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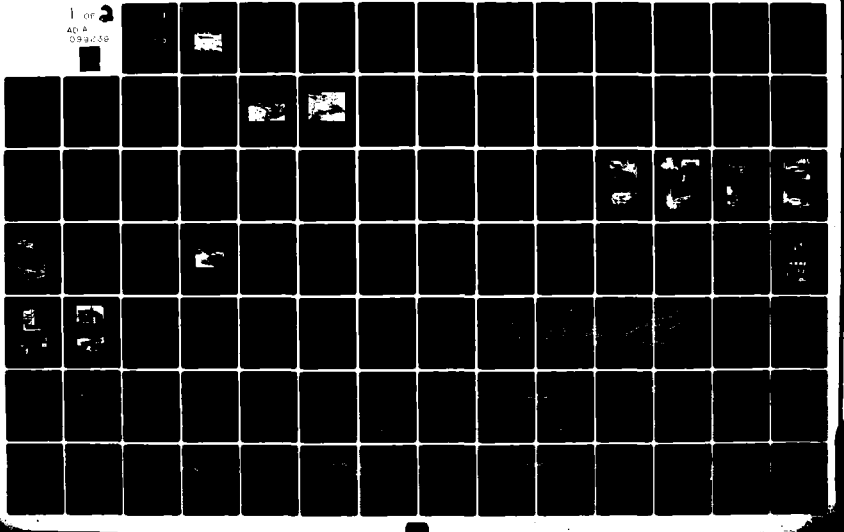

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FLOOD PLAIN INFORMATION

CONNECTICUT RIVER, WEST RIVER
AND
WHETSTONE BROOK

BRATTLEBORO
VERMONT

PREPARED FOR
THE TOWN OF BRATTLEBORO
BY
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION CORPS OF ENGINEERS
WALTHAM, MASS.

JANUARY 1972

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INTRODUCTION

This report summarizes the flood situation along the Connecticut River in the vicinity of Brattleboro, Vermont, along the West River from its mouth upstream to the Brattleboro Town Line, and along Whetstone Brook from its mouth upstream for a distance of about four miles to the mouth of Halladay Brook and up Halladay Brook for about a mile to Sunset Lake Road (Plates 1 & 2).

It was prepared at the request of the Town of Brattleboro with the intent that it be used by the State of Vermont, the Town of Brattleboro, and interested developers and business men as a guide to control future development on the flood plain. The report is based on information on rainfall, runoff, historical flood records, bridge geometry, U. S. Geological Survey streamflow data gathered in the general area, other technical data pertinent to the size and frequency of floods in the Brattleboro area, and a considerable amount of specific data collected in the field relative to the geometry of the stream channels. It is intended to aid those affected by flooding to help themselves.

This report covers in general, two phases of the flood situation along the Connecticut River, West River, and Whetstone Brook. The first phase relates to past floods in the area. The second phase discusses the probability of future floods of various magnitudes

including the Intermediate Regional Flood (see page 32) and the Standard Project Flood (see page 34). These flood magnitudes are determined from an analysis of past floods on the Connecticut and West Rivers and of floods on streams which have hydraulic characteristics similar to Whetstone Brook and are in the same general physiographic and geographic region. The Standard Project Flood is rare and on most streams is considered larger than any flood that has occurred in the past. However, a flood of this magnitude should be considered in planning for use of the flood plain.

In problems concerned with the control of developments on the flood plains of the Connecticut and West Rivers, and in reaching decisions on the size of floods to consider for this purpose, appropriate consideration should be given to the mitigating effect of flood-control structures and other flood-peak reducing features presently existing in these basins.

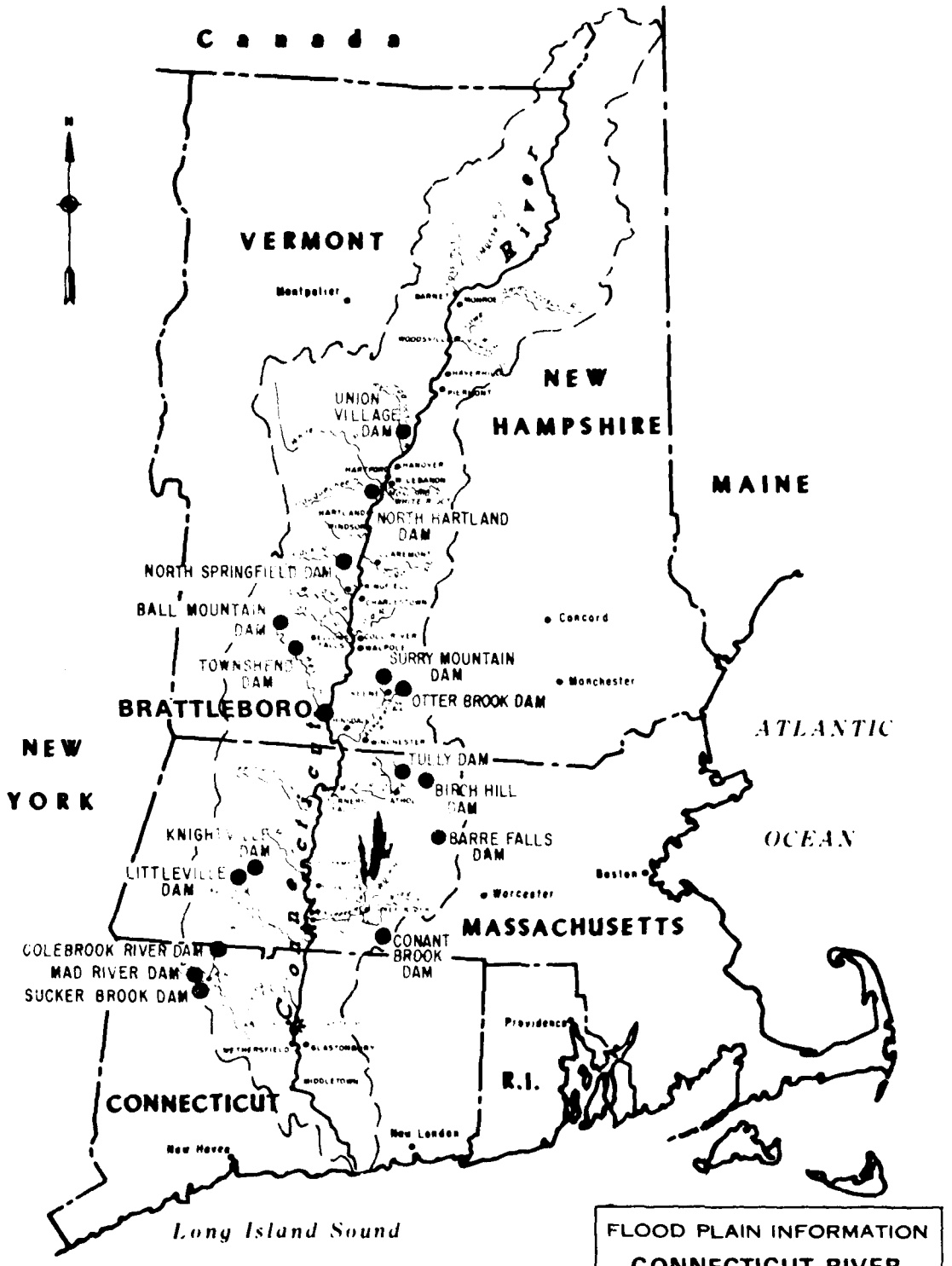
Maps and profiles which show the extent of flooding that might occur in the future in the Brattleboro area along with high-water marks of past floods are included in this report. From these, the depth of probable flooding at any location may be estimated.

The report does not include plans for the solution of flood problems. Rather, it is intended to provide the basis for further

study and planning on the part of the Town of Brattleboro in arriving at solutions to minimize vulnerability to flood damage. This involves local planning programs to guide developments by controlling the type of use made of the flood plain through zoning and subdivision regulations, the construction of flood protection works, or a combination of the two.

It is not intended to extend any Federal authority over zoning or other regulation of flood plain use, and the report is not to be construed as committing the Federal government in the future to investigate, plan, design, construct, operate or maintain any facilities discussed or to imply any intent to undertake such activities unless specifically authorized by Congress. It is intended, as mentioned before, as an aid to local authorities.

This report was prepared by Dufresne-Henry Engineering Corp., North Springfield, Vermont under the direction of the New England Division, Corps of Engineers, located in Waltham, Massachusetts. Representatives from the Corps of Engineers will, upon request of State and local governmental agencies, provide technical assistance in the interpretation and use of the information contained herein and provide other available flood data related thereto.

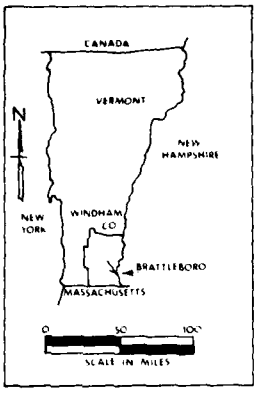


FLOOD PLAIN INFORMATION

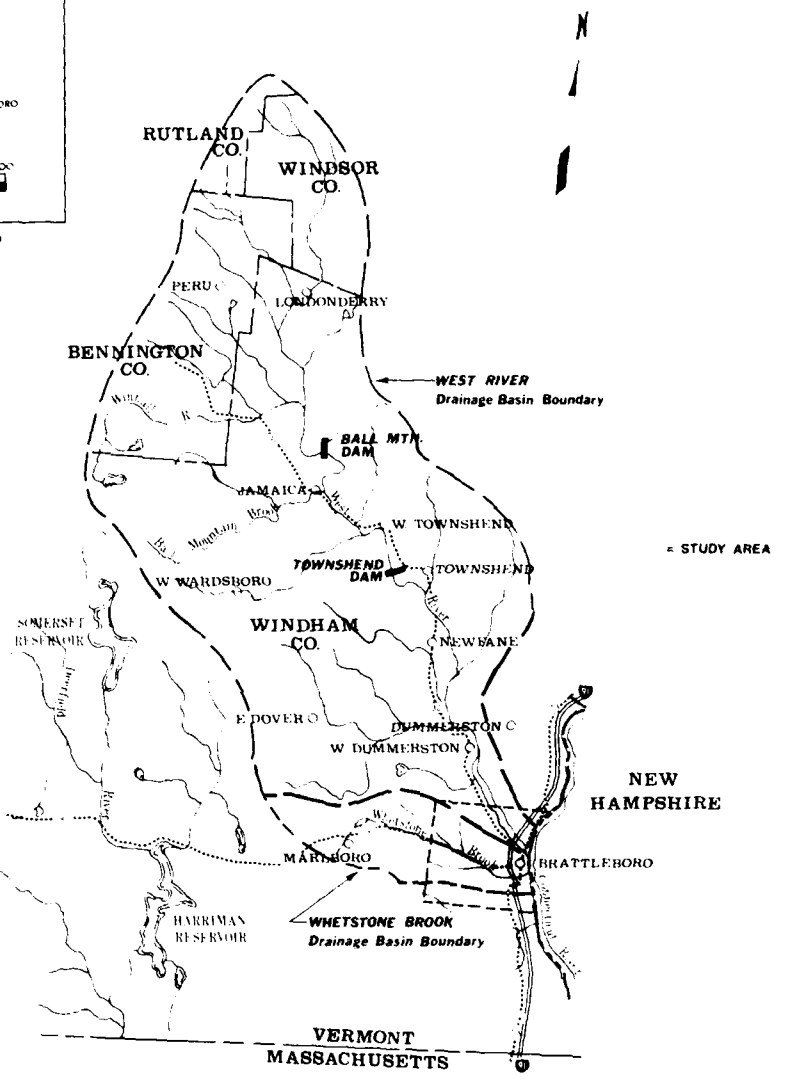
CONNECTICUT RIVER BASIN MAP

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO. 1



LOCATION MAP



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SCALE IN MILES

DUFRESNE HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD VERMONT

FLOOD PLAIN INFORMATION

WEST RIVER AND WHETSTONE BROOK BRATTLEBORO, VERMONT

BASIN MAP

PREPARED FOR THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO. 2

DESCRIPTION OF STUDY AREA

Settlement

The Town of Brattleboro, Vermont, is in the southeastern part of the state in Windham County. It was chartered in 1753 and its population in 1970 was 11,734. The urban area of the town is built on the west bank of the Connecticut River south of West River and westward along Whetstone Brook, which bisects the urban area in an east-west direction.

General Conditions and Past Floods

The principal residential and business development is on high ground but a number of homes and businesses are on the flood plains of West River, Connecticut River and Whetstone Brook. In recent years, substantial growth has taken place in the use of the Whetstone Brook flood plain at West Brattleboro and westward to a point where the extensive flood plain narrows to a plain less than 100 feet wide. Parts of the downtown area of Brattleboro along Whetstone Brook and the extensive flood plain mentioned above have been inundated by floods in the past and will be flooded again by the potentially greater floods of the future.

Over the years, more than 300 mobile homes have been moved

onto or adjacent to the flood plain at West Brattleboro where the owners have taken advantage of the flat terrain. More recently two large housing developments for the elderly have been constructed on the flood plain and floods of the future may cause significant damage and may result in loss of life in these areas.

Although Brattleboro is situated along the Connecticut River in the vicinity of the mouths of West River and Whetstone Brook, both the Connecticut River and West River are subject to significant regulation provided by flood-control structures, so that a large part of the major flood problems in the future will be related to Whetstone Brook.

Planned regulation of streams to control flooding is accomplished by storing part of the flood flows in impounding reservoirs. The impoundment of water decreases the flow rate in the stream below the impoundment until such time as water can be released safely from the impoundment, that is, until the normal peak has passed on downstream.

Additional flood-peak reduction on the Connecticut River is accomplished as a result of surcharge on the water surface upstream from dams constructed for power development. There are a number of such dams on the Connecticut River and on some of its major tributaries. The combination of storage behind 5 flood-control structures

and upstream from power dams reduces most flood peaks on the Connecticut River at Brattleboro to a manageable level. The probability of significant damage in the Brattleboro area from flooding of this river has thus been reduced materially.

Flooding along the West River also has been significantly reduced since 1960 by the construction of flood-control structures at Ball Mountain and Townshend. The principal flood problems along the West River within the Town of Brattleboro are those arising from ice jamming near the mouth of the river either during the spring breakup or at the time of an unexpected mid-winter breakup. In the past State Highway Route 30 along the right bank of the river has been topped in several places by flood waters but with its reconstruction and raising of grade in 1967, the chances of overtopping have been lessened considerably.

Whetstone Brook, on the other hand, is presently unregulated and flooding can occur within this basin at any time when meteorological elements combine to produce heavy rain and high rates of runoff. This may result from a combination of rapid snow melt and warm rain as in March 1936, or by heavy rain alone, and can conceivably happen during any month of the year. Several floods in the past have resulted from coastal storms or hurricanes at which time large volumes of water have been deposited during relatively short time intervals, notably those of November 1927, September 1938 and July 1969.

Flood Damage Prevention Measures

Since 1936, the New England Division, Corps of Engineers, has been active in a program of investigating the possibility of constructing flood control reservoirs in the various river basins in New England. As of June 1970, five such projects had been completed in the Connecticut River basin above Brattleboro.

Two of the reservoirs are in the West River basin and are described in the following paragraphs (see photographs following page 8).

Townshend Dam and Reservoir

Townshend Dam is located on the West River about 19.5 miles upstream from its mouth at the Connecticut River at Brattleboro. The site is about two miles northwest of the town of Townshend.

The project features a rolled-earth and rockfill dam, 133 feet high and 1,700 feet long; outlet works founded on bedrock under the dam; and a side channel spillway 439 feet long at the left abutment. The project was completed in June 1961.

The reservoir has a capacity of 33,200 acre-feet, equivalent to 6 inches of runoff from the 106 square miles of drainage area below Ball Mountain Reservoir, which is located 9.5 miles upstream. When

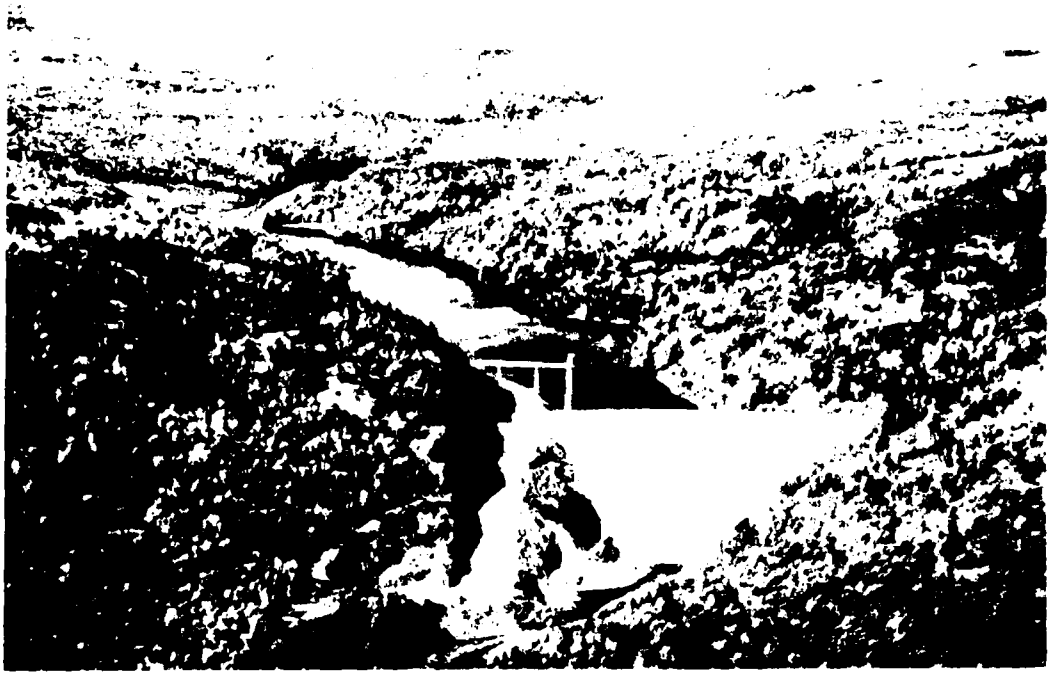
full, a 730-acre pool would extend 4.5 miles upstream in Townshend and Jamaica. The project is operated as a unit in the comprehensive plan for flood protection in the Connecticut River basin and provides protection for downstream damage centers on the West and Connecticut Rivers. The project has had six significant storage operations since its completion, which have prevented damages of an estimated $780,000. In a recurrence of the March 1936 basin flood of record, it would prevent damages of about $8,498,000.

Ball Mountain Dam and Reservoir

Ball Mountain Dam is located on the West River about 29 miles upstream of the Connecticut River at Brattleboro. The site is two miles north of the town of Jamaica at a point where the West River flows through a narrow, steep-sided valley on the north flank of Ball Mountain.

The project features an earth and rockfill dam 265 feet high and 915 feet long, with a concrete chute spillway 235 feet long at the right abutment of the dam. The outlet is tunneled in rock under the dam. Construction of the dam and appurtenance works was completed in November 1961.

The dam creates a reservoir capable of storing 54,600 acre-feet of floodwaters, equivalent to 6 inches of runoff from the 172



Ball Mountain Dam and Reservoir

Townshend Dam and Reservoir

square mile drainage area. A 75-acre seasonal conservation pool is held from mid-May to mid-October to enhance the fishway resource, prevent excessive siltation behind the dam, and achieve aesthetic purposes. At full flood pool, an 800-acre pool would extend 6.5 miles upstream in Jamaica and Londonderry.

The reservoir provides flood protection for downstream communities in the West River valley and is operated with other reservoirs in the comprehensive plan for the Connecticut River basin to reduce flood stages in all main-stem communities downstream of Bellows Falls. Since its construction, there have been six significant operations of storage which have prevented damages estimated at $1.3 million. In a recurrence of the 1936 basin flood of record, the project would prevent damages of about $12,550,000.

Flood Warning and Forecasting Services

The U. S. Department of Commerce, Environmental Science Services Administration, National Weather Service, is responsible for forecasting high water on the nation's rivers and for issuing flood warnings for the protection of life and property. The River Forecast Center at Hartford, Connecticut is responsible for issuing flood warnings for the Connecticut River basin including the West River basin.

A comprehensive network of rainfall and river data reporting

stations has been established with cooperative observers. The flood warnings are issued by teletype simultaneously to the press services, State Police, Civil Defense authorities, and many other state and local agencies.

In the event of communication failure, the State Police and Civil Defense have an emergency plan for receiving flood warnings and notifying the responsible officials. Heeding a flood warning is of prime importance for the protection of life, health and property of the inhabitants on the flood plains of the Brattleboro area.

In contrast, flooding along Whetstone Brook often occurs with little or no opportunity for ample warning since flood peaks may occur within three hours after the start of an intense rainfall. The River Forecast Center at Hartford may issue warnings of local flash flooding but the responsibility for flood warning on Whetstone Brook must of necessity lie in the hands of local officials.

CONNECTICUT RIVER

The Stream and Its Valley

The Connecticut River rises at Connecticut Lakes in the extreme northern part of New Hampshire and for a considerable distance forms the boundary between New Hampshire and Vermont. By the time it

reaches Vernon Dam, a short distance south of Brattleboro, the river includes the drainage of over 6,000 square miles. At Vernon Dam the average flow, adjusted for storage, is about 10,000 cubic feet per second. Much of the river's valley is relatively wide and the flood plain has been developed to a considerable extent both as farmland and by several sizeable urban centers.

Developments on the Flood Plain

Within the study area of this report only about six miles of the Connecticut River are considered. Throughout this reach the left bank of the river is steep, and sparsely developed. The right bank is in general less steep with a limited amount of development and encroachment on the flood plain particularly at and below urban Brattleboro.

Under low-water conditions the stage of the river throughout the entire six-mile reach varies little from that at Vernon Dam four miles downstream. During extreme flood conditions, a fall in water surface of as much as 10 feet can be expected between the upstream Brattleboro town line and Vernon Dam.

Flood Records - Stages and Discharges

Connecticut River at Vernon, Vt. - Continuous records of river

stages and discharges on Connecticut River in the study area have been maintained since October 1944 when the U. S. Geological Survey installed a water-stage recorder on the right bank of the river just downstream from Vernon Dam (Drainage area 6,266 sq. mi.).

Historic records indicate that from 1770 to 1936, 19 damaging floods occurred on the Connecticut River in New Hampshire and Vermont. A tabulation of these floods in chronological order is given in Table 1, below:

TABLE 1

HISTORIC FLOODS

CONNECTICUT RIVER BASIN

	1770	April	1852	Spring	1876
Autumn	1771	April	1862	April	1895
	1797	February	1868		1896
May	1818	April	1869	March	1913
	1828	October	1869	November	1927
January	1841			April	1928
April	1850			March	1936

Data on these floods except the one in March 1936 are meager and their magnitudes are unknown.

Since 1935 discharge data for four notable floods are available as follows:

Date	Discharge(cfs)	Date	Discharge(cfs)
March 19, 20, 1936	176,000	March 23, 1948	101,000
September 22, 1938	132,500	April 5, 6, 1960	107,000

Flooded Areas and Flood Profile

Future floods along the Connecticut River within the study area for this report will, in general, be lower than those in 1938 and before due to the operation of the existing flood-control reservoirs. The Intermediate Regional Flood for this reach of river is approximately equal to the 1938 flood with the Standard Project Flood being about five feet higher (see Plate 4A). The approximate areas which will be covered by flood waters are delineated on Plate 4. The actual limits of these overflow areas on the ground may vary some from those shown on the maps because the contour interval and scale of the maps do not permit the precise plotting of the flooded area boundaries. Were it not for the large amount of flood-control in the basin, both the Standard Project and Intermediate Regional Floods would be considerably greater than the 1938 flood. As a result of the regulation provided by the flood-control structures upstream, future flood damage at Brattleboro from the Connecticut River should be at a minimum.

Bridges over Connecticut River

Two highways, New Hampshire State Highway 9 and State Highway 119, and a bridge of the B & M Railroad cross the Connecticut River within the study area of this report. The railroad bridge offers no appreciable obstruction to the flood flows. However, hydraulic studies indicate that each of the highway bridges cause slightly more than two feet of backwater during floods as indicated by the flood profiles (see plate 4A). The underclearances of the bridges are shown in Table 2.

TABLE 2

BRIDGES OVER CONNECTICUT RIVER

Mile	Identification	Bridge Elev. Deck	Bridge Elev. Low Steel	Flood Crests SPF	Flood Crests IRF	Underclearance Rel. to IRF
		feet	feet	feet	feet	feet
147.1	B & M Railroad	240	230.5	234.2	229.2	1.3
148.2	N.H. Route 119	239.2	237.0	237.2	232.2	4.8
150.6	N.H. Route 9	256.3	253.8	240.5	235.5	18.3

WEST RIVER

The Stream and Its Valley

West River rises in south central Vermont and flows

southeasterly into the Connecticut River north of the urban area of Brattleboro, a distance of about 45 miles. Devastating floods have occurred along this river, the worst of which during recent years, was in 1938. The valley of this river varies from very narrow in places to a flood plain several hundred feet wide near its mouth.

Development of the Flood Plain

Relatively little development has taken place on the flood plain of West River along the reach from its mouth to the Brattleboro town line, a distance of about three miles. A well field and pumping station for emergency water supply is located on Retreat Meadows. A few homes and small business establishments lie along State Highway 30, but most of the land is either wooded or used for agricultural purposes. In the past, damage has occurred as a result of washing along State Highway 30, but in 1967 parts of this stretch of roadway were raised and damage within the Town of Brattleboro from West River flood waters should be lessened materially in the future.

Flood Records - Stages and Discharges

West River at Newfane, Vt. Records of river stages and discharges on West River at a point about seven miles north of the

study area have been maintained by United States Geological Survey for the period 1919-1923 and since October 1928 (water-stage recorder installed June 27, 1931, drainage area 308 sq. mi.).

Historic records indicate damaging floods in this basin occurred in October 1869, November 1927, March 1936 and September 1938.

Since 1927, discharge data for four notable floods are available as follows:

Date	Discharge(cfs)	Date	Discharge(cfs)
November 3, 1927	45,000	September 21, 1938	52,300
March 18, 1936	39,000	December 31, 1948	39,600

Floods since 1960 have been lowered by the operation of two flood control reservoirs.

Flooded Areas and Flood Profile

The flood profile for West River within the study area is approximately flat for nearly two miles since it is determined by the elevation of the water surface of Connecticut River at the mouth of West River. A gradual rise begins at about the two-mile point and continues upstream past the Brattleboro town line. The areas which will be covered by flood waters are delineated on plates 5, 7 and 8. The actual limits of these overflow areas on the ground may vary some

from those shown on the maps because the contour interval and scale of the maps do not permit the precise plotting of the flooded area boundaries.

Bridges over West River

There are four bridges over West River within the study area of this report. Two of these bridges, the U. S. Route 5 bridge and a railroad bridge, are very close to the mouth of the river and usually offer little restriction to flow since this reach of river is in the backwater of Vernon Dam on the Connecticut River. These bridges do, together with two pair of old bridge abutments between them, contribute to the formation of ice jams resulting in backing up of water onto Retreat Meadows, a condition which has been serious at times in the past.

The third and fourth bridges, those of the crossing of Interstate Highway 91, are many feet above even the level of the Standard Project Flood and offer no obstruction to flood flows except for the slight effect created by the piers of the bridges (see Table 3).

The magnitude and frequency of flooding due to ice jams or other obstructions to flow cannot be predetermined and such conditions are not treated in this report.

TABLE 3

BRIDGES OVER WEST RIVER

Station	Identification	Bridge Elev. Deck	Bridge Elev. Low Steel	Flood Crests SPF	Flood Crests IRF	Underclearance Rel. to IRF
		feet	feet	feet	feet	feet
0+90	B & M Railroad	252.0	244.0	237.8	232.8	11.2
3+15	U. S. Route 5	241.0	238.0	237.8	232.8	5.2
53+75	I-91 Northbound	323.0	289.0	237.8	232.8	56.2
54+55	I-91 Southbound	323.0	289.0	237.8	232.8	56.2

WHETSTONE BROOK

The Stream and its Valley

Whetstone Brook rises at elevation 2019 feet on Central Mountain in the Town of Marlboro, about 10 miles west of Brattleboro, Windham County, Vermont. The brook drains an area of 28.1 square miles of generally hilly terrain before it enters the Connecticut River at Brattleboro. The gradient of the stream is steep with a fall of nearly 1800 feet in 11.5 miles of length or an average fall of 157 feet per mile. Much of the fall (over 1300 feet) occurs in the upper six miles of the watershed. However, an appreciable amount of fall does take place within the urban area of Brattleboro where a drop in elevation of over 100 feet takes place within a distance of less than a mile downstream from the stream's passage under Interstate Highway 91. Upstream from Highway 91 the fall through the balance of the study area totals slightly more than

300 feet in about 4 miles.

In addition to the main stem of Whetstone Brook, there are two sizeable tributaries, Halladay Brook which contributes flow from 5.9 square miles, and Ames Hill Brook which drains 4.9 square miles. Both of these tributaries have steep gradients and relatively narrow valleys.

Little storage in the form of lakes, ponds, or swamps exists in the entire watershed. As a result of the steep terrain and absence of appreciable storage, runoff is rapid and accumulates to peak rates of flow of sizeable magnitude. Peaks are sharp and frequently occur as quickly as three hours after the start of an intense rain. Peaks of this kind are usually more hazardous than are flatter, more sluggish peaks which usually occur on larger streams and which give some warning of their approach.

This study relates only to the flood hazards in the lower five miles of the stream channel including a sizeable reach in West Brattleboro where the flood plain is several hundred feet wide, and a narrower, steeper section of the stream through urban Brattleboro. Both of these areas are critical because of the considerable encroachment on the flood plain that has taken place and is taking place from y to year.

Within the upper of these critical areas, where the valley is wide and the stream gradient relatively flat, are several clusters of mobile homes, the total number of units being in excess of three hundred. Also within this same reach two housing developments for the elderly, each having a capacity of about 100 persons, have been constructed by the Brattleboro Housing Authority. Both the mobile homes and housing developments will be affected seriously by a major flood with heavy property damage and possible loss of life resulting.

In the lower reach within the urban limits of Brattleboro, are located a number of residential and industrial structures encroaching upon the flood plain. Damage throughout this area has been significant in the past and would be heavy during either a Standard Project Flood or an Intermediate Regional Flood. In 1967, it was estimated average annual flood and sediment damages in the basin were about $63,000.00.

Developments in the Flood Plain (Upstream from State Highway 9 Bridge)

Except for a few homes and small businesses along Route 9 at West Brattleboro, the encroachment on the flood plain upstream from Route 9 Highway Bridge consists of two major elements. These are (1) a number of concentrations on or adjacent to the flood plain of mobile homes totaling over 300 units and (2) two housing developments

for the elderly consisting of one-story and two-story structures with a total of more than 150 units in which reside 200 persons.

Mobile Homes - More than 300 of what used to be called trailers, but which have grown to a size that most require special tractors to move them, are situated on or close to the flood plain in West Brattleboro. Many of these units are located semipermanently, having been raised off their wheels, provided with some kind of foundation, and in many cases with wheels removed and/or additions constructed (Figure 8). Few of these units are readily movable and consequently most could not be removed to high ground within the short warning interval that is generally associated with flash flooding. As a result many of them would be vulnerable to flood waters with the consequence that nature would do what man had no chance to do, move the units from their foundations, topple some of them over, and create havoc in general. The resulting property damage would be high and only as the result of some miracle could loss of life be avoided particularly if the flood wave occurred during the night.

Housing Developments for the Elderly

The development on Melrose Terrace at the end of George F. Miller Drive in West Brattleboro was completed in 1968 and consists of 80 units in one-story brick structures housing about 100 persons. Study of this area indicates that water as much as five feet deep

could be expected to top the left bank of Whetstone Brook at the upstream end of the housing development. Flow could enter some of the upstream structures to a considerable depth on the first floor. Other structures would have water of lesser depth or possibly only be surrounded by water.

A second housing development of two-story wooden buildings one-half mile upstream was completed in 1970. Analysis of the hydraulics of Whetstone Brook at this location indicates much less danger of flooding although flood waters may surround some of the buildings and may enter two structures close to the stream channel.

Encroachments on the Flood Plain at and below State Highway 9 Bridge

Part of the business district of West Brattleboro including several homes would be subject to possible damage during a flood equal to or greater than the Intermediate Regional Flood. More damage would result from a flood equal to or greater than the Standard Project Flood. (See Plates 11 and 12 and Figure 6).

Further downstream, flood waters can be expected to submerge the deck of the bridge providing access to Brookside Development and to extend 150 feet to the right with depths as great as four feet in places.

Encroachments in the Brattleboro Business District

Little difficulty is expected until Whetstone Brook passes through the downstream Williams Street bridge. However, from this point down to Main Street, definition of the inundated area for both the Standard Project Flood and Intermediate Regional Flood is somewhat uncertain.

At several points, water will overflow the stream banks, particularly along the north or left side and flow through streets, lumber yards, and other structures. About a dozen buildings will be surrounded by water either just below the lower Williams Street bridge or just above the Elliot Street bridge, all along the left bank of the stream.

All the water is expected to pass under the Elliot Street Bridge, but immediately below, flood flows will spread out over both left and right banks. However, for much of the way from Elliot Street to Main Street, the right bank is fairly high, except along Frost Place, and will confine much of the flow. The left bank is low however, and water will top this bank in a number of places. At times overflow will constitute a channel separate from the main channel and possibly at a higher elevation. Some of the buildings along Frost, Elm, and Flat Streets will appear as islands separating main flow from the overflow. Under such conditions water may travel

down Flat Street all the way to Main Street, even though the ground along Flat Street is higher than the main stream channel.

Several buildings in this area will be subject to inundated basements and in some cases, water depths on the first floor may be as great as 1 or 2 feet. Large quantities of lumber stored on the flat areas may be floated away.

Bridges Across the Stream

Eighteen bridges cross Whetstone Brook or Halladay Brook within the area covered by this report. Several of these bridges are sizeable, well-built structures which will contain most floods without danger of being overtopped or seriously damaged and without causing appreciable backwater.

One exception to this is the Elm Street Bridge in downtown Brattleboro, which is low at its left end (Figure 2). During a major flood, the left bridge approach will be overtopped and considerable overflow around the left side will occur. The bridge structure itself, however, is adequate.

The one major bridge which is inadequate is that on State Highway 9 between Brattleboro and West Brattleboro. The deck of the concrete-arch bridge will be overtopped by both the Standard

Project Flood and the Intermediate Regional Flood and a large amount of flow will pass over the highway east and west of the bridge, making the crossing impassable during floods of these magnitudes. In 1938 this bridge deck was reported as being overtopped to a depth of three feet (Figure 4).

Considerable flow also will occur on the left of the access bridge on George F. Miller Drive to the lower housing development in West Brattleboro (Figure 5).

Upstream from this point, all bridges are inadequate and some in poor condition. Flooding of bridge decks and approaches can be expected. It is doubtful if some of these bridges would withstand a major flood. The existence of these inadequate stream crossings and the possibility of debris catching and obstructing the available waterway under these bridges add to the hazards of existing and/or future encroachment on the flood plain in the West Brattleboro area.

Some system of warning motorists and pedestrians of the possible danger at several of the bridges during flash floods would be highly desirable if loss of life is to be prevented.

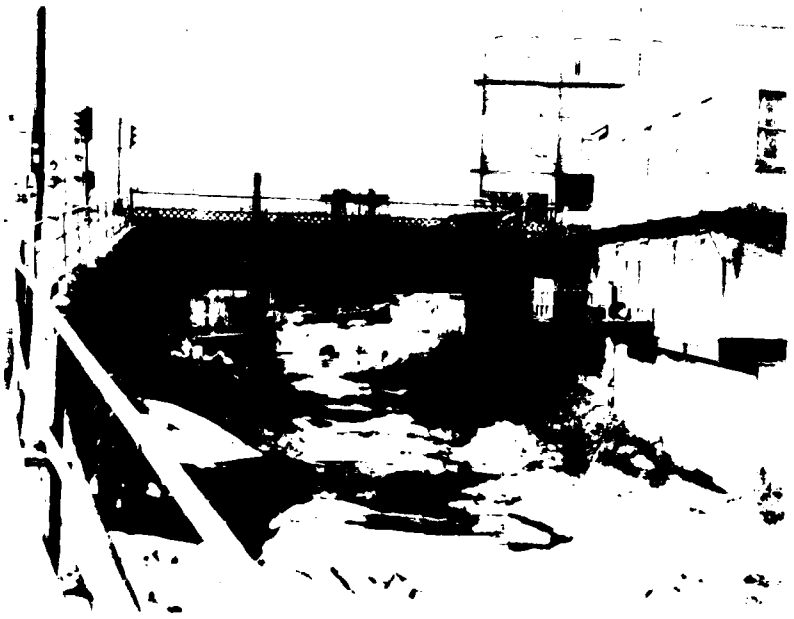
Table 4 summarizes specific details concerning the several bridges throughout the study area and their relationship to the

TABLE 4

BRIDGES ACROSS WHETSTONE BROOK AND HALLADAY BROOK

STATION	IDENTIFICATION	STREAM BED ELEV.	BRIDGE ELEV.		FLOOD CRESTS		WATERWAY AREA	UNDERCLEARANCE RELATION TO IRF	
			DECK	LOW STEEL	SPF	IRF		ABOVE	BELOW
		feet	feet	feet	feet	feet	sq. ft.	feet	feet
0+24	C.V. and B&M Railroad	214.3	236.6	227.1	237.0	232.0	722.8		4.9
3+98	Main Street, Route 5	230.6	252.4	247.4	244.0	242.0	920.7	5.4	
17+70	Elm Street	249.8	269.3	265.0	261.3	258.9	1258.1	6.1	
40+64	Elliot Street	265.4	288.5	284.1	283.0	281.0	1198.7	3.1	
68+42	Williams St. (lower)	298.0	311.9	309.9	311.0	309.0	671.0	0.9	
78+60	Williams St. (upper)	309.6	331.2	328.2	319.0	317.0	1241.6	11.2	
89+25	I-91 Northbound	323.0	405.0	400.6	334.0	332.0	--	68.6	
90+00	I-91 Southbound	324.3	405.0	400.6	335.0	333.5	--	67.1	
112+00	Lower Pipeline Crossing	353.5	386.8	380.8	373.2	370.2	1265.5	10.6	
117+30	Upper Pipeline Crossing	383.9	398.6	392.6	395.1	392.9	496.0		0.3
124+80	Guilford Street	395.0	412.4	410.9	408.0	405.8	768.7	5.1	
141+68	Brookside Terrace	404.6	417.8	415.3	418.3	416.5	365.7		1.2
159+05	Western Ave. Route 9	416.6	431.6	430.0	432.7	431.1	493.4		1.1
171+87	George F. Miller Drive	428.2	440.2	435.5	437.8	436.0	435.4		0.5
206+10	Meadowbrook Road	449.5	--	458.7	462.6	461.3	227.5		2.6
256+10	Country Drive	494.3	502.8	501.1	502.8	502.2	175.8		1.1
271+90	Mountain Road	515.5	522.6	521.1	522.0	521.8	118.4		0.7
285+20	Sunset Lake Road	531.8	541.3	538.8	539.6	538.5	136.4	0.3	

Whetstone Brook, looking downstream from Main Street (Route 5) bridge toward railroad bridge and Connecticut River.



Whetstone Brook, looking upstream through Main Street bridge.

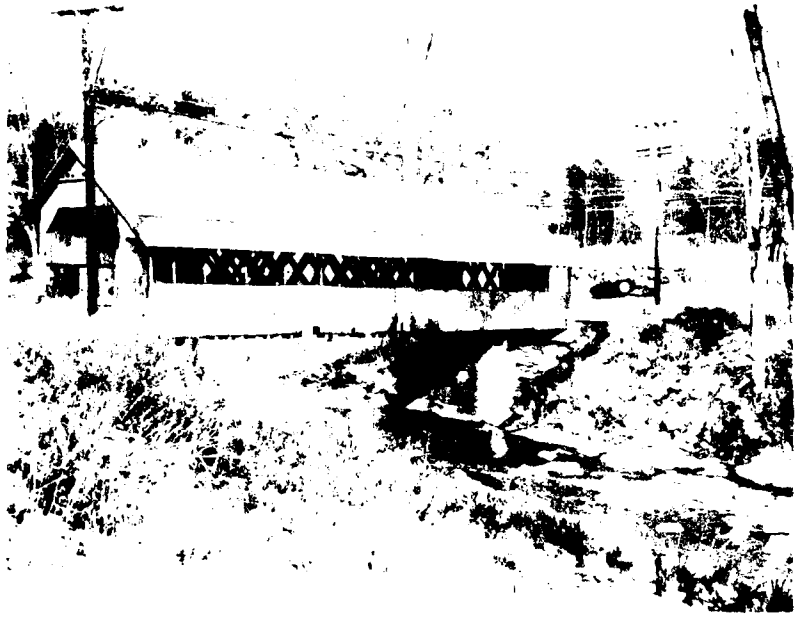
Figure 1

Looking downstream from Main Street during high water of July 1969 (see opposite page).

Looking upstream through Main Street bridge during highwater of July 1969 (see opposite page).

Whetstone Brook looking downstream through Elm Street bridge. A portion of the flood flow will bypass this bridge because of low left-bank approach.

Figure 2



Covered bridge over Whetstone Brook at Guilford Street. All flood flow will pass under this bridge.

Brookside Terrace bridge. Both Standard Project and Intermediate Regional Floods will overtop this bridge deck.

State Highway 9 bridge over Whetstone Brook. Standard Project Flood will overtop bridge deck by about three feet.

Meadowbrook Road bridge. Both Standard Project and Intermediate Regional Floods will overtop this bridge deck.

Figure 4

George F. Miller Drive bridge over Whetstone Brook. Entrance to Melrose Terrace housing development. Considerable flow will bypass this bridge through area in vicinity of cars.

Melrose Terrace Housing Development for Elderly, looking downstream. Standard Project Flood will overtop bank in foreground to a depth of as much as five feet.

Figure 5

Intermediate Regional Flood. Several of the bridges would be inadequate and hazardous even during considerably lesser floods.

Flooded Areas and Flood Profiles

Plates 9-13 show the approximate areas along Whetstone Brook throughout the study area that would be inundated by floods equal to or greater than the Intermediate Regional Flood and the Standard Project Flood. The actual limits of these overflow areas on the ground may vary some from those shown on the maps because the contour interval and scale of the maps do not permit the precise plotting of the flooded area boundaries. In many cases the boundaries of the flooded areas for the two floods coincide so closely it is impractical to try to delineate both.

The stream profiles are for the natural stream channel and for the floods of the two magnitudes indicated. Expected depths of water in the flooded areas may be estimated by projecting flood-profile elevations to the left or right of the main channel. Use of these profiles can be helpful in planning the location of structures on the flood plain and in selecting floor levels high enough to escape flood damage or in estimating the flood hazard to structures not high enough to avoid flood damage.

DESCRIPTION OF PAST NOTABLE FLOODS

Flooding in the Brattleboro, Vermont area is not something of recent occurrence only. For more than 100 years, serious floods have been documented, some in considerable detail. A few of the comments relative to notable flood happenings are included in this report as follows:

October 4, 1869

(From "Vermont Phoenix", October 8, 1869) "The most destructive flood ever known in this town occurred on Monday, October 4. The Whetstone Brook which has its sources in the hill country west of us and which always rises suddenly when great rains fall, became higher about noon than ever known before and carried everything, bridges, houses, lumber, and every variety of thing along through its channel to the Connecticut River. The whole distance from the site of the Connecticut River bridge all the way up to Centreville is one scene of desolation and ruin. What took the labors of long years of inventive genius and patient industry was destroyed and swept away in a few minutes." (Over three columns additional detail are included.)

November 4, 1927

(From "Brattleboro Reformer", November 4, 1927) "In Brattleboro, probably more damage was suffered in the Great Rise of Whetstone October 4, 1869, but the damage of today's flood was more widespread."

March 1936

(From "Brattleboro Reformer", March 14, 1936) "Industrial plants on Vernon Street, which 2 or 3 weeks ago, had taken usual spring precautions against high water, were flooded in their basements as were three dwellings near the Crosby Milling Company plant. R. J. Pierce's establishment was under water 4 feet at height of flood last night."

(From "Brattleboro Reformer", March 18, 1936) "Whetstone Brook reached such a height that fear for the safety of the railroad arch bridge at its mouth worried town and railroad company officials. Sand bags were used to protect the foundations at each end."

Photo courtesy Lewis R. Brown, Inc.

Destruction resulting from flood of October 1869. View looking up Whetstone Brook from below Main Street (Route 5) bridge. Damaged abutments of old bridge in foreground. Note inadequate bridge structure and encroachment on flood plain at left. See also figure 1.

(From "Brattleboro Reformer", March 19, 1936) "Last night Whetstone Brook fell as fast as it had risen and left a band of havoc along its banks. Cellars along it were flooded and foundations weakened. A landslide containing hundreds of tons of earth and stones swept into the brook today, coming from the Chestnut Street bank near the concrete bridge on J. E. Bushnell's property."

(Editorial from "Brattleboro Reformer", March 20, 1936) "While the Flood of 1936 as it henceforth will be called did not leave as much death and destruction in its wake over the State as a whole as its noted predecessor, the Deluge of 1927, it was the greatest high-water catastrophe in the history of this section. From now on until a worse one comes, it will serve as a yardstick for all floods."

September 21, 1938

(From "Brattleboro Reformer", September 22, 1938) "Early last evening Whetstone Brook went over its 1936 level and poured water into Flat Street. The edge of the water almost reached the Main Street intersection before it began to recede about 9:30 p.m."

"Although the overflow of water from the brook filled the basement of Latchis Memorial Theater, water was kept from the Auditorium and serious damage avoided. Whetstone Brook, swollen to immense proportions, left its course and inundated sections of West Brattleboro and Frost, Flat, Elm and Williams Streets. A raging torrent passed over Brook Road and Williams Street removing two bridges. The long iron bridge on Williams Street lay on the bed of Whetstone today a twisted wreckage. Several families were routed from their homes on Frost and Williams Streets."

"Nearly 3 feet of water ebbed over the cement bridge on Western Avenue (Route 9) at the Melrose Street intersection at the peak of the inundation period."

"Cellars of all plants, stores, garages and other buildings on Flat Street were flooded and water ran above street level. Water entered the Barber Building, Latchis Block and Chatterton Store."

"Raymond Brown, local meteorologist, reported total precipitation since September 13 was 9.43 inches."

(From "Brattleboro Reformer", September 24, 1938) "Road Commissioner Francis E. Currivan reported today that most of the road damage suffered by the Town of Brattleboro was on Ames Hill Road, Sunset Lake Road and Williams Street. The most expensive reconstruction job, he pointed out, will be replacing the iron bridge washed away on Williams Street."

"West River during the flood height Thursday was two feet higher than in 1927 and damage has been proportionally higher. The lower road from Brattleboro to West Dummerston was pockmarked with washouts, some of them very serious."

July 29, 1969

(From "Brattleboro Reformer", July 29, 1969) "Twelve to fifteen trailers bordering the Whetstone Brook at Mountain Home Park were evacuated early this morning and a rise of two more inches of water would have forced residents of Melrose Terrace (new housing development) to leave."

"The heavy rains of the past few days, climaxed by last night's downpour, brought the Whetstone higher this morning than during last spring according to Edward C. Pickering, deputy Civil Defense Director for Brattleboro."

"A bridge crossing the Whetstone in the vicinity of the Country Kitchen Restaurant at West Brattleboro sustained enough damage to warrant its being temporarily closed. Approaches to the bridge were washed away but repairs are expected to be completed tomorrow."

"Some back roads in town received a washing from the storm that has brought more than 3-1/2 inches of rain in the last two days. The 24-hour record up to 7:30 a.m. today was a wet 2.95 inches."

FUTURE FLOODS

This section of the report discusses the Standard Project Flood and the Intermediate Regional Flood on the Connecticut River, West River, and Whetstone Brook at Brattleboro, Vermont, and some of the hazards of great floods. Floods of the size of the Standard Project Flood represent reasonable upper limits of expected flooding. Those of the size of the Intermediate Regional Flood represent floods that may reasonably be expected to occur more frequently, although they will not be as high as the infrequent Standard Project Flood.

Flooding on a particular stream may be the result of a storm of small areal extent concentrated over all or a part of the stream, or may be the result of a storm of much larger proportions which causes flooding on a considerable number of streams over a relatively large area. It is therefore desirable in connection with any determination of future floods which may occur in the Brattleboro area, to consider storms and floods that have occurred in the general region on watersheds whose topography, watershed cover, and physical characteristics are similar to those of the Connecticut River, West River and Whetstone Brook.

DETERMINATION OF INTERMEDIATE REGIONAL FLOODS

The Intermediate Regional Flood is defined as a flood having an average frequency of occurrence in the order of once in 100 years at a designated location, although such a flood may occur in any year. For this reason the Intermediate Regional Flood is better described as a flood with a one percent chance of occurring each year. Conceivably more than one flood equal to or greater than a flood of this magnitude could occur in any one year. In order to determine the Intermediate Regional Flood for the West River, statistical studies were made using flood data for the gaging station at Newfane, Vermont, for the period of record 1919-23, and 1928 to 1969. Correlation of these records was made with records for other gaged sites in the Connecticut River basin.

Results of the studies indicate that the Intermediate Regional Flood on the West River when modified by the effects of Townshend and Ball Mountain flood-control reservoirs (Table 5) would have a discharge of 30,000 cubic feet per second, which is considerably less than any one of the four outstanding floods of the past on this river, those of 1927, 1936, 1938 and 1948. (see page 16)

The Intermediate Regional Flood on the Connecticut River at Brattleboro when modified by the effects of 5 flood-control reservoirs now in existence would have a discharge of 140,000 cubic feet per second (Table 5).

TABLE 5

INTERMEDIATE REGIONAL FLOODS

PEAK DISCHARGES

Stream	Location	Drainage Area sq. mi.	Discharge cfs
Connecticut River	Vernon	6,266	140,000
West River	Mouth	423	30,000
Whetstone Brook	Mouth	28.1	7,200

In order to determine the Intermediate Regional Flood for Whetstone Brook, statistical studies were made using records of known flood data for Ayers Brook at Randolph, Saxtons River at Saxtons River, Williams River at Brockway Mills, and West River at Newfane.

Results of these studies indicate that the Intermediate Regional Flood for Whetstone Brook at its mouth would have a peak discharge of 7,200 cubic feet per second, equivalent to about 150 percent of the estimated September 1938 flood. The Intermediate Regional Flood at other points in the Whetstone Brook basin are listed in Table 6.

TABLE 6

WHETSTONE BROOK - PERTINENT FLOOD DATA

Location	Drainage Area (sq. mi.)	Peak Discharges Intermediate Regional (100-Year) (cfs)	Standard Project Flood
Whetstone Brook at Mouth	28.1	7,200	11,000
At Ames Hill Brook - Downstream	23.2	6,300	9,600
Upstream	18.3	5,300	8,100
At Halladay Brook - Downstream	15.8	4,800	7,300
Upstream	9.9	3,400	5,300

DETERMINATION OF STANDARD PROJECT FLOOD

Only in rare instances has a specific stream experienced the largest flood that is likely to occur. Severe [illegible] flood may have been on any given stream, it is a commonly accepted fact that, in practically all cases, sooner or later a greater flood can and probably will occur. The Corps of Engineers, in cooperation with the National Weather Service, has made broad and comprehensive studies and investigations based on the past records of exceptional storms and floods and has evolved generalized procedures for estimating the flood potential of streams. These procedures have been used in determining the Standard Project Flood. It is defined as the largest flood that can be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical region involved.

Standard Project Flood estimates have been made for the Connecticut River at Vernon, for West River at its mouth and Whetstone Brook. The estimate for West River is 50,000 cfs, and for the Connecticut River, 227,000 cfs.

For Whetstone Brook, the estimate at the mouth is 11,000 cfs, about 50 percent greater than the Intermediate Regional Flood and a little more than twice the estimated 1938 peak.

Standard Project Flood estimates at a number of points in the Whetstone Brook basin are included in Table 6.

Frequency

It is not practical to assign a frequency to the Standard Project Flood. The occurrence of such a flood would be a rare event; however, it could occur in any year.

Possible larger floods

Floods larger than the Standard Project Flood are possible; however, the combination of factors that would be necessary to produce such floods would seldom occur. The consideration of floods of this magnitude is of greater importance in some problems than in others but should not be overlooked in the study of any problem.

DAMAGES OF GREAT FLOODS

The amount and extent of damage caused by any flood depends in general upon how much area is flooded, the height of flooding, the velocity of flow, the rate of rise, and the duration of flooding.

Areas flooded and heights of flooding

The streams, Connecticut River, West River and Whetstone Brook

which would be flooded by the Standard Project Flood and the Intermediate Regional Flood are shown on Plates 4 through 13. Depths of flow can be estimated from the crest profiles which are shown.

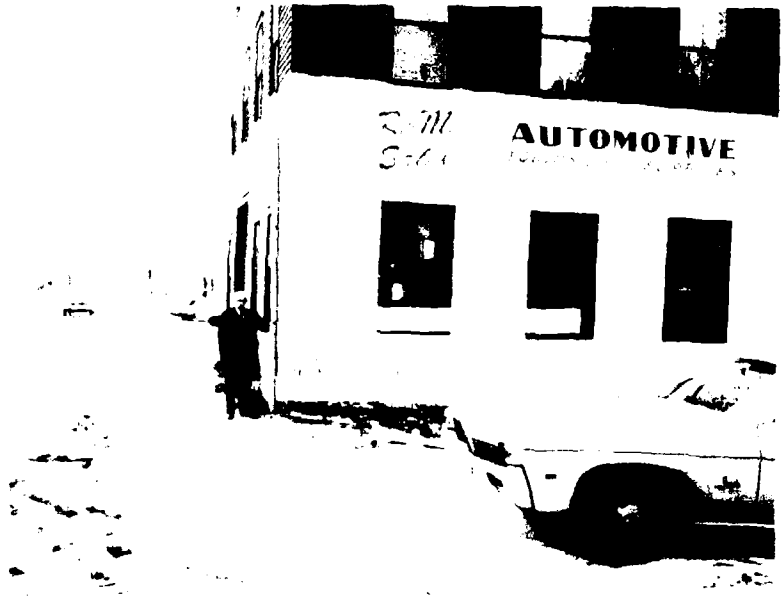
The profiles for the streams were computed by using stream characteristics for selected reaches as determined from observed flood profiles, topographic maps, and valley cross sections. The elevations and overflow areas shown have been determined with an accuracy consistent with the purposes of this study and the accuracy of this data.

The profiles of the Standard Project Flood and the Intermediate Regional Flood depend in part upon the degree of constriction or clogging of various bridges during the flood. Because it is impossible to forecast these events, it was assumed that all bridge structures would stand, and that no clogging would occur.

Field Data Collection

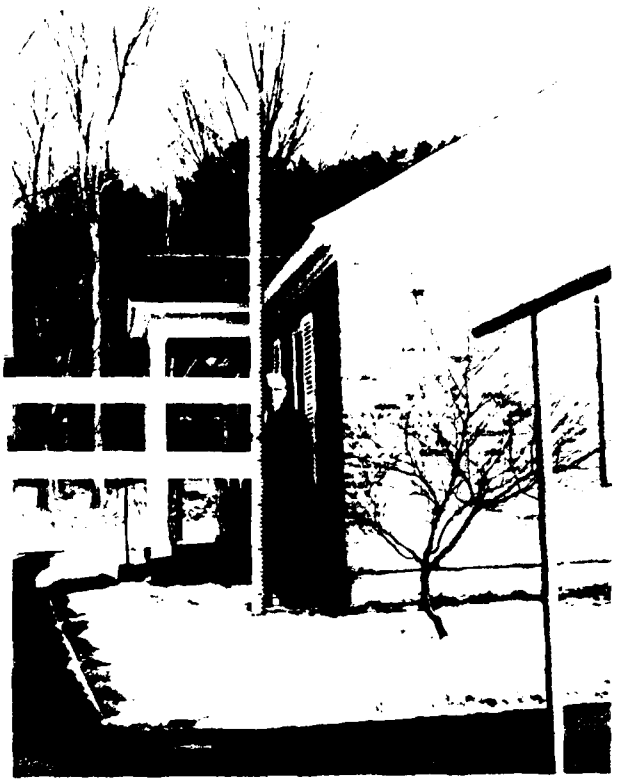
In addition to data available from records of the National Weather Service and U. S. Geological Survey, a considerable amount of data relative to the hydraulics of the Whetstone Brook basin was collected in the field by survey parties, in order to delineate flood profiles and areas subject to inundation.

Flood Heights at Rainbow Shop, east side of Elm Street.



Flood Heights at K & M Sales, Inc. westside of Williams Street, upstream from Elliot Street bridge.

Figure 6



Flood Heights, upstream end of Melrose Terrace Housing Development for the Elderly, West Brattleboro.

Flood Heights, mobile home in Glen Trailer Park, across Whetstone Brook from photograph above.

Figure 7

Flood Heights, mobile home in Mountain Home Trailer Park on left bank of Whetstone Brook opposite Country Kitchen, West Brattleboro.

Flood Heights, mobile home, in Mountain home Trailer Park, right bank Whetstone Brook just downstream from Mountain Road, West Brattleboro.

Figure 8

The geometry of all bridges crossing the brook within the study reach was surveyed and a total of 50 intermediate cross sections were surveyed at points where changes in profile or significant changes in cross sectional area were indicated.

Plates 14 and 15 present seven cross sections taken along Whetstone Brook to illustrate the large differences in cross sections that exist, particularly the extent of the flood plain in some reaches of the brook (Sec. 272+00, 253+90, 141+68) and the narrow stream channel at other points (Sec. 125+00 and 112+00).

Section 17+73 shows the problems relative to the Elm Street bridge.

Figures 6, 7, and 8 show the heights that would be reached by the Standard Project Flood and Intermediate Regional Flood on facilities presently existing within the flood plains in the vicinity of Brattleboro.

GLOSSARY

Backwater.

The resulting high water surface in a given stream due to a downstream obstruction or high stages in an intersecting stream.

Flood.

An overflow of lands not normally covered by water and that are used or usable by man. Floods have two essential characteristics: The inundation of land is temporary; and the lan s adjacent to and inundated by overflow from a river, strea ocean, lake, or other body of standing water.

Normally a "flood" is considered as any temporary rise in streamflow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increase streamflow, and other problems.

Flood Crest.

The maximum stage or elevation reached by the waters of a flood at a given elevation.

Flood Plain.

The areas adjoining a river, stream, watercourse, ocean, lake, or other body of standing water that have been or may be covered by floodwater.

Flood Profile.

A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage.

The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

Hurricane.

An intense cyclonic windstorm of tropical origin in which winds tend to spiral inward in a counterclockwise direction toward a core of low pressure, with maximum surface wind velocities that equal or exceed 75 miles per hour (65 knots) for several minutes or longer

at some points. Tropical storm is the term applied if maximum winds are less than 75 miles per hour.

Hydrograph.

A graph showing flow values against time at a given point, usually measured in cubic feet per second. The area under the curve indicates total volume of flow.

Intermediate Regional Flood.

A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year, it is based on statistical analyses of streamflow records available for the watershed and analyses of rainfall and runoff characteristics in the general region of the watershed.

Left Bank.

The bank on the left side of a river, stream, or watercourse, looking downstream.

Right Bank.

The bank on the right side of a river, stream, or watercourse, looking downstream.

Standard Project Flood.

The flood that may be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Peak discharges for these floods are generally about 40-60 percent of the Probable Maximum Floods for the same basins. As used by the Corps of Engineers, Standard Project Floods are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

Underclearance Elevation.

The elevation at the top of the opening of a culvert, or other structure through which water may flow along a watercourse.

AUTHORITY, ACKNOWLEDGEMENTS AND INTERPRETATION OF DATA

This report has been prepared in accordance with the authority granted by Section 206 of the Flood Control Act of 1960 (PL 86-645) as amended.

****

Assistance and cooperation of the National Weather Service, U. S. Geological Survey, the Vermont Highway Department, the Brattleboro Housing Authority, the Brattleboro Reformer, and private citizens in supplying useful data are appreciated.

****

This report presents the local flood situation for Brattleboro, on the Connecticut River, West River and Whetstone Brook. It was prepared by Dufresne-Henry Engineering Corporation, North Springfield, Vermont, under the direction of the New England Division, Corps of Engineers, Waltham, Massachusetts. Representatives from the Corps of Engineers will, upon the request of State and local governmental agencies, provide technical assistance in the interpretation and use of the information contained herein and will provide other available flood data related thereto.

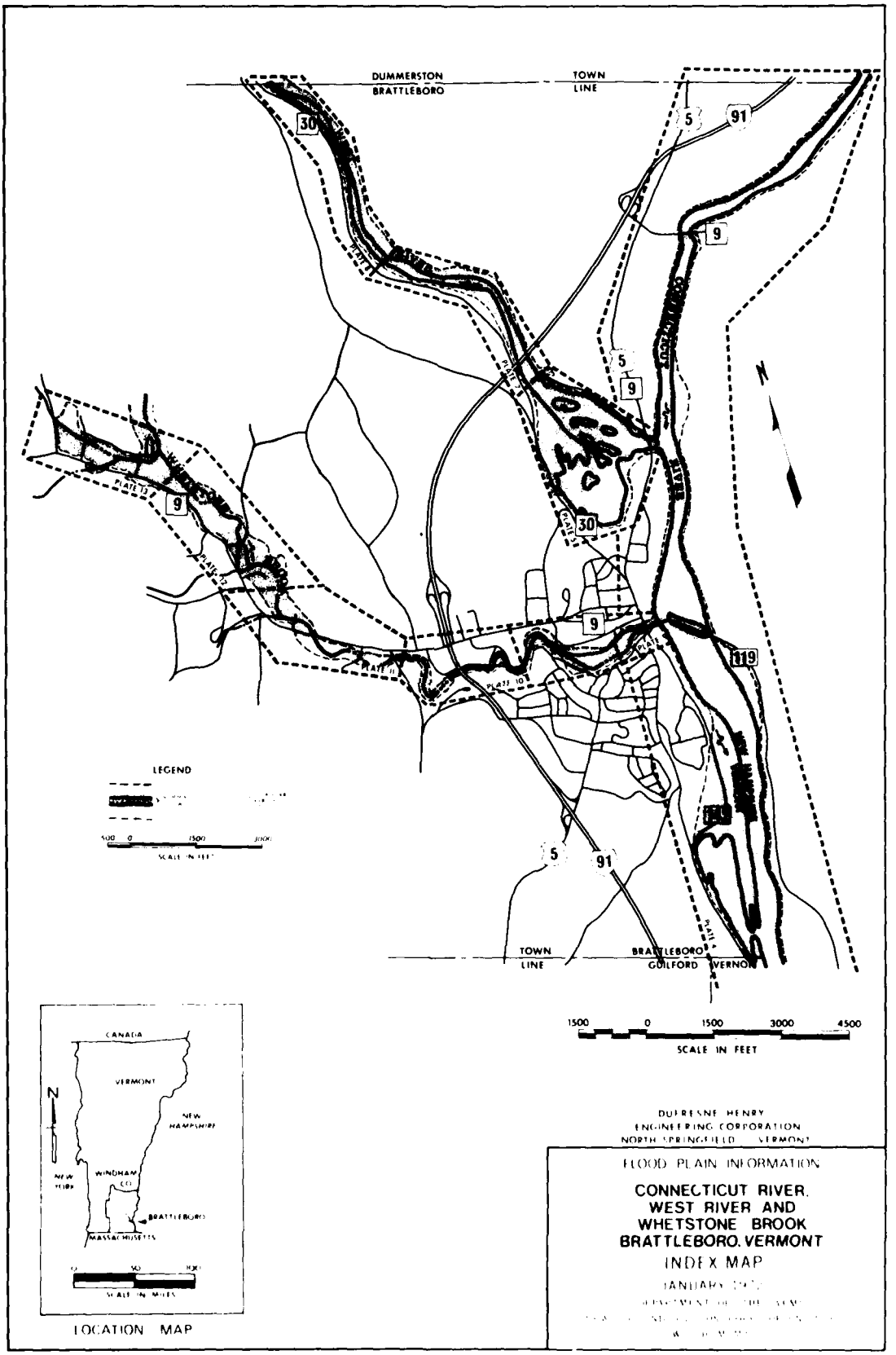
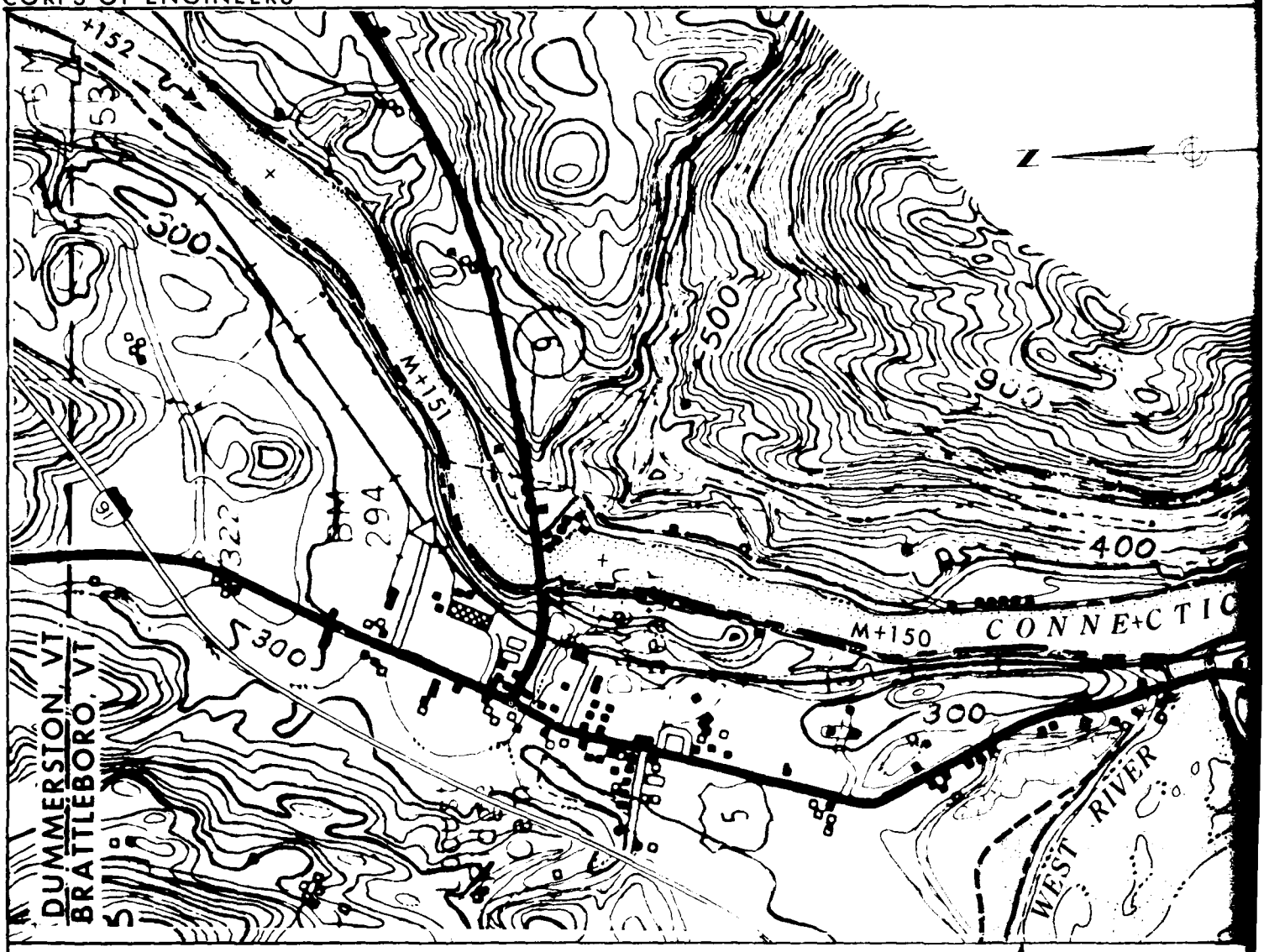

DUMMERSTON
BRATTLEBORO
TOWN
LINE
30
5
91
9
N
PLATE 9
PLATE 10
PLATE 11
PLATE 12
PLATE 13
PLATE 14
PLATE 15
PLATE 16
PLATE 17
PLATE 18
PLATE 19
LEGEND
SCALE IN FEET
TOWN
LINE
BRATTLEBORO
GUILFORD
VERNON
1500 0 1500 3000 4500
SCALE IN FEET
CANADA
VERMONT
NEW HAMPSHIRE
NEW YORK
WINDHAM CO.
BRATTLEBORO
MASSACHUSETTS
SCALE IN MILES
LOCATION MAP
DUFRESNE HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD VERMONT
FLOOD PLAIN INFORMATION
CONNECTICUT RIVER,
WEST RIVER AND
WHETSTONE BROOK
BRATTLEBORO, VERMONT
INDEX MAP
JANUARY 19
DEPARTMENT OF THE ARMY

PLATE NO. 1

CORPS OF ENGINEERS



SCALE IN MI
0 0.25 0.5

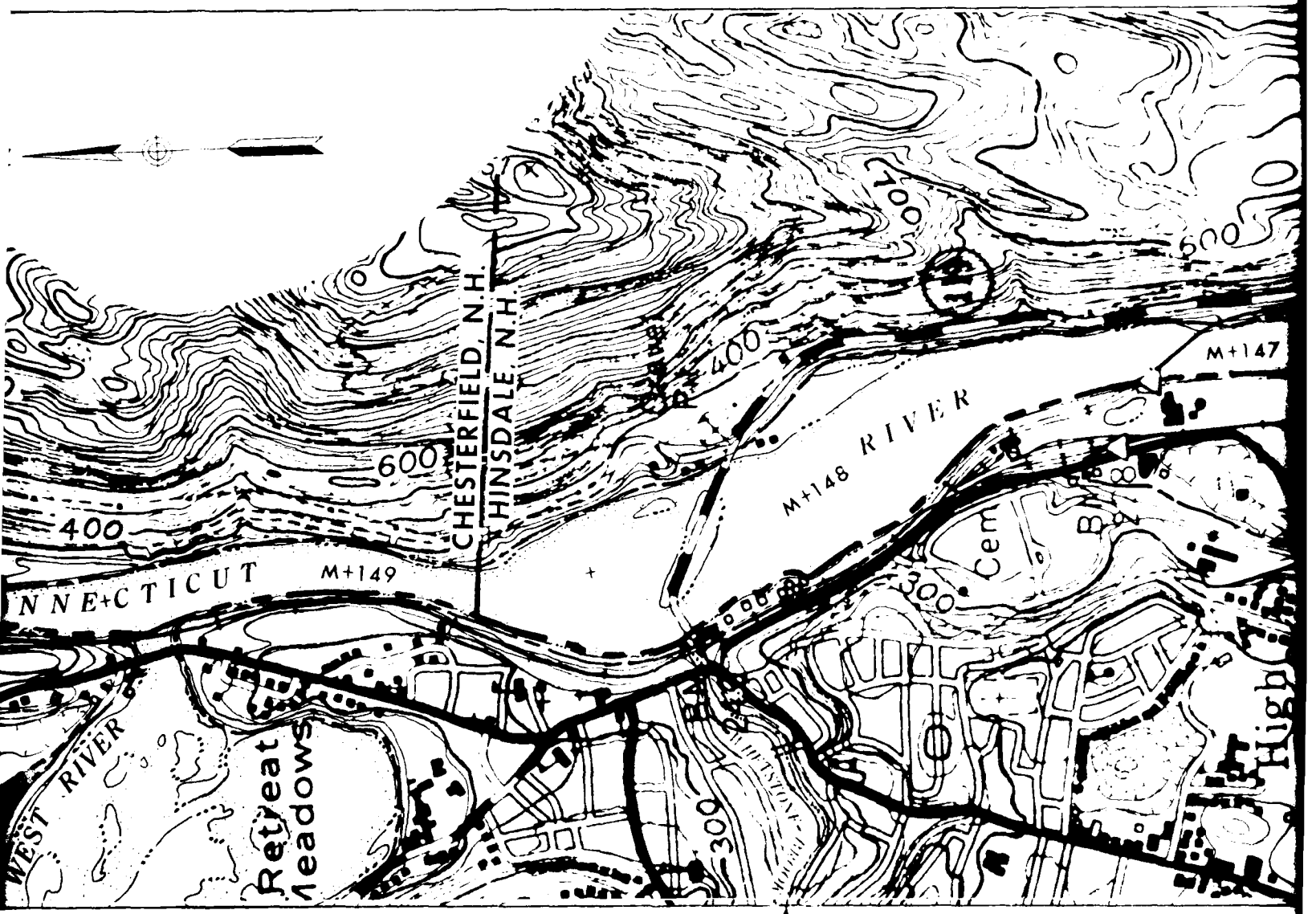
NOTES:

LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON THE GROUND AS EXPLAINED IN THE REPORT.

ELEVATIONS REFER TO MEAN SEA LEVEL DATUM.

CONTOUR INTERVAL EQUALS 20 FEET.

TOPOGRAPHY IS BASED ON PHOTOGRAMMETARY, HIGHWAY PLANS AND FIELD SURVEYS.



FOR CONTINUATION SEE PLATE NO 5

FOR CONTINUATION SEE PLATE NO 9

SCALE IN MILES

0 25 0 5 0 75 1 0

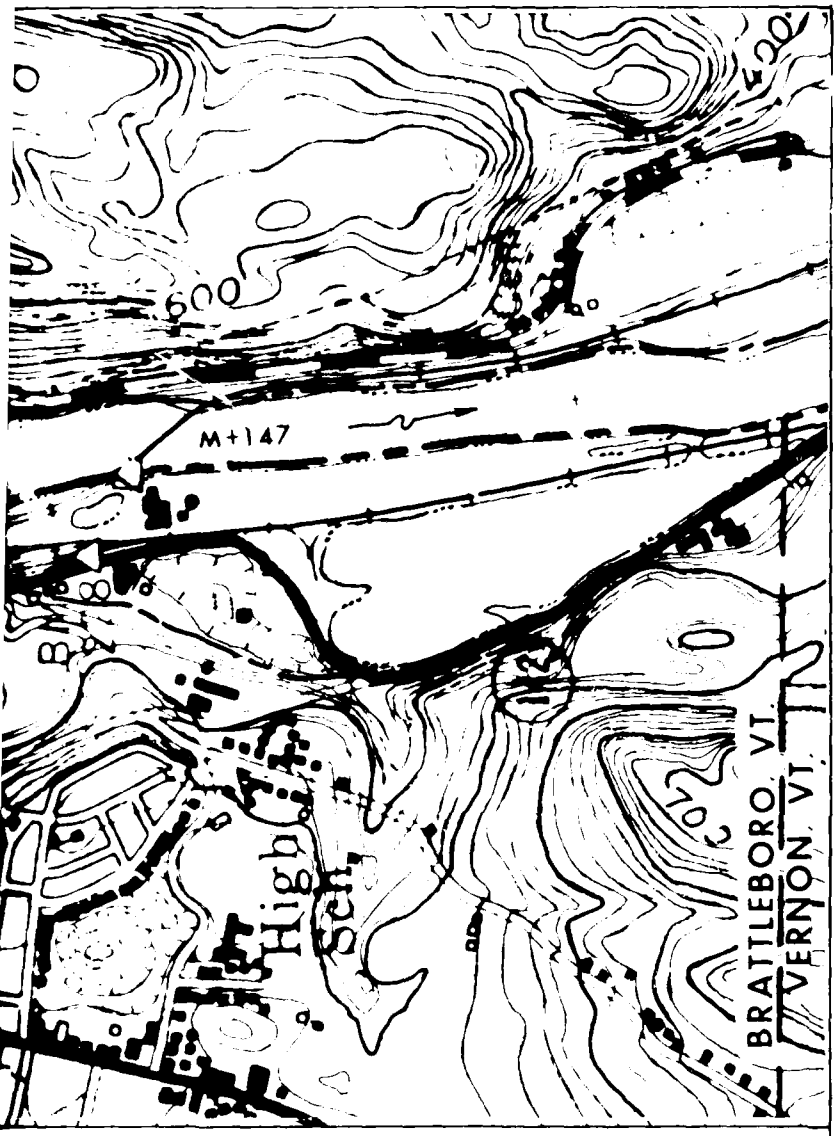
LEGEND

NORMAL FLOW

INTERMEDIATE REGIONAL FLOOD

STANDARD PROJECT FLOOD

U S ARMY



SEE PLATE NO 9

DUFRESNE HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD VERMONT

STANDARD
PROJECT
FLOOD

FLOOD PLAIN INFORMATION

CONNECTICUT RIVER
BRATTLEBORO, VERMONT

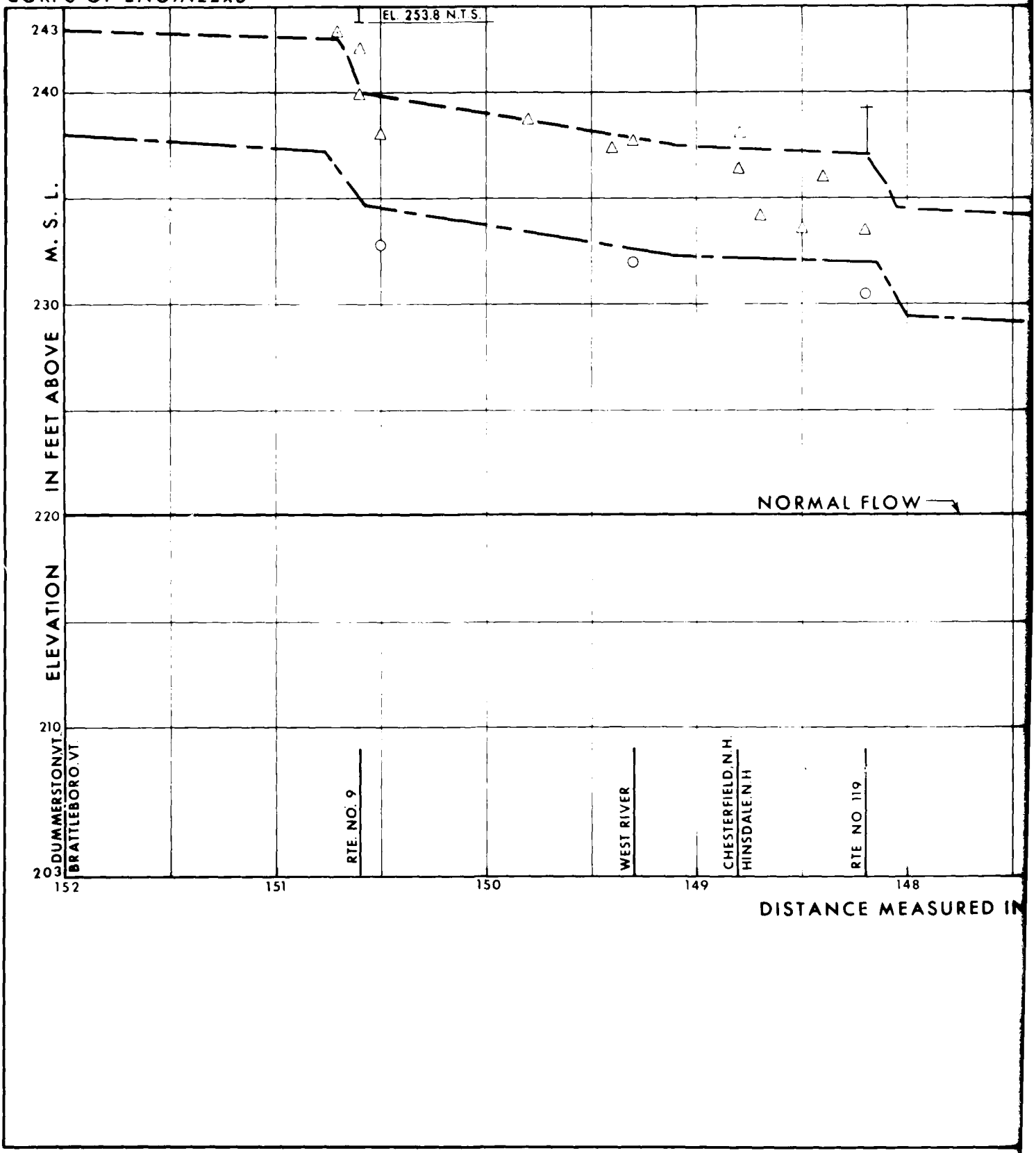
PLAN

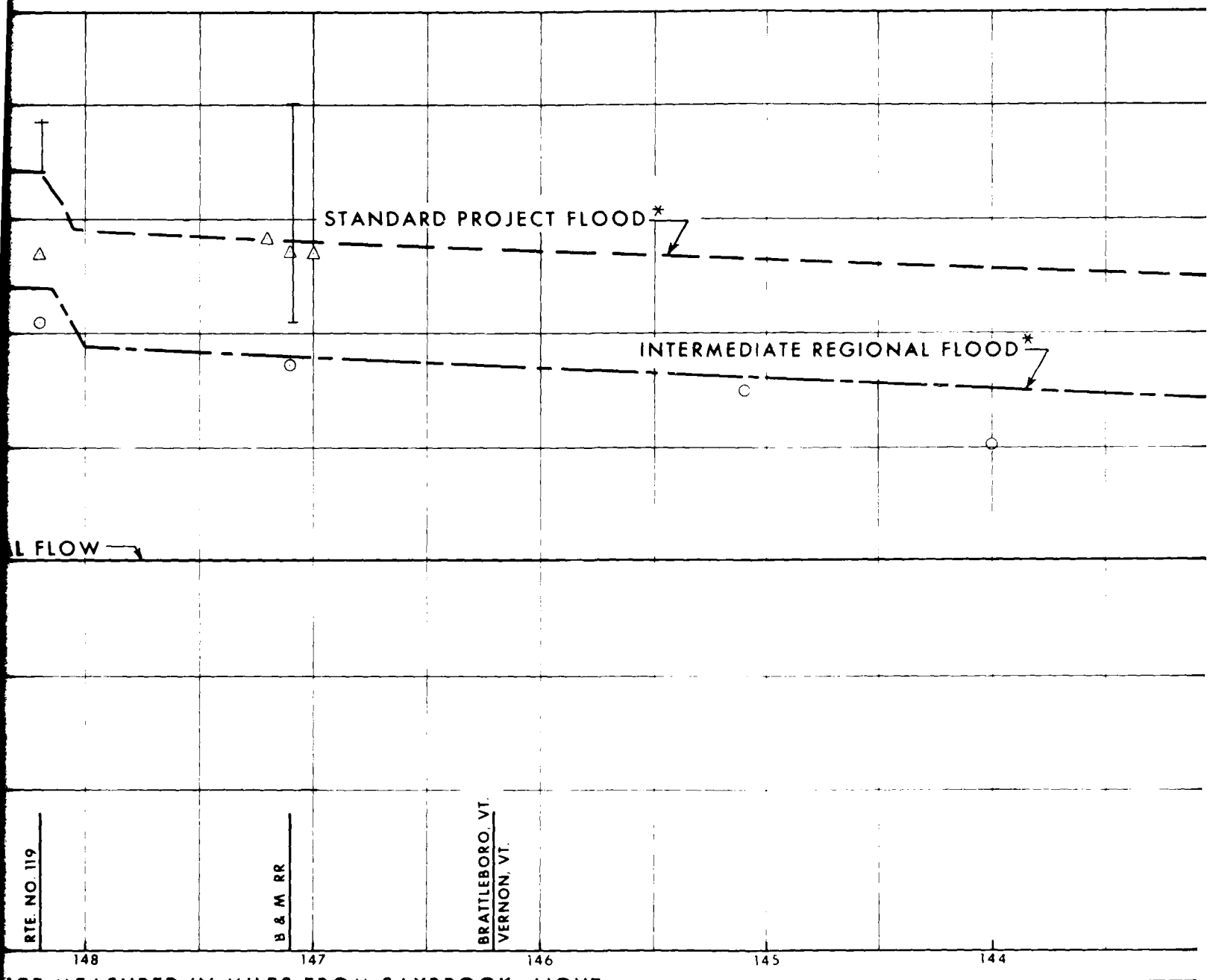
STA MILE 146 2 TO MILE 152 0
JANUARY 1972

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION CORPS OF ENGINEERS
WALTHAM MASS

PLATE NO. 4

CORPS OF ENGINEERS





NCE MEASURED IN MILES FROM SAYBROOK LIGHT

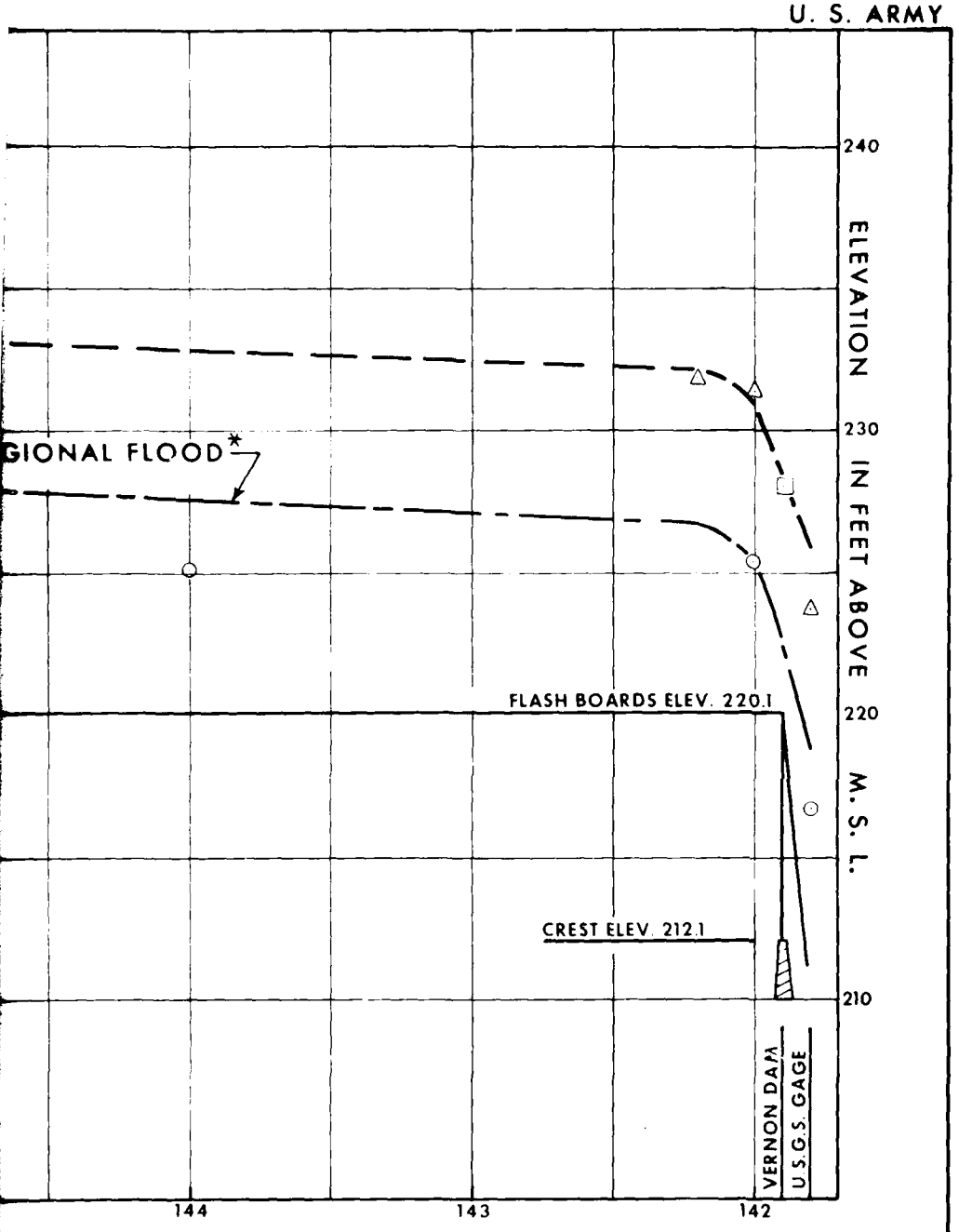
LEGEND

- I BRIDGE
- DAM
- □ OBSERVED 1927 HIGH WATER MARK
- △ OBSERVED 1936 HIGH WATER MARK
- ○ OBSERVED 1938 HIGH WATER MARK
- * MODIFIED BY FIVE EXISTING FLOOD CONTROL DAMS NORTH OF BRATTLEBORO
- N T S NOT TO SCALE

DUFRESNE-HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD, VERMONT

NE

U. S. ARMY



FLOOD PLAIN INFORMATION

CONNECTICUT RIVER

BRATTLEBORO, VERMONT

PROFILE

STA. MILE 141.8 TO MILE 152.0

JANUARY 1972

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION CORPS OF ENGINEERS

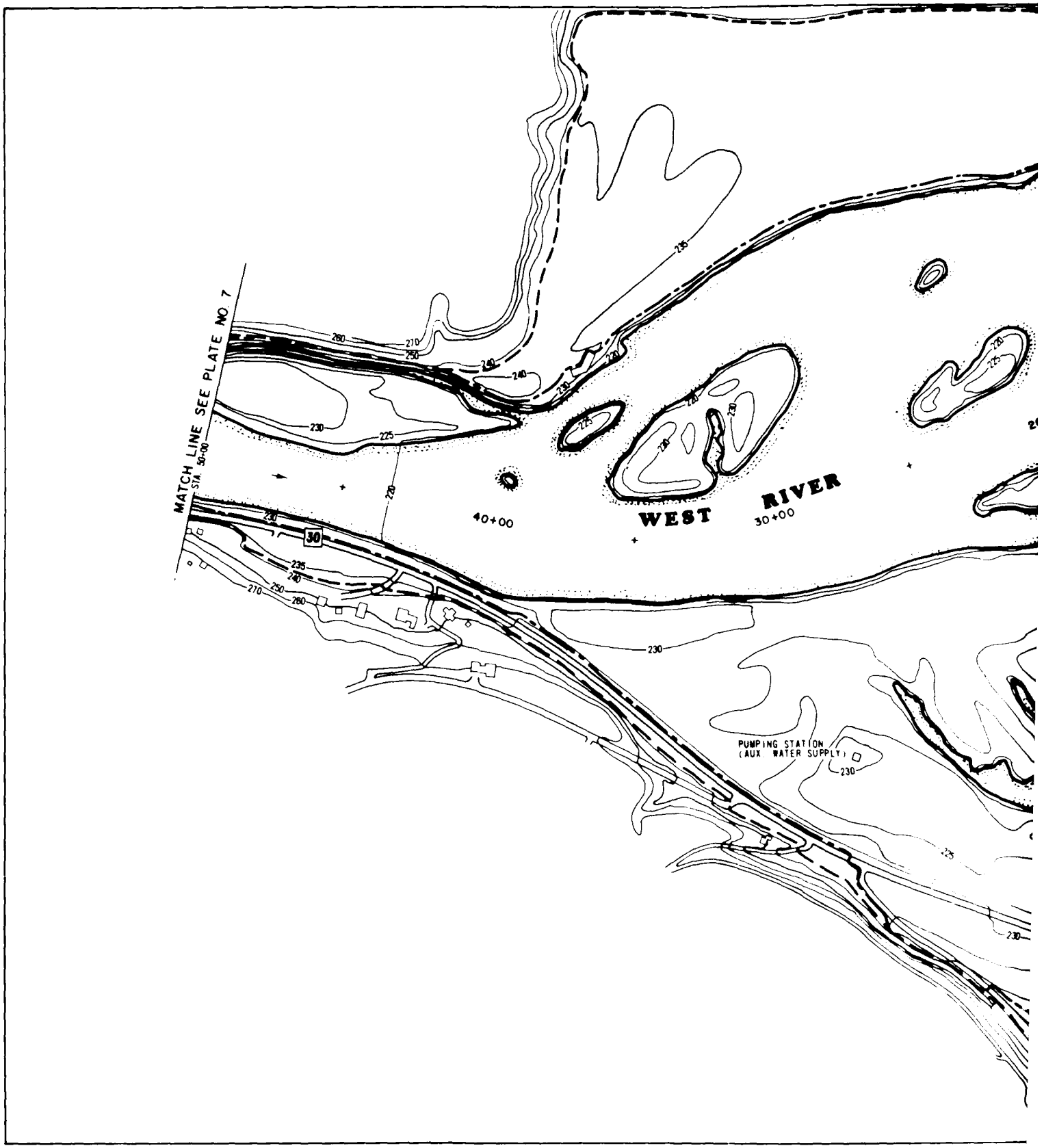
WALTHAM MASS

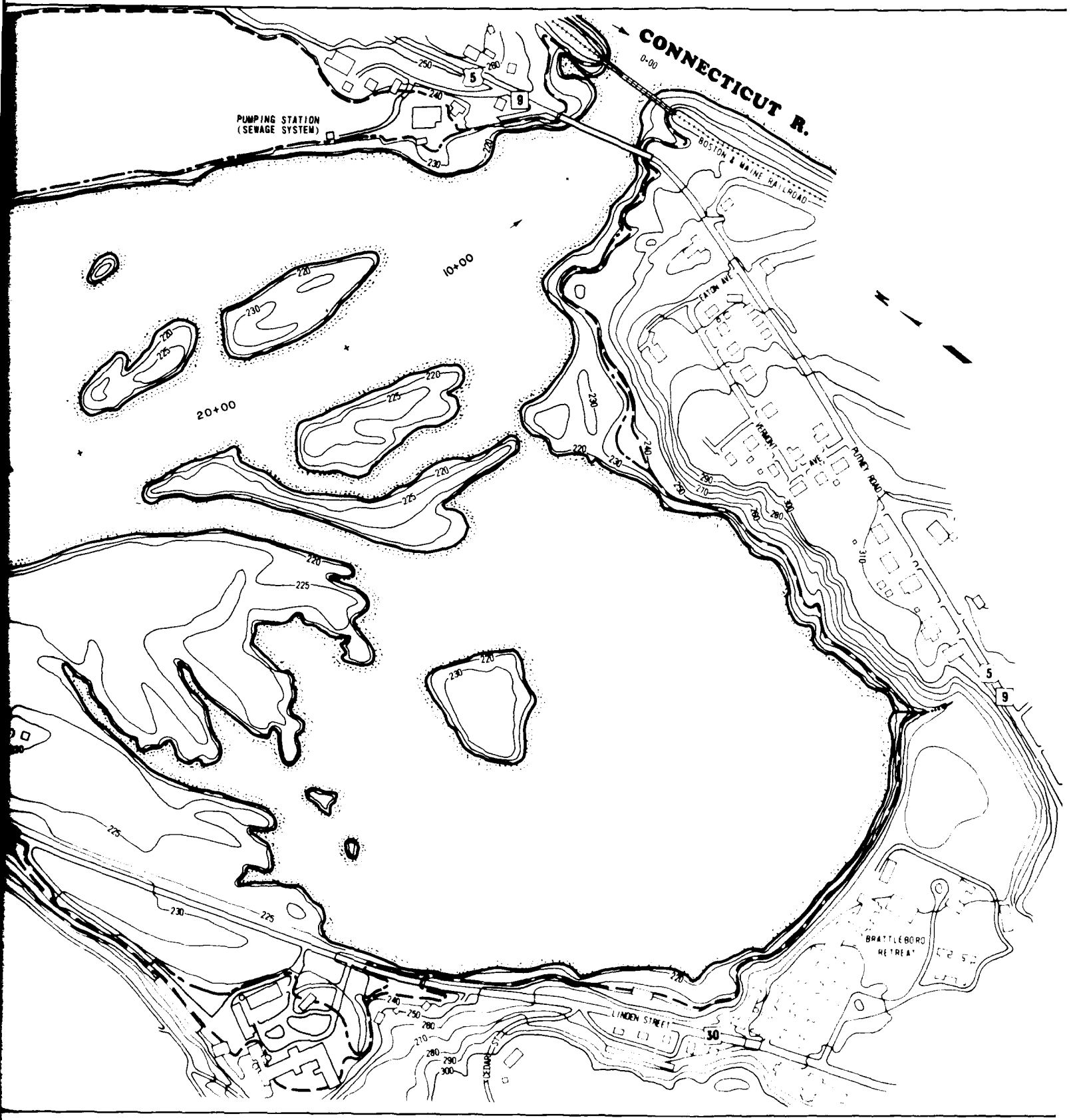
DUFRESNE-HENRY

GINEERING CORPORATION

TH SPRINGFIELD, VERMONT

PLATE NO. 4A


MATCH LINE SEE PLATE NO. 7
STA 50+00
WEST RIVER
40+00
30+00
30
PUMPING STATION
(AUX WATER SUPPLY)
235
240
270
250
260
230
225
220


CONNECTICUT R.
0-00
PUMPING STATION
(SEWAGE SYSTEM)
BOSTON & MAINE RAILROAD
10+00
20+00
EATON AVE.
VERMONT AVE.
PUTNEY ROAD
BRATTLEBORO RETREAT
LINDEN STREET
CEDAR ST.
5
9
30

U S ARMY

DUFRESNE-HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD VERMONT

FLOOD PLAIN INFORMATION

WEST RIVER

BRATTLEBORO, VERMONT

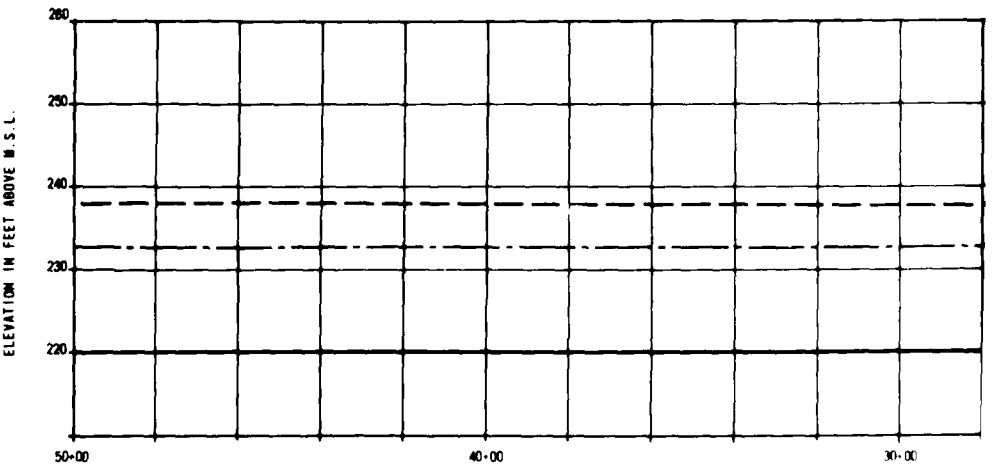
PLAN

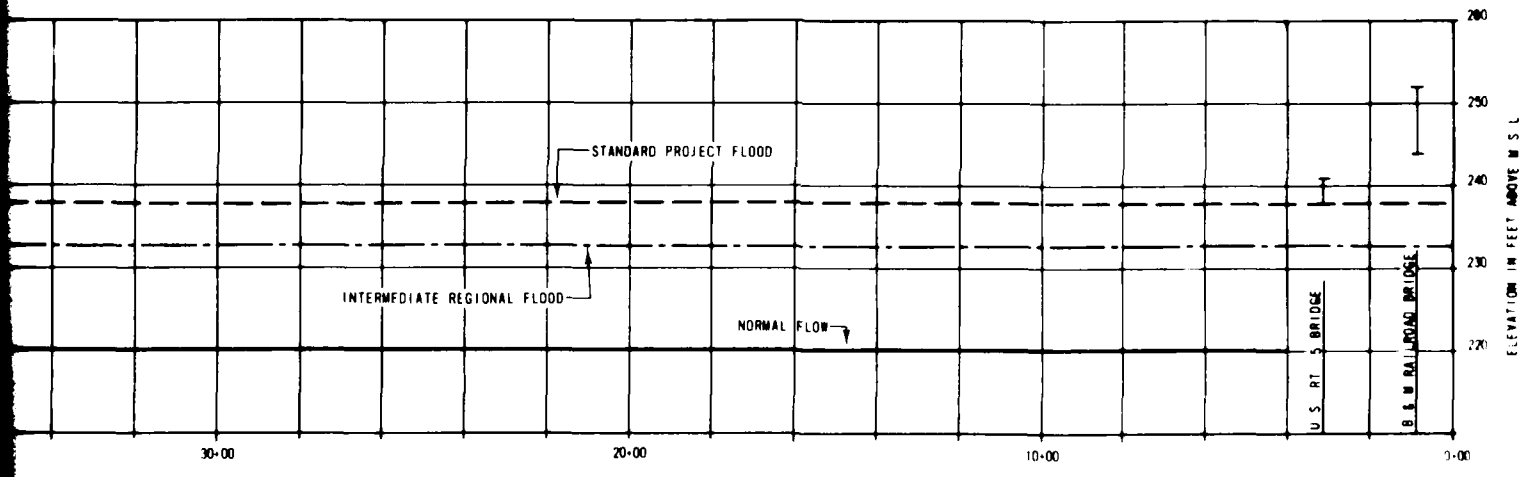
STA 0+00 – 50+00

JANUARY 1972

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO 5

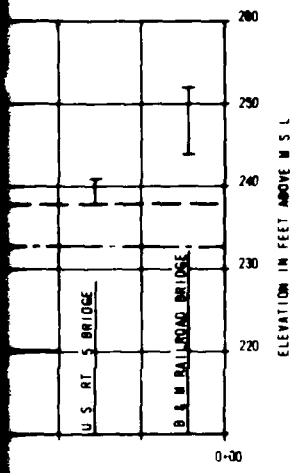

ELEVATION IN FEET ABOVE M.S.L.
260
250
240
230
220
50+00
40+00
30+00
DISTANCE (


STANDARD PROJECT FLOOD
INTERMEDIATE REGIONAL FLOOD
NORMAL FLOW
U.S. RT. 5 BRIDGE
B & M RAILROAD BRIDGE
260
250
240
230
220
ELEVATION IN FEET ABOVE M.S.L.
30+00
20+00
10+00
0+00
DISTANCE IN FEET FROM CONNECTICUT RIVER

U S ARMY

LEGEND

I BRIDGE



DUFRESNE-HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD VERMONT

FLOOD PLAIN INFORMATION

WEST RIVER

BRATTLEBORO, VERMONT

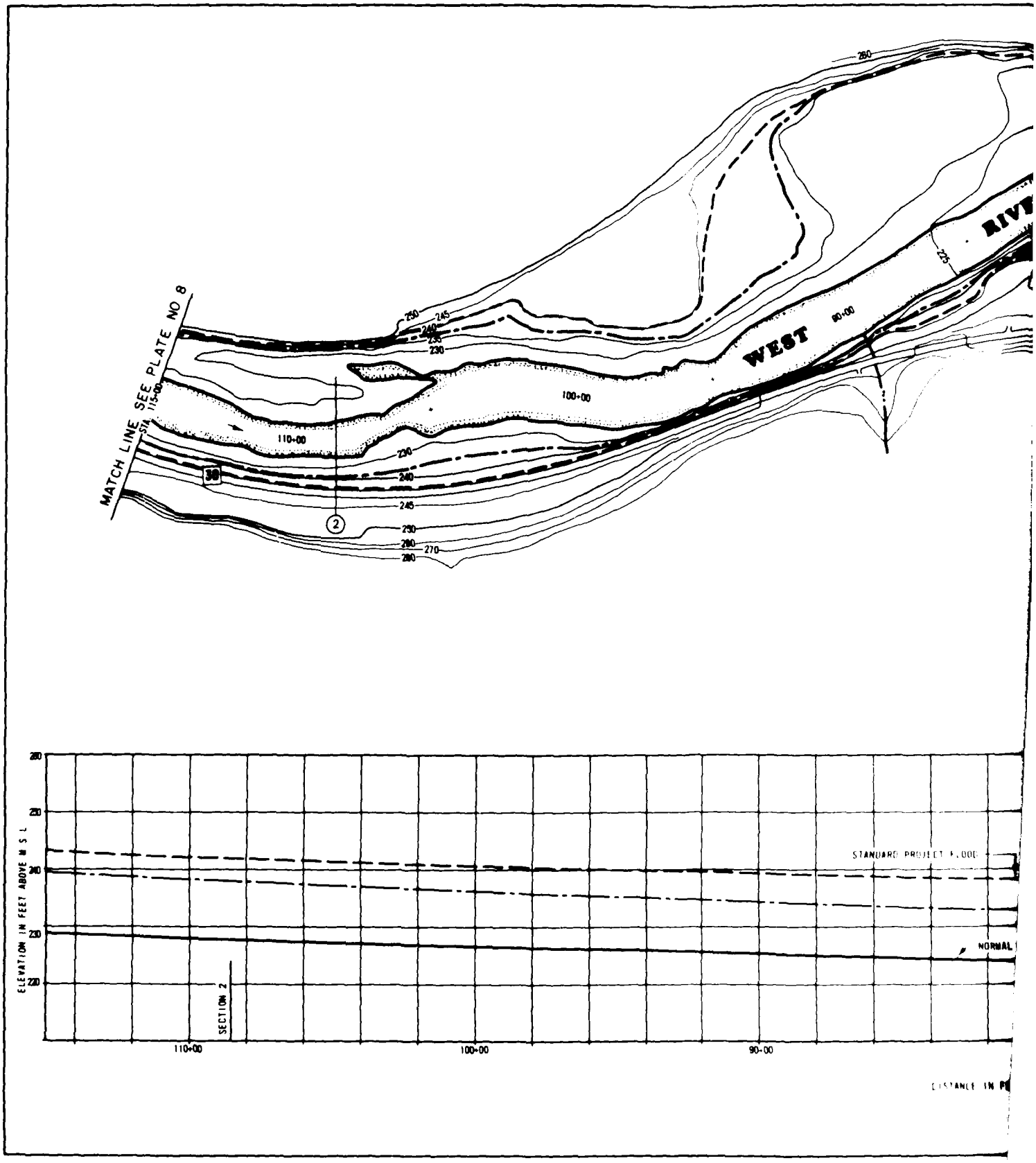
PROFILE

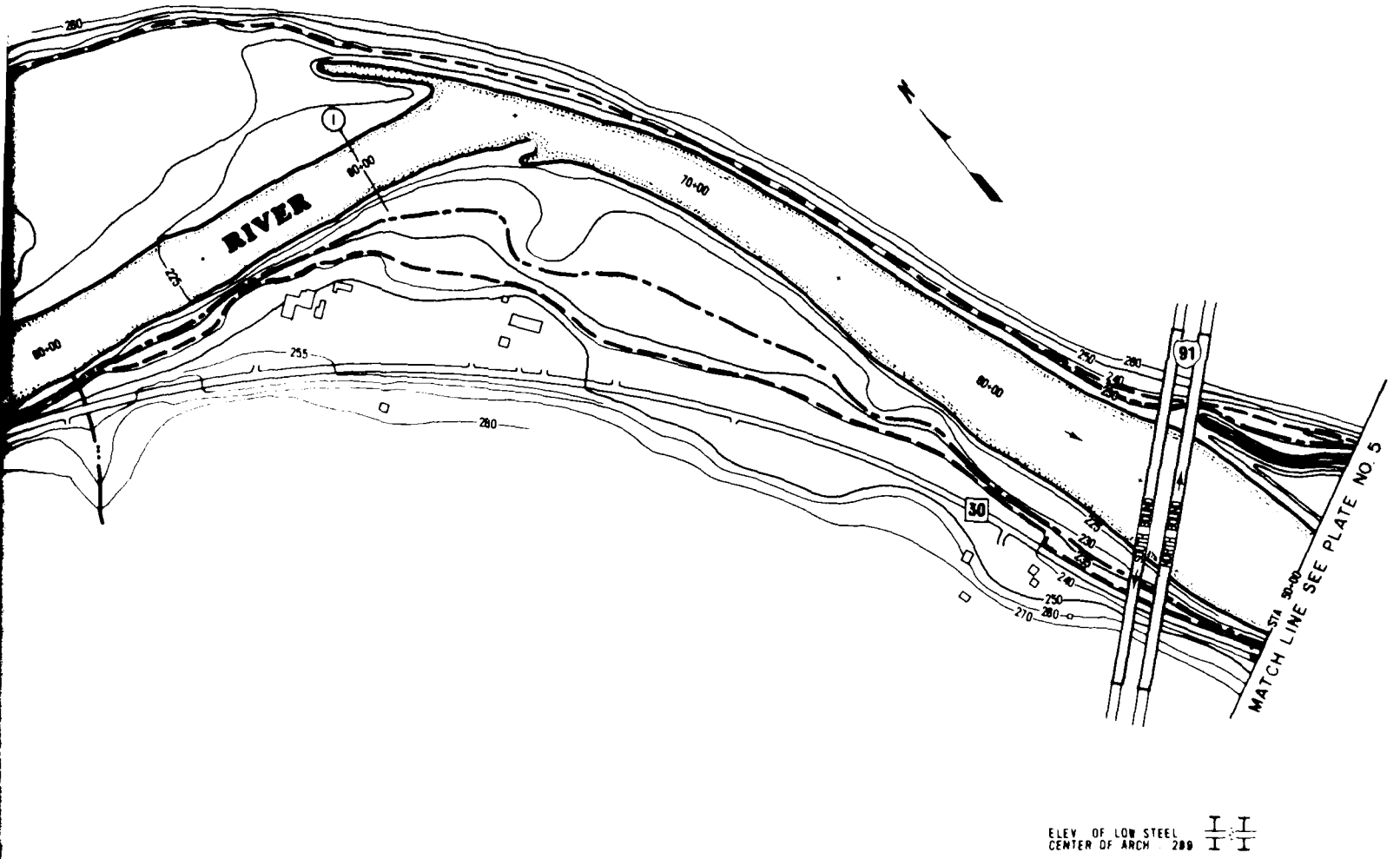
STA 0+00 50+00

JANUARY 1972

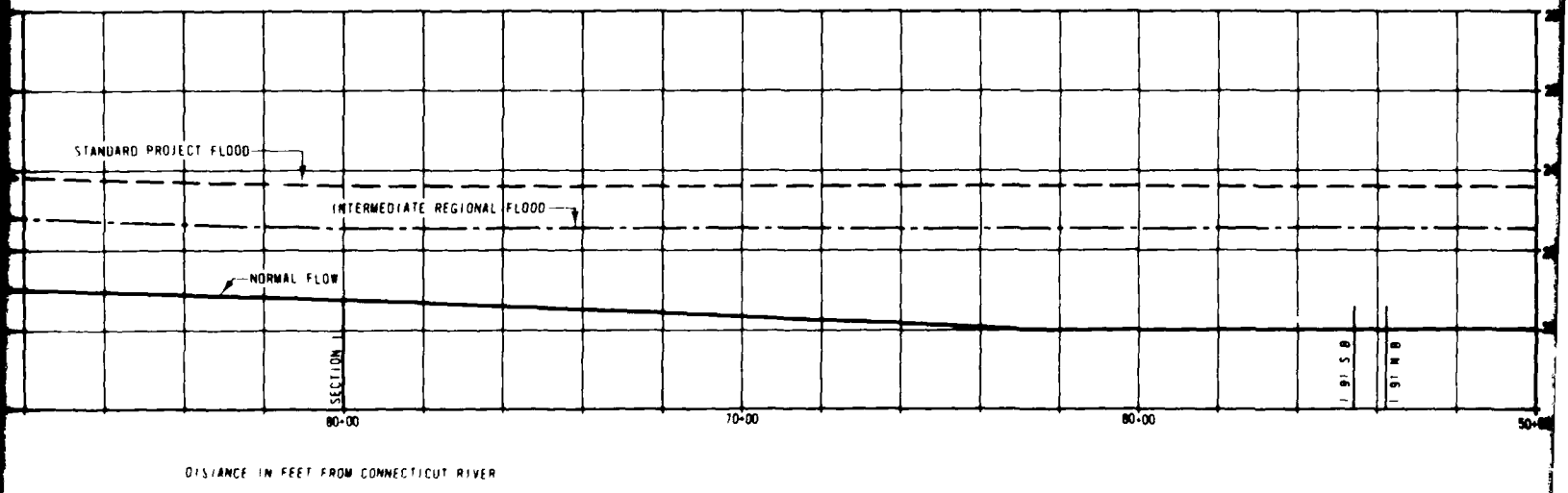
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO 6


MATCH LINE SEE PLATE NO 8
STA 115+00
110+00
100+00
90+00
WEST
RIVE
280
250
245
240
235
230
225
220
270
38
2
SECTION 2
ELEVATION IN FEET ABOVE M S L
STANDARD PROJECT FLOOD
NORMAL
110+00
100+00
90+00
DISTANCE IN F



ELEV OF LOW STEEL
CENTER OF ARCH 289



DISTANCE IN FEET FROM CONNECTICUT RIVER

U S ARMY

LEGEND

NORMAL FLOW
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD

I BRIDGE (6) CROSS SECTION

SCALE IN FEET

200 0 200 400

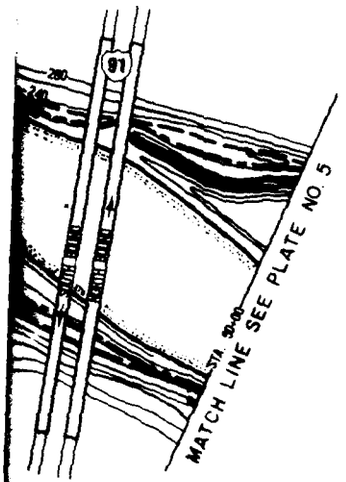
NOTES:

LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON THE GROUND AS EXPLAINED IN THE REPORT

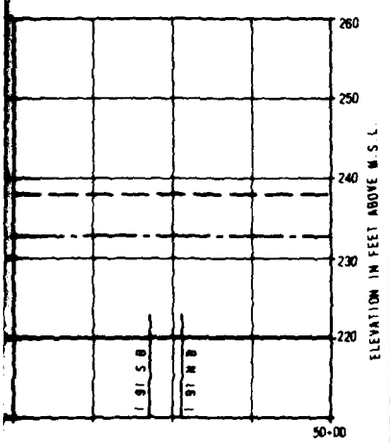
ELEVATIONS REFER TO MEAN SEA LEVEL DATUM

TOPOGRAPHY IS BASED ON PHOTOGRAMMETRY VSHD PLANS AND FIELD SURVEYS

CONTOUR INTERVAL IS AS SHOWN



OF LOW STEEL OF ARCH = 288



DUFRESNE HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD VERMONT

FLOOD PLAIN INFORMATION

WEST RIVER

BRATTLEBORO, VERMONT

PLAN AND PROFILE

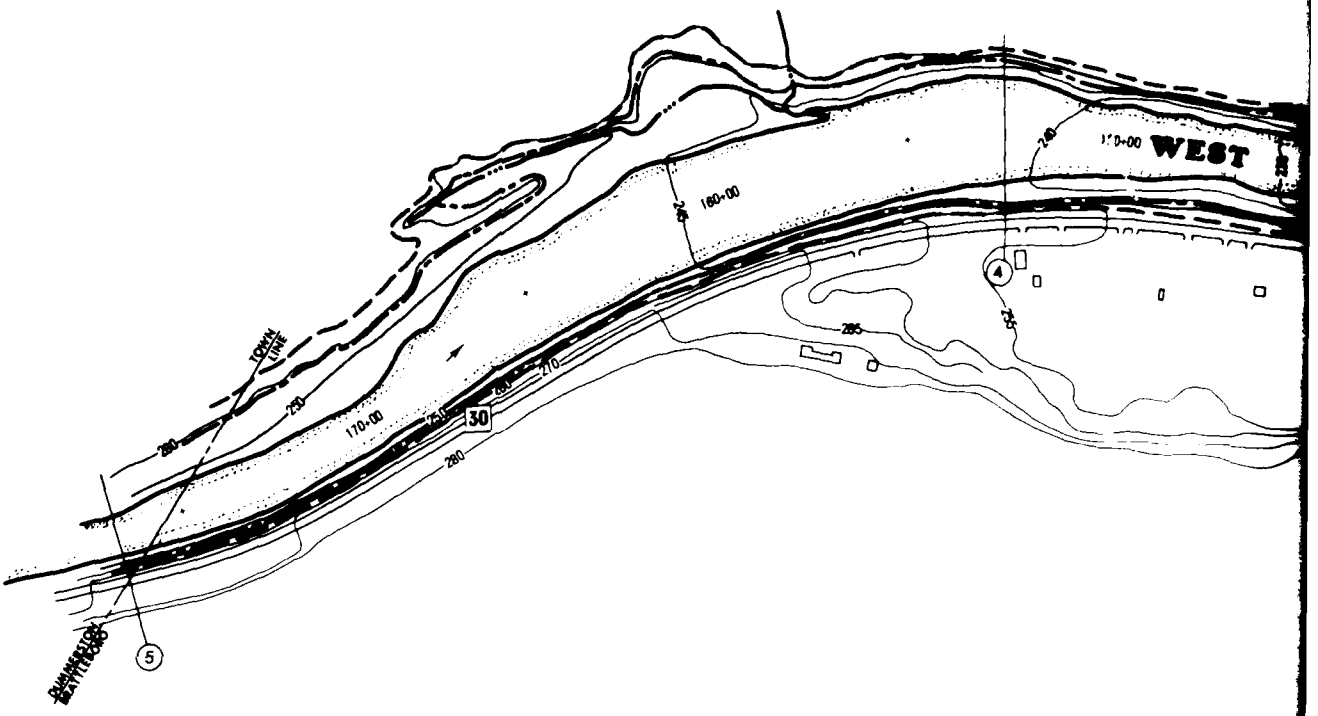
STA 50+00 - 115+00

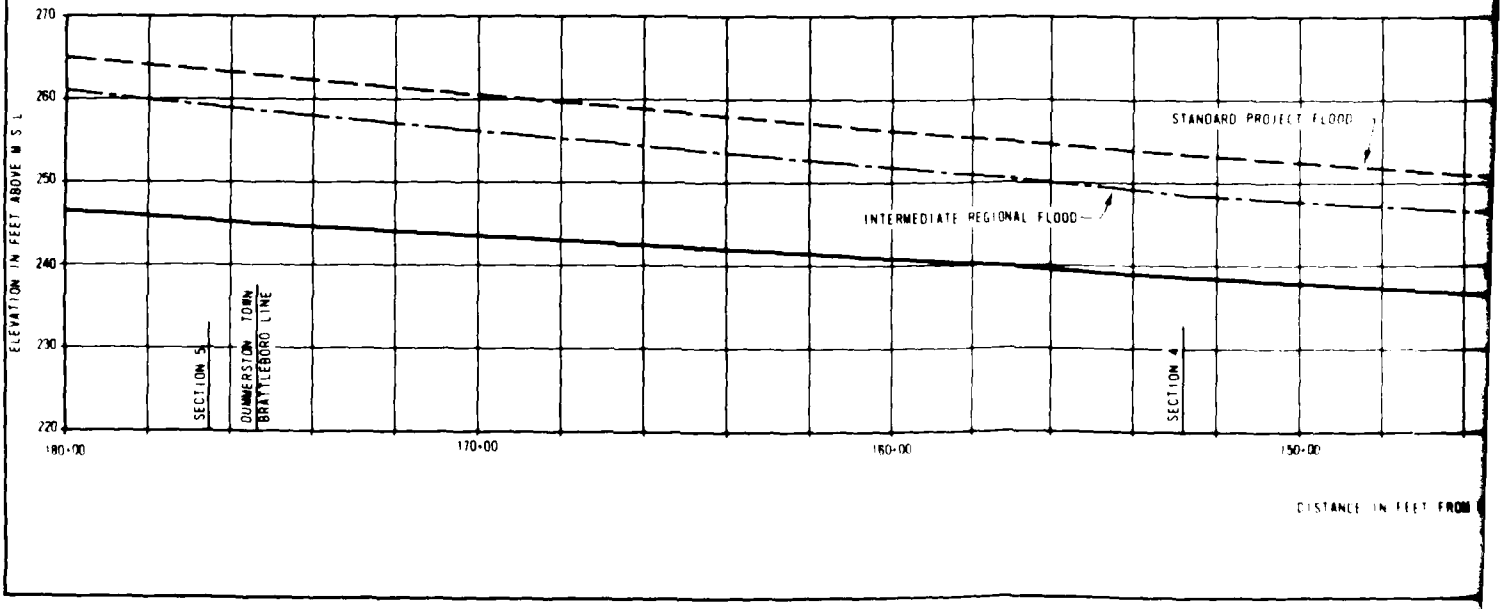
JANUARY 1972

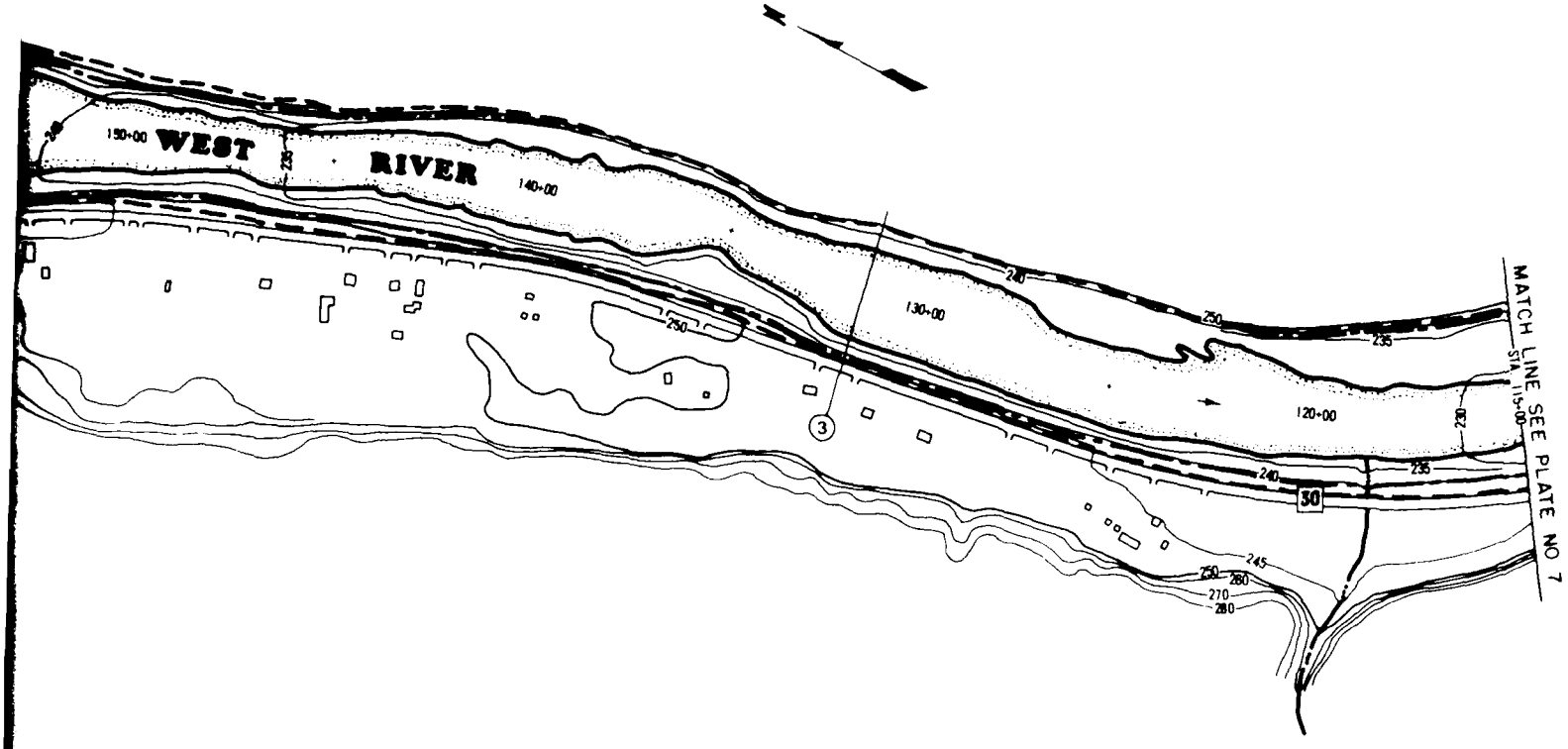
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

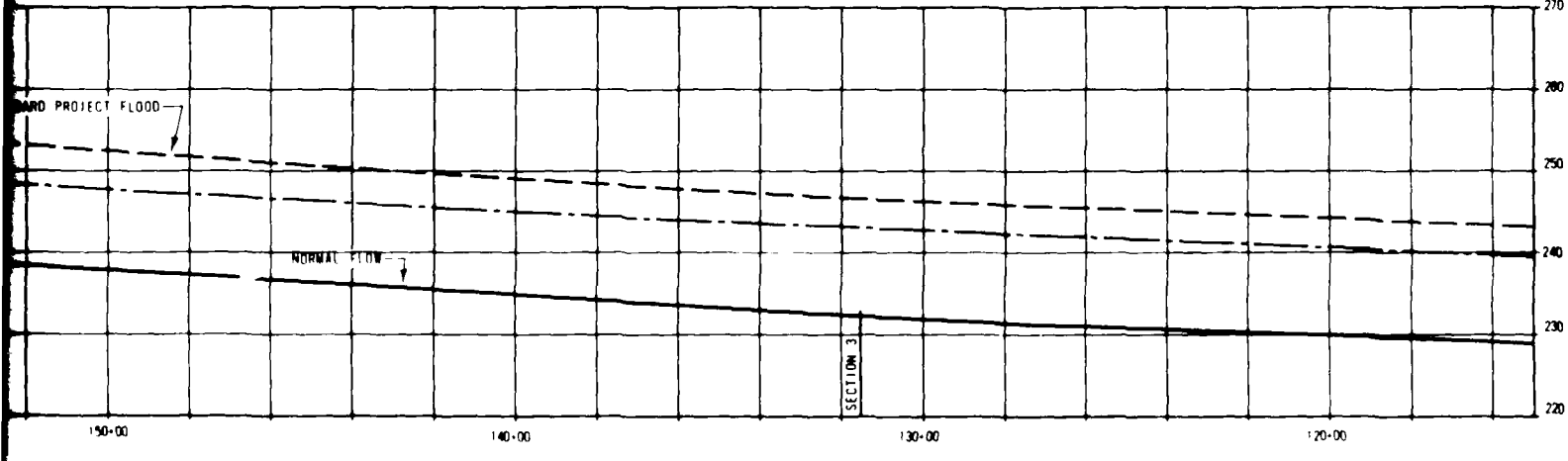
PLATE NO 7

CORPS OF ENGINEERS






WEST
RIVER
150+00
140+00
130+00
120+00
MATCH LINE SEE PLATE NO 7
STA 115+00
30
3
230
235
240
245
250
260
270
280


ARD PROJECT FLOOD
NORMAL FLOW
SECTION 3
270
260
250
240
230
220
ELEVATION IN FEET ABOVE M.S.L.
150+00
140+00
130+00
120+00
DISTANCE IN FEET FROM CONNECTICUT RIVER

LEGEND

NORMAL FLOW
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD

(6) CROSS SECTION

SCALE IN FEET
200 0 200 400

NOTES:

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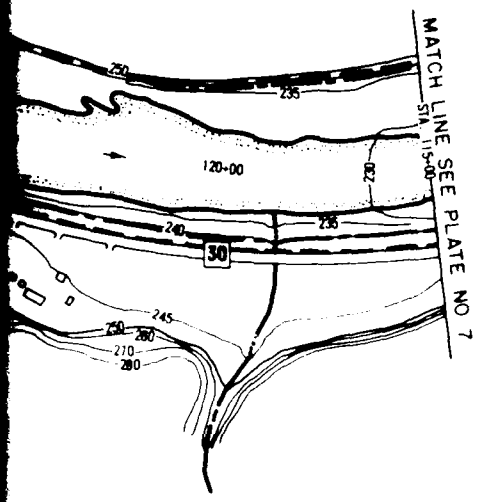
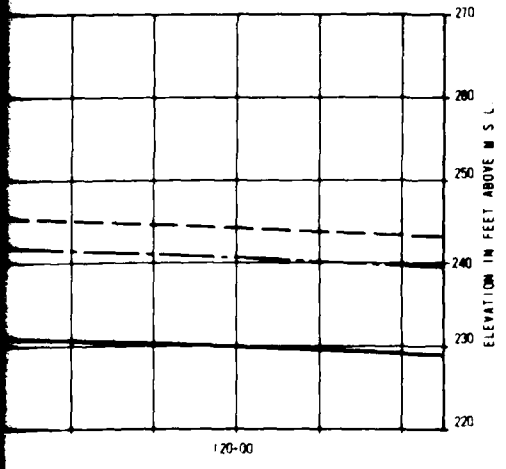
ELEVATIONS REFER TO MEAN SEA LEVEL DATUM

TOPOGRAPHY IS BASED ON PHOTOGRAMMETRY VSHD PLANS AND FIELD SURVEYS

CONTOUR INTERVAL IS AS SHOWN





DUFRESNE-HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD VERMONT

FLOOD PLAIN INFORMATION

WEST RIVER

BRATTLEBORO, VERMONT

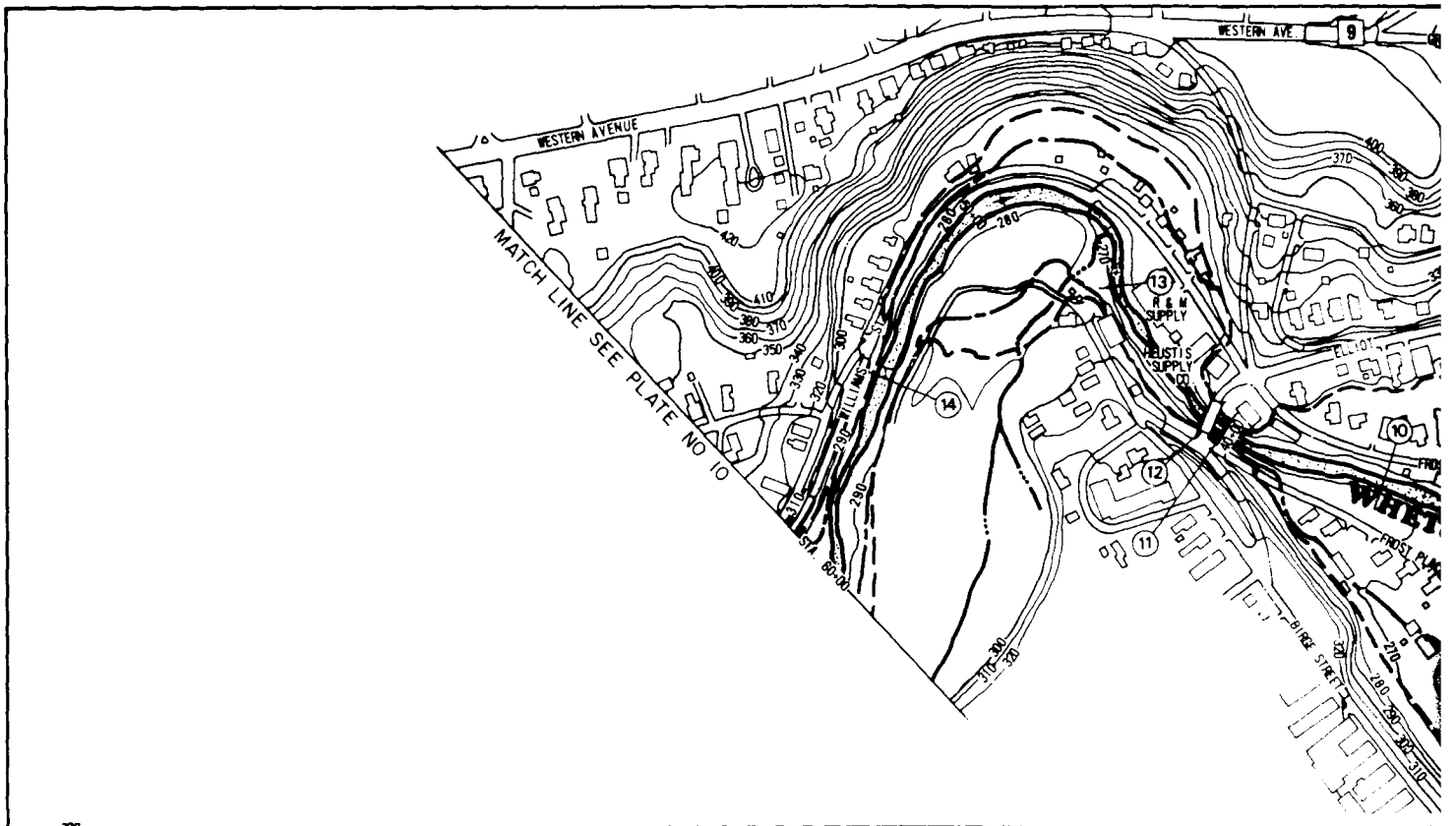
PLAN AND PROFILE

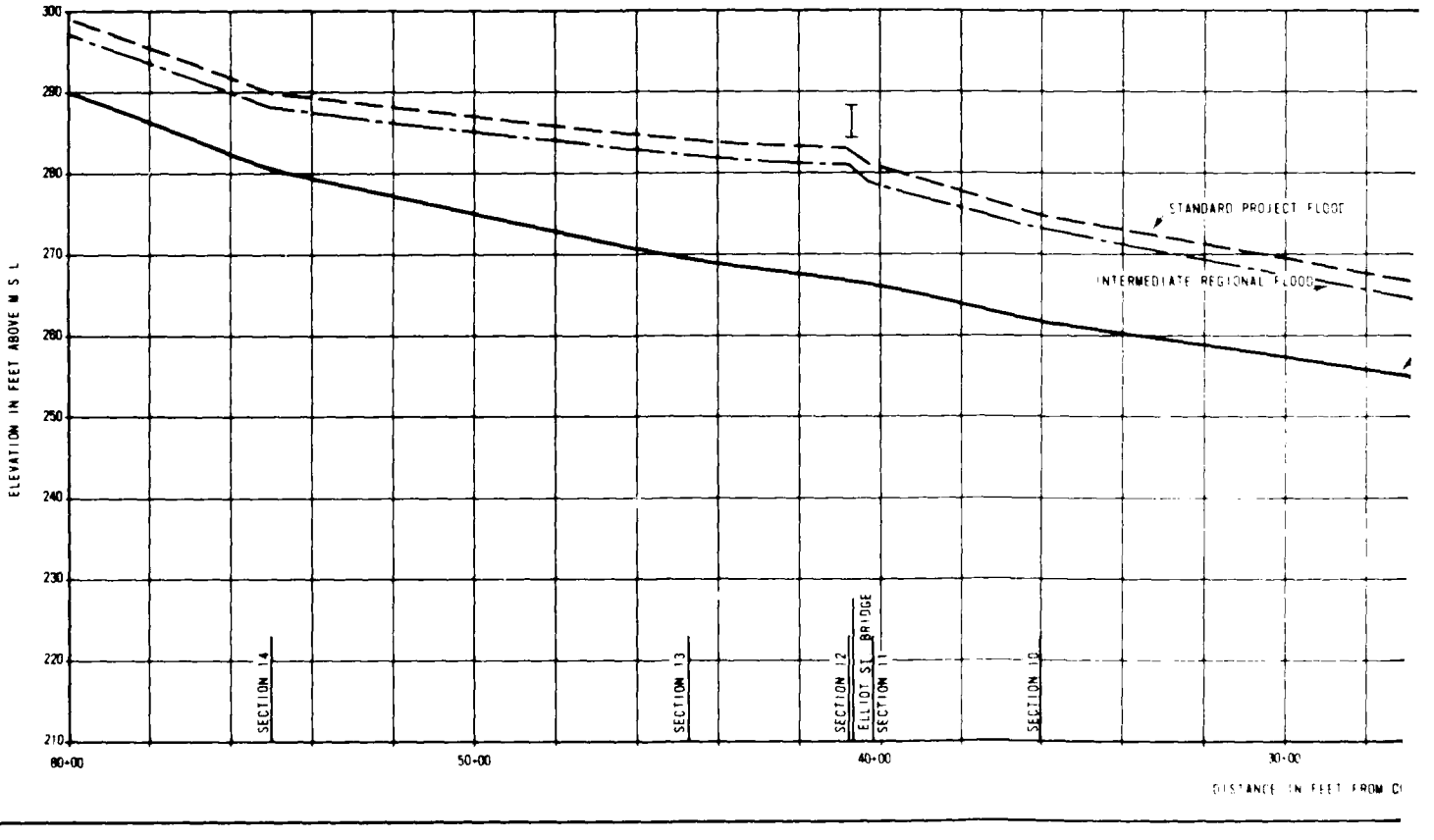
STA 115+00 180+00

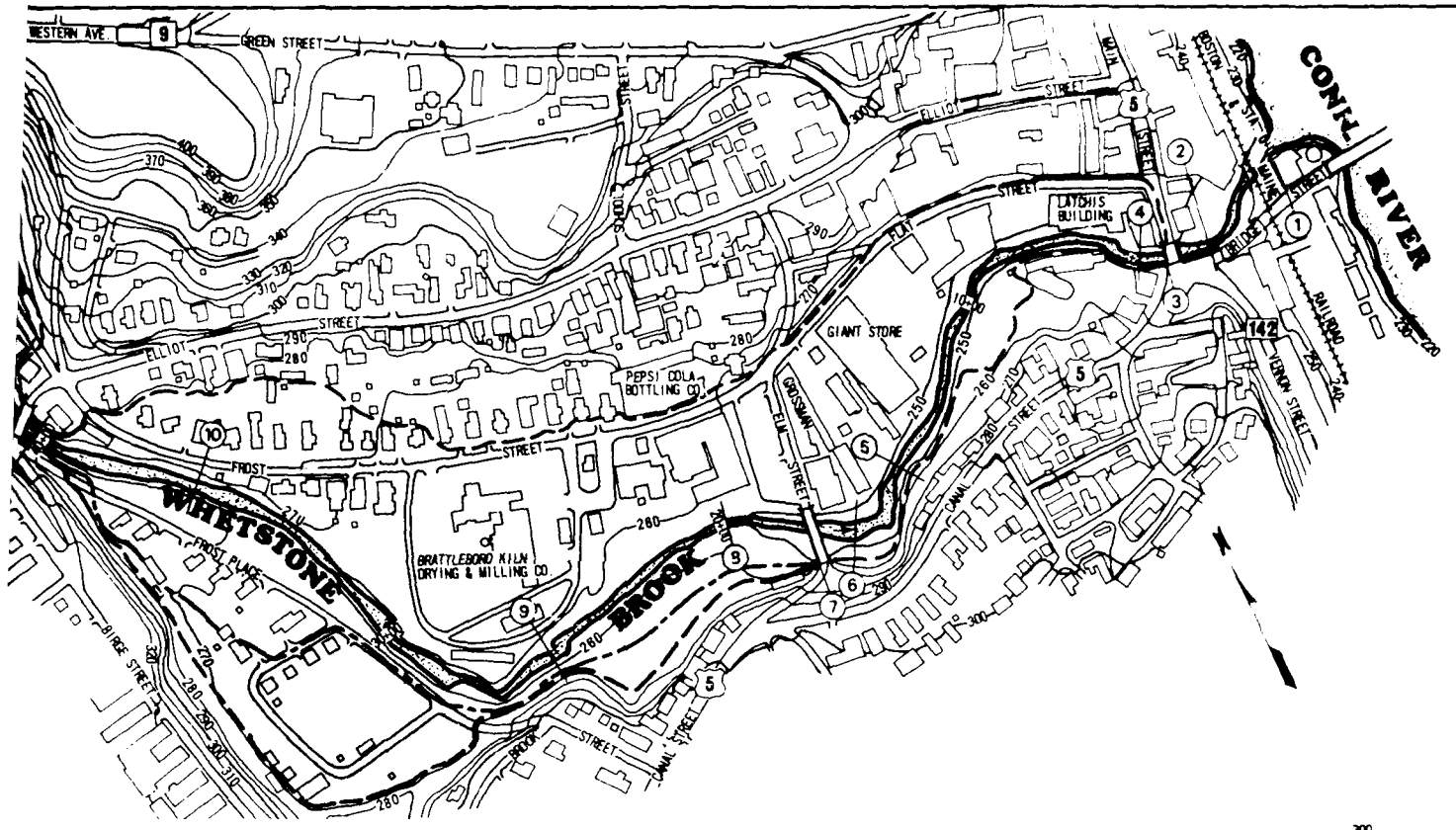
JANUARY 1972

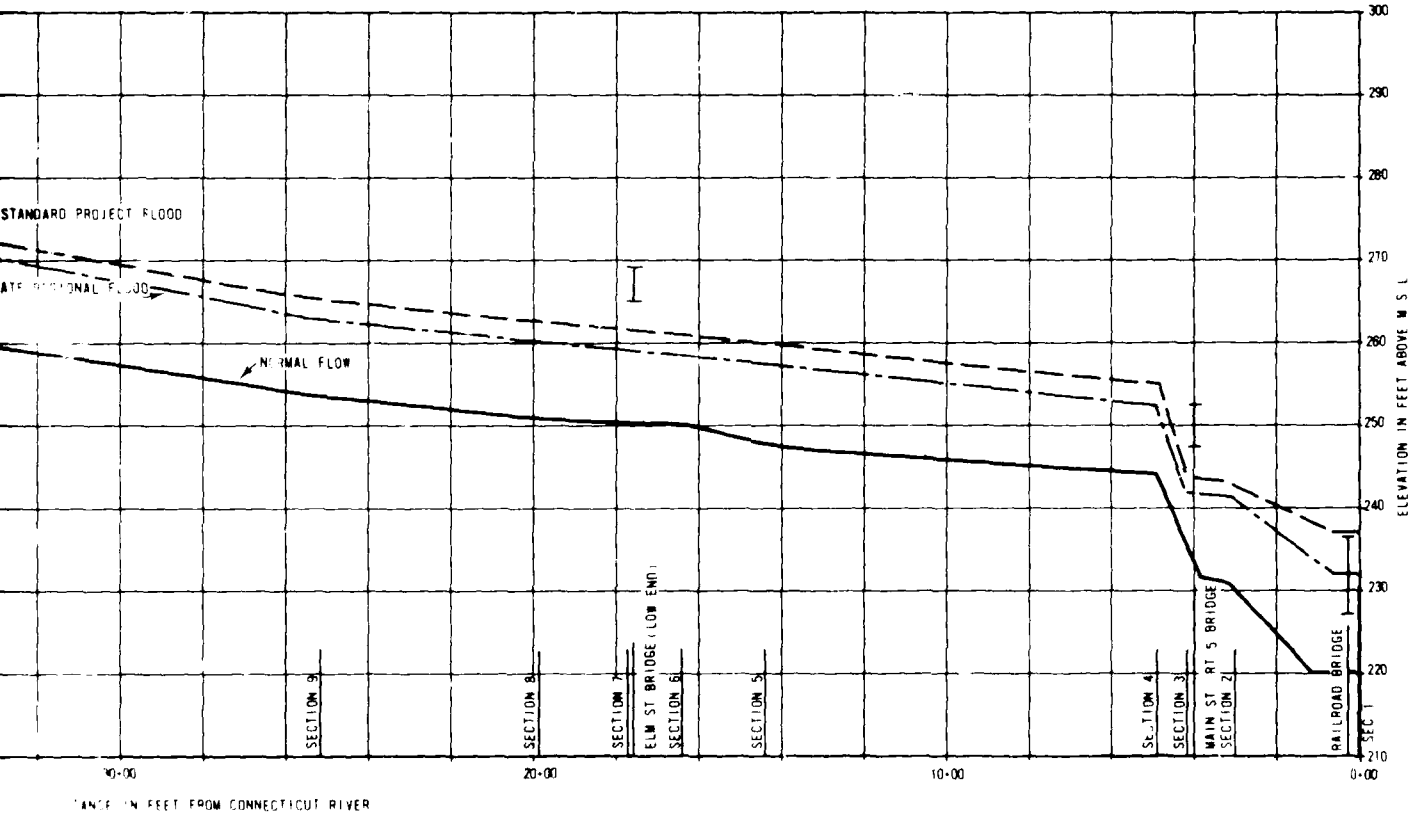
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS

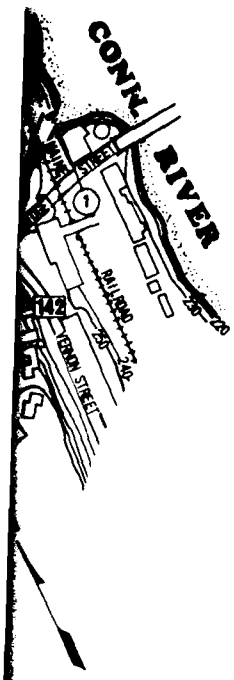
PLATE NO 8


WESTERN AVENUE
WESTERN AVE
MATCH LINE SEE PLATE NO 10
R & M SUPPLY
HEIST'S SUPPLY CO
ELLIOT
BRIDGE STREET
STA 60+00


ELEVATION IN FEET ABOVE M S L
300
290
280
270
260
250
240
230
220
210
STANDARD PROJECT FLOOD
INTERMEDIATE REGIONAL FLOOD
SECTION 14
SECTION 13
SECTION 12
ELLIOT ST BRIDGE
SECTION 11
SECTION 10
60+00
50+00
40+00
30+00
DISTANCE IN FEET FROM C


WESTERN AVE.
GREEN STREET
ELLIOT STREET
MAIN STREET
BOSTON & MAINE R.R.
CONN. RIVER
LATCHIS BUILDING
BRIDGE STREET
RAILROAD
VERNON STREET
142
GIANT STORE
PEPSI COLA BOTTLING CO.
GROSSMAN
ELM STREET
CANAL STREET
FROST
FROST PLACE
WHETSTONE
BROOK
BRATTLEBORO KILN DRYING & MILLING CO.
FLAT STREET


STANDARD PROJECT FLOOD
NORMAL FLOW
SECTION 9
SECTION 8
SECTION 7
ELM ST BRIDGE (LOW END)
SECTION 6
SECTION 5
SECTION 4
SECTION 3
MAIN ST RT 5 BRIDGE
SECTION 2
RAILROAD BRIDGE
SEC 1
ELEVATION IN FEET ABOVE M S L
DISTANCE IN FEET FROM CONNECTICUT RIVER



LEGEND

NORMAL FLOW
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD

I BRIDGE

(6) CROSS SECTION

SCALE IN FEET

200 0 200 400

NOTES:

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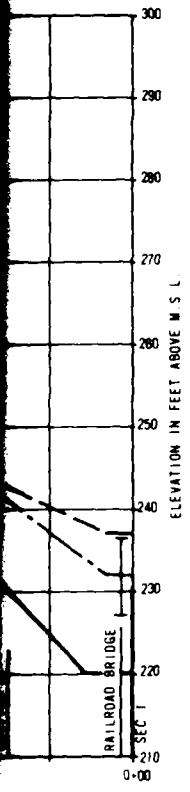
ELEVATIONS REFER TO MEAN SEA LEVEL DATUM

TOPOGRAPHY IS BASED ON PHOTOGRAMMETRY VSHD PLANS AND FIELD SURVEYS

CONTOUR INTERVAL IS AS SHOWN



DUFRESNE-HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD VERMONT

FLOOD PLAIN INFORMATION

WHETSTONE BROOK

BRATTLEBORO, VERMONT

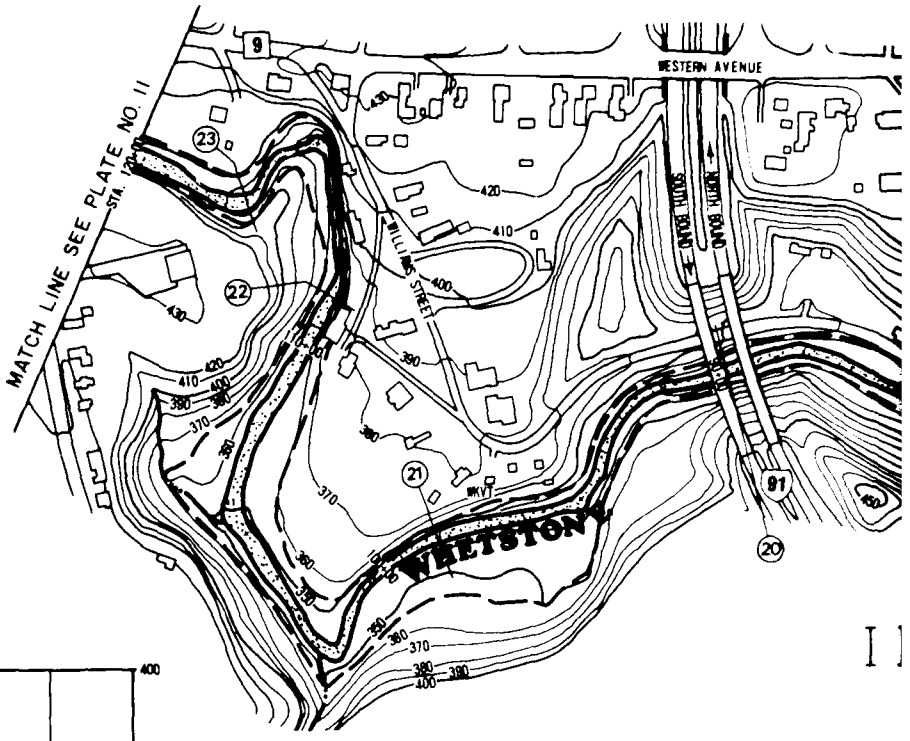
PLAN AND PROFILE

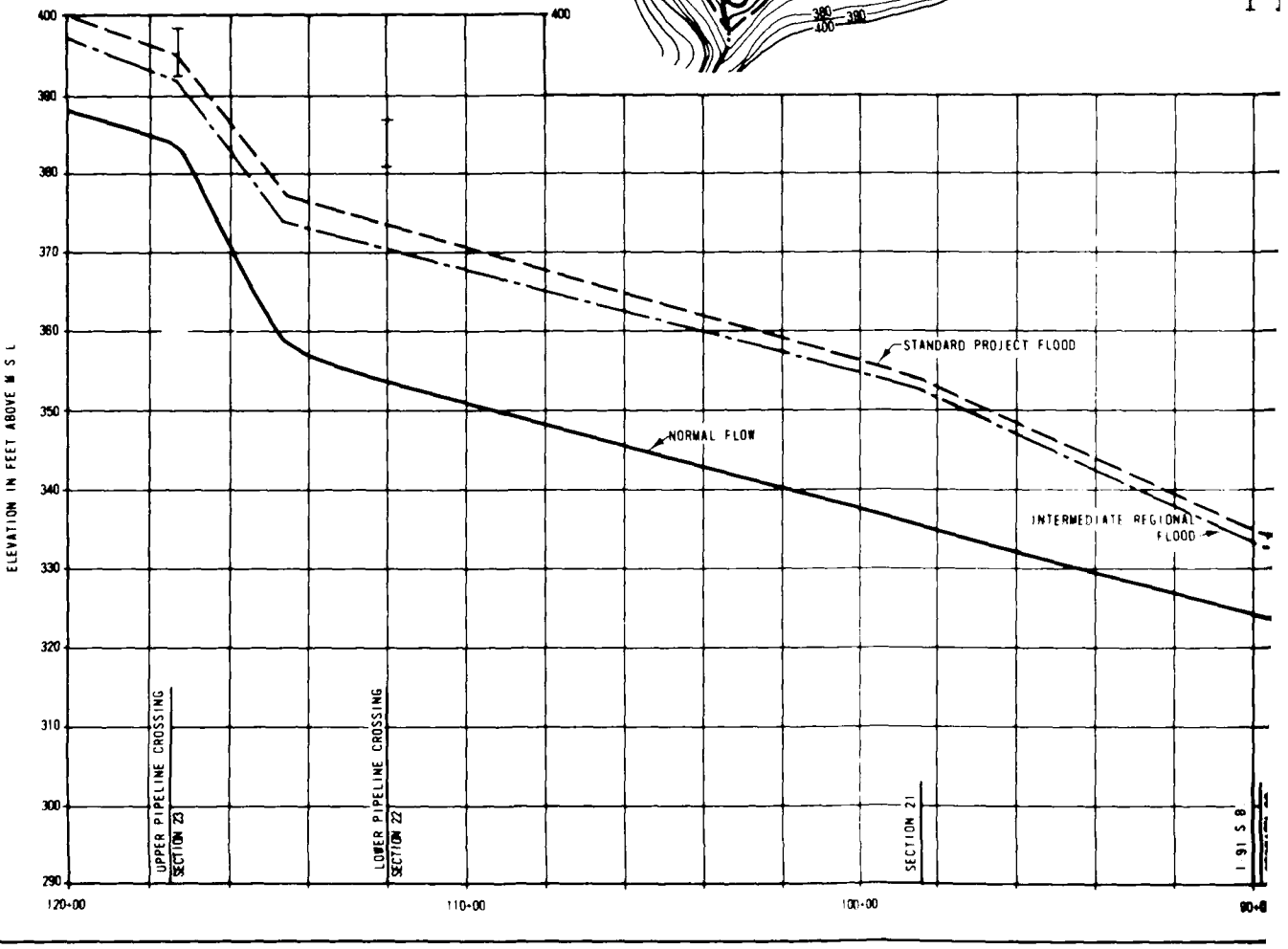
STA 0+00 - 60+00

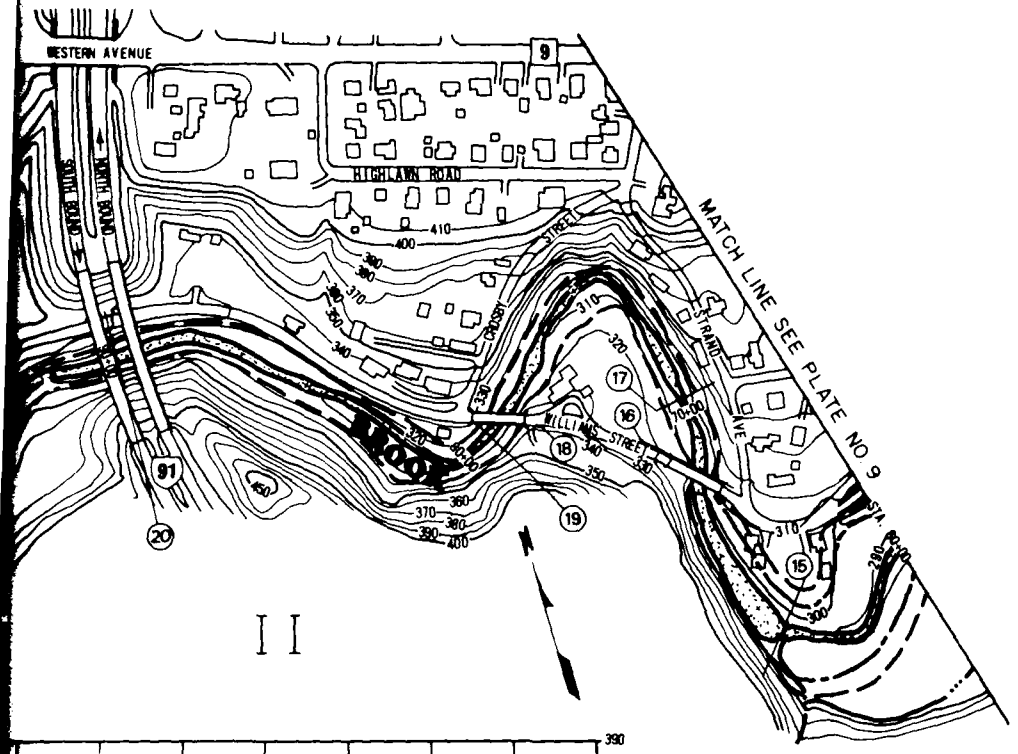
JANUARY 1972

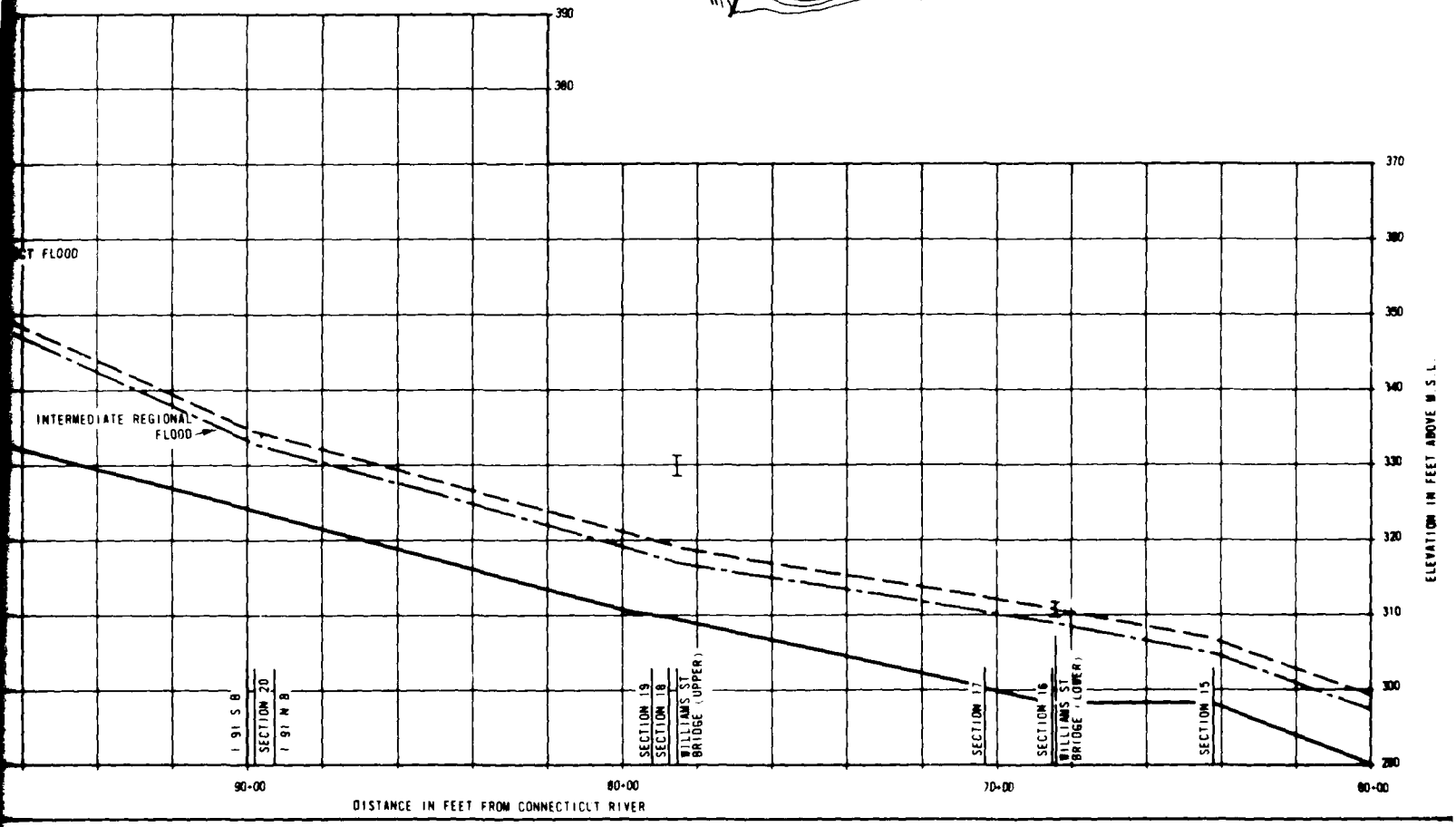
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO 9


MATCH LINE SEE PLATE NO. II
STA. 120+00
WESTERN AVENUE
WILLIAMS STREET
SOUTH BOUND
NORTH BOUND
WKVT
WETSTONE
9
20
21
22
23
91
420
410
400
390
380
370
360
350


ELEVATION IN FEET ABOVE M S L
400
390
380
370
360
350
340
330
320
310
300
290
STANDARD PROJECT FLOOD
NORMAL FLOW
INTERMEDIATE REGIONAL FLOOD
UPPER PIPELINE CROSSING
SECTION 23
LOWER PIPELINE CROSSING
SECTION 22
SECTION 21
I 91 S 8
120+00
110+00
100+00
90+8


WESTERN AVENUE
HIGHLAWN ROAD
SOUTH BOUND
NORTH BOUND
CROSBY STREET
STRAND AVE
WILLIAMS STREET
MATCH LINE SEE PLATE NO 9
STA. 10+00
9
91
15
16
17
18
19
20
410
400
390
380
370
360
350
340
330
320
310
300
290
280
450


390
380
370
360
350
340
330
320
310
300
290
280
T FLOOD
INTERMEDIATE REGIONAL FLOOD
I 91 S B
SECTION 20
I 91 N B
SECTION 19
SECTION 18
WILLIAMS ST BRIDGE (UPPER)
SECTION 17
SECTION 16
WILLIAMS ST BRIDGE (LOWER)
SECTION 15
90+00
80+00
70+00
60+00
DISTANCE IN FEET FROM CONNECTICUT RIVER
ELEVATION IN FEET ABOVE M.S.L.

U S ARMY

LEGEND

NORMAL FLOW
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD

I BRIDGE (6) CROSS SECTION

SCALE IN FEET
200 0 200 400

NOTES:

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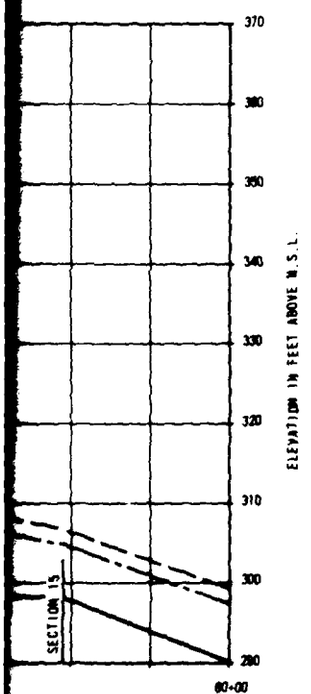
CONTOUR INTERVAL IS AS SHOWN



DUFRESNE-HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD, VERMONT

FLOOD PLAIN INFORMATION

WHETSTONE BROOK

BRATTLEBORO, VERMONT

PLAN AND PROFILE

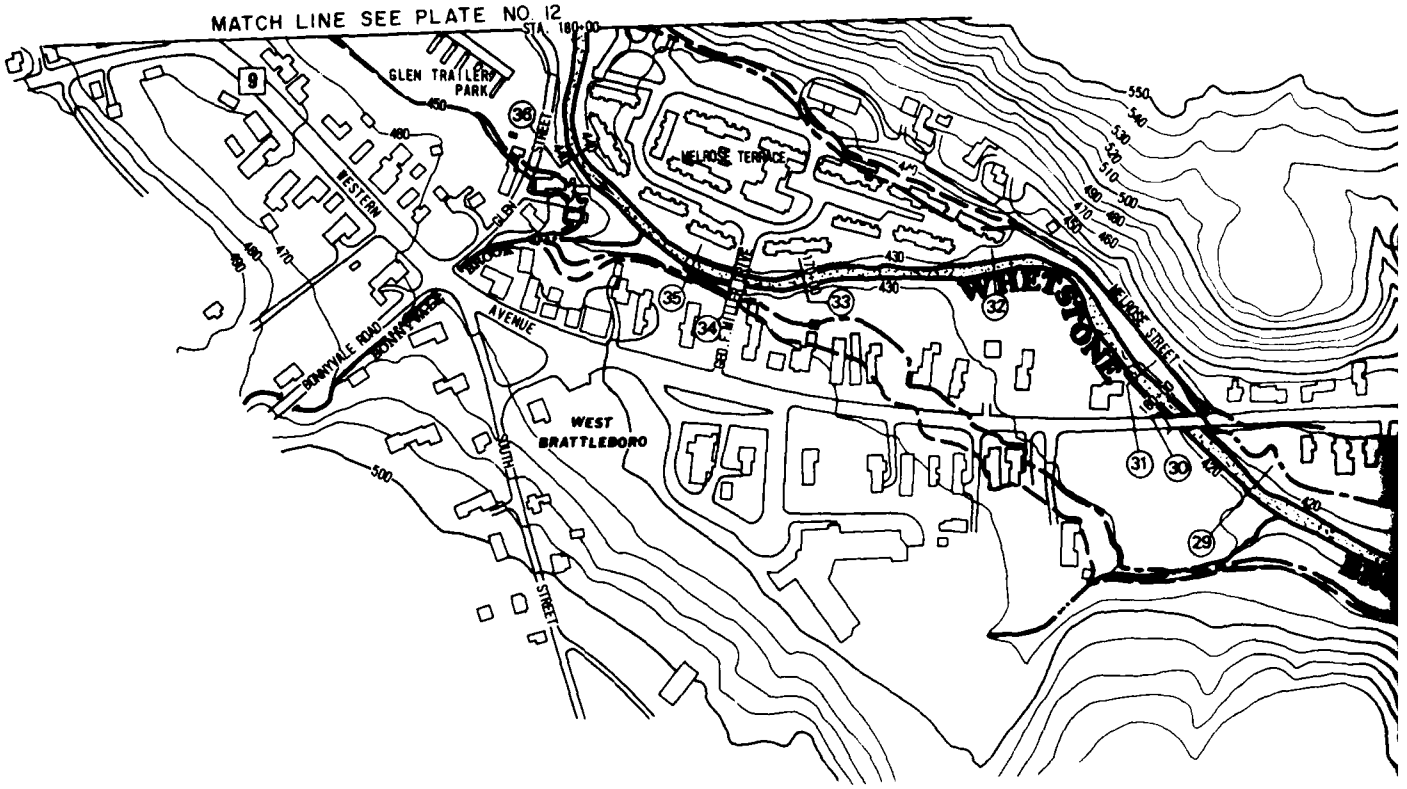
STA 60+00 - 120+00

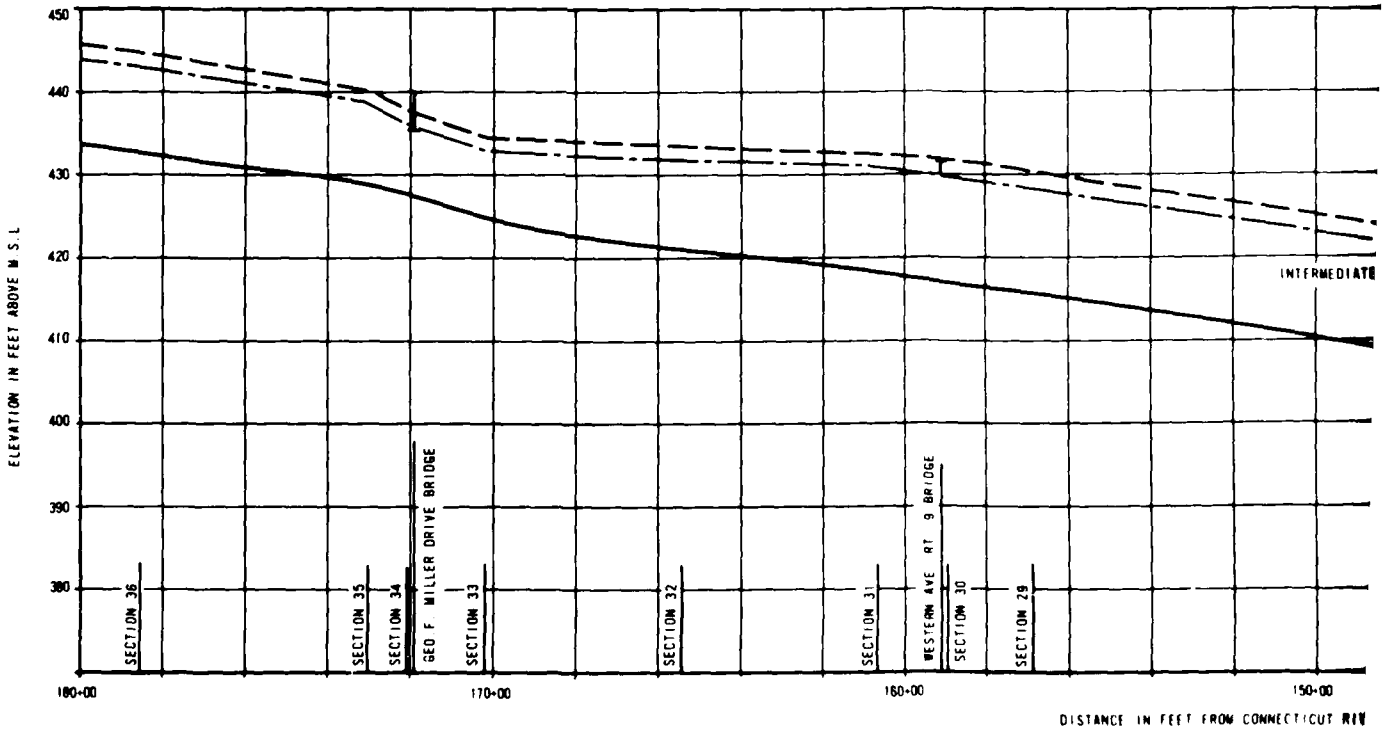
JANUARY 1972

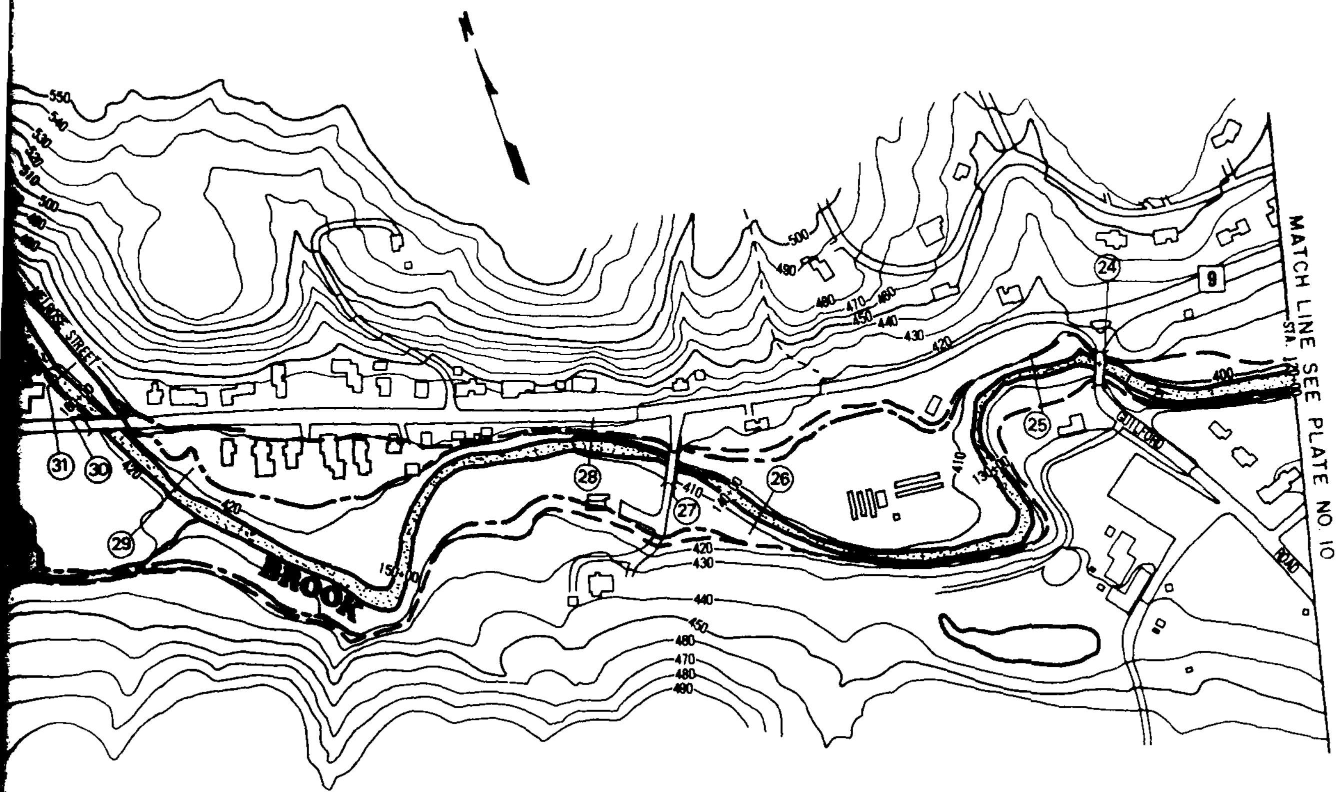
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

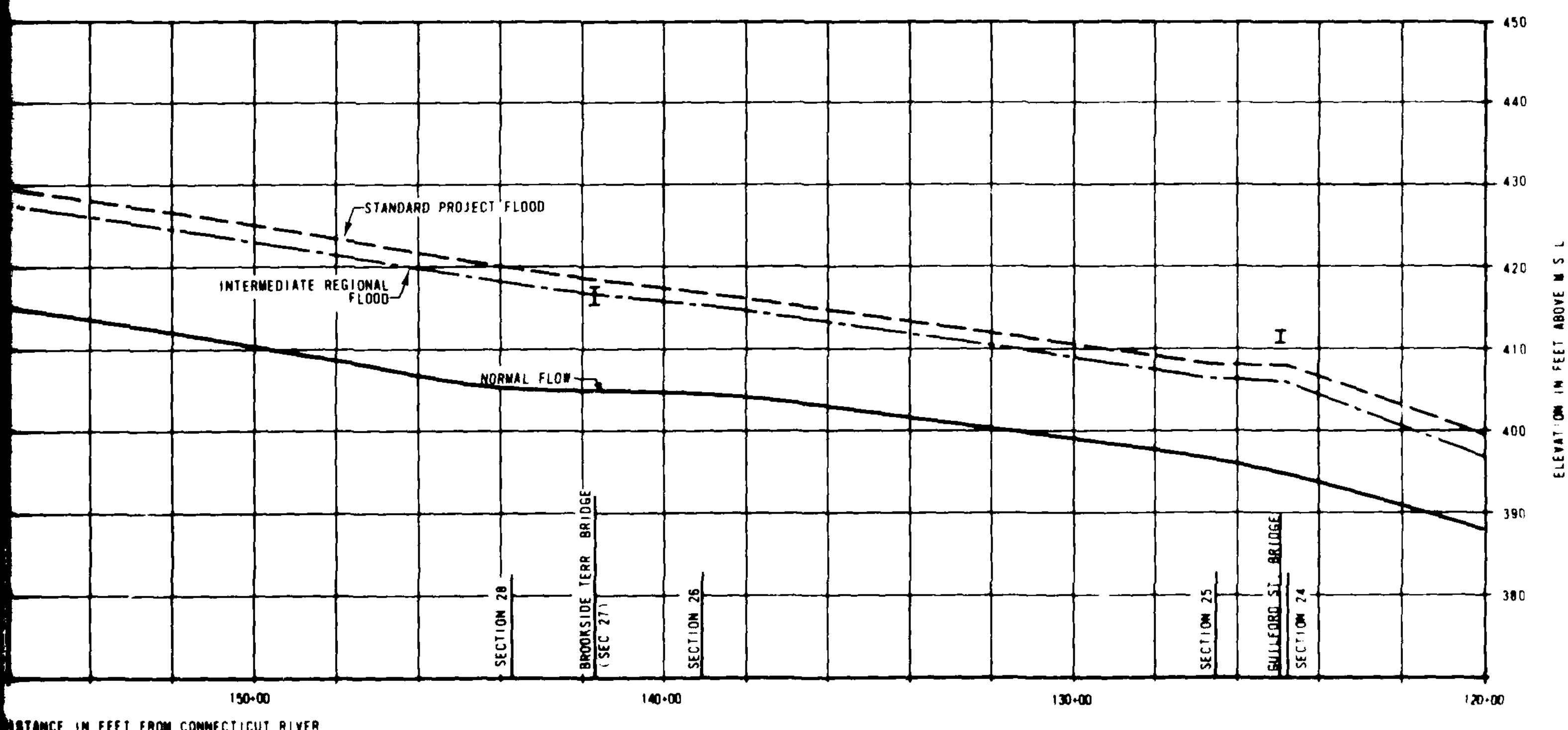
PLATE NO.10

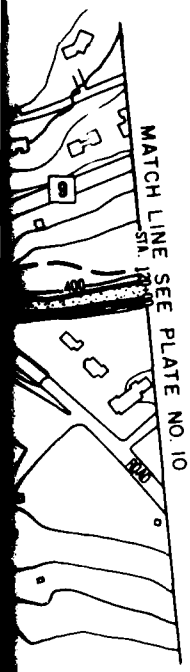
CORPS OF ENGINEERS






MATCH LINE SEE PLATE NO. 10
STA. 120+00
BROOK
GUILFORD
ROAD
150+00
130+00


STANDARD PROJECT FLOOD
INTERMEDIATE REGIONAL FLOOD
NORMAL FLOW
SECTION 28
BROOKSIDE TERR. BRIDGE (SEC 27)
SECTION 26
SECTION 25
GUILFORD ST. BRIDGE
SECTION 24
150+00
140+00
130+00
120+00
DISTANCE IN FEET FROM CONNECTICUT RIVER
ELEVATION IN FEET ABOVE M.S.L.
450
440
430
420
410
400
390
380



LEGEND

NORMAL FLOW
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD

I BRIDGE (6) CROSS SECTION

SCALE IN FEET
200 0 200 400

NOTES:

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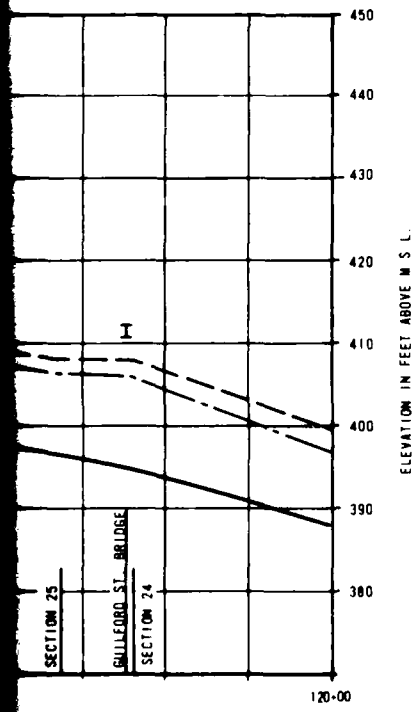
ELEVATIONS REFER TO MEAN SEA LEVEL DATUM

TOPOGRAPHY IS BASED ON PHOTOGRAMMETRY VSHD PLANS AND FIELD SURVEYS

CONTOUR INTERVAL IS AS SHOWN



DUFRESNE-HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD VERMONT

FLOOD PLAIN INFORMATION

WHETSTONE BROOK

BRATTLEBORO, VERMONT

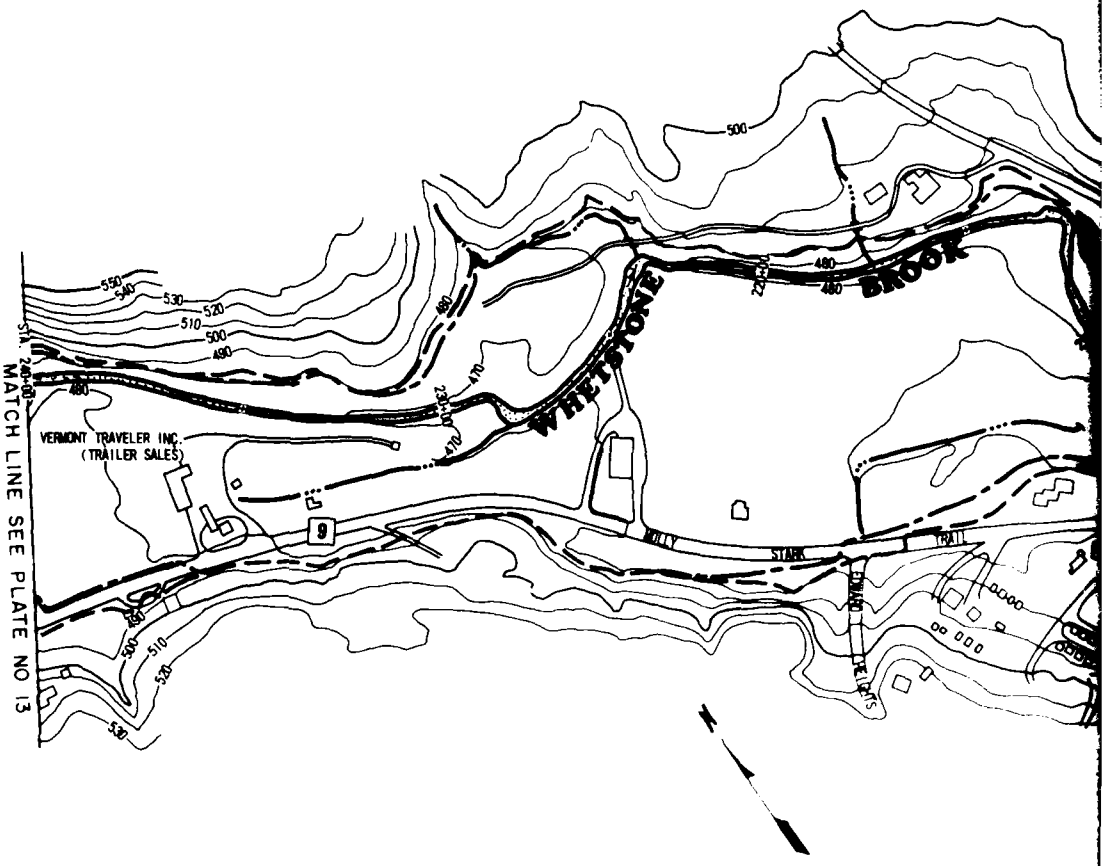
PLAN AND PROFILE

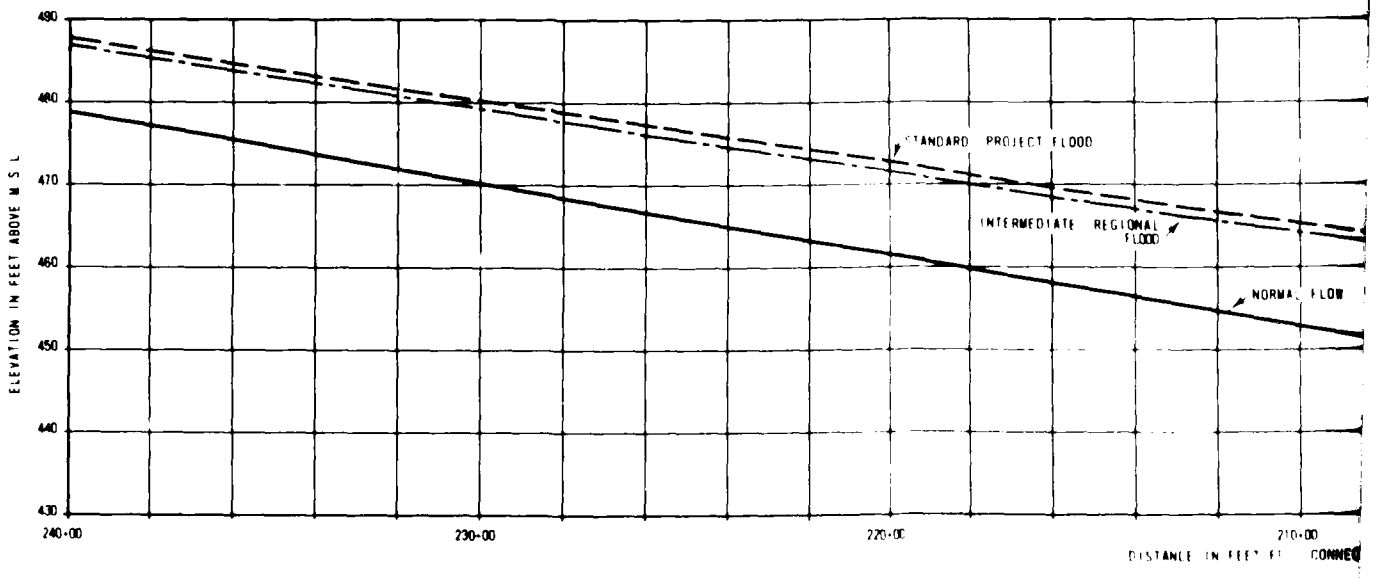
STA 120+00 - 180+00

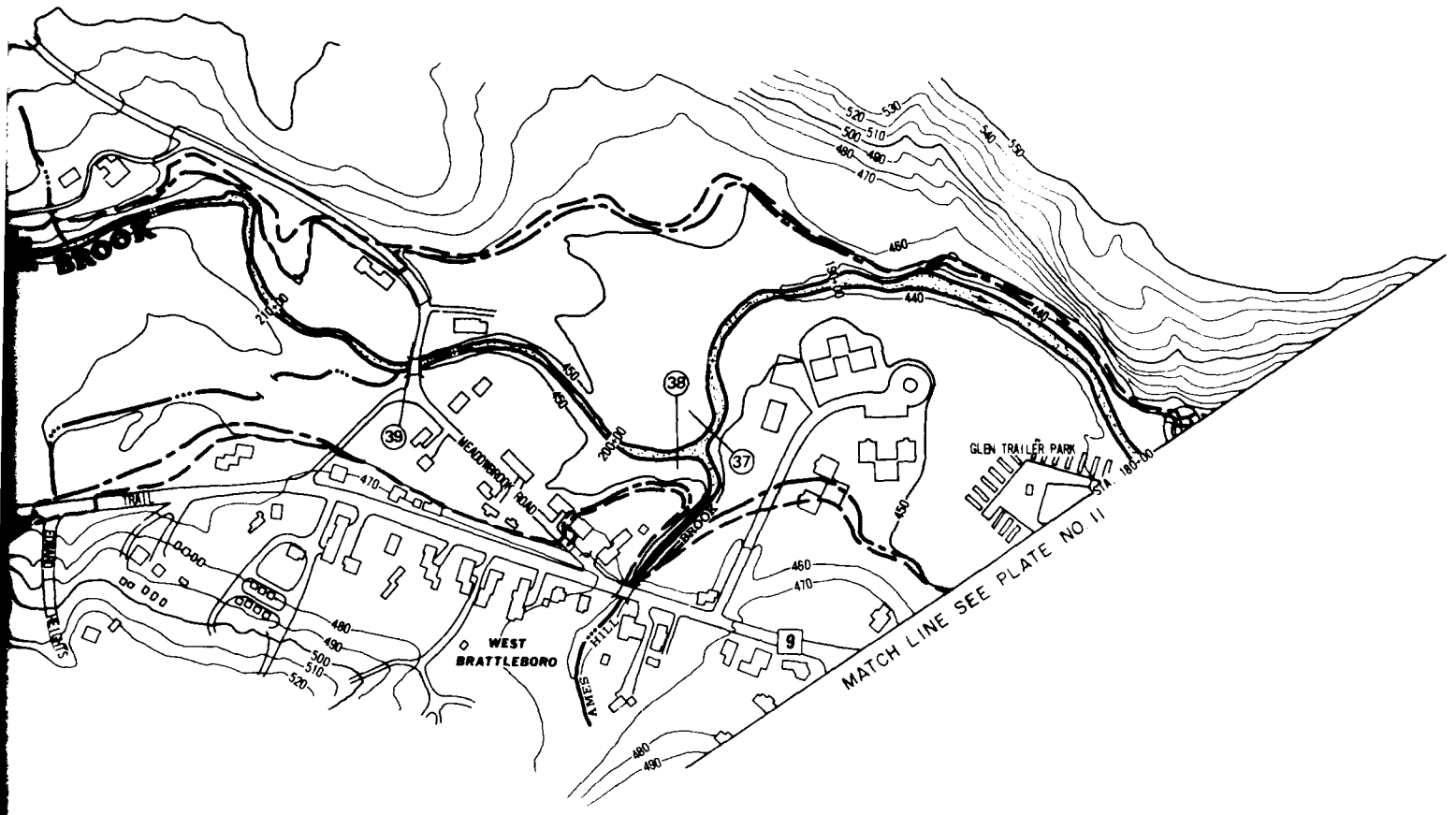
JANUARY 1972

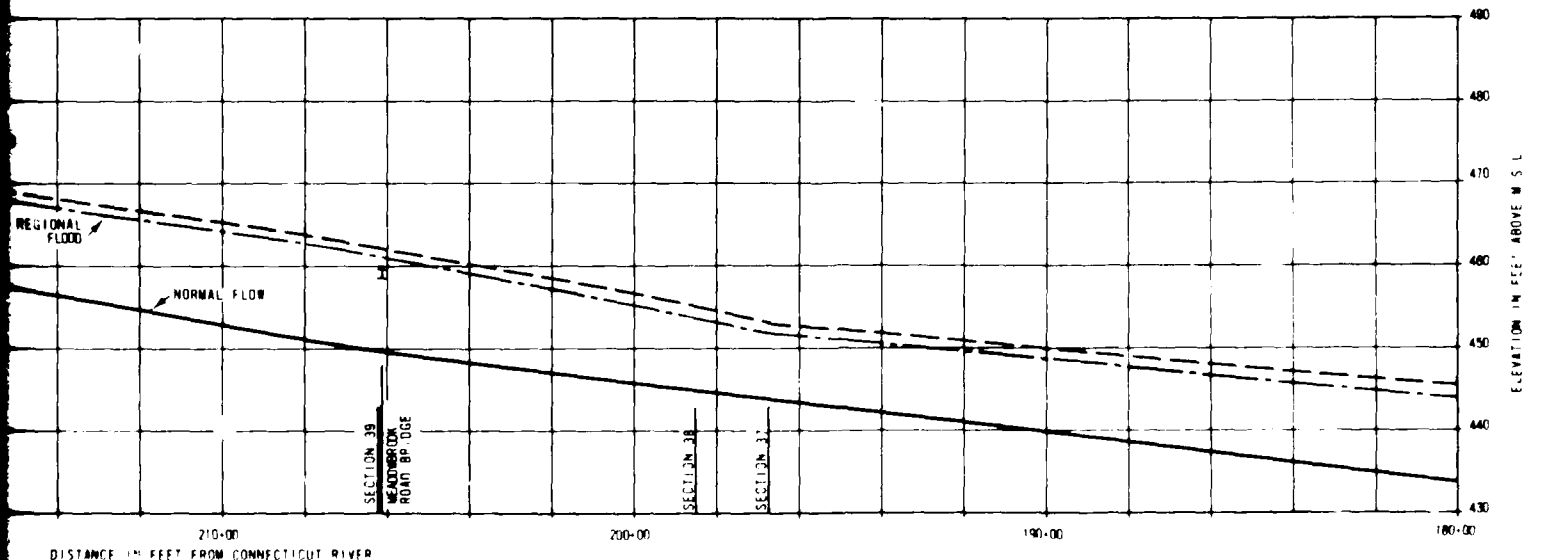
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS

CORPS OF ENGINEERS






BROOK
TRAIL
MEADOWBROOK ROAD
WEST BRATTLEBORO
HILL
GLEN TRAILER PARK
MATCH LINE SEE PLATE NO. II
39
38
37
9
210+00
200+00
190+00
180+00
520
510
500
490
480
470
460
450
440
430


REGIONAL FLOOD
NORMAL FLOW
SECTION 39
MEADOWBROOK ROAD BRIDGE
SECTION 38
SECTION 37
210+00
200+00
190+00
180+00
DISTANCE IN FEET FROM CONNECTICUT RIVER
ELEVATION IN FEET ABOVE M S L
490
480
470
460
450
440
430

U S ARMY

LEGEND

I BRIDGE ⑥ CROSS SECTION

SCALE IN FEET

200 0 200 400

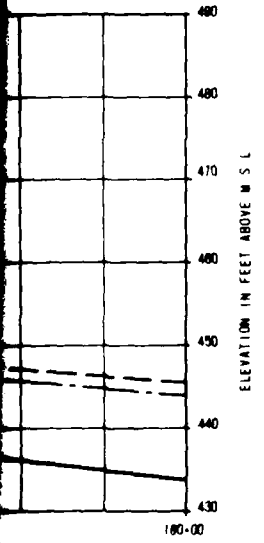
NOTES:

LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON THE GROUND AS EXPLAINED IN THE REPORT

ELEVATIONS REFER TO MEAN SEA LEVEL DATUM

TOPOGRAPHY IS BASED ON PHOTOGRAMMETRY VSHD PLANS AND FIELD SURVEYS

CONTOUR INTERVAL IS AS SHOWN



DUFRESNE-HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD VERMONT

FLOOD PLAIN INFORMATION

WHETSTONE BROOK

BRATTLEBORO, VERMONT

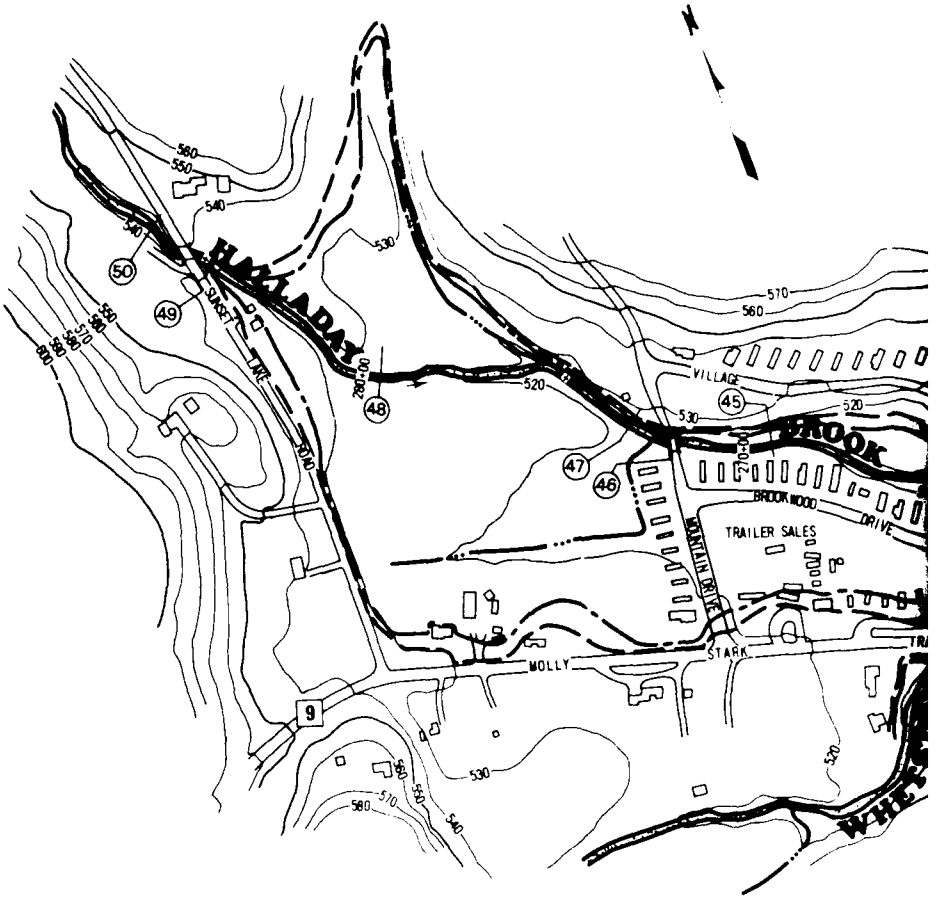
PLAN AND PROFILE

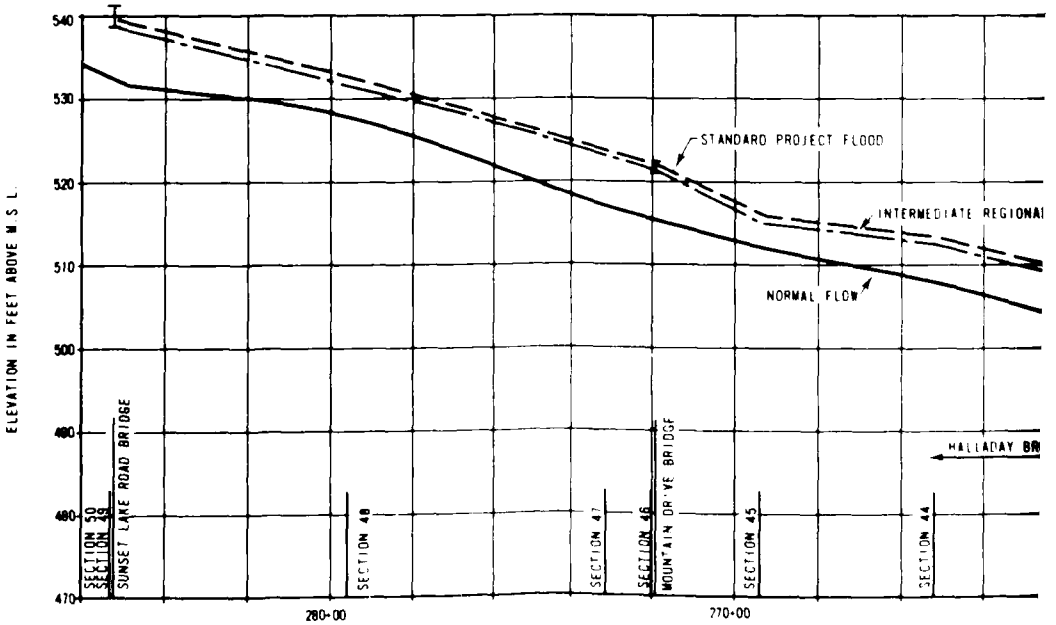
STA 180+00 - 240+00

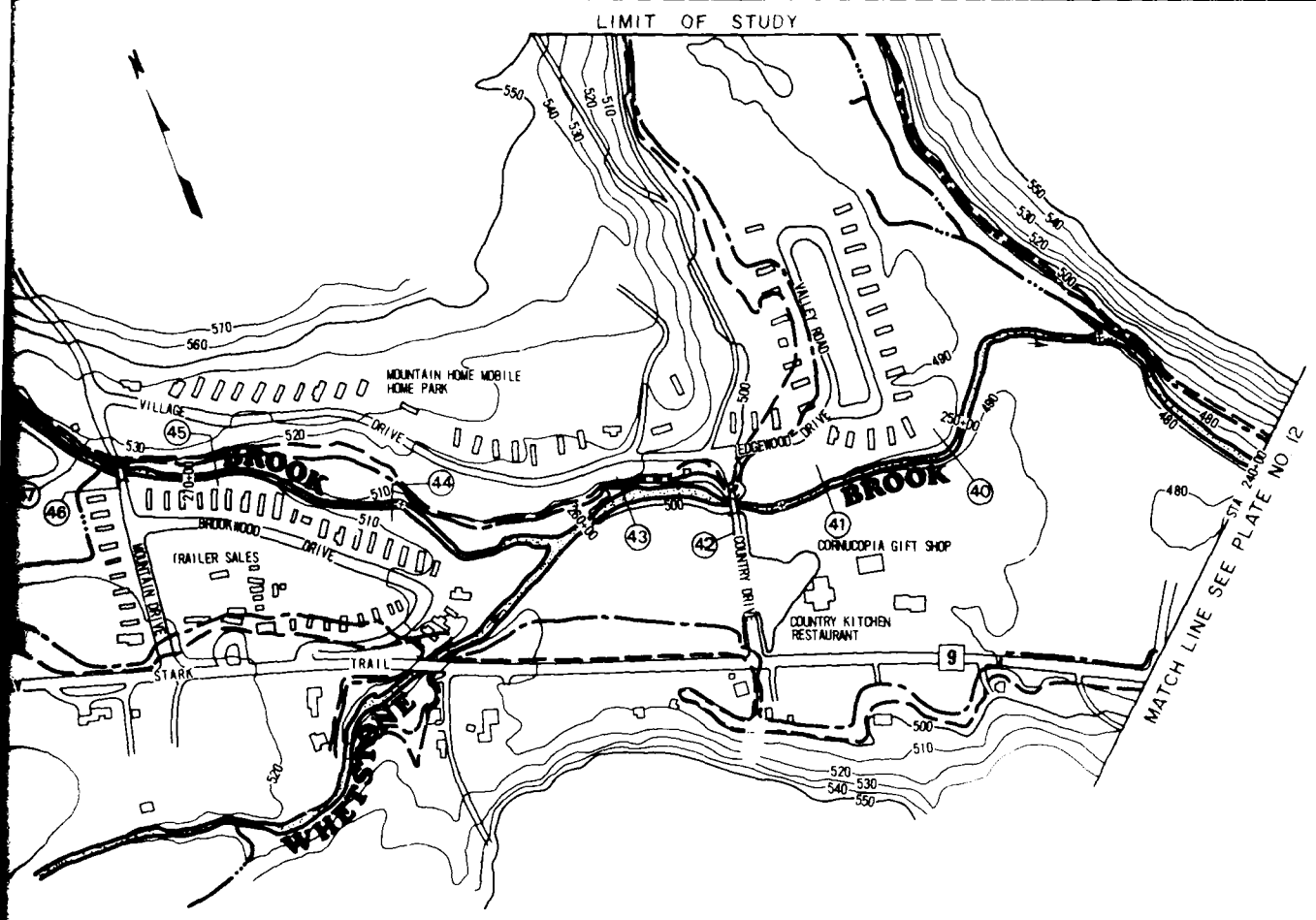
JANUARY 1972

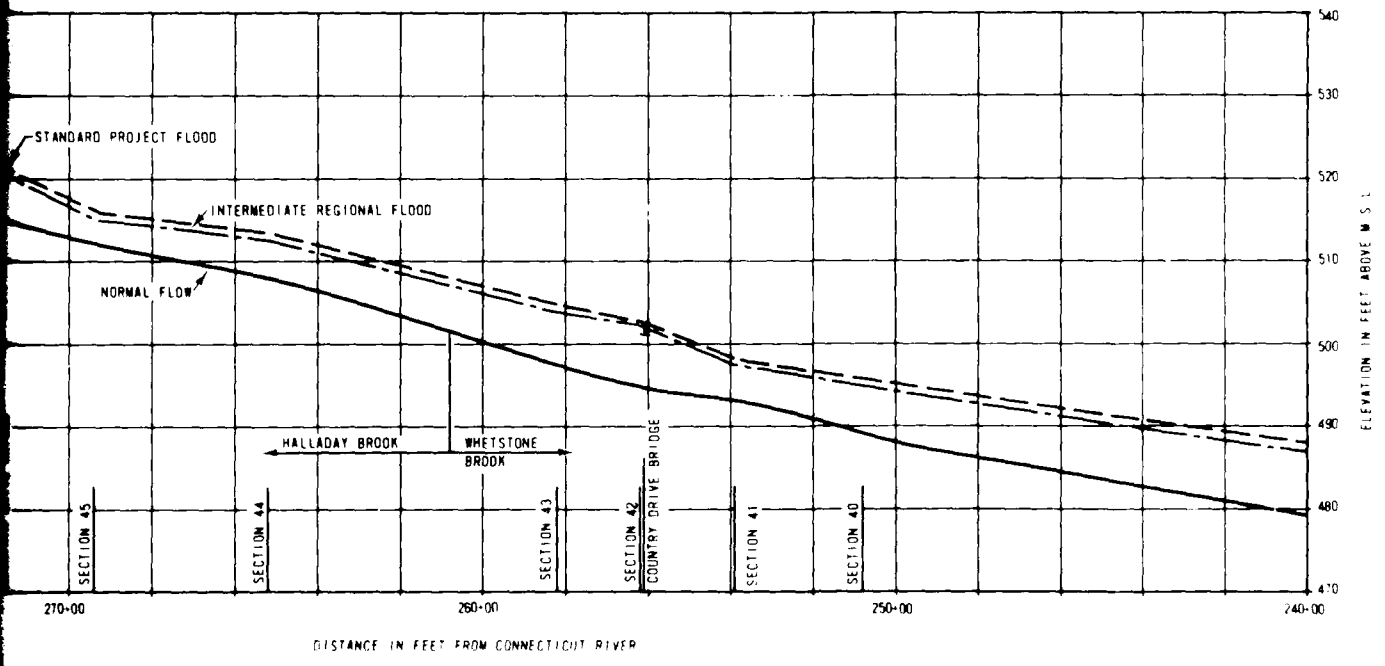
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO12


HALLADAY
SUNSET
LAKE
VILLAGE
BROOK
BROOKWOOD
DRIVE
TRAILER SALES
MOUNTAIN DRIVE
MOLLY
STARK
WHE
50
49
48
47
46
45
9
560
550
540
530
520
570
580
590


ELEVATION IN FEET ABOVE M S L.
540
530
520
510
500
490
480
470
STANDARD PROJECT FLOOD
INTERMEDIATE REGIONAL
NORMAL FLOW
HALLADAY BR
SECTION 50
SECTION 49
SUNSET LAKE ROAD BRIDGE
SECTION 48
SECTION 47
SECTION 46
MOUNTAIN DRIVE BRIDGE
SECTION 45
SECTION 44
280+00
770+00
DISTANCE


LIMIT OF STUDY
MOUNTAIN HOME MOBILE HOME PARK
VILLAGE DRIVE
BROOK
BROOKWOOD DRIVE
TRAILER SALES
MOUNTAIN DRIVE
STARK TRAIL
WHETSTONE BROOK
VALLEY ROAD
EDGEWOOD DRIVE
COUNTRY DRIVE
CORNUCOPIA GIFT SHOP
COUNTRY KITCHEN RESTAURANT
MATCH LINE SEE PLATE NO 12
STA 240+00
45
46
44
43
42
41
40
9


STANDARD PROJECT FLOOD
INTERMEDIATE REGIONAL FLOOD
NORMAL FLOW
HALLADAY BROOK
WHETSTONE BROOK
SECTION 45
SECTION 44
SECTION 43
SECTION 42
COUNTRY DRIVE BRIDGE
SECTION 41
SECTION 40
270+00
260+00
250+00
240+00
DISTANCE IN FEET FROM CONNECTICUT RIVER
ELEVATION IN FEET ABOVE M S L
540
530
520
510
500
490
480
470

U S ARMY

LEGEND

I BRIDGE ⑥ CROSS SECTION

SCALE IN FEET

200 0 200 400

NOTES:

LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON THE GROUND AS EXPLAINED IN THE REPORT

ELEVATIONS REFER TO MEAN SEA LEVEL DATUM

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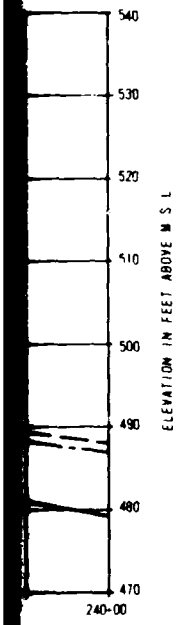
CONTOUR INTERVAL IS AS SHOWN



DUFRESNE-HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD VERMONT

FLOOD PLAIN INFORMATION

WHETSTONE BROOK

BRATTLEBORO, VERMONT

PLAN AND PROFILE

STA 240+00 286+00

JANUARY 1972

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS

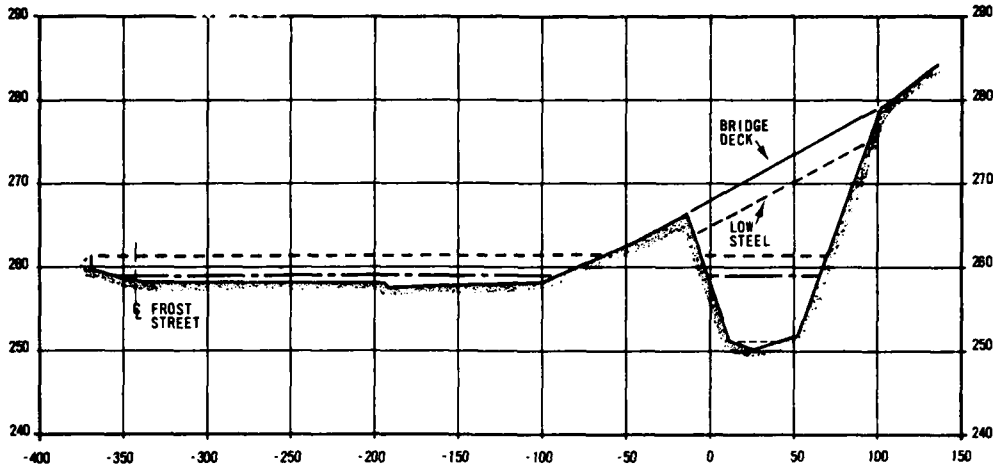
PLATE NO13

AD-A099 239 CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV F/G 8/8
FLOOD PLAIN INFORMATION, CONNECTICUT RIVER, WEST RIVER AND WHET--ETC(U)
JAN 72

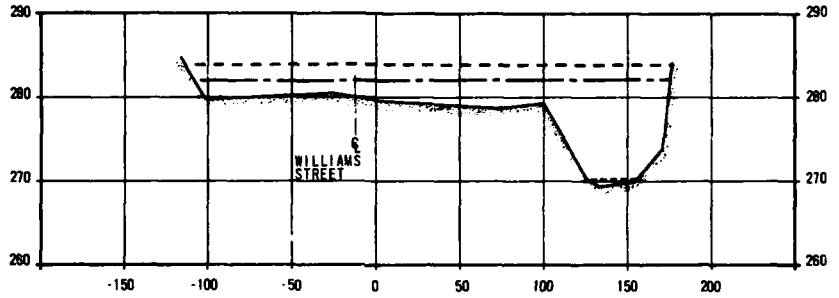
UNCLASSIFIED NL

2 OF 2
AD A
099 239

CORPS OF ENGINEERS U S ARMY



CROSS SECTION NO. 7 - STATION 17+70



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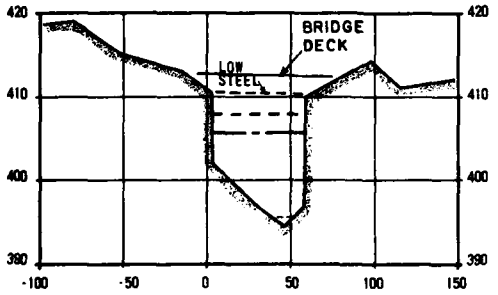
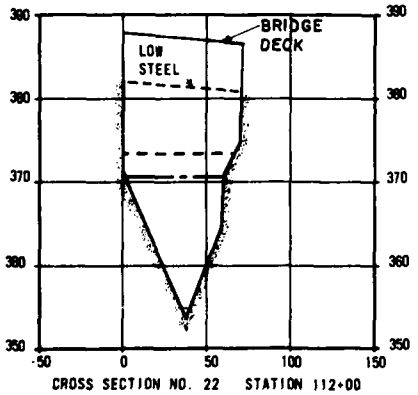


CROSS SECTION NO. 24 - STATION 124+80



CROSS SECTION NO. 22 STATION 112+00

LEGEND

- STANDARD PROJECT FLOOD
- INTERMEDIATE REGIONAL FLOOD
- NORMAL FLOW
- GROUND SURFACE

NOTES

1. ELEVATIONS REFER TO MEAN SEA LEVEL DATUM
2. ALL SECTIONS ARE LOOKING DOWNSTREAM.
3. HORIZONTAL DISTANCES ARE IN FEET.

DUFRESNE-HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD, VERMONT

FLOOD PLAIN INFORMATION

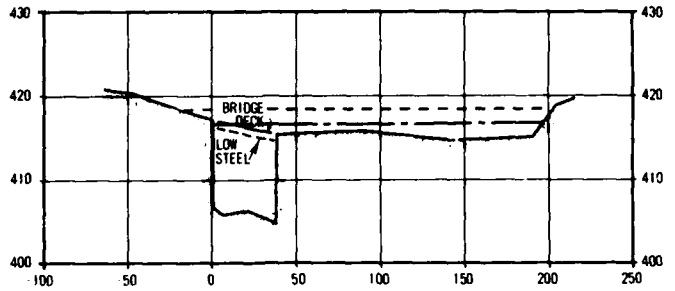
WHETSTONE BROOK
BRATTLEBORO, VERMONT

SELECTED CROSS SECTIONS

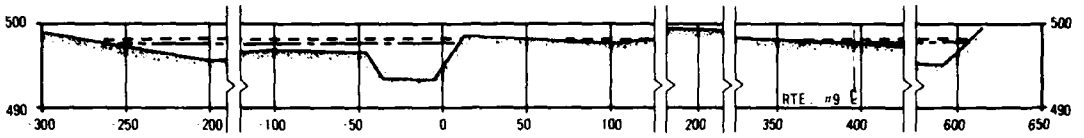
JANUARY 1972

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS

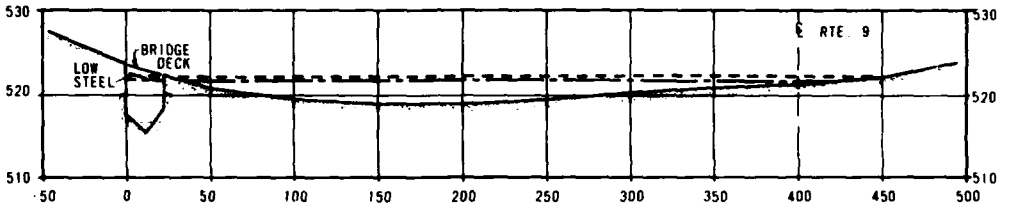
PLATE NO 14



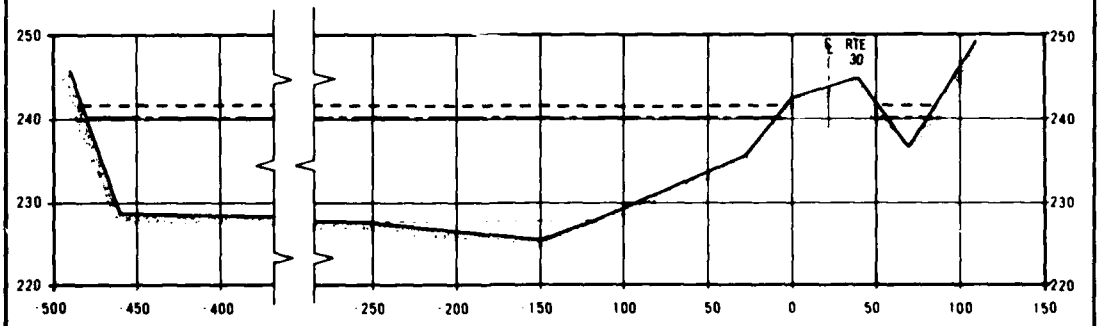
CROSS SECTION NO. 27 STATION 141 + 68
WHETSTONE BROOK



CROSS SECTION NO. 41 STATION 253 + 99
WHETSTONE BROOK



CROSS SECTION NO. 46 STATION 272 + 00
WHETSTONE BROOK



CROSS SECTION NO 2 STATION 108 + 50
WEST RIVER

DUFRESNE HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD VERMONT

LEGEND
- STANDARD PROJECT FLOOD
- INTERMEDIATE REGIONAL FLOOD
- NORMAL FLOW
- GROUND SURFACE

NOTES
1. ELEVATIONS REFER TO MEAN SEA LEVEL DATUM
2. ALL SECTIONS ARE LOOKING DOWNSTREAM
3. HORIZONTAL DISTANCES ARE IN FEET

FLOOD PLAIN INFORMATION

WHETSTONE BROOK AND WEST RIVER BRATTLEBORO, VERMONT

SELECTED CROSS SECTIONS

JANUARY 1972

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION CORPS OF ENGINEERS
WALTHAM MASS

PLATE NO 15