

CDM

Assabet River - Sediment and Dam Removal Study

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USACE New England Assabet River - Sediment and Dam Removal Study



- ◆ Objective:
Reduce **phosphorus** concentrations and improve **aquatic habitat** within the Assabet River from sediment and dam removal.

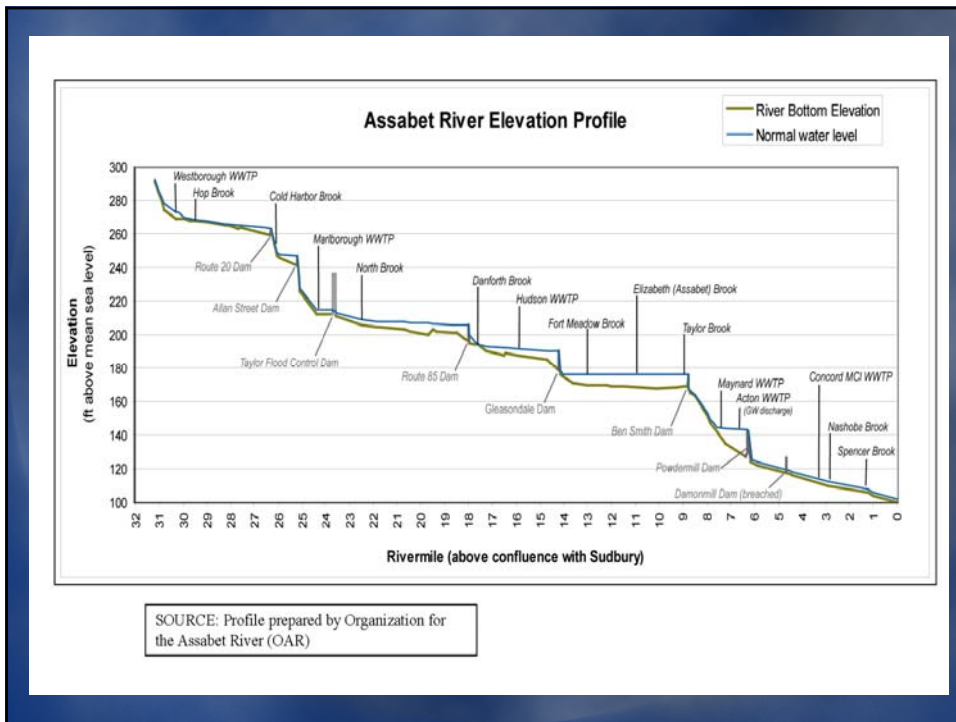
Sediment and Dam Removal Study Objectives

- ◆ Evaluate alternatives that will help achieve water quality compliance and restore aquatic ecosystem
 - ◆ Target: **90% reduction** in phosphorus sediment flux
 - ◆ Alternatives considered:
 - Sediment removal
 - Dam removal
 - ◆ Planned Improvement
 - Lower WWTF phosphorus effluent criteria
- } to reduce P loading from sediment
- } to reduce P loading from point sources

Study Area Description

- ◆ Assabet River ~20 miles west of Boston, MA
- ◆ River
 - 31 miles long
 - DA = 177 sq. mi.
 - average monthly flows: 400 cfs (Mar) – 60 cfs (Aug)*
- ◆ River flows through 9 towns
- ◆ 8 dams located on mainstem (2 are flood control)
- ◆ 5 wastewater treatment facilities discharge into river (4 of these are public)

*flows measured at Maynard USGS gage



Study Objectives

- ◆ Computer models were used to evaluate the impacts of dam removal, dredging, and lower WWTF effluent criteria
- ◆ The following were evaluated:
 - Water surface profiles During high and low flow conditions
 - Sediment volumes and mobility
 - Water quality Specifically, its dependency on hydraulics and sediment nutrient flux

Methodology

Sediment transport model

HEC-6

-> River bed profile and sediment movement

Revised XS

Water surface / hydraulic model

HEC-RAS

-> Water surface profiles and river hydraulics

Revised hydraulics

Watershed and river water quality model

HSPF

-> **Water quality**

Sediment P fluxes

Phosphorus flux model

QUAL2K

-> Sediment P fluxes

Scenarios

Scenario	Wastewater Treatment Plant Improvements	River Sediment Removal	Dam Removal
Existing conditions (2000)			
Planned WWTF improvements	√		
Dredging	√	3 ft from each impoundment	
Full dam removal	√		all 6 dams
Partial dam removal	√		Hudson, Gleasondale, Ben Smith
Partial dam removal	√		Ben Smith

Findings – WWTF Improvements

(2005 NPDES Permits of 1.0 TP winter and 0.1 TP growing season)

- ◆ Reducing phosphorus discharges from the WWTFs has several impacts on water quality:

- Lower instream P concentrations in river
- Lower algal counts
- Improved DO
- Less algal settling
- Reduced P flux from sediment due to lower algal settling

60% reduction in P flux

Note: high summer P fluxes are due not only to algal settling and cycling through sediment, but also the high P in the sediment during winter time

Findings - Sediment Removal/Dredging

- ◆ Based on USGS study, total P sediment concentration in the impoundments was highest in top 3 ft of sediment
- ◆ Removing the top 3 ft of sediment from each impoundment results in the following water quality impacts:

- Reduced sediment phosphorus flux lasts only for a few years; as dredged areas fill back in, P flux will increase back to previous levels
- Dredging increases residence time in impoundments
- Reduces reaeration and dissolved oxygen
- Increases algal growth from deeper impoundments

→ Dredging does not improve water quality

Findings – Dam Removal

Dam	Dam Height (ft)	Sediment Volume (ac-ft)*	Impoundment Area (acre)*	Maximum Water Depth (ft)*	Change in Water Surface if Dam Removed (ft)**
Aluminum City	4.9	0.3	0.4	3.9	- 4.8
Allen Street	9.7	34	7	8.2	- 3.5
Hudson	7.4	45	22	9.8	- 6.9
Gleasondale	6.4	54	14	10.8	- 4.5
Ben Smith	7.9	470	146	10.8	- 7.4
Powdermill	10.8	97	27	8.2	- 7.6

Data sources:

* From *Sediment Studies in the Assabet River, Central Massachusetts* (USGS, 2003)

** From USACE New England Assabet River Sediment and Dam Removal Study modeling, full dam removal scenario for summer average flow conditions (CDM, 2007)

Findings – Dam Removal

◆ Dam removal results in the following water quality impacts:

- Reduced residence time
- Reduced biomass production
- Improved DO
- Less algal settling
- Reduced P flux from sediment due to lower algal settling

Additional 20% reduction in P flux from dam removal for a total of 80%.

Note: Removing the dams for the larger impoundments has the greatest benefit

Summary of Water Quality Findings

Dam	Base Condition (2000)	Planned Improvements	Dredging	Dam Removal
Aluminum City	●	●	—	+
Allen Street	●	●	—	+
Hudson	●	●	—	++
Gleasondale	●	●	—	++
Ben Smith	●	●	—	+++
Powdermill	●	●	—	++
Downstream Load to Concord River	●	●	—	+

Legend

Existing Conditions: ● = Good, ● = Fair, ● = Poor

Improvements: (—) = No improvement, (+) = some improvement, (++) = good improvement, (+++) = significant improvement

Study Findings

- ◆ Sediment removal from impoundments does not help reduce sediment phosphorus flux and has a negative long term effect on water quality
- ◆ Sediment P fluxes vary seasonally and are a function of both summer AND winter loadings
- ◆ A combination of measures may be necessary; including the following :
 - Planned WWTF improvements (expected reduction of 60% from P limits: 0.1 mg/l summer & 1.0 mg/l winter)
 - Lower winter P discharge from WWTF below 1.0 mg/l
 - Consider removing Ben Smith dam and if possible, Gleasondale and Hudson/Rt 85 dams

Questions?