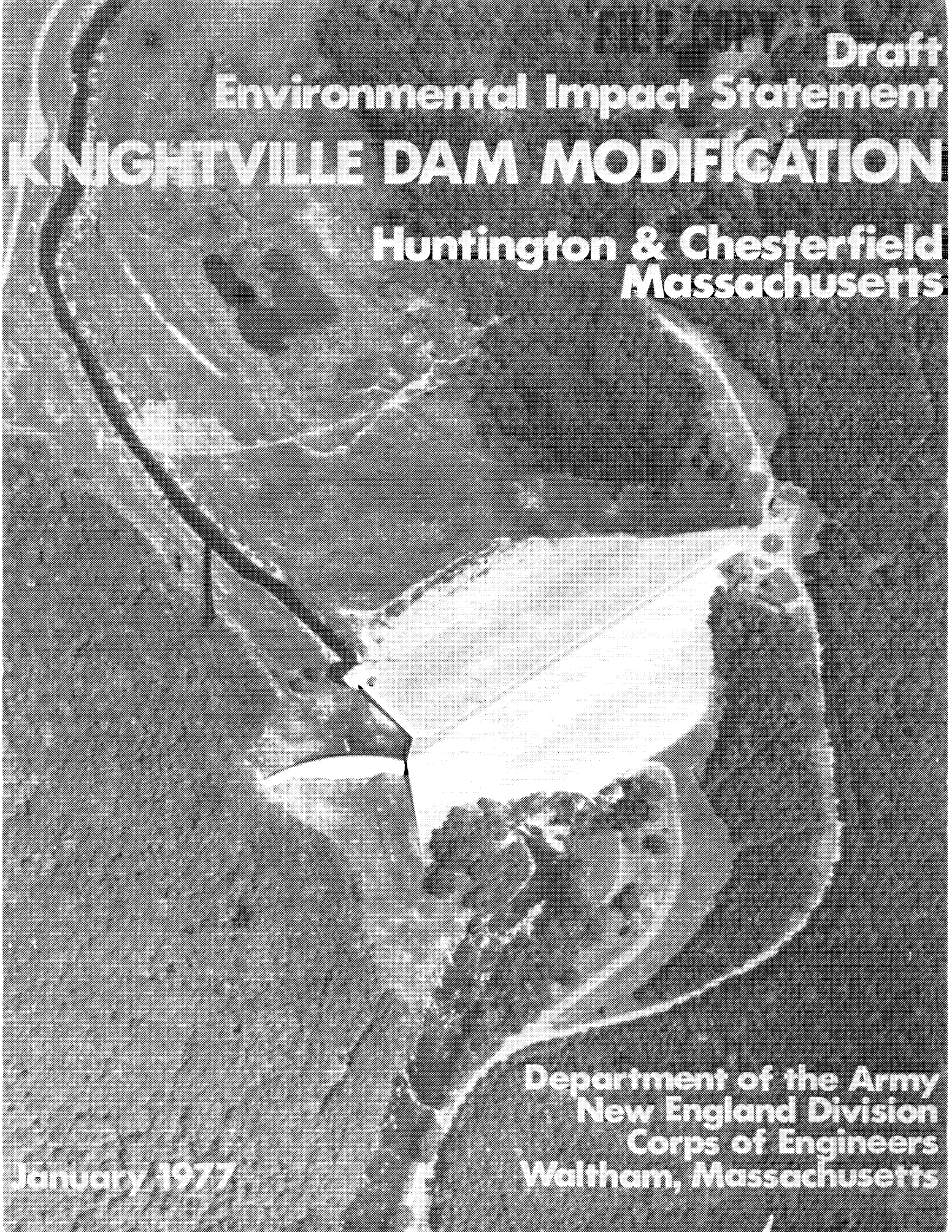
Draft
Environmental Impact Statement

KNIGHTVILLE DAM MODIFICATION

Huntington & Chesterfield
Massachusetts



Department of the Army
New England Division
Corps of Engineers
Waltham, Massachusetts

January 1977

SUMMARY SHEET

KNIGHTVILLE DAM MODIFICATION
Huntington and Chesterfield, Massachusetts

(X) Draft Statement ( ) Final Environmental Statement

Responsible Office: U.S. Army Engineer Division, New England,
424 Trapelo Road, Waltham, MA 02154 (617) 894-2400

1. Name of Action: (X) Administrative ( ) Legislative

2. Description of Action: The U.S. Army Corps of Engineers proposes a modification of Knightville Dam in Huntington, Massachusetts. Knightville Dam is an existing flood control project which was designed in the 1930's and constructed from 1939 to 1941. In order to increase the present flood control reservoir capacity from 49,000 acre-feet to 57,640 acre-feet, the spillway would be raised 8.5 feet, and the dam and appurtenant structures would be raised 11.0 feet. This additional storage capacity would increase the total surface area of the maximum possible flood storage pool from 960 acres to 1050 acres. The potential result would be the infrequent and temporary inundation of an additional 90 acres of land in the reservoir area.

3. Environmental Impacts: In order to increase the height of the dam and spillway, construction activity necessary for modification of existing structures will occur. Operation of construction equipment will be disruptive until the project is completed. The completed project will increase the potential area of maximum reservoir impoundment, but maximum impoundments will be rare and of short duration. Downstream flood protection will also be increased because of additional flood control storage capacity. Structural modification of the project will result in additional earth and rock fill permanently placed on 1 acre of land upstream of the dam. This is considered to be of minor impact.

4. Alternatives to the Proposed Action: The following alternatives to the Knightville Dam modification project were considered:

a. No action.

b. Modify the project to conform to updated design criteria without increasing flood storage capacity.

c. Modify the project to conform to updated design criteria and increase flood storage capacity to include either a seasonal or permanent pool for recreation and downstream low flow augmentation.

d. Other flood storage capacities considered in conjunction with modifying the project to conform to updated design criteria.

5. Comments Requested: Copies of this Draft Environmental Impact Statement are being furnished to the following agencies and private interest groups for their review and comment.

Federal Agencies

U.S. Environmental Protection Agency
U.S. Department of the Interior, Fish and Wildlife Service
U.S. Department of the Interior, National Park Service
U.S. Department of Commerce
U.S. Department of Housing and Urban Development
U.S. Department of Health, Education and Welfare

State and Private Agencies

Mass. State Clearinghouse
Mass. Department of Environmental Management
Mass. State Archaeologist
Mass. Historical Commission
Mass. Audubon Society
Board of Selectmen, Chesterfield, Mass.
Board of Selectmen, Huntington, Mass.
Lower Pioneer Valley Regional Planning Commission
Advisory Council on Historic Preservation
Sierra Club
Mass. PIRG

6. Draft Statement sent to CEQ_____.
Final Statement sent to CEQ_____.

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1.00 PROJECT DESCRIPTION

1.01 Location

Knightville Dam is located in the town of Huntington, Massachusetts on the main branch of the Westfield River about 27 miles above its confluence with the Connecticut River in Agawam, Massachusetts, adjacent to the city of Springfield, Massachusetts. The reservoir occupies portions of the towns of Huntington and Chesterfield. (See Figure 1)

1.02 Authorization

The existing dam was authorized by the Flood Control Act of June 28, 1938 (Public Law 75-761). Construction of the dam was initiated in 1939 and completed in 1941 at a cost of $3,220,400. A resolution by the U.S. Senate Committee on Public Works, adopted 11 May 1962, provided the principle authority and direction for a comprehensive study of the Connecticut River Basin. The focus of the study was the development of a comprehensive plan of water related improvements and determination of the advisability of modifying existing projects.

1.03 Initial investigations of the feasibility of modifying the existing Knightville Project were guided by the results of a previous report "Comprehensive Water and Related Land Resources, Connecticut River Basin", dated June 1970, and a "1980 Connecticut River Basin Plan" recommended by the Coordinating Committee that provided guidance during the investigation. The 1980 Plan was developed to meet the immediate water related needs of the Connecticut River Basin. One element of that plan was the major structural modification of the Knightville Project to provide a recreational pool and low flow augmentation to

enhance the downstream fishery resource. The Comprehensive Connecticut River Basin Study also indicated that Knightville's flood control capability is not adequate to effectively control the flood runoff that is apt to occur on the Westfield River. Consequently the possibility of providing additional storage was investigated, resulting in the present modification proposal.

1.04 Purpose

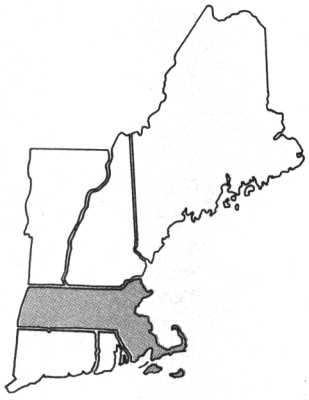
Knightville Dam provides flood protection for Huntington, Westfield, West Springfield and Agawam on the Westfield River. As a unit in the comprehensive plan of flood protection in the Connecticut River Basin, its integrated operation also reduces flood stages at damage centers along the Connecticut River below the mouth of the Westfield River. The proposed modifications to the dam and appurtenant structures would increase the flood storage capacity of Knightville Dam and thus provide a greater measure of flood protection for these downstream areas.

1.05 Project Dimensions

Knightville Dam is a hydraulic earth-fill embankment 1,200 feet long with a dumped rock shell and downstream rock toe. It has a top width of 30 feet and slopes on both faces varying from 1 on 2.5 (one foot of vertical rise for every 2.5 feet of horizontal distance) to 1 on 3.0. The top elevation at 630 feet above mean sea level (msl) is 20 feet above spillway crest. Maximum height of the dam is 160 feet above the riverbed. The spillway is an uncontrolled, curved ogee weir 400 feet long, located on rock in a saddle at the right (west) abutment of the dam, with a concrete crest at elevation 610 feet msl.

KNIGHTVILLE DAM
HUNTINGTON, MASSACHUSETTS

SITE LOCATION MAP



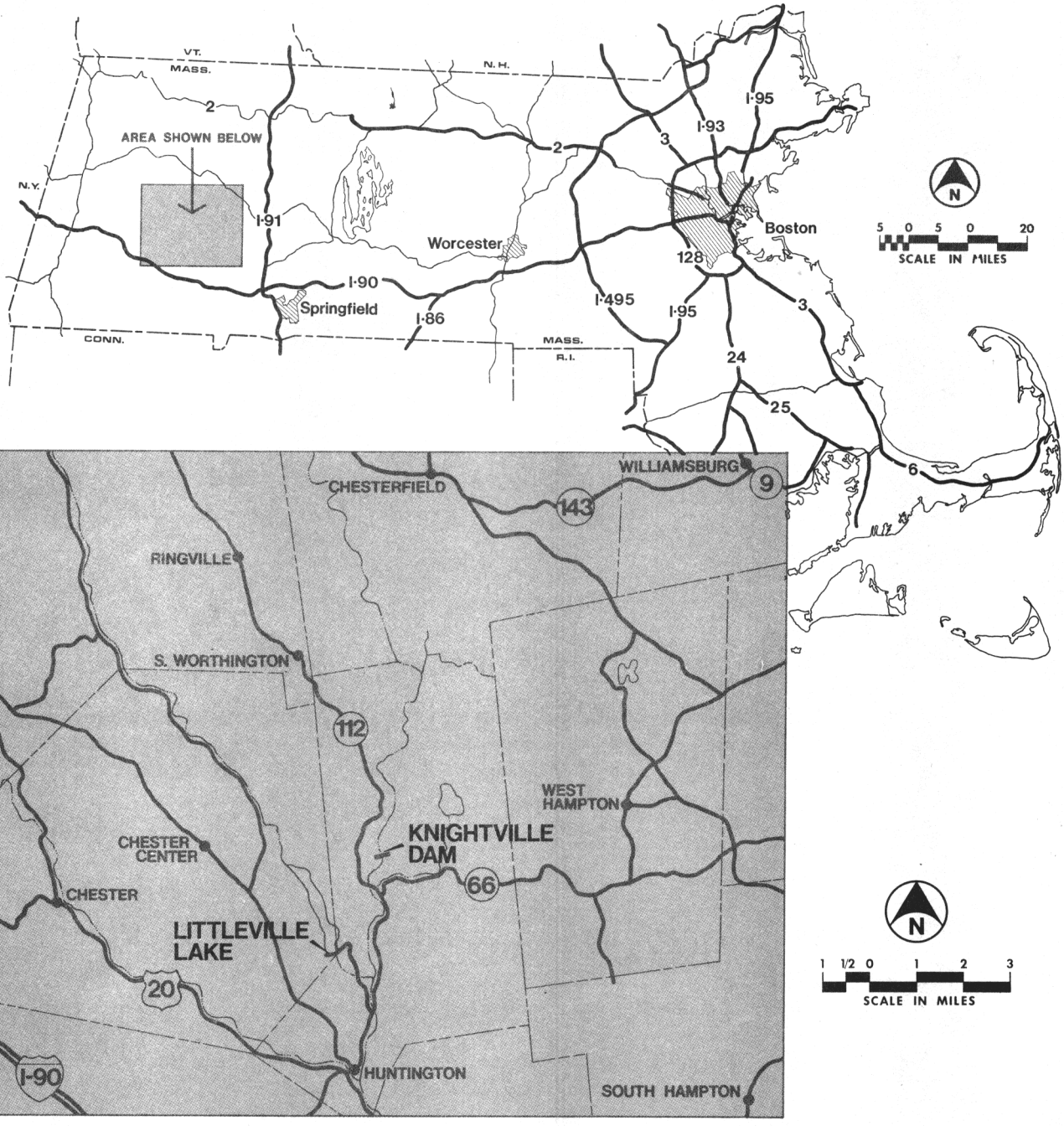


Figure 1

1.06 The outlet works in the west abutment consist of an intake channel 280 feet in length and a 16-foot diameter concrete lined rock cut tunnel 605 feet long. Discharges are controlled by three 6-foot by 12-foot broome gates mechanically operated through a control tower from the gatehouse above.

1.07 Under normal operations, the gates are kept open and the reservoir is empty, because no permanent pool is maintained behind the dam. During flood control operations Knightville reservoir presently has a flood storage capacity at spillway crest of 49,000 acre-feet which is equivalent to about 5.7 inches of runoff from the drainage area of 162 square miles. When filled to spillway crest, the reservoir is about six miles long with a surface area of 960 acres and a shoreline length of more than sixteen miles. Project land owned in fee totals 2430 acres, with 258 additional acres of flowage easements.

1.08 The proposed modification to Knightville Dam involves increasing the height of the dam structure 11 feet, raising the concrete spillway structure 8.5 feet, and raising and modifying the intake tower and appurtenant structures.

1.09 Raising the height of the dam will involve temporary removal of a portion of the rock protection, addition of earth fill, and replacement of rock. This new fill with rock protection will result in approximately one acre of additional structural fill encroachment on a presently vegetated area at the east end of the dam.. No other additional encroachment will occur because the fill necessary to raise the height of the dam will be deposited on the present 1 on 3 slope of the upstream face of the

dam, increasing the slope to 1 on 2.5. The steeper slope will cause the new fill to taper to meet the existing structure near its present base. Earthen dam materials and rock for slope protection will be obtained from existing off-site commercial sources chosen by the contractor with Federal Government approval. Other construction materials will also be obtained locally. Modification of the spillway will involve the installation of vertical drilled-in and grouted post-tensioned rock anchors, and addition to the height of the present structure, with minimal alteration of the surrounding landscape. Additions to the intake tower will also be limited to an increase in the height of the present structure to accommodate raising of the operating floor and machinery. During construction, the project will be maintained in operable condition through planned sequencing of each phase of modification.

1.10 Raising the height of the dam will necessitate removal of the present project office and utility building. This structure will be replaced by a new building of similar dimensions in the same general location. The present rotary at the east end of the dam will also be eliminated and replaced by a roadway at the proposed new grade.

1.11 The proposed modification will increase the maximum surface area of the flood control pool from 960 acres to 1050 acres. This increase may result in the inundation of approximately 90 additional acres of land in a narrow strip directly above the 610 foot contour elevation (the elevation of the existing spillway).

1.12 The only non-structural measure required to implement the proposed plan is the acquisition of 46 acres of flowage easements. These easements would restrict present land owners from building habitable structures on their land, while fee title to the land would remain with the existing owner and the property would remain on the town tax rolls. No existing structures will be affected by acquisition of these easements. Of the approximately 46 acres of easement to be acquired, about 33 acres are situated in Chesterfield and the remaining 13 acres are in Huntington. The remaining 44 acres of the total 90 additional acres which may be inundated are project lands previously acquired in fee or easement.

1.13 The total project cost is estimated to be about $3,513,000. The benefit to cost ratio derived for the project is 1.2 to 1.0. The project is estimated to take two years to complete. Details of the proposed plan are shown on Plates 2, 3, 4 and 5.

2.00 ENVIRONMENTAL SETTING WITHOUT THE PROJECT

2.01 Area Description

The region surrounding Knightville Dam and Reservoir, including the Massachusetts towns of Huntington and Chesterfield, in Hampshire County, is predominantly rural in character. The nearest urban centers are the towns of Westfield, 16 miles downstream of Knightville Dam, and Springfield and West Springfield, Massachusetts, on the Connecticut River, 25 miles southeast of Knightville Dam.

2.02 The region is generally referred to as the Berkshires, an area of rugged topography between the Connecticut River Valley and the Berkshire Valley (which includes both the Hoosic and Housatonic River Valleys). The combination of rugged topography, low population density, lush forest vegetation, and scenic rural New England charm make this region a major center for recreation and tourism in the northeast.

2.03 The Westfield River Basin extends from the eastern slopes of the Hoosac Range east of Adams, Massachusetts downstream to the confluence with the Connecticut River in Agawam, Massachusetts. The river basin encompasses 517 square miles. Of this total the runoff from 162 square miles is controlled by Knightville Dam on the main branch of the Westfield River. An additional 52.3 square miles of the basin is controlled by Littleville Lake on the Middle Branch of the Westfield River, approximately two linear miles from Knightville Dam. The Westfield River Basin is shown in Plate 1.

2.04 Topography

Elevations in the Westfield River watershed vary from 2,505 feet msl in the headwaters to about 40 feet msl at the river's confluence with the Connecticut River. The 517 square mile watershed has an approximate length, north to south, of 48 miles and an average width of 11 miles. The Westfield River has a gradient of 34 feet per mile from its source to Knightville Dam, but it drops an average of only 7 feet per mile from the Westfield City line to its mouth. In the immediate vicinity of the project, elevations range from about 470 feet msl to more than 1,400 feet atop some of the surrounding hills.

2.05 Vegetation

The Knightville project area lies within the northern hardwood forest zone, typified by American beech, yellow birch, and sugar maple as the predominant species in mature woodlands. Commonly associated species are eastern white pine, eastern hemlock, black cherry, white ash, American elm, several oaks and hickories. The more open sites and abandoned agricultural fields are characterized by pioneer species such as aspen, gray and paper birch, and other relatively short-lived trees. Existing woodlands are not virgin stands but instead are second growth forests that have reclaimed land that was once largely cleared for farming and timber harvesting. Vegetation management is limited to work done in conjunction with a pheasant management program in which the Massachusetts Division of Fisheries and Wildlife has planted cover and grain crops and shrubs in the flat area along the Westfield River

Figure 2. Upstream face of dam showing winter pool level. Right foreground shows grass area to be covered by new fill.

and the lowermost portion of the Little River. Plantings have included buckwheat, winter rye, hay, and multi-flora rose.

2.06 Much of the reservoir is forest-covered and a distinct transition from basically open land, to pioneer tree growth, to mixed forest can be seen on the hillsides flanking the reservoir basin. Regular flooding has killed almost all the woody vegetation on the lowest 300 to 400 acres of the reservoir, although a large portion of the area near the river had been cleared for agriculture prior to construction of the project. Frequent flood control operations, plus maintenance of a pool during World War II to augment flows for hydroelectric power production at downstream plants, have resulted in loss of most trees below approximately the 500-foot contour, but some regrowth of aspens, birches, red maples and other trees has occurred along the forest edges on the reservoir slopes.

2.07 Few perennial plants have been able to survive flooding in the bottom of the reservoir. Annual weeds, grasses and other herbaceous plants thus comprise the basic vegetative cover in those areas which are left dry from the end of the spring flood period through the growing season. Vegetation at higher elevations in the reservoir shows progressively less mortality or damage from flooding, and the mature forests on the hillsides appear generally healthy.

2.08 A forest management plan for Knightville reservoir is presently being prepared by the Corps. Objectives are basically to inventory the forest resources and develop a program to enhance the value of the forested lands in the reservoir for public recreation, wildlife habitat, aesthetic purposes, and for the preservation of natural

conditions. The forested areas at the project are for the most part well stocked with a diversity of age classes and species. Commercial timber production is not a specific management objective as environmental benefits of the woodlands exceed the value realized from harvesting limited amounts of merchantable timber.

2.09 A review of the proposed list of Endangered and Threatened Species (Plants) as published in the Federal Register, June 16, 1976 (Vol. 41, No. 117, pp. 24524-24572) and records of the Harvard University Herbarium indicate that no endangered or threatened plant species are known to exist in the project area.

2.10 Geological Features

The Westfield River drainage basin is known geologically as the Green Mountain Highlands which form a belt extending southward from Vermont across Massachusetts. The western half of this highland is formed largely from ancient gneisses and granites and the eastern portion from later schists, with extensive accumulations of glacial till. At higher elevations in the western part of the basin Hermon soils and rough stony land predominate. Rough stony soils have little agricultural value and the land, much of which was once cleared for farming, is now predominantly woodland with occasional pastures. In the eastern part of the basin, a large proportion of the soils are of the Gloucester series, a sandy loam derived from course textured glacial till. A noteable geologic feature in the region is the Chesterfield Gorge, a rock chasm located 6.5 miles upstream of the dam in an area owned by the Massachusetts Trustees of Reservations.

2.11 Climate and Precipitation

The climate of the Westfield River basin is characterized as humid continental, due to the prevailing westerly winds which deliver interior continental weather to Massachusetts. Local conditions can vary throughout the region due primarily to the large differences in local topography. While the lower basin is relatively mild, the rougher topography and higher elevations at the headwaters of the tributaries experience a more severe climate.

2.12 The mean annual temperature in the basin ranges from about 44°F in the mountainous regions to about 50°F in the lower valleys. Extremes of 102°F and -30°F have been recorded in the basin. The average January temperature at the project is 23°F, while the average July temperature is about 70°F.

2.13 Storms over the watershed are of four general types: (1) extratropical continental storms which move across the basin under the influence of the prevailing westerly winds, (2) extratropical maritime storms which originate over the ocean and move northward along the eastern coast of the United States, (3) storms of tropical origin, sometimes of hurricane magnitude and intensity, and (4) thunderstorms produced by local convective action or by more general frontal movements. Historically, tropical storms have been the most severe and have occurred during late summer and early autumn.

2.14 Precipitation is evenly distributed among the seasons and averages about 46 inches at nearby Chester, Massachusetts. Snowfall varies widely over the basin, with an average depth of about 55 inches

at the dam (elevation 630 feet msl) and over 70 inches at Chesterfield (1,425 feet msl) and Peru (1,860 feet msl). Annual runoff for the Westfield River near Westfield, Massachusetts has varied from 45.30 to 14.82 inches with a long term mean of 26.12 inches.

2.15 Minor floods are frequent in the basin usually because of intense rainfall, melting snow, or a combination of both. Floods develop very rapidly in the basin, and experience gained from regulation of Knightville Dam and Littleville Lake indicates that floods in the principal branches of the Westfield River crest about four hours after the end of intense rainfall. At Westfield, the time of concentration is between six and eight hours following the end of heavy precipitation.

2.16 Regional Land Use

The land use study area or that area considered directly affected by Knightville Dam and Reservoir includes the towns of Chesterfield, Huntington, Montgomery, Russell, Agawam, West Springfield, and the city of Westfield. Chesterfield and Huntington are located in Hampshire County; the other 5 communities are in Hampden County.

2.17 The study area, which totals 112,260 acres, can be divided into an urban sector and a rural sector. The urban sector consists of the communities of West Springfield, Agawam, and Westfield. The towns of Chesterfield, Huntington, Russell and Montgomery make up the rural sector. Over one half of the total land area is uninhabited. Much of this land is heavily wooded with rugged hillsides.

2.18 Recreational use makes up the largest proportion of total land area developed. Land uses are summarized in Table 2-1.

Figure 3. Aerial view of Knightville Dam on August 28, 1955 when 58% of reservoir storage capacity was utilized. Surface of pool as shown is 584 msl.

TABLE 2-1

REGIONAL LAND USE

	Total (in acres) for study area	% of total land developed
Residential	8,185	17.1
Commercial	531	1.1
Industrial	1,061	2.2
Transportation	4,520	9.5
Recreation	18,244	38.3
Public Utilities	725	1.5
Public buildings	358	.8
Agriculture	14,067	29.5
Total land developed	47,691	100.0

The dam and reservoir area can accommodate a variety of recreational activities year round. Fishermen in the spring and hunters in the fall as well as snowmobilers in the winter enjoy the recreational diversity offered in this area. The reservoir is licensed to the Massachusetts Division of Fisheries & Wildlife for wildlife management programs. Their programs include stocking the river with trout as well as stocking the reservoir area with pheasants. Maintaining a habitat appropriate for pheasants has been a problem. The Division has planted various food plants to enhance the habitat, but recurrent flooding has hindered growth of vegetation. The State is concerned with this, since there is a scarcity of available land in the region suitable for this kind of hunting activity. Another activity that is limited by lack of suitable conditions is white water canoeing. At the request of the Westfield River White Water Canoe Club, procedures were set up in 1965 to regulate the flow from the Knightville Dam at the end of the spring snowmelt season to provide suitable conditions for canoeing. Each spring the dam serves as the site for the

Westfield Wildwater Canoe Races. Thousands of spectators from all over New England reportedly attended the event last year.

2.19 The land immediately surrounding the Corps property is undeveloped. A wildlife area maintained by the State borders the reservoir on the north. Not too far from the area, still in Huntington is the Gardner State Park which provides facilities for picnicking, swimming, fishing, hiking, ski touring, and horseback riding.

2.20 Agriculture use, second to recreational use, makes up 29.5% of the total land developed. Agricultural land comprises the largest percentage of developed land in Agawam with 48.11% and in Westfield with 37.16%. In the rural communities, agricultural and recreational land uses total over 85% of the developed land area in each community.

2.21 Any significant concentration of manufacturing activity lies in Westfield and West Springfield. Commercial and industrial development tend to locate in the flood plains between the Westfield and Little Rivers where they are seriously threatened by flooding. As a suburb of Springfield, West Springfield has the largest percentage of 30.63% of residential development of the seven communities in the study area. Table 2-3 indicates the land use for the study area in major use categories.

2.22 Population

The entire region has experienced increases in population from 1960-1970 with the largest increase in Montgomery with a 39.9% population growth. Projected growth is shown in Table 2-2 with data compiled by the Lower Pioneer Valley Regional Planning Commission.

TABLE 2-3

REGIONAL LAND USE

Land Use Figures in Acres	Residential	Commercial	Industrial	Transportation	Recreation	Public Utilities	Public Buildings	Agriculture	Total Land Developed	Vacant Land	Water Bodies	Total Area Land & Water	Total Land Area
Chesterfield	330	7	14	-	1769	15	6	665	2806	16,938	102	19,846	19,744
Huntington	490	16	44	173	3406	69	11	1349	5558	10,360	1219	17,137	15,918
Montgomery	203	-	-	121	2730	31	5	881	3971	5602	111	9684	9573
Russell	201	10	42	194	3204	65	5	100	3821	7467	269	11,557	11,288
Westfield	2741	208	579	2265	2596	229	157	5190	13,965	15,901	538	30,404	29,866
Agawam	2149	95	105	790	2245	185	40	5200	10,809	4324	453	15,586	15,133
No. Springfield	2071	195	277	977	2294	131	134	682	6761	3977	493	11,231	10,738
Total For Study Area	8185	531	1061	4520	18,244	725	358	14,067	47,691	64,569	3185	115,445	112,260

Source: Lower Pioneer Valley Regional Planning Commission

TABLE 2-2

LPVRPC Population for 1970 and Projection for 1990

	1970 Pop.	% Change 1960-70	1990 Pop.	% Change 1970-90	Density 1970
Chesterfield	704	26.6	900	27.8	23
Huntington	1,593	14.4	1,700	6.7	61
Montgomery	466	39.9	600	28.7	31
Russell	1,382	5.8	1,500	8.5	78
Westfield	31,433	19.5	39,500	25.6	671
Agawam	21,717	37.8	33,200	52.8	930
West Springfield	28,461	14.1	36,200	27.1	1,699

2.23 The urban area has an average population density of 937 persons per square mile; the rural area an average of 47 persons. This greatly constrasts with the density of 14,846 persons per square mile for the city of Boston.

2.24 Economics

Manufacturing plays a major role in the economy of the Westfield River Basin, with most of the diverse activity concentrated in the urban communities of Westfield and West Springfield. These lowland areas were developed first because of their close proximity to river transportation. In Westfield, the manufacture of whips and the making of cigars became principal occupations early in the 19th century. With the growth of firms producing such things as bicycles, textile machinery, wood products, precision tools, Westfield rapidly changed from an agricultural community to a thriving industrial city by the latter part of the 19th century. Industrial growth was also predominant in West Springfield during the first part of the 19th century. There were tanneries, a gin and brandy distillery, and a hat factory. Later came a cotton factory, 2 paper companies and a steam sawmill and grist mill.

2.25 Throughout the region, manufacturing traditionally has been the most important sector of the economy, accounting for roughly half of total employment. In the first half of the 20th century, employment in manufacturing declined, a trend apparent not only in this region and the Commonwealth of Massachusetts; but also, in New England and the country as a whole. During this period, the region followed the national and state trends with increased shares of employment in the wholesale, retail, and service sectors. Over the past few decades manufacturing has not declined at the same rate, but has shown a shift from non-durable industries to durable industries.

2.26 In the urban area of Westfield, West Springfield, and Agawam manufacturing was first or second to wholesale and retail trade as the largest source of employment as indicated in Table 2-4.

TABLE 2-4

Employment Distribution

Source: Town	Percentage of Employment in Manufacturing	Percentage of Employment in Wholesale & Retail Trade
Westfield	54.7%	27.0%
West Springfield	26.5%	38.5%
Agawam	43.2%	24.4%

2.27 Early industry in the rural area of Chesterfield, Huntington, Montgomery, and Russell included grist mills, saw mills, cider mills and paper mills. The rugged and mountainous terrain that covers much of this area inhibited any further industrial development. Agriculture then became economically important with maple products such as syrup, sugar, and candy among the principal goods.

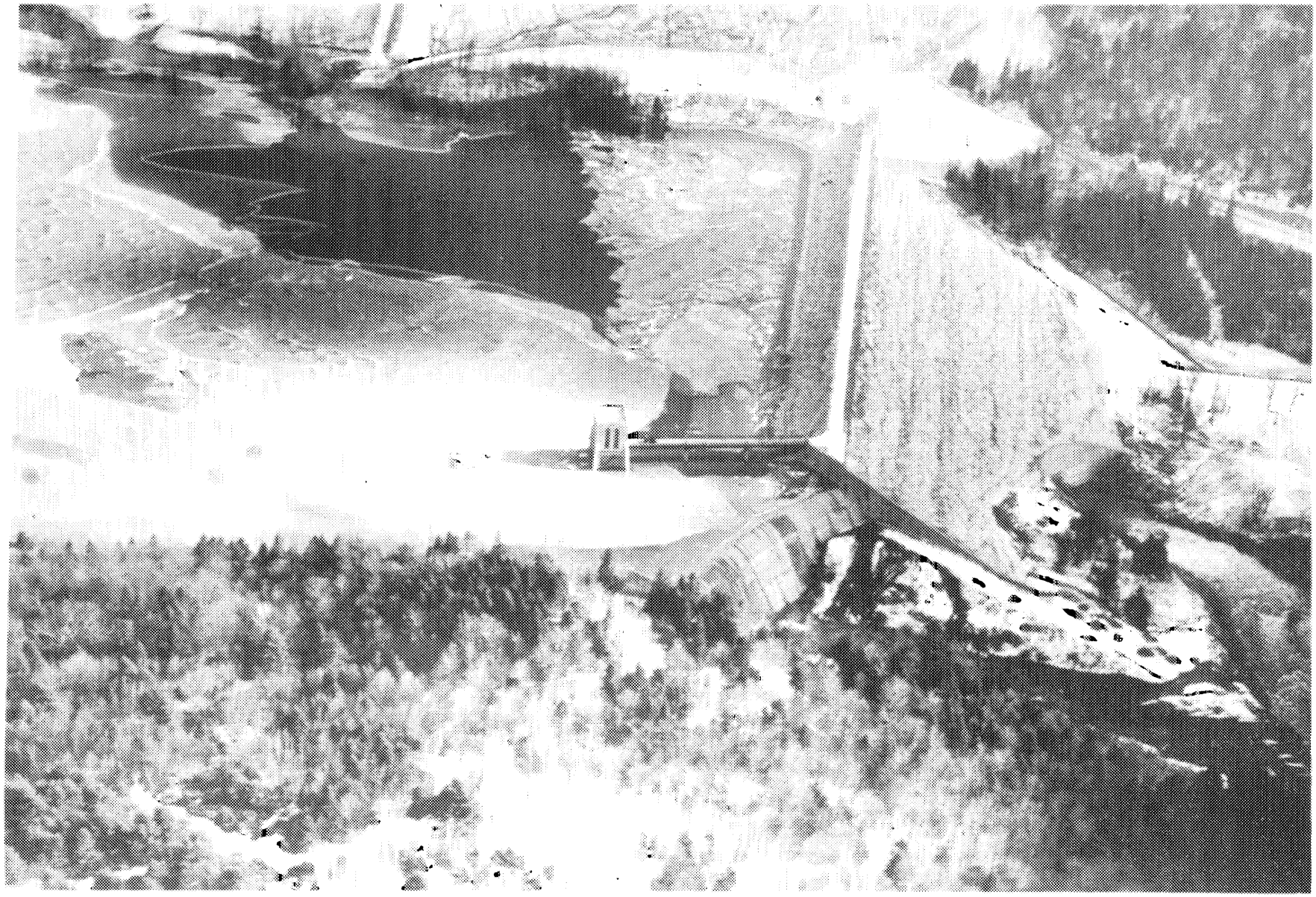


Figure 4. Aerial view of Knightville Dam in January 1949, when total flood storage capacity was utilized and a small amount of spillway discharge occurred.

2.28 Income data was not available for all the communities in the study area, so county data has been compared. The median income of Hampshire County including Chesterfield and Huntington was $5,197; of Hampton County including the other 5 communities it was $8,431, with an average for the urban area of $10,567.*

2.29 Project Land Use

The Knightville reservoir area includes 258 acres in easement for temporary flowage, and 2430 acres owned in fee. The Corps operates the Indian Hollow Campground, 4 miles upstream of the dam, and a small picnic area located near the dam. The Massachusetts Department of Fisheries, Wildlife and Recreational Vehicles holds a license to conduct an annual pheasant stocking program in 2100 acres of the reservoir and stocks trout in the streams within the reservoir area.

2.30 The Corps of Engineers retains authority and responsibility for all management activities in the licensed area that do not pertain to fish and wildlife management. These activities include, but are not limited to, the maintenance of roads, timber management, trails management and administration and control of recreation activities other than fishing, hunting and trapping.

2.31 There is presently a group camping area at the Indian Hollow Campground, with adequate room for possible expansion in the future. The single vehicular access is via Huntington Road which leads into the reservoir from South Street in Chesterfield. Planned improvements at the area include installation of flush toilets and showers, which

*U.S. Census, 1970

are presently under construction. Inundation of the camping area occurs only at high pool stages and therefore its use is normally not curtailed except in the event of major summer impoundments.

2.32 Immediately downstream of the dam is a small picnic and day use area adjoining the river. The river here is utilized for fishing and white water canoeing. Organized seasonal canoe racing began in 1954 and, at the request of the Westfield River White Water Canoe Club, procedures were set up and first utilized in April 1965 for regulating flow from Knightville Dam to provide suitable conditions. An outflow of 1,000-1,400 cubic feet per second (cfs) from Knightville Dam provides optimum flow conditions for racing. The races are conducted in early April as natural flows may recede rapidly later and holding storage from spring runoff for later release is undesirable, because of reduced flood storage capacity and possible additional damage to reservoir vegetation.

2.33 Total visitation at Knightville Dam and the reservoir area averaged about 71,000 per year in the period 1965 through 1975. A large proportion of visitation is composed of sightseers, many of whom did not actually use the project lands for various recreational activities, but only visited the dam site itself.

2.34 Fish and Wildlife

The Westfield River drainage basin contains both cold and warm water fish; smaller tributary streams and the main branches in the

upper watershed provide the most suitable trout habitat, while the lower basin supports mainly warm water species.

2.35 Within the reservoir area, species include brook, brown and rainbow trout, white sucker, creek chub, black-nosed dace and other minnows. Trout populations are sustained largely through stocking, although there is some carry-over and natural reproduction. Typical warm water species inhabiting the Westfield River below Knightville Dam are brown bullhead, yellow perch, bluegill, smallmouth and large-mouth bass, and chain pickerel.

2.36 Nineteen significant storage operations (stage exceeding 60 feet, 13 percent of capacity) have occurred during the prime cold water fishing months of April, May and June since Knightville Dam was constructed. The average volume of water stored in these instances has been about 13,300 acre-feet, inundating 4 miles of the Westfield River or 60 percent of the total length subject to flooding, plus 0.6 mile of the Little River. Loss of stream fishing opportunity has been attributable directly to inaccessibility or undesirable conditions caused by high water, to muddy banks, silt and debris accumulation after pool drawdown and, on occasion, to the inability to stock at the normal times before and during the spring trout season. In spite of regular flooding of portions within the reservoir, the Westfield River is a heavily used and important trout stream for much of its length.

2.37 More than 470 acres of reservoir land have been flooded on an average of once every ten months. Flood storage operations have taken place throughout the year, but impoundment in April for spring runoff

has accounted for 40 percent of the significant operations. The 470-acre area subjected to annual or more frequent flooding includes all of the land in the vicinity of the Little and Westfield River confluence which is managed as a stocked pheasant hunting area by the Massachusetts Division of Fisheries and Game. The Division had in the past planted various herbaceous cover and food plants for enhancement of pheasant habitat, but these programs have been discontinued, partially due to the failure to realize significant benefits in view of recurrent flooding. The area has little value for other forms of wildlife since vegetation is scant, but does serve as part of their range when not under water.

2.38 The rural, mostly forested area surrounding Knightville reservoir offers a diversity of both game and non-game wildlife. The only big-game animals at the project are white-tailed deer and occasional black bear. Upland game species found in the reservoir area are red and gray squirrels, ruffed grouse, woodcock, cottontail rabbit, and varying hare. Waterfowl utilization of the project is relatively low, but small nesting populations of wood ducks and hooded merganzers have been observed in the past. During migration, black ducks, blue-winged teals, green-winged teals, and American merganzers use the Westfield River for feeding and resting.

2.39 Red and gray foxes, bobcats, weasels, opossum and striped skunks inhabit the reservoir or include it in their range. Othe mammals generally associated with the stream environment are raccoon, mink, otter, beaver and muskrat.

2.40 The osprey and marsh hawk, both of which are considered to be locally rare, have been sighted in the Knightville project area. A

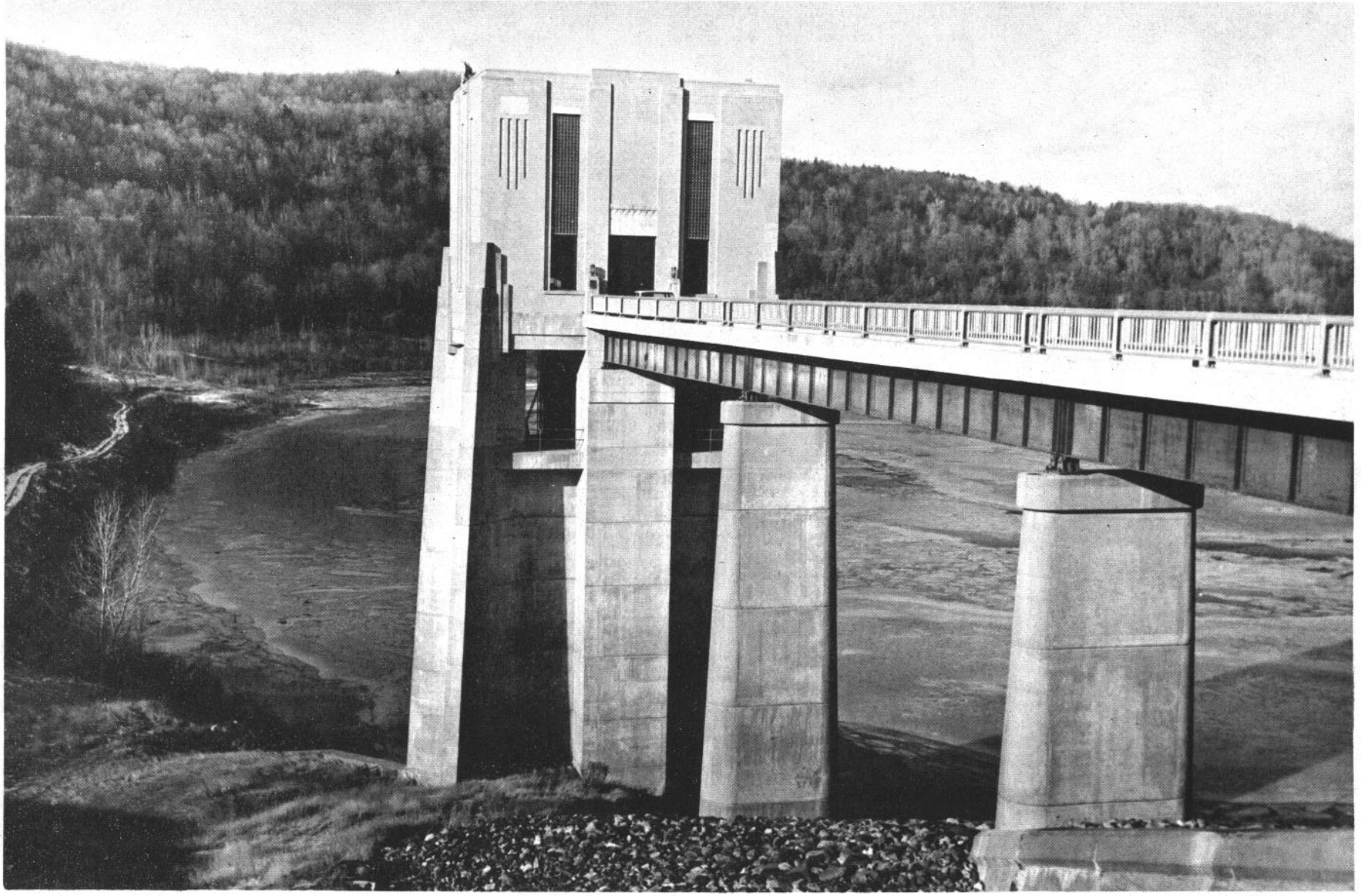


Figure 5. Intake tower and access bridge at Knightville Dam.

review of the list of Endangered and Threatened Wildlife as published in the Federal Register, October 27, 1976, (Vol. 41, No. 208, pp. 47180-47198) indicates that there are no known wildlife species in the project area considered to be endangered or threatened.

2.41 As a normally empty reservoir during non-flood periods, Knightville Dam does not retard flows in the Westfield River and, therefore, has no detrimental effects on downstream biota. The river has a relatively steep gradient of about 25 feet per mile for more than 10 miles below Knightville dam which produces water velocities sufficient to prevent most fine suspended matter from settling out except when flows are very low.

2.42 During a moderate or major flood, reservoir discharges are restricted to a minimum flow (about 10 cfs) which is considered necessary for maintenance of downstream fish life. Impoundment during large floods may require closure of the gates for two to four days as high inflows to the reservoir need to be stored temporarily. For example, in January 1949, when the pool reached spillway crest elevation, the gates were closed for just under three days, and in August 1955 for less than four days. Sykes Brook joins the Westfield River about one-quarter of a mile downstream from Knightville Dam, and Pond Brook plus two small unnamed streams also enter the river between the dam and the confluence with the Middle Branch. Discharges from these streams augment the minimum releases and prevent sustained low flow conditions from occurring in the Westfield River immediately downstream from Knightville while water is being impounded. For many flood regulations, the gates have not been closed during impoundment; rather, flows of up to 400 cfs have been permitted downstream while the reservoir stage was rising.

2.43 Heavy rainfall and runoff in the watershed usually produce turbidity in the Westfield River. When flood control operations become necessary, and waters are impounded, any sediment which has settled to the bottom of the reservoir near the gate structure is released as the flood pool is drawn down. Because of the high stream gradient and the magnitude of peak regulated discharges accompanying drawdown, which have historically averaged about 3,200 cfs with a maximum since project construction of 6,660 cfs in March 1945, there have been no significant problems with inordinately high suspended solids concentrations in the discharge or with sedimentation in the downstream channel which would adversely affect habitat conditions for trout and other fish species. It is probable too that sediment loads are decreased somewhat, since some of the fine material is deposited in the upper reservoir and is not discharged immediately.

2.44 Existing Water Quality and Water Supplies

The Westfield River, including the reach above Knightville Dam, has been classified by the Massachusetts Division of Water Pollution Control as Class B water. These waters are suitable for bathing and other water contact recreation. Class B waters are acceptable for public water supply after appropriate treatment. It is also suitable for agricultural uses and certain industrial cooling and process water. Class B waters provide an excellent fish and wildlife habitat in addition to being of excellent aesthetic value.

2.45 The Corps of Engineers has been collecting periodic seasonal water samples at inflow and outflow stations of the dry bed reservoir since 1970.

2.46 Five parameters are routinely obtained: temperature, dissolved oxygen, pH, conductivity and turbidity. Other parameters which have been sporadically or solitarily measured are total coliform bacteria, fecal coliform bacteria, color, hardness, ammonia, nitrite, nitrate, phosphate, calcium, chloride, floride, chlorine and some heavy metals.

2.47 These parameter measurements indicate that the standards for Class B waters are not always achieved in the river normally flowing through the project. Some of the total coliform bacteria samples taken in four years of sampling exceed the concentration limits of the Class B standards. The maximum single total coliform bacteria count was 6,500 bacteria per 100 ml in July 1973. The pH standard was not always achieved at either the inflow stations or the discharge station. The range of pH values has varied from 5.3 to 8.2. Although no dissolved oxygen concentrations were measured less than the minimum 5 mg/l allowable for Class B waters, approximately 17 percent of the dissolved oxygen measurements were below the 75 percent saturation level. The duration of dissolved oxygen saturation level below 75 percent was not determined. Water temperature (^{O}F) at the inflow station was often recorded in the high 70's during the summer months between 1970-1978, inclusive. In July 1971, a water temperature in the low 80's was recorded.

2.48 Present operation of Knightville Dam has little or no impact on water quality in non-flood periods, as outflows are equivalent to inflows. Rapid runoff associated with flood periods generally causes increased erosion and, consequently, increased sediment loads in the Westfield River and tributaries. Historically, flood waters have been stored in Knightville reservoir for a maximum of just over two weeks, but residence times are often considerably less depending

on a number of hydrologic factors and hydraulic operating criteria. By delaying and reducing peak flows, flood control operations have typically had the effect of prolonging turbid conditions in the river. If unimpeded by the dam, sediment would be carried downstream as far and as long as flow and velocity were sufficient to keep the material in suspension. Although some settling out does occur in the reservoir, storage times are not adequate to allow significant clarification of the stored water. Moreover, the discharge structure unavoidably releases the most turbid water from the bottom of the pool. It is improbable that important changes in the chemical quality of flood water occur during the short detention time in the reservoir; nevertheless, the accumulation of organic and inorganic oxygen-demanding detritus might temporarily suppress dissolved oxygen levels while the pool is being drawn down after the recession of a flood.

2.49 Historical and Archaeological Features

In compliance with Executive Order 11593, National Historic Preservation Act of 1966, the National Environmental Policy Act of 1969 and EC 1105-2-37, Identification and Administration of Cultural Resources, the New England Division, U.S. Army Corps of Engineers conducted and completed a cultural resource reconnaissance. The reconnaissance, conducted by the New England Division Archaeologist, included a literature search, a field reconnaissance and selected subsurface testing of the ground surface to be altered by the proposed project. No cultural resources were identified within the proposed project area.

2.50 The cultural resource reconnaissance included an intensive literature search of existing documents located at various State and academic repositories. The State Historic Preservation Officer's records were examined along with the records of the State Archaeologist. This research indicated there are no known historical and/or archaeological sites listed on the most current National Register of Historic Places, or in the process of being nominated to the National Register that will be impacted by this proposed project.

2.51 The field reconnaissance of this area included a 100% walk over the area, and selected subsurface testing of the ground surface to be altered. Subsurface examination was in the form of shovel testing and hand augering the project area. Soil excavated from eleven 40 x 40 cm shovel units, 50 cm deep, were sieved through a 102 mm screen. In addition, soil samples obtained by hand augering to a depth of 185 cm were sieved and tested in the same manner. All shovel test units and subsequent augering of those units produced no physical evidence of either historic or archaeological resources.

2.52 Sewage and Solid Waste Disposal

There are no major problems with waste disposal at the Knightville project. Construction of improved sanitary facilities at Indian Hollow Campground has high priority and will be completed in 1976. Littering and improper trash disposal are evident in several parts of the reservoir, and the Division of Fisheries and Wildlife has noted particular problems during the fall hunting season. However, the Corps has little control over undeveloped areas which are used by fishermen, hunters, hikers and other recreationists. By locating

camping and picnicking facilities in relatively small areas, most solid waste can be removed by routinely emptying the trash receptacles, and much of the littering which does occur is confined to a similarly small area, facilitating general clean-up by Corps personnel during and after the recreation season.

2.53 Regulation Procedures

The regulation of Knightville Dam and Littleville Lake is governed by precipitation reports and river stages at index stations along the Westfield and Connecticut Rivers. During normal periods, the flood gates at Knightville Dam are maintained at three-foot openings which does not retard normal river flows. To prevent ice build-up in the gate structure, flood gates are closed sufficiently to maintain a winter pool at a stage of approximately 20 feet from about December 1 to March 15. Normal river flow is not retarded significiantly, once the winter pool is established.

2.54 All reservoir regulations are preceded by communications with, and instructions from the Corps' Reservoir Control Center (RCC). The Project Manager alerts RCC when any of the following conditions occur (1) one inch of precipitation during a 24-hour period at any station within the Westfield River network, (2) a rising stage of 522 feet msl is reached at Littleville or 25 feet at Knightville, (3) a stage of 3.8 feet is reached at the USGS gaging station on the West Branch of the Westfield River, and (4) a stage of 8.0 feet is reached at the USGS gauging station in Westfield.

2.55 Downstream Flood Prevention

Since its completion in 1941, the operation of Knightville Dam for flood control has prevented damages in excess of $17.5 million. The reservoir has been filled to a stage of 60 feet (540 feet msl) or greater, representing 13 percent of the total flood storage capacity, 37 times. The most significant flood control operations occurred in January 1949 (when the total storage capacity was utilized and a small amount of spillway discharge occurred), October 1955 (96 percent), April 1960 (60 percent), and August 1955 (58 percent).

2.56 Primary flood damage reduction benefits accrue to the city of Westfield, where several thousand acres of developed flood plain are subject to flooding. The project also contributes to reducing flood stages on the main stem Connecticut River from the damage centers of Springfield and Agawam, Massachusetts to Hartford, Connecticut. Operation of the project would prevent damage of $10.5 million in a recurrence of the March 1936 Connecticut River Basin flood of record and $3.5 million in a recurrence of the August 1955 flood, the flood of record in most of the Westfield River watershed. These potential damages are somewhat higher than previous estimates, due in part to recent construction in the flood plain.

2.57 Aesthetics

The two important aesthetic concerns at Knightville Dam, as at most flood control reservoirs, are the visual impacts of the dam and its associated structures, and the fluctuating flood pool effect on the reservoir landscape.

2.58 The rock covered dam and concrete spillway form a barrier 160 feet above the river and 1,600 feet across the river valley. The earth fill dam covers approximately 15 acres, imposing a large unnatural form on the rural landscape of the Westfield River valley. The spillway discharge channel encompasses approximately 9 acres that have been cleared of trees leaving a conspicuous opening in the river bank vegetation, highly visable from the road to the picnic area below the dam.

2.59 The principle aesthetic concerns associated with the fluctuating flood pool periodically created behind Knightville Dam involve debris accumulation, siltation and damage to natural vegetation by inundation or ice movement.

2.60 Debris may enter the pool with runoff from upstream watercourses or when the rising flood waters inundate reservoir upland. Most debris eventually floats downstream to be trapped by a stop log barrier near the upstream base of the dam. Accumulated debris is then removed by the Project Manager.

2.61 Damage to vegetation by flood pool inundation varies according to the season, duration and depth of inundation, height of plants, extent of siltation and the particular susceptibility of each species. Ice movement can also cause additional damage by injuring bark and stripping branches. Ice damage is most noticeable below an elevation of approximately 540 feet msl where many branches have been stripped from large trees, and shrubs and small trees have been damaged..

2.62 The siltation which can occur in the reservoir basin after a major flood control operation and the vegetation damage inflicted directly by inundation can temporarily diminish the aesthetic appeal of the area for general recreation use. Summer impoundments, such as in June-July 1973, are the most destructive as they occur during the growing season and have often destroyed all the foliage of both coniferous and deciduous species. The needles of pines and hemlocks are normally persistent for two or more seasons, and thus these trees are somewhat more susceptible than hardwoods to flood damage induced loss of foliage. Many of the hardwoods, however, are able to survive the loss of one year's foliage and have been observed to bud and leaf out fully in the next growing season.

2.63 Major damage susceptibility is now minimized by the age of the project in that the frequent inundations since 1941 have by now eliminated sensitive species leaving the more tolerant species to dominate the upper elevations of the reservoir. The lowest areas were either already cleared for agricultural uses prior to construction of the dam or were cleared for a pool which was maintained during World War II. The lower elevations of the reservoir area are now dominated by water tolerant grasses, herbaceous growth and some woody shrubs after the pool is drawn down in the spring.

3.00 RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE

3.01 The Lower Pioneer Valley Regional Planning Commission regional land use plan through 1990 delineates the Knightville Dam reservoir area and surrounding land for fish and wildlife habitat, recreation open space and flood control purposes. Modification of the dam and increasing the acreage of flowage easement do not conflict with these long range land use plans.

4.00 THE PROBABLE IMPACT OF THE PROPOSED MODIFICATION ON THE ENVIRONMENT

4.01 Effects of Site Construction Activities

During construction of the proposed modifications, temporary disturbances will occur in the local area. Construction activity will involve increased vehicular traffic on local roads, and noise associated with on-site operation of equipment. Operation of construction equipment may result in local erosion and occasional degradation of air quality due to dust. Noise and increased traffic may also cause some disturbance to local fish and wildlife. However, these disruptions will be temporary and are not considered serious.

4.02 Vegetation Loss Due to Construction

Construction of modifications to the dam and appurtenant structures will result in the encroachment of approximately one acre of land on the upstream side of the dam and a minimal area on the upstream side of the spillway. Vegetation on the land to be lost is primarily mown grass or an unmown mix of grasses, forbs and small shrubs within the present reservoir area. Some larger trees may also be lost in the immediate construction area but this is all vegetation which has been planted or become established naturally since completion of the existing dam in 1941.

4.03 Preservation of Open Space

The acquisition of flowage easements for 46 acres of land in the proposed area of increased impoundment will prevent the building of any structures on this land, preserving the area as open space during the life of the project.

4.04 Impact on Upstream Vegetation and Wildlife

Since the proposed action is a modification of an existing project, most significant impacts have already occurred. However, increasing the height of the spillway 8.5 feet will result in increased impoundment impact behind Knightville Dam. On the infrequent occasions when the planned flood pool rises to the height of the new spillway, approximately 90 additional acres of upland habitat will be inundated. While this inundation at the highest elevations of the proposed flood pool would probably last no more than a few days, certain sensitive plant species may be damaged or killed. In addition, wildlife losses may also occur due to drowning or damage to habitat, particularly during certain times of the year such as nesting season for birds. This potential for disruption of vegetation and wildlife will continue throughout the life of the project.

4.05 Downstream Impact

The increased flood protection provided by the proposed modification should not have a significant impact on downstream floodplain development, because the potential for major flooding from the uncontrolled portion of the Westfield River basin would remain for downstream communities such as Westfield. While the proposed modifications would reduce the peak discharge in rare floods, the reduction in actual land area inundated would be slight due to the topographic character of the flood plain.

4.06 Increased Flood Protection Benefits

The most important beneficial impact that the modification will contribute will be increased flood protection for Westfield and other damage centers downstream. Measured in dollars the incremental benefits with the additional one inch of storage are estimated to be ~~$218,900~~ $269,400 (current prices, September 1976) in reduction of losses on an annual basis. This consists of $36,600 in redevelopment benefits, $218,900 in prevention of flood losses and an estimated value of affluence growth of $13,900. Of this $218,900 in annual flood control benefits for the entire Westfield River to its confluence with the Connecticut River in West Springfield, $210,000 are received by the city of Westfield.

4.07 Redevelopment benefits may be taken since the Springfield-Chicopee-Holyoke SMSA in which Huntington is located, has been designated as a redevelopment area under PL 89-136. Redevelopment areas are characterized by high unemployment. Under the law, benefits for a project may be increased when local labor and resources are utilized. It is regular practice for a contractor to maintain a skilled skeleton crew and fill the rest of his requirements from the local labor pool. It is estimated that 75% of the laborers will be hired locally for this project. While not all of this labor will come from the rolls of the unemployed, the jobs that they leave will be filled by either the unemployed, or the underemployed; thus 75% is used. It is estimated that the work will take two years to complete.

With interest at 6-3/8% the redevelopment benefits are $36,600 as was indicated above.

4.08 The modification will reduce physical losses such as losses or damages to structures, machinery and stock, and cost of clean up and repairs. Non-physical losses to be reduced are unrecoverable wages and business, cost of temporary facilities and increased cost of operation. For the most part, these benefits will be gained by the city of Westfield.

4.09 Water Quality

Flood conditions resulting in rapid runoff and soil erosion increase the sediment load to the Westfield River. By reducing the peak flow, flood control operations have altered the riverine sediment transport system by prolonging turbid conditions and decreasing the maximum instantaneous settleable solids concentration downstream of the project. However, it is improbable that significant changes in the chemical quality of flood waters occur during the short detention time in the reservoir. Modifications to the dam will not appreciably alter any effect which reservoir regulation may presently have on water quality.

4.10 Non-flood operation of Knightville Dam has little or no impact on water quality because no water is stored behind the dam and river flow is not impeded.

5.00 ANY PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

5.01 Fish and Wildlife Losses

Dispersion of resident fish species by reservoir inundation almost every year may have short-term adverse affects. When significant reservoir filling occurs during early or mid-summer, the upstream river fisheries are most susceptible to losses as spawning or early development of fry is interrupted. Any such damage should not be increased by the proposed modification except in the event of an unusually large storm when up to approximately 1600 feet of additional upstream river habitat would be temporarily inundated at spillway crest elevation.

5.02 The additional reservoir impoundment which may result from the proposed project may effect 90 additional acres of upland habitat and may deter it use by some wildlife species. Reservoir regulation may result in frequent losses to small game and non-game animals which are more susceptible to drowning during flood operations. There is no present indication, however, of any significant decrease in local animal populations.

5.03 Periodic Inundation of Vegetation

Storage of flood waters behind Knightville Dam has resulted in a detrimental impact on vegetation in the reservoir area. The major impact on trees and other vegetation caused by frequent inundation occurs in the lower reservoir, although the greatest loss occurred within the first few years of operation. Most vegetation now growing

in the lower reservoir area is comprised of species which tolerate inundation with little apparent damage. In the higher elevations of the reservoir area, because flooding is much less frequent and of short duration, vegetation losses have been minimal. Increasing the storage capacity of the dam may result in a greater area of inundation, but the additional area will be subject to the least impact in terms of depth and duration of inundation. However, lower areas of the reservoir may be subject to longer periods of inundation, which may result in greater total vegetation impact throughout the life of the project.

5.04 Vegetation Clearing During Construction

Construction of modifications to the dam and related facilities will require clearing a small area of woodland near the existing maintenance building to accomplish necessary grade changes. An area of approximately one acre of grasses and forbs will also be permanently covered by additional fill as a part of the dam modification. The loss of this vegetation is considered minor in relation to the vast acreage of vegetation presently preserved as open space in the project area and existing in the surrounding region.

5.05 Construction Activity Disturbance of Fish and Wildlife

During construction, the noise and increased traffic in the vicinity of the dam will cause some disturbance to the fish and wildlife inhabitants of the project area. However, this adverse impact is expected to be minimal and of relatively short duration. When construction activity is complete and the site has been restored, many of the wildlife species which originally inhabited the immediate area should return.

6.00 ALTERNATIVES TO THE PROPOSED ACTION

6.01 No Action

Without implementation of the dam modification project, flood protection downstream of Knightville Dam would only be provided by existing flood control facilities. Even with the protection currently provided by the Knightville and Littleville projects, there exists a need for further protection in the city of Westfield and other areas because of continuing development in the flood plain. Prevention of future flood plain development is the responsibility of local officials, and it is expected that downstream communities will adopt zoning and building regulations to qualify for the National Flood Insurance Program. However, until such regulations are fully implemented, development will most likely continue, increasing the level of average annual flood damages. In addition, modifications needed to bring the project up to present day hydrologic design criteria would not be completed.

6.02 Modify the Project to Conform to Updated Design Criteria Without Increasing Flood Storage Capacity.

This alternative would involve structural stabilization of the spillway, and increasing in the freeboard of the dam to the standard of five feet by raising the top of the dam and appurtenant structures 2.3 feet. While such measures would update the design of the dam to present design criteria, additional downstream flood protection would not be provided. Thus the increased need for flood protection would not be met.

6.03 Modify the Project to Conform to Updated Design Criteria and Increase Flood Storage Capacity To Include Either A Seasonal Or Permanent Pool for Recreation and Downstream Low Flow Augmentation.

The original proposal for structural modification of Knightville Dam, as presented in the "1980 Early Action Plan", was to provide a recreational pool with low flow augmentation for the Westfield River. In addition, the Connecticut River Basin report indicated the need to investigate the possibility of providing additional flood control storage at Knightville Dam as the present storage capacity was determined to be inadequate to effectively control predicted runoff in the upper Westfield River Basin.

6.04 Low flow augmentation for the purpose of enhancing fishery resources would be small and available only during the late summer when the majority of the stocked fish have been removed. Therefore, the beneficial effect on the fishery would be minimal. Without significant benefit, provisions for low flow augmentation are not justified and the proposal has been eliminated.

6.05 Creation of a permanent recreation pool by providing additional storage capacity would require that the dam and appurtenant structures be raised to compensate for the flood storage capacity lost by the pool. Federal regulations require that the Commonwealth of Massachusetts bear 50% of the cost associated with raising the height of the dam for recreational purposes. Discussions with State officials have indicated that the cost of modifications would be greatly in excess of the benefits derived from the recreation pool, and the State would be unable to fund its share. The U.S. Fish and

Wildlife Service and the Massachusetts Department of Fisheries, Wildlife and Recreation Vehicles have also indicated their opposition to the creation of a permanent pool because of the impact to the area of permanent inundation. The pool would eliminate the principle reservoir area presently utilized for stocking and hunting of pheasant, and approximately 2.5 miles of a normally free-flowing cold-water stream would become a warm-water pond. Therefore, this proposal has also been eliminated.

6.06 Unlike a permanent pool, a summer pool would only temporarily effect the flood storage capacity of the project, and would not require modification of the dam to compensate for lost storage capacity. However, the detrimental environmental effects would be similar to those of a permanent pool, with the additional problem of the creation of mud flats during parts of the year when the pool was drawn down. Consequently, a summer recreational pool was dropped as a project purpose.

6.07 Other Flood Storage Capacities Considered in Conjunction With Modifying the Project to Conform to Updated Design Criteria

In the process of conducting preliminary engineering studies for means to provide additional flood protection for the Westfield River flood basin, various increments or amounts of additional storage at Knightville Dam were evaluated in terms of their effectiveness in controlling downstream flooding and the cost of providing this storage. The various amounts of additional storage considered are listed in Table 6-1.

TABLE 6-1

Proposed Levels of Flood Control Storage

Additional Acre-Feet	Total Acre-Feet	Elevation of Pool	Additional Inches of Runoff Stored
4,320	53,320	614.3	1/2
8,640	57,640	618.5	1
12,960	61,960	622.6	1-1/2
17,280	66,280	626.5	2

Also considered were alternative methods of raising the dam, stabilizing and raising the spillway, and raising other structures, in order to determine the most economical method of modifying these structures. Analysis of this information determined that providing 8,640 acre-feet of additional storage was the most desirable plan in terms of net benefits over costs.

7.00 THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

7.01 Inundation Impact

Periodic inundation of the reservoir during flood conditions results in short-term damage to plant and animal life. This effect will continue throughout the life of the project. However, should the project cease to operate, the reservoir would naturally revegetate and wildlife would immigrate from the surrounding region, with no significant effect on long-term productivity.

7.02 Area Land Use

The land use at Knightville Dam is already committed as a dam and flood water storage reservoir. The operation of the dam has had minimal effect on land use in the area surrounding the reservoir because of the existing rural woodland character, with little pressure for development. The reservoir did eliminate some farming activity, and undoubtedly the scenic character of the river valley would attract some residential development, but development could reoccur should the project cease to operate, and the potential for long term productivity has not been destroyed.

7.03 Downstream Flood Plain Ecosystem

Downstream of Knightville Dam, the flood protection provided communities on the Westfield River has probably contributed to continued development in the flood plain. This development has not been countered by effective and comprehensive nonstructural programs by the

local communities such as flood hazard area zoning to discourage building. Natural valley storage areas in the lower Westfield River basin become undesirable for the storage and slow release of flood waters, and instead require flood protection when indiscriminate development is not controlled. The flood plain ecosystem, composed of bottom land species of trees and plants tolerant of and dependent on periodic flooding, is adversely affected directly by removal of vegetation for construction of roads, parking lots and buildings, and indirectly when structural protection measures such as dams and levees reduce natural inundation of the river lowlands. These combined effects may interrupt the water balance sufficiently to alter marshes and decrease groundwater recharge. The result may be a significant decrease in long term natural diversity and productivity in these downstream areas.

7.04 Socio-Economic Effects

The downstream areas which benefit from flood control operations at Knightville Dam are highly developed and industrialized. Most of the residential, commercial and industrial developments are located on the lowlands in the city of Westfield, about sixteen miles below the dam. The flood of record for the Westfield River watershed occurred in August 1955, during which Knightville Dam was in operation and prevented damages of $6.48 million. Residual losses in this flood were still nearly $14 million, and serious flooding potential led to the construction of Littleville Lake in 1965.

7.05 The necessity for the flood control project lies in the hydrologic and topographic characteristics of the watershed, which has a relatively high flood potential throughout the year because of

steep stream gradients conducive to rapid runoff. However, the channel slope in the Westfield area is much smaller than on tributary streams in the upper basin, causing river stages to rise more rapidly and flood waters to spread over the low-lying areas, some of which are highly developed. The magnitude of the manufacturing carried on in Westfield and West Springfield is dependent in part on the flood protection afforded by the upstream reservoirs and local protection projects in the lower watershed. Agriculture, primarily tobacco production, is also benefitted by the mitigation of flood flows. The continuation of the Westfield area as a center for industry and manufacturing is substantially beneficial to long-term economic productivity of the region.

8.00 ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

8.01 The proposed action will involve the commitment of steel, concrete, earth fill and rock fill. These materials will be obtained from existing local off-site commercial sources approved by the Government. No materials will be obtained from the immediate area of the dam or from the reservoir area, and landscape alteration will be limited to the construction area only. Existing upstream rock protection will be removed, stockpiled and replaced after raising the dam. Any spoil material generated during construction will be deposited in Government approved upland sites outside the project area.

8.02 The placement of earth and rack fill necessary for structural modification of the dam and spillway will eliminate approximately one acre of vegetation. Most of this vegetation is unmown grass and forbes or areas frequently disturbed by mowing, and its destruction does not represent a serious loss to the region.

8.03 An increase in the area of potential reservoir impoundment may result in the damage or death of additional vegetation and the disruption of wildlife habitat not already altered by previous flood pools. Natural succession and regrowth of damaged plants will gradually reduce evidence of vegetation and habitat damage, but periodic redamage may continue to occur throughout the life of the project.

9.00 COORDINATION WITH OTHER AGENCIES

Coordination with various Federal, State and local interests resulted in valuable input to this Environmental Impact Statement. Following is a list of the several interests with whom coordination took place:

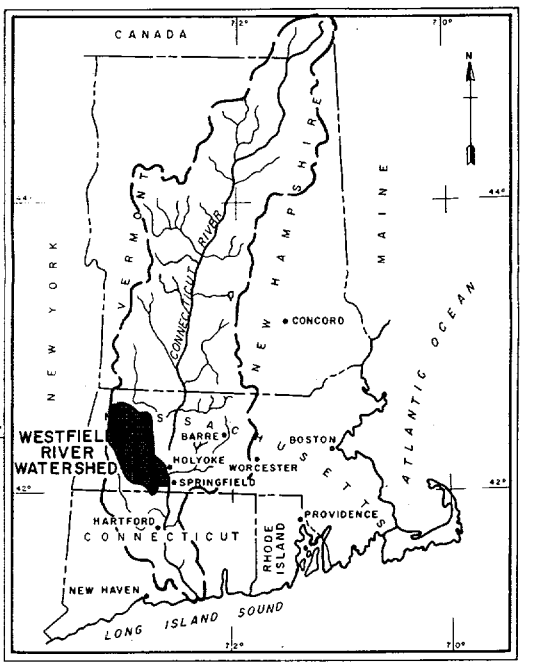
U.S. Fish and Wildlife Service

Soil Conservation Service

Massachusetts Department of Fisheries, Wildlife and Recreational Vehicles

Massachusetts Department of Environmental Management

Massachusetts Department of Environmental Quality Engineering



REGIONAL MAP

SCALE
10 0 10 20 30 40 50 MI.

AREAL SUB-DIVISIONS		
AREA	DESCRIPTION	DRAINAGE AREA SQ. MI.
A	Westfield River at Knightville	162
B	Middle Branch at Goss Heights	52.6
C	West Branch at Huntington	93.7
D1	Little River at Cobble Mountain Reservoir	45.8
D2	Little River - Cobble Mountain Reservoir to Mouth	38.2
L-1a	Local Area - Knightville to Elm Street Bridge	57
L-1b	Local Area - Elm Street Bridge to Westfield Gage	47
	Westfield River at Westfield Gage	497
TOTAL	WESTFIELD RIVER AT MOUTH	517

LEGEND
- STREAM GAGING STATIONS.
- PRECIPITATION GAGES.
- PRECIPITATION AND TEMPERATURE GAGES.

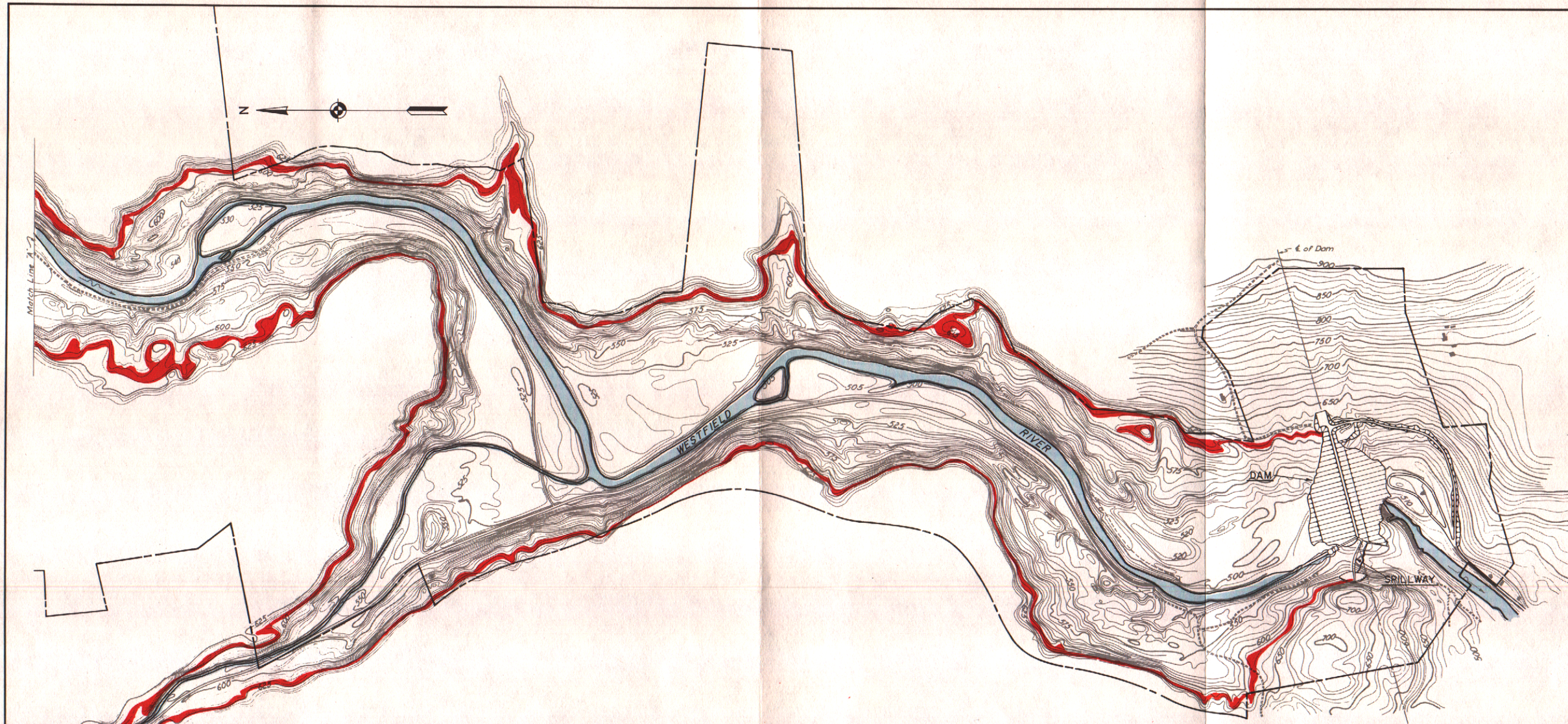
SCALE IN MILES
3 2 1 1/2 0 3

WATER RESOURCES INVESTIGATION
CONNECTICUT RIVER BASIN

WESTFIELD RIVER WATERSHED

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

PLATE 1



KNIGHTVILLE DAM
MODIFICATION
IMPOUNDMENT AREA
SEGMENT I

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WALTHAM, MASS. JANUARY 1977

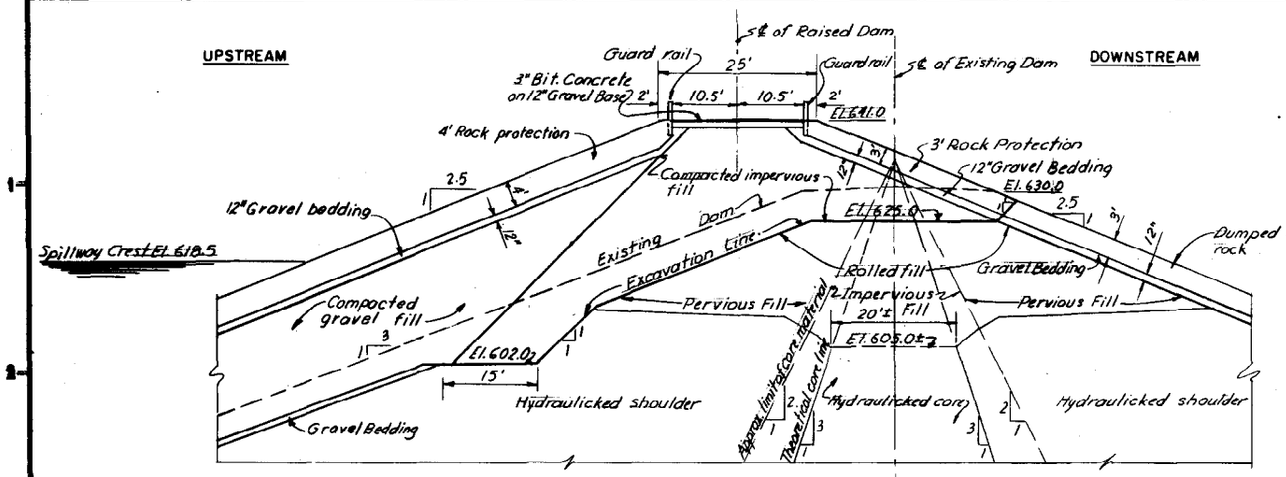
PLATE 2

KNIGHTVILLE DAM
MODIFICATION
IMPOUNDMENT AREA
SEGMENT II

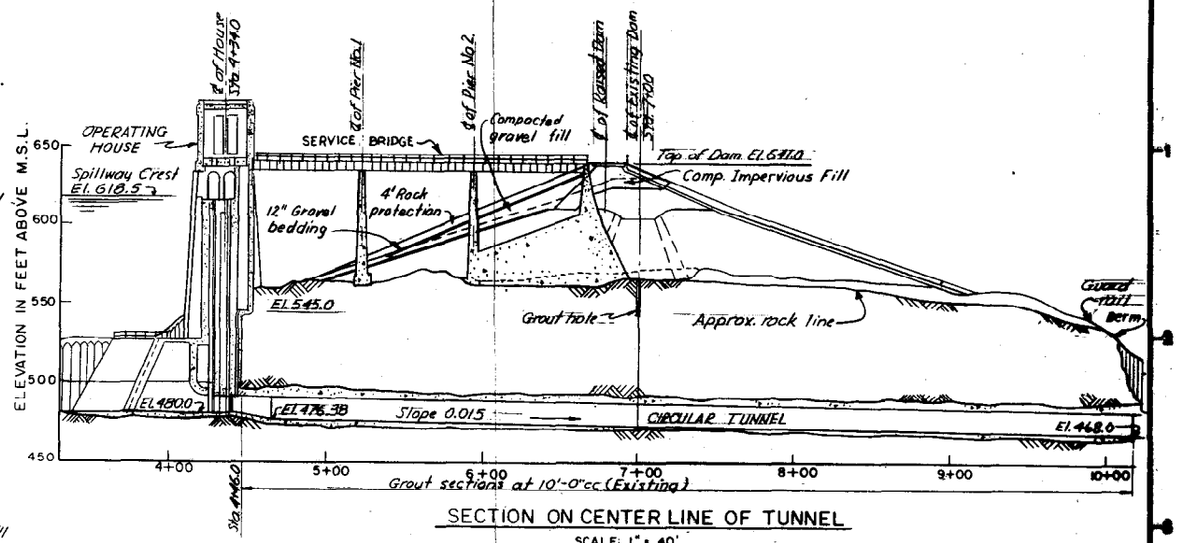
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. JANUARY 1977

PLATE 3

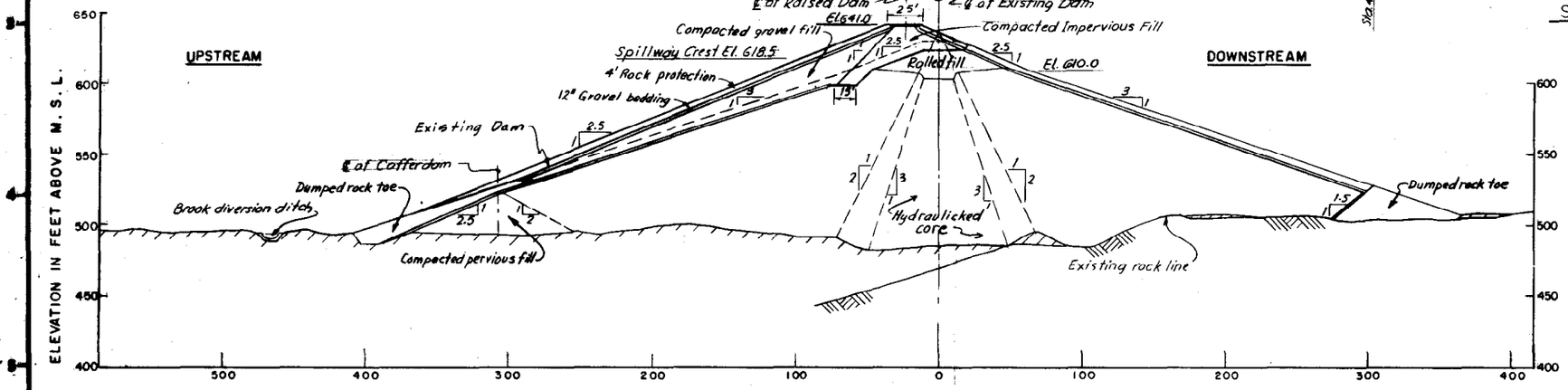
CORPS OF ENGINEERS — U. S. ARMY



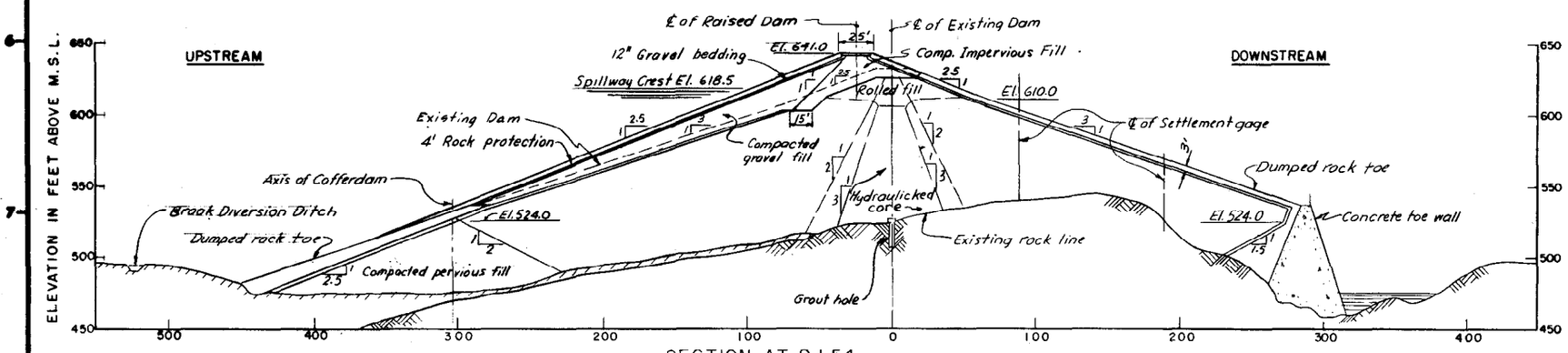
DETAIL - TOP OF DAM
SCALE: 1" = 10'



SECTION ON CENTER LINE OF TUNNEL
SCALE: 1" = 40'



SECTION AT 7 + 30
SCALE: 1" = 40'



SECTION AT 9+54
SCALE: 1" = 40'

GRAPHIC SCALES
1"=40' — 40' 0 40' 80'
1"=10' — 10' 0 10' 20'

REVISION	DATE	DESCRIPTION	BY

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

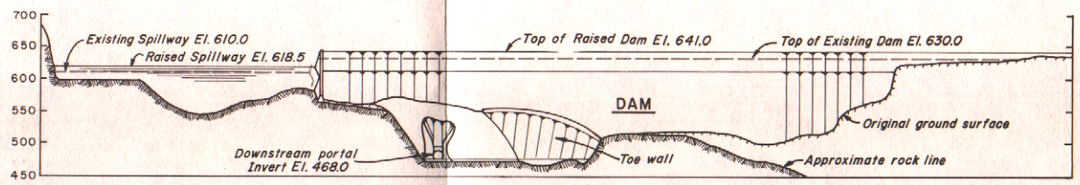
DES. BY | DR. BY | CK. BY

SUBMITTED:
CHIEF, SECTION
APPROVAL RECOMMENDED:
CHIEF, TECH. ENGR. BRANCH
REVIEWED:
PROJECT ENGINEER
APPROVAL RECOMMENDED:
CHIEF BRANCH

WATER RESOURCES DEVELOPMENT PROJECT
CONNECTICUT RIVER BASIN
KNIGHTVILLE MODIFICATION
DAM EMBANKMENT
SECTIONS AND DETAIL
WESTFIELD RIVER MASSACHUSETTS
APPROVED DATE
CHIEF, ENGINEERING DIVISION

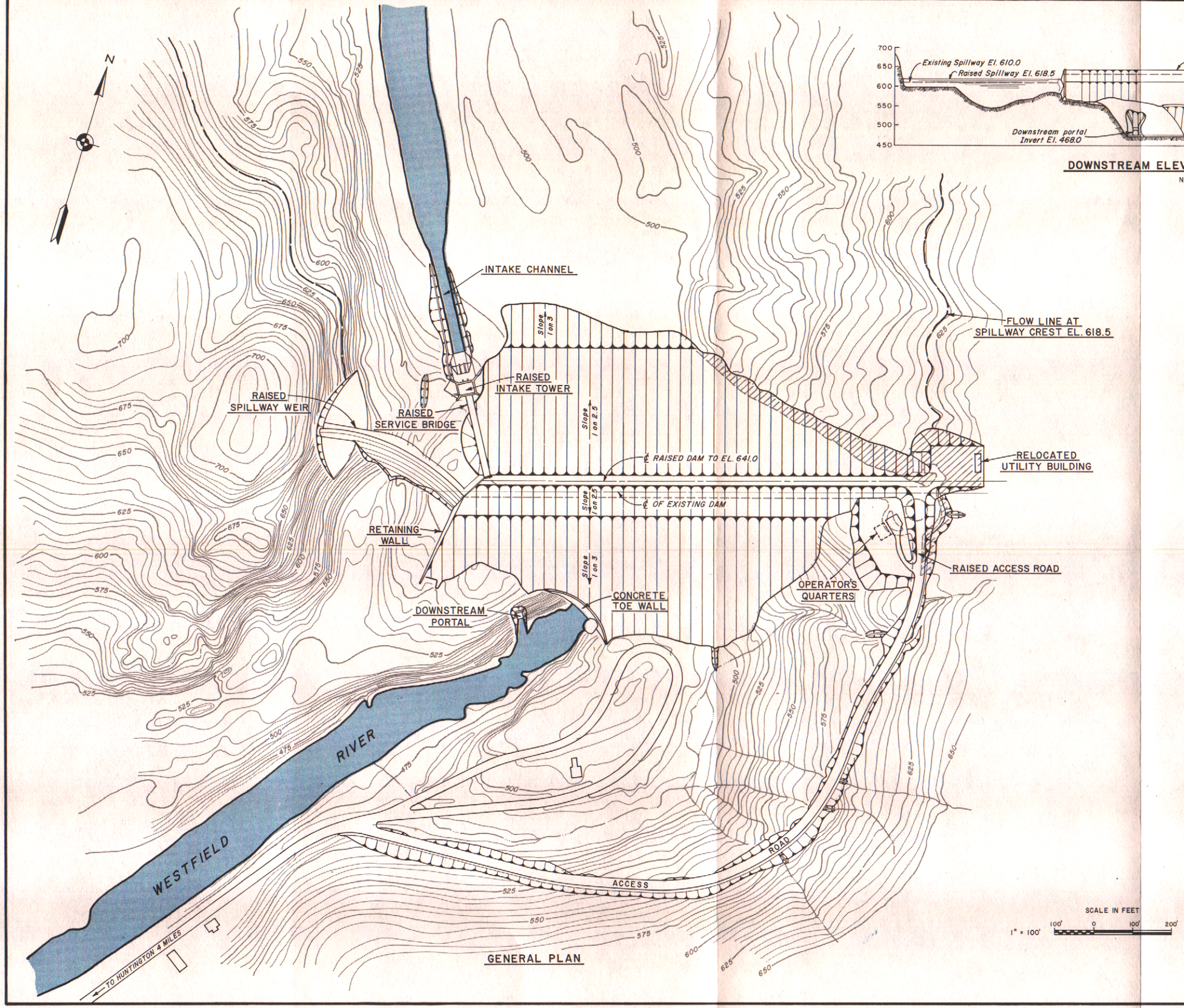
SCALE | SPEC. NO.
DRAWING NUMBER
SHEET

PLATE 4



DOWNSTREAM ELEVATION OF DAM-DEVELOPED

NOT TO SCALE



GENERAL PLAN

SCALE IN FEET

1" = 100' 100' 0 100' 200'

KNIGHTVILLE DAM MODIFICATION

IMPOUNDMENT AREA GENERAL PLAN & ELEVATION

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. JANUARY 1977

PLATE 5