
TECHNICAL MEMORANDUM

TO: RACHEL CALABRO, RIVERWAYS PROGRAM TAUNTON RIVER WILD & SCENIC LIAISON
FROM: BRIAN GRABER, FLUVIAL GEOMORPHOLOGIST, RIVERWAYS PROGRAM
SUBJECT: TAUNTON RIVER ASSESSMENT
DATE: 12/14/2004
CC: JOAN KIMBALL, RIVERWAYS PROGRAM DIRECTOR

This Technical Memorandum summarizes and provides recommendations developed from a July 21, 2004 meeting and a July 22, 2004 site visit to assess portions of the Taunton River watershed. The meeting included a review of general issues impacting the proposed Wild & Scenic portions of the watershed. Several of the sites in the upper portion of the watershed were visually assessed during the site visit. Note that this Memorandum describes selective issues and should not be considered a comprehensive assessment of the watershed.

The site visit took place on a hot and sunny day with air temperatures in the 80s Fahrenheit. The Taunton mainstem was flowing near baseflow, slightly elevated by a small storm two days earlier.

Suspected Major Issues

- Stormwater Management
 - Suspected because of high percentage of impervious surface in portions of the watershed.
 - Poor stormwater management can result in:
 - Lower baseflows
 - Warmer water
 - More contaminants in water and sediment
 - More damaging floods
 - Urban areas of particular concern:
 - Brockton
 - Taunton
 - Fall River
 - Middleborough

- Wastewater Impacts on Water Quality
 - Wastewater treatment plants that discharge into the river can be a major source of nutrients, which can result in excessive algal growth and dissolved oxygen sags
 - Two treatment plants of concern:
 - Brockton
 - Bridgewater

- Dams
 - Act as barriers for anadromous species and fragment habitat for resident species
 - Increase water temperatures in the summer, decreasing dissolved oxygen
 - Collect nutrients which promote excessive plant and algae growth, potentially leading to dissolved oxygen sags
 - Convert natural river habitat to impounded habitat
 - While the Taunton mainstem is free-flowing, most of the tributaries have one or more dams. The water quality impacts of dams affect areas downstream including the mainstem.

- Local habitat degradation
 - There are eroding banks and incised channels in portions of the watershed, most likely due to increased flood power from concentrated urban stormwater and land clearing and from historic channel modifications in some places
 - The Taunton River watershed is marked by very low gradient stream channels and extensive wetlands. These factors result in a river with relatively low natural erosion potential. Therefore, areas of excessive erosion are more clearly a result of human activities.

General Recommendations (loosely in order of priority)

- Continue to assess and prioritize watershed-wide issues. While the Wild & Scenic study area is designed to protect the Taunton mainstem and the most significant tributaries, I would encourage that the impacts of human activities throughout the watershed be considered and be included in restoration planning. A river is the product of everything upstream and therefore activities outside of the Wild & Scenic study area can significantly affect the quality within the study area. For example, efforts to manage and restore challenges on the Mill and Matfield Rivers could significantly improve the water quality and overall ecosystem of the mainstem Taunton.

- Aggressively pursue the removal of inactive dams. Consider the impacts of dams on more than just anadromous fish runs. Dams affect water quality and particularly impact small pockets of coldwater. Focus first on those dams that can open up the most habitat to the ocean and on those that are having the greatest impact on water quality, particularly in areas with high nutrient loads and in the rare coldwater portions of the watershed.

- Accompany dam removal feasibility studies with assessments of fish passage at culverts upstream and downstream of the dams.

- Work to decrease the nutrient load in the river, particularly from Brockton wastewater treatment plant.

- Work to improve stormwater management in urban areas. Assess the relative contribution of different factors that contribute to less infiltration and concentrated flows, such as road runoff, storm sewers discharging directly to the river, wide expanses of impervious surface, and runoff from individual lots.

- Determine the baseflow from each tributary relative to their drainage areas, by actual measurement, not from regression equations. The absolute baseflow will show which tributaries contribute the most to the mainstem and therefore which have the greatest potential to impact the mainstem. Measuring baseflow per drainage area will additionally show where the greatest groundwater inputs to the system are and sites that are most challenged by low flow issues.
- Assess coldwater habitat and coldwater potential throughout the watershed. Coldwater fish are a good indicator species, requiring high water quality and cold temperatures. The Taunton has a few pockets of coldwater habitat that should specifically be protected and restored because of the rarity and fragility of such habitat in southeastern Massachusetts.
- Some portions of the Taunton watershed would provide interesting sites for geomorphic assessments. With both nearly pristine sections and highly impacted sections, geomorphic assessments could quantify the differences between the two to provide concepts for restoring degraded reaches. For example, an assessment of straightened reaches in the Matfield relative to more pristine portions of the watershed would quantify the impact of straightening on habitat and subsequent channel recovery.

Specific Issues

The mainstem Taunton and most of the major tributaries are included as part of the Taunton Wild & Scenic River proposal.

Major Tributaries (from west around mainstem to east)

1) Muddy Cove Brook

- not part of the Wild & Scenic study area
- has a dam with a contamination site – Muddy Cove Dam

2) Segreganset River

- The Segreganset River has several dams, beginning from the Taunton:
 - Unnamed Dam – has a good fish ladder
 - Montaup Dam
 - Has no fish passage and is a barrier to a lot of river habitat
 - Briggs Pond?
 - Poppaquash Dam?
 - Segreganset Dam?
- On a tributary – Sunken Brook, there is no dam but has a perched culvert

3) Threemile River

The Threemile has two potentially significant barriers:

- Dam below Harodite
 - The fish ladder blew out and doesn't work
 - Planning to reconstruct – need someone to do the work
 - EOEA has money for repair

- Repairing the fish ladder would open up a lot of habitat
 - Dam is currently a complete barrier
- Threemile River #1 Dam
 - Lots of river downstream to Harodite
 - Could be a barrier to a lot of upstream and downstream habitat

4) Mill River

- The Mill River is not included as part of the Wild & Scenic proposal because it is degraded due to stormwater problems, nutrient problems, and dams.
- The river flows through the city of Taunton.
- The first three dams on the river are complete barriers:
 - Taunton State Hospital Dam – no passage
 - West Britannia Dam – no passage
 - Whittendon Street Dam – no passage

5) Forge River

- There are no dams on the Forge until it branches.
- East Branch
 - Unnamed dam at Raynham Dept of Parks and Recreation
 - 4-ft dam
 - Does not appear in our dams database
 - Johnson Pond Dam
 - Recreational pond with milfoil
 - No fish passage
 - Tracy Pond Dam
 - Is not in our newer dams database
 - On a tributary to the East Branch
 - Hewitt Pond
 - Does not have fish passage
- West Branch (Pine Swamp Brook)
 - Kings Pond Dam
 - Has no fish passage
 - Wilbur Pond Dam
 - Breached?
 - Prospect Hill Pond

6) Town River and Matfield/Satucket Rivers

Town River

- Removing three broken-down dams from the Town River watershed would open up a large amount of habitat for anadromous species.
 - Plymouth Street Dam (AKA Mill Street Dam)
 - First dam to the coast

- Small, failing, partially breached structure, only 2 feet hydraulic head – breached near river left
- Dam breach may be velocity barrier
- Owner has expressed wanting possibility of low head hydro facility at dam – could calculate head at the site and compare to potential energy production to show that facility would likely be uneconomical
- Non-jurisdictional
- Note the high turbidity in the picture below – may be suspended sediment coming from the Matfield



Figure 1. Plymouth Street Dam

- Town River Dam (AKA High Street Dam)
 - At the Bridgewater Highway Department
 - Really 2 dams with a fish ladder
 - Fish ladder on upstream structure appears to be a barrier at lowflow – perched on both upstream and downstream ends – may be passable at high flows
 - Significant hazard dam in poor/fair condition
 - Inspected in 1998 and no repairs have been made
 - Dirt road is eroding into the river here



Figure 2. Dirt Road eroding into river at Bridgewater Highway Dept

- War Memorial Dam
 - Dam is multiple structures with control boards in three different places
 - Attractive structure in pretty park
 - Fishway is inadequate
 - Dam is in poor condition – seepage through structure
 - Impoundment is full of organic muck on surface and bottom – may be sucking up oxygen



Figure 3. War Memorial Dam



Figure 4. Seepage through War Memorial Dam



Figure 5. Organic material on water surface of War Memorial Dam impoundment

Matfield River

- The Matfield receives flow from Brockton Wastewater Treatment Plant, which is a major source of nutrients to the entire river system.
- The Matfield has high suspended sediment and turbidity compared to other tributaries
 - The water is a lot clearer at the Rt. 106 Bridge further upstream indicating that sources are further downstream
- The Matfield has a reach with eroding banks (see Local Habitat Degradation section)
- The Bridge Street Bridge footer may be impounding water – there is a steep drop under bridge.
- Matfield Dams:
 - Plymouth Street – see above
 - Brockton Edison Dam
 - Has been breached

Tributary Dams

- Meadow Brook
 - Forge Pond Dam
 - Fish ladder is in poor condition and is not passable
 - Just downstream is a culvert/dam at Willow Ave that is impassable at low flow
- Satucket River
 - Cotton Carver Dam
 - Dam has breached and impoundment drained
 - Its removal would open up a large amount of habitat and many tributaries. Only one of the tributaries has a dam (Robbin Pond)

- Owner is amenable to removal and towns are also in support – primarily need funding to proceed
- The mill building would make a nice riverside structure for a restaurant or some other business (I'd like the Cotton Carver Combo light on the mayo)
- Army Corps is beginning a Section 206 feasibility study
 - Project will be expensive and time-consuming with Corps involved
 - Could get out of the 206 and pursue other funding?



Figure 6. Cotton Carver Gin Mill Dam



Figure 7. Channel forming in impoundment of Cotton Carver Dam

7) Winnetuxet River

- The Winnetuxet is generally free from dams.
- Some of the tributaries have dams higher up in the system
 - There is a long stretch of river before the first dams
 - The dams are outside of the Wild & Scenic study area

8) Nemasket River

- Nemasket dams, beginning closest to the Taunton:
 - Oliver Mills
 - Has bypass channel around dam
 - Wareham Street Dam
 - Has fish ladder
 - Assawompset Pond Dam
 - Large natural lake augmented by a dam
 - Fish passage is inefficient and could be better
- There are also culvert problems between Pocksha and Quittacas Ponds

9) Assonet River

- The Assonet River is a priority to The Nature Conservancy and Mass Audubon.
- Freetown tried to acquire funding for fish ladders on three failing dams
 - All three dams are owned by the town
 - The dams are low priority for DMF because of the cost, but they should be removed
 - Tisdale Pond Dam
 - Dam is in bad shape with no passage
 - Monument Dam
 - Dam is in bad shape with no passage
 - Forge Pond Dam
 - Dam is in bad shape with no passage
 - The dam leaks badly, draining the impoundment
- On a tributary – Cedar Swamp River
 - Wing Pond Dam – appears to have drawn down

10) Mainstem Taunton

- The mainstem of the Taunton is free-flowing.
- The channel appears to be incised in the upper portions (see discussion on Local Habitat Degradation)

Coldwater Habitat

The Taunton watershed has patches of coldwater habitat, which is rare in low gradient/high wetland watersheds and rare in southeastern Massachusetts. While coldwater segments have been mapped based on fish surveys, the data are not comprehensive and in some cases appear to reflect habitat that either no longer exists or was a stocked fishery rather than native habitat. A more complete assessment of current coldwater habitat and historic habitat (or current habitat potential) could help direct

protection and restoration efforts of these fragile ecosystems. Coldwater habitat potential should particularly be assessed in segments upstream and downstream of known coldwater locations. This could help determine if isolated pockets were actually once longer reaches but have been affected by things like stormwater and dams. Coldwater habitat potential may follow a geologic pattern. For example, the southern divide of the Taunton watershed is a glacial moraine. The upper portions of moraines are commonly loose glacial till that infiltrates most of the precipitation that occurs there. Typically the water will move through the ground and exit as coldwater springs lower down on the moraine. Following a pattern such as this along with current locations of coldwater patches could help determine coldwater habitat potential. Water temperatures on a sunny day in July were in the high 70s in Town Brook and even warmer downstream. That is too warm for coldwater habitat on the mainstem. We briefly investigated some mapped coldwater pockets:

- Puddingshear Brook at Pleasant Street
 - Small brook with brown sediment and large gravel to small cobble bed.
 - Water temperature is 71.2 °F while the air temperature is 83 °F
 - Appears to be wetland just upstream open to the sun
 - May be marginal coldwater
- Poquoy Trout Brook at Rt. 44
 - Stream is incised and murky with high sediment load
 - Supposed coldwater stream coming in here appears to be dry
- Unnamed coldwater stream near Pratt Farm at Rt. 105
 - Water temperature is 68.7 °F on warm sunny summer day
 - Bed is red – oxidized iron deposit
 - Appears to be coldwater brook

Local Habitat Degradation

The Taunton River is a very low-gradient watershed marked by extensive wetlands. The only significant gradients occur along the edge of the watershed, such as at the southern edge of the watershed where there is a glacial moraine. This results in a system with less natural flood power and therefore, the primary impacts on instream habitat loss due to bank erosion or channel incision are a result of human activities, such as increased stormwater and land clearing.

Incision and Channel Evolution

The upper portion of the mainstem Taunton River appears to be incised, such that flood flows go over the banks less frequently. This allows upland species to overtake near-bank areas, limiting riparian habitat and increasing erosive flood power by concentrating it within the stream channel (see Figure 8). Smaller tributaries that enter the river in this area appear to be perched, indicating that the incision has occurred at least in the last several decades. On the other hand, the middle portion of the river near the USGS stream gauge does not appear to be incised (Figure 9). This pattern represents a common sequence resulting from increased flow power due to land clearing and concentrated stormwater flows. Typically such rivers will have an incisional upper portion, a depositional lower portion, and a transitional middle portion. Both gauge information and the relative slope of the river bed can help identify where these portions occur.



Figure 8. Incised portion of mainstem Taunton near Cherry Street Bridge

Figure 10 includes a flood frequency analysis, lowflow information, and preliminary bankfull estimates computed from USGS gauge data. ‘Bankfull’ refers to the surface where water first spills out onto the floodplain in more natural river reaches. Identifying bankfull on a degraded reach can show the degree of incision or deposition. For example, on an incised reach, bankfull will occur below the top of the banks. Bankfull typically occurs at the level of frequent floods between approximately the 1.2- to 2-year floods.



Figure 9. Taunton River at USGS gauge

USGS 01108000 TAUNTON RIVER NEAR BRIDGEWATER, MA

drainage area 261 sq. mi.

Bankfull estimates

	low	high	mean
bankfull discharge (cfs)	1717	2411	2064
bankfull stage (ft)	7.2	9.3	8.3
bankfull width (ft)	84.0	85.0	84.5
bankfull mean depth (ft)	4.4	6.3	5.4
bankfull W/D	13.3	19.3	16.3
bankfull velocity (ft/sec)	4.7	4.9	4.8
bankfull x-section area (sq.ft.)	370.0	540.0	455.0

Flood Frequency Analysis

Recurrence Interval Discharge (cfs)

100-yr	4607
50-yr	4327
25-yr	4016
10-yr	3547
5-yr	3129
2-yr	2411
1.5-yr	2079
1.2-yr	1717
median mean daily flow - July 22	96

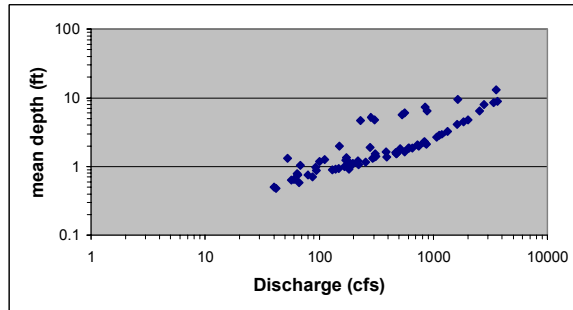
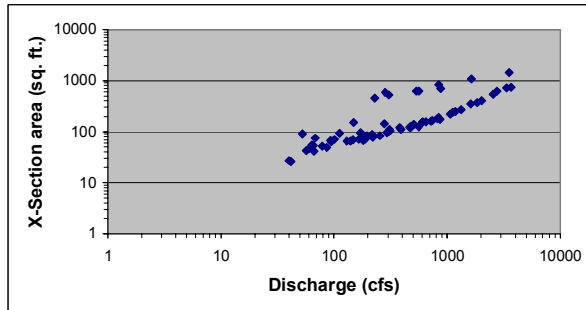
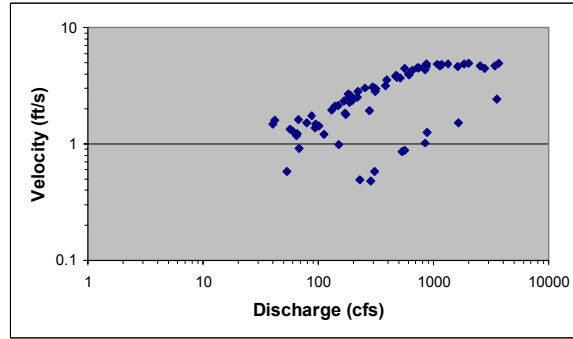
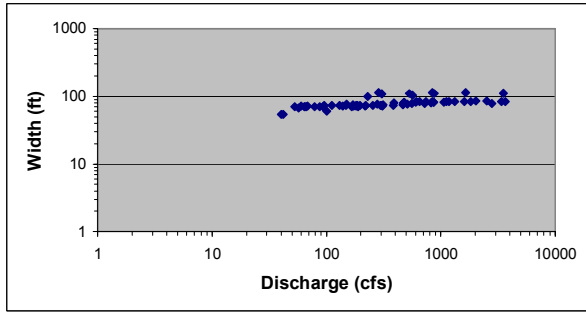
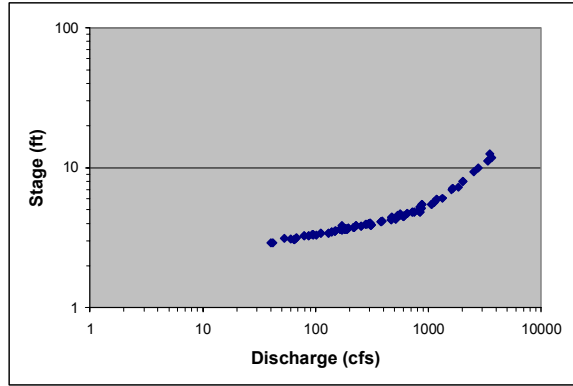


Figure 10. Preliminary bankfull estimates at the USGS Taunton River gauge

Bank Erosion

A recent Stream Team Shoreline Survey identified excessive bank erosion in the Matfield River upstream of Bridge Street. An air photo, shown below, provides some clear evidence about the cause of the erosion (Figure 11). Note the highly sinuous meandering pattern of the river in the upper left portion of the air photo. This highly sinuous pattern is naturally characteristic of low gradient broad floodplain rivers like this portion of the Matfield. However, the river continues through a much straighter reach as it approaches Bridge Street, which crosses the river in the bottom right portion of the air photo. This portion of the river was straightened at some time in the past, possibly to help drain water from agricultural fields or simply to move the river out of the way for farming. Channel straightening typically results in long-term erosion, as the same amount of water now flows over a shorter distance with less form resistance and therefore carries more erosive power than the same water winding through the meandering stretches. The channel here on the Matfield is gradually eroding to reform its meandering pattern. The river is preferentially eroding local outside bends and depositing on the inside of bends. This process contributes additional sediment to the river and will continue potentially for many years. Additional measurements would be necessary to estimate the quantity of sediment that is ending up in the river and thereby determine whether this erosion is significant on a watershed scale. Based on visual assessment, the Matfield does appear to carry greater suspended sediment than other tributaries, but this may result more from Brockton runoff.



Figure 11. Air photo showing meandering and straightened portions of the Matfield River



Figure 12. A portion of the Matfield River showing bank erosion at the downstream end of the straightened reach. Note particularly under the trees in the background.