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CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV
ENVIRONMENTAL ASSESSMENT. NORTH NASHUA RIVER CHANNEL IMPROVEMENT--ETC(U)
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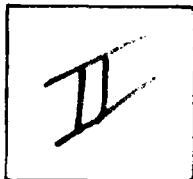


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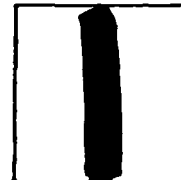
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FITCHBURG LOCAL PROTECTION, Fitchburg, Massachusetts
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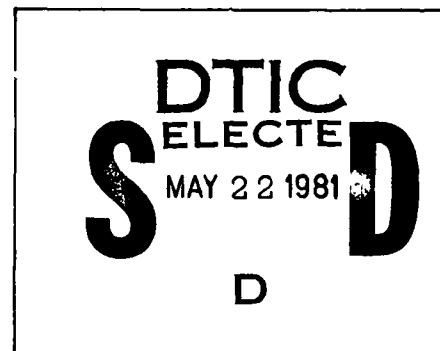
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ENVIRONMENTAL ASSESSMENT

*NORTH NASHUA RIVER
CHANNEL IMPROVEMENT*

**FITCHBURG LOCAL PROTECTION
FITCHBURG, MASSACHUSETTS**

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

NOVEMBER 1977

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ENVIRONMENTAL ASSESSMENT

NORTH NASHUA RIVER CHANNEL IMPROVEMENT
FITCHBURG LOCAL PROTECTION
FITCHBURG, MASSACHUSETTS

Prepared by

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS 02154

November 1977

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Environmental Assessment
North Nashua River Channel Rehabilitation
Fitchburg Local Protection
Fitchburg, Massachusetts

Table of Contents

<u>Paragraph No.</u>	<u>Title</u>
1.	Project Description and Location
2.	Environmental Setting Without The Project
3.	The Environmental Impact of the Proposed Action
	(1) Bank Restabilization
	(2) Rock and Debris Removal
	(3) Granite, Concrete and Gabion Wall Construction
	(4) Concrete Cribbing and Grouted Riprap Repair
	(5) Selective Streambank Vegetation Removal
4.	Any Adverse Environmental Effects Which Cannot be Avoided Should the Proposal Be Implemented
5.	Alternatives
6.	The Relationship Between Local Short Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity
7.	Identification of "Any Irreversible or Irretrievable Commitment of Resources Which Would Be Involved in the Proposed Action Should it be Implemented"
8.	Environmental Factors
	a. Aesthetic
	b. Fisheries
	c. Wildlife Habitat
	d. Plant Life
	e. Recreation
	f. Noise
	g. Historical
	h. Water Quality
9.	Economic and Social Impacts

10. Summary
11. Coordination with Other Agencies
12. Conclusions

Plates

1. Channel Rehabilitation - General Plan No. 1
2. Channel Rehabilitation - General Plan No. 2
3. Channel Rehabilitation - General Plan No. 3
4. Channel Rehabilitation - General Plan No. 4

Attachments

1. Abridged Scope of Work

1.00 PROJECT DESCRIPTION

This project proposes the rehabilitation of the North Nashua River Local Protection Project. It consists of repair and/or reconstruction of those walls, cribs, and grouted riprap which have deteriorated. In addition, there will be removal of channel obstructions and depositions and reshaping and scraping the bottom so as to provide a relative smooth channel with relative uniform width at various places in the channel, large isolated stones will be placed randomly for environmental enhancement.

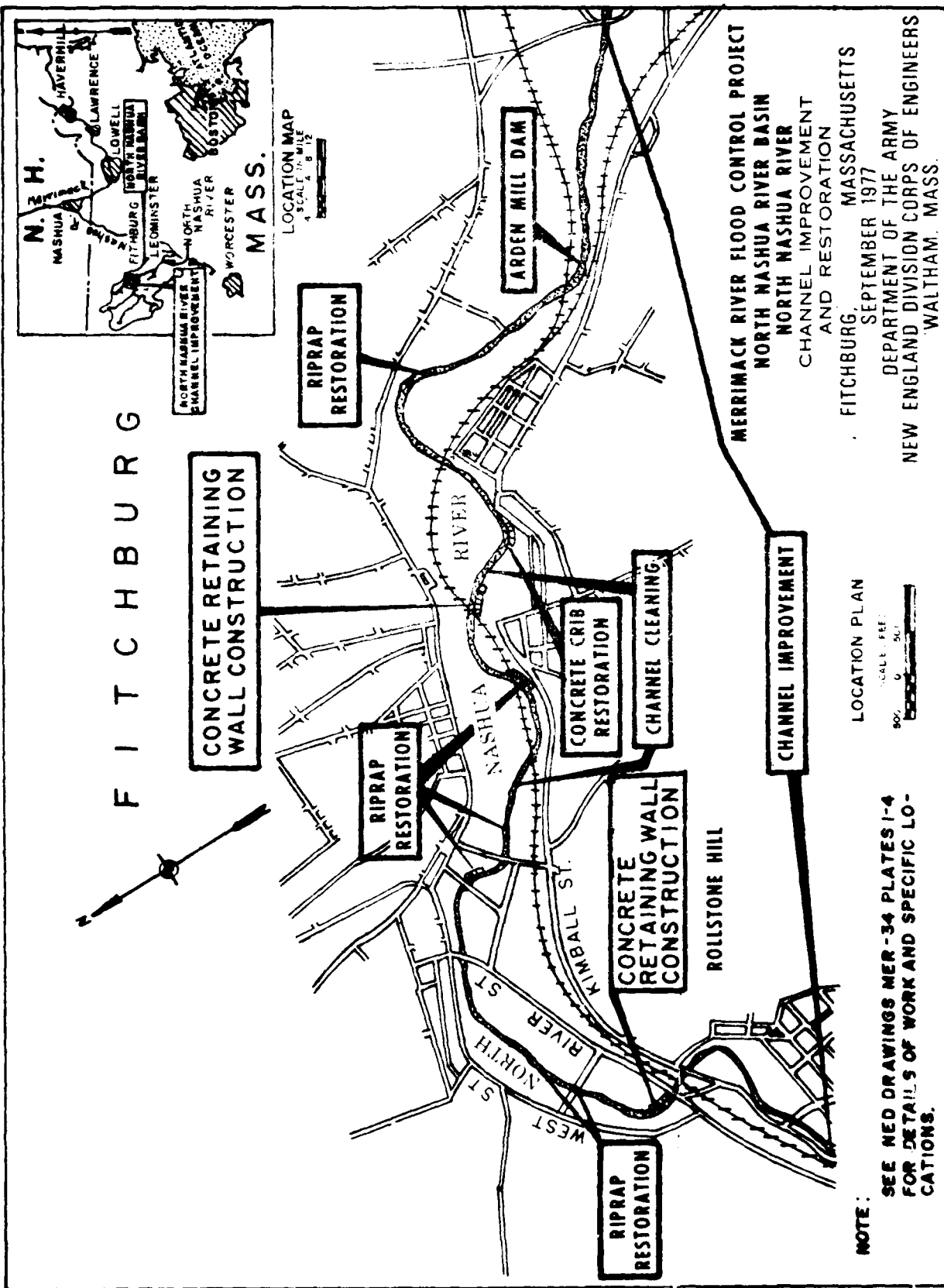
Because of high channel velocities during flood periods, banks are required to be protected against erosion, and consequent deposition in the improved channel. Within the past 40 years, there has been some major flooding in the North Nashua River Basin. Four substantial floods have occurred between the years 1936-1955. In 1937, work was done under a Work Relief Project to improve conditions in the river and provide a means of flood control. It consisted mainly of installation of cribs and walls, and also placement of grouted riprap. Since then only emergency repair work has been done, once in 1955, and again in 1968. This work consisted of removal of gravel deposits and debris, and filling washed-out riverbanks. Concrete cribbing was also stabilized.

Over the years, these works have deteriorated so extensively that they no longer fulfill their design function. The cribbing

is broken, or covered by stone or plant growth. Concrete slabs have fallen into the river, adding to the already existing debris. The bottom of the river is covered mostly by sludge from the paper mills, with the water carrying paper fibers, creating stagnant pools of the sludge.

The intent of the project is to restore the deteriorated channel to its 1937 condition and capacity of 9,000 cubic feet per second. It is expected that the rehabilitation work will improve the visual aspects of the channel and riverbanks, while also providing a harmonious relationship with the stream environment and its functional purpose of flood control.

The existing project area begins upstream in the city of Fitchburg at the site of the now removed Cowee's Mill Dam, and extends 5.5 miles downstream to the Leominster town line below the Fitchburg Airport. The immediate area of interest extends from Cowee's Mill Dam 4 miles downstream to the vicinity upstream of the Falulah Road Bridge. An abridged scope of the work is shown on Attachment No. 1.



2.00 ENVIRONMENTAL SETTING WITHOUT THE PROJECT

The North Nashua River Basin is situated in north-central Massachusetts in the northern portion of Worcester County and north-west Middlesex County. The study area, located in Fitchburg, is one of the 10 Standard Metropolitan Statistical Areas (SMSA) in Massachusetts and constitutes the major population center within the basin. The river, above the confluence of Baker Brook, controls some 64 square miles of watershed drainage.

The North Nashua River is formed at the confluence of the Whitman River with Flagg Brook in the city of Fitchburg, Worcester County, Massachusetts at an elevation of 590 feet above mean sea level. The principal tributaries are Whitman River, Flagg, Phillips, Baker and Monoosnoc Brooks, with a number of smaller streams adding to the system.

The river flows in a substantially west to east direction through a typically urban industrially and commercially oriented portion of the city. The surrounding topography is characterized by wide valleys and broad, steep-sided hills, affording a watershed which is highly conducive to rapid run-off.

The existing protective works at Fitchburg were constructed following the major flood of 1936. At several places earth banks were protected with concrete crib walls, at other locations the riverbed and toes of the banks were protected against scour by

grouted riprap. The work included channel enlargement, relocation of the outlet of Punch Brook, and removal of several abandoned dams.

Upon examination of the existing project, it was found that its present condition has vastly deteriorated. Cultural debris in the river includes discarded shopping carts, trash, and paper fibers; there is also a large amount of rock debris. Large stone slabs which were either remains of old structures, or of unknown origin have tumbled into the stream along the bank.

At a number of sites, observations included deteriorated concrete cribbing, some with dumped granite in front of it. The banks at River Street Bridge, Circle Street Bridge, and Walnut Street were among those which were in the worst condition.

At certain areas around the banks a large amount of repair was needed. They have either eroded to the point of needed repair, or had rock landslides.

The basin is a center of industrial and commercial areas critical to the economy of central Massachusetts. Manufacturing is the principal occupation, and employment by industries within the floodplain of the river represents over 50% of the total employment in Fitchburg. The serious consequences of any additional flooding of past magnitudes would gravely retard the current progress of economic and social well being.

The stream flow is moderately rapid because of the moderately steep gradient of the streambed.

Although pollution is still quite evident in the present state of the river, steps are being taken to improve the river's condition. Construction and operation of two wastewater treatment plants have improved the condition considerably over the past couple of years.

The primary cause of pollution was the discharge of industrial wastes, principally paper wastes, along the upper and middle portions of the river. Measures are being taken by the paper companies and other industries to diminish the discharge of wastes directly into the river. Although evidence of wastes are still apparent in the river, its condition is an improvement over what it has been in the past. With the diminution of discharge wastes, the North Nashua will improve in the future with its moderate flow and self-scouring action.

The natural setting surrounding the North Nashua is typical of a stressed, urbanized environment. Aquatic fauna have been reduced as a result of past pollution and accumulated paper wastes.

Many of the tall trees along the top of the banks have been in existence for at least 40 years, as seen from historical photographs. Oaks, maples, willows and poplars are among those present. Shrubs and overgrowth immediately along the river are pollution - tolerant species.

Because of the years of pollution, the North Nashua River is not used for any recreational purposes. A Greenway Belt along a section of the river has been proposed in order to provide recreational opportunities

for the people of Fitchburg along the banks of the river. Bicycle and jogging paths and walkways have been proposed. Development plans are being actively pursued by local interests.

3.00 THE ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

Major actions that will be undertaken are:

- (1) Bank Restabilization
- (2) Rock and Debris Removal
- (3) Granite, Concrete and Gabion Wall Construction
- (4) Concrete Cribbing and Grouted Riprap Repair
- (5) Selective Streambank Vegetation Removal

(1) Bank Restabilization

Bank restabilization will be implemented at the site of the now removed Cowee's Mill Dam, and also in the vicinity of the Falulah Street Bridge. This work will consist of placing large stones, slabs and dumped rock upon the sides of the banks. Construction activities will necessitate the cutting and grading of the existing areas. These areas will be stabilized and revegetated in order to mitigate any undesirable affects.

Work will also consist of the removal of debris which has collected at the foot of the banks. This will aid in keeping an unimpeded flow. This action will also necessitate the reshaping of the banks at the specific areas where debris removal will be implemented.

No adverse effects on the environment can be foreseen.

(2) Rock and Debris Removal

Removal of rock and debris will have a tendency to improve the appearance of the river. The intent of this work is to restore the natural river bed and eliminate areas of sluggishness within the stream.

As a result of this work, some sediment will be released, but only for a short-term and will most likely settle back. Fiber waste which has accumulated over the years will be flushed out with any high river flows. These accumulated wastes should not continue to build up as the introduction of new fiber diminishes. There will be no adverse effects on any aquatic species due to their reduction from past pollution.

(3) Granite, Concrete and Gabion Wall Construction

Wall construction will be undertaken at the following sites which can be located on the various plates.

Concrete - Location F, O, P and Q

Granite - Location B

Gabion - Location A

The impacts as a result of this construction will be minimal. In cases where it necessitates the removal of vegetation, revegetation measures will be implemented.

(4) Concrete Cribbing and Grouted Riprap Repair

This repair work will have little adverse effect on the surrounding environment. Upstream of Oak Hill Road some Japanese bamboo is abundant in front of the walls which require repair. Although this will be removed, it is a minor effect, as natural vegetation will most likely occur.

(5) Streambank Vegetation Removal

Channel rehabilitation will require the removal of some trees on the river banks. Tree removal will be kept to a minimum and will occur only in those areas where there may be interference with flood flows. Selective removal of vegetation will be conducted as outlined in the Scope of Work (Attachment No. 1).

Clearing in the channel area in zone 1 (0-8) will insure the integrity of the flood control channel and serve to maintain the desired hydraulic character of the channel. The aesthetic impacts of this clearing will be minimal as small shoots and other shrub foliage will be retained.

Clearing in zone 2 will further maintain the integrity of the project while mitigating any potential loss of aesthetics. New trees from nursery stock will be planted along the top of channel banks in areas where trees are taken out.

Trees would be selectively marked for clearing by members of the Corps' Environmental Analysis Branch in coordination with the city of Fitchburg. Designated new planting will also be coordinated.

All lands disturbed by the rehabilitation work will be replanted with grass. Trees and shrubs will also be replanted in certain areas of publicly owned land where flood flow will not be impeded. While tree planting possibilities are limited by the narrow shape of the channel in most of the project area, planting of select shrubs will be possible in many areas. Final revegetation measures will take into consideration local plans for development of a recreation greenbelt along the river.

4.00 ANY ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED
SHOULD THE PROPOSAL BE IMPLEMENTED

Any adverse environmental effects which can be considered would be those associated with the removal of large trees along the banks of the river. Removal will be carried out only in those areas where the trees, if fallen into the river, would impede flow or create a hazard during flooding conditions. Shrubs and overgrowth along the immediate bank of the river will be removed by construction activities and/or for flood control purposes. Mitigation procedures will be carried out to eliminate any landscape scars as a result of construction and the movement of heavy equipment.

5.00 ALTERNATIVES

The local protection works in the city of Fitchburg were only one of the many projects deemed necessary to alleviate the total flooding problem. All practicable means of solving the flood control problem study area were considered. Inasmuch as the project is a rehabilitation of existing local flood protection facilities no other structural alternatives were considered.

The possibility of nonstructural measures was investigated and an analysis of nonstructural types of alternatives is as follows:

<u>Alternative No.</u>	<u>Plan</u>	<u>Comment</u>
1	No Action	The "no action" plan would be to leave the existing project in its present condition of disrepair and with physical obstructions to river flow. There would not be any monetary costs involved, however, and such a course of action would be unsuitable and not be an aid in reducing flood problems.
2	Evacuation of Floodplain	The removal of all existing development in the floodplains of the Fitchburg area would cause tremendous disruption of human needs and resources. It would cause adverse social and institutional effects associated with large scale relocation and the cost, although not estimated, would be exorbitant. Such a plan would eliminate the need for channel improvements.
3	Floodplain Management	This plan would greatly reduce further encroachment of floodplain areas, however, it does not protect the highly developed areas of Fitchburg against floods. The floodplain in the city is predominantly commercial and industrial with large content values (i.e., raw materials, equipment and manufactured goods).

- | | | |
|---|-------------------------------|--|
| 4 | Floodproofing and Evacuation | This alternative provides individual type flood protection for some properties and areas. However, areas and bridges, roads, etc., between the protected buildings would remain subject to flooding, siltation and debris deposition. It does have potential application for some individual properties but not for flooded areas as a whole. |
| 5 | Removal of All Existing Works | The possibility of removing all the existing works and starting all over would be impractical. Also it would not significantly increase protection over that provided by the proposed project. |
| 6 | Channel Rehabilitation | This alternative involves the accomplishment of physical improvements to an existing accepted project. There will be minimum environmental, social-economic impacts and disruption to existing private and public facilities, enterprises, etc. The Improvement Costs are not excessive and the Benefit-Cost Ratio of the project is favorable and above unity and will provide a reduction in losses from flooding. |

Due to the congested built-up area of the city floodplain which mainly comprises a commercial and industrial development, it is considered that the possible nonstructural alternatives are not totally feasible, acceptable or suitable.

The channel rehabilitation project is considered the most acceptable alternative from the points stated above. The channel rehabilitation project has been the authorized project since 1966 and is the "selected" plan of prior studies and consideration of other type alternatives. An updated review of the project has been made and it is considered that the channel rehabilitation remains sound and should be accomplished.

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

The rehabilitation project will enhance the appearance of the area and will result in a stability of flood control works.

The area surrounding this section of the North Nashua River has been industrialized since the mid 1700's. The original restoration works were built in 1937 to insure the city of Fitchburg protection against flood damage.

The rehabilitation of the flood control works is to insure and promote the continued use of the industrialized area by man. The project will also enhance any long-term productivity of natural vegetation along the banks of the river provided that it is maintained in the future.

There will be no new commitment of natural resources.

7.00 IDENTIFICATION OF "ANY IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT
OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION
SHOULD IT BE IMPLEMENTED"

There will be no irreversible or irretrievable commitment of resources which would be involved in the proposed local protection project should it be implemented, other than the labor and material required to construct the project.

Also committed would be approximately \$2 million needed to complete the rehabilitation project.

8.00 ENVIRONMENTAL FACTORS

The factors listed have been observed and reviewed as to the kinds of effects they will have in the construction area.

The various environmental impacts associated with this project have been categorized under the following principal headings: Aesthetics, Fisheries, Wildlife Habitat, Plant Life, Social, Noise and Historical.

Because each area of the river looked at was in poor condition, the environmental factors listed will have a minimal impact.

a. Aesthetic - The appearance of the local protection project will be improved by completion of the project. Improvement will result from the removal of debris, repair of deteriorated works and aesthetic enhancement measures such as texturing of concrete walls and replanting of riverbanks.

b. Fisheries - The survey did not reveal any forms of fish life; therefore, there will be no impact on fisheries. All species have long since been destroyed.

c. Wildlife Habitat - The area is not a significant wildlife habitat; therefore, there will be no impact.

d. Plant Life - Certain shrubs and trees which may interfere with floodwater flow will be removed during construction. Measures will be taken to mitigate vegetation losses when possible by replanting selected shrubs and small trees at higher elevations above the riverbed.

e. Recreation - At present the river is not used for any recreational purposes, and the commercial usage will not be affected. This flood control project will help to insure social and economic well-being. The new rehabilitation work will improve the visual aspects of the channel and the riverbanks. All work is being coordinated with the city of Fitchburg to assist in their plans for future recreational development along the river.

f. Noise - Noise will increase, but only during construction

9.00 ECONOMIC AND SOCIAL IMPACTS

Planning for flood control requires an understanding of the many diverse forces interacting in the proposed impact (study) area. Moving towards economic growth, housing and industrial development, protection of valuable natural resources, higher or lower taxation, changes in transportation patterns, etc. will affect the quality of life in any particular region. Complex interacting social, economic, and environmental factors may bring about both adverse and beneficial effects to the same community.

Having as much information, and raising as many questions and issues as possible is essential in order to better examine different alternatives and arrive at those plans which meet most consensus and which may be most practical and desirable. Such plans would capitalize on beneficial effects while minimizing or mitigating possible adverse effects in both the short and long run.

Fitchburg has a well balanced economic base and accounts for one-half of the firms in the SMSA, 55% of the annual payroll, and 53% of the average annual employment. Manufacturing with 52% of the total employed population accounts for the largest source of employment. The three leading firms, measured in employment, in order of importance were fabricated metals, paper products, and machinery industries (except electrical). Within the watershed area and principally in Fitchburg, paper production amounts to 20% of the total in Massachusetts. In

the past ten years, the population in Fitchburg has remained relatively stable; yet the SMSA's population has increased by 8%. Thus the city of Fitchburg is the employment center for the population of approximately 100,000 residing in the SMSA.

In the past, employment has been hampered by the attraction of many of the region's industries to other parts of the nation. High wages, ever increasing tax burdens, and the high cost of energy and transportation have led to the exodus of manufacturing firms from both the region and state. The unemployment rate during 1976 was 10-1/2% for the SMSA. This was 3% higher than the national average. Therefore, anything that can contribute to the development of employment opportunities in the region should be welcomed.

The positive contribution of the project is the prevention of flood losses. Physical losses include only such losses or damage to structures, machinery and stock, and cost of clean-up and repairs. Non-physical losses include loss of unrecoverable wages and business cost of temporary facilities, and increased cost of operation.

Other positive effects can be associated with the proposed or examined projects. These could include: avoidance of road washouts thus aiding the motorists and travelers, possible additional recreation, reduction of the probability of injury or death attributed to flooding, the easing of the fear of flooding, the reduction of the possibility of flood waters disrupting water supply and sewage

collection systems which may cause contamination and spread of disease, the availability of jobs and employment opportunity during construction of projects and help in the maintenance of employment.

Such flood protection would result in economic and social enhancement of Fitchburg in particular and the watershed region in general, in the long run. The reduction of damages from floods would yield great economic benefits, especially to industry and may halt the flight of manufacturing jobs. It may reduce the abnormally high level of unemployment and at the same time encourage industrial growth. The serious consequences of any additional flooding of past magnitudes would gravely retard the current progress of economic improvement and social well-being.

All of the project plans would cause some local air and noise impacts because of clearing, grading and filling operations during the 1-1/2 year construction period. All local streets would experience increased traffic from trucks bringing in materials for construction and removing debris. Such truck traffic would bring corresponding air quality, noise, safety, and congestion impacts. Most effects during any project construction tend to be temporary, rather intense and impact more limited to the specific site location. These impacts are of a temporary nature and should cause only minor inconvenience. Impacts after project implementation may be according to plans as well as unforeseen. Some will be site specific; others will go beyond the locality.

The non-action alternative shifts the major responsibility and burden of flood protection to those who live and work on the flood plain. Under the no action (do nothing) alternative, no new regional or local structural projects are built as a possible solution to reduce flood damages. No action means forfeiting potential benefits such as construction related jobs, reduced fear from flooding and the long-run security of decreased flood damages.

10.00 SUMMARY

Based on review of relevant facts pertaining to the public need and environmental considerations, the conclusion reached is that the rehabilitation of the local protection project is in the best public interest. The following points were considered pertinent in evaluation of the project:

(1) The environmental impacts of the project are considered to be very minor. As stated previously, pollution by paper waste and sewage has eliminated any aquatic species which may have inhabited this area of the river. Therefore, any repair work alone will not displace fish or any other aquatic animal species.

Aquatic life which may be found downstream from the project area may have short-term stress as a result of disturbed sediment being carried downstream. Associated turbidity will be reduced to ambient prevailing conditions several hundred feet downstream of work areas. (This effect will be minor and temporary.)

(2) Social well-being must be considered. In allowing the present conditions to remain, the surrounding areas would continue to be exposed to flood damage as in the past. Potential damage due to flooding would most likely increase in the future.

(3) The economy of the city would be greatly affected by any flood damage which may occur. Many economic hardships would result as a consequence of flooding. In addition to the damage to private property, a flood would cause damage to Fitchburg's industries, the city's main source

of income. Temporary or even permanent shutdown of plants would result.

The proposed maintenance project has been found to be the only practicable cause of action. Environmental effects have been considered and found to be minimal and total public interest has been considered. The conclusion is that, with all the considerations and alternatives examined, the repair project should proceed.

It is opinioned that an Environmental Assessment in lieu of an Environment Impact Statement (EIS) is applicable and sufficient for assessing and evaluating the impacts caused by the project for the following reasons:

a. The work involves the rehabilitation of a previously authorized project and only includes renovations, reconstruction and some additional similar types of protection works.

b. The stream channel alignment or width is not being changed.

c. New real estate takings or relocations of building or inhabitants are not required. The only real estate activities required are for the purposes of obtaining temporary easements for construction operations where applicable.

d. Due to the previous low water quality rating of the river, and as most aquatic species do not inhabit the river, there should be no impacts on fish life from construction activities. Impacts on plant life will be those associated with vegetation removal from the banks as a result of construction or removal for flood control purposes. Revegetation measures will be carried out where it will not interfere with the intent of the flood control works. (Note: From all indications it is anticipated that the river

quality will gradually improve in the future as a result of this restoration project and the recent completion of two wastewater treatment plants in Fitchburg).

e. Construction of the project will not have any ill effects of social, economic, or public health aspects.

f. The rehabilitation work will enhance the project area from a visual and aesthetic viewpoint.

g. The rehabilitation project does not present any new and/or controversial issues or items of work.

h. The project is considered a minor action and that an Environmental Impact Statement is not required.

11.00 COORDINATION WITH OTHER AGENCIES

Coordination has been maintained throughout the course of the planning of this work with Federal, State and local agencies which have responsibilities or interests in the project.

12.00 CONCLUSIONS

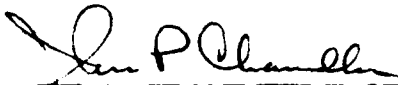
Upon evaluating the information presented in this Environmental Assessment Report, it is my belief that construction of the proposed Channel Rehabilitation for local flood protection in the North Nashua River in Fitchburg, Massachusetts as indicated is in the best public interest.

Such rehabilitative work will not markedly change the hydraulic character of the channel but is required to insure the overall integrity of the channel. Under present deteriorated conditions, it is considered that structural failures would occur at localized areas during flood events of less than design magnitudes. The rehabilitation effort is a restoration of previously authorized and constructed facilities for flood protection purposes. The project may cause minimal temporary inconveniences during the work period only. It is determined that adverse short-term environmental impacts will be minimal and there will be no long-term adverse environmental impacts caused by the project.

In my evaluation, this assessment has been prepared in accordance with the National Environmental Policy Act of 1969 and will be coordinated with appropriate regulatory agencies. From all indications and the type of rehabilitation and restoration work involved, the local protection project is considered a minor action and can be accomplished

with subsequent minimization of environmental impacts. The assessment therefore precludes the need for preparation of a formal Environmental Impact Statement.

7 November 1977
(Date)


JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

ATTACHMENT NO. 1

FITCHBURG LOCAL PROTECTION PROJECT
NORTH NASHUA RIVER

PRELIMINARY ABRIDGED SCOPE OF WORK

The preliminary abridged Scope of Work description is developed at the upstream limits of the work in the vicinity of the now-removed Cowee's Mill Dam, and proceeding downstream to the Leominster town line below the Fitchburg airport. Bank identification is made looking downstream.

Scope of Work

The following restorations are proposed:

- a. Starting about 700 feet above Oak Hill Street bridge, re-stabilize right bank for about 200 feet and remove random boulders in same region along right bank.
- b. Loose stone wall on left bank located about 300 feet upstream of Oak Hill Road bridge to be replaced with similar wall for length of approximately 60 feet. Wash-out of earth adjacent to Routes 12 and 31 to be filled with earth to match existing wall grade surrounding. Estimated fill 65 cubic yards to be placed against new section. Remove portions of breached wall lying in river.
- c. At Daniels Street bridge re-grout cut stone wall upstream on right bank for a distance of about 100 feet.
- d. Remove a few broken stone boulders immediately downstream of the bridge at left side. Restabilize right downstream bank immediately adjacent to the bridge abutment. Also, install approximately

12 feet of 18" RCP for extending storm sewer at bridge. Four shoaling areas, totalling approximately 800 ft., to be removed.

e. Repair channel bottom by grouting cut stones for an area of approximately 30 square yards between Kimball Street Bridge and the Boston and Maine Railroad bridge.

f. At River Street Bridge, Route 31, in the vicinity of West Street, remove from both banks dumped granite riprap covering about 125 feet each side. Remove old deteriorated concrete cribbing beneath the dumped granite (Crib Sites 1 and 2). Replace with poured concrete retaining walls and backfill to match surrounding grade. Construct concrete ramp on the right bank. Approximately 600 ft. of shoaling to be removed downstream of this site.

g. At Sheldon Street Bridge, repair right downstream concrete wall next to bridge.

h. East of Nocke Street immediately downstream of the foot bridge, remove or reposition remains of breached cut stone dam, approximately 80 pieces in 500 - 1000 pound sizes. Replacement with well graded rip-rap. Approximately 400 ft. of shoaling to be removed.

i. At River Street Bridge at West Street, Route 31, remove approximately 30 pieces large stone immediately downstream of the bridge. Do not disturb existing 12-inch crossing main in streambed. Approximately 400 ft. of shoaling to be removed upstream of this site.

j. At Circle Street Bridge, on the left bank downstream, remove dumped granite riprap and deteriorated concrete cribbing. Remove about 200 cubic yards of landslide fill in the streambed. Replace deteriorated cribbing (Crib Site No. 3) with concrete wall or uniform emplaced stone. Approximately 350 ft. of shoaling to be removed.

k. Along the right bank replace footing blocks in granite wall and re-grout.

l. Downstream of Rollstone Street Bridges, repair eroded grouted riprap on the left bank, about 150 feet in length.

m. About 500 feet upstream of Putnam Street on the right bank, repair existing concrete cribbing (Crib No. 4) by addition of concrete cap and refacing of several eroded stretcher members in a total length of about 150 feet. Remove approximately 450 ft. shoaling.

n. Construct 325 feet of concrete capping on top of existing wall. Remove approximately 300 ft. shoaling.

o. At Laurel Street along the right bank above the streambed and adjacent to railroad siding, remove about 250 feet of deteriorated concrete cribbing (Crib Site Nos. 5 and 6) and replace with concrete wall, three sections.

p. At Water Street Bridge, Route 12, vicinity of Walnut Street, upstream of Water Street on the left bank, restore approximately 300 feet of stone wall, removing temporary sand dike, plus material along base of wall in the streambed. Paint 300 feet of existing chainlink fence on top of wall and sandblast wall 310' long - 13' high. Remove approximately 400 ft. shoaling.

q. Prior to completion of Item p above, face existing concrete cribbing, (Crib Site No. 7), with a 1.5 ft. thick concrete veneer for a length of 250 feet, along right bank upstream of Water Street Bridge. Temporary access must be constructed in streambed to accomplish.

r. Deleted.

s. At the Power Station Dam, reset excess broken stone boulders downstream of the service dam. (Approximately 50 pieces 500 - 1000 pound range.)

t. Immediately upstream of the Harvard Street overpass, remove two midstream abutments from prior removed footbridge. Abutment in left bank to be retained but upper two courses of granite block to be regouted for safety.

u. Reset large broken stones in stream immediately downstream from Bemis Road dam.

v. Restore and prevent further erosion of banks and river bottom, regrade and place rip-rap protection on the adjacent river bank area and restore the outlet of the canal into the canal.

w. Remove shoaling.

x. In regard to vegetation and its management along the river, and keeping in mind the functional purpose of the project for flood protection and not allowing interferences with normal and possible flood flows, project vegetation maintenance guidelines were suggested.

(1) Clearing of lower limits of the channel from its bottom to elevation eight feet will consist of removal of all trees three

inches or more in diameter. At present, there are numerous small woody shoots in this zone and very few trees of significant size. This will set a base condition which will be maintained by local interest after completion of the Federal restoration project. This base condition, which will allow no greater than 3 inches in diameter, is intended to maintain the hydraulic character of the river channel so as not to overly inhibit flows during times of flood. It will also insure that no large trees will grow that could eventually uproot during flood stages causing blockage of the channel particularly at restrictive bridge openings causing the possible backwater flooding into developed areas in Fitchburg. A second zone between elevation eight and elevation 15 above river channel or to top of bank has been established wherein trees which lean out over the channel or are in stages of poor health having the inherent potential of falling in during extreme high flows will be removed. The amount of trees in this area held are limited to a small number.

Suggested vegetation management guidelines for the river will be carried out in station 560+00 through 440+00, and also 430+00 to Falulah Road. (See attached plates 1-4)



1. Remove random boulders from the
stream.

P. p. p.
... ..

Rejoice that you will fight back for a distance
of about 100 feet before turning.

Repair localized erosion downstream of bridge on
roadment and remove debris at bridge abutments immediately
to prevent further erosion and shoaling.

8. Do not use the same language with EMMA and John
in the same way as you do with other people
in the same way as you do with other people

(F) After testing Vol. 1 and Vol. 2 remove samples from the rad. and test both banks for 30 min + 105 and 100 min. Re-test and determine the rate. 20 min. after the dumped granite replace right bank with concrete wall and mine and test bank. When the testing is done go to kill. Remove selectively and reposition the large pile in the channel. Shading is to be used.

Repair downstream on pile with least major strengthening.
Also repair gouted pile cap on river bottom and well around pile
cap is to be placed downstream to prevent further pile well cap

11 Remove some large stones & debris with the right hand
to allow the existing stone masonry to be cleaned.
Also digress a great number of things to be done
then used as possible. The work is to be done
is to be done.

⁽¹⁾ REMOVE TO CASE SURVEY THE EXISTING RECORDS AND INFORMATION
RELATIVE TO THE DEPT. OF THE ARMY AND THE ARMY DEPT. OF THE ARMY
AND THE ARMY DEPT. OF THE ARMY AND THE ARMY DEPT. OF THE ARMY

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land No. 5, then over a ramped granite rip-rap bank for about 125 feet on the left side. Prior to this concrete is being beneath the. Replace right bank with concrete wall and rip-rap on left retaining wall and backfill. Rip-rap and reposition the large stones in the left to be removed.

Remove existing rip-rap in river bottom and well as rip-rap on stream bed to prevent further untraveling.

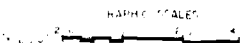
Remove stones and boulders with well graded rip-rap. Existing stones in river shall be removed.

Remove large stones creating a uniform to provide a smooth channel for the river. Stones to be removed.

Remove the existing stream bed to provide a smooth channel for the river. Stones to be removed.

1. Remove approximately vertical rip-rap of wall.
2. Repair graded rip-rap.
3. Repair existing stream bed to provide the addition of a concrete rip-rap and the addition of several rip-rap stones to be removed.

LEGEND
 SS SEISMIC SURVEY
 B B BORING LOG



DESIGN		DATE		DESCRIPTION		BY
DEPARTMENT OF THE ARMY NEW ENGLAND DISTRICT CORPS OF ENGINEERS WALTHAM, MASS.						
WATER RESOURCES DEVELOPMENT PROJECT FITCHBURG, MASSACHUSETTS NORTH NASHUA RIVER CHANNEL REHABILITATION GENERAL PLAN NO. 1						
DESIGNED BY		CHECKED BY		DATE		SCALE
DRAWN BY		APPROVED		DATE		SPEC. NO.
PROJECT NO.		SHEET NO.		DRAWING NUMBER		MER-34
REVIEWED		APPROVED		DATE		SHEET
REVISION		DATE		DESCRIPTION		BY



KEY

(1) 10' concrete wall on left bank so that its top elevation will be the same as the top elevations along left bank wall. Remove shoring.

(2) 6' high concrete wall on right bank with concrete walls No 5 and No 6 and replace with concrete walls.

(3) On the left bank to the right approximately 10 feet of wall remove temporary sand dike and material along base.

(4) 10' high concrete wall on right bank to the right of the bridge and to the right of the sand dike. This wall is to be built on the right bank and to the right of the sand dike.

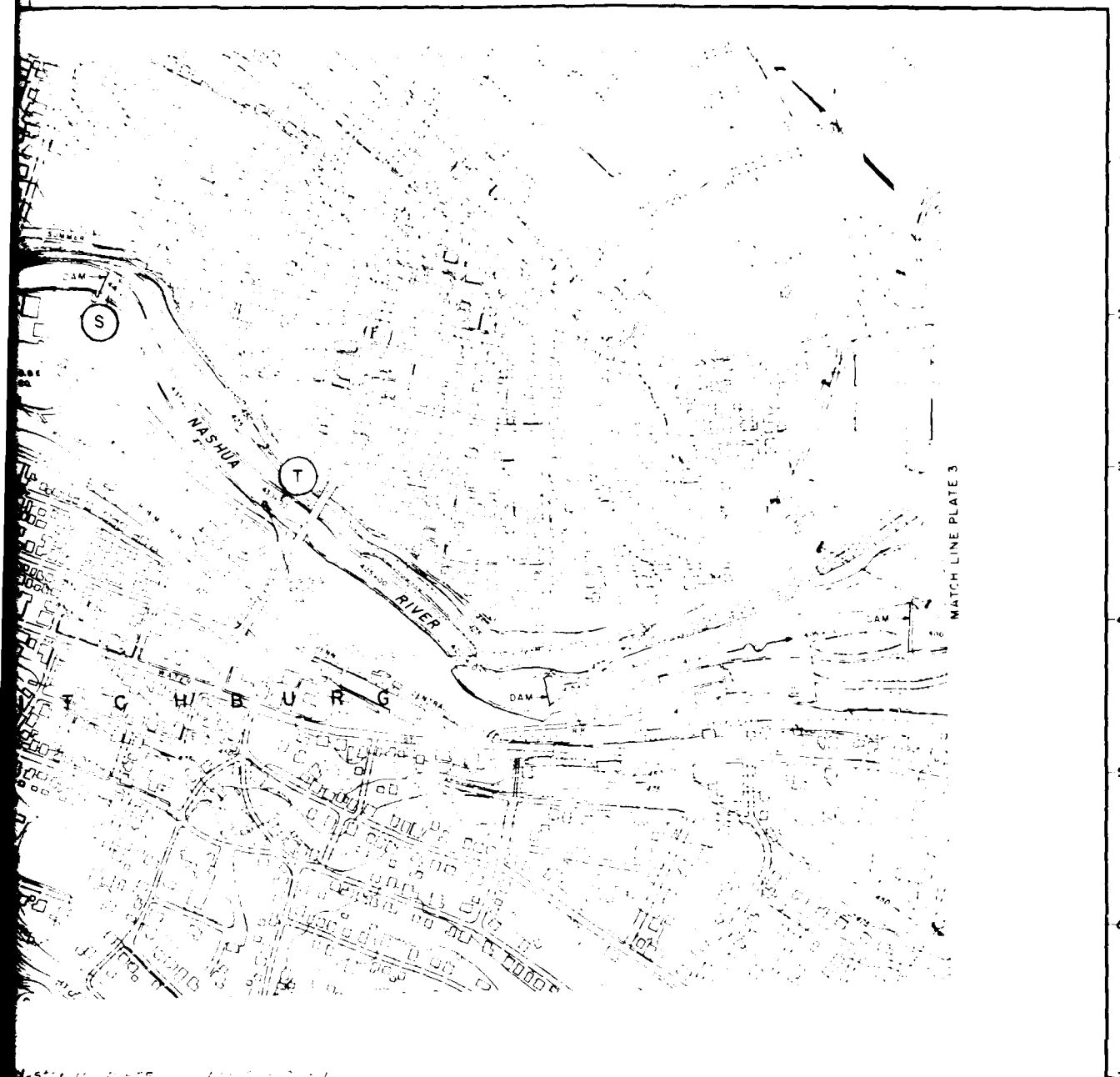
(5) 10' high concrete wall on right bank to the right of the sand dike. This wall is to be built on the right bank and to the right of the sand dike.

Vertical curve to right of center.

(6) 10' high

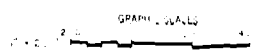
(7) 10' high concrete wall on right bank to the right of the sand dike. This wall is to be built on the right bank and to the right of the sand dike.

Notes: The above work is to be done in the following order: (1) 10' concrete wall on left bank, (2) 6' high concrete wall on right bank, (3) On the left bank to the right approximately 10 feet of wall remove temporary sand dike and material along base, (4) 10' high concrete wall on right bank to the right of the bridge and to the right of the sand dike, (5) 10' high concrete wall on right bank to the right of the sand dike, (6) 10' high, (7) 10' high concrete wall on right bank to the right of the sand dike.



MATCH LINE PLATE 3

4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100-101-102-103-104-105-106-107-108-109-110-111-112-113-114-115-116-117-118-119-120-121-122-123-124-125-126-127-128-129-130-131-132-133-134-135-136-137-138-139-140-141-142-143-144-145-146-147-148-149-150-151-152-153-154-155-156-157-158-159-160-161-162-163-164-165-166-167-168-169-170-171-172-173-174-175-176-177-178-179-180-181-182-183-184-185-186-187-188-189-190-191-192-193-194-195-196-197-198-199-200-201-202-203-204-205-206-207-208-209-210-211-212-213-214-215-216-217-218-219-220-221-222-223-224-225-226-227-228-229-230-231-232-233-234-235-236-237-238-239-240-241-242-243-244-245-246-247-248-249-250-251-252-253-254-255-256-257-258-259-260-261-262-263-264-265-266-267-268-269-270-271-272-273-274-275-276-277-278-279-280-281-282-283-284-285-286-287-288-289-290-291-292-293-294-295-296-297-298-299-300-301-302-303-304-305-306-307-308-309-310-311-312-313-314-315-316-317-318-319-320-321-322-323-324-325-326-327-328-329-330-331-332-333-334-335-336-337-338-339-340-341-342-343-344-345-346-347-348-349-350-351-352-353-354-355-356-357-358-359-360-361-362-363-364-365-366-367-368-369-370-371-372-373-374-375-376-377-378-379-380-381-382-383-384-385-386-387-388-389-390-391-392-393-394-395-396-397-398-399-400-401-402-403-404-405-406-407-408-409-410-411-412-413-414-415-416-417-418-419-420-421-422-423-424-425-426-427-428-429-430-431-432-433-434-435-436-437-438-439-440-441-442-443-444-445-446-447-448-449-450-451-452-453-454-455-456-457-458-459-460-461-462-463-464-465-466-467-468-469-470-471-472-473-474-475-476-477-478-479-480-481-482-483-484-485-486-487-488-489-490-491-492-493-494-495-496-497-498-499-500-501-502-503-504-505-506-507-508-509-510-511-512-513-514-515-516-517-518-519-520-521-522-523-524-525-526-527-528-529-530-531-532-533-534-535-536-537-538-539-540-541-542-543-544-545-546-547-548-549-550-551-552-553-554-555-556-557-558-559-560-561-562-563-564-565-566-567-568-569-570-571-572-573-574-575-576-577-578-579-580-581-582-583-584-585-586-587-588-589-590-591-592-593-594-595-596-597-598-599-600-601-602-603-604-605-606-607-608-609-610-611-612-613-614-615-616-617-618-619-620-621-622-623-624-625-626-627-628-629-630-631-632-633-634-635-636-637-638-639-640-641-642-643-644-645-646-647-648-649-650-651-652-653-654-655-656-657-658-659-660-661-662-663-664-665-666-667-668-669-670-671-672-673-674-675-676-677-678-679-680-681-682-683-684-685-686-687-688-689-690-691-692-693-694-695-696-697-698-699-700-701-702-703-704-705-706-707-708-709-710-711-712-713-714-715-716-717-718-719-720-721-722-723-724-725-726-727-728-729-730-731-732-733-734-735-736-737-738-739-740-741-742-743-744-745-746-747-748-749-750-751-752-753-754-755-756-757-758-759-760-761-762-763-764-765-766-767-768-769-770-771-772-773-774-775-776-777-778-779-780-781-782-783-784-785-786-787-788-789-790-791-792-793-794-795-796-797-798-799-800-801-802-803-804-805-806-807-808-809-810-811-812-813-814-815-816-817-818-819-820-821-822-823-824-825-826-827-828-829-830-831-832-833-834-835-836-837-838-839-840-841-842-843-844-845-846-847-848-849-850-851-852-853-854-855-856-857-858-859-860-861-862-863-864-865-866-867-868-869-870-871-872-873-874-875-876-877-878-879-880-881-882-883-884-885-886-887-888-889-890-891-892-893-894-895-896-897-898-899-900-901-902-903-904-905-906-907-908-909-910-911-912-913-914-915-916-917-918-919-920-921-922-923-924-925-926-927-928-929-930-931-932-933-934-935-936-937-938-939-940-941-942-943-944-945-946-947-948-949-950-951-952-953-954-955-956-957-958-959-960-961-962-963-964-965-966-967-968-969-970-971-972-973-974-975-976-977-978-979-980-981-982-983-984-985-986-987-988-989-990-991-992-993-994-995-996-997-998-999-1000-1001-1002-1003-1004-1005-1006-1007-1008-1009-1010-1011-1012-1013-1014-1015-1016-1017-1018-1019-1020-1021-1022-1023-1024-1025-1026-1027-1028-1029-1030-1031-1032-1033-1034-1035-1036-1037-1038-1039-1040-1041-10



DESIGN DATE		DESIGNING		BY	
DEPARTMENT OF THE ARMY NEW ENGLAND DIVISION CORPS OF ENGINEERS WASHINGTON, MASS.					
WATER RESOURCES DEVELOPMENT PROJECT FITCHBURG, MASSACHUSETTS NORTH NASHUA RIVER CHANNEL REHABILITATION GENERAL PLAN NO 2 NORTH NASHUA RIVER MASSACHUSETTS					
APPROVED		DATE			
CHIEF ENGINEERING DIVISION SCALE		SPEC. NO. DRAWING NUMBER MER-34		SHEET	



KEY

- (U) Reset large broken stones in stream immediately down stream from Bemis Road dam.
- (V) Restore and prevent further erosion of banks and river bottom regrade and place riprap protection on the adjacent river bank and restore the outlet of the canal into the river.
- (W) Remove shoaling.

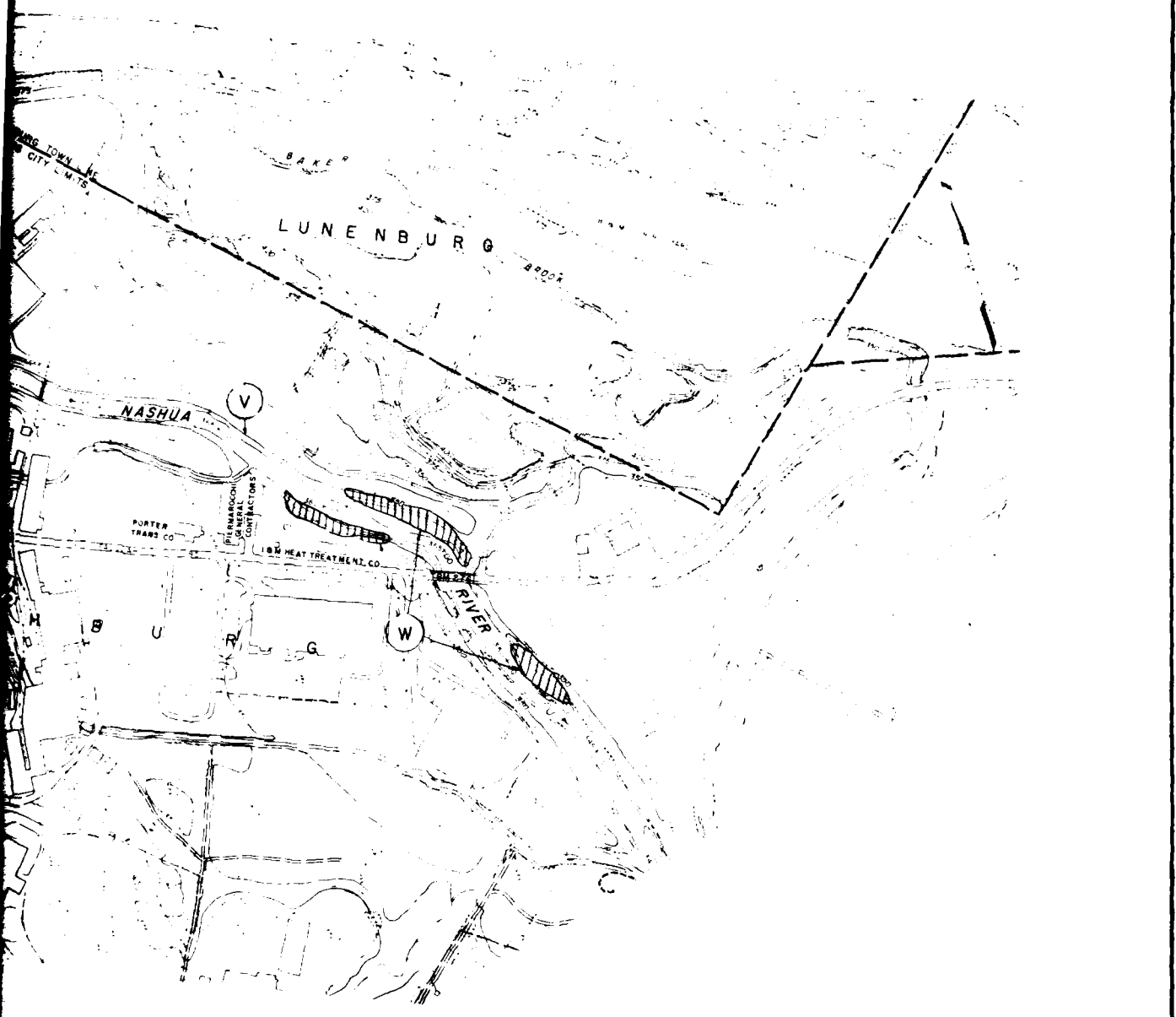
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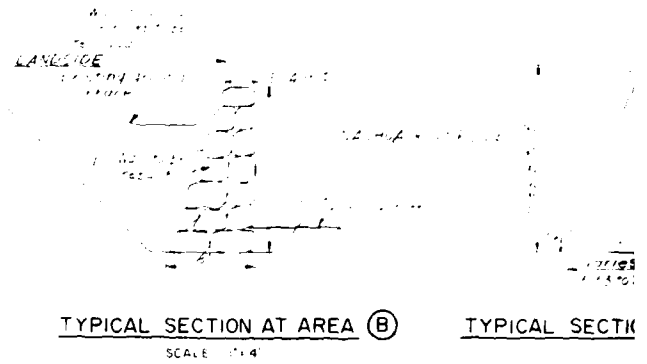
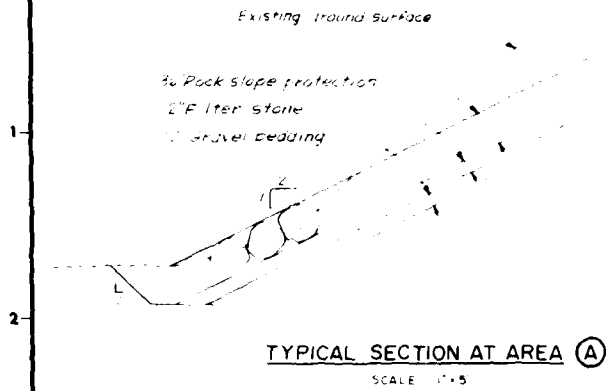
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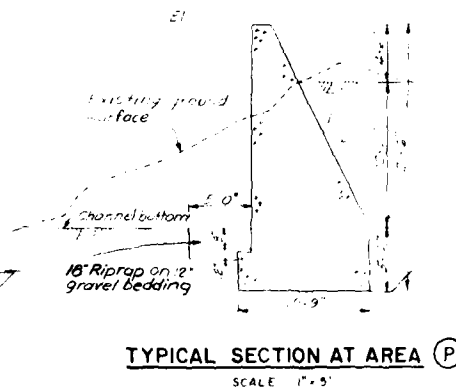
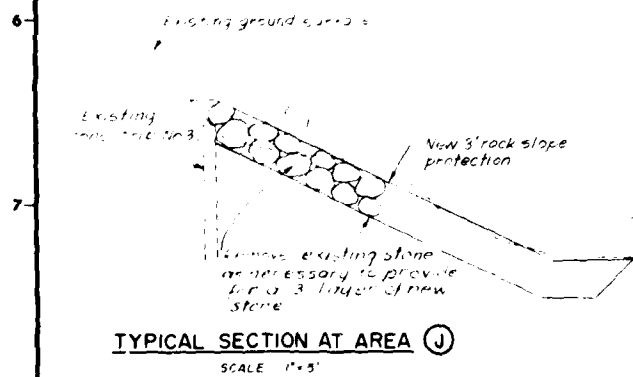
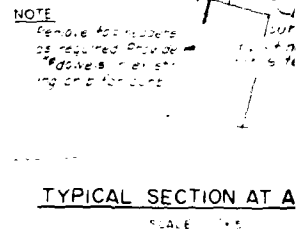
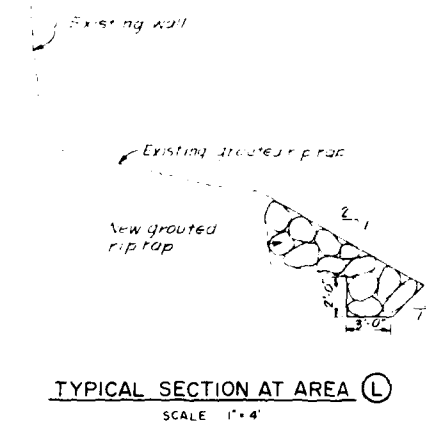
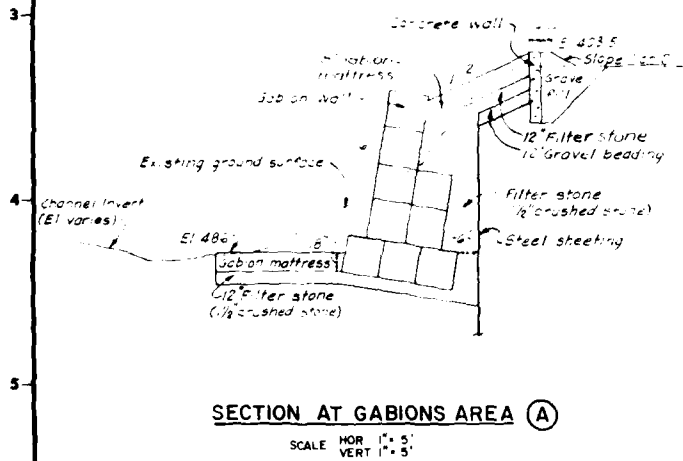
GRAPHIC SCALE
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 FEET

DEPARTMENT OF THE ARMY NEW ENGLAND DIVISION CORPS OF ENGINEERS WALTHAM, MASS.			
WATER RESOURCES DEVELOPMENT PROJECT FITCHBURG, MASSACHUSETTS			
NORTH NASHUA RIVER CHANNEL REHABILITATION GENERAL PLAN NO 3			
NORTH NASHUA RIVER		MASSACHUSETTS	
MER-34			
SHEET			

PLATE 3



TYPICAL SECTION AT AREA (C)



TYPICAL SECTION AT AREA (R)

E

F

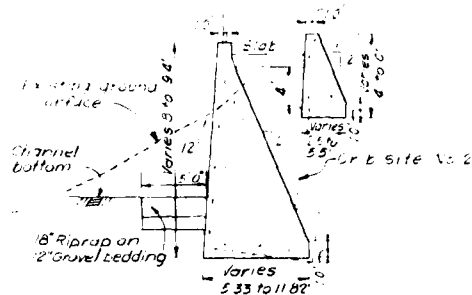
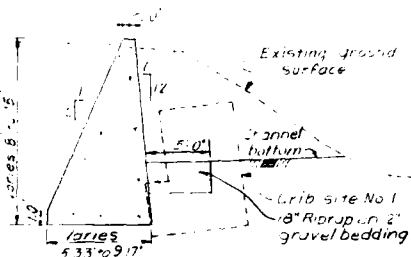
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U. S. ARMY

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NASHUA RIVER SIDE



AT AREA (B)

TYPICAL SECTION AT CRIB SITE NO. 1 AREA (F)

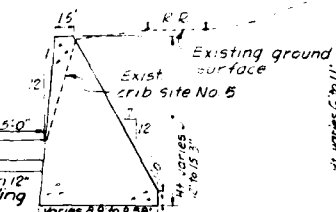
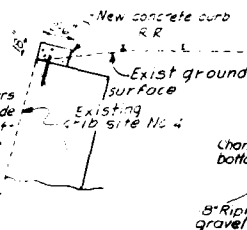
TYPICAL SECTION AT CRIB SITE NO. 2 AREA (F)

SCALE 1"=5'

SCALE 1"=5'

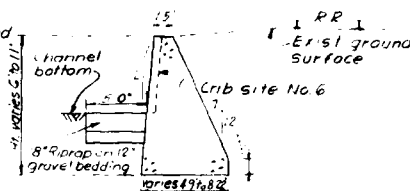
NOTE

Remove top headers as required. Provide 12" panels in existing crib for curb.



NOTE

Existing railroad spur track to be removed and relayed as necessary for removal of existing curb wall and construction of new concrete wall.



TYPICAL SECTION AT AREA (M)

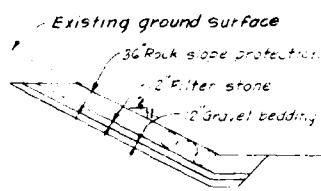
TYPICAL SECTION AT AREA (O)

TYPICAL SECTION AT AREA (O)

SCALE 1"=5'

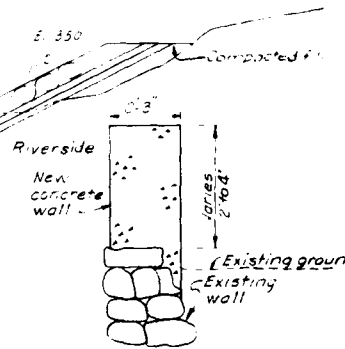
SCALE 1"=5'

SCALE 1"=5'



TYPICAL SECTION AT AREA (V)

SCALE HOR 1"=10' VERT 1"=5'

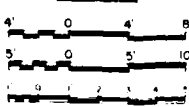


TYPICAL SECTION AT AREA (N)

SCALE 1/2"=1'-0"



GRAPHIC SCALES



TYPICAL SECTION AT AREA (Q)

SCALE 1"=5'

NOTES

1. Place 1/2 inch gravel bedding on 2 inch gravel bedding. 2. Provide 4 inch weep holes at 10 foot intervals along the top of 3 inch concrete wall.

REVISION	DATE	DESCRIPTION	BY

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

DES. BY: CHK. BY: DATE:

SUBMITTED:

CHIEF:

APPROVED:

WATER RESOURCES DEVELOPMENT PROJECT
FITCHBURG, MASSACHUSETTS
NORTH NASHUA RIVER
CHANNEL REHABILITATION
TYPICAL SECTIONS

NORTH NASHUA RIVER MASSACHUSETTS

APPROVED: DATE:

CHIEF:

SCALE: SPEC. NO.

DRAWING NUMBER:

MER-34

SHEET

PLATE 4

DATE
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