WATERSHED WORK PLAN

FOR THE

REPAUPO CREEK WATERSHED

Gloucester County

New Jersey

USDA Soil Conservation Service
1370 Hamilton St., P. O. Box 219
Somerset, N. J. 08873

Key

D. A. Williams, Administrator, 4/11/62
SCS, Washington 25, D.C.

Selden Lee Tinsley, State Conservationist,
SCS, New Brunswick, New Jersey

WATERSHED PROTECTION (P.L. 566) - Application for
the Repaupo Creek Watershed, N.J.

Transmitted herewith is an application from the sponsors of the Repaupo Creek Watershed, Gloucester County, New Jersey.

Also enclosed is a typed list of Sponsoring Organizations, their signers and mailing addresses.

Enclosures

SPONSORS OF THE REPAUPO CREEK WATERSHED P.L. 566 APPLICATION

Gloucester County Soil Conservation District

Leslie Richards, Chairman
R.D.
Sewell, New Jersey

Contact: Mayor Andrew M. Georgiana
Municipal Building
Gibbstown, New Jersey

APPLICATION FOR ASSISTANCE IN PLANNING AND CARRYING OUT WORKS OF IMPROVEMENT
IN NEW JERSEY
UNDER THE
WATERSHED PROTECTION AND FLOOD PREVENTION ACT

(PUBLIC LAW 566 - 83rd Congress)
(Amended PUBLIC LAW 1018 - 84th Congress)

TO THE HONORABLE
THE SECRETARY OF AGRICULTURE
UNITED STATES DEPARTMENT OF AGRICULTURE

The undersigned local organization(s) makes application for Federal assistance under the Watershed Protection and Flood Prevention Act in preparing and carrying out plans for work of improvement for the Repaupo Creek watershed.

The following information is submitted in support of the application:

1. Size of watershed: 13,000 acres.

2. Location of watershed:

   a. State(s) New Jersey

   b. County(ies) Gloucester

   c. Tributary of Delaware River

3. Watershed problems: The urgent and immediate problem is the restoration of a dike that was severely damaged during the March 6-8,1962 storm. This dike is about three (3) miles long and protects a large area in Logan and Greenwich Township from inundation by tidal waters of the Delaware River. Included in this area is the town of Gibbstown, the Thompson Point plant of the Du Pont Company, many hundreds of acres of agricultural land, railroad rights-of-way, many miles of State,County, and Township roads, and numerous suburban and farm residences.

The long-time problem, in addition to the above, is the lack of capacity in the presently installed flood gates. These gates cannot handle the flow from minor storms without some flooding behind the dike. There are several hundred acres of formerly productive farm land and numerous residences that have been abandoned because of this frequent flooding. Portions of the Du Pont plant are flooded periodically. The Du Pont Company tried to alleviate their problem by installing pumps and more recently by the installation of some large manually operated gates. However, the March, 1962 storm occurred during this installation and resulted in a breached dike and the loss of the gates and pipes.

Another long time problem is the deficiency that exists in the size and number of channels that are needed to deliver storm waters to the flood gates.

4. Works of improvement believed to be needed: The immediate need is to quickly rebuild the damaged dikes to provide protection commensurate with the amount of damage that would occur in the event of a reoccurrence of the 1934, 1950, 1955 or 1962 storms. The rebuilt dike should have a stable section and be of sufficient height to provide the necessary protection with adequate freeboard. The top of the dike should be wide enough to provide a roadway for maintenance purposes. Where the dike is not protected from wave action by islands, the outside slope should be protected with stone riprap.
Also needed, but not urgently so, is additional flood gate capacity, channel improvement on existing channels, and some new channels to speed up the flow of storm water to the gates, improvement of those portions of the dike not damaged by the March 1962 storm to provide adequate freeboard and wave protection, and if an investigation shows it is needed, the construction of additional dikes to protect the watershed from undiked adjacent watersheds and water retarding structures to reduce peak flows.

5. Benefits expected to be achieved:
About one (1) mile of the dike has been damaged to such an extent that even a minor storm tide will result in major breaches of the dike. If a breach were to occur, a very large area including portions of Gibbstown, the Du Pont plant, and many hundreds of acres of agricultural land would be under water at a normal high tide of about + 3.5 M.S.L. The dollar damage might be estimated at more than eight million dollars.

6. Extent of local participation:

The Township of Logan and Greenwich, and The Repaupo Meadow Company will all work together in obtaining the necessary land, easements and rights-of-way and funds for the local share of the cost.

The Gloucester County Soil Conservation District will give overall support to the project and take the leadership in getting the needed conservation measures installed on farm lands in the watershed.

7. Status of local organizations:

The Gloucester County Soil Conservation District is a legal subdivision of the State and is a legally qualified sponsor to this project.

Witness the signatures of the undersigned local organization(s) on the dates shown below. (Type or print all information except signature.)

Gloucester County Soil Conservation District

(Name of Local Organization)

By: (Sig.) Leslie Richards

Title Chairman Gloucester Co. Dist.

Date 3/30/62

This action authorized at an official meeting on March 30, 1962 at Trenton, N.J.

Attest: (Sig.) George E. Lamb (Secretary)

(Name of Local Organization)

By: (Sig.) _____

Title _____

Date _____

This action authorized at an official meeting on _____, 19____ at _____

Attest: (Sig.) _____ (Secretary)

(Name of Local Organization)

By: (Sig.) _____

Title _____

Date _____

This action authorized at an official meeting on _____, 19____ at _____

Attest: (Sig.) _____ (Secretary)

Contact: The above local organizations request that all correspondence or contacts pertaining to this application be directed to:

Mayor Andrew M. Georgiana

(Name)

Municipal Building, Gibbstown

(Mail Address)

Gloucester County, New Jersey

The foregoing application for Federal assistance under the Watershed Protection and Flood Prevention Act is hereby approved.

New Jersey Department of Conservation and Economic Development

By: _____

Title: State Forester

Date: 4/6/62

WATERSHED WORK PLAN

REPAUPO CREEK WATERSHED
Gloucester County, New Jersey
November 1962

SUMMARY OF THE PLAN

This project is sponsored by the Gloucester County Soil Conservation District, Repaupo Meadows Company, and Greenwich Township.

The Repaupo Creek Watershed, having a drainage area of 13,000 acres, is located in Greenwich, East Greenwich, Logan, Woolwich and Mantua Townships, Gloucester County, New Jersey. It outlets into the Delaware River opposite Chester, Pennsylvania.

About 5 miles of dike along the Delaware River protects Gibbstown, several industrial plants, and about 1,000 acres of agricultural land from tides. High tides of 7.5 feet mean sea level (m.s.l.) and wave action occurring in March 1962, severely damaged one (1) mile of the dike and damaged other parts to a lesser extent. The Corps of Engineers is currently repairing the dike to pre-storm condition under authority of Public Law 99/84. Consideration will also be given to determining the feasibility of providing further protection from storm tides through other Corps programs.

The existing channels and tidegates are inadequate to dispose of storm runoff from the watershed during periods of high rainfall. Hence, the water table remains high, preventing effective drainage of agricultural and urban land.

Erosion is not a serious problem in the lower part of the watershed, where the terrain is flat. It is,however, a serious problem in the relatively steep upper portion. Most of the sediment, however, is trapped in the upper reaches of the watershed.

A comprehensive plan for solving the problems has been developed jointly by the sponsoring local organizations, the U. S. Soil Conservation Service, the U. S. Forest Service, and the New Jersey Bureau of Forestry. Other State and Federal agencies consulted were the U. S. Corps of Engineers, U. S. Fish and Wildlife Service, the U. S. Agricultural Stabilization and Conservation Service, and the New Jersey Division of Fish and Game.

The work plan proposes installation in a five-year period, of a project for protection and development of the watershed at a total estimated installation cost of $542,744. The Public Law 566 share of this cost is $323,004. The remainder, $219,740, will be paid from other funds.

Land Treatment Measures

The estimated cost for installation of land treatment measures is $165,775. Of this, $152,169 will be borne by local and other funds. The remaining $13,606, to be paid from Public Law 566 funds, is for accelerated technical assistance. This will be entirely for use by the Soil Conservation Service, since all the U. S. Forest Service technical assistance will be from funds of the going programs.

Structural Measures

Structural measures consist of one tidegate structure and 12.3 miles of channel improvement. These are multiple purpose flood prevention and drainage measures. They are designed to lower the water level from 1.1 feet m.s.l. during the 100 year frequency storm to -1.5 feet m.s.l. in about 4 days.

The total installation cost of structural measures is estimated at $376,969. Of this $309,398 will be borne by Public Law 566 funds and $67,571 by other funds. The local share includes $15,800 for land, easements and rights-of-way and $2,856 for administration of contracts.

Benefits

Average annual benefits are estimated at $25,384, of which $24,175 are primary and $1,209 secondary. The primary benefits include $19,911 attributed to flood prevention, $2,153 to agricultural water management, and $2,111 to non-agricultural water management.

The ratio of average annual benefits, $25,384, to average annual costs, $19,302, is 1.3 to 1.0.

Project Installation

The Repaupo Meadows Company and the Township of Greenwich will each pay about half of the local share of construction cost and installation services, estimated at $48,915.

Land, easements and rights-of-way have been obtained by the Repaupo Meadows Company. These represent rights already vested in the organization.

The Township of Greenwich will be the local contracting organization.

Operation and Maintenance

Operation and maintenance will be the responsibility of Repaupo Meadows Company, which will enter into an agreement with Greenwich

Township to actually carry out the works of maintenance. The estimated cost of operation and maintenance is $5,000 annually.

Land treatment measures will be operated and maintained by landowners and operators under agreements with the Gloucester County Soil Conservation District.

DESCRIPTION OF THE WATERSHED

Physical Data

The Repaupo Creek Watershed, having a drainage area of approximately 13,000 acres, flows in a northwesterly direction, through East Greenwich and Greenwich Townships entering the Delaware River opposite Chester, Pennsylvania.

Several tributaries converge in a tidal marsh downstream from U. S. Highway 130 to form Repaupo Creek, which continues through the marsh into the Delaware River.

Whereas the lower part of the watershed is quite flat, the upper part is relatively steep. Elevations range from -1.9 feet m.s.l. to 140 feet m.s.l. About 2,000 acres lie below zero elevation or m.s.l. The channel gradients range from 0.6 feet per mile in the lower 6 miles to 18 feet per mile in the upper 3 miles in the Repaupo Creek drainage system.

Geology and Soils

This watershed lies totally within the North Atlantic Coastal Plain.

The lower one-fourth to one-third of the stream courses traverses broad tidal marsh areas of highly organic silt alluvium through which they are inter-connected by a complex system of drainage ditches. These were constructed many years ago when the marsh was used for agriculture.

The middle one-half to one-third of the stream courses are drowned valleys through which the streams meander over silty muck and alluvium.

The upper one-quarter drains the upland by means of narrow fingering channels.

The underlying formations consist of the unconsolidated members of Cretaceous and Quaternary age traversing the watershed in bands trending NE-SW approximately at right angles to the stream courses and parallel to the Delaware.

About one-third of the area next to the Delaware is underlain by the marine clays of the Magothy and Raritan formations, but are mantled to a depth between a few feet and as much as 30 feet of highly organic silty alluvium.

The next band to the southeast is underlain by the Merchantville sandy clays and the Woodbury clays. This area is mantled by thin sandy alluvium.

Southeast of the Woodbury band lies the belt of glauconetic sands with some clay belonging to the Englishtown, Marshaltown and Mt. Laurel-Wenona sands, capped by sands and gravels of the Cape May formation.

The uppermost quarter of the watershed, farthest to the southeast is underlain by the highly glauconetic Navesink-Hornerstown formations and the Kirkwood fine sand.

The soils of the area range from the organic silts and peats of the tidal marsh and drowned valleys to the dry sands at the upper end.

Loamy sands and sandy loams of the Galestown and Freehold formations make up 75 percent of the upland soils with their off drainage equivalents, Holmdel, Fallsington, and Pocomoke comprising the remainder. The latter are highly productive for vegetable crops when drained. All the soils, except in the uppermost reaches where Marlton and Westphalia soils occur, are derived from reworked alluvial overwash of varied composition.

Most of the organic silty alluvium of the tidal marshes had its source from the Delaware.

Climatic Data

The average annual precipitation is 42 inches, fairly evenly distributed throughout the year. The average annual runoff is 15 inches.

The mean annual temperature is 54.5 degrees, ranging from 28.5 in December to 75.8 in August. The frost free period generally extends from April 11, to October 21.

The average daily tide fluctuates from -2.4 to +3.4 feet m.s.l. A tide of +6.3 may be expected to occur or be exceeded once during any given year. The highest tide of 29 years of record is 8.5 feet m.s.l. This occurred in August 1933, and again in November 1950.

Economic Data

Both agriculture and industry are of major importance in this watershed. Agriculture is almost entirely truck farming. The principal crops are asparagus, tomatoes, sweet corn and peppers.

The 1,700 acres of land below zero elevation was once in agricultural use. This was brought about in the late 1700's when the Repaupo Meadows Company was organized. Installation of dikes and drainage systems enabled use of this low marshland for crop production. It remained in agricultural use for over a century, until the early 1900's. This land is now idle and much of it is owned by industry.

About 80 percent of the land in the watershed is currently in farms. Most of these are owner operated, about 10 percent being tenant operated. The average size is 65 acres, valued at $26,000 per farm.

Of the 190 farms in the watershed, 85 are cooperators with the Gloucester County Soil Conservation District and 53 have basic conservation plans.

Local markets for farm produce are readily accessible. Nearby Swedesboro holds auctions for the fresh vegetable market. Canning house tomatoes and asparagus are marketed both in Swedesboro and Camden. Highway transportation is excellent, including the New Jersey Turnpike and U. S. Route 130, which pass through the watershed. The Pennsylvania-Reading Railroad also crosses the watershed.

Present land use is shown in the following table:

Land Use	Acres	Percent
Cropland	6,300	48
Grassland	700	6
Woodland	3,000	23
Other	3,000	23
Total	13,000	100

Of the 3,000 acres in woodland, almost half is maple swamp and marshland, where little improvement work can be justified at this time. The rest consists primarily of Tulip poplar, Red gum, and mixed oak species, some of which can be benefited by improvement

The Repaupo winds its way to the Delaware River. Channels will be enlarged and cleared of obstructions, and a tidegate will be installed.

Conditions such as this exist in many areas along the Repaupo. Obstructions and inadequate channel capacity results in flooding and restricted drainage.

A large portion of the agricultural benefit area can be seen above the bend of the Repaupo. Asparagus, tomatoes, sweet corn and peppers are the main crops produced.

cuttings. About 300 acres is mature timber, most of which is in the vicinity of Warrington Mill Pond.

There is a relatively slow trend toward urban expansion.

Gibbstown is the only community of any size within the watershed boundaries, having a population of about 4,400. Other nearby communities include Paulsboro, with 8,100; Swedesboro, with 2,400; and Woodbury, with 12,400. Camden and Philadelphia are within 25 miles.

There are four industries within the watershed, located along the Delaware River, with a total employment of about 2,400.

All land in the watershed is privately owned.

WATERSHED PROBLEMS

About 5 miles of continuous dike now protects about half of Gibbstown, several industrial plants along the Delaware River, a railroad, highways and several hundred acres of agricultural land.

Internal drainage is provided for by means of a system of channels and a tidegate structure. Existing channels and the one tidegate structure, however, are inadequate to handle excess runoff. In March 1962, high tides breached the dike in several places, allowing the water to reach an elevation of 2.6 feet m.s.l. inside the dike. It took seven weeks to drop the water level to -1.0 feet ms.l. About 407 acres of cropland, 103 acres of woodland, and 97 acres of urban property are adversely affected by the lag in disposal of floodwater and resulting high water table.

Although there are potential reservoir sites that could be utilized for fish and wildlife enhancement, local interests are not ready to consider these at this time.

Soil erosion, particularly in the upper reaches of the watershed is a serious on-farm problem. There is need for greater application of erosion control measures. Much of the sediment is deposited before it reaches the proposed works of improvement, hence, it presents no serious problem to the proposed structural measures downstream.

Water supply for industries is taken from the Delaware River, supplemented by Repaupo Creek during dry periods when the River water is too brackish.

Gibbstown water supply comes from municipal wells. The supply is adequate for their needs.

Farm water, both for irrigation and domestic use, is obtained from wells and streams. The supply is adequate.

PROJECTS OF OTHER AGENCIES

This project is within the overall Delaware River Basin Project. Although the measures included in this plan are not a part of the Delaware River Basin Project, they are consistent with its overall objectives.

The Corps of Engineers is currently repairing the dike under authority of Public Law 99 and is studying the feasibility of providing greater protection against storm tides. The measures proposed in this work plan are fully coordinated with the present Corps work and are not at variance with any protective measures as yet considered by the Corps.

BASIS FOR PROJECT FORMULATION

Existing channels and tidegate are inadequate to dispose of runoff water in a reasonable period of time. The urban people wish this disposal to take place within a few days rather than several weeks, as it is today.

Damage to urban property occurs in the range of +0.5 to 3.0 m.s.l.

The tidegate and channel system will be designed to allow storage from the 100 year frequency storm to reach a stage of 1.1 feet m.s.l. and drop to -1.5 feet in 4 days through urban areas.

In agricultural areas landowners wish rapid removal of storm runoff in order to permit installation of effective drainage systems. Channels through the benefited agricultural areas will be designed for the 5-year frequency level of protection.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

In the agricultural benefit area, land treatment measures will consist of open drains to take advantage of the improved outlet channels and more rapid lowering of the water table after storms. Erosion is not a problem in this part of the watershed because of the flatness.

Sheet and gully erosion is a problem, however, in the sloping fields in the upper reaches of the watershed. Application of erosion control measures--contour farming, cover cropping, conservation cropping systems, diversions and outlet construction--will be accelerated.

Woodland conservation measures, consisting of tree planting, thinning, weeding and harvest cutting, will be applied under going programs by the New Jersey Bureau of Forestry in cooperation with the U. S. Forest Service. No acceleration with Public Law 566 funds will be needed.

Structural Measures

One tidegate structure with two 12' X 3.7' openings in a concrete headwall and two wooden flapgates is now located at the outlet of Repaupo Creek. The invert elevation is -4.7 feet m.s.l. With the water level inside the dike at +1.1 m.s.l. (100 year flood volume stage) and an average tide cycle, the volume of outflow is 610 acre-feet per day. One additional tidegate structure, having a capacity approximately equal to the existing structure, will be installed at the outlet of White Sluice Race. Its invert elevation will be at -6.5 feet m.s.l. See Figure 2 for typical cross-section.

In conjunction with the tidegate structure, approximately 9.0 miles of inlet channels and 0.5 miles of outlet channels will be improved by straightening and enlarging existing channels. Also, 2.8 miles of inlet channels will be improved by killing and disposing of lily pads. The vegetation will be killed by applications of chemical herbicides. Tidegate and channel capacities will be based on lowering the 100 year frequency flood stage in approximately 4 days for the urban enhancement area. Channels serving only the agricultural benefit area will be designed to carry the 5 year frequency storm. In reaches where vegetation is the only problem, removal of the vegetation will result in greater than 5 year frequency capacity.

The total installation cost for structural measures is estimated to be $376,969. See Tables 1, 2 and 3 for more detailed breakdowns for costs, quantities and design.

Channel capacities range from 80 to 800 cubic feet per second. The maximum capacity of the tidegate is 795 cubic feet per second.

EXPLANATION OF INSTALLATION COSTS

Costs for installing land treatment measures will be paid by landowners with such help as may be obtained under the Agricultural

Conservation Program. Those costs applicable to measures which will be installed with technical assistance from the Soil Conservation Service are estimated to be $129,575. Technical assistance from the Soil Conservation Service is estimated at $19,436, $13,606 of which will be paid from Public Law 566 funds and $5,830 from funds provided by the going program of Soil Conservation Service assistance to Districts. Costs of $14,704 are applicable to measures which will be installed with technical assistance from the New Jersey Bureau of Forestry, in cooperation with the U. S. Forest Service. Technical assistance is estimated at $2,060, all of which will be paid from funds provided by the going program.

Structural Measures Costs

Total construction costs are estimated to be $285,600. This is based upon use of dragline equipment mounted on mats for channel improvement work, and installation of a tidegate structure utilizing bituminous coated corrugated metal pipes. Unit costs were based on recent contracts for similar types of construction work in nearby areas. A contingency of 12 percent was added to all estimated costs of structural measures to arrive at the total construction cost.

Installation services are broken down into Engineering Services and Other Services. Engineering Services consist of surveys, site investigations, designs, and supervision and inspection. These are based upon approximate costs of similar work within the State and are estimated to be $41,126. Other Services include State Office administration and miscellaneous costs of $31,587, based on past experience for similar work. Of the total installation services cost of $72,713, $66,364 will be paid from Public Law 566 funds and $6,349 from other funds.

The cost of land, easements, and rights-of-way, estimated at $15,800, is based on land values provided by a local land assessor.

The cost of administering contracts, estimated at $2,856, is based on a percentage of construction cost for similar types of work and will be paid from other than Public Law 566 funds.

The costs for stream channel improvement and the tidegate structure are allocated to flood prevention and drainage on the basis of the ratio of the cost of channels and tidegate for drainage for the area of wet land alone and the cost of a multiple purpose structure for drainage and flood prevention in accordance with the first alternative method shown in the Watershed Protection Handbook of the Soil Conservation Service. Thus, 82.4 percent, or $310,471, of the cost of the stream channel improvement and tidegate is allocated to flood prevention; and 17.6 percent, or $66,498, to drainage. The drainage cost was further allocated $33,582 to agricultural water

management and $32,916 to non-agricultural water management according to the ratio of primary agricultural and urban benefits.

The Public Law 566 share of the installation costs for flood prevention is $295,106, or approximately 95.1 percent; for agricultural water management $14,292, or 43 percent; and for non-agricultural water management no Public Law 566 funds are authorized.

The following is the proposed schedule of obligations:

FISCAL YEAR	STRUCTURAL MEASURES		LAND TREATMENT MEASURES	
	P. L. 566	Other	P. L. 566	Other
1963	$309,398	$67,571	$2,000	$10,000
1964			$2,900	$30,000
1965			$2,900	$38,000
1966			$2,900	$38,000
1967			$2,906	$36,169

EFFECTS OF WORKS OF IMPROVEMENT

The proposed channel improvement and tidegate structure will provide more rapid disposal of runoff and will result in lowering the water table affecting 97 acres of urban property, 407 acres of truck cropland and 103 acres of woodland.

There are about 60 owners of the agricultural land that will directly benefit by the proposed works of improvement. The agricultural benefits occur as increased net income resulting from higher yields of the same crops as are now grown. Urban benefits in the form of increased values will accrue to more than 100 properties.

The project will protect urban property above 1.1 m.s.l. from the 100 year frequency storm. Flooding will occur for short durations on property below elevations 1.1 m.s.l. For this reason any new building should be above the 1.1 foot elevation.

The structural measures are designed to utilize the 1,700 acres of marshland below elevation 0.0 feet m.s.l. for flood storage. The sponsors are fully aware of the need for maintaining this area for temporary storage and have agreed to prevent subsequent encroachment.

PROJECT BENEFITS

The proposed structural measures will provide flood prevention, agricultural water management and non-agricultural water management benefits to urban and agricultural land. Benefits to 97 acres of urban land, amounting to $12,563 annually, are the result of enhancement, or increased value due to lowering the water table and providing more rapid disposal of storm runoff. In March 1962, it took 7 weeks for the water level to drop from 2.6 feet to -1.0 feet m.s.l. With improved channels and additional tidegate, runoff will drop from a high stage of +1.1 feet to -1.5 feet m.s.l. in 4 days.

Of the $12,563 annual benefits to urban property, $9,854 are flood prevention, $2,111 non-agricultural water management benefits, and $598 secondary benefits. The benefits are based on an average increase in market value from $3,200 to $6,000 per acre, an increase of $2,800.

Annual direct identifiable benefits of $12,210 to 407 acres of cropland are the result of increased net yields from truck crops due to better drainage and more rapid disposal of storm runoff. Of this, $10,057 are flood prevention and $2,153 are agricultural water management benefits. Secondary agricultural benefits amount to $1,590 annually. Of these benefits $611 are included for project justification. Additional urban benefits of $598 were also used for project justification. These are the secondary benefits accruing to local and state interests. It is not anticipated that land use will change from its present use--vegetable crops. The net increase in yields is based on data recently computed for the Tributaries of Maurice River Cove Watershed, in neighboring Cumberland County, New Jersey. See Table 5 for distribution of benefits.

Other benefits, not evaluated, accrue to woodland and other land not in agricultural crops. It is anticipated that mosquito control benefits will be substantial.

COMPARISON OF BENEFITS AND COSTS

Average annual benefits from all the structural measures are estimated at $25,384, and the average annual costs $19,302, a benefit-cost ratio of 1.3 to 1.0.

Table 5 shows the information on benefits and costs.

PROJECT INSTALLATION

Land treatment measures will be established by farm owners and operators in cooperation with the Gloucester County Soil Conservation District over a 5 year period. The Soil Conservation Service will provide sufficient technical services to the Soil Conservation

District to carry out the accelerated program of land treatment within the installation period. The New Jersey Bureau of Forestry, in cooperation with the U. S. Forest Service, will provide similar services for the woodland land treatment measures.

The Gloucester County Agricultural Stabilization and Conservation Committee will cooperate by providing financial assistance to landowners and operators in line with the needs and funds available for those practices which will help accomplish the conservation objectives. The Farmers Home Administration will provide soil and water conservation loans to all eligible farmers requesting them.

Structural measures will be installed in fiscal year 1963.

The Soil Conservation Service will provide technical specialists to assist in the design of the structural measures, the preparation of specifications, the supervision of construction, the preparation of contract payment estimates, the final inspection, the execution of certificates of completion, and the performance of related duties in the establishment of the planned structural measures.

The Repaupo Meadows Company has the authority to install the structural works of improvement within its boundaries. Since the proposed structural measures are entirely within the boundaries of Repaupo Meadows Company, they will provide easements expected to cost $15,800.

The Repaupo Meadows Company and the Township of Greenwich will contribute approximately equally to the local share of construction cost and installation services.

The New Jersey Agricultural Extension Service through the County Agricultural Agent will assist the sponsors in carrying out an information and educational program. This program will be directed toward developing an understanding and appreciation of the program by land owners and all interested people in the watershed.

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the works of improvement as described in the work plan will be provided under the authority of the Watershed Protection and Flood Prevention Act, Public Law 566 (83d Cong., 68 Stat. 666) as amended.

Land, easements, and rights-of-way, estimated at $15,800, have been obtained by Repaupo Meadows Company.

The cost of administration of contracts, estimated at $2,856, will be assumed by the Township of Greenwich, the local contracting organization.

The local share of the construction cost, estimated at $42,566, and the installation services cost, estimated at $6,349, will be paid by Greenwich Township and the Repaupo Meadows Company, each contributing about 50 percent. Greenwich Township will budget money for this purpose. Loans, if needed, will be obtained from private sources. These sources have indicated their willingness to make the loans.

The Repaupo Meadows Company will finance their share by assessment of members. Their expenditures for dike repairs in the past have indicated their financial capability. Over the past 10 years they have averaged over $4,000 a year for repair of dikes and tidegates.

The Public Law 566 share of the construction cost is estimated at $243,034. The local sponsoring organization must certify that all necessary land, easements and rights-of-way have been obtained or assured by condemnation proceedings before Federal money for installation services and construction cost is made available. Technical assistance for installation of land treatment measures will be made available from Public Law 566 funds. Federal financial assistance is contingent upon funds appropriated under the Act.

Cost-share assistance for installation of land treatment measures will be made available to eligible landowners and operators, in line with needs and funds available through the Agricultural Conservation Program.

PROVISIONS FOR OPERATION AND MAINTENANCE

Operation and maintenance of all structural measures is estimated at $5,000 annually. This includes repair of any damage to tidegates; removal of debris that may prevent proper operations of the tidegates; replacing of decayed timbers and corroded metal parts when this becomes necessary for proper operations; and removal of sediment, vegetation and debris clogging channels in order to maintain design capacity.

The Repaupo Meadows Company will assume responsibility for operation and maintenance of all structural measures. The Township of Greenwich will give financial assistance to Repaupo Meadows Company in carrying out the operation and maintenance measures through agreement between the two organizations.

Failure of the Township of Greenwich to carry out the actual maintenance, as per agreement, will in no way lessen the responsibility of Repaupo Meadows Company in carrying out the needed operations and maintenance.

Funds for operation and maintenance will be obtained by budgeting for that purpose by Greenwich Township.

Inspections will be made at least once a year and after each major storm by representatives of Repaupo Meadows Company, Greenwich Township, and the Gloucester County Soil Conservation District. Inspection reports will be prepared and made available at any time to the Soil Conservation Service. At least once a year a joint inspection will be made with a representative of the Soil Conservation Service.

The Soil Conservation Service will notify the responsible local organizations of the needs for maintenance. The Service will provide any technical assistance that may be needed and available in carrying out works of maintenance.

A maintenance agreement between the Soil Conservation Service and the responsible local organizations will be executed prior to issuance of invitations to bid. Also, supplementary agreements between local organizations will be executed, with copies to the Soil Conservation Service, prior to execution of the operation and maintenance agreement with the Service.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Repaupo Creek Watershed, New Jersey

Installation Cost Item	Unit	No. To Be Applied	Estimated Cost (Dollars) 1/ P.L. 566	Other	Total
LAND TREATMENT					
Soil Conservation Service					
Contour Farming	acre	2,500	-	20,000	20,000
Cover Cropping	acre	4,000	-	68,000	68,000
Conservation Cropping System	acre	1,000	-	30,000	30,000
Diversion Construction	mile	5	-	2,750	2,750
Outlet Construction	feet	5,000	-	625	625
Open Drains	mile	3.9	-	8,200	8,200
Technical Assistance	dollars	-	13,606	5,830	19,436
SCS Subtotal			13,606	135,405	149,011
Forest Service					
Tree Planting	acre	20	-	800	800
Hydrological Cultural Operations	acre	632	-	13,904	13,904
Technical Assistance	dollars	-	-	2,060	2,060
FS Subtotal			-	16,764	16,764
TOTAL LAND TREATMENT			13,606	152,169	165,775
STRUCTURAL MEASURES					
Soil Conservation Service					
Stream Channel Improvement 2/	mile	12.3	243,034	42,566	285,600
SCS Subtotal			243,034	42,566	285,600
Installation Services					
Soil Conservation Service					
Engineering			37,535	3,591	41,126
Other			28,829	2,758	31,587
SCS Subtotal			66,364	6,349	72,713
Other Costs					
Land, Easements & R/W			-	15,800	15,800
Administration of Contracts			-	2,856	2,856
Subtotal - Other			-	18,656	18,656
TOTAL STRUCTURAL MEASURES			309,398	67,571	376,969
TOTAL PROJECT			323,004	219,740	542,744
SUMMARY					
Subtotal SCS			323,004	202,976	525,980
Subtotal FS			-	16,764	16,764
TOTAL PROJECT			323,004	219,740	542,744

1/ Price Base 1961

2/ Includes tidegate structure

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Repaupo Creek Watershed, New Jersey

(Dollars) 1/

Structure	Installation Cost - PL 566 Funds				Installation Cost - Other Funds						Total Installation Cost
		Installation Services		Total Public Law 566			Other				
	Construction	Engineering	Other		Construction	Installation Services	Adm. of Contracts	Easements & R/W	Water Rights	Total Other	
Stream Channel Improvement 2/	243,034	37,535	28,829	309,398	42,566	6,349	2,856	15,800	-	67,571	376,969
GRAND TOTAL	243,034	37,535	28,829	309,398	42,566	6,349	2,856	15,800	-	67,571	376,969

1/ Price Base 1961

2/ Includes tidegate structure.

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Repaupo Creek Watershed, New Jersey

(Dollars) 1/

Item	Purpose			Total
	Flood Prevention	Agric. Water Mgt.	Non-Agric. Water Mgt.	
	COST ALLOCATION			
Stream Channel Improvement 2/	310,471	33,582	32,916	376,969
Total	310,471	33,582	32,916	376,969
	COST SHARING			
Public Law 566	295,106	14,292	-	309,398
Other	15,365	19,290	32,916	67,571
Total	310,471	33,582	32,916	376,969

1/ Price Base 1961

2/ Includes Tidegate Structure

TABLE 2B - BASIS FOR SHARING AGRICULTURAL WATER MANAGEMENT COSTS

Repaupo Creek Watershed, New Jersey

(Dollars) 1/

Purpose	Estimated Average Annual Agricultural Water Management Benefits			Total
	Direct Identifiable		Other	
	Dollars	Percent	Secondary	
Drainage	2,153	57.44	1,595	3,748

1/ Price Base 1961

TABLE 3 - STRUCTURAL DATA

TIDEGATE STRUCTURE

Repaupo Creek Watershed, New Jersey

Item	Unit	Total
Average High Tide	feet (m.s.l.)	3.4
Average Low Tide	feet (m.s.l.)	-2.4
Highest Tide of Record	feet (m.s.l.)	8.5
Size of Opening	sq.ft.	88
Average Capacity of Tidegate	cfs	300
Maximum Discharge Through Tidegate	cfs	795
Elevation, Tidegate Invert	feet (m.s.l.)	-6.5

TABLE 3A

STRUCTURE DATA - CHANNELS

Repaupo Creek Watershed, New Jersey

Channel Designation	Station Numbering For Reach Sta. (1000')	Sta. (1000')	Watershed Area ($mi.^2$)	Required Drainage Curve	Required Channel Capacity (cfs)	Planned Channel Capacity (cfs)	Avg. Bottom Width (ft.)	Avg. Side Slope	Avg. Depth (ft.)	Avg. Grade (pct)	Avg. Vel. in Channel (ft/sec)	Volume of Excavation (1000 cu. yds.)
Repaupo Creek	1.5	4.8	7.4	-	500 1/	507	40	1:1	7.0	0.012	1.54	9.5
	4.8	7.5	7.4	-	500 1/	500	32	1:1	6.8	0.015	1.81	6.5
	7.5	15.0	7.4	-	334 2/	334	32	1:1	6.2	0.020	1.41	16.8
	15.0	17.5	6.1	-	283 2/	283	24	1:1	5.4	0.050	1.78	3.4
	17.5	23.2	6.1	C	93 3/	93	12	1:1	5.0	0.023	1.09	4.2
White Sluice Race	0	2.0	11.4	-	500 1/	500	30	1:1	6.5	0.020	2.02	5.3
	2.0	4.6	11.4	-	415 1/	415	30	1:1	6.5	0.015	1.75	7.4
White Sluice Rc.&Still Run	4.6	7.4	7.5	-	415 2/	415	30	1:1	6.5	0.015	1.75	7.6
	7.4	10.8	7.5	-	346 2/	346	24	1:1	6.1	0.030	1.88	7.5
Still Run	10.8	15.8	5.4	-	347 1/	347	35	3:1	7.0	0.024	1.24	0 5/
London Branch of Still Run	12.0	15.8	1.6	C	80 3/	80+	20	2:1	6.5	0.026	1.21	0 5/
Nehonsey Brook	0.0	3.3	3.8	-	179 2/	179	20	1:1	5.6	0.010	1.25	5.7
	3.3	4.9	3.8	-	250 2/	250	28	1:1	5.6	0.010	1.31	3.0
	4.9	7.1	3.8	-	206 2/	206	24	1:1	5.5	0.020	1.27	2.2
	7.1	10.0	3.3	-	161 2/	161	22	1:1	5.0	0.000	1.19	0 5/
	10.0	13.0	2.9	-	206 2/	206	24	2:1	5.6	0.000	1.29	0 5/
	13.0	14.9	2.9	-	163 2/	163	20	1:1	5.3	0.030	1.22	3.2
Marsh Laterals To and Between Main Channels	-	-	-	-	-	-	-	-	-	-	-	18.8
Aunt Deb's Ditch (Outlet Ditch)	0	2.7	19.1	-	795 4/	800	70	1:1	5.0	0.000	2.1	31.0

1/ Based on tidegate capacity with inside water level of -1.00 ft. m.s.l. at low tide.
2/ 100 yr.-24 hr. duration frequency storm.
3/ 5 yr.-24 hr. frequency storm.
4/ Based on inside water level of +1.10 ft. m.s.l. at low tide.
5/ Cleaning and snagging.

TABLE 4 - ANNUAL COST

Repaupo Creek Watershed, New Jersey

(Dollars) 1/

Evaluation Unit	Amortization 3/ of Installation Cost	Operation and 4/ Maintenance Cost	Total
Stream Channel Improvement 2/	14,302	5,000	19,302

1/ Price Base 1961

2/ Includes Tidegate

3/ Amortized 50 years @ 2-7/8%

4/ Long-term prices as projected by ARS Sept. 1957

TABLE 5 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Repaupo Creek Watershed, New Jersey

(Dollars) 1/

Evaluation Unit	AVERAGE ANNUAL BENEFITS					Avg. Ann. Cost	Benefit Cost Ratio
	Flood Prevention More Intensive Land Use	Agric. Water Management Drainage	Non-Agric. Water Mgt. Drainage	Secondary 2/ Benefits	Total Benefits		
Stream Channel Improvement 3/	19,911	2,153	2,111	1,209	25,384	19,302	1.3:1

1/ Price Base 1961 for installation. Long-term prices as projected by ARS Sept. 1957 for operation and maintenance.

2/ Used for project justification.

3/ Includes tidegate.

INVESTIGATIONS AND ANALYSES

Hydrology and Hydraulics

Tide data was obtained from the Corps of Engineers. The outflow from the tidegate structures was computed using the Delaware River mean tide curve at Baldwins Station, Pennsylvania.

The runoff volume for the 100 year 24 hour duration storm was computed using precipitation from Weather Bureau Technical Paper #29 and a runoff curve number of 70. With the use of a stage-storage curve and the 100 year flood volume of 3,076 acre feet an elevation of +1.10' m.s.l. was set at the outlet (assuming no outflow during the storm.)

A stage-storage curve and stage-volume of outflow curve was used for routing through the existing tidegate structure. It would take approximately 9.2 days to lower the 100 year flood stage to a normal level of -1.5 feet m.s.l. This is based on adequate channel capacities to deliver the water to the tidegate structure (2 - 12' X 3.7' openings.) Since the present channels are inadequate, the times stated above would be considerably longer.

An additional tidegate structure, having a capacity approximately equal to the existing structure, and inlet and outlet channels to the structures were designed to meet project objectives. These objectives are described under the section, Basis for Project Formulation. (See Figures 1 and 2.) The inlet and outlet channels (with their associated floodplain) were designed to deliver the maximum discharge of the tidegates at all stages inside. The invert of the additional tidegate structure will be -6.5 ft. m.s.l.

With the works of improvement installed, the 100 year flood volume will be lowered to its normal level in about 4.1 days.

The 100 year frequency and 5 year frequency storms were routed through the channels using Wilson's Method of Flood Routing. (Engineering Handbook, Hydrology Section 4, Supplement A.) The 5 year frequency discharge was used to determine the size of the channels in the agricultural land. This will provide a greater degree of protection than would be provided with "C" curve drainage.

Channel cross-section areas and water surface slope inserted in Manning's formula were used to arrive at the size of the design channels. The final design will be checked by more detailed water surface profile computations.

Engineering and Geology

The tidegate structure will be located at the end of White Sluice Race. The dike may, at some future time, be constructed to a higher elevation by the Corps of Engineers under Public Law 685 or under a regular flood control authority. There are two reasons for selecting this location. First, inlet and outlet channels are available. White Sluice Race will be used for the inlet channel and Aunt Deb's Ditch, which runs along the outside of the dike, will be used for the outlet channel. Second, Monds Island provides good protection to the outlet from wave action on the Delaware River.

Bench levels were run using m.s.l. datum to set permanent bench marks in the vicinity of the proposed works of improvement. Cross-sections were taken approximately 2,000 feet apart along the 12.3 miles of stream channel improvement. Aerial photographs (scale 1" = 660') were used for horizontal control.

The stage storage data used for the tidegate and channel designs was taken from Corps of Engineers topographic map of the marsh area below Route #44. This data was supplemented by U. S. Geological Survey topo sheets, the stream channel sections and spot elevations that were surveyed.

Soil borings were taken at approximately 2,000 foot intervals along the streams where channel improvement is proposed. The borings show that the soils being excavated are organic silts and organic clays and have an average depth of five feet. Side slopes of 1:1 are proposed for these channels.

The channel excavation was computed by plotting the design section on the surveyed stream channel cross-sections and planimetering the area to be excavated. This area was multiplied by the scaled length of reach to determine the estimated quantity of earthwork.

The area of cleaning and snagging was estimated by multiplying the average width of channel by the scaled length of reach. Refer to Table 3A for a listing of the estimated quantities of channel excavation and cleaning and snagging.

A detailed stream channel survey by reaches will be made prior to the final design of the channels.

Economics

Economic evaluation is based on enhancement of agricultural and urban property.

The agricultural benefits resulting from the proposed works of improvement were based upon the net income with and without the project on land now used primarily for vegetable production. This land is located below elevation 5.0 m.s.l.

Elevations were plotted on aerial photographs containing standard soil survey data prepared by the Soil Conservation Service, and the 5 foot contour line established. The benefit area below the 5 foot contour line was determined by planimetering from the aerial photographs.

Basic data for associated costs of production and harvest recently developed for the Tributaries of Maurice River Cove in nearby Cumberland County were used for establishing net income for yields both without and with the project. Yield levels and average crop distribution for the agricultural lands were used with this associated cost data to establish net income.

Benefits were based on the September 1957, ARS price projection for commercial vegetables.

Urban benefits from improved channels and increased tidegate capacity were based on increased value of building lots between elevations 0.5 and 3.0 m.s.l. with the project installed. Lot values were obtained from the local tax assessor.

In addition to allocating the cost of the channel improvement to flood prevention and drainage, as described previously in the Section, Explanation of Installation Costs, the drainage costs were further allocated between agricultural water management and non-agricultural water management in proportion to respective benefits. Thus 50.5 percent of the costs allocated to drainage was allocated to agricultural water management, and 49.5 percent to non-agricultural water management.

The following table shows the division of cost allocation between flood prevention and agricultural and non-agricultural water management. It further shows the breakdown of cost to be paid from Public Law 566 funds and other funds.

COST SHARING

Repaupo Creek Watershed, New Jersey

Construction	(82.36%) FLOOD PREVENTION			(17.64%) AGRIC. WATER MGT.			NON-AGR. WATER MGT.			(100%) TOTAL FUNDS		
	Public Law 566 (A)	Other (B)	Total (C) (A+B)	Public Law 566 (D) 42.56%	Other (E) 57.44%	Total (F) (D+E)	Public Law 566 (G)	Other (H)	Total (I) (G+H)	Public Law 566 (J) (A+D+G)	Other (K) (B+E+H)	Total (L) (J+K)
				(50.5%)			(49.5%)			(100%)		
Engineering Estimate	210,018	-	210,018	6,977	15,739	22,716	-	22,266	22,266	216,995	38,005	255,000
Contingencies 12%	25,202	-	25,202	837	1,889	2,726	-	2,672	2,672	26,039	4,561	30,600
Subtotal	235,220	-	235,220	7,814	17,628	25,442	-	24,938	24,938	243,034	42,566	285,600
Installation Services												
Engineering Services 14.4%	33,871	-	33,871	3,664	-	3,664	-	3,591	3,591	37,535	3,591	41,126
Other 10.5%	26,015	-	26,015	2,814	-	2,814	-	2,758	2,758	28,829	2,758	31,587
Subtotal	59,886	-	59,886	6,478	-	6,478	-	6,349	6,349	66,364	6,349	72,713
Other Costs												
Land Easements	-	13,013	13,013	-	1,407	1,407	-	1,380	1,380	-	15,800	15,800
Admin. of Contracts	-	2,352	2,352	-	255	255	-	249	249	-	2,856	2,856
Subtotal	-	15,365	15,365	-	1,662	1,662	-	1,629	1,629	-	18,656	18,656
TOTAL STRUCTURAL MEASURES	295,106	15,365	310,471	14,292	19,290	33,582	-	32,916	32,916	309,398	67,571	376,969

Direct benefits constitute 57.46 percent of the total agricultural water management benefits. Therefore, this percentage of costs was allocated to other than Public Law 566 funds.

State and local secondary benefits used in project justification were estimated to be 5 percent of the total direct benefits. Through more efficient operation of shipping facilities, processing and manufacturing plants, operation of public facilities, and labor dependability benefits have a far reaching effect. The intensive type of agricultural production involved and the industrial base of the community in chemicals influence a large area of variable occupations. Additional secondary effects will be derived from the increase in agricultural products available for local processing, added security to the community and a saving in secondary costs which result from inadequate disposal of runoff. Secondary benefits used in project justification are:

Urban	$598
Agricultural	$611
Total	$1,209

The needs for land treatment measures for watershed protection were determined by consultation with the Work Unit Conservationist and local personnel representing the Extension Service, Agricultural Stabilization and Conservation Service, Gloucester County Soil Conservation District and the New Jersey Bureau of Forestry in cooperation with the U. S. Forest Service.

TYPICAL CROSS-SECTIONS

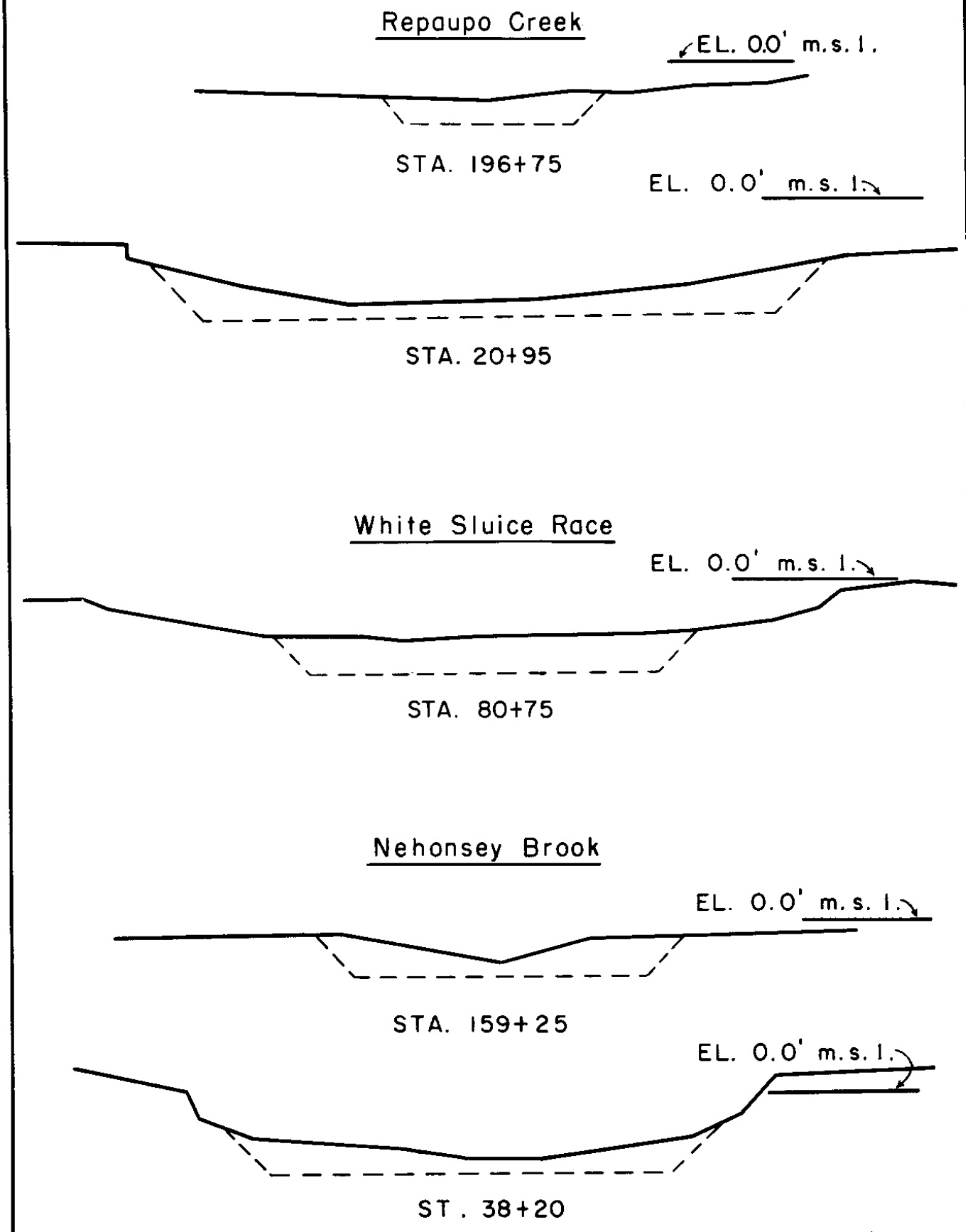
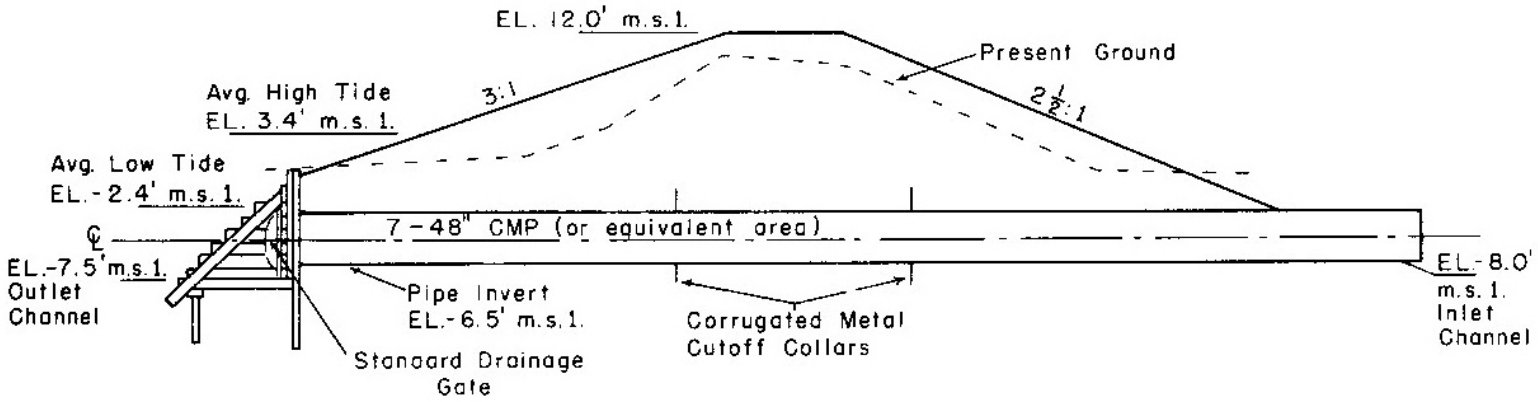


Figure 1

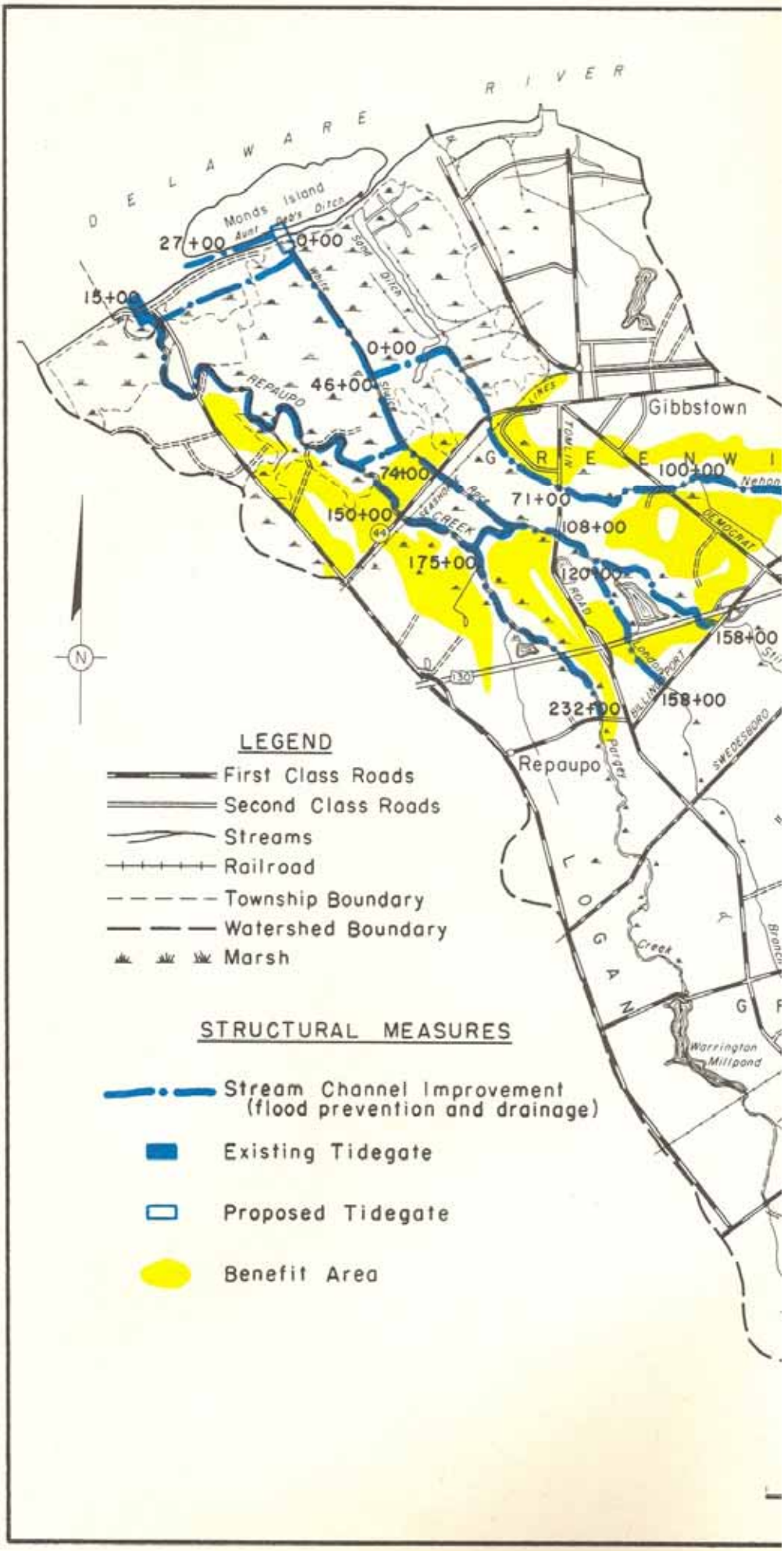
TYPICAL CROSS-SECTION OF DIKE AT TIDEGATE STRUCTURE

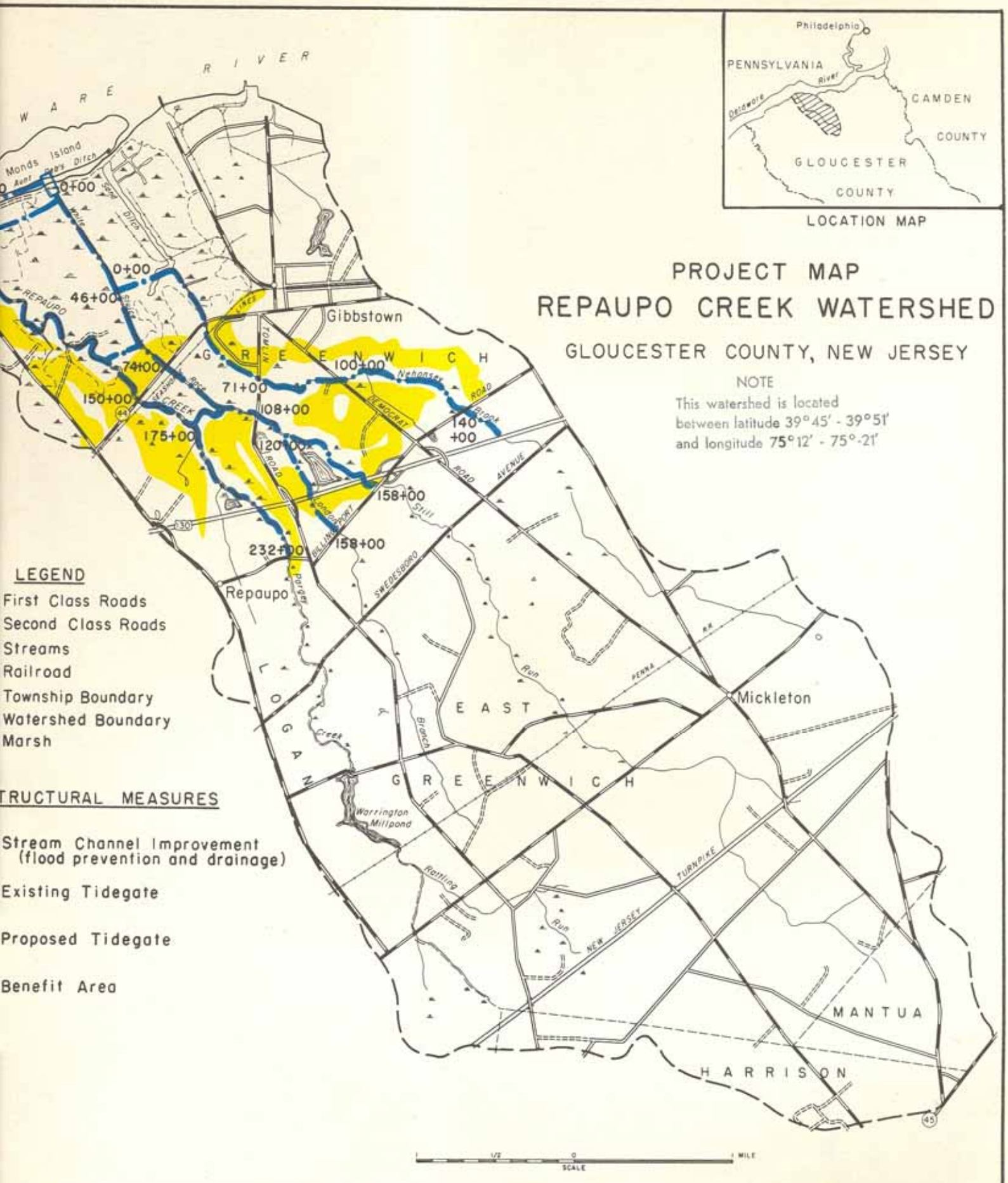
Repaupo Creek Watershed, New Jersey



SCALE: 1" = 20'

Figure 2


DELAWARE RIVER
Monds Island
27+00
0+00
15+00
0+00
46+00
74+00
150+00
175+00
71+00
100+00
108+00
120+00
158+00
158+00
232+00
Gibbstown
GREENWICH
Repaupo
LOGAN
Warrington Millpond
N
LEGEND
First Class Roads
Second Class Roads
Streams
Railroad
Township Boundary
Watershed Boundary
Marsh
STRUCTURAL MEASURES
Stream Channel Improvement (flood prevention and drainage)
Existing Tidegate
Proposed Tidegate
Benefit Area



USDA-SCS-BELTSVILLE, MD. 1968

TABLE OF CONTENTS (cont'd.)

Repaupo Creek Watershed, New Jersey

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WATERSHED WORK PLAN AGREEMENT

between the

GLOUCESTER COUNTY SOIL CONSERVATION DISTRICT
Local Organization

GREENWICH TOWNSHIP
Local Organization

REPAUPO MEADOWS COMPANY
Local Organization

(hereinafter referred to as the Sponsoring Local Organization)

State of New Jersey

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Repaupo Creek Watershed, State of New Jersey, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Repaupo Creek Watershed, State of New Jersey, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about five (5) years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Sponsoring Local Organization will acquire without cost to the Federal Government such land, easements, or rights-of-way as will be needed in connection with the works of improvement. (Estimated cost $15,800.)

2. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to State law as may be needed in the installation and operation of works of improvement.

3. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

Works of Improvement	Sponsoring Local Organization (Percent)	Service (Percent)	Estimated Construction Cost (Dollars)
Stream Channel Improvement (including tidegate)	14.9	85.1	285,600

4. The percentages of the cost for installation services to be borne by the Sponsoring Local Organization and the Service are as follows:

Works of Improvement	Sponsoring Local Organization (Percent)	Service (Percent)	Estimated Installation Service Cost (Dollars)
Stream Channel Improvement (including tidegate)	8.7	91.3	72,713

5. The Sponsoring Local Organization will bear the costs of administering contracts. (Estimated cost $2,856.)

6. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.

7. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

8. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

9. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

10. This agreement does not constitute a financial document to serve as a basis for the obligation of Federal funds, and financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

    Where there is a Federal contribution to the construction cost of works of improvement, a separate agreement in connection with each construction contract will be entered into between the Service and the Sponsoring Local Organization prior to the issuance of the invitation to bid. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

11. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.

12. No member of or delegate to Congress, or resident commissioner shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

Gloucester County Soil Conservation District
Local Organization

By Leslie Richards

Title Chairman

Date November 9, 1962

The signing of this agreement was authorized by a resolution of the governing body of the Gloucester County Soil Conservation District, Local Organization adopted at a meeting held on November 9, 1962.

Robert W Taylor
(Secretary, Local Organization)

Date November 9, 1962

Greenwich Township
Local Organization

By Andrew M Georgiana

Title Mayor

Date Nov. 5, 1962.

The signing of this agreement was authorized by a resolution of the governing body of Greenwich Township, Local Organization adopted at a meeting held on Nov. 5, 1962.

Mildred L. Greene
(Secretary, Local Organization)

Date 11-5-62

FINAL

TABLE 1 - PROJECT INSTALLATION COSTS

Repaupo Creek Watershed, New Jersey

March 1, 1970

Installation Cost Item	Unit	No. Applied	Cost (Dollars) P.L. 566	Other	Total
LAND TREATMENT					
Soil Conservation Service					
Contour Farming	Acre	27		216	216
Cover Cropping	Acre	2,397		40,749	40,749
Conservation Cropping System	Acre	1,279		38,370	38,370
Diversion Construction	Feet	200		22	22
Open Drains	Feet	10,260		4,001	4,001
Other Practices	-			66,266	66,266
Technical Assistance			6,815	1,919	8,734
SCS Subtotal			6,815	151,543	158,358
Forest Service					
Forest Land Treatment	Acre	106		2,644	2,644
Technical Assistance				534	534
FS Subtotal			-	3,178	3,178
TOTAL LAND TREATMENT			6,815	154,721	161,536
Structural Measures					
Soil Conservation Service					
Stream Channel Improvement 1/ 3 Tidegates	Mile	12.3	453,583	35,294	488,877
SCS Subtotal			453,583	35,294	488,877
Installation Services					
Soil Conservation Service					
Engineering			142,748	13,631	156,379
Other			109,456	10,495	119,951
SCS Subtotal			252,204	24,126	276,330
Other Costs					
Land, Easements and Rights of Way				15,800	15,800
Administration of Contracts				2,856	2,856
Subtotal - Other				18,656	18,656
TOTAL STRUCTURAL MEASURES			705,787	78,076	783,863
TOTAL PROJECT			712,602	232,797	945,399

SUMMARY			
Subtotal SCS	712,602	229,619	942,221
Subtotal FS		3,178	3,178
TOTAL PROJECT	712,602	232,797	945,399

1/ Includes (1) tidgegate structure

FINAL

NEW JERSEY

Repaupo Watershed Project (P.L. 566) Gloucester County

The project in brief. Authorized - January 9, 1963. Estimated completion - in fiscal year 1967. Area - 13,000 acres, all in private ownership. Sponsors - Gloucester County Soil Conservation District, Greenwich Township, and Repaupo Meadow Company. Estimated total cost - $542,744 ($323,004 Federal and $219,740 other.) Principal problem - flooding of farm and urban lands because of inadequate outlets. Land use - cropland 48%, grassland 6%, woodland 23% and other 23%.

Progress in land treatment. There are 82 district cooperators with 5,478 acres and 54 basic plans with 4,240 acres. Estimated cost of the planned land treatment measures is $152,000.

Progress in structural measures. Project agreement covering 14 miles of channels and 1 concrete tidegate structure was signed on June 27, 1963. Contract will be awarded early in September 1963.

Progress in obtaining easements and rights-of-way. All easements for the first contract have been obtained. The Township Attorney is presently engaged in obtaining easements for additional lengths of channel which may be treated or dug later.

NEW JERSEY

Repaupo Watershed Project (P.L. 566) Gloucester County

The Project in Brief. Authorized - January 9, 1963. Estimated completion - in fiscal year 1967. Area - 13,000 acres, all in private ownership. Sponsors - Gloucester County Soil Conservation District, Greenwich Township, and Repaupo Meadow Company. Estimated total cost - $542,744 ($323,004 Federal and $219,740 other). Principal problem - flooding of farm and urban lands because of inadequate outlets. Land use - cropland 48%, grassland 6%, woodland 23% and other 23%.

Progress in Land Treatment. There are 79 district cooperators with 5,422 acres and 57 basic plans with 4,182 acres. Estimated cost of the planned land treatment measures is $152,000. Conservation practices installed are contour farming - 27 acres; 1% of planned; cover cropping - 1,800 acres, 45% of planned; outlet construction - 7,230 feet, 145% of planned.

Forestry accomplishments consist of 4.0 M trees planted on 4.0 acres and providing technical services to 8 forest landowners.

Progress in Structural Measures. Project agreement covering 14 miles of channels and 1 concrete tidegate structure was signed on June 27, 1963. Contracts were awarded on September 13, 1963, one for the tidegate structure and the other for about 14 miles of channel. These contracts will be completed in October and November 1964.

Progress in Obtaining Easements and Rights-of-Way. All easements for the first contract have been obtained. The Township Attorney is presently engaged in obtaining easements for additional lengths of channel which may be treated or dug later.

NEW JERSEY

Repaupo Watershed Project (P.L. 566) Gloucester County

The Project in Brief. Authorized - January 9, 1963. Estimated completion - in fiscal year 1967. Area - 13,000 acres, all in private ownership. Sponsors - Gloucester County Soil Conservation District, Greenwich Township, and Repaupo Meadow Company. Estimated total cost - $542,744 ($323,004 Federal and $219,740 other). Principal problem - flooding of farm and urban lands because of inadequate outlets. Land use - cropland 48%, grassland 6%, woodland 23%, and other 23%.

Progress in Land Treatment. There are 79 district cooperators covering 5,422 acres and 58 basic plans on 4,293 acres.
Practices on the land as of June 30, 1965:

Contour Farming - 185 acres	Drainage Main - 8,260 feet
Cover Crops - 2,300 acres	Pasture Planting - 375 acres
Dam, Multipurpose - 3 each	Irrigation Reservoir - 15 each
Diversions - 3,500 feet	Tile Drain - 2,233 feet
Farm Ponds - 19 each	

Forestry accomplishments consist of 5.0 M trees planted on 5.0 acres and providing technical services to 12 forest landowners.

Progress in Structural Measures. Project agreement covering 14 miles of channels and one concrete tidegate structure was signed on June 27, 1963. Contracts were awarded on September 13, 1963, one for the tidegate structure and the other for about 14 miles of channel. These contracts where completed in December 1964 and February 1965. On December 22, 1964 a washout under the structure occurred which made operation of the structure impossible. The leak was temporarily closed by December 25, 1964. Plans for permanent repair are now being prepared.

Progress in Obtaining Easements and Rights-of-Way. All easements for the construction have been obtained.

NEW JERSEY

Repaupo Watershed Project (P.L. 566) Gloucester County

The Project in Brief. Authorized - January 9, 1963. Estimated completion - in fiscal year 1967. Area - 13,000 acres, all in private ownership. Sponsors - Gloucester County Soil Conservation District, Greenwich Township, and Repaupo Meadow Company. Estimated total cost - $542,744 ($323,004 Federal and $219,740 other). Principal problem - flooding of farm and urban lands because of inadequate outlets. Land use - cropland 48%, grassland 6%, woodland 23%, and other 23%.

Progress in Land Treatment. There are 79 district cooperators covering 8,689 acres and 62 basic plans on 4,394 acres.
Practices on the land as of June 30, 1966:

Contour Farming - 185 acres
Cover Crops - 2,369 acres
Dam, Multipurpose - 3 each
Diversions - 3,500 feet
Farm Ponds - 21 each
Drainage Main - 9,785 feet
Pasture Planting - 375 acres
Irrigation Reservoir - 15 each
Tile Drain - 3,233 feet
Conservation Cropping System - 1,028 acres

Forestry accomplishments consist of 5.0 M trees planted on 5.0 acres and providing technical services to 14 forest landowners. Two (2) management plans on 54 acres were prepared. Thirty-six (36) acres were marked for improvement or harvest.

Progress in Structural Measures. Project agreement covering 14 miles of channels and one concrete tidegate structure was signed on June 27, 1963. Contracts were awarded on September 13, 1963, one for the tidegate structure and the other for about 14 miles of channel. These contracts were completed in December 1964 and February 1965. On December 22, 1964 a washout under the structure occurred which made operation of the structure impossible. The leak was temporarily closed by December 25, 1964. Contract for permanent repair was awarded to Rudolf Meckel & Son Inc. for $189,202 on March 23, 1966 and should be completed in December 1966.

Progress in Obtaining Easements and Rights-of-Way. All easements for the construction have been obtained.

NEW JERSEY

Repaupo Watershed Project (P.L. 566) Gloucester County

The Project in Brief. Authorized - January 9, 1963. Estimated completion - in fiscal year 1968. Area - 13,000 acres, all in private ownership. Sponsors - Gloucester County Soil Conservation District, Greenwich Township, and Repaupo Meadow Company. Estimated total cost - $542,744 ($323,004 Federal and $219,740 other). Principal problem - flooding of farm and urban lands because of inadequate outlets. Land use - cropland 48%, grassland 6%, woodland 23%, and other 23%.

Progress in Land Treatment. There are 79 district cooperators covering 5,422 acres and 62 basic plans on 4,394 acres.
Practices accomplished as of June 30, 1967:

Contour Farming - 27 acres
Cover Crops - 2,370 acres
Crop Residue Use - 1,038 acres
Farm Ponds - 4 each
Drainage Main - 8,755 feet
Irrigation Reservoir - 15 each
Tile Drain - 5,096 feet
Conservation Cropping System - 1,279 acres

Forestry accomplishments consist of 5.0 M trees planted on 5.0 acres and providing technical services to 14 forest landowners. Two (2) management plans on 54 acres were prepared. Thirty-six (36) acres were marked and cut for harvest.

Progress in Structural Measures. Project agreement covering 14 miles of channels and one concrete tidegate structure was signed on June 27, 1963. Contracts were awarded on September 13, 1963; one for the tidegate structure and the other for about 14 miles of channel. These contracts were completed in December 1964 and February 1965. On December 22, 1964 a washout under the structure occurred which made operation of the structure impossible. The leak was temporarily closed by December 25, 1964. Contract for modification of the structure awarded to Rudolf Meckel & Son Inc. for $189,202 on March 23, 1966 was completed on March 25, 1967.

Progress in Obtaining Easements and Rights-of-Way. All easements for the construction have been obtained.

NEW JERSEY

Repaupo Project (P.L. 566) Gloucester County

The Project in Brief. Authorized - January 9, 1963. Completed in fiscal year 1969. Area - 13,000 acres, all in private ownership. Sponsors - Gloucester County Soil Conservation District, Greenwich Township, and Repaupo Meadow Company. Estimated total cost - $930,000 ($710,000 Federal and $220,000 other). Principal problem - flooding of farm and urban lands because of inadequate outlets. Land use - cropland 48%, grassland 6%, woodland 23%, and other 23%.

Progress in Land Treatment. The accelerated land treatment program is completed. Based on an estimated value 104 percent of the amount planned was accomplished. Seventy-five district cooperators with 5,433 acres have 61 conservation plans in 4,445 acres. Some practices on the land are:

Contour Farming - 185 acres
Crop Residue Management - 1,567 acres
Conservation Cropping System - 2,040 acres
Farm Ponds - 22 each
Drainage Main - 12,500 feet
Irrigation Pits - 36
Deversions - 3,700 feet
Land Adequately Treated - 3,700 acres

Forestry accomplishments consist of 6,000 trees planted on 6 acres. Harvest cuts were marked and completed on 46 acres. Eight management plans were prepared for 54 acres.

Progress in Structural Measures. Project agreement covering 14 miles of channels and one concrete tidegate structure was signed on June 27, 1963. Contracts were awarded on September 13, 1963; one for the tidegate structure and the other for about 14 miles of channel. These contracts were completed in December 1964 and February 1965. On December 22, 1964 a washout under the structure occurred which made operation of the structure impossible. The leak was temporarily closed by December 25, 1964. Contract for modification of the structure, awarded to Rudolf Meckel & Son Inc. for $189,202 on March 23, 1966, was completed on March 25, 1967. All structural measures planned have been completed.

Progress in Obtaining Easements and Rights-of-Way. All easements for the construction were obtained by Greenwich Township and the Repaupo Meadow Company.

Effectiveness of Project. The tidegate structure and channels have fulfilled their purpose. There has been no flooding of farm or urban lands.