NUREG-0564

Draft Supplement to the DRAFT ENVIRONMENTAL STATEMENT

related to operation of

SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2
PENNSYLVANIA POWER AND LIGHT COMPANY
ALLEGHENY ELECTRIC COOPERATIVE, INC.

Docket Nos. 50-387
and 50-388

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U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
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NUREG-0564
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DRAFT SUPPLEMENT

TO THE

DRAFT ENVIRONMENTAL STATEMENT

BY THE

U. S. NUCLEAR REGULATORY COMMISSION

FOR

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SUMMARY AND CONCLUSIONS

This Supplement to the Draft Environmental Statement was prepared by the U.S. Nuclear Regulatory Commission (NRC), Office of Nuclear Reactor Regulation (the staff).

1. The action is administrative.

2. The proposed action is the issuance of construction permits by local, state, and federal agencies (including the Susquehanna River Basin Commission, SRBC) for the construction of a water storage reservoir in the Pond Hill Creek drainage basin. The proposed site is located on a small tributary of the Susquehanna River in Conyngham Township, Luzerne County, Pennsylvania. The site is approximately 11 km northeast of the borough of Berwick, Pennsylvania, and about 3.7 km northeast of the Susquehanna Steam Electric Station (SSES), now under construction. The purpose of the proposed reservoir is to supply water to the Susquehanna River during periods of low riverflow to replace the water consumptively used by SSES.

   Action by the NRC is not required for the issuance of construction permits for this reservoir. This Environmental Statement has been prepared by the Nuclear Regulatory Commission to describe the environmental impacts of construction and operation of the Pond Hill Reservoir since the facility is associated with the operation of the Susquehanna Steam Electric Station.

   The facility will consist of an earth and rockfill dam constructed across the valley, about 1.3 km east of the Susquehanna River, a spillway, an inlet-outlet structure, a pipeline, and a pumping station. The dam would be about 730 m in length at crest level; the maximum height above the streambed will be about 67 m. Normal water storage capacity of the reservoir would be about 30×10^6 m^3 (24,100 acre-feet), of which about 90% (27,000,000 m^3), will be available for augmentation flow. The water area of the reservoir will be about 128 ha at the design normal water level of 299 m MSL.

3. The information in this statement represents an assessment of the environmental impacts associated with the construction of the Pond Hill Reservoir, pursuant to the guidelines of the National Environmental Policy Act of 1969 (NEPA) and 10 CFR 51 of the Commission's regulations. The staff has reviewed the impacts that would occur due to the construction and operation of the reservoir. The staff's analysis is based on a review of material supplied by the applicant, Pennsylvania Power & Light Co. (PP&L); a review of other material secured independently; a visit to the proposed and four of the alternate sites; and discussions with various state, local, and federal officials. The potential impacts, both beneficial and adverse, are summarized as follows:

   a. The valley and Pond Hill Creek will be permanently altered.

   b. Approximately 525 ha of land will be dedicated to the reservoir for the life of the facility.

   c. About 2.3 km of Pond Hill Creek will be converted from a free-flowing stream to a reservoir; the 1.3-km section of the creek below the dam will be converted from a free-flowing, sometimes intermittent, stream to a partially regulated stream with a minimum flow maintained by releases from the reservoir.

   d. As much as 195 ha of terrestrial environment may be directly affected and variously altered due to development of the Pond Hill Reservoir. About 128 ha of forested area will be inundated. Impoundment structures will occupy about 16 ha. Most of the remaining disturbed area will be reclaimed and landscaped following construction.

   e. Vegetation in the areas covered by water and structures will be converted into habitat for aquatic biota.

f. Some wildlife mortality will occur as the result of construction activities and the initial filling of the reservoir; in addition, some animals will be displaced from affected areas. Adverse effects on terrestrial wildlife will be variously offset by reclamation of disturbed areas, creation of aquatic habitat, and the implementation of a wildlife habitat improvement program.

g. Land-clearing and construction activities will temporarily cause locally increased levels of noise as well as emissions of smoke and dust. Some soil erosion will occur despite the implementation of control measures. Also, topsoil materials used in reclamation will have undergone adverse physical and chemical changes that may be reflected by reduced future productivity of the affected areas.

h. Fluctuating water levels, to the extent the project is used for low-flow augmentation, will result in exposed areas and will alter some of the aquatic habitat created by the dam for the period of drawdown and refill.

i. There will be a temporary increase in highway traffic due to workers commuting to and from the area during construction and to trucks bringing in construction materials and supplies and removing refuse.

j. The water quality of Pond Hill Creek below the reservoir will generally be lower than that prior to reservoir establishment.

k. Based on the droughts of record, the discharge and storage capacities of the reservoir are greater than those required to provide augmentation water to the Susquehanna River as a result of SSES operation.

l. About 145 ha of land will be converted from their present use to certain recreational uses, such as hunting and hiking. The reservoir may be developed for certain water recreational activities, such as non-power boating and fishing.

m. As a result of reservoir development, an increase in waterfowl and aquatic and shoreline wildlife may occur.

n. Minor changes in local demography, settlement patterns, and sociocultural structures will result from the construction and operation of the reservoir.

4. The following federal, state, and local agencies will be asked to comment on the Supplement to the Draft Environmental Statement:

Susquehanna River Basin Commission
Advisory Council on Historic Preservation
Department of Agriculture
Department of the Army, Corps of Engineers
Department of Commerce
Department of Health and Human Services
Department of Housing and Urban Development
Department of the Interior
Department of Transportation
Department of Energy
Environmental Protection Agency
Federal Energy Regulatory Commission
Pennsylvania State Clearinghouse
Pennsylvania Department of Environmental Resources
Luzerne County Planning Commission
Economic Development Council of Northeastern Pennsylvania
Board of Supervisors, Berwick

5. This Supplement to the Draft Environmental Statement was made available to the public in March 1980.

6. On the basis of the analysis and evaluation set forth in this statement, and after weighing the environmental, economic, technical, and other benefits against environmental costs and after considering available alternatives it is concluded that the construction of the Pond Hill Reservoir is an acceptable method for complying with the low-flow water use requirements of the Susquehanna River Basin Commission. The staff's assessment indicates that the

environmental and other impacts of the reservoir will be minimal and is subject to the following commitment for the protection of the environment:

> The potential exists that unknown cultural resource sites may be destroyed by direct and/or indirect construction and operational activities. Prior to construction, the applicant is committed to carry out an archeological survey. If cultural resources are identified, the applicant is committed to take preventive measures to protect the resources. The applicant's proposed program is given in Appendix B.

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FOREWORD

This Supplement to the Draft Environmental Statement was prepared by the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation (the staff), in accordance with the Commission's regulation, 10 CFR 51, which implements the requirements of the National Environmental Policy Act of 1969 (NEPA).

NEPA states, among other things, that it is the continuing responsibility of the federal government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate federal plans, functions, programs, and resources to the end that the nation may:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
- Assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings.
- Attain the widest range of beneficial uses of the environment without degradation risk to health or safety, or other undesirable and unintended consequences.
- Preserve important historic, cultural, and natural aspects of the national heritage, and maintain, wherever possible, an environment that supports diversity and variety of individual choice.
- Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities.
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Further, with respect to major federal actions significantly affecting the quality of the human environment, Section 102(2)(C) of NEPA calls for preparation of a detailed statement on:

(i) the environmental impact of the proposed action

(ii) any adverse environmental effects that cannot be avoided should the proposal be implemented

(iii) alternatives to the proposed action

(iv) the relationship between local short-term uses of the human environment and the maintenance and enhancement of long-term productivity

(v) any irreversible and irretrievable commitments of resources that would be involved in the proposed action, should it be implemented

An environmental report accompanies each application for a construction permit. A public announcement of the availability of the report is made. Any comments on the report by interested persons are considered by the staff. In conducting the required NEPA review, the staff meets with the applicant to discuss items of information in the environmental report, to seek new information from the applicant that might be needed for an adequate assessment, and generally to ensure that the staff has a thorough understanding of the proposed project. In addition, the staff seeks information from other sources that will assist in the evaluation and visits and inspects the project site and surrounding vicinity. Members of the staff may meet with state and local officials who are charged with protecting state and local interests. On the basis of all the foregoing and other such activities or inquiries as are deemed useful and appropriate, the staff makes an independent assessment of the considerations specified in Section 102(2)(c) of NEPA and 10 CFR 51.

This evaluation leads to the publication of a draft environmental statement, prepared by the Office of Nuclear Reactor Regulation, which is then circulated to federal, state, and local governmental agencies for comment. A summary notice of the availability of the applicant's environmental report and the draft environmental statement is published in the Federal Register. Interested persons are also invited to comment on the proposed action and the draft statement. Comments should be addressed to the Director, Division of Site Safety and Environmental Analysis, at the address shown below.

After receipt and consideration of comments on the draft statement, the staff prepares a final environmental statement, which includes a discussion of questions and objections raised by the comments and the disposition thereof; a final benefit-cost analysis, which considers and balances the environmental effects of the facility and the alternatives available for reducing or avoiding adverse environmental effects with the environmental, economic, technical, and other benefits of the facility.

This environmental review deals with the impact of construction and operation of the Pond Hill Reservoir on the environment. This evaluation is based on information supplied by the applicant, Pennsylvania Power & Light Company, in Appendix H to the Environmental Report for the Susquehanna Steam Electric Station (May 1979) and other documents, a visit to the site of the proposed reservoir (and four of the alternate sites), and meetings with state and local officials.

No NRC action is required prior to the start of construction or operation of this facility, since the nuclear power plant can be granted an operating license without the reservoir. Prior to start of construction, the applicant will obtain the necessary permits from state, local and federal agencies, such as the Susquehanna River Basin Commission (SRBC), U.S. Corps of Engineers (COE), and the U.S. Environmental Protection Agency (EPA).

Copies of this statement are available for inspection at the Commission's Public Document Room, 1717 H Street NW, Washington, DC, and at the Ousterhout Free Library, Reference Department, 71 South Franklin Street, Wilkes Barre, PA. Single copies of this statement may be obtained by writing to:

Director, Division of Site Safety
and Environmental Analysis
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Mr. S. Singh Bajwa is the NRC Environmental Project Manager for this project. Mr. Bajwa may be contacted at the above address or at 301/492-8441.

1. INTRODUCTION

1.1 HISTORY

Makeup water for the two nuclear reactors of the Susquehanna Steam Electric Station (SSES) will be withdrawn from the Susquehanna River. When construction permits CPPR-101 and CPPR-102 were issued on 2 November 1973, there were no restrictions on the amount of water that could be consumptively used by SSES. Water uses and withdrawals in the Susquehanna River Basin are controlled by the Susquehanna River Basin Commission (SRBC). This commission, formed by a compact between the states of New York, Pennsylvania, and Maryland and the federal government, issued new rules in 1976 prohibiting large water users, such as the applicant, from withdrawing water from the river and using it consumptively during periods of low riverflow without returning to the river, from offstream storage reservoirs, water at a rate equal to actual consumptive losses. The cutoff point for limiting withdrawals has been set by the SRBC as the consecutive seven-day low flow to be expected every ten years (called the Q7-10 flow rate).

The SRBC has determined that, based on 80 years of riverflow data, the Q7-10 value applicable to SSES is 22.7 m^3/s, as measured at the Wilkes-Barre gauge (letter from R. J. Bielo, SRBC, to W. H. Regan, Jr., NRC, 30 August 1979).

The applicant has considered three alternatives for meeting the low-flow augmentation requirements of SRBC:

1. Not to operate the plant whenever riverflow is at or below the Q7-10 value.

2. To purchase the required water from an existing reservoir.

3. To construct its own water storage reservoir.

Option 1, called "river following," would require replacement electrical-generating capacity, either from other Pennsylvania Power & Light facilities or from the PJM* grid.

The applicant has examined the relative merits of these three alternatives and has concluded that the most economically desirable and most reliable means of meeting the low-flow augmentation requirement would be by the construction of a new reservoir owned and controlled by PP&L.

After examining 13 sites along the Susquehanna River, the applicant selected a small unnamed valley on the east bank of the river about 3.7 km upstream of SSES as the site for the proposed reservoir. The valley contains a small creek that flows intermittently and is near the settlement of Pond Hill. The company has named the proposed facility "Pond Hill Reservoir."

1.2 PERMITS AND LICENSES

The NRC has no legal authority for the issuance or denial of any permit to construct or operate a water storage reservoir, since SSES can be granted an operating license without such a facility.

The NRC has reviewed the applicant's request to build an offstream water storage reservoir and has prepared this supplemental Draft Environmental Statement, Pond Hill Low-Flow Augmentation Reservoir, Construction Phase (DES-PH-CP) to describe the environmental impacts of the proposed facility as well as alternatives to the proposed action.

In March 1979 the applicant submitted an application to the SRBC to build the Pond Hill Reservoir; to date the Commission has not completed its review of the application. The applicant will obtain the necessary permits from state and local officials. The proposed facility is in Conyngham Township, Luzerne County, Pennsylvania.

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*Interconnection Group located in Pennsylvania, New Jersey, and Maryland.

2. THE SITE AND ITS ENVIRONS

2.1 PLANT LOCATION

The site of the proposed Pond Hill Reservoir is a small valley drained by a small tributary of the Susquehanna River, about 3.7 km upstream of SSES (Fig. 2.1). The site is about 24 km southwest of the city of Wilkes-Barre and 11 km northeast of the Borough of Berwick, PA. The site is about 32 river kilometers downstream of Wilkes-Barre. The creek draining this valley is not named on detailed U.S. Geological Survey maps (Nanticoke 7.5 minute U.S.G.S. Quadrangle), but is known locally as Catfish Creek. Figure 2.2 is a plan view of the proposed project, showing the location of various structures as well as high and low water levels in the proposed reservoir.

The site of the proposed facility is in Conyngham Township of Luzerne County. Since the creek and valley are located just north of the settlement of Pond Hill, the applicant has used the terms Pond Hill Reservoir for the water storage facility and Pond Hill Creek for the tributary.

The coordinates of the site are 40°8'N, 76°7'W. Present access to the site is over secondary roads through the settlement of Pond Hill.

The north slope of the valley is steep, with a ridge rising from about 215 m to 245 m above the valley floor (see Figs. 2.2 and 2.3). The south slope of the Pond Hill Creek drainage area is flatter, with a ridge line about 60 to 90 m above streambed.

State Highway 239 parallels the Susquehanna River just to the west of the site and connects the villages of Wapwallopen and Mocanaqua. The Pennsylvania Department of Transportation estimated that the average daily traffic on this stretch of Route 239 was 1550 cars/day in 1978. Local Road 40120 is the primary access road from Route 239, the Pond Hill Reservoir site, the settlement of Pond Hill, and the Lily Lake community bordering the lake; estimated usage in 1978 was 750 cars/day.

The Delaware and Hudson Railroad runs a single-track, north-south line parallel to the river just to the west of State Route 239. Maximum daily use of this line is four trains per day.

2.2 LAND USE

Although the exact site boundaries (and, therefore, the site area) have not yet been established, the area of the site is expected to be about 525 ha. The tentative site boundaries are shown in Fig. 2.3; this figure also shows local roads, local topography, and the settlements of Pond Hill and Lily Lake.

One unoccupied structure lies within the proposed site area. There are no inhabited structures.

About 93% of the site is presently covered with second-growth forests and about 7% consists of old fields and croplands. Less than 1% of the area is classified as wetlands.

Recreational use of the site includes walking, hiking, nature study, and hunting. Fishing is not now possible since the stream does not support a viable gamefish population.

2.3 METEOROLOGY AND HYDROLOGY

2.3.1 Meteorology

Since the site of the proposed reservoir is less than 4 km northeast of the site of SSES, meteorological and climatological conditions of the site are the same as those given in Section 2.4 of the Draft Environmental Statement for SSES.

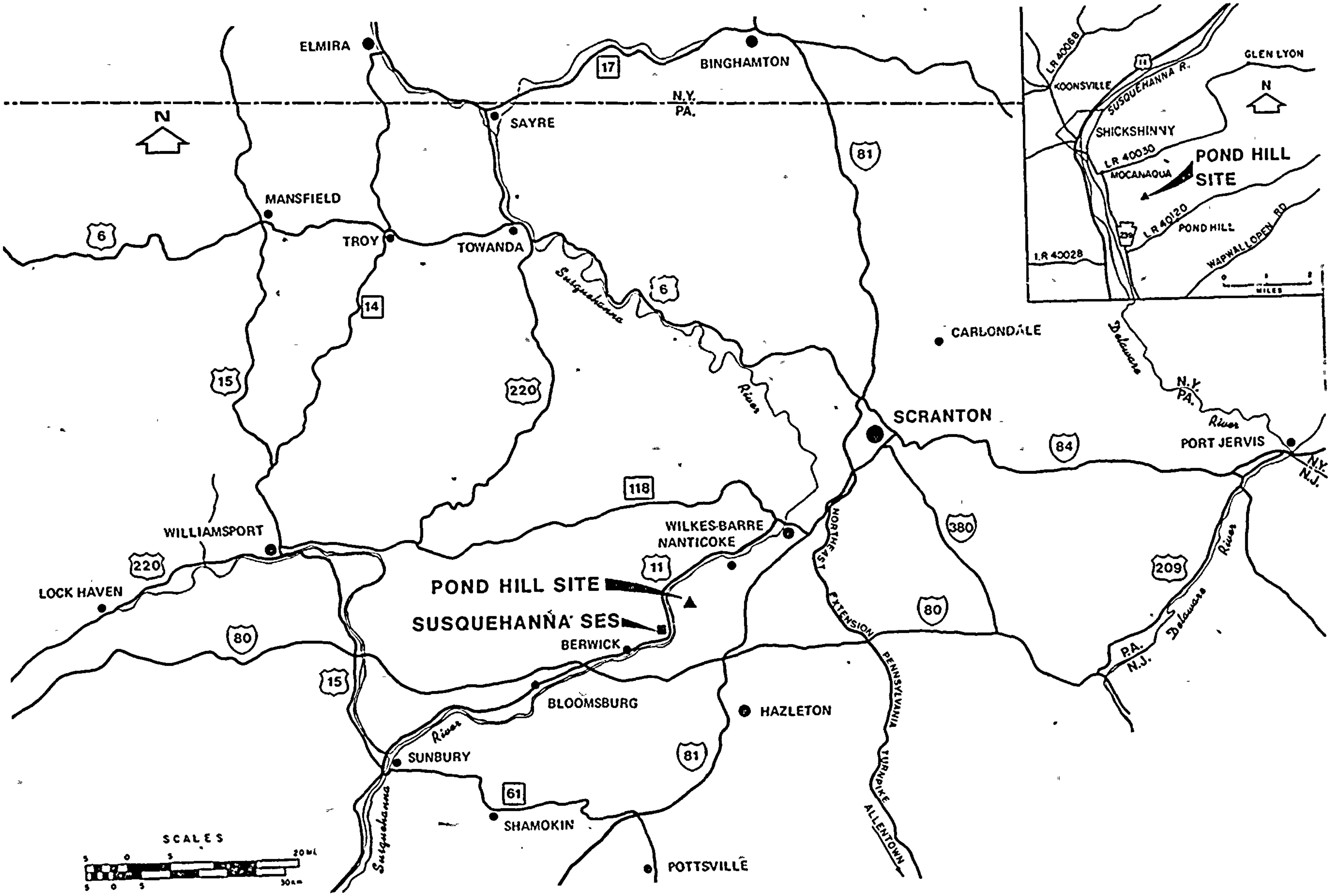


Fig. 2.1. Pond Hill Reservoir Site Location

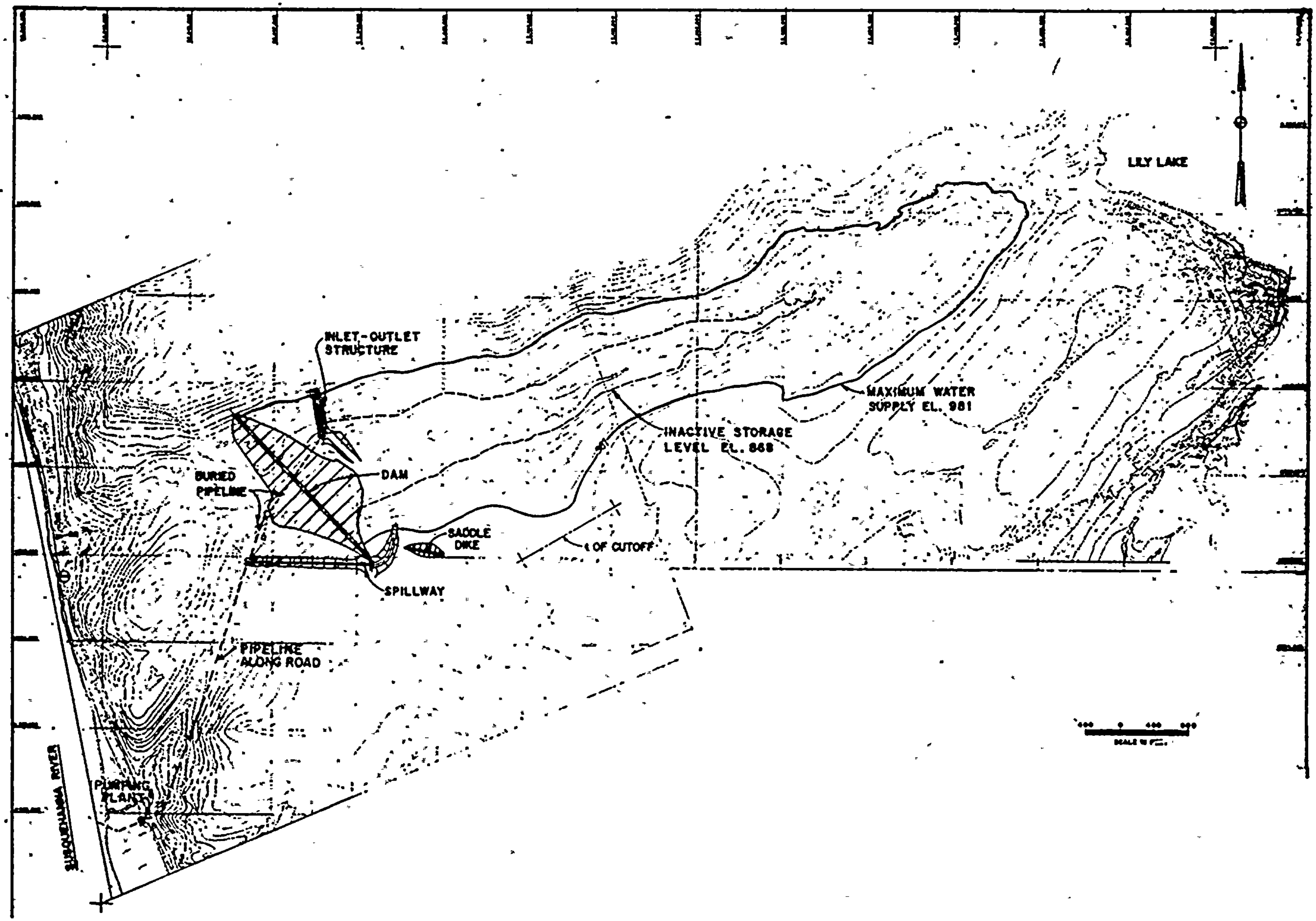
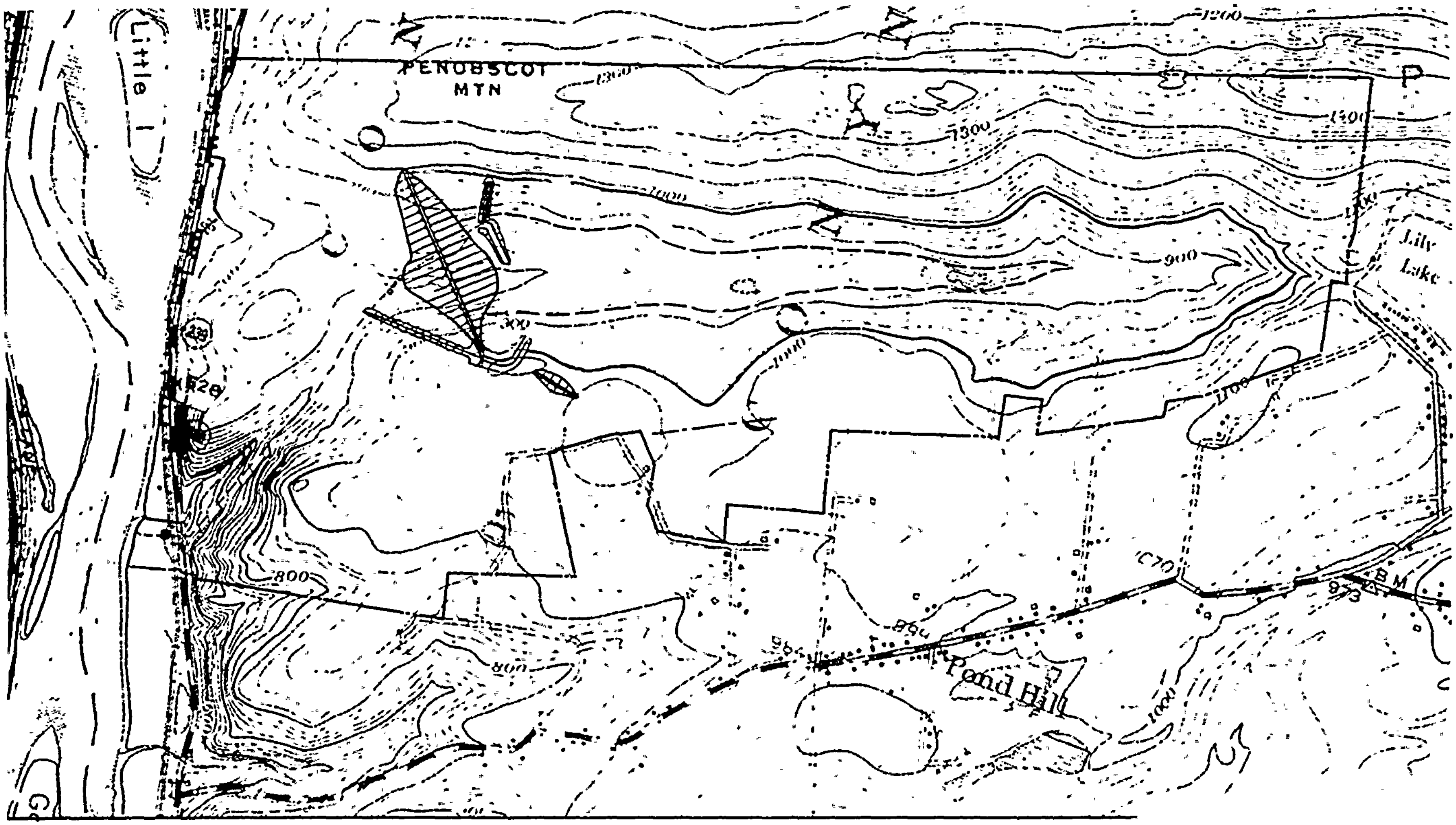


Fig. 2.2. General Plan of the Pond Hill Reservoir Project



MINIMUM POOL ELEVATION
RESERVOIR MAXIMUM WATER SUPPLY ELEVATION
SITE PERIMETER

Fig. 2.3. Land Requirements for the Pond Hill Reservoir Project

2.3.2 Hydrology

Pond Hill Creek is a small stream with headwaters approximately 1.3 km north of the town of Pond Hill. The stream flows westerly for 3.5 km to its confluence with the Susquehanna River, 3.7 km upstream from the Susquehanna Steam Electric Station. There are no significant tributaries to Pond Hill Creek. During dry periods, the streamflow decreases and some sections become essentially intermittent, with water remaining only in the streambed interstices. The proposed reservoir will inundate a 2.3-km (64%) upstream section of the stream, leaving 1.3 km from the dam to the Susquehanna River. For purposes of this discussion, the flooded stream and lower, unflooded section are referred to as the "upper" and "lower" portions of Pond Hill Creek, respectively.

The upper section of Pond Hill Creek has an average 11 m/km stream gradient. Throughout most of this section, the stream alternates between small-pool and riffle habitats, with a substrate of boulders, rubble, and some bedrock. This pattern is interrupted in two areas, which were previously inundated as a result of beaver dams. In these areas, the streambed is mostly silt, mud, and gravel. Thus, the resultant stream habitat becomes a long, continuous run. The upper stream has a 2.1-m average width, with measurements ranging from 0.8 to 3.6 m throughout the year. The average depth is approximately 0.1 m, with a total range of from 0.03 to 0.39 m. Current velocities average 0.005 m/s, ranging from 0.003 to 0.02 m/s.

The lower section of Pond Hill Creek has a much steeper gradient; the average stream gradient in this section is about 70 m/km. The 2.6-m average stream width ranges from 0.9 to 4.2 m, and the average depth is approximately 0.1 m, with a minimum of 0.03 and a maximum of 0.39 m. Current velocities average roughly 0.007 m/s, ranging from 0.003 to 0.02 m/s. Characteristically, the stream substrate is bedrock and boulders along with some rubble and isolated patches of gravel. Because of the sharp gradient, stream habitats are typically shallow, fast-flowing riffles interspersed with small pools. There are several small, and one relatively large, waterfalls in this part of the stream. In addition, at Route 239, the stream passes through a culvert and falls about 1.5 m from the elevated culvert back into the stream channel.

Since there are neither extensive nor accessible published data concerning the aquatic ecology of Pond Hill Creek, information presented in the following sections was gathered from field surveys conducted by the applicant from September 1977 to August 1978 (ER-OL, Section 3.2.3.1.1). The locations of the water quality and biological sampling stations used at Pond Hill Creek are presented in Figure 2.4. Water quality samples were taken monthly at the site, and biological samples were collected quarterly. In addition, a fish sample was taken from three small farm ponds, which are located at the site and drain into Pond Hill Creek.

The drainage area of the stream above the proposed site of the dam is 329 ha. Because there is no gauging station on the stream, no information on historic flows is available. The applicant did, however, estimate flood flows using standard hydrologic methods. The estimated 4% chance (25-year recurrence) flood flow is 39.3 m^3/s, the 1% chance (100-year) flood flow is 49.7 m^3/s, and the estimated probable maximum flood flow is 202 m^3/s. In addition, the methodology utilized by the Pennsylvania Department of Environmental Resources (DER) to estimate the seven-day ten-year low flow results in a flow of 0.005 m^3/s. It is probable, however, that the stream does not flow at all during drought periods. The hydrology of the Susquehanna River is discussed in the DES for the Susquehanna Steam Electric Station (SSES).

The floodplain of Pond Hill Creek below the proposed site of the dam is very narrow (Fig. 2.5). The floodplain of the Susquehanna River in the vicinity of the proposed location of the pumping station is also shown in Figure 2.5.

Data from borings and wells indicate that the groundwater contours in the vicinity of the proposed reservoir generally follow the surface contours. On the ridges north and south of the stream channel, groundwater was usually encountered between 4 and 15 m below the surface. The stream valley contains several marshes, springs, and farm ponds.

2.3.3 Water Sources

At present there are no users of Pond Hill Creek water. Most of the nearby residences obtain water from individual wells. There are no wells within the proposed project boundary.

2.4 GEOLOGY AND SEISMOLOGY

2.4.1 Geology

The proposed Pond Hill Reservoir site is located in the Penobscot Mountain area in the northern portion of the Valley and Ridge Physiographic Province. The province is characterized by intensely

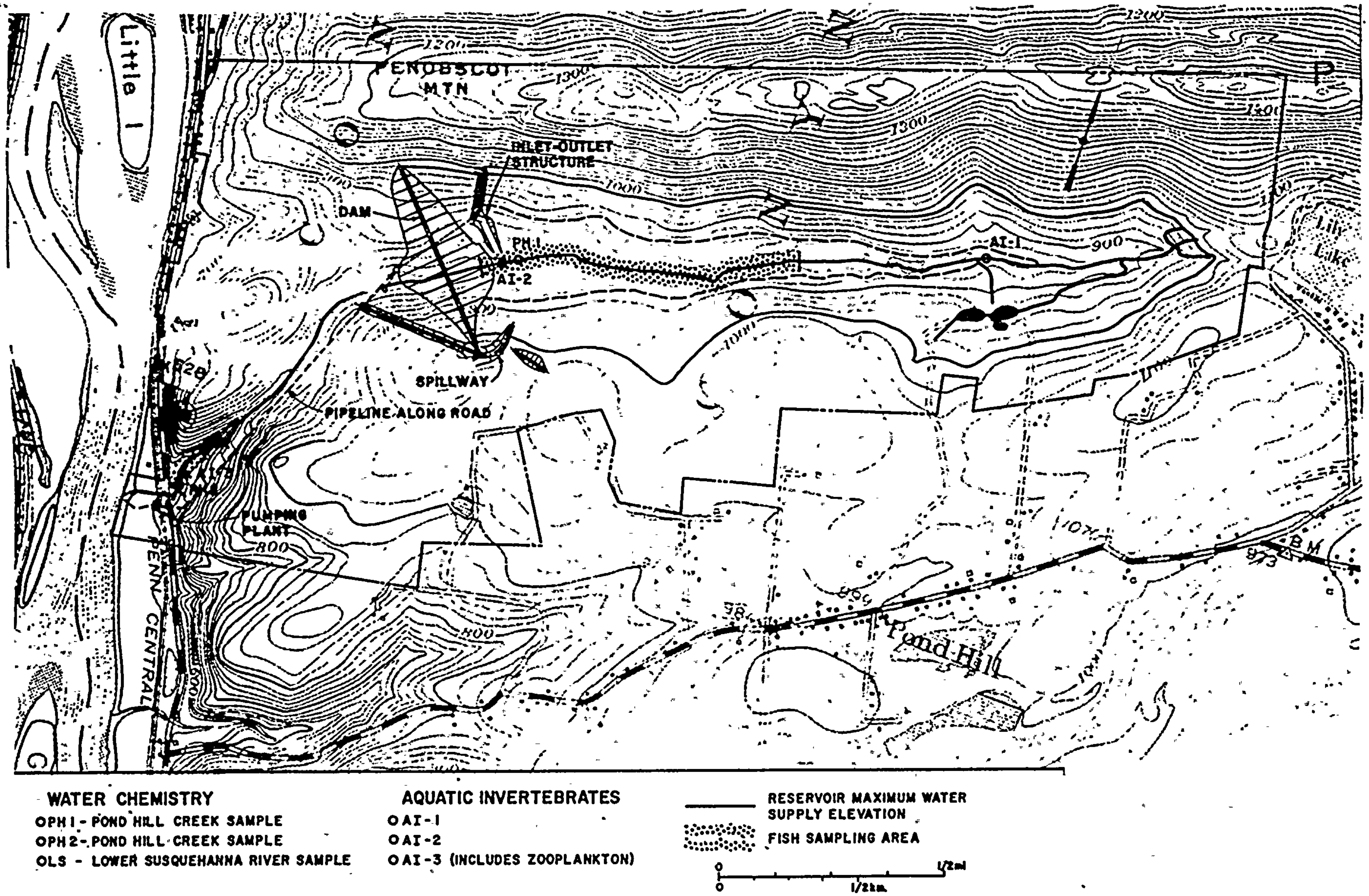


Fig. 2.4. Water Quality and Aquatic Life Sampling Stations at Pond Hill Creek. (Source: Tippetts-Abbett-McCarthy-Stratton/Engineering and Architects.)

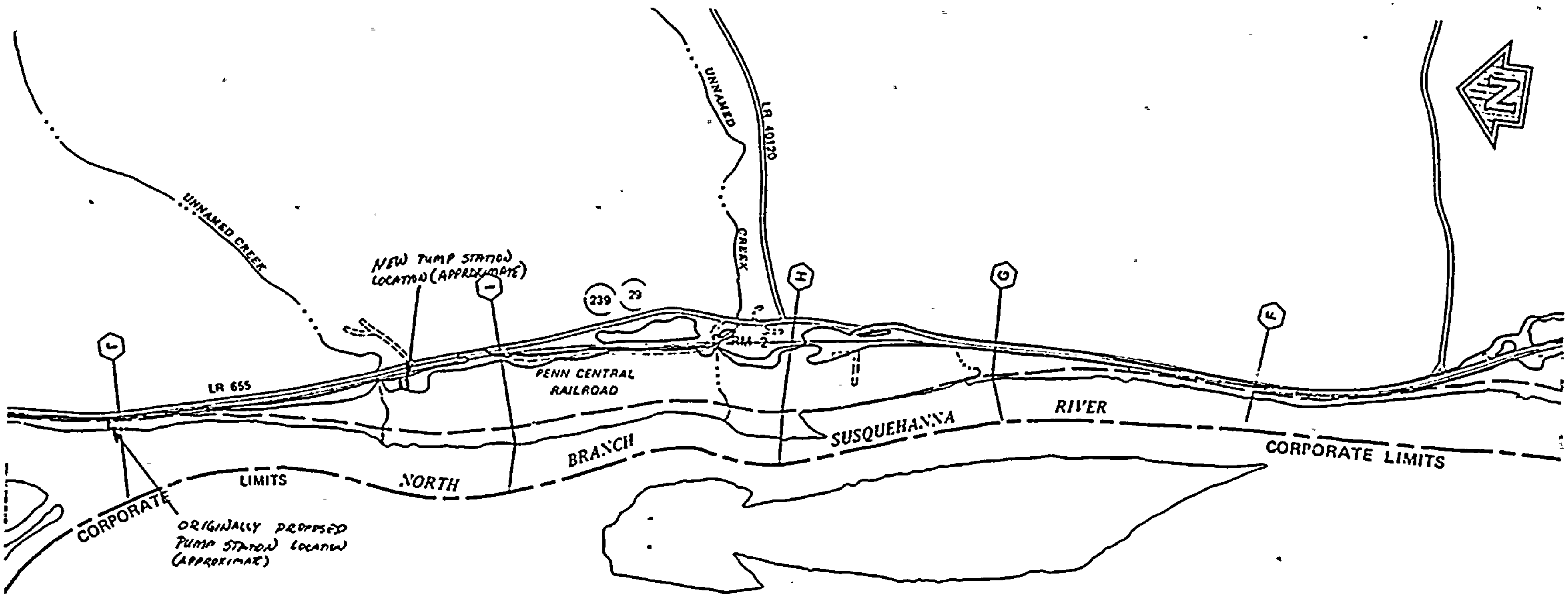


Fig. 2.5. Floodplain of the Susquehanna River in the Vicinity of the Pond Hill Site.

faulted and deeply eroded sedimentary rocks of Paleozoic age. Topographically, erosion-resistant sandstone formations form long narrow ridges; valleys were formed in the less resistant limestones and shales.

During the Paleozoic era, the Appalachian Mountain region was a depositional basin collecting thick sediments. Sedimentation was interrupted several times by mountain-building activities climaxing in the Appalachian Mountains toward the end of the era. Since that time, the primary ongoing geologic process has been erosion.

The reservoir site is in an area that was glaciated during the last ice age, the Pleistocene Epoch. As a result, the highly weathered rocks (parent material) and original soil were removed; the present soils are typical of those formed in glaciated regions.

Bedrock in the reservoir area consists of sandstone, siltstone, and shale of the Catskill formation of Devonian age. To the north, the Catskill formation is overlain by younger Mississippian and Pennsylvania formations including anthracite coal beds. To the south, the Catskill formation is underlain by older sedimentary rocks.

The strike of the formations is N 68 degrees E, and dip is northwesterly at angles from about 40 to 60 degrees, averaging about 45 degrees. Jointing is evident and primarily parallels the bedding, although a few low and high angle joints are also present. Joints in the weathered zone are filled with clay. Below the weatherbed zone, the joints are generally tight; some have been healed with calcite.

2.4.2 Seismology

The site is located in Zone 1 (minor damage) on the Seismic Risk Map of the Conterminous United States.[1] The site is about 160 km from the nearest Zone 2 (moderate damage) boundary and 210 km from the nearest Zone 3 (major damage) boundary.

Records of earthquake history in the site region were examined together with an evaluation of regional and local geologic structures to estimate the seismic risk at the site. This analysis resulted in a recommended design basis seismic coefficient of 0.025.

Several Intensity VI (Modified Mercalli Scale) earthquakes have been recorded within 160 km of the site. Many of these were not felt at the site; others were felt at the site with intensities equal to or less than IV.

No known faults have been identified in the vicinity of the site. Although low angle thrust faults abound in this part of the Valley and Ridge Province, they ordinarily cannot be identified except through detailed mapping. Thrust faults, however, are not generally associated with recurring seismic activity.

Reservoir-induced earthquakes are not anticipated as the proposed reservoir is small and there are no known subsurface structural weaknesses.

On the basis of this assessment, the seismic coefficient of 0.05 that has been used in the design of project features is considered by the staff as conservative.

2.5 SITE ECOLOGY

2.5.1 Terrestrial Ecology

The north and south boundaries of the Pond Hill site generally parallel the upper ridges of a small, steep-walled valley; thus the environmental conditions at given locations within the site strongly reflect the influence of the local topography (see Fig. 2.3). The occurrence of aquatic environments is essentially limited to the narrow valley bottom traversed by Pond Hill Creek, a small drainageway that converges with the Susquehanna River near the west boundary of the site. In general, soil moisture levels in terrestrial environments decrease at increasing distances normal to Pond Hill Creek. However, the topographic influence on local soil moisture gradients is most pronounced in the northern portion of the site, where the valley wall is higher, the slopes are uniformly steeper, and the predominately south-facing slopes are exposed to greater insolation. Accordingly, plant communities occurring on the middle and upper valley slopes tend to be dominated by species tolerant of relatively low soil moisture levels, while lowland vegetation is typically dominated by species with relatively high moisture requirements.

2.5.1.1 Vegetation

The Pond Hill site is located in the extreme northern portion of the Ridge and Valley Section, a subdivision of the Oak-Chestnut Region delineated by Braun.[2] Although hardwood communities were considered characteristic vegetation for this part of the section, Braun also noted the presence of hemlock and hemlock-white pine communities, referred to as the "most mesic" communities of the higher valleys. The occurrence of hemlock and white pine was considered indicative of transition to the more northerly Hemlock-White Pine-Northern Hardwoods Region. The foregoing and other reported observations are generally consistent with the applicant's characterization of forest vegetation occurring at the Pond Hill site.

The applicant differentiated vegetation of the site into two forest types, two wetland communties, and undifferentiated old fields and cropland (ER-OL, Appendix H, Table 3-1). About 92% of the total site (525 ha) is classified as forest land, about 7% as old fields and cropland, and less than 1% as wetlands. Principal species of each vegetation type are indicated in Table 2.1.

Essentially all forest vegetation is second growth having developed subsequent to logging believed to have occurred during the early 1900s (ER-OL, Appendix H, Section 3.2.2.2). Most of the forest stands have not been disturbed for the last 30 to 40 years. The Mixed Deciduous is the most extensive of the two forest types, occurring on about 74% of the site; the Mixed Coniferous - Deciduous type on about 19%. The latter type is present in relatively narrow, irregular belts paralleling all but the extreme lower portion of Pond Hill Creek where the stream gradient is particularly steep. This type also occurs as scattered stands on the lower slopes adjacent to the Susquehanna River, and as relatively small outliers on upland portions of the south valley slope where the more favorable soil moisture conditions prevail. The Mixed Deciduous type generally occurs on the drier uplands, thus flanking distributions of the Mixed Coniferous - Deciduous type. However, stands of the Mixed Deciduous type occur adjacent to Pond Hill Creek in limited areas. Wetlands, old fields and cropland occurs on the remaining 7% of the site.

Small wetlands are located in the valley bottom adjacent to Pond Hill Creek. The Type 3 wetland, an inland shallow fresh marsh,[3] results from the union of several seeps and soils are saturated throughout the year. The presence of at least five small areas of Type 2 wetlands, inland fresh meadows, is attributed to previous beaver activities; the beaver dams are presently in disrepair.

Old field and cropland vegetation occurs as variously scattered blocks adjacent to, or near, the south boundary of the Pond Hill site. The distribution of this vegetation type generally corresponds with relatively level areas of upland terrain where farm machinery can be operated with relative ease. As observed by the staff during site inspection, most of these areas were being managed for hay production.

In addition to a general site survey, the applicant sampled systematically selected forest stands that would be inundated or otherwise disturbed during completion of the proposed project. The applicant's analysis involved pooling data and calculating overall importance values for individual species (ER-OL, Appendix H, Table 3.2.2-3). Accordingly, the principal overstory species include the following, in decreasing order of importance: red maple, American elm, white oak, eastern white pine, eastern hemlock, and shagbark hickory. A similar listing of understory species includes: American elm, red maple, flowering dogwood, witch-hazel, hawthorn, and round-leaved dogwood.

2.5.1.2 Wildlife Resources

A relatively broad array of wildlife habitat types exists within the Pond Hill site. However, as indicated in Section 2.5.1.1, forest habitats prevail throughout most of the site. The predominance and the distribution of forest vegetation occurring onsite tends to limit the occurrence of less mobile animals that are at least partially dependent on resources of other habitat types. In general, transitions or ecotones between diverse, adjoining plant communities are utilized by animals common to both communities, as well as additional species variously dependent on habitat conditions existing only in the ecotone. The density of animals associated with the ecotone also frequently exceeds that for either of the adjoining communities.[4] Thus the diversity and density of wildlife animals associated with extensive, uniform forest vegetation tend to be lower than for populations frequenting an equal area in which forest and other plant communities are variously interspersed. In view of the greater interspersion of habitats (forest types, old fields, cropland, and wetlands) in the southern uplands and valley floor of the Pond Hill site, the abundance and diversity of wildlife populations is expected to be relatively high compared to that for northern portions of the site, where the vegetation consists primarily of uniform deciduous forest.

Mammals

Published distribution maps indicate that the Pond Hill site is within the ranges of about 55 mammals,[5] however, habitat requirements for many of these species is lacking or poorly represented at the site. The applicant has identified 15 species as being "field checked" during site surveys; an additional species, porcupine (*Erethizon dorsatum*), was subsequently observed at the site (ER-OL, Supp., Response to NRC Q.13, 28 September 1979).

Table 2.1. Principal Plant Species of Terrestrial Vegetation Types Occurring at the Pond Hill Site[a]

Vegetation Types	Principal Species
Mixed Coniferous-Deciduous	
Overstory:	American elm (*Ulmus Americana*), eastern hemlock (*Tsuga canadensis*), red maple (*Acer rubrum*), eastern white pine (*Pinus strobus*), white ash (*Fraxinus americana*)
Associate species:	Black ash (*Fraxinus nigra*), white oak (*Quercus alba*), round-leaved dogwood (*Cornus rugosa*), flowering dogwood (*C. florida*), hawthorn (*Crataegus* sp.), shagbark hickory (*Carya ovata*)
Understory and ground flora:	Chestnut oak (*Quercus prinus*), swamp white oak (*Q. bicolor*), American beech (*Fagus grandifolia*), witch-hazel (*Hamamelis virginiana*), hawthorn, Virginia creeper (*Parthenocissus quinquefolia*), lady fern (*Athyrium filix-femina*), Christmas fern (*Polystichum acrostichoides*) poison ivy (*Rhus radicans*)
Mixed Deciduous	
Overstory:	American elm, red maple, white oak, shagbark hickory, sassafrass (*Sassafras albidum*)
Associate species:	Chestnut oak, flowering dogwood, eastern white pine, eastern hemlock, gray birch (*Betula populifolia*)
Understory and ground flora:	Flowering and round-leaved dogwood, witch-hazel, American elm, red maple, white oak, gray birch, sassafrass, American chestnut (*Castanea dentata*), mountain laurel (*Kalmia latifolia*), ground cedar (*Lycopodium tristachyum*), tree clubmoss (*Lycopodium obscurum*)
Type 2 wetland:	
Overstory:	Dead trees
Understory and ground flora:	Mad-dog skullcap (*Scutellaria laterifolia*), goldenrods (*Solidago* sp.), sphagnum (*Sphagnum* sp.), skunk-cabbage (*Symplocarpus foetidus*)
Type 3 wetland	
Overstory:	Eastern hemlock
Understory and ground flora:	Sphagnum, skunk-cabbage, cinnamon fern (*Osmunda cinnamomea*), common cattail (*Typha latifolia*), shining clubmoss (*Lycopodium lucidulum*), mayapple (*Podophyllum peltatum*)
Old-fields and cropland	
Ground flora:	White and red clover (*Trifolium repens, T. pratense*), common sorrel (*Rumex acetosella*), ox eye daisy (*Chrisanthemum leucanthemum*), common and English plantains (*Plantago major, P. lanceolata*), timothy (*Phleum pratense*), junegrass (*Koelria cristata*), sweet vernal grass (*Anthoxanthum odoratum*)

[a]Source: ER-OL, Appendix H, Section 3.2.2.2.

The whitetail deer (*Odocoileus virginianus*) and black bear (*Ursus americanus*) are the largest of the game species occurring in the area. Eastern gray squirrels (*Sciurus carolinensis*) are abundant, but the density of eastern cottontail (*Sylvilagus floridanus*), a popular game species, is relatively low compared to that of other areas (ER-OL, Appendix H, Section 3.2.2.3). Other species that may be legally hunted with firearms, and are known or likely to occur in the area include: eastern fox squirrel (*Sciurus niger*), red squirrel (*Tamiasciurus hudsonicus*), raccoon (*Procyon lotor*), woodchuck (*Marmota monax*), and snowshoe hare (*Lepus americanus*). Locally-trapped species of fur-bearing animals include: raccoon, striped skunk (*Mephitis mephitis*), shorttail and longtail weasels (*Mustela erminea, M. frenata*), opossum (*Didelphis marsupialis*), mink (*Mustela vison*), red fox (*Vulpes fulva*), gray fox (*Urocyon cinereoargenteus*), muskrat (*Ondatra zibethica*), and beaver (*Castor canadensis*).

The applicant conducted small-mammal trapping studies at the site, resulting in the capture of shorttail shrew (*Blarina brevicauda*), boreal redback vole (*Clethrionomys gapperi*), and white-footed mouse (*Peromyscus leucopus*). The pine vole (*Pitymys pinetorum*), eastern chipmunk (*Tamias striatus*), and deer mouse (*Peromyscus maniculatus*) were also observed (ER-OL, Appendix H, Table 3.2.2.6).

None of the ten bat species reported to occur in the region[2] were observed during site surveys; however, all are variously associated with forest or woodland habitats. Some species probably frequent the site, at least on occasion. Other likely inhabitants of the site are noted as follows. Meadow jumping mouse (*Zapus hudsonius*) and meadow vole (*Microtus pennsylvanicus*) are frequently occurring species of moist meadows, old fields, and cropland.[6] Masked and smoky shrews (*Sorex cinereus, S. fumeus*) are also typical inhabitants; the former inhabits a wide range of habitats, the latter inhabits hemlock forest.

Birds

Information presented by the appliant indicates that "the list of birds for the region" includes 135 species, and that recent seasonal surveys verified the occurrence of 75 resident and migratory species at the Pond Hill site. Also noted, "60 species not field checked may also be using the area" (ER-OL, Supp., Response to NRC Q.11, 28 September 1979). However, a total of 210 bird species were identified during surveys conducted in the vicinity of the Susquehanna Steam Electric Station located about four kilometers downstream from the Pond Hill site.[7] All species identified at Pond Hill are included in the inventory compiled from surveys at the SSES site. The inventories for the two sites are also similar in that both are comprised of a high proportion of species representative of the families Parulidae (wood warblers) and Fringillidae (grosbeaks, finches, sparrows). In combination, species of the named families comprise 35.8% (21.1 and 14.7%, respectively) of the Pond Hill species inventory. As derived from 1978 surveys at the SSES site, comparable percentages for the two families were 15.1 and 13.5, respectively.

The major difference between the SSES and Pond Hill inventories is apparent in that the latter does not include waterfowl and other species variously associated with aquatic habitats. However, the 1978 SSES surveys entailed censusing the Susquehanna River, including that portion of the river adjacent to the Pond Hill site. The species most frequently observed during the spring migration period included, in decreasing order of occurrence: Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), woodduck (*Aix sponsa*), common merganser (*Mergus merganser*), ring-necked duck (*Aythya collaris*), and black duck (*Anas rubripes*). Some of these species, especially woodduck and mallard, probably inhabit the Pond Hill site at various times. Other recorded species that variously use habitats similar to those onsite include: killdeer (*Charadrius vociferus*), spotted sandpiper (*Actitis macularia*), greater and lesser yellowlegs (*Tringa melanoleucus, T. flavipes*), belted kingfisher (*Megaceryle alcyon*), and great blue heron (*Ardea herodius*).

Upland game birds identified during surveys at the Pond Hill site include only ruffed grouse (*Bonasa umbellus*) and wild turkey (*Meleagris gallopavo*) (ER-OL, Appendix H, Table 3.2.2-6). Eastern portions of the site are periodically stocked with turkey and ring-necked pheasants (*Phasianus colchicus*); the latter species was not observed during surveys. Typical habitat of the American woodcock (*Philohela minor*) exists onsite, and, although not observed, the species is expected to be present (ER-OL, Appendix H, Section 3.2.2.3). The bobwhite (*Colinus virginianus*) is also known to occur in the Pond Hill area.[7] Ruffed grouse was the only commonly observed game bird species during site survey.

Information concerning the relative abundance of nongame birds that frequent the Pond Hill site is not available, but other studies serve to characterize local bird populations.[7,8] Accordingly, the characteristic species of forest habitats include: black-capped chickadee (*Parus atricapillus*), slate-colored junco (*Junco hyemalis*), white-breasted nuthatch (*Sitta carolinensis*), golden-crowned kinglet (*Regulus satrapa*), and downy woodpecker (*Dendrocopus pubescens*). Other species—abundant during two or more seasons include: blue jay (*Cyanositta cristata*), ovenbird (*Seirus aurocapillus*), and wood thrush (*Hylocichla mustelina*).

Bird populations of open-field habitats tend to be dominated by field sparrows (*Spizella pusilla*), song sparrows (*Melospiza melodia*), starling (*Sturnus vulgaris*), and American goldfinch (*Spinis tristis*). Other seasonally abundant species include: yellowthroat (*Geothlypis trichas*), slate-colored junco, and indigo bunting (*Passerina cyanea*).

Characteristic species of wetland habitats include: swamp sparrows (*Melospiza georgiana*), song sparrows, red-winged blackbird (*Agelaius phoeniceus*), cardinal (*Richmondena cardinalis*), and American goldfinch. Other species well represented during two or more seasons include: robin (*Turdus migratorius*), yellow warbler (*Dendroica petechia*), gray catbird (*Dumetella carolinensis*), yellowthroat, and starling.

Reptiles and Amphibians

Inventories of reptiles and amphibians reported occurring in Pennsylvania consist of 48 and 38 species and subspecies, respectively.[9] Based on published species-distribution maps, only 20 amphibians and 19 reptiles are likely to inhabit the Pond Hill area.[10] Inventories compiled from surveys of the Pond Hill site consist of 5 reptiles and 17 amphibians (ER-OL, Appendix H, Table 3.2.2-6).

Reptiles reported as occurring onsite include 3 snakes and 2 turtles. The venomous northern copperhead (*Agkistrodon contortrix mokasen*) is associated with forest habitat; the northern water snake (*Ratrix sipedon sipedon*) with all aquatic habitats, and the eastern garter snake (*Thamnophis sirtalis sirtalis*) with all terrestrial and aquatic habitats. Midland painted turtles (*Chrysemys picta marginata*) were observed in the marshes; the eastern box turtle (*Terrapene carolina carolina*) occurred in all terrestrial habitats (ER-OL, Appendix H, Table 3.2.2-6).

Anurans (frogs and toads) reported as occurring in forest habitats near water include: American toad (*Bufo americanus*), spring peeper (*Hyla crucifer*), and gray treefrog (*Hyla versicolor*). Wood frog (*Rana sylvatica*) were observed in moist woods, as well as streamside. Northern leopard frog (*Rana pipiens*) was observed to frequent meadow habitats. Other anurans (3 frogs) identified during surveys were associated with the limited stream and marsh habitats occurring onsite. Similarly, most salamanders, as well as the red-spotted newt (*Notopthalmus viridescens viridescens*) were observed in streamside habitats. The exceptions, red-backed and slimy salamanders (*Plethodon cinereus cinereus, Plethodon glutinosus glutinosus*), were associated with forest and rocky woodland habitats. Mountain dusky salamanders (*Desmognathus ochrophaeus*) and northern spring salamanders (*Gyrinophilus porphayriticus*) were reported to frequent wet woods as well as streamside habitats.

2.5.1.3 Endangered and Threatened Species

None of the current federally-designated plant species (including varieties) of endangered or threatened status occur in Pennsylvania.[11] Five plants that were proposed for federal listing in 1976[12] are reported to occur in the state; known distributions of these five species, however, do not include Luzerne County, within which the Pond Hill site is located (see Appendix A). A grass species (*Poa paludigina*) proposed for federal listing in 1975[13] has been collected in Luzerne County; however, the species was not observed in 1979 site surveys (ER-OL, Supp., Response to NRC Q.9, 28 September 1979).

The Pond Hill site is within the reported distributional range of two mammals and three birds included in the federal list of threatened and endangered species;[11] namely, the eastern cougar (*Felis concolor cougar*), Indiana bat (*Myotis sodalis*), bald eagle (*Haliaeetus leucocephalus*), and American and arctic peregrine falcons (*Falco peregrinus anatum, F. p. tundrius*). None of these animals was observed during surveys of the Pond Hill site (ER-OL, Appendix H, Section 3.2.2.3), although recent local sightings of bald eagle and American peregrine falcon have been reported.[7,8] The nature of these sightings is consistent with information received by the staff that indicates federally listed or proposed endangered or threatened animals under the jurisdiction of the U. S. Fish and Wildlife Service (including those mentioned) are not known to frequent the Pond Hill area other than as occasional transient individuals (see Appendix A).

None of the reptiles and amphibians designated as threatened or endangered species by the Pennsylvania Fish Commission[14] was observed during surveys of the Pond Hill site (ER-OL, Appendix H, Section 3.2.2.3). Comparable state designations of endangered or threatened mammals and birds have not been made at this time (ER-OL, Supp., Response to NRC Q. TER- 6.1).

2.5.1.4 Soils

An estimated 84% of the Pond Hill site soils are of Capability Classes V through VIII as defined by the U.S. Soil Conservation Service (ER-OL, Appendix H, Table 3.2.6-4) and are unsuited for normal tillage of agricultural crops. These onsite soils are characterized by excessive stoniness, wetness, shallowness, and/or erosion hazard. Capability Class II soils (including prime farmland) are present on about 9.6% of the site, and occur as scattered, irregular tracts near or adjacent to the south boundary of the site. The distribution of Class II soils is limited to the more level areas of upland terrain.

The remaining soils of the site are designated as Class III and IV soils (ER-OL, Appendix H, Fig. 3-13), thus indicating suitability for the production of cultivated crops. However, the respective severe and very severe limitations of Class III and IV soils restrict cropland management alternatives, such as choice of crop plants and/or soil management practices required to conserve the soil resource. Some scattered patches of Class III and IV soils occur in the valley bottom and adjacent to the Susquehanna River; most of these soils, however, are contiguous with Class II soils in uplands of the southern portion of the site.

The foregoing groupings of onsite soils are based on relative potentials for agricultural productivity. In view of the high proportion of forest vegetation occurring onsite, soil-woodland site index correlations are also indicative of onsite soil productivity. With one exception, woodland productivity ratings for the major grouping of onsite soils are high (ER-OL, Appendix H, Table 3.2.6-5).

2.5.2 Aquatic Ecology

2.5.2.1 Water Quality

2.5.2.1.1 *POND HILL CREEK*. The Pennsylvania Department of Environmental Resources has recently promulgated a revised set of water quality regulations for the state's surface waters. The water quality criteria that apply to Pond Hill Creek under these regulations are presented in Table 2.2. In this system, Pond Hill Creek is classified with the unnamed tributaries to the North Branch of the Susquehanna River, and has a designated protected water use for the maintenance and/or propagation of coldwater fishes, specifically the Salmonidae (trout); however, fish sampling by DER failed to reveal the presence of trout in the stream (ER-OL, Section 3.2.3.1.2).

Monthly water samples were collected from both the upper and lower sections of Pond Hill Creek. Results of the analyses of these samples are presented in Tables 2.3 and 2.4. In general, Pond Hill Creek is a clear, highly oxygenated, coldwater stream. It has soft water and is weakly buffered. The water quality of Pond Hill Creek meets both the criteria proposed by DER and those recommended for fish and other aquatic life by EPA. A few parameters, specifically fecal coliforms and ammonia, occasionally exceeded DER criteria, but the magnitude by which the standards were surpassed was not excessive.

2.5.2.1.2 *SUSQUEHANNA RIVER AT RESERVOIR PUMP STATION SITE*. Water quality criteria and analyses for the Susquehanna River are discussed in the SSES-DES.

Additional samples were collected from the river at the intake location; results of the analyses are tabulated in Table 2.5. Sampling was conducted from March to August 1978. The data indicate that all parameters except total iron and fecal coliform bacteria comply with the DER recommended criteria for the river.

2.5.2.2 Aquatic Life

2.5.2.2.1 *POND HILL CREEK*. Qualitative samples of plankton, periphyton, and macrophytes were collected in Pond Hill Creek. Quantitative sampling was conducted for benthic macroinvertebrates (ER-OL, Section 3.2.3.1.3) and fishes.

Very few organisms were found in any of the plankton samples taken at Pond Hill Creek. Virtually all of the planktonic species collected were washed out or detached from the periphyton community. These included the diatoms (*Synedra, Nitzschia, Navicula,* and *Stauroneis*) along with fragments of the filamentous green algae (*Spriogyra*). Zooplankton samples revealed the presence of a few rotifers, ostracods, cladocerans, copepods, and some drifting insect larvae. In general, the plankton of Pond Hill Creek is typical of most small streams, where the constant turbulent and fast-flowing water usually inhibits the development of a true self-reproducing drift community. Instead, a normally sparse make-shift plankton community is derived from organisms washed out of small ponds and quiet backwaters or dislodged from the streambed and periphyton.

The periphyton community in Pond Hill Creek is dominated by filamentous algae and attached diatoms. The most abundant diatoms were those listed in the previous paragraph. Other relatively common diatoms included *Melosira* and *Cymbella*. The most commonly observed filamentous algae was the green algae *Spirogyra*. Collectively, filaments of *Spriogyra* often formed noticeable tufts upon rocks, sticks, and other debris in the stream. Other filamentous algae present in the periphyton included green algae (*Oedogonium* and *Desmidium*), red algae (*Batrachospermum*), and blue-green algae (*Oscillatoria*). Microfauna found in the periphyton consisted primarily of protozoans, particularly the ciliate *Colpidium* and rotifers from the family Brachionidae.

Table 2.2. Water Quality Criteria for Pond Hill Creek[a]

Stream	Zone
Unnamed Tributaries of the Susquehanna River (North Branch)	Basins, Lackawanna River to West Branch Susquehanna River
Protected water uses	Coldwater fishes; maintenance and/or propagation of fish species including the family Salmonidae and additional flora and fauna indigenous to a coldwater habitat.
Dissolved oxygen	Minimum daily average 6.0 mg/L; no value less than 5.0 mg/L. For lakes and impoundments only, no value less than 5.0 mg/L at any point.
pH	Not less than 6.0 and not more than 9.0.
Iron	Not to exceed 1.5 mg/L as total iron; not to exceed 0.3 mg/L as dissolved iron.
Temperature	No measurable rise when ambient temperature is 14°C or above; not more than a 2.8°C rise above ambient temperature until stream temperature reaches 14°C; not to be changed by more than 1.1°C during any one-hour period.
Total filterable residue at 105°C	Not more than 500 mg/L as a monthly average value; not more than 750 mg/L at any time.
Bacteria (fecal coliform)	During the swimming season (May 1 - September 30), the fecal coliform level shall not exceed a geometric mean of 200 per 100 mL based on five consecutive samples collected on different days; for the remainder of the year, the fecal coliform level shall not exceed a geometric mean of 2000 per 100 mL based on five consecutive samples collected on different days.
Alkalinity	Alkalinity shall be 20 mg/L or more as $CaCO_3$ for freshwater aquatic life, except where natural conditions are less.
Total manganese	Not to exceed 1.0 mg/L.
Flouride	Not to exceed 2.0 mg/L.
Cyanide	Not to exceed 0.005 mg/L as free cyanide.
Sulfate	Not to exceed 250 mg/L.
Phenol	Not to exceed 0.005 mg/L.
Copper	Not to exceed 0.1 of the 96-hour LC 50 for representative important species.
Zinc	Not to exceed 0.01 of the 96-hour LC 50 for representative important species.
Aluminum	Not to exceed 0.1 of the 96-hour LC 50 for representative important species.
Arsenic	Not to exceed 0.05 mg/L.
Chromium	Not to exceed 0.05 mg/L as hexavalent chromium.
Lead	Not to exceed 0.05 mg/L.
Nickel	Not to exceed 0.01 of the 96-hour LC 50 for representative important species.
Nitrite plus nitrate as nitrogen	Not to exceed 10 mg/L as nitrate nitrogen.
Ammonia nitrogen	Not more than 0.5 mg/L.

[a]Source: ER-OL, Table 3.2.3-1.

Table 2.3. Water Quality Data from the Upper Section of Pond Hill Creek[a]

	1977				1978												
Parameter[b]	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	N[c]	Mean	S.D.[d]	Max.	Min.
Temperature, water (°C)	17.0	9.0	6.0	3.5	-0.5	0.0	5.0	8.0	10.0	12.0	14.0	17.5	12	8.5	2.92	17.5	-0.5
Dissolved oxygen (ppm)	9.3	11.2	11.3	12.5	13.0	12.4	--	12.3	11.6	9.9	8.4	8.2	11	10.9	3.30	13.0	8.2
BOD	7.0	3.0	2.1	0.5	<0.5	<1	<1	<1	2.0	<1.0	<1.0	1.0	12	1.8	1.33	7.0	<0.5
COD	10.1	8.0	3.6	4.0	<5	7.3	<5	<5	<5	17.0	9.0	23.0	12	8.5	2.92	23.0	3.6
pH (s.u.)	7.00	6.30	7.25	6.70	6.80	7.25	6.45	7.20	--	7.30	6.60	6.80	11	6.88	2.622	7.30	6.30
Alkalinity as $CaCO_3$	5.5	2.8	2.3	6.4	17.5	3.7	1.8	8.3	4.0	14.0	17.0	17.0	12	8.4	2.89	17.5	1.8
Total hardness as $CaCO_3$	24.0	17.0	20.0	15.0	15.0	16.0	17.5	30.0	14.0	18.0	82.0	20.0	12	24.0	4.90	82.0	14.0
Total dissolved solids	89.4	44.8	8.4	<0.5	99.4	37.8	3.0	45.5	37.6	56.5	47.4	50.4	12	43.4	6.59	99.4	<0.5
Total suspended solids	150.0	<0.5	516.0	3.4	11.3	13.1	6.1	6.3	2.5	9.6	6.3	40.7	12	63.8	7.99	516.0	0.5
Turbidity (JTU)	--	1.0	2.5	0.6	2.2	6.0	2.3	2.0	1.9	5.5	7.0	10.0	11	3.7	1.93	10.0	0.6
Specific conductance (µmhos)	55	48	42	46	48	48	48	52	52	49	--	53	11	49.2	7.10	55	42
Color (CPU)	11	<1	3	4	5	6	<1	7	10	22	23	28	12	10.1	3.18	28	<1
Sulphate as S	13.7	11.0	12.0	11.0	16.0	10.5	11.3	12.0	11.0	6.0	1.0	<1.0	12	9.7	3.12	16.0	1
Ortho phosphate as P	0.02	0.01	0.01	0.02	0.01	0.04	0.01	<0.02	0.03	0.02	0.05	<0.01	12	0.02	0.144	0.05	0.01
Total phosphate as P	0.01	0.02	0.02	0.08	0.01	0.04	0.06	0.03	0.09	<0.02	0.05	1.11	12	0.13	0.358	1.11	0.01
Nitrate as N	0.01	0.05	0.10	0.03	0.27	0.20	0.24	0.20	0.43	0.13	0.12	0.16	12	0.16	0.402	0.43	0.01
Chloride	1.6	3.4	2.3	4.3	5.5	3.1	<0.5	0.5	1.7	0.4	1.7	0.6	12	2.1	1.461	5.5	0.4
Total copper	<0.02	<0.02	<0.02	0.03	<0.02	0.05	0.02	0.02	<0.02	<0.02	<0.02	<0.02	12	0.02	0.153	0.05	<0.02
Total iron	0.47	0.49	0.21	0.26	0.29	0.39	0.40	0.35	0.80	0.87	1.40	1.64	12	0.63	0.794	1.64	0.21
Total manganese	0.05	0.03	0.03	<0.02	0.02	0.02	0.04	<0.02	0.05	0.05	0.07	0.02	12	0.05	0.224	0.20	<0.02
Coliform total MPN/100 mL	1100	1100	1100	210	43	240	240	>2400	210	>2400	1100	2400	12	1045.3	32.33	>2400	43
Coliform fecal MPN/100 mL	93	93	150	64	<3	<3	240	460	23	1100	23	1100	12	279.3	16.71	1100	<3
Fecal streptococci MPN/100 mL	<1	<1	5	25	<1	<1	<1	<1	20	35	10	30	12	10.9	3.30	35	<1

[a]Source: ER-OL, Table 3.2.3-2.
[b]Units mg/L unless stated otherwise.
[c]N = number of samples.
[d]S.D. = standard deviation.

Table 2.4. Water Quality Data from the Lower Section of Pond Hill Creek[a]

Parameter[b]	1977				1978												
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	N[c]	Mean	S.D.[d]	Max.	Min.
Temperature, water (°C)	16.0	9.0	6.5	3.5	0.0	1.0	4.0	6.5	8.0	10.0	14.5	19.0	12	8.2	2.86	16.0	0.0
Dissolved oxygen (ppm)	9.5	11.8	12.0	13.0	13.9	13.1	--	13.3	13.2	12.4	8.9	8.0	11	11.7	3.43	13.9	8.0
BOD	8.0	4.0	1.2	0.5	<0.5	<1	3	<1	2.0	<1.0	<1	1.0	12	2.0	1.42	8.0	<0.5
COD	11.1	7.4	3.4	9.0	6.8	<5.0	<5.0	<5.0	<5.0	7.0	18.0	12.0	12	7.9	2.81	18.0	3.4
pH (s.u.)	7.10	6.65	7.60	7.10	7.00	7.30	7.30	7.55	--	7.10	6.70	6.80	11	7.11	2.666	7.60	6.65
Alkalinity as $CaCO_3$	7.4	11.0	2.3	1.8	23.0	1.8	<1.0	11.0	5.0	11.0	19.0	16.0	12	9.2	3.03	23.0	<1.0
Total hardness as $CaCO_3$	24.0	23.0	19.0	15.0	16.0	17.0	15.5	21.0	22.0	14.0	20.0	21.0	12	19.0	4.35	24.0	14.0
Total dissolved solids	108.0	49.6	15.4	<0.5	102.0	56.0	14.2	133.0	43.3	52.3	44.4	56.2	12	56.2	7.50	133.0	<0.5
Total suspended solids	120.0	<0.5	1.4	3.1	8.9	6.1	5.2	4.9	8.3	8.2	22.4	8.0	12	16.4	4.05	120.0	<0.5
Turbidity (JTU)	--	0.7	3.0	0.8	1.6	5.5	0.6	1.3	2.5	3.6	5.2	3.8	11	2.6	1.61	5.5	0.7
Specific conductance (μmhos)	59	45	48	48	46	45	68	49	50	50	--	55	11	51	7.2	68	45
Color (CPU)	10	<1	3	4	5	4	<1	3	15	12	10	22	12	8	2.7	22	1
Sulphate as S	13.2	12.0	11.8	12.5	16.8	13.6	11.9	11.0	9.0	12.0	6.0	7.0	12	11.4	3.38	16.8	6.0
Ortho phosphate as P	0.02	0.01	0.02	<0.01	0.02	<0.02	0.02	<0.02	0.04	0.06	0.02	<0.01	12	0.02	0.150	0.06	<0.01
Total phosphate as P	0.01	<0.01	0.02	<0.01	0.01	0.05	0.10	<0.02	0.08	0.04	0.02	0.47	12	0.07	0.265	0.47	<0.01
Nitrate as N	<0.01	0.07	<0.05	0.03	0.33	0.21	0.12	<0.10	0.08	0.27	0.24	0.21	12	0.14	0.379	0.33	0.01
Chloride	0.7	2.6	9.5	<0.5	2.9	11.1	<0.5	<0.5	2.1	0.4	1.08	1.1	12	2.7	1.66	11.1	0.4
Total copper	<0.02	<0.02	<0.02	0.03	0.03	0.06	0.02	<0.02	<0.02	0.02	<0.02	<0.02	12	0.03	0.158	0.06	<0.02
Total iron	0.60	0.46	0.22	0.20	0.25	0.39	0.34	0.25	0.41	1.08	3.11	0.65	12	0.66	0.814	3.11	0.20
Total manganese	0.03	0.04	0.02	0.04	0.02	0.02	<0.02	<0.02	0.03	0.04	0.21	0.10	12	0.05	0.222	0.21	<0.02
Coliform total MPN/100 mL	460	240	150	150	43	43	460	460	210	>2400	240	>2400	12	609	24.7	>2400	43
Coliform fecal MPN/100 mL	240	9	23	23	4	<3	43	43	43	93	9	93	12	52	7.2	240	<3
Fecal streptococci MPN/100 mL	10	<1	<1	<1	<1	<1	<1	<1	10	20	<1	<1	12	4	2.0	20	<1

[a]Source: ER-OL, Table 3.2.3-3.

[b]Units mg/L unless stated otherwise.

[c]N = number of samples.

[d]S.D. = standard deviation.

Table 2.5. Water Quality in the Susquehanna River near the Proposed Intake Site[a]

Parameter[b]	1978 Mar.	Apr.	May	June	July	Aug.	N[c]	Mean	S.D.[d]	Max.	Min.
Temperature, water (°C)	3.0	7.0	13.5	16.0	22.0	25.0	6	14.4	3.80	25.0	3.0
Dissolved oxygen (ppm)	--	12.6	10.7	14.9	8.9	9.0	5	11.2	3.35	14.9	3.35
BOD	1.0	<1	3.0	<1	2.0	5.0	6	2.2	1.47	5.0	<1
COD	7.0	24.0	5.0	7.0	10.0	25.0	6	13.0	3.61	25.0	5.0
pH (s.u.)	7.25	7.60	--	8.60	7.20	7.20	5	7.57	2.751	8.60	7.20
Alkalinity as $CaCO_3$	23.0	41.4	19.0	46.0	66.0	60.0	6	42.6	6.52	66.0	19.0
Total hardness as $CaCO_3$	66.1	84.0	73.0	109.0	167.0	136.0	6	105.9	10.29	167.0	66.1
Total dissolved solids	67.2	122.0	138.0	196.0	290.0	215.0	6	171.4	13.09	290.0	67.2
Total suspended solids	9.1	21.7	7.5	19.9	9.5	36.5	6	17.4	4.17	36.5	9.1
Turbidity (JTU)	16	7.5	5.1	9.8	11.0	12.0	6	10.2	3.20	16.0	5.1
Specific conductance (μmhos)	160	190	200	230	--	330	5	222	14.9	330	160
Color (CPU)	26	7	25	68	65	80	6	45	6.72	80	7
Sulphate as S	28.8	30.0	46.0	97.0	180.0	148.0	6	88.3	9.40	180.0	28.8
Ortho phosphate as P	0.06	0.04	0.06	0.02	<0.01	0.10	6	0.05	0.22	0.10	<0.01
Total phosphate as P	0.07	0.05	0.12	0.10	0.04	0.84	6	0.20	0.45	0.84	0.04
Nitrate as N	0.97	1.00	0.73	0.61	0.43	0.55	6	0.72	0.846	1.00	0.43
Chloride	12.8	11.0	6.2	11.5	18.4	14.5	6	12.4	3.52	18.4	6.2
Total copper	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	6	<0.02	0.141	<0.02	<0.02
Total iron	2.11	1.96	1.63	2.43	2.34	4.70	6	2.53	1.590	4.70	1.63
Total manganese	0.29	0.19	0.32	0.49	0.66	0.90	6	0.48	0.689	0.90	0.19
Coliform, total MPN/100 mL	>2400	43	>2400	>2400	>2400	>2400	6	2007	44.8	>2400	43
Coliform, fecal MPN/100 mL	240	3	210	460	460	1100	6	412	20.3	1100	3
Fecal streptococci MPN/100 mL	10	<1	35	85	10	65	6	34	5.9	85	<1

[a]Source: ER-OL, Table 3.2.3-7.

[b]Units mg/L unless stated otherwise.

[c]N = number of samples.

[d]S.D. = standard deviation.

The most common flowering plants found in the stream included cattails (*Typha*), pondweed (*Potamogeton*), bush pondweed (*Najas*), waterweed (*Elodea*), iris (*Iris*), and watercress (*Nasturtium*). Cattails, pondweeds, and waterweeds were relatively abundant in the upper section of Pond Hill Creek in areas previously inundated by beaver dams. However, the most noticeable macrophytes in the stream were water moss (*Fontinalis*) and leafy liverwort (*Chiloscyphus*), both of which formed dense growths on most of the stones and boulders in the streambed. Water moss and liverwort are generally considered typical inhabitants of hard-bottomed, coldwater streams.[15]

A total of 12,435 macroinvertebrate specimens were collected from seasonal visits to each of three sampling stations at Pond Hill Creek. The average density of these macroinvertebrates was 3,844 organisms/m^2, ranging from a low of 1,789 to a high of 10,411.

The dominant insects found in the macroinvertebrate community of Pond Hill Creek were fly larvae (Diptera) and mayfly nymph (Ephemeroptera). These two groups of insect larvae comprised 44.2 and 28.3%, respectively, of all organisms collected. The most abundant Dipteran larvae were midge larvae of the family Chironomidae. *Ironopsis* and *Ephemerella* were the most numerous mayflies observed. Other well-represented macroinvertebrates included stonefly larvae (10.3% of the total specimens), caddisfly larvae (8.8%). beetles (2.3%), clams (2.1%), and worms (1.9%). Collectively, these macroinvertebrates are typical of stony-bottomed, small streams.

Diversity indices calculated for all of the macroinvertebrate samples collected in Pond Hill Creek ranged from 2.87 to 4.18. Only two of the twelve indices were below 3.0. The overall average index was 3.66. These very high values indicate that Pond Hill Creek supports a well-balanced community of macroinvertebrates.

The stream supports a very limited fish community. Seasonal fish samples collected in the upper and lower sections of the stream revealed only five species. The primary factor limiting the fish community in Pond Hill Creek is apparently the intermittent nature of the stream. Also, since fish are prevented from moving up into the stream from the Susquehanna River by an elevated culvert near the stream's mouth, there are no migratory species present in the stream.

Fish sampling in Pond Hill Creek covered a distance of about 250 m of the lower section and approximately 830 m of the upper section. Samples were collected with an electrical shocker and minnow seines.

Of the five species found, only the blacknose dace (*Rhinichthys-atratulus*), a common minnow species in Pennsylvania and other parts of the northeastern United States, was abundant. Other common minnow species found included: golden shiners (*Notemigonus crysoleucas*), fathead minnows (*Pimephales promelas*), and creek chub (*Semotilus atromaculatus*). However, only 9, 10, and 1 specimens, respectively, of these three species were collected. The remaining fish species was represented by a single specimen of largemouth bass (*Micropterus salmoides*) caught in the lower section of the stream in December 1977. Since only this one individual was found in all the fish samples, it is clear that Pond Hill Creek does not support a large resident population of this species. Furthermore, it is probable that the single bass juvenile originated from one of the small farm ponds located near the stream. These ponds are connected to Pond Hill Creek near its source by a small rivulet.

None of the species found in Pond Hill Creek is included on either the U. S. Fish and Wildlife Service's list of Endangered and Threatened Wildlife and Plants nor the Pennsylvania Fish Commission's list of Endangered, Threatened or Indeterminate Fishes, Amphibians or Reptiles of Pennsylvania. The stream has never been stocked by the Pennsylvania Fish Commission, and no fishermen were observed on the stream during the sampling program.

2.5.2.2.2 *SUSQUEHANNA RIVER AT RESERVOIR PUMP STATION SITE*. Biological data gathered near SSES provide the most adequate representation of the nature of the aquatic biota in the vicinity of the proposed reservoir intake site.

The reader is referred to the applicant's annual reports and the Draft Environmental Statement related to the operation of SSES for additional information about the site (DES-OL).[16-20]

2.6 SOCIOECONOMIC PROFILE OF THE LOCAL AREA

The socioeconomic profile for the area surrounding the proposed Pond Hill reservoir will focus on Conyngham Township, Luzerne County. This area has been selected because the proposed reservoir site is centrally located in this township, and the most direct impacts of construction and operation are expected to occur here.

2.6.1 Demography

In 1970, the total population of Luzerne County was 342,301, a 22.5% decrease from 1940 (ER-OL, Table 3.1-1). Between 1970 and 1977, population declined at a rate of 1% per year.[21] In comparison, Conyngham Township's populations totaled 1,693 in 1970 and was projected to have increased to 1,788 in 1976, an increase of 5.6%.[22]

Compared to national trends, the age structure of the county and township can be characterized as an older population because of the proportion of people over 65 years of age.[22,23] In 1970, the proportion of people over 65 was 13.0% for the county and 13.1% for the township, as compared to 10.8% for the state.[24]

2.6.2 Settlement Pattern

Population concentrations are located in four areas of Conyngham Township; Mocanaqua, Wapwallopen, Pond Hill, and Lily Lake.[24] Scattered houses and small farms were observed surrounding these small population centers and in the areas between them.

Housing

In general, the township housing stock is characterized as old; about 83% of the current structures were built before 1939.[24] However, the condition of the available 1976 housing was still rated as fair to good, and the demand for new houses is expected to increase by 1980.[25] Repair and renovation of older homes and summer homes was observed by the staff, particularly in the Pond Hill and Lily Lake areas.

Recreation

A series of recreational facilities are located in Conyngham Township; these have been listed in a county recreational study and presented as Table 3.8.3 of Reference 24. In addition to these listed facilities, trout fishing is available in Little Wapwallopen Creek, fishing and boating opportunities at Lily Lake, and hunting and hiking in several of the state gamelands.[24]

Detailed information on current recreational needs and plans for the township are not available. However, a need for additional recreational facilities of different types has been identified for all of Luzerne County, which would include Conyngham Township (see DES-OL, Section 2.2.3.3).

2.6.3 Social Organization

An estimated 80% of the 1970 households in the township were composed of families. The sociocultural characteristics of the township have been described as rural in terms of its population density, atmosphere, and available services. However, the population concentrated in the settlement of Mocanaqua, which has been historically associated with the coal-mining industry, is now distinctively agricultural and more diverse than that typically associated with rural areas.[24]

2.6.4 Social Services

Sewage and Water

Public water services are currently available in Mocanaqua and Wapwallopen.[24] Mocanaqua has some public sewage, but needs renovation of its system.[26] Sewage treatment is planned for Wapwallopen and Lily Lake.[26]

Fire and Police Protection

The township has a part-time police force made up of four persons and is also served by the state police.[24] Volunteer fire companies provide fire protection.[24]

2.6.5 Political Organization

Conyngham is defined as a second-class township because it has fewer than 300 residents per square mile.[27] The township is governed by a board of three supervisors elected at-large for six-year terms.[27] The board exercises general governmental functions, including maintenance of a police force, the road system, and the levy and collection of taxes.[24]

2.6.6 Economic Organization

By the 1920s, anthracite mining was the chief source of employment and the economic base of Luzerne County.[27] As coal production began to decline in the 1930s, the economic base was diversified to counteract serious income and job losses.[27] Today the economy is broad-based and has a strong apparel-industry orientation.[27,28]

In 1976, the Department of Commerce listed only four establishments for this township employing a total of 154 employees.[28] One business is a sawmill, another a footwear firm;[24,27] two businesses were undefined. Additional retail and service facilities are located within the township, primarily in Mocanaqua, Wapwallopen, and Pond Hill.[24]

2.6.7 Sociocultural Characteristics

The staff observed no resident population living on the proposed site. The applicant states that the property does not contain any facilities or structures used by the local communities nor does it support any commercial or industrial activities.[24] The applicant also reports that there is no residential activity below the dam site.[29]

Recreation

The applicant stated that this site is used for walking, hiking, hunting, and nature study by the people living in the nearby vicinity.[24] Since this information has not been quantified,[24] neither the number of individuals using this site nor the man-days of usage can be determined. The applicant identified and characterized esthetic qualities of the site.[24] During the site visit, the staff observed that the site area was esthetically pleasing because of the steep topography, rock outcrops, waterfalls, and dense, but variable, forest cover. Therefore, it is reasonable that people would be attracted to the site to hike and enjoy the kind of natural environment present on the property.

In addition to recreational use of the natural area, the staff observed that a pond has been constructed on the site. The applicant stated that the pond was used for fishing and swimming by several local residents. The extent of the pond's usage cannot be quantified at this time.

2.7 CULTURAL RESOURCES

2.7.1 Region

A profile of the regional culture history for the Luzerne and Columbia county areas was provided in the DES for SSES, Section 2.6.1. In this section, the staff pointed out that complete county inventories of prehistoric and historic cultural resources are not available, although numerous cultural resource sites are known for this general area.

2.7.2 Pond Hill Site

A systematic survey for prehistoric and historic cultural resources, including testing for surface and subsurface resources, has not been made on the Pond Hill site. The applicant did make a brief presurvey foot inspection of a limited part of the site to be flooded; no cultural resources were identified.[4] During the site visit, the staff observed an extensive series of stone walls, presumably part of a nineteeth-century farmstead. However, the ground surface of the site was densely covered by vegetation and reliable transect observation of cultural resources that might exist on the ground surface could not be made.

The applicant stated that a cultural resource survey will be conducted on the entire Pond Hill site property (Appendix B). This program will include a literature search and a field survey. The proposed method for identification of unknown sites is a shovel test along 30-m transects. Areas with rock-shelter formation will also be closely inspected. Should archeological sites be encountered during this study, the applicant will make recommendations to the staff regarding the testing of these sites to ascertain their eligibility for inclusion in the National Register of Historic Places.

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3. RESERVOIR DESCRIPTION

3.1 INTRODUCTION

In order to provide the desired water storage, a dam will be constructed across Pond Hill Creek 1.3 km upstream from its confluence with the Susquehanna River. The reservoir will have all of the features typical of this type of project, including a spillway and an inlet-outlet structure. Since the drainage area above the dam is too small to fill and refill the reservoir and also keep it full between uses, an intake structure and pumping plant near the bank of the Susquehanna River and a water conduit from the pumping station to the inlet-outlet structure on the north shore of the reservoir will be constructed. A permanent access road will be provided. During construction, a concrete batch plant and borrow pits will be used. The location of the batch plant and borrow pits are shown on Fig. 3.1.

The applicant has supplied detailed design information for a dam with a normal water level of 287 m MSL and a storage volume of 12.5×10^6 m^3 (ER-OL, Appendix H). In response to SRBC recommendations on water conservation, the applicant submitted design information on a larger dam, one utilizing 85% of the valley's maximum capacity. The higher, larger dam (normal water level 299 m MSL), will have a storage volume of about 30×10^6 m^3 (responses to NRC questions, letters from N.W. Curtis, PP&L, to D.E. Sells, NRC, 12 October, 13 November, and 17 December, 1979). The minimum water level for the larger reservoir is 264.6 m MSL.

Figs. 2.2 and 2.3 show local topography, the layout of the dam and the other structures, and the area to be covered by water at maximum and minimum water elevations. Fig. 3.2 is a detailed plan view of the dam and related structures.

3.1.1 Embankment Dam

The dam will be of earth and rockfill construction using materials obtained mostly from the area to be inundated. The crest of the dam will be about 730 m long at 302 m MSL. The maximum height of the crest of the dam above the existing creekbed will be about 67 m. The applicant's engineering studies have shown that sufficient core materials are available from onsite borrow areas.

Because of low topography along the southern edge of the reservoir, construction of two additional water retention barriers will be required (see Fig. 3.2). In the saddle area, immediately southeast of the main dam, a shallow, about 150 m long and 2.4 m high, dike will be constructed. About 800 m east of the dam an impervious subsurface cutoff (about 380 m long and 6 m deep) may be required to prevent seepage in the saddle.

3.1.2 Spillway

An overflow-type of spillway located on the south abutment of the dam will be provided to release floodwaters when water levels exceed the 299-m MSL crest of the spillway (see Fig. 3.2). A 425-m concrete-lined chute will carry the overflow water from the spillway to the existing riverbed. A concrete structure will be used to dissipate most of the kinetic energy of the flow.

3.1.3 Inlet-Outlet Structure

This structure will be used to both control releases from the reservoir for conservation and augmentation purposes, and to discharge pumped inflows into the reservoir. The inclined concrete structure will be constructed on the north slope of the reservoir and connected to the pumping plant by an underground pipeline (see Alternative B, Fig. 3.2). Pumped inflow will enter the reservoir at the 247-m MSL level. Four outlet ports, each at a different level, will be used for augmentation and conservation flows. The outlet port used for a given release will be the one at which the temperature of the water in the reservoir most closely matches that of the Susquehanna River.

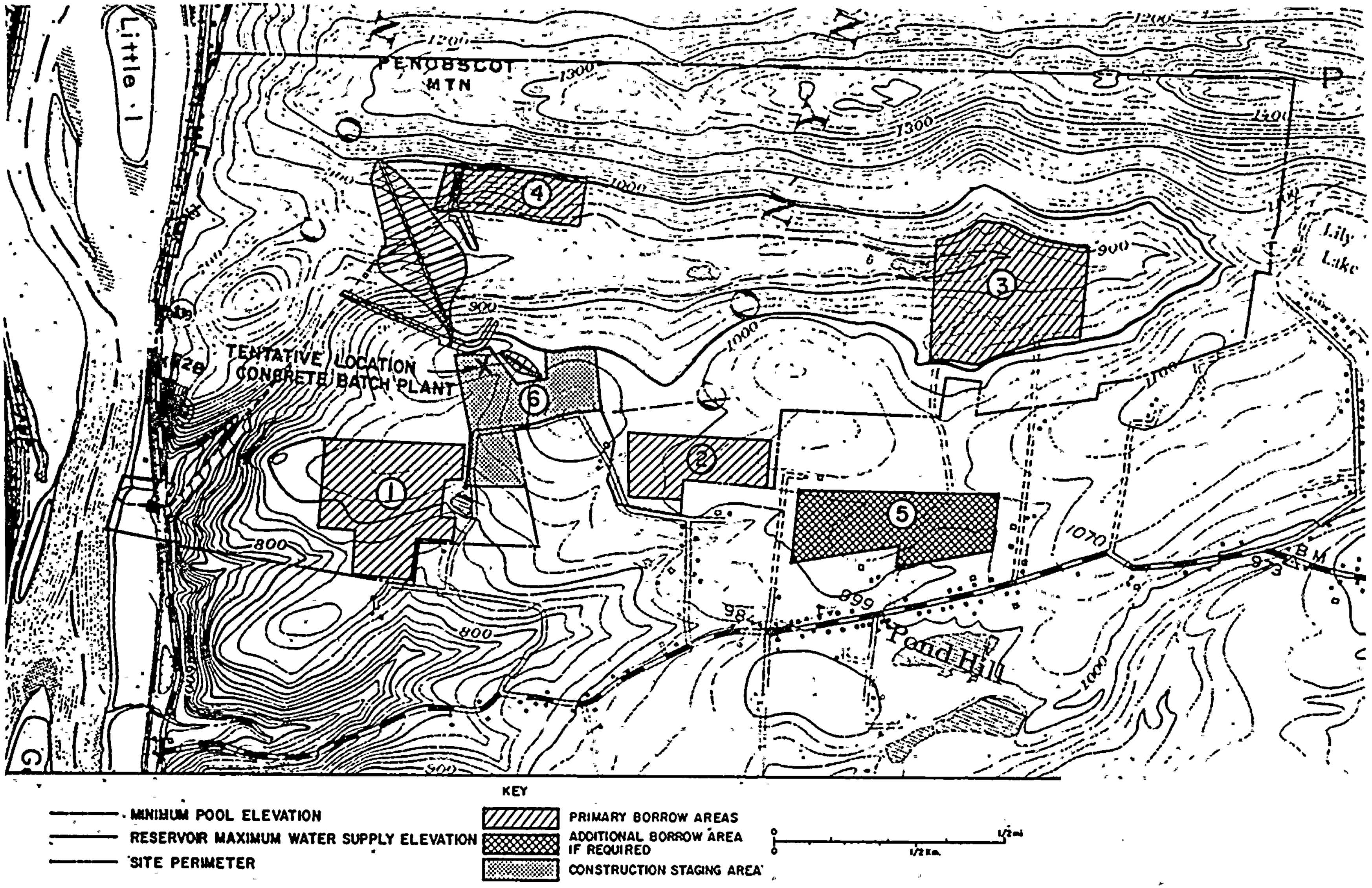

Fig. 3.1. Pond Hill Reservoir Construction Areas. (Source: Reference 1)

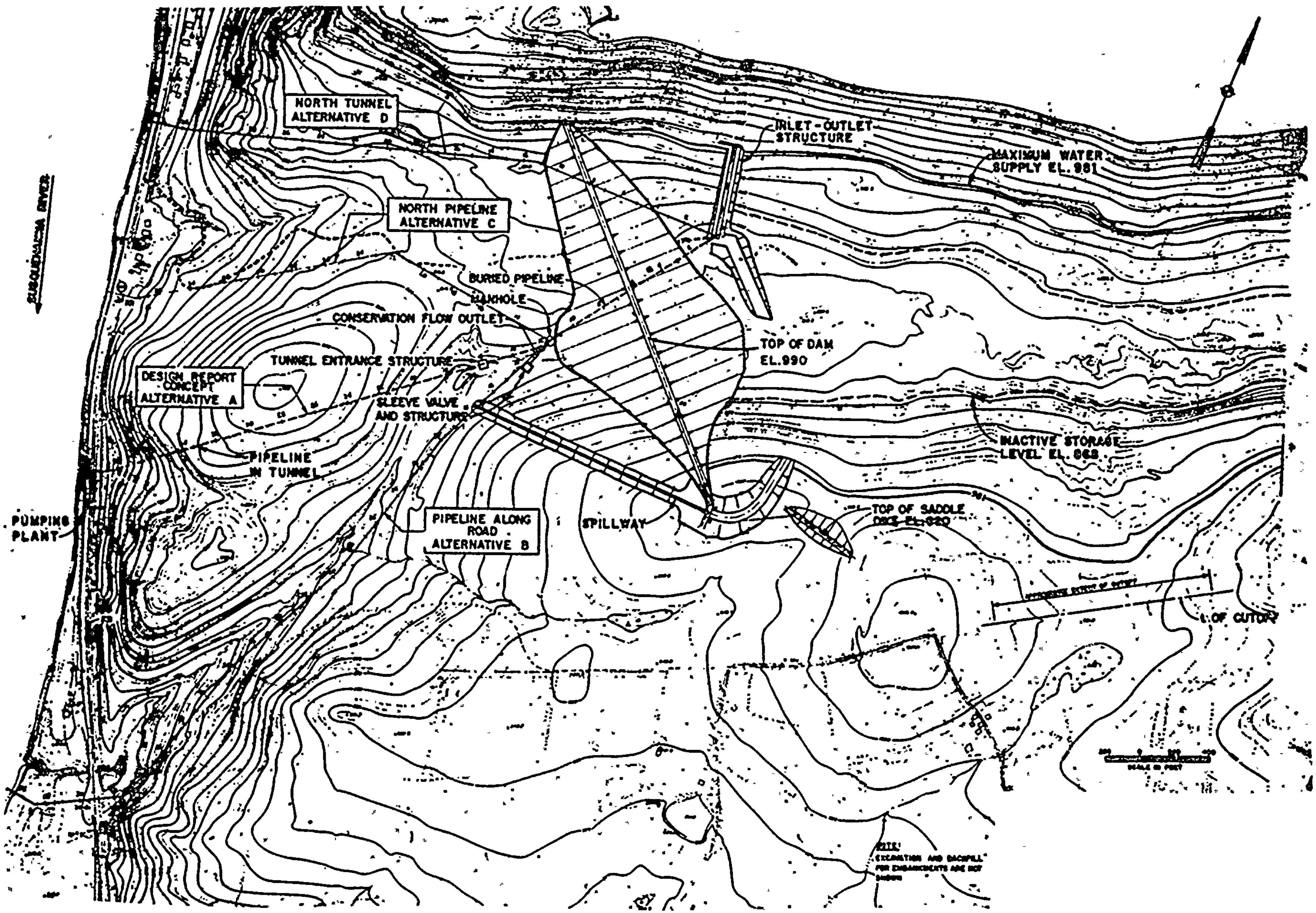

Fig. 3.2. General Project Plan for Pond Hill Reservoir with Alignment of Alternatives. (Source: Reference 1)

3.1.4 Water Conduit

A steel pipeline will be used to transport water between the pumping plant and the inlet-outlet structure (see Fig. 3.2, Alternative B). The pipe will be capable of carrying 3.8 m^3/s of water from the pumps to the reservoir, and up to 3.0 m^3/s for augmentation releases. The pipe from the inlet-outlet structure to the pumping plant will have a diameter of 1.22 m. The pipeline will be constructed in a cut-and-cover trench along the proposed access road (see Fig. 3.2).

A 0.61-m pipeline with a control valve will branch from the pipeline, near the downstream toe of the dam, to allow releases to Pond Hill Creek. The system will be able to release water at a rate of up to 0.57 m^3/s, a flow approximately equal to the capacity of the creek channel to carry water without flooding.

3.1.5 Pumping Plant and Intake Structure

The proposed pump station will be built adjacent to the railroad in an area outside the floodplain (see Figs. 3.2 and 3.3). The proposed intake will consist of two parallel steel pipes extending about 30 m into the river (see Fig. 3.3). Although the final design of the intake structure has not been selected, screens similar to those manufactured by Johnson Screen Company or slotted steel pipes similar to those manufactured by Ranney Co., approximately 60 m of 0.6-m diameter screens, will be provided. The maximum approach velocity will be about 0.12 m/s. The pipe and screen low points will be about 0.6 m above river bottom; pipe tops will be about 1.2 m below water level at minimum pumping flows. Figure 3.3 shows the contemplated configuration of the proposed pump station, intake structure, and the buried pipeline from the pumping plant to the intake screens. Augmentation releases to the river would be through the screens. Three 1.25-m^3/s electrical driven pumps will be used to pump water into the reservoir.

3.1.6 Access Road

A new paved access road will be constructed from State Route 239 to the construction areas. The road will parallel the pipeline.

The road will be approximately 1220 m long and 9 m wide; the area impacted by the construction of the road and pipeline will be about 2 ha. The use of this road will minimize construction traffic through the villages of Pond Hill and Lily Lake.

3.2 MODE OF OPERATION

3.2.1 Initial Filling of Reservoir

Most of the water required to fill the reservoir will come from the Susquehanna River, the remainder from drainage and precipitation. The applicant is committed to pumping only when riverflow is greater than 85.4 m^3/s. The three pumps in the pumping plant are capable of delivering up to 3.8 m^3/s to the reservoir. Pumping at this rate, it would take 84 days to fill the reservoir.

3.2.2 Augmentation Releases

During periods of low riverflow, defined as the Q7-10 value of 22.7 m^3/s plus the average consumptive use of 1.4 m^3/s by SSES, the applicant will be required to discharge water from the reservoir at the actual consumptive use rate. Consumptive water use of SSES will be determined by measuring the difference between the volume of water withdrawn from the river (primarily to replace that evaporated in the plant's cooling towers) and blowdown to the river.

The maximum rate of discharge from the reservoir will be 3.0 m^3/s; the active storage capacity of the dam will be such that this flow could be maintained for 106 days. The applicant estimates peak water consumptive use at about 1.8 m^3/s, and average use at 1.4 m^3/s.

Augmentation water will be taken from one of the four outlet ports in the inlet-outlet structure, pass through the conduit, and be discharged into the Susquehanna River via the multislotted pipes. The outlet port selected would be the one at which the temperature in the reservoir most closely matches that of the river.

3.2.3 Conservation Releases

The Pennsylvania Department of Environmental Resources requires that all new reservoirs provide a minimum release to maintain downstream flows. On streams without water-flow data, a value of

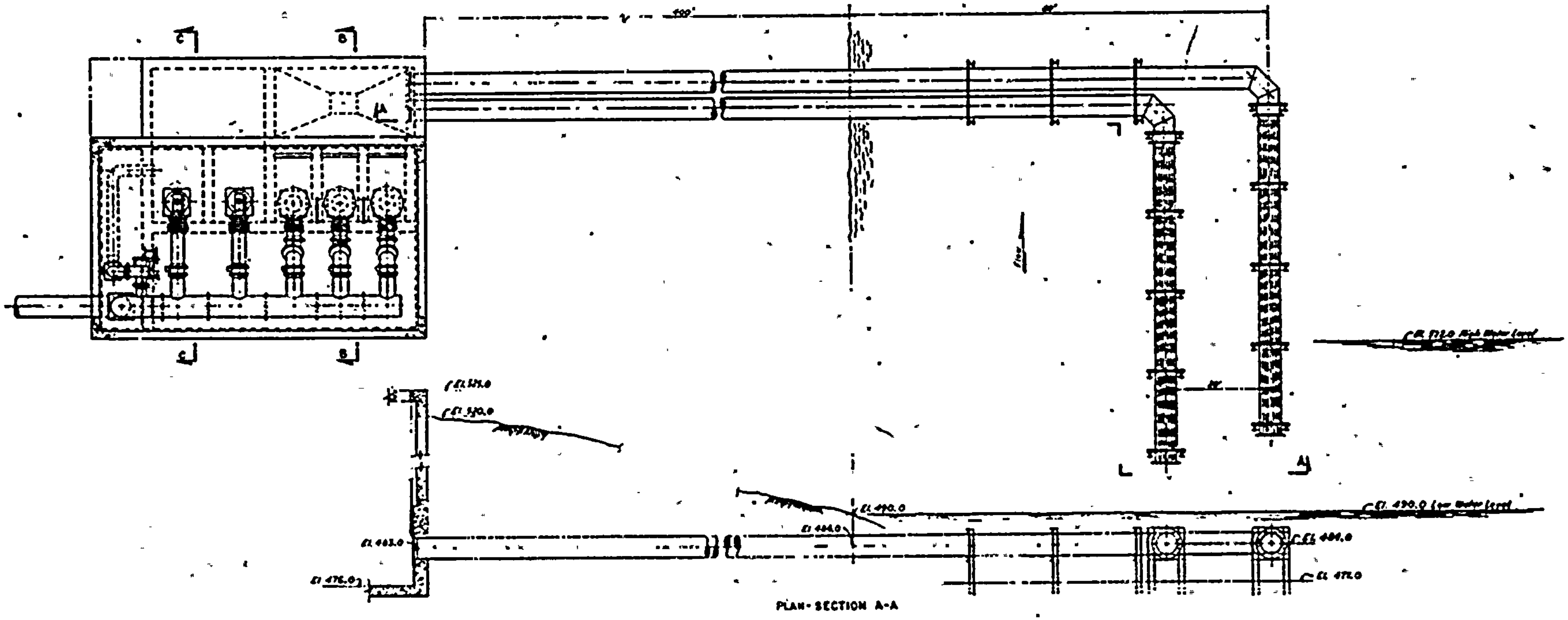

Fig. 3.3. Proposed Intake for Pond Hill Reservoir (pumping station concept without traveling screens). (Source: Reference 1)

1.64 L/s per square kilometer of upstream drainage area is normally utilized by DER. Since the area upriver from the proposed dam is about 4.4 km^2, the applicant proposes a conservation release of at least 5.7 L/s. The release point for this discharge would be just west of the toe of the dam (see Fig. 3.2).

Precipitation on the lake and drainage in excess of that required to keep the water level at 299 m would be discharged into Pond Hill Creek through the conservation-flow outlet (up to 0.57 m^3/s), over the spillway, or directly into the Susquehanna River via the conduit and the pumping plant.

3.2.4 Refilling the Reservoir

Additional water will be pumped into the reservoir whenever precipitation and drainage are insufficient to keep the pond full and replace losses due to seepage, evaporation, augmentation, and conservation flows. As stated earlier, pumping will be permitted only with riverflows in excess of 85.4 m^3/s.

3.3 RECREATION AREA

The applicant proposes to construct a recreation area so that the recreational potential of the reservoir may be utilized. The proposed facilities include a 30- to 50-car parking lot, a launching ramp for non-combustion-engine boats, and a system of trails for hiking and nature trails (ER-OL, Appendix H, Section 4.2.8). Hunting will be permitted in season in the buffer areas around the reservoir. The Pennsylvania Fish Commission will be asked to stock the reservoir for sport fishing; the new aquatic habitat will be suitable for warmwater fishing.

3.4 ESTHETICS

3.4.1 Construction

The appearance of approximately 146 ha of land will be altered by construction and operation of the Pond Hill Reservoir. One hundred twenty-eight hectares of forested land will be inundated. Impoundment structures will convert about 16 ha from natural cover to built-up structures.

3.4.2 Operation

Since most of the buffer area surrounding the site will not be altered during construction, no appreciable changes in the esthetic quality of these areas will occur. The primary change in esthetic values will be the conversion of forested lands to a lake. None of the facilities will be visible from the settlements of Lilly Lake and Pond Hill, or from the roads leading to these communities. Since topographic features will screen the dam from view, the pumphouse will be the only structure visible from State Route 239.

Reference

1. Tippetts-Abbett-McCarthy-Stratton/Engineers and Architects, "Design Report: Pond Hill Reservoir," prepared for Pennsylvania Power & Light Company, February 1979.

4. ENVIRONMENTAL EFFECTS OF CONSTRUCTION AND OPERATION

4.1 IMPACTS ON LAND USE

Approximately 525 ha of land will be converted from present uses to land dedicated to a water storage project. Pond Hill Creek and most of the valley it drains will be permanently altered. About 146 ha of the site will be permanently altered by construction and operation of the reservoir; about 128 ha of presently wooded lands will be inundated and another 16 ha covered by impoundment structures, such as the dam, spillway, and inlet-outlet structure. The access road-pipeline corridors will occupy an additional 2 ha. Most of the areas disturbed by construction activities (about 51 ha) will be reclaimed and landscaped following construction; there will be only minor changes in land use in the remaining undisturbed areas of the site.

Farming on a controlled basis will be permitted to continue within the buffer area of the site.

The impacts of reservoir construction and operation on the terrestrial environment are discussed in Section 4.3.1, those on the aquatic environment are discussed in Section 4.3.2.

4.2 IMPACTS ON WATER USE

<u>Construction</u>

All effluents generated during the concrete batch plant operation will be collected in a holding pond. After the solids have settled out, the supernatant will be either recycled or discharged via a pipeline to Pond Hill Creek. With this treatment, the staff believes that the waste effluent disposal will meet DER requirements for disposal of such waste.

<u>Operation</u>

The staff concludes that the quality of the water discharged from the Pond Hill Reservoir will meet applicable DER and EPA criteria except for an occasional high level of iron. This failure will result in minimal and localized effects on river biota since the iron level will generally be lower than that in the river. Approximately eighteen months prior to operation of the reservoir, the applicant intends to apply for an NPDES permit applicable to reservoir discharges.

4.3 ENVIRONMENTAL IMPACTS

4.3.1 <u>Terrestrial</u>

<u>Construction Impacts</u>

Construction plans for the proposed project have not yet been completely finalized. As currently reported by the applicant, the principal areas to be directly affected by construction activities are indicated in Figs. 2.2, 2.3, 3.1, and 3.2; however, the use of some designated impact areas is qualified as follows. The location of the construction staging area, as well as facilities within the staging area, will be dependent on needs and requirements of the applicant's construction contractor. Also, borrow areas 3 and 4, located within the proposed impoundment area (see Fig. 3.1), will be the principal sources of fill materials used in dam construction (ER-OL, Supp. Response to NRC Q. 17, 28 September 1979). To the extent that suitable core materials available at borrow area 3 are insufficient to complete the dam embankment, the required materials will be removed from either or both borrow areas 1 and 2. Although the need for additional materials is "not anticipated," the applicant has also identified borrow area 5 as a possible offsite source of core materials (ER-OL, Supp., Response to NRC Q. 17, 28 September 1979). Thus a total of about 45 ha of local land outside the impoundment area (borrow areas 1, 2, and 5) may be disturbed to acquire materials for dam construction (ER-OL, Supp. Response to NRC Q. 5, 28 September 1979).

The most obvious and extensive of the adverse construction impacts on the terrestrial environment will result from the destruction or alteration of local vegetation. Most of the vegetation to be affected during construction consists of forest and woodland. Merchantable wood products will be salvaged to the extent practicable (ER-OL, Appendix H, Section 4.3.2.5); however, the growth and growth potential of trees that have not yet attained merchantable size represent a loss of forest resources. The most significant loss of forest vegetation will occur within the proposed impoundment area and within the dam embankment and spillway sites (see Figs. 2.2 and 3.2), about 144 ha of total land area (ER-OL, Supp. Response to NRC Q. 1, 28 September 1979). Virtually all of this area will be cleared of woody vegetation prior to or during construction (ER-OL, Appendix H, Section 4.2.5.2); nearly 140 ha of mixed deciduous and coniferous-deciduous forest will be destroyed. Several small tracts of forest vegetation inside the perimeter of the impoundment area will be left intact to provide habitat for fish (ER-OL, Appendix H, Section 4.2.2.2).

The level of use and activity within the onsite construction staging area will be relatively intense, severely affecting the local vegetation. As noted previously, the size and location of the staging area are not yet resolved. However, given the area as indicated in Figure 3.1, about 8 ha of forest and 6 ha of hayland and old field vegetation will be destroyed or disturbed. Also, the extent to which upland borrow areas (areas 1, 2, and 5; Fig. 3.1) will be disturbed to acquire fill materials for dam construction has not been established (ER-OL, Supp., Response to NRC Q. 17, 28 September 1979). Assuming total utilization of all designated borrow areas, about 22 ha of forest and woodland, and a similar area of herbaceous vegetation will be destroyed. Some additional vegetation, primarily forest, will be disturbed in the vicinity of small construction sites, including those identified in Figure 3.2; namely, the saddle dike and cutoff structure adjacent to the proposed impoundment, the pumping-plant site, and the narrow corridor (18 m wide) cleared for construction of water pipelines and the primary access road (Alternative B). About 2 ha of vegetation will be cleared from the common right-of-way required for pipeline and access-road construction; lesser areas will be affected at the other small construction sites.

The intensity and pattern of soil disturbance resulting from construction will closely correspond to impacts on the local vegetation as discussed. Soils of the proposed impoundment and dam sites will be committed, either totally disrupted during construction or inundated following construction. Land within these areas is unsuitable for cultivation, with the exception of isolated small tracts of Capability Class IV soils (see Sec. 2.5.1.4).

About 29 ha of Class II soils (including prime farmland) occur within the construction staging and upland borrow areas (see Fig. 3.1); the remaining land includes small tracts of Class III and IV soils and more extensive soils unsuited for cultivation (ER-OL, Appendix H, Fig. 3-13). These soils will be variously disturbed during construction; however, soil impacts will be mitigated as follows. The applicant will require that the construction contractor schedule project activities so as to minimize erosion potential. Further, work areas will be stripped of topsoil that, in turn, will be stockpiled and stabilized by establishing a temporary vegetative cover (ER-OL, Appendix H, Section 4.3.2.1). Reclamation of disturbed areas will entail establishing the approximate original contours, replacing topsoil, and providing suitable landscaping.

The applicant will also require the contractor to develop and submit an erosion and sediment control plan for the project site; this plan will be subject to review by appropriate agencies, including the Pennsylvania Department of Environmental Resources (ER-OL, Appendix H, Section 4.3.2.1). The plan will include details concerning practices to be employed, design specifications of control structure(s), and maintenance schedules to ensure effective erosion control. Given that the relatively marginal soils within the impoundment and dam sites will be disrupted or otherwise committed, the staff considers the foregoing provisions and requirements to be adequate precautions for conserving soil resources, provided that such measures are properly implemented. In view of the generally steep gradient of the proposed access road (see Fig. 3.2), the staff recommends that culverts and water-spreader structures be installed at appropriate intervals to control the volume and velocity of runoff from the paved access road as well as runoff intercepted by the roadbed.

The applicant's commitment to landscaping certain disturbed areas will variously offset the adverse construction impacts on the local vegetation. Additionally, the established vegetation will partially offset losses of wildlife habitat incurred during land-clearing and construction activities. However, development of the dam and impoundment sites will preclude reclamation, thus more than two thirds (144 ha) of the total affected wildlife habitat will be severely altered during construction and will be unavailable for use by terrestrial wildlife during reservoir operation.

The extent and types of wildlife habitats affected during construction are implicit in the preceding discussion of impacts on the vegetation. Accordingly, the principal types to be affected will be forest and woodland habitats. Wildlife species strongly dependent on resources of these habitats include locally important game species such as whitetail deer, black bear, eastern red and gray squirrels, wild turkey, ruffed grouse, and American woodcock. Most of the locally occurring mammals utilize forest habitats to varying degrees. For example, the habitat preferences of the eastern cottontail includes brushy areas typical of forest - old field ecotones. However, representative areas of all major habitat types occurring onsite will be affected during construction; thus populations of all mammals identified in Section 2.5.1.2 will probably be deprived of habitat to some extent. Characteristic habitat types of nongame birds as well as reported habitats of locally observed reptiles and amphibians are also indicated in Section 2.5.1.2.

The alteration of habitats will be accompanied by a general migration of animals from the affected areas. The displaced animals will cause increased competition for habitat resources and space in adjacent habitats; the effects of this increased competition will be local and generally of short duration since habitat types similar to those onsite occur extensively throughout the surrounding area. However, all animals will not escape the impacted areas. Some of the less mobile animals, as well as juveniles of other species, will be impinged, buried, or otherwise destroyed during land-clearing and earth-moving activities. Any remaining animals will be subject to increased predation due to the removal of vegetative cover and to destruction of underground refuges. Some additional mortality will occur as the result of collisions with project-related traffic.

Construction noise and activity will also affect animal populations in areas not affected by construction. The applicant will require that noise emissions from construction equipment be in compliance with federal guidelines (OSHA, EPA) (ER-OL, Appendix H, Section 4.3.2.4). The intensity of blasting vibrations will also be controlled to the extent that local structures will not be affected. However, some of the more wary species, such as the wild turkey, will probably vacate the site during the construction period.

As noted, disturbed construction areas (with the exception of the proposed impoundment and dam sites) will be reclaimed if feasible, thus mitigating project impacts on wildlife. The applicant has further committed to improving wildlife habitat of the project site (see Sec. 4.4.1). Pending final establishment of site boundaries, the applicant, in consultation with the Pennsylvania Fish and Game Commissions, will prepare a management plan for the site (ER-OL, Supp., Response to NRC Q. 15, 28 September 1979). Given proper implementation of a sound habitat management program, the staff believes the adverse construction impacts on wildlife can be offset to a substantial extent. The proposed reservoir will provide management opportunities not currently available.

Other construction impacts on the terrestrial environment include dust emissions from work areas and disturbed surfaces; however, the applicant will require the contractor to implement suitable dust control measures (ER-OL, Appendix H, Section 4.3.2.4). Slash materials and other combustible construction wastes will be burned in accord with applicable federal, state, and local regulations (ER-OL, Appendix H, Section 4.3.2.5). The disposition of waste effluents generated during batch plant operation will be in compliance with requirements of the Pennsylvania Department of Environmental Resources (ER-OL, Supp., Response to NRC Q. 6, 28 September 1979). The staff believes that adherence to the foregoing precautions will limit the anticipated impacts to acceptable levels.

Operational Impacts

The most significant operational impacts will occur with the initial filling of the reservoir, i.e., conversion of terrestrial habitats to an aquatic environment. Any residual soils and vegetation within the impoundment area will be inundated. Resident animals will either perish or be forced to migrate as the water level within the reservoir rises. Mortality will occur as animals seek temporary refuge on isolated islands created during initial filling of the reservoir, and as these islands are subsequently inundated. The number and kinds of animals that escape will be influenced by the swimming ability of the various species. The number of affected individuals will be relatively low since most will have been destroyed or displaced during land-clearing and construction activities.

Terrestrial habitat adjacent to the perimeter of the filled reservoir will be subject to disturbance due to wave action. However, the applicant proposes that "suitable ground cover of the slopes in the vicinity of the water line will be provided at all areas where sloughing may be a problem" (ER-OL, Supp. Response to NRC Q. 14, 28 September 1979). Thus, the onsite terrestrial habitat available to wildlife will be decreased by about 127 ha due to filling and operation of the reservoir. This loss of terrestrial habitat will to some extent be offset by the creation of a similar area of aquatic environment that will be used by both terrestrial and aquatic organisms. The future use of the reservoir by wildlife cannot be readily quantified. However, given the applicant's commitment to undertake a wildlife habitat improvement program, the staff does not believe that project related impacts will cause an unacceptable diminution in the overall wildlife productivity of the Pond Hill site.

Other impacts on the terrestrial environment directly attributable to reservoir operation will be of minor consequence. For example, vegetation within the utility right-of-way extending from the pumping-plant site to the reservoir (about 1.2 km) will be controlled. The applicant indicates that only chemicals approved by EPA will be used to control vegetation (ER-OL, Supp. Response to NRC Q. 15, 28 September 1979). Other human activities associated with routine operation and maintenance will generally result in negligible impacts on vegetation, soils, and terrestrial wildlife resources of the site. Operational noise levels will be relatively low; power units used for periodic refilling of the reservoir will consist of electric motors.

The applicant plans to allow public use of the site for specific recreational activities (ER-OL, Appendix H, Section 4.2.2.3). However, such use will be controlled to prevent degradation of the site resources (ER-OL, Appendix H, Section 4.3.3).

4.3.2 Aquatic

4.3.2.1 Pump House and Intake Screens

Construction

As presently proposed, the construction of the pump house will have minimal, if any, impact on either the water quality or the biota of the Susquehanna River. The applicant is committed to construction practices that minimize erosion and control sedimentation. The staff concludes that there will be no aquatic impacts to the two unnamed creeks bordering the proposed pump house on the north and south (see Fig. 2.4).

Installation of the slotted-pipe or wedge-wire screen type of intake (see Sec. 3.1.5) will result in loss of habitat, increased turbidity, and siltation. The staff concludes that the loss of habitat will be insignificant and that increases in turbidity and siltation will be temporary.

Operation

Operation of either a slotted-pipe or wedge-wire screen type of intake is expected to have minimal impacts on the aquatic community of the Susquehanna River. The applicant did not indicate what the slot width would be; however, slot widths as small as 0.25 mm are suggested as a means of screening fine debris and preventing the entrainment of ichthyoplankton.[1] Impingement is purportedly minimized by the absence of a confining screenwell, which may entrap fish, and by the flushing action of ambient currents flowing around the cylindrical screen. To minimize impingement mortalities and to enhance the escape potential of organisms in the zone of influence of the intake flow, the entrance-slot velocity for cylindrical wedge-wire screen designs is generally taken as 12.2 cm/s or less.[2] As the proposed maximum approach velocity for the Pond Hill intake is 11.6 cm/s, the staff concludes that approach velocities should pose no problems.

4.3.2.2 Inundation and Operational Impacts

The rocky, shallow, fast-flowing stretch of Pond Hill Creek to be inundated will become a soft-bottomed, deep, slow-moving body of water. As a result, the aquatic biota will change from a lotic to a lentic community.

The effects of the reservoir on the water quality of lower Pond Hill Creek can be projected by comparing the water quality of the Susquehanna River with that of Pond Hill Creek. A comparison of the respective maximum, minimum, and average water-quality parameters is shown on Table 4.1. The comparison shows that although some amelioration will take place in the reservoir, the water quality of lower Pond Hill Creek will be substantially lowered by the reservoir discharge.

The algae community in Pond Hill Creek consists of periphytic algae and diatoms that become free-floating only when detached during high flow. After inundation, conditions in the reservoir will permit the establishment of phytoplankton and zooplankton populations that will become the principal source of primary production. The reservoir will represent a significant ecosystem change from the present stream habitat, which relies upon the input of organic matter from the surrounding area as the chief source of primary production.

Productivity levels in Pond Hill Reservoir will depend, to a large extent, on the amount of nutrients available for the growth of phytoplankton. The Susquehanna River, which will be the main source of inflowing water for the reservoir, contains high nutrient concentrations year round (ER-OL, Section 4.2.3.2.2). To prevent the development of algal blooms and to control eutrophication, EPA has recommended that total phosphates as phosphorous should not exceed 0.050 mg/L in any stream at the point where it enters any lake or reservoir, nor 0.025 mg/L within the lake or reservoir.[3] Data gathered from 1972 to 1976 indicate that nearly-all monthly

Table 4.1. Comparisons of Water Quality of Susquehanna River and Pond Hill Creek

Parameter[a]	Pond Hill Creek Mean	Max.	Min.	Susquehanna River Mean	Max.	Min.
Temperature (°C)	8.2	16.0	0.0	14.4	25.0	3.0
Dissolved oxygen	11.7	13.9	8.0	11.2	14.9	3.35
BOD	2.0	8.0	<0.5	2.2	5.0	<0.1
COD	8.9	18.0	3.4	13.0	25.0	5.0
pH (units)	7.1	7.6	6.65	7.6	8.6	7.2
Alkalinity as $CaCO_3$	9.2	23.0	<1.0	42.6	66.0	19.0
Total hardness as $CaCO_3$	19.0	24.0	14.0	105.9	167.0	66.1
Total dissolved solids	56.2	133.0	<0.5	171.4	290.0	67.2
Total suspended solids	16.4	120.0	<0.5	17.4	36.6	9.1
Turbidity (JTU)	2.6	5.5	0.7	1.2	16.0	5.1
Specific conductance (μmhos)	51.0	68.0	45.0	222.0	330.0	160.0
Color (CPU)	8.0	22.0	1.0	45.0	80.0	7.0
Sulphate as S	11.4	16.8	6.0	88.0	180.0	28.0
Ortho phosphate as P	0.02	0.06	<0.01	0.05	0.10	<0.01
Total phosphate as P	0.07	0.47	<0.01	0.2	8.84	0.04
Nitrate as N	0.14	0.33	0.01	0.72	1.0	0.43
Chloride	2.7	11.1	0.4	12.4	18.4	6.2
Total copper	0.03	0.06	<0.02	<0.02	0.02	<0.02
Total iron	0.66	3.11	0.20	2.5	4.7	1.63
Total manganese	0.05	0.21	<0.02	0.48	0.9	0.19
Coliform total MPN/100 mL	609.0	>2400.0	43.0	2007.0	72400.0	43.0
Coliform fecal MPN/100 mL	52.0	240.0	<3	412.0	1100.0	3.0
Fecal streptococci MPN/100 mL	4.0	20.0	<1	34.0	85.0	<1

[a]Units mg/L unless stated otherwise.

and annual means of total phosphate levels in the river near SSES considerably exceeded these criteria (ER-OL, Section 4.2.3.2.2). Consequently, based on the total phosphate levels that would be expected in the inflowing water, the potential that eutrophic conditions will occur in Pond Hill Reservoir is relatively high.

The potential for high productivity (i.e., eutrophic conditions) during the first few years of impoundment will be enhanced, since the recently inundated terrestrial vegetation and soils will provide an additional large source of nutrients (ER-OL, Section 4.2.3.2.2). A reservoir becomes less productive over a period of time due to a decline in the quantities of land-supplied nutrients and organic matter and the loss of nutrients to bottom sediments.[3,4,5] Reservoirs act as traps for the nutrients, which adhere to clay particles and settle to the bottom. Once removed, nutrients are less likely to reach surface waters because thermal stratification and chemical conditions in the sediment hinder resuspension or dissolution. During spring and fall circulation of water in the reservoir, some of the nutrients are recycled to the surface for use by phytoplankton. However, once phosphorus reaches the bottom sediments, very little of it usually returns to the epilimnion (ER-OL, Section 4.2.3.2.2). With increasing age, productivity levels in the reservoir will to a large extent depend upon nutrients introduced by inflowing waters and brought to the surface during overturns.

Whenever water must be pumped from the river to meet storage requirements, nutrients in high concentrations will enter Pond Hill Reservoir. Consequently, although nutrients may be somewhat depleted in the reservoir as time passes, an additional supply will be provided during refilling operations. On the other hand, very little pumping will be required during most years.

In general, Pond Hill Reservoir appears to have a relatively high potential for initial eutrophication, followed by a gradual decline in productivity levels as nutrients are lost to bottom sediments. This cyclic pattern may be repeated following periods of pumping to fill the reservoir.

Elevated concentrations of iron will enter the reservoir from the Susquehanna River (ER-OL, Section 3.2.3.2.2). Mean monthly levels of iron in the river ranged from 2.2 to 7.3 mg/L from 1972 to 1976. Most of the iron entering the proposed reservoir will be oxidized, forming precipitates that will subsequently settle to the bottom. Some of this iron will appear in the water column during spring and fall circulation, and in the hypolimnion if it becomes anaerobic; but, with the exception of iron chelated with organic matter, most of it will be oxidized and returned to the sediments as insoluble compounds. Since the iron will probably remain oxidized in bottom sediments, the dissolved iron concentration in the water column will be less than the 1.0 and 1.5 mg/L recommended for the protection of aquatic life.

Iron (by combination and precipitation) does not appear to have reduced phosphate levels nor severely limited phytoplankton productivity near SSES. Because iron concentrations in the Pond Hill Reservoir will decrease, and the levels recorded in the river at present do not appear to have seriously reduced primary production, the effects of iron on productivity in the Pond Hill Reservoir is not expected to be great.

Impacts on water quality from other substances entering the reservoir from the river should be insignificant, since the remaining parameters have been found to meet criteria recommended by DER and EPA. Fecal coliform levels in the river usually exceed standards acceptable for bathing waters. However, fecal pathogenic bacteria will survive for only a few days in the reservoir.[4]

Since the reservoir will be eutrophic, large growths or blooms of diatoms, green algae, and blue-green algae may seasonally occur in some years. However, extensive algal blooms would not be anticipated every year, since there will be a net loss of nutrient salts to the bottom sediments. Macrophytes, such as cattails and pondweeds, should appear in the shallow, inshore waters, but the amount of growth of macrophytes and periphytic algae in Pond Hill Reservoir will be limited, since much of the shoreline will be steep-sided. Mosses and liverworts, which are abundant in Pond Hill Creek, will be eliminated following inundation, since they require hard, unsilted substrates and continuously flowing water for survival.[5] Other periphyton will generally be confined to the littoral or inshore areas of the new reservoir, since growing conditions in the flooded stream channel will no longer be suitable. Iron deposits may also inhibit macrophyte development.

Following reservoir-pool formation, a thin layer of silt will accumulate on the bottom, and a fairly uniform benthic habitat will result throughout the new reservoir. Consequently, since quiet and riffle water habitats and a variety of substrates will be eliminated or covered over by silt, the diversity of benthic macroinvertebrates in the proposed reservoir should be less than that observed in Pond Hill Creek. Species composition will also change significantly. The Pond Hill Creek macroinvertebrates, which require a running-water habitat (stoneflies, caddisflies, and most mayflies), will not survive in the impoundment; those capable of adjusting to quieter waters and/or preferring soft substrates (oligochaete worms, snails, dragonflies, and midge larvae) will become more abundant in the reservoir. However, benthic macroinvertebrates may be further limited by iron deposits on the bottom and/or low dissolved oxygen levels in the hypolimnion. Thus, only the more tolerant macroinvertebrate forms would be expected to inhabit the bottom of the lake. Midge larvae (Chironomidae) will probably dominate the reservoir benthos, since they survive at very low oxygen levels and were found to be abundant in sections of the Susquehanna River in which heavy iron deposits were observed.

Pond Hill Creek is very small and presently supports a limited fish population comprised chiefly of minnows. No endangered or rare fish species inhabit the stream, nor are there any permanent game fish populations present.

A number of factors will affect the type of fish community that will develop in the reservoir. The fish species presently found in Pond Hill Creek, which prefer and/or require running-water habitats, are not expected to occur in the proposed reservoir. These include blacknose dace and creek chubs. On the other hand, golden shiner and fathead minnows, along with bluegills, largemouth bass, and other species inhabiting the small ponds adjacent to the stream may become abundant in the new reservoir.

Low dissolved oxygen and chemically-reduced substances released from bottom sediments may create an unfavorable habitat in the hypolimnion during late summer for many fish species. However, oxygen levels in the epilimnion should remain sufficiently high to support warmwater fishes (ER-OL, Section 4.2.3.3.2).

Iron levels near the intake site have been consistently higher than the 1.0 and 1.5 mg/L criteria. However, a total of forty-two fish species have been found to inhabit this section of the river. Apparently the ambient iron concentrations in the river are not directly toxic to these species. Nor do growth or spawning success seem to have been adversely affected. Consequently, most of the fish species, including a number of game fish, inhabiting the Susquehanna River near the intake site would be relatively unaffected by the iron levels in the reservoir. Possible detrimental effects of iron on the fish in the reservoir should be further reduced by the fact that iron concentrations will be lower than those usually found in the river.

Periodic drawdowns should have no major detrimental effects on fish or other aquatic life in the reservoir. Drawdowns generally will be infrequent and will expose a relatively small amount of the lake bottom; an extensive drawdown of the reservoir would be anticipated only once in about 71 years. All drawdowns would be expected to occur in the late summer and fall months.

The staff also concludes that evaporation rates will have insignificant effects on spawning habitat. The applicant's anticipated evaporation rates are presented in Table 4.2 (Response to NRC Q. 23, 12 October 1979).

Table 4.2. Anticipated Evaporation Rated on a Monthly Basis for the Pond Hill Reservoir[a]

Month	Evaporation (cm)	Month	Evaporation (cm)
January	0.0	July	1.9
February	0.0	August	1.7
March	0.0	September	1.2
April	1.3	October	0.8
May	1.7	November	0.6
June	1.8	December	0.0

[a]Source: Response to NRC Question 23, 12 October 1979.

In general, the proposed reservoir would be a suitable habitat for many warmwater game fish; these could include pickerel, muskellunge, catfish, bluegill (and other sunfish), crappie, smallmouth bass, largemouth bass, yellow perch, and walleye, all of which presently occur in the Susquehanna River near the intake site. These fish will be introduced and maintained by a fishery management program (ER-OL, Section 4.2.3.3.2). A number of these species would probably establish permanent populations in the reservoir.

4.3.2.3 Discharge System

Construction Impacts

Since the discharge system, as presently proposed, will be contained within the same structure as the intake (see Fig. 3.3), impacts associated with construction of the discharge will be the same as those discussed for the intake system (see Sec. 4.4.2.1.1).

Operational Impacts

The applicant indicates that the quality and temperature of water discharged from the reservoir into the downstream section of Pond Hill Creek and the Susquehanna River will be controlled by the multilevel inlet-outlet structure (ER-OL, Sec. 4.3.1). Based on the outlet port elevations (Fig. 4.1), a minimum pool elevation of 264.4 m MSL, and an epilimnion of approximately 6 m, it is the staff's opinion that, as presently designed, only hypolimnetic water will be withdrawn.

Discharging cold, hypolimnetic water into the Susquehanna River for augmentation purposes will result in cold shock for many of the organisms. This loss cannot presently be quantified as proper model information on behavior of the coldwater plume is not available. However, the staff believes that the multi-slotted discharge will enhance dilution and thus mitigate the effect to some degree.

In addition to extreme temperature changes, nutrient concentrations in the discharge may be higher than presently expected, depending on from what portion of the hypolimnion the water is withdrawn. The deeper the water, the higher the concentrations. An exception would be during turnover, when the concentrations are more uniformly distributed.

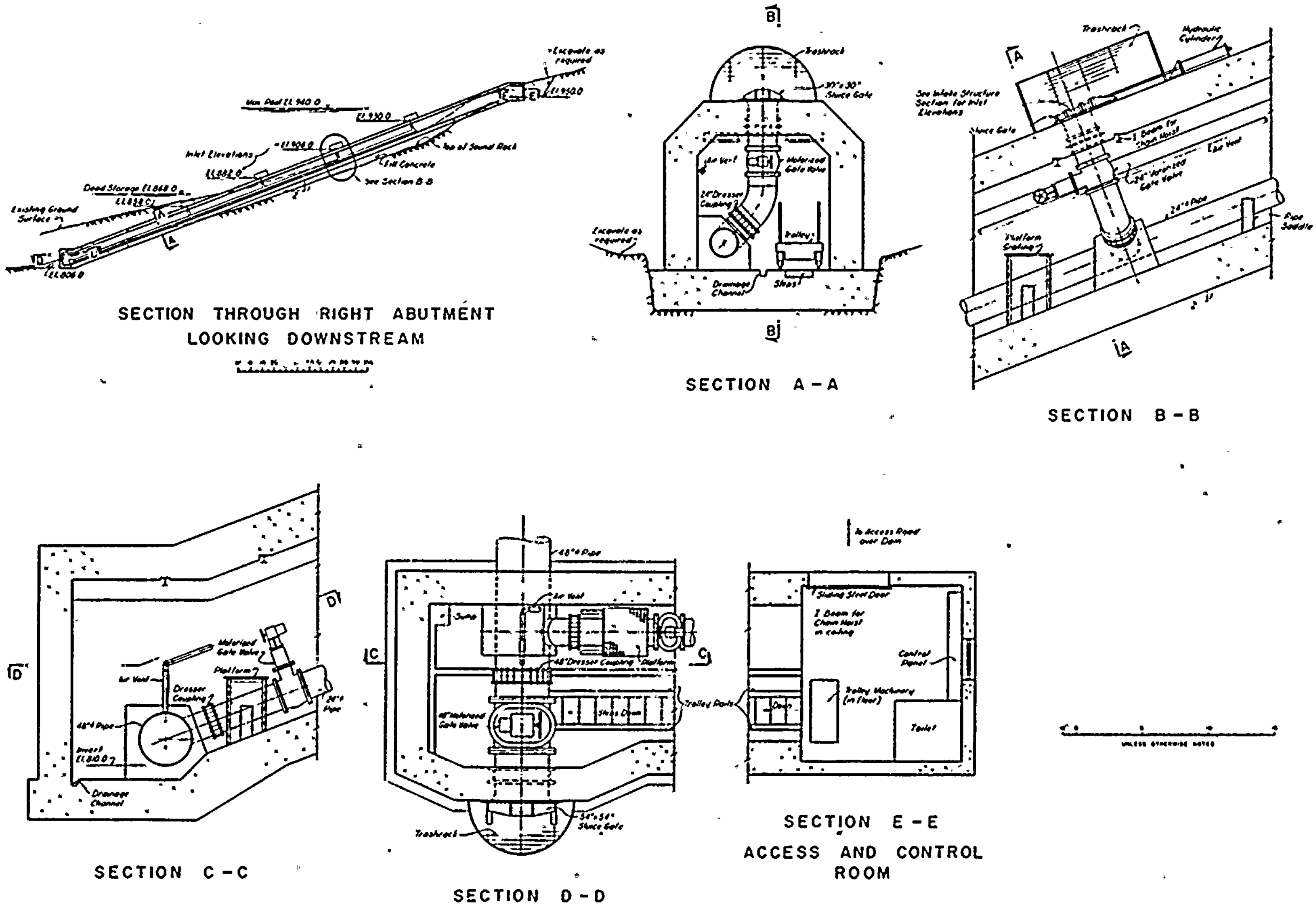

Fig. 4.1. Inlet-Outlet Structure.

Iron levels in the discharge water may be high, especially if release coincides with overturns. In addition, since the reservoir may be eutrophic, large amounts of organic matter may appear in discharges. High iron and organic-matter concentrations in the discharges should have little impact on the Susquehanna River, since augmentation releases will be infrequent and usually small in volume.

Dissolved oxygen concentrations vary inversely with reservoir depth. Anoxic conditions may exist in the deeper parts of the hypolimnion. Obviously the discharge of anoxic water to either Pond Hill Creek or the Susquehanna River would be adverse, with the effects being localized.

A conservation release of 5.7 L/s will be maintained for the remaining section of Pond Hill Creek below the dam. Most of the time, however, the downstream releases will exceed this rate due to natural runoff in the watershed. Although there should be a sufficient quantity of water to support the existing aquatic life in the stream, the quality of the downstream release water may be detrimental to some of the stream organisms. But iron levels in the release water may exceed the recommended criteria, particularly during reservoir overturns. This could result in the deposition or iron precipitates on the stream substrate, which in turn, could limit periphyton and macroinvertebrate communities to iron-tolerant species.

Some scour will result from augmentation releases. The staff concludes that impacts associated with scour will be localized and temporary since the releases will be infrequent and small in volume.

4.3.3 Atmospheric

Converting 128 ha of mixed woodland/field vegetative cover to water will have minimal impact on the atmosphere. The thermal inertia of the stored water will moderate air temperatures slightly. In fall and early winter, light steam fog will occasionally form over the water and move a few tens of meters inland before evaporating. Since there is no heat load on the reservoir, the frequency and density of steam fog will be similar to that of other small lakes in the area.

Equipment used in construction will comply with the criteria established by OSHA and EPA for noise and exhaust emissions. The applicant will require the contractor to employ dust control measures (ER-OL, Appendix H, pp. 4-87).

4.4 HYDROLOGIC IMPACTS

4.4.1 Construction

Stripping of vegetation from the area to be inundated and from other areas will increase the runoff coefficient, resulting in higher peak flows in Pond Hill Creek. However, since this effect will be temporary (the dam, when complete, will provide flood control for the remaining section of the stream) and since there are no residences that can be affected by the higher streamflows, the staff concludes that the impact will be minimal.

The major hydrologic impact of the construction of the dam will be to convert a natural stream, Pond Hill Creek, into a reservoir and a stream whose maximum and minimum flows will be controlled. The hydrologic aspects of the stream before construction are discussed in Section 2.3.2. The upper portion of that stream will be replaced by a reservoir with a normal, or full-pool, elevation of 299 m MSL. This reservoir would cover 128 ha and contain approximately 30×10^6 m^3 of water. The maximum depth during normal pool operation would be about 67 m; the average depth would be 23.3 m.

The applicant used the Hydrologic Engineering Center (HEC) Water Quality Model to simulate the thermal behavior of the reservoir. The model results are sensitive to calibration constants that can only be determined by field measurements. For the Pond Hill thermal simulation, the vertical eddy diffusion coefficients were estimated by comparison with similar lakes and reservoirs. Although the analysis was performed for the smaller reservoir originally proposed by the applicant, the results are useful in that they provide a general description that should be representative of the proposed reservoir's thermal characteristics.

The HEC model predicted that the proposed reservoir would be thermally stratified during the summer with turnovers and mixing in early spring and late fall. A relatively stable thermocline was predicted to form in late April and remain throughout the rest of the spring, summer, and early fall (through October). The model predicted an epilimnion (upper layer) approximately 4.6 to 6.1 m thick with summer temperatures between 20° and 25°C. Temperatures in the hypolimnion (lower layer) were predicted to range from 5° to 10°C.

The proposed location of the pumping station is adjacent to the railroad in an area outside the 1% chance (100-year) floodplain as shown in Figure 2.5. Pipelines connecting the pumping plant to the submerged intake and discharge will be buried in the floodplain. The applicant is committed to restore the land surface in the floodplain after completion of construction. The staff concludes that there is no practicable alternative to the construction of this section of pipeline in the floodplain and that the hydrologic impacts would be minimal.

4.4.2 Operation

4.4.2.1 Water Supply

The Pond Hill Reservoir was proposed to provide replacement for Susquehanna River water consumed by the Susquehanna Steam Electric Station during periods of low flow as defined in 18 CFR 803. The low-flow criterion is the seven-year, ten-day (Q7-10) low flow of the Susquehanna River plus the consumptive water use of the power plant. At Wilkes-Barre, the Q7-10 is estimated to be 22.7 m^3/s. Thus, the requirement for replacement of consumed water becomes effective whenever the riverflow at Wilkes-Barre is below 22.7 m^3/s plus the plant's actual measured consumptive use. Average plant consumptive use is estimated to be 1.4 m^3/s, with the maximum estimated to be 1.8 m^3/s. Therefore, water replacement may be required when flow at Wilkes-Barre is below 24.5 m^3/s.

The reservoir was designed to be able to supply the required replacement water to the Susquehanna River during a recurrence of the drought of record, August to November 1964. During this drought, flow at Wilkes-Barre was below 24.1 m^3/s on 106 days, including one period of 85 continuous days. There was only one additional day when the flow was below 24.5 m^3/s. If it were assumed that the maximum consumptive use occurred on that day, the conclusions would not change significantly. At normal full pool, the reservoir will contain approximately 30 × 10^6 m^3 of water with approximately 27.1 × 10^6 m^3 available for release. If released at an average rate of 1.4 m^3/s, the estimated average plant consumptive use, there will be enough water for more than 220 days without refilling the reservoir. The applicant has assumed a higher release rate of about 2.9 m^3/s. At this rate, the reservoir's available storage would be used up in about 106 days, the number of days for which replacement water would be required during a repeat of the drought of record.

At the assumed average release rate of 2.9 m^3/s, an average of 1.4 m^3/s would be needed for replacement of plant water consumption and 1.5 m^3/s would be available for other uses. During times of greater plant water consumption, the water available for other purposes would be reduced. At the maximum estimated plant consumption rate of 1.8 m^3/s, approximately 1.1 m^3/s would be available for other uses.

The design rate at which the reservoir could be refilled with water from the Susquehanna River is 3.7 m^3/s. At this rate, it would take approximately 84 days to refill the reservoir. However, the applicant has stated that refilling will not occur at times when the flow in the Susquehanna River is below 85.0 m^3/s. Even with this restriction, it is almost certain that the reservoir would be refilled prior to the next low flow.

4.4.2.2 Pond Hill Creek

The operation of the Pond Hill Reservoir will change the character of the remaining portion of Pond Hill Creek, primarily during periods of high and low flow. Most of the time, with the reservoir full, surface flow into, or rainfall onto, the reservoir will be released through the spillway. This flow will be directed to the remaining lower portion of Pond Hill Creek. The replacement of approximately 39% of the upper drainage area of the stream with a reservoir will increase the flow at the spillway during moderate storms. However, during severe storms, the discharge will be limited by the cross-sectional area of the spillway. The excess inflow to the reservoir will be accommodated by a rise in water level.

The applicant analyzed the system response during a 1% chance flood (100-year recurrence flood). The analysis indicated that under natural conditions the peak stream discharge would be about 49.7 m^3/s. The calculated peak inflow (overland flow into and rainfall onto) to the reservoir was estimated to be about 60.8 m^3/s. However, the peak discharge through the spillway was calculated to be only 0.84 m^3/s. The reservoir, therefore, will serve to considerably attenuate the effects of the flood on the downstream portion of the stream.

Normally, with the reservoir at full-pool elevation of 299 m MSL, all inflow to the upper portion of the watershed will pass to the lower portion of the stream via the spillway. The applicant has stated, however, that a minimum flow of 5 L/s will be maintained. A section of pipeline, connected to the reservoir-to-pumping plant pipeline immediately downstream of the dam will be used for this purpose. The release point will be between the toe of the dam and the spillway discharge location. The choice of 5 L/s for the minimum flow is based upon the methodology used by DER to estimate the seven-day, ten-year low flow on ungauged streams. Since the natural streamflow probably ceases during drought periods, the proposed conservation release represents a change in the hydrology of the downstream portion of the stream.

4.4.2.3 Hydrologic Design of Dam

The staff reviewed the hydrologic criteria proposed by the applicant in the hydrologic design of the Pond Hill Dam and has compared the hydrologic criteria with those adopted by the Nuclear Regulatory Commission and many water resources agencies of the United States. Significant differences between NRC criteria and those of the applicant are discussed below.

The applicant used a flood series consisting of the Probable Maximum Flood (PMF) and a "Recurrent Flood" to determine the required storage volume of the dam. The maximum reservoir level calculated was 300 m MSL, more than 1.5 m below the crest of the dam. This would provide adequate freeboard to prevent overtopping of the dam by coincident wind waves. Dam design criteria used by the staff would result in a dam designed to handle the PMF preceded 3 to 5 days by 40 percent of the PMF.

The applicant estimated the depth of the Probable Maximum Precipitation (PMP) at 508 mm in 6 hours. NRC criteria would result in a 6-hour PMP of 673 mm. The differences in the estimates are the result of the staff's use of a more recent report on precipitation than that used by the applicant. In addition, the applicant used an unsupported 20 percent reduction based upon watershed area and shape.

The applicant's "Recurrent Flood" precipitation, based on the record rainfall in the region, is 231 mm in 6 hours. The antecedent flood, based on staff criteria of 40 percent of the PMP is 269 mm. Staff evaluation also indicates that the critical duration for the PMF should be greater than 6 hours, the duration (and depth) of the antecedent flood would also be increased.

Because the proposed spillway is small, it would not be able to pass the peak inflow of the PMF developed using NRC criteria. Instead, most of the inflow would be held in storage in the reservoir, raising the water level until the inflow decreases to equal the outflow through the spillway near the end of the flood. This is characteristic of a volume-controlled flood routing. Because of this characteristic, a PMF of only 6 hours may not be appropriate.

In addition, the applicant applied the "Recurrent Flood" two days after the PMF. This procedure does not raise the calculated maximum reservoir level, which is achieved during the PMF. A common approach in evaluating reservoir volume is to assume an antecedent flood. This serves to raise the water level in the reservoir before the PMF and thus to increase the maximum level attained during the PMF. This sequence of flooding is not only representative of generally used design criteria but, with respect to relative magnitudes, is more representative of flood sequences noted in historical records. Applying NRC criteria to this dam would raise the calculated maximum water level in the reservoir, to the extent that overtopping would be expected.

The applicant, using its criteria, did not predict overtopping of the dam. If the dam were to be overtopped, staff believes that the dam could fail. The flooding that would result from failure of the dam would produce rapidly rising water elevations downstream of the dam site. The potential exists to trap and drown persons and wildlife in the downstream floodplain during such flooding. The potential for harm to persons using Route 239 and the railroad during such flooding also exists.

4.4.2.4 Groundwater Effects

Filling of the reservoir will alter the groundwater conditions within the drainage area of the upper portion of Pond Hill Creek. The groundwater level should rise to at least the level of the reservoir at its perimeter. Since groundwater levels in the ridge north of the reservoir are clearly well above the reservoir level, there should be no effect on the groundwater regime north of the Pond Hill Creek drainage area. The limited information available on the groundwater conditions on the ridge south of the reservoir indicate that groundwater levels are also above the proposed water level in the reservoir. In addition, the applicant has proposed a saddle dam and an impervious cutoff section along the two lowest sections of that ridge. The staff, therefore, concludes that groundwater levels south of the ridge should not be affected by the reservoir.

4.5 SOCIOECONOMIC IMPACTS

The following is an assessment of the potential socioeconomic impacts of the construction and operation of the Pond Hill Reservoir on local communities in Luzerne County. Direct and indirect changes to the sociocultural systems of local communities are expected to be a result of the construction work force and related activities and of the presence of a lake in a previously wooded, rural area.

4.5.1 Demography

The peak construction work force will contain 125 individuals with 85% (106) of the workers expected to be commuters and 15% (19) in-migrating workers (Response to NRC Question 26). The applicant estimates that fewer than five of the expected in-migrants will bring their families; assuming two children per family, an additional ten school-aged children are expected as a result of this project (Response to NRC Q. 26).

Because of the short duration (two years) of construction and concurrent phasedown of construction at the Susquehanna Plant, the staff believes that induced service personnel will not result from the nineteen additional workers and their families moving into the local area. If these in-migrants are dispersed throughout the impact area, their additional service demands should be met by current staff and facilities.

4.5.2 Settlement Pattern

4.5.2.1 Housing

Specific information on the housing type and location preferred by the in-migrants is not available. The applicant states that workers at the Pond Hill site are expected to make arrangements for temporary housing--motels, boarding houses--and return home on weekends (Response to NRC Q. 26).

Available housing in communities close to the project area, such as Pond Hill, Mocanaqua, and Shickshinny, is virtually nonexistent. However, the applicant believes that some transient housing would be available in Wilkes-Barre or Nanticoke and additional housing is expected to become available in the Berwick-Bloomsburg area as the SSES work force is reduced.

However, factors such as local scenic qualities, recreational opportunities, gasoline prices, cost of living, etc., may attract more than the projected number of in-migrants. They and their families might choose to seek housing in the immediate area during some parts of the year rather than to commute from larger service centers. In such an event, housing competition may occur.

Operation of this project may also produce a secondary effect on local housing patterns because of the land-use changes brought about by the reservoir. Some residential development may take place in the areas surrounding the reservoir and buffer area. The applicant has provided estimates of the maximum and minimum number of residential development units that may be constructed, 35 and 140 units, respectively.[6] However, future development will depend on a combination of sociocultural factors, including the perceived attractiveness of the area, goals and values of the individuals wanting to build, local planning goals, availability of private land, and attitudes of local landowners.

The applicant should monitor the housing changes as part of the SSES socioeconomic monitoring program. If housing impacts are identified, local planners should be notified and the applicant should cooperate to mitigate impacts determined to be undesirable.

4.5.2.2 Transportation

The construction and operation of the Pond Hill reservoir will impact local transportation systems. During construction, Route 239 and, to a lesser extent, LR 40120 will be affected by increased use for transport of construction-related equipment and materials and commuting workers.[6] In order to minimize traffic impacts in Pond Hill, the applicant will build a new access road to the reservoir site (Response to NRC Q. 8, part b). In addition, Route 239 will be affected by the construction of the pump station, when traffic will temporarily be reduced to one lane. The applicant has studied the cumulative effect of the Pond Hill and SSES projects and concludes that an additional police officer will be needed to facilitate traffic flow so as to avoid major transportation impacts.[6]

During operation, increased traffic volumes are anticipated on township roads because of the recreational facilities that will be available at the reservoir.[6] And, although the construction of a new access road to the site will lessen some of the impacts, the specific magnitude of these increases and their specific locations are not known at this time.

The applicant is committed to cooperation with the local townships to repair roads damaged due to reservoir construction activities.

4.5.2.3 Recreation

The applicant has summarized the outdoor recreational areas by owner and acreage for the general region and Conyngham Township (Reference 6, Tables 3.2.8-1 through 3.2.8-3). Forecasts of state recreational demands show a need for more facilities in almost all outdoor recreational activities. The staff believes that some of the projected recreational needs will be met by the Pond Hill Reservoir and associated facilities described in Section 3.3. The Pennsylvania Fish Commission will be asked to stock the lake for warmwater sport fishing. The recreational potential created by these facilities is estimated to be from 7,300 to 10,000 visitor-days per year, not including visitations related to hunting or winter sports.[6]

The applicant has defined five recreational development objectives in order to maintain the ecological characteristics and remote setting of the site and to minimize impacts of operation on the local communities while providing facilities that meet their perceived needs.[1] The staff notes that these objectives were considered in the designs for recreational use and project maintenance particularly to avoid greater use of the site than its intended design capacity. However, realistic management of the recreational use of the facility requires a monitoring program to quantify use and need estimates and to guide programs intended to prevent overuse of the site.

4.5.3 Impacts to the Social System

The applicant states that short- and long-term impacts to the cohesion of local communities near the reservoir site are not expected (Reference 6, Sec. 4.2.4.7). The staff believes that direct impacts to social institutions or cohesion will not be severe because of the small work force and projected number of in-migrants and because the project area does not physically divide a community or separate communities. Potential effects on lifestyle; values; beliefs; and solidarity of local groups, neighborhoods, and communities would be due to indirect operational impacts of induced development. Such impacts could begin during construction. The potential for developmental impacts to the local settlement system were discussed in Section 4.6.2.1 of Reference 6.

4.5.4 Social Services

Because of the small work force, short duration of the project, and expectation of few in-migrants, impacts to most kinds of social services are not expected. However, impacts associated with increased traffic may require traffic-control personnel in some local areas.

4.5.5 Impacts to the Political System

Direct impacts to the political organization of local communities are not expected. Should indirect impacts occur, such as induced development, planning decisions, increased personnel, financing and zoning, consideration may be required. A well-designed monitoring program that provides local governments with the study results in a timely manner could make future planning decisions more effective and could help ameliorate undesirable impacts before they occur at local levels.

4.5.6 Impacts to the Economic System

Although the economic impacts of the construction phase of the project will be small, they are expected to be beneficial to the region and to some local businesses. The applicant states that construction cost (50% in materials) will have a multiplier effect on the regional economy.[6] Moreover, many construction materials and equipment may be purchased within Luzerne County; additional spending may result as these industries increase their purchases from other industries and hire more labor.[6]

The applicant has also studied regional labor availability for this project. Based on the data presented in Section 4.2.4.3.2, of Reference 6, and the Response to NRC Question 27, the staff agrees that a surplus of labor exists within an 80-km radius of the project area, and it is likely that all project labor can be supplied from within the economic study region. Workers and their families within this area are expected to spend and invest part of their salaries in the communities in which they reside.

Operation of the reservoir will be primarily automated, requiring only a one- or two-person maintenance crew and few supplies; consequently, significant economic impacts are not expected.[1]

4.6 IMPACTS TO CULTURAL RESOURCES

The applicant will conduct a field reconnaissance program for the location of cultural resources on the reservoir property during the spring of 1980. Details of the applicant's proposed archeological survey program are presented in Appendix B. Should cultural resource sites be located, a management program for the evaluation, mitigation, and/or monitoring and protection of each site must be developed prior to construction activities. This management program must be designed to consider protection from both direct and indirect impacts of construction and operation.

References

1. "Johnson Screens in Surface Water Intake Systems," Bulletin 1S577. Johnson Division of United Oil Products, Inc. St. Paul, MN, 1977.
2. J. B. Canon et al., "Fish Protection at Steam-Electric Power Plants: Alternative Screening Devices," Prepared for USNRC, Division of Site Safety and Environmental Analysis, under Interagency Agreement DOE 40-544-75 and the USEPA, Region II, Water Facilities, Branch-Energy & Thermal Wastes Section, Water Division, July 1979.
3. "Quality Criteria for Water," U.S. Environmental Protection Agency, Washington, D.C., 1976.
4. E. T. Chanlett, Environmental Protection, New York: McGraw-Hill, 1973.
5. H. B. N. Hynes, The Ecology of Running Water, Toronto: University of Toronto Press, 1972.
6. Tippetts-Abbett-McCarthy-Stratten/Engineers and Architects, "Design Report: Pond Hill Reservoir," prepared for Pennsylvania Power & Light Company, 1979.

5. ALTERNATIVES, NEED FOR FACILITY, AND BENEFIT-COST ANALYSIS

5.1 ALTERNATIVES TO CONSTRUCTING A WATER STORAGE RESERVOIR

The applicant has given consideration to two alternative procedures that would not require the construction of an offstream water storage reservoir and would comply with the requirements of the Susquehanna River Basin Commission:

1. Not operate the Susquehanna Steam Electric Station whenever flow in the Susquehanna River fell below the consecutive seven-day low flow expected to occur every ten years (the Q7-10 value).

2. Purchase makeup water from existing reservoirs.

The applicant has submitted the following documents in support of analysis of alternatives:

1. Appendix H, Section 2 to the Environmental Report for SSES.

2. "Assessment of Sites for an Augmentation Reservoir for the Susquehanna Steam Electric Station," Tippetts-Abbett-McCarthy-Stratton, August 1977.

3. Letters from N. W. Curtis, PP&L, to D. E. Sells, NRC, 12 October and 13 November, 1979. Item 3 contains the applicant's response to staff questions on alternatives.

5.1.1 <u>No Action Alternative--"River Following"</u>

The applicant could meet SRBC requirements by choosing not to operate SSES during periods of low riverflow (defined as less than 24.1 m^3/s as measured at the Wilkes-Barre gauge). This mode of operation, called "river following," would require the generation of replacement electrical power from other units within the PP&L or PJM power system, or the purchase of power from other utilities.

Based on the critical flow value, 24.1 m^3/s, the river-following mode of operation would have required the shutdown of SSES for 106 days in 1964, the year of record low flow in the river.

The use of the river-following option would, in some years, require several additional shutdowns and startups of the SSES reactors, and also of the generating units providing the replacement electrical power. This cycling of units would add to maintenance costs and efforts and would probably decrease plant and system reliability.

5.1.2 <u>Use of Existing Reservoirs</u>

The applicant has examined the potential for purchasing the required volume of replacement water from an existing (or under-construction) reservoir, including those owned by the Pennsylvania Gas and Water Company (PGW), the U.S. Army Corps of Engineers (COE), and the Soil Conservation Service. Expansion of PGW's Nesbitt Reservoir to hold the required volume of water would entail the construction of a new 64-m high dam and a long refilling pipeline from either the Lackawanna or Susquehanna River. Estimated costs of expanding the Nesbitt Dam would be greater than that of constructing the Pond Hill Reservoir. The staff agrees with the applicant that, due to higher costs and potential for delays, the use of PGW's water storage facilities is not to be preferred over the Pond Hill Reservoir.

COE has two dams under construction in Tioga County, Pennsylvania. The applicant has sent to COE a request to purchase augmentation water flow from the Cowanesque Reservoir, scheduled for completion in 1982. SRBC's response to this request was that the Cowanesque Reservoir is not now a timely alternative (ER-OL, Appendix H, page 2-3). COE has also indicated that congressional action may be required to make water storage an authorized use of the water in Cowanesque Lake (PP&L response to NRC questions). No firm cost values can be assigned to the use of COE-stored water.

5.1.3 Summary

The staff agrees with the applicant that the river-following alternative, while a viable one, is less desirable than the construction of Pond Hill Reservoir. The staff also agrees with the applicant and the Susquehanna River Basin Commission that there is the potential for long delays in obtaining the required augmentation releases from Cowanesque Lake, making the second option less desirable than the construction of Pond Hill Reservoir.

5.2 ALTERNATIVE SITES

The applicant has identified twelve potential alternate locations for the Pond Hill Reservoir (ER-OL, Appendix H, Section 2.4). This analysis is based on a usable water storage requirement of 11.7×10^6 m^3, the volume of water that would be required for an augmentation flow of 1.42 m^3/s for 96 days.

The thirteen site were selected in part from a 1970 SRBC study. In 1977, an engineering consulting firm identified and investigated the technical, economic, and environmental characteristics of each site (Reference 1 and ER-OL, Appendix H, Section 4.2). TAMS's analysis of the 12 alternate sites was based primarily on reconnaissance-level information.

The applicant subjectively rated each site on the basis of eleven environmental engineering factors: number of residential units within the site; number of residential units below the proposed dam site; amount and type of agricultural activity affected; agricultural capability classification of soils within site; length of stream inundated; quality of the affected stream's fishery; water quality of the reservoir's water source (this would directly affect the reservoir's potential water quality); potential impact on pumping source (with particular emphasis on proportion of total flow to be pumped and on fishery quality); a qualitative judgment of the wildlife habitat within the site relative to the other sites studied; length and type of water conduit (i.e., pipeline or tunnel) and character of area that would be traversed by a pipeline; and area exposed by maximum drawdown (directly related to the size and shape of the reservoir).

Factors such as topography, hydrology, geology, and estimated cost of construction were also evolved. Construction impacts, except for the water conduit pipe and route, were considered to be similar for all sites. This analysis showed that the Pond Hill site would be the preferred site.

The staff has reviewed the applicant's site selection procedures and concludes that the methodology used by the applicant is satisfactory and that none of the alternate sites is environmentally obviously superior to Pond Hill Creek. The staff's judgment is based in part on visits to the Pond Hill area and to four alternate sites.

5.3 BENEFIT-COST ANALYSIS

5.3.1 No Action Alternative--"River Following"

Based on historical riverflow, the riverflow will be lower than the critical level on an average of 3.3 days per year (ER-OL, Appendix H, Section 1). Under the river-following alternative, the applicant would have to buy replacement energy to make up for the loss of generation due to the shutdown of SSES. The applicant estimated the average annual energy requirement for four days of shutdown (including that for start-up time) to be between 160,000 MWh and 170,000 MWh (response to NRC Q. 33, 12 October 1979). The energy range is due to the difference in length of start-up time associated with cold or hot reactor shutdown conditions. If an equal probability of hot or cold shutdown condition is assumed, the average annual energy requirement, as per the applicant's estimate, would be 165,000 MWh. Staff's estimate of energy loss during the four-day period, assuming 70% capacity factor, is 146,000 MWh. The applicant's and the staff's thirty-year present worth of the average annual replacement energy cost are 117.8 and 104.2 million dollars, respectively (Table 5.1). In order to make a fairer comparison for benefit-cost purposes, it is important to subtract the cost of operating SSES from the replacement energy cost. It should be noted, however, that there are some advantages (such as improved systems reliability) of operating SSES over and above the difference between replacement energy costs and SSES operating cost.

The applicant's and staff's thirty-year present worth of the average annual replacement energy cost at the incremental price are 64.3 and 56.9 million dollars, respectively (Tables 5.1 and 5.2). The staff's estimate of present value of average annual replacement energy cost falls between $41 million for the best-case (average annual shutdown of three days) and $192 million for the worst-case (average annual shutdown of fourteen days). The probability of shutdown of less than or equal to 3 days and 14 days are 86.1 and 99.1 %, respectively (Table 5.3).

Table 5.1. Thirty-year Present Worth of the Average Annual Replacement Energy Cost

	Applicant[a]	Staff	Pond Hill Reservoir Cost[b] w/o tax	w/tax
Annual 4-day energy loss (MWh)	165,000	146,000	--	--
30-year present worth at incremental price (M$)[a]	64.3	56.9	48.7	62.3
30-year present worth at replacement price (MS)	117.8	104.2	49.5	63.1

[a]Response to NRC Question 33, 12 October 1979.

[b]Letter from L.E. Schroder, PP&L, to R. Prasad, ANL, 19 November 1979.

Table 5.2. Staff Estimates of Replacement Energy Cost at the Incremental Price

Year	Replacement Price (mills/kWh)	Nuclear Gen. Price (mills/kWh)	Price Growth (%)	Incremental Price (mills/kWh)
1978	25	--	--	--
1980	35	13.0	--	--
1983	35	15.90	6.96	19.1
1985	40	18.20	6.9	21.8
1990	65	29.5	10.19	35.5
1995	100	45.5	8.99	54.6
1995-over	--	--	5.0	--

Table 5.3. Shutdown Probabilities[a]

Days	% Probability of Generation Loss	Annual Average Day Loss	Present Worth ($ million) At Replacement Price	At Incremental Price
0	83.00	--	--	--
≤3	86.00	3	75.6	41.2
≤4	89.00	4	100.7	55.0
≤7	90.00	7	176.3	96.2
≤14	94.00	14	352.6	192.4
≤31	99.0	31	780.8	426.1
96	1.0	96	2418.1	1319.8

[a]Source: ER-OL, Vol. 4, pp. 1-4, Table 1.3.2-1.

5.3.2 Use of Existing Reservoirs

The applicant has explored the potential for using water supply storage in an existing storage facility to augment the riverflow during the low riverflow period to keep SSES operating. Among the projects considered, the applicant, in consultation with COE, found the Cowanesque project to be the most suitable from the point of view of timeliness and availability of water supply storage. But in their recent response they have pointed out many uncertainties regarding the availability of water storage due to congressional approval requirements and the Susquehanna River Basin Commission's comment that Cowanesque Lake cannot presently be considered as a timely alternative for supplying makeup water for SSES (applicant's response to NRC Q. 39, 12 October 1979). The applicant estimates the approximate cost of this alternative to be $12 million over a 30-year period. The staff does not have sufficient information to substantiate the cost.

5.3.3 Pond Hill Reservoir

The third alternative considered was the building of a reservoir; this would assure a source of low-flow augmentation. The applicant has proposed to build Pond Hill Reservoir for water supply storage. The overall cost of the project is estimated by the applicant as $47 million (in 1983 dollars). The applicant has assumed that the only cost associated with the Pond Hill Reservoir will be the electricity cost of pumping water into the reservoir. They estimate a yearly capacity cost of $40,300 and 2417 MWh (3357 kWh × 30 days × 24 hours of electricity) (personal communication, L. E. Schroder, PP&L, to R. Prasad, ANL, 19 November 1979). The present values of this alternative, over 30 years, are $48.7 and $49.5 million, including incremental and replacement price of electricity. On a purely economic benefit-cost analysis, which treats the tax cost as the transfer payment, these would be the costs of the project. If the property tax (in Pennsylvania the public utility realty tax is 3% of value) were treated as an added project cost, the staff's estimate of $63 million present value of the project would be very close to the replacement energy cost under the river-following alternative. One can also look at the property tax of $1.41 million as a compensation (benefit) for the environmental cost (undetermined) to the community.

5.3.4 Discussion and Conclusions

The cost of the river-following alternative is very dependent upon the probability of the occurrence of period length (number of days) of low riverflow. From the analysis, it appears that, if low riverflow were to occur at an annual average of four days, the cost of the Pond Hill Reservoir alternative would be very close to the replacement cost of electricity under the river-following alternative. But, if the annual average period of low riverflow were 25 days (4% probability), the energy replacement cost could be as high as $344 million.

The best economic alternative would appear to be the use-an-existing-reservoir alternative. Based on the information available, Cowanesque appears to be the most economic among all alternative reservoirs, given that concerned authorities grant the use of water for flow augmentation.

The river-following alternative took into account only the cost of replacement energy; it did not consider the effect of SSES shutdown on system reliability. The effect of shutdown on reserve margin is shown in Table 5.4. PP&L's projected reserve margin without Susquehanna after year 1985 is significantly lower than its historical margin since 1973. PJM's reserve margin without SSES is projected to be approximately 25%, which is acceptable for the reliable operation of the interchange. PP&L, being a winter-peaking system, is able to operate with a reserve margin of 5%. PP&L could provide reliable service to its customers even during a short interval of shutdown of SSES.

5.4 EVALUATION OF UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

5.4.1 Land

The 525-ha site will be removed from current uses and dedicated to reservoir uses for the life of the project.

The development of the Pond Hill dam and impoundment sites will result in a long-term commitment of about 146 ha of land area. About 16 ha of this area will be altered during construction of the dam embankment, the spillway, and the overflow channel; 128 ha will be inundated following construction. About 2 ha will be used for the development of ancillary impoundment structures, water pipelines, pumping plant, service facilities, and highway access. Virtually all of the areas to be committed are presently forested land.

Table 5.4. Effect of Shutdown on Reserve Margin[a]

Projected	PJM/PP&L Reserve Margin 1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
With Susquehanna										
PJM	34	33	34	30	30	31	30	31	29	27
PP&L	29	44	58	53	48	46	42	35	33	30
Without Susquehanna										
PJM	37	30	29	25	25	27	26	27	25	23
PP&L	29	26	23	18	15	13	10	4	2	1

Historical	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
PJM	13	21	22	16	28	39	42	38	40	35
PP&L	1	6	14	34	30	39	27	48	39	35

[a]Response to NRC Question 35, 12 October 1979.

Other principal land areas that will be disrupted or otherwise adversely affected during project construction include a construction staging site and upland tracts excavated to acquire core material for dam construction. An estimated 14 ha of land will be used for construction staging. The areas affected by borrowing activities will be dependent on the amount of core materials available at the various sites; a total of about 45 ha of upland terrain has been designated as primary and reserve source areas for borrow materials. There will be less land available for hunting and hiking.

5.4.2 Water

A 128-ha lake will be created in an area now forested. About 2.3 km of Pond Hill Creek will be destroyed and inundated. The lower 1.3-km stretch of Pond Hill Creek will be converted from a free flowing stream to a regulated one with a minimum flow of 5.7 L/s. Water quality in the lower reaches will be degraded during construction (erosion) and operation of the reservoir.

5.4.3 Air

Once the reservoir has been completed, there will be a very minor increase in the frequency of steam fog in the area. Air quality in the construction areas will be decreased during the construction period due to fugitive dust and emissions from construction equipment.

5.4.4 Terrestrial Ecology

Construction

Assuming total utilization of all designated borrow areas, about 195 ha of vegetation and, therefore, wildlife habitat will be destroyed or disturbed during land-clearing and construction activities. More than 80% of the vegetation to be affected consists of forest communities. Site reclamation will entail landscaping about 25% of the denuded area, partially mitigating losses of vegetation and wildlife habitat. Some individuals of the less mobile wildlife species will be destroyed during construction; other species will vacate the disturbed areas. The displaced animals will cause increased competition for habitat resources in adjacent areas; however, the consequences will probably be minor in nature and of short duration since habitat conditions similar to those onsite occur extensively in the surrounding area.

Operational

The principal impacts resulting from project operation will occur with the initial filling of the reservoir. Residual vegetation will be inundated. Some additional wildlife will perish by drowning or be displaced from the impoundment site. The end effect of reservoir filling will be the conversion of about 128 ha of terrestrial habitat into an aquatic environment.

5.4.5 Aquatic Ecology

About 2.3 km of aquatic habitat along Pond Hill Creek, a healthy, unpolluted, natural stream, will be converted from that of a free-flowing small stream to that of a stagnant reservoir. The reservoir will support a much larger fish population than the area presently supports. There will be some loss of fish and other aquatic life in the Susquehanna River due to impingement and entrainment during periods when water is pumped into the reservoir; these losses are expected to be minimal.

Reference

1. Tippetts-Abbett-McCarthy-Stratton/Engineers and Architects, "Design Report: Pond Hill Reservoir," prepared for Pennsylvania Power & Light Company, 1977.

APPENDIX A.

Letter from U.S. Fish and Wildlife Service re federally proposed endangered and threatened species in Pennsylvania

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
One Gateway Center, Suite 700
NEWTON CORNER, MASSACHUSETTS 02158

IN REPLY REFER TO:

William H. Regan, Jr., Chief
U.S. Nuclear Regulatory Commission
Environmental Projects Branch 2
Division of Site Safety and Environmental Analysis
Washington, D.C. 20555

Dear Mr. Regan:

This responds to your May 23, 1979, request for information on the presence of Federally listed or proposed endangered or threatened species within the impact area of the proposed 230 acre reservoir to be operated in conjunction with the Susquehanna Steam Electric Station near Berwick, Pennsylvania.

Except for occasional transient individuals, no Federally listed or proposed species under our jurisdiction are known to exist in the project impact area. Therefore, no Biological Assessment or further Section 7 consultation is required with the Fish and Wildlife Service (FWS). Should project plans change, or if additional information on listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to endangered species under our jurisdiction. It does not address any other FWS concern or concerns of the National Marine Fisheries Service (NMFS). As the shortnose sturgeon (Acipenser brevirostrum) is under NMFS jurisdiction and may inhabit the project impact area, contact should be made with Mr. Robert Lippson, National Marine Fisheries Service, Oxford Laboratory, Railroad Avenue, Oxford, Maryland 21654, Telephone No. (301) 226-5771.

Lists of Federally listed and proposed endangered and threatened species in Pennsylvania are enclosed for your information. Thank you for your interest in endangered species. Please contact us if we can be of further assistance.

Sincerely yours,

Howard N. Larsen
Regional Director

Enclosure

FEDERALLY PROPOSED ENDANGERED
AND THREATENED SPECIES IN PENNSYLVANIA

Common Name	Scientific Name	Proposed Status	Distribution
Fishes:			
None			
Reptiles:			
None			
Birds:			
None			
Mammals:			
None			
Mollusks:			
None			
Plants:			
Waterweed, Schweinitz's	*Elodea schweinitzii*	E	Northampton (Bethlehem Area) County
Bullrush (Unnamed)	*Scirpus ancistrochaetus*	E	Lackawanna, Lehigh, Clinton, Blair Counties
Pogonia, small whorled	*Isotria medeoloides*	E	Green, Centre, Monroe, Montgomery, Philadelphia, Berks Chester Counties
Mouse-ear Chickweed, (Unnamed)	*Cerastium arvense* var. *villosissimum*	E	Chester, Lancaster Counties
Globeflower, Spreading	*Trollius laxus*	E	Centre, Erie, Bucks Lawrence, Monroe, Northampton, Lehigh Counties

Region 5 7/11/79

ENDANGERED AND THREATENED SPECIES IN PENNSYLVANIA

Common Name	Scientific Name	Status	Distribution
FISHES:			
Cisco longjaw	Coregonus alpenae	E	Lake Erie - probably extinct
Pike, blue	Stizostedion vitreum glaucum	E	Deep water of Lake Erie probably extinct
Sturgeon, shortnose*	Acipenser brevirostrum	E	Delaware River and other Atlantic coastal river
REPTILES:			
None			
BIRDS:			
Eagle, bald	Haliaeetus leucocephalus	E	Entire state
Falcon, American peregrine	Falco peregrinus anatum	E	Entire state - re-establishment to former breeding range in progress
Falcon, Arctic peregrine	Falco peregrinus tundrius	E	Entire state migratory - no nesting
MAMMALS:			
Bat, Indiana	Myotis sodalis	E	Entire state
Cougar, eastern	Felis concolor cougar	E	Entire state - probably extinct
MOLLUSKS:			
None			
PLANTS:			
None			

*Principal responsibility for this species is vested with the National Marine Fisheries Service.

APPENDIX B

ARCHEOLOGICAL SURVEY PLAN FOR THE POND HILL RESERVOIR SITE

Prepared for

PENNSYLVANIA POWER & LIGHT

by

Curtis E. Larsen, Archeologist,

Commonwealth Associates, Inc.
Jackson, Michigan

31 October 1979

INTRODUCTION

The Pond Hill Reservoir Site is a project allied to the construction of the Susquehanna Steam Electric Station near Berwick, Pennsylvania. The purpose of the reservoir is to compensate for water which will be withdrawn from the Susquehanna River by the cooling process for the power plant. Because of differential cooling rates, approximately two-thirds of the water will be lost by evaporation. PP&L is required to augment water lost by the Susquehanna River, especially during low flow periods. The proposed reservoir will meet these requirements by storing river water in the reservoir which can be released to the river during periods of low flow.

The reservoir will be located on a small tributary stream on the east bank of the Susquehanna, This stream is locally referred to as Catfish Creek, but is unnamed on the Nanticoke 7.5 minute USGS quadrangle. The site is approximately seven miles northeast of the Borough of Berwick and one mile south of the village of Mocanaqua. The valley of Catfish Creek is oriented east-west. The reservoir will be created by constructing a dam across the mouth of the valley about one mile upstream from the confluence of Catfish Creek with the Susquehanna. The valley is undeveloped and in places is heavily wooded. The entire area to be included within the reservoir is approximately 150 acres, however the entire area to be affected by the PP&L project is 1300 acres. This total includes both of the valley sides and the upland surfaces of the adjacent ridges. In addition to the reservoir, some of these adjacent areas will provide borrow material for various construction activities others will be used as staging areas for heavy equipment. Because much of the entire 1300 acres will be disturbed in some way, it will be necessary to take an inventory of any historic or archeological resources which may be impacted by the proposed construction. Such assessments are to be made pursuant to 36CFR800, Section 106 of the National Historic Preservation Act of 1966 as amended (16USC470), by Executive Order 11593, May 13, 1971 "Protection and Enhancement of the Cultural Environment," and by the President's Memorandum on Environmental Quality and Water Resources Management, July 12, 1978. This legislation outlines Federal Agency responsibilities with regard to National Register elibible properties and provides for the protection and enhancement of such properties.

To meet these directives, it is necessary to inventory the cultural resources of the project area prior to construction activities. This will require an adequate literature search to determine past historic uses of the area as well as to ascertain the presence of previously recorded archeological sites within the project boundaries. In addition, an on ground survey must be conducted to insure that archeological resources are not endangered by the proposed project. To satisfy these requirements, a plan for survey and literature search must be devised which satisfies the licensing requirements of the Nuclear Regulatory Commission with the participation of the State Historic Preservation Officer acting through the Pennsylvania Archeological Commission. The following plan is submitted to assist PP&L with these requirements.

Cultural Resource Inventory Plan

The cultural resource inventory of the Pond Hill Reservoir Site will consist of two concurrent investigations. The first of these will involve a literature and archival search to determine whether previous historic or prehistoric sites have been recorded for the project area. This will involve a canvass of the records of the State Historic Preservation Officer as well as a visit to the Luzerne County Courthouse in Wilkes-Barre. Should this research identify any previously recorded sites, each of these will be relocated in the field for future testing, if necessary. In addition to records' searches or published references, our staff will investigate the oral histories of the project area through interviews in the communities of Pond Hill, Mocanaqua, and Wapwallopen.

On the ground archeological survey will consist of a thorough canvass of the project area. At the present time, at least seventy-five percent of the valley of Catfish Creek is wooded. Areas of exposed soils are only present along cleared roads installed during test boring operations. Only a few cultivated fields exist within the area. These are located on upland surfaces near the village of Pond Hill. These too are overgrown. Because of difficulties in surface visibility, it will be necessary to shovel test the entire area to verify the presence or absence of archeological evidence. Our survey program will combine the necessary shovel testing with surface examination where, possible, along a series of walked transects across the project area.

The site will be canvassed by walking compass-oriented transects at 30 m intervals across the site. At 30 m intervals, along the transect, a shovel test pit will be excavated to examine the soil beneath the surface debris or vegetation. Each pit will be no larger than 25 cm x 25 cm nor deeper than 25 cm. The soils removed from each pit will be carefully disaggregated and examined for artifacts. Should any indication of an archeological site be encountered, the area will be flagged with survey tape and labeled in a coding system which will allow a site to be identified only by persons with direct responsibilities for archeological resources. This will prevent unauthorized persons from damaging sites. Any sites discovered will then be located on existing base maps. These will supply the client with the necessary site information to plan for the protection or mitigation of cultural resources that may be threatened by the project construction.

The potential incidence of rock-shelters is a major concern for archeological investigation along the Susquehanna River. More specifically, these are overhanging rock ledges which may have offered shelter to past human groups. At the Pond Hill Site, the northern valley slopes display the bedrock configuration for rock-shelter formation. Because of this potential for rock-shelters, the northern valley slopes must be given special attention. The best method for approaching this problem is to locate the outcrop patterns of the pertinent resistant sandstone beds along the valley sides. Then, linear traverses will be made along the base of any such outcrops. Should characteristic overhanging ledges be found, shovel test pits will be excavated below them to check for archeological evidence. Once again, if evidence is found, each site will be flagged and located on base maps.

Analysis and Report

Following field survey and literature search, any archeological collections will be analyzed and described. The results of our survey will then be presented in a written report setting forth our research strategy, methodology and the results of our fieldwork. Should archeological sites be encountered during this survey, recommendations will be made regarding the testing of these sites to ascertain their eligibility for inclusion on the National Register of Historic Places. These recommendations will consist of a Phase II testing program with man-hour estimates for investigating the pertinent sites by hand excavation.

A draft report for the on-ground survey work presented here, will be submitted to PP&L in the spring of 1980. Following client comments, if any, Commonwealth will prepare a final report in the required number of copies for agency review and PP&L record purposes.