 cfs	Pump-in	Delaware
Red Cr.	70 cfs	Pump-in	Schuylkill
Irish Cr.	70 cfs	Pump-in	Schuylkill
(max.)	102 cfs	Pump-in	Schuylkill
Mill Cr. (Berne)	70 cfs	Pump-in	Schuylkill
(max.)	102 cfs	Pump-in	Schuylkill

The following is the latest schedule of capacity additions in the Delaware River Basin through 1988. This list has been prepared based on information recently provided for the 1975 revision of the Master Siting Study.

Unit	Service Date	Average Augmentation Required (cfs)	Cumulative Total (cfs)
Martins Creek #3	1975	5.2	5.2
Martins Creek #4	1977	5.2	10.4
Gilbert #8	1977	2.0	12.4
Summit #1	1981	3.0	15.4
Limerick #1	1981	27.0	42.4
Hope Creek #1	1982	5.0	47.4
Limerick #2	1982	27.0	74.4
Hope Creek #2	1984	5.0	79.4
Summit #2	1984	3.0	82.4
Cliff #1	1986	35.0	117.4
Chester #10	1987	8.8	126.2
Chester #11	1988	11.7	137.9
Cliff #2	1988	35.0	172.9

Conclusions.

Seven possible developments at about the 70 cfs level, sufficient for Limerick, Hope Creek and Summit, have been evaluated to be practical. The evaluation of these sites has been conducted using a variety of assumptions regarding minimum allowable conservation releases, permissible river flows for pumping, and seasonal pumping limitations. The assumptions are explained in detail in the attached reports. Most of these sites are not suitable for considerably larger-scale development. A combination of the Equinunk and Milanville projects could be developed to provide a total yield of about 500 cfs. However, if pump-in projects are not permitted in the upper-Delaware, which may be designated a wild river, and might therefore prohibit development, there is only one suitable large-scale reservoir site remaining - Little Martins Creek at 279 cfs. In addition, either the Irish Creek or Mill Creek sites could be developed at an intermediate level of about 100 cfs. The flow regime of the Schuylkill River allows the development of only one of the three alternate sites studied on that stream.

Several of the smaller reservoirs could be constructed to meet the aggregate yield desired. This would, however, duplicate siting and permit difficulties and would not take advantage of the economies of scale that could be realized. The magnitude of this potential savings may be illustrated by pointing out that the Little Martins Creek project could yield 279 cfs at about $43,000 per cfs and a combination of four 70 cfs projects (Little Martins Cr., Milanville, Red Cr., Blacks Cr.) would yield 280 cfs at about $96,000 per cfs.

The schedule of milestone dates submitted by PECo to the AEC for the development of a reservoir reveals that, even with the recently delayed service dates of Limerick and Hope Creek, work must continue on site selection and evaluation studies in order to provide the lead time required by Limerick. Based on this schedule the Environmental Report should be completed by January 1977 so that licensing review, and permit activities can start immediately thereafter. The size of the reservoir desired must be chosen early in these studies so that the best site for development may be chosen, and land acquisition started before the submittal of the Environmental Report. The previous list of alternate sites indicates the range of yields available.

The development of one of the 100 cfs projects would provide for all planned DRBEUG consumptive requirements into the mid-1980's. If Mill Creek were chosen for development, a portion of its yield would have to be reassigned to the GPU units as they come on-line in the 1990's. The consumptive requirements of those displaced, or bumped, units would then have to be assigned to other reservoir projects developed either by the utilities or the Corps of Engineers. The Delaware projects to about the 280 cfs level would provide for the requirements of all scheduled additions into the mid-1990's. Furthermore, any of the Upper Delaware sites could be enlarged, at some future date, to provide an additional 140 cfs.

ATTACHMENT 1

TIMETABLE FOR DEVELOPMENT OF A WATER SUPPLY RESERVOIR IN THE DELAWARE RIVER BASIN

PHILADELPHIA ELECTRIC CO.

DECEMBER 1974

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS
NEW YORK, N.Y.

TIMETABLE FOR DEVELOPMENT OF A WATER SUPPLY RESERVOIRS IN THE DELAWARE RIVER BASIN

INTRODUCTION

This report covers the results of preliminary investigations of certain water supply reservoir sites in the Delaware River Basin. The reservoirs are being considered as possible sources of cooling water supply to be released during dry periods for consumptive use at thermal power stations. The report includes the criteria used for establishing the capacities of project facilities, discussion of alternative sites, descriptions of selected reservoir projects, capacity and cost data, and a proposed program and timetable for reservoir development.

WATER REQUIREMENTS

Certain conditions have been imposed by the Delaware River Basin Commission (DRBC) concerning the withdrawal of water for cooling water make-up at new thermal power stations. These conditions as applied to the Limerick Generating Station (Philadelphia Electric Co.) prohibit withdrawals from the Delaware River when the discharge at Trenton would be reduced below 3000 cfs and from the Schuylkill when the discharge at Pottstown falls below 560 cfs. Schuylkill withdrawals are also prohibited when water temperature at Pottstown exceeds 59°F. Similar restrictions have been proposed for the Hope Creek (Public Service Electric & Gas Co.) and Summit (Delmarva) Generating Stations.

Hydrologic studies have analyzed the effect of these restrictions on plant operation. Without augmentation a plant supplied with water only from the Schuylkill would have to be shut down about 50% of the time. One based on the Delaware would have to be shut down from 10% to 13% of the time.

As a part of its approvals for water supply for the Limerick Generating Station, the DRBC has stated that on or before January 1, 1977, it may direct the plant owner to construct a water supply reservoir for release of cooling water supply during the periods when withdrawals would otherwise be restricted. DRBC staff have indicated that similar requirements may be applied to the Hope Creek and Summit Generating Stations.

As a condition to its AEC construction permit for Limerick, Philadelphia Electric Co. is required to submit by December 19, 1974, a timetable for selection and development of a reservoir site or sites to provide water supply to the plant. The average consumptive use at Limerick will be 54 cfs. It was considered desirable to also include the average consumptive use at Hope Creek (10 cfs) and Summit (6 cfs) in studying possible reservoir sites. The average consumptive use requirements for the three plants total 70 cfs. The reservoir should be capable of storing sufficient water to provide for these requirements during the periods when DRBC limitations on withdrawals are in force. This is equivalent to an average storage release of 140 acre-feet per day. Reservoir outlet works would be sized to release the maximum consumptive use requirements of 81 cfs.

Hydrologic records adjusted to reflect conditions to be expected in the future have been analyzed to determine periods when water may not be withdrawn at the generating stations without augmentation. The longest period of shortage on the Delaware was 155 days (1965). There were two other years in the 44 year period of record when comparable shortages occurred indicating that a shortage of this magnitude is not a remote possibility. It would be prudent to base the size of a reservoir for augmenting Delaware flows on the 155 day period. The corresponding live storage requirement is about 22,000 acre-feet.

For the Schuylkill, including both the flow and water temperature

limitations, the longest period of shortage was 283 days (1930). The next most severe shortages (4 years) were all of about 240 days duration. The extreme year was also used in this case for determining the live storage requirement on the Schuylkill.

The withdrawal from the Schuylkill at Limerick is 54 cfs. The balance (16 cfs) is being withdrawn at the two other plants on the Delaware. If it is assumed that the years of critical shortage for the Schuylkill and Delaware will coincide, the live storage requirement for 54 cfs on the Schuylkill and 16 cfs on the Delaware is about 34,000 acre-feet.

In addition to the three plants listed above, another thermal plant has been proposed for future construction near Berne on the Schuylkill River. Present plans for the proposed plant include a storage reservoir to supply cooling water make-up supply during low flow periods. The requirements for this plant have not been included in this report.

There are also a number of other generating stations planned for construction in the Delaware River Basin during the next 15 years. Since some of the more favorable reservoir sites on the Delaware are capable of development to produce substantially greater releases than 70 cfs, alternative development of some of these sites for releases up to 420 cfs has also been studied.

RESERVOIR CRITERIA

All of the reservoirs covered in this report are located on tributary streams to the Delaware or Schuylkill Rivers. Some are conventional storing the natural run-off of the tributary watershed. Some are pump-ins, storing water pumped in from the main rivers. Some have been considered for both types of storage.

Yields of conventional reservoirs were estimated from mass curve analysis of available gaging records or by correlation with records for near-

by streams. Availability of water for pump-in storage was estimated from examination of pertinent streamflow records on the main rivers during critical dry periods. It was assumed that minimum conservation releases (0.15 cfs per square mile in Pennsylvania) would be maintained at all reservoirs. A possible change to a somewhat higher conservation release requirement was also investigated.

Possible environmental constraints have been evaluated on the basis of field reconnaissance of all sites on a number of occasions over the past three years.

For reservoirs on the Delaware, it was assumed that water could be stored when the flow at Trenton was above 3000 cfs and, for reservoirs above Montague, when the flow was above 1750 cfs (New York City reservoirs not releasing). Alternative possible special limitations related to releases for the oyster industry are discussed below.

For reservoirs on the upper Schuylkill, it was assumed that water could be stored when the flow measured at the Berne gage is in excess of 50% of the median flow and when the temperature in the river at Pottstown is below 59°F. These are the same criteria applied by DRBC at the Pottstown gage for limiting withdrawals at Limerick.

RESERVOIR SITES

In the March 1972 report "Water Resources Study for Power Systems - Delaware River Basin", 21 reservoir sites were given some degree of priority for possible development for water supply for thermal power station cooling. These were:

High Priority	Priority	
Equinunk	Hawley	Little Martins Creek
Milanville	New Hampton	Tinicum Creek
F. E. Walter	Crosswicks Creek	Wickecheake Creek
Cherry Creek	Newtown	Plum Creek
Pidcock Creek	Maiden Creek	Irish Creek
Stony Run	Lederach	Pigeon Creek
Red Creek	Clove Brook	Pine Creek

Subsequent examination of these sites on a number of occasions has resulted in a change in priorities.

Equinunk and Milanville continue to be rated as good sites for conventional or pump-in reservoirs.

F. E. Walter was identified as a possible expansion of an existing Corps of Engineers flood control reservoir to incorporate water supply. DRBC has a similar expansion project at Walter in its Comprehensive Plan. The project has been dropped from consideration for power company development because of expected difficulties and delays in reaching agreement with the Corps and other agencies.

Cherry Creek is potentially capable of very large development as a pump-in reservoir (440,000 acre-feet). However, recent changes in the development pattern in the reservoir area have increased the difficulty of acquisition and development. It is no longer recommended for development by the power companies.

Pidcock Creek has been re-evaluated and dropped from consideration due to development in the reservoir area and location in close proximity to a state park.

Stony Run as originally proposed involved a diversion tunnel from the Little Schuylkill and a pump station. Although the reservoir site is good, the project has been dropped because of the complicated water supply.

Red Creek remains a high priority pump-in site on the Schuylkill.

The original Hawley site was dropped because of interferences with scenic and recreational facilities. A new site (Middle Creek) has been identified for a conventional reservoir to be located upstream. It is not as attractive as other sites and has been dropped.

The New Hampton reservoir area has been subject to continuing residential development and improvement. It is no longer considered favorable.

Crosswicks included a connected reservoir on adjacent Black Creek. Crosswicks has been dropped due to poor reservoir configuration but a pump-in project using the Black Creek reservoir remains in consideration.

Newtown has been dropped due to proximity to the Philadelphia urban area with attendant development in the reservoir area.

Maiden Creek was a diversion project to increase the utilization of DRBC's proposed Maiden Creek reservoir. Since there is no apparent activity toward developing the basic project, the diversion scheme has been dropped.

Lederach was dropped after re-evaluation of residential development in and around the reservoir area.

Clove Brook has been dropped because of increased new housing construction in the reservoir area.

Little Martins Creek now appears to have higher priority mostly due to lack of intensive reservoir area development compared with other sites.

Tinicum Creek and Wickecheake Creek have been dropped because of potential acquisition difficulties due to the type of development in the reservoir areas.

Plum Creek was dropped because of the existence of a church and large cemetery and state game preserve in the reservoir area.

Irish Creek remains under consideration although the reservoir is relatively shallow and presently taken up by large dairy farms. No change has occurred since the original evaluation.

Pigeon Creek has been dropped due to its location in a growing residential area.

Pine Creek is no longer in consideration due to re-evaluation of existing reservoir area development and complications involved in diverting water from the Little Schuylkill.

As a result of the re-evaluations summarized above, the following projects are now recommended for further consideration:

Equinunk - Conventional for 70 cfs and pump-in for 420 cfs.
Milanville - Conventional for 70 cfs and pump-in for 420 cfs.
Little Martins Creek - Pump in for 70 or 279 cfs.
Black Creek - Pump-in for 70 cfs.
Irish Creek - Pump-in for 70 cfs.
Red Creek - Pump-in for 70 cfs.

Preliminary layouts and cost estimates for these projects have been up-dated and modified to conform with current requirements. Reservoir yield and capacities are based upon releasing 70 cfs or higher amounts up to 420 cfs during the periods when DRBC withdrawal limitations are in effect.

Pertinent information on the foregoing projects scaled to yield 70 cfs is given in Table 1 Similar information for higher yields at some of the sites is given in Table 2.

Descriptions of the individual projects are presented in the following section. Project layouts are shown on Exhibits 1 to 6.

PROJECT DESCRIPTIONS

Equinunk

This project is located on Equinunk Creek, a right bank tributary of the Delaware River about ten miles downstream from Hancock, N. Y. The damsite is about one mile from the Delaware River upstream on the creek from Equinunk, Pa. The project is located in the service area of Pennsylvania Electric Co. The drainage area of 59 square miles would yield over 70 cfs with a conventional reservoir.

About 80% of the reservoir area is in natural forest cover; the lower portions along the creeks consist of old, generally unused fields. The streams probably support a cold water fishery. There is evidence of both small and large game in the area, including birds. Heavily wooded areas around the reservoir would permit movement of game population displaced by the reservoir.

A paved road follows the entire course of the South Branch within the reservoir area. Dirt roads follow almost the entire length of Equinunk Creek and its other branches.

There are about 40 houses in the immediate area of the main dam and along Equinunk Creek and its branches. Many of these are near

the upper end of the reservoir and may or may not be displaced. Most of the houses are neither new nor pretentious.

Substantial flood damage has occurred along Equinunk Creek since earlier reconnaissance. The road appeared to have been washed out in two locations and two bridges have been replaced with pipe-culverts. A program of streambed clearing and road embankment replacement is still in progress. A number of gabion flow deflectors are being installed in the creek.

Aside from the streambed work and road and bridge repairs, there has been no significant change during the last three years.

Milanville

This project is located on Calkins Creek, a right bank tributary of the Delaware River about halfway between Port Jervis and Hancock, N.Y. The damsite proposed in 1972 was about 1/2 mile from the Delaware River upstream on the creek from Milanville, Pennsylvania. The project is in the service area of the Pennsylvania Power and Light Company. Conventional storage at the site would yield over 70 cfs.

The originally proposed damsite is 1/2 mile from the Delaware River just downstream from the confluence of the North and South Branches of Calkins Creek. The dam would be located in a gap between the hills immediately adjacent to the Delaware River. Alternative sites on each branch were also considered.

The drainage area of each branch is about 23 square miles and neither is sufficient to support a conventional reservoir to yield 70 cfs. Supplemental pump-in facilities would be required for either branch reservoir to yield 70 cfs.

This site appeared to be the least disturbed area of the sites visited. A large heavily wooded portion of the South Branch valley was only accessible by jeep and appeared to be in a virgin state. Deer tracks were

observed as well as a large flock of wild turkey. The streams within the area were all clear and appear unpolluted, and probably support a cold water fishery. The upper portion of the North Branch is in farmland, some still in use.

The damsite on the North Branch is about 1/2 mile upstream from the confluence. Dirt roads follow the course of the North Branch and all of its tributaries. The reservoir area contains several farms and 20-25 houses (some new) scattered along its course.

There are two alternate damsites on the South Branch, one just upstream from the confluence and one about one mile further upstream. There are two roads in the lower part of the reservoir, one dirt and one paved. There are 10-12 houses along these roads. Both of these roads climb out of the reservoir downstream of the upper alternate damsite. Upstream from the upper site there is no development in the reservoir area except for a jeep trail which follows the stream and a secondary road which crosses the reservoir near its upstream extremity.

There has been no significant change in development in this reservoir area in the last three years.

Little Martins Creek

This project is located on the right bank of the Delaware River about eight miles north of Easton, Pennsylvania. It is located in the Metropolitan Edison Company service area. The drainage area is insufficient for conventional development.

The lower portion of the reservoir consists of steep-sided wooded valleys with only a few scattered houses. The upper elevations are practically all in dairy farms. These are fairly large operating farms (10-15) with well-kept barns and other buildings. There are also about ten new houses scattered along the roads at or near the upper level of the reservoir. Two major trans-

mission lines (from Martins Creek G.S.) and a gas pipeline cross the reservoir. Paved secondary roads follow all major Creek branches.

The streams appear too small for fishing and game is probably limited to small game and birds due to the predominance of farmland.

There has been little change in this reservoir area in the last three years.

Black Creek

This project is located on a left bank tributary to the Delaware River in New Jersey southeast of Trenton. During the 1972 Delaware Study, it was determined that the construction of connected reservoirs on the adjacent Crosswicks and Black Creeks would provide sufficient storage to regulate the combined drainage area to yield over 100 cfs. This project has now been dropped from consideration but study continues of an alternative to use the Black Creek site as a pump-in reservoir.

A principal feature in the Black Creek reservoir is the Old York golf course located in the immediate vicinity of the damsite. The club house overlooks the reservoir site and a large part of the golf course, and some of the access road would be inundated. It may be possible to compensate the club for its loss by developing land at the rear.

Most of the reservoir area consists of wooded valley bottoms surrounded by fields. Generally, the farm buildings, access roads and principal farmed areas are outside the reservoir area. There appears to be one large and well maintained estate which would be affected by the reservoir.

Irish Creek

The Irish Creek reservoir is relatively shallow and covers a large area for its capacity. The entire reservoir area is in large and apparently

prosperous operating dairy farms. It is traversed by paved secondary roads. A 500 KV transmission line passes along the southern rim of the reservoir area and some towers might require relocation. There do not appear to be any special problems and acquisition would involve buying out the farms.

There has been no significant change in the reservoir area in the last three years.

Red Creek

This project is located on a right bank tributary of the Schuylkill River about one mile from Landingville, Pennsylvania. It is in the service area of Pennsylvania Power & Light Company. It was proposed in the Delaware Study as a pump-in reservoir. The drainage area is insufficient to yield 70 cfs.

The reservoir area is in a narrow, deep valley; partly in woodland and partly cleared. There is little existing development except for about 25 houses and farms and a small concrete pre-casting yard along the paved secondary road which runs the length of the reservoir. This appears to be the reservoir least disruptive to the environment and least difficult to acquire of those considered in the Schuylkill Basin.

SCHEDULE FOR BUILDING A COOLING WATER SUPPLY RESERVOIR

The schedule is based on meeting three significant dates:

1. December 19, 1974, the date when the schedule should be presented to the AEC Director of Licensing (as per the AEC Construction Permit for the Limerick Generating Station).

2. January 1, 1977, the latest date the DRBC can give a decision on the need for a cooling water supply reservoir (as per DRBC Docket for Limerick).

3. April, 1981, the date when the Limerick plant will begin commercial operation.

The schedule is divided into phases as follows:

1. Site Selection Studies. The objective of this phase is to select the three most promising sites for further study. Factors to be evaluated in these studies are cost, environment impact, and land acquisition and relocation problems. Only reconnaissance-type field work would be scheduled.

2. Evaluation of Priority Sites. The scope of work and timing for this phase is to select a site, design the project and have ready for transmittal to the proper agencies by January 1, 1977, all required data reports and applications needed to obtain clearance for construction. This is the latest date the DRBC has to determine the need for the reservoir. Some field surveying, subsurface exploration and on-site environmental studies will be required for this phase.

3. Land Acquisition. Land acquisition could begin after selection of the preferred site. However there is always the possibility that the site may not be acceptable to the state and federal reviewing agencies.

4. Project Review, Environmental Review, and Issuance of Permits by Responsible Agencies. A period of 16 months beginning January 1, 1977, is shown for this phase. To meet this schedule, the environmental report must be submitted soon after this date. A draft Environmental Impact Statement (EIS) by the lead agency, the review thereof, preparation of a final EIS., and the Council of Environmental Quality Review can be accomplished during this period. All necessary permit applications will be filed as early as possible during this phase.

5. Preconstruction Engineering. Detailed engineering and data collection will proceed concurrently with the Environmental review described as Phase 4. The work for this phase will include topographic surveying, subsurface exploration and detailed design of project facilities to produce the engineering plans and specifications required for contract bidding. A bidding period is scheduled to follow immediately the review period (Phase 4).

6. Construction. A period of 30 months is shown on the schedule for construction. Procurement and installation of the electrical and mechanical equipment is the critical item during this phase. However it is expected that manufacturing, installation and testing of the equipment can be completed prior to January 1, 1981. This completion date should be met if reservoir releases are to be made in the summer of 1981.

7. Filling of the Reservoir. Commercial operation of the Limerick plant is scheduled for April, 1981. The reservoir should be filled sufficiently to meet cooling water requirements in the Summer of 1981. A period of five months is allowed for the first filling.

SCHEDULE FOR BUILDING A COOLING WATER SUPPLY RESERVOIR IN THE DELAWARE RIVER BASIN

Site Selection Studies — 6 Sites
Finalization of hydrologic and design criteria
Detailed geologic and environmental reconnaissance
Evaluation of land acquisition and relocation difficulties
Selection of 3 priority sites

Evaluation of Priority Sites
Preparation of topographic maps (from air photos)
Subsurface exploration including bore holes and seismic surveys
Collection of environmental data
Preparation of project layouts, designs and cost estimates
Selection of primary and secondary sites
Preparation of design report
Preparation of environmental report

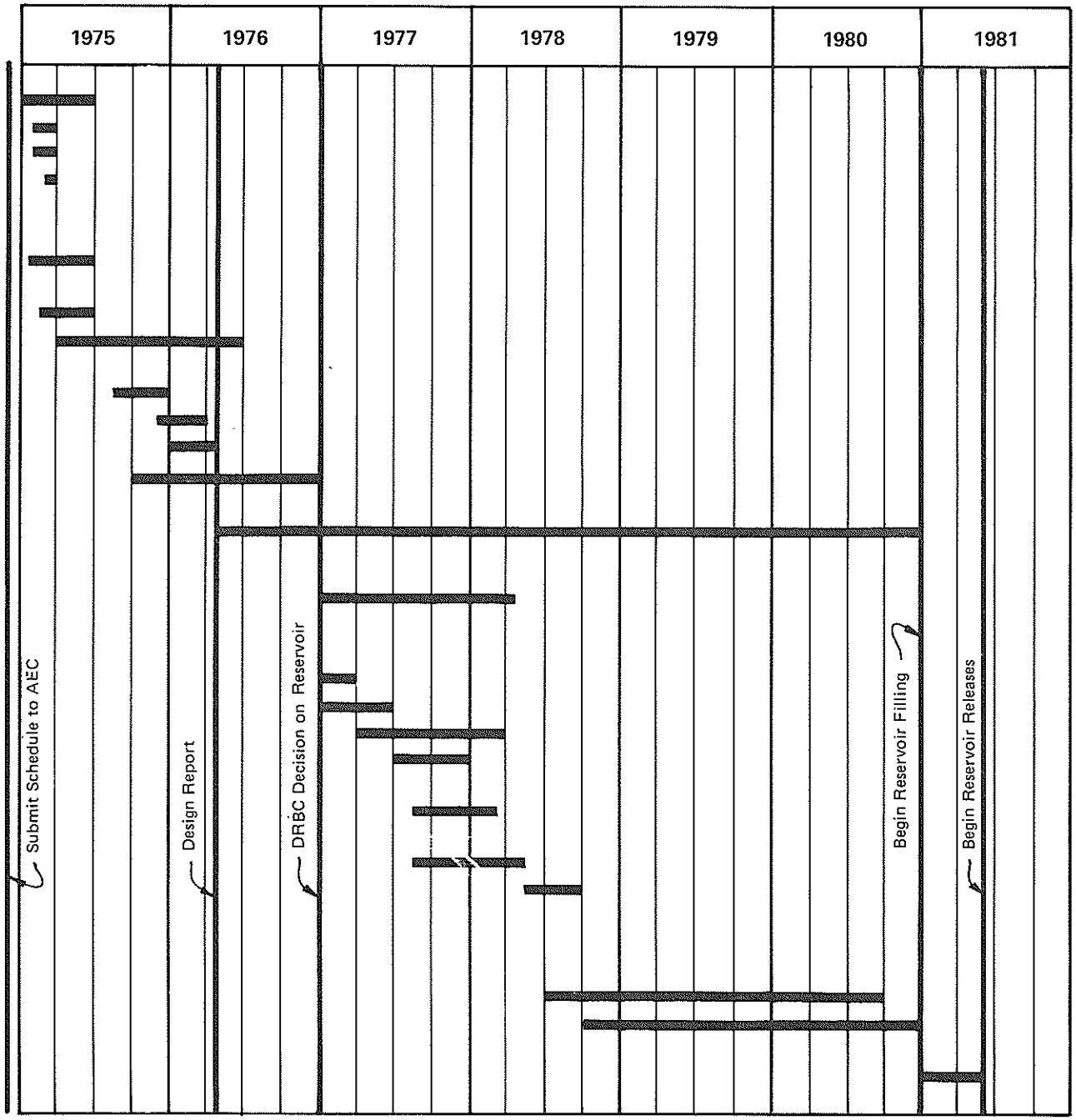
Land Acquisition

Project Review, Environmental Review and Issuance of Permits by Responsible Agencies

Preconstruction Engineering
Additional topography
Additional subsurface exploration
Detailed design of project facilities
Design of relocations
Preparation of bid documents for procurement of electrical and mechanical equipment
Preparation of bid documents for civil works construction
Bidding period and analyses of bids

Construction
Manufacturing and Installation of electrical and mechanical equipment
Civil works construction

Filling of Reservoir



DISCUSSION OF ALTERNATIVES

WATER SUPPLY RESERVOIRS-DELAWARE RIVER BASIN

DISCUSSION OF ALTERNATIVES

WATER SUPPLY RESERVOIRS - DELAWARE RIVER BASIN

INTRODUCTION

This report covers the results of preliminary investigations of certain water supply reservoir sites in the Delaware River Basin. The reservoirs are being considered as possible sources of cooling water supply to be released during dry periods for consumptive use at thermal power stations. The scope of the report was agreed to in meetings with the DRBEUG Reservoir Sub-committee at Philadelphia Electric Co. on August 27, September 12 and October 25, 1974. A field reconnaissance was made of all sites described in the report.

WATER REQUIREMENTS

Certain conditions have been imposed by the Delaware River Basin Commission (DRBC) concerning the withdrawal of water for cooling water make-up at new thermal power stations. These conditions as applied to the Limerick Generating Station (Philadelphia Electric Co.) prohibit withdrawals from the Delaware River when the discharge at Trenton would be reduced below 3000 cfs and from the Schuylkill when the discharge at Pottstown falls below 560 cfs. Schuylkill withdrawals are also prohibited when water temperature at Pottstown exceeds $59^{\circ}F$. Similar restrictions have been proposed for the Hope Creek (Public Service Electric & Gas Co.) and Summit (Delmarva) Generating Stations.

Hydrologic studies have analyzed the effect of these restrictions on plant operation. Without augmentation a plant supplied with water only from the Schuylkill would have to be shut down about 50% of the time. One based on the Delaware would have to be shut down from 10% to 13% of the time.

As a part of its approvals for water supply for the Limerick Generating Station, the DRBC has stated that on or before January 1, 1977, it may direct the plant owner to construct a water supply reservoir for release of cooling water supply during the periods when withdrawals would otherwise be restricted. DRBC staff have indicated that similar requirements may be applied to the Hope Creek and Summit Generating Stations.

As a condition to its AEC construction permit for Limerick, Philadelphia Electric Co. is required to submit by December 19, 1974, a timetable for selection and development of a reservoir site or sites to provide water supply to the plant. The average consumptive use at Limerick will be 54 cfs. It was considered desirable to also include the average consumptive use at Hope Creek (10 cfs) and Summit (6 cfs) in studying possible reservoir sites. The average consumptive use requirements for the three plants total 70 cfs. The reservoir should be capable of storing sufficient water to provide for these requirements during the periods when DRBC limitations on withdrawals are in force. This is equivalent to an average storage release of 140 acre-feet per day. Reservoir outlet works would be sized to release the maximum consumptive use requirements of 81 cfs.

Hydrologic records adjusted to reflect conditions to be expected in the future have been analyzed to determine periods when water may not be withdrawn at the generating stations without augmentation. The longest period of shortage on the Delaware was 155 days (1965). There were two other years in the 44 year period of record when comparable shortages occurred indicating that a shortage of this magnitude is not a remote possibility. It would be prudent to base the size of a reservoir for augmenting Delaware flows on the 155 day period. The corresponding live storage requirement is about 22,000 acre-feet.

For the Schuylkill, including both the flow and water temperature

limitations, the longest period of shortage was 283 days (1930). The next most severe shortages (4 years) were all of about 240 days duration. The extreme year was also used in this case for determining the live storage requirement on the Schuylkill.

The withdrawal from the Schuylkill at Limerick is 54 cfs. The balance (16 cfs) is being withdrawn at the two other plants on the Delaware. If it is assumed that the years of critical shortage for the Schuylkill and Delaware will coincide, the live storage requirement for 54 cfs on the Schuylkill and 16 cfs on the Delaware is about 34,000 acre-feet.

In addition to the three plants listed above, another thermal plant has been proposed for future construction near Berne on the Schuylkill River. Present plans for the proposed plant include a storage reservoir to supply cooling water make-up supply during low flow periods. The requirements for this plant have not been included in this report.

There are also a number of other generating stations planned for construction in the Delaware River Basin during the next 15 years. Since some of the more favorable reservoir sites on the Delaware are capable of development to produce substantially greater releases than 70 cfs, alternative development of some of these sites for releases up to 420 cfs has also been studied.

RESERVOIR CRITERIA

All of the reservoirs covered in this report are located on tributary streams to the Delaware or Schuylkill Rivers. Some are conventional storing the natural run-off of the tributary watershed. Some are pump-ins, storing water pumped in from the main rivers. Some have been considered for both types of storage.

Yields of conventional reservoirs were estimated from mass curve analysis of available gaging records or by correlation with records for near-

by streams. Availability of water for pump-in storage was estimated from examination of pertinent streamflow records on the main rivers during critical dry periods. It was assumed that minimum conservation releases (0.15 cfs per square mile in Pennsylvania) would be maintained at all reservoirs. A possible change to a somewhat higher conservation release requirement was also investigated.

Possible environmental constraints have been evaluated on the basis of field reconnaissance of all sites on a number of occasions over the past three years.

There are a number of special considerations which have been examined. These can have an important effect on the scale and location of possible reservoir projects and even upon the ability to develop certain sites. They include:

1. The amended Supreme Court Decree concerning diversions from the Delaware River Basin refers to the possible construction of new reservoirs upstream from the Montague gage. It directs that in the event new reservoirs are constructed aggregating in capacity over 25 billion gallons, the New York reservoirs must continue to make required releases as would be required in the absence of these new reservoirs.

   This does not appear to impose any particular requirements on the developer of the new reservoir or reservoirs.

   Three of the reservoir sites covered in this report are located upstream of Montague. At least one can be developed to a capacity of more than 25 billion gallons. It has been assumed that the Supreme Court Decree does not prohibit the construction of reservoirs at these sites no matter what the capacity. However, it is also assumed that such a proposal would have to be negotiated with New York City and other affected parties through the DRBC.

2. The portion of the Delaware River between Hancock and Port Jervis is being considered for designation as a wild river. This will prohibit or strictly regulate all new construction along the river to the immediate ridge line (generally less than one mile from the river). It has been assumed that this would not affect the ability to construct conventional reservoirs on small tributaries along this stretch as long as all structures are at or beyond the ridge line. One alternative reservoir site has its main embankment at the ridge line. Clarification of the criteria will be required in this instance.

   As an alternative, the possibility of constructing pumping facilities at the Delaware for filling two of the tributary reservoirs has also been considered.

3. For reservoirs on the Delaware, it was assumed that water could be stored when the flow at Trenton was above 3000 cfs and, for reservoirs above Montague, when the flow was above 1750 cfs (New York City reservoirs not releasing). Alternative possible special limitations related to releases for the oyster industry are discussed below.

4. The Tocks Island E.I.S. included a proposed operational requirement that all inflows (below 70,000 cfs) during April, May and June be released to inhibit oyster drill activity in the estuary. Correspondence between DRBC and GPU related to the proposed Berne reservoir indicated that storage of Schuylkill water during these three months would be prohibited. This requirement, if applied to the reservoirs covered in this report would prevent the development of the conventional reservoirs to the desired capacity. It also would sharply increase the required pumping capacity at pump-in sites on

the Delaware and might require substantially higher reservoir volumes and multi-year storage operation at some of the pump-in reservoirs. The effect of this on reservoirs on the Schuylkill has been analyzed for both cases -with and without the oyster requirements- and the results are given in a following section.

5. For reservoirs on the Schuylkill, a number of assumptions were made concerning limitations on ability to store. In the first case evaluated, it was assumed that pumping to storage would be allowed when the flow was greater than the median flow. The actual and median flows at the Berne gage were used to indicate the days when pumping was possible in this and other cases considered. As indicated in Table 1, the reservoir would refill every year for this case.

   The second case assumed the DRBC temperature restrictions on withdrawals to Limerick would apply. The required reservoir storage based on refilling when flows are in excess of 50, 75 and 100% of the median (using the Berne gage as an index) is given in Table 1.

   The third case considered oyster needs in the Lower Delaware Bay in addition to the temperature restriction. This precludes pumping to storage during the months of April, May and June. Reservoir storage requirements considering these restrictions and only pumping flows in excess of 50, 75 and 100% of the median are also summarized in Table 1.

   It should be noted that reservoir layouts and cost estimates (Tables 2 and 3 and Exhibits 5 and 6) are based on criteria adopted by the DRBC for withdrawals at Limerick (Case IIc in Table 1).

6. One of the more favorable reservoir sites considered is located on a tributary to the Schuylkill a short distance upstream from its confluence with the Little Schuylkill. Under median-flow criteria for pumping period limitations, there is insufficient water in the Schuylkill to pump into the reservoir in the amounts desired. Addition of Little Schuylkill flows changes this situation to the extent that the reservoir becomes feasible. It has been assumed that this reservoir can be operated on the basis of storage of water available from both the Schuylkill and Little Schuylkill as measured at the Berne gage. This has the effect of reducing the flow during certain periods in the short section of the Schuylkill above the confluence to 40 cfs.

RESERVOIR SITES

In the March 1972 report "Water Resources Study for Power Systems - Delaware River Basin", 21 reservoir sites were given some degree of priority for possible development for water supply for thermal power station cooling. These were:

High Priority	Priority	
Equinunk	Hawley	Little Martins Creek
Milanville	New Hampton	Tinicum Creek
F. E. Walter	Crosswicks	Wickecheake Creek
Cherry Creek	Newtown	Plum Creek
Pidcock Creek	Maiden Creek	Irish Creek
Stony Run	Lederach	Pigeon Creek
Red Creek	Clove Brook	Pine Creek

Subsequent examination of these sites on a number of occasions has resulted in a change in priorities.

Equinunk and Milanville continue to be rated as good sites for conventional or pump-in reservoirs.

F. E. Walter was identified as a possible expansion of an existing Corps of Engineers flood control reservoir to incorporate water supply. DRBC has a similar expansion project at Walter in its Comprehensive Plan. The project has been dropped from consideration for power company development because of expected difficulties and delays in reaching agreement with the Corps and other agencies.

Cherry Creek is potentially capable of very large development as a pump-in reservoir (440,000 acre-feet). However, recent changes in the development pattern in the reservoir area have increased the difficulty of acquisition and development. It is no longer recommended for development by the power companies.

Pidcock Creek has been re-evaluated and dropped from consideration due to development in the reservoir area and location in close proximity to a state park.

Stony Run as originally proposed involved a diversion tunnel from the Little Schuylkill and a pump station. Although the reservoir site is good, the project has been dropped because of the complicated water supply.

Red Creek remains a high priority pump-in site on the Schuylkill.

The original Hawley site was dropped because of interferences with scenic and recreational facilities. A new site (Middle Creek) has been identified for a conventional reservoir to be located upstream. It is not as attractive as other sites and has been dropped.

The New Hampton reservoir area has been subject to continuing residential development and improvement. It is no longer considered favorable.

Crosswicks included a connected reservoir on adjacent Black Creek. Crosswicks has been dropped due to poor reservoir configuration but a pump-in project using the Black Creek reservoir remains in consideration.

Newtown has been dropped due to proximity to the Philadelphia urban area with attendant development in the reservoir area.

Maiden Creek was a diversion project to increase the utilization of DRBC's proposed Maiden Creek reservoir. Since there is no apparent activity toward developing the basic project, the diversion scheme has been dropped.

Lederach was dropped after re-evaluation of residential development in and around the reservoir area.

Clove Brook has been dropped because of increased new housing construction in the reservoir area.

Little Martins Creek now appears to have higher priority mostly due to lack of intensive reservoir area development compared with other sites.

Tinicum Creek and Wickecheake Creek have been dropped because of potential acquisition difficulties due to the type of development in the reservoir areas.

Plum Creek was dropped because of the existence of a church and large cemetery and state game preserve in the reservoir area.

Irish Creek remains under consideration although the reservoir is relatively shallow and presently taken up by large dairy farms. No change has occurred since the original evaluation.

Pigeon Creek has been dropped due to its location in a growing residential area.

Pine Creek is no longer in consideration due to re-evaluation of existing reservoir area development and complications involved in diverting water from the Little Schuylkill.

As a result of the re-evaluations summarized above, the following projects are now recommended for further consideration:

Equinunk - Conventional for 70 cfs and pump-in for 420 cfs.
Milanville - Conventional for 70 cfs and pump-in for 420 cfs.
Little Martins Creek - Pump in for 70 or 279 cfs.
Black Creek - Pump-in for 70 cfs.
Irish Creek - Pump-in for 70 cfs.
Red Creek - Pump-in for 70 cfs.

Preliminary layouts and cost estimates for these projects have been up-dated and modified to conform with current requirements. Reservoir yield and capacities are based upon releasing 70 cfs or higher amounts up to 420 cfs during the periods when DRBC withdrawal limitations are in effect.

Pertinent information on the foregoing projects scaled to yield 70 cfs is given in Table 2 Similar information for higher yields at some of the sites is given in Table 3.

Descriptions of the individual projects are presented in the following section. Project layouts are shown on Exhibits 1 to 6.

PROJECT DESCRIPTIONS

Equinunk

This project is located on Equinunk Creek, a right bank tributary of the Delaware River about ten miles downstream from Hancock, N. Y. The damsite is about one mile from the Delaware River upstream on the creek from Equinunk, Pa. The project is located in the service area of Pennsylvania Electric Co. The drainage area of 59 square miles would yield over 70 cfs with a conventional reservoir.

This site is above the Montague gage and project operation would need to be established within the context of the requirements of the Supreme Court Decree. Pump-in development may conflict with designation of this stretch of the Delaware as a wild river.

About 80% of the reservoir area is in natural forest cover; the lower portions along the creeks consist of old, generally unused fields. The streams probably support a cold water fishery. There is evidence of both small and large game in the area, including birds. Heavily wooded areas around the reservoir would permit movement of game population displaced by the reservoir.

A paved road follows the entire course of the South Branch within the reservoir area. Dirt roads follow almost the entire length of Equinunk Creek and its other branches.

There are about 40 houses in the immediate area of the main dam and along Equinunk Creek and its branches. Many of these are near the upper end of the reservoir and may or may not be displaced. Most of the houses are neither new nor pretentious.

Substantial flood damage has occurred along Equinunk Creek since earlier reconnaissance. The road appeared to have been washed out in two locations and two bridges have been replaced with pipe culverts. A program of streambed clearing and road embankment replacement is still in progress. A number of gabion flow deflectors are being installed in the creek.

Aside from the streambed work and road and bridge repairs, there has been no significant change during the last three years.

Milanville

This project is located on Calkins Creek, a right bank tributary of the Delaware River about halfway between Port Jervis and Hancock, N.Y.

The damsite proposed in 1972 was about 1/2 mile from the Delaware River upstream on the creek from Milanville, Pennsylvania. The project is in the service area of the Pennsylvania Power and Light Company. Conventional storage at the site would yield over 70 cfs.

The originally proposed damsite is 1/2 mile from the Delaware River just downstream from the confluence of the North and South Branches of Calkins Creek. The dam would be located in a gap between the hills immediately adjacent to the Delaware River. Alternative sites on each branch were also considered.

The drainage area of each branch is about 23 square miles and neither is sufficient to support a conventional reservoir to yield 70 cfs. Supplemental pump-in facilities would be required for either branch reservoir to yield 70 cfs.

The site is located above the Montague gage on the Delaware River and its development would require consideration of any effect it would have on minimum flows at Montague under the Supreme Court Decree. Pumping facilities at the Delaware may conflict with the wild river designation.

This site appeared to be the least disturbed area of the sites visited. A large heavily wooded portion of the South Branch valley was only accessible by jeep and appeared to be in a virgin state. Deer tracks were observed as well as a large flock of wild turkey. The streams within the area were all clear and appear unpolluted, and probably support a cold water fishery. The upper portion of the North Branch is in farmland, some still in use.

The damsite on the North Branch is about 1/2 mile upstream from the confluence. Dirt roads follow the course of the North Branch and all of its tributaries. The reservoir area contains several farms and 20-25 houses (some new) scattered along its course.

There are two alternate damsites on the South Branch, one just upstream from the confluence and one about one mile further upstream. There are two roads in the lower part of the reservoir, one dirt and one paved. There are 10-12 houses along these roads. Both of these roads climb out of the reservoir downstream of the upper alternate damsite. Upstream from the upper site there is no development in the reservoir area except for a jeep trail which follows the stream and a secondary road which crosses the reservoir near its upstream extremity.

There has been no significant change in development in this reservoir area in the last three years.

Little Martins Creek

This project is located on the right bank of the Delaware River about eight miles north of Easton, Pennsylvania. It is located in the Metropolitan Edison Company service area. The drainage area is insufficient for conventional development.

The lower portion of the reservoir consists of steep-sided wooded valleys with only a few scattered houses. The upper elevations are practically all in dairy farms. These are fairly large operating farms (10-15) with well-kept barns and other buildings. There are also about ten new houses scattered along the roads at or near the upper level of the reservoir. Two major transmission lines (from Martins Creek G.S.) and a gas pipeline cross the reservoir. Paved secondary roads follow all major Creek branches.

The streams appear too small for fishing and game is probably limited to small game and birds due to the predominance of farmland.

There has been little change in this reservoir area in the last three years.

Black Creek

This project is located on a left bank tributary to the Delaware River in New Jersey southeast of Trenton. During the 1972 Delaware Study,

it was determined that the construction of connected reservoirs on the adjacent Crosswicks and Black Creeks would provide sufficient storage to regulate the combined drainage area to yield over 100 cfs. This project has now been dropped from consideration but study continues of an alternative to use the Black Creek site as a pump-in reservoir.

A principal feature in the Black Creek reservoir is the Old York golf course located in the immediate vicinity of the damsite. The club house overlooks the reservoir site and a large part of the golf course, and some of the access road would be inundated. It may be possible to compensate the club for its loss by developing land at the rear.

Most of the reservoir area consists of wooded valley bottoms surrounded by fields. Generally, the farm buildings, access roads and principal farmed areas are outside the reservoir area. There appears to be one large and well maintained estate which would be affected by the reservoir.

Irish Creek

The Irish Creek reservoir is relatively shallow and covers a large area for its capacity. The entire reservoir area is in large and apparently prosperous operating dairy farms. It is traversed by paved secondary roads. A 500 KV transmission line passes along the southern rim of the reservoir area and some towers might require relocation. There do not appear to be any special problems and acquisition would involve buying out the farms.

There has been no significant change in the reservoir area in the last three years.

Red Creek

This project is located on a right bank tributary of the Schuylkill River about one mile from Landingville, Pennsylvania. It is in the service

area of Pennsylvania Power & Light Company. It was proposed in the Delaware Study as a pump-in reservoir. The drainage area is insufficient to yield 70 cfs.

The reservoir area is in a narrow, deep valley; partly in woodland and partly cleared. There is little existing development except for about 25 houses and farms and a small concrete pre-casting yard along the paved secondary road which runs the length of the reservoir. This appears to be the reservoir least disruptive to the environment and least difficult to acquire of those considered in the Schuylkill Basin.

TABLE 1

SCHUYLKILL RIVER RESERVOIR STORAGE REQUIREMENTS

(Median Flow at Berne - 400 cfs)

Case	Design Criteria	Water Supply Storage (Acre-feet)	Length of Critical Period Years 1/	Assumed Pump Station Capacity Cfs
I	Pumping flows above median to storage	35,400	1	400
II	Pumping following percent of median flow to storage - when water temperature at Pottstown is below 59°			
	a) 100% of median flow	46,100	2	600
	b) 75% of median flow	38,800	2	500
	c) 50% of median flow 2/	35,400	1	400
III	Pumping following percent of median flow to storage -when water temperature at Pottstown is below 59° except during April, May, and June			
	a) 100% of median flow	53,800	3	600
	b) 75% of median flow	47,100	2	500
	c) 50% of median flow	37,800	1	400

1/ Time for reservoir to completely refill.

2/ This case used for preparing project layouts for cost estimates.

SCHEDULE FOR BUILDING A COOLING WATER SUPPLY RESERVOIR

The schedule is based on meeting three significant dates:

1. December 19, 1974, the date when the schedule should be presented to the AEC Director of Licensing (as per the AEC Construction Permit for the Limerick Generating Station).

2. January 1, 1977, the latest date the DRBC can give a decision on the need for a cooling water supply reservoir (as per DRBC Docket for Limerick).

3. April, 1981, the date when the Limerick plant will begin commercial operation.

The schedule is divided into phases as follows:

1. Site Selection Studies. The objective of this phase is to select the three most promising sites for further study. Factors to be evaluated in these studies are cost, environment impact, and land acquisition and relocation problems. Only reconnaissance-type field work would be scheduled.

2. Evaluation of Priority Sites. The scope of work and timing for this phase is to select a site, design the project and have ready for transmittal to the proper agencies by January 1, 1977, all required data reports and applications needed to obtain clearance for construction. This is the latest date the DRBC has to determine the need for the reservoir. Some field surveying, subsurface exploration and on-site environmental studies will be required for this phase.

3. Land Acquisition. Land acquisition could begin after selection of the preferred site. However there is always the possibility that the site may not be acceptable to the state and federal reviewing agencies.

4. Project Review, Environmental Review, and Issuance of Permits by Responsible Agencies. A period of 16 months beginning January 1, 1977, is shown for this phase. To meet this schedule, the environmental report must be submitted soon after this date. A draft Environmental Impact Statement (EIS) by the lead agency, the review thereof, preparation of a final EIS., and the Council of Environmental Quality Review can be accomplished during this period. All necessary permit applications will be filed as early as possible during this phase.

5. Preconstruction Engineering. Detailed engineering and data collection will proceed concurrently with the Environmental review described as Phase 4. The work for this phase will include topographic surveying, subsurface exploration and detailed design of project facilities to produce the engineering plans and specifications required for contract bidding. A bidding period is scheduled to follow immediately the review period (Phase 4).

6. Construction. A period of 30 months is shown on the schedule for construction. Procurement and installation of the electrical and mechanical equipment is the critical item during this phase. However it is expected that manufacturing, installation and testing of the equipment can be completed prior to January 1, 1981. This completion date should be met if reservoir releases are to be made in the summer of 1981.

7. Filling of the Reservoir. Commercial operation of the Limerick plant is scheduled for April, 1981. The reservoir should be filled sufficiently to meet cooling water requirements in the Summer of 1981. A period of five months is allowed for the first filling.

SCHEDULE FOR BUILDING A COOLING WATER SUPPLY RESERVOIR IN THE DELAWARE RIVER BASIN

Site Selection Studies — 6 Sites
Finalization of hydrologic and design criteria
Detailed geologic and environmental reconnaissance
Evaluation of land acquisition and relocation difficulties
Selection of 3 priority sites

Evaluation of Priority Sites
Preparation of topographic maps (from air photos)
Subsurface exploration including bore holes and seismic surveys
Collection of environmental data
Preparation of project layouts, designs and cost estimates
Selection of primary and secondary sites
Preparation of design report
Preparation of environmental report

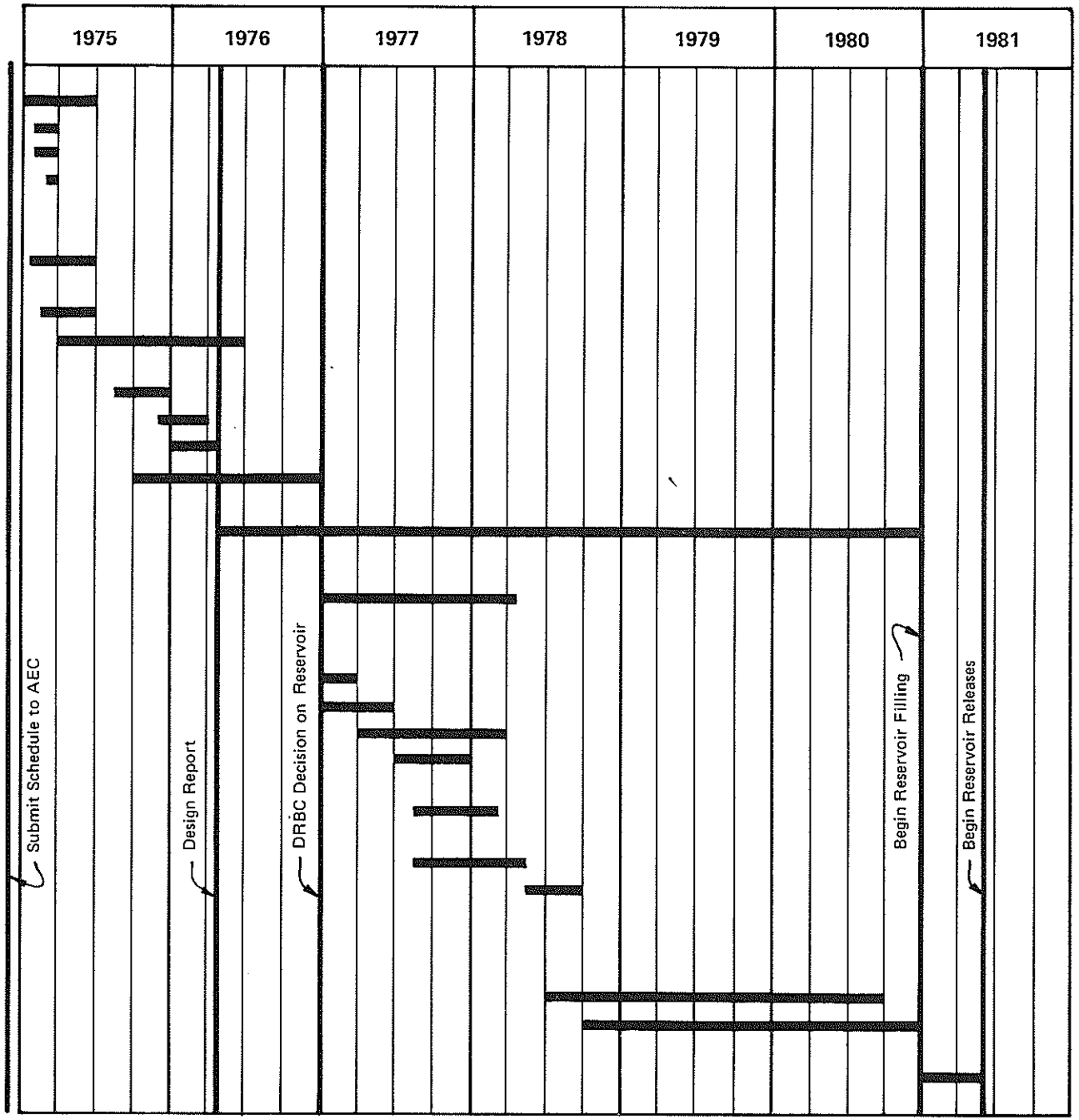
Land Acquisition

Project Review, Environmental Review and Issuance of Permits by Responsible Agencies

Preconstruction Engineering
Additional topography
Additional subsurface exploration
Detailed design of project facilities
Design of relocations
Preparation of bid documents for procurement of electrical and mechanical equipment
Preparation of bid documents for civil works construction
Bidding period and analyses of bids

Construction
Manufacturing and Installation of electrical and mechanical equipment
Civil works construction

Filling of Reservoir



ATTACHMENT 3

GPU SERVICE CORPORATION

LETTER OF NOVEMBER 12, 1974

SUBJECT: PROPOSED BERN RESERVOIR PROJECT

ATTACHMENT 3

GPU SERVICE CORPORATION
(a subsidiary of General Public Utilities Corporation)
Post Office Box 1018
Reading, Pennsylvania 19603/215-376-6611

November 12, 1974

Mr. David Marano
Philadelphia Electric Company
2301 Market Street
Philadelphia, Pennsylvania 19101

Subject: Proposed Berne Reservoir Project

Dear Dave:

R. D. Ley has asked that I provide you with key project data concerning the proposed Berne Reservoir development. Such data are shown on the attached sheet.

As you know, the project involves pumping a portion of certain Schuylkill River flood flows to off-river storage for subsequent consumptive use. The project design was formulated on the basis of tentative criteria suggested for consideration by the DRBC staff. Although the hydrologic record of the Berne gage is not too lengthy, it does include the basin-wide drought of record. Consequently, for planning purposes and for conservatism, the proposed design was established on the basis of the critical one-year period of record and no recognition was given to the contribution of the local drainage area upstream from the impoundment.

Roger has requested that I remind you that it is the GPU position that the Contingency Study should provide not only for Limerick, Hope Creek and Summit, but also for Portland 5 (28 cfs). As indicated by the tabulation, the GPU requirements as of 1988 are 20 cfs, or 46 cfs less than the yield of the Berne Reservoir. Roger has indicated that GPU is willing to consider a temporary assignment of that 46 cfs (or any part of it) to the use of others. Tentatively, such assignment would later be reduced, when Berne 2 (requiring about 28 cfs) becomes operational, to 18 cfs.

I will be pleased to discuss any questions you may have regarding this material.

Sincerely yours,

R. C. Richert,
Hydraulic Engineer

RCR:DSK

CC: Mr. Eugene O'Brien

Attach.

BERNE RESERVOIR - PROJECT DATA

1.	Drainage Areas	
	(a) Schuylkill River Diversion	355 sq.mi.
	(b) Reservoir on Mill Creek	17 sq.mi.
2.	Reservoir Storage	
	(a) Total	47,500 A.F.
	(b) Active Water Supply	38,000 A.F.
3.	Diversion Pumping Capability (tentative)	700 cfs
4.	Minimum Safe Annual Yield	66 cfs
5.	Anticipated GPU Requirements as of 1988	
	(a) Berne #1	14 cfs average
	(b) Titus Cooling Towers	4 " "
	(c) Gilbert 8	2 " "
	Total	20 cfs
6.	Estimated Project Cost (1974 Basis)	$46,000,000

RCR:DSK

11/12/74

ATTACHMENT 4

INVESTIGATION OF MILL CREEK RESERVOIR

INVESTIGATION OF MILL CREEK RESERVOIR

(Supplement to Discussion of Alternatives - Water Supply Reservoirs - Delaware River Basin, dated November 20, 1974)

Introduction.

This report covers the results of preliminary investigations of a reservoir on Mill Creek, a tributary of the Schuylkill River near West Hamburg and Berne, Pa. The investigation was based on a map study, a reconnaissance of the site and criteria and procedures used in developing the reservoir data presented in Discussion of Alternatives - Water Supply Reservoirs - Delaware River Basin, dated November 20, 1974. The site has not previously been studied as an alternative and is, therefore, reported on in slightly more detail than those in the November 20, 1974 report.

The G. P. U. Service Company has proposed a cooling water supply reservoir at this site.[1/] Their investigation of the reservoir was based on slightly different criteria than was used in the evaluation of the alternative reservoirs reported on the November 20, 1974 TAMS report. To be consistent with the studies of those alternatives, the same procedures and criteria are used for this evaluation of the Berne Site.

Reservoir Area.

The reservoir is located along Mills Creek, in Berks County, Pa., on the opposite side of the Schuylkill River from the City of Hamburg. It would be formed by damming Mill Creek about one half mile upstream of the village of Berne.

1/ See letter dated November 12, 1974 from R. C. Richert, of GPU Service Corp. to David Marano of Philadelphia Electric Co.

The reservoir area is mostly rolling farm land with a few scattered wooded areas. The farms appear well kept and prosperous. Urban development has begun to spill over into the reservoir area. There are houses on the western outskirts of West Hamburg which overlook and limit the extent of the reservoir. There are also houses within the reservoir area along the Hex Highway (Rt. 122).

The Hex Highway traverses the reservoir in an east-west direction. Rt. 22-78 traverses along the Northern edge and crosses two arms of the reservoir. It is suspected that Rt. 22 will be rebuilt eventually to interstate highway standards. There are also many secondary roads providing access throughout the area.

Reservoir Development

A plan of reservoir development is shown on Exhibit VII. It is based on Case IIC, Table 1, of the November 20, 1974 report. This case allows pumping from the Schuylkill River for refilling the reservoir when the river flow is above 50% of the median and the water temperature at Pottstown is below 59 degrees F. This criteria was also used in sizing the Irish Creek and Red Creek reservoirs described in the November report. These three developments, therefore, are comparable.

This would be the minimum size reservoir required to supply the 70 cfs needed for the downstream plants.

The development (Exhibit VII) is one of several considered. The studies of all the alternatives are summarized in Table IV. Included are alternatives for several different heights of dams and for two sets of criteria for refilling. One set (Case IIC) is mentioned above. The second set was based on tentative criteria used by the GPU Service Co. engineers in their appraisal of the site. Their criteria limited refilling from the Schuylkill River to the period when flow is greater than 250 cfs, and water

temperature is below 59 degrees F., except in April, May, June when refilling will not be allowed. This last restriction is for protection of oysters from the oyster drill which can not survive in low salinity water. The flow that would be available under each alternative is given in Table IV.

It should be noted that the GPU appraisal was based on historical hydrologic data covering the most severe drought recorded at the Berne gage. For purposes of conservatism in the GPU analysis (because of the relatively short record at the Berne gage and the absence from that record of the 1930 drought), no recognition was given to the yield which might be obtained from the Mill Creek drainage area runoff (16.6 square miles). The TAMS evaluation of the Mill Creek Reservoir was based on hydrologic data covering the drought of the 1930's transposed from nearby index gages. This transposed record is a more severe test of the site capabilities than the actual record and consequently tends to reduce their indicated yield of the project. When evaluated on a consistent basis but allowing for some contribution from the Mill Creek watershed, the project yield based on the transposed record would approximate about 90% of the yield based on the 1960's drought of record without giving recognition to the Mill Creek watershed.

Relocations.

There are approximately 200 farm buildings and residences which would probably have to be acquired for the reservoir. This would require the relocation of about 400 to 500 people.

In addition, two major highways would require either rerouting or raising. In the cost estimates it was assumed that the Hex Highway (Rt. 122) would be rerouted south of the reservoir. Route 22 was assumed to be raised above the reservoir level and two bridges provided.

ATTACHMENT 1

TIMETABLE FOR DEVELOPMENT OF A WATER SUPPLY RESERVOIR IN THE DELAWARE RIVER BASIN

TABLE I

ALTERNATIVE RESERVOIR SITES

POWER PLANT COOLING - DELAWARE RIVER BASIN

YIELD - 70 c.f.s. (IMMEDIATE NEEDS)

Item	Unit	Equinunk Creek	Milanville* Site Calkins Cr.	Little Martins Creek	Blacks Creek	Red Creek*	Irish Creek*
Drainage Area	sq. mi.	59	46	7	20	7	11
No. of Days of Release		155	155	155	155	283	283
Total Yield	c.f.s.	70	70	70	70	70	70
Yield from Pump-in	c.f.s.	-	-	56	40	54	57
Assumed Pump Capacity	c.f.s.	-	-	70	50	600	600
Total Water Supply Storage	A.F.	26,000	23,200	22,300	20,300	35,000	33,000
Pump-in Storage	A F	-	-	17,300	12,400	34,000	28,300
Conservation Release	c.f.s.	9	7	1	3	1	2
Water Supply Storage Level	ft., MSL	1040	900	500	70	660	400
Construction Cost	$	49,800,000	38,000,000	38,600,000	34,500,000	52,300,000	52,000,000
Annual Cost	$	7,500,000	6,000,000	5,900,000	6,100,000	8,000,000	8,600,000
Energy Cost for Pumping	$	-	-	70,000	10,000	160,000	100,000

* Development based on release pattern governed by the DRBC temperature and flow restrictions at Pottstown for withdrawals at Limerick.

TABLE II

ALTERNATIVE RESERVOIR SITES

POWER PLANT COOLING - DELAWARE RIVER BASIN

YIELD - 70 c.f.s. (IMMEDIATE NEEDS)

Item	Unit	Equinunk Creek	Equinunk Creek Min. Storage 25×10^9 gal.	South Br. Calkins Cr. Upper Site	South Br. Calkins Cr. Lower Site	North Br. Calkins Cr.	Milanville* Site Calkins Cr.	Little Martins Creek	Blacks Creek	Red* Creek	Irish* Creek
Drainage Area	sq. mi.	59	59	23	23	23	46	7	20	7	11
No. of Days of Release		155	155	155	155	155	155	155	155	283	283
Total Yield	c.f.s.	70	70	70	70	70	70	70	70	70	70
Yield from Pump-in	c.f.s.	–	–	38	38	38	–	56	40	54	57
Assumed Pump Capacity	c.f.s.	–	–	50	50	50	–	70	50	600	600
Total Water Supply Storage	A.F.	26,000	26,000	22,800	22,800	22,700	23,200	22,300	20,300	35,000	33,000
Pump-in Storage	A.F.	–	–	11,800	11,800	11,800	–	17,300	12,400	34,000	28,300
Conservation Release	c.f.s	9	9	3	3	3	7	1	3	1	2
Max. Conservation Release, Re: Pa. D.E.R	c.f.s.	12.5	14.4	5.8	5.8	5.8	10.2	1.8	–	1.75	3.5
Add'l. Storage for Max. Conservation Release	A.F.	1,400	2,200	1,200	1,200	1,200	1,300	320	–	320	630
Water Supply Storage Level	ft. MSL.	1040	1065	980	940	980	900	500	70	660	400
Construction Cost	$	49,800,000	54,300,000	42,400,000	54,900,000	40,500,000	38,000,000	38,600,000	34,500,000	52,300,000	52,000,000
Additional Construction Cost for Oyster Requirmts.	$	–	–	900,000	800,000	500,000	–	1,300,000	300,000		
Annual Cost	$	7,500,000	8,200,000	6,300,000	8,200,000	6,000,000	6,000,000	5,900,000	6,100,000	8,000,000	8,600,000
Energy Cost for Pumping		–	–	41,000	36,000	42,000		70,000	10,000	160,000	100,000

* Development based on release pattern governed by the DRBC temperature and flow restrictions at Pottstown for withdrawals at Limerick.

TABLE II

ALTERNATIVE RESERVOIR SITES

POWER PLANT COOLING - DELAWARE RIVER BASIN

FULL SITE DEVELOPMENT

Item	Unit	Equinunk Creek *	Milanville Site Calkins Cr. *	Little Martins Creek
Drainage Area	sq. mi.	59	46	7
No. of Days of Release		155	155	155
Total Yield	c.f.s.	420	420	279
Yield from Pump-in	c.f.s.	331	344	265
Assumed Pump Capacity	c.f.s.	380	420	320
Total Water Supply Storage	A.F.	133,000	131,000	88,000
Pump-in Storage	A.F.	103,000	108,000	83,000
Conservation Release	c.f.s.	9	7	1
Water Supply Storage Level	ft.	1160	995	585
Construction Cost	$	107,600,000	92,700,000	77,700,000
Annual Cost	$	16,100,000	14,000,000	11,900,000
Energy Cost for Pumping	$	350,000	360,000	370,000

* Development limited for max. yield of 420 c.f.s.

TABLE III

ALTERNATIVE RESERVOIR SITES

POWER PLANT COOLING - DELAWARE RIVER BASIN

FULL SITE DEVELOPMENT

Item	Unit	Equinunk Creek *	South Br. Calkins Cr. Upper Site *	South Br. Calkins Cr. Lower Site *	North Br. Calkins Cr.	Milanville Site Calkins Cr. *	Little Martins Creek
Drainage Area	sq. mi.	59	21	21	21	46	7
No. of Days of Release		155	155	155	155	155	155
Total Yield	c.f.s.	420	420	420	216	420	279
Yield from Pump-in	c.f.s.	331	380	388	184	344	265
Assumed Pump Capacity	c.f.s	380	460	460	220	420	320
Total Water Supply Storage	A.F.	133,000	131,000	131,000	68,000	131,000	88,000
Pump-in Storage	A.F.	103,000	120,000	120,000	57,000	108,000	83,000
Conservation Release	c.f.s.	9	3	3	3	7	1
Water Supply Storage Level	ft.	1160	1090	1035	1030	995	585
Construction Cost	$	107,600,000	81,100,000	90,600,000	56,700,000	92,700,000	77,700,000
Additional Cost for Oyster Requirements	$	9,600,000	10,800,000	10,500,000	4,700,000	8,500,000	7,400,000
Annual Cost		16,100,000	12,300,000	13,700,000	8,600,000	14,000,000	11,900,000
Energy Cost for Pumping		350,000	520,000	450,000	220,000	360,000	370,000

* Development limited for max. yield of 420 c.f.s.

TABLE IV
MILL CREEK RESERVOIR
SUMMARY OF STUDIES

CRITERIA	UNIT	CASE IIC (Limerick)[1]				GPU (Berne Plant)[2]			
Top of Dam Level	Ft.	455	465	470	480	455	465	470	480
Maximum Water Supply Level	Ft.	440	450	455	465	440	450	455	465
Storage at Max. Water Supply Level	A.F.	35,100	48,000	55,000	71,400	35,100	48,000	55,000	71,500
Dead Storage	A.F.	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Reserved for Natural Runoff	AF	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400
Allowance for Evaporation and Conservation flow	AF	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400
Pump-in Volume	AF	27,700	41,600	47,600	64,000	27,700	41,600	47,600	64,000
Reservoir Yield 3/	cfs	54-70[4/ 5/]	74-96	80-105	91-118	54-70	64-83	69-89	80-114
Construction Cost	$	48,400,000	52,000,000	54,000,000	-	48,400,000	52,000,000	54,000,000	-
Annual Cost	$	8,100,000	8,700,000	9,250,000	-	8,100,000	8,700,000	9,250,000	-

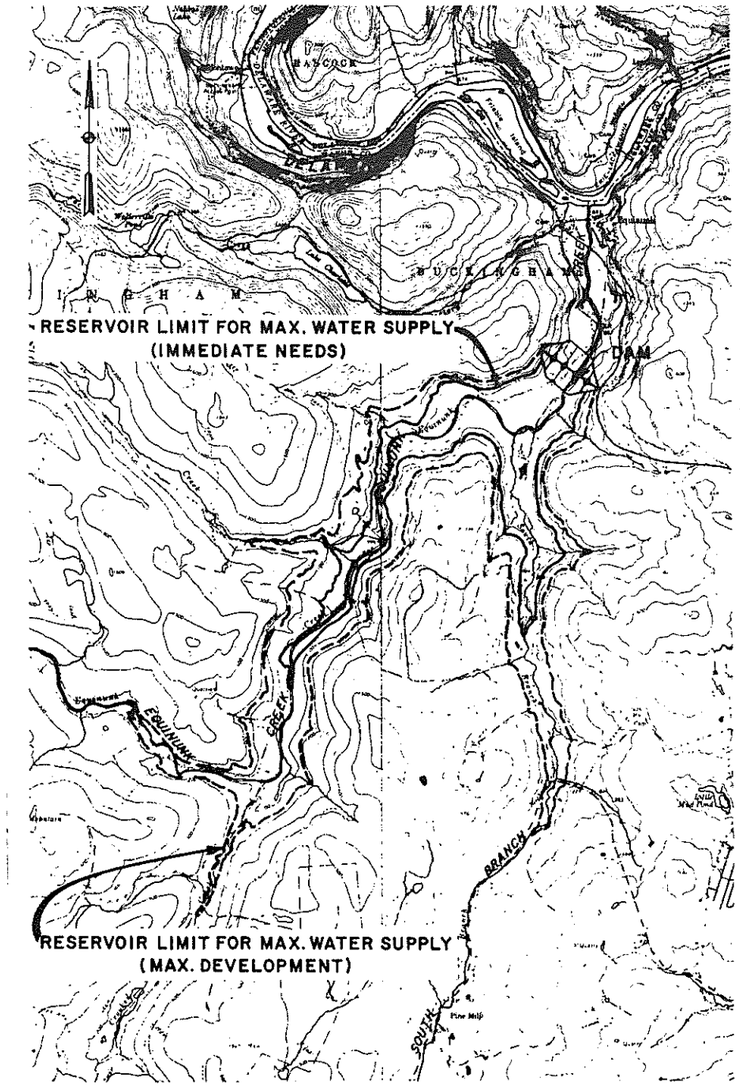
1. Limerick Criteria - Pumping from Schuylkill when flow at Berne Gage is greater than 200 cfs (50% of median) and temperature is less than 59°F.

2. Berne Criteria - Pumping from Schuylkill when flow at Berne Gage is greater than 250 cfs and temperature is less than 59°F, except no pumping in April, May and June.

3. Includes a Yield of 13.5 cfs (Continuous) from the Mill Creek drainage area (16.6 sq. m.). Based on a mas curve study of Marsh Cr. at Lydell, Pa.

4. Yield available for the Berne Plant based on a continuous need.

5. Yield available for Limerick and other downstream plants based on a criterial period of 283 days.



RESERVOIR PLAN

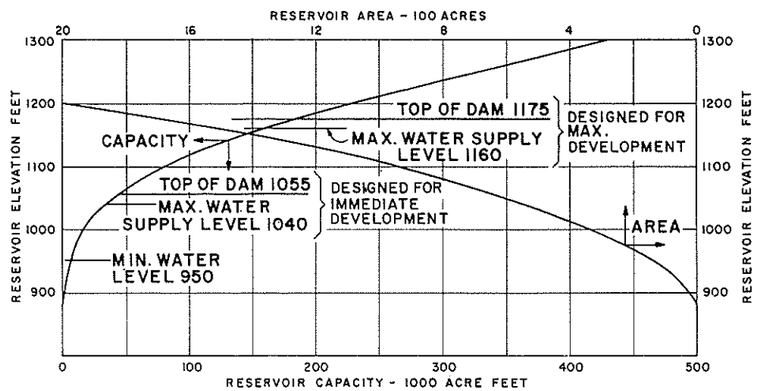
0 1/2 1
SCALE - MILES

SUMMARY OF COST

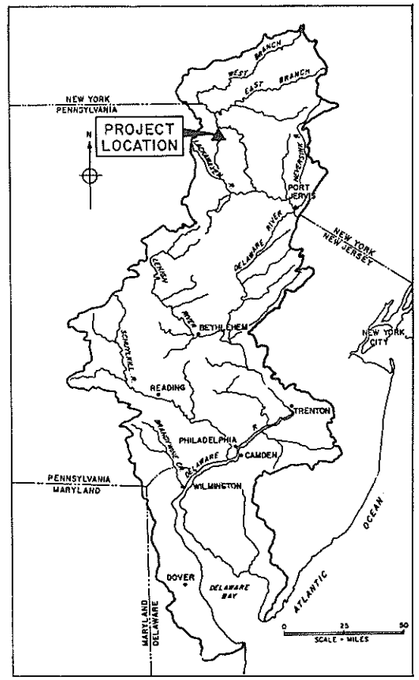
ITEM	DESIGNED FOR IMMEDIATE NEEDS	DESIGNED FOR MAXIMUM DEVELOPMENT
LAND AND LAND RIGHTS	$ 5,000,000	$ 6,300,000
RELOCATIONS	500,000	600,000
DAM	14,800,000	28,700,000
SERVICE OUTLET	2,500,000	3,700,000
SPILLWAY	7,100,000	13,700,000
PUMP STATION	–	11,200,000
TUNNEL	–	3,100,000
MISCELLANEOUS	3,300,000	5,600,000
SUBTOTAL	$ 33,200,000	$ 72,900,000
CONTINGENCIES, ENGINEERING, ETC.	16,600,000	34,700,000
CONSTRUCTION COST	$ 49,800,000	$ 107,600,000
AVERAGE ANNUAL COST	$ 7,500,000	$ 16,100,000
CONSTRUCTION COST PER ACRE FOOT OF WATER SUPPLY STORAGE	$ 1,660	$ 810
AVERAGE ANNUAL COST PER CFS OF WATER SUPPLY YIELD	$ 107,000	$ 38,300

SUMMARY OF HYDROLOGY

ITEM		DESIGNED FOR IMMEDIATE NEEDS	DESIGNED FOR MAXIMUM DEVELOPMENT
DRAINAGE AREA	sq.mi.	59	59
AVERAGE RUNOFF	cfs	90	90
MINIMUM DOWNSTREAM FLOW	cfs	9	9
ESTIMATED FIRM WATER SUPPLY	cfs	70	420
WATER SUPPLY STORAGE	ac.ft.	30,000	133,000
MAXIMUM STORAGE LEVEL	ft.	1,050	1,170
MAXIMUM WATER SUPPLY LEVEL	ft.	1,040	1,160
PUMP CAPACITY	cfs	–	380



AREA AND CAPACITY CURVES



LOCATION MAP

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS & ARCHITECTS
NEW YORK, N.Y.

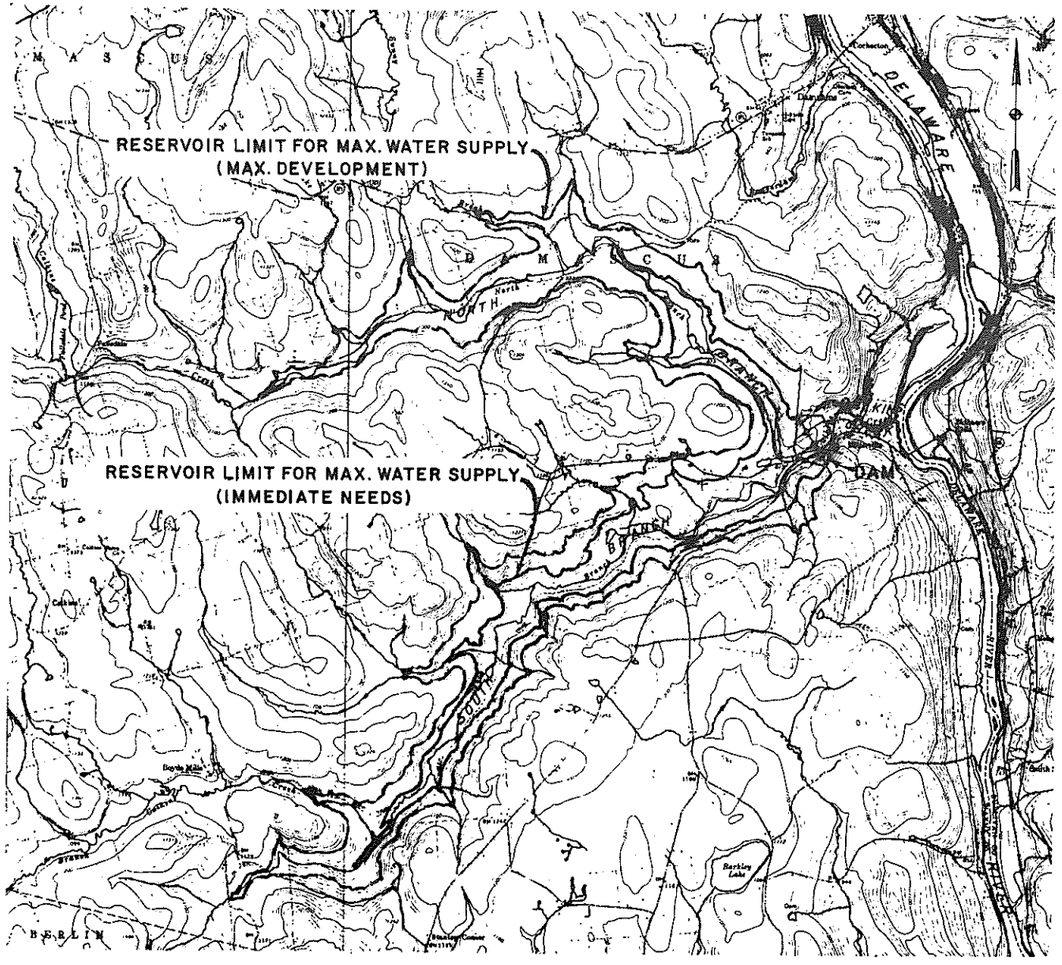
WATER RESOURCES STUDY

DELAWARE RIVER BASIN

WATER SUPPLY RESERVOIR

EQUINUNK CREEK

EXHIBIT I



RESERVOIR PLAN

0 1/2 1

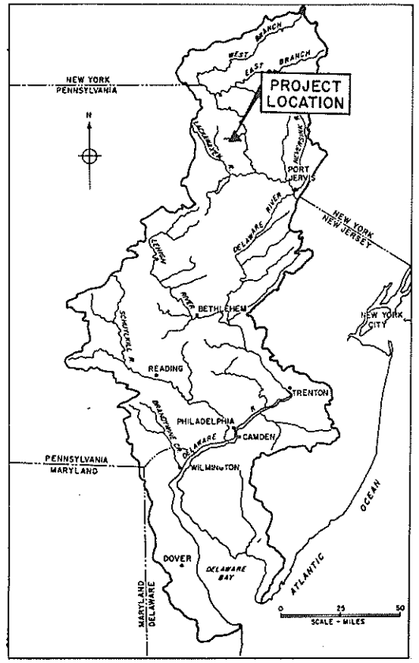
SCALE-MILES

SUMMARY OF COST

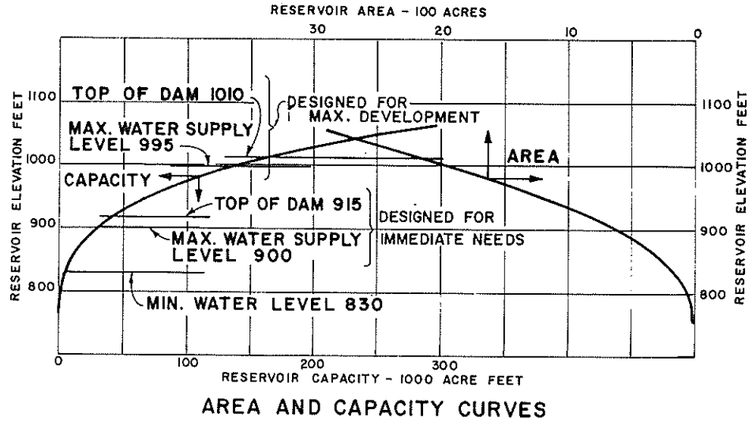
ITEM	DESIGNED FOR IMMEDIATE NEEDS	DESIGNED FOR MAXIMUM DEVELOPMENT
LAND AND LAND RIGHTS	$ 4,000,000	$ 5,800,000
RELOCATIONS	400,000	1,300,000
DAM	8,300,000	25,600,000
SERVICE OUTLET	2,750,000	3,900,000
SPILLWAY	7,410,000	9,600,000
PUMP STATION	—	9,400,000
TUNNEL	—	1,300,000
MISCELLANEOUS	2,500,000	6,000,000
SUBTOTAL	$ 25,360,000	$62,900,000
CONTINGENCIES, ENGINEERING, ETC.	12,680,000	29,800,000
CONSTRUCTION COST	$ 38,000,000	$92,700,000
AVERAGE ANNUAL COST	$ 6,000,000	$14,000,000
CONSTRUCTION COST PER ACRE FOOT OF WATER SUPPLY STORAGE	$ 1,640	$ 700
AVERAGE ANNUAL COST PER CFS OF WATER SUPPLY YIELD	$ 86,000	$ 34,000

SUMMARY OF HYDROLOGY

ITEM		DESIGNED FOR IMMEDIATE NEEDS	DESIGNED FOR MAXIMUM DEVELOPMENT
DRAINAGE AREA	sq.mi.	46	46
AVERAGE RUNOFF	cfs	70	70
MINIMUM DOWNSTREAM FLOW	cfs	7	7
ESTIMATED FIRM WATER SUPPLY	cfs	70	420
WATER SUPPLY STORAGE	ac.ft.	23,200	131,000
MAXIMUM STORAGE LEVEL	ft.	910	1,005
MAXIMUM WATER SUPPLY LEVEL	ft.	900	995
PUMP CAPACITY	cfs	—	420



LOCATION MAP



AREA AND CAPACITY CURVES

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS & ARCHITECTS
NEW YORK, N.Y.

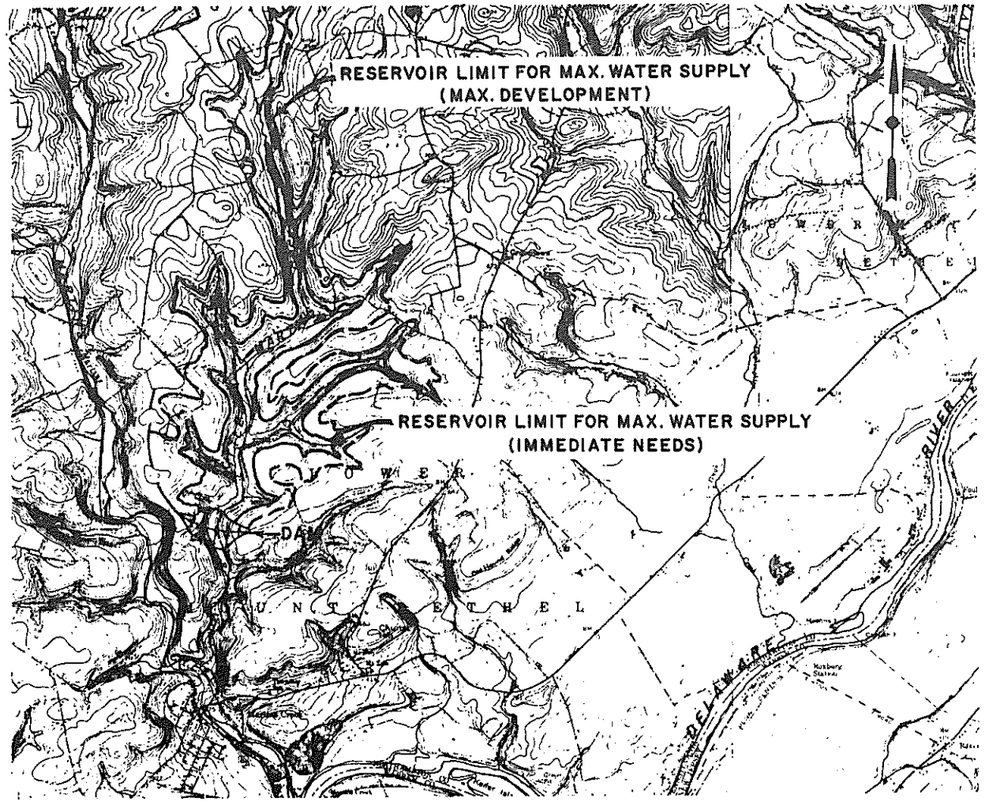
WATER RESOURCES STUDY

DELAWARE RIVER BASIN

WATER SUPPLY RESERVOIR

MILANVILLE SITE.-CALKINS CREEK

EXHIBIT II



RESERVOIR PLAN

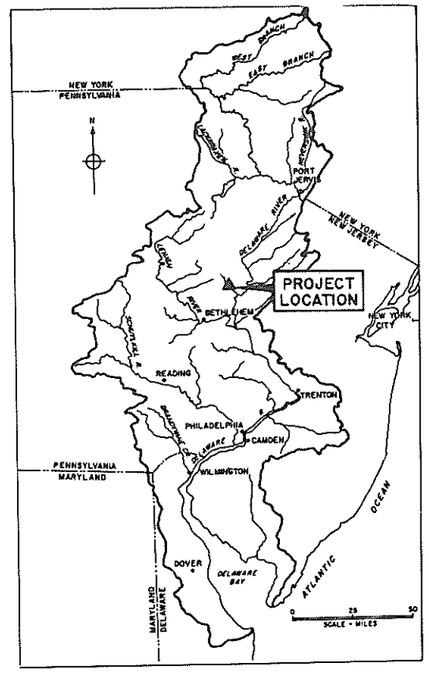
0 1/2 1
SCALE - MILES

SUMMARY OF COST

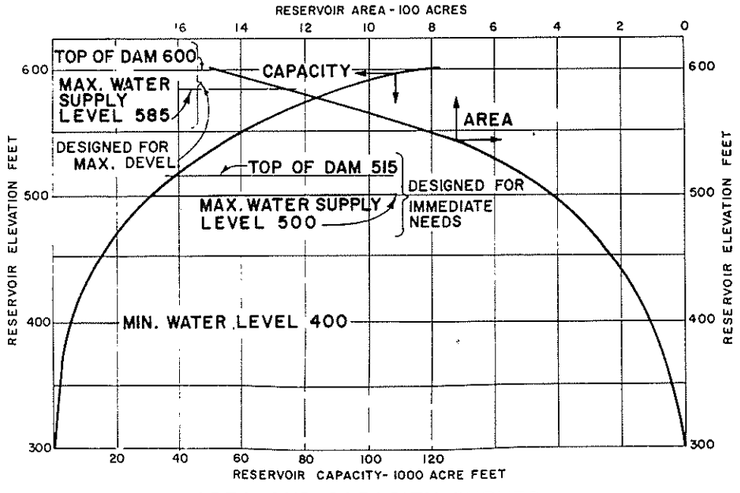
ITEM	DESIGNED FOR IMMEDIATE NEEDS	DESIGNED FOR MAXIMUM DEVELOPMENT
LAND AND LAND RIGHTS	$ 3,600,000	$ 5,900,000
RELOCATIONS	1,100,000	1,400,000
DAM	7,100,000	19,200,000
SERVICE OUTLET	3,000,000	4,200,000
SPILLWAY	2,900,000	3,800,000
PUMP STATION	2,200,000	9,600,000
TUNNEL	4,200,000	4,200,000
MISCELLANEOUS	1,900,000	3,400,000
SUBTOTAL	$ 26,000,000	$ 51,700,000
CONTINGENCIES, ENGINEERING, ETC.	12,600,000	26,000,000
CONSTRUCTION COST	$ 38,600,000	$ 77,700,000
AVERAGE ANNUAL COST	$ 5,900,000	$ 11,900,000
CONSTRUCTION COST PER ACRE FOOT OF WATER SUPPLY STORAGE	$ 2,200	$ 936
AVERAGE ANNUAL COST PER CFS OF WATER SUPPLY YIELD	$ 85,000	$ 43,000

SUMMARY OF HYDROLOGY

ITEM		DESIGNED FOR IMMEDIATE NEEDS	DESIGNED FOR MAXIMUM DEVELOPMENT
DRAINAGE AREA	sq.mi.	7	7
AVERAGE RUNOFF	cfs	10	10
MINIMUM DOWNSTREAM FLOW	cfs	1	1
ESTIMATED FIRM WATER SUPPLY	cfs	70	279
WATER SUPPLY STORAGE	ac.ft.	17,300	83,000
MAXIMUM STORAGE LEVEL	ft.	510	595
MAXIMUM WATER SUPPLY LEVEL	ft.	500	585
PUMP CAPACITY	cfs	70	320



LOCATION MAP



AREA AND CAPACITY CURVES

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS & ARCHITECTS
NEW YORK, N.Y.

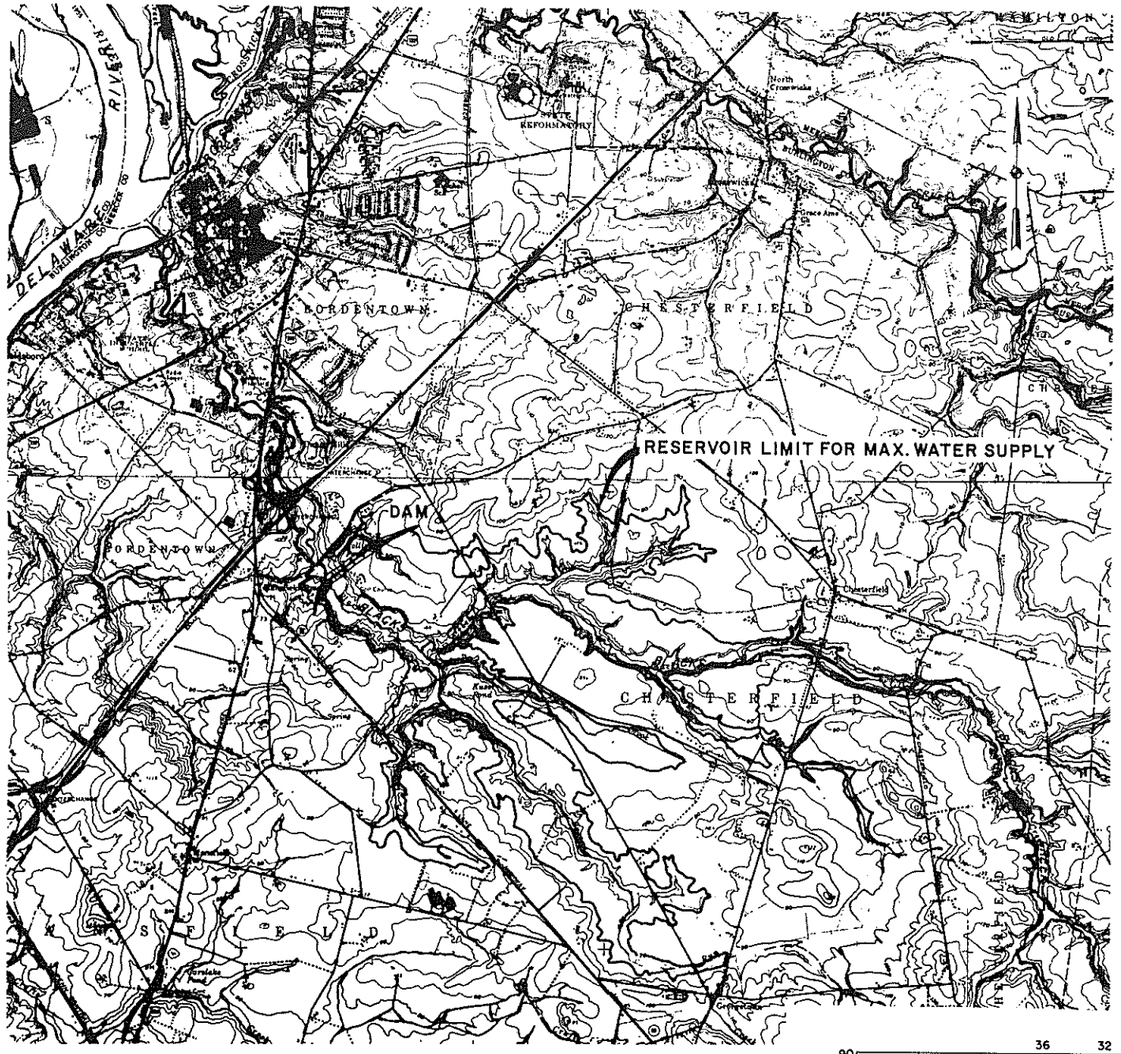
WATER RESOURCES STUDY

DELAWARE RIVER BASIN

WATER SUPPLY RESERVOIR

LITTLE MARTINS CREEK

EXHIBIT III



RESERVOIR PLAN

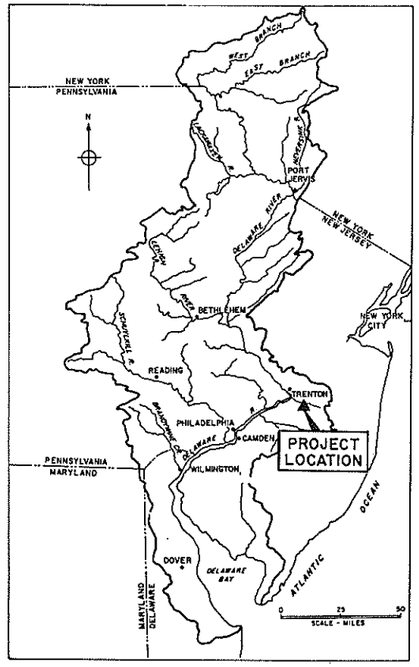
0 1/2
SCALE - MILES

SUMMARY OF COST

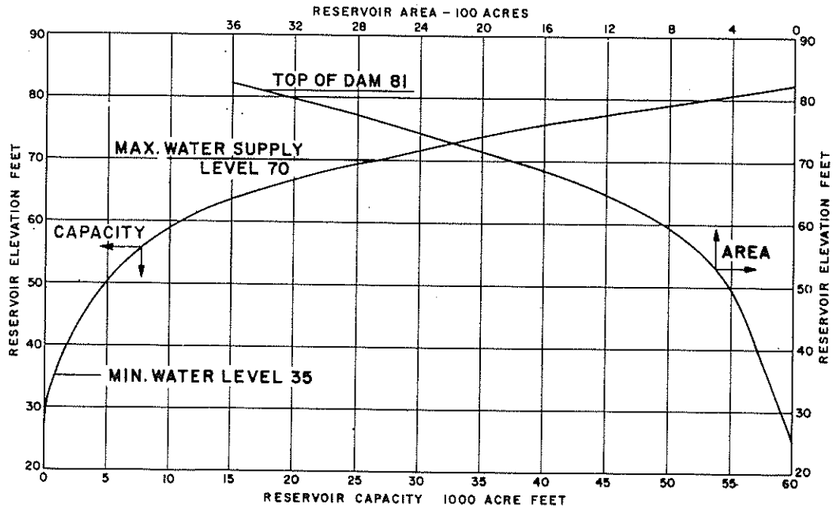
ITEM	COST
LAND AND LAND RIGHTS	$ 13,000,000
RELOCATIONS	900,000
DAM	2,200,000
SERVICE OUTLET	1,000,000
SPILLWAY	2,100,100
PUMP STATION	600,000
WATER CONDUIT	1,000,000
MISCELLANEOUS	1,700,000
SUBTOTAL	$ 22,800,000
CONTINGENCIES, ENGINEERING, ETC.	11,700,000
CONSTRUCTION COST	$ 34,500,000
AVERAGE ANNUAL COST	$ 6,100,000
CONSTRUCTION COST PER ACRE FOOT OF WATER SUPPLY STORAGE	$ 1,700
AVERAGE ANNUAL COST PER CFS OF WATER SUPPLY YIELD	$ 88,000

SUMMARY OF HYDROLOGY

ITEM		
DRAINAGE AREA	sq.mi.	20
AVERAGE RUNOFF	cfs	16
MINIMUM DOWNSTREAM FLOW	cfs	3
ESTIMATED FIRM WATER SUPPLY	cfs	13
WATER SUPPLY STORAGE	ac.ft.	20,300
MAXIMUM STORAGE LEVEL	ft.	76
MAXIMUM WATER SUPPLY LEVEL	ft.	70
PUMP CAPACITY	cfs	70



LOCATION MAP



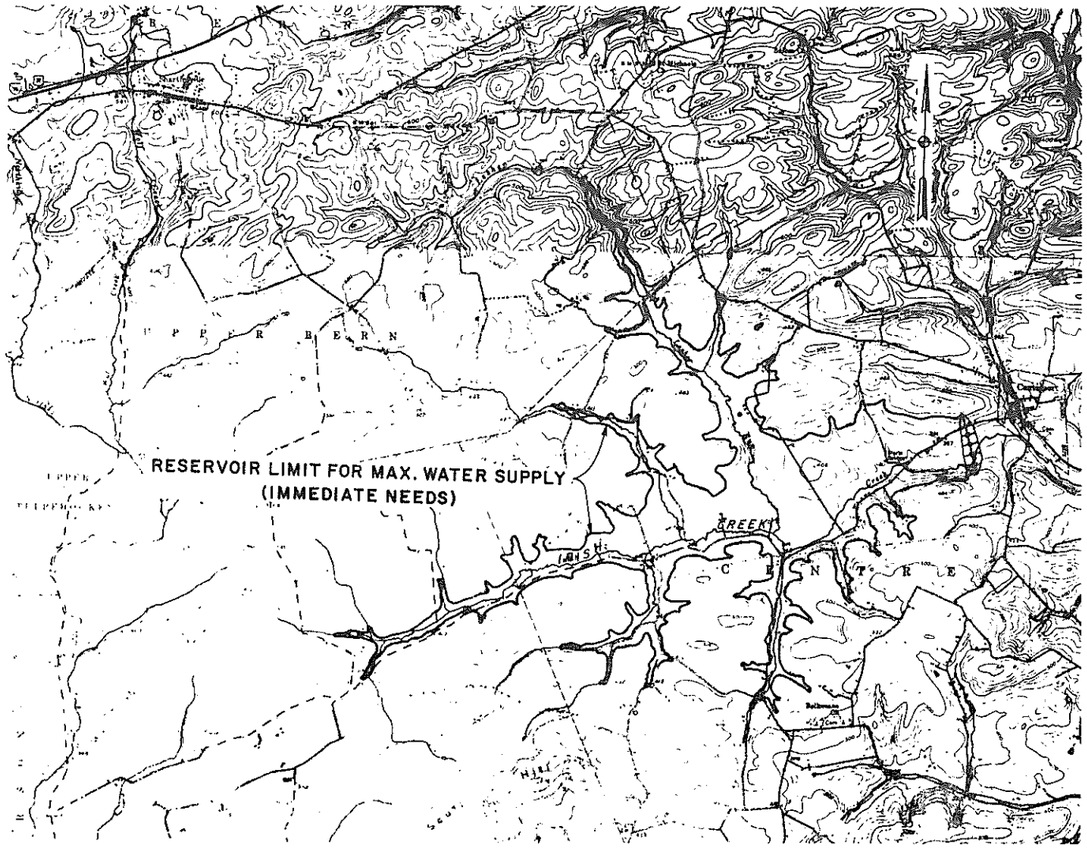
AREA AND CAPACITY CURVES

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS & ARCHITECTS
NEW YORK, N.Y.

WATER RESOURCES STUDY
DELAWARE RIVER BASIN

WATER SUPPLY RESERVOIR
BLACKS CREEK

EXHIBIT IV

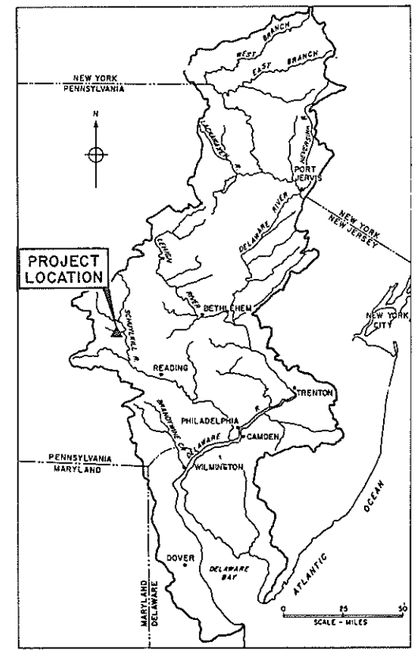


RESERVOIR PLAN

0 1/2 1
SCALE - MILES

SUMMARY OF COST

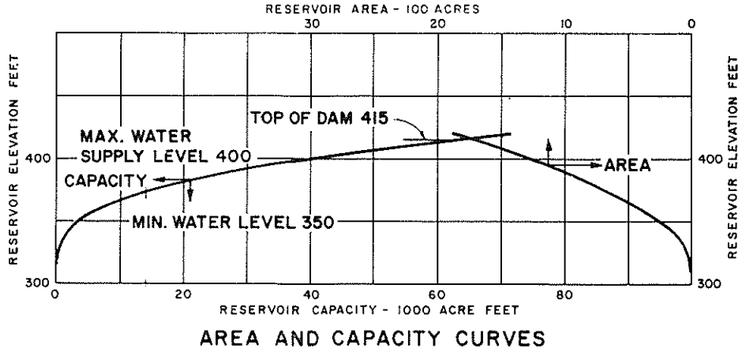
ITEM	COST
LAND AND LAND RIGHTS	$ 9,800,000
RELOCATIONS	2,900,000
DAM	4,500,000
SERVICE OUTLET	1,300,000
SPILLWAY	1,800,000
PUMP STATION	6,100,000
TUNNEL	5,700,000
MISCELLANEOUS	2,400,000
SUBTOTAL	$34,500,000
CONTINGENCIES, ENGINEERING, ETC.	17,500,000
CONSTRUCTION COST	$52,000,000
AVERAGE ANNUAL COST	$ 8,600,000
CONSTRUCTION COST PER ACRE FOOT OF WATER SUPPLY STORAGE	$ 1,600
AVERAGE ANNUAL COST PER CFS OF WATER SUPPLY YIELD	$ 123,000



LOCATION MAP

SUMMARY OF HYDROLOGY

ITEM		
DRAINAGE AREA	sq.mi.	14
AVERAGE RUNOFF	cfs	20
MINIMUM DOWNSTREAM FLOW	cfs	2
ESTIMATED FIRM WATER SUPPLY	cfs	70
WATER SUPPLY STORAGE	ac.ft.	33,000
MAXIMUM STORAGE LEVEL	ft.	410
MAXIMUM WATER SUPPLY LEVEL	ft.	400
PUMP CAPACITY	cfs	600



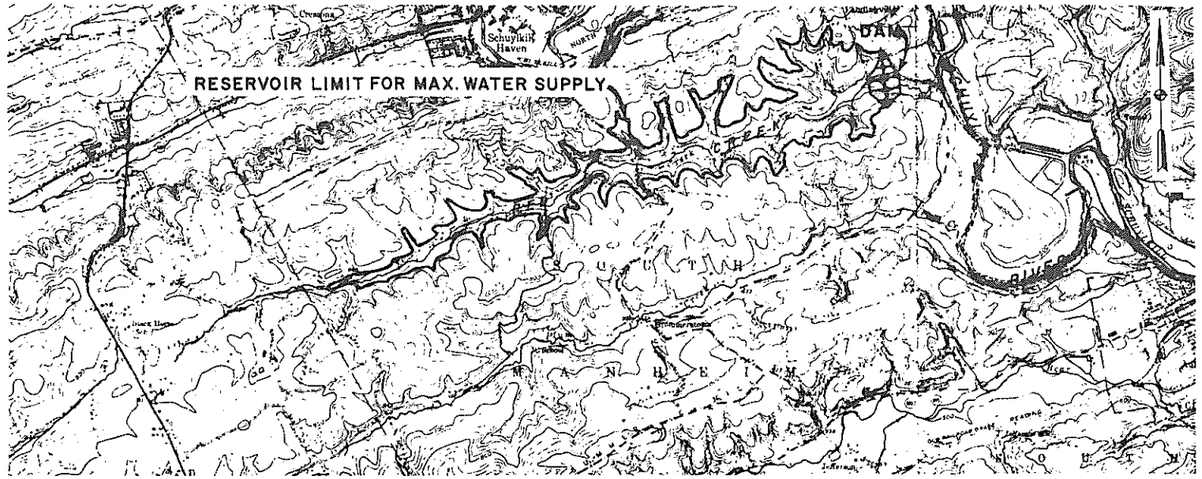
AREA AND CAPACITY CURVES

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS & ARCHITECTS
NEW YORK, N.Y.

WATER RESOURCES STUDY
DELAWARE RIVER BASIN

WATER SUPPLY RESERVOIR
IRISH CREEK

EXHIBIT V

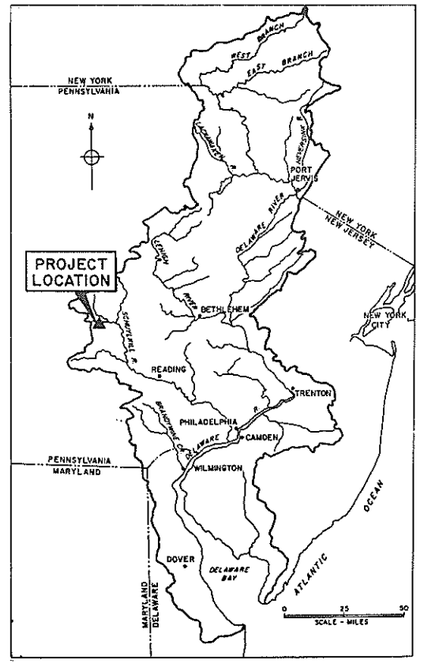


RESERVOIR PLAN

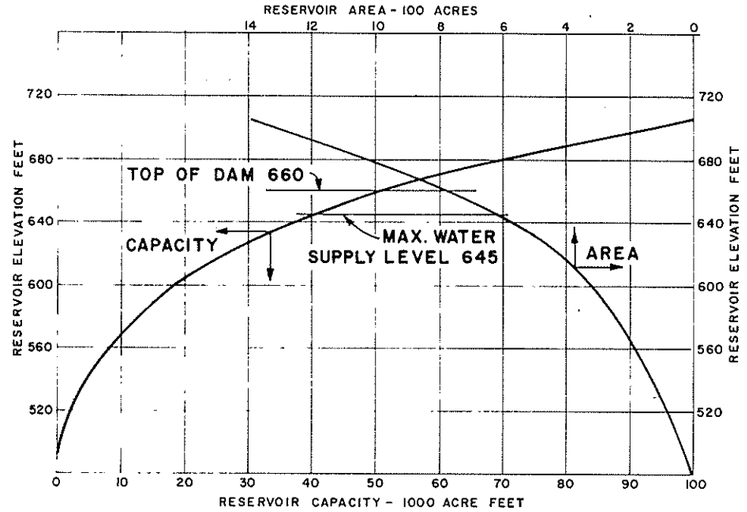
0 1/2 1
SCALE - MILES

SUMMARY OF COST

ITEM	
LAND AND LAND RIGHTS	$ 4,217,000
RELOCATIONS	985,000
DAM	11,500,000
SERVICE OUTLET	2,500,000
SPILLWAY	2,200,000
PUMP STATION	9,200,000
TUNNEL	1,870,000
MISCELLANEOUS	2,400,000
SUBTOTAL	$ 34,872,000
CONTINGENCIES, ENGINEERING, ETC.	17,436,000
CONSTRUCTION COST	$ 52,300,000
AVERAGE ANNUAL COST	$ 8,000,000
CONSTRUCTION COST PER ACRE FOOT OF WATER SUPPLY STORAGE	$ 1,500
AVERAGE ANNUAL COST PER CFS OF WATER SUPPLY YIELD	$ 115,000



LOCATION MAP



AREA AND CAPACITY CURVES

SUMMARY OF HYDROLOGY

ITEM		
DRAINAGE AREA	sq.mi.	6
AVERAGE RUNOFF	cfs	11
MINIMUM DOWNSTREAM FLOW	cfs	1
ESTIMATED FIRM WATER SUPPLY	cfs	70
WATER SUPPLY STORAGE	ac.ft.	35,200
MAXIMUM STORAGE LEVEL	ft.	655
MAXIMUM WATER SUPPLY LEVEL	ft.	645
PUMP CAPACITY	cfs	600

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS & ARCHITECTS
NEW YORK, N.Y.

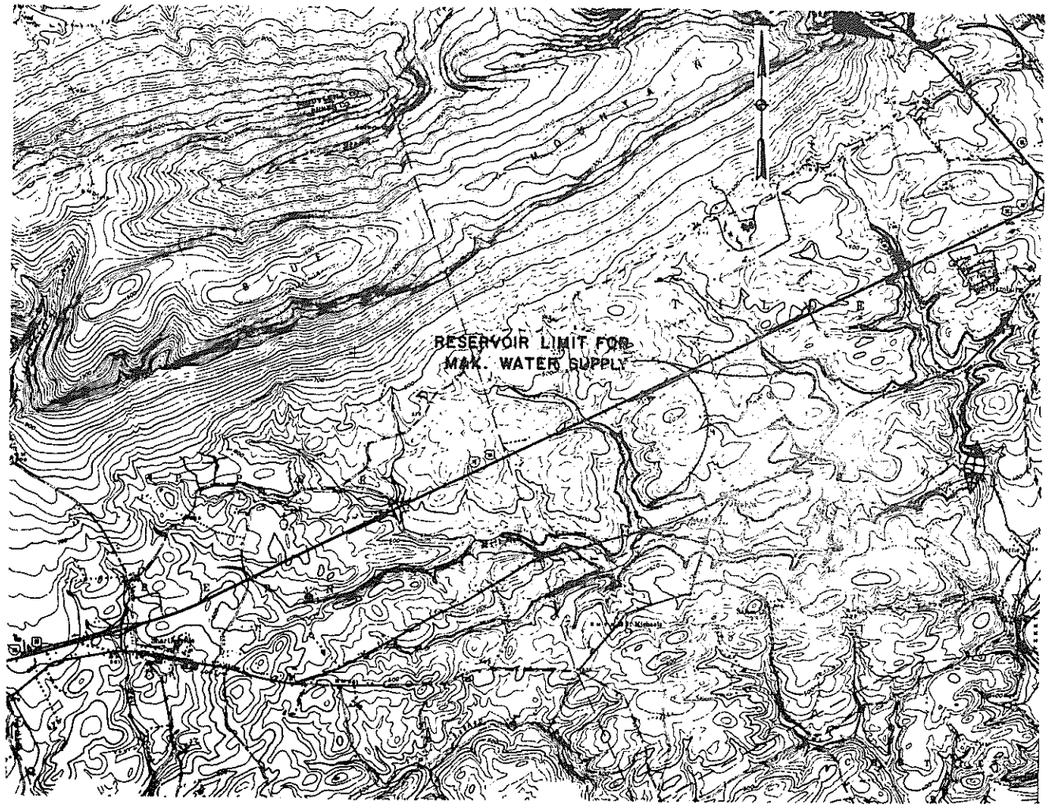
WATER RESOURCES STUDY

DELAWARE RIVER BASIN

WATER SUPPLY RESERVOIR

RED CREEK

EXHIBIT VI



RESERVOIR PLAN

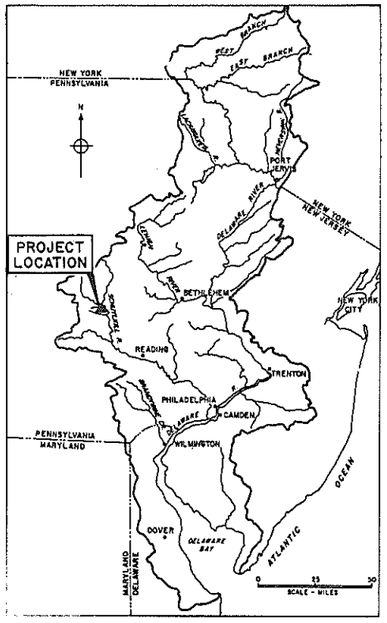
0 1/2 1
SCALE - MILES

SUMMARY OF COST

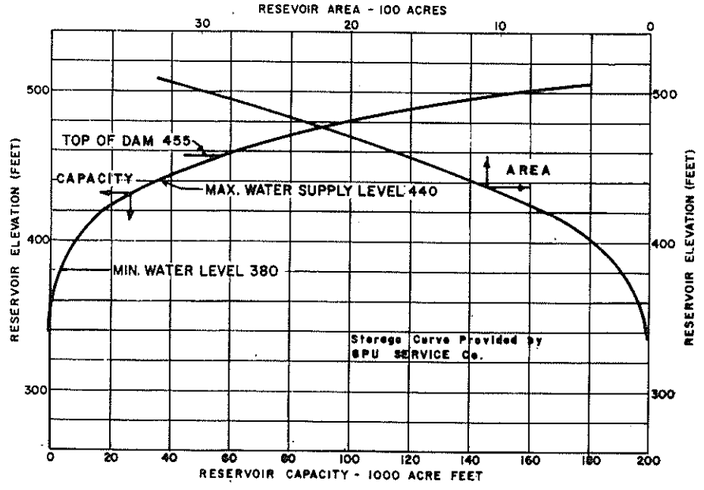
ITEM	COST
LAND AND LAND RIGHTS	$ 8,800,000
RELOCATIONS	5,300,000
DAM	4,000,000
SERVICE OUTLET	1,700,000
SPILLWAY	2,400,000
PUMP STATION	7,200,000
WATER CONDUIT	1,600,000
MISCELLANEOUS	2,000,000
SUBTOTAL	33,000,000
CONTINGENCIES, ENGINEERING, ETC.	15,400,000
CONSTRUCTION COST	48,400,000
AVERAGE ANNUAL COST	8,100,000
CONSTRUCTION COST PER ACRE FOOT OF WATER SUPPLY STORAGE	1,500
AVERAGE ANNUAL COST PER CFS OF WATER SUPPLY YIELD	116,000

SUMMARY OF HYDROLOGY

ITEM		
DRAINAGE AREA	sq.mi.	16.6
AVERAGE RUNOFF	cfs	24
MINIMUM DOWNSTREAM FLOW	cfs	2.5
ESTIMATED FIRM WATER SUPPLY	cfs	70
WATER SUPPLY STORAGE	ac.ft.	33,000
MAXIMUM STORAGE LEVEL	ft.	450
MAXIMUM WATER SUPPLY LEVEL	ft.	440
PUMP CAPACITY	cfs	600



LOCATION MAP



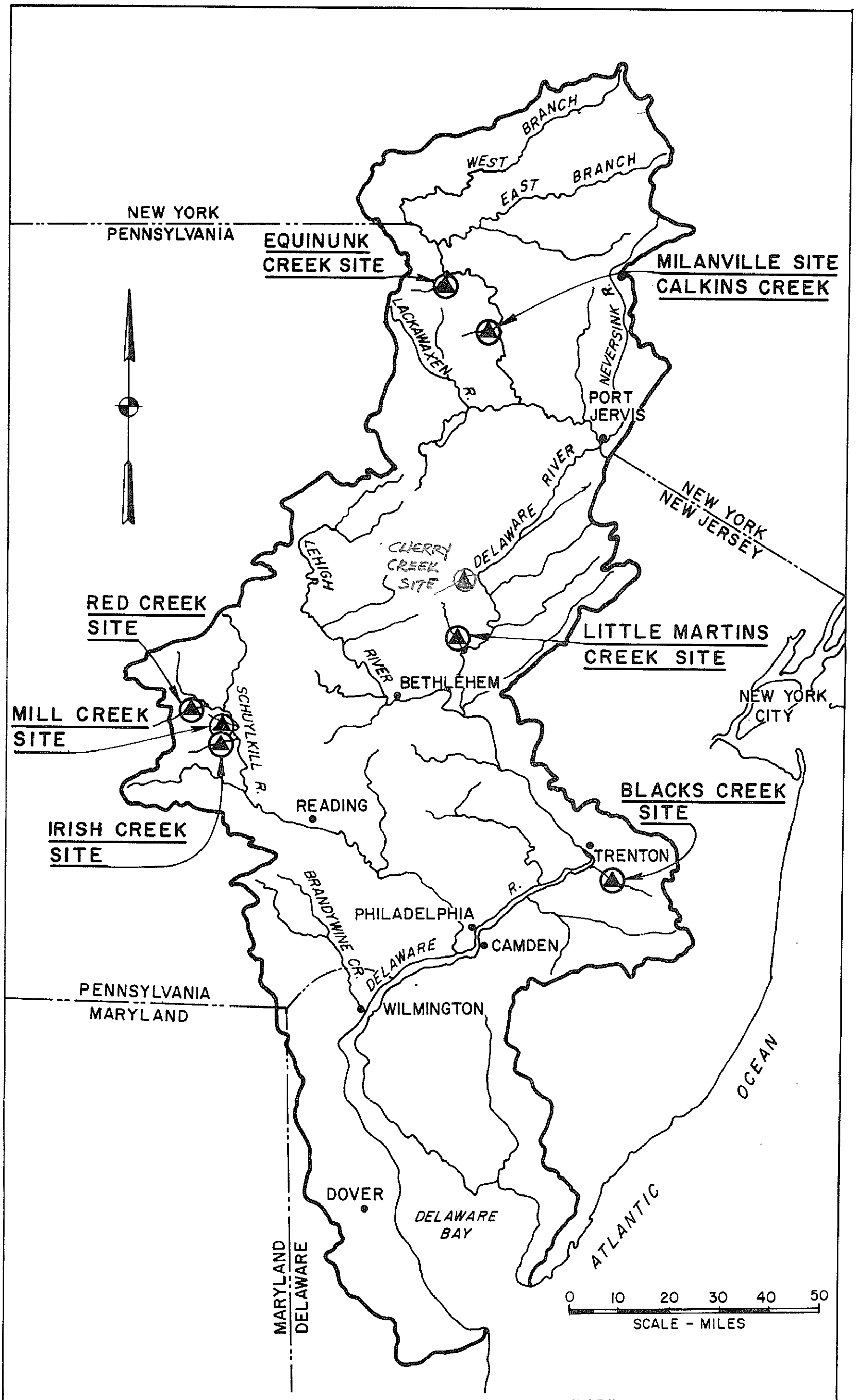
AREA AND CAPACITY CURVES

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS & ARCHITECTS
NEW YORK, N.Y.

WATER RESOURCES STUDY
DELAWARE RIVER BASIN

WATER SUPPLY RESERVOIR
MILL CREEK

EXHIBIT VII



WATER RESOURCES STUDY
DELAWARE RIVER BASIN

LOCATION MAP
WATER SUPPLY RESERVOIRS

TIPPETTS-ABBETT-McARTHY-STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

Alternative water supply reservoirs in t
Delaware River basin - Addendum # 1 (1
table) 6/30/75

Additions to the agenda of DRBEUG-TAC me
on 7/1/75 (Proposed by Mr. Roger Ley)

Delaware River basin reservoir for power
cooling (9 p. & 1 folded leave and 1 t

letter:E. O'Brien, Tippetts-Abbett-McCart
Stratton, to D. Helwin, Philadelphia El
Co., 5/19/75 with schedule

letter (draft): J. K. to W.A. Verrochi, G
Service Corp., 7/75

handwritten note (pencil) (1 p.)

TAB. 12

Alternative Water Supply Reservoirs in the Delaware River Basin - Addendum #1

Unit	Service Date	Average Consumptive Usage (cfs)	Freshwater * Augmentation Required (cfs)	Cumulative Augmentation (cfs)
Eddystone #3	1974	2.3	1.9 **	1.9
Edge Moor #5	1974	3.2	1.9 **	3.8
Eddystone #4	1975	2.3	1.9 **	5.7
Martins Creek #3	1975	5.2	5.2 > 35%	10.9
Martins Creek #4	1977	5.2	5.2	16.1
Gilbert #8	1977	2.0	2.0	18.1
Cromby Cooling Towers	1977	6.5	3.2 ***	21.3
Summit #1	1981	9.8 9.9 x .32	3.0 3.2	24.3
Limerick #1	1981	27.0	27.0	51.3
Hope Creek #1	1982	26.3 26.6 x .18	5.0 4.8	56.3
Limerick #2	1984	27.0	27.0	83.3
Hope Creek #2	1984	26.3 26.6 x .18	5.0 4.8	88.3
Summit #2	1984	9.8 9.9 x .32	3.0 3.2	91.3
Cliff #1	1986	35.0	35.0	126.3
Chester #10	1987	8.8 .8.8 x 0.77	5.8 6.8	132.1
Chester #11	1988	11.7 11.7 x 0.77	7.7 9.0	139.8
Cliff #2	1988	35.0	35.0	174.8

70.0

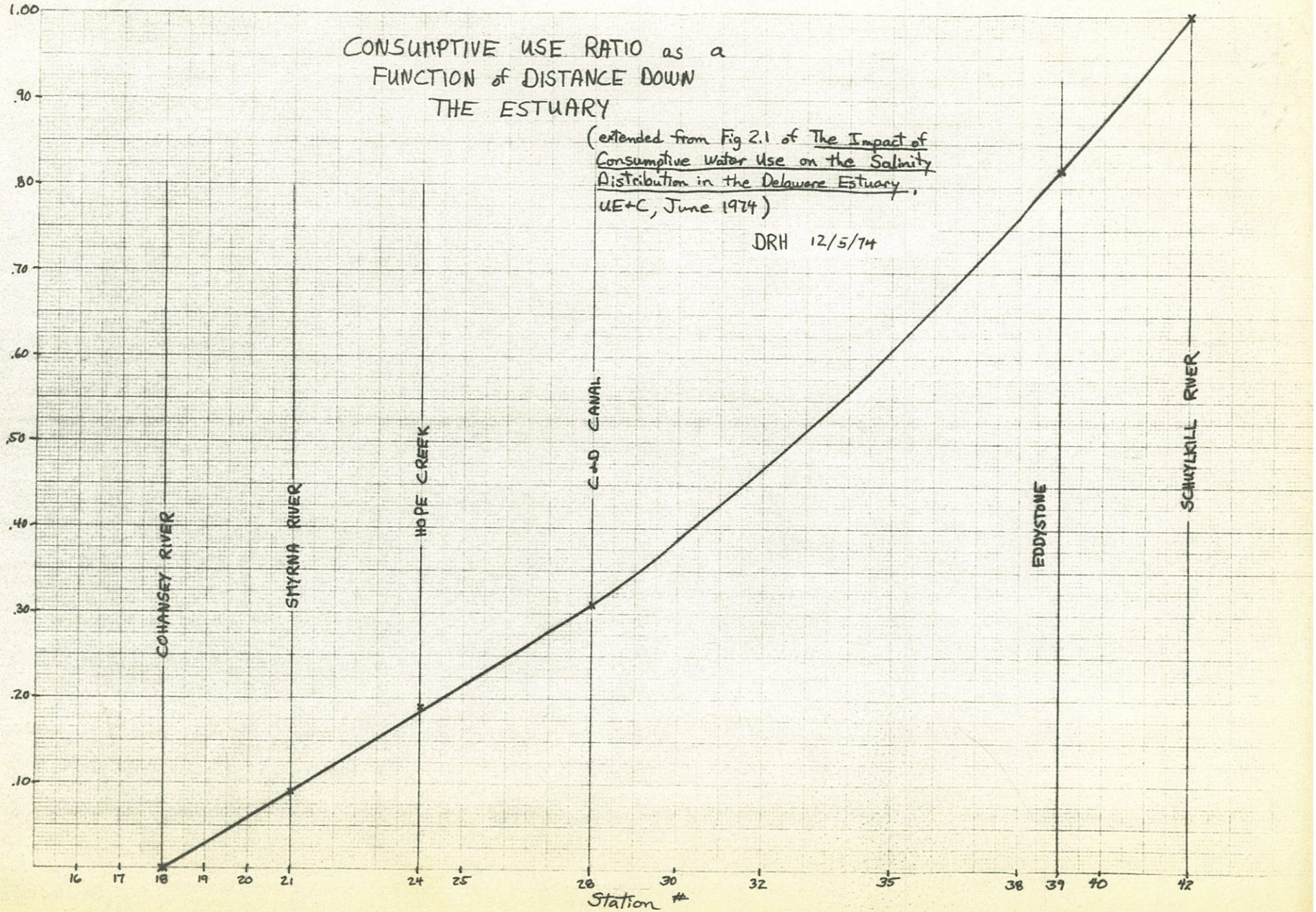
* The freshwater augmentation required for units located on the Delaware estuary, below the mouth of the Schuylkill River, is a percentage of their consumptive usage. The percentage for each unit has been selected based on the results of The Impact of Consumptive Use of Water on the Salinity Distribution in the Delaware Estuary, UE&C, June, 1974. The DRBC has extrapolated the results of this study from the Chesapeake & Delaware Canal to the mouth of the Schuylkill River. (See attached graph.) May be self-supplied (Martins Cr)

** The DRBC Docket Decisions for Eddystone #3 and #4 and Edge Moor #5 do not contain limitations based on river flows or requirements for reservoir releases. The DRBC has, however, included these limitations in the water payment contracts currently being negotiated.

*** The installation of cooling towers at this station would increase the average rate of evaporation by about 3.2 cfs. These towers will only be installed if there is a negative determination on the EPA Section 316(a) Appeal, which has been filed for this station.

.... add footnote - last sentence 1975 MSS

DRH:drd
6/30/75


CONSUMPTIVE USE RATIO as a FUNCTION of DISTANCE DOWN THE ESTUARY
(extended from Fig 2.1 of The Impact of Consumptive Water Use on the Salinity Distribution in the Delaware Estuary, UE+C, June 1974)
DRH 12/5/74
Consumptive Use Ratio
1.00
.90
.80
.70
.60
.50
.40
.30
.20
.10
COHANSEY RIVER
SMYRNA RIVER
HOPE CREEK
C+D CANAL
EDDYSTONE
SCHUYLKILL RIVER
16
17
18
19
20
21
24
25
28
30
32
35
38
39
40
42
Station #

ADDITIONS TO THE AGENDA OF DRBEUG-TAC

MEETING ON 7/1/75

(Proposed by Mr. Roger Ley)

2d. Answers to the following 4 questions:

A. Does the Managing Committee accept the recommendation of the TAC subcommittee report to proceed with the next phase and to use TAMS?

TAMS - OK TAC to recommend to Managing Comm.

A1. TAC accepts Reservoir Report - by TAMS w/ addendum. → need expanded Scope Description for further work.

B. Should the objective be to provide water for Limerick, for Limerick, Hope Creek and Summit, or for as many other facilities as possible?

Optimization Process

C. What companies should be involved?

PP&L - Management decision - no more power plants in DRB requiring water supply

D. What should be the cost sharing?

GPU - Suggest sharing on basis of cfs requirements (10%) after assigning a nominal fixed percentage to each Company ↓ Peak load ↙ ~~Use load and Capacity Forecast~~

Orange & Rockland - wants out

Furnished by TAMS at DRBEUG-TAC Mtg on July 1, 1975.

DELAWARE RIVER BASIN
RESERVOIR FOR POWER PLANT COOLING

TAMS studied the Delaware River Basin for possible reservoir sites in the 1972 study, "Water Resources Study for Power Systems".[1/] A total of 105 sites were examined of which 7 tributary sites were classified as high priority sites and 14 as priority sites.

Further studies of these sites were made for the Philadelphia Electric Company in 1972 and the DRBEUG TAC in 1974. The sites identified as having the best potential for development are:

Site	Yield for Power Plant Cooling
Equinunk Creek	70-420 cfs
Calkins Creek - Milanville	70-420 cfs
Little Martins Creek	70-280 cfs
Blacks Creek	70 cfs
Red Creek (Schuylkill)	70 cfs
Irish Creek (Schuylkill)	70 cfs
Mill Creek (Schuylkill)	70 cfs

These later studies explored in detail the hydrology of the sites and their yield capabilities under various criteria. The effects of developing these sites were assessed, particularly in regard to environmental factors. Supplemental pumping was considered at all sites to increase the yield. These studies, including project layouts and cost estimates, are summarized in the DRBEUG Reservoir Contingency Study Subcommittee report, "Alternative Water Supply Reservoirs in the Delaware River Basin", May, 1975.

ALTERNATIVES FOR POWER PLANT COOLING

To provide additional data so that DRBEUG TAC can better assess the need for and the desirability of proceeding further with the reservoir

1/ See Appendix B, Additional Water Supply Projects

studies, TAMS has set up a series of tentative alternatives for supplying power plant cooling water. The alternatives are based on selecting one or more of the reservoirs described above to provide the cooling water needed for various conditions of power plant construction.

The present worth as of January 1976 of the construction cost and the operating cost for the selected reservoirs to the year 2000 was used in comparing the alternatives. A discount rate of 10 percent and an inflation rate of 6 percent were used in computing the present worth.

It should be noted that additional engineering and studies will be needed to prove out the technical, financial and environmental feasibility of any of the reservoir sites described above. These additional engineering and studies are outlined and discussed in the next section of this memorandum.

ALTERNATIVE 1 - SUPPLYING LIMERICK GENERATING STATION

This alternative considers Limerick Generating Station only which is scheduled for operation in 1981. The station is located on the Schuylkill River near Pottstown. Its average cooling water requirement is 54 cfs. The yield from Mill Creek, Red Creek or Irish Creek all on the Schuylkill River could supply the plant. It should be noted that the river hydrology and the refilling criteria used in the May 1975 report precludes the development of more than one reservoir on the Schuylkill River. If Mill Creek is developed and used for Limerick, another source other than the Schuylkill will be needed about the year 1990 when GPU brings in their Berne plant.

Limerick could also be supplied by a reservoir on a Delaware tributary. A pipeline, however, would be needed to convey the flow to the plant. It should be noted that the cost of the pipeline has not been included in the cost comparison given below.

Three reservoir schemes for supplying only the needs of the Limerick plant are compared in Table 1. There are other alternatives. Those

selected for comparison in the table are, however, representative of the many possibilities.

TABLE 1

ALTERNATIVE 1 - COST OF PROVIDING COOLING WATER FOR LIMERICK GENERATING STATION

Schedule & Scheme	Yield CFS	Construction Costs 1975 Prices	Cost - Present Worth until Year 2000 **	Cost Per CFS
A. 1981-90, Mill Creek *		$48,400,000		
1990-2000, Blacks CR.	54	$33,100,000	$76,400,000	$1,410,000
B. 1981-2000 Irish CR	54	$46,800,000	$74,600,000	$1,380,000
C. 1981-2000 Little Martins Creek	54	$37,000,000	$53,500,000	$ 990,000

* It is assumed that the yield of Mill Creek site will be used by GPU for their proposed Berne Generating Plant in 1990. Present worth cost for this reservoir is based on estimated annual charge to be paid to GPU.

** Includes PW of construction and O & M costs except for Mill Creek.

ALTERNATIVE 2 - SUPPLYING LIMERICK, HOPE CREEK AND SUMMIT GENERATING STATIONS

This alternative considers the Limerick, Hope Creek and Summit generating stations. These are the large nuclear stations which are presently licensed and for which the DRBC has indicated a supplemental source of cooling water may be needed. The average fresh cooling water make-up supply for these plants and the date when needed are listed below:

Plant	Date	Cooling Water Make-up cfs.
* Summit # 1	1981	3.0
Limerick # 1	1981	27.0

Plant (Cont'n...)	Date	Cooling Water Make-up cfs
* Hope Creek #1	1982	5.0
Limerick #2	1982	27.0
* Hope Creek # 2	1984	5.0
* Summit #2	1984	3.0
Total:		70.0

* Only the estimated fresh water component of the consumptive use is to be supplied.

As for Alternative 1, these requirements can be obtained from developments on Mill Creek, Irish Creek or Red Creek on the Schuylkill or from the Delaware tributary sites. If a Delaware tributary site is selected, that portion needed by Limerick will have to be conveyed by pumps and pipelines.

Several schemes which can satisfy the requirements of this alternative are given in Table 2. These schemes are similar to those for Alternative 1, and are representative of the many possibilities.

TABLE 2 - ALTERNATIVE 2

COST OF PROVIDING COOLING WATER FOR LIMERICK, HOPE CREEK AND SUMMIT STATIONS

Schedule and Scheme	Yield	Construction Cost 1975 Prices	Cost-Present Worth until the Year 2000 **	Cost Per cfs
A. 1981-90, Mill Creek * 1990-2000, Blacks Creek	70 cfs	$52,000,000 36,700,000	$83,900,000	$1,200,000
B. 1981-2000, Irish Creek	70 cfs	52,000,000	82,100,000	1,170,000
C. 1981-2000, Little Martins Creek	70 cfs	39,000,000	55,800,000	800,000

* It is assumed that the yield of Mill Creek Site will be used by GPU for their proposed Berne Generating Plant in 1990. PW cost for this reservoir is based on annual charges to be paid to GPU.

** Includes PW of construction and O & M cost except for Mill Creek

ALTERNATIVE 3 - SUPPLYING COOLING WATER NEEDS THROUGH YEAR 2000

This alternative considers providing the cooling water make-up requirements for the generating plants in the basin to be put on line between the years 1975 and 2000 for which the DRBC may require a supplemental water supply. The following is the estimated cumulative water requirements through the year 2000. The requirements through 1988 were taken from the May 1975 report and reflect capacity addition information supplied for the 1975 revision of the Master Siting Study. It was assumed that requirements for the year 2000 would be about 400 cfs.

Year	Cumulative Cooling Water Make-up Requirements cfs
1975	12.4
1977	42.4
1981	74.4
1982	79.4
1984	117.4
1986	126.2
1987	137.9
1988	172.9
2000	400.0

These requirements are shown graphically on Enclosure 1.

Several reservoir implementation schedules to supply these requirements are shown in Table 3 along with the present worth of the construction and operation and maintenance costs through the year 2000. Each schedule includes a mixture of reservoirs located in the Schuylkill and the Main Delaware Basins. There are many possible variations in the selection and scheduling of the reservoirs. Those listed were selected to be representative of the many

possibilities and their costs.

Enclosure 1 illustrates one of the reservoir schedules given in Table 3. The capabilities of this schedule to meet the requirements are also compared. In this schedule, the Little Martins Creek Reservoir is constructed in two stages to meet make-up water requirements through 1993. The Equinunk Reservoir is built in 1993 to provide the additional needs through the year 2000.

TABLE 3

ALTERNATIVE 3 - COST OF SUPPLYING COOLING WATER REQUIREMENTS IN THE DELAWARE BASIN THROUGH ~~1980~~ 2000

Schedule & Scheme	Yield cfs	Construction Cost 1975 Prices	Cost Present Worth ** to Year 2000	Cost Per cfs
A. 1981-90 Mill Creek *	70	$ 52,000,000	$ 43,700,000	
1986-90 1st. Stage Little Martins Creek	100	51,300,000	44,500,000	
1990-2000 2nd. Stage Little Martins Creek	180	33,700,000	43,800,000	
1994-2000 1st. Stage Equinunk Creek	120	55,700,000	40,600,000	
Total	400		172,600,000	430,000
B. 1981-86 1st. Stage Little Martins Creek	100	51,300,000	53,900,000	
1986-2000 2nd. Stage Little Martins Creek	180	33,700,000	58,700,000	
1994-2000 1st. Stage Equinunk Creek	120	55,700,000	40,600,000	
Total	400		153,200,000	380,000
C. 1981-86 1st. Stage Equinunk Creek	80	54,800,000	56,100,000	
1986-91 2nd. Stage Equinunk Creek	140	61,500,000	57,600,000	
1991-2000 3rd. Stage Equinunk Creek	180	6,000,000	26,000,000	
Total	400		139,700,000	350,000
D. 1981-2000 Equinunk Creek	400	107,600,000	148,700,000	372,000

* It is assumed that the yield of Mill Creek site will be used by GPU for their proposed Berne Generating Plant in 1990. Present worth cost for this reservoir is based on annual charges to be paid to GPU.

** Includes PW of construction and O & M costs except for Mill Creek.

ADDITIONAL ENGINEERING REQUIRED

Studies of reservoir sites in the Delaware Basin to date have been based on topographic data shown on the U. S. Geological Survey maps with a scale of 1 inch = 2000 feet, field reconnaissance and other published data. These studies have been sufficient to indicate that the seven sites are attractive. Additional studies, engineering, and field data are necessary, however, before a reservoir project can be implemented. A schedule for the studies, designs, field data and construction was included in the May 1975 report.

TAMS estimated the cost of the engineering work needed for permit application which include completing the environmental report for the selected site to be about $475,000. The cost would be approximately the same regardless of the reservoir selected. It could, however, be greater if more than one reservoir must be constructed and if significant additional delays in the schedule are encountered.

REVISED SCHEDULE

A revised schedule showing in red a new timetable for the Site Selection Studies and Evaluation of Priority Site is shown as Enclosure 2. The revisions are based on beginning work about July 1, 1975 and completing these phases by January 1977, as originally scheduled. No revisions to the remaining phases of the work are required at this time.

The critical item for the revised schedule is the preparation of topographic maps. Aerial photos for the maps should be taken in the fall season when vegetation is minimum. The revised schedule is based on mid-November 1975, as the earliest date to make these photos. This will delay design studies needed for the evaluation of priority sites until early 1976.

Spring is the best period to make the environmental reconnaissance needed for the Site Selection Studies. A reconnaissance now, in conjunction with a thorough literature search should provide sufficient information for this phase of the studies.

The revised schedule shows 19 months for the initial two phases of the work. This is sufficient time to complete the engineering and other studies needed to obtain a permit for the project, should no unforeseen problems arise.

We would hope that once started, the studies would progress smothly according to the revised schedule. However, it is difficult at this time to foresee or anticipate delays that might arise because of the many public agencies which will be involved in the project formulation. Therefore, to preserve the remaining contingency time allowance in the schedule, we recommend that the studies begin as soon as possible. The initial work should include exploratory meetings with the DRBC to establish acceptable reservoir filling criteria.

Any substantial delay in beginning the next phase of the work could result in a crash program of engineering and construction to meet the scheduled date when cooling water make-up is required.

ENGINEERING COSTS

The $475,000 estimate for the engineering includes the foreseeable costs to complete the Site Selection Studies and the Evaluation of Priority Sites including subsurface exploration, surveying and environmental data collection. The only cost not included would be those incurred by the DRBEUG TAC or the individual power companies in their participation in the work.

A breakdown of the cost for these two phases is given in Enclosure 3. About 25 percent of the cost can be attributed to a continuation of the screening studies leading to selection of a single project and 75 percent to the design and the preparation of an environmental report for the selected project.

SCHEDULE FOR BUILDING A COOLING WATER SUPPLY RESERVOIR IN THE DELAWARE RIVER BASIN

Site Selection Studies — 6 Sites
Finalization of hydrologic and design criteria
Detailed geologic and environmental reconnaissance
Evaluation of land acquisition and relocation difficulties
Selection of 3 priority sites

Evaluation of Priority Sites
Preparation of topographic maps (from air photos)
Subsurface exploration including bore holes and seismic surveys
Collection of environmental data
Preparation of project layouts, designs and cost estimates
Selection of primary and secondary sites
Preparation of design report
Preparation of environmental report

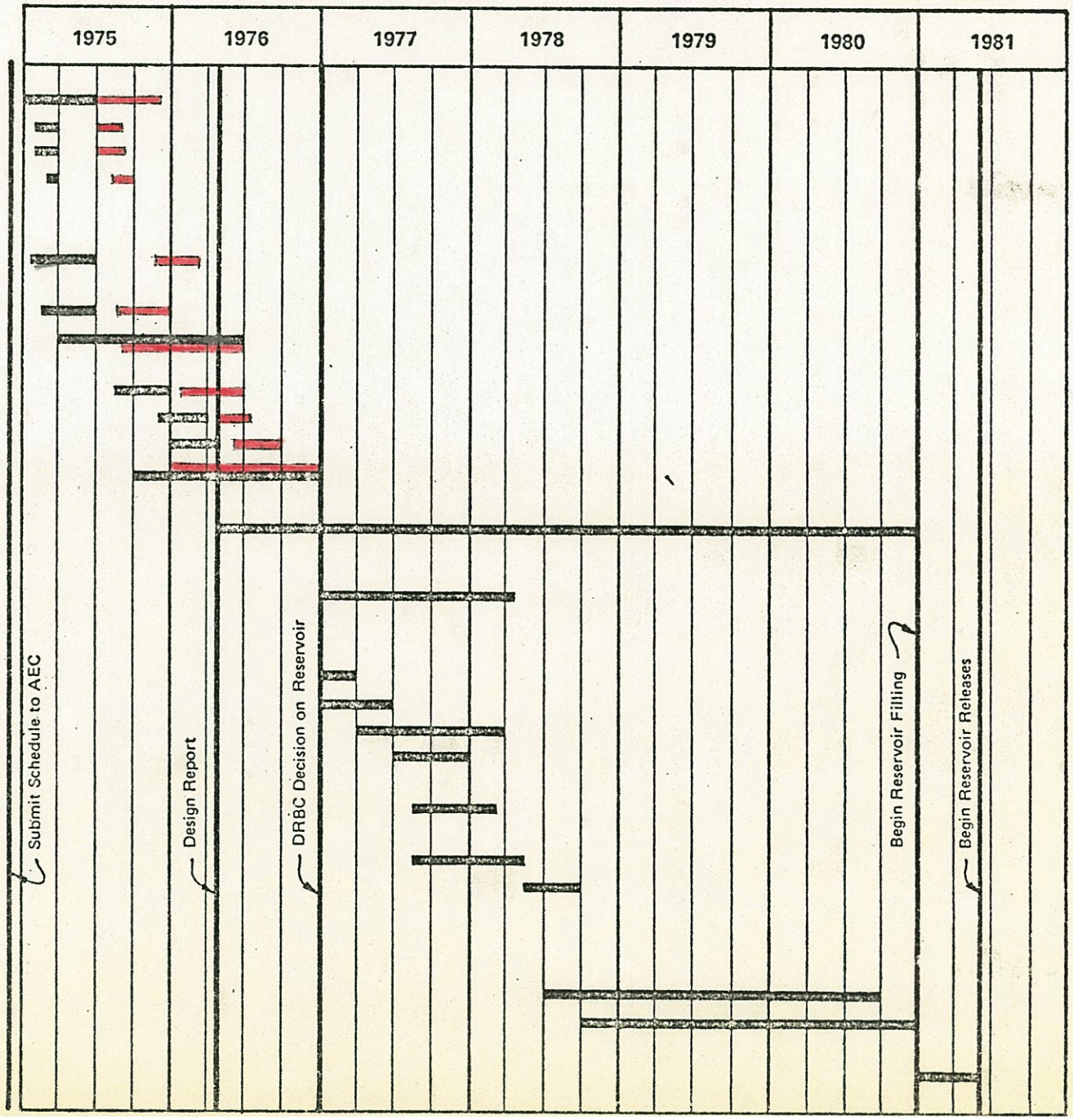
Land Acquisition

Project Review, Environmental Review and Issuance of Permits by Responsible Agencies

Preconstruction Engineering
Additional topography
Additional subsurface exploration
Detailed design of project facilities
Design of relocations
Preparation of bid documents for procurement of electrical and mechanical equipment
Preparation of bid documents for civil works construction
Bidding period and analyses of bids

Construction
Manufacturing and Installation of electrical and mechanical equipment
Civil works construction

Filling of Reservoir



ENCLOSURE 2

ENCLOSURE 5

January 28, 1975

COOLING WATER SUPPLY RESERVOIR

DELAWARE RIVER BASIN

SITE SELECTION, PRELIMINARY DESIGN AND ENVIRONMENTAL REPORT

COST ESTIMATE

Work Item	Man-Months	$
Site Selection Studies (7 Sites)		
Hydrologic & design criteria	3.0	13,500
Geologic & environmental reconnaissance	6.0	27,000
Land acquisition & relocations	2.0	9,000
Selection of 3 priority sites	1.0	4,500
	12.0	
Evaluation of Priority Sites (3 sites)		
Topographic maps - subcontract		40,000
Subsurface exploration - subcontract		54,000
- supervision	6.0	27,000
Collection of environmental data	6.0	27,000
Layouts, designs, cost estimates	25.0	112,500
Selection of site & design report	6.0	27,000
Environmental report	20.0	90,000
	63.0	
Project Coordination & Supervision	5.0	25,000
Travel and Other Direct Expenses		18,500
TOTAL:	80.0	$ 475.000

WHD
DRH

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS
345 PARK AVENUE, NEW YORK, N. Y. 10022

PARTNERS
LEONARD A. LOVELL, P. E.
WALTHER PROKOSCH, R.A.
JOHN LOWE, III, P. E.
WILSON V. BINGER, P. E.
ANDREW S. BALBIANI, P. E.
E. PER SORENSEN, P. E.
RAYMOND J. HODGE, P. E.
AUSTIN E. BRANT, JR., P. E.
JOHN E. BARDES, P. E.
ROBERT F. HEINS, P. E.
DANA E. LOW, P. E.
EUGENE O'BRIEN, P. E.
DONALD R. PEIRCE, R.A.

THEODORE T. KNAPPEN
(1942-1951)

CONSULTANTS
ERNEST F. TIPPETTS, P. E.
ROBERT W. ABBETT, P. E.
GERALD T. McCARTHY, P. E.
JAMES H. STRATTON, P. E.
EDWARD K. BRYANT, P. E.
FRANK LILIEN, P. E.
THOMAS J. FRATAR, P. E.
BARNETT SILVESTON, P. E.
FREDERICK J. CLARKE, P. E.

CONTROLLER
EDWARD T. SANDS, C. P. A.

May 19, 1975

Mr. David Helwig
Philadelphia Electric Company
2301 Market Street
Philadelphia, Pennsylvania, 19106

Dear Dave:

We confirm sending to you on May 8, 1975, by separate mail, 40 copies of the report "Alternative Water Supply Reservoirs" dated May, 1975.

As you suggested in the telephone conversation of May 8, with John Dixon, we have reviewed the Schedule for Building a Cooling Water Supply Reservoir in the Delaware River Basin. A revised schedule showing in red a new timetable for the Site Selection Studies and Evaluation of Priority Sites phases is enclosed.

The revisions are based on beginning work about June 1, 1975, and completing these phases on January 1, 1977 as originally scheduled. No revisions to the schedule for the remaining phases of the work are indicated at this time.

The critical item for the revised schedule is the preparation of topographic maps. Aerial photos for the maps should be taken in the fall to spring period when vegetation is minimum. It is too late this spring to do this work. The revised schedule is based on Mid November 1975, as the earliest date to make these photos. This will delay design studies needed for the evaluation of priority sites until early 1976.

Spring is the best period to make the environmental reconnaissance needed for the Site Selection Studies. A reconnaissance now, in conjunction with a thorough literature search should provide sufficient information for this phase of the studies.

The revised schedule shows 19 months for the initial two phases of the work. This is sufficient time to complete the engineering and other studies needed to obtain a permit for the project, should no unforeseen problems arise.

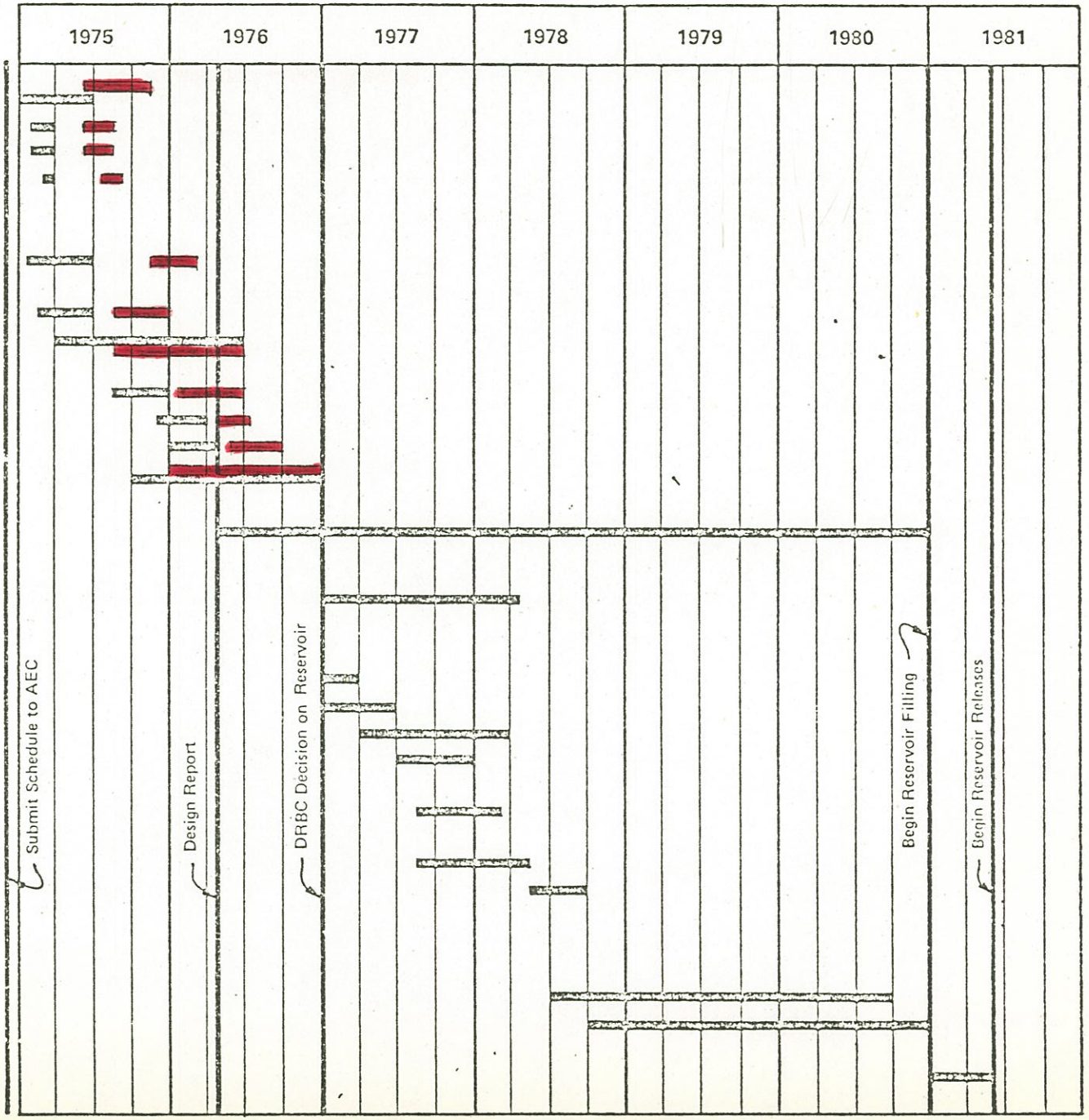
We would hope that once started, the studies would progress smoothly according to the revised schedule. However, it is difficult at this time to foresee or anticipate delays that might arise because of the many public agencies which will be involved in the project formulation. Therefore, to preserve the remaining contingency time allowance in the schedule, we recommend that the studies begin as soon as possible. The initial work should include exploratory meetings with the DRBC to establish acceptable reservoir filling criteria.

Very truly yours,

TIPPETTS-ABBETT-McCARTHY-STRATTON

Eugene O'Brien
Partner

SCHEDULE FOR BUILDING A COOLING WATER SUPPLY RESERVOIR IN THE DELAWARE RIVER BASIN



Site Selection Studies — 6 Sites
Finalization of hydrologic and design criteria
Detailed geologic and environmental reconnaissance
Evaluation of land acquisition and relocation difficulties
Selection of 3 priority sites

Evaluation of Priority Sites
Preparation of topographic maps (from air photos)
Subsurface exploration including bore holes and seismic surveys
Collection of environmental data
Preparation of project layouts, designs and cost estimates
Selection of primary and secondary sites
Preparation of design report
Preparation of environmental report

Land Acquisition

Project Review, Environmental Review and Issuance of Permits by Responsible Agencies

Preconstruction Engineering
Additional topography
Additional subsurface exploration
Detailed design of project facilities
Design of relocations
Preparation of bid documents for procurement of electrical and mechanical equipment
Preparation of bid documents for civil works construction
Bidding period and analyses of bids

Construction
Manufacturing and Installation of electrical and mechanical equipment
Civil works construction

Filling of Reservoir

D R A F T

July 1975

Mr. W. A. Verrochi, Chairman
Managing Committee, DRBEUG
GPU Service Corporation
260 Cherry Hill Road
Parsippany, New Jersey 07054

Dear Mr. Verrochi:

At a meeting in Atlantic City on July 1, 1975, the Technical Advisory Committee of DRBEUG voted to recommend to the Managing Committee that (1) the subcommittee report regarding reservoir contingency plans, contained in a letter dated _____, be accepted, (2) authorization be given to proceed with the next phase of the contingency plan study, namely, the evaluation of priority sites, under a contract with TAMS, containing provisions limiting the total payment to $475,000 and requiring that the work be completed by _____, (3) the administration of such contract be assigned to TAC (including the authority to assign certain phases of such administration to appropriate subcommittees), (4) the cost of the evaluation of priority sites be allocated among the DRBEUG companies in proportion to the product of (a) the present-worth factor relating 1976 to the dates, as set forth by the Master Siting Study or the PJM Load and Capacity Forecast, of plant startup and (b) their consumptive use of the fresh-water flow of the Delaware River (except for that use for which other compensating storage will be provided by the using company), and (5) the evaluation of priority sites include an optimization of the degree of development of at least the selected and the next-best sites.

Yours truly,

J. K.

Mtg July 1 - DRBC-TAC
Atlantic Electric

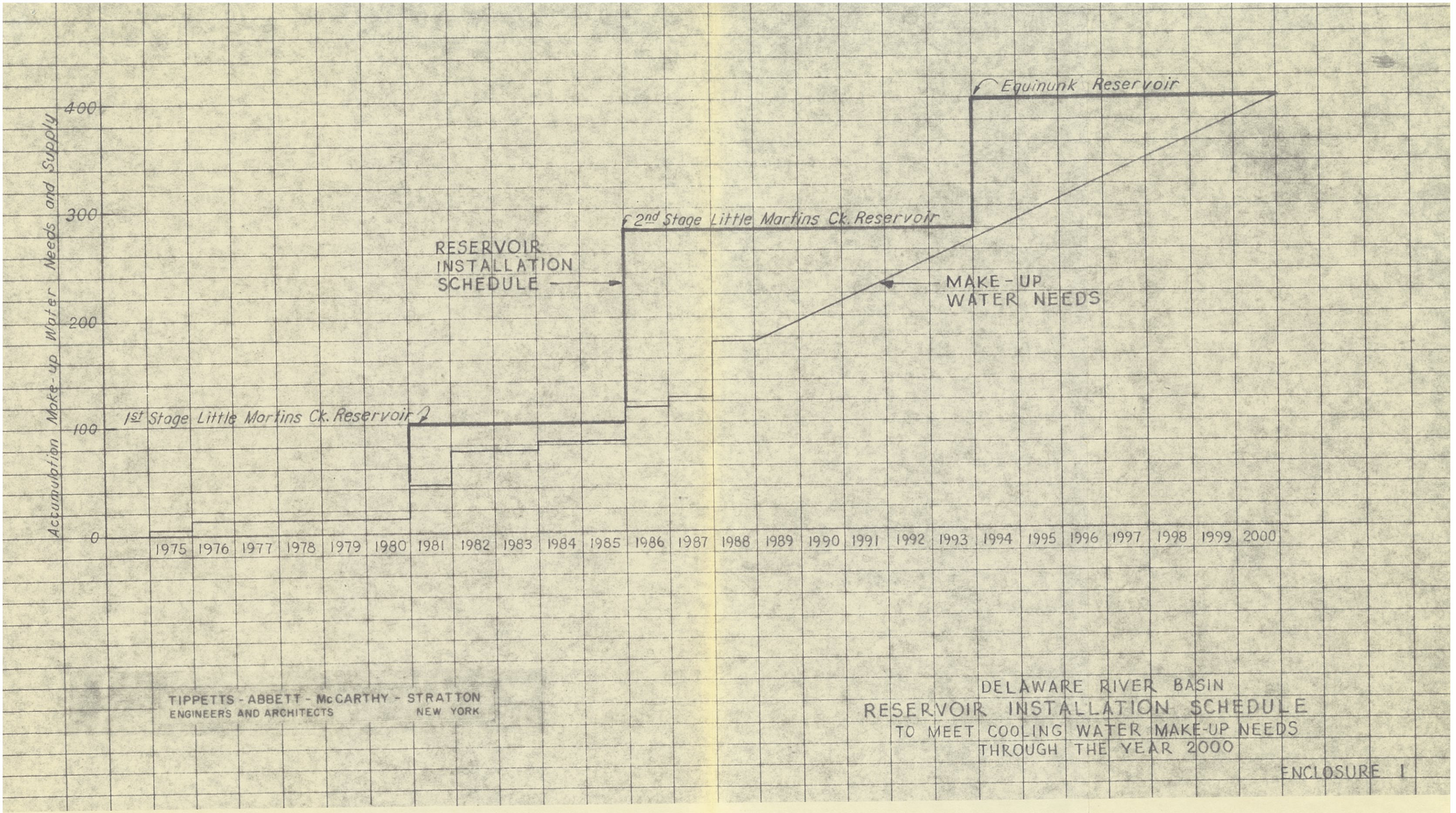
Reservoirs

Mochel - Phila Elec is in a jam
- do we build small or large reservoir?

Ley - confidentiality - mandate from Managing Comm.

Helwig -
favorable appeals board decision - from AEC -
DRBC recognized for all water supply matters.
Jan 1, 1977 - DRBC decision
10/80 Limerick - DRBC docket
↑ initial power

PE wants 4/81 - commercial operation - PE will discuss with DRBC.



TIPPETTS - ABBETT - McCARTHY - STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

DELAWARE RIVER BASIN
RESERVOIR INSTALLATION SCHEDULE
TO MEET COOLING WATER MAKE-UP NEEDS
THROUGH THE YEAR 2000

ENCLOSURE 1