DBC PROJECT NO. P 375

PHASE I - PRE-DESIGN STUDY

BRIDGES ON APPALACHIAN TRAIL

SUSSEX COUNTY, NEW JERSEY

MARCH 1985

GAR CHEW LAI ENGINEERS
10 EVERGREEN AVENUE
NORTH HALEDON, NJ 07508

GAR CHEW LAI ENGINEERS • ENGINEER AND ARCHITECT
10 EVERGREEN AVENUE NORTH HALEDON, N.J. 07508 201.427.7752

March 8, 1985

State of New Jersey
Dept. of the Treasury
Div. of Building & Construction
West State and Willow Streets
P.O. Box CN 029
Trenton, NJ 08625

Attention: Mr. Terry D. Pollin
Group Engineer

Re: Sussex - Bridges
Wallkill River & Pochuck Creek -
Transmittal of Report
DBC No. P 375
Our File No. 721

Gentlemen:

In accordance with our contract agreement of April 20, 1983, we herewith transmit six (6) copies of the Pre-Design Study for Bridges on the Appalachian Trail, Wallkill River and Pochuck Creek, Sussex County, New Jersey.

Very truly yours,

GAR CHEW LAI ENGINEERS

Lawrence Edler

Lawrence Edler, P.E.

LE:mvd
Enclosure
cc: Mr. Dale Smith, DBC
Mr. John Garcia, DEP, Div. of Parks & Forestry
Mr. Dennis Duffy, DEP, Div. of Capital Improvements

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1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of the study is to review various footbridges which could be constructed across the Wallkill River and Pochuck Creek in Sussex County for the Appalachian Trail. (See the following Vicinity Map, Dwg. No. 721.) The State of New Jersey has acquired land or secured easements to relocate a portion of the Appalachian Trail for which these bridges are intended.

The Trail presently leaves the State of New Jersey in the vicinity of Unionville, New York. Much of the Trail in this area is along public roads. The State of New Jersey desires to have the Trail entirely on State owned property; and, only to leave the State border at two locations, i.e., the Delaware Water Gap and Wawayanda State Park.

The proposed footbridges will be located in a nature environment on State owned land, thereby protected from future commercial development.

1.2 Coordination

Mr. John J. Garcia, Jr., Supervisor of the Planning and Design Section of the State Park Services supplied aerial, contour, and property maps of the proposed bridge locations.

Mr. Robert Medina, P.E., of the RBA Group of Morristown, New Jersey provided Federal Emergency Management Agency flood data for the Wallkill River bridge site location. Mr. John P. Petrovich of the Flood Plain Management Services of the Army Corps of Engineers provided flood information for the Pochuck Creek at the New Jersey - New York border. No flood studies have been made for the Pochuck Creek located in New Jersey.

Mr. Robert F. Leone, Field Representative for the Appalachian Trail Conference provided information with respect to approaches and efforts of volunteers who will blaze the trails to the proposed bridge locations.

1.3 Authority and Acknowledgements

The pre-design study for the proposed Appalachian Trail bridges was authorized by the State of New Jersey, Department of the Treasury, Division of Building and Construction (DBC). Messrs. Dale B. Smith and Terry D. Pollin coordinated the study for DBC. Mr. Dennis C. Duffy of the Department of Environmental Protection, Division of Capital Improvements had been involved with the initial stages of the pre-design study for DBC.

2.0 LOCATION OF PROJECT

2.1 Wallkill River

The location of the proposed pedestrian bridge across the Wallkill River is located immediately south of the New York - New Jersey State line, approximately one-half mile east of Route 284 and 1,400 feet south of Oil City Road, Orange County, New York. (See Appendix E, Location Dwg. No. 721-1). The Wallkill River is the border of Wantage Township to the west and Vernon Township to the east.

2.2 Pochuck Creek

The location of the proposed pedestrian bridge across the Pochuck Creek is located in Vernon Valley, approximately 1-1/4 miles south of the New York - New Jersey State line in Vernon Township, New Jersey. It is bounded by Canal Road on the east, Maple Grange Road on the south, and Route 517 on the west. (See Appendix E, Location Dwg. No. 721-2).

3.0 SCOPE OF PRE-DESIGN STUDY

The scope of the pre-design study is to research, conduct and coordinate the following tasks:

a. Field Investigation

Conduct a survey to determine bridge spans and elevations.

b. Hydraulic and/or Hydrology Study

Complete the necessary hydraulics and/or hydrology studies and to meet all requirements issued by the Division of Water Resources, New Jersey Department of Environmental Protection and the Army Corps of Engineers. The consultant shall be responsibile for filing and obtaining all permits and approvals from the appropriate authorities for the construction of the two footbridges.

c. Site Borings

Site borings shall be performed at the bridge sites.

d. Environmental Assessment

The environmental assessment shall be prepared on the probable impacts of the proposed pedestrian bridges and shall include a section on cultural resource determination.

e. Feasibility Design

The consultant shall investigate and recommend feasible design alternates for both the bridges and access to the bridges. Construction cost estimates shall also be prepared.

4.0 FIELD INVESTIGATION

4.1 Wallkill River

An initial site visit to the east bank of the Wallkill River was made by foot with State personnel on May 12, 1982. Access to the proposed bridge site was made along the top of a farmer's dike, paralleling the river and through approximately 1,200 feet of heavily wooded area underlain with poison ivy. In April of 1983, the east side of the Wallkill River was flooded for greater than one-half mile. The top of the dike was also inundated.

The bridge site on the west side of the Wallkill River is an open field with field grass. This field extends approximately 900 feet to the west. Thereafter, and to the west, the State property, which is a hill, is heavily wooded. The west side of the Wallkill River also was observed flooded, approximately 900 feet to the west.

The width of the Wallkill River at the bridge site is 120 feet. The river is relatively shallow. The plan and profile of the Wallkill bridge site is in Appendix F.

4.2 Pochuck Creek

The location of the proposed Pochuck Creek bridge was viewed from a vehicle with State personnel on May 12, 1982 from Carol Drive, off Route 517. Improper clothing and foot gear prevented participants from hiking to the bridge site. State personnel also indicated the direction toward the proposed bridge site from Price Switch Road located northeast of the site.

On October 21, 1982, the consultant and surveyor hiked to the west bank of the Pochuck Creek. Drawings which were provided by the State were used to ascertain the State land where the bridge would be located. Hip boots were necessary to traverse the 1,300 feet of swampy land from Carol Drive. The purpose of the field visit was to establish a surveyor's proposal.

The Pochuck Creek was crossed with waders and hip boots. The banks of the creek are nearly vertical. On the east side of the Pochuck Creek is a large marshy field. State land adjacent to the east side of the Pochuck Creek and proceeding southeast is heavily wooded to Canal Road.

It was found later that access to the east bank of Pochuck Creek could be made by a farm road from Price Switch Road. This farm road, belonging to Marshy Acre Farm, meanders to a base of a hill on the opposite side of the large marshy field. This farm road has a few muddy areas which cannot be traversed by small cars or trucks, but is passable with large wheel equipment.

In April of 1983, banks of the Pochuck Creek had flooded to the base of the hill to the east, and to Carol Drive to the west, distances of 1,200 and 1,400 feet respectively.

The width of the Pochuck Creek at the bridge site is 60 feet. The creek is relatively shallow, 4 to 5 feet. The plan and profile for the Pochuck Creek is in Appendix F.

5.0 HYDRAULICS AND/OR HYDROLOGY STUDY

5.1 Wallkill River

The width of the Wallkill River at the proposed bridge site is 120 feet. Elevation of the river bottom is 377 based on U.S.G.S. datum. Top of bank elevation is 383. One-hundred year flood elevation is 389.6 based on Federal Emergency Management Agency (FEMA) data. Maximum river velocity during a 100-year flood is approximately 0.5 feet per second.

5.2 Pochuck Creek

The width of the Pochuck Creek at the proposed bridge site is 60 feet. Elevation of the creek bottom is 386. Top of bank elevation is 393.6. No flood data is available for the Pochuck Creek in New Jersey. However, at the New Jersey - New York State border, COE Flood Plain Information for the Pochuck Creek indicates a 100-year flood elevation of 393. The bridge site is 1-1/4 miles south of the State line. It was determined on April 20, 1983 that the Pochuck Creek in the vicinity of the proposed bridge site flooded to an elevation of 400 feet. This was determined by interpretation of contour drawings. The velocity of Pochuck Creek during a 100-year flood at the New Jersey - New York State border is 1.1 feet per second.

5.3 DEP Stream Encroachment Permit

The following letter from DEP Stream Encroachment dated July 12, 1983, appended to the end of this report, indicates that the proposed bridges are considered minor projects and

that hydraulic calculations and cross-section upstream and downstream were not necessary with a permit application.

A meeting was held at DEP Stream Encroachment in Trenton on January 24, 1985. Significant criteria which was established at this meeting were:

a. The bridge structures did not have to be above 100-year flood elevation.

b. No fill shall be placed for approaches to the bridges.

c. All temporary fill used for the construction of the bridges has to be removed.

d. Top of abutment must be at existing grade.

e. The Pochuck Creek bridge is designated a wetland.

On February 15, 1985, DEP Stream Encroachment indicated to the consultant that 6 to 12-inch steel columns on abutments to raise the bridge above minor flood elevations would probably not receive objections from the Department. Also, catwalks constructed on post, 2 - 3 feet above ground surface, which would not restrict water flow and field growth, would be preferred rather than fill and cross-drains for bridge approaches.

Appended to this report, Appendix D, are Stream Encroachment Permit Applications to DEP for the proposed bridges.

5.4 Army Corps of Engineer's Permit

On June 25, 1982, a letter from the consultant engineer, indicating the bridge locations was forwarded to Army Corps of Engineers. It was requested whether COE permits were required.

On August 12, 1982, a response from COE indicated more information was needed, particularly water elevations. COE application data also indicated that the type of foundation for the bridges would have to be submitted if applications were necessary.

Another letter from the consultant engineer was forwarded to COE on January 23, 1985, stating the bridges would not have any obstructions in the waterways. This letter had been suggested by DEP. COE responded to the consultant engineer via telephone that the bridges are considered low priority and a nationwide permit would be issued.

6.0 SITE BORINGS

Site borings were taken on the banks of the proposed bridge sites on August 9 through August 17, 1984. The soils report is included in Appendix A.

Organic soils were encountered at each site. The soils consultant report suggested two alternates for foundations at both sites. These are:

a. Excavate and remove organic soils, backfill with crushed stone.

b. Drive piles for foundations.

6.1 Wallkill River

The depth of organic soils at the Wallkill River is 17 feet. This organic soil could be removed by a large backhoe or a small backhoe with extended boom. Water would have to be controlled by pumping. The sides of the excavation may slough because of the soft organic soils; but this effect may be able to be controlled by a steel box similar to those used in sewer construction. The excavation and backfill with crushed stone should be completed in one day for each footing by this method. If the excavation has to be sheeted, the operation will take longer. It may also be possible to terrace down the grade adjacent to the excavation in order to remove organics greater than 17 feet deep. Specifications for the footing excavations should stipulate sheeting if required.

Since the profile of the bridge has been relocated south approximately 150 feet to avoid having the east abutment on private property, it is recommended that additional borings be taken at each footing location for the Wallkill River site. Difficulties could arise if organics are encountered greater than 20 feet deep. The cost of the additional borings to determine exact organic soil depths would be less than $2,000 and this is less costly than a claim by a contractor should organics be encountered at depths greater than indicated on the plans.

The other alternate for the bridge foundation at the Wallkill River site are piles for each abutment. The cost of piles ranges from $225 to $313 for 30 to 50 feet pile lengths. Since stiff silt and clay underlies the organic material below 17 feet, it is recommended that 50 foot piles be used to attain bearing capacities and the excess pile length be cut off rather than drive test piles. The reason for this is the timber pile is inexpensive and would be less costly than a separate test pile operation to determine pile lengths. The cost of a pile driving crew using a free hammer with no leads costs $3,600 per day. Mobilization and demobilization costs plus the cost for moving to the opposite side of the river is $8,000. Installation of piles for the Wallkill River site would be approximately $16,000. This does not include preparing access to the abutment locations.

6.2 Pochuck Creek

Review of the soil logs shows that orgainc soils are to a depth of 14 feet at the Pochuck Creek bridge site. Organic soils could easily be removed with a small rubber tire backhoe. The excavation would then be backfilled with crushed stone to foundation level. The allowable soil pressure would be 4,000 pounds per square foot. Approximately 8 square feet would be required for the abutment footing. The abutment footing constructed would be larger than this, and would reduce the bridge load pressure below 4,000 pounds per square foot on the crushed stone backfill.

The soil consultant recommends additional borings to determine pile lengths if the pile foundation alternate is selected. We suggest the possibility of using excessive pile lengths rather than test borings or test piles. This method may be less costly than the additional borings or test piles.

7.0 ENVIRONMENTAL ASSESSMENT

7.1 Environmental Impact Statement

This report, enclosed in Appendix B, indicates that the proposed bridges will be beneficial to hikers of the Appalachian Trail, will be compatible with the surroundings, will not harm the natural environment, or effect farmlands and water courses.

The construction impacts of the bridges will be short-term and minimal (approximately 2 weeks).

7.2 Cultural Resource Reconnaissance

This report, enclosed in Appendix C, describes the proposed bridges in a flood plain immediately adjacent to two water courses. Some 10,000 acres located primarily along the Wallkill River and Pochuck Creek had become renown as the "Drowned Lands of the Wallkill". When wet, the land had been recorded in history as inhospitable, uninhabitable, and virtually an unusable marshland environment. The present situation within the former Drowned Lands region was created during the 19th century as the area was eventually successfully drained in a farmland reclamation effort. The former marshland environment had been replaced with a flood plain environment, more suitable to various agricultural pursuits.

The land has rich black soil. Artificial means of drainage are still used in some areas. Onions are a major crop. A large sod farm operates east of the Wallkill River bridge site.

No cultural resources were encountered in or near the proposed localities of the Wallkill River and Pochcuk Creek bridges and associated elevated walkways.

The proposed bridges are viewed as a beneficial effect on the Appalachian Trail, a cultural resources embodying potential National Register significance.

8.0 FEASIBILITY DESIGN

8.1 Approaches

The following is a description of the land on each side of the proposed bridges for which approaches for hikers were considered. After these descriptions is a section on a catwalk or decking for the west approach to the Pochuck Creek bridge; this approach is considered the most difficult to traverse; even in dry weather.

A trail made with fill and cross-drains was not researched further or proposed subsequent to the pre-application meeting with DEP Stream Encroachment where it was delineated that the Pochuck Creek is in a wetland and that fill placed for a trail would not receive approval.

Wallkill River - West

The low lying field west of the Wallkill River is approximately 900 feet wide. The field is composed of bogs of field grass. The field is approximately the same elevation as the top of the bank of the river. Surveyor maps describe this field as marsh, "drowned land" meadows. During dry periods, hikers would be able to walk to the Wallkill River. During rains or shortly thereafter, this field would be wet because of poor surface drainage. Obviously, during flooding stages of the Wallkill River, this field would have to be crossed with waders, hip boots or a boat.

The field on the west side of the Wallkill River could be crossed in dry or wet weather with regular foot gear or rubber boots. A catwalk may be considered for this marshy field. Alternate routes should be considered when the Wallkill River floods. Further west of the Wallkill River, the State land rises in grade and is heavily wooded.

Wallkill River - East

State land east of the Wallkill River is heavily wooded. The ground surface is relatively level and about the same elevation as the top of the bank of the Wallkill River. During wet weather, this land would be passable by walking with proper foot gear. The area appears to have poor surface drainage. Catwalks may be considered for this side of the bridge. The distance from the river to the farmer's dike is approximately 1,200 feet. During flood conditions, an alternate route for the Appalachian Trail would have to be used.

Pochuck Creek - West

The State land on the west side of the Pochuck Creek is swampy with high reeds. There are interlaced channels. Hip boots are necessary to cross this land, even in dry weather. A catwalk is recommended. The distance for the catwalks from Route 517 to the Pochuck Creek is approximately 2,200 feet.

Pochuck Creek - East

Although the field on the east side of the Pochuck Creek appears to indicate poor surface drainage characteristics, hikers should be able to establish a trail along the top of the east bank of the Pochuck Creek in a southeasterly direction towards the wooded areas and slightly higher elevations.

8.1.1 Catwalks and Decking

Catwalks are narrow walkways and are generally associated with marine structures. These structures are often improvised with no great concern for safety.

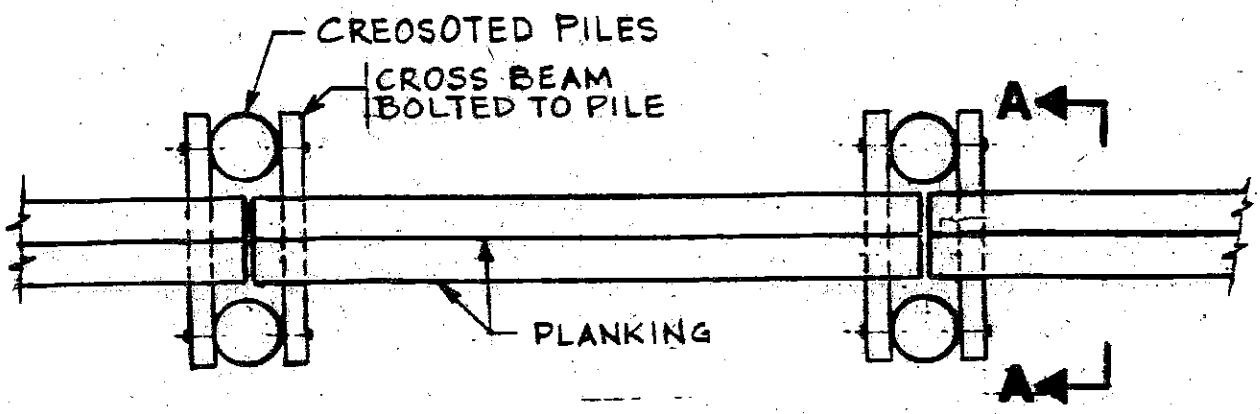
There is on the market a modular polyethylene material referred to as Superdeck, manufactured by K & O, Inc. of Minneapolis, MN. Essentially, Superdeck would be a sidewalk laid on the wetland. Cost of this Superdeck would be $8.00 per square foot. The cost of a Superdeck from the manufacturer for 2,200 feet on the west side of the Pochuck Creek would be greater than $62,000.

Similarly, a pre-treated wood sidewalk across the wetland could be constructed. It is considered that wood decking, directly on the meadow surface, would not last a long time and would deteriorate because of moisture conditions.

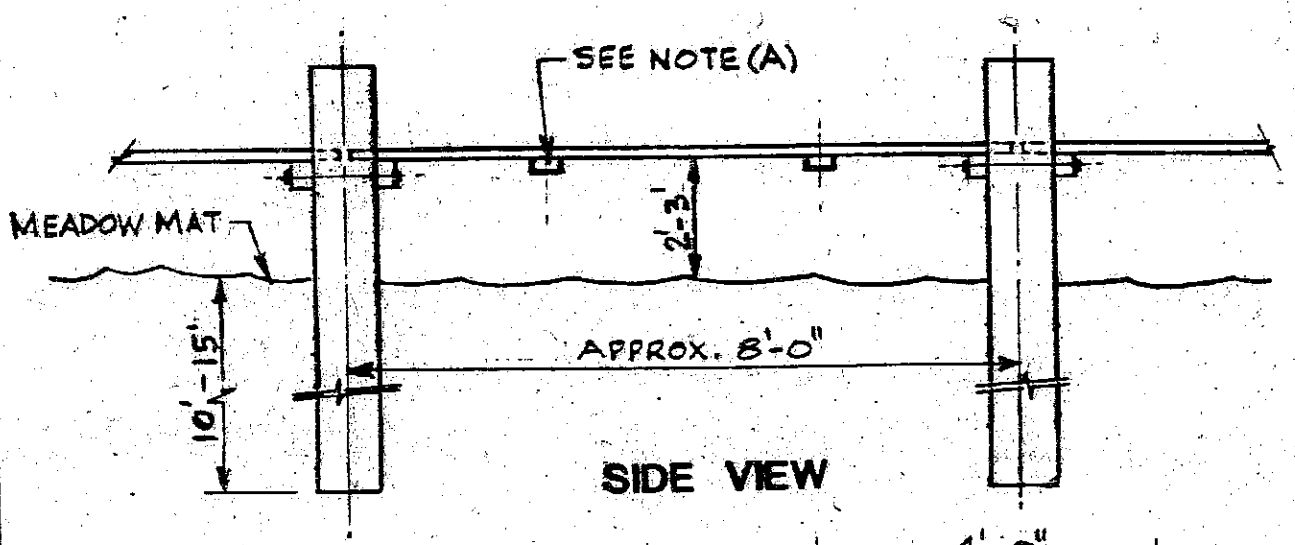
Another method of providing trail hikers access to the west bank of the Pochuck Creek would be by providing an elevated catwalk. This catwalk would not inhibit the growth and flow of water through the wetland. The catwalk would be 2 to 3 feet above the meadow mat. It is suggested two creosote piles be driven through the organic soils to the underlying sandy subsoil. The length of pile would be approximately 20 feet near the bridge. It is assumed that the deepest organic soils is near the Pochuck Creek; and that this thickness will decrease as the distance is increased from the creek. Piles are recommended rather than pretreated 4 x 4 lumber because they would be less susceptible to sway, would have more resistance to floating away during a flood, and the creosote provides long life.

A pre-treated beam could be connected with bolts between the piles with pre-treated planks fastened to the beam to provide a walkway. (See the following Proposed Catwalk Dwg. No. 721-3.)

Construction of decking or catwalks would have to have the approval of the environmentalists.

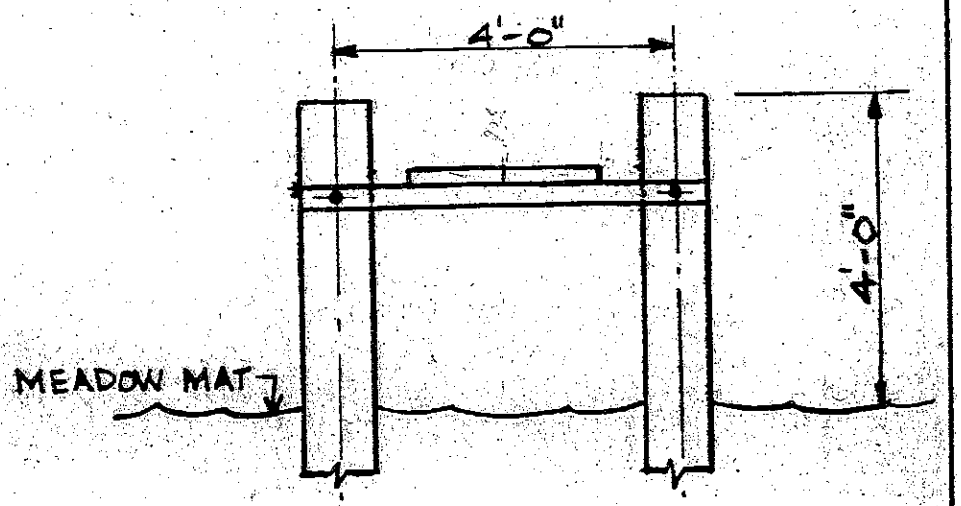


PLAN VIEW



SIDE VIEW

NOTE (A)
BOLTED STABILIZING CROSS PIECE.



SEC. A-A

GAR CHEW LAI ARCHITECT - ENGINEER NORTH HALEDON, NEW JERSEY	**PROPOSED CATWALK**	DWG. NO. 721-3
	SCALE: NONE / DATE: MARCH 1985	SHEET NO. 3

8.2 Bridge Design Alternates

The following bridges were considered for the Appalachian Trail sites.

a. Suspension Bridge

b. Center Pier Bridge

c. Steel Beam Bridge

d. Wood Bridge

e. Prestressed Concrete Bridge

f. Prefabricated Steel Truss Bridge

8.2.1 Suspension Bridge

Suspension bridges are exclusively used for long spans. They have an aesthetically pleasing appearance. Generally, the suspension bridges would have a lighter dead load than a comparable steel truss bridge. Basic components of the suspension bridge are the towers, flexible supporting cables, and stiffening beams which support the deck. The stiffening beams are suspended from the main cables. In addition to the concrete pier footings to support the towers, there are also required masses of concrete to resist the tension of the main cables of the bridge which support the dead and live loads. Sometimes the cables are connected to the ends of the stiffening beams.

The suspension bridge may generate oscillations by live load or wind. Oscillations due to wind can become dangerous if excessive exciting impulses approach the natural frequency of the structure. Oscillating wind forces are caused by eddies, which may be generated outside the structure or by the structure itself. Oscillations which cause twisting or fluttering are the most dangerous.

To prevent oscillations and reduce air resistance, trusses are sometimes used for stiffening beams and/or openings are provided in the deck. The rigidity of the structure may also be increased by having the stiffening beams continuous past the towers, and diagonal steel staying members connected to the tower.

Anchorages and footings should be designed for adequate safety against uplift, tipping, and sliding from any possible combination of acting forces.

8.2.2 Center Pier Bridge

Center pier bridges received no further consideration for this report in that permit data submitted to the New Jersey Department of Environmental Protection Stream Encroachment and Army Corps of Engineers indicated no obstructions would be located in the stream channels. The center pier could have a damming effect from debris and ice.

8.2.3 Steel Beam Bridge

A simple steel beam bridge could be designed to span the water bodies and rest on concrete abutments. This would involve a pair of wide flange beams, approximately 33 inches in depth and weighing 118 pounds per foot for the Pochuck Creek. Additional steel would be required for decking and railings.

The disadvantage of the steel beam bridge is the uneconomical distribution of steel in relation to stress requirements.

The weight of a steel beam bridge for the Pochuck Creek would be twice that of a steel truss bridge and cost more.

The design of a steel beam bridge for the Wallkill River would have greater than 3 feet web depth, would be considerably heavy, and would have splices. It may not be possible to install the bridge with single lift with a crane. The foundation requirements would be greater for this type bridge than a truss bridge.

8.2.4 Wood Bridge

Wood has been used for centuries for structural purposes. It has beauty, strength and workability. It has a high strength-to-weight ratio.

Large structural members of wood today are rare. This has been overcome by glued-laminated timbers. Laminated timber can be formed to any shape or size.

A defect of structural timber members is checking. Checking is the separation of grain and is caused by the difference of moisture contents between the inner and outer portions of wood. Checks affect the horizontal shear strength of timber.

Glued-laminated timber construction is relatively free from checking. Seasoning checks may occur in laminated members. Rapid changes in moisture content of large wood sections after gluing will result in shrinkage; and checking may develop both in glued joints and the wood.

Checks have little effect on the strength of glued-laminated members unless checks are significant in depth and occur in the mid-height of the member near the support, and then only if shear governs the design of the members.

Fungi will destroy wood with favorable air, moisture, and 90-50^{o}F temperature conditions. Where wood is in contact with the ground or with water, or where there is an alternating wet and dry period, a preservative treatment is necessary to obtain adequate service life. For glued-laminated timber, the

members may be treated with preservative before or after gluing. There is a problem in gluing treated wood. Some combinations of adhesive, treatment and wood species are compatible, others are not. The glued bonding strength may be reduced.

There are two general types of wood preservatives. Oils, such as creosote and petroleum solution of pentachlorophenol; and waterborne salts that are applied as water solutions. Creosote would adversely affect the cleanliness of the structure. Pentachlorophenols slightly alter the natural color of the wood. Waterborne preservatives, such as tanalith, (Wolman Salts-Wolmanized lumber), are principally employed in the treatment of wood which will not be in contact with ground or water and where treated wood requires painting. The waterborne preservatives are not considered equal in effectiveness to creosote when used under similar conditions.

Wood is also subject to degradation by wood-attacking insects.

8.2.5 Prestressed Concrete Bridge

Prestressed concrete bridges were considered for the Appalachian Trail bridges.

A concrete beam requires a depth of 1/20 its span. For the Wallkill River and Pochuck Creek, the depth of the bridges would be 7 and 4 feet respectively. Since it is anticipated the bridges will not be constructed above the 100-year flood elevation, the bridges would have a damming effect and would block the flow of water, whereas a truss bridge would allow passage of water through it. The dead weight of the precast concrete bridges is 10 to 8 times greater than truss bridges. Footing soil bearing areas would have to be increased, or additional piles would have to be installed.

It is doubtful that New Jersey Department of Environmental Protection would permit precast prestressed concrete bridges below the 100-year flood elevation.

A precast concrete bridge could be installed across the Pochuck Creek with a 140 ton crane. No determination of crane size for a precast concrete bridge at the Wallkill River was made because of the excessive bridge weight and long boom reach to the centerline of the river.

8.2.6 Prefabricated Steel Truss Bridge

Prefabricated steel truss bridges can be made for spans of 10 through 160 feet with various widths of 4 to 10 feet. They are made of a high-strength, low-alloy Cor-Ten steel. They are all-welded and may be sectionalized to meet span requirements.

Cor-Ten steel weathers and takes on its own natural color from exposure to the elements. Cor-Ten steel has a yield strength that is up to 40% higher than ordinary carbon steel which allows lighter designs with slender, more aesthetically-pleasing profiles.

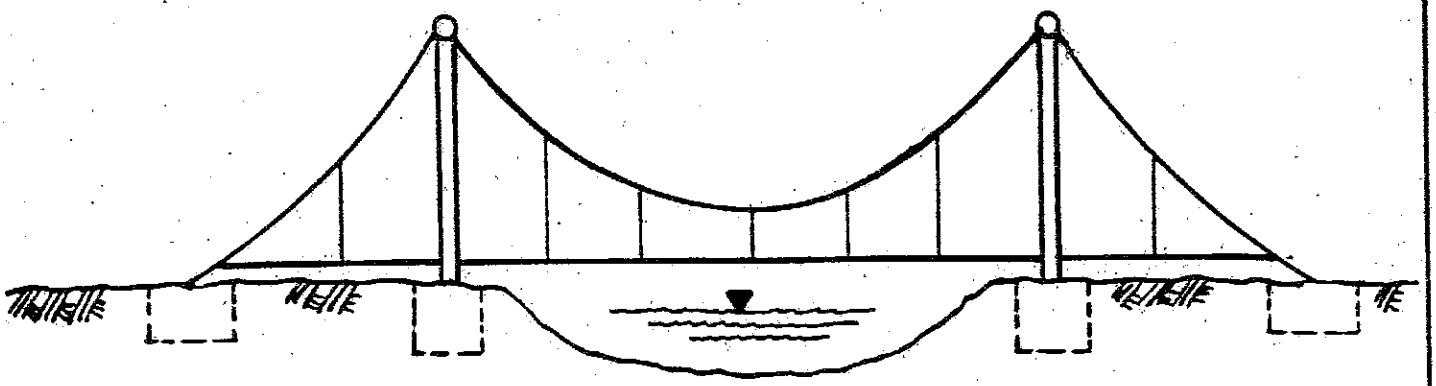
The natural oxide coating of "weathered" Cor-Ten steel is about the same thickness as a heavy coat of paint. Any minor damage to the oxide coating will be repaired by further "weathering". The color of the coating will change from a rusty red-orange to a dark rich brown. The "weathering" occurs over a period of two or three years.

The wood decking of the prefabricated steel truss bridge is treated Douglas Fir or Southern Yellow Pine. The Cor-Ten steel and treated wood decking makes the bridge nearly maintenance-free. It is assumed that after a number of years, the treated wood decking would eventually have to be replaced.

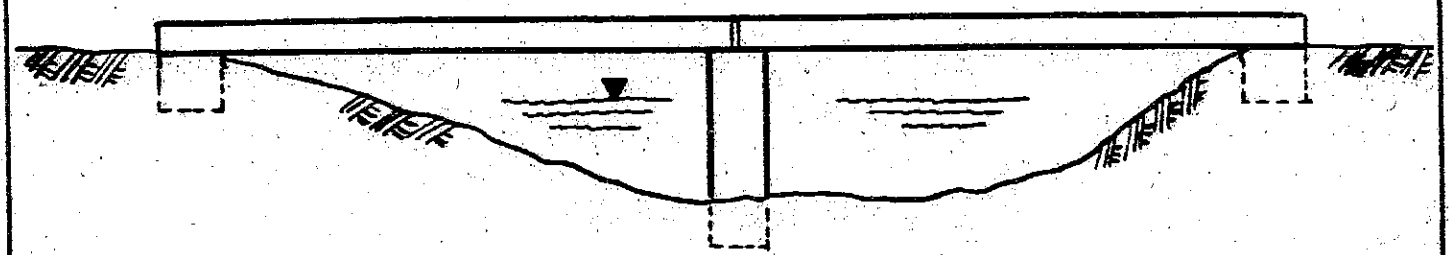
The prefabricated steel truss bridges are made in accordance with specifications, design, fabrication and erection of structural steel by the American Institute of Steel Construction (AISC). The truss bridges have a slight arch of 5%.

The prefabricated steel truss bridges are delivered in sections to the bridge sites. They are unloaded and assembled. The manufacturer provides easy field connection joints. The assembling of the bridge and setting the bridge across the water body on to concrete abutments are done with a crane.

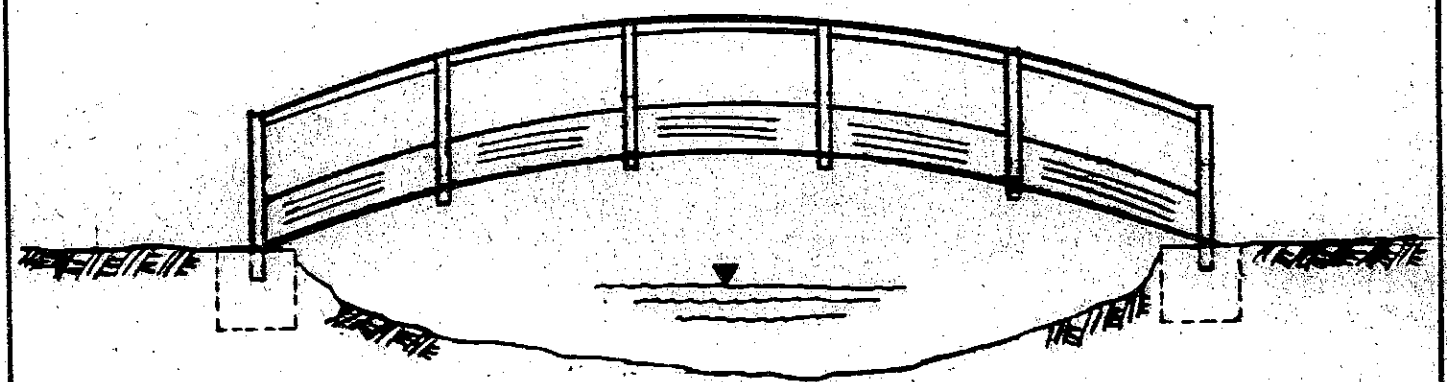
The concrete foundation for the bridge is done prior to the delivery of the prefabricated truss bridge sections.



SUSPENSION BRIDGE

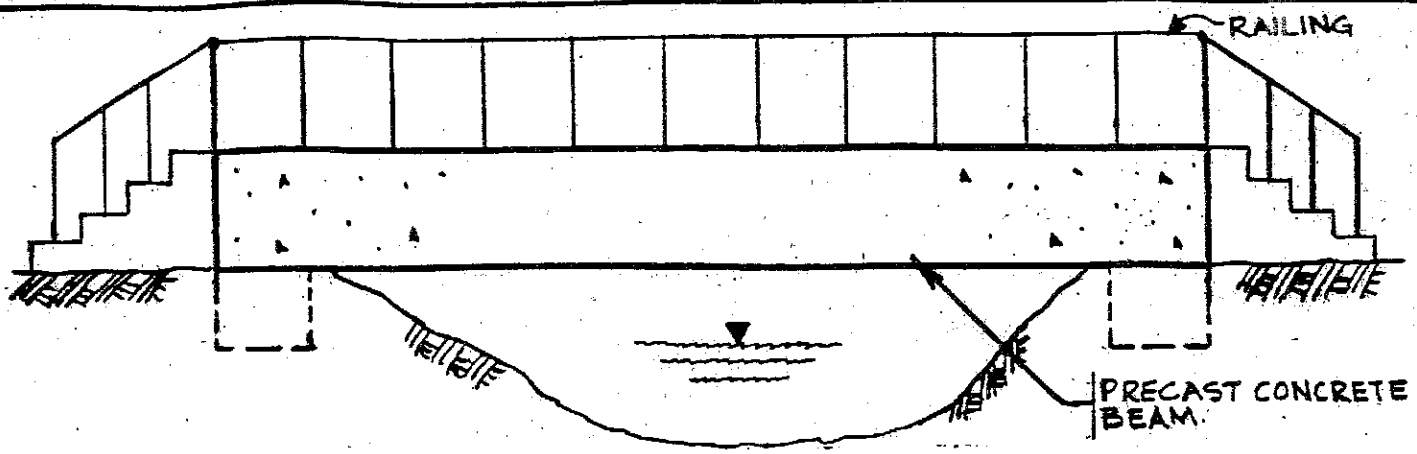


CENTER PIER BRIDGE

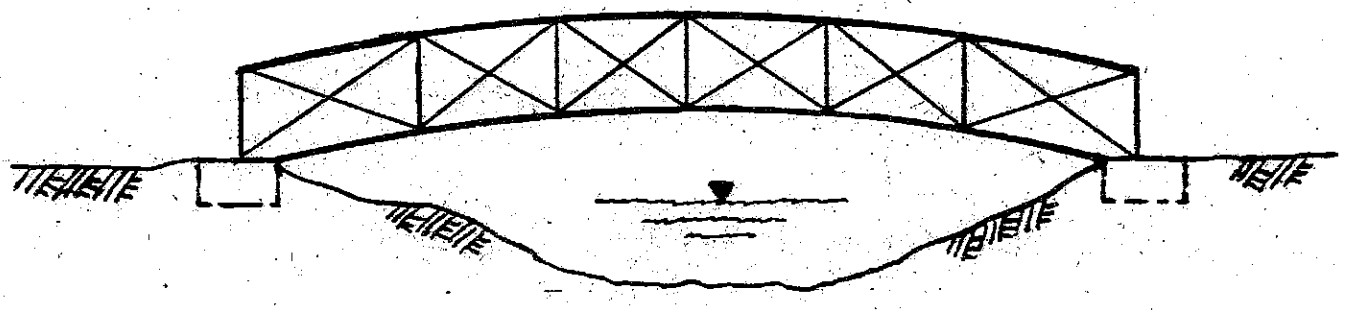


WOOD LAMINATED BRIDGE

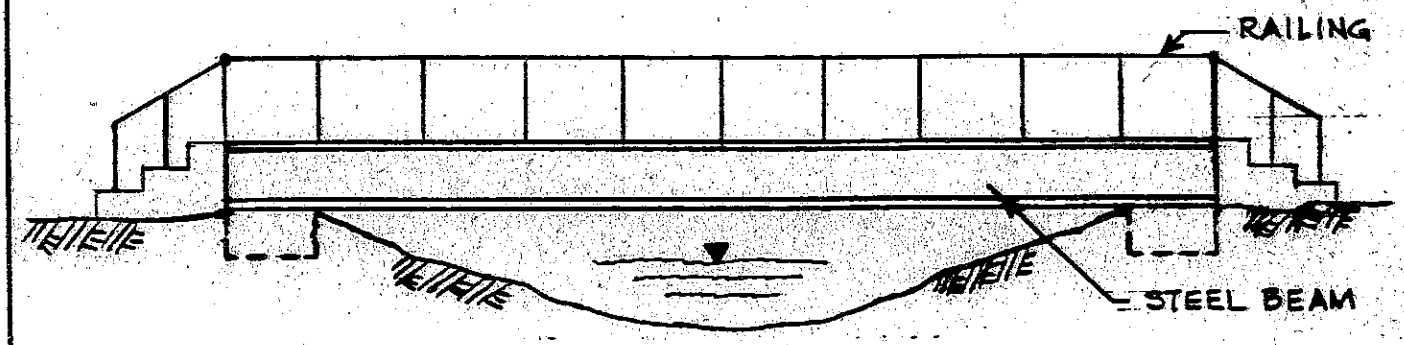
GAR CHEW LAI ARCHITECT - ENGINEER NORTH HALEDON, NEW JERSEY	**SCHEMATICS OF BRIDGES** SCALE: NONE — DATE: MARCH 1985	DWG. NO. 721-4A SHEET NO. 4A



PRECAST CONCRETE BRIDGE



PREFABRICATED STEEL TRUSS BRIDGE



SIMPLE STEEL BEAM

GAR CHEW LAI ARCHITECT - ENGINEER NORTH HALEDON, NEW JERSEY	**SCHEMATICS OF BRIDGES** SCALE: NONE DATE: MARCH 1985	DWG. NO. 721-4B SHEET NO. 4B

8.3 Construction Cost Estimates

Preliminary design assumption for both bridge sites is to construct foundations 10 feet from the top of the bank. The reasons for this are:

1. Wallkill River - There are very soft organic soils which may tend to creep, and the banks may scour easily with the passage of water, even though the maximum velocity for the river during a 100-year flood is approximately 0.5 ft./sec. The area floods almost annually.

2. Pochuck Creek - The banks of this creek are nearly vertical and are composed of medium stiff clay. The creek has many turns near the bridge location. The water force is therefore directed toward the banks of these turns and scour and erosion are increased. The velocity of the creek during a 100-year flood is approximately 1.1 feet/sec. This site also floods almost yearly. In order to avoid possible scour behind abutments, it is recommended to keep the abutments back from the bank. Also, this would eliminate and decrease the foundation cost of having the bottom of the abutment elevation 3 feet below the invert of the creek. Removal of organic soils at the creek banks

would also involve potentially greater dewatering problems for the contractor, rather than having to dewater an excavation 10 feet from the creek.

Removing organic soils and pile foundations are estimated for both sites.

It is assumed construction equipment will have access to both sides of the Wallkill River, but only the east side of the Pochuck Creek. It is assumed that construction labor, equipment and materials will cross the Pochuck Creek from the east side in order to construct the west foundation. This may be done by crossing the Pochuck Creek at the low flow with construction equipment. It is assumed that placement of the transit mix concrete for the west foundation will be done by crane or payloader.

The contractor may want to construct a temporary culvert of large reinforced concrete pipe in order for construction equipment and concrete trucks to cross the Pochuck Creek.

The construction cost estimate for the suspension bridge was made by making preliminary evaluations of loads, reactions, and cable tension. Approximate structural steel members were used to obtain a steel supplier's quote. The material costs for the suspension bridge was multiplied by a factor of 1.5 to obtain labor and equipment cost for installing the bridge.

WALLKILL RIVER

6 x 140

CONSTRUCTION COST ESTIMATE

BRIDGE ALTERNATES

Work Description	Suspension	Steel Beam*	Wood**	Prestress Concrete*	Steel Truss
1. Access	$ 29,000				$ 29,000
2. Foundation Preparation	17,500				11,000
3. Concrete Footings	28,000				15,000
4. Bridge	138,000				80,000
5. Site	22,000				22,000
	$234,500				$157,000
15% Contingencies	35,200				23,600
TOTAL CONSTRUCTION COST ESTIMATE	$269,700				$180,600
USE	$270,000				$181,000
With Pile Foundations	$282,000				$197,000

* Not estimated because of long span.

** Not recommended by wood bridge manufacturers for long span.

POCHUCK CREEK

4 x 80

CONSTRUCTION COST ESTIMATE

BRIDGE ALTERNATES

Work Description	Suspension	Steel Beam	Wood	Prestress Concrete	Steel Truss
1. Access	$ 23,000	$ 23,000	$ 23,000	$ 23,000	$ 23,000
2. Foundation Preparation	11,000	7,000	7,000	7,000	7,000
3. Concrete Footings	27,500	17,000*	17,000*	17,000*	17,000*
4. Bridge	94,000	34,000	38,000	23,000	26,000
5. Site	15,000	15,000	15,000	15,000	15,000
	$170,500	$ 96,000	$100,000	$ 85,000	$ 88,000
15% Contingencies	25,600	14,400	15,000	12,800	13,200
TOTAL CONSTRUCTION COST ESTIMATE	$196,100	$110,400	$115,000	$ 97,800	$101,200
USE	$196,000	$110,000	$115,000	$ 98,000	$101,000
With Pile Foundations	$208,000	$123,000	$128,000	$110,000	$114,000

*Footing cost greater than Wallkill River because estimate includes crane to place concrete for west bank of Pochuck Creek.

PREFABRICATED BRIDGE QUOTES

Type of Bridge	Manufacturer	Date	Wallkill River 6 x 140	Pochuck Creek 4 x 80
Steel Truss (Delivered To Site)	General Recreation, Inc.	2/15/85	$49,366.00	$10,437.00
Steel Truss (Delivered To Site)	Continental Custom Bridge Company	2/21/85	$38,000.00	$13,000.00
Wood (Delivered To Site)	St. Regis/ Champion	2/27/85	*	$20,640.00
Wood (Delivery Not Included)	Koppers Company, Inc.	2/26/85	*	$21,798.00 To $25,665.00 (Depending On Model)
Precast Concrete (Delivery Not Included)	Kenvil Newcrete Products, Inc.	2/21/85	$12,600.00 **	$ 6,400.00 **
Steel Beams (Delivery Not Included)	Victory Iron Works	3/4/85	---	$12,000.00 ***

* Manufacturer does not recommend wood bridge for 140 feet clear span.

** For prestressed concrete beam only. Does not include decking, railings or stairs.

*** For steel beams only. Does not include decking, railings or stairs.

CONSTRUCTION COST ESTIMATE

PROPOSED CATWALK
WEST SIDE OF POCHUCK CREEK
2,200 FEET

1. Installation of 550 piles	$ 128,800.
2. Construction of beams and planking	74,600.
	$ 203,400.
15% Contingencies	30,500.
	$ 233,900.
USE	$ 234,000.

NOTE: Cost of a catwalk could possibly be decreased by utilizing wider pile bent spacing, or wider pile bent spacing with wood stringers and decking.

PROPOSED DECKING
WEST SIDE OF POCHUCK CREEK
2,200 FEET

1. Superdeck	$ 98,100.
15% Contingencies	14,700.
	$ 112,800.
USE	$ 113,000.
2. Pretreated Wood Decking	$ 40,700.
15% Contingencies	6,100.
	$ 46,800.
USE	$ 47,000.

8.4 Comments and Recommendation on Bridge Alternates

The suspension bridge would have to be designed and would require special materials, e.g., cable rollers and suspender clamps. It would take longer to construct in the field than a prefabricated bridge. The environmentalist's opinion of suspension bridges for both sites is ".....cable suspension bridge in this lowland setting lacks some of the solidity and fitness to the surrounding bottomlands....." The bridge would require painting and maintenance. Both bridge sites are subject to changing wind directions and eddies because of open fields and heavily wooded areas near the locations. Changing wind directions are unfavorable to suspension bridges with respect to damaging oscillations. Additional concrete footing construction would be required if the main cables are restrained by masses of concrete.

No consideration was given to the center pier bridge because permit data submitted to the New Jersey DEP Stream Encroachment and Army Corps of Engineers indicated no obstructions would be located in the stream channels. The center pier could cause a damming effect with debris or ice.

The simple steel beam bridge would weigh and cost more than other types of bridges. This bridge may be practical for the Pochuck Creek, but is conceived impractical for the Wallkill River because of the long span, large steel web depth, large dead load, splices and multi-stage construction.

A wood bridge is not recommended for the locations because of moisture conditions. The bridge may not be constructed over the 100-year flood elevation. Flood waters may flow over the bridge. The life of the bridge is dependent on the effectiveness of the wood preservative.

The prestressed concrete bridge would have a depth of 4 feet for the Pochuck Creek, plus an additional 3 to 4 feet of railing. The appearance of an over-all 8 foot depth bridge would be bulky. The depth of the precast beam may be considered an obstruction to flood water; and, the depth decreases the clearance of the bridge and channel water level. The depth and weight of a prestressed precast concrete bridge for the Wallkill River would be considerably greater than the Pochuck Creek and probably could not be installed with a single crane.

Based on the above comments, it is recommended that prefabricated steel truss bridges be utilized for this project. The truss also acts as a railing. The bridge has five percent camber which increases the clearance with the water body. Maintenance for a Cor-Ten steel truss bridge is minimal. No painting is required. Installation would be faster than a field constructed bridge. The openings of the truss would allow passage of flood waters.

LETTERS

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State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF WATER RESOURCES
P. O. BOX CN 029
TRENTON, NEW JERSEY 08625

ARNOLD SCHIFFMAN
DIRECTOR

Lawrence Edler, P.E.
10 Evergreen Avenue
North Haledon, New Jersey 07508

JUL 12 1982

Re: Stream File No. 1922-82
Vernon & Wantage Townships

Dear Mr. Edler:

This is with reference to your letter of June 29, 1982 concerning the proposed pedestrian bridge over the Wallkill River, at a location approximately 3500 feet easterly of the intersection of Oil City Road and Route 284, in the Townships of Wantage and Vernon, and the proposed pedestrian bridge over the Pochunck Creek, at a location approximately 4500 feet northerly of the intersection of Canal and Maple Grange Roads, in the Township of Vernon, both within Sussex County, New Jersey.

Please be advised that a review of the submitted material indicates that it will be necessary to obtain a stream encroachment permit from the Bureau of Flood Plain Management for the proposed pedestrian bridges. This proposal is considered a minor project, therefore, it will not be necessary to submit backwater calculations and cross sections of the stream 500 feet upstream and downstream of the project.

It is suggested that you arrange for a pre-application conference with one of the Bureau's engineers before final design.

Enclosed please find a stream encroachment permit application package.

Should you have any further questions, please contact the undersigned at (609) 292-2402.

Very truly yours,

Susan Hiller

Susan Hiller
Stream Encroachment Section
Bureau of Flood Plain Management

SH:reb
Enclosure
cc: Wantage Township Engineer & Clerk
Vernon Township Engineer & Clerk
Sussex County Engineer

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