



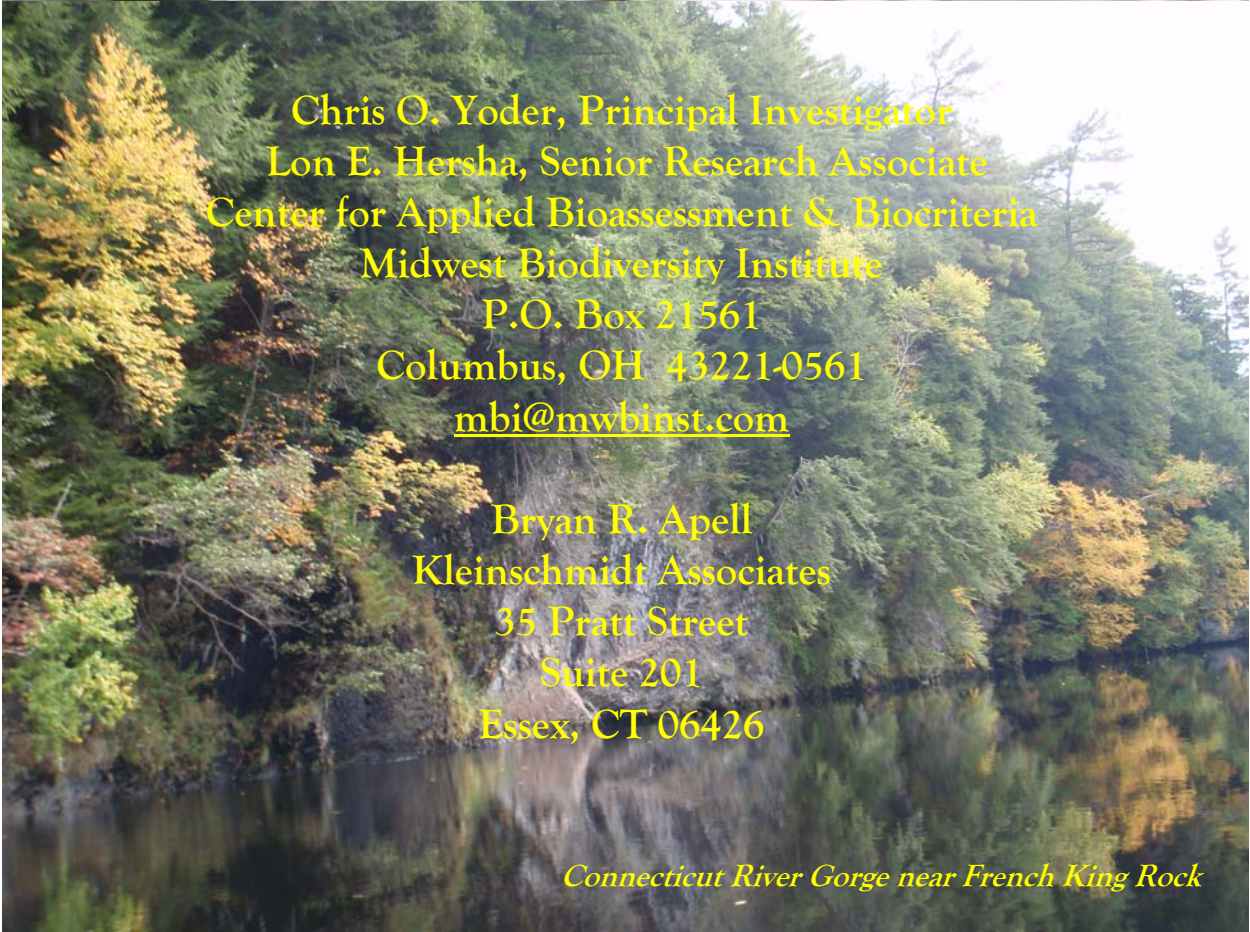
Fish Assemblage and Habitat Assessment of the Upper Connecticut River:

A Preliminary Report and Presentation of Data

MBI Technical Report MBI/2009-8-3

August 31, 2009

Bedell Bridge State Park



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Connecticut River Gorge near French King Rock

Fish Assemblage and Habitat Assessment of the Upper Connecticut River: Preliminary Results and Data Presentation

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EPA Contract Number EP-C-06-033
Work Assignment 2-14

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INTRODUCTION

The Midwest Biodiversity Institute received funding from U.S. EPA via a subcontract with the Great Lakes Environmental Center (GLEC) in 2008 to conduct an assessment of the fish assemblage of the mainstem Connecticut River between Lake Francis and the freshwater extent of the tidal estuary. This project is intended in part to extend to other New England Rivers and is based on the assessment of the fish assemblages in the large rivers of Maine that has been underway since 2002. Two project reports completed in 2006 (Yoder et al. 2006a,b) describe the methods and logistics of that project, and these were applied on the Connecticut River in 2008. A third Maine report (Yoder et al. 2008) completed in 2008 describes the development of an interim Index of Biotic Integrity (IBI) applicable to the larger freshwater rivers of Maine. That index is applied herein along with another IBI developed for the Atlantic slope (Daniels et al. 2005) to provide an initial assessment of the upper Connecticut River mainstem fish assemblages. The overall goal of this project is to assess the current status of the fish assemblages and as it is related to both historical and contemporary biological, chemical, and physical characteristics and stressors.

New England Rivers Fish Assemblage Assessments

A long term objective of the various New England large rivers fish assemblage studies that have been supported by U.S. EPA, Region I over the past 7 years is the development of a fish assemblage assessment tool that can be used to systematically assess the status of large rivers. Large rivers are also referred to as “non-wadeable” since effective sampling requires a boat or raft mounted method. Hence the sphere of this and its related projects deal with rivers that are too large to *effectively* sample with wading methods and hence require a floating platform such as a boat or a raft. Attempting to define parameters around which such decisions can be made is an important goal of an allied Regional EMAP project (MBI 2008a).

When developed such a tool can be used to assess multiple resource management objectives (Figure 1) including the existing status and quality of individual rivers and the effectiveness of management efforts aimed at restoring native fish assemblages including diadromous species. An ongoing purpose of the New England large rivers projects is the development and testing of the U.S. EPA Biological Condition Gradient (BCG), which is a product of the U.S. EPA Tiered Aquatic Life Uses working group (U.S. EPA 2005). The testing of biological assessment methods

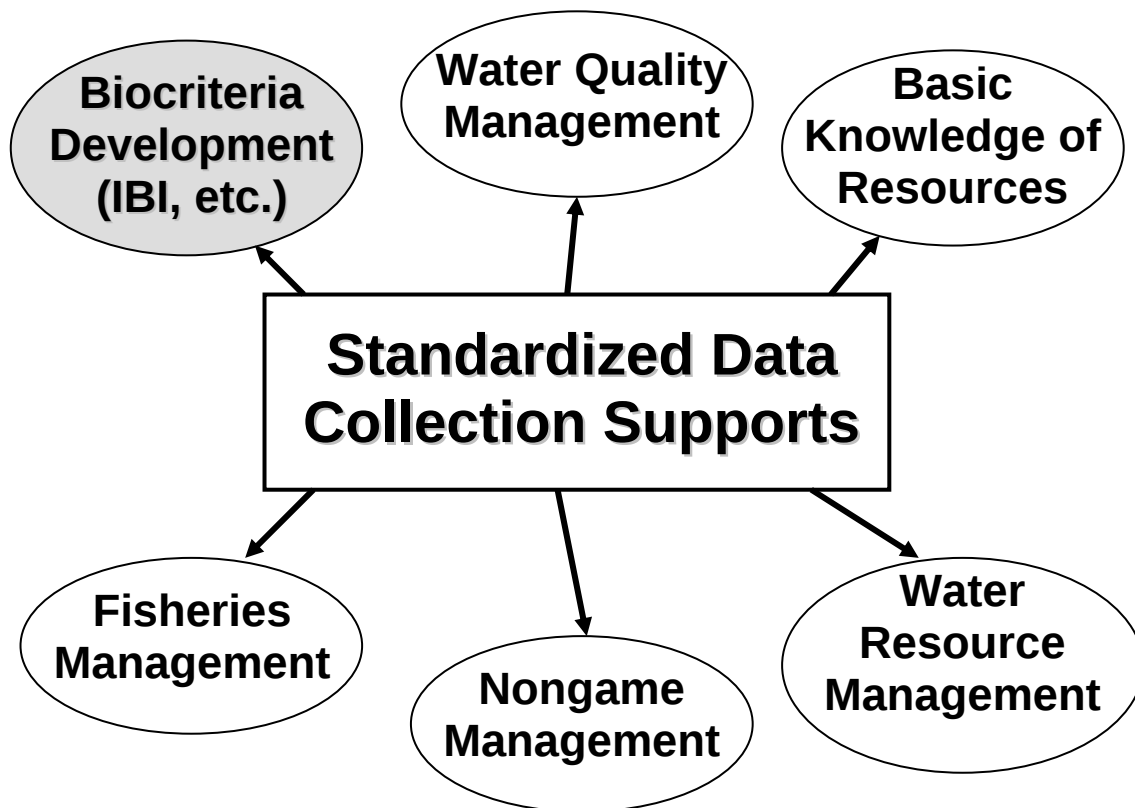


Figure 1. Multiple and integrated uses of the data and information produced by systematic biological assessment.

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biological criteria for large rivers is also a principal objective of the EPA National Biocriteria Program and this project is at least indirectly tied to that effort.

In addition to the biocriteria related objectives of this study, the baseline information provided about the distribution and abundance of fish species supports important resource management objectives including;

1. restoration and management of diadromous species;
2. management of hydroelectric generating facilities and river flows;
3. fisheries management issues; and,
4. documentation and management of introduced species.

Upper Connecticut River Fish Assemblage Assessment

This study contributes to the basic understanding of the distribution and abundance of freshwater and diadromous fishes in the Upper Connecticut River. While the initial goal was to assess the entire mainstem, Endangered Species Act (ESA) concerns with shortnose sturgeon downstream from Turners Falls delayed sampling of the lower river until 2009. We are not aware of any similarly focused studies that have been done at least in the recent past hence comparatively little is known about the relative abundance, distribution, and composition of the fish assemblage beyond species of historical and contemporary management interest. Of particular interest is the documentation of introduced species that occur in the same habitats required by fish species that are the focus of high profile management and restoration interests. The interim Maine Rivers IBI was developed in an attempt to highlight and potentially address those very issues. It is used here as one of the key analytical methodologies to assess the present condition of the resident fish assemblages and reveal how it relates to historical and contemporary stressors and prospects for future restoration.

Background and Management Issues

The Connecticut River has been the subject of recent interest and concern in terms of overall quality and restoration of a once thriving diadromous fish assemblage. Dams and flow management for the production of hydroelectric power have significantly altered these populations. As such diadromous species are the focus of the most intensive management efforts directed at the upper mainstem. In addition, the introduction of non-native species comprised of both inter- and intra-continental origin have been commonplace with several of these species becoming naturalized.

We are not aware of any previous efforts to characterize the fish assemblage as a whole and with a study design that includes the systematic collection of fishes from multiple sites along the mainstem. As such, this may represent the first effort of this kind in the mainstem itself.

STUDY AREA DESCRIPTION

The study area for this project extends from just downstream from the Murphy Dam at Lake Francis to the Turners Falls impoundment just upstream from the Turners Falls dam. An attempt was made to locate sites upstream from Lake Francis, but these segments proved to be too shallow to effectively sample with the raft under normal summer-fall flows. Within the study area 41 discrete mainstem locations were sampled for fish, qualitative habitat, and limited water quality (temperature, dissolved oxygen, and conductivity) once each during August 24 –October 12, 2009 (Table 1).

Table 1. Location of electrofishing sites and major sources of potential impact in the Upper Connecticut River mainstem sampled August 25 -October 12, 2008 (EF = electrofishing site [CTR#]; Dam [with number]; NPDES - permitted discharge). Letters and numbers in brackets are used on the figures.

River Mile	Site Type	Location - Description	Habitat Type	Site Code
325.6	Dam	Murphy Dam - Lake Francis [19]		-
323.6	EF	Dst. Murphy Dam		CTR4
322.0	EF	Ust. Lower (Canaan) Dam		CTR5
316.4	Dam	Lower (Canaan) Dam [17]		-
313.7	EF	Dst Lower (Canaan) Dam & Canaan WWTP		CTR6
	NPDES	Canaan WWTP (VT0100625)		-
307.1	EF	Near Colebrook, NH		CTR7
291.0	EF	Near N. Stratford, VT - Nulhegan R. confluence		CTR8
	Tributary	Upper Ammonoosuc R.		-
267.8	EF	Dst. Groveton (Wyoming) Dam		CTR9
	NPDES	Lancaster WWTP (NH0100145)		-
257.9	EF	Dst. Lancaster WWTP		CTR10
247.3	Dam	Gillman Project Dam [15]		-
247.0	EF	Dst. Gillman Project Dam		CTR11
243.8	EF	Moore Reservoir (upper end)		CTR12
236.0	Dam	Moore Reservoir Dam [14]		-
235.9	EF	Dst. Moore Reservoir		CTR13
228.7	Dam	Comerford Station Dam [13]		-
228.5	EF	Dst. Comerford Station Dam		CTR14
	Tributary	Passumpsic River		-
	NPDES	Stratford WWTP (NHG580536)		-
227.1	EF	Dst. Passumpsic River		CTR15
221.7	Dam	McIndoe Station Dam [12]		-
	NPDES	Dalton Hydro LLC (VT0000116)		-
221.7	EF	Dst. McIndoe Station Dam		CTR16
217.7	Dam	Ryegate Dam [11]		-
217.6	EF	Dst. Ryegate (Dodge Falls) Dam		CTR17
	Tributary	Ammonoosuc River		
213.1	EF	Dst. Ammonoosuc R. confluence		CTR18
200.7	EF	Near Bedell Bridge State Park (NH)		CTR19
	NPDES	Bradford WWTP (VT0100803)		-
194.4	EF	Dst. Bradford WWTP		CTR20
179.2	EF	Near E. Thetford, VT		CTR21

Table 1. (continued)

River Mile	Site Type	Location - Description	Habitat Type	Site Code
170.9	EF	Ust. Hanover, NH		CTR22
	NPDES	Hanover WWTP (NHG580099)		-
166.3	EF	Dst. Hanover WWTP		CTR23
165.6	EF	Wilder Dam impoundment		CTR24
164.0	Dam	Wilder Dam [10]		-
163.9	EF	Dst. Wilder Dam		CTR25
	Tributary	White River		-
	NPDES	Lebanon WWTP (NH0100366)		-
	NPDES	Hartford WWTP (VT0101010)		-
161.5	EF	Dst. White R.; Hartford & New Leb. WWTPs		CTR26
155.6	EF	Near N. Hartland, VT		CTR27
	NPDES	Windsor WWTP (VT0100919)		CTR27A
148.5	EF	Dst. Windsor WWTP		CTR28
	NPDES	Claremont WWTP (NH0101257) - via trib.		-
144.4	EF	Dst. Claremont WWTP tributary		CTR29
139.5	EF	Ust. Black R. confluence (ust. Charlestown)		CTR30
	NPDES	Charlestown WWTP (NH0100765)		-
137.4	EF	Ust. Weathersfield		CTR31
133.2	EF	Dst. Glidden Island		CTR31A
131.4	EF	Ust. Black River		CTR31B
125.6	EF	Dst. Charlestown WWTP		CTR32A
121.9	EF	Bellows Falls impoundment		CTR32
120.7	Dam	Bellows Falls Dam [9]		-
116.2	EF	Dst. Bellows Falls Dam		CTR33
	NPDES	Bellows Falls WWTP (VT0100013)		-
114.7	EF	Dst. Bellows Falls WWTP		CTR34
105.7	EF	Near Westminster, VT		CTR35
102.3	EF	Dst. Putney, VT (2 NPDES)		CTR36
97.6	EF	Ust. West River confluence & Brattleboro, VT		CTR37
	Tributary	West River		-
	NPDES	Brattleboro WWTP (VT0100064)		-
92.5	EF	Dst. Brattleboro WWTP		CTR38
90.1	EF	Vernon Dam impoundment		CTR39
89.0	EF	Ust. Entergy VT Yankee mixing zone		CTR39A
88.5	Dam	Vernon Dam [7]		-
88.4	EF	Dst. Vernon Dam; ust. Entergy VT Yankee		CTR40
	NPDES	Entergy Vermont Yankee (VT0000264)		-

Table 1. (continued)

River Mile	Site Type	Location - Description	Habitat Type	Site Code
83.3	EF	Ust. Northfield, MA		CTR42
	NPDES	Northfield WWTP (MA0100200)		-
79.2	EF	Ust. St. Rt. 10		CTR 43
	NPDES	Erving WWTP (MA0101516)		-
72.2	EF	Dst. Erving WWTP; ust. Turners Falls		CTR44
68.8	EF	Turners Falls Dam impoundment		CTR45
67.9	Dam	Turners Falls Dam [6]		-

METHODS

General Scope and Design

This study consisted of ascertaining the relative abundance, composition, distribution, and general health of the fish assemblage in the Upper Connecticut River mainstem between the Murphy Dam at Lake Francis and the Turners Falls impoundment. The methodology followed that developed by the Maine Rivers fish assemblage assessment that was initiated in 2002 (MBI 2002; Yoder et al. 2006a) and is presently being extended to other New England rivers by this and allied projects. This methodology specifies sampling within a summer-early fall seasonal index period of July 1 – September 30 particularly when the interim fish Index of Biotic Integrity (IBI; Yoder et al. 2008) and associated data is used to assess the quality of the fish assemblage. As such the sampling was conducted between August 24 and October 12, 2009, being extended beyond September 30 only as weather and flows permitted. While sampling would have taken place in July and early August, it was delayed in 2008 to avoid the persistent and record high river flows that occurred during the early portion of the index period.

Equipment Specifications

Boat electrofishing was the method of choice based on its successful application as a single gear method to selected large rivers in Maine by Kleinschmidt in 2000-1 and by MBI and Kleinschmidt in 2002-7 (MBI 2002; Yoder et al. 2006 a,b). Rivers that offer sufficient width and depth are sampled using a 16' john boat rigged for daytime and nighttime electrofishing. Electric current generated by a Smith-Root 5.0 GPP generator/pulsator combination is transmitted by anodes and cathodes located in front of the bow. Anodes (+ electrode) consisted of gangs of 3/16" stainless steel woven cable; a gang consisted of 4-6 separate strands bundled together. Cathodes (- electrode) consisted of four ¾" diameter flexible stainless steel conduit cut to lengths of 6-8' (or longer for deep rivers) and suspended directly from the bow. A positive pressure foot pedal switch is located on the bow platform and operated by a primary netter. Two netters were located on the bow platform. Emergency cutoff switches are located within easy reach of the boat driver on the rear seat and on the 5.0 GPP pulsator unit. Lights are affixed the safety railing to enable night

sampling. The 16' electrofishing boat is propelled by a 15 and 25 h.p. outboards mounted on the transom.

A 14' heavy duty inflatable raft with an outboard transom was used at sites where width and/or depth precluded the effective and safe use of the 16' john boat. Electric current is generated by a Smith-Root 2.5 GPP generator/pulsator combination and transmitted by similarly arrayed anodes and cathodes. The electrode configuration is similar to the 16' boat, except that the 6 cathodes of 6-8' in length were suspended from the sides of the raft, 3 from each side. The anode gangs were hung from a retractable (telescoping) aluminum boom that was secured to the raft with locking ratchet straps. A single netter was positioned on a bow seat. Battery powered 12 volt lights were mounted on the aluminum frame to support nighttime sampling, although all riverine sites in 2006 were sampled during daytime. The 14' raft is propelled by a 15 h.p. short shaft outboard with multiple tilt settings. The latter feature was essential for maneuvering the raft in swift flowing, shallow, and boulder laden habitats. Electrofishing unit settings were typically governed by relative conductivity. At low conductivity sites ($15\text{-}40\ \mu\text{S}/\text{m}^2$) the GPP unit settings selected were the high voltage range (500-1000 v) at 120 Hz and 100% of the voltage range to produce 2-4 A. At sites with higher relative conductivity ($>40\text{-}100\ \mu\text{S}/\text{m}^2$) the same settings at 80-100% of the voltage range produced 5-10A (4-8 A for the 2.5 GPP unit). For the 5.0 GPP unit, higher relative conductivity in excess of $200\ \mu\text{S}/\text{m}^2$ necessitated switching to the low voltage range (maximum = 500 v) at 50-80% of the voltage range to produce 12-18A. The latter situations were rare and occurred only at the tidal influenced site. The selection of the 120 Hz pulse frequency was accomplished by trial and error testing in 2001 and initially during the 2002-3 surveys (Yoder et al. 2006a). This was determined to be the most effective pulse setting based on visual observations of the comparative effectiveness in stunning all fish species. Lower settings (30, 60 Hz) were much less effective and are deemed unsuitable for New England rivers. Care is taken to avoid injury and all processed fish were examined for visible signs of injury and damage.

Field Data Recording

Detailed field data recording and sample processing procedures are described in the Connecticut River project QAPP (MBI 2008b). Captured fish are immediately placed in an aerated live well for processing. If necessary, fish are anesthetized to minimize trauma and handling stress. Trout and salmon are placed in separate aerated containers and processed first to minimize their holding time. Individual fish are identified to species, weighed to the nearest gram, and examined for external anomalies. Species that occur in large numbers are subsampled with a minimum of 15 individuals for large adults and 50 for smaller species and 1+ or 0+ life stages. Most species are distinguished as adults, 1+ (juveniles), or 0+ (young-of-year) in accordance with the criteria in Table 2 (Yoder et al. 2006a). The principal purposes of this differentiation were to increase the accuracy of extrapolations based on subsampling and for potential IBI guild classification. Species of recreational and/or commercial interest are also measured for total length to the nearest mm.

Table 2. Criteria (weight, length, or other) used to determine adult (A), 1+ (juvenile; B), and 0+ (young-of-year; Y) designations for Connecticut river fish species for the primary purpose of assuring the accuracy of extrapolated total biomass based on subsamples and for IBI guild classification. Not all species are differentiated.

Species	Adult	1+ ¹	0+
Sea lamprey (<i>Petromyzon marinus</i>)	fully developed ²	²	ammocoete
American eel (<i>Anguilla rostrata</i>)	>500 g		<10 g
Blueback herring (<i>Alosa aestivalis</i>)	>100 g		<10 g
Alewife (<i>Alosa pseudoharengus</i>)	>100 g		<10 g
American shad (<i>Alosa sapidissima</i>)	>100 g		<10 g
Lake chub (<i>Couesius plumbeus</i>)	>10 g		<1 g
Common carp (<i>Cyprinus carpio</i>)	>1000 g		<50 g
Common shiner (<i>Luxilus cornutus</i>)	>10 g		<1 g
Golden shiner (<i>Notemigonus crysoleucas</i>)	>100 g		<10 g
Spottail shiner (<i>Notropis hudsonius</i>)	>10 g		<1 g
Eastern blacknose dace (<i>Rhinichthys atratulus</i>)		not determined	
Longnose dace (<i>Rhinichthys cataractae</i>)		not determined	
Creek chub (<i>Semotilus atromaculatus</i>)		not determined	
Fallfish (<i>Semotilus corporalis</i>)	>50 g		<3 g
Longnose sucker (<i>Catostomus catostomus</i>)	>1000 g		<10 g
White sucker (<i>Catostomus commersonii</i>)	>1000 g		<10 g
White catfish (<i>Ameiurus catus</i>)	>100 g		<10 g
Brown bullhead (<i>Ameiurus nebulosus</i>)	>100 g		<10 g
Northern pike (<i>Esox lucius</i>)	>500 g		<10 g
Chain pickerel (<i>Esox niger</i>)	>80 g		<10 g
Rainbow trout (<i>Oncorhynchus mykiss</i>)	>100 g		<10 g
Atlantic salmon (<i>Salmo salar</i>)	>500 mm		<10 g
Landlocked salmon (<i>Salmo salar sebago</i>)	>100 g		<10 g
Brown trout (<i>Salmo trutta</i>)	>100 g		<10 g
Brook trout (<i>Salvelinus fontinalis</i>)	>100 g		<10 g
Burbot (<i>Lota lota</i>)	>100 g		<10 g
Banded killifish (<i>Fundulus diaphanus</i>)		not determined	
Mummichog (<i>Fundulus heteroclitus</i>)		not determined	
Slimy sculpin (<i>Cottus cognatus</i>)	>20 g		<2 g
White perch (<i>Morone americana</i>)	>100		<10 g
Striped bass (<i>Morone saxatilis</i>)	>500 mm		<50 g
Rock bass (<i>Ambloplites rupestris</i>)	>80 g		<10 g

¹ Juvenile criteria are <adult, >y-o-y.

² Parasitic habitats fully developed in adults; buccal funnel is fully developed in juveniles, but is not yet parasitic.

Table 2. (continued)

Species	Adult	1+	0+
Redbreast sunfish (<i>Lepomis auritus</i>)	>50 g		<5 g
Pumpkinseed sunfish (<i>Lepomis gibbosus</i>)	>50 g		<5 g
Smallmouth bass (<i>Micropterus dolomieu</i>)	>150 mm		<10 g
Largemouth bass (<i>Micropterus salmoides</i>)	>150 mm		<10 g
Black crappie (<i>Pomoxis nigromaculatus</i>)	>100 g		<10 g
Yellow perch (<i>Perca flavescens</i>)	>50 g		<5 g

The majority of captured fish are identified to species in the field; however, any uncertainty about the field identification of individual fish requires the retention of voucher specimens for laboratory identification. Fish were preserved in a solution of borax buffered 10% formalin and labeled by date, river, and site designation. Identification is made to the species level in all cases and follows the nomenclature of the American Fisheries Society (Nelson et al. 2004). Immature and post-larval fish less than 15-20 mm in length were generally not included in the sample.

All fish that are weighed, whether done individually, in the aggregate, or as subsamples, were examined for the presence of gross external anomalies. An external anomaly is defined as the presence of a visible skin, extremity (fin, barbell, operculum), skeletal, or subcutaneous disfigurement, and is expressed as the weighted percentage of affected fish among all fish weighed. Light and heavy infestations are noted for certain types of anomalies and follow the guidance in Ohio EPA (1989) and Sanders et al. (1999).

Physical measurements are also taken in the field during fish sampling and include the sample site distance, GPS coordinates, temperature (°C), dissolved oxygen (D.O.; mg/l), relative conductivity ($\mu\text{S}/\text{cm}^2$), and the Qualitative Habitat Evaluation Index (QHEI; Rankin 1989, 1995; Ohio EPA 2006) modified for application to Maine rivers (Yoder et al. 2006 a,b).

Site distance was determined with a GPS unit. This was done by tracking the cumulative lineal distance as the sampling progressed in the prescribed downstream direction. Waypoints were established as necessary to account for the curvature of the shoreline and/or the sampling track that was followed within each site. Each river was designated with a unique alpha code (e.g., Connecticut River = "CTR") and each site with a unique numeric descriptor (e.g., "CTR4"). The upstream end, or beginning of each site was designated "A" and subsequent waypoints were designated B, C, D, and so on. The downstream terminus of each zone was designated with a "Z".

Crew Composition and Logistics

A boat electrofishing crew consists of three persons - two netters and a boat driver. The netter's primary responsibility is to capture all fish sighted; the driver's responsibility is to maneuver the boat

so as to provide the netters the best opportunities to capture and land stunned fish (the driver may assist in netting stunned fish that appear near the stern or behind the boat). The boat driver also operates the electrofishing unit. Each task requires skill and training, but boat maneuvering requires the most experience to gain adequate proficiency and ensure safe operation. The latter skill was particularly important in the faster flowing sections of the study area. In actual practice, the boat driver also functions as the crew leader that supervises all aspects of the data collection.

The netters are usually seasonal technicians with the physical ability to perform all crew member tasks. The netters are clad in chest waders and wear life jackets and rubber gloves; the driver is also clad in chest waders. Sampling sites are positioned at selected intervals along a contiguous river reach and sampling takes place along the shoreline(s) offering the most diverse macrohabitat features. In other areas of the U.S. this usually includes the gradual outside bends of large rivers (Gammon 1973, 1976), but this is not invariable. Maine's rivers presented many similarities and a few dissimilarities, the latter being manifest in faster current velocities including swift chutes, runs, and rapids and cover types (e.g., large boulders, log cribs, deep runs, bedrock ledges) away from the shoreline that required some adaptations of the existing methods.

A typical sampling day consists of launching the boat at an upstream access point, shuttling the truck and trailer to a downstream retrieval point, and returning to sample sites between the launch and retrieval points by navigating in a downstream direction. Normally, three 1.0 km sites can be sampled each day within river reaches of less than 10 to more than 15 miles in length. If continuous navigation of a river segment was limited or precluded by falls, dams, or other safety concerns, the boat was launched and retrieved from a single access site in proximity to the sampling site. In the Presumpscot River access was precluded mostly by navigational safety concerns, particularly in some of the smaller impoundments. Site location was seldom precluded by a lack of launch or retrieval access, although many locations required what is termed as "rough launching". A four wheel drive truck with the capacity to transport a three-person crew and the electrofishing boat is essential to this type of sampling. Sufficient traction and pulling power is needed to access remote or unimproved access sites.

Habitat Assessment

A qualitative evaluation of macrohabitat is made by the fish field crew leader after each location is sampled using the Qualitative Habitat Evaluation Index (QHEI; Rankin 1989, 1995; Ohio EPA 2006). The QHEI is a physical habitat index designed to provide an empirical, qualitative evaluation of the lotic macrohabitat characteristics that are important to fish assemblages. It consists of a visual estimate of the quality, composition, amount, and extent of substrate, cover, channel, riparian, flow, pool/run/riffle, and gradient variables. It has been shown to correspond predictably with key attributes of fish assemblage quality (Rankin 1989, 1995) and as such is an important tool in the diagnosis of habitat related fish assemblage impairments. The QHEI was originally developed as a rapid assessment tool and in recognition of the constraints associated with the practicalities of conducting a large-scale monitoring program, i.e., the need for a rapid assessment tool that yields meaningful information and which takes advantage of the knowledge and insights of experienced field biologists who conduct the biological assessment. The QHEI has been used widely outside of Ohio and parallel habitat evaluation techniques are in widespread

existence throughout the U.S. The QHEI incorporates the types and quality substrate, the types and amounts of instream cover, several characteristics of channel morphology, riparian zone extent and quality, bank stability and condition, and pool-run-riffle quality and characteristics. Slope or gradient is also factored into the QHEI score. We followed the guidance and scoring procedures outlined in Ohio EPA (1989, 2006) and Rankin (1989) with some modifications made during 2002 and 2003 (Yoder et al. 2006a). These modifications include the addition of large boulder and granitic origin to the substrate metric and impoundment to the channel morphology and pool/run/riffle metrics. This data is entered, stored, and analyzed in the Maine ECOS data management system used by MBI.

Elevated flow conditions can adversely affect electrofishing efficiency, particularly if they result in abnormally turbid conditions. High flows can also temporarily affect fish distribution by displacing them away from their typical habitats. Our protocol requires that sampling be conducted under “normal, summer-fall low flow conditions.” Knowing what this is requires local knowledge and a familiarity with flow gage readings and conditions. Generally, these conditions coincide with low flow durations of approximately 80% or greater, i.e., flows that are exceeded 80% of the time for the period of record. These statistics are available for New England rivers from the U.S. Geological Survey at: <http://waterdata.usgs.gov/>. The key is to avoid sampling during conditions that deter and reduce sampling efficiency. In such cases sampling should be delayed until flow and water conditions return to “normal” conditions.

Sampling and Survey Design

Mainstem rivers are treated as linear assessment units in order to understand how changes take place along a longitudinal continuum with respect to both natural and anthropogenic influences. Important in the delineation of these assessment units are natural features and transitional boundaries (e.g., thermal, ecological, and geological boundaries) and clusters of anthropogenic sources (e.g., major urban/industrial areas, impoundments, discharges, etc.). Study areas can include up to 150-200 km long river reaches in order to capture all relevant influences, include zones of impact and recovery thus exposing pollution gradients, and to provide context for interpreting results within a localized reach or at a given location. This design yields a detailed assessment of status, the extent and severity of indicator responses in a particular series of river reaches, and temporal changes both within season and between years. This produces assessments of the severity (departure from the desired state) and extent (lineal extent of the departures) of biological impairments in a river (Yoder et al. 2005).

We followed a combination of the preceding designs, which are similar in many respects in that the goal of each is to produce a dataset capable of providing information for multiple environmental and natural resource management purposes (Figure 1). We targeted the largest volume point sources directly and bracketed major aggregations of point sources, urban areas, and changes in habitat of both natural and man-made origin. This is done irrespective of actual site quality, but includes the range of conditions from minimally impacted background (usually upstream) through the gradient of impacts and conditions that reflect the severity of impacts in a particular study area. In the Upper Connecticut River mainstem this resulted in sampling sites

that generally occurred within 4-5 miles of each other. As such, we sampled 41 mainstem sites (1.0 km each) in 260 miles of the Upper Connecticut River study area in 2008.

Data Management and Analysis

Data were analyzed using routines available in the Maine ECOS data management system that was adapted for use by MBI in the Maine Rivers project. Maine ECOS produces standardized data reports on fish species relative abundance and condition that includes assemblage attributes such as numbers, biomass, functional and tolerance guilds, condition metrics, and compositional expressions. Recently the interim Maine Rivers IBI was added along with the Modified Index of Well-Being (MIwb). These outputs can also be exported as Excel files. Relative abundance data is reported as numbers and biomass per kilometer.

Expected Fish Assemblages along the Biological Condition Gradient (BCG)

Developing an understanding of the native fish assemblages that historically occurred in Maine's non-wadeable rivers was a critical task for determining the current status of the fish assemblages and their potential for restoration. We used the Biological Condition Gradient (BCG) concept developed by U.S. EPA (2005; Figure 2) and as detailed by Davies and Jackson (2006) for this task. This process required us to characterize the "as naturally occurs" assemblage as the ultimate potential for quality and restoration. While restoring all rivers to such a condition may be impractical given the economically dependent activities and ingrained species introductions that have substantially altered the Maine fish fauna, it is important to at least qualitatively visualize this penultimate condition. It serves as an essential anchor for the "upper end" of the BCG. We accomplished this by visualizing the "as naturally occurs" fish fauna that was likely encountered by the first European settlers coupled with our knowledge of how such assemblages were most likely organized based on current knowledge of species autecology and distribution. The latter was partly derived from analyses of the statewide database (Yoder et al. 2006b, 2008).

This process permits the visualization about how the "as naturally occurs" fish fauna likely changes as the effect of large scale human disturbances such as land uses (forestry, agriculture, urbanization), water pollution (point source discharges, nonpoint source runoff), habitat modification (dams/impoundments, riparian encroachment, channel modification), hydrologic alterations (flow diversions, withdrawals), changes to energy processing (nutrient enrichment, climatic changes), and biotic changes (introductions of non-native species) increased in magnitude and scope through space and time. Each of these stressor categories illustrates the fundamental concept of Karr's five factors that determine the integrity of a water resource (Karr et al. 1986). Many of these impacts are well documented in Maine's rivers and the biological consequences as currently reported in terms of the macroinvertebrate assemblage (Davies et al. 1999), using Maine DEP's standardized methods and biological criteria (Davies and Tsomides 1997), key species of management interest (Warner 2005; Saunders et al. 2006), environmental tolerance and guilds (Halliwell et al. 1999), and native status (Halliwell 2005). The BCG is a conceptual model that describes how ecological attributes change in response to increasing levels of the *effect* of stressors (Davies and Jackson 2006; Figure 2). It is portrayed as a "gradient of condition" with descriptions about how key assemblage attributes and properties are expected to change with increasing stress

Tiered Aquatic Life Use Conceptual Model: Draft Biological Tiers

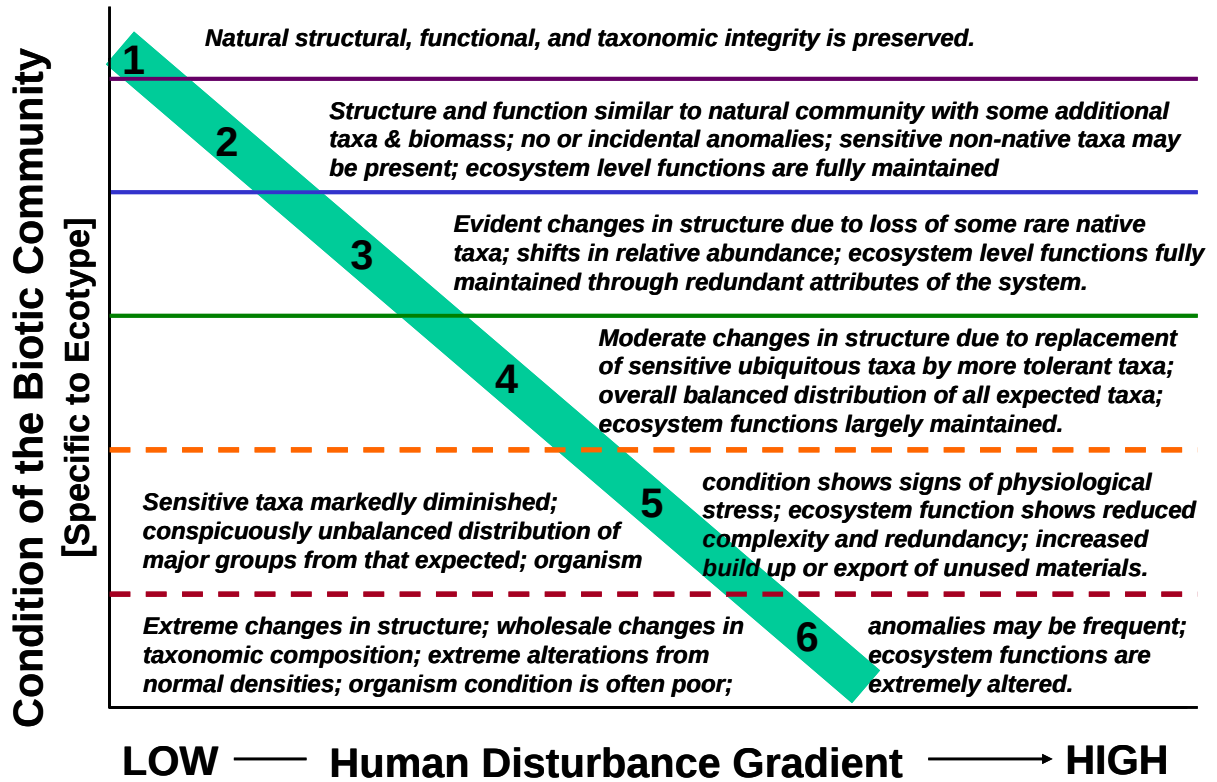


Figure 2. The Biological Condition Gradient (BCG) conceptual model and descriptive attributes of tiers along a gradient of quality and increasing disturbance (Davies and Jackson 2006).

in a succession of six tiers from “as naturally occurs” to “severely degraded”. Ten attributes that include characteristics of taxa representation, proportion, membership, condition, along with two functional categories are included for each of the six BCG tiers. This template can be used to develop a model for aquatic assemblages that are representative of a specific region or aquatic ecotype. This provides an organized starting point for assuring that specific quantitative measures (e.g., IBI) are conceptually sound and consistent with our best understanding of how aquatic ecosystems respond to stress. It also promotes the incremental measurement and characterization of biological assemblage data beyond comparatively simple and less detailed “pass/fail” thresholds.

It also enables the development of tiered expectations for specific water bodies. U.S. EPA (2005) described this as tiered aquatic life uses (TALU), a concept that is emulated by Maine DEP's codified and quantitative biological criteria for macroinvertebrates (Davies et al. 1997). In developing a BCG model for Maine's non-wadeable fish assemblages Yoder et al. (2006b, 2008) accessed general information about the riverine fish assemblages relying on historical information and expert judgment in the process. Some of this was accomplished via an ad hoc project advisory group comprised of U.S. EPA, U.S. F&WS, NOAA, the applicable Maine state agencies (DEP, IF&W, DMR), and other interested groups (Trout Unlimited, Penobscot Indian Nation). One important outcome of these discussions was the conclusion that the "as naturally occurs" fish

Tiered Aquatic Life Use Conceptual Model: Maine Rivers

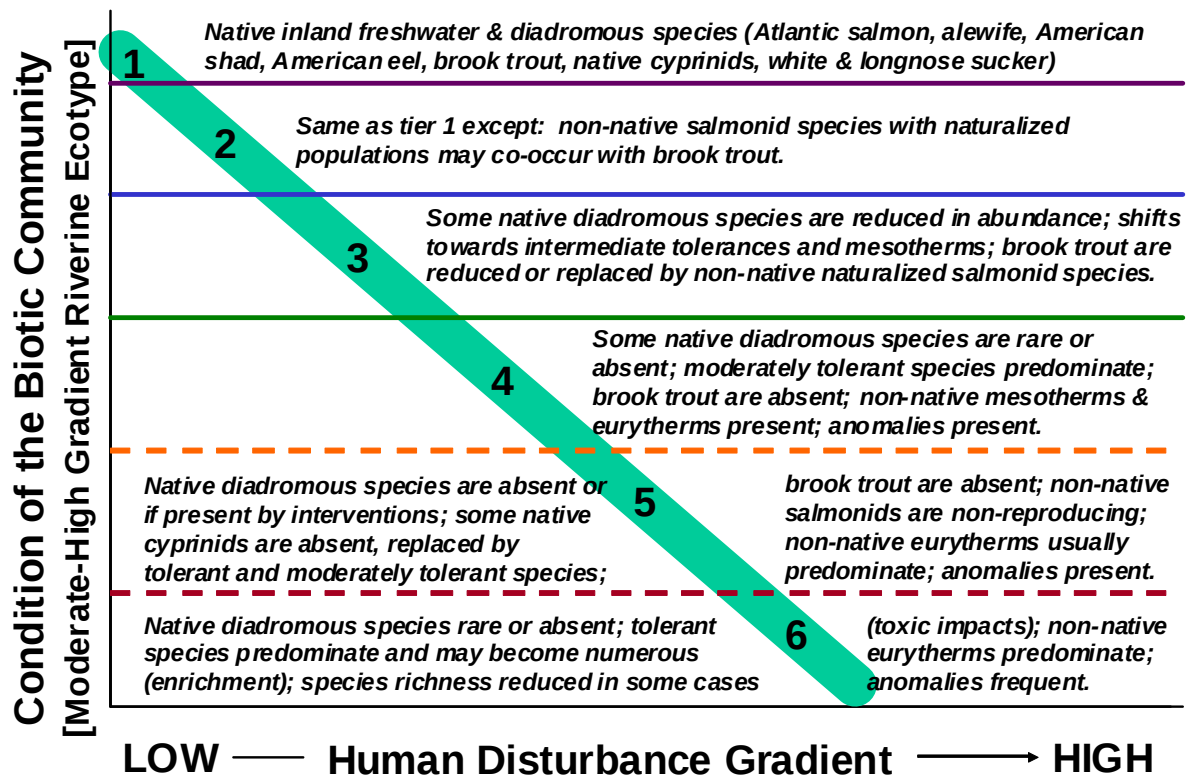


Figure 5. The Biological Condition Gradient (BCG) model for the moderate-high gradient riverine ecotype in Maine (Yoder et al. 2006b, 2008).

assemblage in the moderate-high gradient riverine ecotype was largely comprised of native cold water species. The comparatively simple BCG for Maine's non-wadeable moderate-high gradient rivers was the result (Figure 3; Yoder et al. 2006b, 2008). This reflects a comparatively simple, qualitative method of visualizing what has happened in many instances to the "as naturally occurs" fish assemblage for this riverine ecotype in Maine through time. The current departures from tier 1 attributes and characteristics are the result of multiple modifications to water quality, habitat, flow regime, and the native fauna via the introduction of alien species. This was initially used by Yoder et al. (2008) to generally vet the efficacy of the interim Maine Rivers IBI. We believe this is

a potential starting point for the Upper Connecticut River fish assemblage given their respective similarities, i.e., cold water, depauperate, and with a significant diadromous component.

Indices of Biotic Integrity (IBI)

We used the interim Maine Rivers IBI (Yoder et al. 2008) and the Atlantic Slope IBI (Daniels et al. 2005) to initially portray the results of the Upper Connecticut River fish assemblage results. The Maine IBI consists of 12 metrics that were selected based on the consideration of the metric responsiveness to a reference based gradient analysis and ecological role fulfillment and relevance (Yoder et al. 2008). The metrics and their resulting scoring equations and other necessary adjustments appear in Table 2. The Maine ECOS programming produces a report that includes the individual metrics values and scores and the aggregate interim IBI score by sampling location. The Atlantic Slope IBI (Table 3) consists of 12 metrics and it utilized the traditional 12-60 scoring range of Karr et al. (1986). We did not use any scoring criteria to distinguish relative quality, but the scale of both indices generally should correspond to the BCG scale and tiers of condition.

Modified Index of Well-Being (MIwb)

Gammon (1976) and Gammon et al. (1981) originally developed and tested the Index of Well-Being (Iwb) as a multiparameter evaluation of large river fish assemblages. The Iwb is based on four measures of diversity, abundance, and biomass and represents an attempt to produce an integrated evaluation of these baseline assemblage attributes. The individual performance of numbers, biomass, and the Shannon index as consistent indicators of the quality of fish communities has historically been disappointing. However, when combined in the Iwb these individual community attributes respond in a more complimentary and intuitively predictable manner. For example, an increase in total numbers and/or biomass caused by one or two predominant species is usually offset by a corresponding decline in the Shannon index. In addition, the log_e transformation of the numbers and biomass components acts to reduce much of the variability inherent to these parameters alone. Gammon (1976) found the variability of each of the four Iwb components as measured by a coefficient of variation to range from 20-50%, yet the composite variability reflected by the Iwb was only 7%. High numbers and/or biomass are commonly, and at times inaccurately, perceived as a positive attribute of a fish assemblage. High numbers and biomass result in a high Iwb score only if a relative “evenness” is maintained between the abundance of the common species. However, this is not invariable, especially with environmental perturbations which tend to restructure fish assemblages without corresponding decreases in diversity (e.g., nutrient enrichment, habitat modification). Fish assemblages in habitat modified rivers can frequently exhibit very high

A modification of the original Iwb was developed by Ohio EPA (1987) and further explained by Yoder and Smith (1999). The modified Iwb retains the same computational formula as the original Iwb, but eliminates species designated as highly tolerant, aliens, and hybrids from the numbers and biomass metrics; these species are retained in the Shannon index calculations. This modification eliminates the “undesired” effect caused by a high abundance of tolerant or alien species, but retains their “desired” influence in the Shannon indices. The computational formula used is as follows:

$$\text{Modified Index of Well-Being (MIwb)} = 0.5 \ln N + 0.5 \ln B + H(\text{no.}) + H(\text{wt.});$$

where:

N = CPUE; relative numbers minus species designated highly tolerant (Ohio EPA 1987);

B = CPUE; relative biomass minus species designated highly tolerant (Ohio EPA 1987);

H (no.) = Shannon diversity index based on numbers (version which uses $\log_e$);

H (wt.) = Shannon diversity index based on biomass (version which uses $\log_e$).

We used the MIwb to primarily assess the assemblage level properties of the 2008 results.

RESULTS

The 2008 sampling effort included standardized boat electrofishing at 46 discrete sampling locations for a cumulative effort of 44.74 km. Most sites were 1.0 km in length with the exception of two sites that were restricted by the configuration of the river channel and one discharge mixing zone site. A total of 7,262 individual fish comprised of 40 different species and 1 hybrid were included in the collections. Average relative abundance was 169 individuals/km and 8.41 kg/km.

Assemblage Composition

A general pattern in the composition of the fish assemblage existed between the “upper” and “lower” mainstem (Table 5). The “upper” mainstem (between Lake Francis and the Wilder impoundment) included mesothermic and stenothermic species being predominated numerically by yellow perch and white sucker in terms of biomass. Stenotherms included slimy sculpin, round whitefish, brown trout, rainbow trout, brook trout, and Atlantic salmon. The assemblage in the “lower” mainstem (Wilder Dam to the Turners Falls impoundment) included eurythermic species and was both numerically and in terms of biomass predominated by smallmouth bass. Stenothermic species were absent from this segment of the mainstem. Diadromous species were not a major part of the samples with the exception of American eel in the “lower” mainstem.

Assemblage Condition

Overall assemblage condition is expressed here by the interim Maine Rivers IBI (Yoder et al. 2008), the Atlantic slope IBI (Daniels et al. 2005), and the modified Index of Well-Being (MIwb; Gammon et al. 1981). While neither IBI is specifically derived nor calibrated for the Connecticut River there is some value in using each to initially portray the mainstem fish assemblages. The Atlantic slope IBI was developed for the neighboring Hudson and Delaware River basins and the authors felt it would be relevant in adjacent basins. The interim Maine IBI was developed for

Table 3. Interim Maine non-wadeable rivers IBI metrics with calibrated scoring equations and manual scoring adjustment criteria. Proportional (%) metrics are based on numbers unless indicated otherwise (after Yoder et al. 2008).

Metric	Scoring Equation	Scoring Adjustments	
		Score = 0	Score = 10
Native Species Richness	$10 * (-0.2462 + (0.0828 * \text{numspec}^2))$	<3 sp.	≥15 sp.
Native Cyprinid Species (excluding fallfish)	$(10 * (0.4457 + (0.0109 * \text{allcyp_ff}) - (0.00005629 * (\text{allcyp_ff}^2))))$	Eq ¹	Eq
Adult white & longnose sucker abundance (biomass)	$(10 * (0.3667 + (0.008 * \text{ws_lns_pb}) - (0.000023592 * (\text{ws_lns_pb}^2))))$	0	≥128 kg/km
%Native Salmonids	$(10 * (0.9537 + (0.00000000039 * \text{nat_salm}) - (0.000078892 * (\text{nat_salm}^2))))$	0	≥20%
%Benthic Insectivores	$10 * (0.010966 * \text{benth_pc_n})$	0	≥91.2%
%Blackbasses	$10 - (10 * (-0.09684 + (0.5638 * \log_{10}(\text{blackbass}))))$	Eq	0
%Fluvial Specialist/Dependent	$(10 * (0.2775 + (0.0073 * \text{fluv_pc_n})))$	0%	Eq
%Macrohabitat Generalists	$10 - (10 * (0.1017 + (0.0096 * \text{macro_gen})))$	>90%	Eq
Temperate Stenothermic Species	$(10 * (0.7154 + (0.4047 * (\log_{10}(\text{steno}))))))$	0 sp.	>5 sp.
Non-guarding Lithophilic Species	$(10 * (0.2979 + (0.8975 * \log_{10}(\text{lith_ng}))))$	<1	>10
Alien Species	$10 - (10 * (0.1063 + (0.3271 * \text{Alien_sp}) - (0.029 * (\text{Alien_sp}^2))))$	≥5	0
%DELT Anomalies	$10 - (10 * (0.8965 + (0.1074 * \log_{10}(\text{delta}))))$	Eq	0

¹ No scoring adjustments are necessary; scoring determined by equation (Eq) across entire metric scoring range of 0-10.

Table 4. Atlantic slope Index of Biotic Integrity metrics and scoring criteria (after Daniels et al. 2005).

Metric	5	3	1
1. Species Richness (excluding non-native)	MSRL Equation ²		
2. Number of Benthic Insectivore Species	MSRL Equation		
3. Number of Water Column Species	MSRL Equation		
4. Number of Terete Minnow Species	MSRL Equation		
5. Proportion of Dominant Species	<40%	40-55%	>55%
6. Proportion of White Sucker	<3%	3-15%	>15%
7. Proportion of Generalists	<20%	20-45%	>45%
8. Proportion of Insectivores	>50%	25-50%	<25%
9. Proportion of Top Carnivores	>5%	1-5%	<1%
10. Number of fish in the sample	MDL ³		
11. Proportion in two size classes	>40%	15-40%	<15%
12. Proportion of fish with anomalies	0%	0-1%	>1%

larger rivers and is based on a presumption of a cold water fish assemblage, which at least applies to the upper reaches of the 2008 study area. Regardless of the current efficacy of either IBI a more refined approach will be needed to fully and fairly assess assemblage condition.

Both the Atlantic slope and Maine IBIs had their highest values in the upper reaches of the 2008 study area, although the longitudinal pattern in each was somewhat different (Figures 6 and 7). Both IBI declined markedly downstream from the series of 5 dams between RM 247.3 and 217.7. The Atlantic slope IBI was perhaps more even downstream and did not necessarily reflect the alternation of impounded and riverine habitats. The Maine IBI reflected a wider range of response reflecting the inclusion of stenothermic and mesothermic species and fluvial dependent

² MSRL – maximum species richness line equations were used to score these metrics.

³ MDL – maximum density line equation was used to score this metric.

Table 5. Most abundant fish species ranked by average numbers (No./Km) and biomass (Kg/Km) collected in the Upper Connecticut River mainstem August 25 – October 12, 2009 at 45 1.0 km boat electrofishing sites. The study area is separated in “upper” (upstream Wilder Dam) and “lower” (downstream Wilder Dam to Turners Falls impoundment) segments.

Species	No./Km	Species	Kg/Km
Upper Mainstem (Dst. Lake Francis to Wilder impoundment)			
Yellow perch (<i>Perca flavescens</i>)	47.9	White sucker (<i>Catostomus commersonii</i>)	5.71
Fallfish (<i>Semotilus corporalis</i>)	16.7	Smallmouth bass (<i>Micropterus dolomieu</i>)	1.03
White sucker (<i>Catostomus commersonii</i>)	14.6	Round whitefish (<i>Prosopium cylindraceum</i>)	0.70
Pumpkinseed sunfish (<i>Lepomis gibbosus</i>)	14.3	Yellow perch (<i>Perca flavescens</i>)	0.48
Slimy sculpin (<i>Cottus cognatus</i>)	12.4	Brown trout (<i>Salmo trutta</i>)	0.41
Smallmouth bass (<i>Micropterus dolomieu</i>)	5.0	Rock bass (<i>Ambloplites rupestris</i>)	0.38
Rock bass (<i>Ambloplites rupestris</i>)	4.6	Brook trout (<i>Salvelinus fontinalis</i>)	0.24
Round whitefish (<i>Prosopium cylindraceum</i>)	3.1	Atlantic salmon (<i>Salmo salar</i>)	0.19
Common shiner (<i>Notropis cornutus</i>)	3.1	Rainbow trout (<i>Oncorhynchus mykiss</i>)	0.17
Largemouth bass (<i>Micropterus salmoides</i>)	2.1	Northern pike (<i>Esox lucius</i>)	0.16
Longnose dace (<i>Rhinichthys cataractae</i>)	2.1	Black crappie (<i>Pomoxis nigromaculatus</i>)	0.15
Tessellated darter (<i>Etheostoma olmstedii</i>)	1.9	Pumpkinseed sunfish (<i>Lepomis gibbosus</i>)	0.12
Lower Mainstem (Dst. Wilder Dam to Turners Falls impoundment)			
Smallmouth bass (<i>Micropterus dolomieu</i>)	32.3	Smallmouth bass (<i>Micropterus dolomieu</i>)	2.00
Common shiner (<i>Notropis cornutus</i>)	31.3	Largemouth bass (<i>Micropterus salmoides</i>)	1.00
Spottail shiner (<i>Notropis hudsonius</i>)	25.2	White sucker (<i>Catostomus commersonii</i>)	0.89
Fallfish (<i>Semotilus corporalis</i>)	24.8	Yellow perch (<i>Perca flavescens</i>)	0.55
Yellow perch (<i>Perca flavescens</i>)	21.5	Common carp (<i>Cyprinus carpio</i>)	0.40
White sucker (<i>Catostomus commersonii</i>)	15.1	Bluegill (<i>Lepomis macrochirus</i>)	0.38
Largemouth bass (<i>Micropterus salmoides</i>)	6.9	Rock bass (<i>Ambloplites rupestris</i>)	0.23
Rock bass (<i>Ambloplites rupestris</i>)	6.7	Pumpkinseed sunfish (<i>Lepomis gibbosus</i>)	0.20
Yellow bullhead (<i>Ameiurus natalis</i>)	6.1	Northern pike (<i>Esox lucius</i>)	0.16
Bluegill (<i>Lepomis macrochirus</i>)	5.9	Chain pickerel (<i>Esox niger</i>)	0.14
Tessellated darter (<i>Etheostoma olmstedii</i>)	4.6	Fallfish (<i>Semotilus corporalis</i>)	0.13
Pumpkinseed sunfish (<i>Lepomis gibbosus</i>)	3.9	American eel (<i>Anguilla rostrata</i>)	0.13

and specialist species in the upper 30-40 miles. The decline in a general downstream direction was more pronounced and also reflected the alternating impounded and riverine habitats in the lower part of the 2008 study area. It also reflects the shift towards eurythermic species and macrohabitat generalists. A key question that remains to be answered is if this is a “natural” change or if it is accentuated by flow and habitat modifications as each accumulates in a downstream direction.

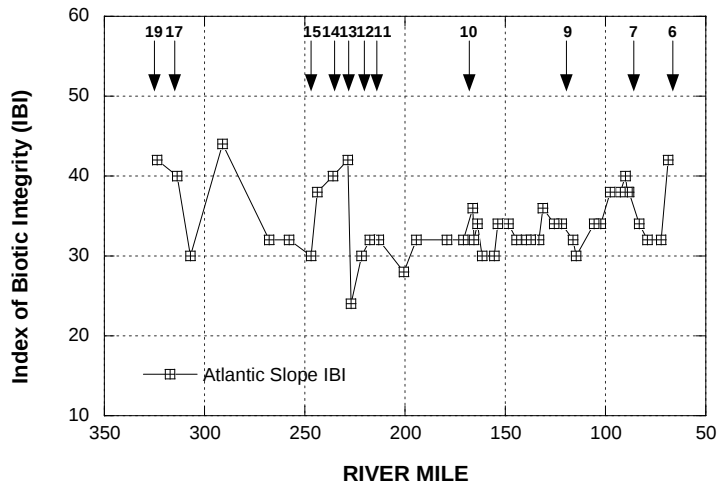


Figure 6. Atlantic slope Index of Biotic Integrity (IBI; Daniels et al. 2005) results in the upper Connecticut R. between Lake Francis and Turners Falls, 2008.

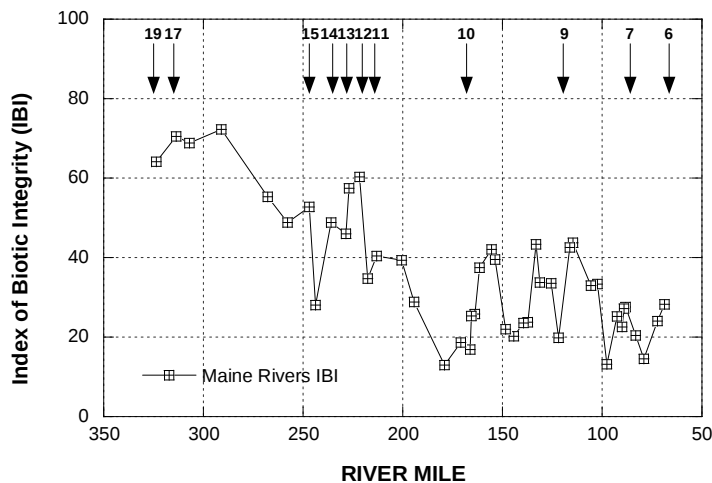


Figure 7. Interim Maine Rivers Index of Biotic Integrity (IBI; Yoder et al. 2008) results in the upper Connecticut R. between Lake Francis and Turners Falls, 2008.

location. Appendix B is the Atlantic slope and Maine IBI metric values, scores, and aggregate index score. In addition the Maine IBI table reports the MIwb values. Appendix C reports the Qualitative Habitat Evaluation Index (QHEI) results as the QHEI metric values and overall index score and a QHEI matrix that sorts “good” and “modified” attributes as an interpretive tool for assessing the effect of habitat modifications. Finally Appendix D are the river mile index maps that were used to delineate the river mile (RM) assigned to each sampling location.

This will be examined in pending data analyses associated with the 2009 mainstem sampling and the Region EMAP project.

The Modified Index of Well-Being (MIwb) was also used to analyze the 2008 assemblage results. This index is based on two Shannon diversity indices and both numbers and biomass, hence it acts on different attributes of the data than an IBI. It showed a general decline similar to both IBIs from the upstream most sites downstream to just above the Wilder Dam (Figure 8). However, and unlike the IBIs, the MIwb increased and “recovered” somewhat in the lower part of the 2008 study area. The MIwb reflects numbers and biomass that are contributed by species that do not impact certain IBI metrics so an assemblage that is composed of largely facultative and intermediate tolerant species will affect the MIwb moreso than an IBI.

Data Appendices

The data from the 2008 fish assemblage and habitat assessment are presented and summarized in Appendices A-D. Appendix A is a listing of the location of each electrofishing site and a summary of fish species with relative abundance and other data at each

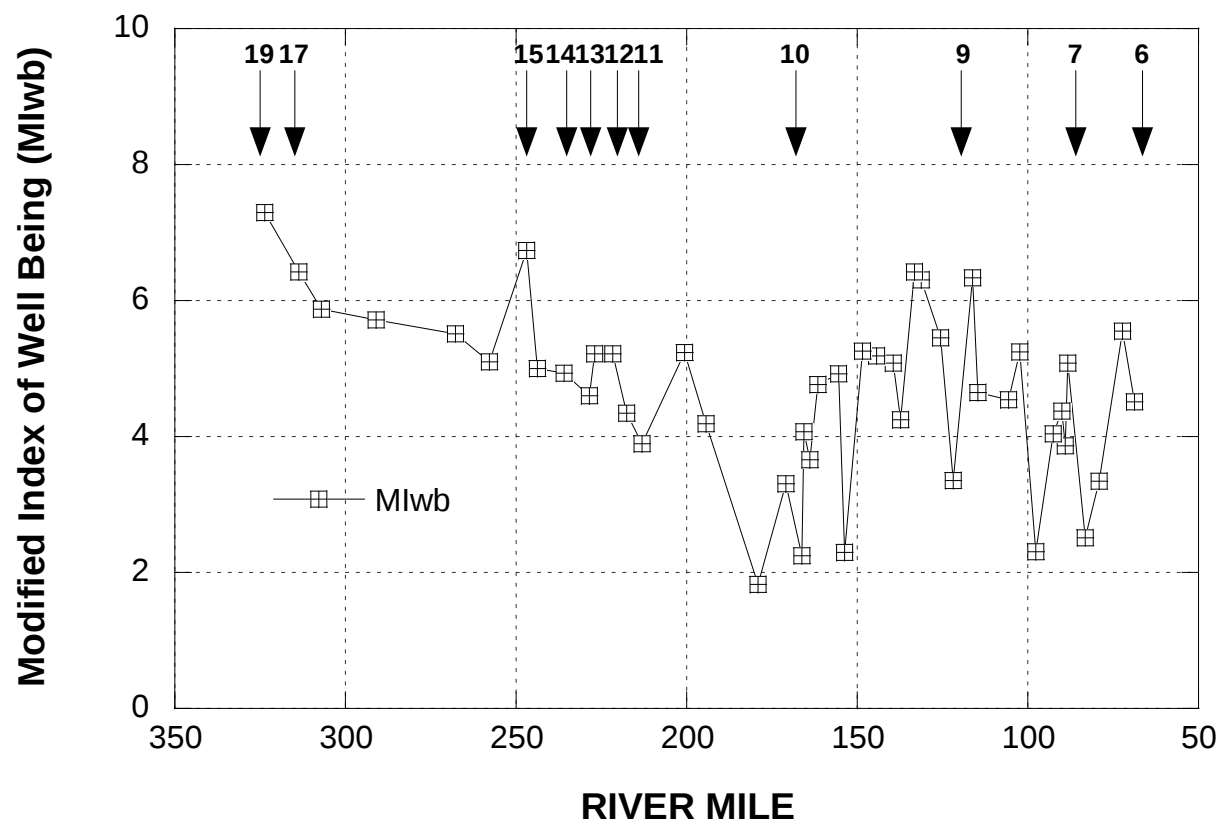


Figure 8. Modified Index of Well-Being (MIwb) results in the upper Connecticut R. between Lake Francis and Turners Falls, 2008.

References

- Daniels, R.A., K. Riva-Murray, D.B. Halliwell, D. Vana-Miller, and M.D. Bilger. 2005. An Index of Biological Integrity for northern mid-Atlantic slope drainages. *Trans. Am. Fish. Soc.* 131:1044-1060.
- Davies, S.P. and S.K. Jackson. 2006. The biological condition gradient: a descriptive model for interpreting change in aquatic ecosystems. *Ecological Applications* 16 (4): 1251-1266 + appendices.
- Davies, S.P., L. Tsomides, J.L. DiFranco, and D.L. Courtemanch. 1999. Biomonitoring retrospective: fifteen year summary for Maine rivers and streams. Maine Dept. of Environmental Protection, Bureau of Land and Water quality, Division of Environmental Assessment, Augusta, ME. DEPLW1999-26. 192 pp.
- Davies, S.P. and L. Tsomides. 1997. Methods for biological sampling and analysis of Maine's inland waters. Maine Dept. of Environmental Protection, Bureau of Land and Water quality, Division of Environmental Assessment, Augusta, ME. 29 pp.
- Gammon, J. R., A. Spacie, A., J. L. Hamelink, and R. L. Kaesler. 1981. Role of electrofishing in assessing environmental quality of the Wabash River, in *Ecological assessments of effluent impacts on communities of indigenous aquatic organisms*, in Bates, J. M. and Weber, C. I., Eds., ASTM STP 730, 307 pp.
- Gammon, J. R. 1976. The fish populations of the middle 340 km of the Wabash River, Purdue University Water Resources Research Center Technical Report 86. 73 pp.
- Gammon, J. R. 1973. The effect of thermal inputs on the populations of fish and macroinvertebrates in the Wabash River. Purdue University Water Resources Research Center Technical Report 32. 106 pp.
- Halliwell, D.B. 2005. Introduced fish in Maine. *Focus on Freshwater Biodiversity, MABP Series*. 12 pp.
- Halliwell, D.B, R.W. Langdon, R.A. Daniels, J.P. Kurtenbach, and R.A. Jacobson. 1999. Classification of freshwater fish species of the northeastern United States for use in the development of indices of biological integrity, with regional applications, pp. 301-338. in T.P. Simon (ed.), *Assessing the Sustainability and Biological Integrity of Water Resources Using Fish Communities*. CRC Press, Boca Raton, FL.
- Karr, J. R., K. D. Fausch, P. L. Angermier, P. R. Yant, and I. J. Schlosser. 1986. Assessing biological integrity in running waters: a method and its rationale. *Illinois Natural History Survey Special Publication* 5: 28 pp.

- Midwest Biodiversity Institute (MBI). 2008a. Quality Assurance Project Plan and Detailed Work Plan: Development and Assessment of Methods and Designs for the Biological Assessment of Non-Wadeable Rivers in New England. Submitted to U.S. EPA, Region I (June 30, 2008). Midwest Biodiversity Institute, Inc. Columbus, OH. 122 pp.
- Midwest Biodiversity Institute (MBI). 2008b. Quality Assurance Project Plan: Fish Assemblage Assessment of Selected New England Non-Wadeable Rivers. Submitted to U.S. EPA, Region I (May 31, 2008). Midwest Biodiversity Institute, Inc. Columbus, OH. 85 pp.
- Midwest Biodiversity Institute (MBI). 2002. Quality Assurance Project Plan: Fish Assemblage Assessment of the Kennebec River Mainstem, Bingham to Merrymeeting Bay, Maine. Submitted to U.S. EPA, Region I (August 19, 2002; revised February 28, 2005). Midwest Biodiversity Institute, Inc. Columbus, OH. 36 pp. + appendices.
- Nelson, J.S., E. J. Crossman, H. Espinosa-Pérez, L.T. Findley, C.R. Gilbert, R.N. Lea, and J.D. Williams. 2004. Common and scientific names of fishes from the United States, Canada, and Mexico. Sixth edition. American Fisheries Society Spec. Publ. 29. 386 pp.
- Ohio Environmental Protection Agency. 2006. Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (QHEI). Ohio EPA Tech. Bull. EAS/2006-06-1. Revised by Midwest Biodiversity Institute for Division of Surface Water, Ecological Assessment Section, Groveport, Ohio. 26 pp.
- Ohio Environmental Protection Agency. 1989. Biological criteria for the protection of aquatic life. volume III: standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities, Division of Water Quality Monitoring and Assessment, Columbus, Ohio.
- Ohio Environmental Protection Agency. 1987. Biological criteria for the protection of aquatic life: volume II. users manual for biological field assessment of Ohio surface waters, Division of Water Quality Monitoring and Assessment, Surface Water Section, Columbus, Ohio.
- Sanders, R. S., R. J. Miltner, C. O. Yoder, and E. T. Rankin. 1999. The use of external deformities, erosions, lesions, and tumors (DELT anomalies) in fish assemblages for characterizing aquatic resources: a case study of seven Ohio streams, pages 225-248. *in* T.P. Simon (ed.), *Assessing the Sustainability and Biological Integrity of Water Resources Using Fish Communities*. CRC Press, Boca Raton, FL.
- Rankin, E. T. 1995. The use of habitat assessments in water resource management programs, pages 181-208. *in* W. Davis and T. Simon (eds.). *Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making*. Lewis Publishers, Boca Raton, FL.

- Rankin, E. T. 1989. The qualitative habitat evaluation index (QHEI), rationale, methods, and application, Ohio EPA, Division of Water Quality Planning and Assessment, Ecological Assessment Section, Columbus, Ohio.
- Saunders, R., M.A. Hachey, and C.W. Fay. 2006. Maine's diadromous fish community: past, present, and implications for Atlantic salmon recovery. *Fisheries* 31(11): 537-547.
- U.S. Environmental Protection Agency. 2005. Use of biological information to better define aquatic life designated uses in state and tribal water quality standards: tiered aquatic life uses. EPA 822-R-05-001. Office of Water, Health and Ecological Criteria Division, Washington, DC 20460. 188 pp.
- Warner, K. 2005. Smallmouth bass introductions in Maine: history and management implications. *Fisheries* 30(11): 20-26.
- Yoder, C.O., R.F. Thoma, E.T. Rankin, B.H. Kulik, and B.J. Apell. 2008. Maine Rivers Fish Assemblage Assessment: Development of an Interim Fish Assemblage Index for Non-wadeable Maine Rivers. MBI Technical Report MBI/2008-11-2. Report to U.S. EPA, Region I, Boston, MA. 67 pp.
- Yoder, C.O., B.H. Kulik, and J.M. Audet. 2006a. The spatial and relative abundance characteristics of the fish assemblages in three Maine Rivers. MBI Technical Report MBI/12-05-1. Grant X-98128601 report to U.S. EPA, Region I, Boston, MA.. 136 pp. + appendices.
- Yoder, C.O., B.H. Kulik, B.J. Apell, and J.M. Audet. 2006b. 2005 Maine Rivers Fish Assemblage Assessment: I. Northern Maine Rivers Results; II. Maine Rivers Fish Species Distribution Atlas; III. Toward the Development of a Fish Assemblage Index for Maine Rivers. MBI Technical Report 12-06-1. Report to U.S. EPA, Region I, Boston, MA. 71 pp. + appendices.
- Yoder, C.O. and 9 others. 2005. Changes in fish assemblage status in Ohio's nonwadeable rivers and streams over two decades, pp. 399-429. *in* R. Hughes and J. Rinne (eds.). Historical changes in fish assemblages of large rivers in the America's. American Fisheries Society Symposium Series.

Fish Assemblage and Habitat Assessment of the Upper Connecticut River

Appendix A

Site Catalogue Species Data by Date and Location

August-October 2008

River Mile	Date	Samp Type	Dist Fished	Latitude/Longitude		Draing Area	Source	Invl Samp	No of Species	Location
80-001	Connecticut River									
323.60	08/28/2008	A	1.000	45.05480	-71.4212	180.6	99		15	DST Lake Francis, NH
322.00	08/28/2008	A	1.000	45.02092	-71.4637	259.1	99		9	UST Canaan Dam/UST SR 3 bridge, Stewartstown, NH
313.70	08/29/2008	A	1.000	44.99283	-71.5370	377.2	99		14	DST Canaan Dam, Canaan, VT
307.10	08/29/2008	A	1.000	44.91690	-71.5024	487.8	99		13	UST Colebrook, NH/ DST Rest Stop access
291.00	08/30/2008	A	1.000	44.75410	-71.6252	651.5	99		10	UST M. Stratford, NH bridge
267.80	10/08/2008	A	1.000	44.56217	-71.5660	1194.7	99		9	DST Wyoming Dam (breached), Guildhall, VT
257.90	08/30/2008	A	1.000	44.48413	-71.6057	1330.5	99		8	DST Lancaster WWTP, Lancaster, NH
247.00	09/06/2008	A	1.000	44.41134	-71.7225	1513.5	99		14	DST Gilman Project Dam, Gilman, VT
243.80	09/06/2008	A	1.000	44.39891	-71.7783	1557.1	99		11	Upper end Moore Reservoir, Littleton, NH
235.90	09/07/2008	A	1.000	44.33926	-71.8817	1614.2	99		15	DST Moore Dam, Littleton, NH
228.50	10/07/2008	A	1.000	44.32188	-72.0101	1635.7	99		12	DST Comeford Station Dam
227.10	10/07/2008	A	1.000	44.31081	-72.0324	2145.8	99		8	DST Passumpsic River confluence
221.70	10/07/2008	A	1.000	44.45485	-72.0586	2205.9	99		9	DST McIndoe Station Dam
217.60	10/06/2008	A	1.000	44.20300	-72.0585	2224.7	99		10	DST Ryegate dam
213.10	10/06/2008	A	1.000	44.14986	-72.0428	2749.4	99		8	DST Amonoosuc River confluence/ DST SR 302 bridge
200.70	10/05/2008	A	1.000	44.04798	-72.0664	2824.1	99		8	UST old bridge piers, near Bedell Bridge State Park
194.40	10/06/2008	A	1.000	43.98982	-72.1142	3018.4	99		7	DST Bradford, NH WWTP
179.20	10/04/2008	A	1.000	43.83356	-72.1809	3137.1	99		4	DST N. Thetford boat ramp/ near E. Thetford, VT
170.90	10/04/2008	A	1.000	43.73931	-72.2496	3317.3	99		8	UST Hanover, NH
166.30	10/11/2008	A	1.000	43.69410	-72.3023	3368.5	99		8	DST Hanover, NH WWTP
165.60	8 /27/2008	A	1.000	43.68745	-72.3031	3374.7	99		7	Wilder Dam Impoundment
163.90	8 /27/2008	A	1.000	43.66365	-72.3068	3378.1	99		9	DST Wilder Dam
161.50	8 /28/2008	A	1.000	43.63513	-72.3280	4286.1	99		11	DST White River/ Hartford and New Lebanon WWTP
155.60	8 /28/2008	A	1.000	43.57559	-72.3782	4555.4	99		10	Near N. Hartland, VT
153.80	8 /29/2008	A	1.000	43.54864	-72.3794	4558.1	99		5	North of Windsor near N. Hartland, VT
148.50	8 /29/2008	A	1.000	43.47303	-72.3853	4689.1	99		7	DST WWTP, Windsor, VT
144.40	8 /30/2008	A	1.000	43.42803	-72.3947	4694.1	99		9	South of Windsor near Cornish/Claremont Border
139.50	8 /30/2008	A	1.000	43.36038	-72.4071	4992.1	99		9	DST Claremont WWTP trib.
137.40	8 /30/2008	A	1.000	43.34568	-72.4007	4997.1	99		7	UST Weathersfield
133.20	8 /31/2008	A	0.700	43.28354	-72.4066	5038.1	99		10	DST Glidden Island, NH
131.40	8 /31/2008	A	0.690	43.26219	-72.4225	5051.2	99		11	UST Black River confluence and Charlestown, NH
125.60	8 /31/2008	A	1.000	43.19328	-72.4439	5278.6	99		11	DST Charlestown WWTP
121.90	10/03/2008	A	1.000	43.14709	-72.4570	5410.1	99		10	UST N. Walpole Dam/(dam pool)
116.20	09/01/2008	A	0.690	43.07837	-72.4375	5611.1	99		10	DST Belows Falls Dam
114.70	9 /01/2008	A	1.000	43.06061	-72.4578	5614.1	99		12	DST Bellows Falls WWTP

River Mile	Date	Samp Type	Dist Fished	Latitude/Longitude		Draing Area	Source	Invld Samp	No of Species	Location
80-001	Connecticut River									
105.70	9 /02/2008	A	1.000	42.96852	-72.4912	5705.2	99		8	Near Westminster, VT
102.30	9 /02/2008	A	1.000	42.94139	-72.5252	5731.8	99		10	DST Putney, VT
97.60	9 /02/2008	A	1.000	42.88562	-72.5515	5765.4	99		7	UST West River confluence and Brattleboro, VT
92.50	10/03/2008	A	1.000	42.81555	-72.5421	6244.0	99		12	DST Brattleboro, VT WWTP
90.10	10/02/2008	A	1.000	42.78747	-72.5142	6257.1	99		10	UST Vemont Yankee Entergy thermal discharge
89.00	10/02/2008	A	0.660	42.77442	-72.5113	6258.9	99		12	At and DST mixing zone thermal discharge Vermont Yankee
88.40	10/03/2008	A	1.000	42.76683	-72.5141	6265.2	99		11	DST Vernon Dam Vernon, VT
83.30	10/01/2008	A	1.000	42.73085	-72.4569	6694.5	99		5	UST Northfield, NH WWTP/UST Pauchaug Brook
79.20	10/02/2008	A	1.000	42.68238	-72.4719	6721.2	99		8	UST SR 10 bridge
72.20	10/01/2008	A	1.000	42.59651	-72.4970	7150.1	99		13	UST King of France Bridge, Turner's Falls, MA
68.80	09/27/2008	A	1.000	42.59645	-72.5437	7152.4	99		13	Turners Falls dam pool, Turners Falls, MA

River Code: 80-001	Stream: Connecticut River		River Segment Totals	
Mile Range: 68.80			Date Range: 08/27/2008	
Thru: 323.60			Thru: 10/11/2008	
Dist Fished: 44.74 km	Basin: Connecticut River	No of Passes: 46	Sampler Type: A	
	Lat: 0.000000	Lat: 0.000000		

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec.	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A		82	1.85	1.10	0.01	0.15	6.80
American Shad	N	P	A		27	0.60	0.35	0.01	0.07	9.59
Brown Trout	E		FS		19	0.42	0.25	0.21	2.44	489.74
Rainbow Trout	E		FD		16	0.35	0.21	0.13	1.53	369.38
Brook Trout [T]			FS		28	0.61	0.36	0.11	1.34	184.86
Round Whitefish		V	FD	I	67	1.46	0.86	0.33	3.96	228.57
Atlantic Salmon	E		A		34	0.74	0.44	0.09	1.07	121.59
Chain Pickerel	E	P	MG		39	0.88	0.52	0.11	1.32	122.31
Northern Pike	F	P	MG		7	0.15	0.09	0.16	1.86	1,027.14
White Sucker	W	O	FD	T	652	14.87	8.80	3.19	37.98	223.91
Longnose Sucker [E]	R	I	FS		6	0.13	0.08	0.01	0.18	113.33
Common Carp	G	O	MG	T	2	0.04	0.03	0.21	2.49	4,825.00
Golden Shiner	N	I	MG	T	97	2.11	1.25	0.02	0.29	11.41
Longnose Dace	N	I	FS	R	45	0.98	0.58	0.01	0.07	5.80
Creek Chub	N	G	FS	T	1	0.02	0.01	0.00	0.00	2.00
Common Shiner	N	I	FD		633	17.79	10.53	0.03	0.37	1.87
Spottail Shiner	N	I	MG	P	600	13.69	8.10	0.06	0.70	4.36
Mimic Shiner	N	I	FD	I	2	0.04	0.03	0.00	0.00	2.00
Northern Redbelly Dace	N		MG		14	0.30	0.18	0.00	0.01	1.57
Eastern Blacknose Dace	N				19	0.41	0.24	0.00	0.01	2.68
Fallfish	N		FD		917	20.90	12.37	0.11	1.31	4.98
Bridle Shiner	N	I			4	0.09	0.05	0.00	0.00	4.25
White Catfish	E	I	MG		1	0.02	0.01	0.00	0.02	70.00
Yellow Bullhead		I	MG	T	97	3.20	1.89	0.00	0.02	0.62
Brown Bullhead		I	MG	T	22	0.48	0.28	0.05	0.60	106.36
American Eel [T]		C	C		2	0.05	0.03	0.07	0.80	1,205.00
Eastern Banded Killifish	E	I	MG	T	4	0.09	0.05	0.00	0.00	4.50
Burbot [S]			FD		26	0.57	0.33	0.02	0.24	35.96
White Crappie	S	I	MG		10	0.22	0.13	0.00	0.01	2.60
Black Crappie	S	I	MG		23	0.53	0.32	0.10	1.22	198.74
Rock Bass	S	C	MG		250	5.69	3.36	0.30	3.57	53.59
Smallmouth Bass	F	C	MG	M	840	19.24	11.38	1.54	18.31	82.24
Largemouth Bass	F	C	MG		188	4.61	2.73	0.53	6.31	115.41
Bluegill Sunfish	S	I	MG	P	148	3.50	2.07	0.20	2.43	51.01
Pumpkinseed Sunfish	S	I	MG	P	397	8.87	5.25	0.16	1.91	16.95
Redbreast Sunfish	S		MG		2	0.05	0.03	0.02	0.18	275.00
Hybrid X Sunfish					1	0.02	0.01	0.00	0.00	10.00
Walleye	F	P	MG		4	0.09	0.05	0.07	0.81	783.50
Yellow Perch			MG		1,526	34.11	20.19	0.52	6.13	14.76
Tesselated Darter	D	I			138	3.31	1.96	0.01	0.09	2.39
Slimy Sculpin			FS		272	5.91	3.50	0.02	0.21	2.97
<i>Stream Total</i>					7,262	169.00		8.41		
<i>Number of Species</i>					40					
<i>Number of Hybrids</i>					1					

River Code: 80-001	Stream: Connecticut River	Sample Date: 08/28/2008
River Mile: 323.60	Location: DST Lake Francis, NH	Invalid Sample:
Time Fished: 2893 sec	Drainage: 180.6 sq mi	Depth: 120
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 45.054800	Lat: -71.421240
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Brown Trout	E		FS	1	1.00	0.71	0.75	5.39	745.00
Rainbow Trout	E		FD	5	5.00	3.55	1.04	7.53	208.00
Brook Trout [T]			FS	11	11.00	7.80	3.20	23.14	290.55
Round Whitefish		V	FD I	14	14.00	9.93	4.89	35.40	349.29
Atlantic Salmon	E		A	15	15.00	10.64	1.18	8.54	78.67
Chain Pickerel	E	P	MG	1	1.00	0.71	0.48	3.47	480.00
White Sucker	W	O	FD T	23	23.00	16.31	1.63	11.80	70.87
Longnose Sucker [E]	R	I	FS	4	4.00	2.84	0.20	1.45	50.00
Longnose Dace	N	I	FS R	1	1.00	0.71	0.00	0.01	2.00
Common Shiner	N	I	FD	2	2.00	1.42	0.02	0.14	10.00
Northern Redbelly Dace	N		MG	4	4.00	2.84	0.01	0.06	2.00
Eastern Blacknose Dace	N			4	4.00	2.84	0.01	0.09	3.00
Fallfish	N		FD	11	11.00	7.80	0.13	0.94	11.82
Brown Bullhead		I	MG T	3	3.00	2.13	0.18	1.30	60.00
Slimy Sculpin			FS	42	42.00	29.79	0.10	0.72	2.38
<i>Date Total</i>				141	141.00		13.81		
<i>Number of Species</i>				15					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 08/28/2008
River Mile: 322.00	Location: UST Canaan Dam/UST SR 3 bridge,	Invalid Sample:
Time Fished: 2731 sec	Drainage: 259.1 sq mi	Depth: 100
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 45.020920	Lat: -71.463650
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Brook Trout [T]			FS	17	17.00	13.18	1.98	63.89	116.47
Atlantic Salmon	E		A	1	1.00	0.78	0.06	1.94	60.00
White Sucker	W	O	FD T	6	6.00	4.65	0.57	18.39	95.00
Longnose Dace	N	I	FS R	9	9.00	6.98	0.07	2.26	7.78
Eastern Blacknose Dace	N			9	9.00	6.98	0.02	0.77	2.67
Fallfish	N		FD	10	10.00	7.75	0.06	1.77	5.50
Brown Bullhead		I	MG T	7	7.00	5.43	0.08	2.58	11.43
Burbot [S]			FD	5	5.00	3.88	0.07	2.26	14.00
Slimy Sculpin			FS	65	65.00	50.39	0.19	6.13	2.92
	<i>Date Total</i>			129	129.00		3.10		
	<i>Number of Species</i>			9					
	<i>Number of Hybrids</i>			0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 08/29/2008
River Mile: 313.70	Location: DST Canaan Dam, Canaan, VT	Invalid Sample:
Time Fished: 3367 sec	Drainage: 377.2 sq mi	Depth: 220
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 44.992830	Lat: -71.537010
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Brown Trout	E		FS	5	5.00	3.88	1.36	5.53	272.00
Rainbow Trout	E		FD	2	2.00	1.55	0.38	1.54	190.00
Round Whitefish		V	FD I	44	44.00	34.11	9.20	37.40	209.09
Atlantic Salmon	E		A	2	2.00	1.55	0.08	0.33	40.00
White Sucker	W	O	FD T	24	24.00	18.60	13.27	53.94	552.92
Golden Shiner	N	I	MG T	2	2.00	1.55	0.01	0.04	5.00
Longnose Dace	N	I	FS R	4	4.00	3.10	0.02	0.07	4.50
Common Shiner	N	I	FD	3	3.00	2.33	0.01	0.02	1.67
Northern Redbelly Dace	N		MG	2	2.00	1.55	0.00	0.02	2.00
Eastern Blacknose Dace	N			5	5.00	3.88	0.01	0.06	2.80
Fallfish	N		FD	5	5.00	3.88	0.03	0.12	6.00
Brown Bullhead		I	MG T	2	2.00	1.55	0.07	0.28	35.00
Burbot [S]			FD	1	1.00	0.78	0.09	0.37	90.00
Slimy Sculpin			FS	28	28.00	21.71	0.07	0.28	2.50
<i>Date Total</i>				129	129.00		24.60		
<i>Number of Species</i>				14					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 08/29/2008
River Mile: 307.10	Location: UST Colebrook, NH/ DST Rest Stop access	Invalid Sample:
Time Fished: 3742 sec	Drainage: 487.8 sq mi	Depth: 120
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 44.916900	Lat: -71.502360
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Round Whitefish		V	FD I	5	5.00	2.22	0.31	1.61	62.80
Atlantic Salmon	E		A	3	3.00	1.33	0.00	0.02	1.33
Chain Pickerel	E	P	MG	3	3.00	1.33	0.15	0.77	50.00
White Sucker	W	O	FD T	101	101.00	44.89	18.46	94.88	182.81
Longnose Dace	N	I	FS R	1	1.00	0.44	0.00	0.02	4.00
Common Shiner	N	I	FD	8	8.00	3.56	0.04	0.23	5.50
Northern Redbelly Dace	N		MG	8	8.00	3.56	0.01	0.05	1.25
Fallfish	N		FD	82	82.00	36.44	0.28	1.45	3.44
Burbot [S]			FD	2	2.00	0.89	0.14	0.72	70.00
Smallmouth Bass	F	C	MG M	2	2.00	0.89	0.00	0.02	2.00
Pumpkinseed Sunfish	S	I	MG P	2	2.00	0.89	0.03	0.15	15.00
Yellow Perch			MG	1	1.00	0.44	0.00	0.01	2.00
Tessellated Darter	D	I		7	7.00	3.11	0.01	0.06	1.71
<i>Date Total</i>				225	225.00		19.46		
<i>Number of Species</i>				13					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 08/30/2008
River Mile: 291.00	Location: UST M. Stratford, NH bridge	Invalid Sample:
Time Fished: 2436 sec	Drainage: 651.5 sq mi	Depth: 75 cm
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 44.754100	Lat: -71.625220
		Data Source: 99
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Brown Trout	E		FS	8	8.00	4.08	3.42	44.45	426.88
Rainbow Trout	E		FD	2	2.00	1.02	0.24	3.12	120.00
Round Whitefish		V	FD I	4	4.00	2.04	0.91	11.85	227.50
Atlantic Salmon	E		A	1	1.00	0.51	0.05	0.65	50.00
White Sucker	W	O	FD T	17	17.00	8.67	2.60	33.85	152.94
Longnose Dace	N	I	FS R	25	25.00	12.76	0.08	1.07	3.28
Fallfish	N		FD	6	6.00	3.06	0.04	0.52	6.67
Yellow Perch			MG	1	1.00	0.51	0.01	0.13	10.00
Tesselated Darter	D	I		6	6.00	3.06	0.01	0.13	1.67
Slimy Sculpin			FS	126	126.00	64.29	0.33	4.23	2.58
	<i>Date Total</i>			196	196.00		7.68		
	<i>Number of Species</i>			10					
	<i>Number of Hybrids</i>			0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/08/2008
River Mile: 267.80	Location: DST Wyoming Dam (breached), Guildhall, VT	Invalid Sample:
Time Fished: 3606 sec	Drainage: 1194.7 sq mi	Depth: 270
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 44.562170	Lat: -71.566010
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Brown Trout	E		FS	1	1.00	0.70	0.37	35.37	365.00
White Sucker	W	O	FD T	2	2.00	1.41	0.05	4.84	25.00
Common Shiner	N	I	FD	33	33.00	23.24	0.11	10.66	3.33
Fallfish	N		FD	82	82.00	57.75	0.22	21.32	2.68
Brown Bullhead		I	MG T	2	2.00	1.41	0.04	3.88	20.00
Burbot [S]			FD	6	6.00	4.23	0.14	13.08	22.50
Pumpkinseed Sunfish	S	I	MG P	6	6.00	4.23	0.08	7.46	12.83
Yellow Perch			MG	2	2.00	1.41	0.02	1.45	7.50
Tesselated Darter	D	I		8	8.00	5.63	0.02	1.94	2.50
<i>Date Total</i>				142	142.00		1.03		
<i>Number of Species</i>				9					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 08/30/2008
River Mile: 257.90	Location: DST Lancaster WWTP, Lancaster, NH	Invalid Sample:
Time Fished: 3868 sec	Drainage: 1330.5 sq mi	Depth: 280
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 44.484130	Lat: -71.605690

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Chain Pickerel	E	P	MG	8	8.00	6.25	0.14	2.16	17.50
White Sucker	W	O	FD T	15	15.00	11.72	5.87	90.45	391.60
Fallfish	N		FD	29	29.00	22.66	0.07	1.08	2.41
Burbot [S]			FD	4	4.00	3.13	0.06	0.92	15.00
Largemouth Bass	F	C	MG	5	5.00	3.91	0.03	0.52	6.80
Pumpkinseed Sunfish	S	I	MG P	33	33.00	25.78	0.21	3.30	6.48
Yellow Perch			MG	29	29.00	22.66	0.09	1.39	3.10
Tessellated Darter	D	I		5	5.00	3.91	0.01	0.18	2.40
<i>Date Total</i>				128	128.00		6.49		
<i>Number of Species</i>				8					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 09/06/2008
River Mile: 247.00	Location: DST Gilman Project Dam, Gilman, VT	Invalid Sample:
Time Fished: 4840 sec	Drainage: 1513.5 sq mi	Depth: 150
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 44.411340	Lat: -71.722480

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Brown Trout	E		FS	1	1.00	0.60	0.18	0.35	180.00
Rainbow Trout	E		FD	2	2.00	1.19	0.42	0.82	210.00
Atlantic Salmon	E		A	2	2.00	1.19	1.00	1.96	500.00
Chain Pickerel	E	P	MG	1	1.00	0.60	0.34	0.67	340.00
White Sucker	W	O	FD T	44	44.00	26.19	37.13	72.71	843.86
Longnose Sucker [E]	R	I	FS	1	1.00	0.60	0.34	0.67	340.00
Common Shiner	N	I	FD	4	4.00	2.38	0.01	0.02	2.75
Fallfish	N		FD	11	11.00	6.55	0.37	0.72	33.27
Burbot [S]			FD	8	8.00	4.76	0.44	0.86	55.00
Rock Bass	S	C	MG	31	31.00	18.45	4.94	9.67	159.35
Smallmouth Bass	F	C	MG M	14	14.00	8.33	4.74	9.27	338.29
Pumpkinseed Sunfish	S	I	MG P	1	1.00	0.60	0.00	0.01	4.00
Yellow Perch			MG	45	45.00	26.79	1.15	2.25	25.56
Tesselated Darter	D	I		3	3.00	1.79	0.01	0.01	2.00
<i>Date Total</i>				168	168.00		51.06		
<i>Number of Species</i>				14					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 09/06/2008
River Mile: 243.80	Location: Upper end Moore Reservoir, Littleton, NH	Invalid Sample:
Time Fished: 3134 sec	Drainage: 1557.1 sq mi	Depth: 999
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 44.398910	Lat: -71.778310
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Pike	F	P	MG	1	1.00	0.18	0.27	2.16	270.00
White Sucker	W	O	FD T	4	4.00	0.74	2.24	17.93	560.00
Golden Shiner	N	I	MG T	21	21.00	3.87	0.05	0.40	2.38
Fallfish	N		FD	18	18.00	3.31	0.09	0.72	5.00
White Crappie	S	I	MG	10	10.00	1.84	0.03	0.21	2.60
Rock Bass	S	C	MG	30	30.00	5.52	0.16	1.28	5.33
Smallmouth Bass	F	C	MG M	33	33.00	6.08	5.49	43.94	166.36
Largemouth Bass	F	C	MG	19	19.00	3.50	0.14	1.15	7.58
Pumpkinseed Sunfish	S	I	MG P	224	224.00	41.25	1.03	8.24	4.60
Yellow Perch			MG	182	182.00	33.52	2.99	23.93	16.43
Tessellated Darter	D	I		1	1.00	0.18	0.00	0.03	4.00
<i>Date Total</i>				543	543.00		12.49		
<i>Number of Species</i>				11					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 09/07/2008
River Mile: 235.90	Location: DST Moore Dam, Littleton, NH	Invalid Sample:
Time Fished: 4933 sec	Drainage: 1614.2 sq mi	Depth: 300
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 44.339260	Lat: -71.881720
		Data Source: 99
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Brown Trout	E		FS	1	1.00	0.18	0.36	1.50	360.00
Atlantic Salmon	E		A	2	2.00	0.36	1.09	4.53	545.00
Chain Pickerel	E	P	MG	2	2.00	0.36	0.00	0.01	1.00
White Sucker	W	O	FD T	18	18.00	3.24	17.94	74.64	996.67
Golden Shiner	N	I	MG T	7	7.00	1.26	0.57	2.37	81.43
Common Shiner	N	I	FD	3	3.00	0.54	0.01	0.02	2.00
Mimic Shiner	N	I	FD I	1	1.00	0.18	0.00	0.01	2.00
Fallfish	N		FD	13	13.00	2.34	0.01	0.04	0.77
Brown Bullhead		I	MG T	1	1.00	0.18	0.13	0.54	130.00
Rock Bass	S	C	MG	8	8.00	1.44	1.22	5.08	152.75
Smallmouth Bass	F	C	MG M	10	10.00	1.80	0.64	2.66	64.00
Largemouth Bass	F	C	MG	2	2.00	0.36	0.04	0.17	20.00
Yellow Perch			MG	485	485.00	87.39	2.02	8.40	4.16
Tesselated Darter	D	I		1	1.00	0.18	0.00	0.01	2.00
Slimy Sculpin			FS	1	1.00	0.18	0.00	0.01	2.00
<i>Date Total</i>				555	555.00		24.04		
<i>Number of Species</i>				15					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/07/2008
River Mile: 228.50	Location: DST Comeford Station Dam	Invalid Sample:
Time Fished: 2862 sec	Drainage: 1635.7 sq mi	Depth: 200
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 44.321880	Lat: -72.010120
		Data Source: 99
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Rainbow Trout	E		FD	1	1.00	0.36	1.66	25.40	1,660.00
White Sucker	W	O	FD T	11	11.00	4.01	1.55	23.72	140.91
Longnose Sucker [E]	R	I	FS	1	1.00	0.36	0.14	2.14	140.00
Golden Shiner	N	I	MG T	1	1.00	0.36	0.02	0.31	20.00
Fallfish	N		FD	2	2.00	0.73	0.03	0.46	15.00
Brown Bullhead		I	MG T	1	1.00	0.36	0.05	0.77	50.00
Black Crappie	S	I	MG	2	2.00	0.73	0.04	0.61	20.00
Rock Bass	S	C	MG	5	5.00	1.82	0.83	12.70	166.00
Smallmouth Bass	F	C	MG M	4	4.00	1.46	0.60	9.10	148.75
Pumpkinseed Sunfish	S	I	MG P	27	27.00	9.85	0.40	6.12	14.81
Yellow Perch			MG	213	213.00	77.74	1.15	17.60	5.40
Slimy Sculpin			FS	6	6.00	2.19	0.07	1.07	11.67
<i>Date Total</i>				274	274.00		6.54		
<i>Number of Species</i>				12					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/07/2008
River Mile: 227.10	Location: DST Passumpsic River confluence	Invalid Sample:
Time Fished: 1741 sec	Drainage: 2145.8 sq mi	Depth: 250
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 44.310810	Lat: -72.032380

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Brown Trout	E		FS	1	1.00	2.33	2.58	12.18	2,580.00
Rainbow Trout	E		FD	1	1.00	2.33	0.10	0.47	100.00
Atlantic Salmon	E		A	5	5.00	11.63	0.46	2.15	91.00
White Sucker	W	O	FD T	27	27.00	62.79	17.49	82.54	647.78
Longnose Dace	N	I	FS R	2	2.00	4.65	0.06	0.26	27.50
Black Crappie	S	I	MG	1	1.00	2.33	0.41	1.93	410.00
Smallmouth Bass	F	C	MG M	2	2.00	4.65	0.05	0.24	25.00
Slimy Sculpin			FS	4	4.00	9.30	0.05	0.24	12.50
<i>Date Total</i>				43	43.00		21.19		
<i>Number of Species</i>				8					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/07/2008
River Mile: 221.70	Location: DST McIndoe Station Dam	Invalid Sample:
Time Fished: 3059 sec	Drainage: 2205.9 sq mi	Depth: 160
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 44.454850	Lat: -72.058560
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Atlantic Salmon	E		A	2	2.00	2.35	0.17	2.73	82.50
White Sucker	W	O	FD T	13	13.00	15.29	4.40	72.85	338.46
Common Shiner	N	I	FD	2	2.00	2.35	0.06	0.99	30.00
Fallfish	N		FD	51	51.00	60.00	0.50	8.28	9.80
Rock Bass	S	C	MG	7	7.00	8.24	0.11	1.82	15.71
Smallmouth Bass	F	C	MG M	6	6.00	7.06	0.79	13.08	131.67
Bluegill Sunfish	S	I	MG P	1	1.00	1.18	0.01	0.08	5.00
Pumpkinseed Sunfish	S	I	MG P	1	1.00	1.18	0.01	0.13	8.00
Yellow Perch			MG	2	2.00	2.35	0.00	0.03	1.00
<i>Date Total</i>				85	85.00		6.04		
<i>Number of Species</i>				9					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/06/2008
River Mile: 217.60	Location: DST Ryegate dam	Invalid Sample:
Time Fished: 2645 sec	Drainage: 2224.7 sq mi	Data Source: 99
Dist Fished: 1.00 km	Basin: Connecticut River	Sampler Type: A
	Lat: 44.203000	Lat: -72.058510

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	FD T	2	2.00	5.41	1.08	37.42	537.50
Longnose Dace	N	I	FS R	1	1.00	2.70	0.01	0.35	10.00
Common Shiner	N	I	FD	1	1.00	2.70	0.01	0.28	8.00
Brown Bullhead		I	MG T	3	3.00	8.11	0.11	3.83	36.67
Rock Bass	S	C	MG	11	11.00	29.73	0.65	22.62	59.09
Smallmouth Bass	F	C	MG M	1	1.00	2.70	0.03	0.87	25.00
Largemouth Bass	F	C	MG	2	2.00	5.41	0.14	4.87	70.00
Bluegill Sunfish	S	I	MG P	6	6.00	16.22	0.33	11.49	55.00
Pumpkinseed Sunfish	S	I	MG P	8	8.00	21.62	0.50	17.40	62.50
Yellow Perch			MG	2	2.00	5.41	0.03	0.87	12.50
<i>Date Total</i>				37	37.00		2.87		
<i>Number of Species</i>				10					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/06/2008
River Mile: 213.10	Location: DST Amonoosuc River confluence/ DST SR	Invalid Sample:
Time Fished: 2128 sec	Drainage: 2749.4 sq mi	Depth: 570
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 44.149860	Lat: -72.042750

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	FD T	8	8.00	21.62	1.21	87.13	150.63
Longnose Dace	N	I	FS R	2	2.00	5.41	0.02	1.45	10.00
Fallfish	N		FD	7	7.00	18.92	0.03	2.17	4.29
Eastern Banded Killifish	E	I	MG T	1	1.00	2.70	0.01	0.72	10.00
Smallmouth Bass	F	C	MG M	13	13.00	35.14	0.08	5.42	5.77
Bluegill Sunfish	S	I	MG P	1	1.00	2.70	0.01	0.72	10.00
Yellow Perch			MG	3	3.00	8.11	0.02	1.45	6.67
Tesselated Darter	D	I		2	2.00	5.41	0.01	0.94	6.50
<i>Date Total</i>				37	37.00		1.38		
<i>Number of Species</i>				8					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/05/2008
River Mile: 200.70	Location: UST old bridge piers, near Bedell Bridge State	Invalid Sample:
Time Fished: 2427 sec	Drainage: 2824.1 sq mi	Depth: 400
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 44.047980	Lat: -72.066360
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	FD T	4	4.00	6.56	0.03	15.63	7.50
Spottail Shiner	N	I	MG P	20	20.00	32.79	0.02	12.50	1.20
Fallfish	N		FD	24	24.00	39.34	0.03	15.63	1.25
Brown Bullhead		I	MG T	1	1.00	1.64	0.04	20.83	40.00
Bluegill Sunfish	S	I	MG P	2	2.00	3.28	0.01	4.17	4.00
Pumpkinseed Sunfish	S	I	MG P	4	4.00	6.56	0.02	10.42	5.00
Yellow Perch			MG	2	2.00	3.28	0.02	10.42	10.00
Tessellated Darter	D	I		4	4.00	6.56	0.02	10.42	5.00
<i>Date Total</i>				61	61.00		0.19		
<i>Number of Species</i>				8					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/06/2008
River Mile: 194.40	Location: DST Bradford, NH WWTP	Invalid Sample:
Time Fished: 2298 sec	Drainage: 3018.4 sq mi	Depth: 350
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.989820	Lat: -72.114220
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Spottail Shiner	N	I	MG P	3	3.00	7.50	0.01	1.56	4.00
Fallfish	N		FD	16	16.00	40.00	0.03	3.25	1.56
Rock Bass	S	C	MG	3	3.00	7.50	0.07	9.09	23.33
Smallmouth Bass	F	C	MG M	3	3.00	7.50	0.54	70.13	180.00
Pumpkinseed Sunfish	S	I	MG P	7	7.00	17.50	0.08	9.74	10.71
Yellow Perch			MG	4	4.00	10.00	0.03	3.25	6.25
Tessellated Darter	D	I		4	4.00	10.00	0.02	2.99	5.75
<i>Date Total</i>				40	40.00		0.77		
<i>Number of Species</i>				7					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/04/2008
River Mile: 179.20	Location: DST N. Thetford boat ramp/ near E. Thetford,	Invalid Sample:
Time Fished: 2100 sec	Drainage: 3137.1 sq mi	Depth: 610
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.833560	Lat: -72.180910
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Rock Bass	S	C	MG	1	1.00	5.88	0.06	10.89	55.00
Smallmouth Bass	F	C	MG M	1	1.00	5.88	0.28	55.45	280.00
Largemouth Bass	F	C	MG	2	2.00	11.76	0.02	2.97	7.50
Yellow Perch			MG	13	13.00	76.47	0.16	30.69	11.92
	<i>Date Total</i>			17	17.00		0.51		
	<i>Number of Species</i>			4					
	<i>Number of Hybrids</i>			0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/04/2008
River Mile: 170.90	Location: UST Hanover, NH	Invalid Sample:
Time Fished: 2378 sec	Drainage: 3317.3 sq mi	Depth: 730
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.739310	Lat: -72.249600
		Data Source: 99
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Chain Pickerel	E	P	MG	2	2.00	4.65	0.09	10.47	45.00
Mimic Shiner	N	I	FD I	1	1.00	2.33	0.00	0.23	2.00
Bridle Shiner	N	I		4	4.00	9.30	0.02	1.98	4.25
Rock Bass	S	C	MG	1	1.00	2.33	0.00	0.47	4.00
Largemouth Bass	F	C	MG	7	7.00	16.28	0.05	5.81	7.14
Bluegill Sunfish	S	I	MG P	10	10.00	23.26	0.02	1.98	1.70
Pumpkinseed Sunfish	S	I	MG P	1	1.00	2.33	0.05	5.81	50.00
Yellow Perch			MG	17	17.00	39.53	0.63	73.26	37.06
<i>Date Total</i>				43	43.00		0.86		
<i>Number of Species</i>				8					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/11/2008
River Mile: 166.30	Location: DST Hanover, NH WWTP	Invalid Sample:
Time Fished: 2920 sec	Drainage: 3368.5 sq mi	Depth: 360
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.694100	Lat: -72.302250

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Chain Pickerel	E	P	MG	1	1.00	2.00	0.04	0.93	40.00
Spottail Shiner	N	I	MG P	1	1.00	2.00	0.00	0.09	4.00
Brown Bullhead		I	MG T	1	1.00	2.00	0.82	19.13	820.00
Eastern Banded Killifish	E	I	MG T	1	1.00	2.00	0.00	0.09	4.00
Rock Bass	S	C	MG	2	2.00	4.00	0.22	5.20	111.50
Smallmouth Bass	F	C	MG M	5	5.00	10.00	2.47	57.51	493.00
Largemouth Bass	F	C	MG	3	3.00	6.00	0.02	0.47	6.67
Yellow Perch			MG	36	36.00	72.00	0.71	16.57	19.72
<i>Date Total</i>				50	50.00		4.29		
<i>Number of Species</i>				8					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 8 /27/2008
River Mile: 165.60	Location: Wilder Dam Impoundment	Invalid Sample:
Time Fished: 4182 sec	Drainage: 3374.7 sq mi	Depth: 200
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.687450	Lat: -72.303090
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Pike	F	P	MG	2	2.00	4.88	3.18	40.54	1,590.00
White Sucker	W	O	FD T	2	2.00	4.88	0.10	1.27	50.00
Common Shiner	N	I	FD	5	5.00	12.20	0.01	0.13	2.00
Black Crappie	S	I	MG	8	8.00	19.51	1.97	25.05	245.63
Smallmouth Bass	F	C	MG M	3	3.00	7.32	1.06	13.51	353.33
Largemouth Bass	F	C	MG	6	6.00	14.63	0.04	0.51	6.67
Yellow Perch			MG	15	15.00	36.59	1.49	18.99	99.33
	<i>Date Total</i>			41	41.00		7.85		
	<i>Number of Species</i>			7					
	<i>Number of Hybrids</i>			0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 8 /27/2008
River Mile: 163.90	Location: DST Wilder Dam	Invalid Sample:
Time Fished: 3922 sec	Drainage: 3378.1 sq mi	Depth: 400
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.663650	Lat: -72.306800
		Sampler Type: A

Species Name / ODNr status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Chain Pickerel	E	P	MG	1	1.00	3.85	0.52	5.57	520.00
Common Shiner	N	I	FD	6	6.00	23.08	0.02	0.21	3.33
Black Crappie	S	I	MG	1	1.00	3.85	0.85	9.10	850.00
Rock Bass	S	C	MG	1	1.00	3.85	0.14	1.50	140.00
Smallmouth Bass	F	C	MG M	12	12.00	46.15	6.01	64.34	501.00
Pumpkinseed Sunfish	S	I	MG P	1	1.00	3.85	0.15	1.61	150.00
Walleye	F	P	MG	2	2.00	7.69	1.65	17.66	825.00
Yellow Perch			MG	1	1.00	3.85	0.00	0.01	1.00
Tesselated Darter	D	I		1	1.00	3.85	0.00	0.01	1.00
<i>Date Total</i>				26	26.00		9.34		
<i>Number of Species</i>				9					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 8 /28/2008
River Mile: 161.50	Location: DST White River/ Hartford and New Lebanon	Invalid Sample:
Time Fished: 3900 sec	Drainage: 4286.1 sq mi	Depth: 300
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.635130	Lat: -72.327960

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	3	3.00	1.64	0.02	0.46	6.67
White Sucker	W	O	FD T	74	74.00	40.44	1.16	26.40	15.68
Common Shiner	N	I	FD	12	12.00	6.56	0.04	0.91	3.33
Fallfish	N		FD	5	5.00	2.73	0.05	1.14	10.00
Eastern Banded Killifish	E	I	MG T	1	1.00	0.55	0.00	0.05	2.00
Black Crappie	S	I	MG	1	1.00	0.55	0.03	0.68	30.00
Rock Bass	S	C	MG	9	9.00	4.92	0.06	1.37	6.67
Smallmouth Bass	F	C	MG M	52	52.00	28.42	2.95	67.14	56.73
Pumpkinseed Sunfish	S	I	MG P	20	20.00	10.93	0.07	1.52	3.33
Yellow Perch			MG	4	4.00	2.19	0.01	0.30	3.33
Tessellated Darter	D	I		2	2.00	1.09	0.00	0.05	1.00
<i>Date Total</i>				183	183.00		4.39		
<i>Number of Species</i>				11					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 8 /28/2008
River Mile: 155.60	Location: Near N. Hartland, VT	Invalid Sample:
Time Fished: 4461 sec	Drainage: 4555.4 sq mi	Depth: 300
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.575590	Lat: -72.378170
		Data Source: 99
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Pike	F	P	MG	2	2.00	1.71	0.52	5.51	260.00
White Sucker	W	O	FD T	23	23.00	19.66	2.23	23.57	96.78
Creek Chub	N	G	FS T	1	1.00	0.85	0.00	0.02	2.00
Common Shiner	N	I	FD	3	3.00	2.56	0.00	0.02	0.67
Fallfish	N		FD	68	68.00	58.12	0.21	2.22	3.09
Eastern Banded Killifish	E	I	MG T	1	1.00	0.85	0.00	0.02	2.00
Rock Bass	S	C	MG	1	1.00	0.85	0.00	0.01	1.00
Smallmouth Bass	F	C	MG M	11	11.00	9.40	6.48	68.55	588.64
Largemouth Bass	F	C	MG	1	1.00	0.85	0.00	0.03	3.00
Tesselated Darter	D	I		6	6.00	5.13	0.00	0.04	0.67
<i>Date Total</i>				117	117.00		9.45		
<i>Number of Species</i>				10					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 8 /29/2008
River Mile: 153.80	Location: North of Windsor near N. Hartland, VT	Invalid Sample:
Time Fished: 4100 sec	Drainage: 4558.1 sq mi	Depth:
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.548640	Lat: -72.379400
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	2	2.00	11.11	0.01	0.08	4.00
Rainbow Trout	E		FD	2	2.00	11.11	1.85	19.11	925.00
Atlantic Salmon	E		A	1	1.00	5.56	0.05	0.52	50.00
Eastern Blacknose Dace	N			1	1.00	5.56	0.00	0.01	1.00
Smallmouth Bass	F	C	MG M	12	12.00	66.67	7.77	80.28	647.58
<i>Date Total</i>				18	18.00		9.68		
<i>Number of Species</i>				5					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 8 /29/2008
River Mile: 148.50	Location: DST WWTP, Windsor, VT	Invalid Sample:
Time Fished: 3912 sec	Drainage: 4689.1 sq mi	Depth: 300
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.473030	Lat: -72.385290
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	4	4.00	1.56	0.04	0.33	10.00
White Sucker	W	O	FD T	16	16.00	6.25	8.02	65.36	500.94
Fallfish	N		FD	86	86.00	33.59	0.22	1.79	2.56
Rock Bass	S	C	MG	8	8.00	3.13	0.85	6.93	106.25
Smallmouth Bass	F	C	MG M	128	128.00	50.00	3.02	24.63	23.59
Yellow Perch			MG	9	9.00	3.52	0.11	0.88	12.00
Tessellated Darter	D	I		5	5.00	1.95	0.01	0.08	2.00
<i>Date Total</i>				256	256.00		12.26		
<i>Number of Species</i>				7					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 8 /30/2008
River Mile: 144.40	Location: South of Windsor near Cornish/Claremont	Invalid Sample:
Time Fished: 4019 sec	Drainage: 4694.1 sq mi	Depth: 400
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.428030	Lat: -72.394740
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	4	4.00	1.35	0.03	0.99	6.25
Chain Pickerel	E	P	MG	1	1.00	0.34	0.24	9.49	240.00
White Sucker	W	O	FD T	33	33.00	11.15	0.07	2.57	1.97
Fallfish	N		FD	102	102.00	34.46	0.16	6.13	1.52
Rock Bass	S	C	MG	34	34.00	11.49	0.74	29.10	21.64
Smallmouth Bass	F	C	MG M	98	98.00	33.11	1.04	41.12	10.61
Redbreast Sunfish	S		MG	1	1.00	0.34	0.20	7.91	200.00
Yellow Perch			MG	10	10.00	3.38	0.03	1.19	3.00
Tesselated Darter	D	I		13	13.00	4.39	0.04	1.50	2.92
<i>Date Total</i>				296	296.00		2.53		
<i>Number of Species</i>				9					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 8 /30/2008
River Mile: 139.50	Location: DST Claremont WWTP trib.	Invalid Sample:
Time Fished: 4062 sec	Drainage: 4992.1 sq mi	Depth: 300
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.360380	Lat: -72.407130
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	3	3.00	1.49	0.02	0.62	6.67
Northern Pike	F	P	MG	1	1.00	0.50	0.08	2.50	80.00
White Sucker	W	O	FD T	47	47.00	23.38	0.60	18.73	12.77
Fallfish	N		FD	18	18.00	8.96	0.06	1.87	3.33
Rock Bass	S	C	MG	26	26.00	12.94	1.07	33.40	41.15
Smallmouth Bass	F	C	MG M	77	77.00	38.31	1.28	39.95	16.62
Walleye	F	P	MG	1	1.00	0.50	0.00	0.12	4.00
Yellow Perch			MG	7	7.00	3.48	0.04	1.25	5.71
Tesselated Darter	D	I		21	21.00	10.45	0.05	1.56	2.38
<i>Date Total</i>				201	201.00		3.20		
<i>Number of Species</i>				9					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 8 /30/2008
River Mile: 137.40	Location: UST Weathersfield	Invalid Sample:
Time Fished: 3702 sec	Drainage: 4997.1 sq mi	Data Source: 99
Dist Fished: 1.00 km	Basin: Connecticut River	Sampler Type: A
	Lat: 43.345680	Lat: -72.400690

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	19	19.00	13.10	0.11	4.32	5.79
White Sucker	W	O	FD T	21	21.00	14.48	0.09	3.34	4.05
Fallfish	N		FD	12	12.00	8.28	0.11	4.32	9.17
Rock Bass	S	C	MG	9	9.00	6.21	0.09	3.69	10.44
Smallmouth Bass	F	C	MG M	67	67.00	46.21	2.06	80.78	30.67
Yellow Perch			MG	5	5.00	3.45	0.06	2.36	12.00
Tessellated Darter	D	I		12	12.00	8.28	0.03	1.18	2.50
<i>Date Total</i>				145	145.00		2.54		
<i>Number of Species</i>				7					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 8 /31/2008
River Mile: 133.20	Location: DST Glidden Island, NH	Invalid Sample:
Time Fished: 4128 sec	Drainage: 5038.1 sq mi	Depth: 100
Dist Fished: 0.70 km	Basin: Connecticut River	Flow: C
	Lat: 43.283540	Lat: -72.406570

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	FD T	42	60.00	11.14	1.03	35.62	17.14
Common Shiner	N	I	FD	253	361.43	67.11	0.46	15.84	1.26
Fallfish	N		FD	15	21.43	3.98	0.29	9.91	13.33
Rock Bass	S	C	MG	11	15.72	2.92	0.39	13.37	24.55
Smallmouth Bass	F	C	MG M	28	40.00	7.43	0.13	4.47	3.21
Largemouth Bass	F	C	MG	6	8.57	1.59	0.05	1.73	5.83
Pumpkinseed Sunfish	S	I	MG P	1	1.43	0.27	0.01	0.49	10.00
Redbreast Sunfish	S		MG	1	1.43	0.27	0.50	17.33	350.00
Yellow Perch			MG	3	4.29	0.80	0.01	0.24	1.67
Tesselated Darter	D	I		17	24.29	4.51	0.03	1.00	1.18
<i>Date Total</i>				377	538.57		2.89		
<i>Number of Species</i>				10					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 8 /31/2008
River Mile: 131.40	Location: UST Black River confluence and Charlestown,	Invalid Sample:
Time Fished: 4152 sec	Drainage: 5051.2 sq mi	Depth: 300
Dist Fished: 0.69 km	Basin: Connecticut River	Flow: C
	Lat: 43.262190	Lat: -72.422530

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	2	2.90	0.59	0.01	0.08	5.00
White Sucker	W	O	FD T	18	26.09	5.34	1.88	11.07	72.22
Common Shiner	N	I	FD	111	160.87	32.94	0.23	1.36	1.44
Fallfish	N		FD	14	20.29	4.15	0.26	1.53	12.86
Rock Bass	S	C	MG	8	11.59	2.37	0.80	4.72	69.38
Smallmouth Bass	F	C	MG M	18	26.09	5.34	0.32	1.87	12.22
Largemouth Bass	F	C	MG	42	60.87	12.46	3.13	18.39	51.43
Bluegill Sunfish	S	I	MG P	17	24.64	5.04	5.90	34.68	239.59
Pumpkinseed Sunfish	S	I	MG P	11	15.94	3.26	1.79	10.52	112.36
Yellow Perch			MG	84	121.74	24.93	2.65	15.58	21.79
Tessellated Darter	D	I		12	17.39	3.56	0.03	0.17	1.67
<i>Date Total</i>				337	488.41		17.02		
<i>Number of Species</i>				11					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 8 /31/2008
River Mile: 125.60	Location: DST Charlestown WWTP	Invalid Sample:
Time Fished: 3641 sec	Drainage: 5278.6 sq mi	Depth: 200
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.193280	Lat: -72.443930
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Chain Pickerel	E	P	MG	1	1.00	0.75	0.18	7.58	180.00
White Sucker	W	O	FD T	1	1.00	0.75	0.01	0.21	5.00
Golden Shiner	N	I	MG T	1	1.00	0.75	0.02	0.84	20.00
Common Shiner	N	I	FD	51	51.00	38.35	0.10	4.21	1.96
Fallfish	N		FD	6	6.00	4.51	0.05	1.89	7.50
Rock Bass	S	C	MG	14	14.00	10.53	0.31	12.84	21.79
Smallmouth Bass	F	C	MG M	21	21.00	15.79	0.05	2.11	2.38
Largemouth Bass	F	C	MG	11	11.00	8.27	0.10	4.21	9.09
Bluegill Sunfish	S	I	MG P	3	3.00	2.26	0.21	8.84	70.00
Pumpkinseed Sunfish	S	I	MG P	2	2.00	1.50	0.45	18.95	225.00
Yellow Perch			MG	22	22.00	16.54	0.91	38.32	41.36
<i>Date Total</i>				133	133.00		2.38		
<i>Number of Species</i>				11					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/03/2008
River Mile: 121.90	Location: UST N. Walpole Dam/(dam pool)	Invalid Sample:
Time Fished: 2484 sec	Drainage: 5410.1 sq mi	Depth: 360
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.147090	Lat: -72.457030
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Chain Pickerel	E	P	MG	4	4.00	3.60	0.41	3.82	102.50
Northern Pike	F	P	MG	1	1.00	0.90	3.14	29.22	3,140.00
Golden Shiner	N	I	MG T	16	16.00	14.41	0.05	0.47	3.13
Spottail Shiner	N	I	MG P	14	14.00	12.61	0.03	0.28	2.14
Brown Bullhead		I	MG T	1	1.00	0.90	0.82	7.63	820.00
Smallmouth Bass	F	C	MG M	1	1.00	0.90	0.56	5.21	560.00
Largemouth Bass	F	C	MG	11	11.00	9.91	4.04	37.60	367.27
Bluegill Sunfish	S	I	MG P	42	42.00	37.84	0.07	0.65	1.67
Pumpkinseed Sunfish	S	I	MG P	3	3.00	2.70	0.66	6.14	220.00
Yellow Perch			MG	18	18.00	16.22	0.97	8.98	53.61
<i>Date Total</i>				111	111.00		10.75		
<i>Number of Species</i>				10					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 09/01/2008
River Mile: 116.20	Location: DST Belows Falls Dam	Invalid Sample:
Time Fished: 4214 sec	Drainage: 5611.1 sq mi	Depth: 200
Dist Fished: 0.69 km	Basin: Connecticut River	Flow: C
	Lat: 43.078370	Lat: -72.437460
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	5	7.25	2.28	0.04	1.17	6.00
Brown Trout	E		FS	1	1.45	0.46	0.44	11.86	300.00
Chain Pickerel	E	P	MG	3	4.35	1.37	1.13	30.82	260.00
White Sucker	W	O	FD T	10	14.49	4.57	0.20	5.51	14.00
Common Shiner	N	I	FD	60	86.96	27.40	0.17	4.75	2.00
Fallfish	N		FD	71	102.90	32.42	1.06	28.85	10.28
Rock Bass	S	C	MG	6	8.70	2.74	0.19	5.13	21.67
Smallmouth Bass	F	C	MG M	53	76.81	24.20	0.33	9.08	4.34
Yellow Perch			MG	6	8.70	2.74	0.07	1.96	8.33
Tesselated Darter	D	I		4	5.80	1.83	0.03	0.79	5.00
<i>Date Total</i>				219	317.39		3.67		
<i>Number of Species</i>				10					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 9 /01/2008
River Mile: 114.70	Location: DST Bellows Falls WWTP	Invalid Sample:
Time Fished: 3871 sec	Drainage: 5614.1 sq mi	Depth: 200
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 43.060610	Lat: -72.457770
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	1	1.00	0.58	0.02	0.24	20.00
American Shad	N	P	A	1	1.00	0.58	0.00	0.04	3.00
Rainbow Trout	E		FD	1	1.00	0.58	0.22	2.63	220.00
Chain Pickerel	E	P	MG	1	1.00	0.58	0.03	0.36	30.00
White Sucker	W	O	FD T	7	7.00	4.07	0.02	0.29	3.43
Common Shiner	N	I	FD	64	64.00	37.21	0.13	1.55	2.03
Fallfish	N		FD	56	56.00	32.56	0.17	1.97	2.95
Rock Bass	S	C	MG	5	5.00	2.91	0.34	4.07	68.20
Smallmouth Bass	F	C	MG M	30	30.00	17.44	7.21	86.05	240.17
Largemouth Bass	F	C	MG	3	3.00	1.74	0.06	0.66	18.33
Bluegill Sunfish	S	I	MG P	1	1.00	0.58	0.12	1.43	120.00
Yellow Perch			MG	2	2.00	1.16	0.06	0.72	30.00
<i>Date Total</i>				172	172.00		8.37		
<i>Number of Species</i>				12					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 9 /02/2008
River Mile: 105.70	Location: Near Westminster, VT	Invalid Sample:
Time Fished: 3798 sec	Drainage: 5705.2 sq mi	Depth: 300
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 42.968520	Lat: -72.491170
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Chain Pickerel	E	P	MG	1	1.00	0.92	0.10	7.97	100.00
White Sucker	W	O	FD T	2	2.00	1.83	0.32	25.50	160.00
Common Shiner	N	I	FD	9	9.00	8.26	0.01	0.72	1.00
Fallfish	N		FD	59	59.00	54.13	0.12	9.24	1.97
White Catfish	E	I	MG	1	1.00	0.92	0.07	5.58	70.00
Smallmouth Bass	F	C	MG M	32	32.00	29.36	0.59	46.69	18.31
Largemouth Bass	F	C	MG	3	3.00	2.75	0.05	3.98	16.67
Tesselated Darter	D	I		2	2.00	1.83	0.00	0.32	2.00
<i>Date Total</i>				109	109.00		1.26		
<i>Number of Species</i>				8					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 9 /02/2008
River Mile: 102.30	Location: DST Putney, VT	Invalid Sample:
Time Fished: 3649 sec	Drainage: 5731.8 sq mi	Depth: 200
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 42.941390	Lat: -72.525150
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	5	5.00	5.95	0.03	0.63	6.00
White Sucker	W	O	FD T	5	5.00	5.95	1.86	39.15	371.40
Common Shiner	N	I	FD	3	3.00	3.57	0.01	0.13	2.00
Fallfish	N		FD	24	24.00	28.57	0.08	1.69	3.33
Black Crappie	S	I	MG	1	1.00	1.19	0.30	6.33	300.00
Rock Bass	S	C	MG	1	1.00	1.19	0.02	0.38	18.00
Smallmouth Bass	F	C	MG M	13	13.00	15.48	1.86	39.28	143.31
Largemouth Bass	F	C	MG	5	5.00	5.95	0.07	1.48	14.00
Bluegill Sunfish	S	I	MG P	1	1.00	1.19	0.05	0.95	45.00
Yellow Perch			MG	26	26.00	30.95	0.47	9.99	18.23
	<i>Date Total</i>			84	84.00		4.74		
	<i>Number of Species</i>			10					
	<i>Number of Hybrids</i>			0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 9 /02/2008
River Mile: 97.60	Location: UST West River confluence and Brattleboro,	Invalid Sample:
Time Fished: 3841 sec	Drainage: 5765.4 sq mi	Depth: 300
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 42.885620	Lat: -72.551510
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Rock Bass	S	C	MG	2	2.00	2.63	0.06	1.42	30.00
Smallmouth Bass	F	C	MG M	24	24.00	31.58	2.17	51.53	90.42
Largemouth Bass	F	C	MG	3	3.00	3.95	0.05	1.19	16.67
Bluegill Sunfish	S	I	MG P	4	4.00	5.26	0.72	17.10	180.00
Pumpkinseed Sunfish	S	I	MG P	1	1.00	1.32	0.02	0.47	20.00
Yellow Perch			MG	41	41.00	53.95	1.19	28.16	28.93
Tessellated Darter	D	I		1	1.00	1.32	0.01	0.12	5.00
<i>Date Total</i>				76	76.00		4.21		
<i>Number of Species</i>				7					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/03/2008
River Mile: 92.50	Location: DST Brattleboro, VT WWTP	Invalid Sample:
Time Fished: 3335 sec	Drainage: 6244.0 sq mi	Depth: 340
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 42.815550	Lat: -72.542070
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	3	3.00	1.36	0.06	0.37	20.00
American Shad	N	P	A	2	2.00	0.91	0.03	0.18	15.00
Chain Pickerel	E	P	MG	3	3.00	1.36	0.66	4.03	220.00
White Sucker	W	O	FD T	1	1.00	0.45	1.00	6.10	1,000.00
Golden Shiner	N	I	MG T	34	34.00	15.45	0.29	1.77	8.53
Spottail Shiner	N	I	MG P	67	67.00	30.45	0.29	1.77	4.33
Black Crappie	S	I	MG	3	3.00	1.36	0.16	0.98	53.33
Rock Bass	S	C	MG	2	2.00	0.91	0.23	1.40	115.00
Largemouth Bass	F	C	MG	10	10.00	4.55	9.67	58.99	966.60
Bluegill Sunfish	S	I	MG P	15	15.00	6.82	0.69	4.21	46.00
Pumpkinseed Sunfish	S	I	MG P	4	4.00	1.82	0.21	1.28	52.50
Yellow Perch			MG	76	76.00	34.55	3.10	18.92	40.79
<i>Date Total</i>				220	220.00		16.39		
<i>Number of Species</i>				12					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/02/2008
River Mile: 90.10	Location: UST Vermont Yankee Entergy thermal	Invalid Sample:
Time Fished: 3921 sec	Drainage: 6257.1 sq mi	Depth: 270
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 42.787470	Lat: -72.514150
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
American Shad	N	P	A	7	7.00	4.46	0.04	0.49	5.71
Chain Pickerel	E	P	MG	2	2.00	1.27	0.05	0.59	24.00
Common Carp	G	O	MG T	1	1.00	0.64	3.35	40.91	3,350.00
Golden Shiner	N	I	MG T	10	10.00	6.37	0.06	0.67	5.50
Spottail Shiner	N	I	MG P	65	65.00	41.40	0.17	2.08	2.62
Black Crappie	S	I	MG	3	3.00	1.91	0.54	6.60	180.00
Largemouth Bass	F	C	MG	8	8.00	5.10	1.27	15.51	158.75
Bluegill Sunfish	S	I	MG P	12	12.00	7.64	0.38	4.64	31.67
Pumpkinseed Sunfish	S	I	MG P	10	10.00	6.37	0.75	9.10	74.50
Yellow Perch			MG	39	39.00	24.84	1.59	19.42	40.77
<i>Date Total</i>				157	157.00		8.19		
<i>Number of Species</i>				10					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/02/2008
River Mile: 89.00	Location: At and DST mixing zone thermal discharge	Invalid Sample:
Time Fished: 2815 sec	Drainage: 6258.9 sq mi	Depth: 460
Dist Fished: 0.66 km	Basin: Connecticut River	Flow: C
	Lat: 42.774420	Lat: -72.511340
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
American Shad	N	P	A	1	1.52	0.51	0.01	0.09	8.00
White Sucker	W	O	FD T	3	4.55	1.54	0.06	0.44	13.33
Spottail Shiner	N	I	MG P	58	87.88	29.74	0.27	1.96	3.10
Yellow Bullhead		I	MG T	97	146.97	49.74	0.09	0.65	0.62
American Eel [T]		C	C	1	1.52	0.51	2.06	14.81	1,360.00
Black Crappie	S	I	MG	3	4.55	1.54	0.42	3.00	92.00
Rock Bass	S	C	MG	1	1.52	0.51	0.02	0.11	10.00
Smallmouth Bass	F	C	MG M	2	3.03	1.03	4.56	32.77	1,505.00
Largemouth Bass	F	C	MG	5	7.58	2.56	5.06	36.36	668.00
Bluegill Sunfish	S	I	MG P	10	15.15	5.13	0.04	0.25	2.30
Pumpkinseed Sunfish	S	I	MG P	11	16.67	5.64	0.27	1.96	16.36
Yellow Perch			MG	3	4.55	1.54	1.06	7.62	233.33
<i>Date Total</i>				195	295.46		13.92		
<i>Number of Species</i>				12					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/03/2008
River Mile: 88.40	Location: DST Vernon Dam Vernon, VT	Invalid Sample:
Time Fished: 3617 sec	Drainage: 6265.2 sq mi	Depth: 120
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 42.766830	Lat: -72.514090
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	23	23.00	32.39	0.12	2.06	5.22
Chain Pickerel	E	P	MG	2	2.00	2.82	0.31	5.33	155.00
White Sucker	W	O	FD T	1	1.00	1.41	1.18	20.29	1,180.00
Spottail Shiner	N	I	MG P	2	2.00	2.82	0.01	0.17	5.00
Fallfish	N		FD	5	5.00	7.04	0.23	3.96	46.00
Rock Bass	S	C	MG	2	2.00	2.82	0.10	1.72	50.00
Smallmouth Bass	F	C	MG M	28	28.00	39.44	2.07	35.51	73.75
Largemouth Bass	F	C	MG	1	1.00	1.41	0.02	0.34	20.00
Bluegill Sunfish	S	I	MG P	1	1.00	1.41	0.14	2.41	140.00
Walleye	F	P	MG	1	1.00	1.41	1.48	25.45	1,480.00
Yellow Perch			MG	5	5.00	7.04	0.16	2.75	32.00
<i>Date Total</i>				71	71.00		5.82		
<i>Number of Species</i>				11					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/01/2008
River Mile: 83.30	Location: UST Northfield, NH WWTP/UST Pauchaug	Invalid Sample:
Time Fished: 3040 sec	Drainage: 6694.5 sq mi	Depth: 200
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 42.730850	Lat: -72.456870
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	2	2.00	22.22	0.02	1.41	9.50
White Sucker	W	O	FD T	1	1.00	11.11	0.18	12.97	175.00
Rock Bass	S	C	MG	1	1.00	11.11	0.01	0.89	12.00
Smallmouth Bass	F	C	MG M	4	4.00	44.44	1.14	84.14	283.75
Yellow Perch			MG	1	1.00	11.11	0.01	0.59	8.00
	<i>Date Total</i>			9	9.00		1.35		
	<i>Number of Species</i>			5					
	<i>Number of Hybrids</i>			0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/02/2008
River Mile: 79.20	Location: UST SR 10 bridge	Invalid Sample:
Time Fished: 2967 sec	Drainage: 6721.2 sq mi	Depth: 370
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 42.682380	Lat: -72.471910
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	3	3.00	15.00	0.02	1.08	6.67
Chain Pickerel	E	P	MG	1	1.00	5.00	0.20	10.78	200.00
Fallfish	N		FD	1	1.00	5.00	0.04	2.16	40.00
Rock Bass	S	C	MG	2	2.00	10.00	0.04	2.16	20.00
Smallmouth Bass	F	C	MG M	8	8.00	40.00	1.44	77.63	180.00
Largemouth Bass	F	C	MG	1	1.00	5.00	0.06	3.23	60.00
Bluegill Sunfish	S	I	MG P	1	1.00	5.00	0.02	0.81	15.00
Pumpkinseed Sunfish	S	I	MG P	3	3.00	15.00	0.04	2.16	13.33
<i>Date Total</i>				20	20.00		1.86		
<i>Number of Species</i>				8					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 10/01/2008
River Mile: 72.20	Location: UST King of France Bridge, Turner's Falls,	Invalid Sample:
Time Fished: 4176 sec	Drainage: 7150.1 sq mi	Depth: 590
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 42.596510	Lat: -72.496970
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Sea Lamprey	E	P	A	3	3.00	4.00	0.03	0.64	8.67
American Shad	N	P	A	1	1.00	1.33	0.01	0.20	8.00
White Sucker	W	O	FD T	4	4.00	5.33	1.13	27.73	282.50
Golden Shiner	N	I	MG T	2	2.00	2.67	0.02	0.44	9.00
Spottail Shiner	N	I	MG P	14	14.00	18.67	0.11	2.58	7.50
Fallfish	N		FD	8	8.00	10.67	0.07	1.60	8.13
American Eel [T]		C	C	1	1.00	1.33	1.05	25.77	1,050.00
Rock Bass	S	C	MG	3	3.00	4.00	0.10	2.45	33.33
Smallmouth Bass	F	C	MG M	17	17.00	22.67	0.89	21.87	52.41
Largemouth Bass	F	C	MG	1	1.00	1.33	0.07	1.60	65.00
Bluegill Sunfish	S	I	MG P	5	5.00	6.67	0.34	8.22	67.00
Pumpkinseed Sunfish	S	I	MG P	7	7.00	9.33	0.14	3.31	19.29
Yellow Perch			MG	9	9.00	12.00	0.15	3.61	16.33
<i>Date Total</i>				75	75.00		4.08		
<i>Number of Species</i>				13					
<i>Number of Hybrids</i>				0					

River Code: 80-001	Stream: Connecticut River	Sample Date: 09/27/2008
River Mile: 68.80	Location: Turners Falls dam pool, Turners Falls, MA	Invalid Sample:
Time Fished: 3712 sec	Drainage: 7152.4 sq mi	Depth: 580
Dist Fished: 1.00 km	Basin: Connecticut River	Flow: C
	Lat: 42.596450	Lat: -72.543740
		Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Target Spec. Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
American Shad	N	P	A	15	15.00	2.63	0.17	1.62	11.33
Chain Pickerel	E	P	MG	1	1.00	0.18	0.05	0.48	50.00
White Sucker	W	O	FD T	22	22.00	3.85	0.33	3.16	15.09
Common Carp	G	O	MG T	1	1.00	0.18	6.30	60.06	6,300.00
Golden Shiner	N	I	MG T	3	3.00	0.53	0.02	0.23	8.00
Spottail Shiner	N	I	MG P	356	356.00	62.35	1.79	17.06	5.03
Rock Bass	S	C	MG	5	5.00	0.88	0.01	0.11	2.40
Smallmouth Bass	F	C	MG M	7	7.00	1.23	0.21	2.00	30.00
Largemouth Bass	F	C	MG	31	31.00	5.43	0.23	2.19	7.42
Bluegill Sunfish	S	I	MG P	16	16.00	2.80	0.36	3.41	22.38
Pumpkinseed Sunfish	S	I	MG P	9	9.00	1.58	0.42	4.00	46.67
Hybrid X Sunfish				1	1.00	0.18	0.01	0.10	10.00
Yellow Perch			MG	103	103.00	18.04	0.58	5.53	5.63
Tessellated Darter	D	I		1	1.00	0.18	0.00	0.04	4.00
<i>Date Total</i>				571	571.00		10.49		
<i>Number of Species</i>				13					
<i>Number of Hybrids</i>				1					

Fish Assemblage and Habitat Assessment of the Upper Connecticut River

Appendix B

Atlantic Slope and Interim Maine Index of Biotic Integrity Scores and Metrics Modified Index of Well-Being Scores

August-October 2008

Appendix Table 1. Atlantic Slope IBI scores and metrics at boat sites in the Connecticut River during 2008 --- DRAFT----

River Mile	Type	Date	Distance (meters)	Drainage area (sq km)	Number of				Percent of Individuals									Relative Abundance	IBI	Original lwb
					Total Native♦ Species	Benth. Insect. species	Water Column Species	Terete. Minnow Species	Gener- alists	Insect- ivores	Top Carni- vores	Domi- nant Species	Adult & Juveniles Classes	White Suckers	DELT anomalies					
Connecticut River - (80001)																				
Year: 2008																				
68.80	A	09/27/2008	1000	18524	12(3)	1(1)	1(1)	1(1)	9.1(5)	63(5)	26(5)	80.4(1)	25.0(3)	3.9(3)	0.0(5)	571(5)	42	7.1		
72.20	A	10/01/2008	1000	18518	12(3)	0(1)	1(1)	1(1)	34.7(3)	19(1)	41(5)	30.7(5)	42.9(5)	5.3(3)	1.3(1)	75(3)	32	6.9		
79.20	A	10/02/2008	1000	17407	7(1)	0(1)	0(1)	0(1)	25.0(3)	0(1)	60(5)	35.0(5)	33.3(3)	0.0(5)	0.0(5)	20(1)	32	4.5		
83.30	A	10/01/2008	1000	17338	4(1)	0(1)	0(1)	0(1)	11.1(5)	0(1)	67(5)	44.4(3)	66.7(5)	11.1(3)	0.0(5)	9(1)	34	3.2		
88.40	A	10/03/2008	1000	16226	10(3)	0(1)	1(1)	1(1)	9.9(5)	3(1)	55(5)	63.4(1)	20.0(3)	1.4(5)	0.0(5)	71(3)	38	6.2		
89.00	A	10/02/2008	660	16210	12(3)	0(1)	1(1)	1(1)	62.1(1)	30(3)	8(5)	79.5(1)	20.0(3)	1.5(5)	0.0(5)	295(5)	38	7.1		
90.10	A	10/02/2008	1000	16205	9(3)	0(1)	1(1)	1(1)	21.0(3)	41(3)	33(5)	66.2(1)	50.0(5)	0.0(5)	0.0(5)	157(3)	40	7.0		
92.50	A	10/03/2008	1000	16171	11(3)	0(1)	1(1)	1(1)	24.6(3)	30(3)	43(5)	65.0(1)	50.0(5)	0.5(5)	0.5(3)	220(3)	38	7.2		
97.60	A	9/02/2008	1000	14932	7(1)	1(1)	0(1)	0(1)	6.6(5)	1(1)	92(5)	46.1(3)	60.0(5)	0.0(5)	0.0(5)	76(3)	38	5.2		
102.30	A	9/02/2008	1000	14845	9(3)	0(1)	0(1)	1(1)	39.3(3)	0(1)	55(5)	53.6(3)	22.2(3)	6.0(3)	0.0(5)	84(3)	34	6.1		
105.70	A	9/02/2008	1000	14776	8(3)	1(1)	0(1)	1(1)	64.2(1)	2(1)	34(5)	67.0(1)	20.0(3)	1.8(5)	0.0(5)	109(3)	34	4.9		
114.70	A	9/01/2008	1000	14540	10(3)	0(1)	0(1)	1(1)	74.4(1)	0(1)	24(5)	64.5(1)	9.1(1)	4.1(3)	0.0(5)	172(3)	30	5.9		
116.20	A	09/01/2008	690	14532	8(3)	1(1)	0(1)	1(1)	64.4(1)	2(1)	32(5)	51.1(3)	14.3(1)	4.6(3)	0.0(5)	317(5)	32	7.0		
121.90	A	10/03/2008	1000	14012	10(3)	0(1)	1(1)	1(1)	55.9(1)	13(1)	32(5)	54.1(3)	25.0(3)	0.0(5)	0.0(5)	111(3)	34	6.9		
125.60	A	8/31/2008	1000	13671	11(3)	0(1)	0(1)	1(1)	48.1(1)	0(1)	52(5)	54.1(3)	22.2(3)	0.8(5)	0.0(5)	133(3)	34	6.3		
131.40	A	8/31/2008	690	13082	10(3)	1(1)	0(1)	1(1)	50.7(1)	4(1)	45(5)	44.5(3)	55.6(5)	5.3(3)	0.0(5)	488(5)	36	7.7		
133.20	A	8/31/2008	700	13048	10(3)	1(1)	0(1)	1(1)	82.8(1)	5(1)	13(5)	75.1(1)	14.3(1)	11.1(3)	0.0(5)	539(5)	32	6.6		
137.40	A	8/30/2008	1000	12942	6(1)	1(1)	0(1)	0(1)	22.8(3)	8(1)	56(5)	55.9(1)	16.7(3)	14.5(3)	0.0(5)	145(3)	32	5.2		
139.50	A	8/30/2008	1000	12929	8(3)	1(1)	0(1)	0(1)	32.3(3)	10(1)	56(5)	54.2(3)	25.0(3)	23.4(1)	0.0(5)	201(3)	32	6.2		
144.40	A	8/30/2008	1000	12157	8(3)	1(1)	0(1)	0(1)	46.0(1)	4(1)	48(5)	65.2(1)	33.3(3)	11.2(3)	0.3(3)	296(5)	32	6.0		
148.50	A	8/29/2008	1000	12144	6(1)	1(1)	0(1)	0(1)	39.8(3)	2(1)	57(5)	78.9(1)	50.0(5)	6.3(3)	0.4(3)	256(5)	34	5.9		
153.80	A	8/29/2008	1000	11805	3(1)	0(1)	0(1)	1(1)	5.6(5)	0(1)	83(5)	66.7(1)	25.0(3)	0.0(5)	0.0(5)	18(1)	34	4.2		
155.60	A	8/28/2008	1000	11805	10(3)	1(1)	1(1)	2(1)	81.2(1)	6(1)	13(5)	72.7(1)	37.5(3)	19.7(1)	0.0(5)	117(3)	30	5.7		
161.50	A	8/28/2008	1000	11100	10(3)	1(1)	1(1)	1(1)	60.7(1)	2(1)	36(5)	63.9(1)	28.6(3)	40.4(1)	0.0(5)	183(3)	30	5.7		

* - Native species and intra-state exotics

** - Excludes fallfish

Appendix Table 1. Atlantic Slope IBI scores and metrics at boat sites in the Connecticut River during 2008 --- DRAFT----

River Mile	Type	Date	Distance (meters)	Drainage area (sq km)	Number of				Percent of Individuals									Original lwb
					Total Native* Species	Benth. Insect. species	Water Column Species	Terete. Minnow Species	Gener- alists	Insect- ivores	Top Carni- vores	Domi- nant Species	Adult & Juveniles Classes	White Suckers	DELT anomalies	Relative Abundance	IBI	
163.90	A	8 /27/2008	1000	8724	9(3)	1(1)	0(1)	1(1)	26.9(3)	4(1)	69(5)	53.9(3)	16.7(3)	0.0(5)	0.0(5)	26(1)	34	5.5
165.60	A	8 /27/2008	1000	8724	7(3)	0(1)	0(1)	1(1)	17.1(5)	0(1)	83(5)	41.5(3)	14.3(1)	4.9(3)	0.0(5)	41(1)	32	6.0
166.30	A	10/11/2008	1000	8724	8(3)	0(1)	2(1)	1(1)	2.0(5)	4(1)	94(5)	82.0(1)	0.0(1)	0.0(5)	0.0(5)	50(3)	36	4.9
170.90	A	10/04/2008	1000	8591	7(3)	1(1)	1(1)	2(1)	25.6(3)	12(1)	63(5)	62.8(1)	0.0(1)	0.0(5)	0.0(5)	43(1)	32	4.5
179.20	A	10/04/2008	1000	8125	4(1)	0(1)	0(1)	0(1)	0.0(5)	0(1)	100(5)	88.2(1)	0.0(1)	0.0(5)	0.0(5)	17(1)	32	3.2
194.40	A	10/06/2008	1000	7817	7(3)	1(1)	1(1)	1(1)	57.5(1)	18(1)	25(5)	57.5(1)	33.3(3)	0.0(5)	0.0(5)	40(1)	32	4.6
200.70	A	10/05/2008	1000	7314	8(3)	1(1)	1(1)	1(1)	57.4(1)	39(3)	3(3)	72.1(1)	0.0(1)	6.6(3)	0.0(5)	61(3)	28	5.6
213.10	A	10/06/2008	1000	7120	8(3)	2(1)	1(1)	1(1)	43.2(3)	14(1)	43(5)	51.4(3)	50.0(5)	21.6(1)	0.0(5)	37(1)	32	4.3
217.60	A	10/06/2008	1000	5761	10(3)	1(1)	0(1)	2(1)	54.1(1)	3(1)	43(5)	51.4(3)	66.7(5)	5.4(3)	0.0(5)	37(1)	32	5.9
221.70	A	10/07/2008	1000	5713	9(3)	0(1)	0(1)	1(1)	80.0(1)	0(1)	20(5)	68.2(1)	40.0(3)	15.3(1)	0.0(5)	85(3)	30	5.4
227.10	A	10/07/2008	1000	5557	6(1)	2(3)	0(1)	1(1)	62.8(1)	14(1)	23(5)	72.1(1)	20.0(3)	62.8(1)	2.3(1)	43(1)	24	5.4
228.50	A	10/07/2008	1000	4236	11(3)	2(3)	0(1)	0(1)	15.3(5)	3(1)	82(5)	87.6(1)	50.0(5)	4.0(3)	0.0(5)	274(5)	42	6.6
235.90	A	09/07/2008	1000	4180	13(5)	3(3)	0(1)	2(1)	7.6(5)	1(1)	92(5)	84.7(1)	25.0(3)	3.2(3)	0.2(3)	555(5)	40	6.4
243.80	A	09/06/2008	1000	4032	10(3)	1(1)	0(1)	0(1)	49.2(1)	0(1)	51(5)	74.8(1)	50.0(5)	0.7(5)	0.0(5)	543(5)	38	7.4
247.00	A	09/06/2008	1000	3919	12(3)	2(3)	0(1)	1(1)	35.7(3)	2(1)	62(5)	43.5(3)	22.2(3)	26.2(1)	1.8(1)	168(3)	30	7.3
257.90	A	08/30/2008	1000	3445	8(3)	1(1)	0(1)	0(1)	60.2(1)	4(1)	36(5)	48.4(3)	25.0(3)	11.7(3)	0.0(5)	128(3)	32	5.6
267.80	A	10/08/2008	1000	3094	8(3)	1(1)	0(1)	1(1)	88.0(1)	6(1)	6(5)	81.0(1)	0.0(1)	1.4(5)	0.0(5)	142(3)	32	5.6
291.00	A	08/30/2008	1000	1687	7(3)	4(5)	0(1)	1(1)	11.7(5)	82(5)	6(5)	74.5(1)	33.3(3)	8.7(3)	0.0(5)	196(3)	44	6.2
307.10	A	08/29/2008	1000	1263	12(5)	3(3)	0(1)	3(3)	89.3(1)	6(1)	5(3)	56.9(1)	16.7(3)	44.9(1)	0.9(3)	225(3)	30	5.9
313.70	A	08/29/2008	1000	976	11(3)	3(3)	0(1)	4(5)	33.3(3)	59(5)	8(5)	55.8(1)	16.7(3)	18.6(1)	0.8(3)	129(3)	40	7.0
323.60	A	08/28/2008	1000	467	12(5)	4(5)	0(1)	4(5)	33.3(3)	43(3)	23(5)	46.1(3)	20.0(3)	16.3(1)	0.7(3)	141(3)	42	7.8
Westfield River - (80100)																		
Year: 2008																		
15.90	A	07/21/2008	1000	911	8(3)	2(3)	0(1)	1(1)	24.4(3)	1(1)	75(5)	59.6(1)	50.0(5)	4.4(3)	0.0(5)	225(3)	38	7.4
Chicopee River - (80200)																		
Year: 2008																		

* - Native species and intra-state exotics

** - Excludes fallfish

Appendix Table 1. Atlantic Slope IBI scores and metrics at boat sites in the Connecticut River during 2008 --- DRAFT----

				Drainage area (sq km)	Number of				Percent of Individuals								Relative Abundance	IBI	Original lwb
River Mile	Type	Date	Distance (meters)		Total Native♦ Species	Benth. Insect. species	Water Column Species	Terete. Minnow Species	Gener- alists	Insect- ivores	Top Carni- vores	Domi- nant Species	Adult & Juveniles Classes	White Suckers	DELT anomalies				
6.50	A	07/17/2008	1000	1816	11(3)	1(1)	0(1)	0(1)	56.1(1)	2(1)	41(5)	33.2(5)	70.0(5)	6.4(3)	0.6(3)	328(5)	34	8.7	
Deerfield River - (80300)																			
Year: 2008																			
15.00	A	07/20/2008	1000	1307	6(3)	1(1)	1(1)	2(1)	73.6(1)	9(1)	18(5)	80.1(1)	33.3(3)	70.9(1)	2.9(1)	523(5)	28	6.5	
West River - (80400)																			
Year: 2008																			
1.00	A	09/08/2008	1000	1085	11(3)	1(1)	0(1)	1(1)	12.0(5)	52(5)	33(5)	63.4(1)	54.6(5)	4.2(3)	0.0(5)	552(5)	44	8.1	
6.10	A	09/08/2008	1000	1043	9(3)	1(1)	1(1)	3(3)	46.1(1)	11(1)	43(5)	58.5(1)	33.3(3)	5.5(3)	0.5(3)	219(3)	32	6.2	

* - Native species and intra-state exotics

** - Excludes fallfish

Appendix Table 1. Maine IBI scores and metrics at boat sites in the Connecticut River.

River Mile	Type	Date	Distance (meters)	Drainage area (sq mi)	Number of				Percent of Individuals						White & Longnose Sucker (PB)	DELT anomalies	IBI	Modified lwb
					Total Native♦ species	Steno- therm species	Alien species	Non-Guard. Litho- phils	Cyp- rinids**	Native Salmonids	Benthic Olnsect- vores	Black Basses	Fluvial Specialist	Macrohab. Generalists				
Connecticut River - (80001)																		
Year: 2008																		
68.80	A	09/27/2008	1000	7152	6(2.5)	0(0.0)	6(0.0)	1(3.0)	63(9.1)	0(0.0)	0(0.0)	7(6.3)	4(3.1)	93(0.0)	0(0.0)	0.0(10.0)	28	4.5
72.20	A	10/01/2008	1000	7150	8(4.2)	0(0.0)	5(0.0)	1(3.0)	21(6.5)	0(0.0)	0(0.0)	24(3.2)	16(3.9)	77(1.6)	25(5.5)	1.3(0.9)	24	5.6
79.20	A	10/02/2008	1000	6721	4(0.9)	0(0.0)	4(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	45(1.6)	5(3.1)	80(1.3)	0(0.0)	0.0(10.0)	15	3.3
83.30	A	10/01/2008	1000	6694	3(0.0)	0(0.0)	2(3.6)	1(3.0)	0(0.0)	0(0.0)	0(0.0)	44(1.7)	11(3.6)	67(2.6)	0(0.0)	0.0(10.0)	20	2.5
88.40	A	10/03/2008	1000	6265	5(1.7)	0(0.0)	5(0.0)	1(3.0)	3(4.8)	0(0.0)	0(0.0)	41(1.9)	8(3.4)	59(3.3)	17(5.0)	0.0(10.0)	28	5.1
89.00	A	10/02/2008	660	6258	5(1.7)	0(0.0)	6(0.0)	1(3.0)	30(7.2)	0(0.0)	0(0.0)	4(7.8)	2(2.9)	97(0.0)	0(0.0)	0.0(10.0)	27	3.9
90.10	A	10/02/2008	1000	6257	5(1.7)	0(0.0)	5(0.0)	0(0.0)	48(8.4)	0(0.0)	0(0.0)	5(7.0)	0(0.0)	96(0.0)	0(0.0)	0.0(10.0)	23	4.4
92.50	A	10/03/2008	1000	6244	7(3.3)	0(0.0)	5(0.0)	1(3.0)	46(8.3)	0(0.0)	0(0.0)	5(7.3)	0(2.8)	97(0.0)	6(4.1)	0.5(1.4)	25	4.0
97.60	A	9 /02/2008	1000	5765	2(0.0)	0(0.0)	4(0.5)	0(0.0)	0(0.0)	0(0.0)	1(0.1)	36(2.2)	1(2.9)	99(0.0)	0(0.0)	0.0(10.0)	13	2.3
102.30	A	9 /02/2008	1000	5731	5(1.7)	0(0.0)	5(0.0)	2(5.7)	4(4.8)	0(0.0)	0(0.0)	21(3.5)	38(5.6)	56(3.6)	21(5.2)	0.0(10.0)	33	5.2
105.70	A	9 /02/2008	1000	5705	4(0.9)	0(0.0)	3(1.7)	2(5.7)	8(5.3)	0(0.0)	2(0.2)	32(2.5)	66(7.6)	34(5.7)	0(0.0)	0.0(10.0)	33	4.5
114.70	A	9 /01/2008	1000	5614	7(3.3)	1(7.2)	5(0.0)	2(5.7)	37(7.7)	0(0.0)	0(0.0)	19(3.7)	74(8.2)	24(6.6)	0(0.0)	0.0(10.0)	44	4.7
116.20	A	09/01/2008	690	5611	6(2.5)	1(7.2)	3(1.7)	2(5.7)	27(7.0)	0(0.0)	2(0.2)	24(3.2)	67(7.6)	31(6.0)	0(0.0)	0.0(10.0)	43	6.3
121.90	A	10/03/2008	1000	5410	5(1.7)	0(0.0)	5(0.0)	0(0.0)	27(7.0)	0(0.0)	0(0.0)	11(5.1)	0(0.0)	100(0.0)	0(0.0)	0.0(10.0)	20	3.4
125.60	A	8 /31/2008	1000	5278	7(3.3)	0(0.0)	4(0.5)	2(5.7)	39(7.9)	0(0.0)	0(0.0)	24(3.2)	44(6.0)	56(3.6)	0(0.0)	0.0(10.0)	34	5.5
131.40	A	8 /31/2008	690	5051	6(2.5)	0(0.0)	4(0.5)	2(5.7)	33(7.4)	0(0.0)	4(0.4)	18(3.9)	46(6.1)	53(3.9)	0(0.0)	0.0(10.0)	34	6.3
133.20	A	8 /31/2008	700	5038	6(2.5)	0(0.0)	3(1.7)	2(5.7)	67(9.2)	0(0.0)	5(0.5)	9(5.6)	87(9.1)	13(7.7)	0(0.0)	0.0(10.0)	43	6.4
137.40	A	8 /30/2008	1000	4997	4(0.9)	0(0.0)	2(3.6)	1(3.0)	0(0.0)	0(0.0)	8(0.9)	46(1.6)	31(5.0)	56(3.6)	0(0.0)	0.0(10.0)	24	4.2
139.50	A	8 /30/2008	1000	4992	4(0.9)	0(0.0)	3(1.7)	1(3.0)	0(0.0)	0(0.0)	10(1.1)	38(2.0)	43(5.9)	56(3.6)	0(0.0)	0.0(10.0)	24	5.1
144.40	A	8 /30/2008	1000	4694	6(2.5)	0(0.0)	2(3.6)	1(3.0)	0(0.0)	0(0.0)	4(0.5)	33(2.4)	50(6.4)	49(4.3)	0(0.0)	0.3(1.5)	20	5.2
148.50	A	8 /29/2008	1000	4689	4(0.9)	0(0.0)	2(3.6)	1(3.0)	0(0.0)	0(0.0)	2(0.2)	50(1.4)	42(5.8)	57(3.5)	41(6.5)	0.4(1.5)	22	5.3
153.80	A	8 /29/2008	1000	4558	3(0.0)	2(8.4)	2(3.6)	1(3.0)	6(5.0)	6(9.5)	6(0.6)	67(0.7)	17(4.0)	67(2.6)	0(0.0)	0.0(10.0)	40	2.3
155.60	A	8 /28/2008	1000	4558	5(1.7)	0(0.0)	4(0.5)	2(5.7)	3(4.8)	0(0.0)	5(0.6)	10(5.3)	85(9.0)	15(7.6)	21(5.3)	0.0(10.0)	42	4.9
161.50	A	8 /28/2008	1000	4286	7(3.3)	0(0.0)	3(1.7)	2(5.7)	7(5.1)	0(0.0)	1(0.1)	28(2.8)	51(6.5)	48(4.4)	23(5.4)	0.0(10.0)	38	4.8

* - Native species and intra-state exotics

** - Excludes fallfish

Appendix Table 1. Maine IBI scores and metrics at boat sites in the Connecticut River.

River Mile	Type	Date	Distance (meters)	Drainage area (sq mi)	Number of				Percent of Individuals						White & Longnose Sucker (PB)	DELT anomalies	IBI	Modified lwb
					Total Native* species	Steno- therm species	Alien species	Non-Guard. Litho- phils	Cyp- rinids**	Native Salmonids	Benthic Insect- vores	Black Basses	Fluvial Specialist	Macrohab. Generalists				
163.90	A	8/27/2008	1000	3368	4(0.9)	0(0.0)	3(1.7)	1(3.0)	23(6.7)	0(0.0)	4(0.4)	46(1.6)	27(4.7)	73(2.0)	0(0.0)	0.0(10.0)	26	3.7
165.60	A	8/27/2008	1000	3368	3(0.0)	0(0.0)	4(0.5)	2(5.7)	12(5.7)	0(0.0)	0(0.0)	22(3.4)	17(4.0)	83(1.0)	0(0.0)	0.0(10.0)	25	4.1
166.30	A	10/11/2008	1000	3368	4(0.9)	0(0.0)	4(0.5)	0(0.0)	2(4.7)	0(0.0)	0(0.0)	16(4.2)	0(0.0)	100(0.0)	0(0.0)	0.0(10.0)	17	2.2
170.90	A	10/04/2008	1000	3317	4(0.9)	0(0.0)	3(1.7)	0(0.0)	12(5.6)	0(0.0)	0(0.0)	16(4.1)	0(0.0)	100(0.0)	0(0.0)	0.0(10.0)	19	3.3
179.20	A	10/04/2008	1000	3137	1(0.0)	0(0.0)	3(1.7)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	18(3.9)	0(0.0)	100(0.0)	0(0.0)	0.0(10.0)	13	1.8
194.40	A	10/06/2008	1000	3018	3(0.0)	0(0.0)	3(1.7)	0(0.0)	8(5.2)	0(0.0)	10(1.1)	8(6.0)	50(6.4)	50(4.2)	0(0.0)	0.0(10.0)	29	4.2
200.70	A	10/05/2008	1000	2824	5(1.7)	0(0.0)	2(3.6)	1(3.0)	33(7.4)	0(0.0)	7(0.7)	0(10.0)	52(6.4)	48(4.4)	0(0.0)	0.0(10.0)	39	5.2
213.10	A	10/06/2008	1000	2749	5(1.7)	0(0.0)	2(3.6)	2(5.7)	5(5.0)	0(0.0)	11(1.2)	35(2.3)	51(6.5)	49(4.3)	72(8.2)	0.0(10.0)	40	3.9
217.60	A	10/06/2008	1000	2224	6(2.5)	0(0.0)	4(0.5)	3(7.3)	5(5.0)	0(0.0)	3(0.3)	8(5.8)	11(3.6)	89(0.4)	35(6.2)	0.0(10.0)	35	4.3
221.70	A	10/07/2008	1000	2205	6(2.5)	1(7.2)	3(1.7)	2(5.7)	2(4.7)	2(9.5)	0(0.0)	7(6.2)	78(8.4)	20(7.1)	99(9.3)	0.0(10.0)	60	5.2
227.10	A	10/07/2008	1000	2145	4(0.9)	4(9.6)	4(0.5)	3(7.3)	5(5.0)	12(9.4)	14(1.5)	5(7.2)	81(8.7)	7(8.3)	127(10.0)	2.3(0.6)	58	5.2
228.50	A	10/07/2008	1000	1635	8(4.2)	3(9.1)	4(0.5)	3(7.3)	0(4.5)	0(0.0)	3(0.3)	1(10.0)	8(3.3)	92(0.1)	31(5.9)	0.0(10.0)	46	4.6
235.90	A	09/07/2008	1000	1614	9(5.0)	3(9.1)	4(0.5)	3(7.3)	2(4.7)	0(9.5)	0(0.0)	2(9.1)	7(3.3)	93(0.1)	75(8.3)	0.2(1.8)	49	4.9
243.80	A	09/06/2008	1000	1557	5(1.7)	0(0.0)	5(0.0)	1(3.0)	4(4.9)	0(0.0)	0(0.0)	10(5.4)	4(3.1)	96(0.0)	24(5.5)	0.0(10.0)	28	5.0
247.00	A	09/06/2008	1000	1513	9(5.0)	5(10.0)	4(0.5)	4(8.4)	2(4.7)	1(9.5)	2(0.3)	8(5.8)	44(6.0)	55(3.7)	84(8.7)	1.8(0.8)	53	6.7
257.90	A	08/30/2008	1000	1330	6(2.5)	1(7.2)	1(6.0)	2(5.7)	0(0.0)	0(0.0)	4(0.4)	4(7.6)	41(5.8)	59(3.4)	123(9.9)	0.0(10.0)	49	5.1
267.80	A	10/08/2008	1000	1194	7(3.3)	2(8.4)	1(6.0)	3(7.3)	23(6.7)	0(0.0)	6(0.6)	0(10.0)	93(5.8)	7(8.3)	0(0.0)	0.0(10.0)	55	5.5
291.00	A	08/30/2008	1000	651	6(2.5)	5(10.0)	3(1.7)	3(7.3)	13(5.8)	1(9.5)	82(9.0)	0(10.0)	97(5.8)	3(8.7)	39(6.4)	0.0(10.0)	72	5.7
307.10	A	08/29/2008	1000	487	10(5.8)	3(9.1)	2(3.6)	5(9.3)	8(5.2)	1(9.5)	6(0.6)	1(11.3)	89(9.3)	9(8.1)	113(9.7)	0.9(1.1)	69	5.9
313.70	A	08/29/2008	1000	377	11(6.6)	6(10.0)	3(1.7)	7(10.0)	12(5.7)	2(9.5)	63(6.9)	0(10.0)	60(9.3)	39(5.3)	77(8.4)	0.8(1.2)	71	6.4
323.60	A	08/28/2008	1000	180	12(7.5)	7(10.0)	3(1.7)	7(10.0)	8(5.3)	18(9.3)	46(5.1)	0(10.0)	74(9.3)	16(7.5)	0(0.0)	0.7(1.2)	64	7.3
Westfield River - (80100)																		
Year: 2008																		
15.90	A	07/21/2008	1000	352	4(0.9)	1(7.2)	4(0.5)	2(5.7)	0(4.5)	0(0.0)	1(0.1)	35(2.3)	9(3.4)	61(3.1)	30(5.8)	0.0(10.0)	36	6.3
Chicopee River - (80200)																		
Year: 2008																		

* - Native species and intra-state exotics

** - Excludes fallfish

Appendix Table 1. Maine IBI scores and metrics at boat sites in the Connecticut River.

River Mile	Type	Date	Distance (meters)	Drainage area (sq mi)	Number of				Percent of Individuals							DELT anomalies	Modified	
					Total Native♦ species	Steno- therm species	Alien species	Non-Guard. Litho- phils	Cyp- rinids**	Native Salmonids	Benthic OInsect- vores	Black Basses	Fluvial Specialist	Macrohab. Generalists	White & Longnose Sucker (PB)		IBI	lwb
6.50	A	07/17/2008	1000	701	5(1.7)	0(0.0)	5(0.0)	1(3.0)	0(0.0)	0(0.0)	2(0.3)	14(4.4)	23(4.5)	59(3.4)	19(5.1)	0.6(1.3)	20	7.6
Deerfield River - (80300)																		
Year: 2008																		
15.00	A	07/20/2008	1000	504	3(0.0)	0(0.0)	2(3.6)	2(5.7)	8(5.3)	0(0.0)	3(0.3)	17(4.1)	76(8.4)	22(6.8)	0(0.0)	2.9(0.5)	29	6.2
West River - (80400)																		
Year: 2008																		
1.00	A	09/08/2008	1000	419	7(3.3)	0(0.0)	5(0.0)	1(3.0)	52(8.6)	0(0.0)	0(0.0)	20(3.6)	6(3.2)	91(0.2)	29(5.8)	0.0(10.0)	31	6.3
6.10	A	09/08/2008	1000	403	7(3.3)	1(7.2)	3(1.7)	3(7.3)	12(5.7)	0(9.5)	1(0.2)	39(2.0)	56(6.8)	43(4.8)	66(7.9)	0.5(1.4)	48	5.6

* - Native species and intra-state exotics

** - Excludes fallfish

Fish Assemblage and Habitat Assessment of the Upper Connecticut River

Appendix C

Qualitative Habitat Evaluation Index (QHEI) Scores and Metric Values

August-October 2008

Table 1. QHEI attributes report for sites sampled in the Connecticut River during 2008.

			Good Attributes										Modified Attributes																
River Mile	QHEI	Gradient (ft/mile)											Good Habitat Attributes											Total Modified Attributes	Modified: Good Ratio				
			No Channelization/Recovered Boulder, Cobble, Gravel Substrates	Silt Free Substrates	Good/Excellent Development	Five or More Substrate Types	Extensive-Moderate Cover	Fast Current/Eddies	Low-Normal Overall Embeddedness	Max Depth > 1 m	Low-Normal Riffle/Run Embeddedness	Impounded		Channelized or No Recovery	Silt/Muck Substrates	Sparse or No Cover	Max Depth < 70 cm	Recovering Channel	High/Moderate Silt Cover	Fair-Poor Development	Only 1-2 Cover Types	Slow or No Flow	High-Mod Overall Embeddedness			High-Mod Riffle-Run Embeddedness	No Riffle/Run		
Key																													
QHEI																													
Components																													
80-001)																													
Year: 2008																													
323.6	92.5	13.80	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	10		0	0.00
322.0	89.0	20.10	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	10		0	0.00
313.7	82.5	2.00	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	10		0	0.00
307.1	65.0	2.00	■	■				■	■	■	■		■						■			■		■		6	3	0.50	
291.0	87.0	16.60	■	■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	9		0	0.00
267.8	70.8	1.30						■	■	■	■		■						■			■				5	3	0.60	
257.9	55.5	1.50	■							■									■			■		■		4	4	1.33	
247.0	88.3	2.50	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	10		0	0.00
243.8	58.0	2.50		■				■	■										■	■		■	■	■	■	3	7	1.75	
235.9	71.0	2.50		■				■	■	■	■	■	■	■	■	■	■	■							■	5	3	0.50	
228.5	74.0	2.50		■				■	■	■	■	■	■	■	■	■	■	■							■	5	3	0.50	
227.1	89.3	2.50	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	10		0	0.00
221.7	76.0	2.50	■	■				■	■	■	■	■	■	■	■	■	■	■							■	7	3	0.43	
217.6	83.3	2.50	■	■			■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	9		0	0.00
213.1	93.0	2.50	■	■	■	■				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	10		0	0.00
200.7	50.0	2.50		■				■	■			■	4	◆			◆			■		■	■	■	■	4	6	1.50	
194.4	50.8	2.50							■			2	◆							■		■	■	■	■	5	5	2.50	
179.2	53.0	2.50		■				■	■			3	◆							■	■		■	■	■	6	6	1.50	
170.9	53.0	2.50		■				■	■			3	◆							■	■		■	■	■	6	6	1.50	
166.3	63.0	2.50		■				■	■			4	◆							■	■		■	■	■	6	6	1.50	
165.6	46.0	0.10					■		■			3	◆	◆						■		■	■	■	■	6	6	2.00	
163.9	67.0	2.50	■	■		■					■	7					◆				■			■		3	3	0.50	
161.5	71.5	2.50	■	■		■	■	■			■	6		◆										■		2	2	0.33	
155.6	51.0	2.00						■			■	2	◆	◆						■	■		■	■		6	6	3.00	
153.8	62.8	2.00		■	■					■		6					◆		■		■	■		■		5	5	1.00	
148.5	68.0	2.00		■					■	■		4								■	■	■		■	■	5	5	1.25	
144.4	63.5	2.00	■	■					■			4								■	■		■	■	■	5	5	1.25	
139.5	68.0	2.00	■				■	■	■			5		◆						■		■	■			4	4	0.67	
137.4	68.0	2.00	■	■				■			■	4								■	■		■	■	■	5	5	1.25	
133.2	49.0	2.00	■						■			3		◆						■	■		■	■		5	5	1.67	
131.4	51.0	2.00	■								■	3		◆						■	■		■	■		5	5	2.50	

Table 1. QHEI attributes report for sites sampled in the Connecticut River during 2008.

		Good Attributes										Modified Attributes													
River Mile	QHEI	Gradient (ft/mile)											Good Habitat Attributes											Total Modified Attributes	Modified: Good Ratio
			No Channelization/Recovered Boulder, Cobble, Gravel Substrates	Silt Free Substrates	Good/Excellent Development	Five or More Substrate Types	Extensive-Moderate Cover	Fast Current/Eddies	Low-Normal Overall Embeddedness	Max Depth > 1 m	Low-Normal Riffle/Run Embeddedness	Impounded		Channelized or No Recovery	Silt/ Muck Substrates	Sparse or No Cover	Max Depth < 70 cm	Recovering Channel	High/Moderate Silt Cover	Fair-Poor Development	Only 1-2 Cover Types	Slow or No Flow	High-Mod Overall Embeddedness		
(80-001)																									
Year: 2008																									
125.6	48.5	0.10	■		■		■			■		4	◆	◆				■			■	■	■	6	1.50
121.9	49.0	2.50					■	■		■		2	◆	◆				■	■		■	■	■	7	2.33
116.2	79.0	2.00		■			■	■			■	4					■		■			■		3	0.60
114.7	63.0	2.00	■					■		■	■	4					■	■		■			■	4	1.00
105.7	70.0	2.00	■		■		■		■	■		5							■			■		2	0.40
102.3	59.5	2.00	■					■		■	■	4		◆				■		■		■	■	4	1.00
97.6	54.0	2.00	■		■						■	4		◆		◆		■		■	■	■	■	6	2.00
92.5	55.0	2.50					■	■			■	2	◆	◆				■	■		■	■	■	7	2.33
90.1	48.0	2.50						■			■	2	◆	◆				■	■		■	■	■	7	3.50
89.0	52.0	2.50						■	■		■	3	◆	◆				■	■		■		■	6	2.00
88.4	95.5	2.50	■	■		■	■	■	■	■	■	9												0	0.00
83.3	62.5	2.50	■	■			■	■		■	■	5							■				■	2	0.33
79.2	64.3	2.50	■	■				■		■	■	5							■		■		■	3	0.60
72.2	74.0	2.50	■	■			■	■	■	■	■	7			◆				■				■	3	0.43
68.8	54.5	2.50					■				■	2	◆						■		■	■	■	5	2.50

Appendix Table 1. QHEI metric scores for stations sampled in Connecticut River basin during 2008.

River Mile	QHEI	QHEI Metrics:						Gradient & Score
		Substrate	Cover	Channel	Riparian	Pool	Riffle	
(80001) Connecticut River								
Year: 2008								
323.6	92.50	21.0	16.0	20.0	9.50	11.0	8.0	13.80 - (8)
322.0	89.00	21.0	16.0	18.0	10.00	11.0	8.0	20.10 - (6)
313.7	78.50	19.0	15.0	18.0	5.00	12.0	7.5	0.00 - (2)
307.1	65.00	14.0	16.0	14.0	5.00	10.0	0.0	2.00 - (6)
291.0	87.00	20.0	14.0	19.0	6.00	12.0	8.0	16.60 - (8)
267.8	70.80	11.0	16.0	11.0	2.80	12.0	8.0	1.30 - (10)
247.0	88.30	21.0	13.0	17.0	8.30	12.0	8.0	2.50 - (10)
243.8	58.00	13.0	14.0	5.0	10.00	5.0	0.0	2.50 - (10)
235.6	71.00	16.0	15.0	9.0	10.00	10.0	0.0	2.50 - (10)
228.5	74.00	20.0	11.0	11.0	10.00	11.0	0.0	2.50 - (10)
227.1	89.50	21.0	13.0	19.0	6.50	12.0	8.0	2.50 - (10)
221.7	76.00	16.0	13.0	15.0	10.00	11.0	0.0	2.50 - (10)
217.6	81.00	14.0	15.0	17.0	6.00	12.0	7.0	2.50 - (10)
213.1	93.00	19.0	14.0	20.0	9.00	12.0	8.0	2.50 - (10)
200.7	50.00	12.0	12.0	5.0	6.00	5.0	0.0	2.50 - (10)
194.4	50.80	9.0	16.0	4.0	6.80	5.0	0.0	2.50 - (10)
179.2	53.00	13.0	15.0	5.0	5.00	5.0	0.0	2.50 - (10)
170.9	53.00	13.0	15.0	4.0	6.00	5.0	0.0	2.50 - (10)
166.3	63.00	13.0	19.0	7.0	9.00	5.0	0.0	2.50 - (10)
153.8	62.80	13.0	6.0	11.0	6.80	9.0	7.0	2.00 - (10)
148.5	68.00	13.0	12.0	9.0	8.00	10.0	6.0	2.00 - (10)
144.4	63.50	11.0	14.0	10.0	8.50	8.0	2.0	2.00 - (10)
139.5	68.00	8.0	14.0	13.0	10.00	8.0	5.0	2.00 - (10)
137.4	68.00	11.0	15.0	12.0	8.00	8.0	4.0	2.00 - (10)
133.2	49.00	0.0	12.0	12.0	5.00	8.0	2.0	2.00 - (10)
131.4	51.00	6.0	3.0	14.0	8.00	8.0	2.0	2.00 - (10)
125.6	48.50	5.0	15.0	11.5	5.00	6.0	0.0	0.10 - (6)
121.9	49.00	8.0	15.0	5.0	6.00	5.0	0.0	2.50 - (10)
116.2	79.00	17.0	16.0	10.0	10.00	10.0	6.0	2.00 - (10)
114.7	63.00	8.0	14.0	14.0	10.00	6.0	0.0	2.00 - (10)
105.7	70.00	11.0	16.0	16.0	10.00	6.0	0.0	2.00 - (10)
102.3	59.50	7.0	16.0	11.0	9.50	6.0	0.0	2.00 - (10)
97.6	54.00	4.0	9.0	17.0	8.00	6.0	0.0	2.00 - (10)
92.5	55.00	7.0	17.0	5.0	10.00	5.0	0.0	2.50 - (10)

Appendix Table 1. QHEI metric scores for stations sampled in Connecticut River basin during 2008.

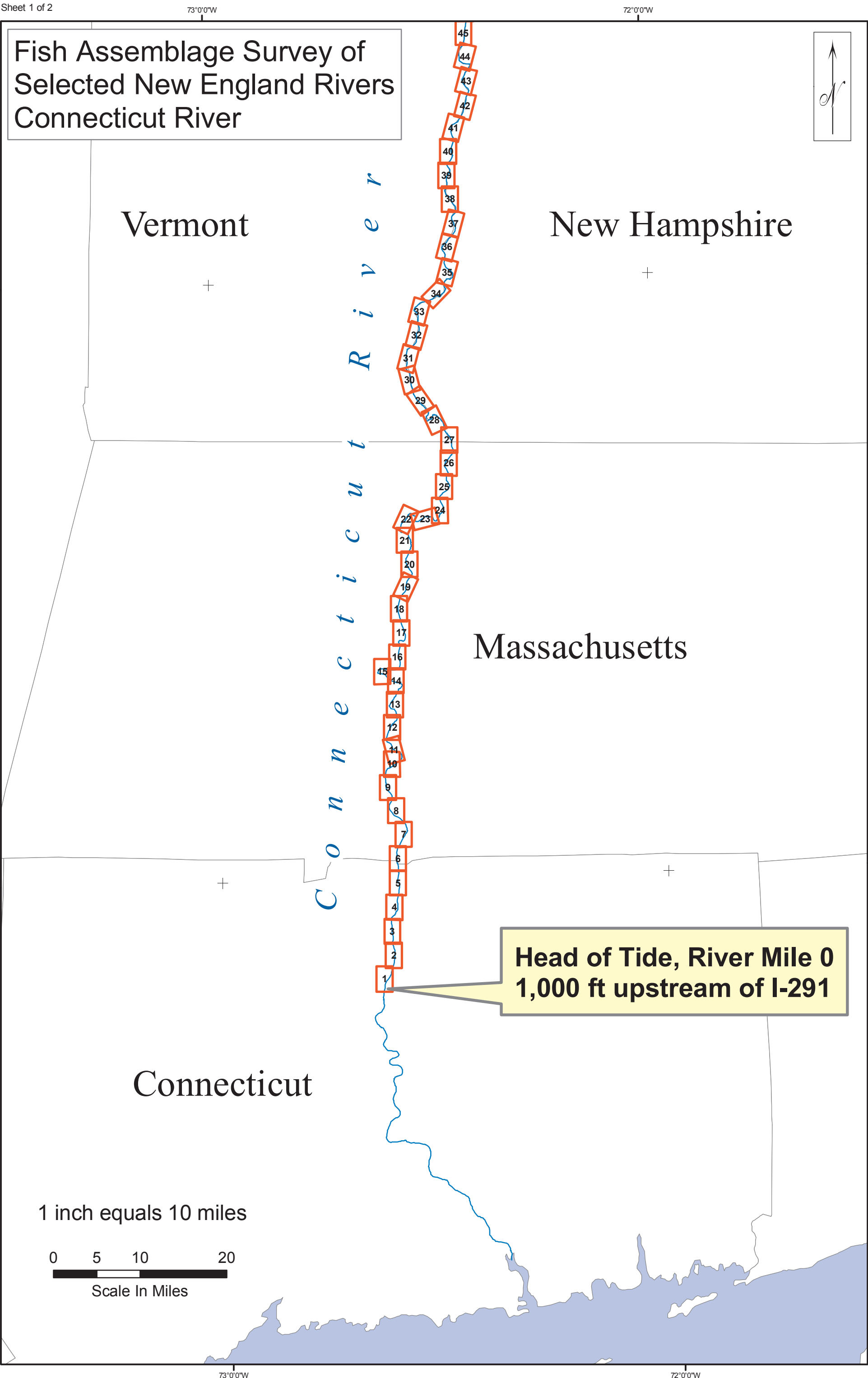
River Mile	QHEI	QHEI Metrics:						Gradient & Score	
		Substrate	Cover	Channel	Riparian	Pool	Riffle		
(80001) Connecticut River									
Year: 2008									
90.1	48.00	1.0	17.0	4.0	10.00	5.0	0.0	2.50 - (10)	
89.0	52.00	6.0	13.0	4.0	10.00	8.0	0.0	2.50 - (10)	
88.4	95.50	17.0	18.0	19.0	10.00	12.0	8.0	2.50 - (10)	
83.3	62.50	13.0	14.0	11.0	5.50	9.0	0.0	2.50 - (10)	
79.2	64.30	13.0	15.0	12.0	7.30	7.0	0.0	2.50 - (10)	
72.2	74.00	16.0	14.0	13.0	10.00	10.0	0.0	2.50 - (10)	
68.8	54.50	10.0	15.0	5.0	10.00	4.0	0.0	2.50 - (10)	
(80100) Westfield River									
Year: 2008									
15.9	84.00	20.0	17.0	17.0	0.00	12.0	8.0	8.30 - (10)	
(80200) Chicopee River									
Year: 2008									
6.5	96.00	20.0	17.0	20.0	10.00	11.0	8.0	7.40 - (10)	
(80300) Deerfield River									
Year: 2008									
15.0	61.00	18.0	16.0	6.0	10.00	6.0	0.0	1.00 - (4)	
(80400) West River									
Year: 2008									
6.1	90.00	21.0	15.0	20.0	10.00	10.0	8.0	19.20 - (6)	
1.0	48.00	10.0	17.0	5.0	6.00	6.0	0.0	1.00 - (4)	

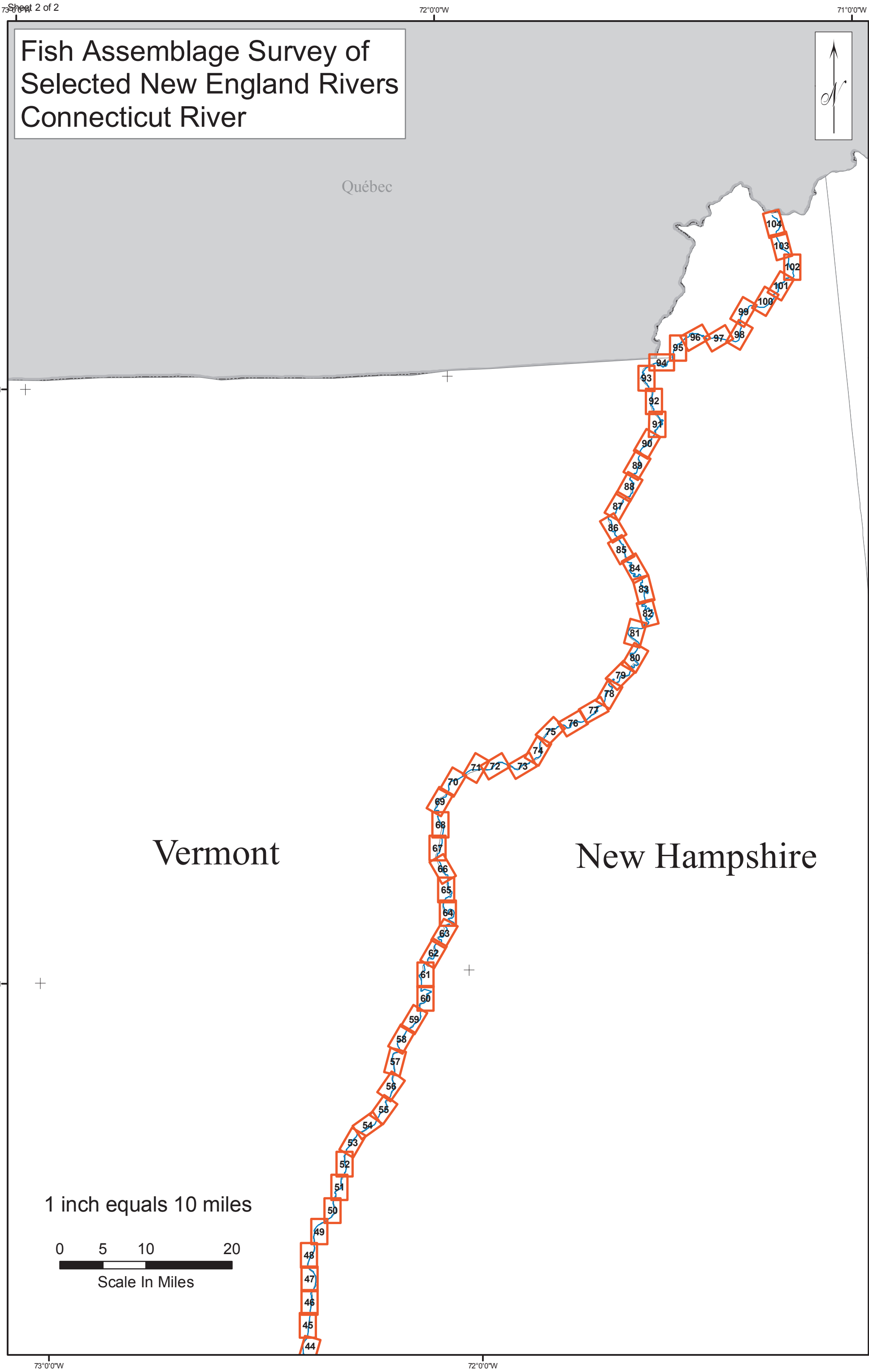
Fish Assemblage and Habitat Assessment of the Upper Connecticut River

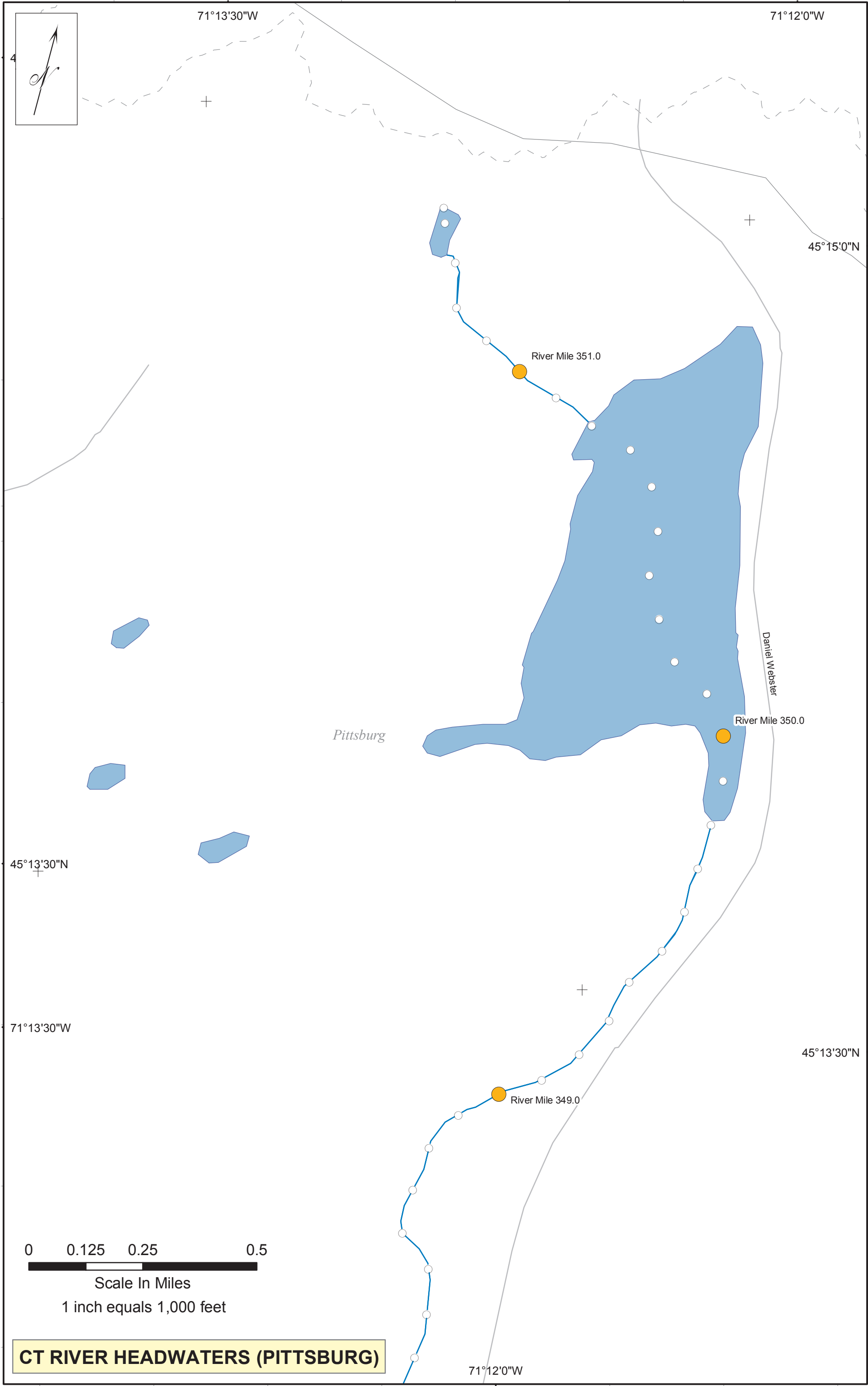
Appendix D

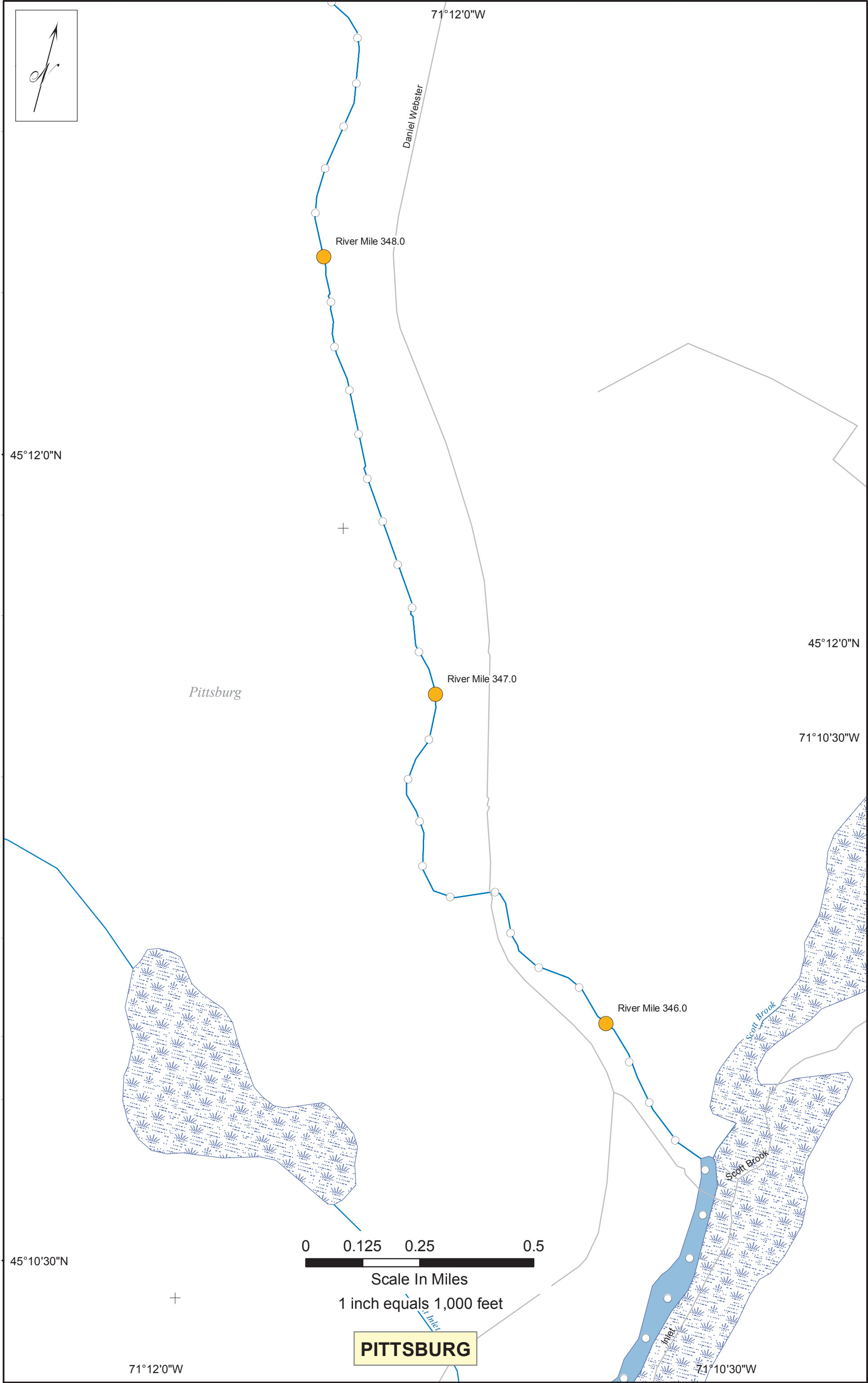
River Mile Maps

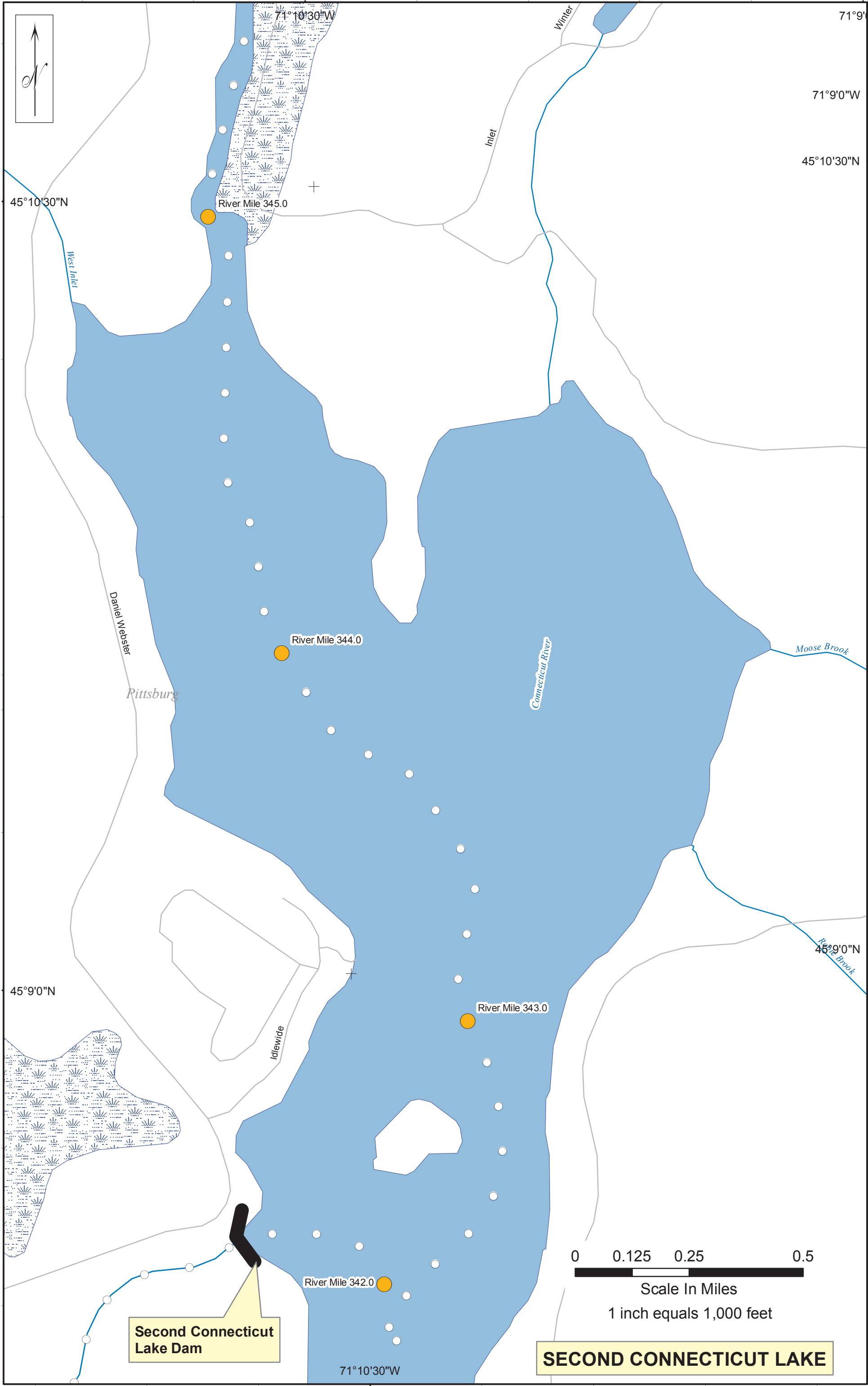
August-October 2008

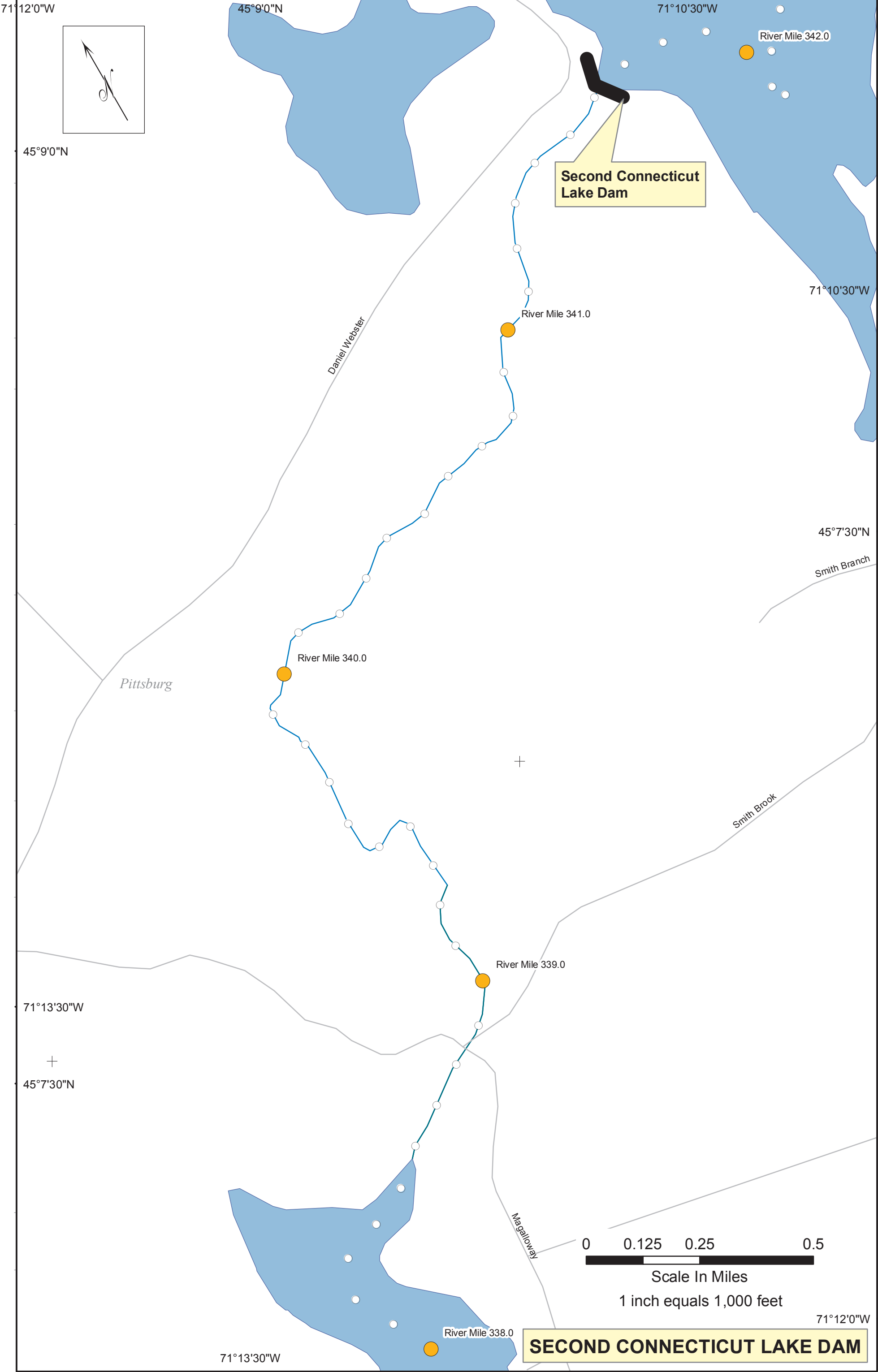




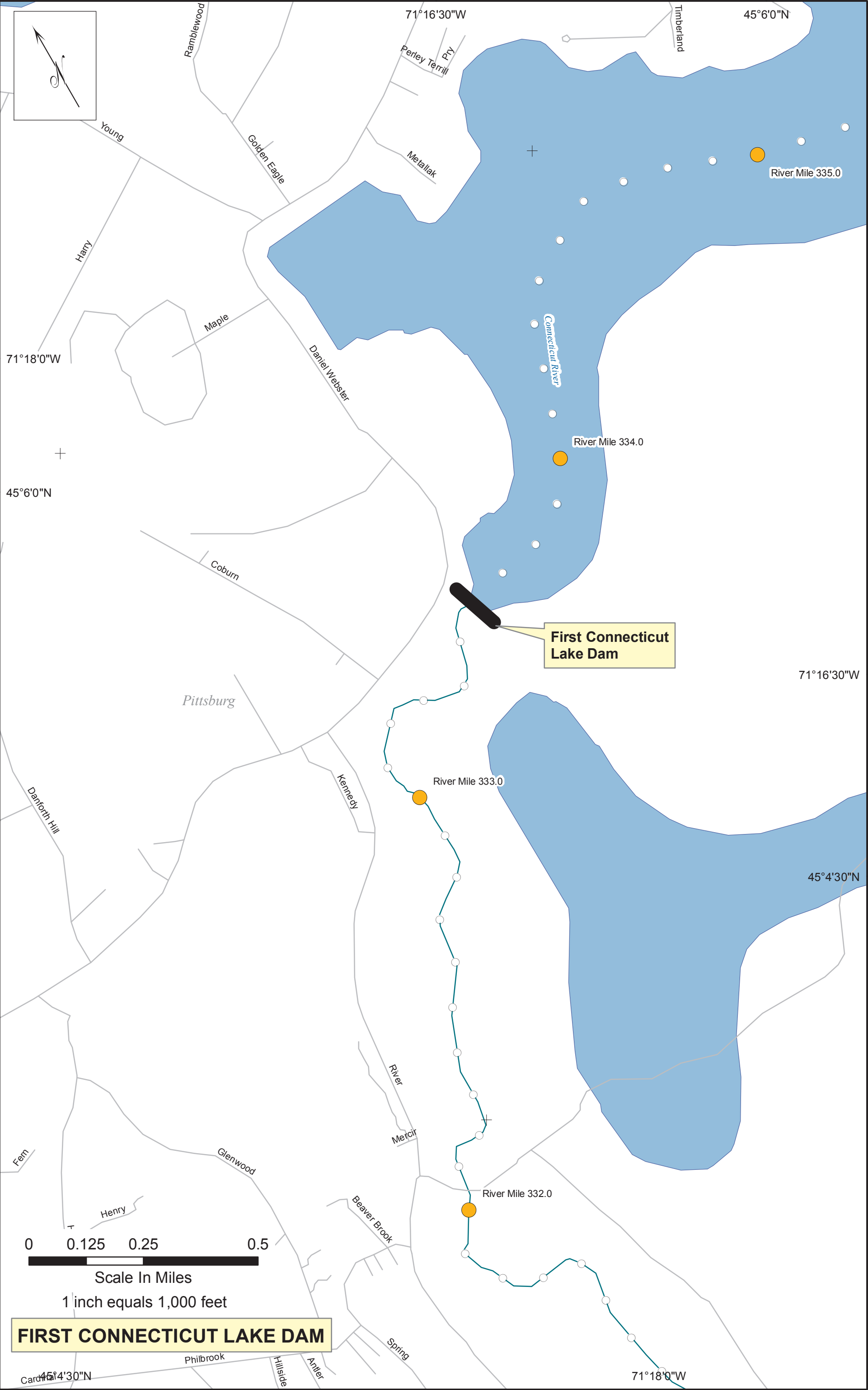




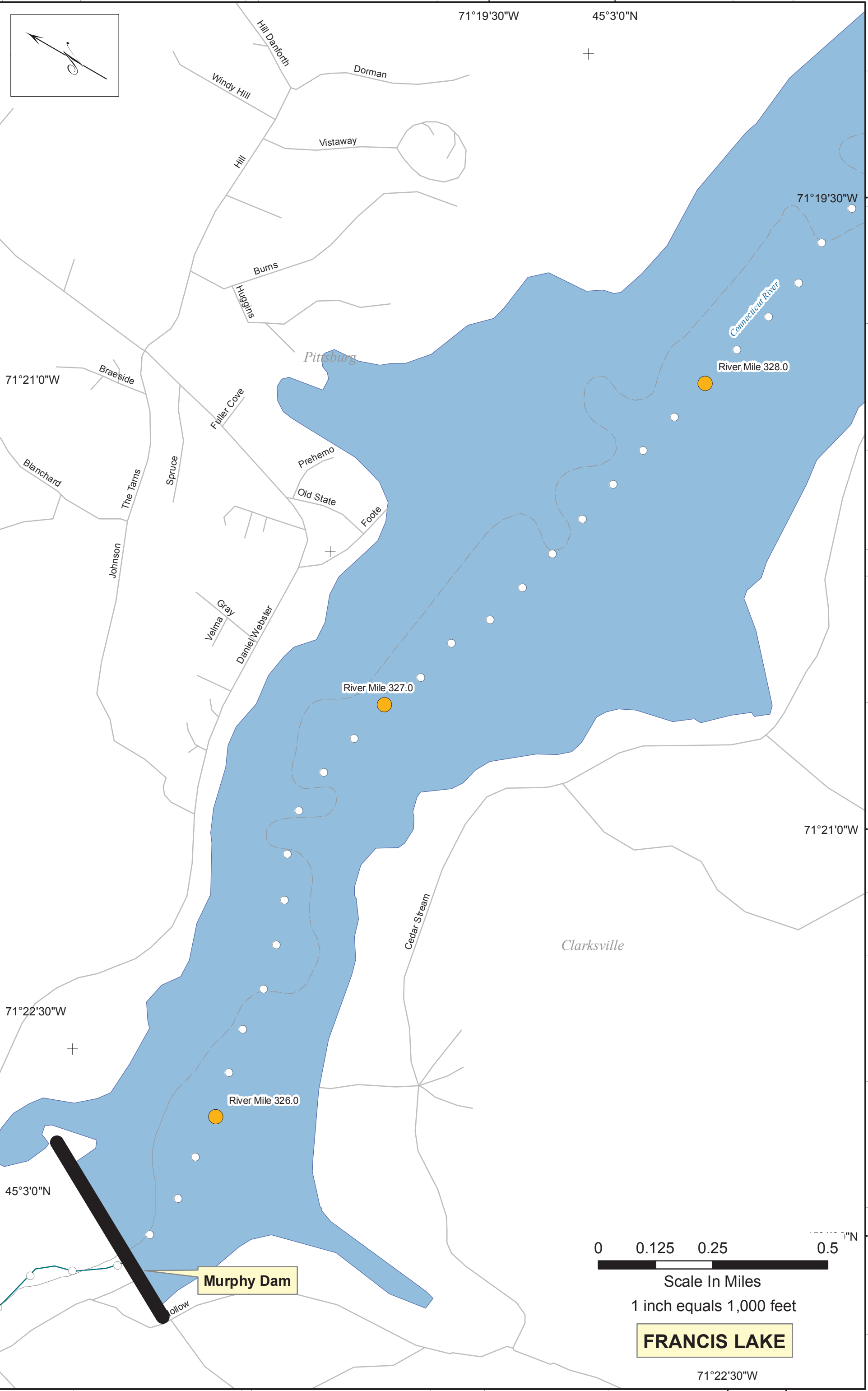


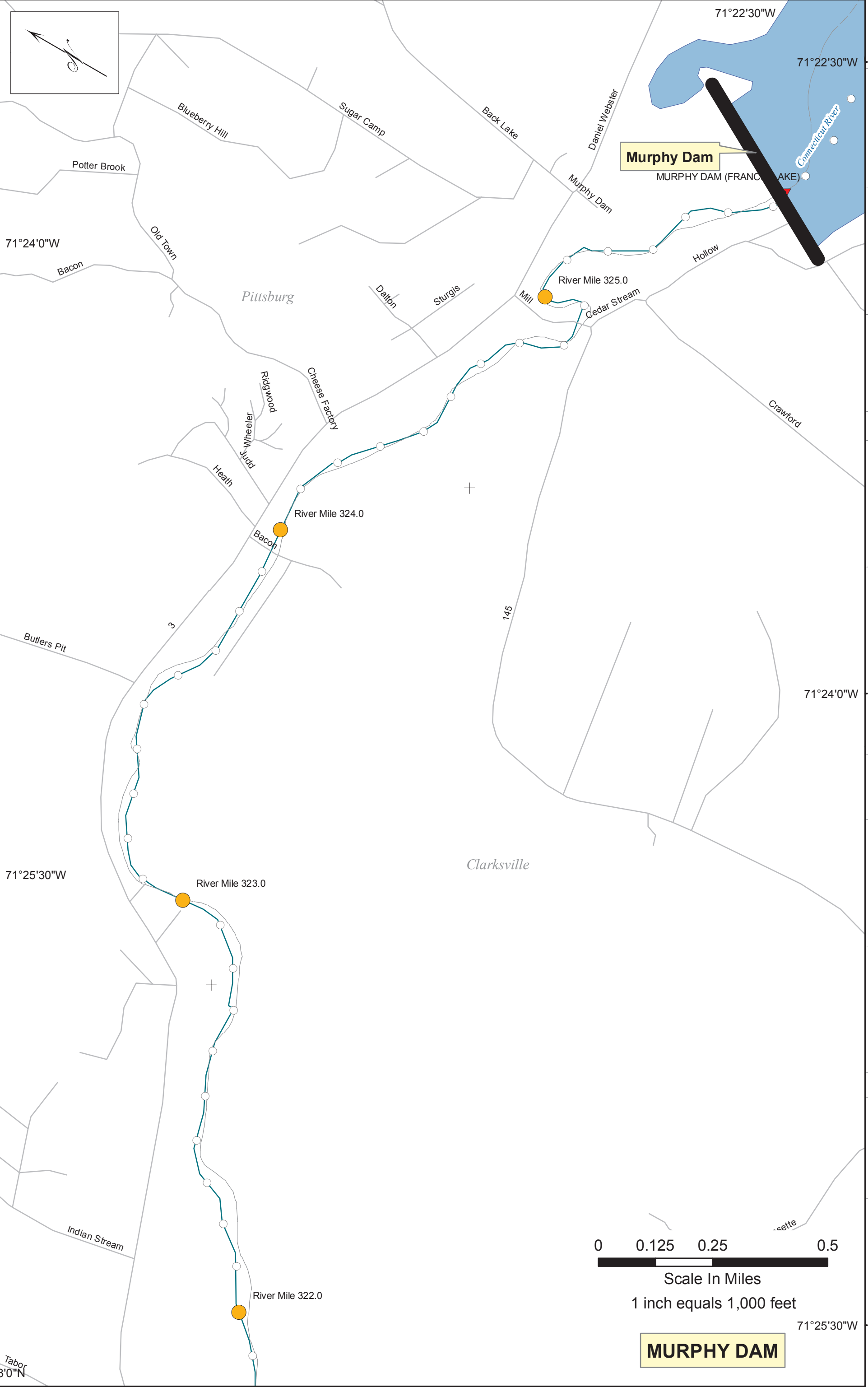














45°3'0"N

71°27'0"W

45°3'0"N

River Mile 322.0

River Mile 321.0

Washburn

3

River Mile 320.0

45°1'30"N

Clarksville

45°1'30"N

Beecher Falls

River Mile 319.0

River

Canaan

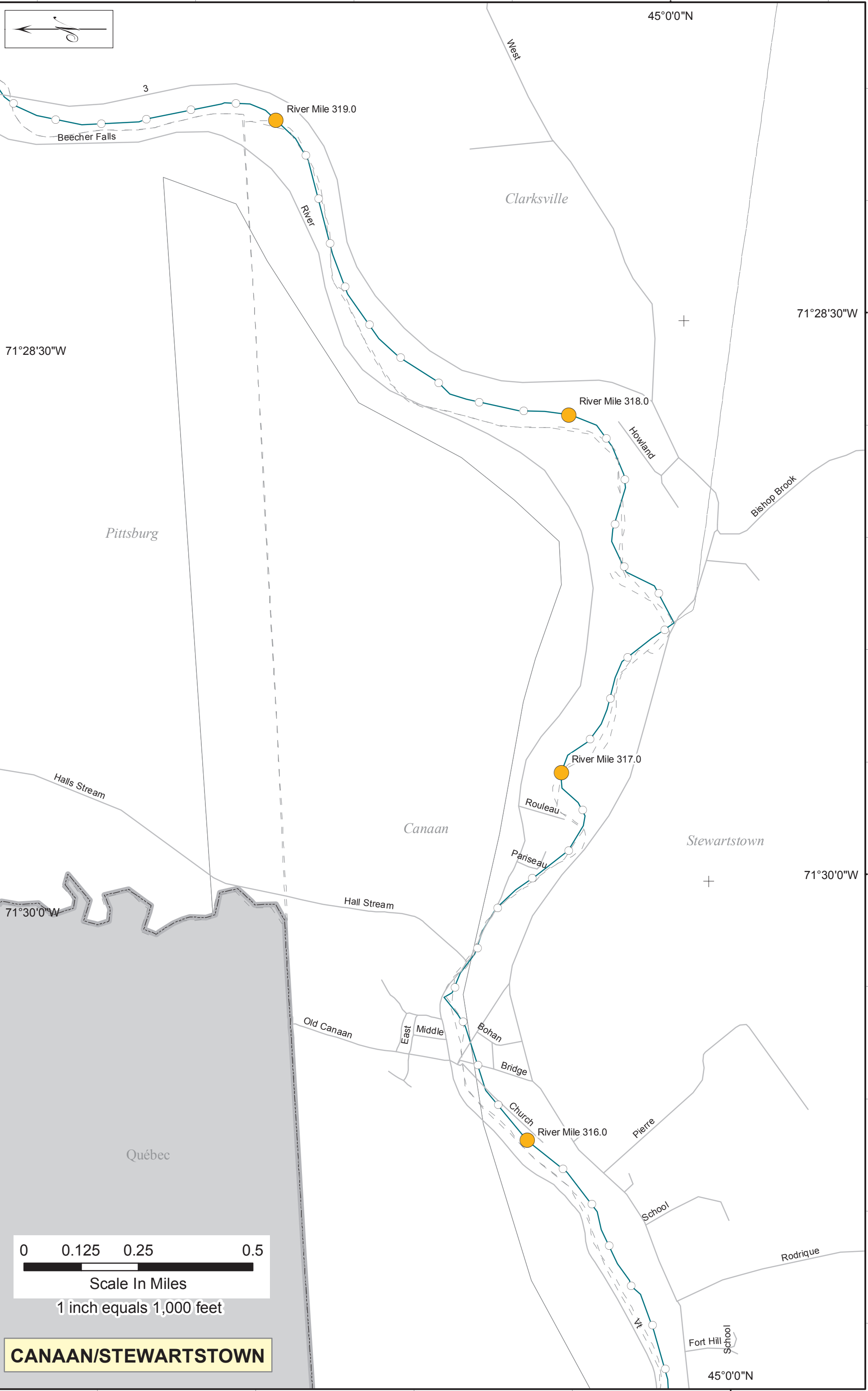
Haynes

71°27'0"W

0 0.125 0.25 0.5

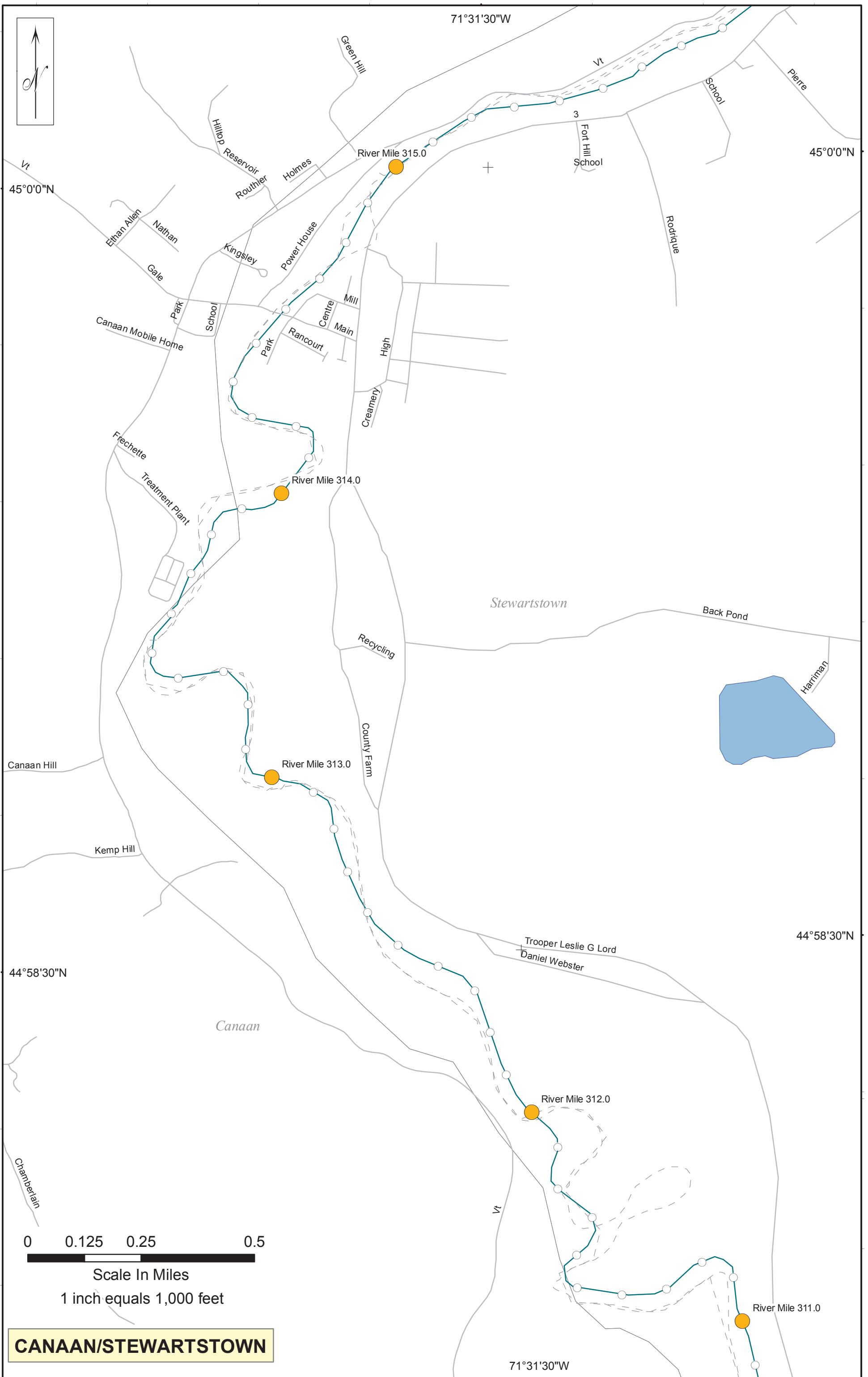
Scale In Miles
1 inch equals 1,000 feet

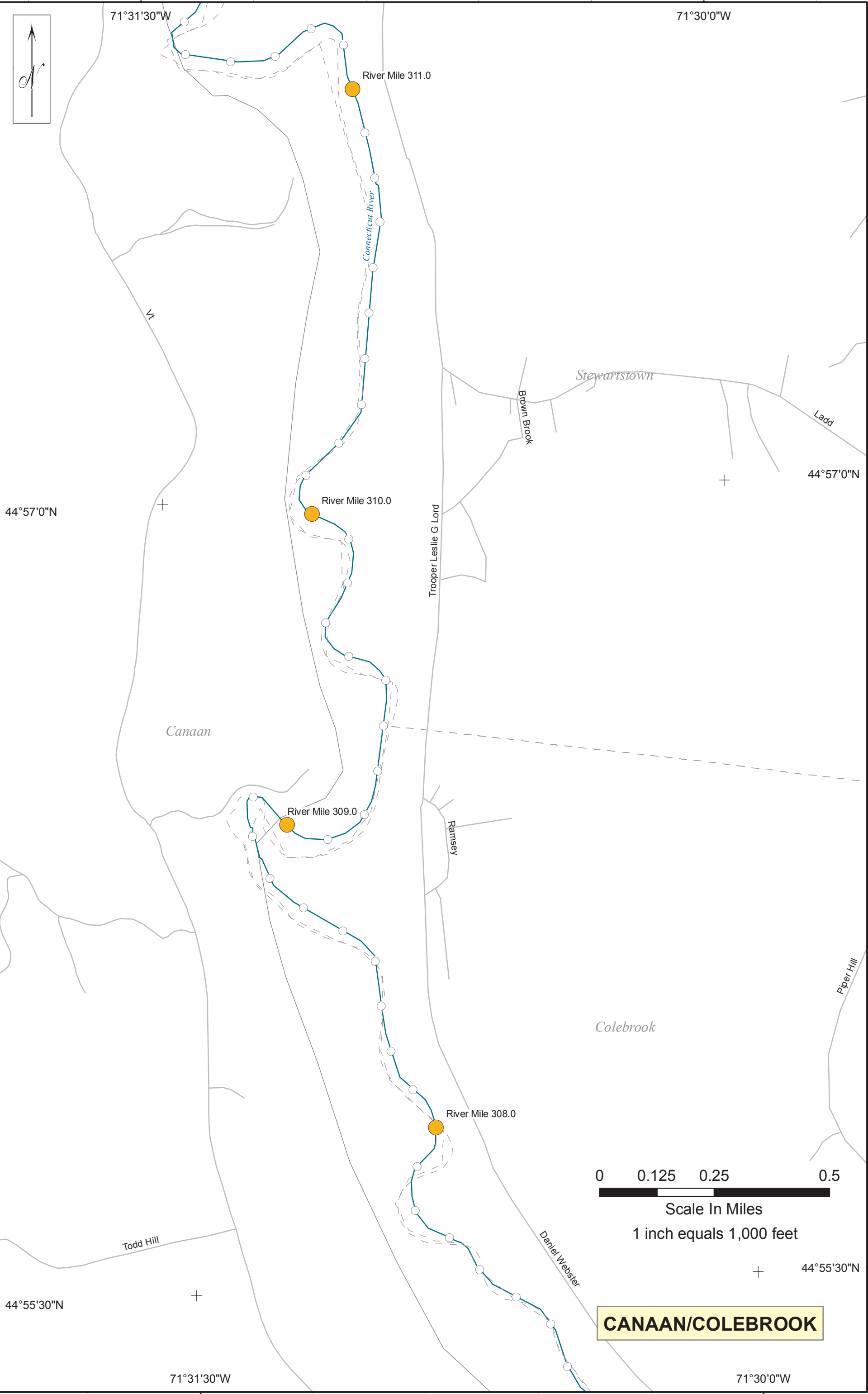
PITTSBURG/CLARKSVILLE

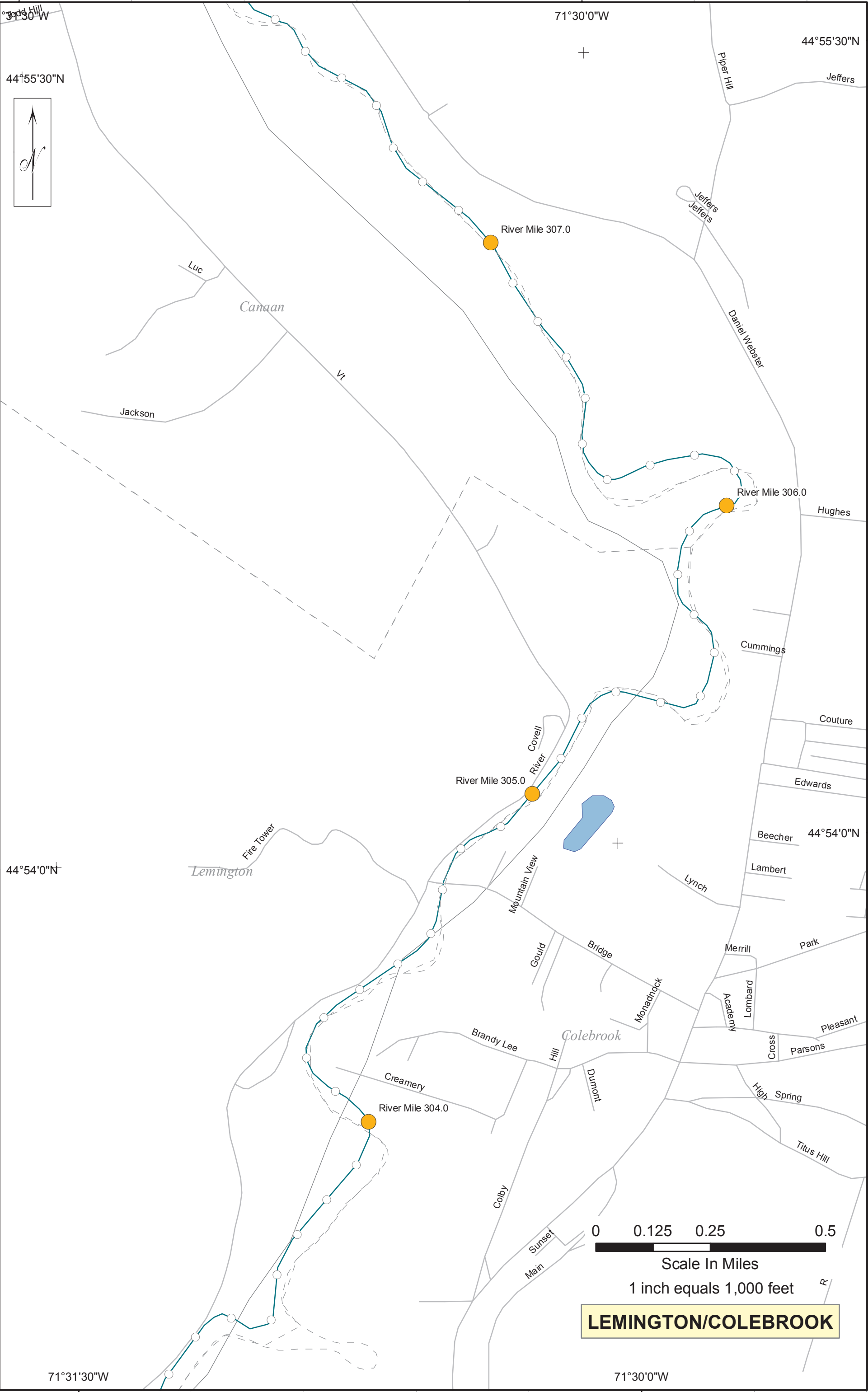


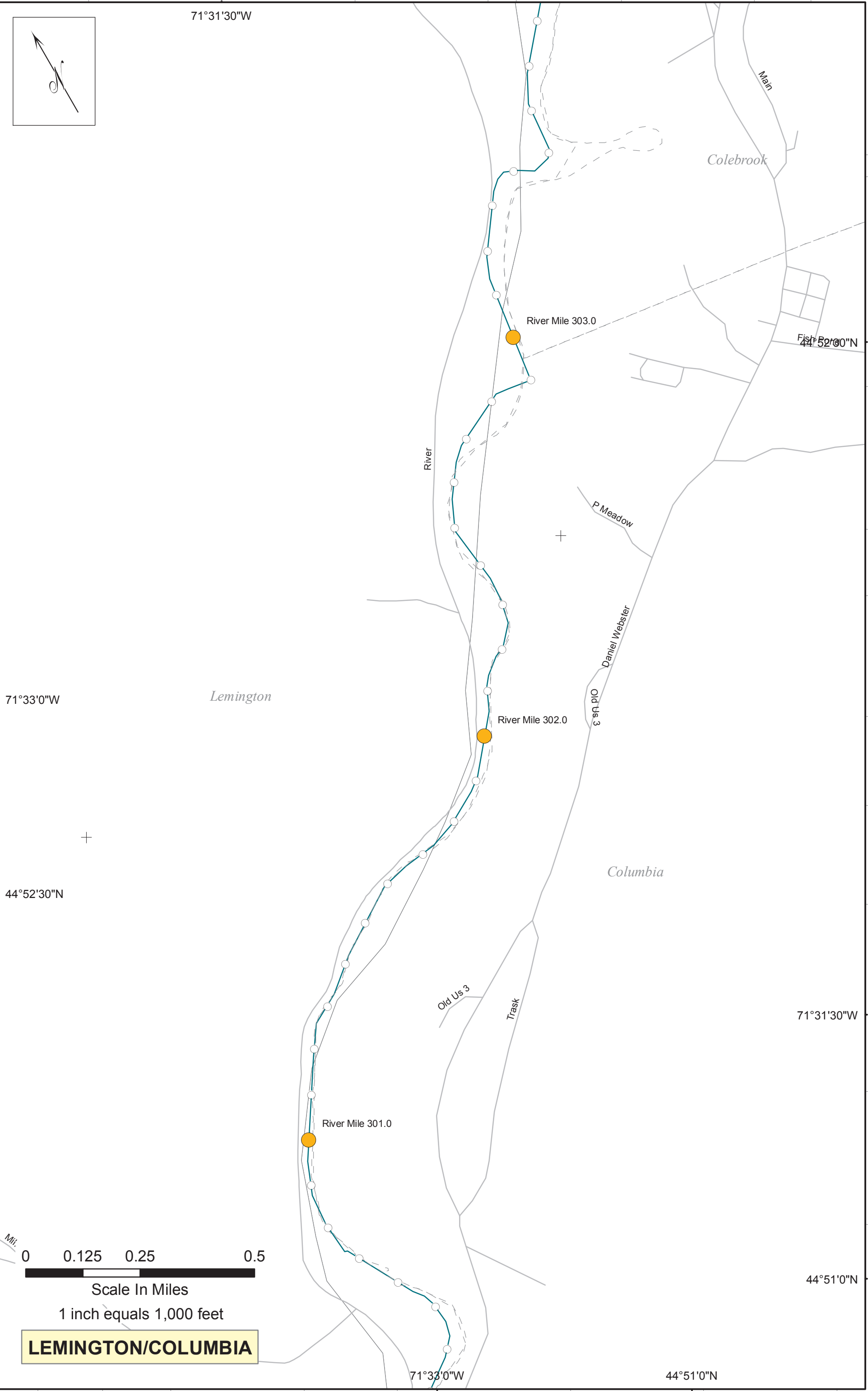
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Scale In Miles
1 inch equals 1,000 feet

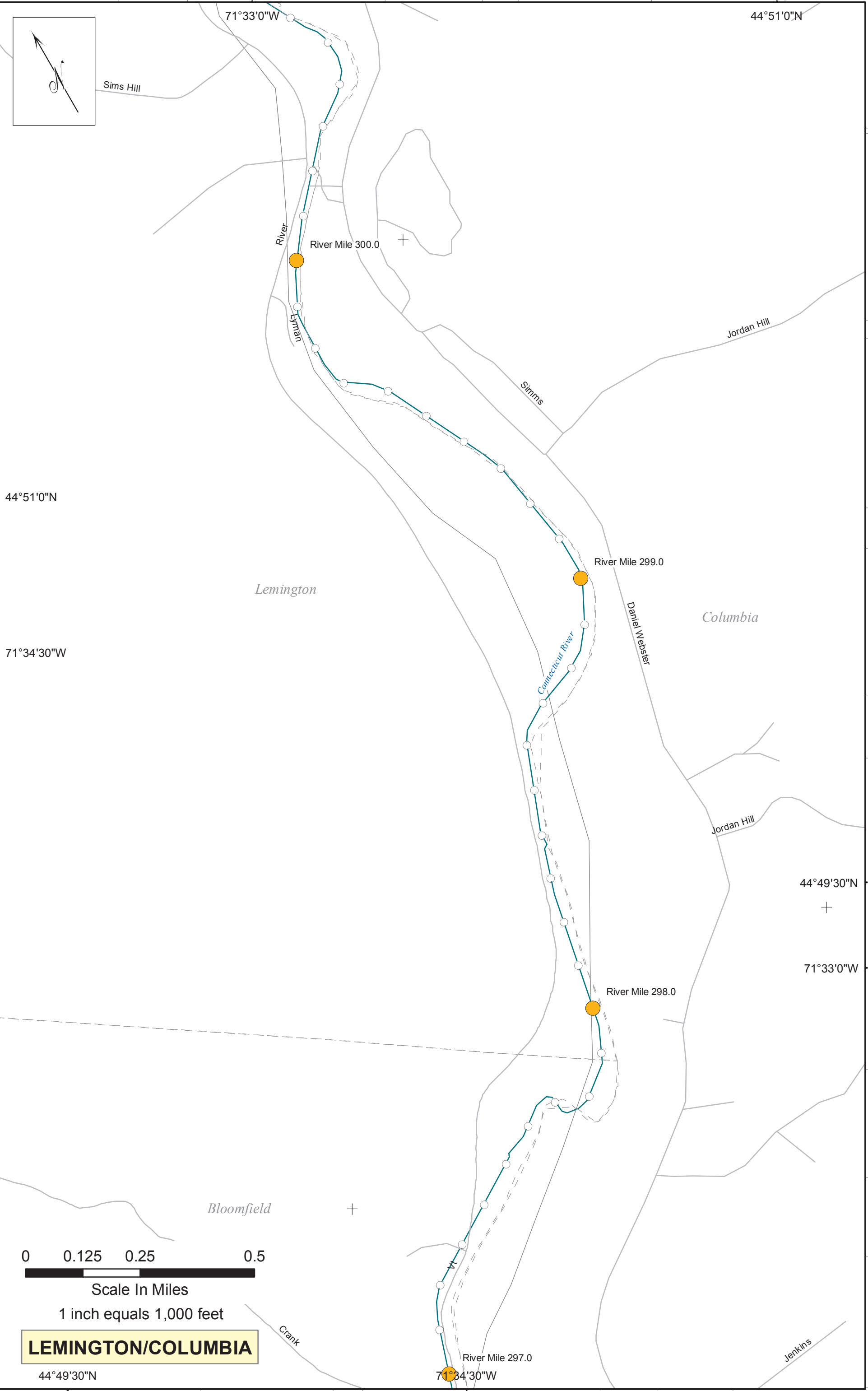
CANAAN/STEWARTSTOWN

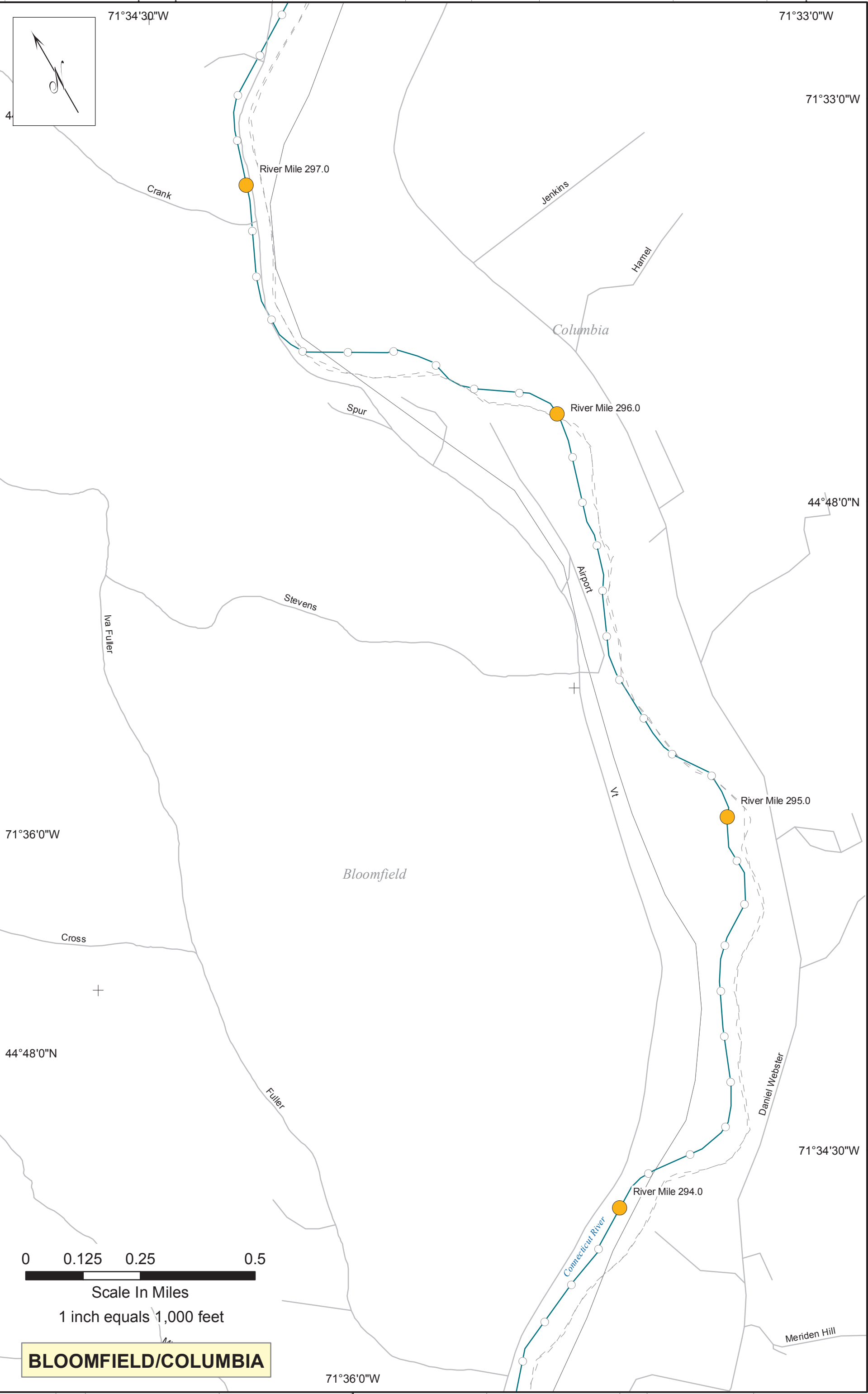


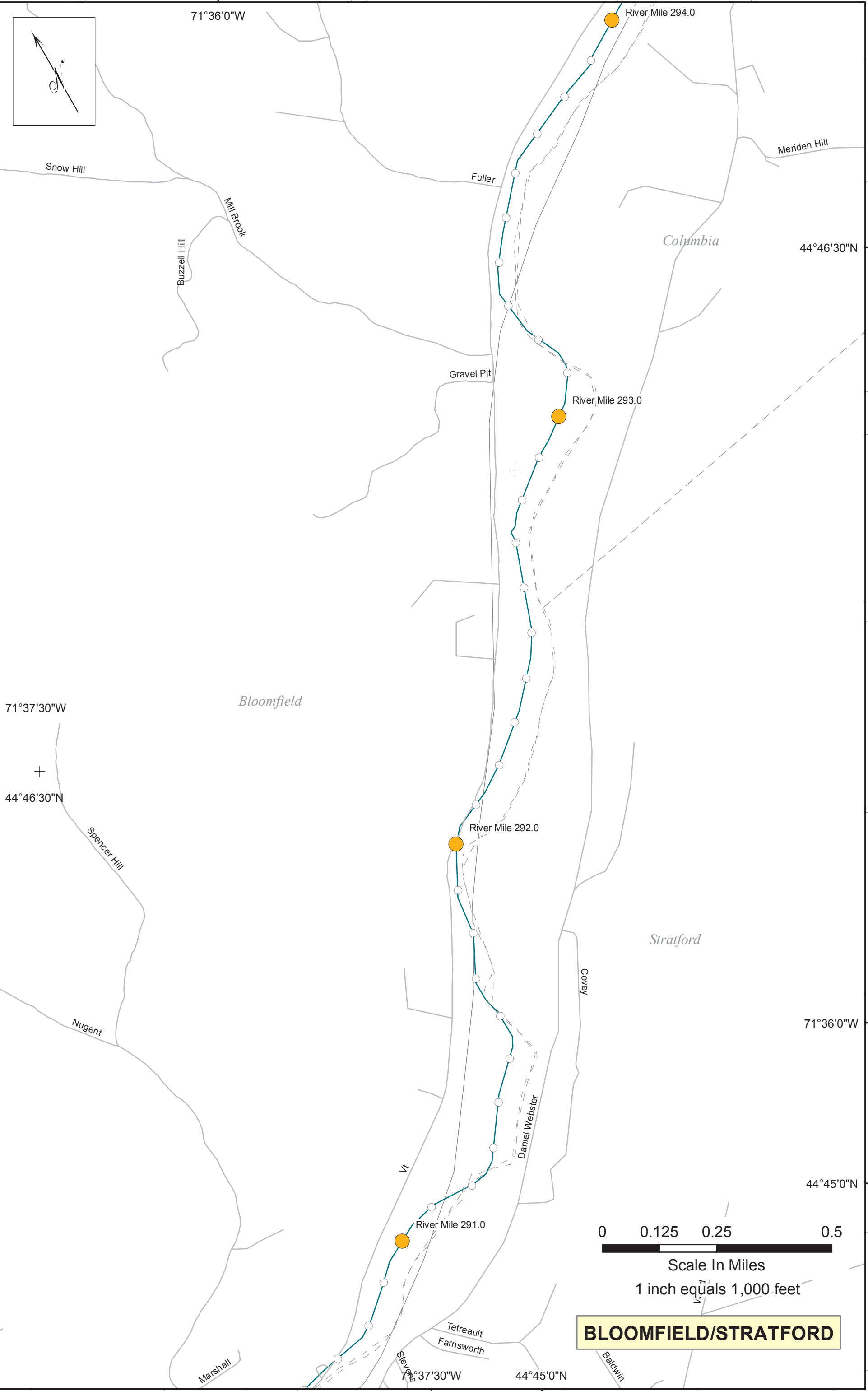


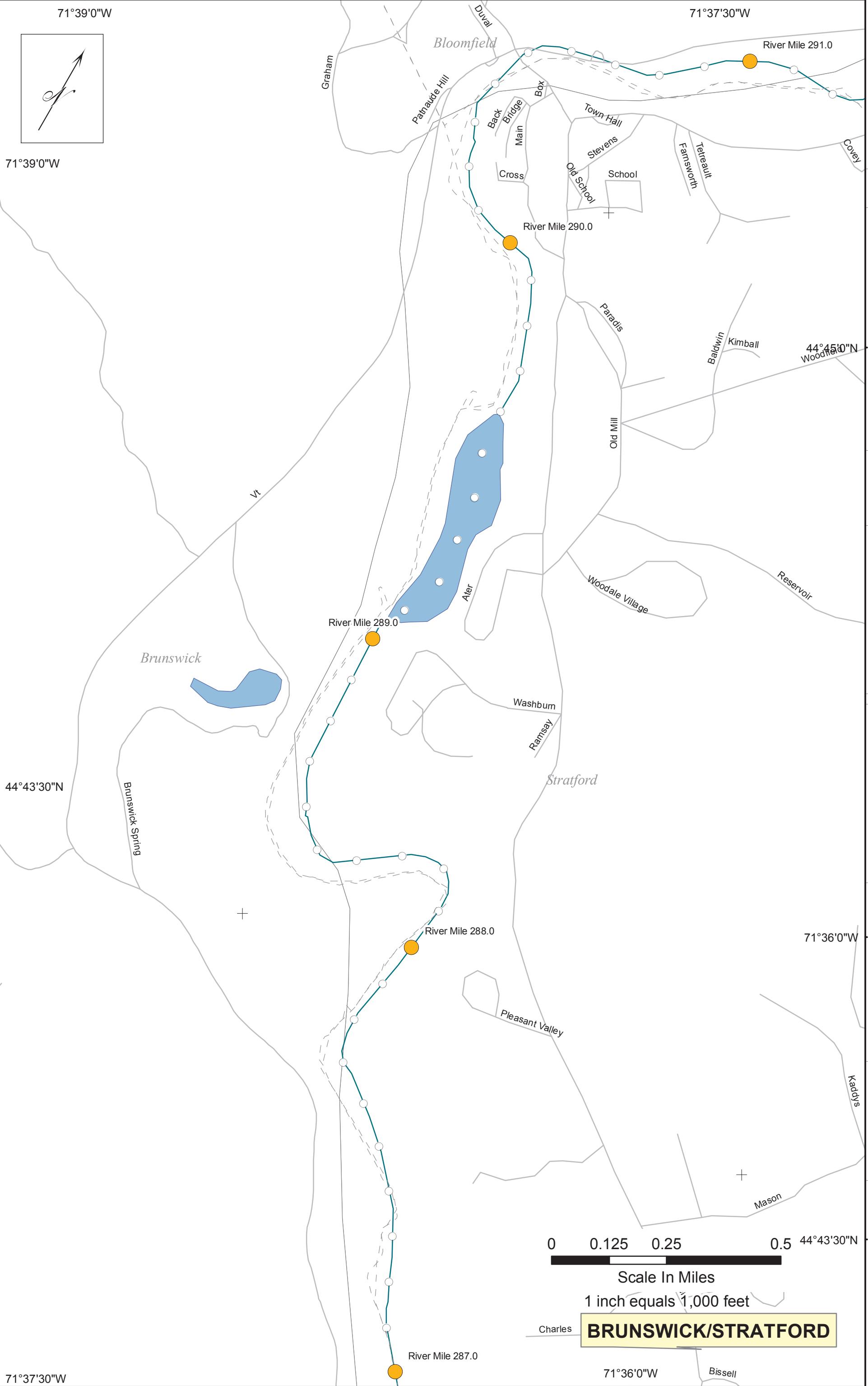












71°39'0"W

71°37'30"W

River Mile 291.0

River Mile 290.0

River Mile 289.0

River Mile 288.0

River Mile 287.0

44°45'0"N

Woodfield

71°36'0"W

44°43'30"N

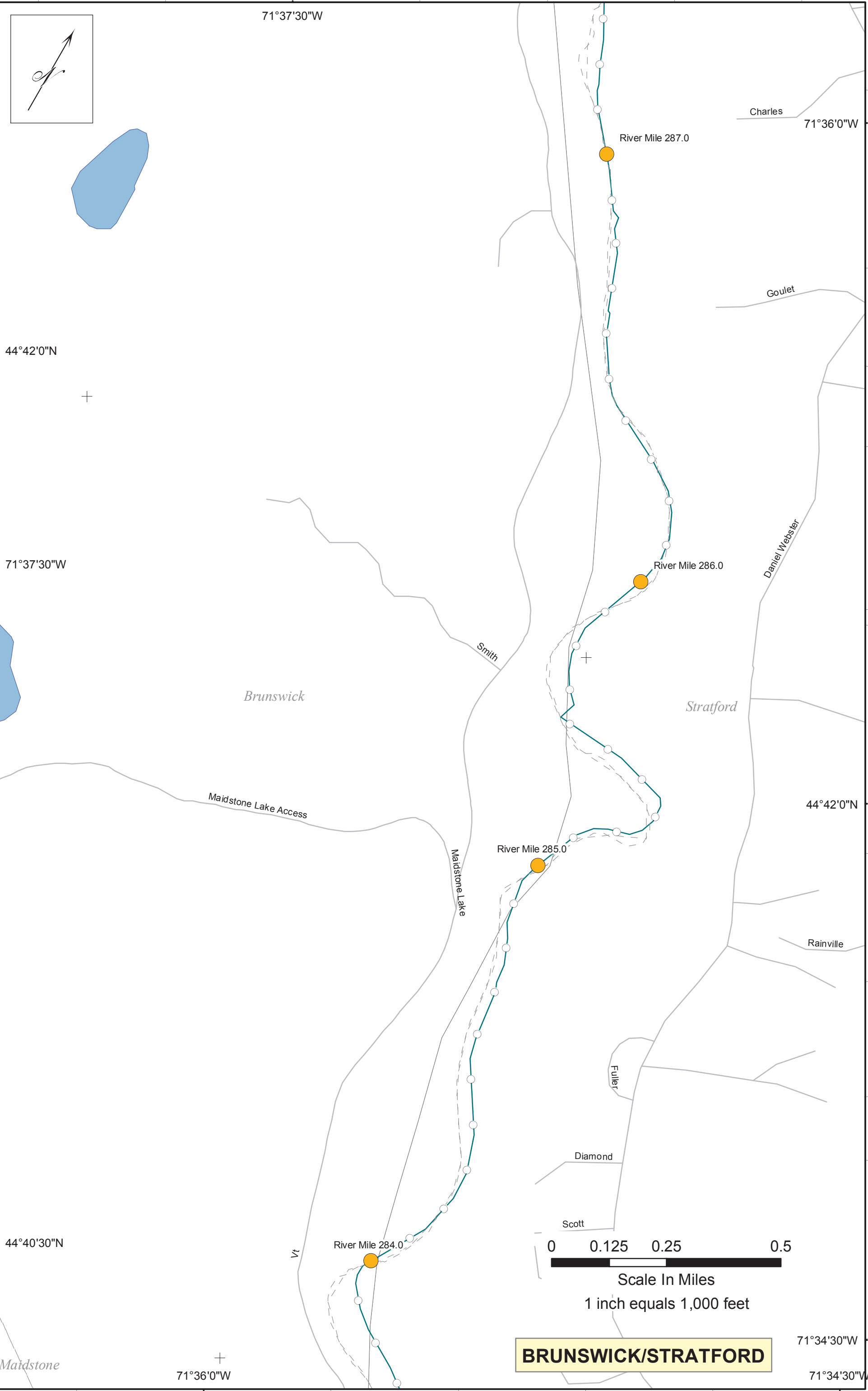
71°37'30"W

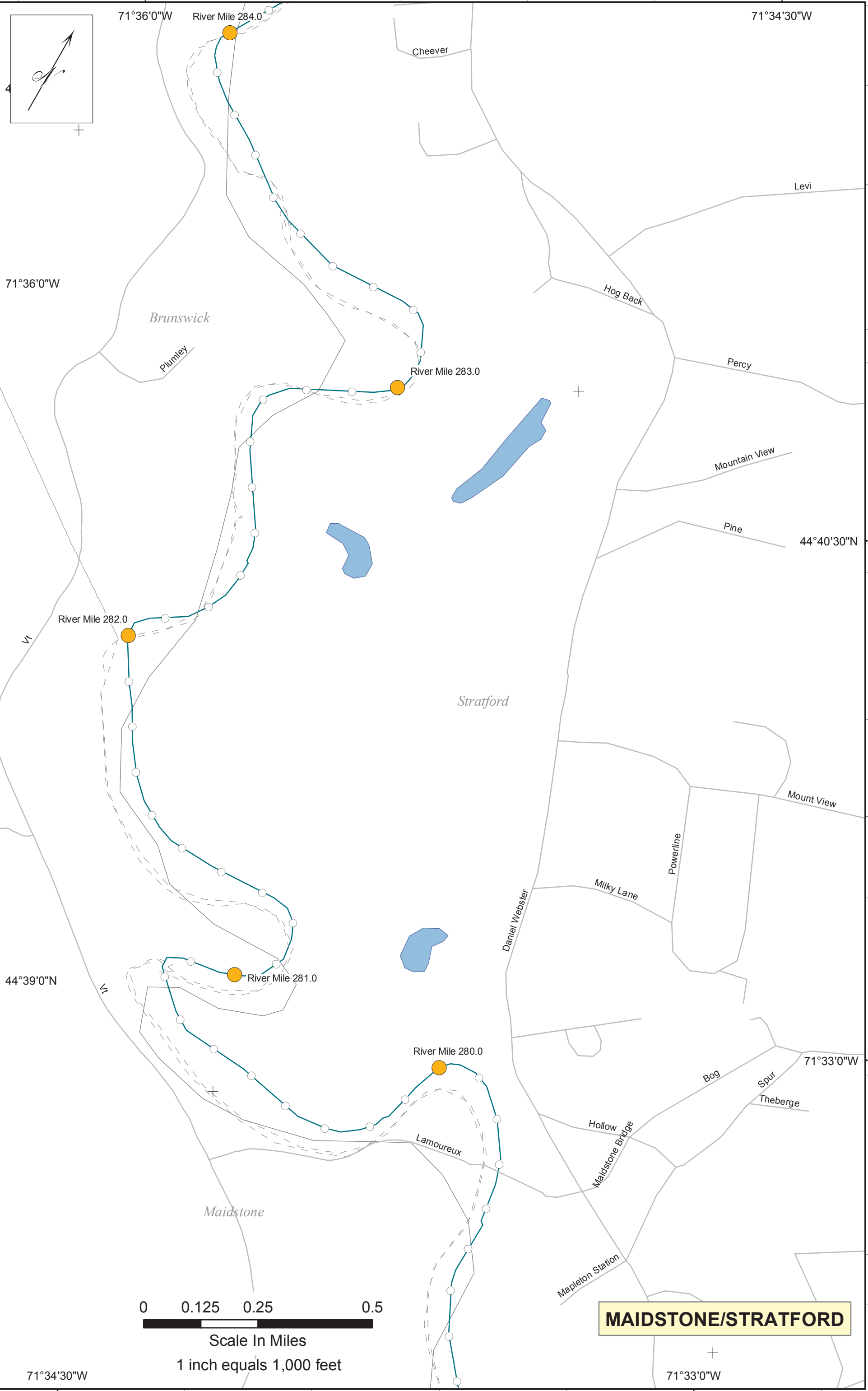
0 0.125 0.25 0.5

Scale In Miles

1 inch equals 1,000 feet

BRUNSWICK/STRATFORD







71°34'30"W

71°33'0"W

44°39'0"N

Stratford

River Mile 279.0

River Mile 278.0

Maidstone

44°37'30"N

River Mile 277.0

River Mile 276.0

44°37'30"N

Ball

Northumberland

Davenport

Daniel Webster

Brown

Mayhew

Vt

Connecticut River

River Mile 275.0

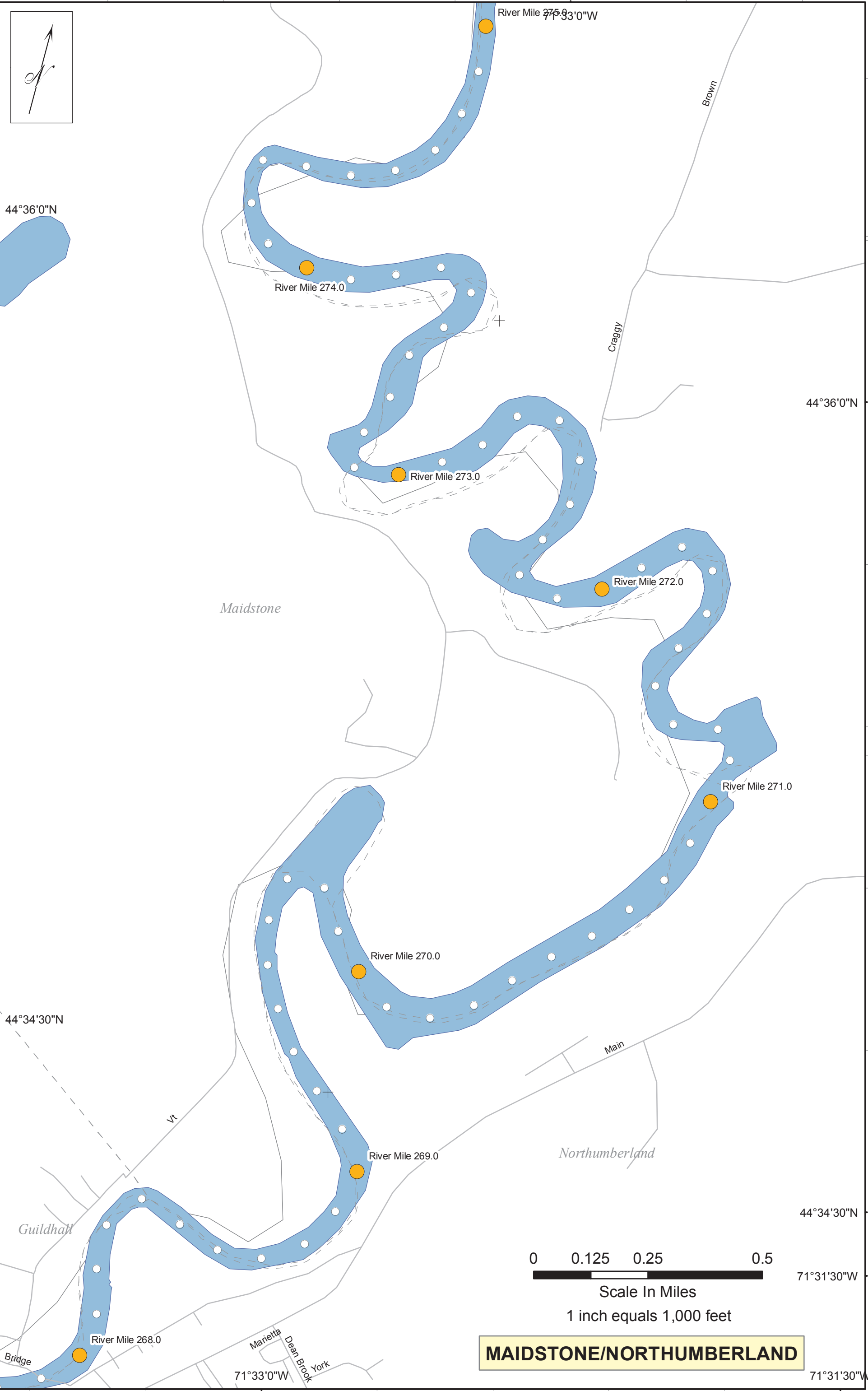
71°33'0"W



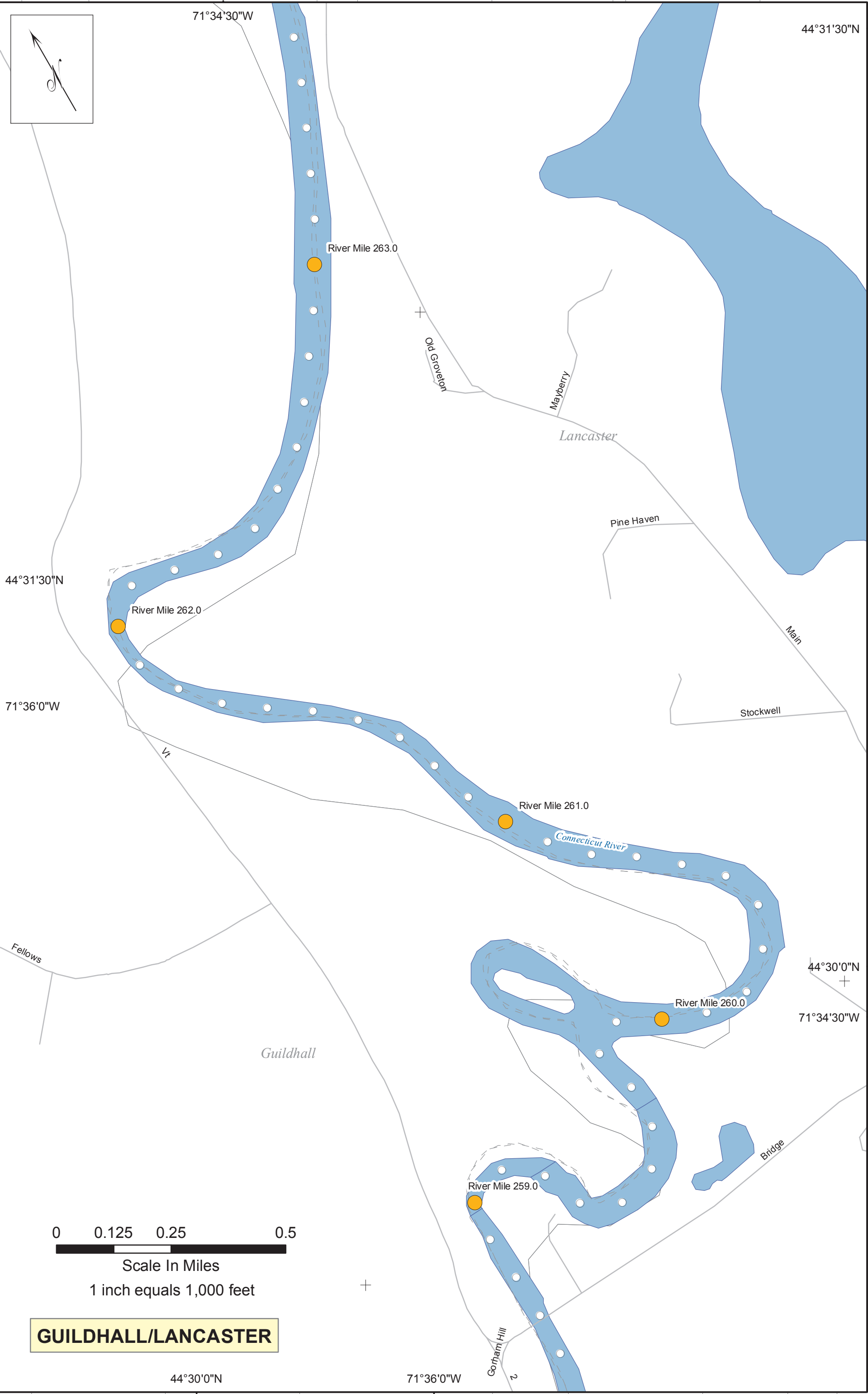
Scale In Miles

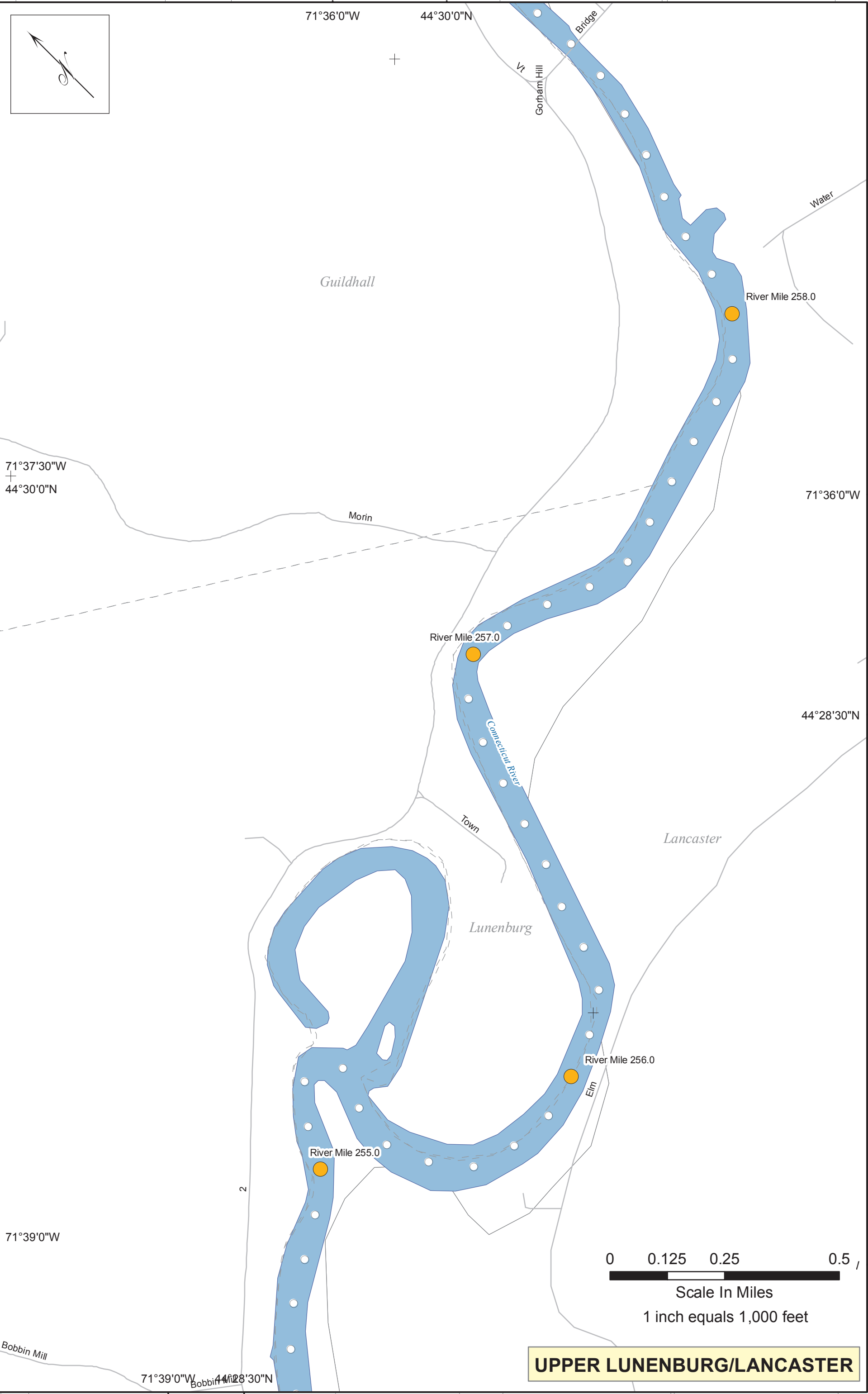
1 inch equals 1,000 feet

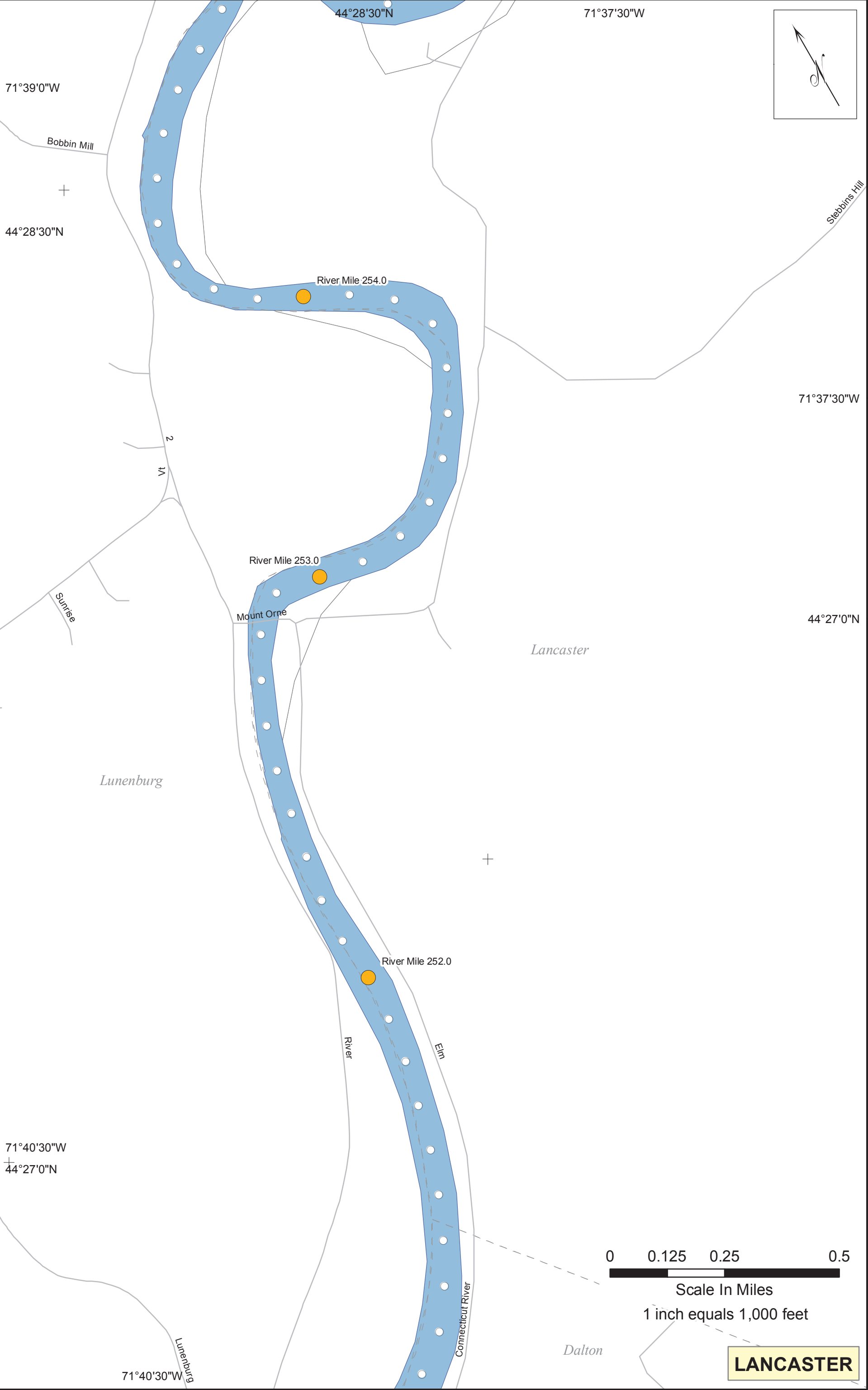
MAIDSTONE/NORTHUMBERLAND

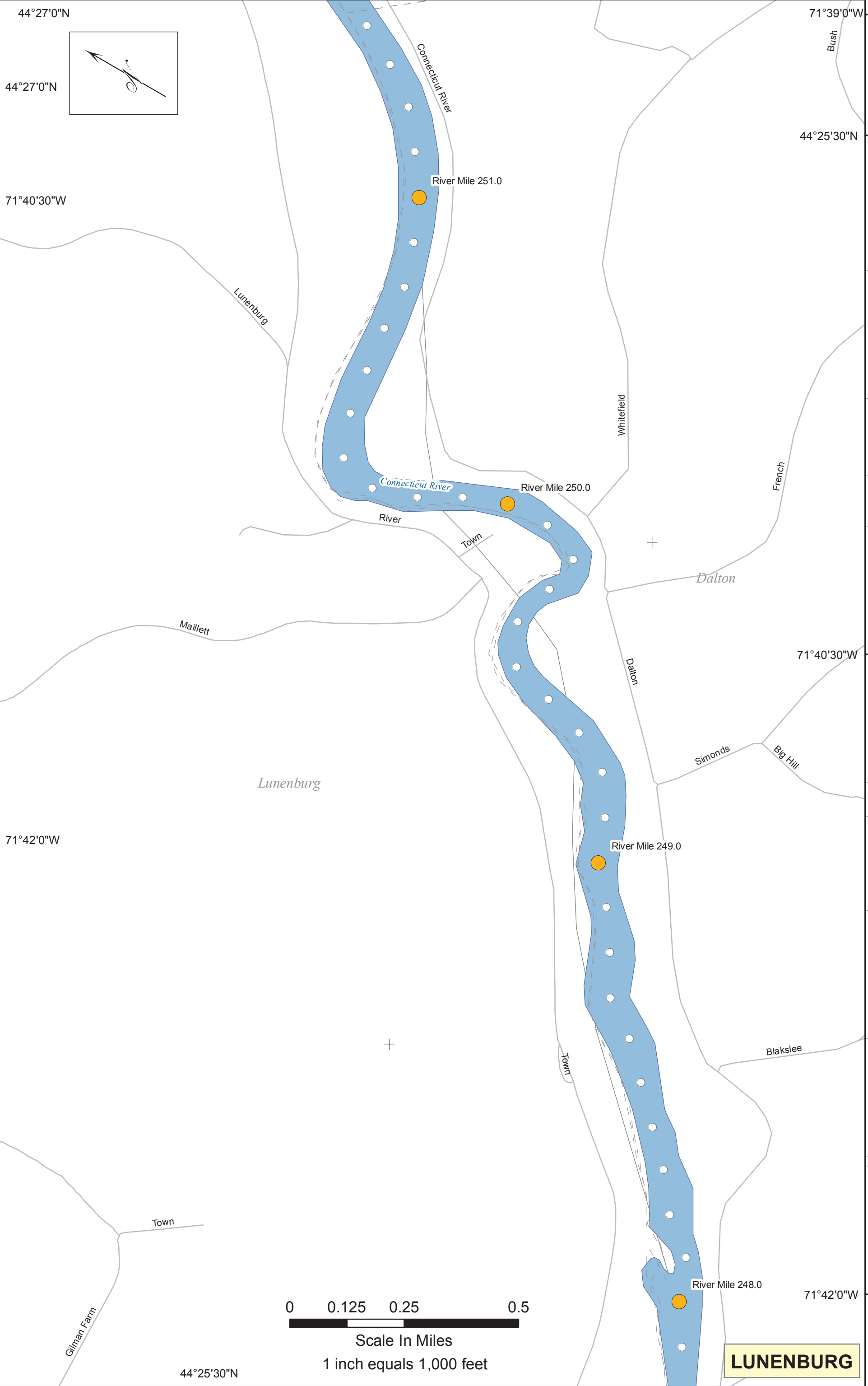


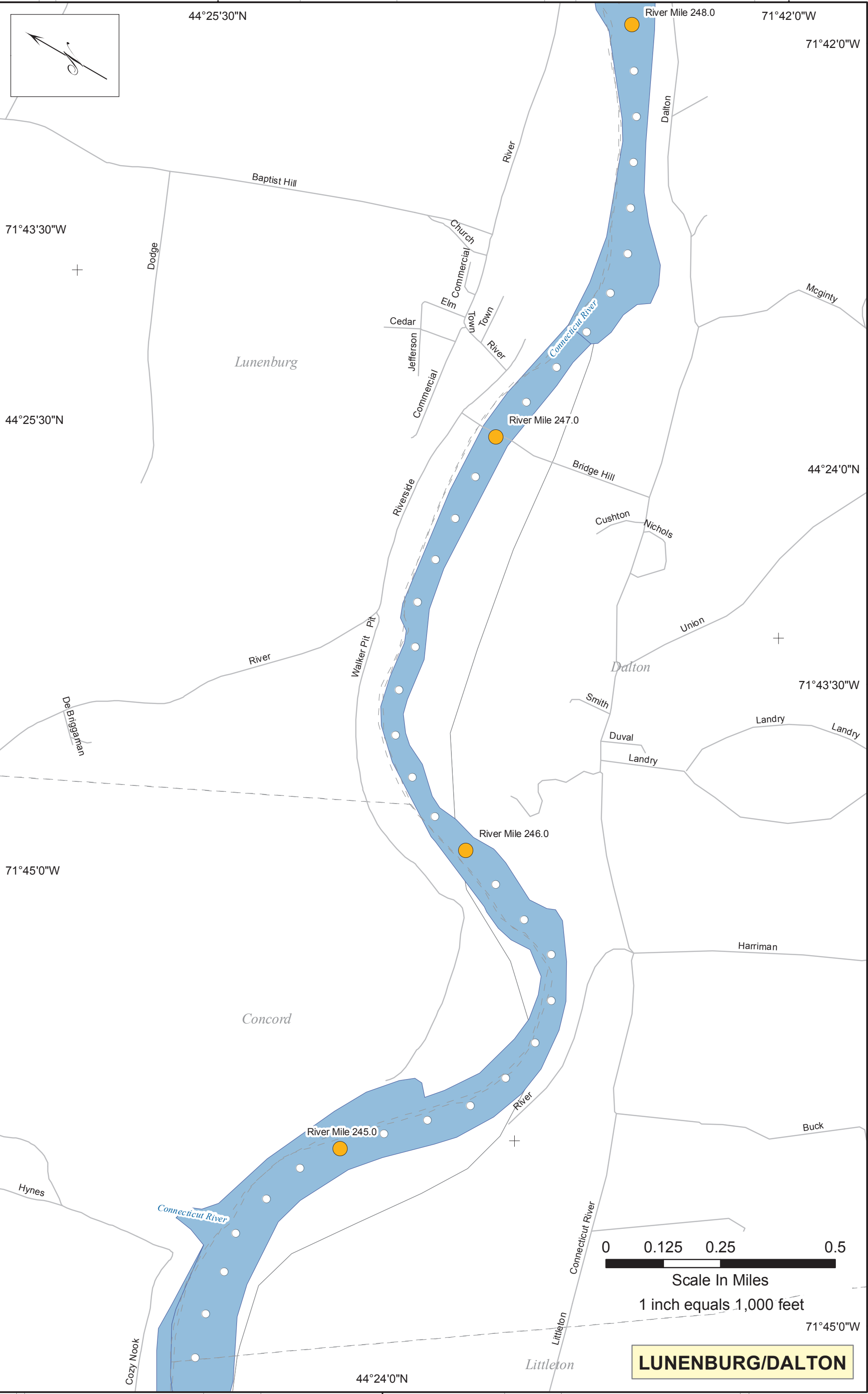




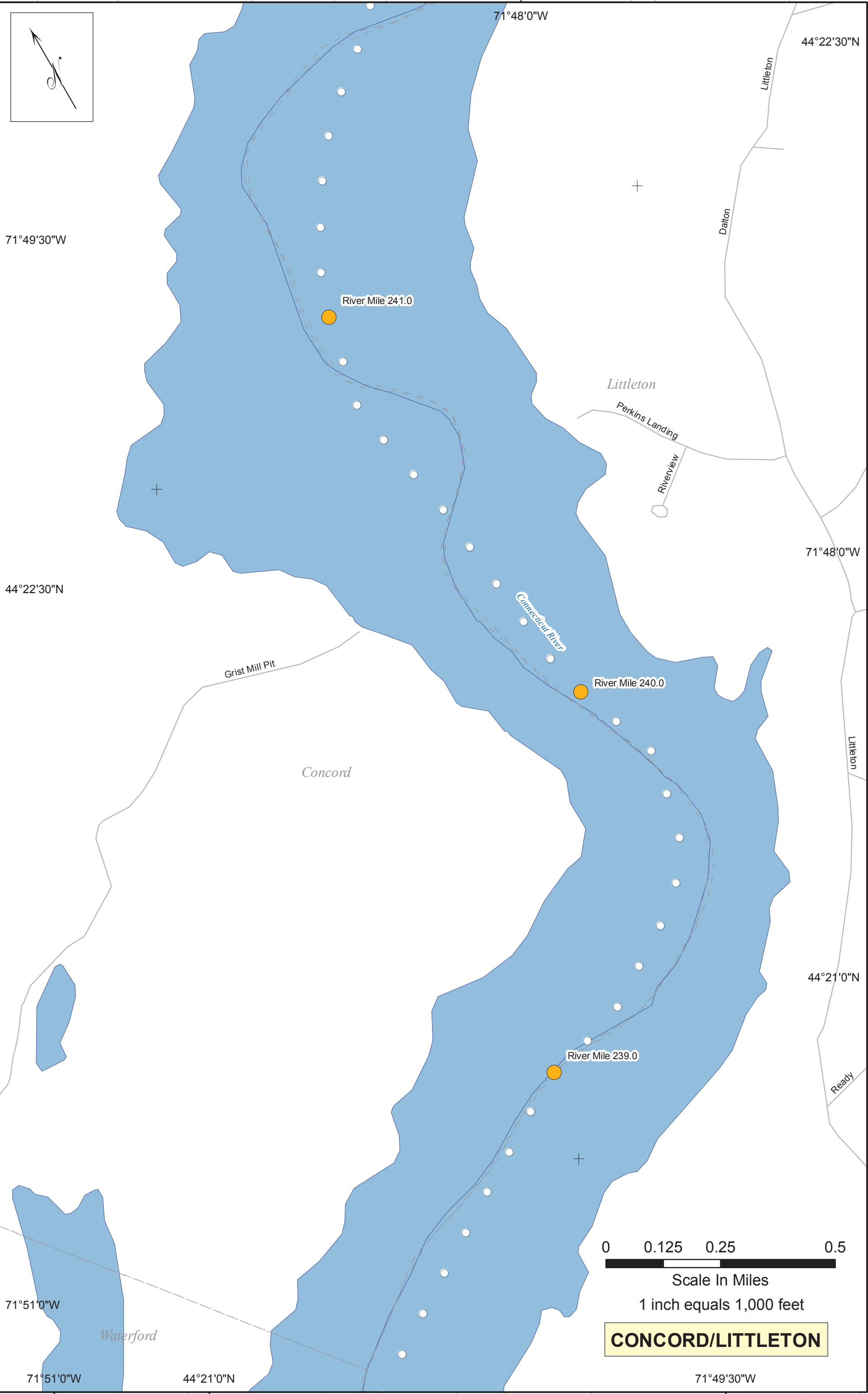


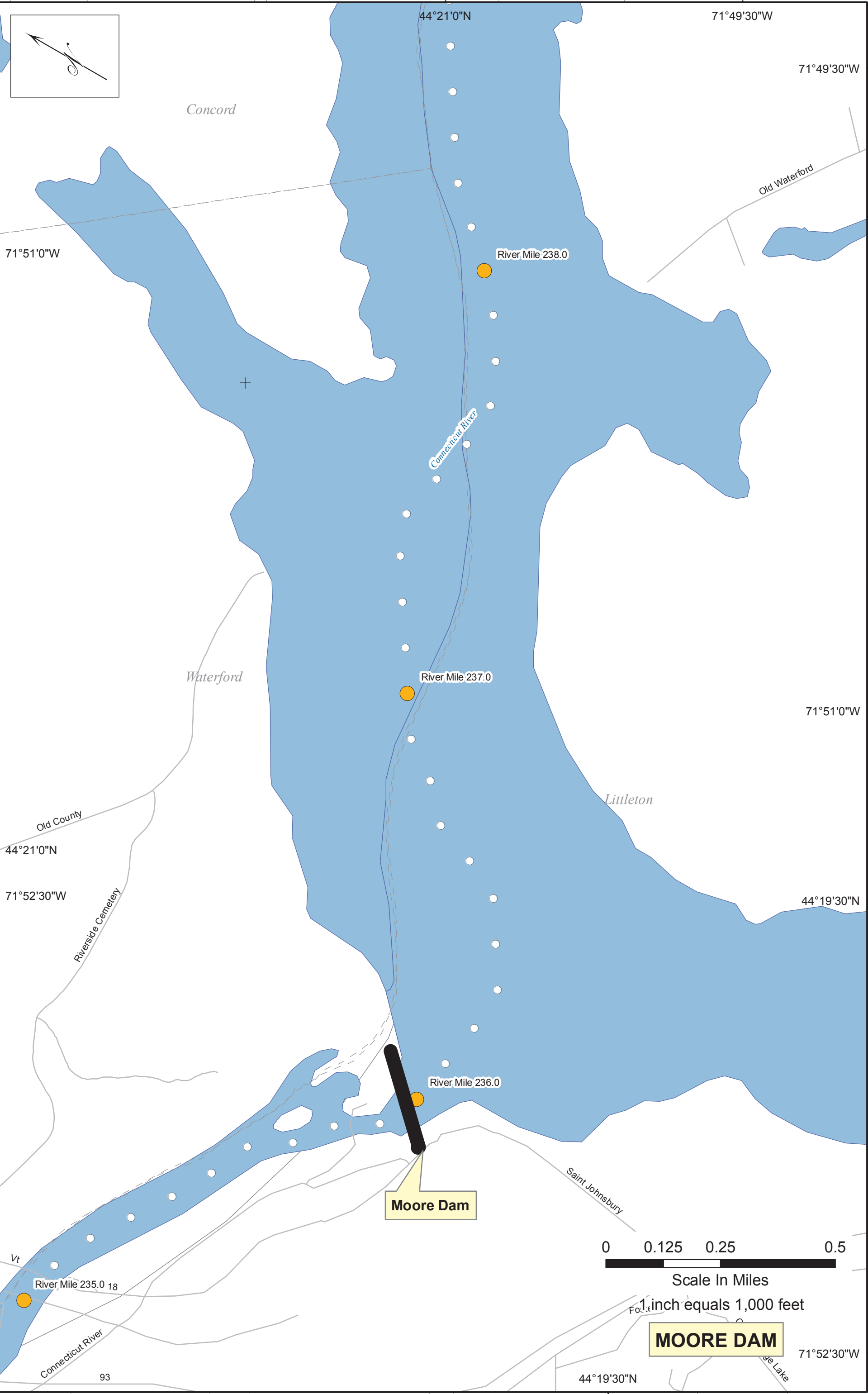




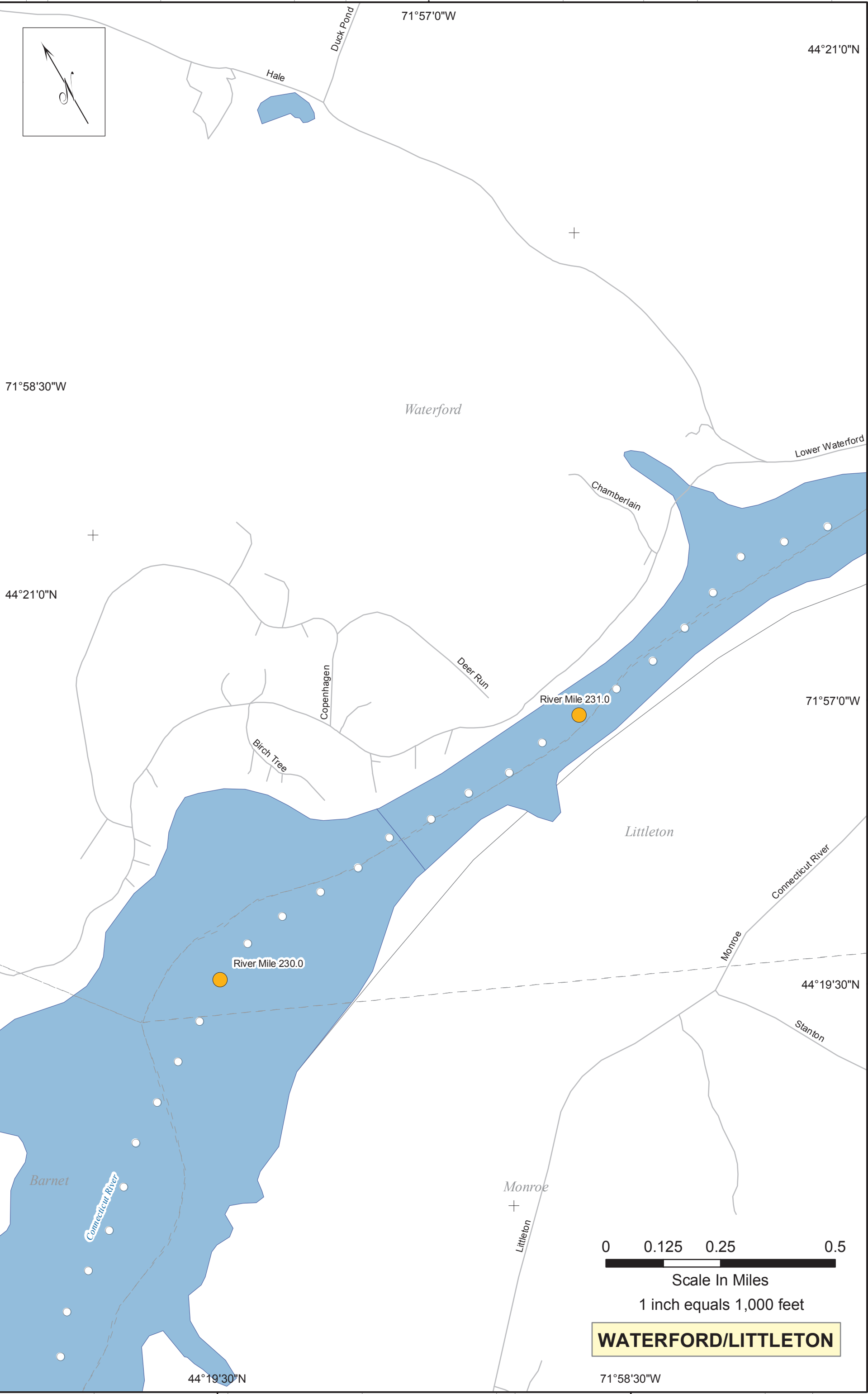


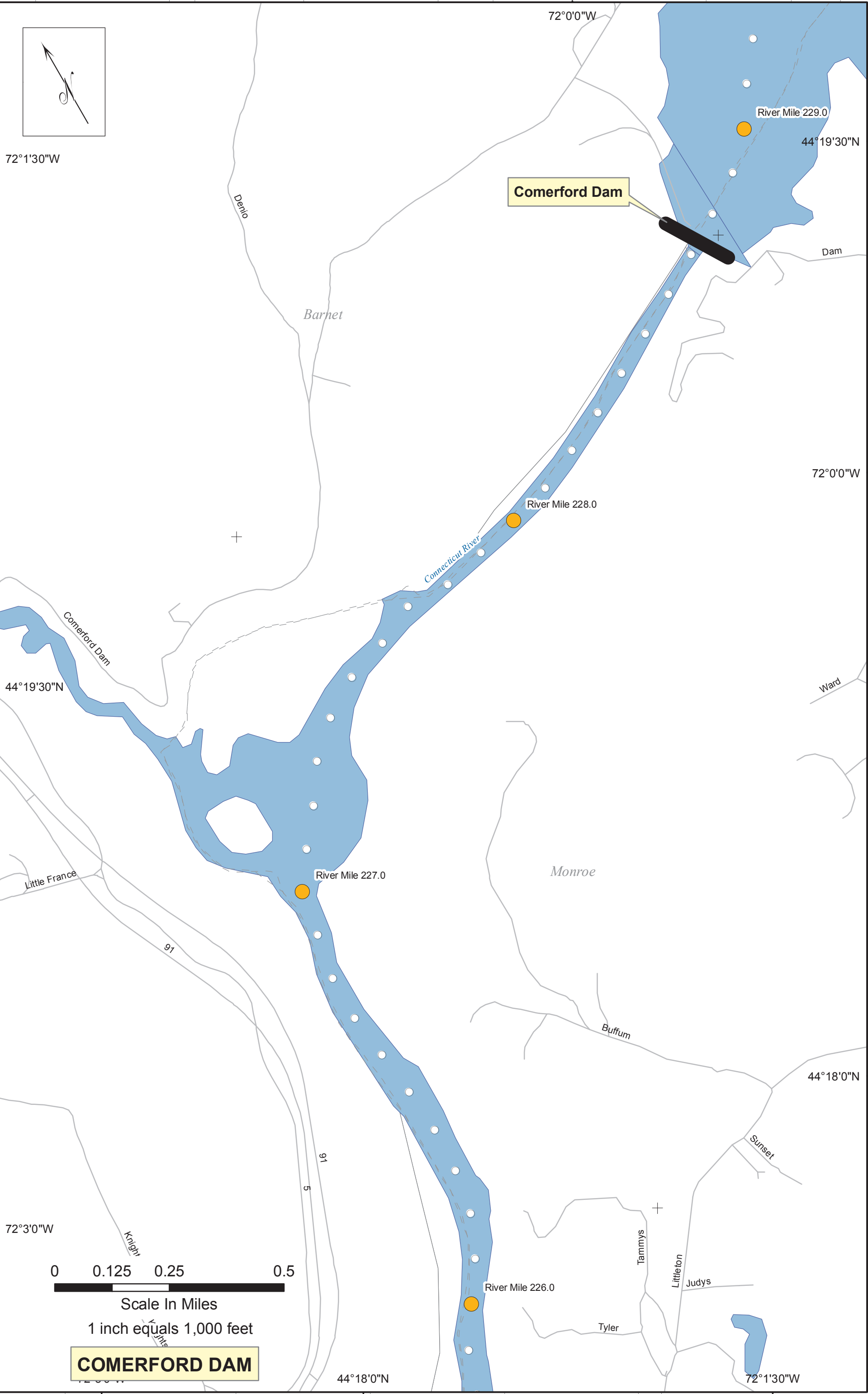




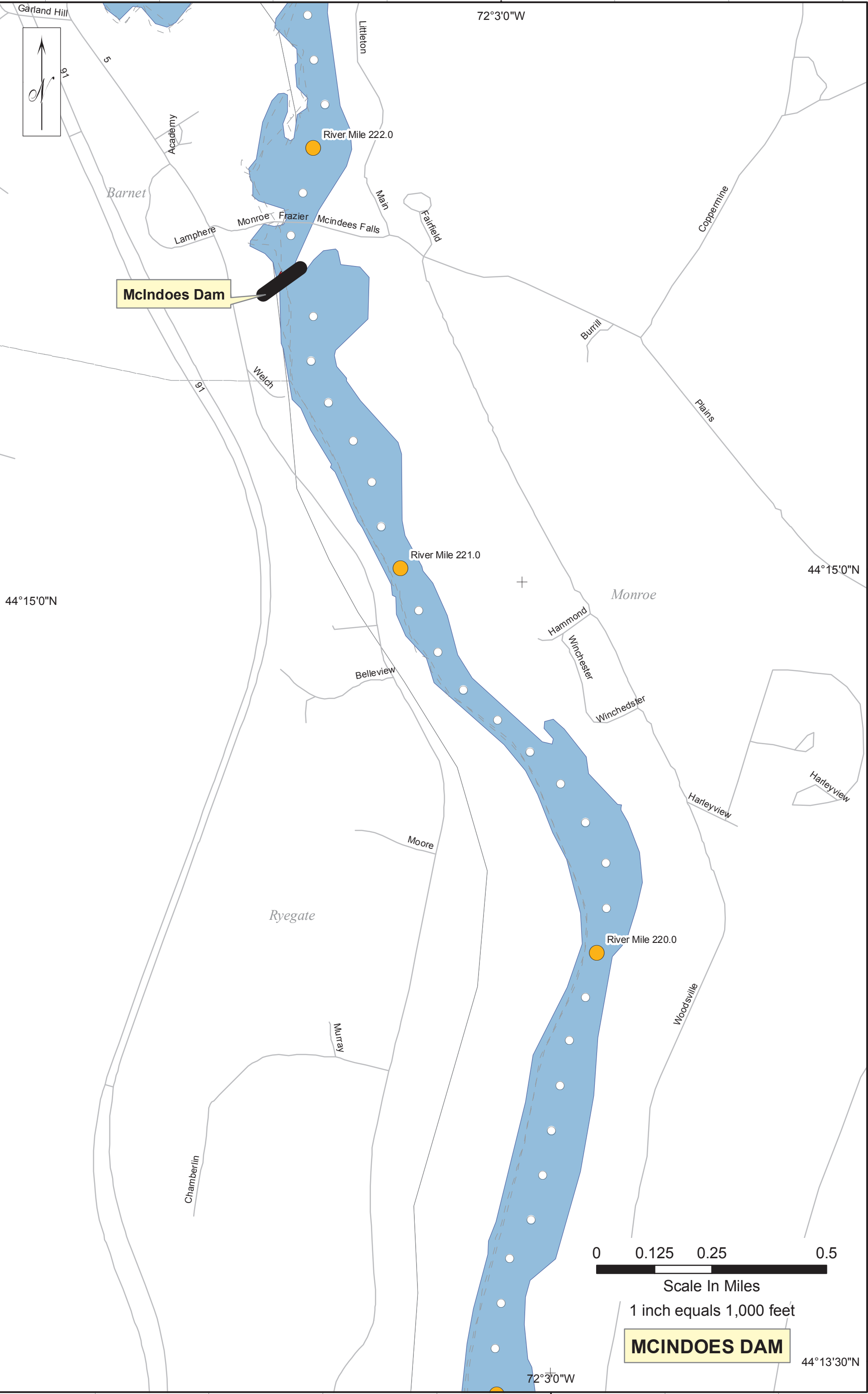


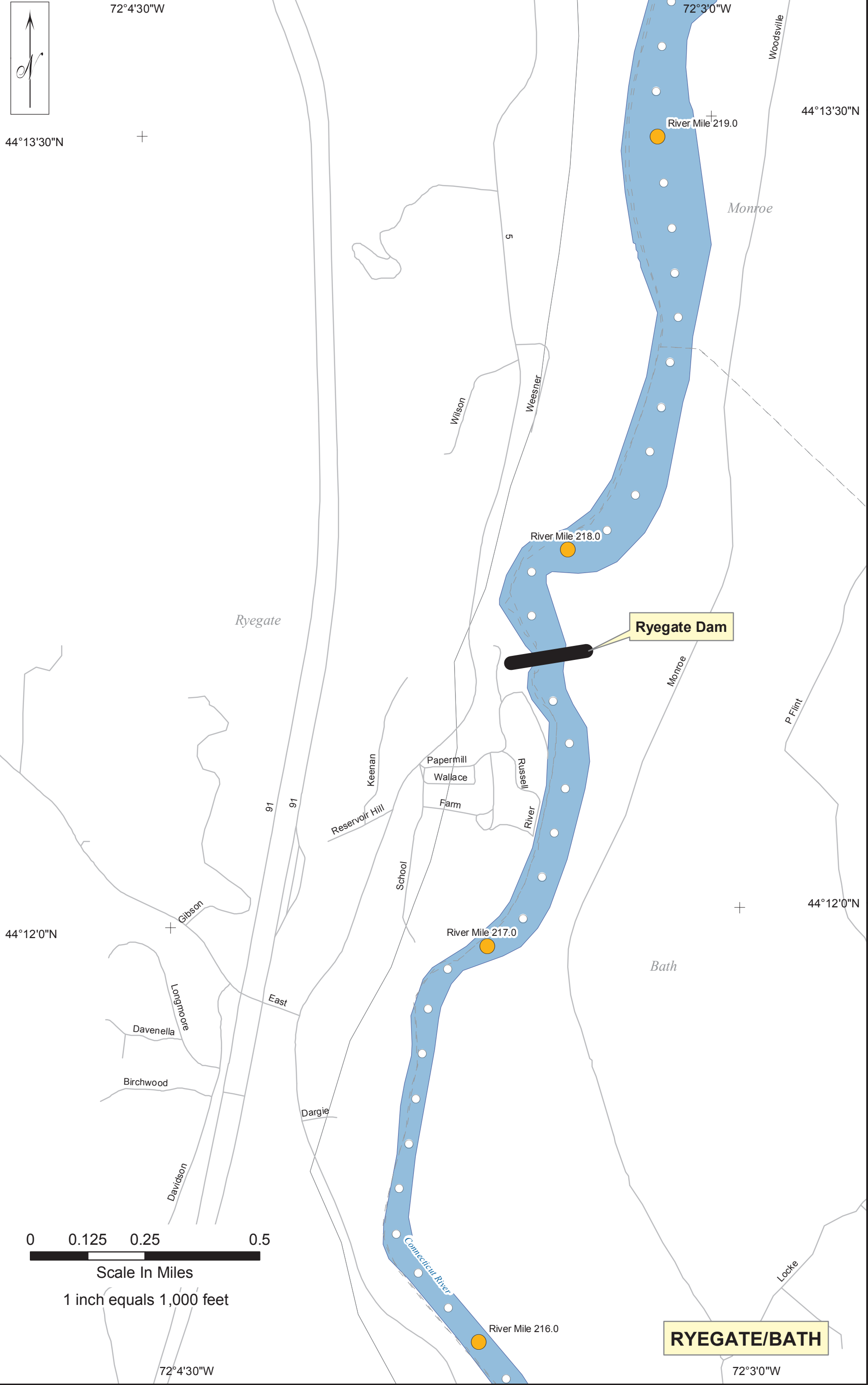






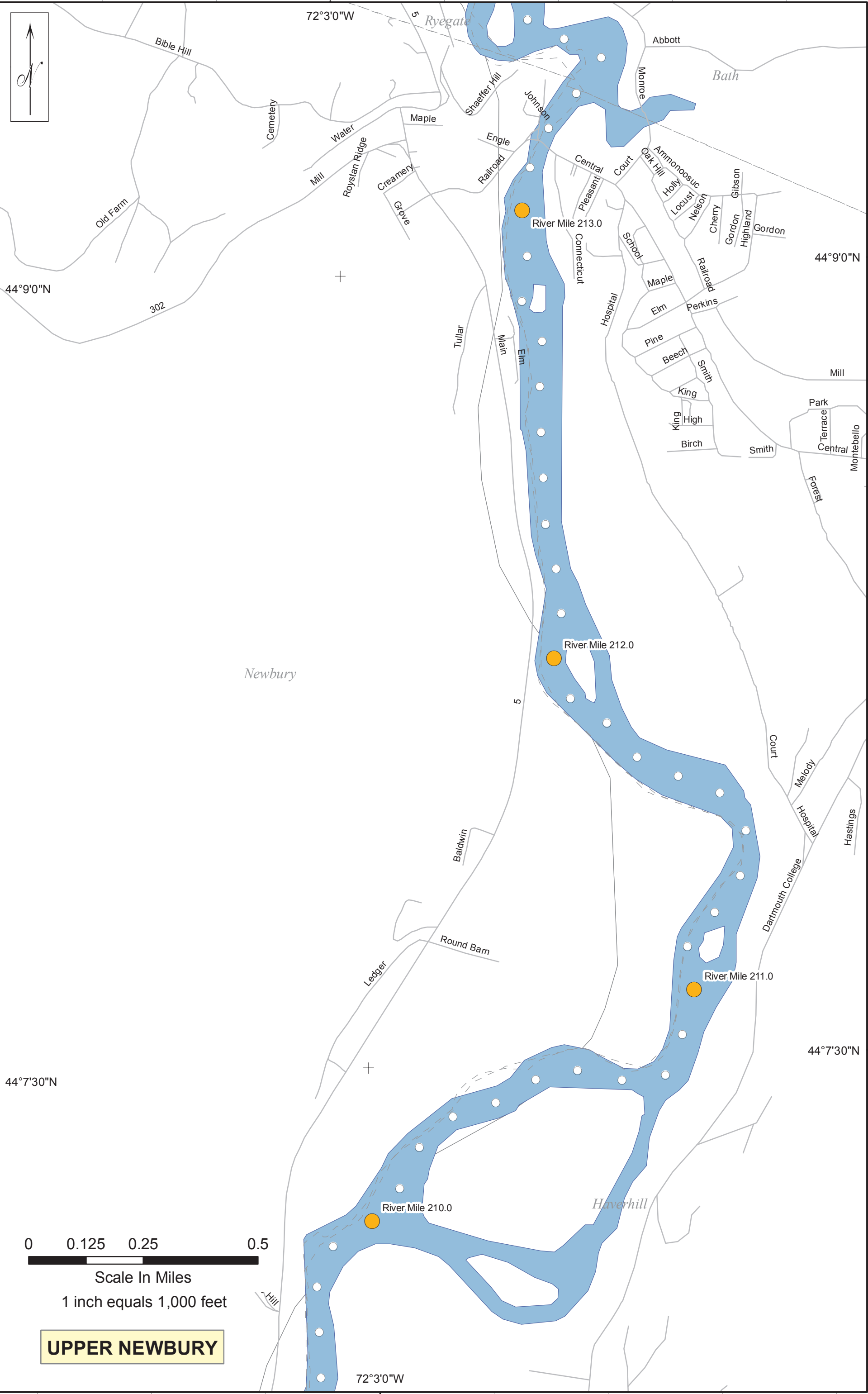




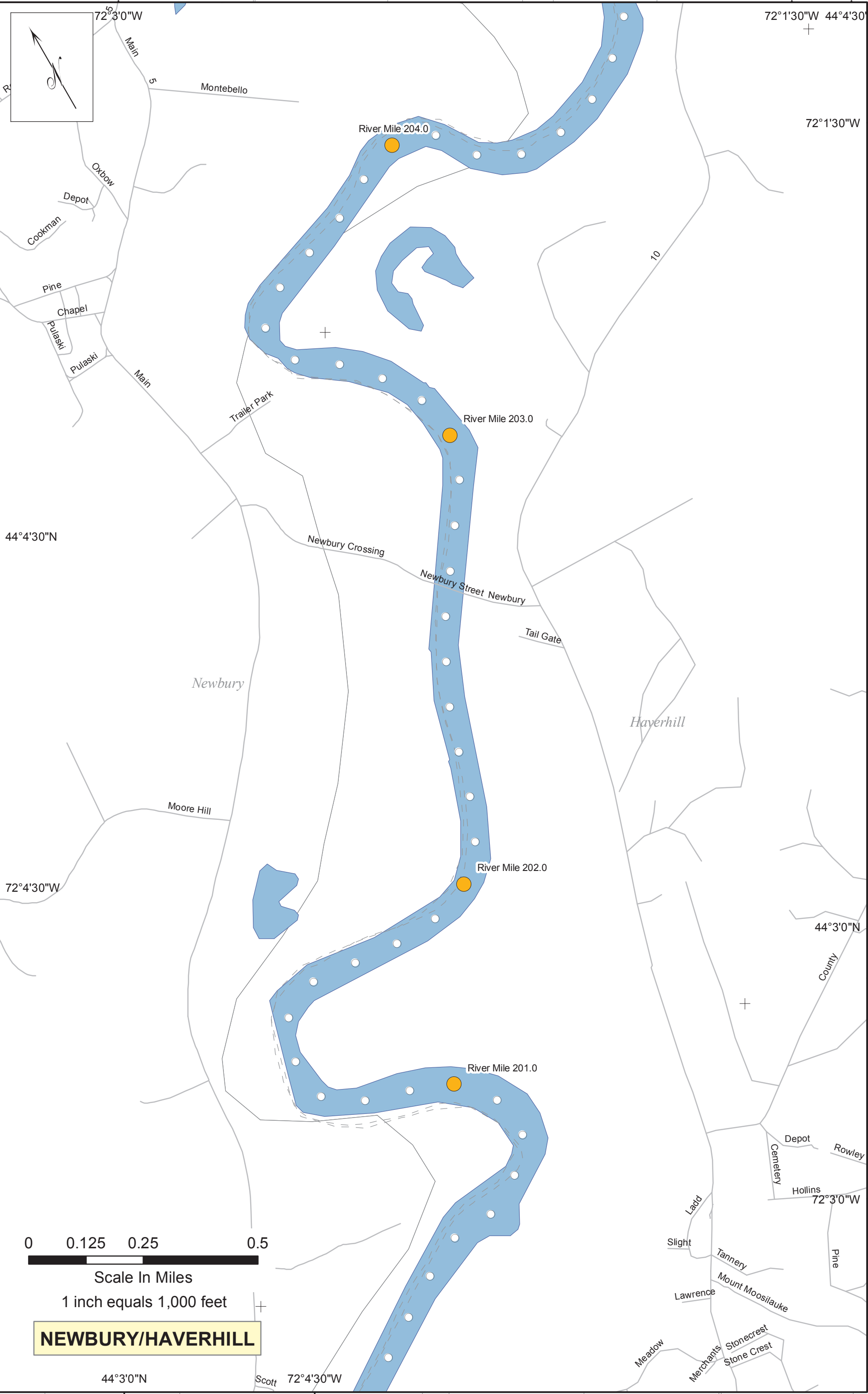




RYEGATE/BATH

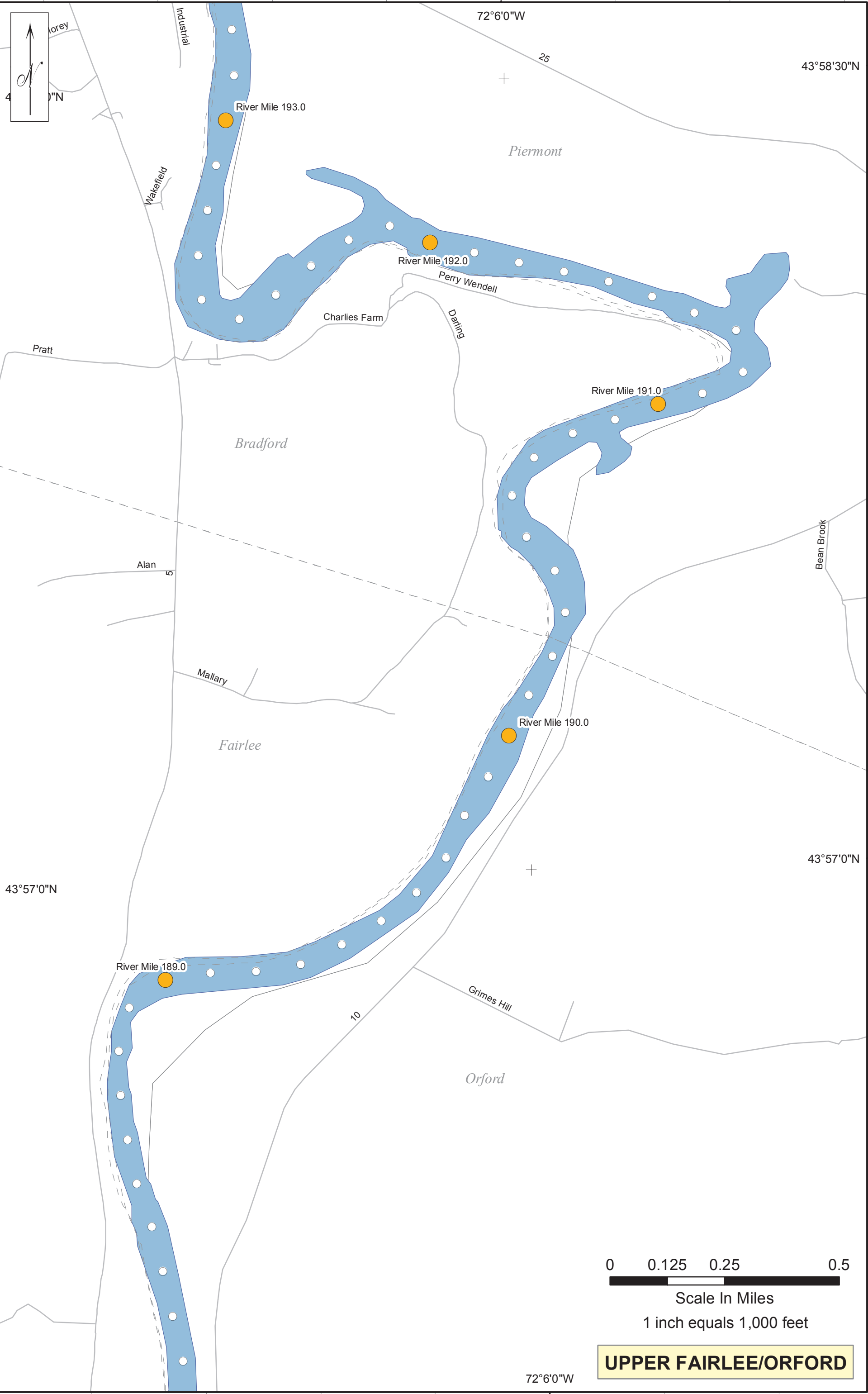












UPPER FAIRLEE/ORFORD





72°10'30"W



River Mile 182.0

River Mile 181.0

43°51'0"N

River Mile 180.0

Connecticut River

43°51'0"N

72°12'0"W

Thetford

Bridge

Thetford

Schoolhouse Hill

Park

Latham

Turnpike

River Mile 179.0

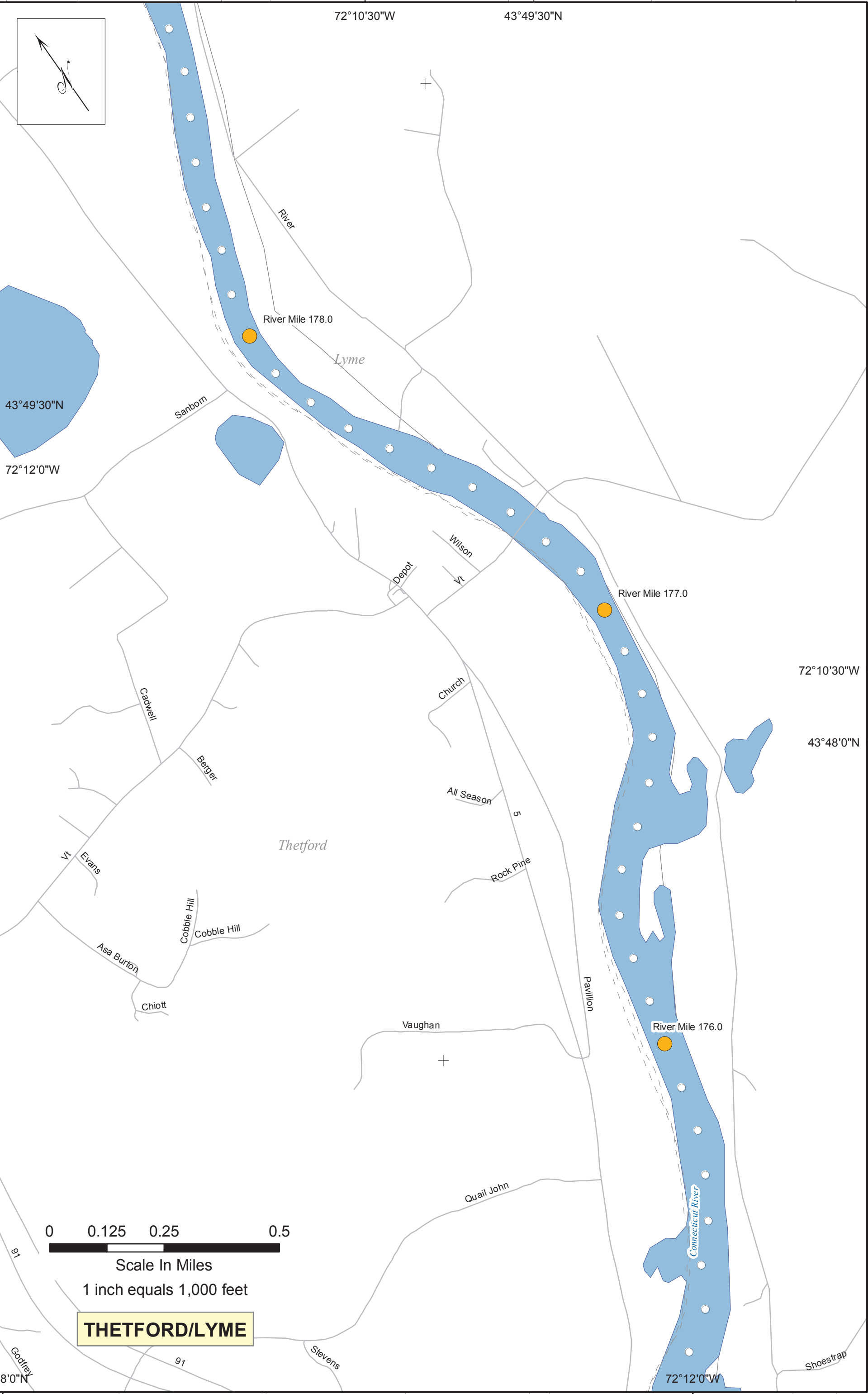


Scale In Miles
1 inch equals 1,000 feet

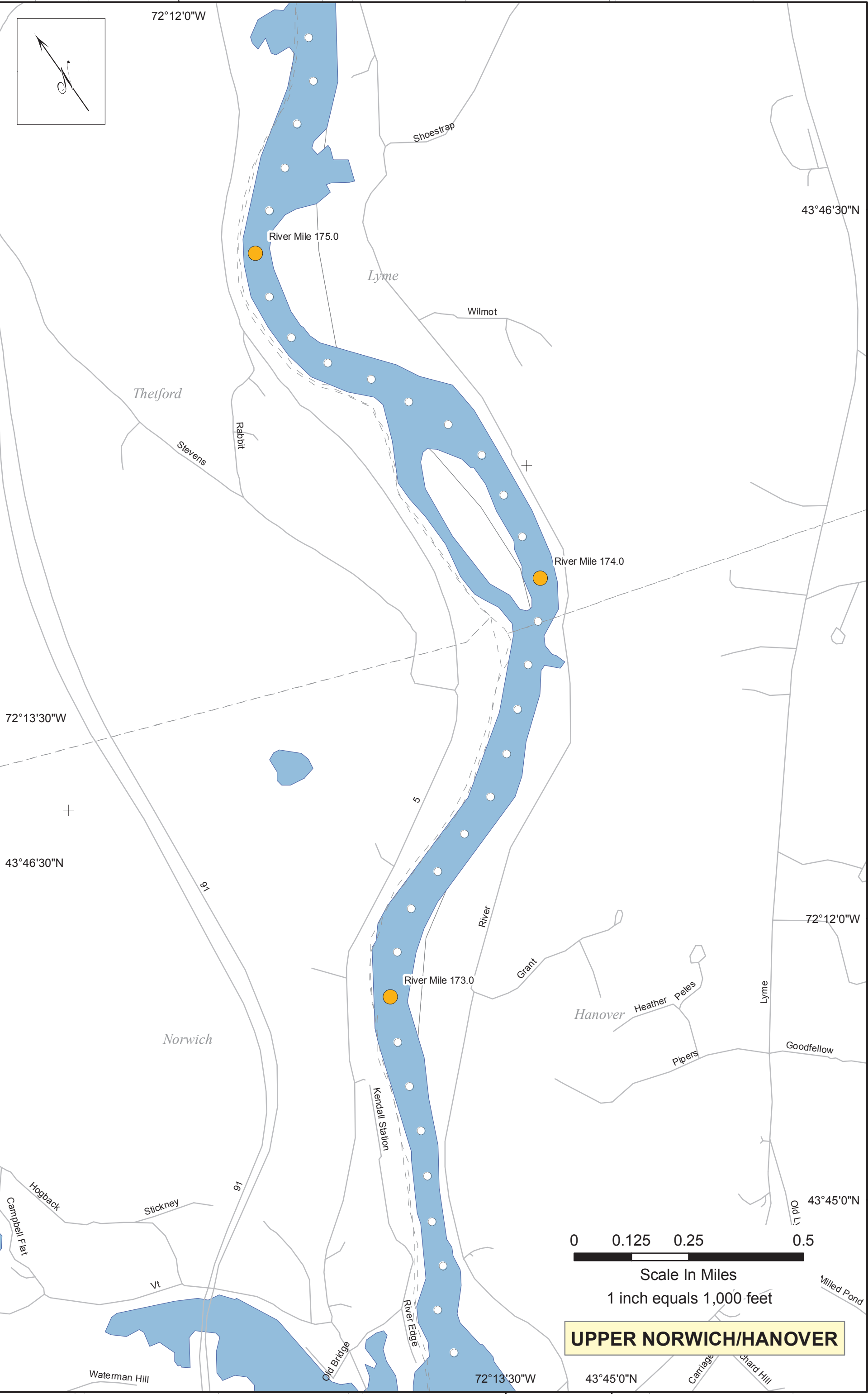
THETFORD/LYME

72°12'0"W

72°10'30"W

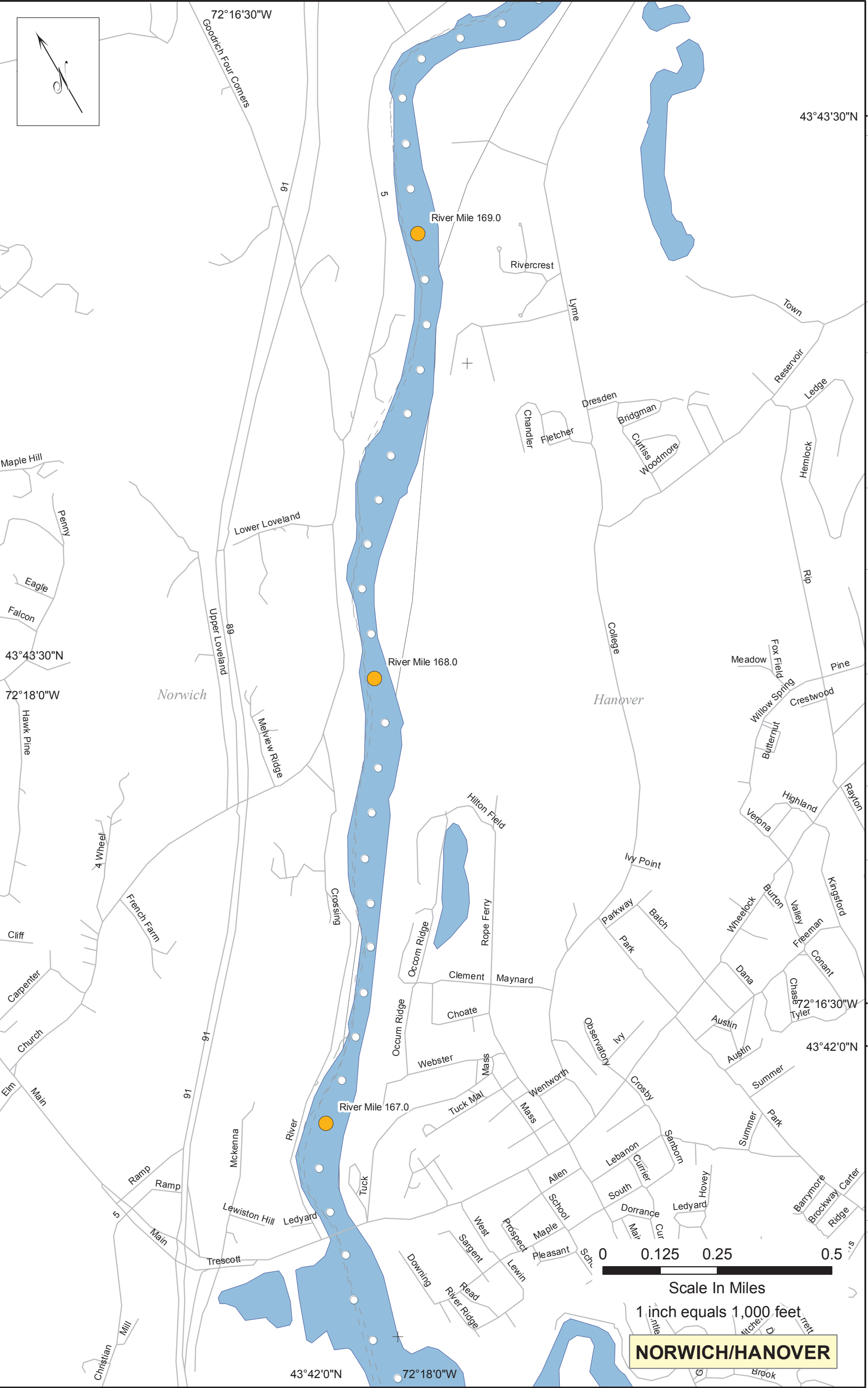


THETFORD/LYME



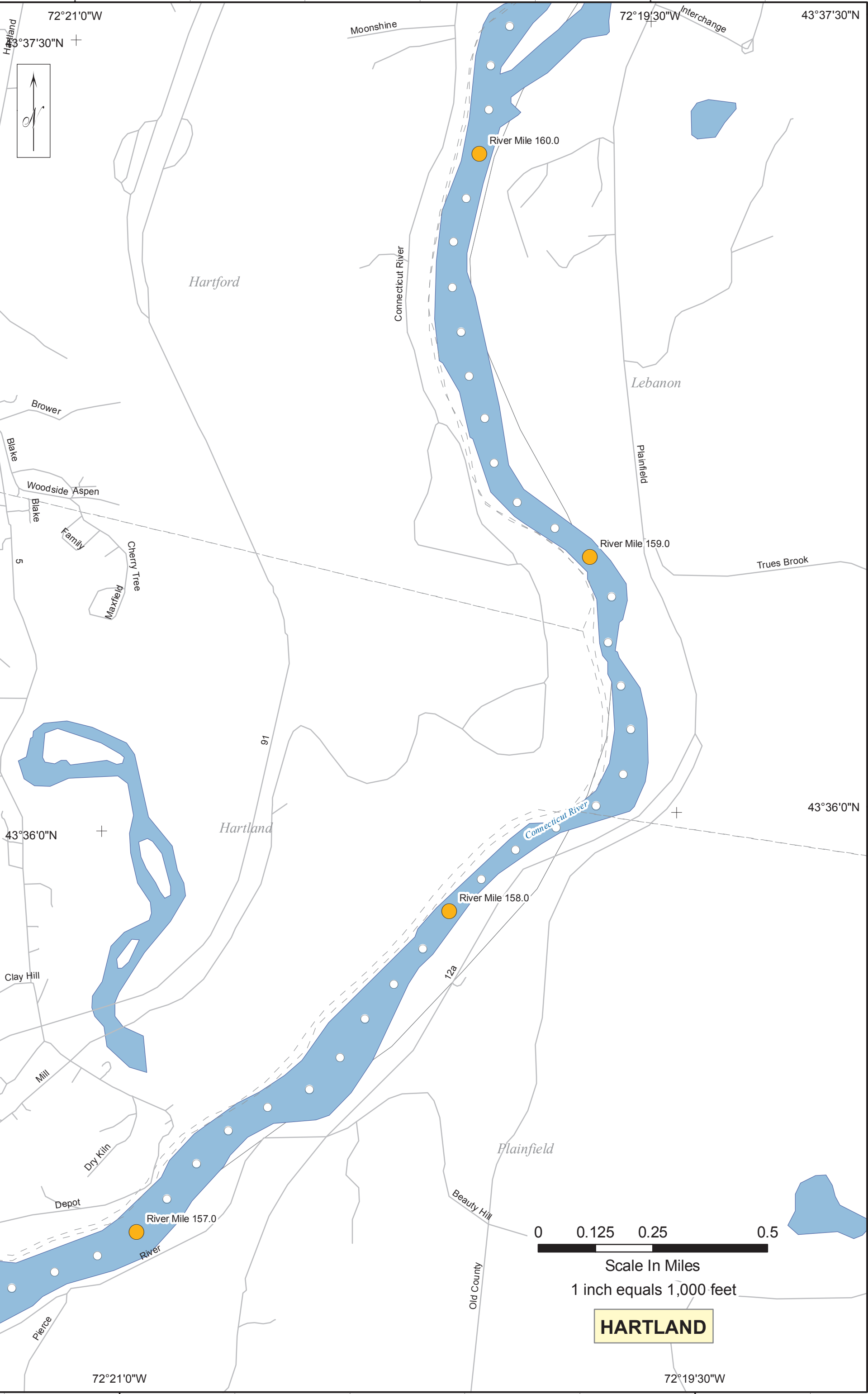


NORWICH/HANOVER









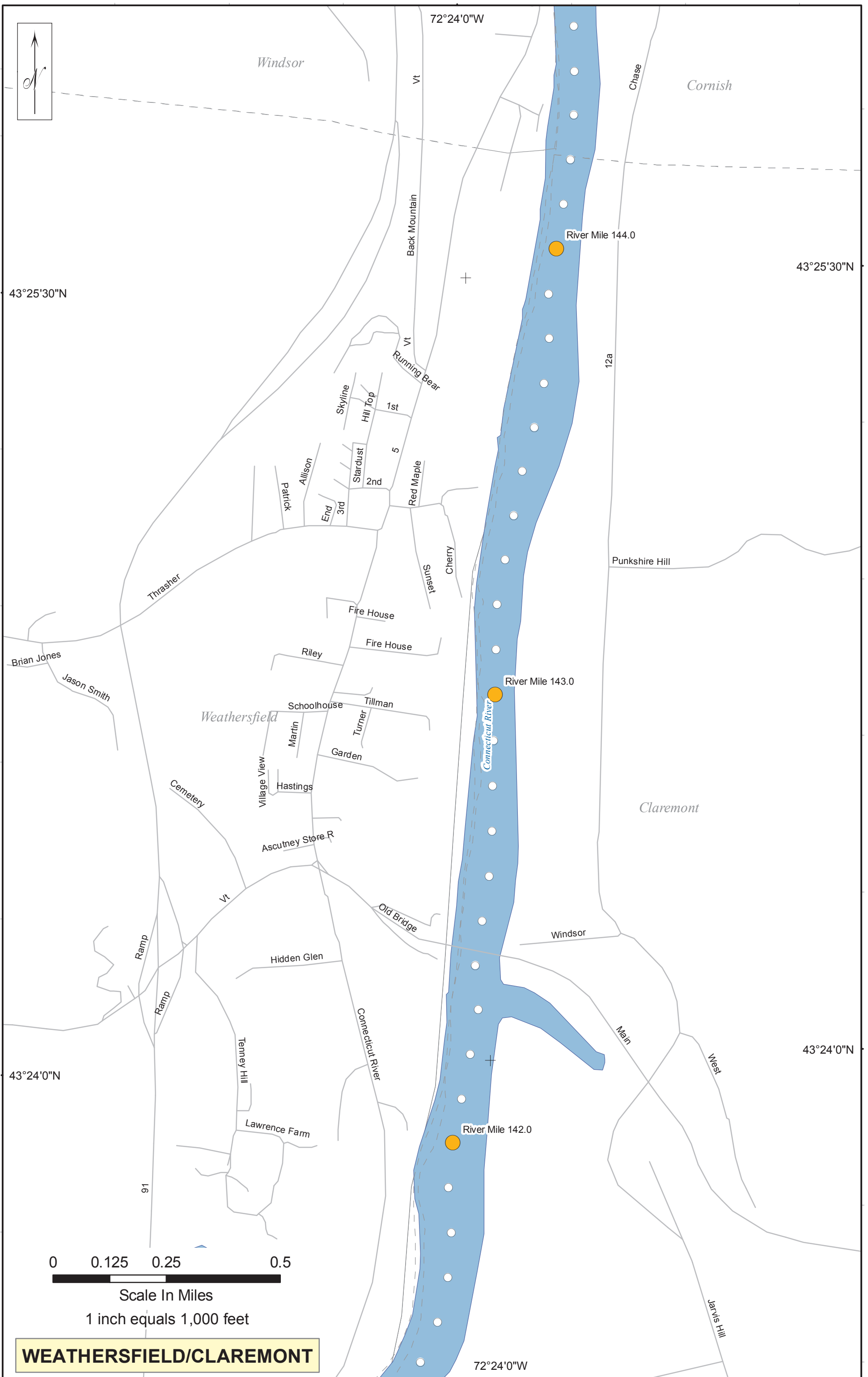


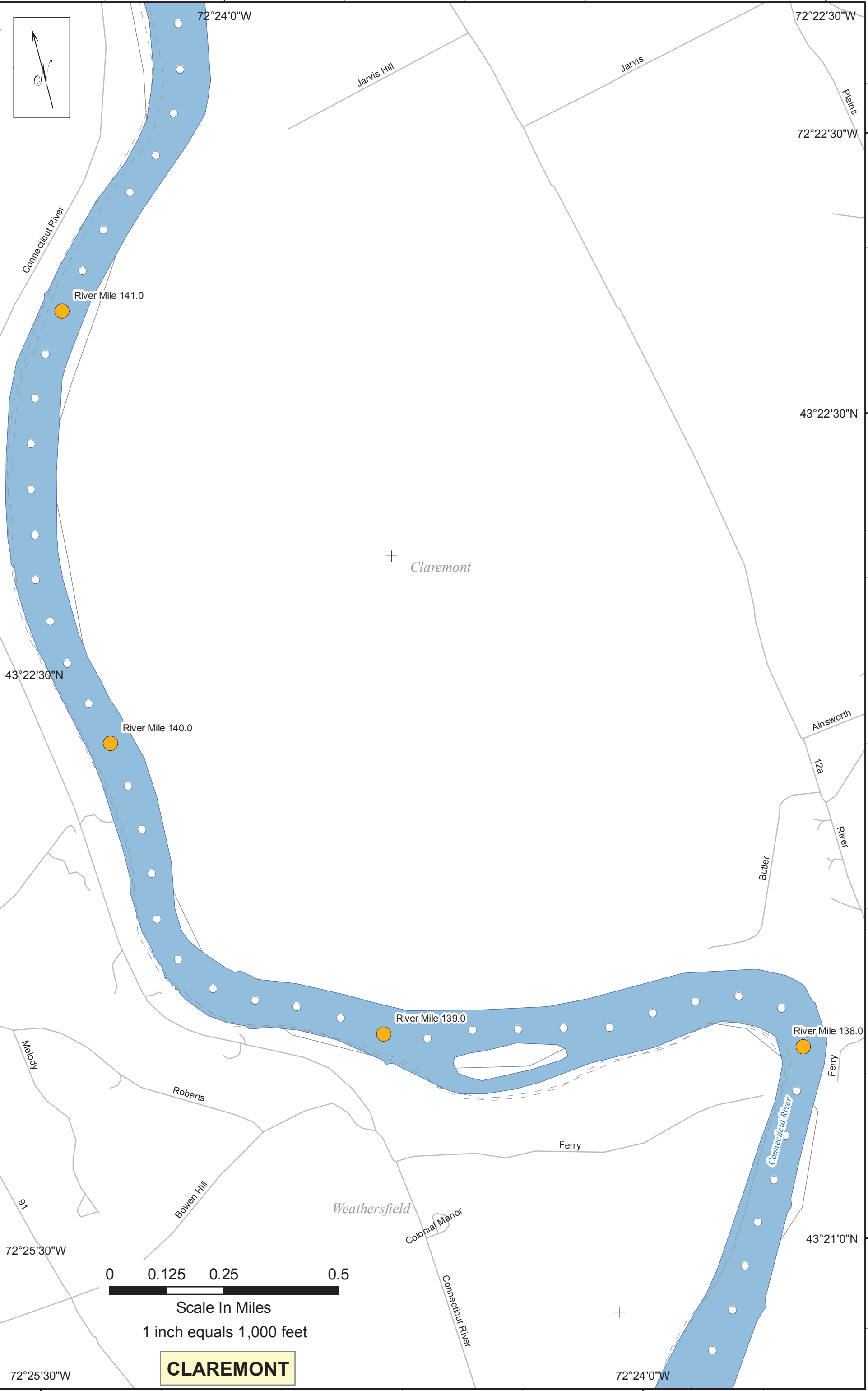


HARTLAND/PLAINFIELD

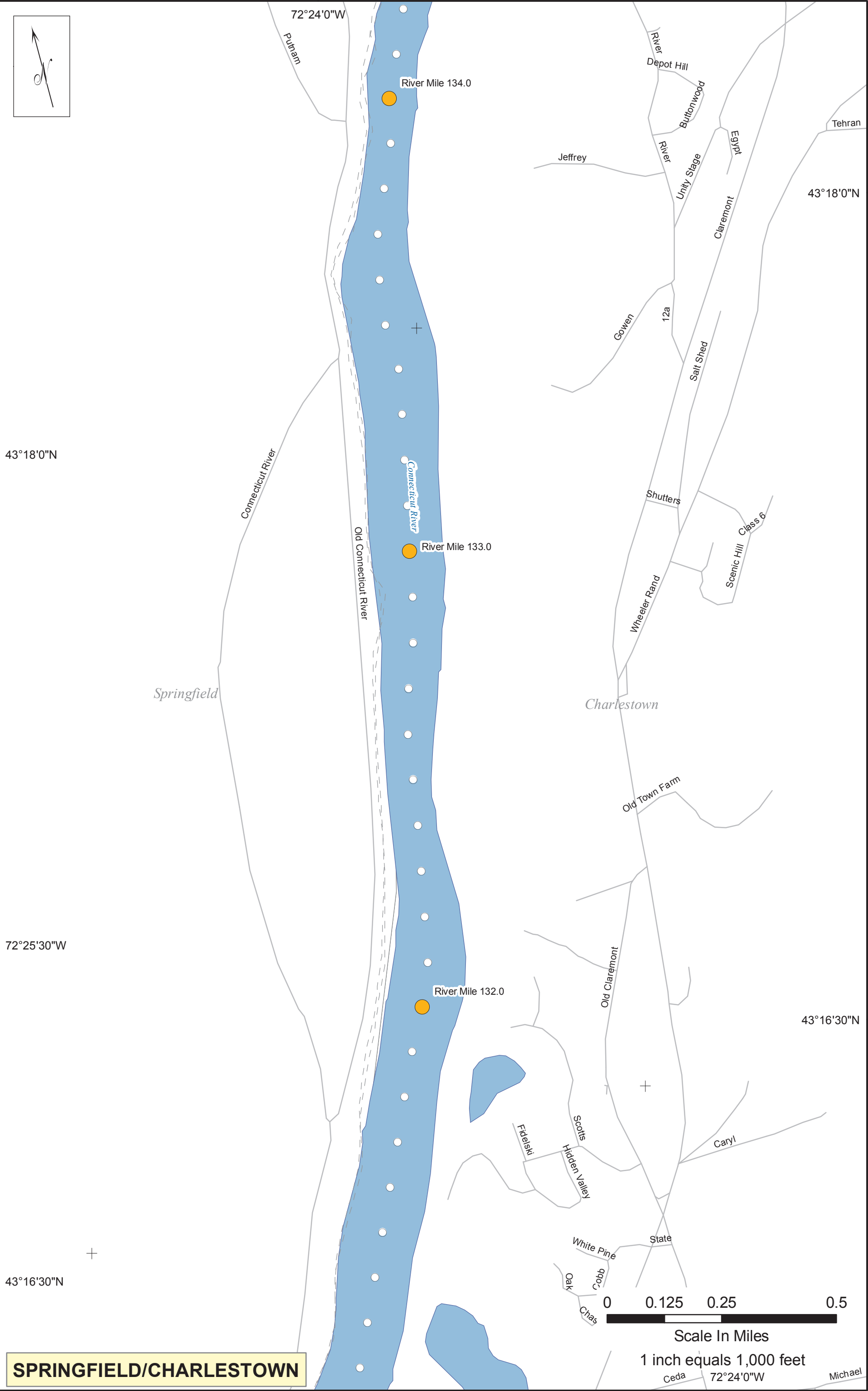


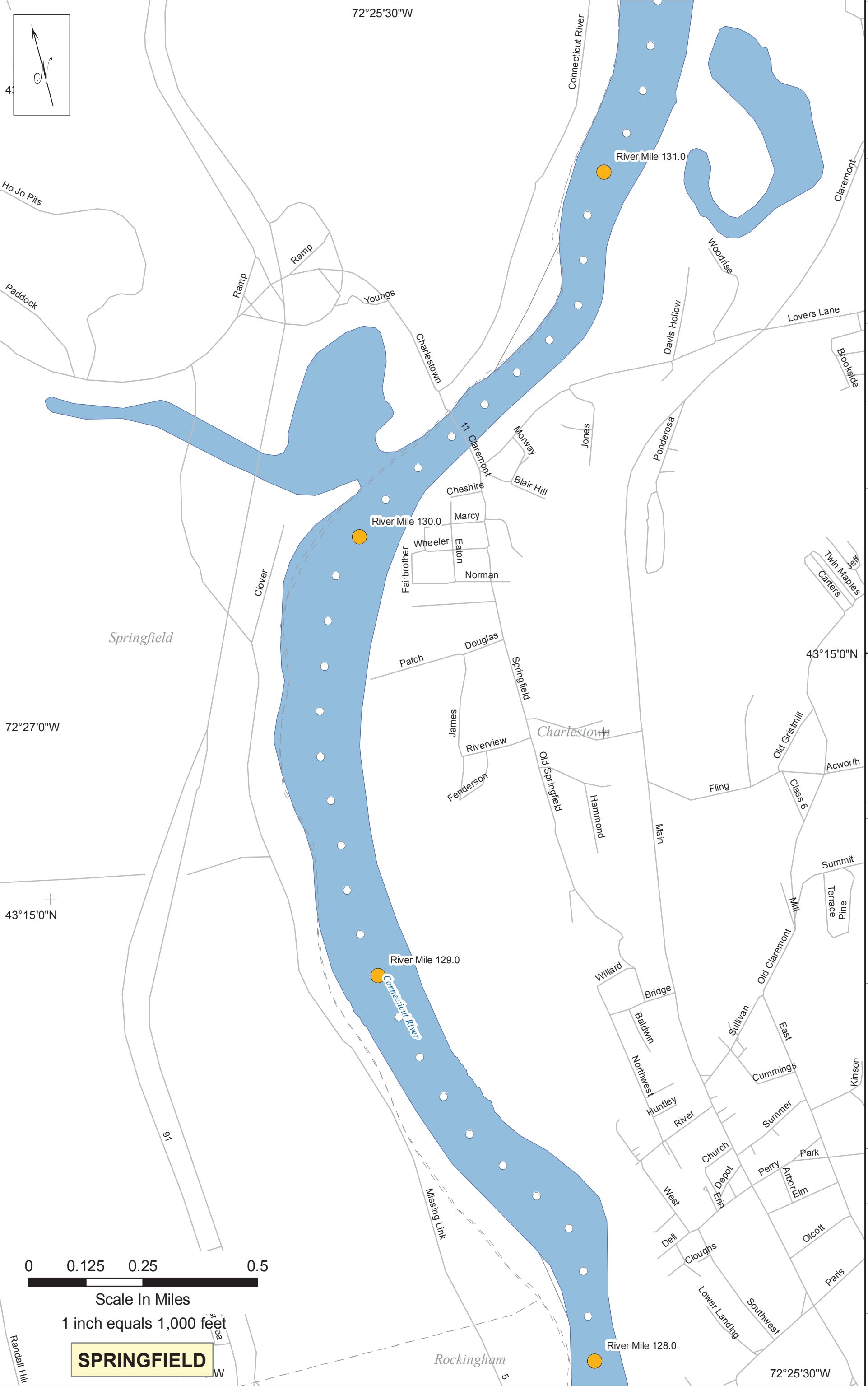








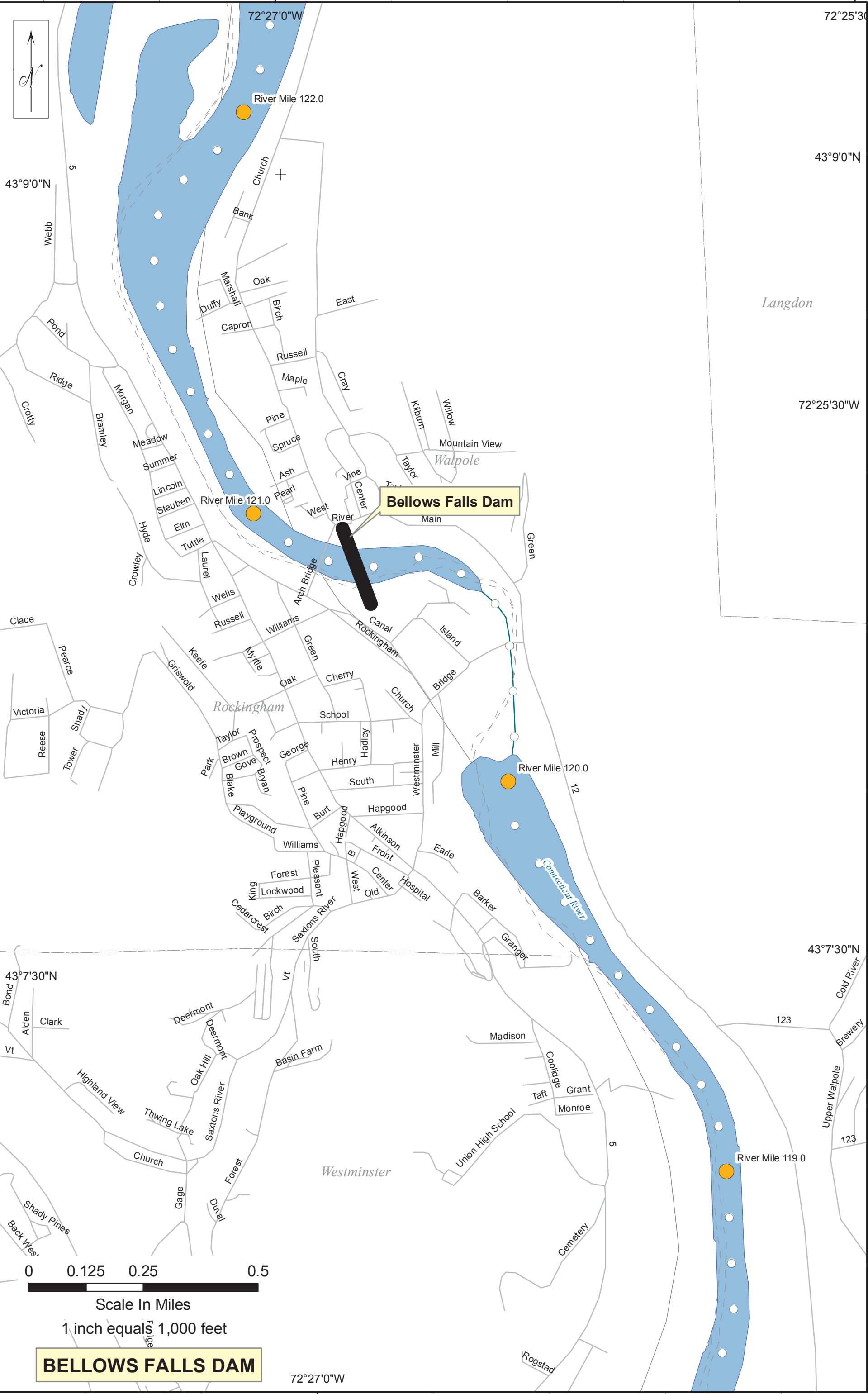




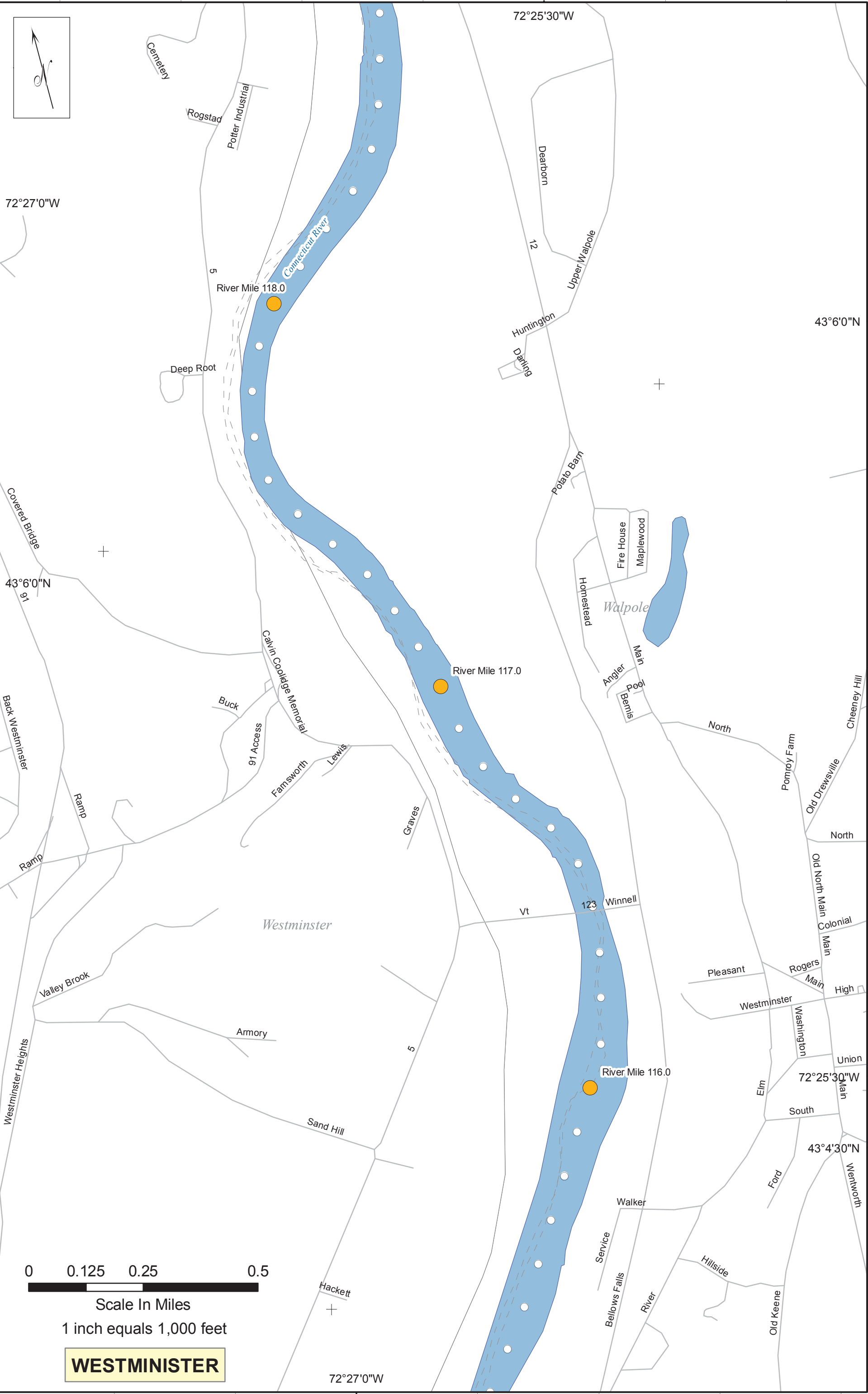


CHARLESTOWN

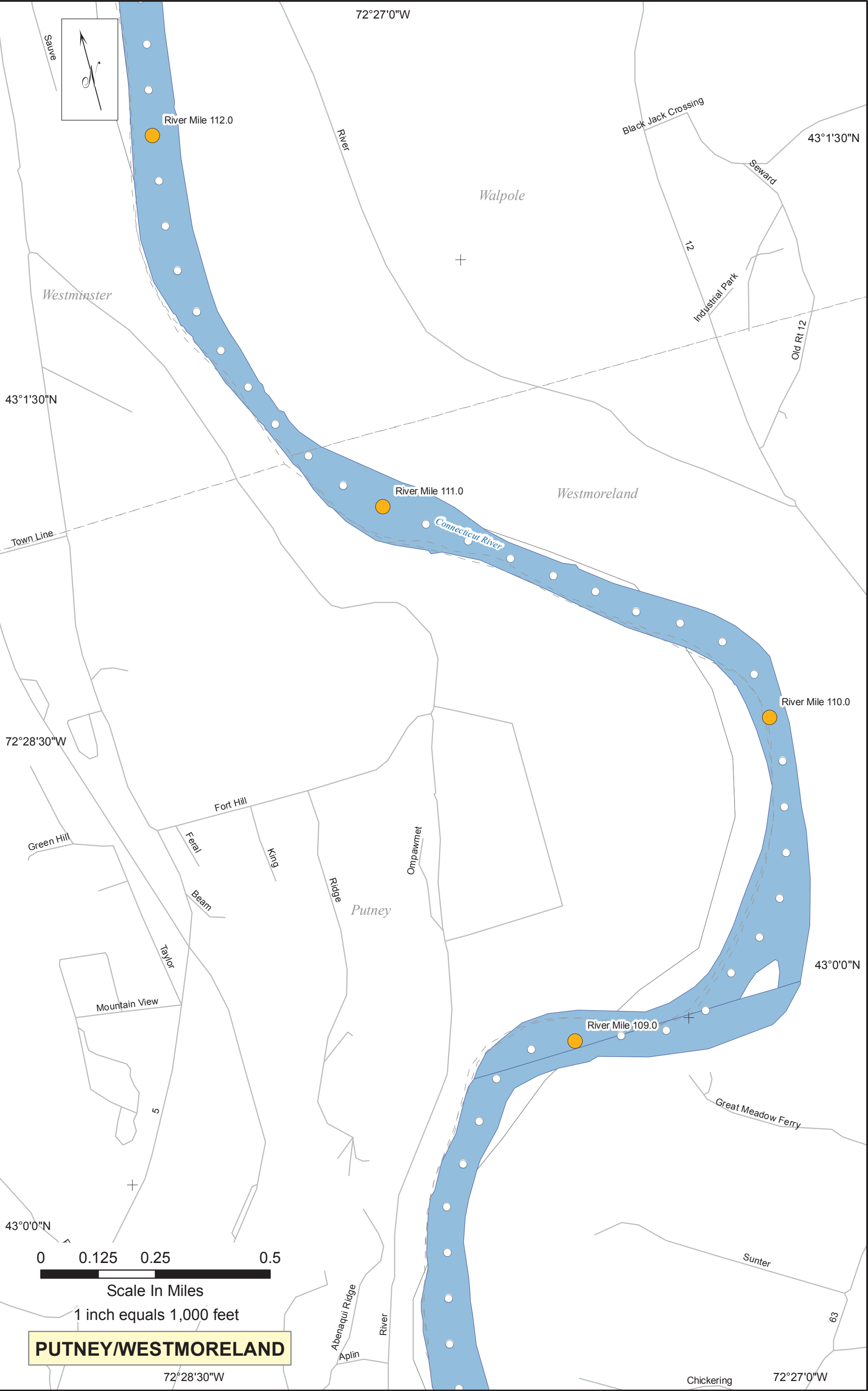


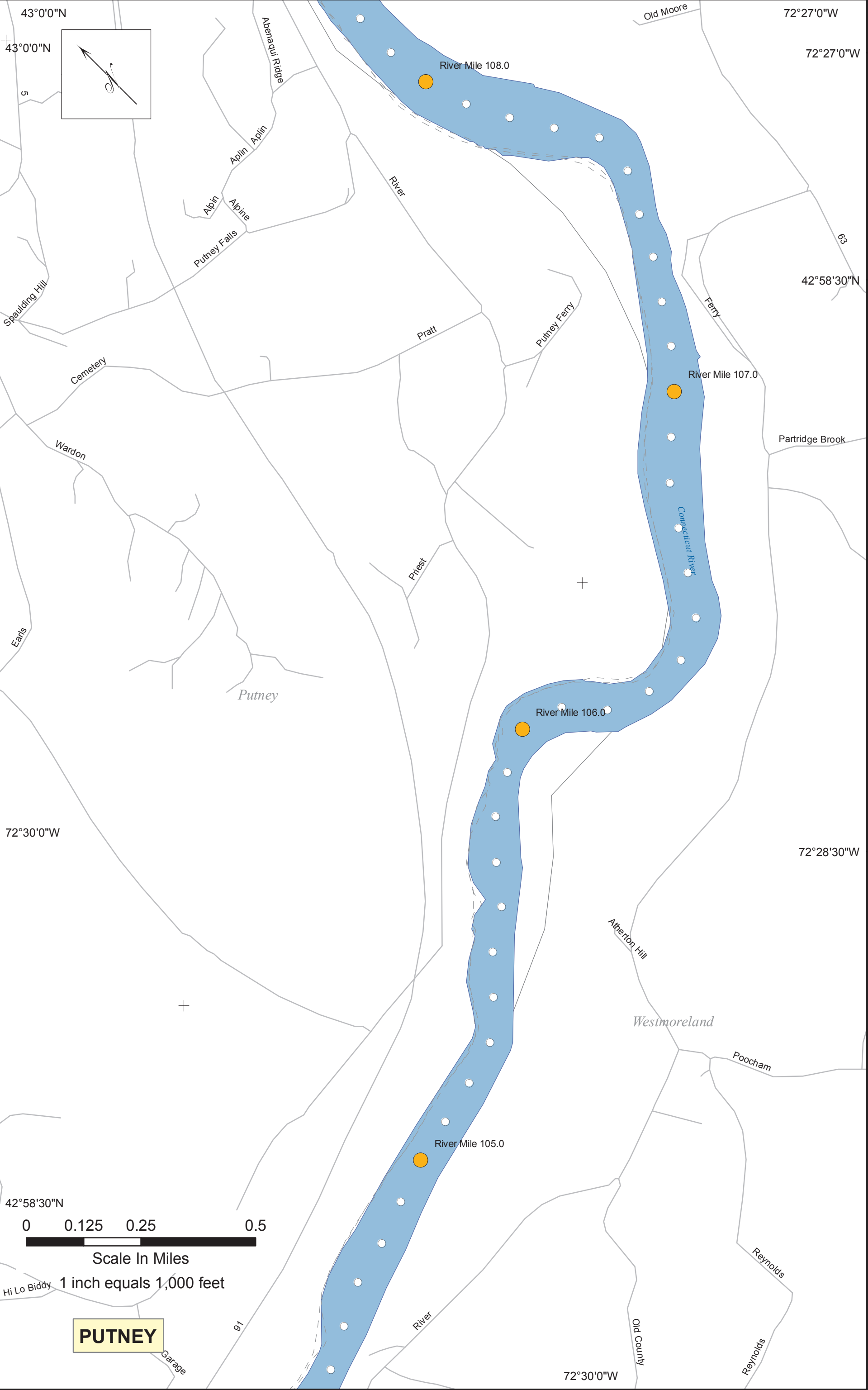


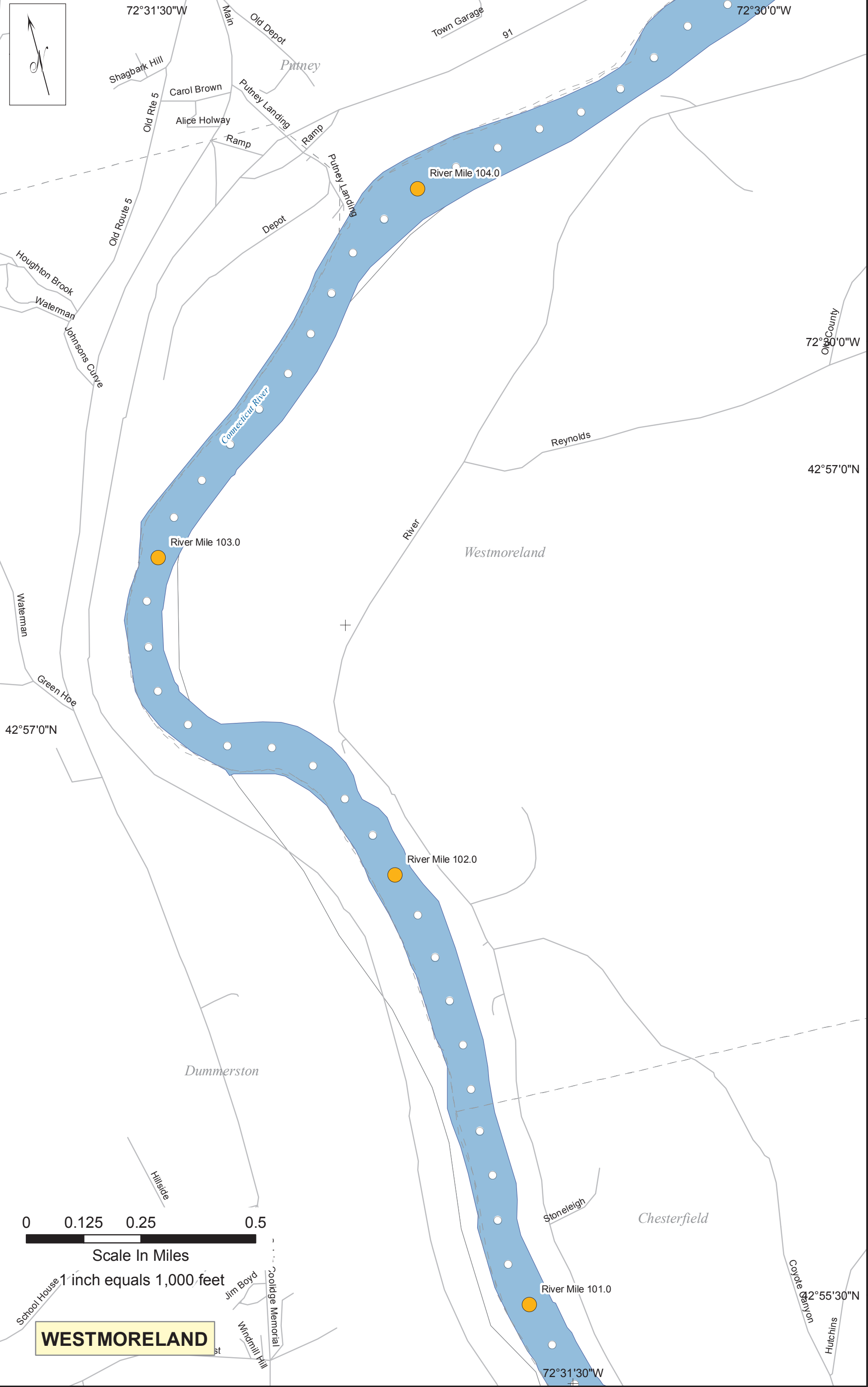
BELLOWS FALLS DAM

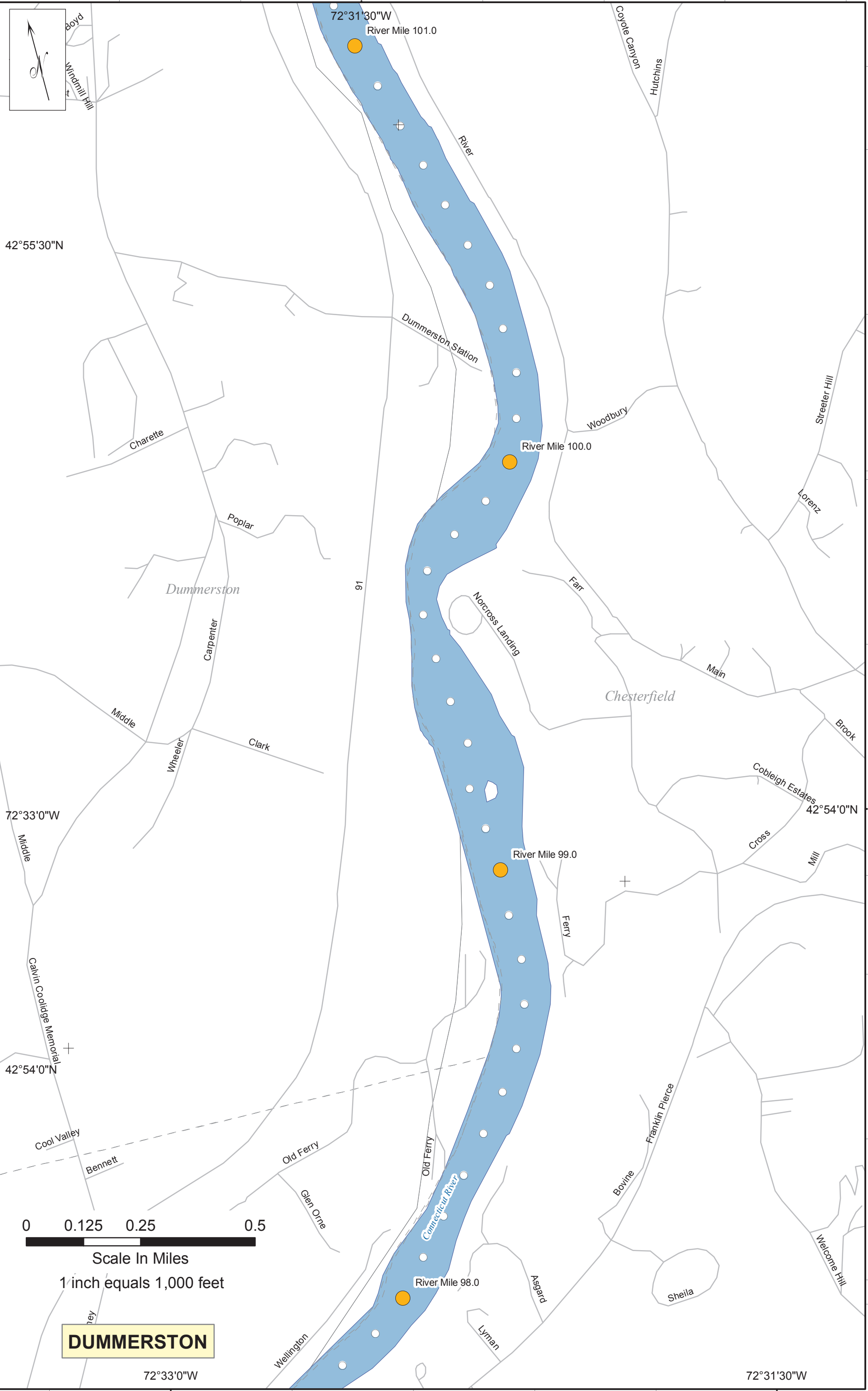




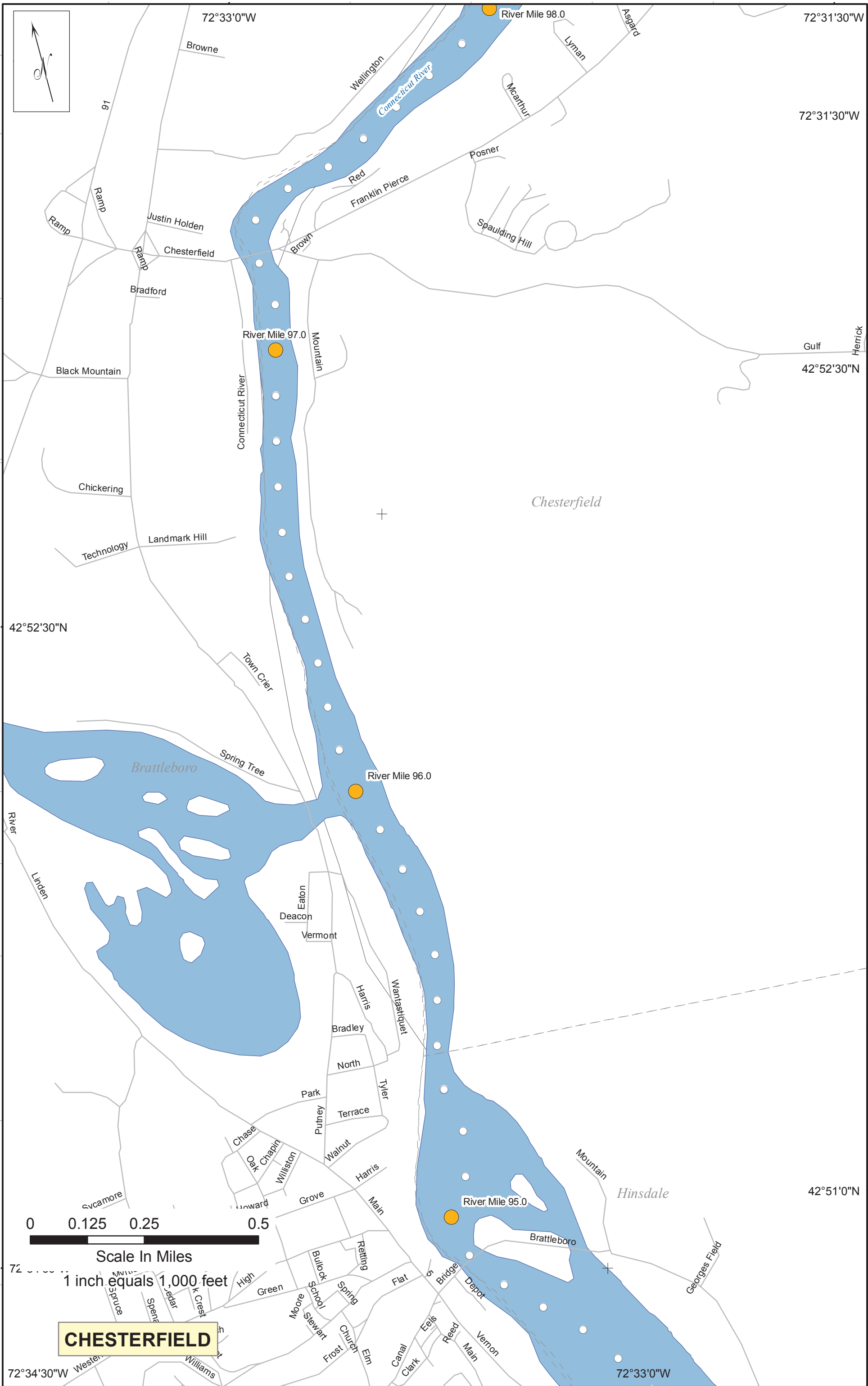




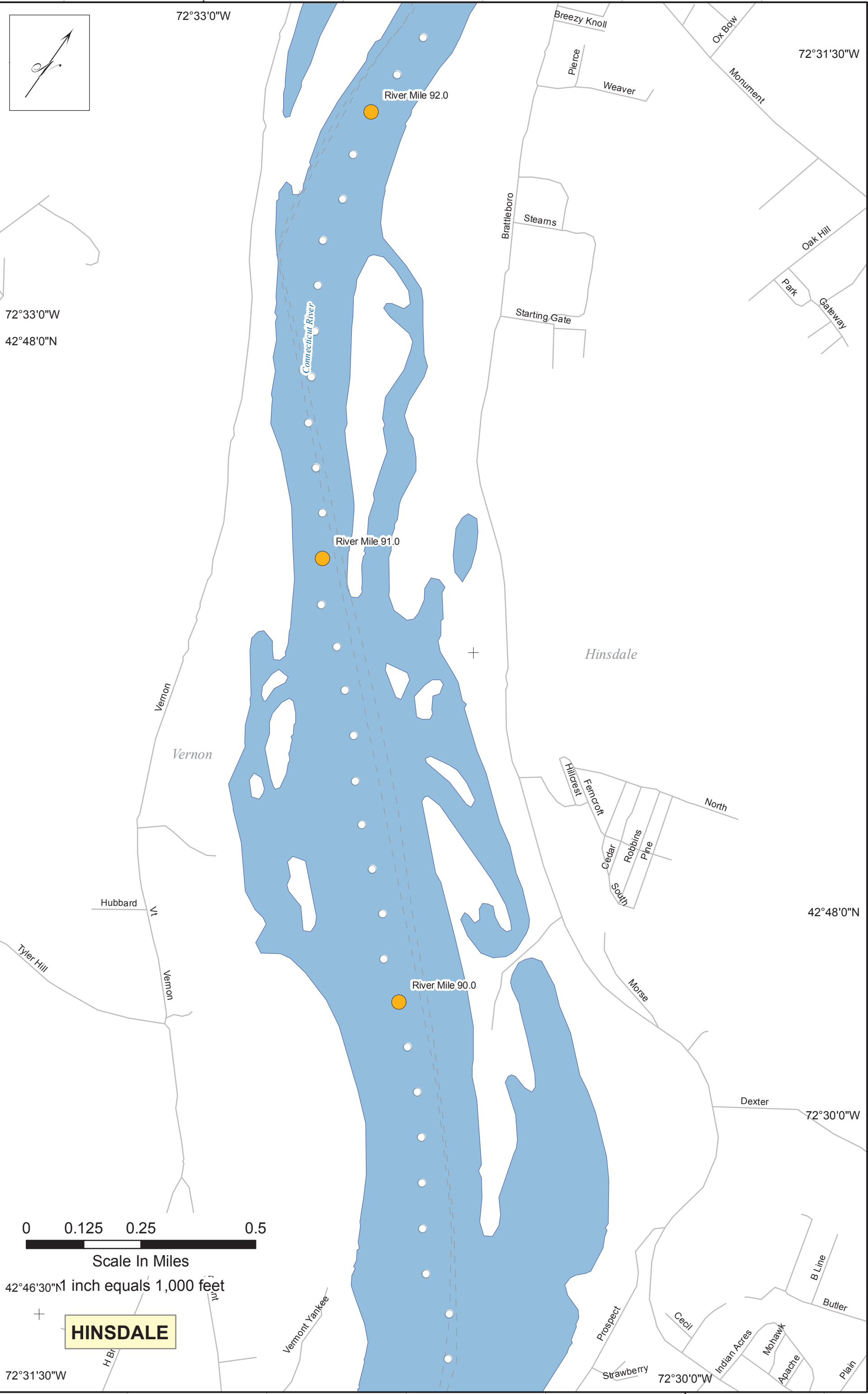




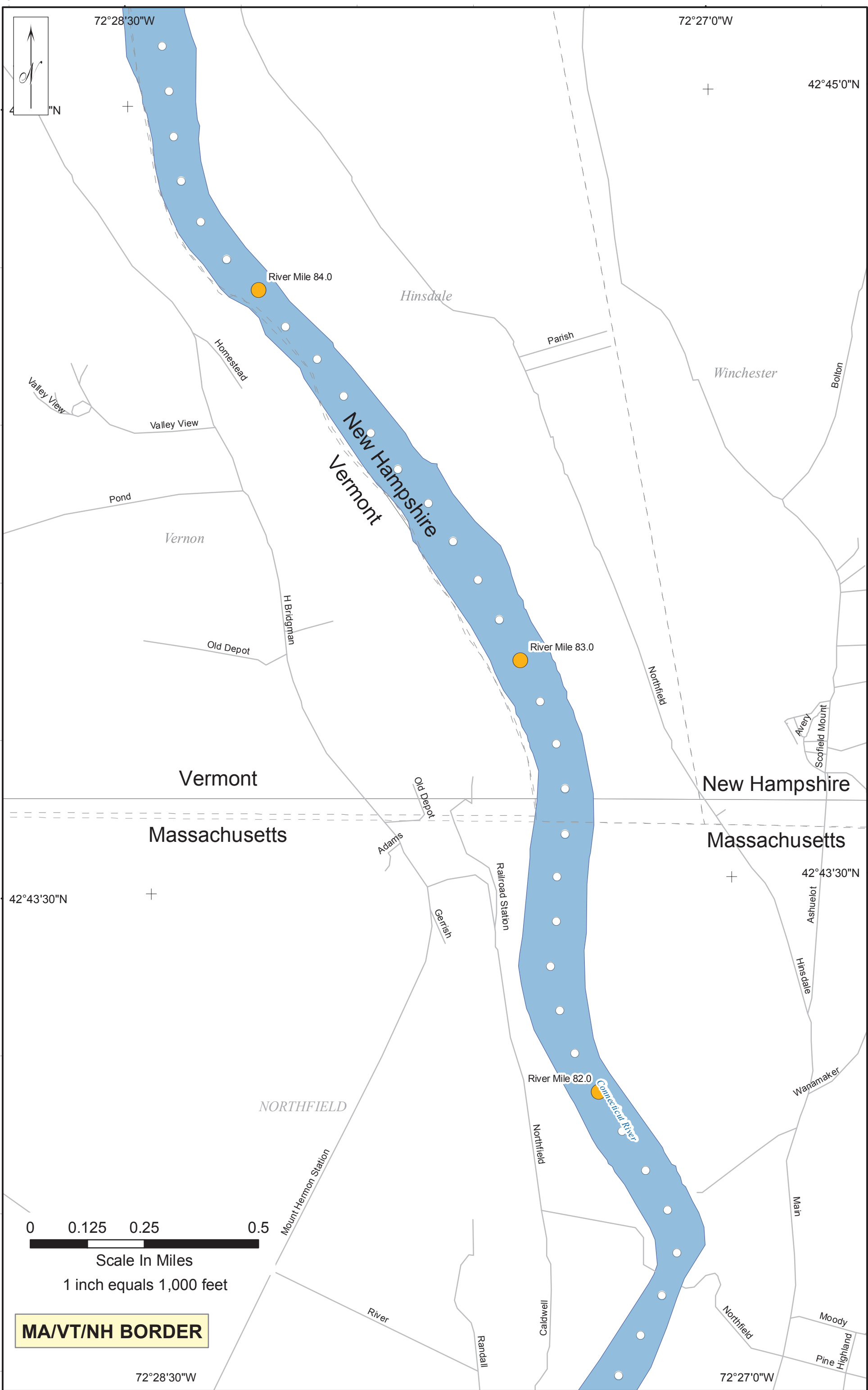
DUMMERSTON

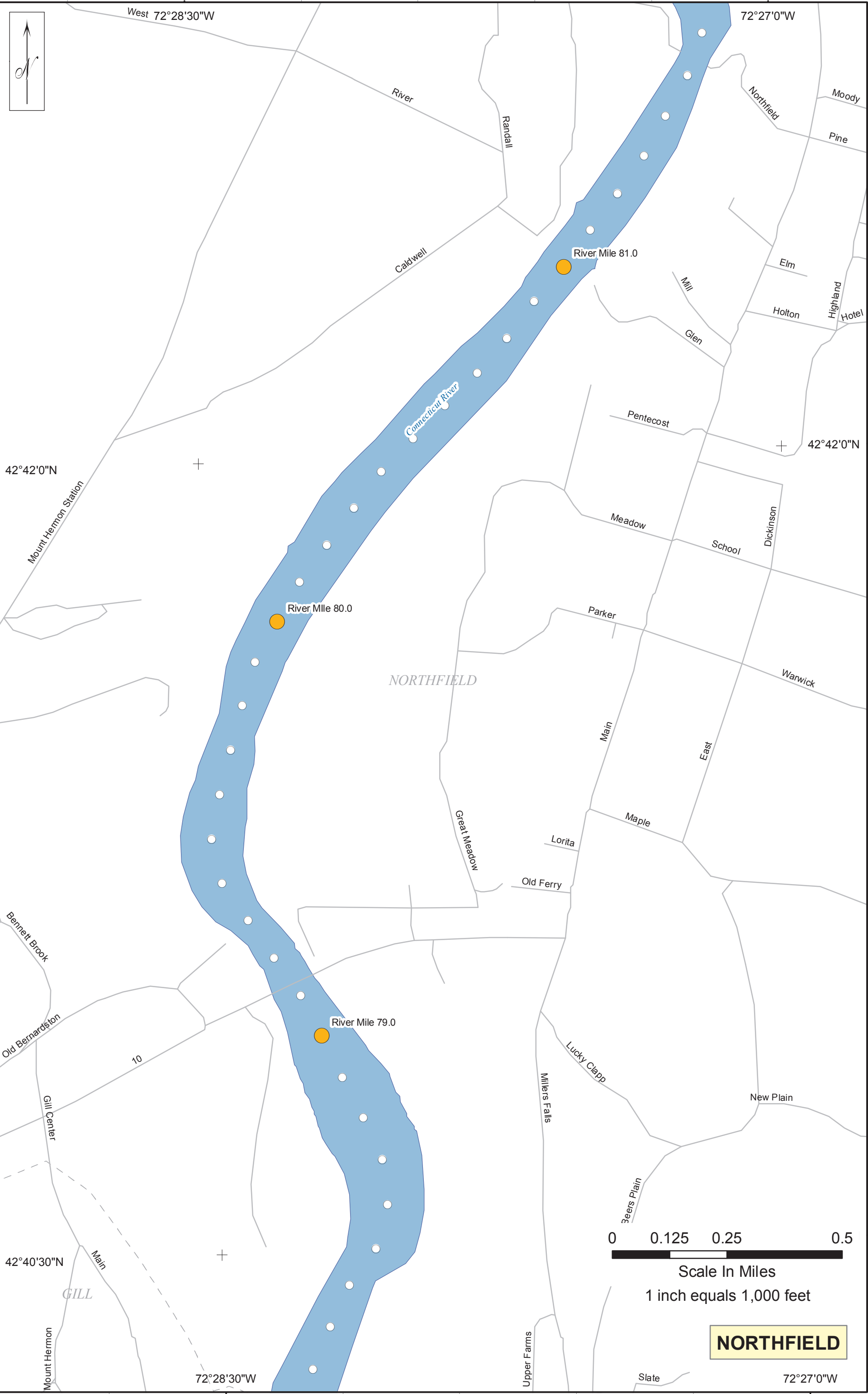


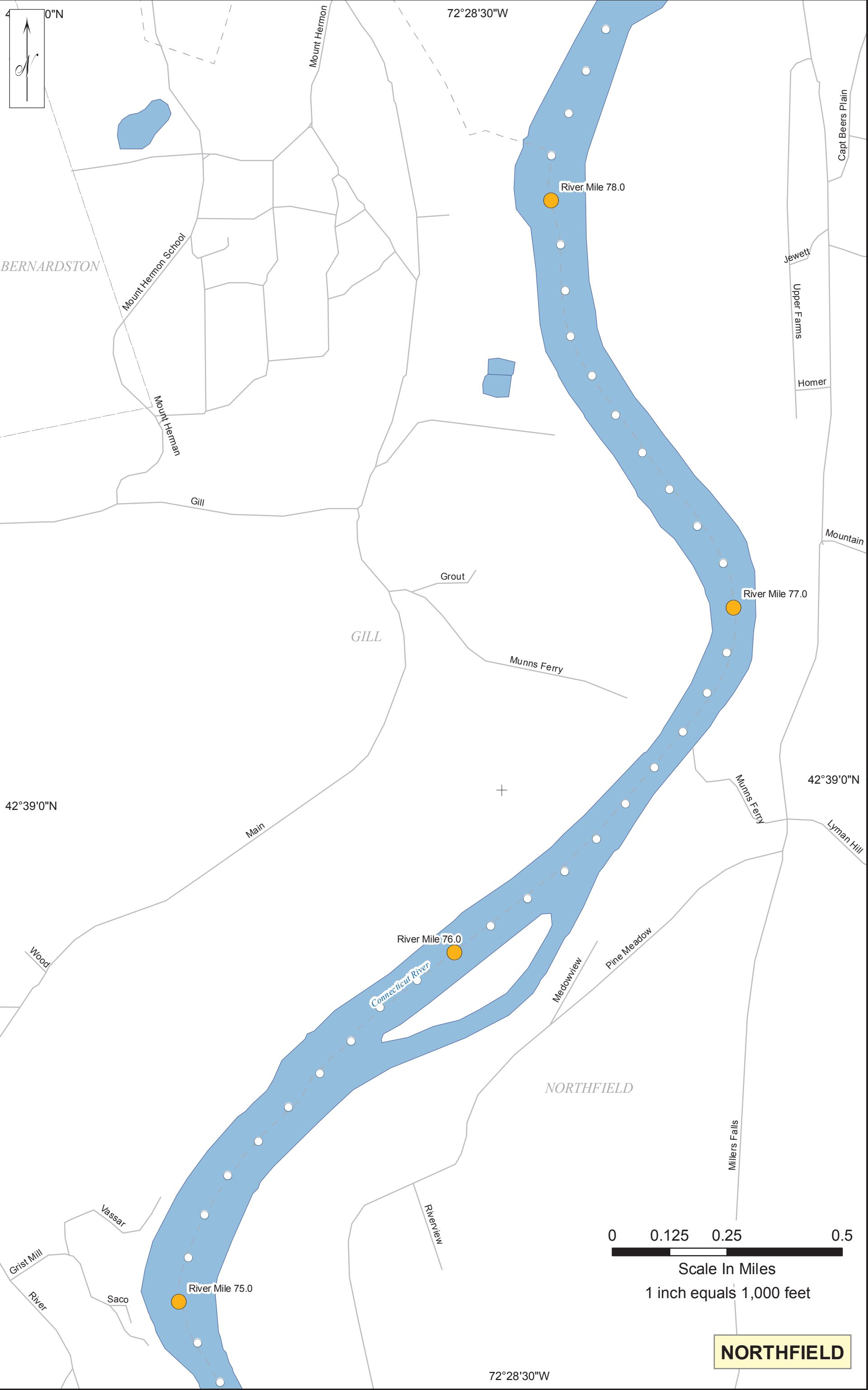




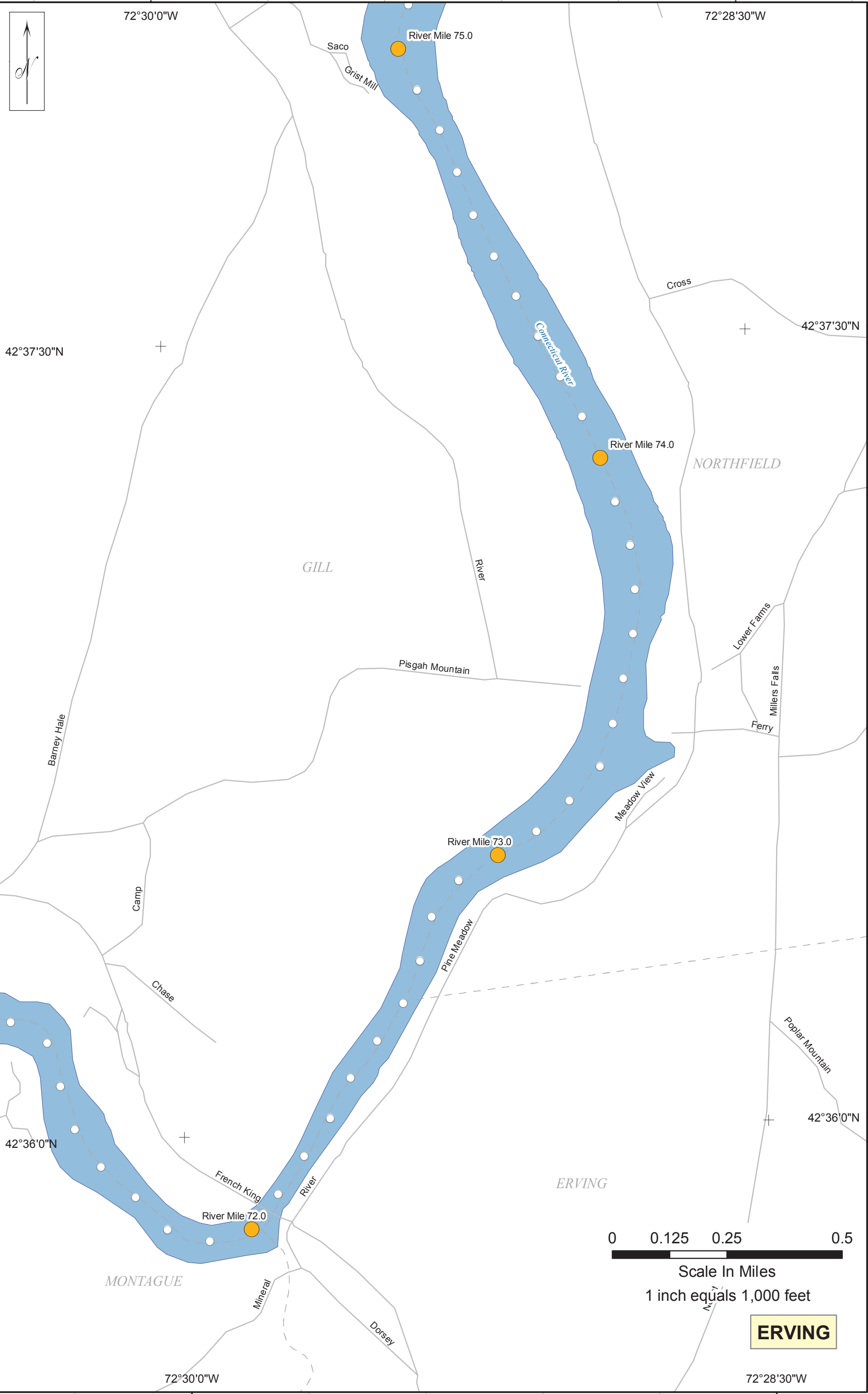




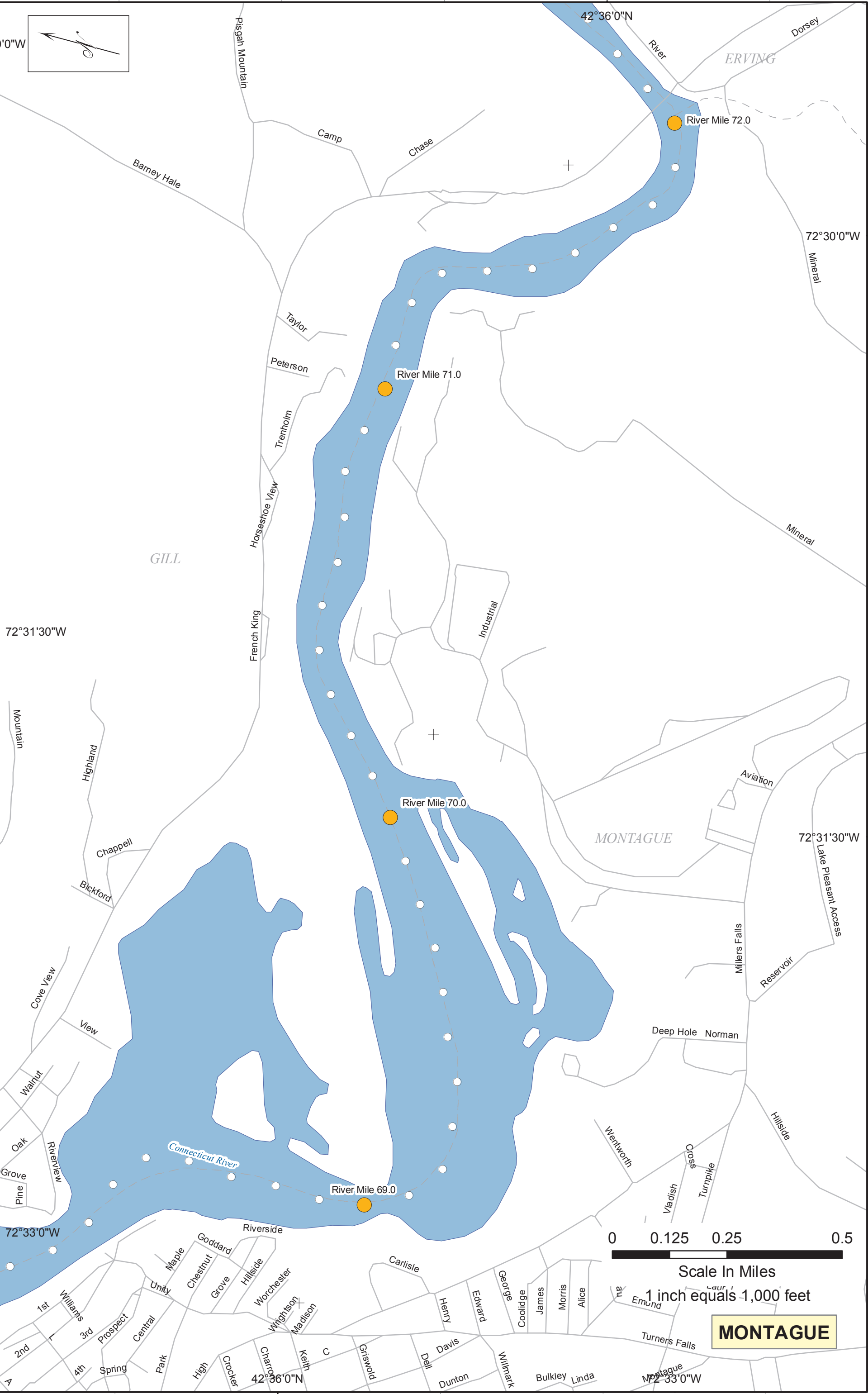
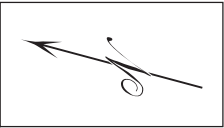




NORTHFIELD



72°30'0"W



42°36'0"N

River

ERVING

Dorsey

River Mile 72.0

Chase

Camp

Barney Hale

Taylor

Peterson

River Mile 71.0

Trenholm

Horseshoe View

GILL

French King

Industrial

Mineral

72°30'0"W

72°31'30"W

Mountain

Highland

Chappell

Bickford

River Mile 70.0

MONTAGUE

72°31'30"W

Lake Pleasant Access

Aviation

Millers Falls

Reservoir

Deep Hole Norman

Hillside

Turnpike

Vladish

Wentworth

72°33'0"W

Connecticut River

River Mile 69.0

Riverside

Goddard

Chestnut

Grove

Hillside

Worcester

Wrightson

Madison

C

Chambers

Keith

Carlisle

Dunton

Dell

Davis

Williamark

Bulkley

Linda

Montague

72°33'0"W

0 0.125 0.25 0.5

Scale In Miles

1 inch equals 1,000 feet

MONTAGUE

