January 6, 2003

Construction-Operations Division

Honorable Dan H. Mylott:
Mayor of Fitchburg
718 Main Street
Fitchburg, MA 01420

Dear Mayor Mylott:

It was a pleasure having you and your Economic Development staff accompany us during the October 25, 2002 inspection of the Fitchburg local protection project (LPP). I have enclosed a copy of the inspection report for your review.

I apologize for the tardiness in issuing the report, however I felt it was important that it reflect information obtained from our recently completed hydrological study of the project. The study should prove to be a valuable tool in evaluating the status of the project. For the first time we have quantitative information relating the impact of vegetation and shoaling on river elevations during flood flows. Since the effects of shoaling and vegetation are evaluated separately along relatively short stretches of the river, a much more exacting and efficient maintenance strategy is now possible.

The study encompassed the entire project area and identified the most flood prone reaches. These were assigned one of three levels of priority. First-priority segments, those most vulnerable to flooding, include the following (see maps enclosed):

- Laurel Street Bridge to Cushing Street Bridge - The hydrological report revealed that, due to the Railroad Bridge restrictions, this stretch cannot pass the 9000 cubic feet per second (cfs) design flow even if maintained in optimum condition. Moreover, this bottleneck is exacerbated by the presence of vegetation and shoaling in the channel. For example, with the 9000 cfs design flood, elevations would rise an additional 0.9 feet. Hence, removal of shoaling and vegetation within this 400-foot reach would substantially reduce flood damages during a design event or prevent flooding for smaller events.

- Putnam Street Bridge to a point 100 feet upstream of the nearby Railroad Bridge – Bank vegetation would cause the Railroad Bridge to be overtopped by 0.3 feet in a design storm. Vegetation removal along this 300-foot reach would reduce flood stage by 0.7 feet, resulting in 0.4 feet of freeboard.

- From the Railroad Bridge downstream of Oak Hill Road Bridge to a point 800 feet upstream of the bridge – Vegetation and shoaling upstream of Oak Hill Road Bridge increase flood stage by 1.5 feet resulting in the bridge being overtopped by 0.4 feet in a design storm. Vegetation downstream of the bridge reduces freeboard by 0.8 feet to 0.2 feet, so that a design storm would just barely be contained within the channel at this location, and greater events would cause flooding more frequently.

Other sections identified as second and third priority areas include: the reach from Sawyer Passway Bridge to a point roughly 300 feet downstream of Water Street Bridge; the reach 200' downstream of Rollstone Bridge to the downstream Railroad Bridge; the stretch between Water Street and Laurel Street bridges; and the reach between Circle Street and lower River Street bridges.

It is noteworthy that the restricted sections, totaling about 5800 linear feet, represent only 25% of the total project reach. This is positive news, signifying that the majority of the project can pass design flows without overtopping. This is not to imply that these areas can be ignored in the future, only that wholesale vegetation removal is not required in order to maintain them to project design standard.

With this new information, the city can concentrate its maintenance efforts within the identified areas, making for a much more manageable task. Moreover, we now know that a modest vegetative corridor, that benefits a variety of wildlife and aesthetics, can be maintained along a significant portion of the project without compromising design flow capacity.

The enclosed material is only a capsule summary of the hydrological study; a full report will be issued shortly and we will send copies to you and your staff as soon as it becomes available. In addition, we would also suggest meeting with you and all concerned to discuss the report firsthand and its implications on future maintenance requirements. We also stand ready to assist your efforts in developing a maintenance plan and discussing its need and potential impacts with all parties/agencies having an interest in the work. If you have any questions or comments concerning the above, please call me at (978) 318- 8438.

Sincerely,

Jim Law
Technical Services Section

Copy Furnished:

President, City Council
718 Main Street
Fitchburg, MA 01420

Mr. James Shuris
Commissioner of Public Works
718 Main Street
Fitchburg, MA 01420

Nancy Thornton, Director
Office of Waterways

Dept. of Env Management
349 Lincoln Street, Bldg. # 45
Hingham, MA 02043

Mr. Bill Salomaa
DEM, Div of Water Resources
251 Causeway Street, Suite 700
Boston, MA 02114-2104

Mr. Mike O'Hara
Office of the Planning Coordinator
718 Main Street
Fitchburg, MA 01420

Mr. Allen Futterman
Outreach Coordinator
Nashua River Watershed Assoc.
592 Main Street
Groton, MA 01450

Mr. David Streb
Planning Coordinator
718 Main Street
Fitchburg, MA 01420

Mr. Orazio Rinaldi
DEM, Office of Waterways
349 Lincoln Street, Building # 45
Hingham, MA 02043

Mr. Martin Jalonski
Env Analyst
MA Dept of Env Prot
627 Main Street
Worcester, MA 01608

Mr. Michael Donnelly
Fitchburg Cons. Commission
718 Main Street
Fitchburg, MA 01420

Mr. Joseph P. Faloretti
Operations Manager
Lower Connecticut River Basin Office
U.S. Army Corps of Engineers, NED
6 Athol-Richmond Road
Royalston, MA 01368-8900

Mr. R. Bruce Williams
Construction-Operations Division
U.S. Army Corps of Engineers, NED
696 Virginia Road
Concord, MA 01742-2751

Mr. Jeffrey C. Mangum
Project Manager
Tully Lake
6 Athol-Richmond Road
Royalston, MA 01368-8900

FITCHBURG, MASSACHUSETTS - LOCAL PROTECTION PROJECT

SEMI-ANNUAL INSPECTION

25 October 2002

GENERAL COMMENTS

Virtually no maintenance of the project has been accomplished since the last inspection and for the past several years.

The Corps recently conducted a hydrological study of the project reach to determine the impact of excess vegetation and shoaling on river elevations. A summary of the results of that study is attached to the inspection report. Also, each segment described below contains a brief (italicized bold) comment from the study. A complete hydrological report will be issued shortly. The following conditions were noted during the inspection:

NOTE: Descriptions in parentheses coincide with stations and work area designations on General Plans 1, 2 and 3 of North Nashua River Channel Rehabilitation, Fitchburg, Massachusetts Operations and Maintenance Manual February 1982.

1. **Project start.** (Several hundred feet upstream of Oak Hill Road Bridge, near station 580+00)

   Woody vegetation is present on the riprap slopes and stone gabions and should be removed.

   This reach is a first priority flood prone area (see study comment #8).

2. **Oak Hill Road Bridge.** (Approximately 300 feet downstream of station 575+00)

   Looking upstream - Significant vegetation, including small trees, is present on both sides of the channel. The shoal on the left bank immediately above and under the bridge appears to be expanding and should be removed.

   Looking downstream - The shoal on the left bank appears to be expanding. The shoal should be removed. Vegetation covering both banks should be removed.

   The above are first priority flood prone areas (see study comment #8).

3. **Daniel Street Bridge.** (Approximately 300 feet downstream of station 565+00)

   Looking upstream – A shoal is present in the south (left) half of the channel above the old railroad bridge. This shoal should be closely monitored. Small trees are growing in both sides of the channel.

   Looking downstream - Both banks are covered with vegetation.

This reach presently has sufficient capacity to pass the design flood of 9000 cubic feet per second (cfs).

4. **Adjacent to the McDonald's Parking Lot.** (Work areas "D" and "E" Located on the left bank downstream of Daniel Street Bridge.)

   Vegetation within the banks of the channel along both sides of the river is 10 to 20 feet high.

   This reach presently has sufficient capacity to pass the design flood of 9000 cfs.

5. **Kimball Street Bridge.** (Station 550+00)

   Looking upstream – Heavy brush growth is present along both banks. A shoal on the right bank should be closely monitored.

   Looking downstream – Vegetative growth is present on the east (right) bank.

   This reach presently has sufficient capacity to pass the design flood of 9000 cfs.

6. **Upper River Street Bridge.** (Work area "F")

   Looking upstream - Trees are growing out of the walls along both sides of the river. A large poplar is growing near the edge of the water.

   Looking downstream - Heavy vegetation is present along both banks.

   This reach presently has sufficient capacity to pass the design flood of 9000 cfs.

7. **Behind The Former Premier Box Company.** Located on the right bank. (Station 550+00 to 545+00)

   Vegetation is present on both banks. A conservation group has proposed development of a river walk between the Upper River Street Bridge and the Sheldon Street Bridge.

   This reach presently has sufficient capacity to pass the design flood of 9000 cfs.

8. **Sheldon Street Bridge.** (Work area "G")

   Looking upstream - Woody vegetation and shoals are present on both banks.

   Looking downstream - Brush, trees, and other undesirable vegetation are present on both banks. A shoal is present on the left bank.

   The channel several hundred feet upstream of the Shelton Street Bridge is at full capacity during a design flood. However, removal of vegetation within this reach would not provide any significant margin of safety as flows are controlled by the constriction at the bridge (see final study comment).

9. **Lower River Street Bridge.** (Work area "I")

Looking upstream - Vegetative growth is present along both banks.

Looking downstream - The large shoal on the left bank sh0uld be removed.
Vegetation should be removed from both banks.

The reach downstream of the bridge is a second priority flood prone area primarily due to shoaling (see study comment #7).

10. **Circle Street Bridge.** (Station 510+00)

Looking upstream - Trees and brush growing in the training walls along both banks should be removed. The shoal on the left side of the channel should be removed.

Looking downstream - Shoals on the both sides of the channel and woody vegetation on the shoals should be removed.

The reach upstream of the bridge is a second priority flood prone area primarily due to shoaling (see study comment #7).

11. **Upper Rollstone Street Bridge.** (Station 505+00) This bridge near the DPW building is closed.

Looking upstream - Heavy vegetative growth is present along both banks of the river. Trees are growing along the bridge abutment in a shoal area by the left bank. The shoal obstructs the north half of the channel under the bridge.

Looking downstream - The river channel narrows at this point and should be kept completely free of obstructions. The significant growth of trees, brush and other vegetation in the concrete lining along the left side of the channel should be removed.

The reach downstream of Rollstone Bridge is a third priority flood prone area primarily due to excess vegetation (see study comment #6).

12. **Putnam Street Bridge.** (Approximately 300 feet downstream of station 485+00)

Looking upstream – There is heavy growth of trees and vegetation in the training walls along both sides of the river, extending well upstream of the railroad bridge. This is also a narrow stretch of the river and should be kept free and open. The shoals on the north (right) bank approximately 100 yards above the railroad bridge and under the right span of the railroad bridge should be removed. The large shoal in the center of the channel about 200 yards upstream of the railroad bridge should be removed. The large elm growing on a shoal at the center bridge pier and the shoal at the railroad bridge center abutment should be removed.

Looking downstream - There is heavy growth of trees, brush and other vegetation within the training

walls and riprap along both sides of the river extending beyond the footbridge, which is about 300 feet downstream of Putnam Street. A large tree is growing next to the bridge abutment. Also, there are trees leaning over the channel approximately 150' from the bridge at the right downstream embankment. A riverfront park has been proposed for the location just downstream of the bridge. The city should closely coordinate this proposal with the Corps of Engineers to insure that the proposal will not negatively impact the function of the project.

This is a first priority flood prone area (see study comment #5).

12. **Railroad Bridge** (Looking upstream from the Putnam Street Bridge.)
The trees and shrubs growing in the channel in the vicinity of the railroad bridge should be removed.

This is a first priority flood prone area (see study comment #5).

13. **Laurel Street Bridge.** (Work areas "O", "P")

Looking upstream - Major shoaling has taken place in the entire area of the upstream railroad crossing. A large shoal, which is nearly covered with vegetation, restricts the western span and half of the center span. This is a significant restriction, which has decreased the discharge capacity of the channel by nearly 33% and needs to be corrected promptly. The shoals and vegetation should be removed.

Looking downstream - The channel narrows downstream of a manhole on the right bank. The trees, brush and vegetation growing along both banks should be removed.

This is a first priority flood prone area and the most likely reach to experience flooding (see study comment #4).

14. **Water Street Bridge.** (Station 460+00)

Looking upstream – The large shoal about 100 feet upstream of the bridge along the north (right) bank near the floodwall should be removed. Significant tree growth along the south bank should be removed. Concrete walls line both sides of the river.

Looking downstream - A shoal has formed on the left bank adjacent to the floodwall. Numerous willow trees have become established.

The reach upstream of Water Street Bridge is a second priority flood prone area primarily due to excess vegetation (see study comment #3).

15. **Sawyer Passway Bridge.** (Approximately 75 feet downstream of station 450+00) This bridge is located about 1,000 feet upstream of the Fifth Street Bridge.

Looking upstream - Shoaling in the center of the river above the bridge and has created a restriction within the channel and should be removed. Small trees have fallen over.

Railroad Bridge Upstream - This bridge has 3 arches (spans). The lower portion of the right span is completely blocked by a shoal. The shoal should be removed.

Downstream - There is major brush, tree and vegetative growth on both banks downstream to the Fifth Street Bridge.

The reach upstream of the bridge is a third priority flood prone area primarily due to excess vegetation (see study comment nos. 1 & 2).

16. **Fifth Street Bridge.** (Work area "T")

Looking upstream - Construction of a new bridge is in progress. The steep slopes near the bridge should be monitored closely to prevent erosion.

Looking downstream - There are trees, brush and vegetative growth within the wide floodway.

This reach presently has sufficient capacity to pass the design flood of 9000 cfs.

17. **Railroad Bridge.** Located several hundred feet downstream of Fifth Street Bridge. (Station 420+00)

Access to this bridge is no longer available. The city should inspect this bridge and/or make provisions to provide access to the site during the semi-annual inspections.

This reach presently has sufficient capacity to pass the design flood of 9000 cfs.

18. **Bemis Road Bridge.** (Work area "U")

Riprap at both bridge abutments is free of vegetation.

Looking upstream - Small trees have become established on the riprap protection and at the toe of the slope along the right bank.

Looking downstream - The river channel is wide and straight. There is a large shoal in the middle of the channel and another on the north (left) bank about 125 yards downstream.

This reach presently has sufficient capacity to pass the design flood of 9000 cfs.

19. **Airport Road Bridge.** (Formerly Falulah Road) (Work area "W")

Looking upstream - Brush and trees are present along both banks. There are trees in the channel at the abutments and on the shoal on the left bank.

Looking downstream - The shoals along the right and left bank have increased in size. The shoal on the right bank extends under the bridge and a short distance upstream of the bridge.

This reach presently has sufficient capacity to pass the design flood of 9000 cfs.

GENERAL

1. The hydrological study identifies roughly 5800 linear feet of restricted channel section, which represents about 25% of the total project. The priority areas should be addressed through an aggressive long-term maintenance program. The Corps stands ready to work with the city in developing a specific plan. The remainder of the project, presently capable of passing the 9000 cfs design flood, should continue to be monitored closely to assure that shoaling and vegetative growth does not progress to the extent that channel capacity is reduced to below the design standard. The hydrological study revealed that some vegetation and shoaling along much of the project may be tolerated without compromising design channel capacity. This allows for the adoption of a more balanced approach that addresses the needs of both flood control and environmental resources.

2. A semi-annual report, due in February and August of each year should be submitted by the city to the Corps. This report should provide an update of the city's progress in accomplishing the necessary maintenance of the project and serves as an important tool in assessing the project status. Semi-Annual reports have not been submitted by the city for many years.

3. The city should obtain all necessary local, state and/or federal permits to accomplish maintenance of the project. The Department of Public Works must work closely with the Fitchburg Conservation Commission and the Massachusetts Department of Environmental Protection and other interested parties to develop a plan and obtain the necessary local, state and federal permits before beginning any work in the river and channel. Obtaining the permits will allow the City of Fitchburg to accomplish the maintenance of the project. This work may include, but is not limited to, brush removal and herbicide treatment, as well as the removal of shoals and other obstructions. The plan should address flood control maintenance and environmental issues and concerns.

4. Cutting is only a partial solution to the problem of undesirable vegetation. Significant resprouting occurs on an annual basis. Application of an approved herbicide, accomplished in accordance with state laws and regulations, is recommended to prevent trees, shrubs and other vegetation from quickly sprouting.

Hydrological analysis based on HEC-RAS model of Fitchburg Local Protection Project (LPP)...

All values are approximate. All references to left or right bank are oriented as if looking downstream. All discussion refers to analysis of a 9,000 cfs event (design capacity for the LPP). The following reaches (listed moving upstream through the LPP) are the areas where there is reason for significant concern due to the lost channel capacity from invading vegetation or the build-up of shoals. Due to the close proximity of some of these reaches to each other, full realization of potential benefits in a reach (as a result of the proposed channel maintenance) depends partly, but not mainly, on maintenance of a nearby downstream reach.

1. From the Fitchburg Gas & Electric Dam, to the railroad bridge upstream of the Sawyer's Passway Bridge: The vegetation on the banks within this reach is causing the 9,000 cfs flood stage to increase by 0.7-feet upstream of Sawyer's Passway. This results in the reduction of the 1.5-feet of freeboard that Sawyer's Passway previously had (by approximately one half). Although 9,000 cfs (design capacity for the LPP) can still be passed beneath Sawyer's Passway, the concern is that the small amount of remaining freeboard could be lost to further flood stage increases caused by debris buildup during the event. This would result in a design capacity event, or even events that would occur more frequently, cresting over Sawyer's Passway and the surrounding area. Removal of all vegetation in this reach would restore previously existing freeboard. **Third priority.**

2. From the railroad bridge located upstream of Sawyer's Passway, to a point 500-feet further upstream: The vegetation in this reach (found on both banks, but mainly on the right bank) is causing the 9,000 cfs flood stage to increase 0.8-feet in the immediate area. This is a concern as the floodwall on the left bank has lost about a half of the 1.5-feet of freeboard previously provided at the reach's least protected point (from the upstream face of the railroad bridge to a point approximately 100-feet upstream). For the same reasons indicated above (for the reach including Sawyer's Passway), the removal of vegetation in this 500-foot reach would be beneficial by decreasing the frequency of floods capable of over-topping the floodwall just upstream of the railroad bridge. **Third priority.**

3. From the Water Street bridge, to the Laurel Street bridge: This reach is most vulnerable towards the middle of it's 1,200-foot length. Currently, the vegetation in this area is responsible for raising the 9,000 cfs flood stage by 1.6-feet, which brings that event within 0.3-feet of flooding developed property along the left bank. Removal of the vegetation throughout this reach would improve the situation in the immediate surroundings. **Second priority.**

4. From the Laurel Street bridge, to the Cushing Street bridge (including railroad bridge in between): This reach is the most likely area in the LPP to experience problems from flooding. Survey work performed for the purposes of this study, during late 2001, has shown that this reach is under tighter constrictions to flow from the railroad bridge and abutments than was assumed for earlier hydrological investigations.

The resulting analysis (with the more detailed survey data) shows that the design capacity that was adopted for the rehabilitation was not realized in the vicinity of this railroad bridge. That is to say that even if the LPP were perfectly maintained, a 9,000 cfs event would still crest over the railroad bridge (previously thought to barely pass the flow) and cause flooding in the left overbank area of this reach (flood crest of approximately 2-feet higher than previously thought). Regardless, this is where primary attention should be given to maintenance of the LPP. Currently, the 9,000 cfs event would rise 0.9-feet higher due to the bank vegetation and shoaling in this reach. The vegetation and shoaling are roughly equally responsible for this rise, 0.4 and 0.5-feet respectively. Since this amount of flow will over-top the railroad bridge and left bank even with the channel maintained (unless significant new rehabilitation of the area is undertaken), all improvements would be realized as direct reduction of flood levels that would impact the area. It should also be noted that under existing conditions, no freeboard exists for the right overbank, and a minimal amount exists for the Cushing Street bridge (for the 9,000 cfs flood stage), but removal of the vegetation and shoals would improve that measurement of safety by the 0.9-feet. Left in the current condition, the LPP only passes 6,000 cfs under the railroad bridge. **First priority.**

5. From the Commercial Street bridge, to a point 100-feet upstream of the Railroad bridge upstream of Putnam Street: Under existing conditions, the railroad bridge would be over-topped by the 9,000 cfs event with 0.3-feet of floodwater. Removal of bank vegetation from the Commercial Street bridge to a point 100-feet upstream of the railroad bridge would allow the flood stage to drop 0.7-feet, and thus the flow would pass beneath the bridge. Left in the current condition, the LPP only passes 8,500 cfs under the railroad bridge. **First priority.**

6. From railroad bridge downstream of Rollstone/Broad Street bridges, to a point 200-feet downstream of the Rollstone/Broad Street bridges: Towards the middle of this reach, existing conditions provide only 1.0-feet of freeboard for the floodwall protecting the overbank area. Removal of the bank vegetation in this reach would recover 1.2-feet of the freeboard that has been lost, for a total of 2.2-feet. **Third priority.**

7. From the Circle Street bridge, to the lower River Street bridge: Due to bank vegetation and shoaling, the floodwall between these two bridges has lost much of the previously existing freeboard. At one point (180-feet upstream of the Circle Street bridge), only 0.3-feet of the previously existing 1.9-feet of freeboard is still available. The shoaling that has developed upstream of the Circle Street bridge is mostly responsible for this, but the vegetation's influence is considerable as well. Removal of the shoaling would restore 1.0-feet of freeboard, while removal of the vegetation would gain the remaining 0.6-feet. Vegetation removal would be of highest priority in the lower half of this reach, but total removal of vegetation between the two bridges would restore valuable freeboard throughout. **Second priority.**

8. From railroad bridge downstream of the Oak Hill Road bridge, to a point 500-feet upstream of the Oak Hill Road bridge: Upstream of the Oak Hill Road bridge, the

bank vegetation and channel shoaling are causing the 9,000 cfs flood stage to rise 1.5-feet higher than the case would be for a fully maintained channel (1.1-feet from vegetation plus 0.4-feet from shoaling). This increase in stage creates flooding that will over-top the Oak Hill Road bridge by 0.4-feet. Downstream of the Oak Hill Road bridge, the bank vegetation between the two bridges of this reach is causing 1.0-feet of freeboard to be reduced to 0.2-feet. If the vegetation within this reach and the shoaling upstream of Oak Hill Road bridge was removed, flooding would be less likely to occur in the overbank areas, and the Oak Hill Road bridge would just manage to pass the design capacity. Left in the current condition, the LPP only passes 8,500 cfs under the Oak Hill Road bridge. **First priority.**

Note on the reach upstream of the Sheldon Street bridge: *As discussed above, concerning the railroad bridge between the Laurel Street bridge and the Cushing Street bridge, survey work performed for the purposes of this study has shown that this reach is under tighter flow constrictions from the Sheldon Street bridge and abutments than was assumed for earlier hydrological investigations. However, at the Sheldon Street bridge, passing the LPP's design capacity under the bridge is not a difficulty. While the upstream channel would be completely full during a 9,000 cfs event, analysis has revealed that maintenance of the channel would have no significant impact on providing a margin of safety, as the constriction at the bridge completely controls the flood stage for several hundred feet upstream.*

CORPS OF ENGINEERS

U S ARMY

AREA

AREA "F"

From RR Bridge upstrea
of Oak Hill Rd. Bridge t
a point 500' Upstream o
Bridge (comment #8)

FIRST PRIORITY

From downstream of Rollstone Bridge to Downstream RR bridge (comment #6).

THIRD PRIORITY

From the footbridge to a point 100' upstream of RR bridge upstream of Putnam Street.

FIRST PRIORITY

KEY

(A) Place 36" rock slo
feet and remove
(See sheet No. 5)

(B) Remove loose sto
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(C) Chink and repoint cut sto
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(D) Repair localized e
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outfall as directed by

(E) Between Kimball
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(See sheet No. 10)
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No. 4 by the
nd resurfacing
members.
10)

SCALES
200' 400'

DIVISION	DATE	DESCRIPTION	BY
		Final field corrections	

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

DES. BY I.R. | DR. BY A.Z. | CK. BY

WATER RESOURCES DEVELOPMENT PROJECT
FITCHBURG, MASSACHUSETTS
NORTH NASHUA RIVER
CHANNEL REHABILITATION
GENERAL PLAN NO. I
NORTH NASHUA RIVER MASSACHUSETTS

APPROVED Joe B. Tyson DATE FEB 1973

SCALES SHOWN | SPEC. NO. DACW33-78-R-0008

DRAWING NUMBER
MER-34

SHEET 2