FLOOD PLAIN MANAGEMENT STUDY

TOWN OF STOCKTON SPRINGS
WALDO COUNTY, MAINE

Prepared by
U.S. Department of Agriculture
Soil Conservation Service
Orono, Maine

In cooperation with
Town of Stockton Springs
Waldo County Soil and Water Conservation District
and the
Maine Soil and Water Conservation Commission

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STOCKTON SPRINGS, MAINE

Introduction

This report presents flood plain information along several unnamed tributaries in the Town of Stockton Springs herein referred to as: (Stockton Springs) Tributary; (Harris Road) Tributary; Main Stream; (Main Stream) Tributary; Stowers Meadow Outlet; Stowers Meadow; and several tributaries of Stowers Meadow. Data generated as a result of this study consists of a flood hazard evaluation, including flood maps, profiles, and recommendations for flood protection.

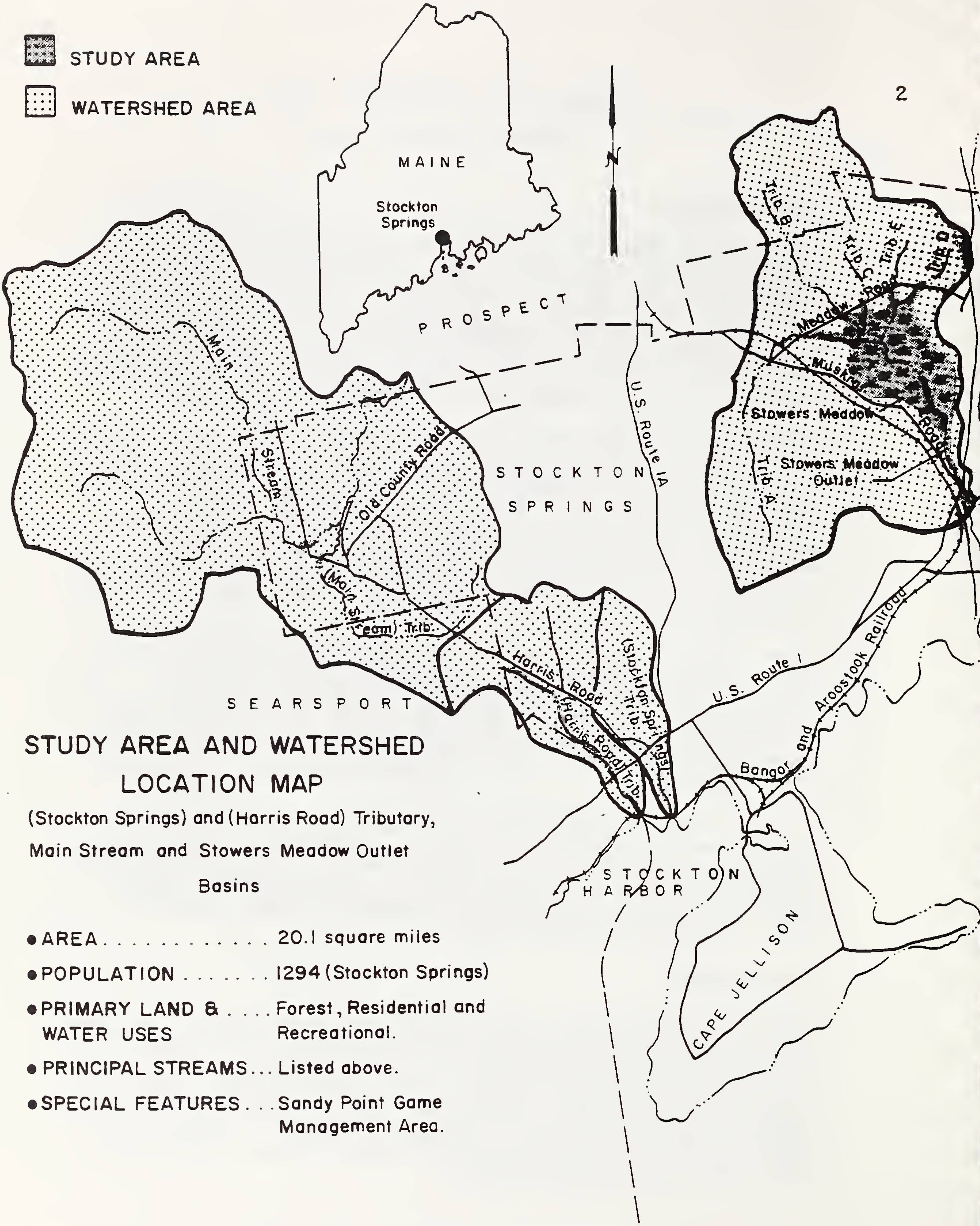
Technical information provided in this study will be useful to the town in identifying flood plain areas, as a guide for developing a flood plain management program for the areas studied, and to update the town's codes and zoning ordinances. The data generated from this study also will be useful for the design of hydraulic structures, roads, bridges, and other types of community planning by federal, state, and local agencies, planning groups, engineers, and conservation district cooperators.

This study was performed in response to a request, by the town of Stockton Springs to the Maine Soil and Water Conservation Commission (MSWCC). A cooperative plan of work was approved by the town and the MSWCC in September 1986, and authorized by the Soil Conservation Service (SCS) in September 1986. That plan provides the basis for funding this study.

The SCS carries out Flood Plain Management Studies under provisions of Section 6 of Public Law 83-566, the Watershed Protection and Flood Prevention Act (1954). Priorities of studies in Maine are established by the MSWCC through a Joint Coordination Agreement between the Commission and the SCS to carry out these studies.

The Watershed

The streams studied in this report are contained within the Penobscot River and Central Coastal Basins. The Penobscot River, with a drainage area of 8,592 square miles, is Maine's largest river basin. The Central Coastal Basin is comprised of a number of coastal streams and rivers located between the Kennebec and Penobscot Rivers. These have a combined drainage area of 1,473 square miles. (See Study Area and Location Map, page 2)



STUDY AREA AND WATERSHED LOCATION MAP

(Stockton Springs) and (Harris Road) Tributary, Main Stream and Stowers Meadow Outlet Basins

- AREA . . . . 20.1 square miles
- POPULATION . . . . 1294 (Stockton Springs)
- PRIMARY LAND & WATER USES . . . . Forest, Residential and Recreational.
- PRINCIPAL STREAMS... Listed above.
- SPECIAL FEATURES . . . Sandy Point Game Management Area.

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE

The uplands throughout the Central Coastal area are blanketed by a thin veneer of glacial till consisting of bouldery, silty, gravelly sand through which the bedrock projects in bold ridges. Glacial sand and gravel, outwashed from the glacier, form eskers, terraces and kames that overlie the till in the valleys. The sand and gravel in the lowlands is generally buried under marine clay and in many sections only the highest parts of the esker ridges project through the clay. Deltas are found in places where the glacial meltwater streams, carrying sand and gravel, debouched through low saddles and bedrock ridges. These ridges acted as successive barriers between the ice sheet and the sea as the glacier receded and the sea encroached on the depressed land. Limited beach deposits, derived from the reworking of the thin till, locally mark the former locations of sea level on the upper slopes.

Glaciation and marine invasion considerably modified the topography of the Central Coastal area by filling the valleys, building large deltas terraces against the flanks of bedrock ridges, and to a considerable extent deranging the old drainage system. Although uplift of the land forced the sea to retreat to the present coastline, the lower parts of the old river valleys are still submerged beneath the marine waters. For this reason, the Maine coast particularly in this area, is classified as a ria or drowned-river-valley coast. Differential erosion of alternating weak and resistant strata resulted in ridges and valleys which are greatly elongated toward the northeast-southwest in accordance with the trend of the rock structure.

The relief of the Central Coastal area is generally moderate with hills and ridges rising 200 to 800 feet above the valley floors. Scattered monadocks rise to elevations of 1,000 feet or more above sea level. (Reference 1)

The Central Coastal Basin is located in the Coastal Climatic Zone and has average daily temperatures that range from 23^{o} F in January to 66^{o} in July. The average annual precipitation is approximately 44 inches which includes the water equivalent of some 70 inches of snow. (Reference 2) Although average precipitation is rather evenly distributed throughout the year, monthly totals are about four inches during the winter as compared to three inches during the summer in the Coastal Zone. Thunderstorm activity is somewhat suppressed by the effects of the cool ocean while winter precipitation is increased by coastal storms or "northeasters".

Ground water in the basins is derived from both bedrock and till. Bed rock 100 to 200 feet deep can yield up to 12 gallons per minute (gpm) while those 600 feet deep can yield up to 80 gpm. Wells in till on the other hand, generally supply only enough for rural homes and farms and may go dry in prolonged drought. Ground water quality is generally satisfactory, but is somewhat harder and contains higher concentrations of minerals and suspended materials than the surface waters. (Reference 1)

The hydrologic unit codes for the basins are 01020005 and 01050003. The study areas are located in sub basins 01020005230 and 01050003330. (Reference 3)

The Study Area

The town of Stockton Springs, in which the study areas are located, is a coastal community in eastern Waldo County. It is situated on Penobscot Bay, approximately 30 miles south of the City of Bangor, at the mouth of the Penobscot River. The town is traversed by U.S. Route 1 which is the major coastal tourist route tourist route linking southern Maine with down-east coastal areas. The total land area contained within the corporate limits is 19.5 square miles. The resident population of Stockton Springs has increased from 1,230 in 1980 to an estimated 1,328 in 1987 (References 4 and 5) giving it a population density of 68 persons per square mile in 1987. This figure increases by nearly 2.5 times during the summer months.

Approximately 75 percent of the land area of the town is forested, 13 percent is agricultural or open, 9 percent is urban, and 3 percent other. Within the flood plains studied, development consists of single and multi-family residences, recreational properties, a game preserve, a railroad, roads, and bridges. Development in Stockton Springs is heaviest at its village centers of Stockton Springs and Sandy Point, on its coastline, and along U.S. Route 1.

The Sears Island containerized cargo port facility, which is under construction (approximately three miles from Stockton Springs), is expected to create intense developmental pressure in the area. Development is anticipated from both the need for housing for workers and commercial enterprises associated with the port. In recent years many retirees have settled along the Maine coast. This also increases the demand for developable land in communities such as Stockton Springs.

The following streams were studied by detailed methods (See Study Area and Location Map, page 2): Main Stream and (Main Stream) Tributary near the Harris Road; Stowers Meadow, its outlet stream, and five small tributaries from the Meadow Road to Penobscot Bay; (Harris Road) Tributary from the Searsport-Stockton Springs town line to Stockton Harbor; and (Stockton Springs) Tributary from U.S. Route 1 to Stockton Harbor.

There are 18 bridges and culverts on the streams studied in Stockton Springs. These include eleven on Stowers Meadow Outlet and its tributaries, three on (Stockton Springs) Tributary, two on (Harris Road) Tributary, one on Main Stream, and One on (Main Stream) Tributary (see Bridge and Culvert Data, page 17, for further information on these).

Historically there have been several dams located on Stowers Meadow Outlet. The only of these remaining, a low head concrete and earth structure, is located at the outlet of Stowers Meadow in the Sandy Point Game Management Area.

Waldo County has been completely soil mapped and a soil survey report published. (Reference 6) Soils information may be obtained from the SCS field office which is located just off U.S. Route 1 on Northport Avenue in Belfast (Tel. 207-338-2320).

Natural Values

Stowers Meadow, located between the Meadow Road and U.S. Route 1, is the site of the Sandy Point Game Management Area. This preserve supports a wide range of wildlife, birds, and fish and is very popular for recreational use and nature study.

Sandy Point Beach, a 1,370 yard long sand beach located at Sandy Point, is also a popular recreational and nature study area.

Fort Point State Park, located on the scenic, eastern tip of Cape Jellison, is used by fishermen, naturalists, picnicker, and historians. It is the site of Fort Pownall whose earthworks and some excavated foundations, which date from 1759, remain. Fort Point Light, a lighthouse which dates from 1836, is nearby.

The Stockton Springs Community Church, the Privateer Briganteen Defence Shipwreck Site, and the Fort Pownall Memorial, all located in Stockton Springs, are listed on the National Register of Historic Places.

The most recent classifications, by the Maine Department of Environmental Protection (MEDEP), of the streams studied in Stockton Springs are: Main Stream and its tributary Class B-2; all other streams studied in town Class C. Class B-2 are acceptable for recreational purposes including water contact, industrial and potable water supplies after adequate treatment, and for fish and wildlife. Class C waters are considered satisfactory for recreational boating, fishing, wildlife habitat, and other uses except potable water supplies and water contact recreation, unless such waters are adequately treated. (Reference 7)

Flood Problems

Flooding generally occurs in the winter and early spring months as a result of heavy rainfall on snow-covered or frozen ground. Coastal flooding is primarily caused by northeastern winter storms. Generally these have large amounts of precipitation, high winds, and are slow moving. Hurricanes are not as severe a threat as the winter storms.

The most recent flooding in Stockton Springs occurred in April 1987 and has an estimated frequency of 5 years. Damage caused by that flood and others has been to single and multi-family residences, recreational property, septic systems, water supplies, roads, and bridges. Stream bank erosion is also a problem .

The following tables summarize the approximate extent of flooding caused by the 10-, 100-, and 500-year events to flood plains and properties.

Approximate Flood Plain Areas[1]
(Acres)

	10-Year	100-Year	500-Year
(Stockton Springs) Tributary[2]			
Woodland	4.	4.	4.
Agricultural Land	2.	2.	2.
Urban[3]	2.	3.	3.
Subtotal	8.	8.	9.
(Harris Road) Tributary[4]			
Woodland	12.	15.	15.
Agricultural Land	4.	4.	4.
Wetlands	10.	11.	11.
Urban[3]	2.	2.	2.
Subtotal	28.	32.	32.
Main Stream[5]			
Wetlands	2.	2.	3.
Urban[3]	1.	1.	1.
Subtotal	3.	3.	4.
(Main Stream) Tributary[6]			
Woodland	1.	1.	1.
Urban[3]	1.	1.	1.
Subtotal	2.	2.	2.
Stowers Meadow Outlet[7] and Tributaries			
Woodland	7.	40.	53.
Wetlands	81.	85.	86.
Urban[3]	5.	6.	7.
Subtotal	93.	131.	146.
GRAND TOTAL	134.	176.	193.

1 Classified by apparent primary land use. Does not include normal stream area.

2 Includes areas of backwater flooding from (Stockton Springs) Tributary, as shown on Flood Plain Maps.

3 Includes commercial, municipal, residential and recreational properties, roads and bridges.

4 Includes areas of backwater flooding from (Harris Road) Tributary, as shown on Flood Plain Maps.

5 Includes areas of backwater flooding from Main Stream, as shown on Flood Plain Maps.

6 Includes areas of backwater flooding from (Main Stream) Tributary, as shown on Flood Plain Maps.

7 Includes areas of backwater flooding from Stowers Meadow Outlet and Stowers Meadow Tributaries, as shown on Flood Plain Maps.

Approximate Number of Properties in Flood Plain

	10-Year	100-Year	500-Year
(Stockton Springs) Tributary			
Commercial	1	1	1
Other	4	4	4
Subtotal	5	5	5
(Harris Road) Tributary			
Commercial	1	1	1
Houses	1	1	1
Subtotal	2	2	2
Stowers Meadow Outlet			
Commercial	1	1	1
Houses	2	2	2
Other	4	4	4
Subtotal	7	7	7
GRAND TOTAL	14	14	14

Flood Plain Management

This Report is intended to provide a technical basis for arriving at solutions to minimize both present and projected flood damages. The management options presented herein are aimed at providing information on various means of flood protection and/or alleviation of monetary loss caused by flooding. These option fall into two major categories (nonstructural and structural)and are briefly described in this section. With further study, the town or individuals may find one, or a combination of several, of these alternatives to be a viable means of reducing flood losses in a given area. Considerations in this evaluation include: if the area is in a high or low hazard area (see glossary for definition); engineering feasibility; economics; effect on flooding elsewhere; and social acceptability.

Nonstructural Measures

1. Floodproofing
   Floodproofing is any measure, or combination thereof, that property owners might take to minimize flood damages to their property. The following are some of the more common means used to floodproof buildings.

   a. Elevating the building above expected flood levels.

   b. Relocating the building to an area where there is no threat of flooding.

c: Construction of earthen levees or masonry floodwalls to prevent water from reaching the building.

d: Water tight closures that can be quickly and easily installed over openings.

e. Application of waterproof sealants to foundations and permanent closing and sealing of lower openings.

f. Protection of utilities and appliances such as furnaces, washers, dryers, electrical and plumbing systems from floodwater.

Several homes in Stockton Springs could derive benefit from floodproofing. The selection of which measure(s) might be most appropriate in any particular case should be based: on the depth, velocity, and duration of flood flows; the cost versus benefit of the measure; engineer ing feasibility; soils types; and local codes and building restrictions.

Further information on floodproofing is contained in the Federal Emergency Management Agency's (FEMA) publication, Design Manual for Retrofitting Flood-prone Structures, FEMA 114. (Reference 8) The publication is available at no cost and can be ordered by writing to the following address:

Federal Emergency Management Agency
P.O. Box 70274
Washington, D.C. 20024
Attn: Publications

2. Purchase and Relocation

In areas where the danger of flooding is so great as to render all other means of flood protection ineffective or impractical, federal/state funds may be available to purchase properties and relocate buildings and/or their occupants. Once the buildings have been removed the land may be used for parks or some other purpose not significantly affected by floodwaters.

It is not expected that this approach would have much support or practical application in Stockton Springs.

3. Land Use Regulation and Flood Insurance

Conservation, scenic, or flood control restrictions, and/or easements may be acquired for floodway or flood hazard areas where little or no development is desirable. Land use restrictions can be used to prevent development that is incompatible with public objectives, while allowing continued private ownership of the land. Certain future land rights, such as construction of buildings that are not consistent with good flood plain management, could be purchased from present land-owners Permitted uses could be farming, wildlife, low intensity recreation, and woodland. Land use restrictions might also result in a lowering of the landowner's tax assessment.

In 1971 the State of Maine enacted the "Mandatory Zoning and Subdivision Control Law" (Chapter 424, Sections 4811 thru 4814, of the Maine Statutes) which requires all municipal units of government to adopt zoning and subdivision control ordinances for shoreland areas. Shore land areas are defined as land within 250 feet of the normal high water mark of any pond, river or salt water body and include a major portion of the flood plain.

Major items that should be considered to enhance the natural and recreational values of the streams in Stockton Springs include the adoption of measures that would regulate development within the 100-year flood plain as well as the preparation of an overall use plan for the streams that would set integrated objectives for such items as public access, historic sites, recreational facilities, and the preservation of significant wildlife habitat areas. Other general recommendations include:

a. Maintain wetland and flood plain vegetation buffers to reduce sedimentation and delivery of chemicals to the water body.

b. Support agricultural practices that minimize nutrient flows into water bodies.

c. Support proper use of pesticides and fertilizer.

d. Minimize soil erosion on land within, or adjacent to, flood plains, on forest road systems, and at timber harvesting operations.

e. Dispose of spoils and waste materials so as not to contaminate ground and surface water or significantly change land contours.

Additional technical information may be obtained from the SCS field office in Belfast.

Since 1987 Stockton Springs has participated in the "regular" phase of the National Flood Insurance Program. This permits existing dwellers within the 100-year flood plain to purchase up to $245,000 worth of flood insurance at subsidized rates on their home and contents ($550,000 for multi-family and small businesses). The community must require building permits for all proposed construction in areas that may be flood-prone and review the permit to assure the sites are reasonably free from flooding. For the flood-prone areas it is also required that structures be properly anchored and that construction materials and methods be used that will minimize flood damage.

Flood plain regulations and flood insurance cannot prevent damages, but they can help alleviate future problems and monetary loss.

4. Warning Signs and Flood Markers

A method which has been successfully used in some communities to discourage flood plain development is the erection of flood warning signs or markers in flood-prone areas or the prominent posting of previous or predicted flood levels. This could be done at stream crossings in Stockton Springs. These markers carry no enforcement, but simply serve to inform the public that a flood hazard exists

5. Flood Warning

In some communities flood warning systems are of major importance in the reduction of flood loss. These systems utilize rainfall and/or water level information in upstream areas to predict flood stages downstream.

Because of the small drainage areas of the streams studied in Stockton Springs a warning system would provide very little advance notice of flood danger and its expense could not be justified.

Structural Measures

Structural measures generally include such items as dams, channel work, removal of channel restrictions, and dikes. The following discussion touches on each of these as they might apply to the town of Stockton Springs. Any structural measure would require in depth engineering, environmental, and economic studies to determine its feasibility. Some factors to be considered in the selection of any structural measure are the effect of increased flood stages (if any) elsewhere on the stream, the cost-benefit ratio, and the environmental impact.

1. Dams

   Dams control flood flows by temporarily storing storm runoff in the reservoir and releasing it slowly after the storm has passed. Because of its high cost-benefit ratio a dam could not be justified in Stockton Springs.

2. Channel Work

   Channel work is generally undertaken to improve the flood carrying capacity of a given stream section and/or reduce flood damage along the segment. This work can involve widening or deepening the channel, lining the channel, or changing the channel alignment.

   On November 5, 1985 the Time and Tide RC&D Council approved a flood prevention measure for the Sandy Point area of Stockton Springs. One of the recommendations of an interdisciplinary team of SCS specialists, who reviewed the problem, was channel work on certain segments of Stowers Meadow Outlet.

   Channel work can have a significant environmental impact. Major channel work such as widening, deepening, and straightening the alignment would be difficult on some streams studied in Stockton Springs due to the proximity of development to the streams.

   Lining a channel with a smooth material, such as concrete, increases channel velocities and reduces flood stages. Structural channels of this type are very expensive and might not be economically justified in Stockton Springs.

3. Removal of Channel Restrictions

   The primary restrictions on the streams studied in Stockton Springs, that could be practically dealt with, are the bridges and culverts. Many of these are undersized. As replacement or improvement of these occurs, consideration should be given to enlargement of their discharge capacity to minimize flood loss through them.

4. Dikes

   Floodwater retaining dikes would have very little practical application due to the close proximity of urban development to the channel in the areas of major damage.

Floodways

Any encroachment in the flood plain which increases the elevation of the land and/or present obstructions to flood flows will reduce the flood carrying capacity, resulting in increased flood heights and flow velocities. Flood hazards, both upstream and downstream of the encroachment itself, generally will be increased in these situations.

One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. Under this concept, the 100-year flood plain is divided into a floodway and a floodway fringe.

The floodway is the main channel of the watercourse plus any adjacent flood plain areas that must be kept clear so that the 100-year flood can be conveyed without substantial increase in flood heights. Minimum standards of FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities do not result.

The floodway fringe includes that portion of the flood plain that can be completely obstructed without increasing the 100-year flood elevation by more than 1.0 foot at any point. Theoretical floodways were computed by the SCS for all streams studied in Stockton Springs on the basis of equal conveyance reduction from each side of the flood plain.

Floodway data are not included in this report but may be obtained upon request from the U.S. Soil Conservation Service, USDA Office Building, Orono, Maine 04473, telephone (207) 581-3446.

Engineering Methods

For the flooding sources studied in Stockton Springs, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management. These events, commonly termed the 10-, 50, 100, and 500-year floods, have a 10, 2, 1, and 0.5 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials existing in the community at the time of completion of the study.

1. Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

Discharges on all the streams studied in Stockton Springs were generated from the SCS Technical Release No. 20 hydrologic evaluation model and checked against the USGS regression equation for Maine. (References 9 and 10)

A summary of the drainage area-peak discharge relationships for each stream studied in Stockton Springs is shown in Table 1, "Summary of Discharges".

SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YE
(STOCKTON SPRINGS) TRIBUTARY					
At Bangor & Aroostook R.R.	0.6	420	570	620	710
At Main Street	0.4	280	400	450	540
At U.S. Route 1	0.4	280	390	440	530
(HARRIS ROAD) TRIBUTARY					
At Bangor & Aroostook R.R.	1.3	760	1,080	1,210	1,460
At U.S. Route 1	1.2	720	1,010	1,130	1,360
At Upstream Town Line	0.3	200	290	320	390
MAIN STREAM					
At Harris Road	5.8	2,450	3,580	4,010	4,880
(MAIN STREAM) TRIBUTARY					
AT Harris Road	1.4	640	920	1,030	1,270
STOWERS MEADOW OUTLET					
At Mouth	4.8	330	480	540	660
At Perkins Street	4.8	330	480	530	650
At Sandy Point Road	4.8	320	470	530	640
At Muskrat Road	4.8	320	470	530	640
At U.S. Route 1	4.5	260	410	460	550
At Stowers Meadow Dam	4.4	250	390	440	530
STOWERS MEADOW TRIBUTARIES (At Meadow Road)					
Tributary A	1.2	510	740	830	1,010
Tributary B	0.8	490	680	760	910
Tributary C	0.4	260	370	410	500
Tributary D	0.2	200	290	320	390
Tributary E	0.2	170	240	260	320

Water-surface elevations for Stowers Meadow were obtained from obtained from the TR-20 reservoir routing procedure. Its 10-, 50-, 100-, and 500-year flood elevations are summarized in "Summary of Stillwater Elevations".

SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION IN FEET (NGVD) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
STOWERS MEADOW				
Entire shoreline within community	38.7	39.4	39.7	40.3

2. Hydraulic Analyses

Analyses of the hydraulic characteristics from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-section data for all streams studied in Stockton Springs were obtained from field surveys. All bridges, dams, and culverts were surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and the Flood Hazard Area Maps.

Water-surface elevations of floods of the selected recurrence intervals on all streams studied in Stockton Springs were computed using the SCS WSP-2 computer program (Reference 11). Profiles for Stowers Meadow Outlet, (Stockton Springs) Tributary, and (Harris Road) Tributary were started from mean spring tide. Profiles on all other streams studied were started from a given slope.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus valid only if hydraulic structures remain unobstructed,, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the Flood Hazard Area Maps; their descriptions are presented in "Elevation Reference Marks".

The boundaries of the 10-, 50-, 100-, and 500-year floods shown on the Flood Hazard Area Maps were delineated from elevations determined at each cross section; between cross sections the boundaries were interpolated using topographic maps at a scale of 1:24,000 and contour intervals of 10 and 20 feet. (Reference 12)

Field Survey information, engineering computations, and other data pertinent to the study are on file with the Soil Conservation Service, USDA Office Building, Orono, Maine 04473, telephone (207) 581-3446.

BRIDGE AND CULVERT DATA

Location	Channel Bottom Elevation	Low Chord Elevation	Road Overflow Elevation	Flood Elevations 10-Year	50-Year	100-Year	500-Yea
(STOCKTON SPRINGS) TRIBUTARY							
Bangor & Aroostook R.R.	6.5	11.5	31.6	30.9	31.9	31.9	32.0
Main Street	97.5	102.5	103.8	104.2	104.4	104.4	104.6
U.S. Route 1	106.3	111.2	119.4	119.6	119.9	120.0	120.0
(HARRIS ROAD) TRIBUTARY							
Bangor & Aroostook	6.4	11.9	32.5	32.8	33.2	33.3	33.5
U.S. Route 1	83.5	88.5	101.6	101.7	102.1	102.2	102.3
MAIN STREAM							
Harris Road	105.4	113.5	115.7	117.3	118.0	118.3	118.8
(MAIN STREAM) TRIBUTARY							
Harris Road	112.2	115.2	119.6	121.3	121.7	121.8	122.0
STOWERS MEADOW OUTLET							
Perkins Street	21.8	25.5	26.5	25.6	27.2	27.3	27.5
Sandy Point Road	23.9	27.9	30.1	30.1	31.1	31.3	31.6
Muskrat Road	28.0	34.5	35.5	33.6	35.0	35.5	36.0
U.S. Route 1	31.6	38.6	53.7	36.9	38.6	39.1	40.2
STOWERS MEADOW TRIBUTARIES (At Meadow Road)							
Tributary A	83.6	83.8	88.9	89.9	90.2	90.3	90.5
Tributary B	40.6	43.6	44.4	44.9	45.0	45.5	45.5
Tributary C	45.2	48.2	49.2	50.7	51.2	51.4	51.6
Tributary D	56.9	58.9	61.7	62.5	62.7	62.8	62.9
Tributary E	57.6	59.6	58.0	59.6	59.8	59.9	60.2

Elevations refer to feet NGVD, at upstream end of bridge or culvert opening.

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION[1]	DESCRIPTION OF LOCATION
RM1	14.13	Stockton Springs, chiseled circle, painted yellow, around high point of northeasterly upstream granite abutment of the culvert on (Stockt Springs) Tributary along the Bango and Aroostook Railroad.
RM2	103.59	Stockton Springs, chiseled square, painted yellow, on the top westerly end of the northerly concrete headwall of the culvert on (Stockton Springs) Tributary along Main Street. 10 feet south-easterly of a old "SHELL" sign.
RM3	110.08	Stockton Springs, chiseled "X", painted yellow, on top of the southerly end of the corrugated metal pipe culvert on (Stockton Springs) Tributary along U.S. Route 1.
RM4	182.099	Stockton Springs, M.D.O.T. standard tablet stamped "MDOT BM 5760, 1983", set in the south-easterly end of the concrete guardrail of the Church Street bridge over U.S. Route 1.
RM5	12.41	Stockton Springs, chiseled square, painted yellow, on the northeast-erly corner of the northeasterly concrete headwall of the culvert on (Harris Road) Tributary along t Bangor and Aroostook Railroad.
RM6	90.10	Stockton Springs, chiseled square, painted yellow, on the north-easterly corner of the northerly headwall of the culvert on (Harris Road) Tributary along U.S. Route 1

[1] National Geodetic Vertical Datum of 1929.

REFERENCE MARK	ELEVATION[1]	DESCRIPTION OF LOCATION
RM7	201.19	Stockton Springs, nail set in utility pole CMP 16, C TEL 1-2 16 along Harris Road immediately across from intersection with Pout Town Road.
RM8	221.56	Stockton Springs, nail set in the top of a three foot pole at the Stockton Springs-Searsport town line.
RM9	114.12	Stockton Springs, chiseled "X", painted yellow, on top of bolt on the top westerly end of the northerly corrugated metal pipe culvert Main Stream along Harris Road.
RM10	116.63	Stockton Springs, chiseled "X", painted yellow, on the top northerly end of the upper corrugated metal pipe culvert on (Main Stream) Tributary along Harris Road.
RM11	95.092	Stockton Springs (Sandy Point), U.S.C.&G.S. tablet set in the top easterly corner of the southerly abutment of the Bangor and Aroostoc Railroad bridge over Sandy Point Road.
RM12	25.54	Stockton Springs (Sandy Point), chiseled square, painted yellow, on top of the southeasterly upstream concrete abutment of the Perkins Road bridge over Stowers Meadow Outlet.
RM13	36.15	Stockton Springs (Sandy Point), chiseled square,painted yellow, on top of the easterly down-stream concrete wingwall of the Muskrat Road culvert on Stowers Meadow Outlet.

1 National Geodetic Vertical Datum of 1929.

REFERENCE MARK	ELEVATION[1]	DESCRIPTION OF LOCATION
RM14	42.40	Stockton Springs (Stowers Meadow), top of protruding iron pin set in the top of the westerly concrete spillway abutment of the Stowers Meadow Dam. Marked with a chiseled square and painted yellow.
RM15	96.748	Stockton Springs, U.S.C.&G.S. standard tablet stamped "96.748 B 19 1933", set in the top of a nine by twelve foot boulder located along the Bangor and Aroostook Railroad 160 feet south of the Meadow Road crossing, 50 feet west of the track centerline.
RM16	89.94	Stockton Springs, iron pin set in the northwesterly upstream concret headwall of most westerly culvert on Meadow Road.
RM17	48.19	Stockton Springs, chiseled "X", painted yellow, on the northerly top end of the three foot corrugated metal pipe culvert located along Meadow Road about 0.85 mile easterly of the intersection with Muskrat Road.
RM18	58.84	Stockton Springs, chiseled square, painted yellow, on the southerly top end of the westerly corrugate metal pipe culvert located along Meadow Road about 1.3 miles easterly of the intersection with Muskrat Road.

[1] National Geodetic Vertical Datum of 1929.

GLOSSARY

Aquisition - Purchasing flood prone properties for the specific purpose of reducing flood damage by changing land use.

CFS or cfs - Cubic feet per second. Used to describe the amount of flow passing a given point in a stream channel. One cubic foot per second is equivalent to approximately 7.5 gallons per second.

Channel - A natural or artificial watercourse with definite bed and banks to conduct and confine flowing water.

Critical Area Treatment - The application of vegetative and mechanical practices used to reduce runoff and erosion. Practices normally consist of seeding, tree planting, grass waterways, diversions, gully stabilization, etc.

Cross Section - A graph or plot of ground elevation across a stream valley or a portion of it, usually along a line perpendicular to the stream or direction of flow.

Environmental Corridor - A strip of land, usually along one or both sides of a stream, which is set aside, regulated, or otherwise protected to preserve its environmental values.

Erosion - The group of processes whereby soil or rock material is loosened or dissolved and removed from any part of the earth's surface.

Flood - An overflow or innundation onto land areas not normally covered by water that are used or usable by people. Floods are usually characterized as temporarily inundating land areas which are adjacent to a body of water such as an ocean, lake, stream, or river.

Flood Crest - The maximum stage or elevation reached by the waters of a flood at any location.

Flood Peak - The maximum instantaneous discharge of a flood at a given location usually occurring at the flood crest.

Flood Plain - The relatively flat area of lowlands adjoining the channel of a river, stream, watercourse, ocean, lake, or other body of standing water which has been or may be covered by floodwater.

Flood Plain Management - The operation of a program intended to lessen the damaging effects of floods, maintain and enhance natural values, and make effective use of water and land resources within the flood plain. It is an attempt to balance values obtainable from use of flood plains with potential losses arising from such use. Flood plain management stresses consideration of a full range of the measures potentially useful in achieving its objectives.

Flood Plain Map - A map showing the lateral extent of projected floods.

Flood Profile - A graph which shows the relationship of water surface elevation to distance along the centerline of the channel. It is used in this report to show the crest elevations of various floods.

Floodproofing - A combination of structural changes or adjustments to new or existing structures and facilities, their contents and/or their sites for the purpose of reducing or eliminating flood damages by protecting against structural failure, keeping water out, or reducing the effect of water entry.

Flood Warning - The issuance and dissemination of information about an imminent or current flood.

Floodway - That portion of the main stream channel plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights.

Frequency - A statistical measure of how often an flood event of a given size or magnitude should, on the average, be equaled or exceeded.

Head - The height of water above any plane of reference.

Head Loss - The effect of obstructions, such as narrow bridge openings or buildings, that limit the area through which water must flow, raising the surface of the water upstream from the obstruction.

High Hazard Zone - An area, normally nearest the stream, where flooding may pose a significant risk to life and property. Areas having any one of the following conditions are generally considered high hazard.

a. Areas where flood velocities exceed 5 feet per second (fps).
b. Areas where flood depths are greater than 3 feet.
c. Areas where the product of the velocity in (fps) and the depth (in feet) of the flood water exceeds 7.

Low Chord - The elevation at which the bridge girder first begins to reduce the flow area of the channel.

Low Hazard Zone - The area between the high hazard zone and the maximum extent of the 100-year frequency flood where the potential for loss of life and property damage is low.

Natural Values of Flood plains - The desirable qualities of, or functions served by, flood plains including, but not limited to: water resources values (e.g., moderation of floods, water quality maintenance, and ground water recharge); living resource values (e.g., fish, wildlife, plant resources, and habitat); cultural resource values (e.g., open space, natural beauty, scientific study, outdoor education, and recreation); and cultivated resources valves (e.g., agricultural, aquacultural, and forestry).

NGVD - National Geodetic Vertical Datum, formerly Mean Sea Level (MSL) 1929.

Nonstructural Measures - All flood plain management measures except structural flood control works. Examples of nonstructural measures are flood warning/preparedness systems, relocation, floodproofing, regulation,land acquisition, and public investment policy.

Relocation - Moving a building from a flood prone area by physically placing it on a vehicle and transporting it from the flood plain.

Road Overflow - The elevation of the point at which water first starts to flow over the road.

Station - Distance in feet along the centerline of the existing channel, increasing in an upstream direction.

Structural Measure - Flood control works such as dams and reservoirs, dikes and floodwalls, channel alterations, and diversion channels which are designed to keep water away from specific developments and/or populated areas, or to reduce flooding in such areas.

Wetland - An area where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities present; generally includes swamps, marshes, bogs, shallow lakes, and similar areas.

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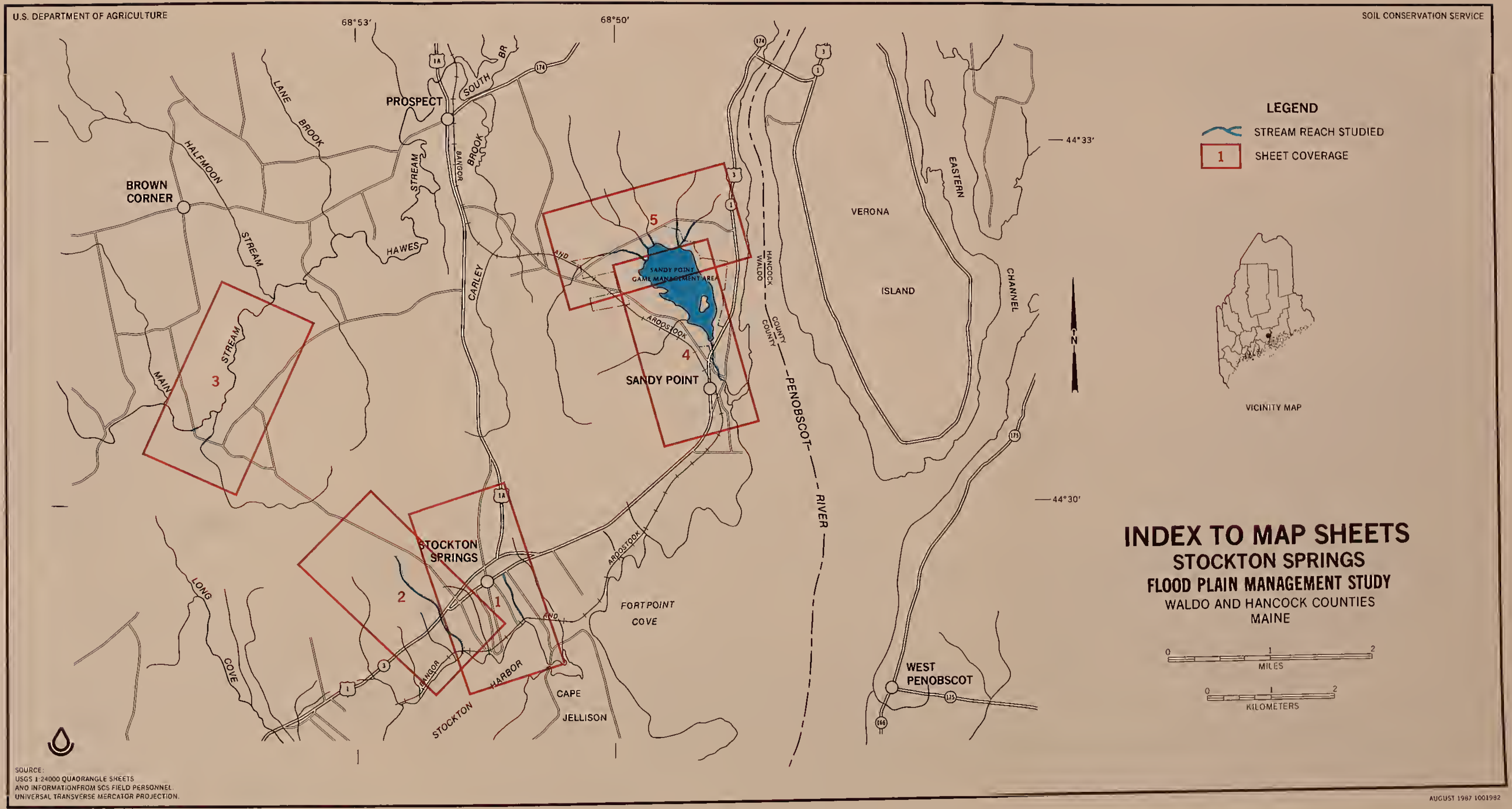

AUGUST 1987 1001982

USDA SCS NATIONAL CARTOGRAPHIC CENTER, FT. WORTH, TX 1987

LEGEND

- 100 YEAR FLOOD HAZARD AREA
- 100 YEAR FLOOD HAZARD AREA
- 10 YEAR FLOOD HAZARD AREA
- 100 YEAR FLOOD ELEVATION
- REFERENCE MARK
- VALLEY CROSS SECTION

NOTE
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 500 1000 FEET
0 100 200 300 METERS
APPROXIMATE

5-83 HAP Photography

FLOOD HAZARD AREA

STOCKTON SPRINGS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STOCKTON SPRINGS
FLOOD PLAIN MANAGEMENT STUDY
WALDO COUNTY, MAINE

SHEET 1 OF 5

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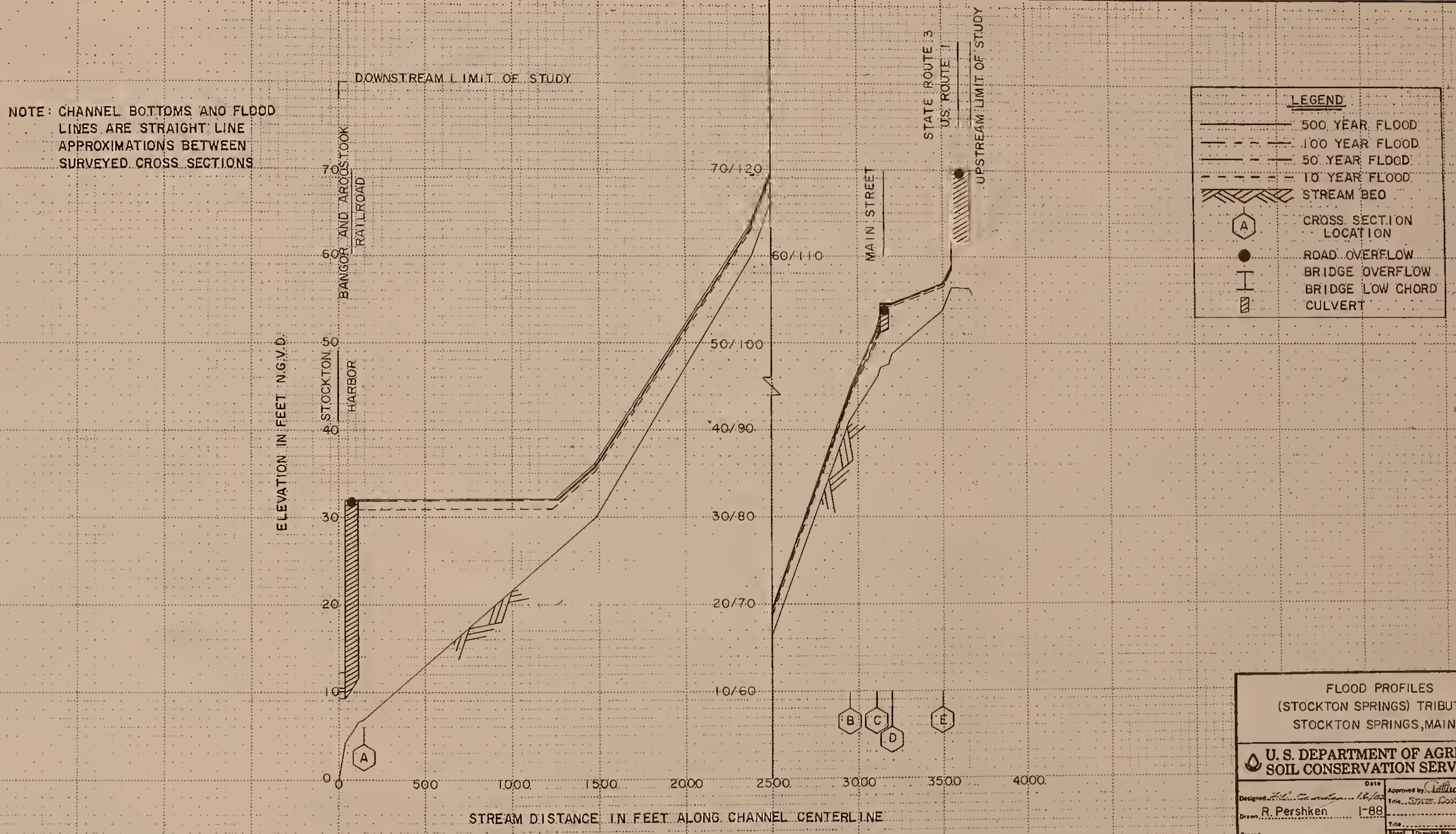

FLOOD PROFILES
(STOCKTON SPRINGS) TRIBUTARY
STOCKTON SPRINGS, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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Drawn	R. Pershken	1-88	Title STATE CONSERVATION ENGINEER
Traced			Title
Checked	[signature]	3/88	Sheet No. 1 of 5

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LEGEND

500 YEAR FLOOD HAZARD AREA
100 YEAR FLOOD HAZARD AREA
10 YEAR FLOOD HAZARD AREA
100 YEAR FLOOD ELEVATION
REFERENCE MARK
VALLEY CROSS SECTION

NOTE:
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SCALE 0 500 1000 FEET
0 100 200 300 METERS
APPROXIMATE

5-83 HAP Photography

FLOOD HAZARD AREA

STOCKTON SPRINGS

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STOCKTON SPRINGS
FLOOD PLAIN MANAGEMENT STUDY
WALDO COUNTY, MAINE

SHEET 2 OF 5

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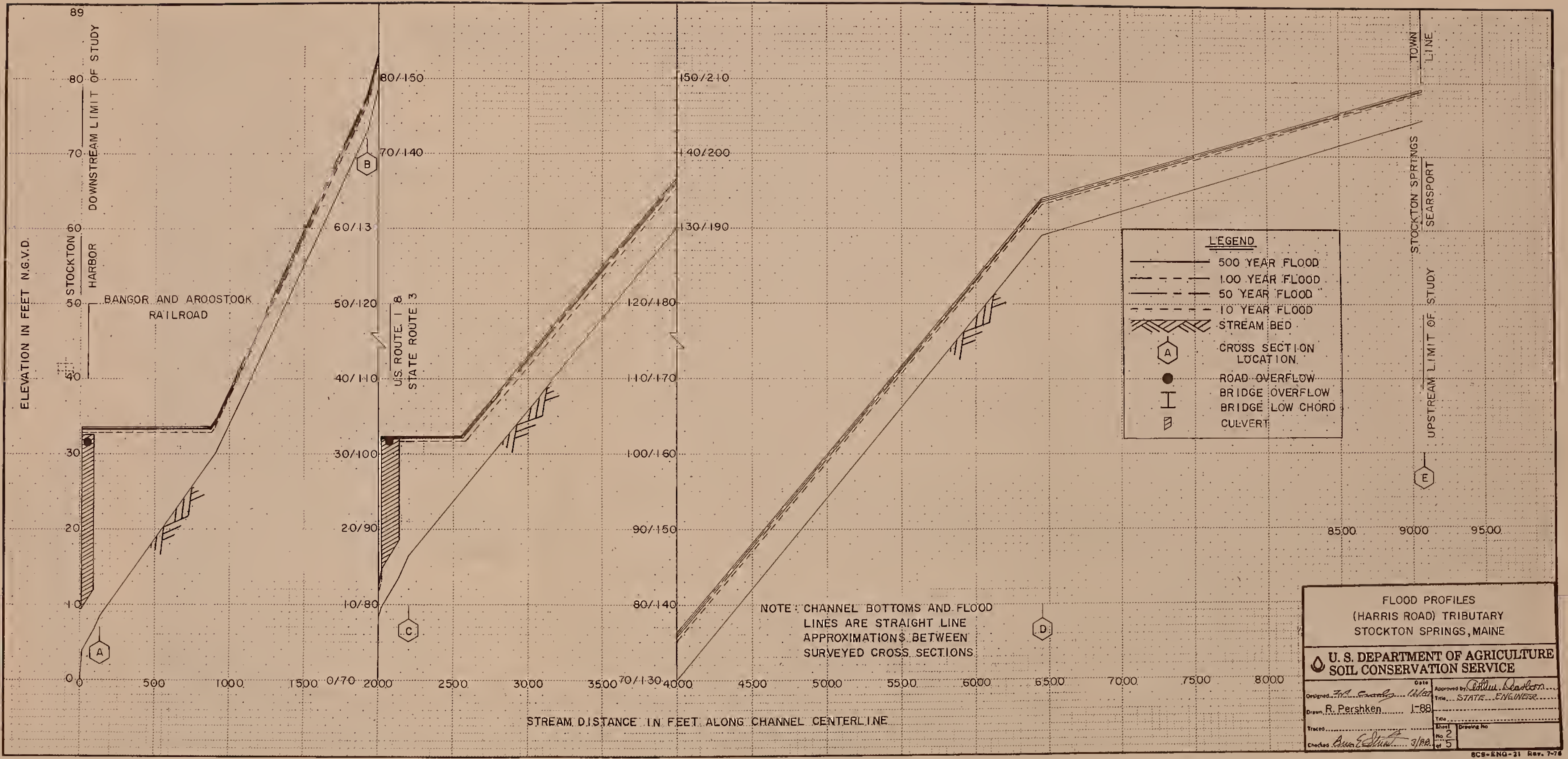

ELEVATION IN FEET N.G.V.D.
STREAM DISTANCE IN FEET ALONG CHANNEL CENTERLINE
STOCKTON HARBOR
DOWNSTREAM LIMIT OF STUDY
BANGOR AND AROOSTOOK RAILROAD
U.S. ROUTE 1 & STATE ROUTE 3
TOWN LINE
STOCKTON SPRINGS
SEARSPORT
UPSTREAM LIMIT OF STUDY
A
B
C
D
E
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION
ROAD OVERFLOW
BRIDGE OVERFLOW
BRIDGE LOW CHORD
CULVERT
NOTE: CHANNEL BOTTOMS AND FLOOD LINES ARE STRAIGHT LINE APPROXIMATIONS BETWEEN SURVEYED CROSS SECTIONS
FLOOD PROFILES
(HARRIS ROAD) TRIBUTARY
STOCKTON SPRINGS, MAINE
U. S. DEPARTMENT OF AGRICULTURE
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Sheet No. 2 of 5
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FLOOD HAZARD AREA
STOCKTON SPRINGS
LEGEND
500 YEAR FLOOD HAZARD AREA
100 YEAR FLOOD HAZARD AREA
10 YEAR FLOOD HAZARD AREA
100 YEAR FLOOD ELEVATION
REFERENCE MARK
VALLEY CROSS SECTION
NOTE
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION
SCALE 0 500 1000 FEET
0 100 200 300 METERS
APPROXIMATE
5-83 HAP Photography
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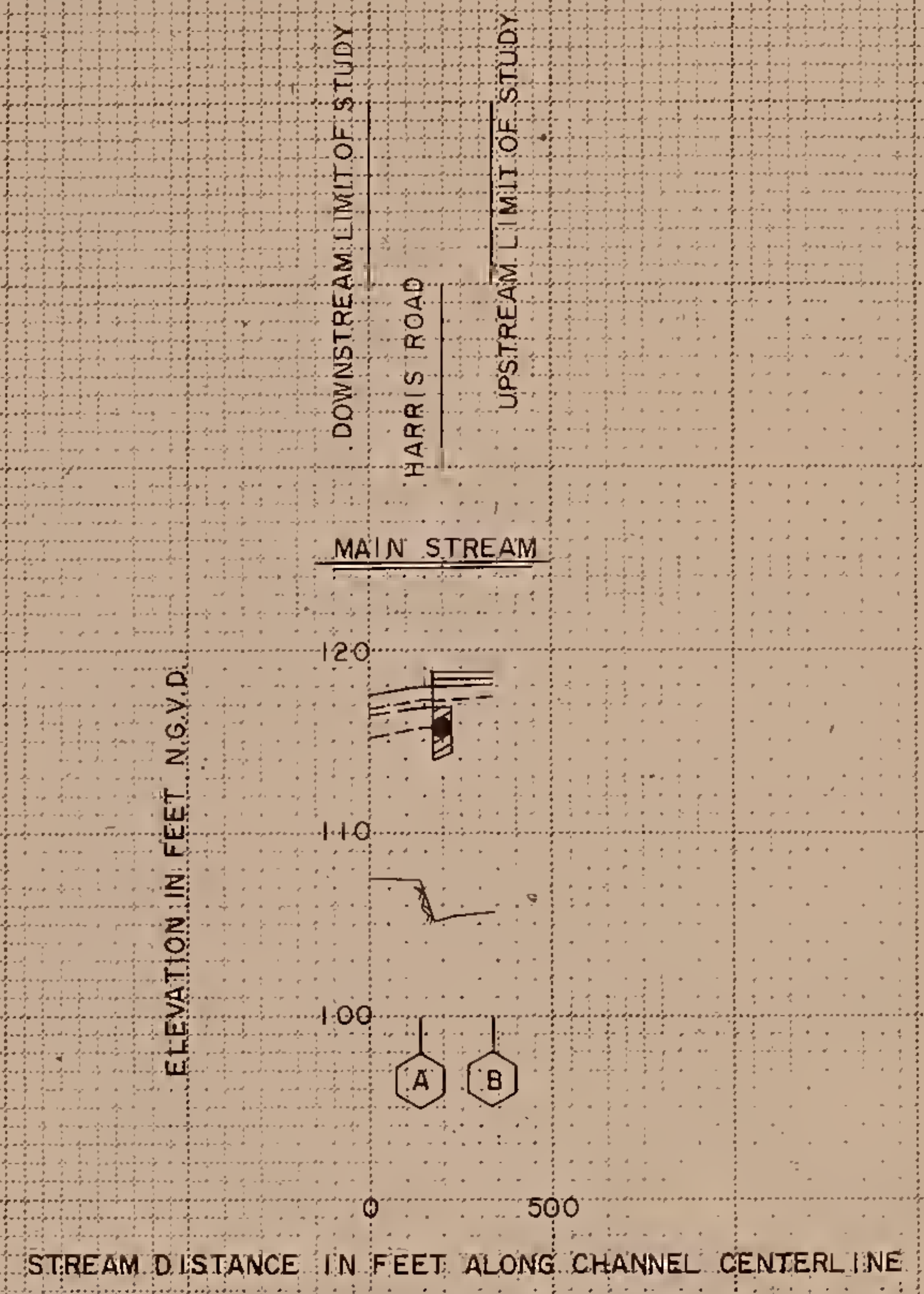
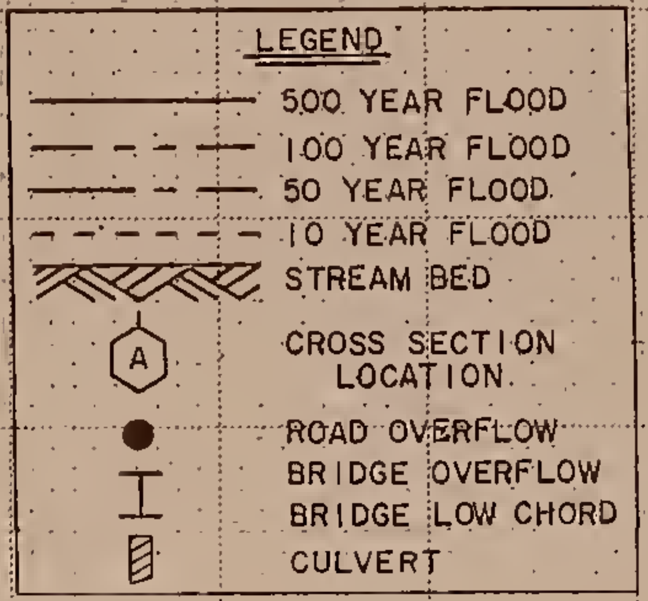
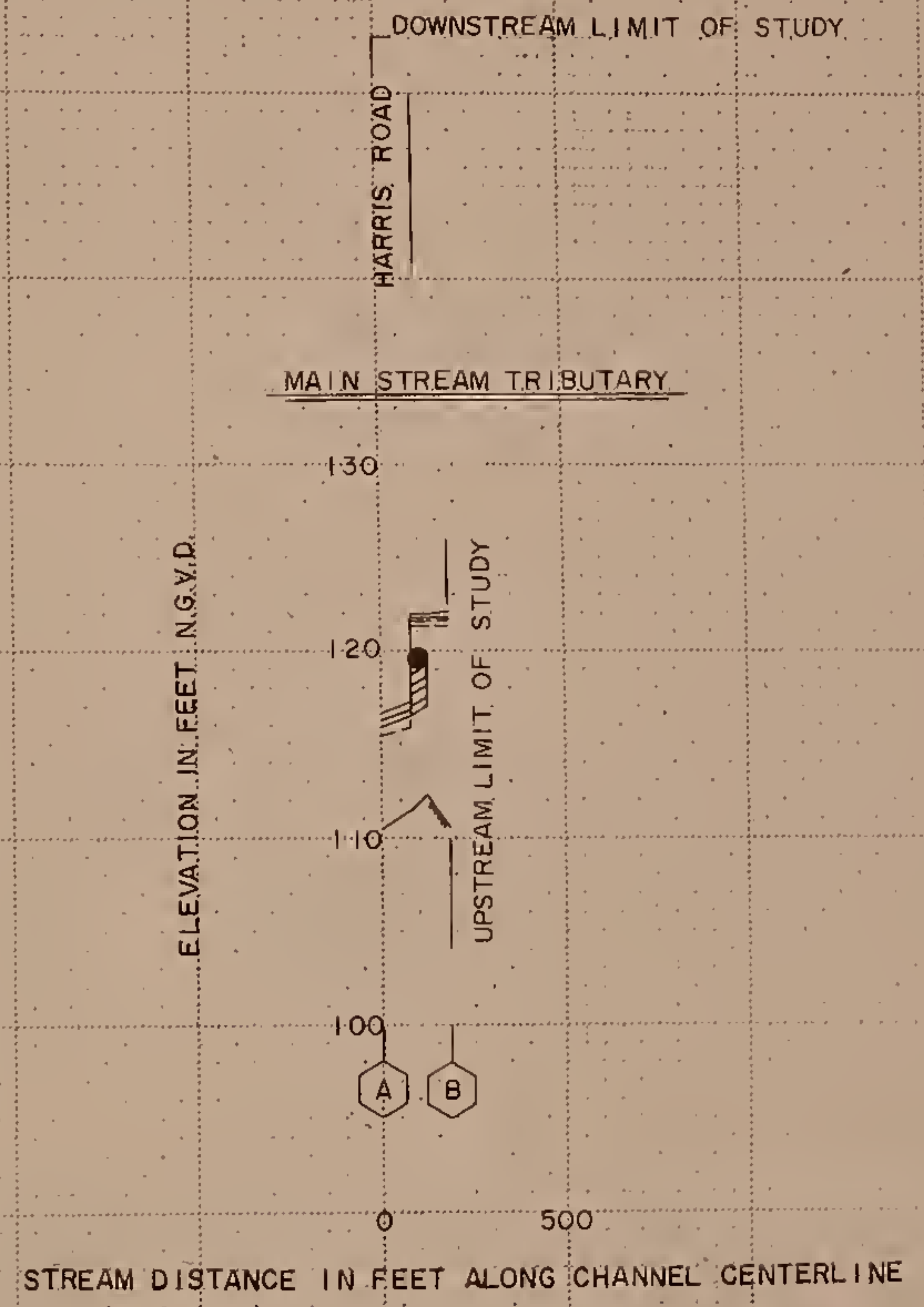
SOIL CONSERVATION SERVICE
STOCKTON SPRINGS
FLOOD PLAIN MANAGEMENT STUDY
WALDO COUNTY, MAINE
SHEET 3 OF 5
AUGUST 1987 1001982
SEARSPORT
STOCKTON SPRINGS
TOWN LINE
PROSPECT
HARRIS ROAD
LIMIT OF STUDY
RM 9
RM 10
117
118
116
122
MAIN STREAM
(MAIN STREAM)
TRIBUTARY
ROBERTS ROAD
POWERLINE
OLD COUNTRY ROAD
MEADOW LANE
USDA-SCS-NATIONAL CARTOGRAPHIC CENTER, FT. WORTH, TX-1989





NOTE: CHANNEL BOTTOMS AND FLOOD LINES ARE STRAIGHT LINE APPROXIMATIONS BETWEEN SURVEYED CROSS SECTIONS



FLOOD PROFILES
MAIN STREAM & (MAIN STREAM) TRIBUTARY
STOCKTON SPRINGS, MAINE

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Sheet No. 3 of 5

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LEGEND

500 YEAR FLOOD HAZARD AREA

100 YEAR FLOOD HAZARD AREA

10 YEAR FLOOD HAZARD AREA

100 YEAR FLOOD ELEVATION

REFERENCE MARK

VALLEY CROSS SECTION

NOTE:
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SCALE 0 500 1000 FEET
0 100 200 300 METERS
APPROXIMATE

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FLOOD HAZARD AREA

STOCKTON SPRINGS

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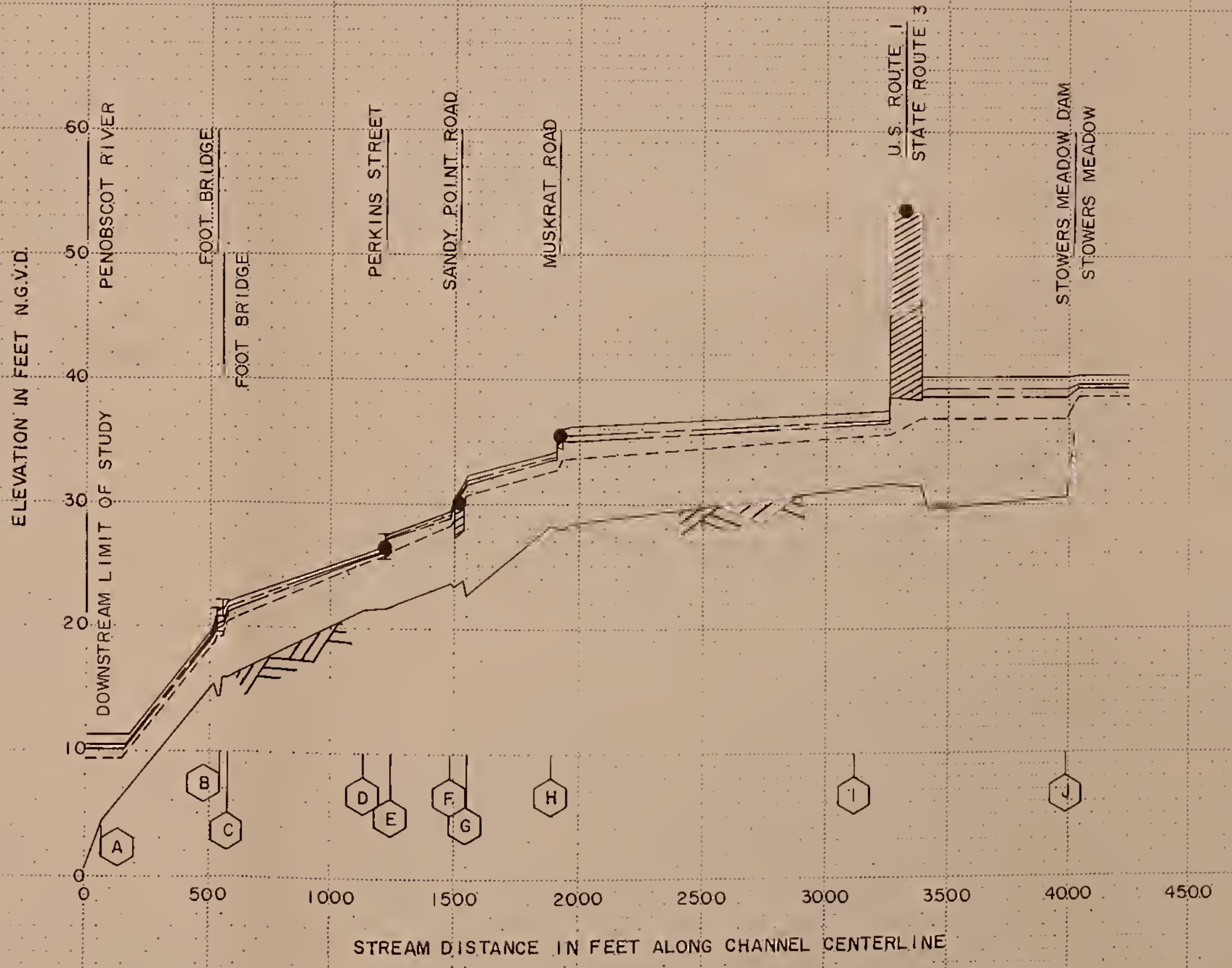

LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION
- ROAD OVERFLOW
- BRIDGE OVERFLOW
- BRIDGE LOW CHORD
- CULVERT
- DAM

STOWERS MEADOW FLOOD ELEVATIONS

500 YEAR	40.3
100 YEAR	39.7
50 YEAR	39.4
10 YEAR	38.7

FLOOD PROFILES
STOWERS MEADOW OUTLET
STOCKTON SPRINGS, MAINE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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LEGEND

500 YEAR FLOOD HAZARD AREA
100 YEAR FLOOD HAZARD AREA
10 YEAR FLOOD HAZARD AREA
100 YEAR FLOOD ELEVATION
REFERENCE MARK
VALLEY CROSS SECTION

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SCALE 0 500 1000 FEET
0 100 200 300 METERS
APPROXIMATE

5-83 HAP Photography

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STOCKTON SPRINGS
FLOOD PLAIN MANAGEMENT STUDY
WALDO COUNTY, MAINE

FLOOD HAZARD AREA

STOCKTON SPRINGS

SHEET 5 OF 5

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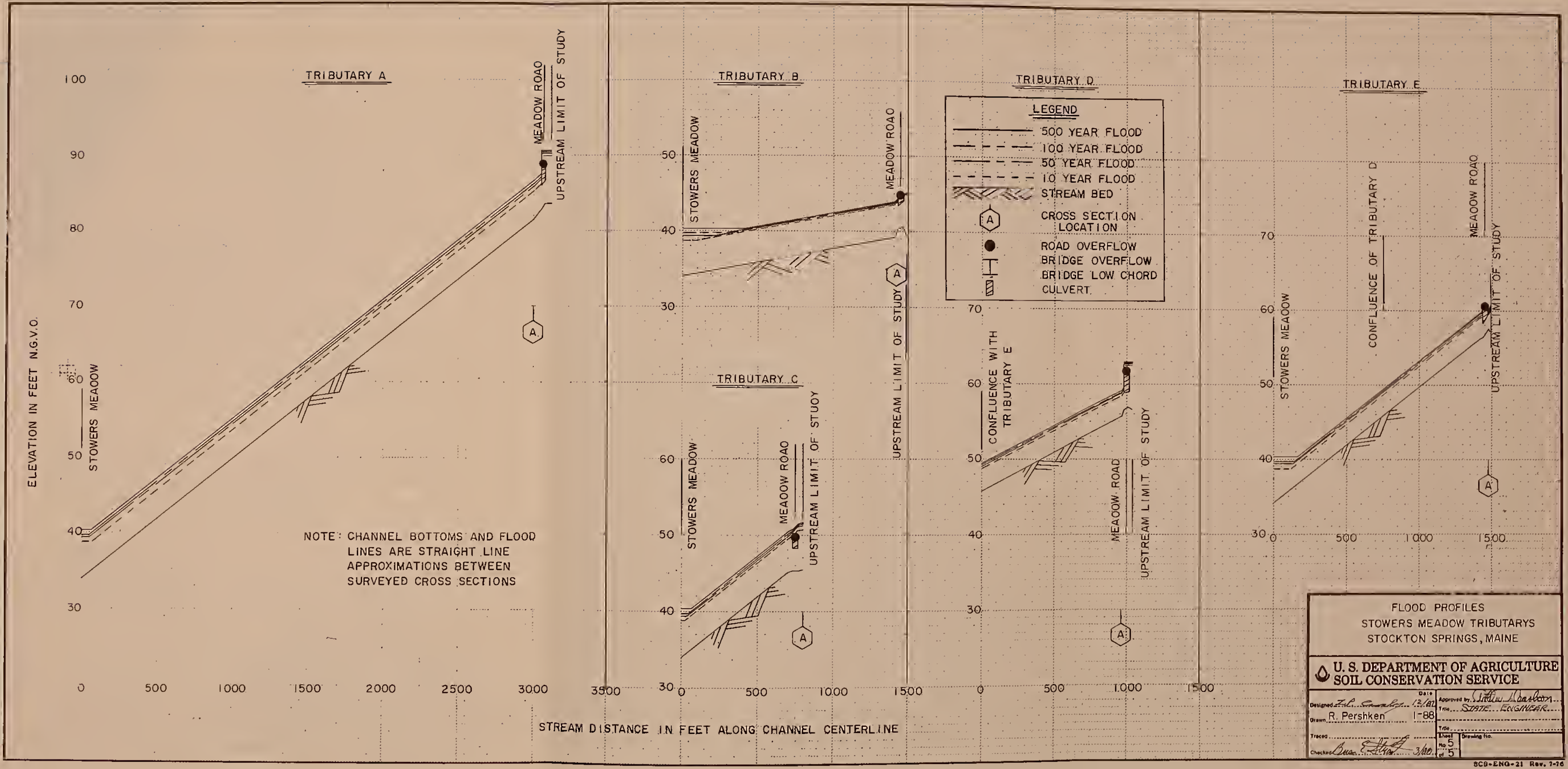

TRIBUTARY A
TRIBUTARY B
TRIBUTARY C
TRIBUTARY D
TRIBUTARY E
ELEVATION IN FEET N.G.V.O.
STREAM DISTANCE IN FEET ALONG CHANNEL CENTERLINE
STOWERS MEAOOW
MEADOW ROAD
UPSTREAM LIMIT OF STUDY
STOWERS MEADOW
MEADOW ROAO
UPSTREAM LIMIT OF STUOY
CONFLUENCE WITH TRIBUTARY E
CONFLUENCE OF TRIBUTARY D
A
NOTE: CHANNEL BOTTOMS AND FLOOD LINES ARE STRAIGHT LINE APPROXIMATIONS BETWEEN SURVEYED CROSS SECTIONS
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION
ROAD OVERFLOW
BRIDGE OVERFLOW
BRIDGE LOW CHORD
CULVERT
FLOOD PROFILES
STOWERS MEADOW TRIBUTARYS
STOCKTON SPRINGS, MAINE
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
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STATE ENGINEER
Sheet 5 of 5
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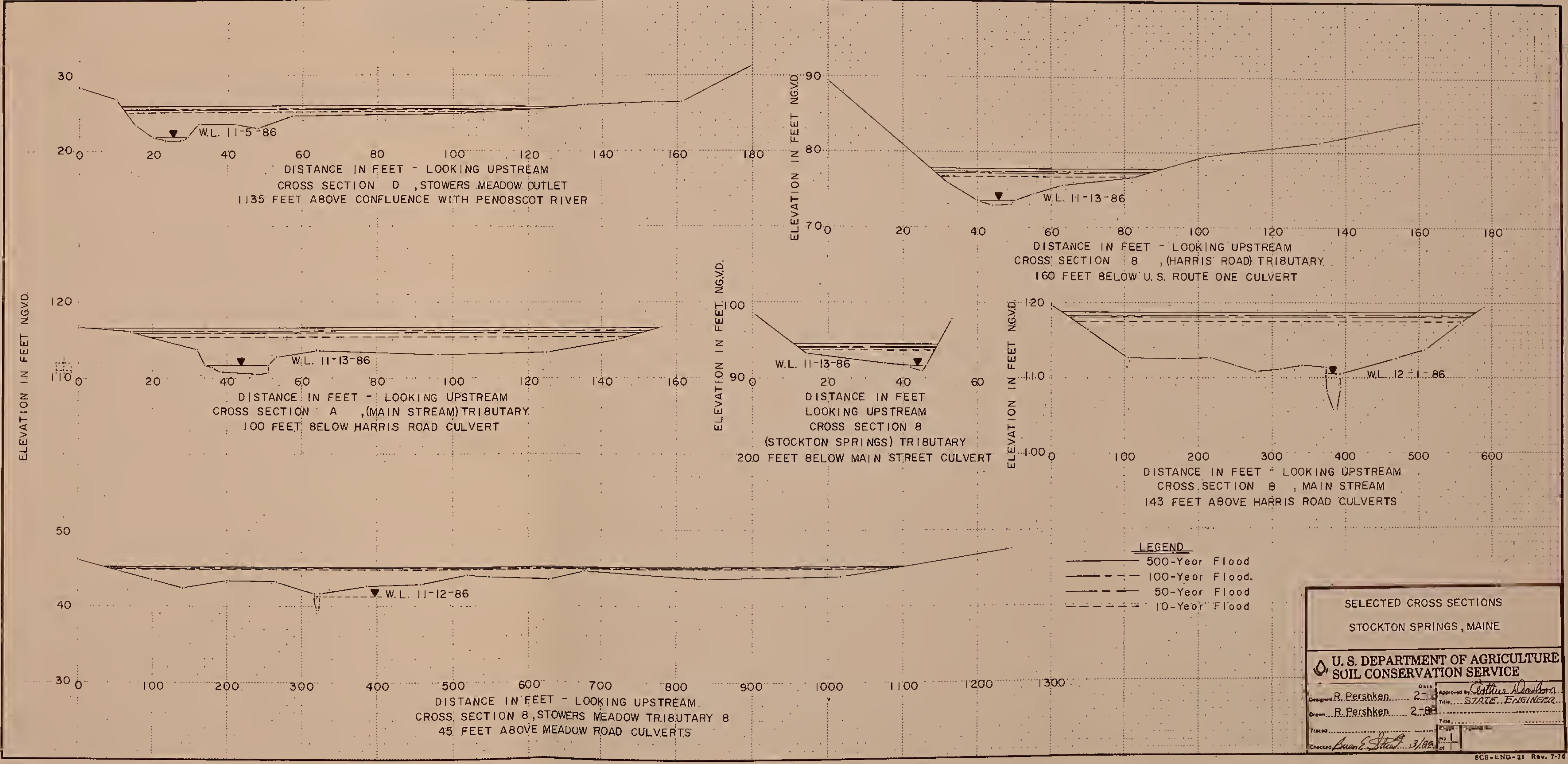
30
20
0 20 40 60 80 100 120 140 160 180
W.L. 11-5-86
DISTANCE IN FEET - LOOKING UPSTREAM
CROSS SECTION D ,STOWERS MEADOW OUTLET
1135 FEET ABOVE CONFLUENCE WITH PENOBSCOT RIVER
ELEVATION IN FEET NGVD.
90
80
70
0 20 40 60 80 100 120 140 160 180
W.L. 11-13-86
DISTANCE IN FEET - LOOKING UPSTREAM
CROSS SECTION B ,(HARRIS ROAD) TRIBUTARY
160 FEET BELOW U.S. ROUTE ONE CULVERT
ELEVATION IN FEET NGVD.
120
110
0 20 40 60 80 100 120 140 160
W.L. 11-13-86
DISTANCE IN FEET - LOOKING UPSTREAM
CROSS SECTION A ,(MAIN STREAM) TRIBUTARY
100 FEET BELOW HARRIS ROAD CULVERT
ELEVATION IN FEET NGVD.
100
90
0 20 40 60
W.L. 11-13-86
DISTANCE IN FEET
LOOKING UPSTREAM
CROSS SECTION B
(STOCKTON SPRINGS) TRIBUTARY
200 FEET BELOW MAIN STREET CULVERT
ELEVATION IN FEET NGVD.
120
110
100
0 100 200 300 400 500 600
W.L. 12-1-86
DISTANCE IN FEET - LOOKING UPSTREAM
CROSS SECTION B , MAIN STREAM
143 FEET ABOVE HARRIS ROAD CULVERTS
50
40
30
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300
W.L. 11-12-86
DISTANCE IN FEET - LOOKING UPSTREAM
CROSS SECTION B ,STOWERS MEADOW TRIBUTARY B
45 FEET ABOVE MEADOW ROAD CULVERTS
LEGEND
500-Year Flood
100-Year Flood
50-Year Flood
10-Year Flood
SELECTED CROSS SECTIONS
STOCKTON SPRINGS, MAINE
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed R. Pershken 2-88
Drawn R. Pershken 2-88
Approved by Arthur Dadson
Title STATE ENGINEER
Traced
Checked 3/88
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