Relicensing Study 3.5.1

BASELINE INVENTORY OF WETLAND, RIPARIAN, AND LITTORAL HABITAT IN THE TURNERS FALLS IMPOUNDMENT, AND ASSESSMENT OF OPERATIONAL IMPACTS ON SPECIAL STATUS SPECIES

ADDENDUM

Study Report

Northfield Mountain Pumped Storage Project (No. 2485)
and Turners Falls Hydroelectric Project (No. 1889)

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FirstLight™ Power Resources

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OCTOBER 2016

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LIST OF ABBREVIATIONS

cfs	cubic feet per second
CTB	Cobblestone tiger beetle
FERC	Federal Energy Regulatory Commission
FirstLight or FL	FirstLight Hydro Generating Company
GIS	Geographic Information Systems
GPS	Global Positioning System
NGVD29	National Geodetic Vertical Datum of 1929
NHESP	Natural Heritage and Endangered Species Program
MADFW	Massachusetts Division of Fisheries & Wildlife
MRSP	Modified Revised Study Plan
PTB	Puritan tiger beetles
RSP	Revised Study Plan
RTE	rare, threatened and endangered
RTK	Real Time Kinematic
TNC	The Nature Conservancy
USFWS	United States Fish and Wildlife Service
VPRS	Vernal Pool & Rare Species Information System
WSEL	water surface elevation

1 INTRODUCTION

On March 1, 2016, FirstLight filed with the Federal Energy Regulatory Commission (FERC) Study Report No. 3.5.1 *Baseline Inventory of Wetland, Riparian, and Littoral Habitat in the Turners Falls Impoundment, and Assessment of Operational Impacts on Special Status Species.* On March 16, 2016, FirstLight held its study report meeting in which Study No. 3.5.1 was discussed. FirstLight filed its meeting minutes on March 31, 2016 and stakeholders had until April 30, 2016 to file comments. Comments on Study No. 3.5.1 were received from the United States Fish and Wildlife Service (USFWS), Massachusetts Division of Fisheries & Wildlife (MADFW), and The Nature Conservancy (TNC).

In FirstLight's responsiveness summary to comments, filed with FERC on May 30, 2016, it agreed to file an addendum to the report to address several comments raised by USFWS and MADFW. Section 2 of this Addendum addresses these comments.

On June 29, 2016, FERC issued its Determination on Requests for Study Modifications and New Studies. FERC noted that MADFW requested FirstLight provide the following:

- Copies of the maps of historic and potentially suitable habitat for state-listed plants used by FirstLight to develop its survey locations;
- A description of habitat suitability preferences used for each of the identified state-listed plant species and a discussion of how these preferences were determined;
- Copies of data collected regarding plant health and vigor and any additional information collected regarding plant flowering and reproduction and habitat quality; and,
- Information on how plant population densities varied with water surface elevation.

FERC concluded "*Because this information could be useful for staff's analysis of project-related effects, staff recommends that the information requested by Massachusetts DFW be included in the addendum or FirstLight should indicated why the information cannot be provided*."

FirstLight addresses the above request in Section 3.

2 RESPONSES TO STAKEHOLDER COMMENTS

As noted above, comments on Study No 3.5.1 were received from USFWS and MADFW. In its response to comments, FirstLight cataloged the comments received such as USFWS-1 (refers to the first USFWS comment on Study No. 3.5.1), USFWS-2, etc. In its response to comments, FirstLight indicated which comments (USFWS-1, NMFS-1, etc.) it would address in an addendum to Study No. 3.5.1. Using the same cataloging system, the subsections below list the comment (such as USFWS-1), which is then followed by FirstLight's response. Note that some comments were addressed in FirstLight's May 30, 2016 response and thus are not included below. FirstLight addresses comments where it indicated an addendum would be provided.

2.1 USFWS-3 Puritan Tiger Beetle

Comment: In addition, all models (Figures 4.6-3 through 4.6-11) should be limited to the period May through August. Adult beetles have typically died by late August, therefore inclusion of flow data from September may bias estimates of typical water surface elevations (WSELs).

Response:

Revised figures are provided below, and now present data ending September 1st rather than September 30th. Figure 4.6-6 of the report filed with FERC on March 1, 2016 filing (hereinafter "3/1/16 Report") was not revised as this figure shows only survey elevations which are independent of season. Figures 2.1-1 through Figure 2.1-8 present the updated figures. By removing the month of September from the analysis WSEL values changed slightly. The new maximum WSEL is 103.4 feet (a change of -0.1 feet); however, the median WSEL remained 101.0 feet (no change).

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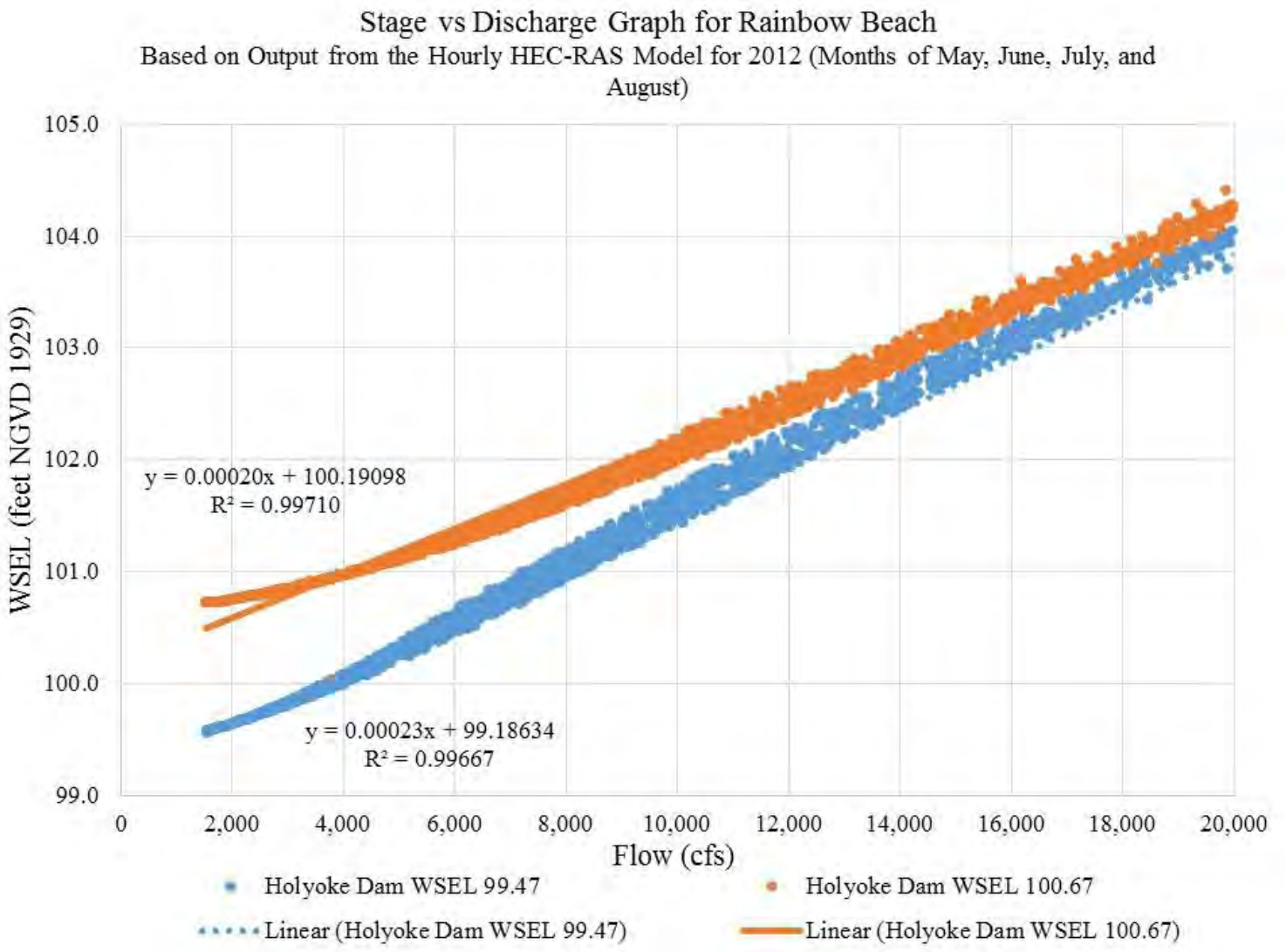

Figure 2.1-1. Revised 3/1/16 Report Figure 4.6-3 showing the period of May through August.

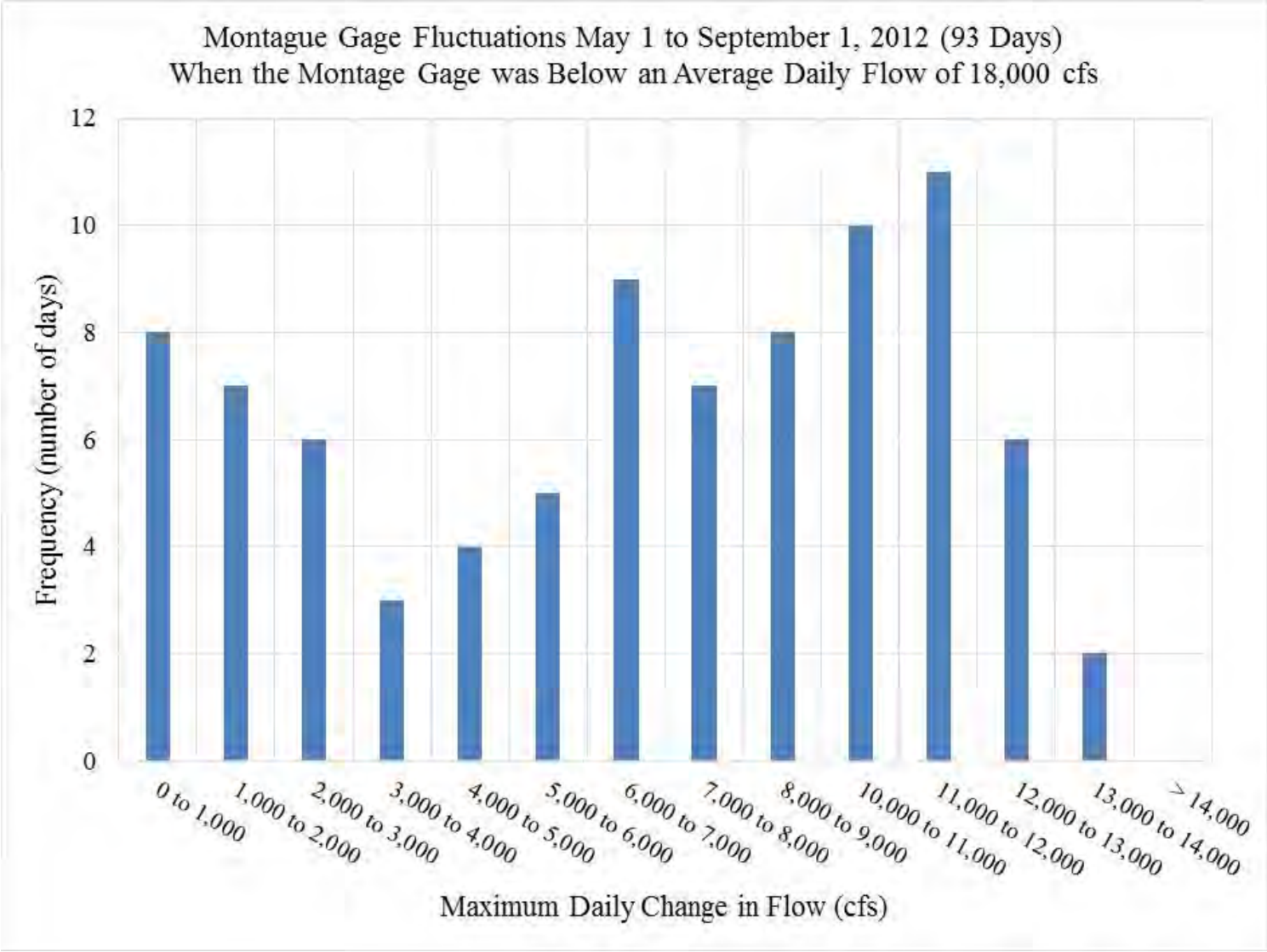

Figure 2.1-2. Revised 3/1/16 Report Figure 4.6-4 showing the period of May through August.

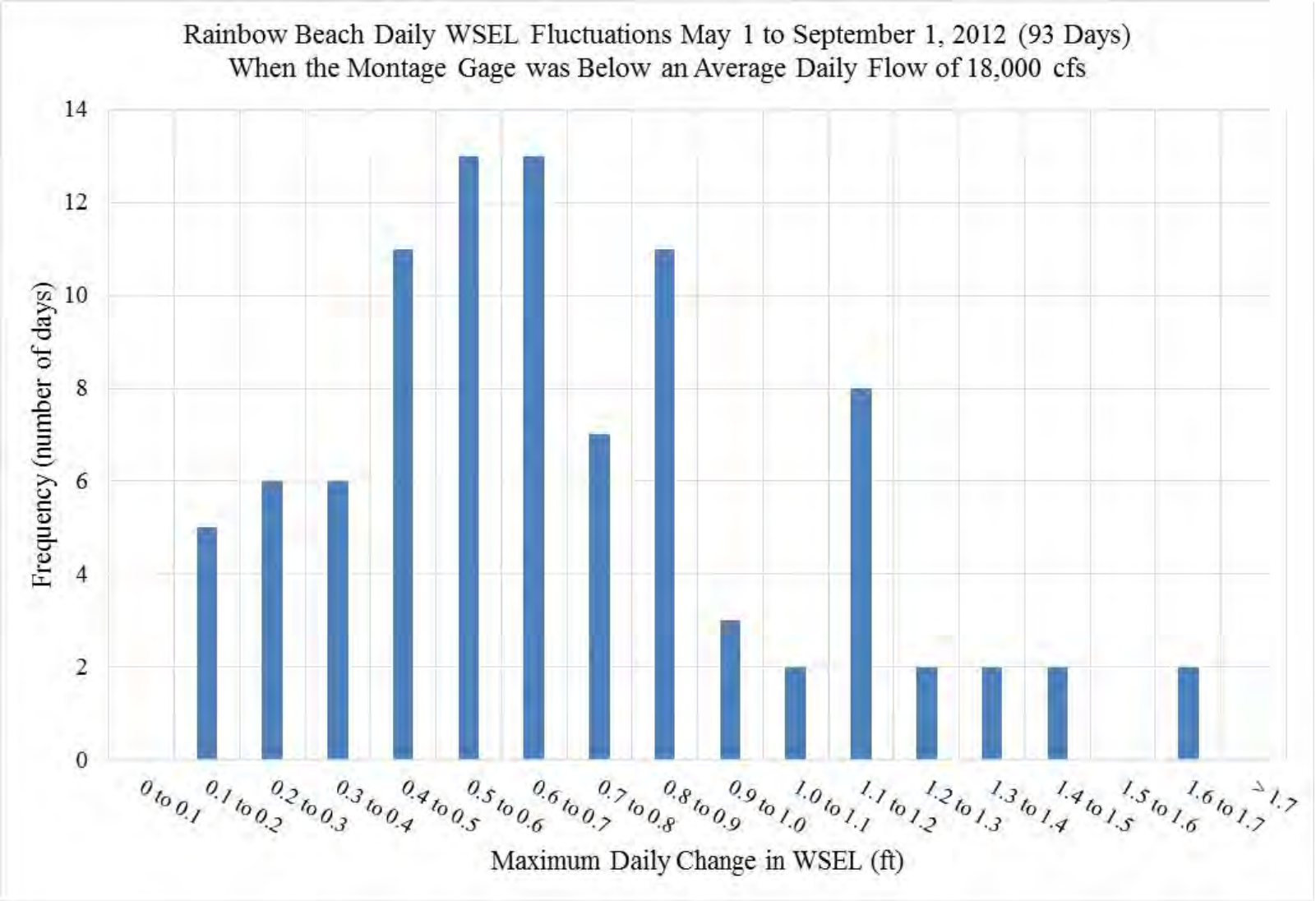

Figure 2.1-3. Revised 3/1/16 Report Figure 4.6-5 showing the period of May through August.

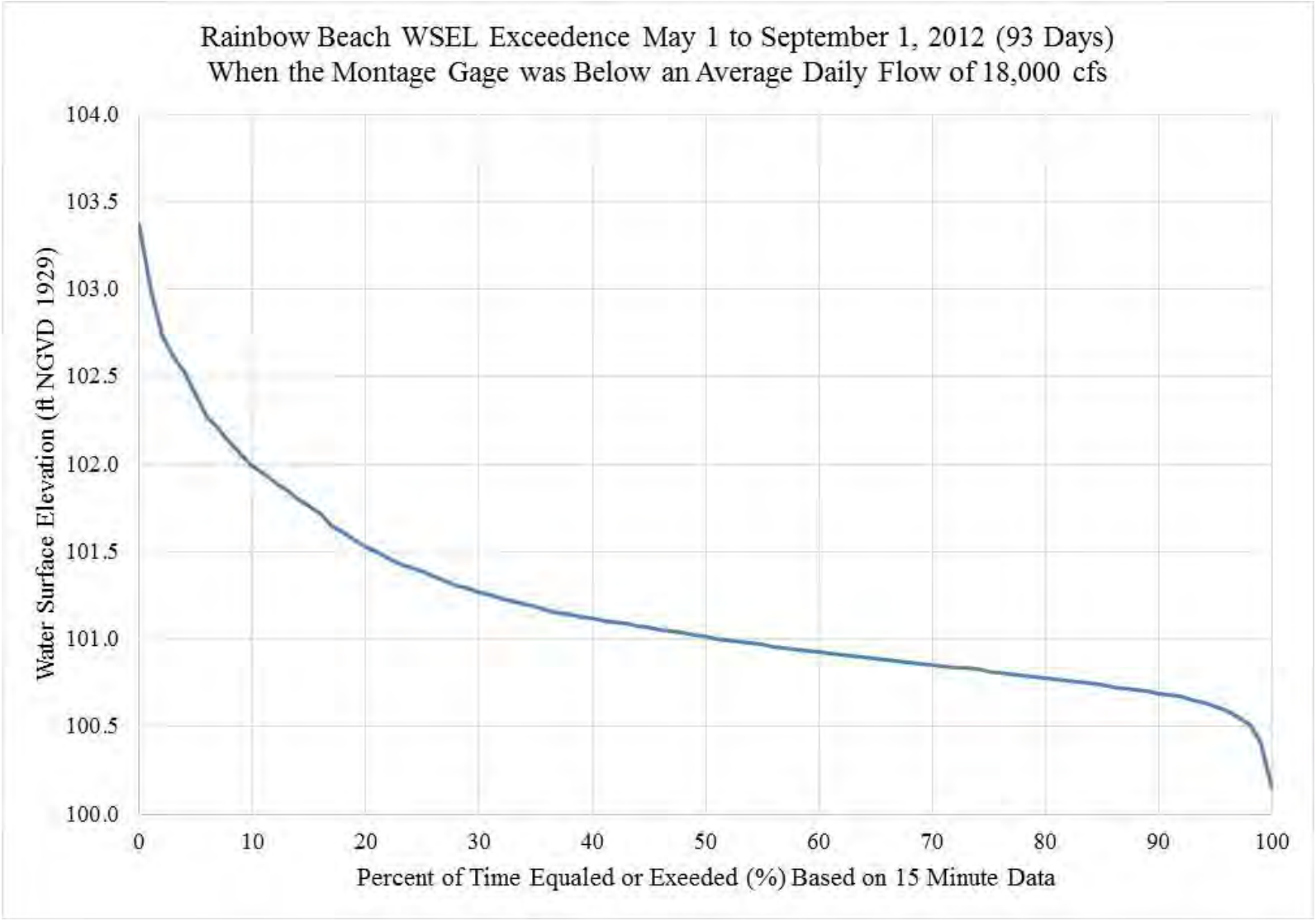

Figure 2.1-4. Revised 3/1/16 Report Figure 4.6-7 showing the period of May through August.

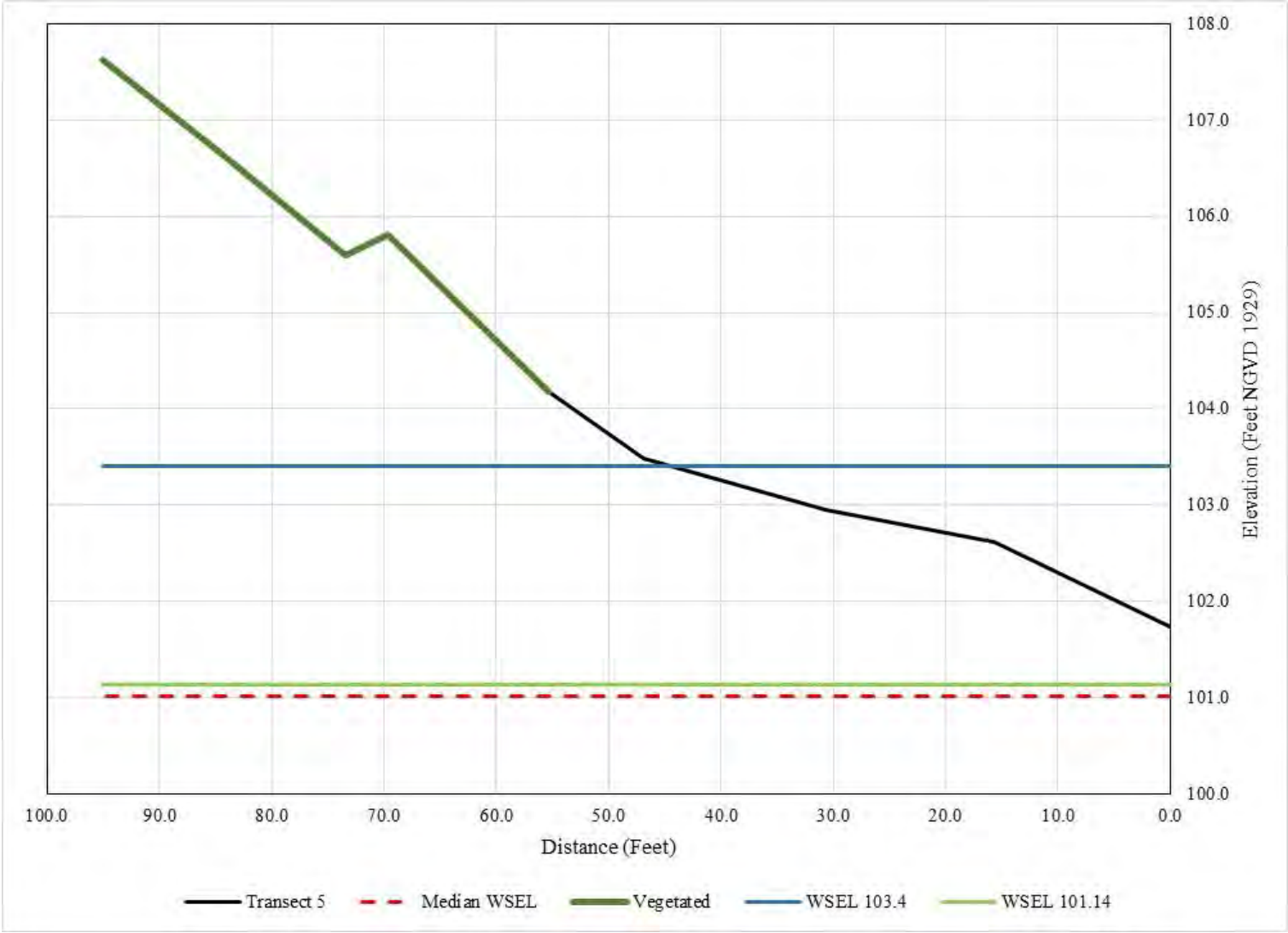

Figure 2.1-5. Revised 3/1/16 Report Figure 4.6-8 Transect 5 showing the period of May through August.

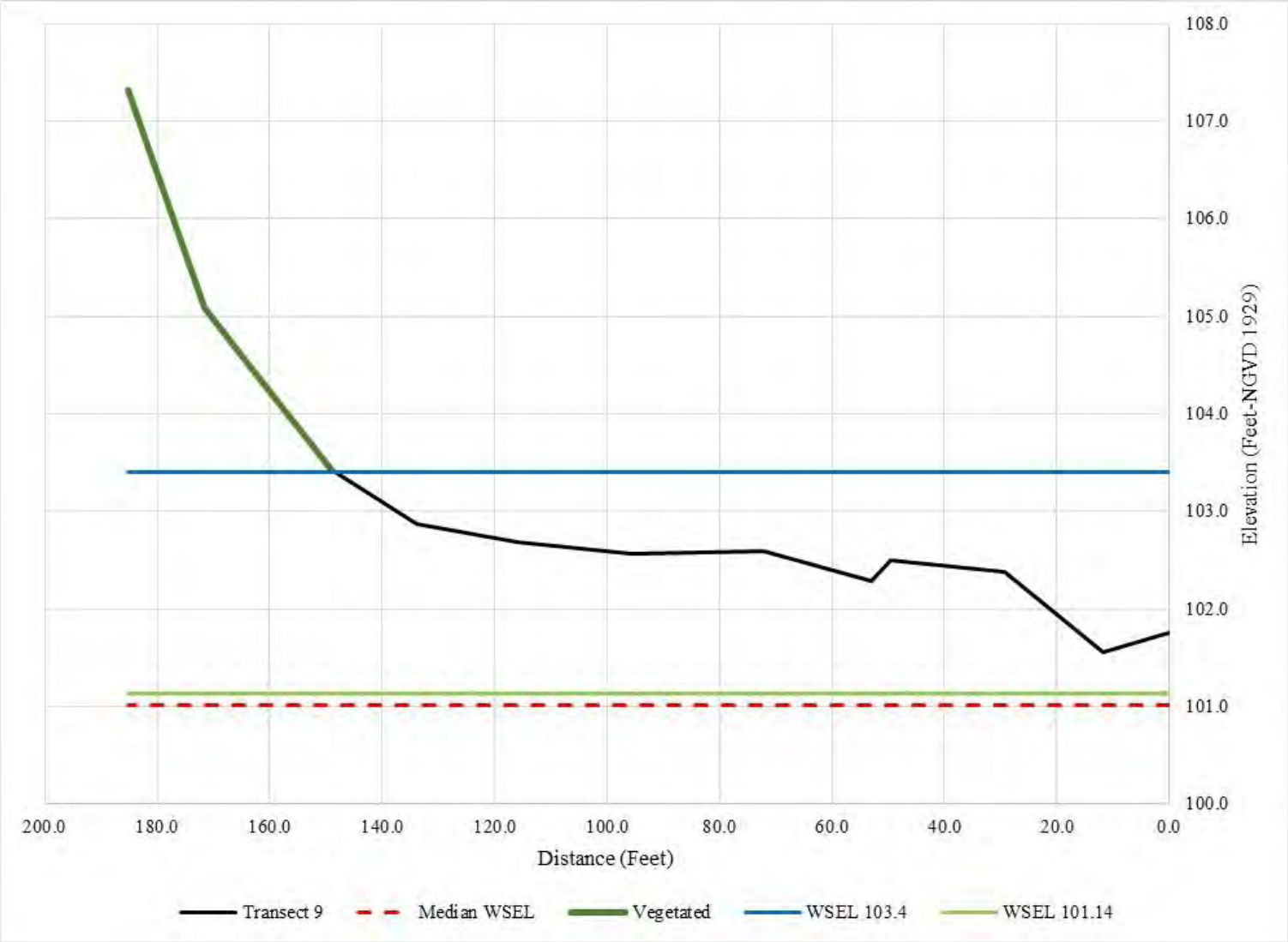

Figure 2.1-6. Revised 3/1/16 Report Figure 4.6-9 Transect 9 showing the period of May through August.

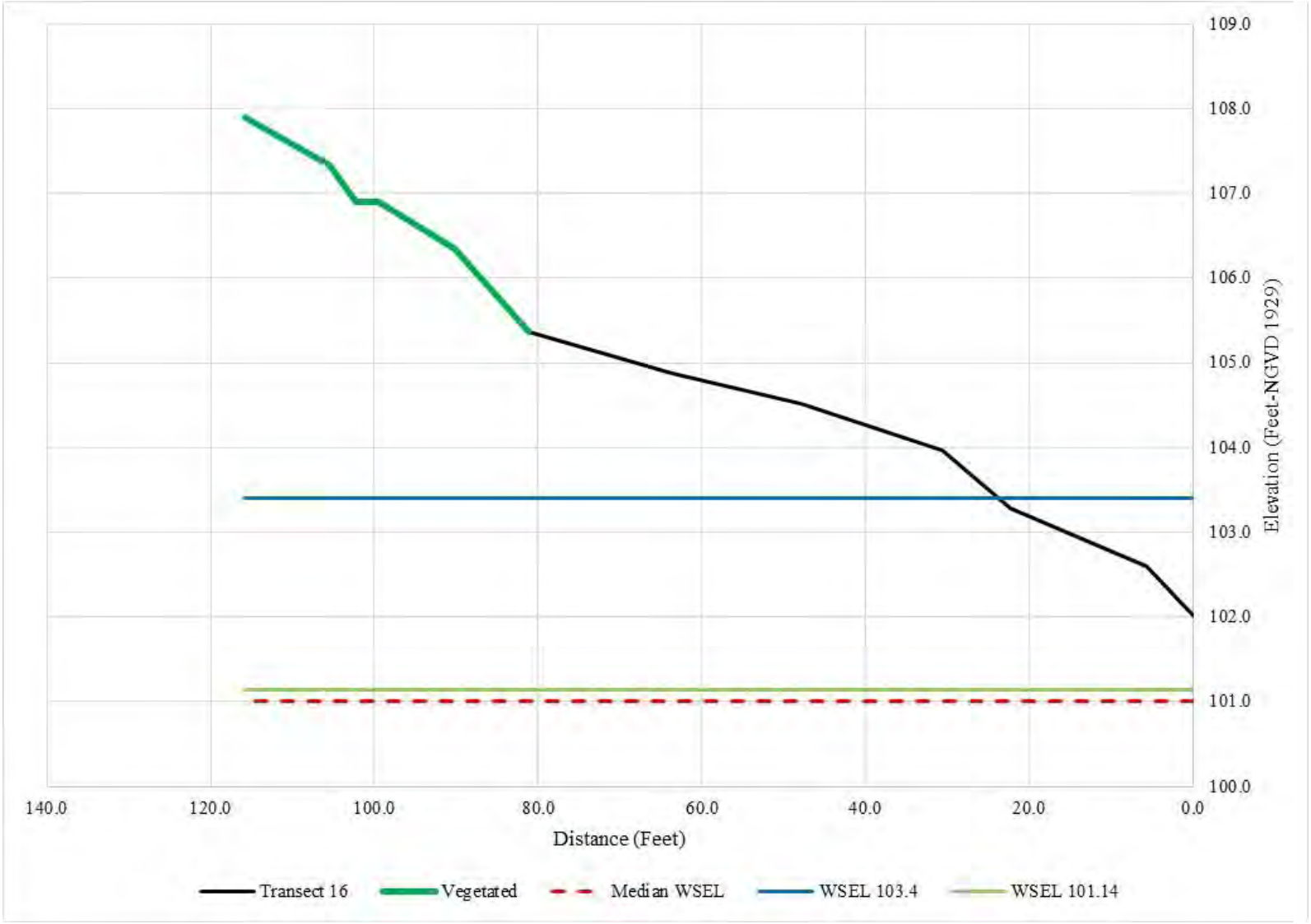

Figure 2.1-7. Revised 3/1/16 Report Figure 4.6-10 Transect 16 showing the period of May through August.

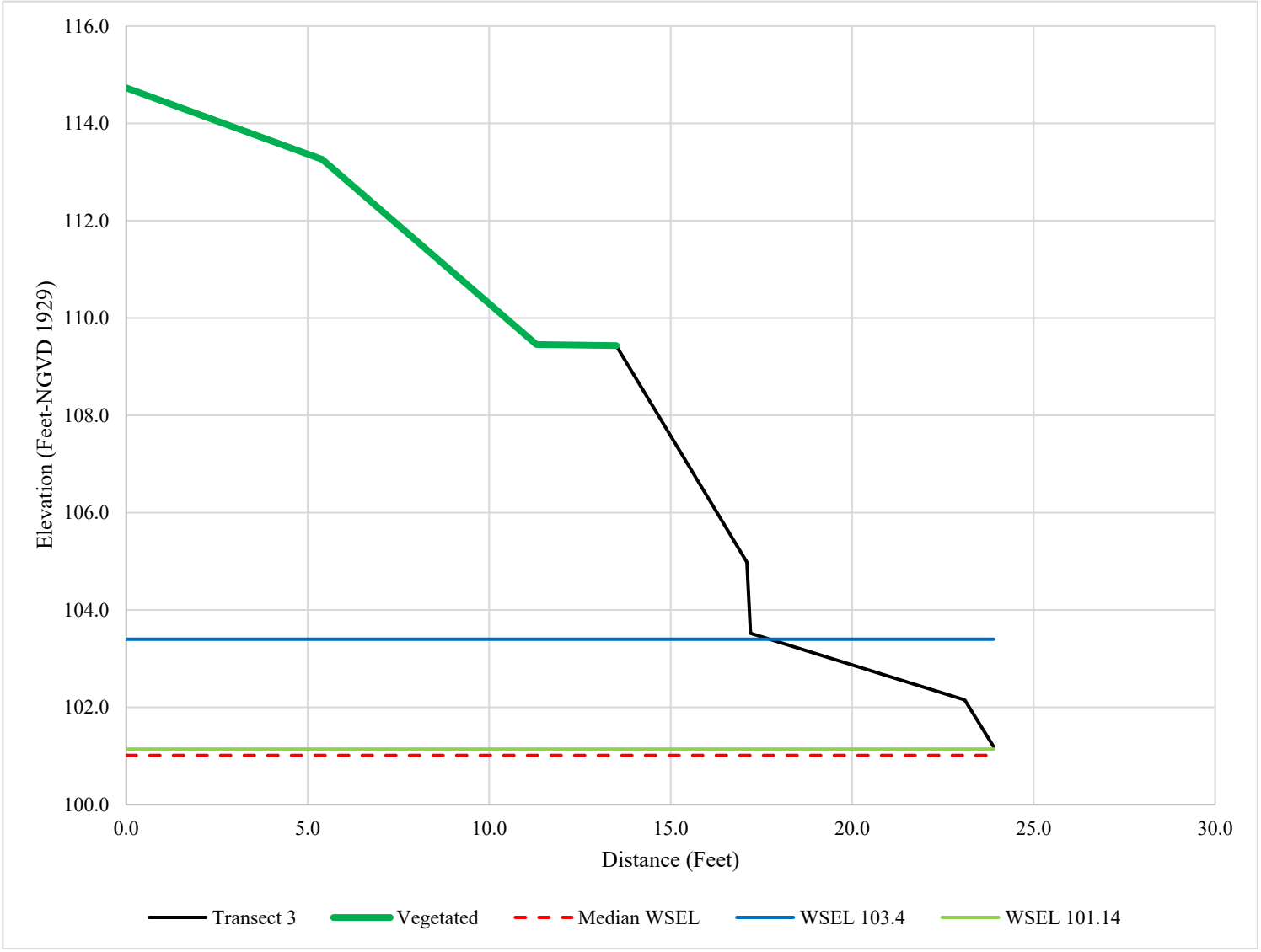

Figure 2.1-8. Revised 3/1/16 Report Figure 4.6-11 Transect 3 showing the period of May through August.

2.2 USFWS-5 Cobblestone Tiger Beetle

Comment: According to the approved Modified Revised Study Plan (MRSP), FL was to use a combination of hydraulic modeling and field data to assess effects of project related water level fluctuations on known and potentially suitable habitat for the cobblestone tiger beetle (CTB). However, the report does not include an assessment of water level fluctuation at the Montague site, nor does it provide an explanation for why the assessment was not completed. As the Montague site represents known, suitable habitat (albeit potentially currently unoccupied), the same analysis that was completed at Rainbow Beach and North Bank for the Puritan tiger beetle (PTB) should have been conducted at the Montague site for CTB.

Response:

In August 2016, potential CTB habitat at the Montague site was visited and six elevation transects were surveyed, using RTK GPS equipment. Figure 2.2-1 shows the location of the proposed transects as well as the location of the transects actually surveyed in August 2016. After consultation with Chris Davis, the CTB consultant, the southernmost transect was shifted to avoid the sandy beach downstream of the potential CTB habitat. In addition, while in the field, proposed locations were modified slightly to better capture changes in elevation and provide better survey coverage for the potential habitat. Elevation data collected during the 2016 survey was combined with elevation/bathymetric data collected for Study No. 3.3.1 *Instream Flow Studies in Bypass Channel and below Cabot Station* to develop a detailed digital terrain model of the potential CTB habitat at the Montague site. This digital terrain model is shown in Figure 2.2-2.

Section 3.1 of the 3/1/16 report included a detailed description of the hydraulic model developed as part of Study No. 3.2.2 *Hydraulic Study of Turners Falls Impoundment, Bypass Reach and below Cabot*. To summarize Section 3.1, an unsteady hourly time step hydraulic model was developed of the Connecticut River from the Montague United States Geological Survey (USGS) gage downstream to the Holyoke Dam. The model was calibrated to observed WSELs measured at water level loggers. The calibrated hydraulic model was then used to simulate WSELs at various locations along this section of the Connecticut River under the actual conditions that occurred every hour between January 1, 2008 and September 30, 2015. Thus, at the location of the potential CTB habitat at the Montague site, simulated hourly WSEL data are available for May, June, July, and August over the eight year period. Using the hourly simulated WSELs, WSEL duration curves were developed for May through August as described below.

Using the Surface Volume tool, available in ESRI Arcmap a 3-dimensional surface area (in square feet) was calculated at 1.0 foot increments within the potential CTB habitat. The available habitat represents the amount of potential habitat available above the listed elevation (which assumes that inundation is occurring up to the presented elevation). Using the lowest elevation (104.0 feet) as the base elevation for all available potential habitat, Table 2.2-1 and Table 2.2-2 show the area and percent of habitat available for the corresponding WSEL as well as the percent of time elevations are inundated (based on the WSEL duration curves developed from the hydraulic model). For summary purposes, the tables show the available habitat based on either 0.0 or 24.0 hours, for the months of May, June, July, and August. All supporting data which includes hourly inundation percentages data has been provided as Attachment A to this addendum.

FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

RELICENSING STUDY 3.5.1
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N

0 0.0225 0.045 0.09
Miles

Figure 2.2-1: Cobblestone Beetle Potential Habitat Elevation Survey Transects

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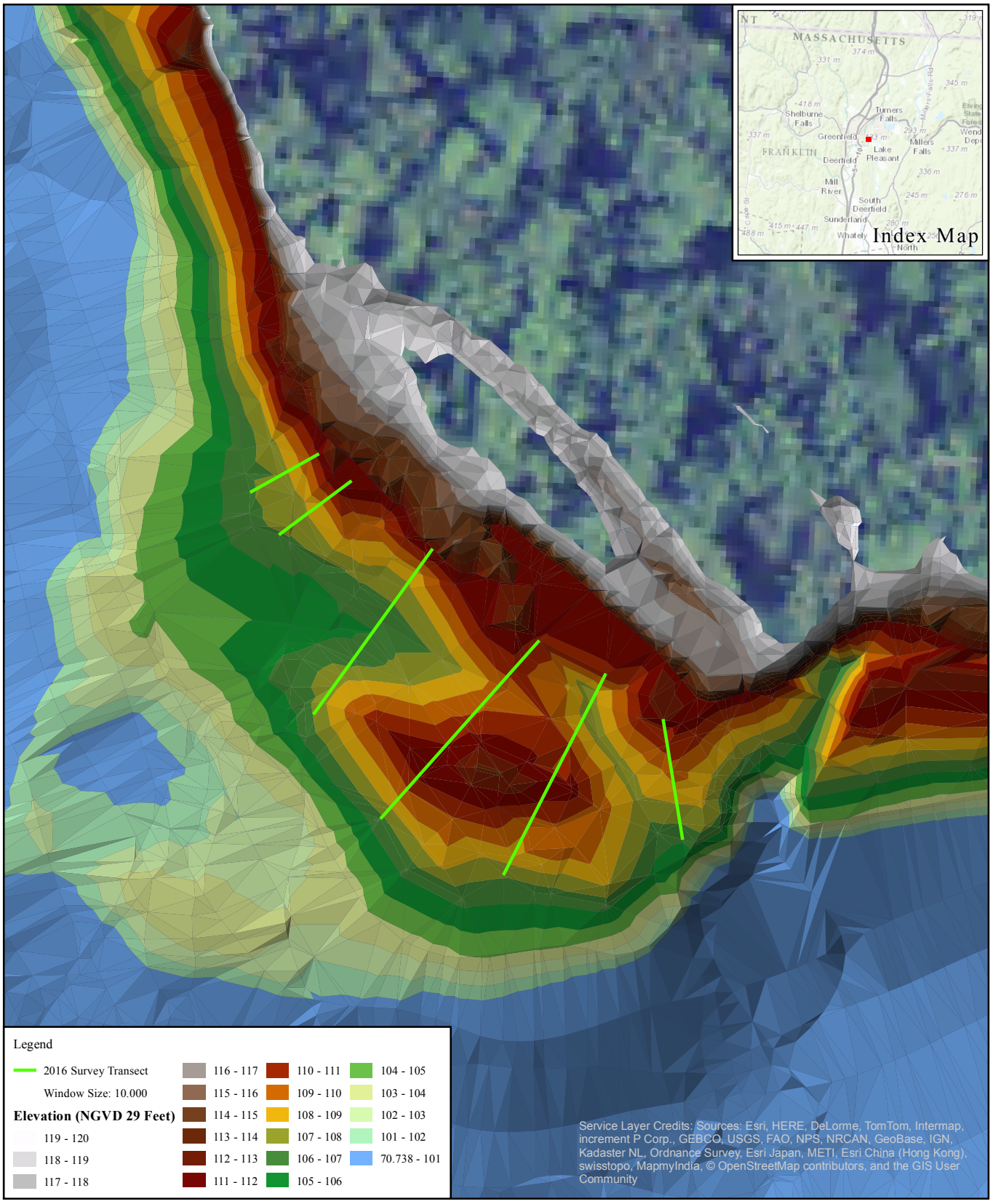

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0 0.0075 0.015 0.03 Miles

Figure 2.2-2: Cobblestone Beetle Potential Habitat Digital Terrain Model

Path: W:\gis\studies\3_5_1\maps\Final_Figures\Study_3_5_1_Addendum Cobblestone Beetle Habitat Digital Terrain Model.mxd

Table 2.2-1. Percent of Days x Elevation was Inundated for 24 Hours and Potential Habitat Available.

WSEL	Available Habitat (Sq Ft)	Available Habitat (Acres)	Percent of Habitat Available	*Percent of Days x Elevation was Inundated for 24 Hours			
				May	June	July	August
104	71,159	1.6	100.0	100.0	100.0	100.0	100.0
105	63,075	1.4	88.6	100.0	100.0	100.0	99.6
106	50,980	1.2	71.6	100.0	100.0	93.6	89.5
107	40,766	0.9	57.3	100.0	99.6	84.7	75.4
108	31,194	0.7	43.8	94.0	92.1	60.5	43.2
109	21,874	0.5	30.7	85.5	70.4	45.6	34.3
110	12,933	0.3	18.2	75.4	60.0	39.9	25.0
111	5,846	0.1	8.2	68.1	49.6	33.5	19.8
112	1,381	0.03	1.9	58.9	40.4	27.4	16.9
113	138	0.003	0.2	52.8	29.2	23.0	12.5
114	0	0.0	0.0	45.2	21.7	19.0	10.5

*Based on hourly simulated WSELs for the period 2008-2015 (8 years).

Table 2.2-2. Percent of Days x Elevation was Inundated for 0 Hours and Potential Habitat Available.

WSEL	Available Habitat (Sq Ft)	Available Habitat (Acres)	Percent of Habitat Available	*Percent of Days x Elevation was Inundated for 0 Hours			
				May	June	July	August
104	71,159	1.6	100.0	0.0	0.0	0.0	0.0
105	63,075	1.4	88.6	0.0	0.0	0.0	0.0
106	50,980	1.2	71.6	0.0	0.0	0.4	0.0
107	40,766	0.9	57.3	0.0	0.0	1.2	1.6
108	31,194	0.7	43.8	0.0	0.0	4.0	4.8
109	21,874	0.5	30.7	0.0	0.4	5.6	10.1
110	12,933	0.3	18.2	0.0	0.8	12.1	17.7
111	5,846	0.1	8.2	2.0	3.3	19.8	30.6
112	1,381	0.03	1.9	9.3	13.8	33.5	43.5
113	138	0.003	0.2	14.9	26.7	50.0	58.9
114	0	0.0	0.0	34.7	48.3	62.5	73.4

*Based on hourly simulated WSELs for the period 2008-2015 (8 years).

2.3 MADFW-4 Puritan Tiger Beetle

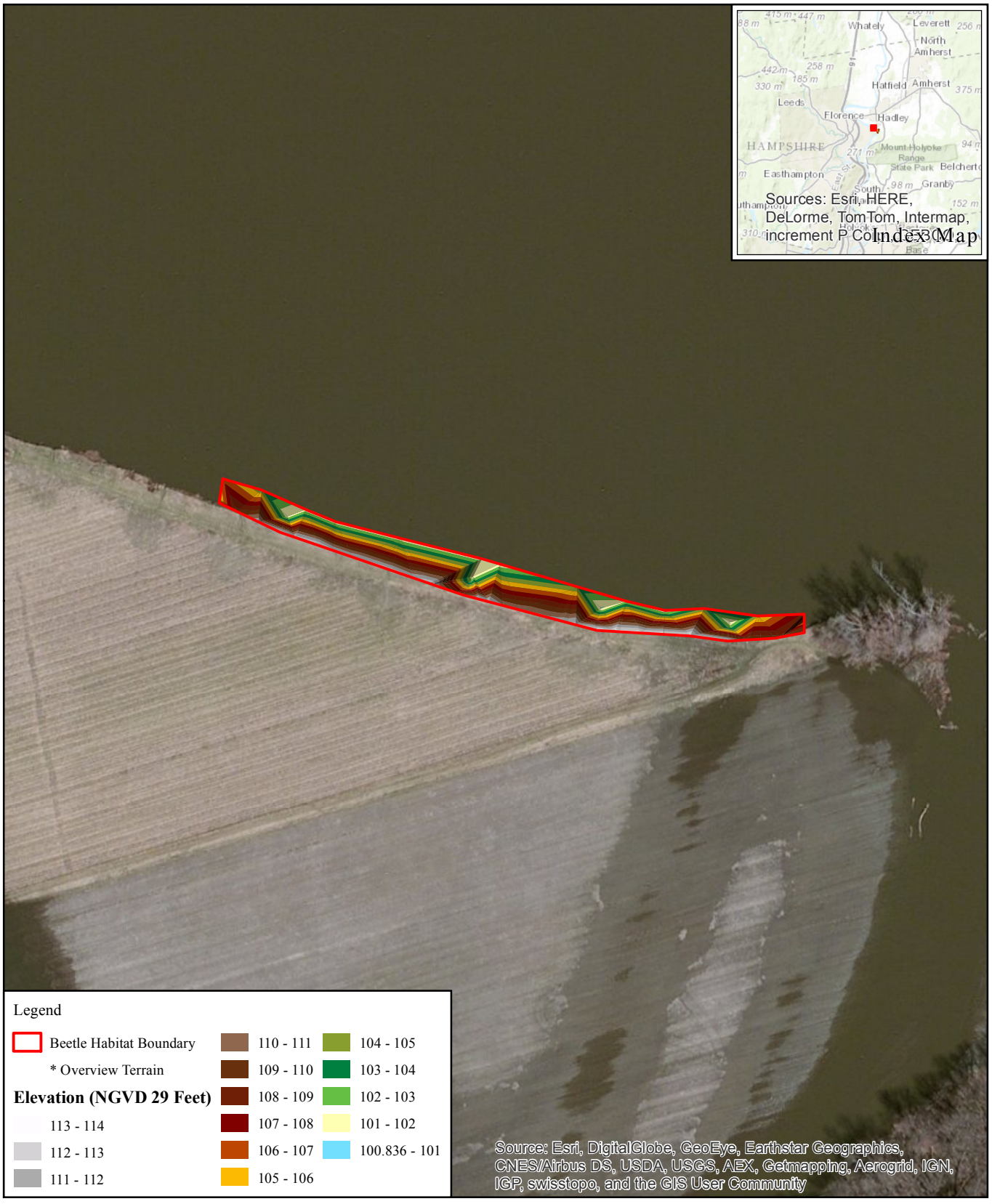
Comment: The report models the percent of time various WSELs are experienced at Rainbow Beach. We recommend that a similar analysis be provided for the North Bank PTB habitat.

Response:

In an effort to provide consistent data and analysis for PTBs, both the North Bank and Rainbow Beach habitats were modeled using elevation data collected at all transects (four at North Bank and 24 at Rainbow Beach) surveyed in 2015. These data were used to develop a detailed digital terrain model of the habitat at the Rainbow Beach and North Bank sites. These digital terrain models are shown in Figure 2.3-1 (North Bank) and Figure 2.3-2 (Rainbow Beach).

Section 3.1 of the 3/1/16 report included a detailed description of the hydraulic model developed as part of Study No. 3.2.2 *Hydraulic Study of Turners Falls Impoundment, Bypass Reach and below Cabot*. To summarize Section 3.1, an unsteady hourly time step hydraulic model was developed of the Connecticut River from the Montague United States Geological Survey (USGS) gage downstream to the Holyoke Dam. The model was calibrated to observed WSELs measured at water level loggers. The calibrated hydraulic model was then used to simulate WSELs at various locations along this section of the Connecticut River under the actual conditions that occurred ever hour between January 1, 2008 and September 30, 2015. Thus, at the location of the potential PTB habitat at the Montague site, simulated hourly WSEL data are available for May, June, July, and August over the eight year period. Using the hourly simulated WSELs, WSEL duration curves were developed for May through August as described below.

Using the Surface to volume tool, available in ESRI Arcmap a 3-dimensional surface area (in square feet) was calculated at 1.0 foot increments within the tiger beetle habitat at both locations. The available habitat represents the amount of potential habitat available above the listed elevation (which assumes that inundation is occurring up to the presented elevation). Using the lowest elevation (100.0 feet) as the base elevation for all available potential habitat, Table 2.3-1 and Table 2.3-2 show the area and percent of habitat available based on 0.0 or 24.0 hours of inundation at Rainbow Beach based on corresponding WSEL (based on the WSEL duration curves developed from the hydraulic model). Table 2.3-3 and Table 2.3-4 show the area and percent of habitat available based on 0.0 or 24.0 hours of inundation at North Bank based on the corresponding WSEL (based on the WSEL duration curves developed from the hydraulic model). Hourly data for both locations, based on within day calculations for the percent of time each elevation is inundated for the months of May, June, July, and August at each location has been provided as Attachment B to this addendum.



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0 80 160 320 Feet

Figure 2.3-1. North Bank Digital Terrain Model

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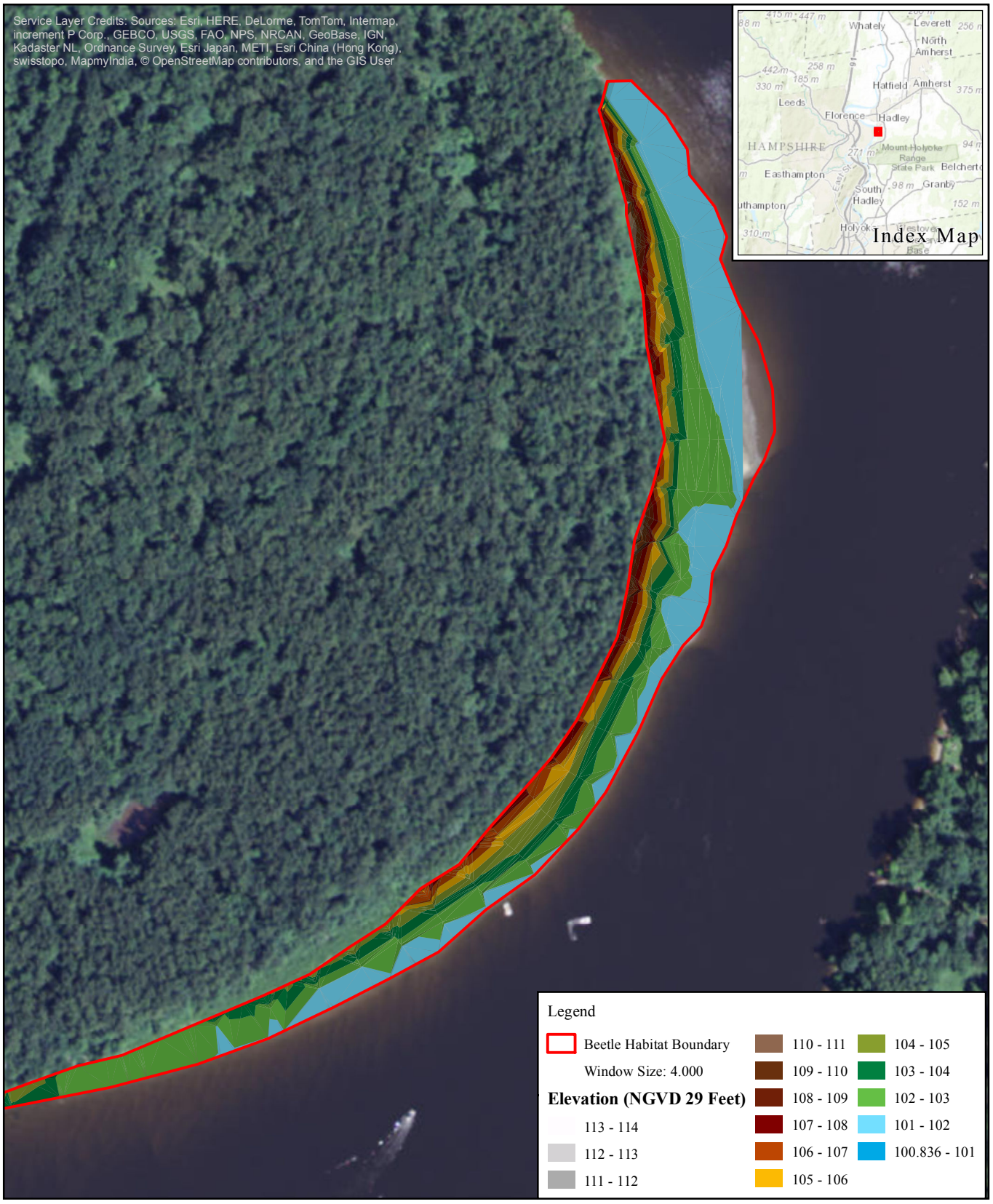

FIRSTLIGHT HYDRO GENERATING COMPANY
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RELICENSING STUDY 3.5.1
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N

0 145 290 580 Feet

Figure 2.3-2. Rainbow Beach Digital Terrain Model

Path: W:\gis\studies\3_5_1\maps\Final_Figures\Study_3_5_1_Addendum Beetle Rainbow Beach Digital Terrain Model.mxd

Table 2.3-1. Percent of Days x Elevation was Inundated for 24 Hours and Potential Habitat Available (Rainbow Beach).

WSEL	Available Habitat (Sq Ft)	Available Habitat (Acres)	Percent of Habitat Available	*Percent of Days x Elevation was Inundated for 24 Hours			
				May	June	July	August
100	356,680	8.19	100.00	100.0	100.0	100.0	100.0
101	356,680	8.19	100.00	91.1	82.5	54.8	40.3
102	242,084	5.56	67.87	71.0	51.7	35.9	23.8
103	138,334	3.18	38.78	54.8	34.2	25.8	14.1
104	94,644	2.17	26.53	40.3	18.3	16.5	9.7
105	64,070	1.47	17.96	24.2	9.6	13.3	7.3
106	41,959	0.96	11.76	16.5	5.0	6.0	6.0
107	22,583	0.52	6.33	11.3	2.1	3.2	4.4
108	11,150	0.26	3.13	6.0	1.7	2.0	2.8
109	5,213	0.12	1.46	2.8	0.8	0.8	2.8
110	1,983	0.05	0.56	1.6	0.4	0.4	1.6
111	172	0.004	0.05	0.8	0.0	0.0	1.2
112	59	0.001	0.02	0.0	0.0	0.0	0.8
113	49	0.001	0.01	0.0	0.0	0.0	0.8
114	20	0.0005	0.01	0.0	0.0	0.0	0.8
115	0	0.0000	0.00	0.0	0.0	0.0	0.4

*Based on hourly simulated WSELs for the period 2008-2015 (8 years).

Table 2.3-2. Percent of Days x Elevation was Inundated for 0 Hours and Potential Habitat Available (Rainbow Beach).

WSEL	Available Habitat (Sq Ft)	Available Habitat (Acres)	Percent of Habitat Available	*Percent of Days x Elevation was Inundated for 0 Hours			
				May	June	July	August
100	356,680	8.19	100.00	0.0	0.0	0.0	0.0
101	356,680	8.19	100.00	0.0	0.4	18.5	30.2
102	242,084	5.56	67.87	10.9	18.3	43.1	55.6
103	138,334	3.18	38.78	31.0	44.6	61.3	71.8
104	94,644	2.17	26.53	47.6	62.9	74.2	85.9
105	64,070	1.47	17.96	63.3	80.0	79.0	89.1
106	41,959	0.96	11.76	74.6	85.8	87.5	91.9
107	22,583	0.52	6.33	81.0	94.6	91.9	93.1
108	11,150	0.26	3.13	88.7	96.7	96.0	95.6
109	5,213	0.12	1.46	94.4	98.3	97.2	96.0
110	1,983	0.05	0.56	96.8	98.3	97.6	96.4
111	172	0.004	0.05	98.4	99.6	100.0	98.4
112	59	0.001	0.02	99.6	100.0	100.0	98.4
113	49	0.001	0.01	100.0	100.0	100.0	98.4
114	20	0.0005	0.01	100.0	100.0	100.0	98.4
115	0	0.0000	0.00	100.0	100.0	100.0	98.8

*Based on hourly simulated WSELs for the period 2008-2015 (8 years).

Table 2.3-3. Percent of Days x Elevation was Inundated for 24 Hours and Potential Habitat Available (North Bank).

WSEL	Available Habitat (Sq Ft)	Available Habitat (Acres)	Percent of Habitat Available	*Percent of Days x Elevation was Inundated for 24 Hours			
				May	June	July	August
100	26,499	0.61	100.0	100.0	100.0	100.0	100.0
101	26,492	0.61	100.0	94.0	85.4	56.9	41.9
102	25,940	0.60	97.9	73.8	55.4	37.9	24.6
103	24,861	0.57	93.8	58.1	37.9	26.6	15.3
104	22,886	0.53	86.4	42.3	19.6	18.5	9.7
105	20,452	0.47	77.2	26.6	10.0	13.3	7.7
106	17,900	0.41	67.6	17.7	6.7	7.3	6.5
107	15,182	0.35	57.3	13.3	2.1	3.6	4.4
108	12,372	0.28	46.7	6.5	1.7	2.8	2.8
109	9,634	0.22	36.4	3.2	0.8	2.0	2.8
110	6,989	0.16	26.4	1.6	0.4	0.8	2.0
111	4,627	0.11	17.5	0.8	0.0	0.0	1.2
112	2,521	0.06	9.5	0.4	0.0	0.0	0.8
113	693	0.02	2.6	0.0	0.0	0.0	0.8
114	33	0.001	0.1	0.0	0.0	0.0	0.8
115	0	0.00	0.0	0.0	0.0	0.0	0.4

*Based on hourly simulated WSELs for the period 2008-2015 (8 years).

Table 2.3-4. Percent of Days x Elevation was Inundated for 0 Hours and Potential Habitat Available (North Bank).

WSEL	Available Habitat (Sq Ft)	Available Habitat (Acres)	Percent of Habitat Available	*Percent of Days x Elevation was Inundated for 0 Hours			
				May	June	July	August
100	26,499	0.61	100.0	0.0	0.0	0.0	0.0
101	26,492	0.61	100.0	0.0	0.4	16.9	27.8
102	25,940	0.60	97.9	10.1	14.6	40.3	51.2
103	24,861	0.57	93.8	26.6	39.6	59.3	71.8
104	22,886	0.53	86.4	44.0	60.8	71.8	83.5
105	20,452	0.47	77.2	61.3	79.2	78.6	88.7
106	17,900	0.41	67.6	73.8	84.6	87.1	91.5
107	15,182	0.35	57.3	77.4	94.2	91.9	91.9
108	12,372	0.28	46.7	87.5	96.7	95.6	95.2
109	9,634	0.22	36.4	94.4	98.3	96.4	95.6
110	6,989	0.16	26.4	96.8	98.3	97.6	96.0
111	4,627	0.11	17.5	98.4	99.6	99.2	98.4
112	2,521	0.06	9.5	98.8	100.0	100.0	98.4
113	693	0.02	2.6	100.0	100.0	100.0	98.4
114	33	0.001	0.1	100.0	100.0	100.0	98.4
115	0	0.00	0.0	100.0	100.0	100.0	98.8

*Based on hourly simulated WSELs for the period 2008-2015 (8 years).

2.4 MADFW-8 RTE Plant Surveys-Transect

Comment: The Division requests that FERC direct FirstLight (FL) to revise the report, and submit it for public review and comment, to provide information on within-day frequencies of WSEL fluctuations and how long each particular WSEL is inundated (e.g., duration of flooding).

Response:

The same analysis was conducted for the following transects:

- Transects 1, 2, 3, 4 (between Montague USGS Gage and Holyoke Dam)
- Transects 5B, 5A, 6C, 6B, 6A, 11A, 11B, 11C, 11, 8, 9B, 9A, 10 (located in the Turners Falls Impoundment).
- Transect T-3 (within the bypass reach) was not included as this transect was not visited in the field, the study plan described using existing elevation information collected and therefore substrate and density information is not available for this transect location. Transect 4, includes a description of substrate and density for habitat of Tradescant's aster.

As described in the 3/1/2016 Report, two calibrated hydraulic models were developed from the Montague USGS Gage to Holyoke Dam ("Montague reach") and from Vernon Dam to the Turners Falls Dam ("Turners Falls Impoundment (TFI) reach"). The hydraulic model of the Montague reach extends from January 1, 2008 to September 30, 2015. The hydraulic model for the TFI reach extends from January 1, 2000 to September 30, 2015.

An analysis of each transect listed in the bullets above was conducted and two figures were developed. The figures present the percent of time that potential habitat for the plant species of interest is either inundated for a period of 24 hours as well as the percent of time potential habitat is inundated for 0.0 hours.

Transect 1 (upstream end of First Island, Sandbar Willow)

Figure 2.4-1 and Figure 2.4-2 present the percent of time that potential habitat for sandbar willow on Transect 1 is either inundated for a period of 24 hours (Figure 2.4-1) as well as the percent of time potential habitat is inundated for 0.0 hours (Figure 2.4-2). The figures show the monthly WSEL duration curves (Apr, May, Jun, Jul, Aug, and Sep) based on hourly simulated elevations at Transect 1 for the eight year period of record. The figures also show the transect (station in meters along the x-axis and plant elevations along the y-axis). By plotting the monthly WSEL duration curves and transects where the sandbar willow were observed, the percentage of time the plant is wetted can be determined. In general potential habitat for sandbar willow is inundated for 24 hours a day for most of April, May, and June (generally speaking at least 50% or more of the time). In July, August, and September potential habitat is inundated 24 hours a day for approximately 10-35% of the time.

Attachment C includes all hourly data calculated for each transect below.

The assessment for the remaining transects follow and are based on the same type of analysis described above.

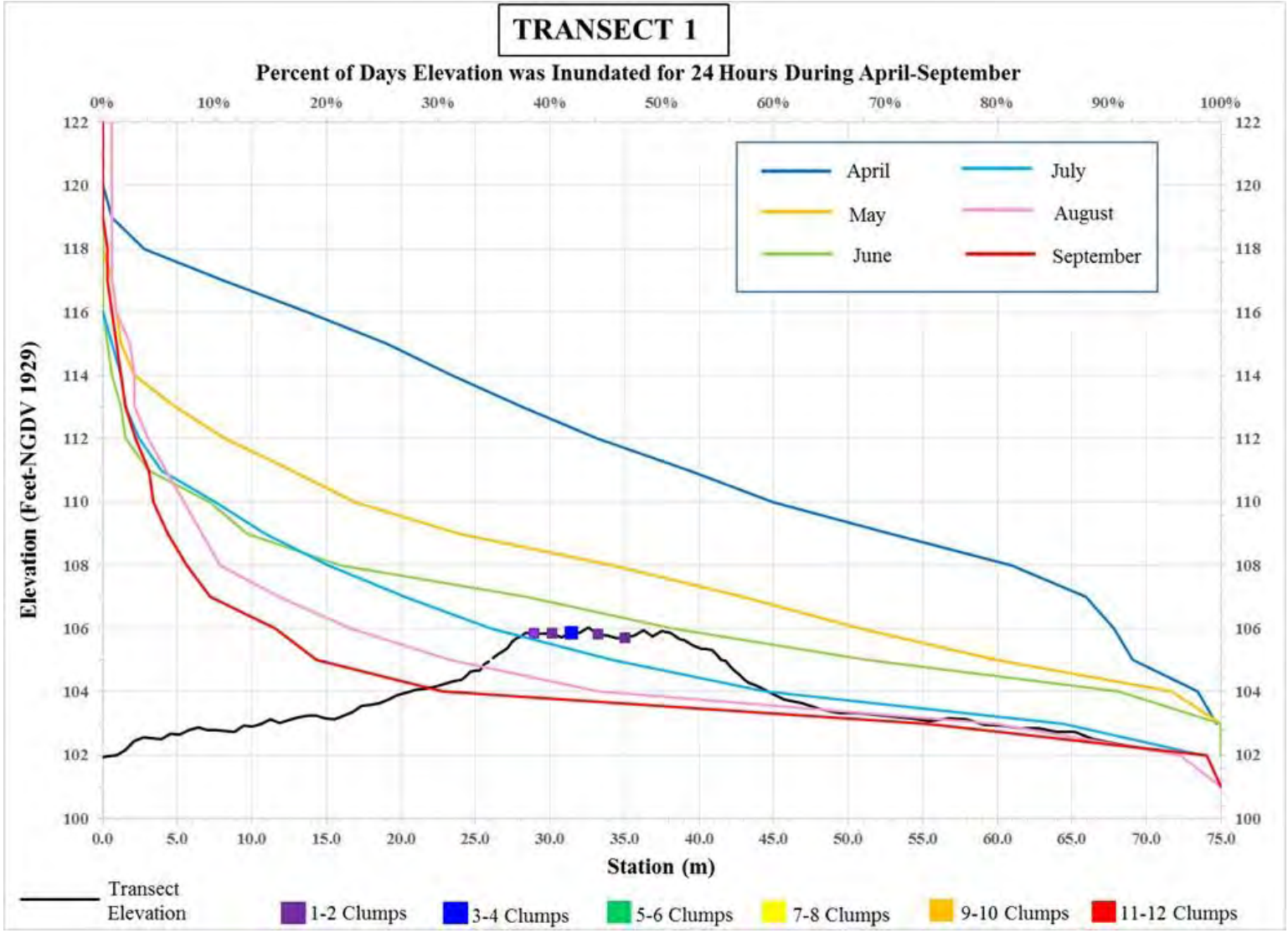


Figure 2.4-1 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 1 near First Island, Sandbar Willow)

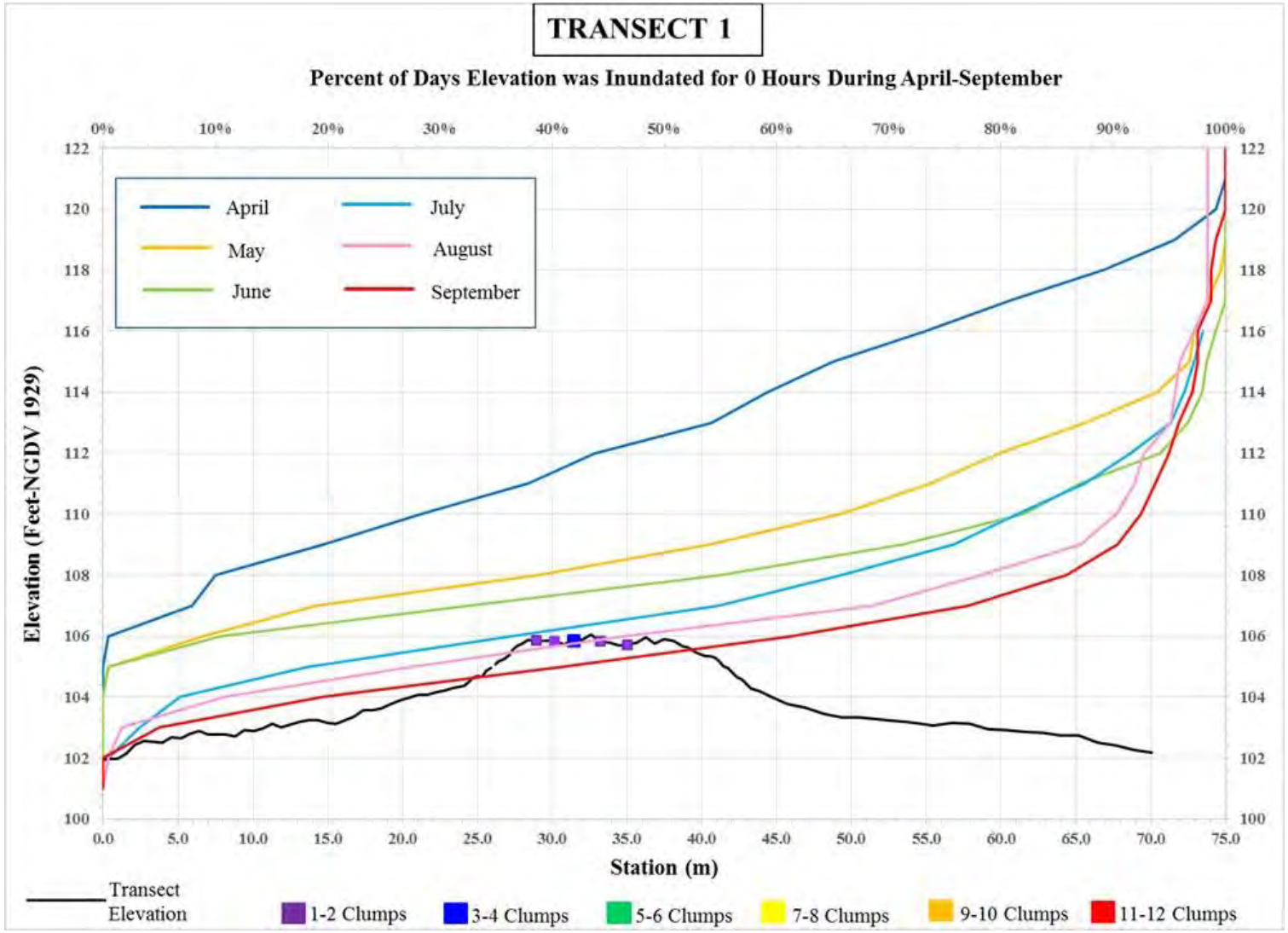


Figure 2.4-2 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 1 near First Island, Sandbar Willow)

Transect 2 (Sandbar Willow, Upstream end of Second Island)

Figure 2.4-3 and Figure 2.4-4 present the percent of time that potential habitat for sandbar willow on Transect 2 is either inundated for a period of 24 hours (Figure 2.4-3) as well as the percent of time potential habitat is inundated for 0.0 hours (Figure 2.4-4). In general, potential habitat for sandbar willow is inundated for 24 hours a day for most of April and May (generally speaking at least 50% or more of the time). In June, July, August, and September potential habitat is inundated 24 hours a day for approximately 5-20% of the time. Two separate populations of sandbar willow are present at this site, generally speaking density of sandbar willow from station 75.0 to 90.0 are higher, this habitat, similar to Transect 1, is inundated around 50% of the time for 24 hours a day in June.

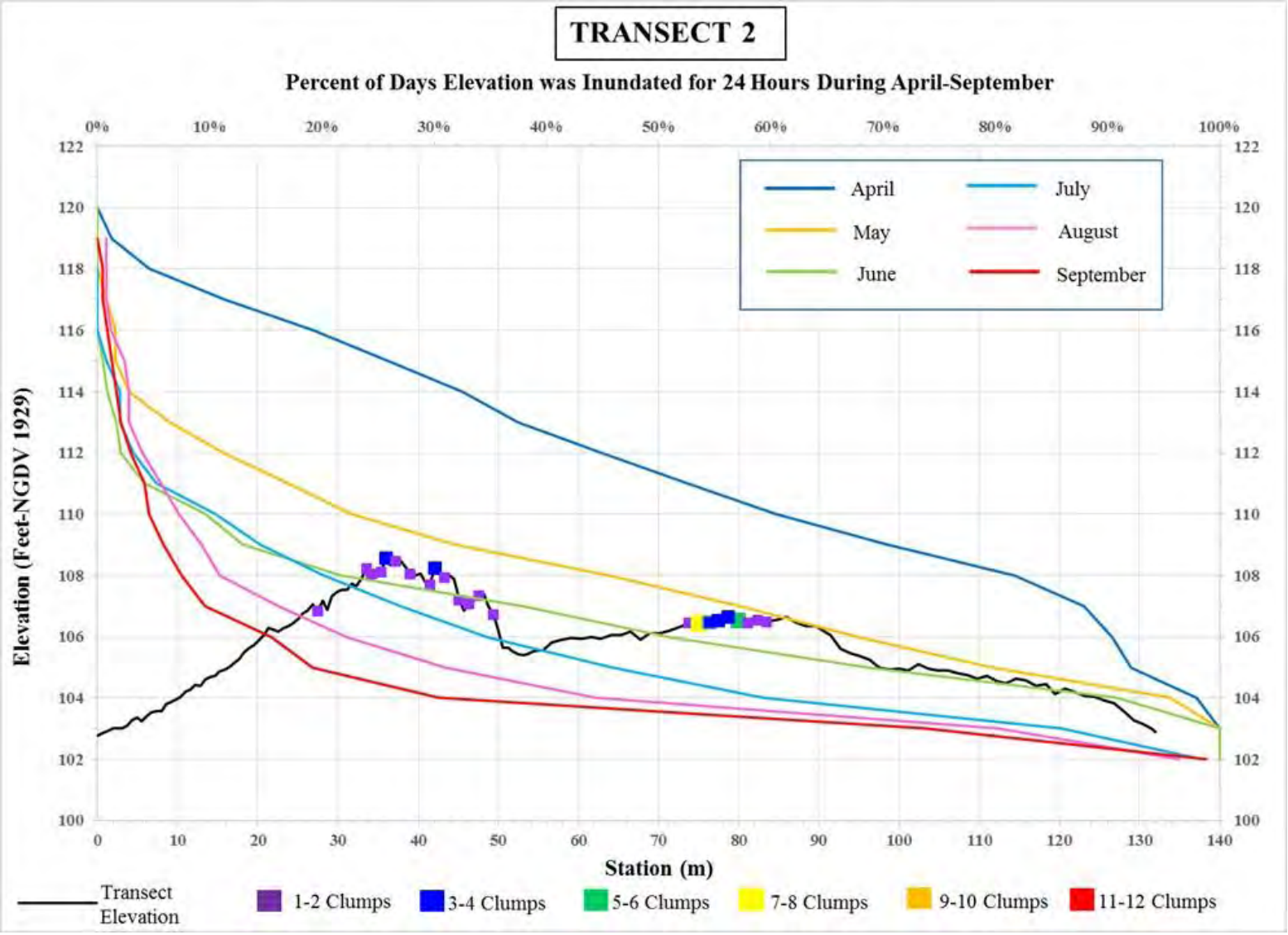


Figure 2.4-3 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 2, near Second Island, Sandbar Willow)

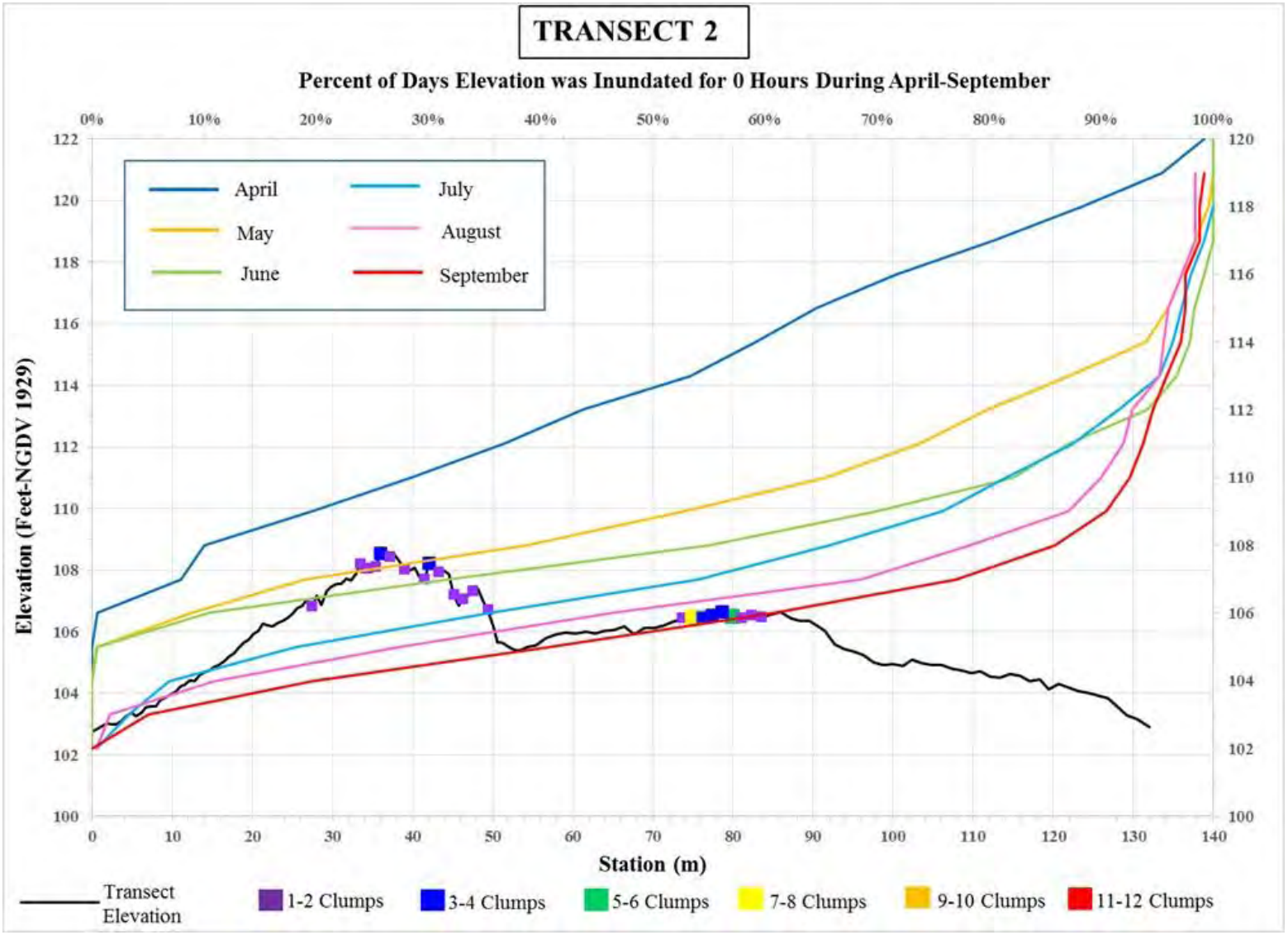


Figure 2.4-4 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 2, near Second Island, Sandbar Willow)

Transect 3 (Sandbar Cherry, upstream end of Fourth Island)

Figure 2.4-5 and Figure 2.4-6 present the percent of time that potential habitat for sandbar cherry on Transect 3 is either inundated for a period of 24 hours (Figure 2.4-5) as well as the percent of time potential habitat is inundated for 0.0 hours (Figure 2.4-6). In general, potential habitat for sandbar cherry is inundated less frequently than habitat for sandbar willow at Transect 1 and 2. At Transect 3, potential sandbar cherry habitat is inundated for 24 hours a day most in April (generally speaking at least 30% or more of the time). In May, June, July, August, and September potential habitat is inundated 24 hours a day generally for less than 10% of the time.

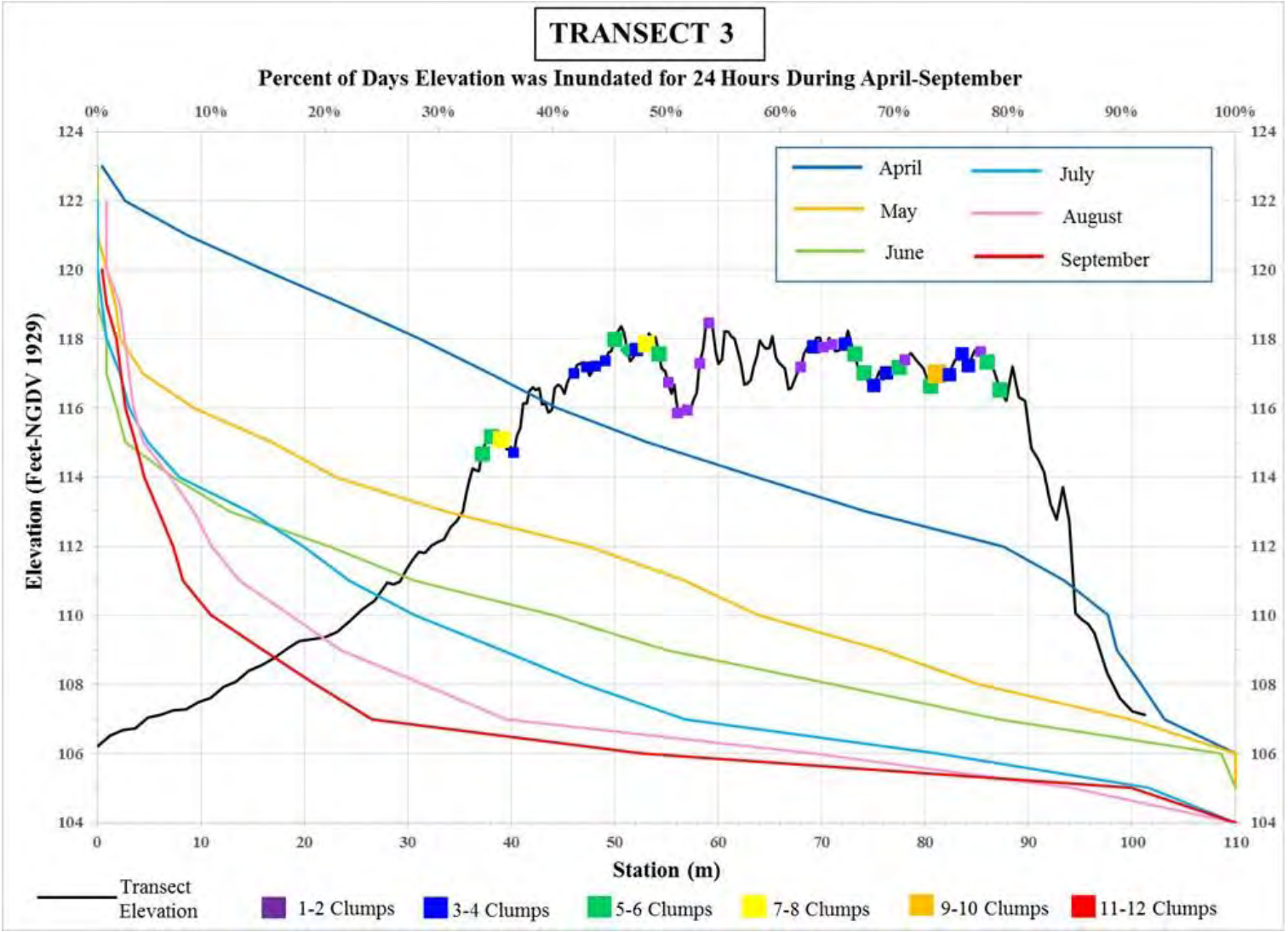


Figure 2.4-5 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 3, near Fourth Island, Sandbar Cherry)

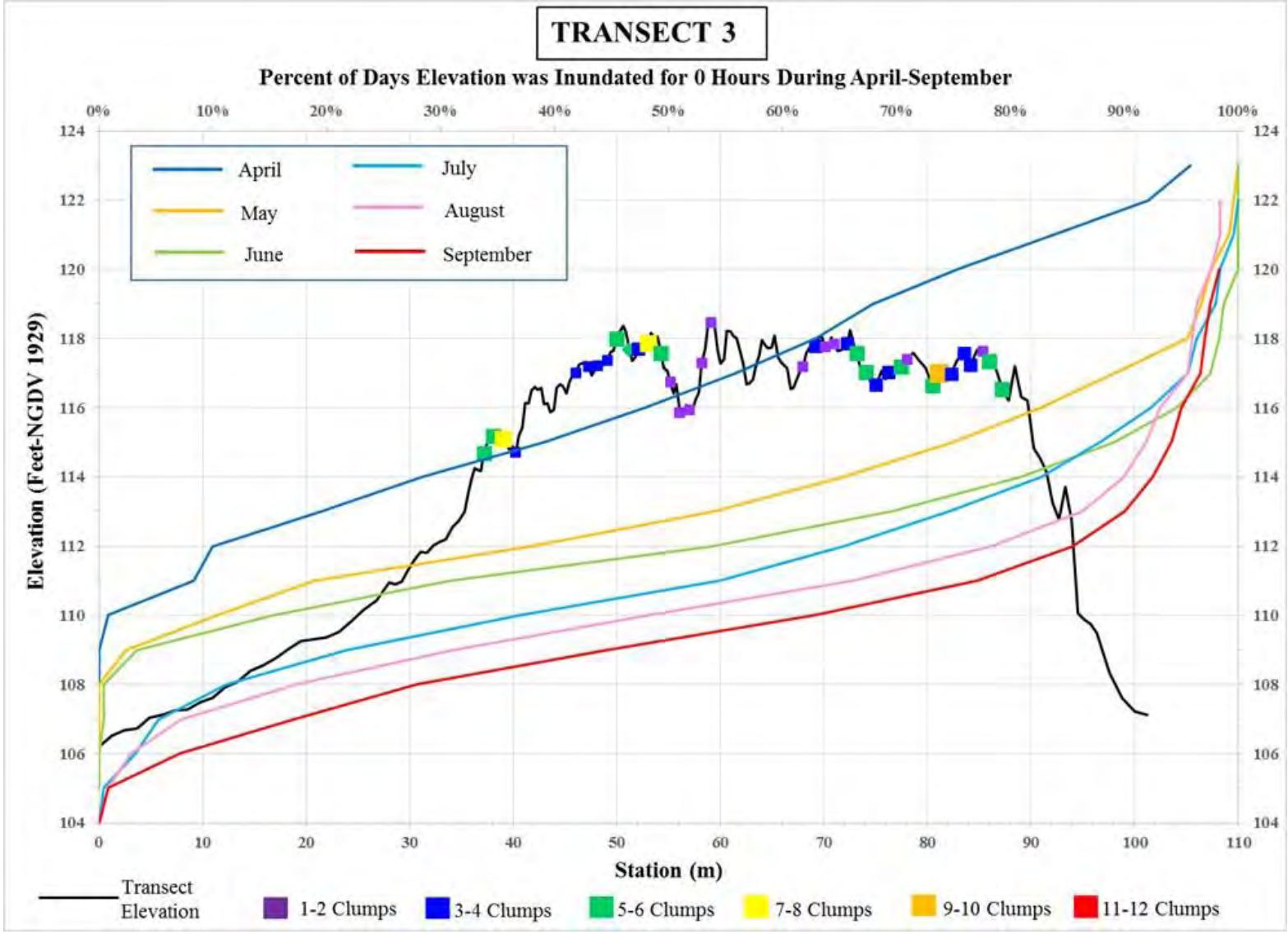


Figure 2.4-6 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 3, near Fourth Island, Sandbar Cherry)

Transect 4 (Tradescant's Aster, south of confluence with Deerfield River)

Figure 2.4-7 and Figure 2.4-8 present the percent of time that potential habitat for Tradescant's aster on Transect 4 is either inundated for a period of 24 hours (Figure 2.4-7) as well as the percent of time potential habitat is inundated for 0.0 hours (Figure 2.4-8). In general, potential habitat for Tradescant's aster is more frequently inundated for 24 hours than both sandbar willow and sandbar cherry. At Transect 4, potential Tradescant's aster habitat is inundated for 24 hours a day most in April, May, June, and July (generally speaking at least 30% or more of the time). In August and September potential habitat is inundated 24 hours a day about 10% of the time.

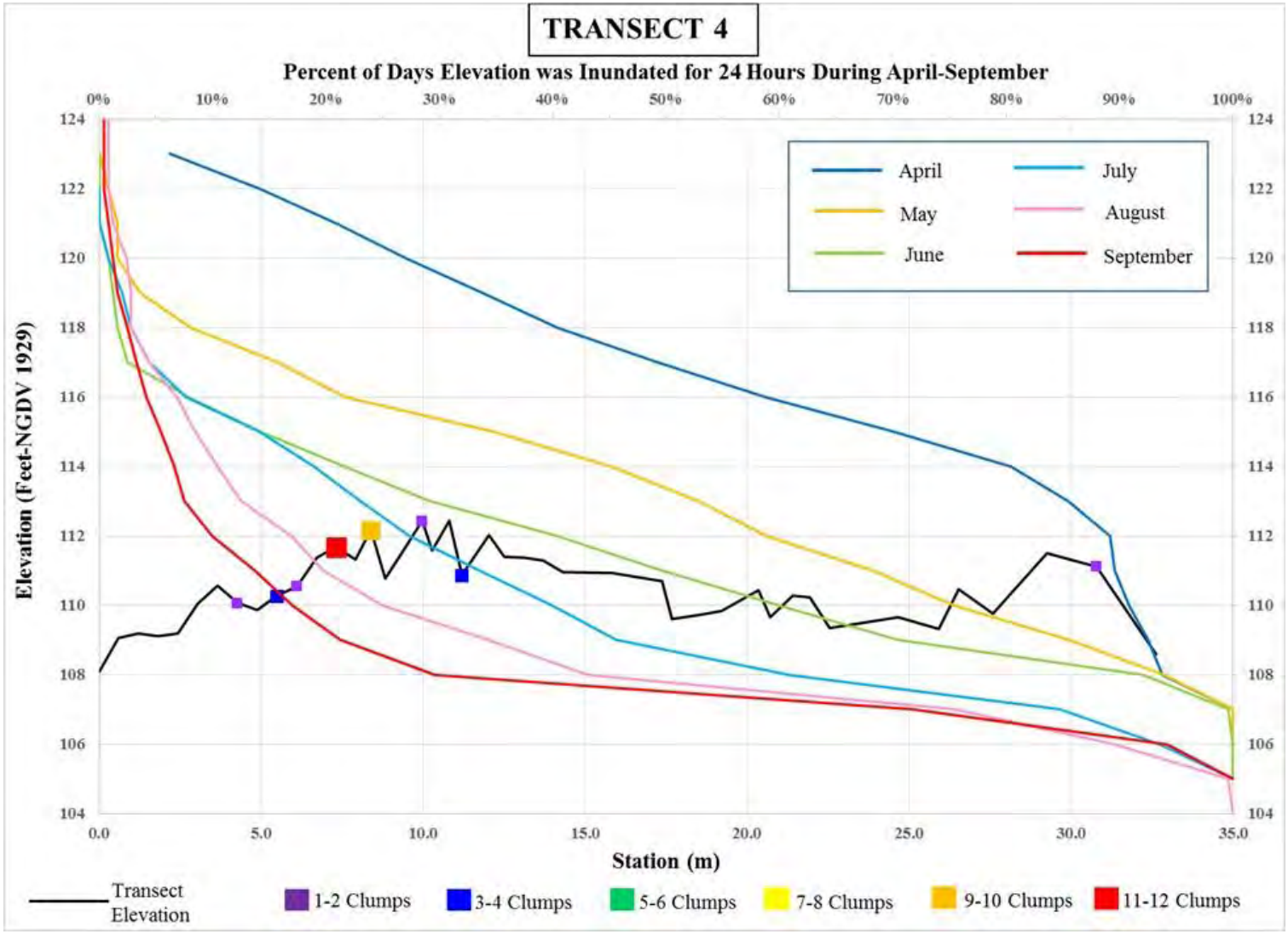


Figure 2.4-7 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 4, near Deerfield River confluence, Tradescant's Aster)

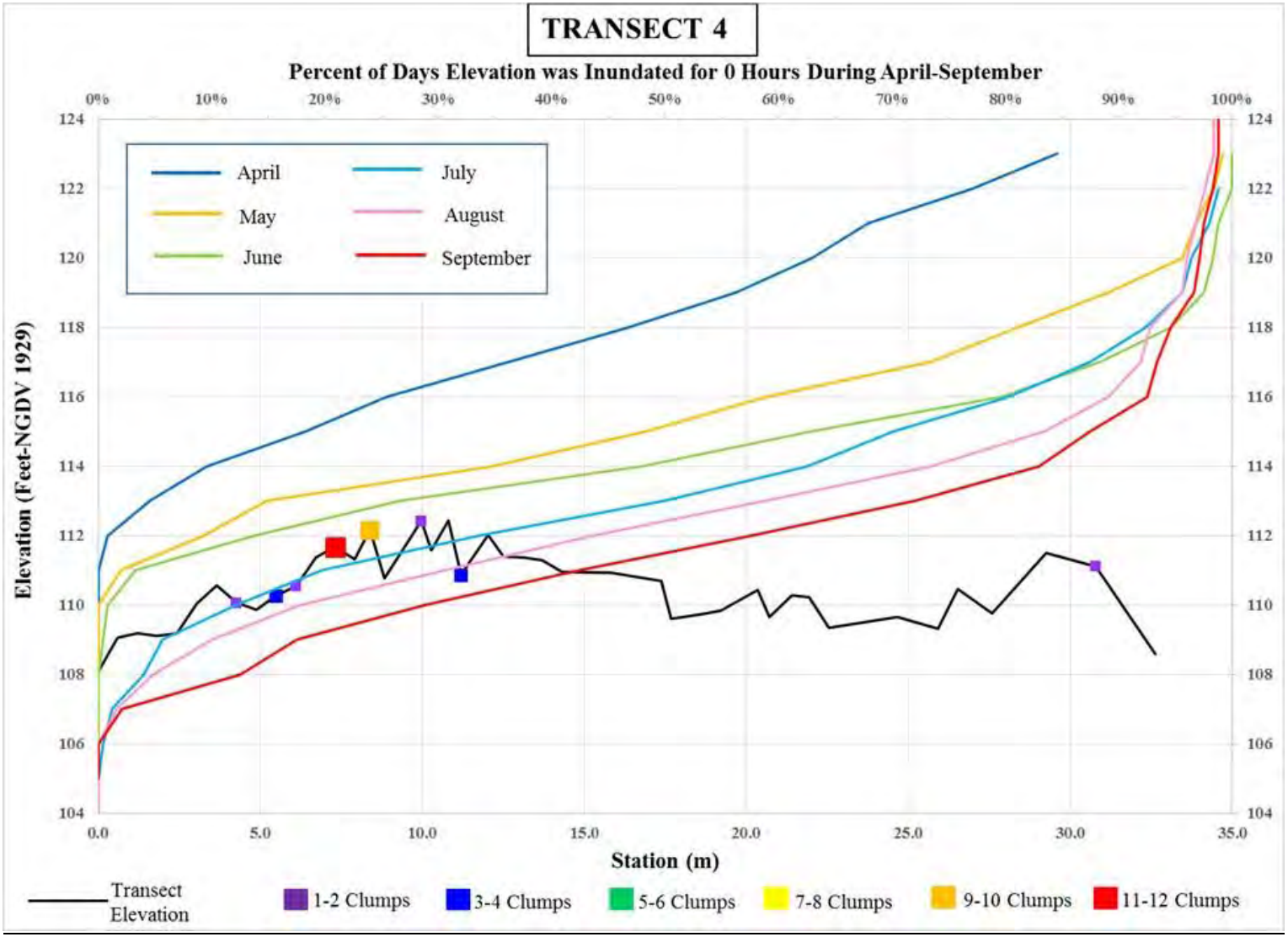


Figure 2.4-8 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 4, near Deerfield River confluence, Tradescant's Aster)

Transect 5A and 5B (Upland White Aster, TFI)

Note that the same analysis was conducted as described above; however, the WSEL duration curve analysis is based on the TFI hydraulic model, which as a period of record from January 1, 2000 to September 30, 2015.

Figure 2.4-9 through Figure 2.4-12 present the percent of time that potential habitat for upland white aster on Transect 5A and 5B is either inundated for a period of 24 hours (Figure 2.4-9 and Figure 2.4-11) as well as the percent of time potential habitat is inundated for 0.0 hours (Figure 2.4-10 and Figure 2.4-12). Potential upland white aster habitat at both Transect 5A and 5B are infrequently flooded for 24 hours for the entire period of April through September. The majority of potential habitat remains exposed for 24 hours a day during that period for approximately 90% of the time.

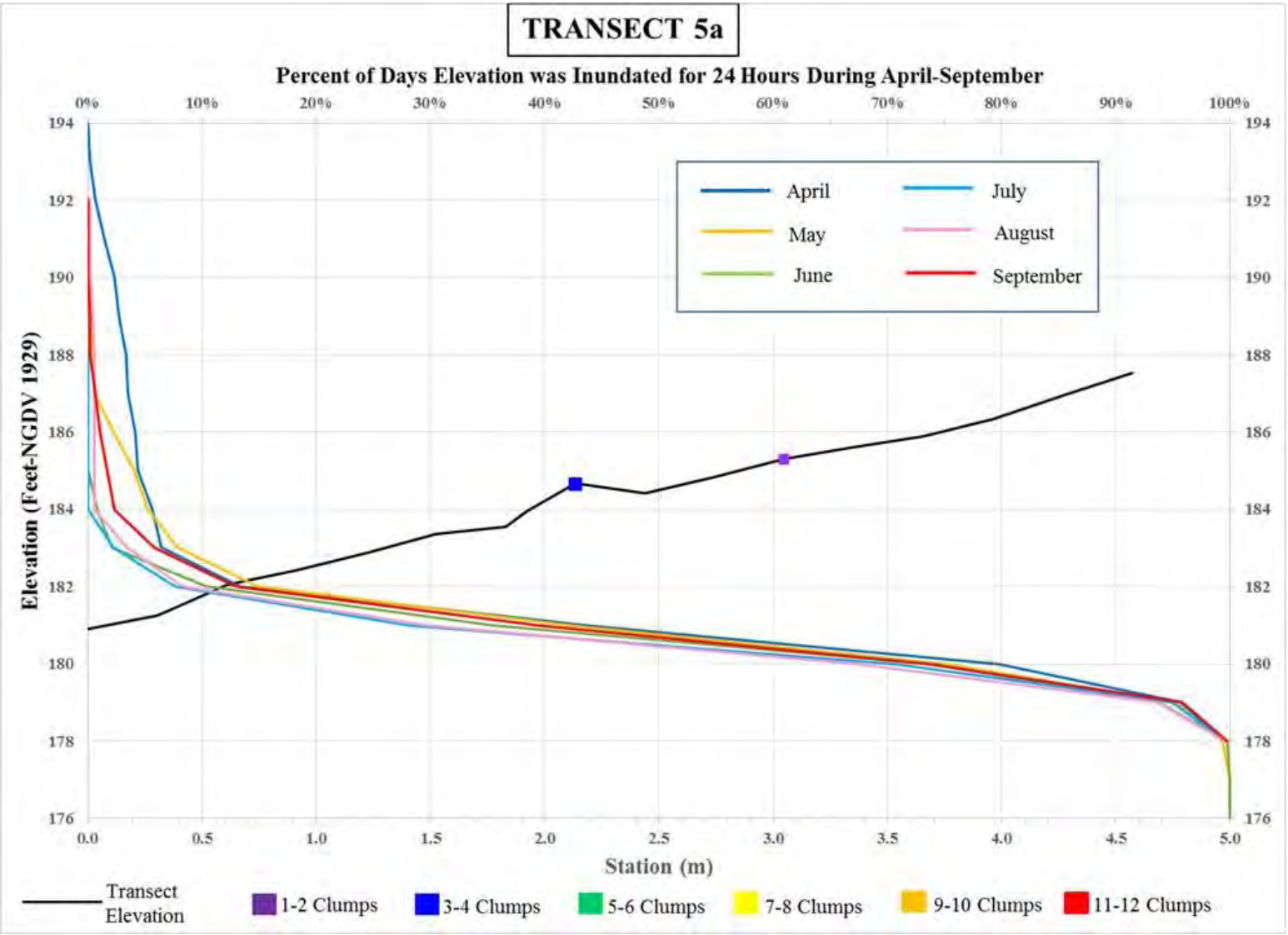


Figure 2.4-9 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 5a, TFI, Upland White Aster)

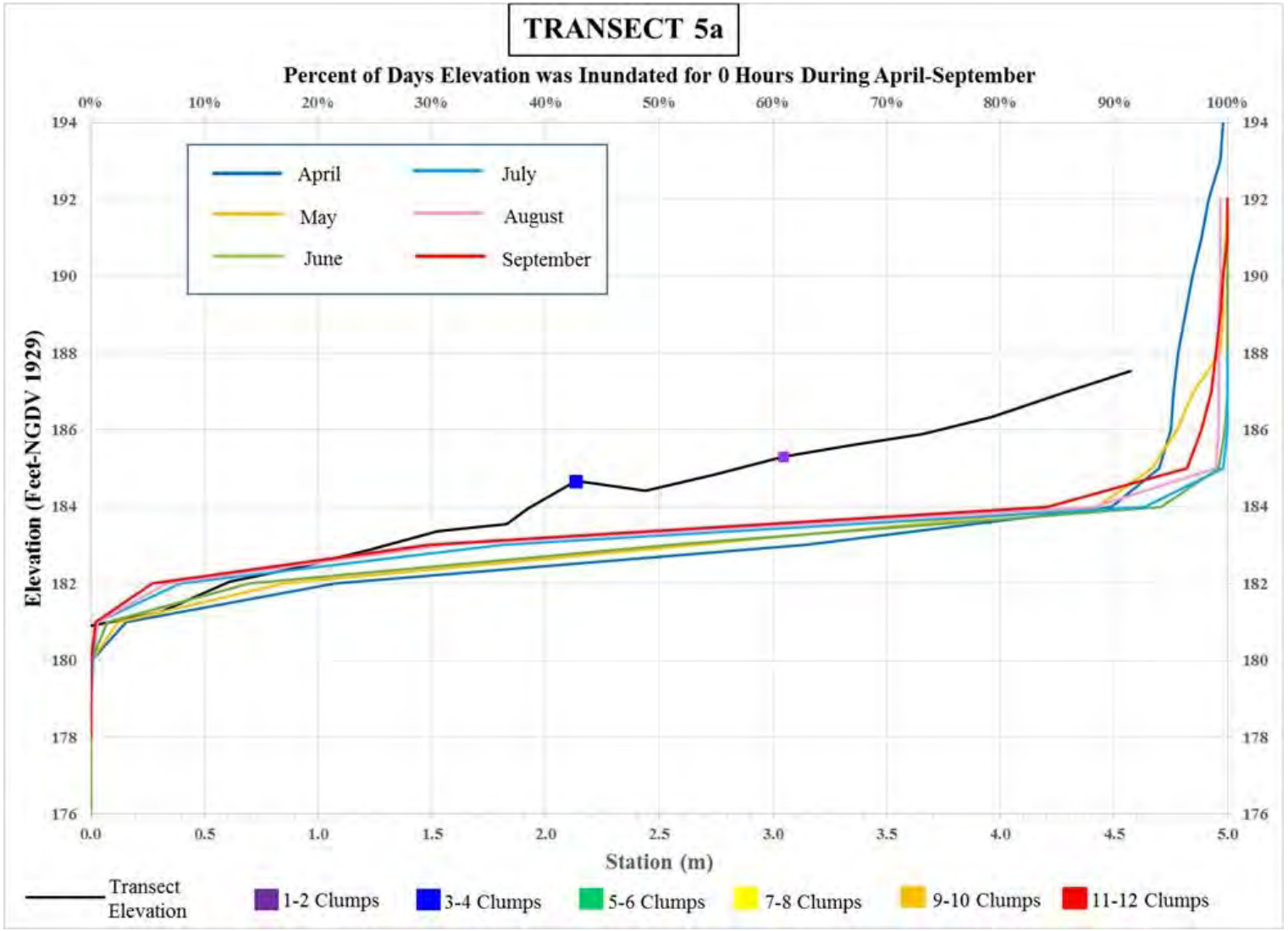


Figure 2.4-10 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 5a, TFI, Upland White Aster)

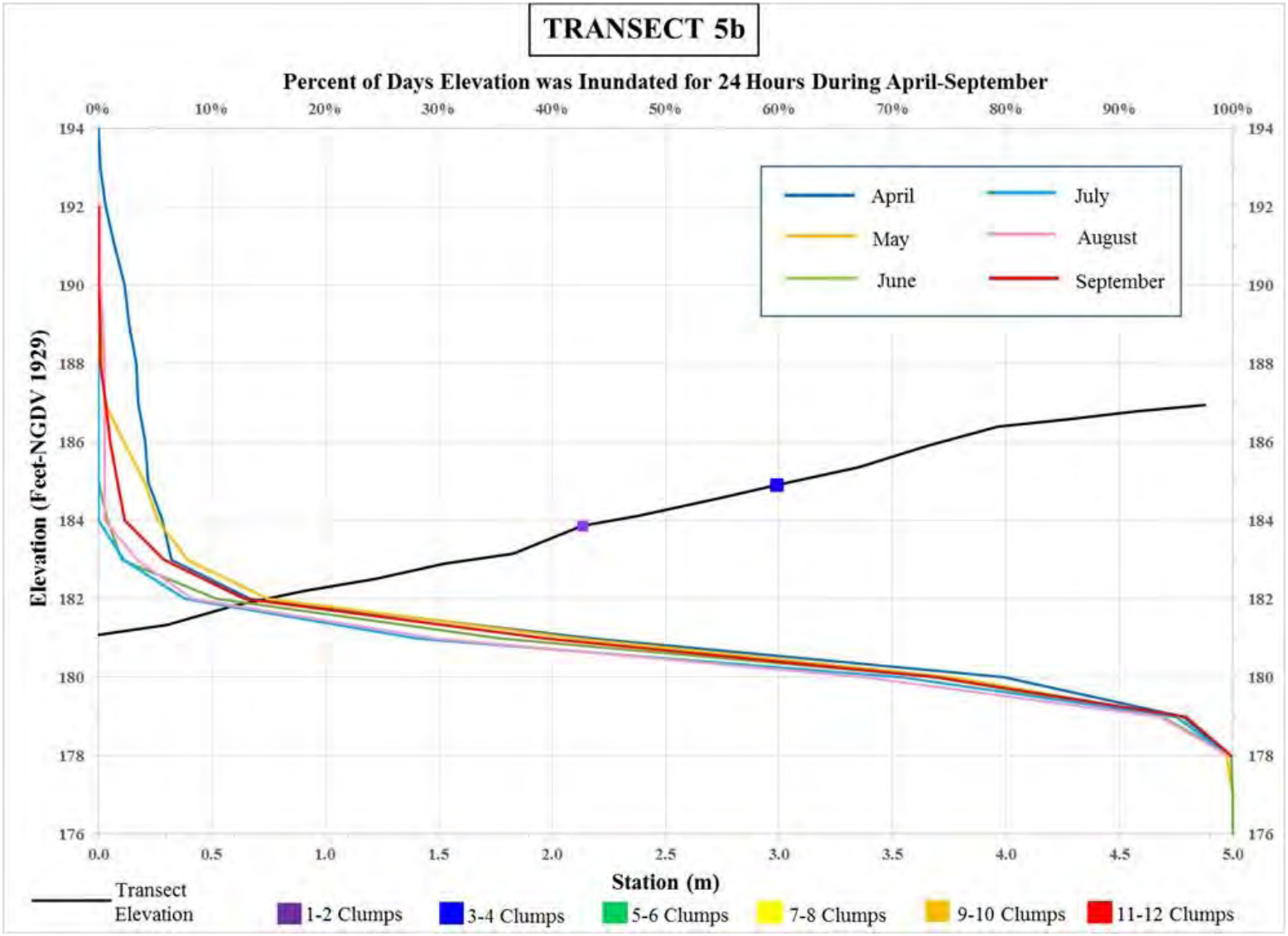


Figure 2.4-11 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 5b, TFI, Upland White Aster)

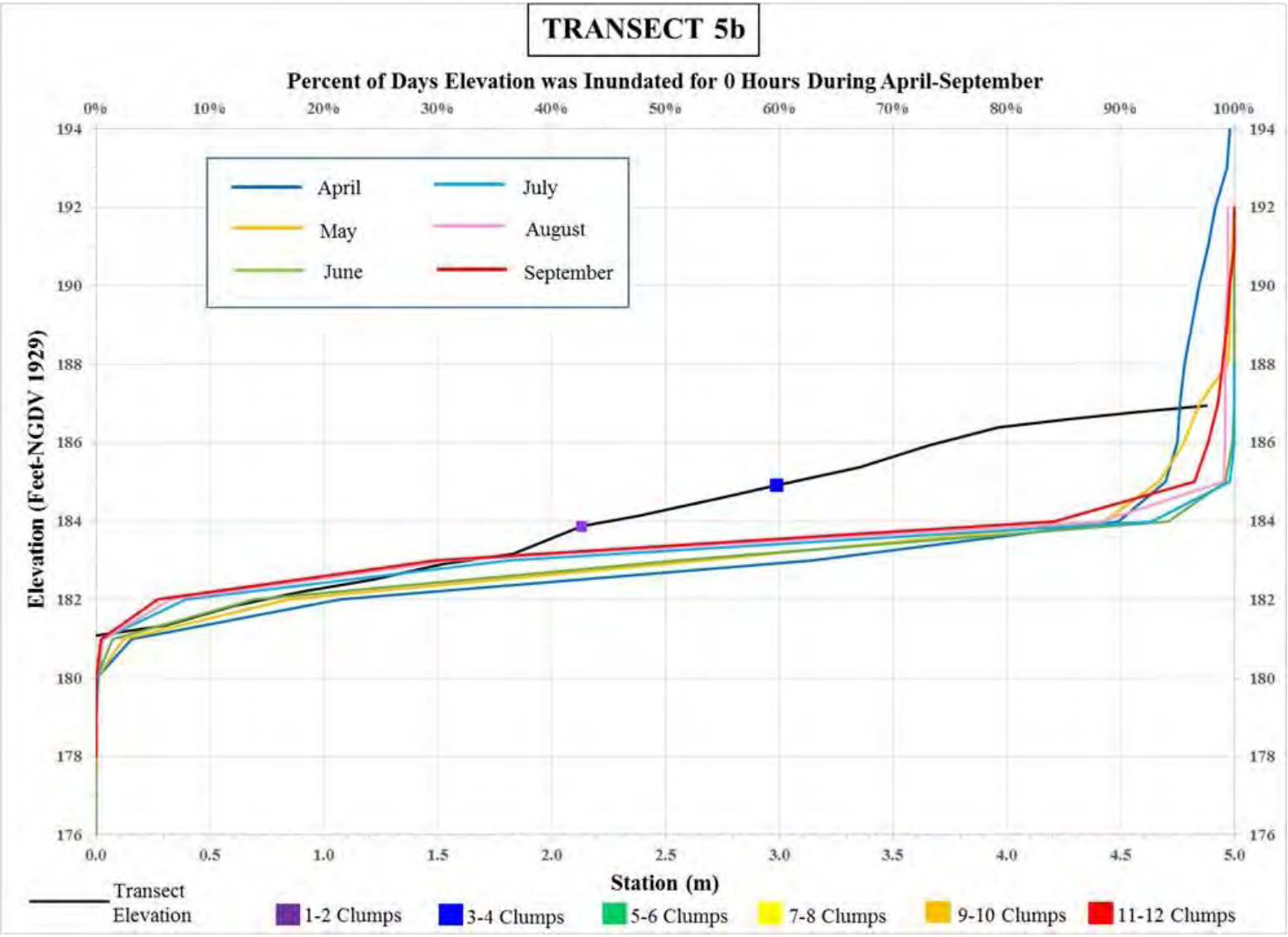


Figure 2.4-12 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 5b, TFI, Upland White Aster)

Transect 6A, 6B, and 6C (Upland White Aster, TFI)

Figure 2.4-13 through Figure 2.4-18 present the percent of time that potential habitat for upland white aster on Transect 6A, 6B, and 6C is either inundated for a period of 24 hours (Figure 2.4-13, Figure 2.4-15, and Figure 2.4-17) as well as the percent of time potential habitat is inundated for 0.0 hours (Figure 2.4-14, Figure 2.4-16 and Figure 2.4-18). Transect 6A, 6B, and 6C differ in topography from most other transects surveyed. This location is a bedrock shelf which steeply rises from the edge of water. At this location potential upland white aster habitat at all transects are infrequently flooded for 24 hours for the entire period of April through September. The majority of potential habitat remains exposed for 24 hours a day during that period for greater than 90% of the time.

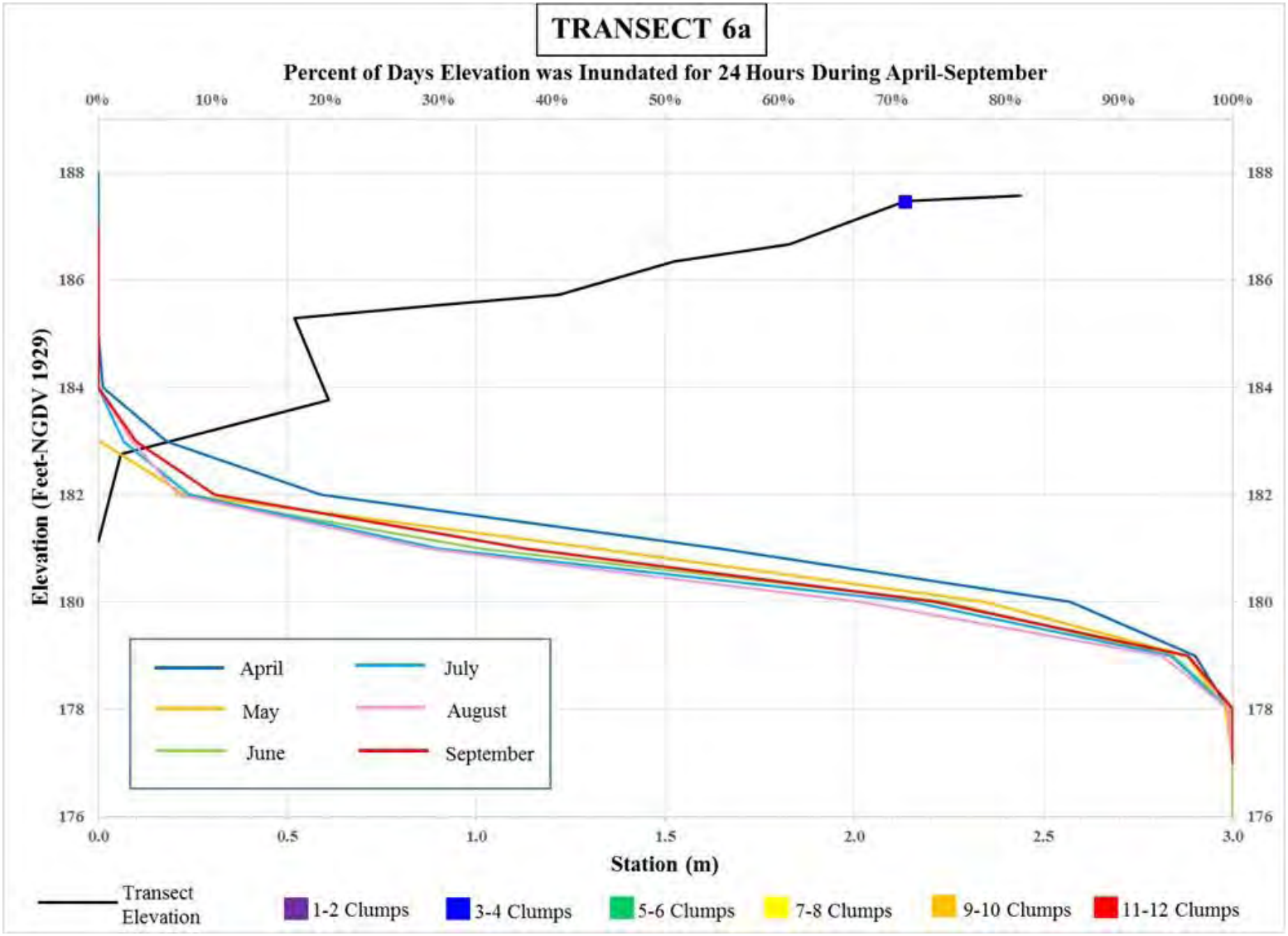


Figure 2.4-13 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 6a, TFI, Upland White Aster)

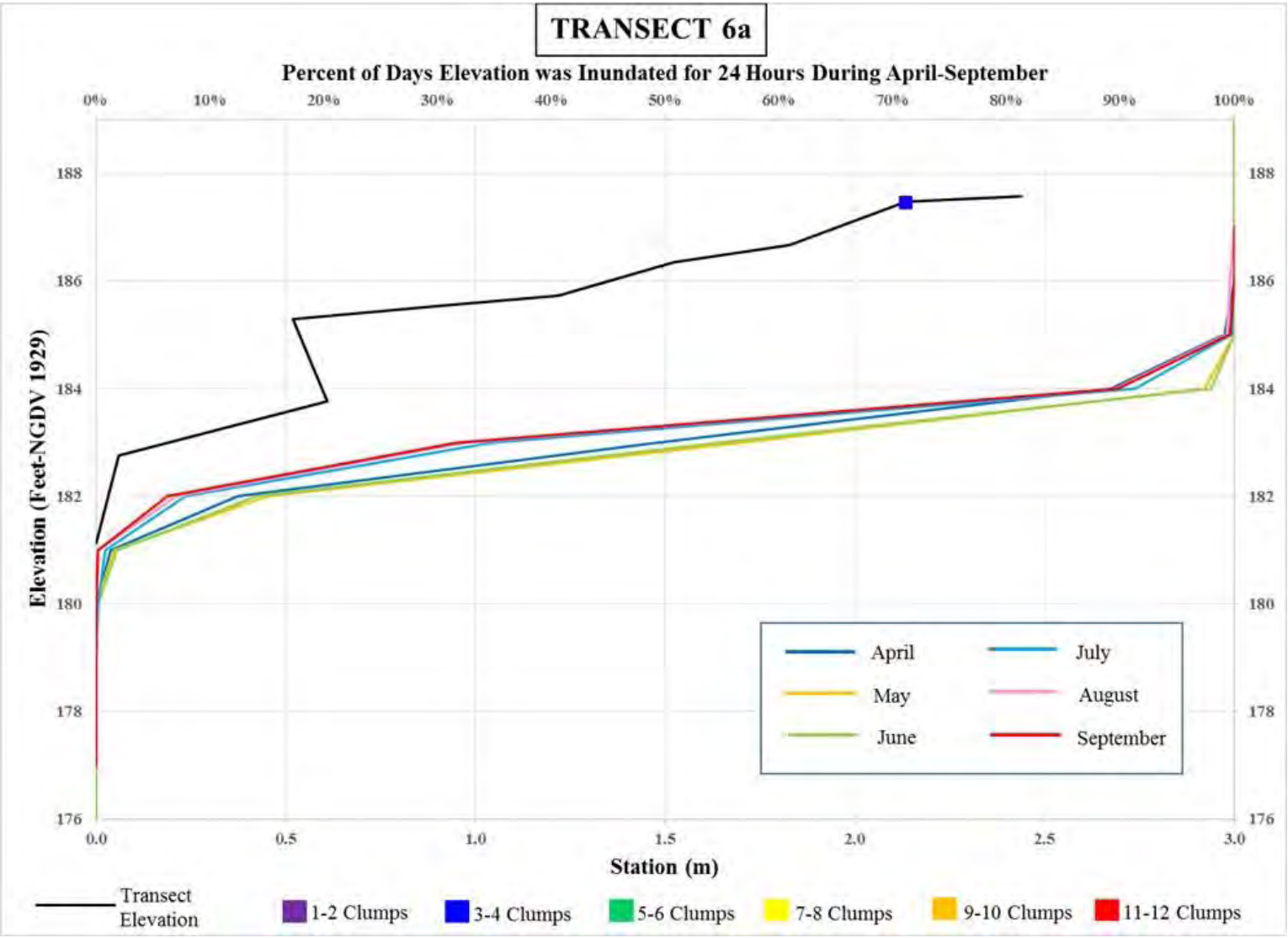


Figure 2.4-14 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 6a, TFI, Upland White Aster)

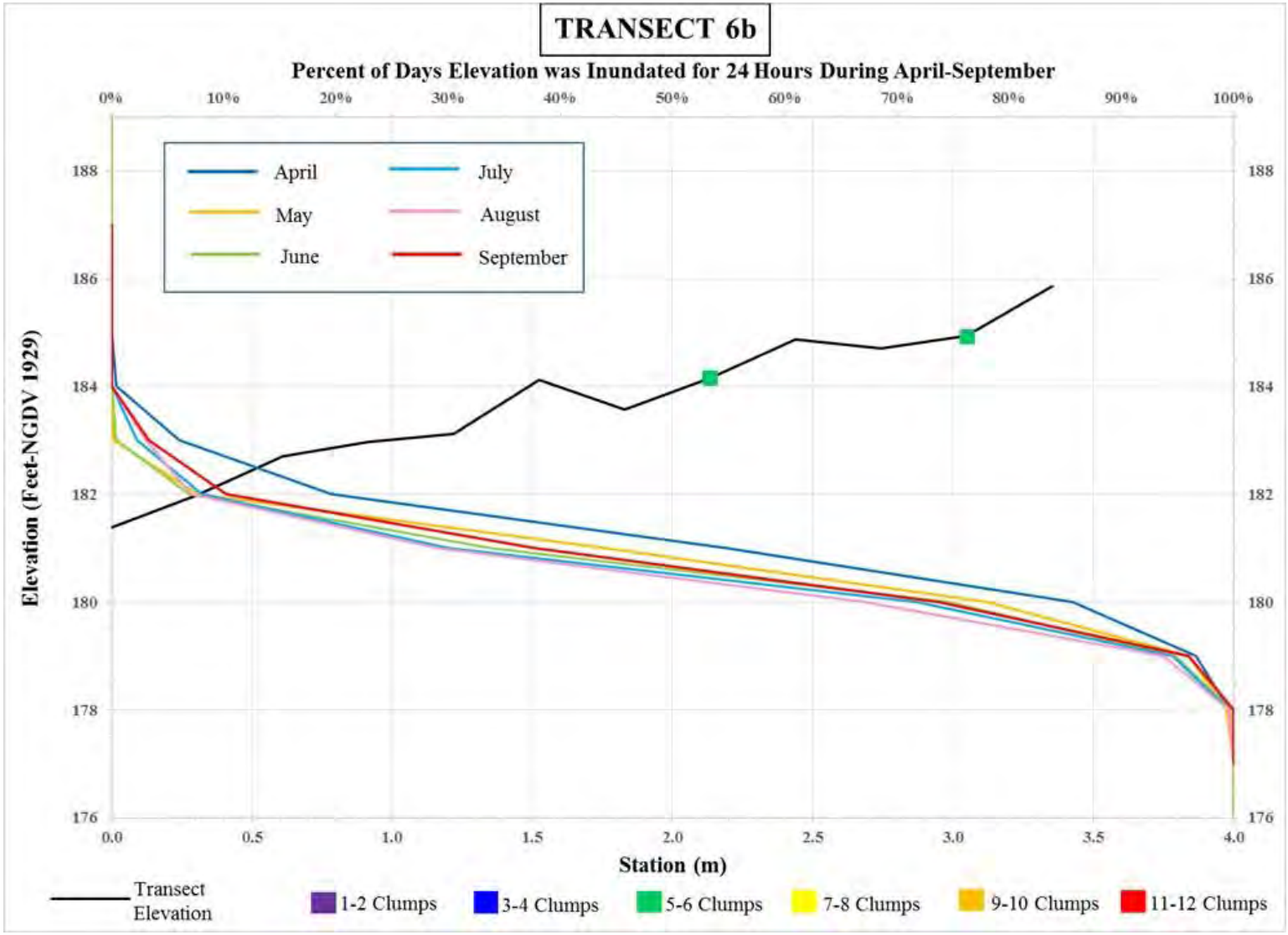


Figure 2.4-15 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 6b, TFI, Upland White Aster)

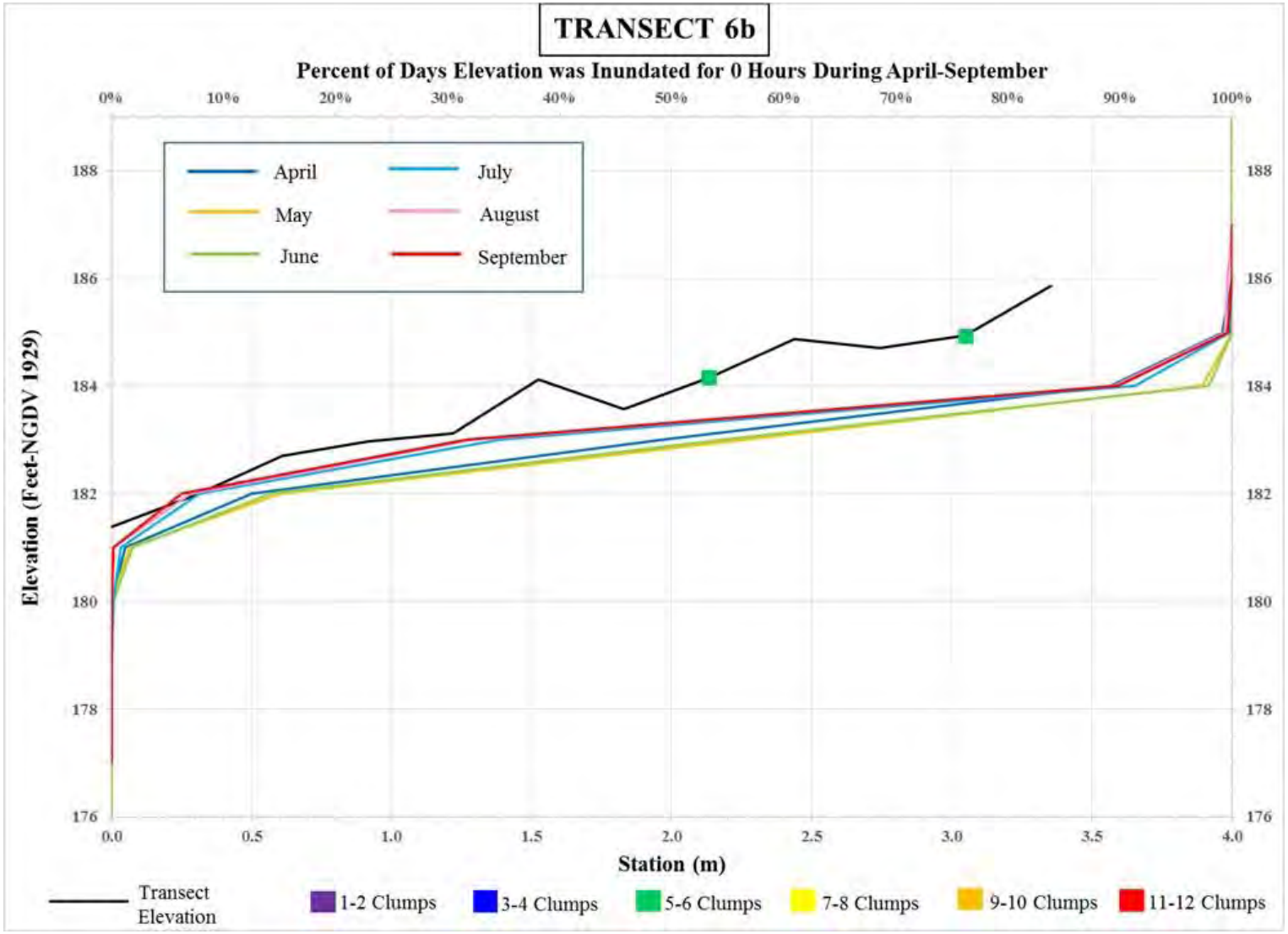


Figure 2.4-16 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 6b, TFI, Upland White Aster)

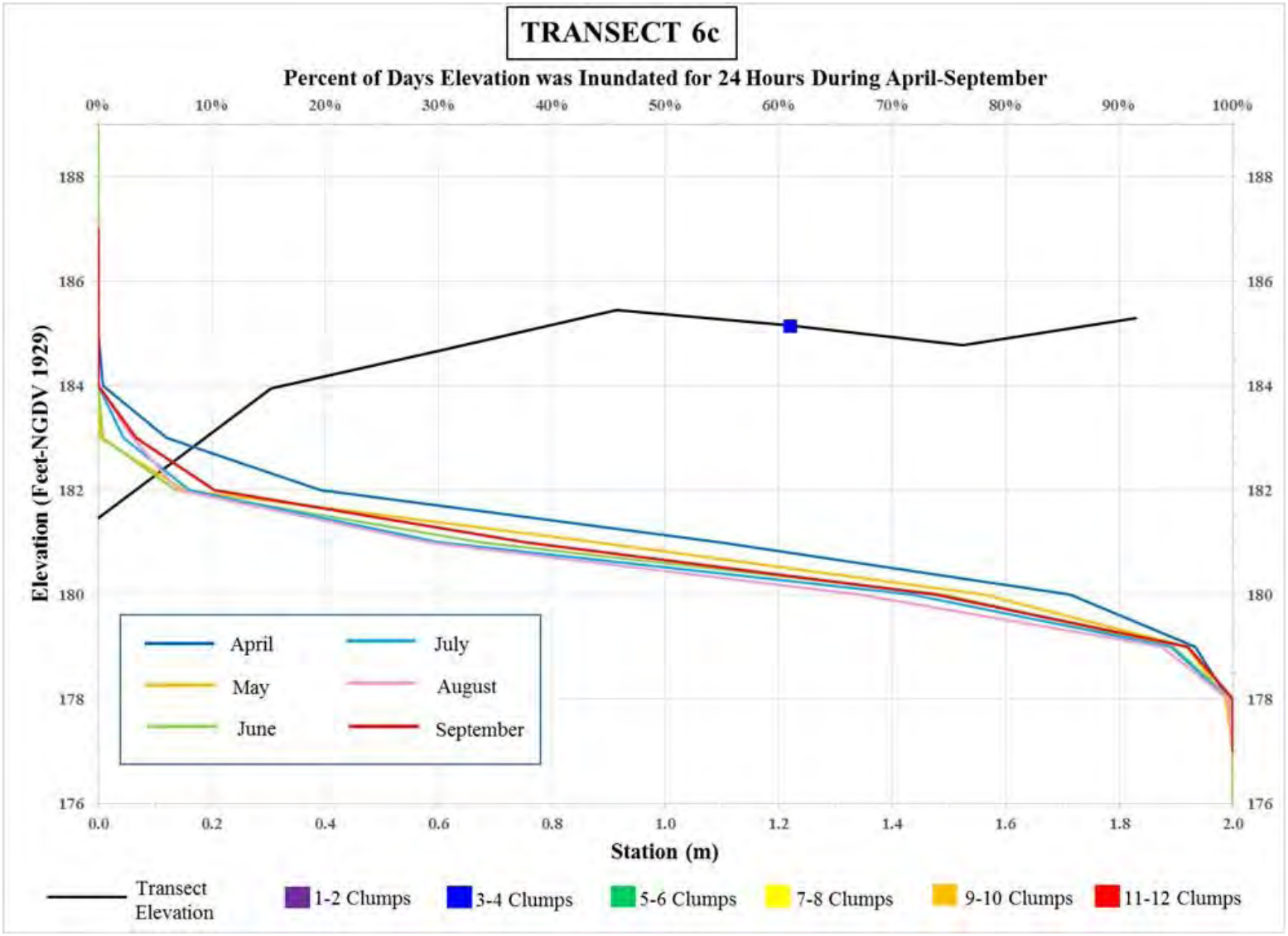


Figure 2.4-17 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 6c, TFI, Upland White Aster)

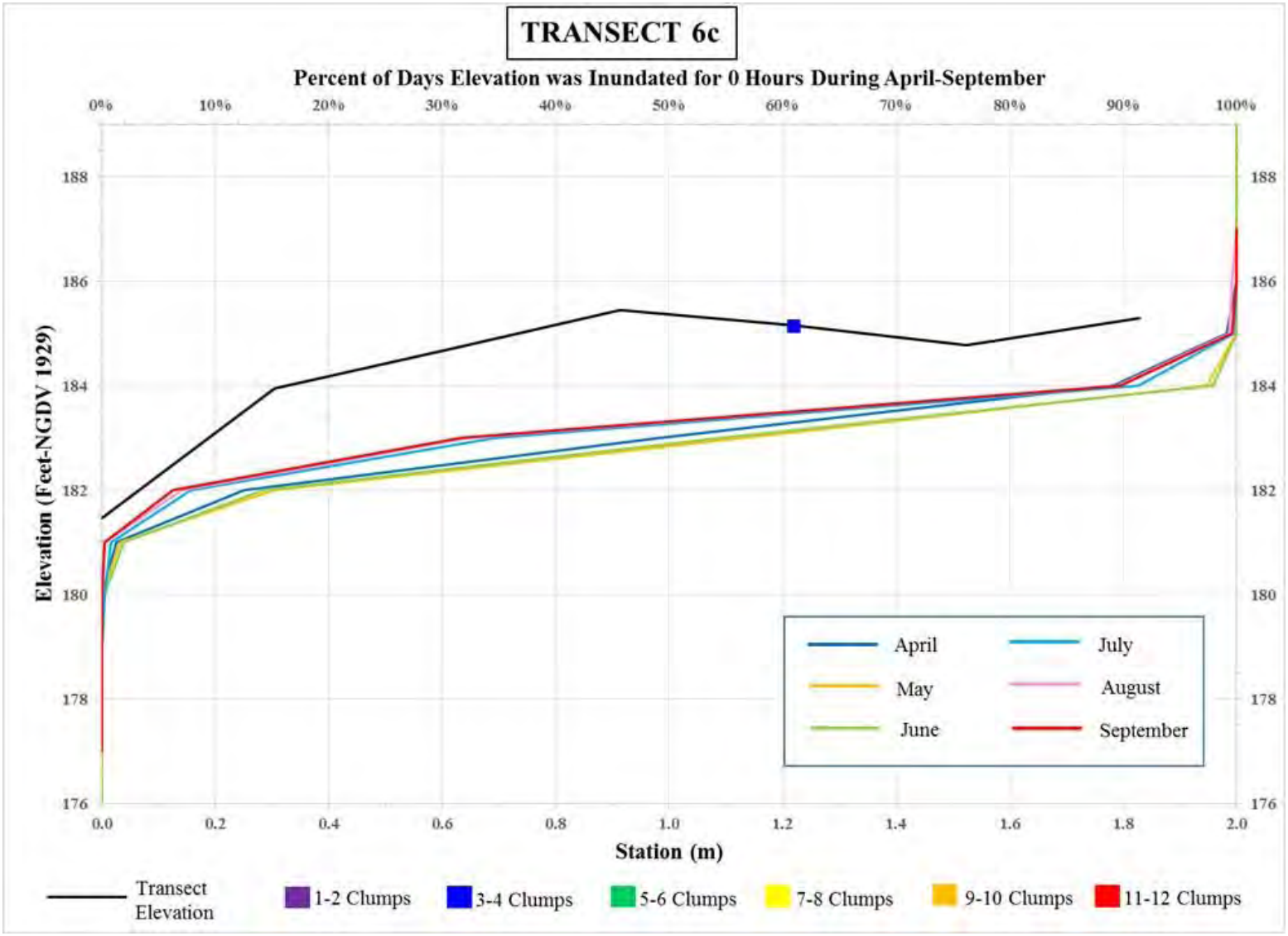


Figure 2.4-18 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 6c, TFI, Upland White Aster)

Transect 11A, 11B, 11C, and 11D (Intermediate Spike Sedge, TFI, Pauchaug)

Figure 2.4-19 through Figure 2.4-26 present the percent of time that potential habitat for protected spikerush species (none identified in 2015) and Frank's love grass (located in 2015 on Transect 11D) on Transect 11A, 11B, 11C, and 11D are either inundated for a period of 24 hours (Figure 2.4-19, Figure 2.4-21, Figure 2.4-23 and Figure 2.4-25) or the percent of time potential habitat is inundated for 0.0 hours (Figure 2.4-20, Figure 2.4-22, Figure 2.4-24 and Figure 2.4-26). At this location potential spikerush and Frank's love grass habitat at all transects are flooded for 24 hours about 30% of the time in April. For the remaining months (May, June, July, August, and September), the majority of potential habitat remains exposed for 24 hours a day during that period for greater than 90% of the time.

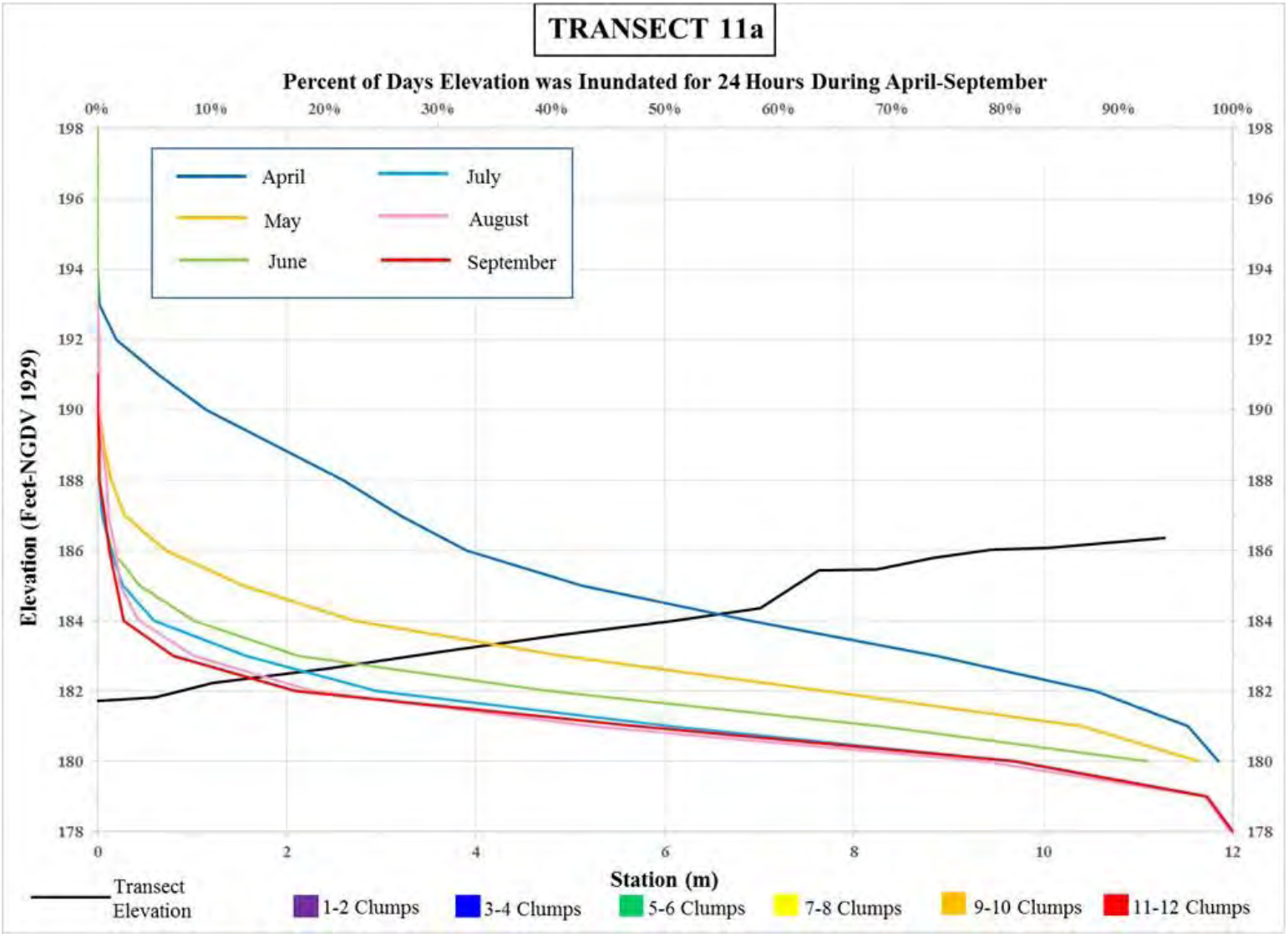


Figure 2.4-19 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 11a, TFI, Intermediate Spike Sedge)

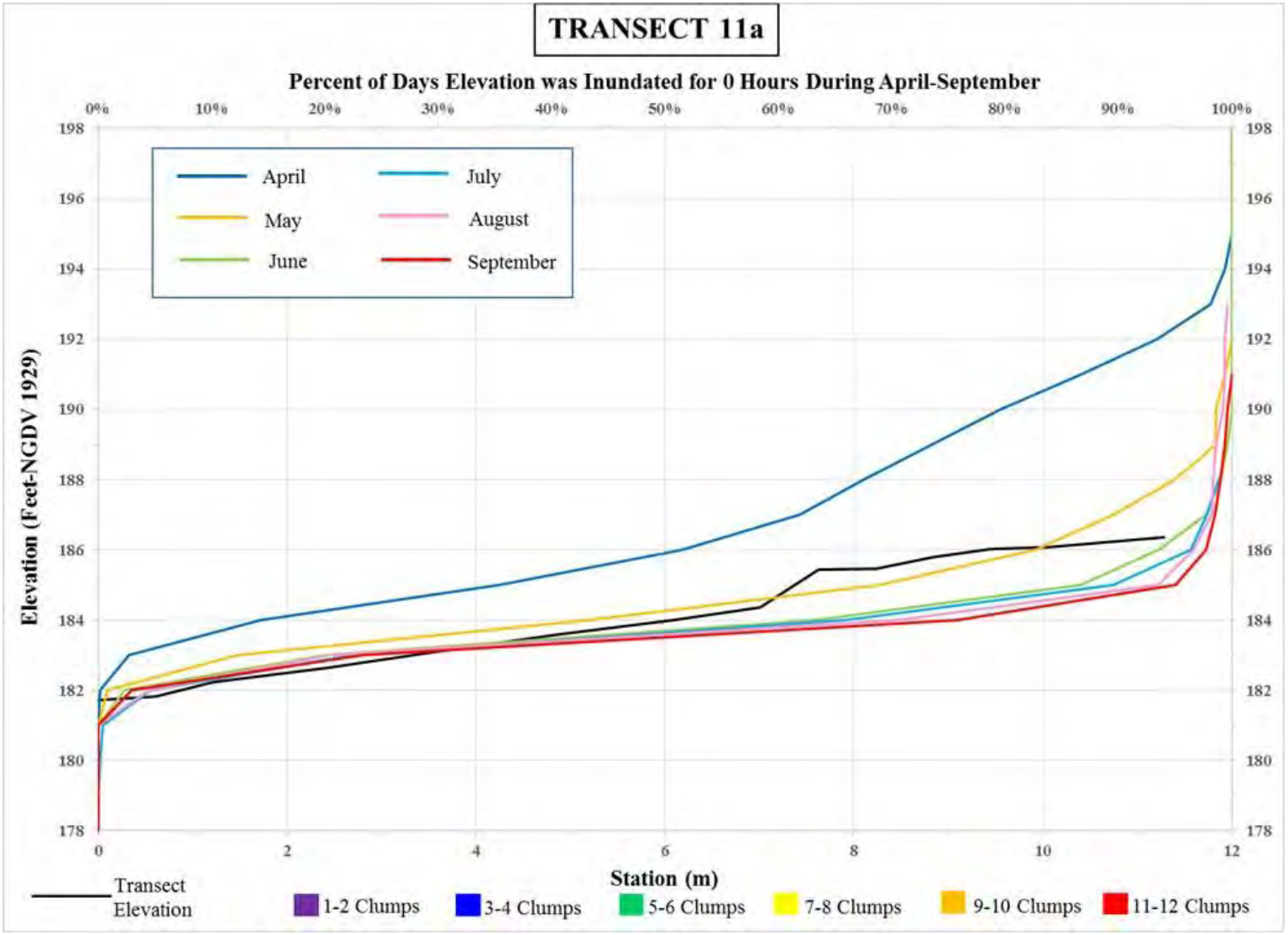


Figure 2.4-20 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 11a, TFI, Intermediate Spike Sedge)

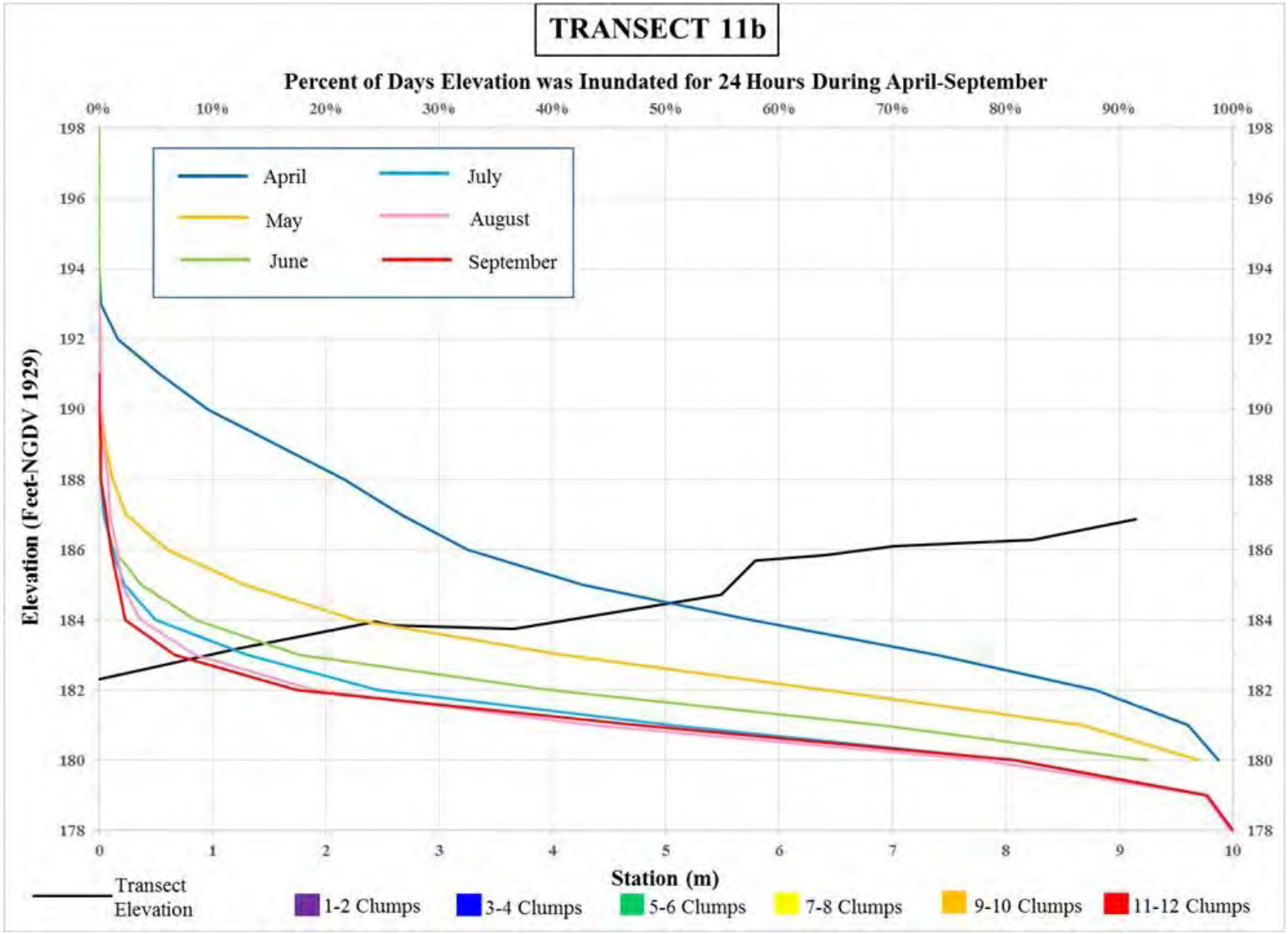


Figure 2.4-21 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 11b, TFI, Intermediate Spike Sedge)

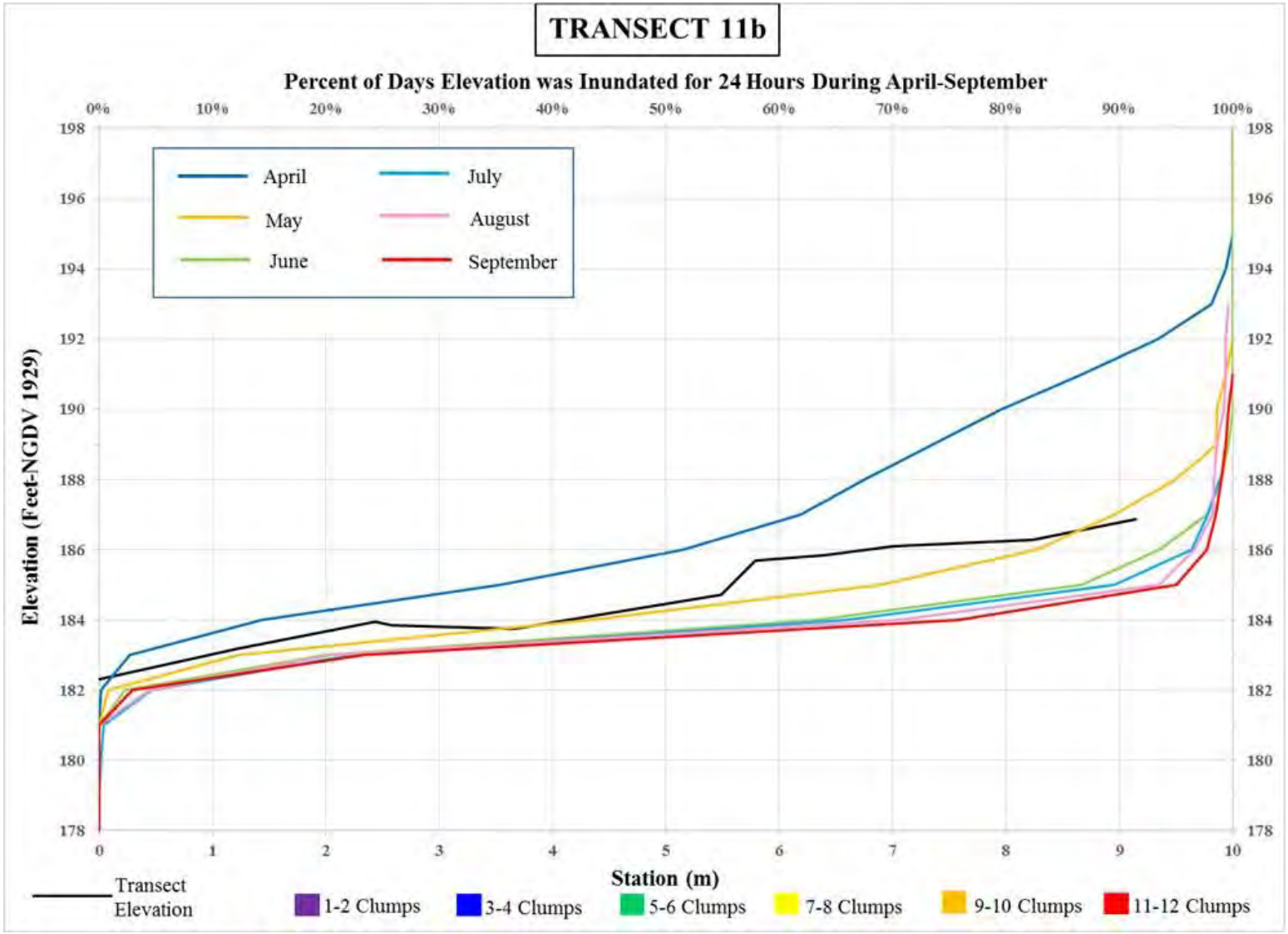


Figure 2.4-22 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 11b, TFI, Intermediate Spike Sedge)

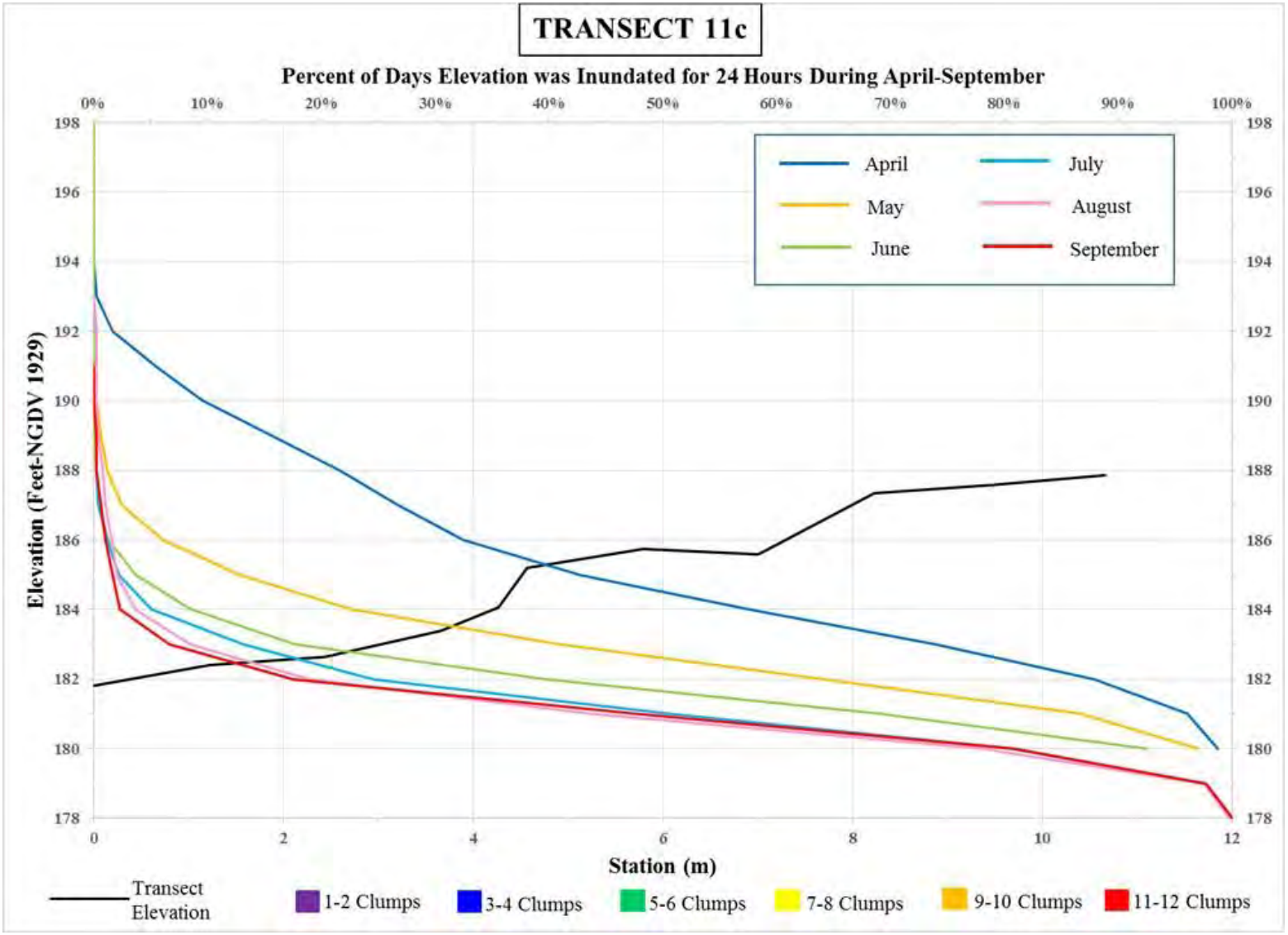


Figure 2.4-23 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 11c, TFI, Intermediate Spike Sedge)

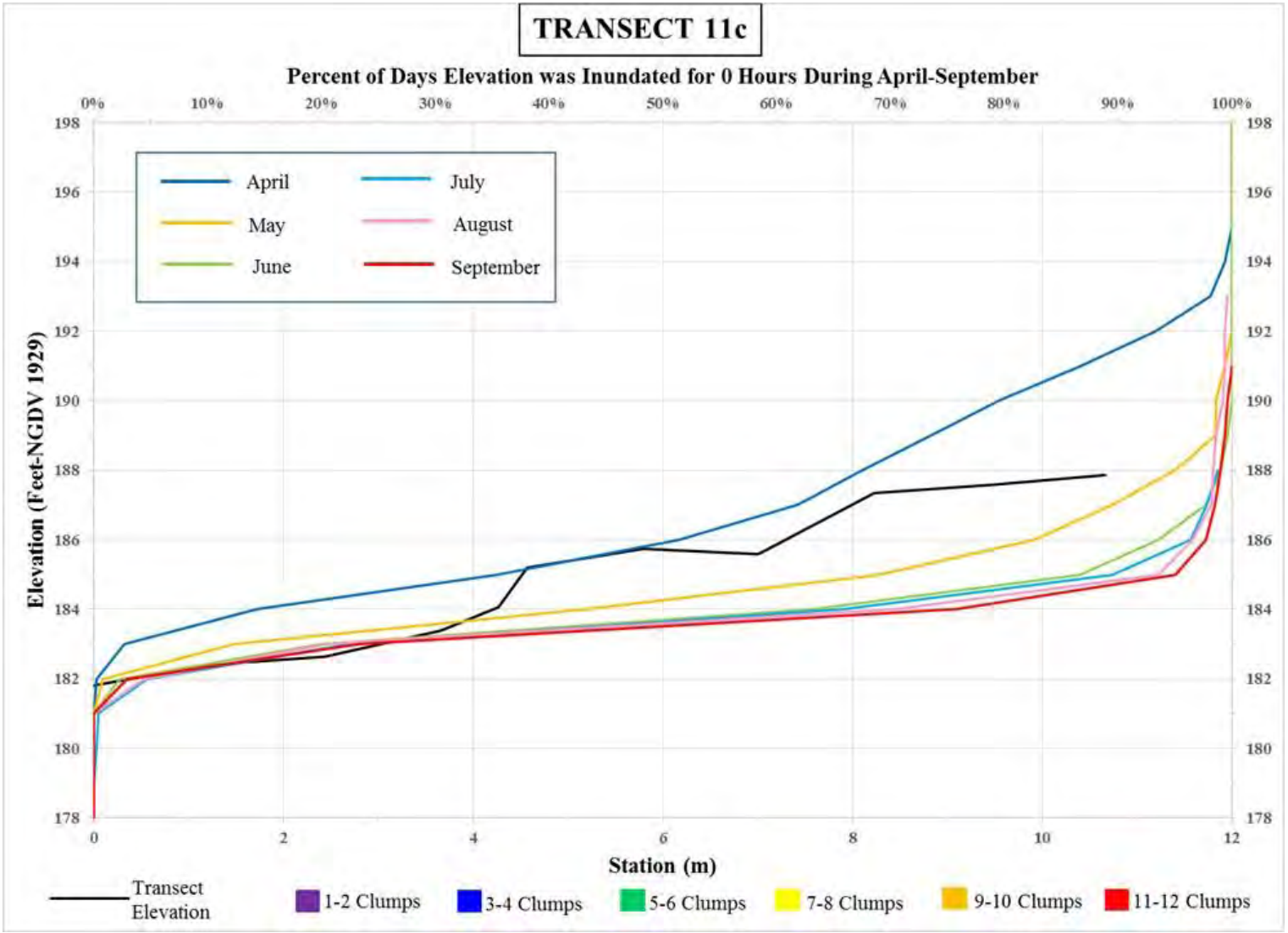


Figure 2.4-24 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 11c, TFI, Intermediate Spike Sedge)

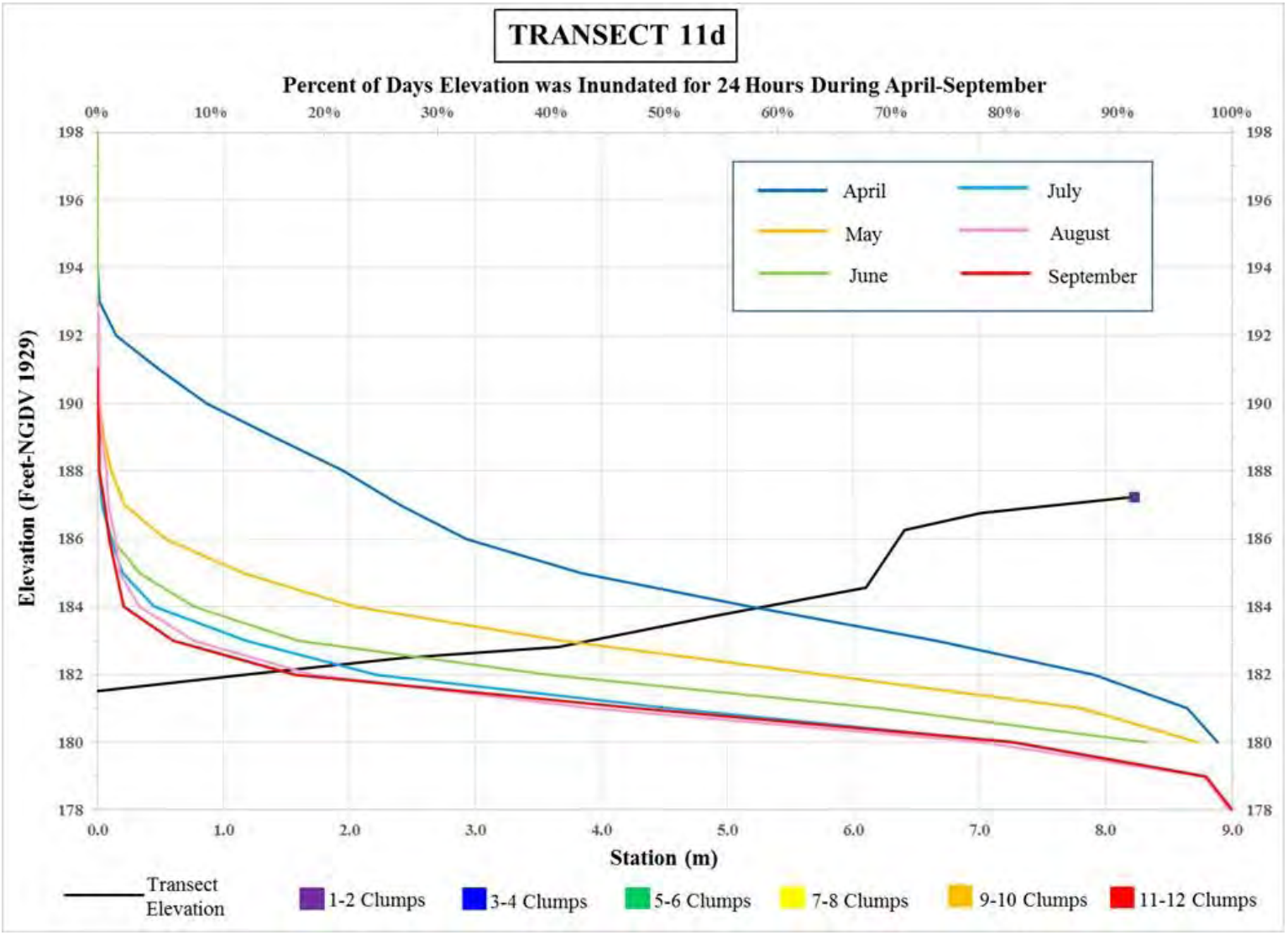


Figure 2.4-25 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 11d, TFI, Intermediate Spike Sedge)

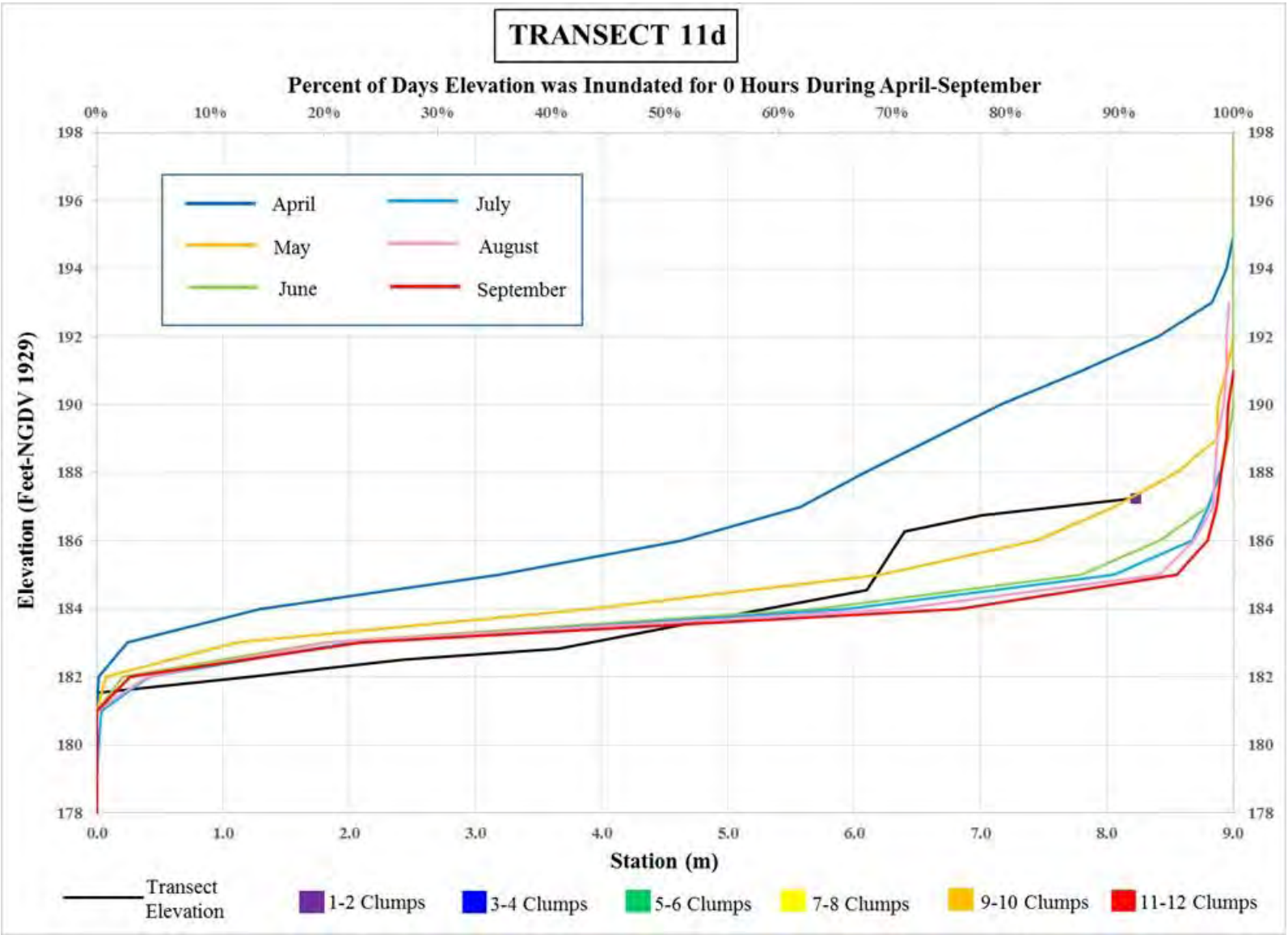


Figure 2.4-26 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 11d, TFI, Intermediate Spike Sedge)

Transect 8 (Sandbar Cherry, TFI near Stebbins Island)

Figure 2.4-27 and Figure 2.4-28 present the percent of time that potential habitat for sandbar cherry on Transect 8 is either inundated for a period of 24 hours (Figure 2.4-27) as well as the percent of time potential habitat is inundated for 0.0 hours (Figure 2.4-28). In general, potential habitat for sandbar cherry is inundated less frequently than habitat for sandbar willow at Transect 1 and 2. In fact, very similar to Transect 3, potential sandbar cherry habitat at Transect 8 is inundated for 24 hours a day most in April (generally speaking at least 30% or more of the time). In May, June, July, August, and September potential habitat at Transect 8 is also inundated 24 hours a day generally for less than 10% of the time.

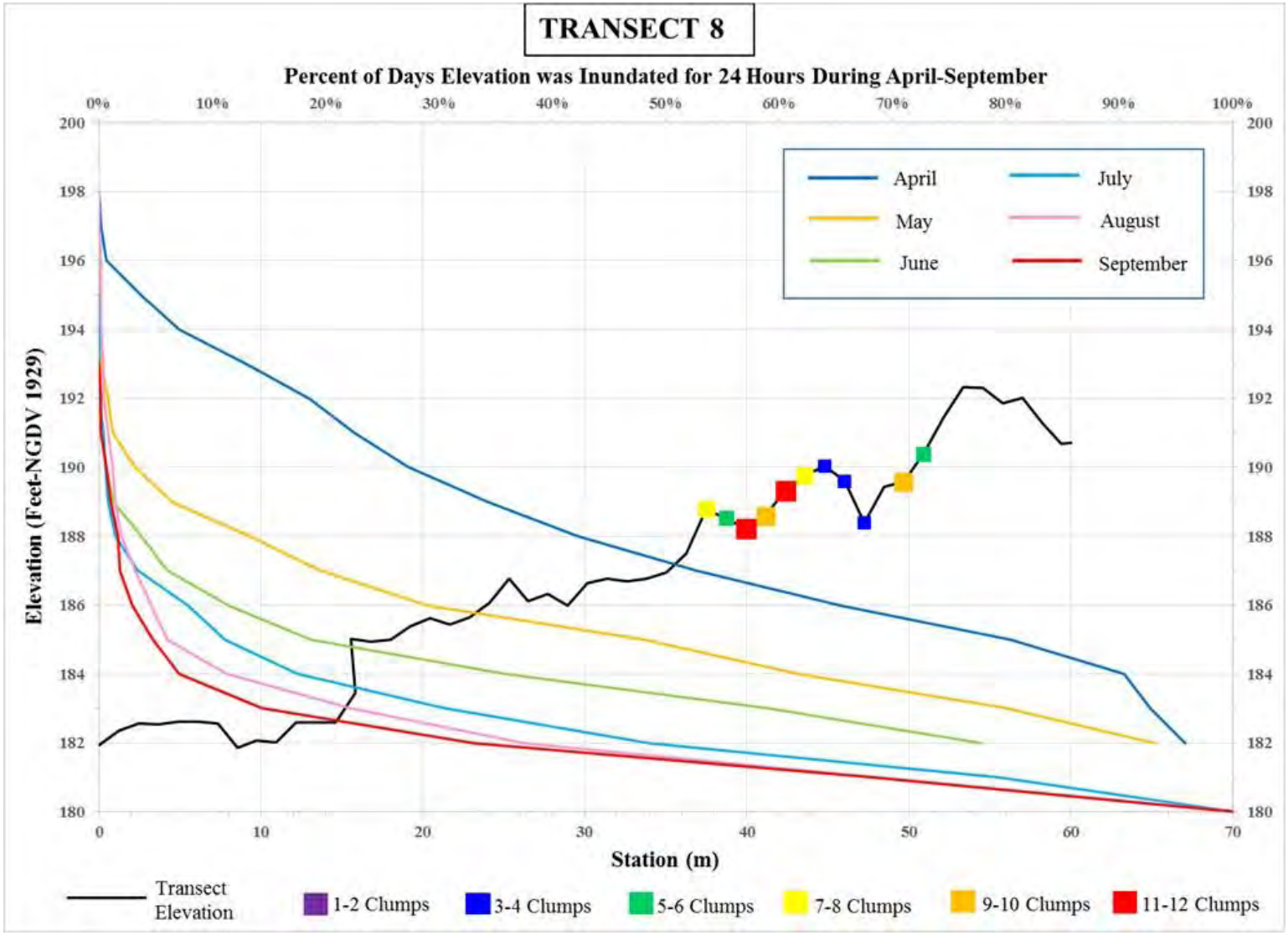


Figure 2.4-27 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 8, TFI, Sandbar Cherry)

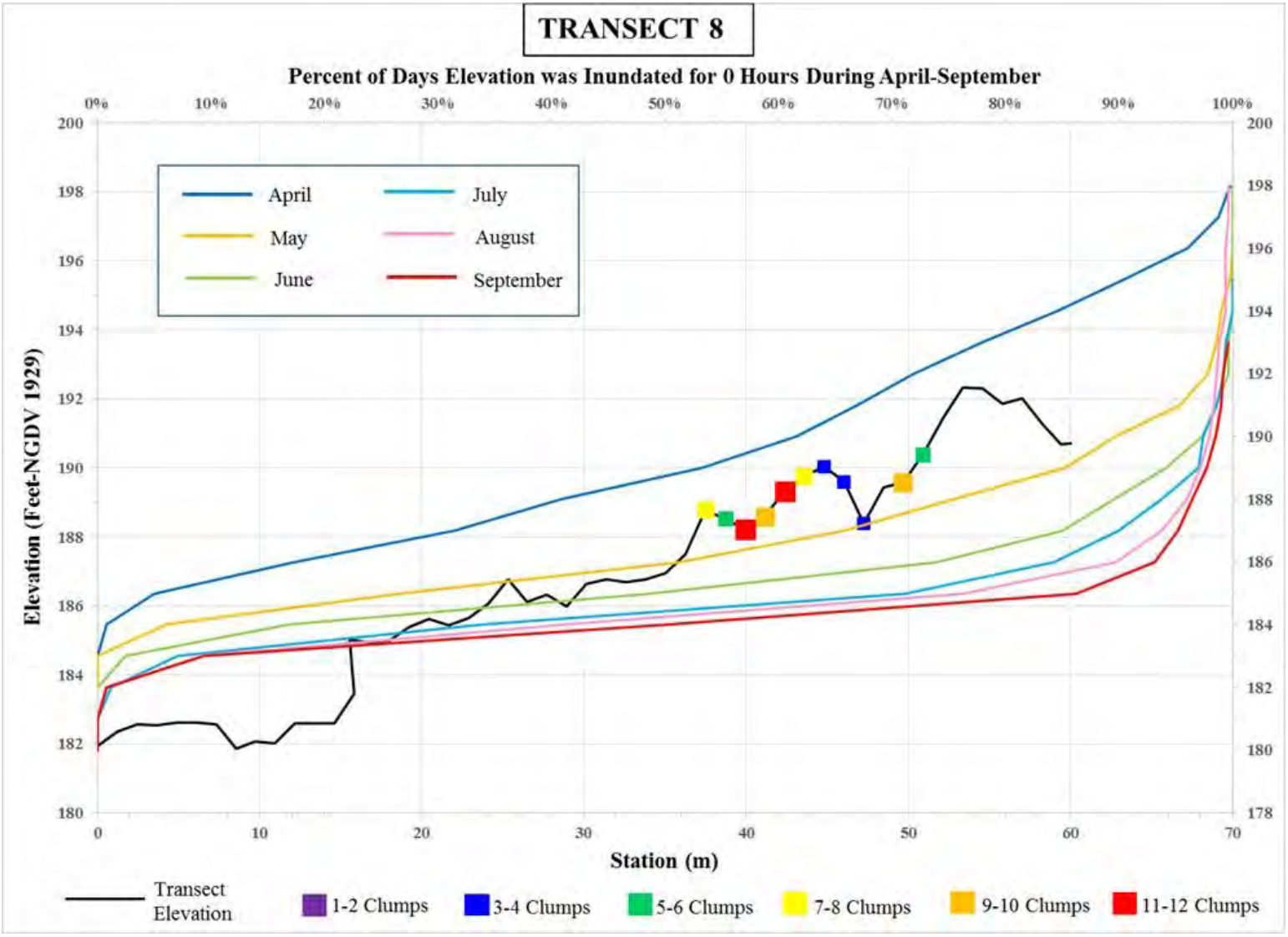


Figure 2.4-28 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 8, TFI, Sandbar Cherry)

Transect 9A and 9B (Sandbar Cherry, Downstream of small island downstream of Vernon Dam, TFI)

Figure 2.4-29 and Figure 2.4-32 present the percent of time that potential habitat for sandbar cherry on Transect 9A and 9B is either inundated for a period of 24 hours (Figure 2.4-29 and Figure 2.4-31) as well as the percent of time potential habitat is inundated for 0.0 hours (Figure 2.4-30 and Figure 2.4-32). Unlike the other transects with sandbar cherry (Transect 3 and Transect 8), Transects 9A and 9B are flooded for 24 hours more frequently, in addition densities of sandbar cherry at this location are lower than all other transects. Unlike Transect 3 and Transect 8, potential sandbar cherry habitat at Transect 9A and 9B is inundated for 24 hours a day in April 60-70% of the time). In May potential habitat at Transect 9A and 9B is also inundated 24 hours a day generally for 30-40% of the time. The remaining months for June, July, August, and September are inundated for 24 hours 20% or less of the time.

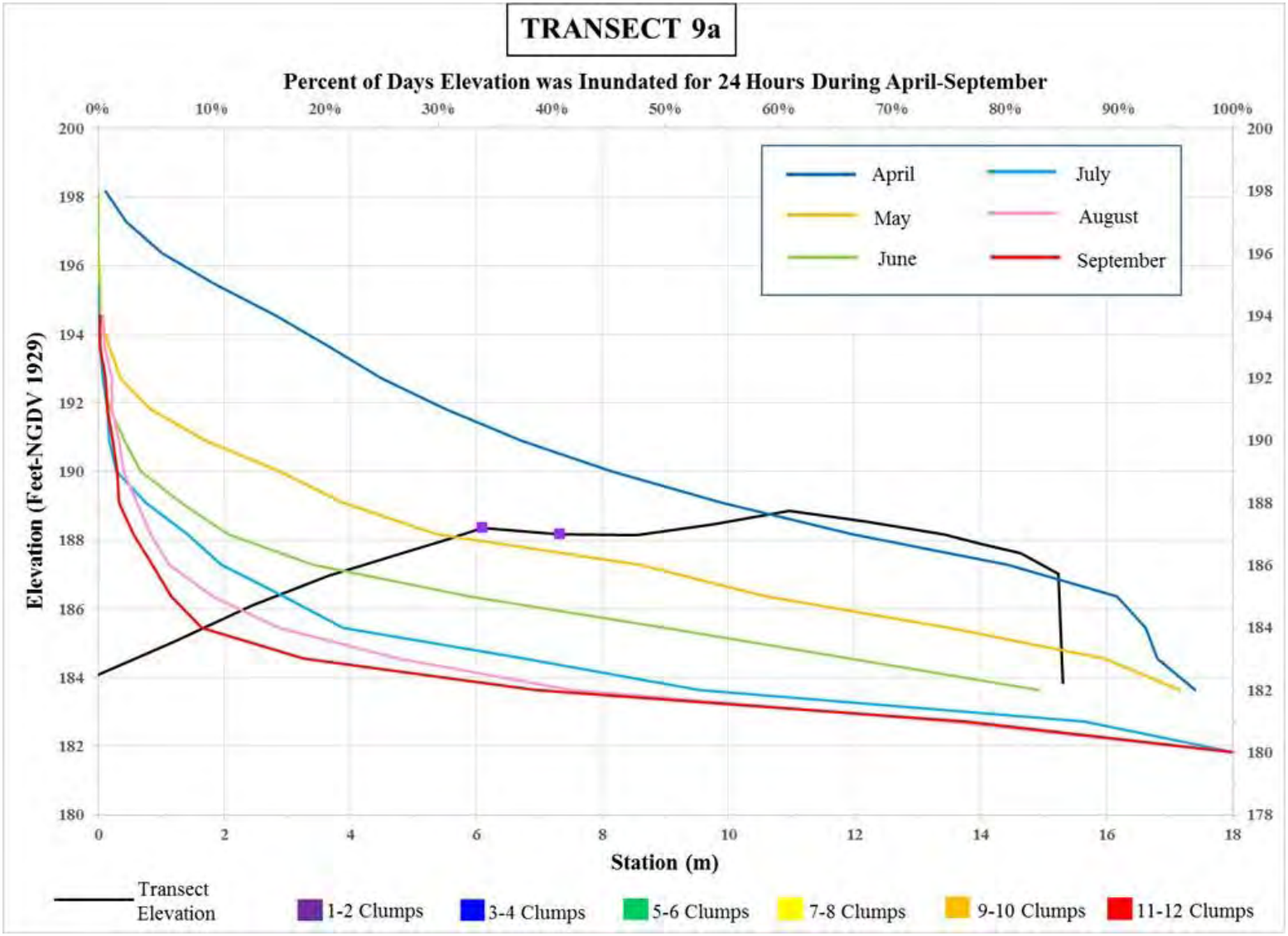


Figure 2.4-29 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 9a, TFI, Sandbar Cherry)

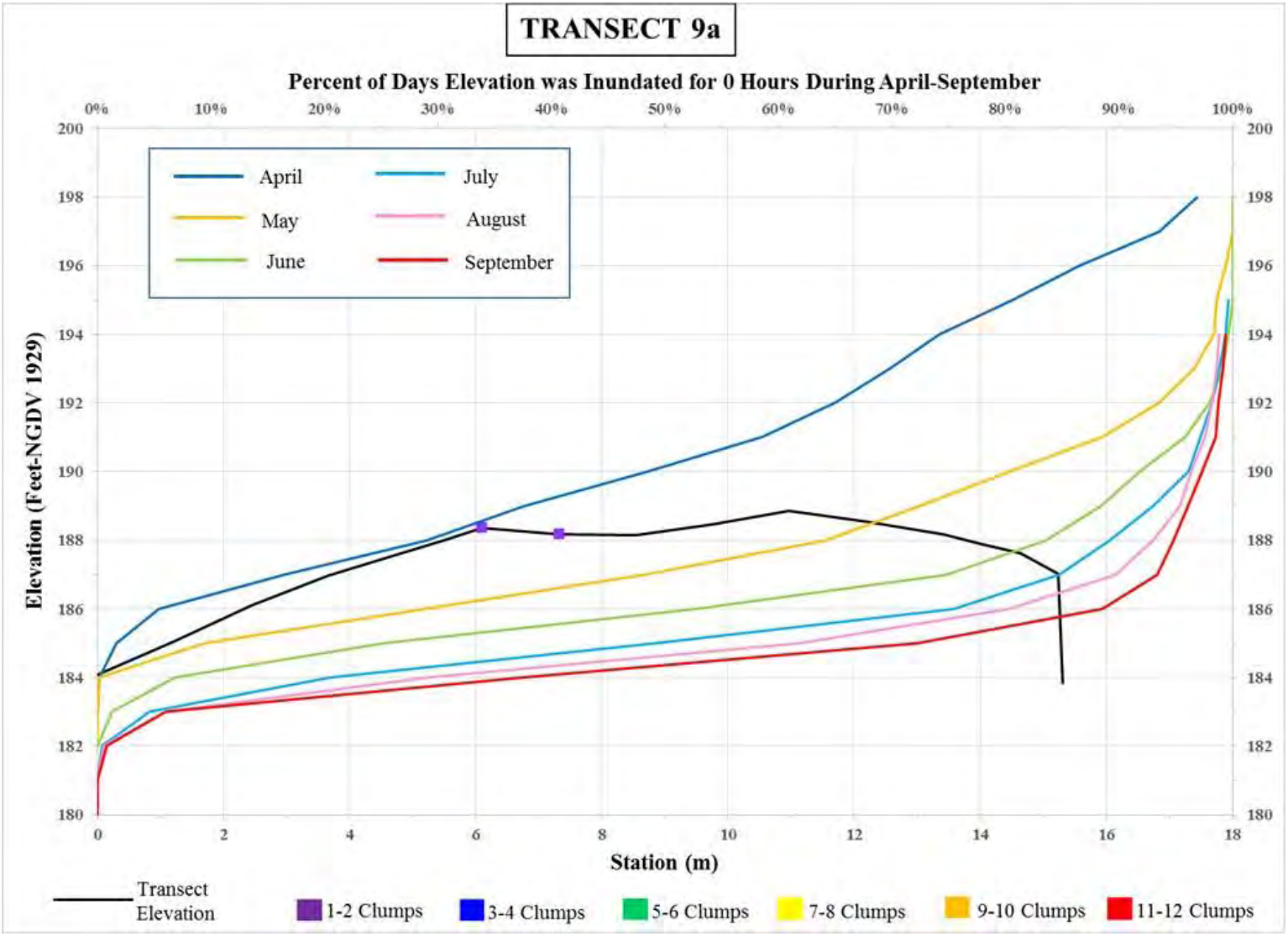


Figure 2.4-30 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 9a, TFI, Sandbar Cherry)

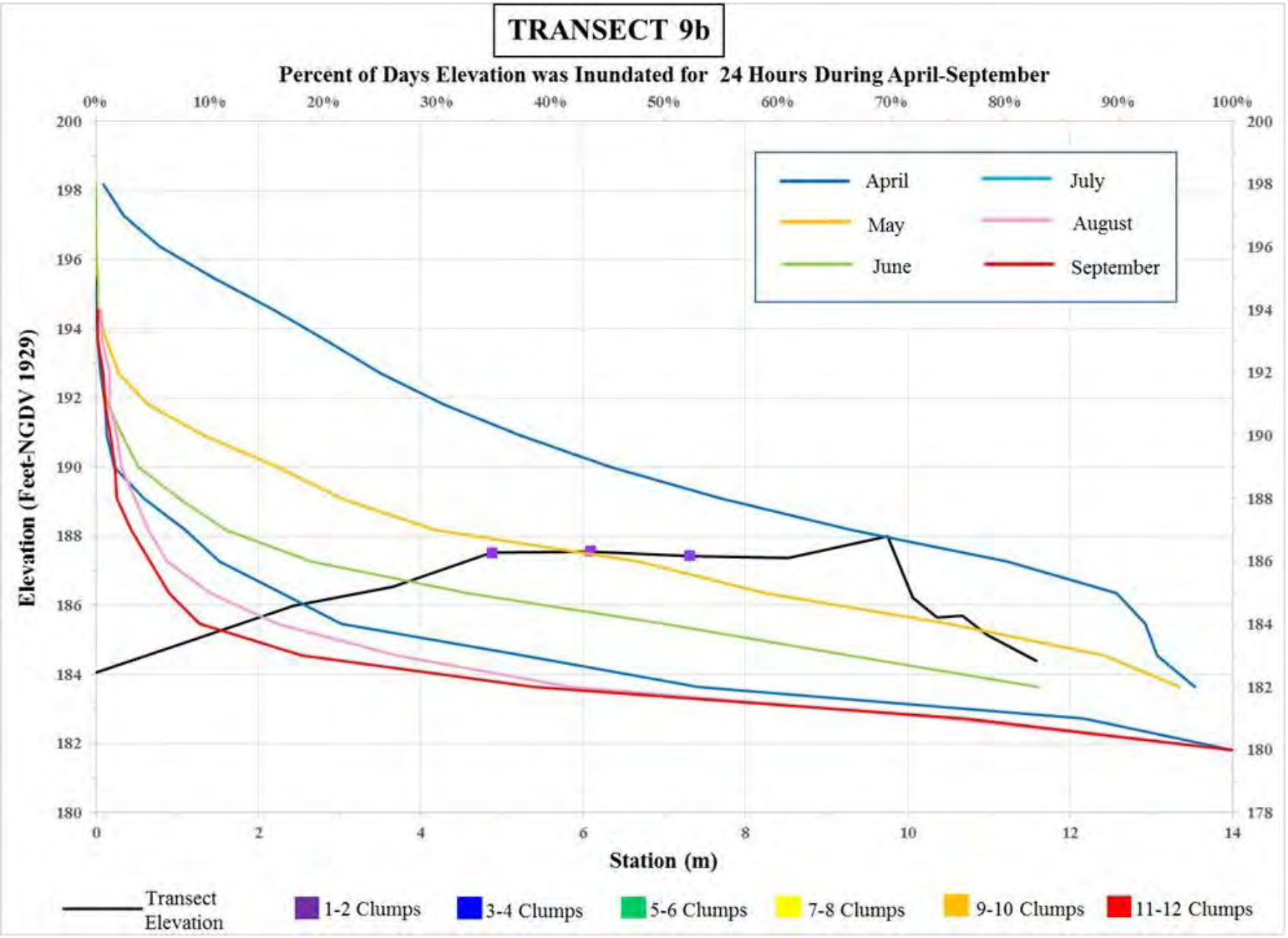


Figure 2.4-31 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 9b, TFI, Sandbar Cherry)

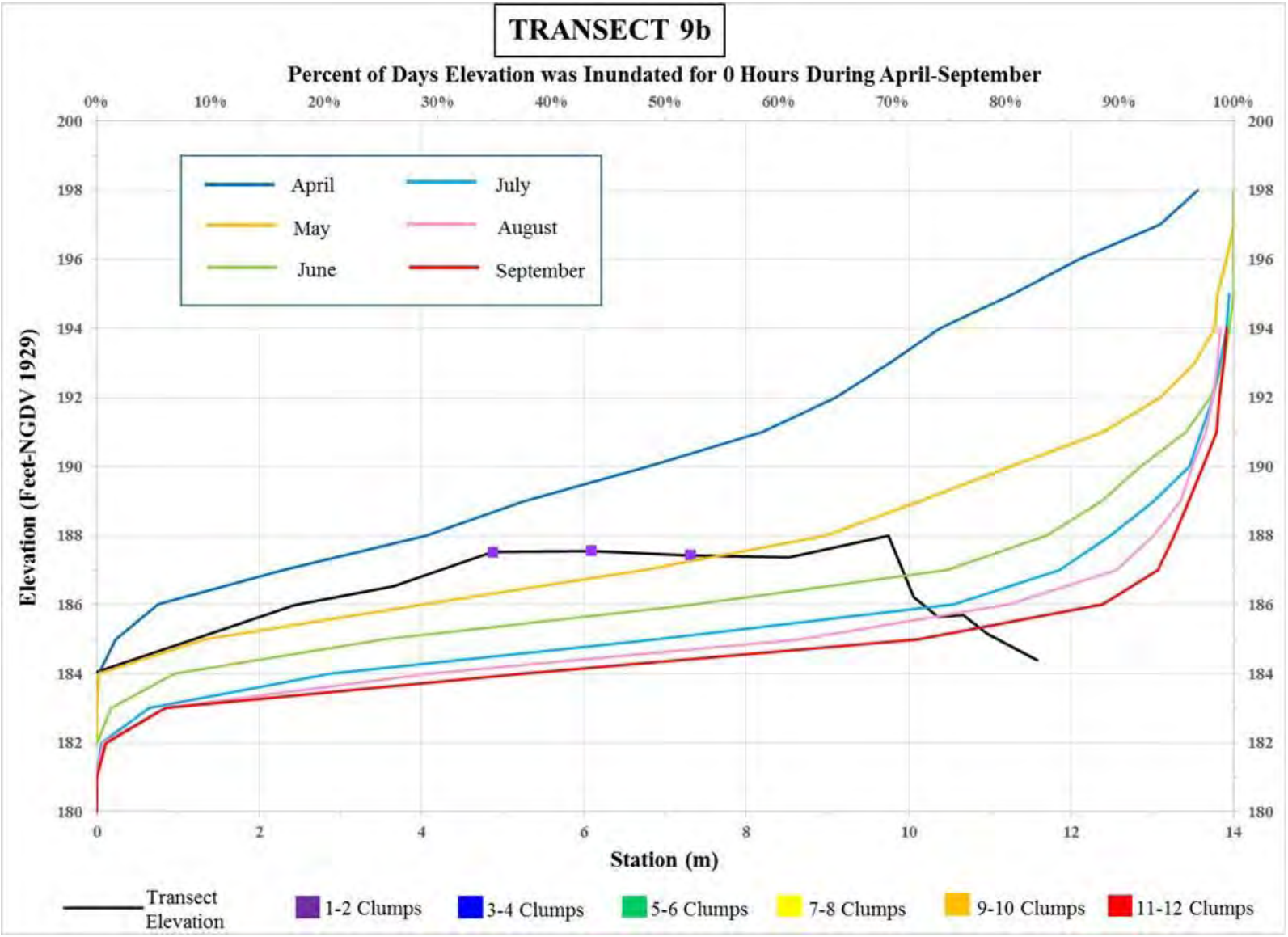


Figure 2.4-32 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 9b, TFI, Sandbar Cherry)

Transect 10 (Mountain Alder and Sandbar Willow, just downstream of Vernon Dam, TFI)

Transect 10 contains two protected species, sandbar willow and mountain alder. Figure 2.4-33 and Figure 2.4-34 present the percent of time that potential habitat for sandbar willow and mountain alder on Transect 10 is either inundated for a period of 24 hours (Figure 2.4-33) or the percent of time potential habitat is inundated for 0.0 hours (Figure 2.4-34). In general, potential habitat for sandbar willow is inundated for 24 hours a day for most of April and May (generally speaking at least 60% of the time). In June, July, August, and September potential habitat for sandbar willow is inundated 24 hours a day for approximately 5-10% of the time, the greatest densities of sandbar willow at Transect 10 are inundated for 24 hours nearly 100% of time in April and 80% of the time in May. Mountain alder on Transect 10 occurs at an elevation that is rarely inundated for 24 hours, even during the month of April. The location of alder on Transect 10 is inundated for a period of 24 hours in April approximately 5% of the time.

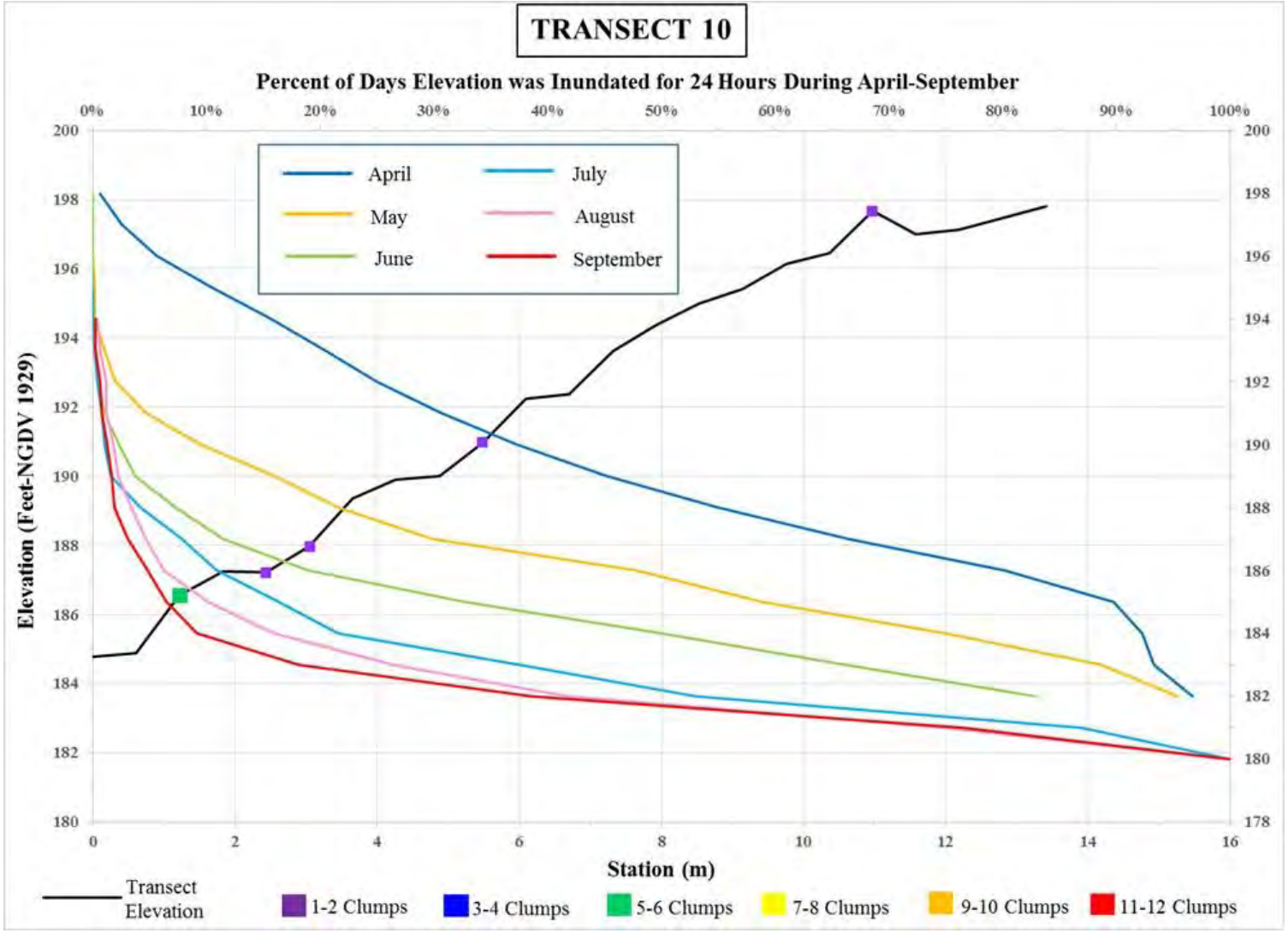


Figure 2.4-33 Percent of Days Elevation was Inundated for 24 Hours During April-September (Transect 10, TFI, Mountain Alder and Sandbar Willow)

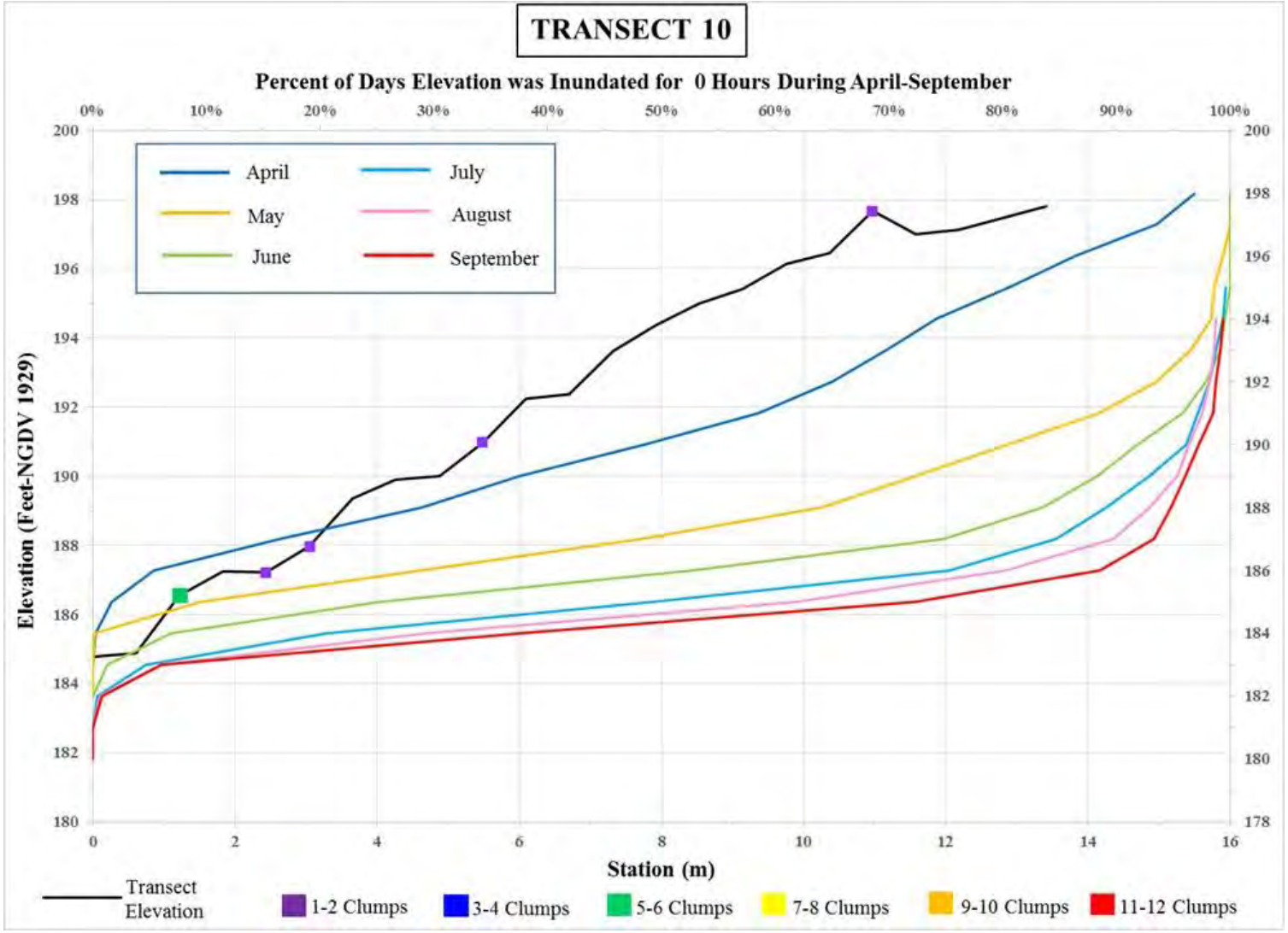


Figure 2.4-34 Percent of Days Elevation was Inundated for 0 Hours During April-September (Transect 10, TFI, Mountain Alder and Sandbar Willow)

2.5 MADFW-10 RTE Plant Survey- Transects

Comment: MADFW requested several revisions to the report regarding Transects 1-4, T-3, 5A, 5B, 6A-6C, 11A-11D.

Response:

Each request or comment by the MADFW is provided below in italics followed by the supporting data and discussion to address comments and requests. For each transect location additional information related to vegetative cover and substrate is provided as well as more detailed descriptions of the overall habitat within each of the transect locations. Although the MADFW requested specific information for Transects 1-4, T-3, 5A, 5B, 6A-6C, and 11A-11D, additional information related to habitat at Transects 8, 9A-9B, and 10 are included to ensure data consistency.

Transect 1 (upstream end of First Island, Sandbar Willow)

Include a description of habitat (e.g., vegetation types, species, shading, substrate, etc.) within the highest elevations, both where plants were observed and where they were not observed, in order to assess why plants may not occur at higher elevations.

Transect 1, located on the upstream end of First Island, is an exposed cobble and gravel bar with varying densities of sandbar willow mixed with low growing herbaceous vegetation. The dominant plant associated with the sandbar willow at Transect 1 is spreading dogbane (*Apocynum androsaemifolium*) which is found in most vegetated areas along the transect. Additional species observed include rough cocklebur (*Xanthium strumarium*), purple loosestrife (*Lythrum salicaria*), and beggar's tick (*Bidens frondosa*). Substrate along the transects is dominated by areas of cobble occurring primarily in un-vegetated areas and gravel occurring in areas of low (0-25%) to moderate (26-50%) vegetative cover. Figure 2.5-1 shows a representative view of Transect 1 looking easterly across the un-vegetated and vegetated portion of the Transect. Figure 2.5-2 shows a representative view of the dominant substrate observed in areas occupied by sandbar willow. The photo presented as Figure 2.5-2 was taken at Station 35.0 Meters, and one clump of sandbar willow is identified at this plot location. Table 2.5-1 presents the survey station, elevation, estimated percent cover of vegetation, and dominant substrate observed at each sample plot location. In 2014 a total of eight sandbar willows were identified at this location, and in 2015 nine sandbar willows were identified along Transect 1 (Figure 2.5-3). Following a review of the elevation data, substrate information, and percent vegetative cover and based on where clumps of sandbar willow were located in 2015, it appears that sandbar willow is likely to occupy areas of gravel with a medium density of vegetative cover at elevations ranging from 104.6 to 106.0 feet; elevation 106.0 is the highest elevation observed on Transect 1. This habitat is present at Transect 1 from station 26.2 meters to 42.7 meters.

Figure 2.5-1 Representative view of Transect 1 looking to the east along the transect.

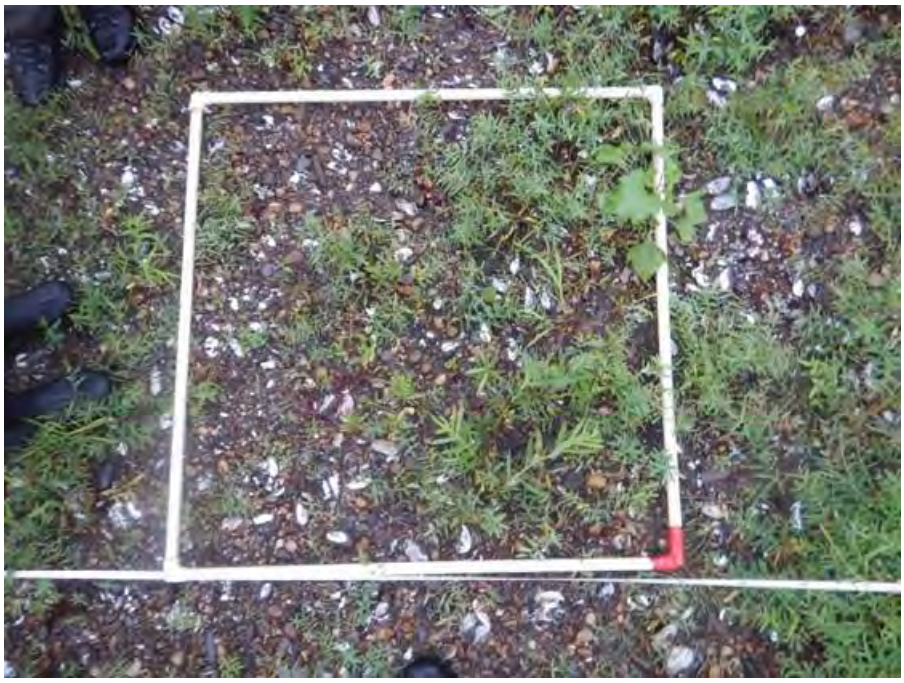


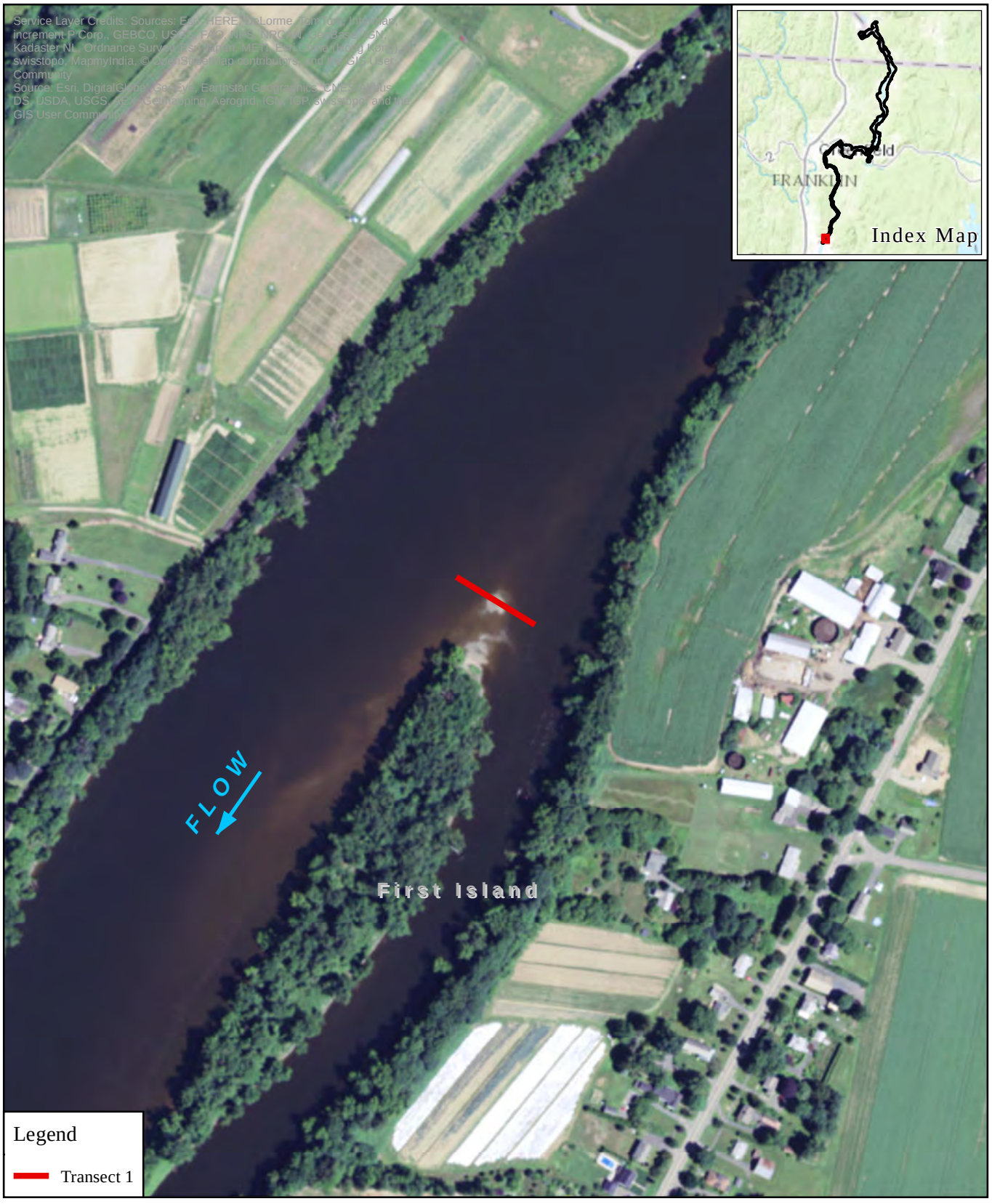
Figure 2.5-2. Representative view of Station 35.0 (Meters), one sandbar willow clump, medium density Apocynum and cocklebur, and gravel substrate present.

Table 2.5-1 Transect 1 Elevation, Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD29, ft)	Density of Sandbar Willow(# clumps)	Estimated Percent Vegetation Cover	Substrate
0.0	101.9	-	No Vegetation	Cobble
0.3	102.0	-	No Vegetation	Cobble
0.9	102.0	-	No Vegetation	Cobble
1.5	102.2	-	No Vegetation	Cobble
2.1	102.5	-	No Vegetation	Cobble
2.7	102.6	-	No Vegetation	Cobble
3.4	102.5	-	No Vegetation	Cobble
4.0	102.5	-	No Vegetation	Cobble
4.6	102.7	-	No Vegetation	Cobble
5.2	102.7	-	No Vegetation	Cobble
5.8	102.8	-	No Vegetation	Cobble
6.4	102.9	-	No Vegetation	Cobble
7.0	102.8	-	No Vegetation	Cobble
7.6	102.8	-	No Vegetation	Cobble
8.2	102.8	-	No Vegetation	Cobble
8.8	102.7	-	No Vegetation	Cobble
9.4	102.9	-	No Vegetation	Cobble
10.1	102.9	-	No Vegetation	Cobble
10.7	103.0	-	No Vegetation	Cobble
11.3	103.1	-	No Vegetation	Cobble
11.9	103.0	-	No Vegetation	Cobble
12.5	103.1	-	No Vegetation	Cobble
13.1	103.2	-	No Vegetation	Cobble
13.7	103.2	-	No Vegetation	Cobble
14.3	103.2	-	No Vegetation	Cobble
14.9	103.2	-	No Vegetation	Cobble
15.5	103.1	-	No Vegetation	Cobble
16.2	103.2	-	No Vegetation	Cobble
16.8	103.4	-	No Vegetation	Cobble
17.4	103.6	-	No Vegetation	Cobble
18.0	103.6	-	Low (0-25%) Apocynum	Cobble
18.6	103.6	-	Low (0-25%) Apocynum	Cobble
19.2	103.8	-	Low (0-25%) Apocynum	Cobble
19.8	103.9	-	Low (0-25%) Apocynum	Cobble
20.4	104.0	-	Low (0-25%) Apocynum	Cobble
21.0	104.1	-	Low (0-25%) Apocynum	Cobble
21.6	104.1	-	Low (0-25%) Apocynum	Cobble

Station (M)	Elevation (NGVD29, ft)	Density of Sandbar Willow(# clumps)	Estimated Percent Vegetation Cover	Substrate
22.3	104.2	-	Low (0-25%) Apocynum	Cobble
22.9	104.2	-	Low (0-25%) Apocynum	Cobble
23.5	104.3	-	Low (0-25%) Apocynum	Cobble
24.1	104.4	-	Low (0-25%) Apocynum	Cobble
24.4	104.5	-	Low (0-25%) Apocynum	Cobble
24.7	104.6	-	Low (0-25%) Apocynum	Cobble
25.0	104.7	-	Low (0-25%) Apocynum	Cobble
25.3	104.7	-	Low (0-25%) Apocynum	Cobble
25.6	104.9	-	Low (0-25%) Apocynum	Cobble
25.9	104.9	-	Low (0-25%) Apocynum	Cobble
26.2	105.1	-	Medium (26-50%) Apocynum	Gravel
26.5	105.2	-	Medium (26-50%) Apocynum	Gravel
26.8	105.3	-	Medium (26-50%) Apocynum	Gravel
27.1	105.4	-	Medium (26-50%) Apocynum	Gravel
27.4	105.6	-	Medium (26-50%) Apocynum	Gravel
27.7	105.7	-	Medium (26-50%) Apocynum	Gravel
28.0	105.8	-	Medium (26-50%) Apocynum	Gravel
28.3	105.9	-	Medium (26-50%) Apocynum	Gravel
29.0	105.8	2	Medium (26-50%) Apocynum	Gravel
29.6	105.8	-	Medium (26-50%) Apocynum	Gravel
30.2	105.8	2	Medium (26-50%) Apocynum	Gravel
30.8	105.7	-	Medium (26-50%) Apocynum	Gravel
31.4	105.9	3	Medium (26-50%) Apocynum	Gravel
32.0	105.9	-	Medium (26-50%) Apocynum	Gravel
32.6	106.0	-	Medium (26-50%) Apocynum	Gravel
33.2	105.8	1	Medium (26-50%) Apocynum	Gravel
33.8	105.8	-	Medium (26-50%) Apocynum	Gravel
34.4	105.7	-	Medium (26-50%) Apocynum	Gravel
35.1	105.7	1	Medium (26-50%) Apocynum	Gravel
35.7	105.8	-	Medium (26-50%) Apocynum	Gravel
36.3	105.9	-	Medium (26-50%) Apocynum	Gravel
36.9	105.7	-	Medium (26-50%) Apocynum	Gravel
37.5	105.9	-	Medium (26-50%) Apocynum	Gravel
38.1	105.8	-	Medium (26-50%) Apocynum	Gravel
38.7	105.7	-	Medium (26-50%) Apocynum	Gravel
39.0	105.6	-	Medium (26-50%) Apocynum	Gravel
39.3	105.6	-	Medium (26-50%) Apocynum	Gravel
39.6	105.5	-	Medium (26-50%) Apocynum	Gravel

Station (M)	Elevation (NGVD29, ft)	Density of Sandbar Willow(# clumps)	Estimated Percent Vegetation Cover	Substrate
39.9	105.4	-	Medium (26-50%) Apocynum	Gravel
40.2	105.4	-	Medium (26-50%) Apocynum	Gravel
40.5	105.4	-	Medium (26-50%) Apocynum	Gravel
40.8	105.3	-	Medium (26-50%) Apocynum	Gravel
41.1	105.2	-	Medium (26-50%) Apocynum	Gravel
41.5	105.0	-	Medium (26-50%) Apocynum	Gravel
41.8	105.0	-	Medium (26-50%) Apocynum	Gravel
42.1	104.8	-	Medium (26-50%) Apocynum	Gravel
42.4	104.7	-	Medium (26-50%) Apocynum	Gravel
42.7	104.6	-	Medium (26-50%) Apocynum	Gravel
43.0	104.4	-	Low (0-25%) Apocynum	Cobble
43.3	104.3	-	No Vegetation	Cobble
43.9	104.2	-	No Vegetation	Cobble
44.5	104.0	-	No Vegetation	Cobble
45.7	103.8	-	No Vegetation	Cobble
46.9	103.7	-	No Vegetation	Cobble
48.2	103.4	-	No Vegetation	Cobble
49.4	103.3	-	No Vegetation	Cobble
50.6	103.3	-	No Vegetation	Cobble
51.8	103.3	-	No Vegetation	Cobble
53.0	103.2	-	No Vegetation	Cobble
54.3	103.2	-	No Vegetation	Cobble
55.5	103.1	-	No Vegetation	Cobble
56.7	103.1	-	No Vegetation	Cobble
57.9	103.1	-	No Vegetation	Cobble
59.1	103.0	-	No Vegetation	Cobble
60.4	102.9	-	No Vegetation	Cobble
61.6	102.9	-	No Vegetation	Cobble
62.8	102.8	-	No Vegetation	Cobble
64.0	102.7	-	No Vegetation	Cobble
65.2	102.7	-	No Vegetation	Cobble
66.4	102.5	-	No Vegetation	Cobble
67.7	102.4	-	No Vegetation	Cobble
68.9	102.3	-	No Vegetation	Cobble
70.1	102.2	-	No Vegetation	Cobble



Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)

Study 3.5.1 Baseline Inventory of Wetland, Riparian and Littoral Habitat in the Turners Falls Impoundment and Assessment of Operational Impacts on Special Status Species

N

0 175 350 700 Feet

Figure 2.5-3: Mapping of RTE Plant Species and Transect 1 Location

Path: W:\gis\studies\3_5_1\maps\Final_Figures\Study_3_5_1_PUBLIC_Addendum_Mapping of RTE Plant Species and Transect 1 Location.mxd

Transect 2 (Sandbar Willow, Upstream end of Second Island)

Transect 2 is located at the northern end of Second Island. The habitat is similar to the Transect 1 location, although the transect bisects an area of higher elevation, which is more vegetated than any plot located at Transect 1. Figure 2.5-4 shows a representative view of Transect 2, looking to the west from the start pin across both un-vegetated and vegetated habitat. Most of the transect is dominated by sand and gravel, and in general, plots in sandy substrates supported areas of denser vegetation. These locations are generally observed above elevation 106.0 feet at Transect 2. Vegetation in these areas is dense (51-100% cover) and dominated by big bluestem (*Andropogon gerardii*) and switchgrass (*Panicum virgatum)* (Figure 2.5-5). Vegetation in the less dense and gravel dominated areas is primarily spreading dogbane (Figure 2.5-6). Portions of the transect are dominated by cobble, and these areas are all located on the western end of Transect 2, and range from un-vegetated to densely vegetated spreading dogbane. The sandbar willows at Transect 2 were observed above elevation 106.4 feet and in areas of medium density vegetation (26-50%) with sand and gravel dominated substrates (Table 2.5-2).

The report states that 55 ramets of sandbar willow were observed along the transect, and that an additional 3 plants were observed off the transect. This suggests that the vast majority of plants were found growing in a straight line along the transect, which seems unlikely and appears to conflict with the state listed plant data submitted to the Division. Describe and provide a graphic showing the overall configuration of the population.

In 2014, 44 ramets (clumps) of sandbar willow were identified within the population identified on Second Island and in 2015 a total of 57 clumps were identified along Transect 2. In 2015, a thorough search of the entire population was not completed, as this work had been completed in 2014. The focus of the 2015 field work was to collect information along the transects, as these were not completed in 2014 due to the overwhelming number of rare plants identified and mapped in the bypass reach. The three additional clumps located off of the survey transect in 2015 were observed incidentally as the survey crew collected additional elevation information at the site, these additional three clumps and the clumps identified on Transect 2 do not comprise the entire sandbar willow population at this location. Figure 2.5-7 shows the location of sandbar willows identified in 2014 as well as the location of Transect 2 surveyed in 2015.

Figure 2.5-4. Representative view, looking west of habitat surveyed on Transect 2

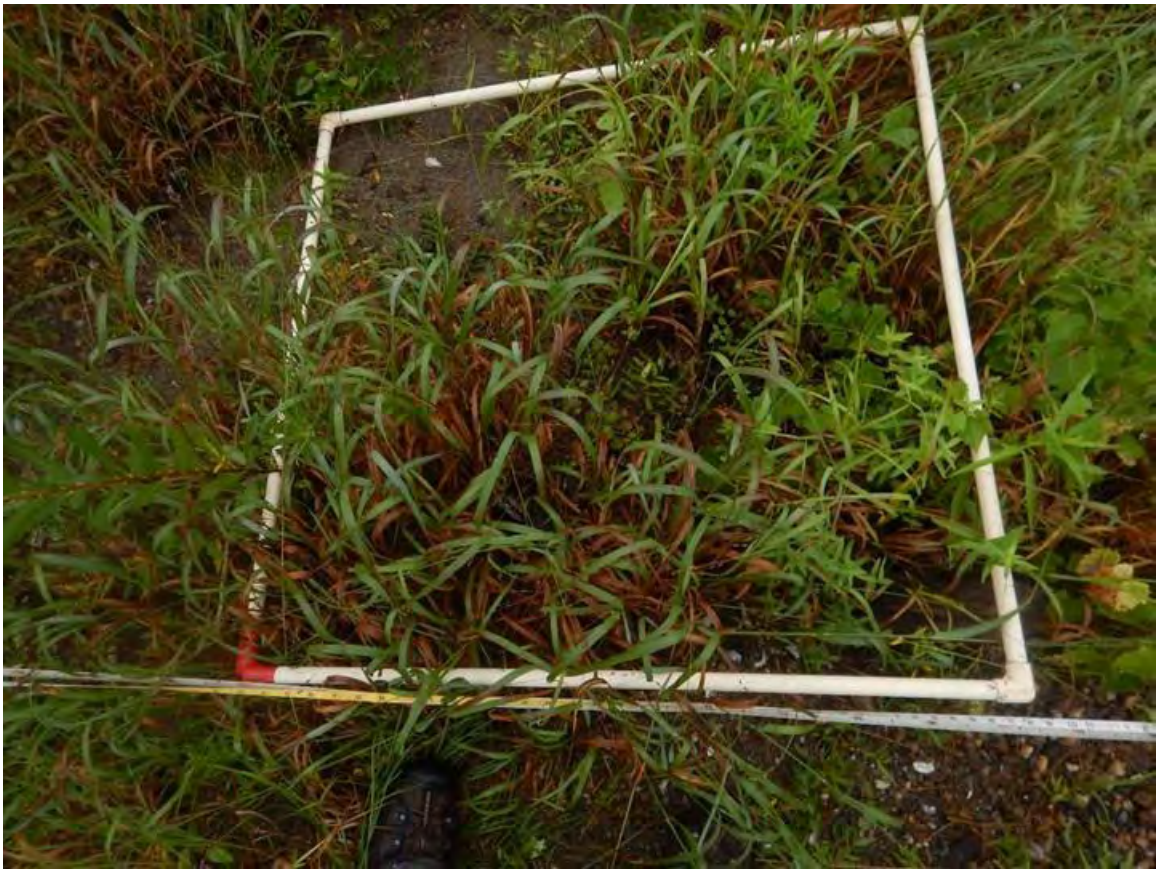


Figure 2.5-5. Representative view of sand substrate and dense (51-100% cover) vegetation at sample plot 34.0 (Meters)

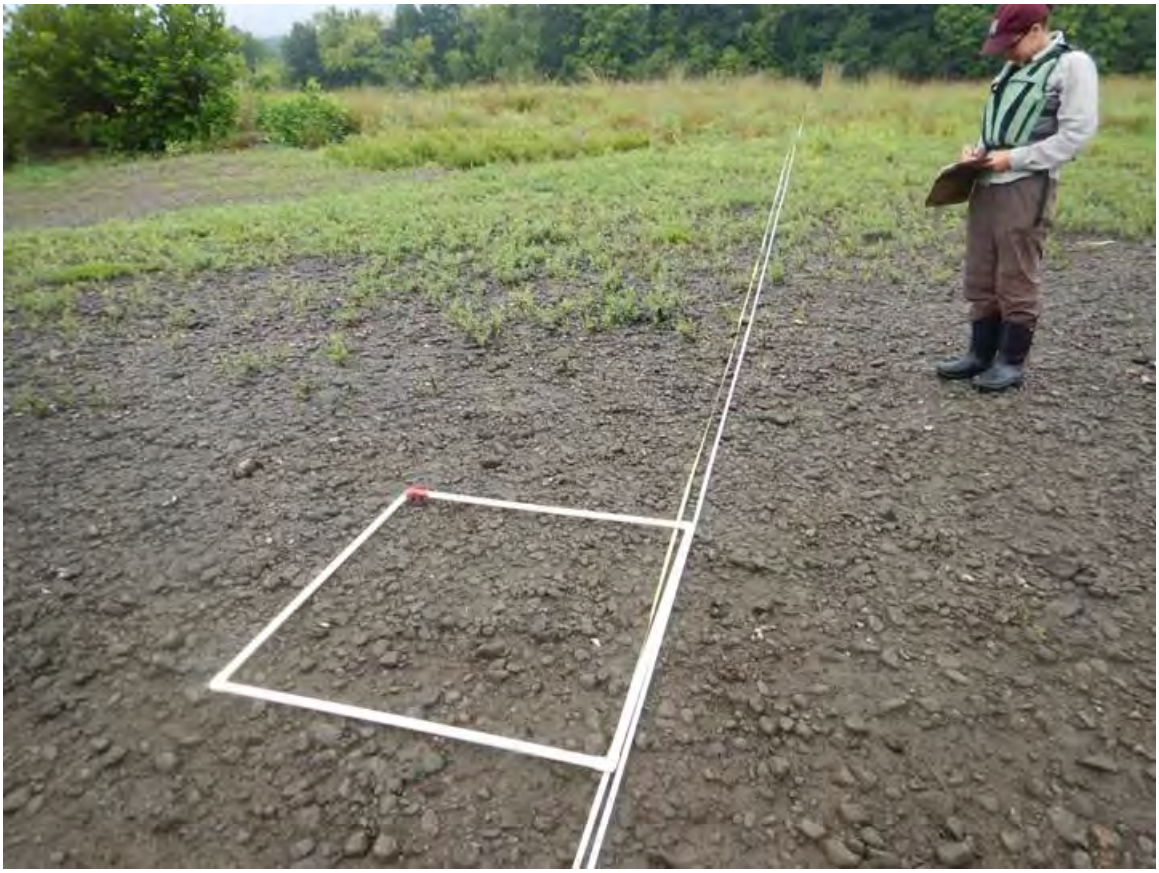


Figure 2.5-6. Representative view of gravel substrate with no vegetation and areas of gravel and dogbane extending from sample plot 0-11.0 (Meters).

Table 2.5-2. Transect 2 Elevation, Estimated Vegetative Cover and Substrate Information

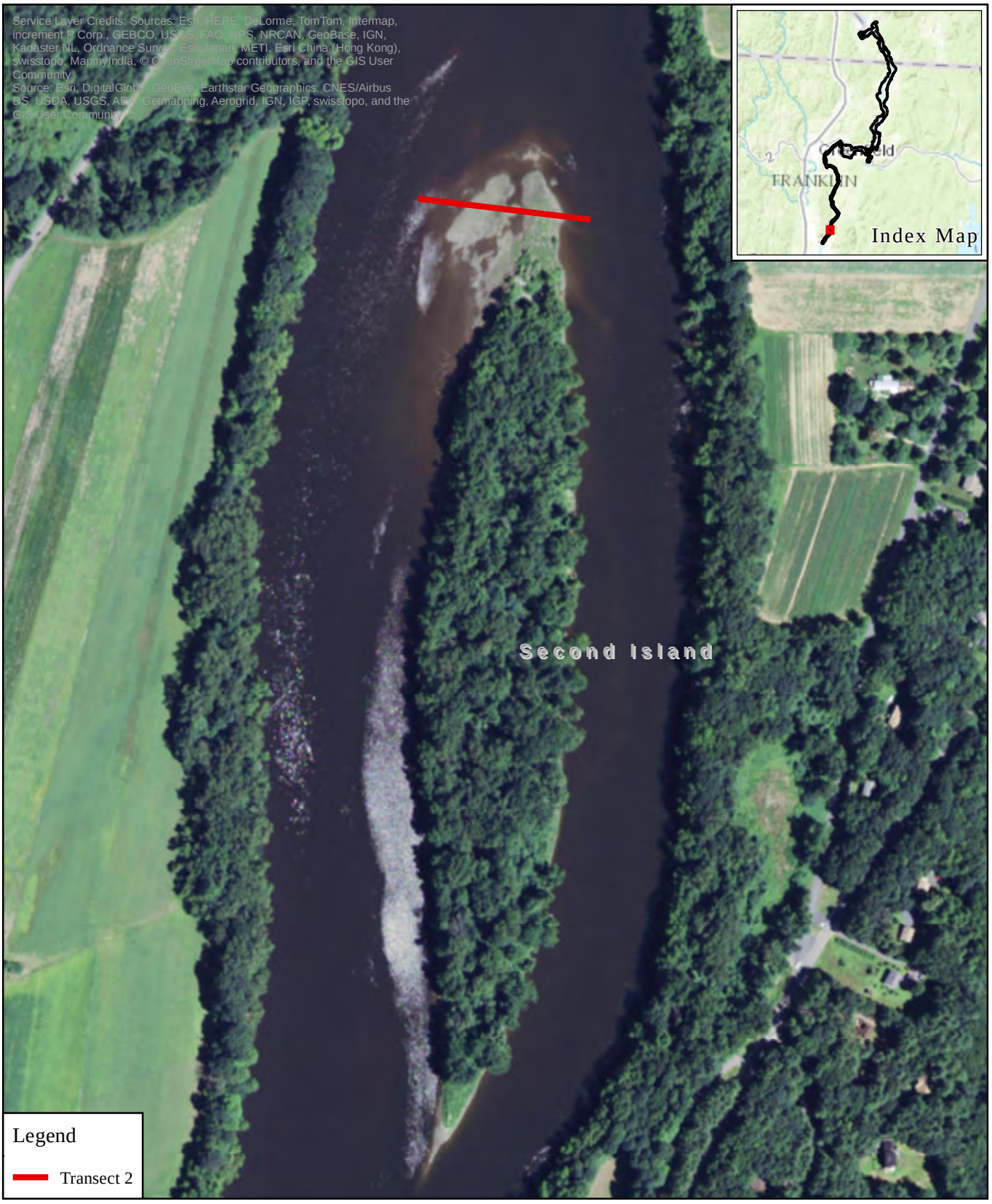
Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Willow (# clumps)	Estimated Percent Vegetation Cover	Substrate
0.0	102.8	-	No Vegetation	Gravel
0.6	102.9	-	No Vegetation	Gravel
1.2	102.9	-	No Vegetation	Gravel
1.8	103.0	-	No Vegetation	Gravel
2.4	103.0	-	No Vegetation	Gravel
3.0	103.0	-	No Vegetation	Gravel
3.7	103.1	-	No Vegetation	Gravel
4.3	103.3	-	No Vegetation	Gravel
4.9	103.4	-	No Vegetation	Gravel
5.5	103.3	-	No Vegetation	Gravel
6.1	103.4	-	No Vegetation	Gravel
6.7	103.5	-	No Vegetation	Gravel
7.3	103.6	-	No Vegetation	Gravel
7.9	103.6	-	No Vegetation	Gravel
8.5	103.8	-	No Vegetation	Gravel
9.1	103.9	-	No Vegetation	Gravel
9.8	104.0	-	No Vegetation	Gravel
10.4	104.0	-	No Vegetation	Gravel
11.0	104.2	-	No Vegetation	Gravel
11.6	104.3	-	Low (0-25%)	Gravel
12.2	104.4	-	Low (0-25%)	Gravel
12.8	104.4	-	Low (0-25%)	Gravel
13.4	104.6	-	Low (0-25%)	Gravel
14.0	104.7	-	Low (0-25%)	Gravel
14.6	104.7	-	Low (0-25%)	Gravel
15.2	104.9	-	Low (0-25%)	Gravel
15.8	104.9	-	Low (0-25%)	Gravel
16.5	105.0	-	Low (0-25%)	Gravel
17.1	105.2	-	Low (0-25%)	Gravel
17.7	105.3	-	Low (0-25%)	Gravel
18.3	105.5	-	Low (0-25%)	Gravel
18.9	105.6	-	Low (0-25%)	Gravel
19.5	105.7	-	Low (0-25%)	Gravel
20.1	105.9	-	Low (0-25%)	Gravel
20.7	106.0	-	Low (0-25%)	Gravel
21.3	106.3	-	Low (0-25%)	Gravel
21.9	106.2	-	Low (0-25%)	Gravel

Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Willow (# clumps)	Estimated Percent Vegetation Cover	Substrate
22.6	106.2	-	Low (0-25%)	Gravel
23.2	106.3	-	Low (0-25%)	Gravel
23.8	106.4	-	Low (0-25%)	Gravel
24.4	106.4	-	Low (0-25%)	Gravel
25.0	106.6	-	Low (0-25%)	Gravel
25.6	106.8	-	Low (0-25%)	Gravel
26.2	106.8	-	Low (0-25%)	Gravel
26.8	107.0	-	Low (0-25%)	Gravel
27.4	106.8	1	Medium (26-50%)	Sand
28.0	107.2	-	Medium (26-50%)	Sand
28.7	106.9	-	Medium (26-50%)	Sand
29.3	107.3	-	Medium (26-50%)	Sand
29.9	107.5	-	Medium (26-50%)	Sand
30.5	107.5	-	Medium (26-50%)	Sand
31.1	107.5	-	Medium (26-50%)	Sand
31.7	107.7	-	Medium (26-50%)	Sand
32.3	107.7	-	Medium (26-50%)	Sand
32.9	107.9	-	Medium (26-50%)	Sand
33.5	108.2	1	Medium (26-50%)	Sand
34.1	108.1	2	Medium (26-50%)	Sand
34.7	107.9	-	Medium (26-50%)	Sand
35.4	108.1	1	Medium (26-50%)	Sand
36.0	108.6	3	Medium (26-50%)	Sand
36.6	108.3	-	Medium (26-50%)	Sand
37.2	108.5	2	Medium (26-50%)	Sand/Gravel
37.8	108.5	-	Medium (26-50%)	Sand/Gravel
38.4	108.3	-	Medium (26-50%)	Sand/Gravel
39.0	108.0	1	Medium (26-50%)	Sand/Gravel
39.6	108.0	-	Medium (26-50%)	Sand/Gravel
40.2	108.1	-	Medium (26-50%)	Sand/Gravel
40.8	107.8	-	Medium (26-50%)	Sand/Gravel
41.5	107.7	1	Medium (26-50%)	Sand/Gravel
42.1	108.2	3	Medium (26-50%)	Sand/Gravel
42.7	108.1	-	Medium (26-50%)	Sand/Gravel
43.3	107.9	2	Medium (26-50%)	Sand/Gravel
43.9	108.0	-	Medium (26-50%)	Sand/Gravel
44.5	107.9	-	Medium (26-50%)	Sand/Gravel
45.1	107.2	1	Medium (26-50%)	Sand/Gravel

Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Willow (# clumps)	Estimated Percent Vegetation Cover	Substrate
45.7	106.8	-	Medium (26-50%)	Sand/Gravel
46.3	107.1	1	Medium (26-50%)	Sand/Gravel
46.9	107.2	-	Medium (26-50%)	Sand/Gravel
47.5	107.3	1	Medium (26-50%)	Sand/Gravel
48.2	107.4	-	Medium (26-50%)	Sand/Gravel
48.8	107.0	-	Medium (26-50%)	Sand/Gravel
49.4	106.7	1	Medium (26-50%)	Sand/Gravel
50.0	106.2	-	Medium (26-50%)	Sand/Gravel
50.6	105.6	-	Medium (26-50%)	Sand/Gravel
51.2	105.6	-	Low (0-25%)	Sand/Gravel
51.8	105.5	-	Low (0-25%)	Sand/Gravel
52.4	105.4	-	Low (0-25%)	Sand/Gravel
53.0	105.4	-	Low (0-25%)	Sand/Gravel
53.6	105.4	-	Low (0-25%)	Sand/Gravel
54.3	105.5	-	Low (0-25%)	Sand/Gravel
54.9	105.5	-	Low (0-25%)	Sand/Gravel
55.5	105.6	-	Low (0-25%)	Sand/Gravel
56.7	105.8	-	Low (0-25%)	Sand/Gravel
57.9	105.9	-	Medium (26-50%)Apocynum	Sand/Gravel
59.1	106.0	-	Medium (26-50%)Apocynum	Sand/Gravel
60.4	105.9	-	Medium (26-50%)Apocynum	Sand/Gravel
61.6	106.0	-	Medium (26-50%)Apocynum	Sand/Gravel
62.8	105.9	-	Medium (26-50%)Apocynum	Sand/Gravel
64.0	106.0	-	Medium (26-50%)Apocynum	Sand/Gravel
65.2	106.1	-	Medium (26-50%)Apocynum	Sand/Gravel
66.4	106.2	-	Medium (26-50%)Apocynum	Sand/Gravel
67.7	105.9	-	Medium (26-50%)Apocynum	Sand/Gravel
68.9	106.1	-	Medium (26-50%)Apocynum	Sand/Gravel
70.1	106.1	-	Medium (26-50%)Apocynum	Sand/Gravel
71.3	106.2	-	Medium (26-50%)Apocynum	Sand/Gravel
72.5	106.3	-	Medium (26-50%)Apocynum	Sand/Gravel
73.8	106.4	1	Medium (26-50%)Apocynum	Sand/Gravel
75.0	106.4	7	Medium (26-50%)Apocynum	Sand/Gravel
76.2	106.5	4	Medium (26-50%)Apocynum	Sand/Gravel
77.4	106.5	4	Medium (26-50%)Apocynum	Sand/Gravel
78.6	106.7	4	Medium (26-50%)Apocynum	Sand/Gravel
79.9	106.5	6	Medium (26-50%)Apocynum	Sand/Gravel
81.1	106.5	1	Medium (26-50%)Apocynum	Gravel

Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Willow (# clumps)	Estimated Percent Vegetation Cover	Substrate
82.3	106.5	1	Medium (26-50%)Apocynum	Gravel
83.5	106.5	2	Medium (26-50%)Apocynum	Gravel
84.7	106.5	-	Medium (26-50%)Apocynum	Gravel
86.0	106.6	-	Medium (26-50%)Apocynum	Gravel
87.2	106.5	-	Medium (26-50%)Apocynum	Gravel
88.4	106.4	-	Medium (26-50%)Apocynum	Gravel
89.6	106.4	-	Medium (26-50%)Apocynum	Gravel
90.8	106.1	-	Medium (26-50%)Apocynum	Gravel
91.4	106.0	-	Medium (26-50%)Apocynum	Gravel
92.7	105.6	-	Medium (26-50%)Apocynum	Gravel
93.9	105.4	-	Medium (26-50%)Apocynum	Gravel
95.1	105.4	-	Medium (26-50%)Apocynum	Cobble
96.3	105.3	-	Low (0-25%)	Cobble
97.5	105.0	-	Low (0-25%)	Cobble
98.8	104.9	-	Low (0-25%)	Cobble
100.0	104.9	-	Low (0-25%)	Cobble
101.2	104.9	-	Low (0-25%)	Cobble
102.4	105.1	-	Low (0-25%)	Cobble
103.6	105.0	-	High (51-100%) Apocynum	Cobble
104.9	104.9	-	High (51-100%) Apocynum	Cobble
106.1	104.9	-	High (51-100%) Apocynum	Cobble
107.3	104.8	-	High (51-100%) Apocynum	Cobble
108.5	104.8	-	High (51-100%) Apocynum	Cobble
109.7	104.6	-	High (51-100%) Apocynum	Cobble
110.9	104.7	-	High (51-100%) Apocynum	Cobble
112.2	104.5	-	High (51-100%) Apocynum	Cobble
113.4	104.5	-	High (51-100%) Apocynum	Cobble
114.6	104.6	-	High (51-100%) Apocynum	Cobble
115.8	104.6	-	High (51-100%) Apocynum	Cobble
117.0	104.4	-	High (51-100%) Apocynum	Cobble
118.3	104.4	-	High (51-100%) Apocynum	Cobble
119.5	104.1	-	High (51-100%) Apocynum	Cobble
120.7	104.3	-	High (51-100%) Apocynum	Cobble
121.9	104.2	-	High (51-100%) Apocynum	Cobble
123.1	104.1	-	High (51-100%) Apocynum	Cobble
124.4	104.0	-	High (51-100%) Apocynum	Cobble
125.6	103.9	-	High (51-100%) Apocynum	Cobble
126.8	103.8	-	High (51-100%) Apocynum	Cobble

Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Willow (# clumps)	Estimated Percent Vegetation Cover	Substrate
128.0	103.6	-	No Vegetation	Cobble
129.2	103.3	-	No Vegetation	Cobble
130.5	103.2	-	No Vegetation	Cobble
131.7	103.0	-	No Vegetation	Cobble
132.0	102.9	-	No Vegetation	Cobble



Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)

Study 3.5.1 Baseline Inventory of Wetland, Riparian and Littoral Habitat in the Turners Falls Impoundment and Assessment of Operational Impacts on Special Status Species

N

0 175 350 700 Feet

Figure 2.5-7: Mapping of RTE Plant Species and Transect 2 Location

Path: W:\gis\studies\3_5_1\maps\Final_Figures\Study_3_5_1_PUBLIC_Addendum_Mapping of RTE Plant Species and Transect 2 Location.mxd

Transect 3 (Sandbar Cherry, Upstream end of Fourth Island)

Transect 3 is located at the northern extent of Fourth Island and bisects the entire population of sandbar cherry at this location. The transect starts in cobble dominated habitat that transitions from un-vegetated to primarily spreading dogbane vegetated habitat until station 36.9 meters (Figure 2.5-8). At station 37.2 there is an increase in elevation and a change in the predominant substrate. From station 37.2 to 93.9 the habitat is consistently pit and mound with occasional bare sandy pits and sandy mounds with dense vegetation growth. Vegetation is dominated by switchgrass and deer-tongue grass (*Dichanthelium clandestinum*) and other sub-dominate herbaceous species (Figure 2.5-9). At Transect 3, sandbar cherry was only identified within sandy habitats, and was often associated with the sloping banks of sand immediately adjacent to areas of dense vegetation (Table 2.5-3).

The report states that 129 sandbar cherry individuals were observed along the transect. This suggests that the vast majority of the plants were found growing in a straight line along the transect, which seems unlikely and appears to conflict with state-listed plant data submitted to the Division. Describe and provide a graphic showing the overall configuration of the population, and confirm the maximum WSEL for the sandbar cherry observed at this location.

In 2014, 28 clumps of sandbar cherry were identified within the population identified on Fourth Island and in 2015 a total of 129 clumps were identified along Transect 3. In 2015, a thorough search of the entire population was not completed, as this work had been completed in 2014. The focus of the 2015 field work was to collect information along the transects, as these were not completed in 2014 due to the overwhelming number of rare plants identified and mapped in the bypass reach. The clumps located at Transect 3 do not comprise the entire sandbar cherry population at this location. Figure 2.5-10 shows the location of sandbar cherries identified in 2014 as well as the location of Transect 3 surveyed in 2015. The maximum WSEL is 115.58 feet, which is based on the April median flow of 33,100 cfs. The maximum elevation at which sandbar cherry is observed on Transect 3 is 118.49 feet.

Figure 2.5-8. Representative view of un-vegetated cobble dominated habitat at Transect 3, looking west from the start pin.

Figure 2.5-9. Representative view of habitat present from station 37.2 to 93.9 Meters.

Table 2.5-3. Transect 3 Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Willow (# clumps)	Estimated Percent Vegetation Cover	Substrate
0.0	106.2	-	No Vegetation	Cobble
1.2	106.5	-	No Vegetation	Cobble
2.4	106.7	-	No Vegetation	Cobble
3.7	106.7	-	No Vegetation	Cobble
4.9	107.0	-	No Vegetation	Cobble
6.1	107.1	-	No Vegetation	Cobble
7.3	107.2	-	No Vegetation	Cobble
8.5	107.3	-	No Vegetation	Cobble
9.8	107.5	-	Medium (26-50%) Apocynum	Cobble
11.0	107.6	-	Medium (26-50%) Apocynum	Cobble
12.2	107.9	-	Medium (26-50%) Apocynum	Cobble
13.4	108.1	-	Medium (26-50%) Apocynum	Cobble
14.6	108.4	-	Medium (26-50%) Apocynum	Cobble
15.8	108.6	-	Medium (26-50%) Apocynum	Cobble
17.1	108.8	-	Medium (26-50%) Apocynum	Cobble
18.3	109.0	-	Medium (26-50%) Apocynum	Cobble
19.5	109.3	-	Medium (26-50%) Apocynum	Cobble
20.7	109.3	-	Medium (26-50%) Apocynum	Cobble
21.9	109.3	-	Medium (26-50%) Apocynum	Cobble
23.2	109.5	-	Medium (26-50%) Apocynum	Cobble
24.4	109.8	-	Medium (26-50%) Apocynum	Cobble
25.6	110.2	-	Medium (26-50%) Apocynum	Cobble
26.8	110.4	-	Medium (26-50%) Apocynum	Cobble
28.0	111.0	-	Medium (26-50%) Apocynum	Cobble
28.7	110.9	-	Medium (26-50%) Apocynum	Cobble
29.3	111.0	-	Medium (26-50%) Apocynum	Cobble
29.9	111.3	-	Medium (26-50%) Apocynum	Cobble
30.5	111.6	-	Medium (26-50%) Apocynum	Cobble
31.1	111.8	-	Medium (26-50%) Apocynum	Cobble
31.7	111.8	-	Medium (26-50%) Apocynum	Cobble
32.3	112.0	-	Medium (26-50%) Apocynum	Cobble
32.9	112.1	-	Medium (26-50%) Apocynum	Cobble
33.5	112.2	-	Medium (26-50%) Apocynum	Cobble
34.1	112.5	-	Medium (26-50%) Apocynum	Cobble
34.7	112.7	-	Medium (26-50%) Apocynum	Cobble
35.4	113.0	-	Medium (26-50%) Apocynum	Cobble
35.7	113.6	-	Medium (26-50%) Apocynum	Cobble

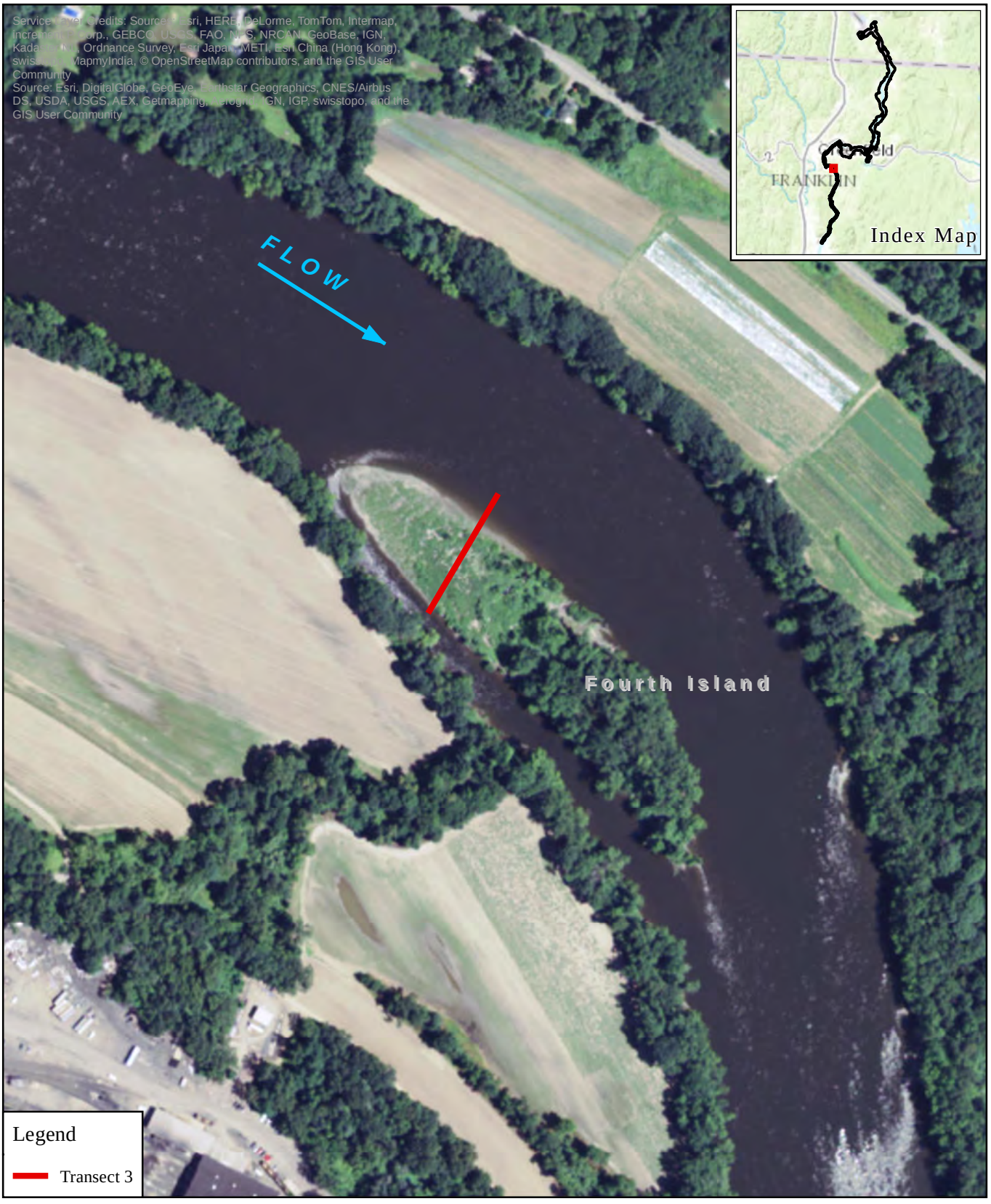
Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Willow (# clumps)	Estimated Percent Vegetation Cover	Substrate
36.0	113.9	-	Medium (26-50%) Apocynum	Cobble
36.3	114.3	-	Medium (26-50%) Apocynum	Cobble
36.6	114.2	-	Medium (26-50%) Apocynum	Cobble
36.9	114.2	-	Medium (26-50%) Apocynum	Cobble
37.2	114.7	6	High (51-100%)	Sandy
37.5	115.0	-	High (51-100%)	Sandy
37.8	115.1	-	High (51-100%)	Sandy
38.1	115.2	5	High (51-100%)	Sandy
38.4	115.3	-	High (51-100%)	Sandy
38.7	115.4	-	High (51-100%)	Sandy
39.0	115.1	7	High (51-100%)	Sandy
39.3	115.0	-	High (51-100%)	Sandy
39.6	114.8	-	High (51-100%)	Sandy
39.9	114.9	-	High (51-100%)	Sandy
40.2	114.7	1	High (51-100%)	Sandy
40.5	115.2	-	High (51-100%)	Sandy
40.8	115.4	-	High (51-100%)	Sandy
41.1	116.1	-	High (51-100%)	Sandy
41.5	116.1	-	High (51-100%)	Sandy
41.8	116.5	-	High (51-100%)	Sandy
42.1	116.6	-	High (51-100%)	Sandy
42.4	116.5	-	High (51-100%)	Sandy
42.7	116.6	-	High (51-100%)	Sandy
43.0	116.1	-	High (51-100%)	Sandy
43.3	116.1	-	High (51-100%)	Sandy
43.6	115.9	-	High (51-100%)	Sandy
43.9	116.0	-	High (51-100%)	Sandy
44.2	116.6	-	High (51-100%)	Sandy
44.5	116.7	-	High (51-100%)	Sandy
44.8	116.6	-	High (51-100%)	Sandy
45.1	116.4	-	High (51-100%)	Sandy
45.4	116.7	-	High (51-100%)	Sandy
45.7	117.0	-	High (51-100%)	Sandy
46.0	117.0	1	High (51-100%)	Sandy
46.3	117.2	-	High (51-100%)	Sandy
46.6	117.3	-	High (51-100%)	Sandy
46.9	117.3	-	High (51-100%)	Sandy
47.2	117.2	1	High (51-100%)	Sandy

Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Willow (# clumps)	Estimated Percent Vegetation Cover	Substrate
47.5	116.9	-	High (51-100%)	Sandy
47.9	117.1	-	High (51-100%)	Sandy
48.2	117.2	2	High (51-100%)	Sandy
48.5	117.2	-	High (51-100%)	Sandy
48.8	117.3	-	High (51-100%)	Sandy
49.1	117.4	2	High (51-100%)	Sandy
49.4	117.6	-	High (51-100%)	Sandy
49.7	117.6	-	High (51-100%)	Sandy
50.0	118.0	5	High (51-100%)	Sandy
50.3	118.2	-	High (51-100%)	Sandy
50.6	118.4	-	High (51-100%)	Sandy
50.9	118.2	-	High (51-100%)	Sandy
51.2	117.7	6	High (51-100%)	Sandy
51.5	117.4	-	High (51-100%)	Sandy
51.8	117.5	-	High (51-100%)	Sandy
52.1	117.7	4	High (51-100%)	Sandy
52.4	117.6	-	High (51-100%)	Sandy
52.7	117.9	-	High (51-100%)	Sandy
53.0	117.9	7	High (51-100%)	Sandy
53.3	118.2	-	High (51-100%)	Sandy
53.6	117.9	-	High (51-100%)	Sandy
53.9	118.1	-	High (51-100%)	Sandy
54.3	117.6	5	High (51-100%)	Sandy
54.6	117.2	-	High (51-100%)	Sandy
54.9	117.1	-	High (51-100%)	Sandy
55.2	116.7	2	High (51-100%)	Sandy
55.5	116.4	-	High (51-100%)	Sandy
55.8	116.7	-	High (51-100%)	Sandy
56.1	115.9	2	High (51-100%)	Sandy
56.4	115.8	-	High (51-100%)	Sandy
56.7	116.1	-	High (51-100%)	Sandy
57.0	115.9	1	High (51-100%)	Sandy
57.3	115.9	-	High (51-100%)	Sandy
57.6	116.2	-	High (51-100%)	Sandy
57.9	116.4	-	High (51-100%)	Sandy
58.2	117.3	1	High (51-100%)	Sandy
58.5	117.7	-	High (51-100%)	Sandy
58.8	118.4	-	High (51-100%)	Sandy

Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Willow (# clumps)	Estimated Percent Vegetation Cover	Substrate
59.1	118.5	1	High (51-100%)	Sandy
59.4	118.5	-	High (51-100%)	Sandy
59.7	117.6	-	High (51-100%)	Sandy
60.0	117.3	-	High (51-100%)	Sandy
60.4	117.4	-	High (51-100%)	Sandy
60.7	118.2	-	High (51-100%)	Sandy
61.0	118.2	-	High (51-100%)	Sandy
61.3	118.1	-	High (51-100%)	Sandy
61.6	118.0	-	High (51-100%)	Sandy
61.9	117.6	-	High (51-100%)	Sandy
62.2	117.3	-	High (51-100%)	Sandy
62.5	116.7	-	High (51-100%)	Sandy
62.8	116.7	-	High (51-100%)	Sandy
63.1	116.8	-	High (51-100%)	Sandy
63.4	117.2	-	High (51-100%)	Sandy
63.7	117.5	-	High (51-100%)	Sandy
64.0	118.0	-	High (51-100%)	Sandy
64.3	117.8	-	High (51-100%)	Sandy
64.6	117.7	-	High (51-100%)	Sandy
64.9	117.7	-	High (51-100%)	Sandy
65.2	118.1	-	High (51-100%)	Sandy
65.5	117.5	-	High (51-100%)	Sandy
65.8	117.3	-	High (51-100%)	Sandy
66.1	117.2	-	High (51-100%)	Sandy
66.4	117.1	-	High (51-100%)	Sandy
66.8	116.6	-	High (51-100%)	Sandy
67.1	116.6	-	High (51-100%)	Sandy
67.4	116.8	-	High (51-100%)	Sandy
67.7	117.0	-	High (51-100%)	Sandy
68.0	117.2	1	High (51-100%)	Sandy
68.3	117.6	-	High (51-100%)	Sandy
68.6	117.7	-	High (51-100%)	Sandy
68.9	117.7	-	High (51-100%)	Sandy
69.2	117.8	3	High (51-100%)	Sandy
69.5	118.0	-	High (51-100%)	Sandy
69.8	118.0	-	High (51-100%)	Sandy
70.1	117.7	1	High (51-100%)	Sandy
70.4	117.7	-	High (51-100%)	Sandy

Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Willow (# clumps)	Estimated Percent Vegetation Cover	Substrate
70.7	118.0	-	High (51-100%)	Sandy
71.0	117.8	1	High (51-100%)	Sandy
71.3	117.6	-	High (51-100%)	Sandy
71.6	117.7	-	High (51-100%)	Sandy
71.9	117.8	-	High (51-100%)	Sandy
72.2	117.9	3	High (51-100%)	Sandy
72.5	118.2	-	High (51-100%)	Sandy
72.8	117.8	-	High (51-100%)	Sandy
73.2	117.6	5	High (51-100%)	Sandy
73.5	117.2	-	High (51-100%)	Sandy
73.8	117.0	-	High (51-100%)	Sandy
74.1	117.0	5	High (51-100%)	Sandy
74.4	116.8	-	High (51-100%)	Sandy
74.7	116.7	-	High (51-100%)	Sandy
75.0	116.7	4	High (51-100%)	Sandy
75.3	116.9	-	High (51-100%)	Sandy
75.6	117.1	-	High (51-100%)	Sandy
75.9	116.8	-	High (51-100%)	Sandy
76.2	117.0	3	High (51-100%)	Sandy
76.8	117.1	-	High (51-100%)	Sandy
77.4	117.2	6	High (51-100%)	Sandy
78.0	117.4	1	High (51-100%)	Sandy
78.6	117.6	-	High (51-100%)	Sandy
79.2	117.4	-	High (51-100%)	Sandy
79.9	117.1	-	High (51-100%)	Sandy
80.5	116.6	5	High (51-100%)	Sandy
81.1	117.0	10	High (51-100%)	Sandy
81.7	117.1	-	High (51-100%)	Sandy
82.3	117.0	4	High (51-100%)	Sandy
82.9	117.4	-	High (51-100%)	Sandy
83.5	117.6	4	High (51-100%)	Sandy
84.1	117.2	3	High (51-100%)	Sandy
84.7	117.7	-	High (51-100%)	Sandy
85.3	117.6	1	High (51-100%)	Sandy
86.0	117.3	5	High (51-100%)	Sandy
86.6	117.1	-	High (51-100%)	Sandy
87.2	116.5	5	High (51-100%)	Sandy
87.8	116.2	-	High (51-100%)	Sandy

Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Willow (# clumps)	Estimated Percent Vegetation Cover	Substrate
88.4	117.2	-	High (51-100%)-*Vitis s*p	Sandy
89.0	116.3	-	High (51-100%)-*Vitis s*p	Sandy
89.6	116.2	-	High (51-100%)-*Vitis s*p	Sandy
90.2	114.8	-	High (51-100%)-*Vitis s*p	Sandy
90.8	114.5	-	High (51-100%)-*Vitis s*p	Sandy
91.4	114.1	-	High (51-100%)	Sandy
92.0	113.2	-	High (51-100%)	Sandy
92.7	112.8	-	High (51-100%)	Sandy
93.3	113.7	-	High (51-100%)	Sandy
93.9	112.7	-	High (51-100%)	Sandy
94.5	110.1	-	Low (0-25%)	Sandy
95.1	109.9	-	Low (0-25%)	Sandy
95.7	109.8	-	Low (0-25%)	Sandy
96.3	109.5	-	Low (0-25%)	Sandy
97.5	108.4	-	Low (0-25%)	Sandy
98.8	107.6	-	No Vegetation	Sandy
100.0	107.2	-	No Vegetation	Sandy
101.2	107.1	-	No Vegetation	Sandy



FirstLight Power Resources

Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)

Study 3.5.1 Baseline Inventory of Wetland, Riparian and Littoral Habitat in the Turners Falls Impoundment and Assessment of Operational Impacts on Special Status Species

N

0 165 330 660 Feet

Figure 2.5-10: Mapping of RTE Plant Species and Transect 3 Location

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Transect 3 (Sandbar Cherry, Upstream end of Fourth Island) - continued

Comment: *The report states that a small population of sandbar willow was observed at the upstream tip of Fourth Island. Provide additional information on the number of plants observed as well as their overall health and vigor. It also appears that this population was observed at higher elevations relative to other locations where sandbar willow was observed, so the Division would suggest utilizing this site in FL's assessment of habitat suitability preferences for this species. The Division requests that rare plant observation forms (via electronic reporting in VPRS or paper forms be submitted for this population).*

Response:

In 2015 approximately 40 clumps of sandbar willow were located at the tip of Fourth Island, these plants were not identified in the 2014 survey or rare species. Figure 2.5-10 shows the location of the edge of the mapped population. The minimum elevation and maximum elevation of this population was 111.25 and 113.48 feet, respectively. This location was included in the analysis of inundation duration of the sandbar willow relative to elevation (discussed in Section 2.4). This observation of a rare plant population will be documented using electronic reporting forms in Vernal & Rare Species Information System (VPRS) and will be submitted the Division.

Comment: Eleocharis sp. appear to have been observed by FL on the northern portion of Fourth Island, but no information was provided about this species in the report. Confirm whether any of the observed Eleocharis sp. were state listed species; if so, additional information should be included sufficient to describe these observations. Additional surveys may be required to ensure that these species were correctly identified and surveyed.

Response:

During the 2014 survey spikerush species were not expressing morphological traits which could be used to identify them to the species level. In an effort to be conservative, GPS locations at these observations were collected. Following additional survey work, during the course of the 2014 field season, these locations were deemed to not be state-listed spikerush species and therefore additional data was not collected.

Transect 4 (Tradescant's Aster, Reach 4, above Fourth Island)

Comment: *The report states that this transect runs north to south. However, Figure 4.3-1 Map 4 depicts the transect as running west to east; confirm the final transect layout and revise description and figure accordingly.*

Response:

The original description of the orientation of Transect 4 was an error, the transect runs in an east to west direction. Figure 2.5-11 shows the location of Transect 4.

Comment: *The Division notes that suitable bedrock habitats extend to the shoreline at this site (see comment #1); the transect should provide elevational data to the maximum height of potentially suitable habitat at this site.*

Response:

While not included in the original elevation survey completed in 2015, Figure 2.5-12 shows the Tradescant's aster locations mapped in 2014 over the digital terrain model developed as part of Study No. 3.3.1 *Instream Flow Studies in Bypass Channel and below Cabot Station*. Based on this modeling information the maximum elevation of identified Tradescant's aster is 113.2 feet. Above this elevation no Tradescant's aster were located at this location, therefore suitable habitat is assumed to fall at or below this elevation down to a minimum elevation of 108.0 feet (the minimum elevation with observed Tradescant's aster based on the digital terrain model).

Comment: *The report provides minimum and maximum WSELs along the transect where state-listed plants were observed, but does not provide minimum and maximum WSEL for the population more broadly. Confirm the minimum and maximum WSEL for Tradescant's aster observed at this location.*

Response:

Based on the elevation data from Transect 4, the minimum elevation and maximum elevation of Tradescant's aster are 109.87 and 112.43 feet, respectively. In addition, the digital terrain model developed as part of Study No. 3.3.1 *Instream Flow Studies in Bypass Channel and below Cabot Station*, was referenced and compared to mapping of Tradescant's aster completed in 2014. Based on this, the population minimum and maximum elevation is 108.8 and 113.2 feet, respectively.

Comment: *Figure 4.3-24 illustrates where Tradescant's aster occurred along the transect; no Tradescant's aster were reported along the eastern portion of the transect. However, Figure 4.3-1 appears to show occupancy along the eastern portion of the transect. Describe and provide a graphic showing the overall configuration of the population and clarify the observations and occupancy. The report should be updated to resolve this conflict.*

Response:

Figure 4.3-1 of the 3/1/16 Report shows the extent of the population Tradescant's aster at the Transect 4 location based on the location of identified plants. Figure 2.5-11 shows the location of Transect 4 as well as the location of Tradescant's asters which were identified and mapped in 2014.

Comment: *If Tradescant's aster does not occur on the eastern portion of the site, as suggested by Figure 4.3-24, then based on the information collected for the site, describe what other factors might explain the absence of the species in the eastern portion of the transect to help inform habitat suitability preferences for this species (e.g., rock types, shading, competing vegetation, flow parameters)?*

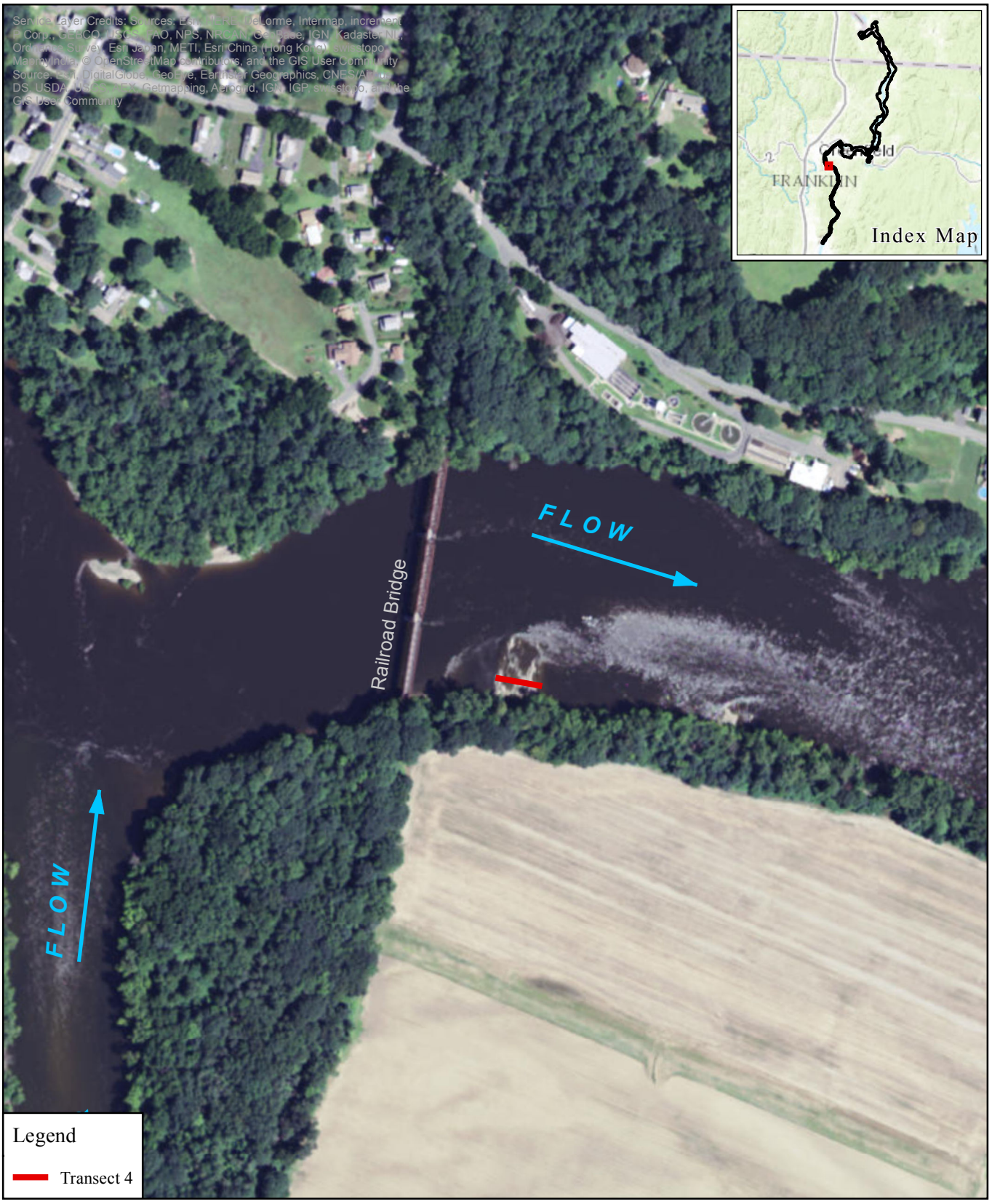
Response:

Transect 4 is dominated by bedrock and percent cover of vegetation is very low for the entire transect; habitat is comparable along the entirety of Transect 4. Table 2.5-4 contains elevation, density of Tradescant's aster, estimated percent cover of vegetation and observed substrate at each of the sample plot locations. Vegetation, when it does occur on the transect, is found within small cracks and crevices within the bedrock (Figure 2.5-13). Based on observations made in the field, habitat within the population at this location is similar throughout the area. Factors that may play a role in the presence of Tradescant's aster are likely related to the availability of cracks or crevices large enough to support growth of vegetation, or the absence of pools with standing water trapped by the bedrock (see Figure 2.5-13), or possibly a lack of competing vegetation. The majority of the Tradescant's asters were found in areas of exposed and scoured bedrock which allows for very little competing vegetation to become established. At higher elevations, more vegetation is present (Figure 2.5-13). The duration of inundation during the growing season was also examined and described in Section 2.4.

Comment: *Eleocharis sp. appear to have been observed by FL on the northern portion of Fourth Island, but no information was provided about this species in the report. Confirm whether any of the observed Eleocharis sp. were state listed species; if so, additional information should be included sufficient to describe these observations. Additional surveys may be required to ensure that these species were correctly identified and surveyed.*

Response:

During the 2014 survey spikerush species were not expressing morphological traits which could be used to identify them to the species level. In an effort to be conservative GPS locations at these observations were collected. Following additional survey work, during the course of the 2014 field season, these locations were deemed to not to be state-listed spikerush species and therefore additional data was not collected.



Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)

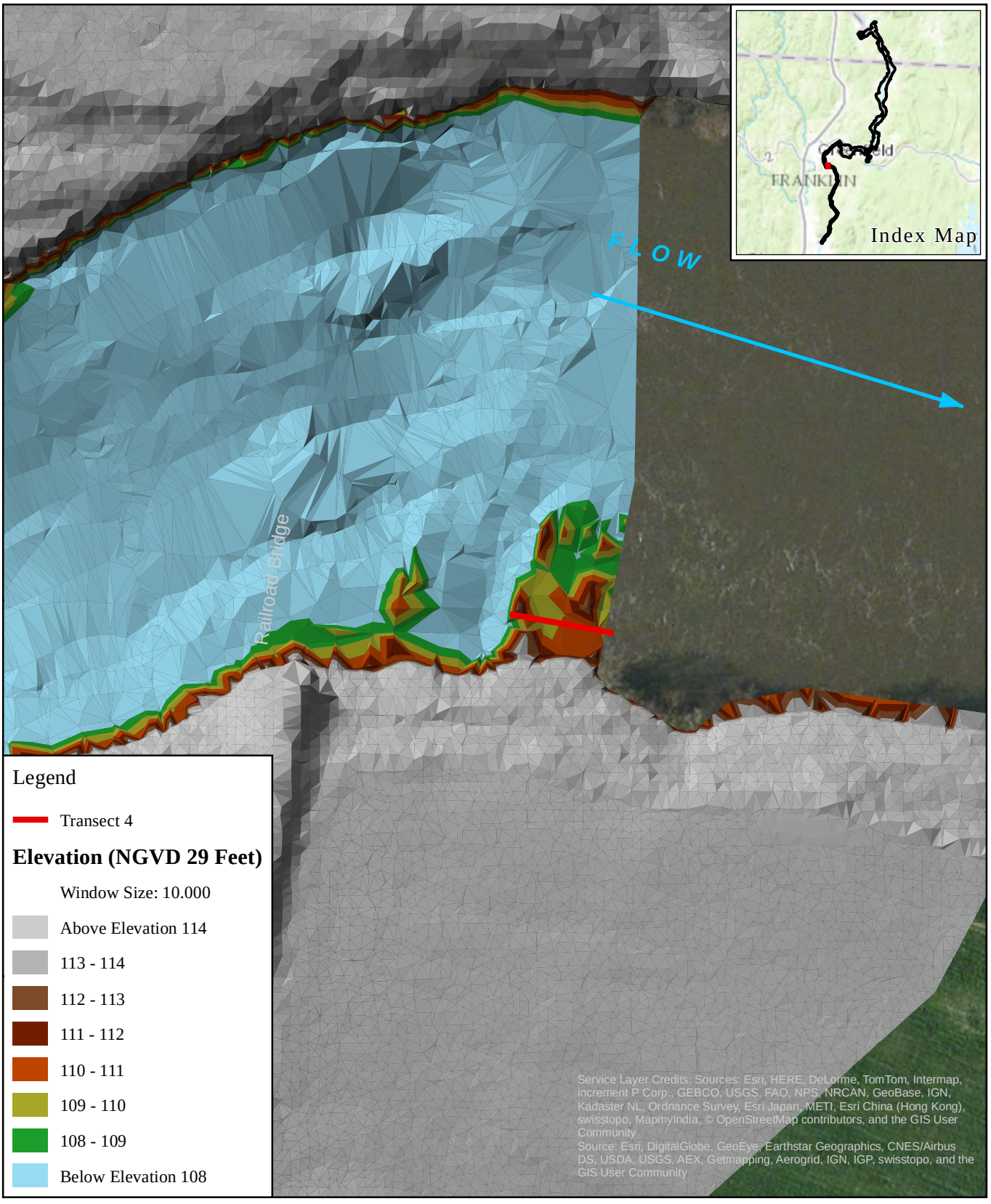
Study 3.5.1 Baseline Inventory of Wetland, Riparian and Littoral Habitat in the Turners Falls Impoundment and Assessment of Operational Impacts on Special Status Species

N

0 165 330 660 Feet

Figure 2.5-11: Mapping of RTE Plant Species and Transect 4 Location

Path: W:\gis\studies\3_5_1\maps\Final_Figures\Study_3_5_1_PUBLIC_Addendum_Mapping of RTE Plant Species and Transect 4 Location.mxd



FirstLight Power Resources

Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)

Study 3.5.1 Baseline Inventory of Wetland, Riparian and Littoral Habitat in the Turners Falls Impoundment and Assessment of Operational Impacts on Special Status Species

N

0 70 140 280 Feet

Figure 2.5-12: Mapping of Transect 4 Location and Digital Terrain Model

Path: W:\gis\studies\3_5_1\maps\Final_Figures\Study_3_5_1_PUBLIC_Addendum Tradescant Aster Transect 4 Digital Terrain Model.mxd

Table 2.5-4. Transect 4 Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Tradescant's Aster (# Stems)	Estimated Percent Vegetation Cover	Substrate
0.0	108.1	-	Low (0-25%)	Bedrock
0.6	109.1	-	Low (0-25%)	Bedrock
1.2	109.2	-	Low (0-25%)	Bedrock
1.8	109.1	-	Low (0-25%)	Bedrock
2.4	109.2	-	Low (0-25%)	Bedrock
3.0	110.1	-	Low (0-25%)	Bedrock
3.7	110.6	-	Low (0-25%)	Bedrock
4.3	110.1	1	Low (0-25%)	Bedrock
4.9	109.9	-	Low (0-25%)	Bedrock
5.5	110.3	4	Low (0-25%)	Bedrock
6.1	110.5	2	Low (0-25%)	Bedrock
6.7	111.4	-	Low (0-25%)	Bedrock
7.3	111.7	11	Low (0-25%)	Bedrock
7.9	111.3	-	Low (0-25%)	Bedrock
8.4	112.2	9	Low (0-25%)	Bedrock
8.8	110.8	-	Low (0-25%)	Bedrock
9.4	111.7	-	Low (0-25%)	Bedrock
10.0	112.4	2	Low (0-25%)	Bedrock
10.3	111.6	-	Low (0-25%)	Bedrock
10.8	112.4	-	Low (0-25%)	Bedrock
11.2	110.9	4	Low (0-25%)	Bedrock
12.0	112.0	-	Low (0-25%)	Bedrock
12.5	111.4	-	Low (0-25%)	Bedrock
13.1	111.4	-	Low (0-25%)	Bedrock
13.7	111.3	-	Low (0-25%)	Bedrock
14.3	111.0	-	Low (0-25%)	Bedrock
15.8	110.9	-	Low (0-25%)	Bedrock
17.4	110.7	-	Low (0-25%)	Bedrock
17.7	109.6	-	Low (0-25%)	Bedrock
18.6	109.7	-	Low (0-25%)	Bedrock
19.2	109.8	-	Low (0-25%)	Bedrock
20.4	110.4	-	Low (0-25%)	Bedrock
20.7	109.7	-	Low (0-25%)	Bedrock
21.4	110.3	-	Low (0-25%)	Bedrock
21.9	110.2	-	Low (0-25%)	Bedrock
22.6	109.3	-	Low (0-25%)	Bedrock
24.7	109.6	-	Low (0-25%)	Bedrock

Station (M)	Elevation (NGVD 29 FT)	Density of Tradescant's Aster (# Stems)	Estimated Percent Vegetation Cover	Substrate
25.9	109.3	-	Low (0-25%)	Bedrock
26.5	110.5	-	Low (0-25%)	Bedrock
27.6	109.7	-	Low (0-25%)	Bedrock
29.3	111.5	-	Low (0-25%)	Bedrock
30.8	111.1	1	Low (0-25%)	Bedrock
32.6	108.6	-	Low (0-25%)	Bedrock

Figure 2.5-13. Representative view of habitat and substrate observed along Transect 4.

Transect T-3 (Bypass Reach)

Comment*: Table 4.3-7, referenced in this section, provides information for Transect 1, not Transect T-3.*

Response:

The incorrect table was identified and linked, the reference should have been "Table 4.3-11: Predicted Water Surface Elevations at IFIM Transect T-3 over a Range of Flows". The appropriate table is included here as Table 2.5-5.

Table 2.5-5: Predicted Water Surface Elevations at IFIM Transect T-3 over a Range of Flows

Flow (cfs)	Water Surface Elevation* (feet) at T-3
150	119
200	119.1
250	119.3
400	119.6
500	119.9
600	120.1
700	120.3
800	120.5
1000	120.8
1200	121.1
1400	121.4
1500	121.5
1600	121.6
1800	121.8
2000	121.9
2500	122.3
3000	122.6
4000	123.2
5000	123.7
6000	124.2
7000	124.6
8000	125.1
9000	125.4
10000	125.8

*WSEL obtained from Reach 2 hydraulic model of the bypass channel.

Comment: *Figure 4.3-30 illustrates the different flows and the elevations where Tradescant's aster was observed. It stated that the flow is maintained at 120 cfs for protection of shortnosed sturgeon "from the date the fishways are closed until the river temp drops to 7°C (usually November 15)." Please include the 120 cfs flow on Figure 4.3-30.*

Response:

The study report figure has been updated and now includes the WSEL for the 120 cfs flow. The figure is provided below as Figure 2.5-14.

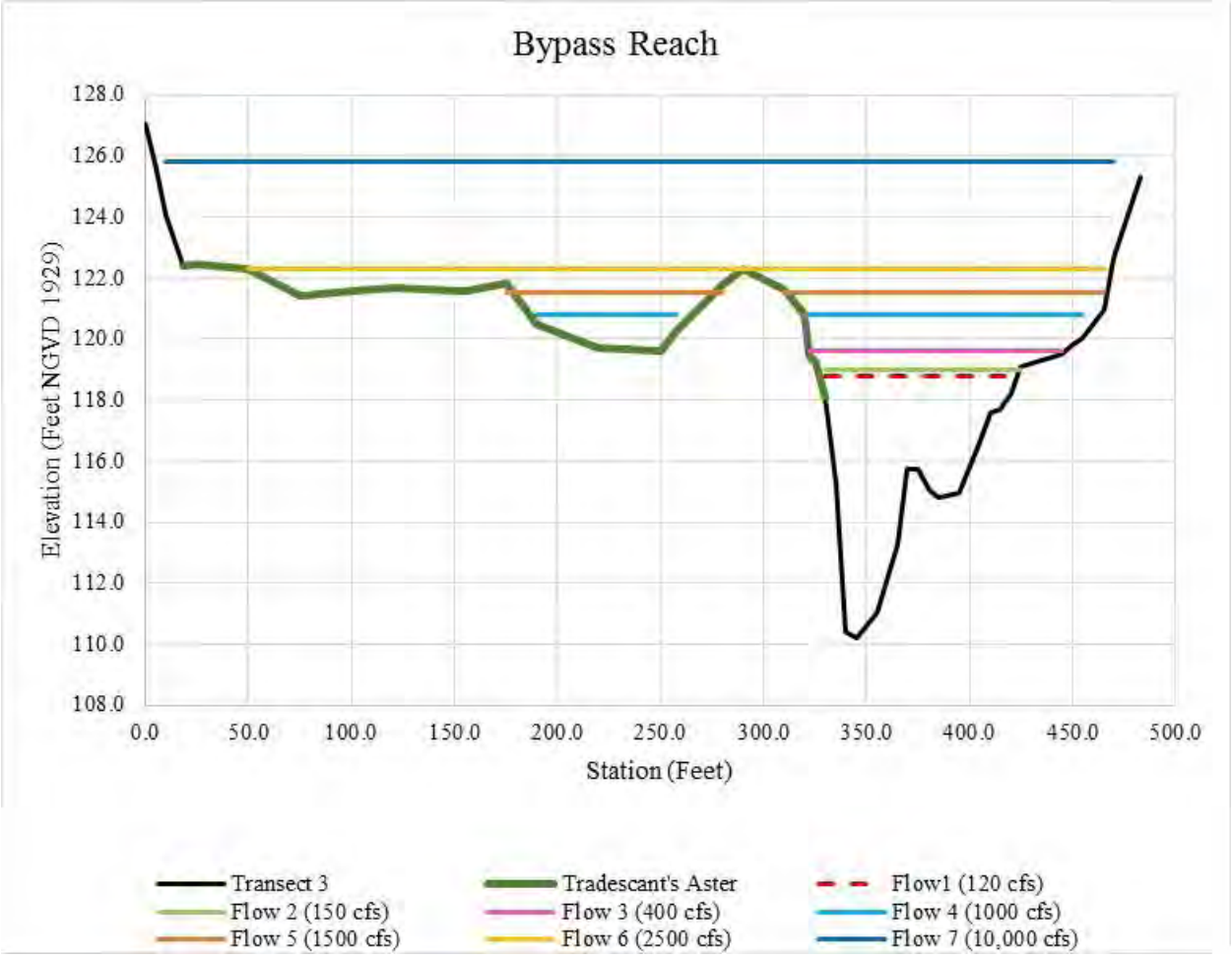


Figure 2.5-14. Updated study report figure 4.3-30 showing WSEL for 120 cfs.

Transects 5A and 5B (Upland White Aster, TFI)

Comment: *Include a description of habitat (e.g., vegetation types, species, shading, substrate, etc.) within the highest elevations, both where plants were observed and where they were not observed in order to assess why plants may not occur at higher elevations.*

Response:

Transect 5A and 5B, are similar in habitat and are located along a sloping bedrock bank with sparse vegetation growing out of cracks and fissures within the bedrock. Portions of the bedrock are wet and support various moss species, due to seepage of groundwater at the base of the forested hillside. The dominant plants associated with the upland white aster at Transect 5A and B are big bluestem, spreading dogbane, harebell (*Campanula rotundifolia*), and New York aster (*Symphyotrichum novi-belgii*). At higher elevations (outside the transect survey) dense growth of common juniper (*Juniperus communis*) and other shrub species appears to shade out the upland white aster and no upland white asters were observed above elevation 184.9 feet (although Transect 5B extended to elevation 187.5 feet). Substrate along the transects are dominated entirely by bedrock. Figure 2.5-15 shows a representative view of Transect 5A and B looking south-easterly across the un-vegetated and vegetated portion of the transects. Table 2.5-6 and 2.5-7 present the survey station, elevation, estimated percent cover of vegetation, and dominant substrate observed at each sample plot location on both Transect 5A and B. In 2014, a total of 11 upland white asters were identified at this location, and in 2015 10 upland white aster were identified along Transect 5A and B. An additional 10 asters were identified and mapped in areas away from the transect locations (Figure 2.5-16).

Figure 2.5-15 Representative photo of habitat at Transect 5A and 5B

Table 2.5-6. Transect 5A Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Upland White Aster (# Stems)	Estimated Percent Vegetation Cover	Substrate
0.0	180.9	-	No Veg	Bedrock
0.3	181.3	-	No Veg	Bedrock
0.6	182.0	-	No Veg	Bedrock
0.9	182.4	-	No Veg	Bedrock
1.2	182.9	-	No Veg	Bedrock
1.5	183.4	-	No Veg	Bedrock
1.8	183.6	-	No Veg	Bedrock
1.9	183.9	-	No Veg	Bedrock
2.1	184.7	3	Low (0-25%)	Bedrock
2.4	184.4	-	Low (0-25%)	Bedrock
2.7	184.8	-	Low (0-25%)	Bedrock
3.0	185.3	2	Low (0-25%)	Bedrock
3.4	185.6	-	Low (0-25%)	Bedrock
3.7	185.9	-	Low (0-25%)	Bedrock
4.0	186.3	-	Low (0-25%)	Bedrock
4.3	186.9	-	Low (0-25%)	Bedrock
4.6	187.5	-	Low (0-25%)	Bedrock

Table 2.5-7. Transect 5B Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Upland White Aster (# Stems)	Estimated Percent Vegetation Cover	Substrate
0.0	181.1	-	No Veg	Bedrock
0.3	181.3	-	No Veg	Bedrock
0.6	181.8	-	No Veg	Bedrock
0.9	182.2	-	No Veg	Bedrock
1.2	182.5	-	No Veg	Bedrock
1.5	182.9	-	No Veg	Bedrock
1.8	183.2	-	No Veg	Bedrock
2.1	183.9	1	No Veg	Bedrock
2.4	184.1	-	Low (0-25%)	Bedrock
2.7	184.6	-	Low (0-25%)	Bedrock
3.0	184.9	4	Low (0-25%)	Bedrock
3.4	185.4	-	Low (0-25%)	Bedrock
3.7	185.9	-	Low (0-25%)	Bedrock
4.0	186.4	-	Low (0-25%)	Bedrock
4.3	186.6	-	Low (0-25%)	Bedrock
4.6	186.8	-	Low (0-25%)	Bedrock
4.9	186.9	-	Low (0-25%)	Bedrock

Figure 2.5-16 Mapping of RTE Plant Species and Transect 5A-5B Location

(Link)

Transect 6A-6C (Upland White Aster, TFI)

Comment: *It appears that these transects did not extent up gradient of observed state-listed plants. The division requests that these transects be extended up-gradient of the population in order to provide additional information on habitat suitability preferences. Include a description of habitat (e.g., vegetation types, species, shading, substrate, etc.) within the highest elevations, both where plants were observed and where they were not observed, in order to assess why plants may not occur at higher elevations.*

Response:

Transects 6A and 6C were all established within similar habitat (Table 2.5-8, 2.5-9, and 2.5-10). At this location there is a bedrock shelf which rises nearly vertically from the water's edge. Habitat is dominated by herbaceous vegetation such as big bluestem, calico aster (Symphyotrichum lateriflorum), common St. Johns wort (*Hypericum perforatum*) growing in a thin layer of soil over bedrock (Figure 2.5-17). This herbaceous extends a short distance (i.e., six to 11 feet) before the bank steepens and an overstory white pine (*Pinus strobus*) and eastern hemlock (*Tsuga canadensis*) provide significant shading. Transect 6B is similar topographically, although the entire transect up to the forest transition is exposed bedrock with very sparse vegetation. The transects all extend from the water's edge to the interface of the open meadow and forest. Within the forest there is very little herbaceous understory due to overystory shading. No upland white asters were observed within the forested habitat at this location in 2014 or 2015. Based on observations, the transects are established within the suitable habitat of the upland white aster; areas further upslope appear to be unsuitable due to the shading provided by pine and hemlock. Figure 2.5-18 shows the location of identified and mapped upland white aster at this location in 2014 and 2015.

Figure 2.5-17. Representative view of suitable upland white aster habitat at the Transect 6A-6C location.

Table 2.5-8. Transect 6A Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Upland White Aster (# Stems)	Estimated Percent Vegetation Cover	Substrate
0.0	181.1	-	Water	N/A
0.1	182.8	-	High (51-100%)	Shallow to bedrock
0.6	183.8	-	High (51-100%)	Shallow to bedrock
0.5	185.3	-	High (51-100%)	Shallow to bedrock
0.9	185.5	-	High (51-100%)	Shallow to bedrock
1.2	185.7	-	High (51-100%)	Shallow to bedrock
1.5	186.3	-	High (51-100%)	Shallow to bedrock
1.8	186.7	-	High (51-100%)	Shallow to bedrock
2.1	187.5	4	High (51-100%)	Shallow to bedrock
2.4	187.6	-	High (51-100%)	Shallow to bedrock

Table 2.5-9. Transect 6B Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Upland White Aster (# Stems)	Estimated Percent Vegetation Cover	Substrate
0.0	181.4	-	Low (0-25%)	Bedrock
0.3	182.0	-	Low (0-25%)	Bedrock
0.6	182.7	-	Low (0-25%)	Bedrock
0.9	183.0	-	Low (0-25%)	Bedrock
1.2	183.1	-	Low (0-25%)	Bedrock
1.5	184.1	-	Low (0-25%)	Bedrock
1.8	183.6	-	Low (0-25%)	Bedrock
2.1	184.2	5	Low (0-25%)	Bedrock
2.4	184.9	-	Low (0-25%)	Bedrock
2.7	184.7	-	Low (0-25%)	Bedrock
3.0	184.9	5	Low (0-25%)	Bedrock
3.4	185.9	-	Low (0-25%)	Bedrock

Table 2.5-10. Transect 6C Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Upland White Aster (# Stems)	Estimated Percent Vegetation Cover	Substrate
0.0	181.5	-	Water	N/A
0.3	183.9	-	High (51-100%)	Shallow to Bedrock
0.6	184.7	-	High (51-100%)	Shallow to Bedrock
0.9	185.4	-	High (51-100%)	Shallow to Bedrock
1.2	185.2	3	High (51-100%)	Shallow to Bedrock
1.5	184.8	-	High (51-100%)	Shallow to Bedrock
1.8	185.3	-	High (51-100%)	Shallow to Bedrock

Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)

Study 3.5.1 Baseline Inventory of Wetland, Riparian and Littoral Habitat in the Turners Falls Impoundment and Assessment of Operational Impacts on Special Status Species

N

0 30 60 120 Feet

Figure 2.5-18:
Mapping of RTE Plant Species and Transect 6A,6B, and 6C Location

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Transect 11A-11D (Intermediate Spike Sedge, TFI, Pauchaug) - continued

Comment: *Revise Figures 4.3-46 through 4.3-49 to show the locations or elevations at which state-listed plants were observed.*

Response:

In 2014 intermediate spike sedge was identified at the Pauchaug survey location, however, no elevation data was collected in 2014. The location of intermediate spike sedge was not relocated in 2015, and therefore it is not possible to identify the elevation at which the sedge occurred at in 2015. Frank's love grass was identified at elevation 187.2 on Transect 11D, an updated Figure 4.3-49 is included here as Figure 2.5-19 which identifies the location of Frank's love grass on Transect 11D.

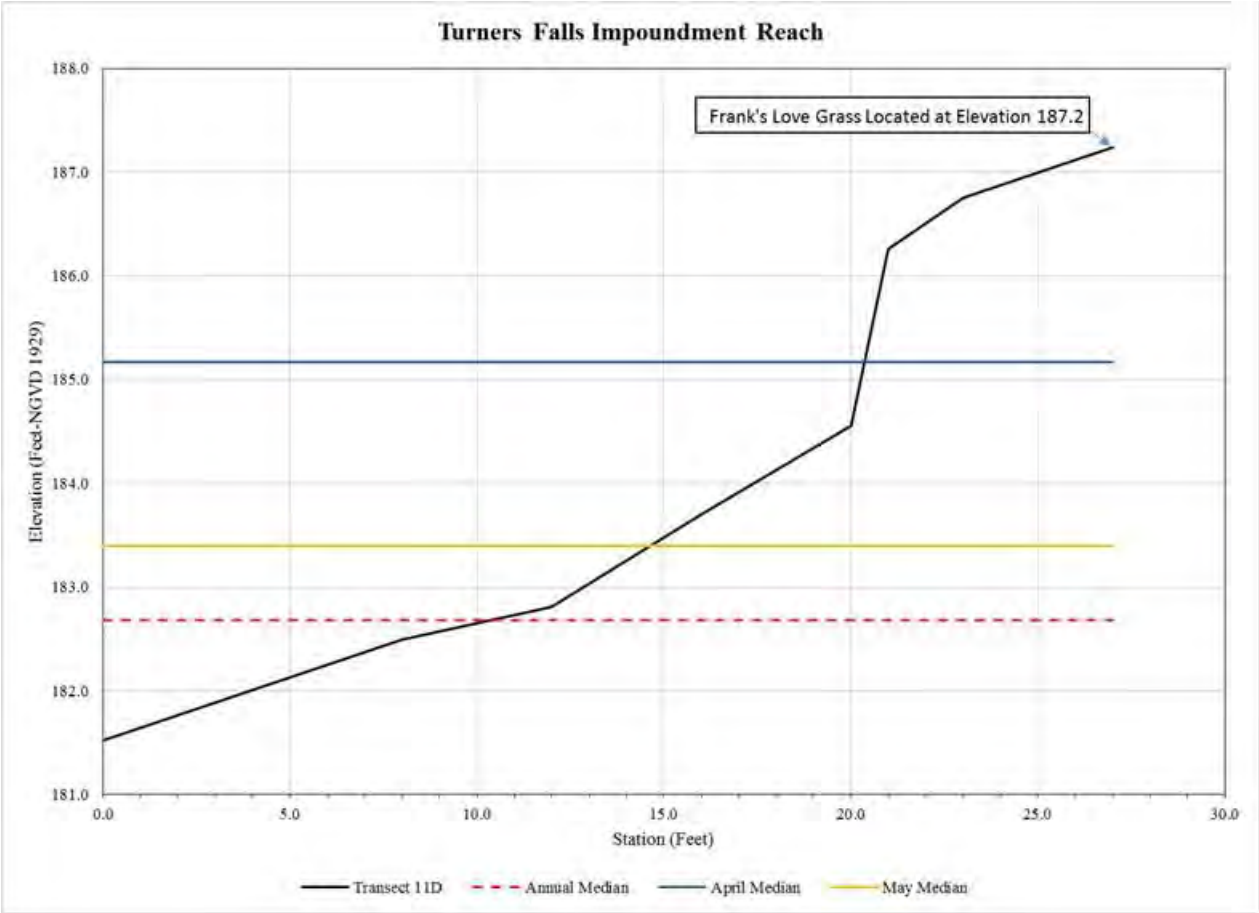

Figure 2.5-19. Updated study report Figure 4.3-19 identifying the location of Frank's love grass on Transect 11.

Transect 6A-6C (Upland White Aster, TFI) - continued

Comment: *The report states that no state-listed spike sedges were observed in this location. However, Figure 4.3-1 suggests that intermediate spike sedge was observed on or near Transect 11D. The report should be updated to resolve this conflict.*

Response:

Intermediate spike sedge was observed and mapped in 2014. In 2015 intermediate spike sedge was not re-located at this location (Figure 2.5-20). Transect 11D was established in the vicinity of the occurrence identified in 2014; however, no elevation data is available from the 2014 documentation.

Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)

Study 3.5.1 Baseline Inventory of Wetland, Riparian and Littoral Habitat in the Turners Falls Impoundment and Assessment of Operational Impacts on Special Status Species

N

0 50 100 200 Feet

Figure 2.5-20: Mapping of RTE Plant Species and Transect 11A-11D Location

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Transect 11A-11D (Spike rush and Frank's love grass, TFI)

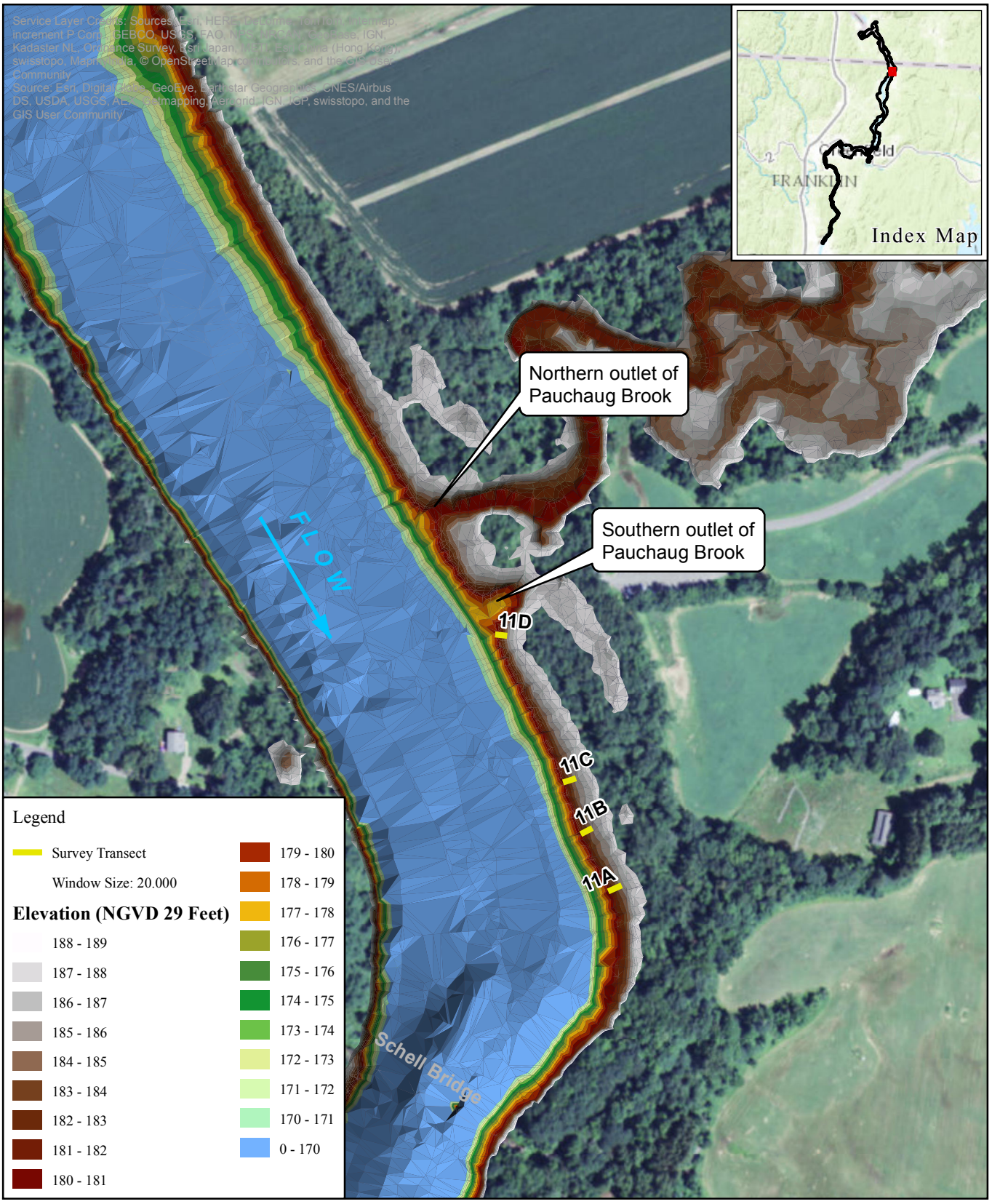
Comment: *Previous observations for intermediate spike sedge, wrights spike-sedge, ovate spike-sedge, and Frank's love grass occurred on the east bank north of Pauchaug Brook's northern outlet as well as between its northern and southern outlets. However, transects only appear to have been placed in a subset of suitable habitat south of the southern outlet, which was not approved by the division. The report should be revised to include information justifying selection of transect locations at this site, including data confirming that existing transects provide an accurate portrayal of conditions for the site as a while.*

Response:

In 2015, the transect locations were selected based in part on the known location of the intermediate sedge identified during survey work completed in 2014 and also because the habitat within the Pauchaug area is very similar on both the north, central, and southern sides of the Pauchaug outlets. Due to problematic coverage with the cellular signal required to collect survey grade GPS data all transects were established on the southern side of Pauchaug in order to ensure data collection was consistent at all locations. In addition, Transect 11D intersected the only occurrence of Frank's love grass based on 2014 and 2015 survey work. Habitat within the entire area is similar, and consists of a narrow band of exposed silt/fine textured material that slopes to a sandy berm where moderate to dense coverage of vegetation is present (Figure 2.5-21). The area near the berm where vegetation begins to occur is likely the preferred habitat of the spike-sedges. The berm at its edge is densely vegetated with wool grass (*Scirpus cyperinus*), common spikerush (*Eleocharis palustris*), joe-pye weed (*Eutrochium purpureum*), and reed-canary grass (*Phalaris arundinacea*). At the higher elevations vegetation becomes dominated by very dense growth of spiny cocklebur (*Xanthium strumarium*); this transition is shown in Figure 2.5-22. Further landward, and above the survey transects habitat transitions to a hardwood floodplain with an overstory of silver maple (*Acer saccharinum*) and cottonwood (*Populus deltoides*). Figure 2.5-23 shows the digital terrain model of the area around Pauchaug, which depicts the similarity in slope configurations across all the survey transects as well as those areas to the north. Based on this, the transects established in 2015, while different than those proposed, provide an accurate depiction of the suitable and un-suitable habitat for spikerush species in the area. Tables 2.5-11, 2.5-12, 2.5-13, and 2.5-14 provide elevation and habitat data for each of the Transects (11A through 11D, respectively) at this location. It appears that suitable habitat for intermediate spikerush is likely found between elevations 182.0 and 184.0 in areas of low growing herbaceous vegetation, and adjacent to the areas of dense wool grass. The observation of Frank's love grass, made on Transect 11D, was made on a footpath (Figure 2.5-24), so while located at a higher elevation dense spiny cocklebur was not present as with other transects at this location.

Figure 2.5-21. Representative view of habitat observed at Transect 11A-11D showing un-vegetated and vegetated areas.

Figure 2.5-22. Representative view of habitat observed at Transect 11A-11D showing the transition from wool grass to spiny cocklebur vegetation.



FirstLight Power Resources

Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)

Study 3.5.1 Baseline Inventory of Wetland, Riparian and Littoral Habitat in the Turners Falls Impoundment and Assessment of Operational Impacts on Special Status Species

N

0 165 330 660 Feet

Figure 2.5-23: Mapping of RTE Transect 11A-11D Location and Digital Terrain Model

Path: W:\gis\studies\3_5_1\maps\Final_Figures\Study_3_5_1_PUBLIC_Addendum_Mapping of RTE Plant Species and Transect 11A-11D Location and Digital Terrain Model.mxd

Table 2.5-11 Transect 11A Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Rare Species	Estimated Percent Vegetation Cover	Substrate
0.0	181.7	-	No Vegetation	Silty/fine
0.6	181.8	-	No Vegetation	Silty/fine
1.2	182.2	-	No Vegetation	Silty/fine
2.4	182.7	-	No Vegetation	Silty/fine
3.7	183.1	-	No Vegetation	Silty/fine
4.9	183.6	-	No Vegetation	Silty/fine
6.1	184.0	-	High (51-100%)	Sandy
7.0	184.4	-	High (51-100%)	Sandy
7.6	185.4	-	High (51-100%)	Sandy
8.2	185.5	-	High (51-100%)	Sandy
8.8	185.8	-	High (51-100%)	Sandy
9.4	186.0	-	High (51-100%)	Sandy
10.1	186.1	-	High (51-100%)	Sandy
11.3	186.3	-	High (51-100%)	Sandy

Table 2.5-12 Transect 11B Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Rare Species	Estimated Percent Vegetation Cover	Substrate
0.0	182.3	-	No Vegetation	Silty/fine
1.2	183.2	-	No vegetation	Silty/fine
2.4	184.0	-	High (51-100%)	Silty/fine
2.6	183.8	-	High (51-100%)	Silty/fine
3.7	183.8	-	High (51-100%)	Sandy
5.5	184.7	-	High (51-100%)	Sandy
5.8	185.7	-	High (51-100%)	Sandy
6.4	185.8	-	High (51-100%)	Sandy
7.0	186.1	-	High (51-100%)	Sandy
8.2	186.3	-	High (51-100%)	Sandy
9.1	186.9	-	High (51-100%)	Sandy

Table 2.5-13 Transect 11C Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Rare Species	Estimated Percent Vegetation Cover	Substrate
0.0	181.8	-	No Vegetation	Silty/fine
1.2	182.4	-	No Vegetation	Silty/fine
2.4	182.6	-	No Vegetation	Silty/fine
3.7	183.4	-	High (51-100%)	Sandy
4.3	184.1	-	High (51-100%)	Sandy
4.6	185.2	-	High (51-100%)	Sandy
5.8	185.7	-	High (51-100%)	Sandy
7.0	185.6	-	High (51-100%)	Sandy
8.2	187.4	-	High (51-100%)	Sandy
9.4	187.6	-	High (51-100%)	Sandy
10.7	187.9	-	High (51-100%)	Sandy

Table 2.5-14 Transect 11D Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Frank's Love Grass (# Stems)	Estimated Percent Vegetation Cover	Substrate
0.0	181.5	-	No Vegetation	Silty/fine
1.2	182.0	-	No Vegetation	Silty/fine
2.4	182.5	-	No Vegetation	Silty/fine
3.7	182.8	-	No Vegetation	Silty/fine
4.9	183.7	-	High (51-100%)	Sandy
6.1	184.6	-	High (51-100%)	Sandy
6.4	186.3	-	High (51-100%)	Sandy
7.0	186.8	-	High (51-100%)	Sandy
8.2	187.2	1	Low (0-25%)	Sandy

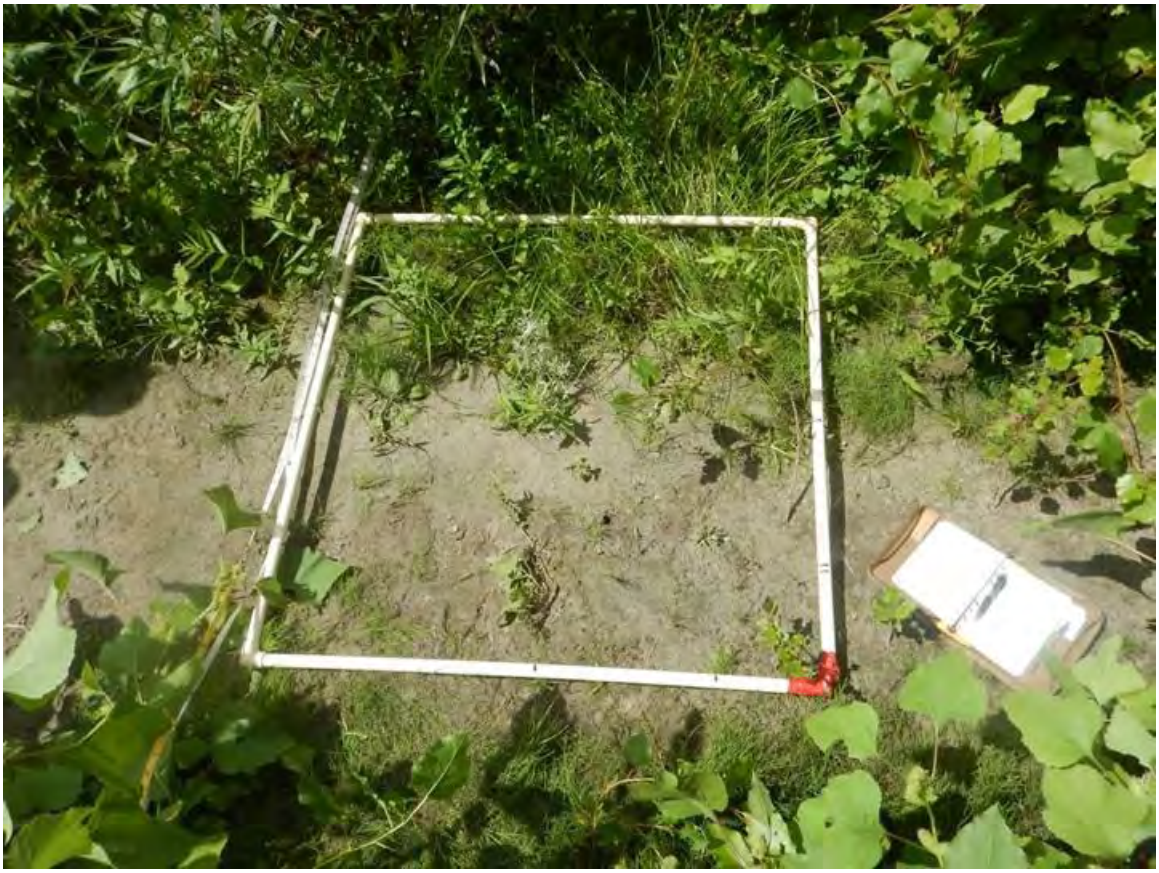


Figure 5.2-24. View of walking path where observation of Frank's love grass was made at Transect 11D.

Transect 8 (Sandbar Cherry, TFI near Stebbins Island)

Transect 8 is located on the upstream end of Stebbins Island and the transect runs in a west to east direction. Initially the transect begins in an area of un-vegetated cobble and then transitions at station 15.5 (meters) to a densely vegetated habitat with sandy soils (Table 2.5-15). Vegetation along this transect is dominated by switchgrass and deer tongue grass as well as several other sub-dominant herbaceous species. Vegetation at this location is much more diverse than species associated with (Transect 3). Figure 2.5-25 is a representative view of habitat along much of Transect 8 which consists of a variety of herbaceous vegetation and sandbar cherry. In 2014, approximately 50 sandbar cherries were identified at the Stebbins Island location and in 2015, 81 sandbar cherry clumps were identified along Transect 8, all of which occurred within the densely vegetated areas (Figure 2.5-26).

Table 2.5-15 Transect 8 Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Cherry (#Clumps)	Estimated Percent Vegetation Cover	Substrate
0.0	181.9	-	No Vegetation	Cobble
1.2	182.3	-	No Vegetation	Cobble
2.4	182.6	-	No Vegetation	Cobble
3.7	182.5	-	No Vegetation	Cobble
4.9	182.6	-	No Vegetation	Cobble
6.1	182.6	-	No Vegetation	Cobble
7.3	182.6	-	No Vegetation	Cobble
8.5	181.9	-	No Vegetation	Cobble
9.8	182.1	-	No Vegetation	Cobble
11.0	182.0	-	No Vegetation	Cobble
12.2	182.6	-	No Vegetation	Cobble
13.4	182.6	-	No Vegetation	Cobble
14.6	182.6	-	No Vegetation	Cobble
15.8	183.4	-	No Vegetation	Cobble
15.5	185.0	-	No Vegetation	Cobble
16.8	184.9	-	High (51-100%)	Sandy
18.0	185.0	-	High (51-100%)	Sandy
19.2	185.4	-	High (51-100%)	Sandy
20.4	185.6	-	High (51-100%)	Sandy
21.6	185.4	-	High (51-100%)	Sandy
22.9	185.6	-	High (51-100%)	Sandy
24.1	186.1	-	High (51-100%)	Sandy
25.3	186.8	-	High (51-100%)	Sandy
26.5	186.1	-	High (51-100%)	Sandy
27.7	186.3	-	High (51-100%)	Sandy
29.0	186.0	-	High (51-100%)	Sandy
30.2	186.6	-	High (51-100%)	Sandy
31.4	186.8	-	High (51-100%)	Sandy
32.6	186.7	-	High (51-100%)	Sandy
33.8	186.8	-	High (51-100%)	Sandy
35.1	187.0	-	High (51-100%)	Sandy
36.3	187.5	-	High (51-100%)	Sandy
37.5	188.8	8	High (51-100%)	Sandy
38.7	188.5	6	High (51-100%)	Sandy
39.9	188.2	11	High (51-100%)	Sandy
41.1	188.6	10	High (51-100%)	Sandy

Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Cherry (#Clumps)	Estimated Percent Vegetation Cover	Substrate
42.4	189.3	12	High (51-100%)	Sandy
43.6	189.8	8	High (51-100%)	Sandy
44.8	190.0	3	High (51-100%)	Sandy
46.0	189.6	3	High (51-100%)	Sandy
47.2	188.4	4	High (51-100%)	Sandy
48.5	189.4	-	High (51-100%)	Sandy
49.7	189.6	10	High (51-100%)	Sandy
50.9	190.4	6	High (51-100%)	Sandy
52.1	191.5	-	High (51-100%)	Sandy
53.3	192.3	-	High (51-100%)	Sandy
54.6	192.3	-	High (51-100%)	Sandy
55.8	191.9	-	High (51-100%)	Sandy
57.0	192.0	-	High (51-100%)	Sandy
58.2	191.3	-	High (51-100%)	Sandy
59.4	190.7	-	High (51-100%)	Sandy
60.0	190.7	-	High (51-100%)	Sandy

Figure 2.5-25. View of representative vegetated habitat along Transect 8.

Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)

Study 3.5.1 Baseline Inventory of Wetland, Riparian and Littoral Habitat in the Turners Falls Impoundment and Assessment of Operational Impacts on Special Status Species

N

0 165 330 660 Feet

Figure 2.5-26: Mapping of RTE Plant Species and Transect 8 Location

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Transect 9A and 9B (Sandbar Cherry, Downstream of small island downstream of Vernon Dam, TFI)

Two transects were established at this location. Habitat on the small island is dominated by low to medium cover and substrates are dominated by cobble and sand. Figure 2.5-27 shows representative habitat found along 9A and 9B. In general, areas of cobble were less vegetated and dominated by spreading dogbane and sandbar cherry. Sandy areas were more vegetated and were dominated by Indiangrass (*Sorghastrum nutans*) and spreading dogbane. As with other sandbar cherry locations, sandy soils seem to be the preferred habitat, although at the Transect 9 location sandbar cherries were observed within cobble substrates (Table 2.5-16 and 2.5-17).

Figure 2.5-27. Representative habitat at Transect 9A and 9B, view looing to the north.

2.5-16 Transect 9A Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Cherry (#Clumps)	Estimated Percent Vegetation Cover	Substrate
0.0	184.1	-	Low (0-25%)	Cobble
1.2	185.0	-	Low (0-25%)	Cobble
2.4	186.1	-	Low (0-25%)	Cobble
3.7	187.0	-	Low (0-25%)	Cobble
4.9	187.7	-	Low (0-25%)	Cobble
5.5	188.0	-	Low (0-25%)	Cobble
6.1	188.4	1	Medium (26-50%)	Cobble
7.3	188.2	1	Medium (26-50%)	Sand
8.5	188.2	-	Medium (26-50%)	Sand
9.8	188.5	-	Medium (26-50%)	Sand
11.0	188.8	-	Medium (26-50%)	Sand
12.2	188.5	-	Medium (26-50%)	Sand
13.4	188.2	-	Medium (26-50%)	Sand
14.0	187.9	-	Medium (26-50%)	Sand
14.6	187.6	-	Medium (26-50%)	Sand
15.2	187.0	-	Medium (26-50%)	Sand
15.3	183.8	-	Medium (26-50%)	Sand

Table 2.5-17 Transect 9B Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Cherry (#Clumps)	Estimated Percent Vegetation Cover	Substrate
0.0	184.1	-	Low (0-25%)	Cobble
1.2	185.0	-	Low (0-25%)	Cobble
2.4	186.0	-	Low (0-25%)	Cobble
3.7	186.5	-	Low (0-25%)	Cobble
4.9	187.5	1	Medium (26-50%)	Sand
6.1	187.6	1	Medium (26-50%)	Sand
7.3	187.4	1	Medium (26-50%)	Sand
8.5	187.4	-	Medium (26-50%)	Sand
9.8	188.0	-	Medium (26-50%)	Sand
10.1	186.2	-	Medium (26-50%)	Sand
10.4	185.6	-	Medium (26-50%)	Sand
10.7	185.7	-	Medium (26-50%)	Sand
11.0	185.1	-	Medium (26-50%)	Sand
11.6	184.4	-	Medium (26-50%)	Sand

Transect 10 (Mountain Alder and Sandbar Willow, just downstream of Vernon Dam, TFI)

Transect 10 is a steeply sloping transect that extends up a boulder dominated hillside. Vegetation here is sparse (0-25%) and dominated by spreading dogbane, mountain alder, and sandbar willow (Figure 2.5-28). Sandbar willow occurs primarily at the lower elevations while the mountain alder occurs much higher on the transect, occupying elevation 197.67 feet (Table 2.5-18).

Figure 2.5-28. Representative view of habitat on Transect 10.

Table 2.5-18 Transect 10 Estimated Vegetative Cover and Substrate Information

Station (M)	Elevation (NGVD 29 FT)	Density of Sandbar Willow (#Clumps)	Density of Mountain Alder (#Clumps)	Estimated Percent Cover of Vegetation	Substrate
0.0	184.78	-	-	Low (0-25%)	Boulder
0.6	184.89	-	-	Low (0-25%)	Boulder
1.2	186.55	5	-	Low (0-25%)	Boulder
1.8	187.23	-	-	Low (0-25%)	Boulder
2.4	187.21	1	-	Low (0-25%)	Boulder
3.0	187.97	2	-	Low (0-25%)	Boulder
3.7	189.35	-	-	Low (0-25%)	Boulder
4.3	189.89	1	-	Low (0-25%)	Boulder
4.9	190.01	-	-	Low (0-25%)	Boulder
5.5	190.96	1	-	Low (0-25%)	Boulder
6.1	192.24	-	-	Low (0-25%)	Boulder
6.7	192.36	-	-	Low (0-25%)	Boulder
7.3	193.61	-	-	Low (0-25%)	Boulder
7.9	194.37	-	-	Low (0-25%)	Boulder
8.5	194.99	-	-	Low (0-25%)	Boulder
9.1	195.40	-	-	Low (0-25%)	Boulder
9.8	196.15	-	-	Low (0-25%)	Boulder
10.4	196.45	-	-	Low (0-25%)	Boulder
11.0	197.67	-	1	Low (0-25%)	Boulder
11.6	197.00	-	-	Low (0-25%)	Boulder
12.2	197.14	-	-	Low (0-25%)	Boulder
13.4	197.82	-	-	Low (0-25%)	Boulder

3 RESPONSE TO FERC DETERMINATION

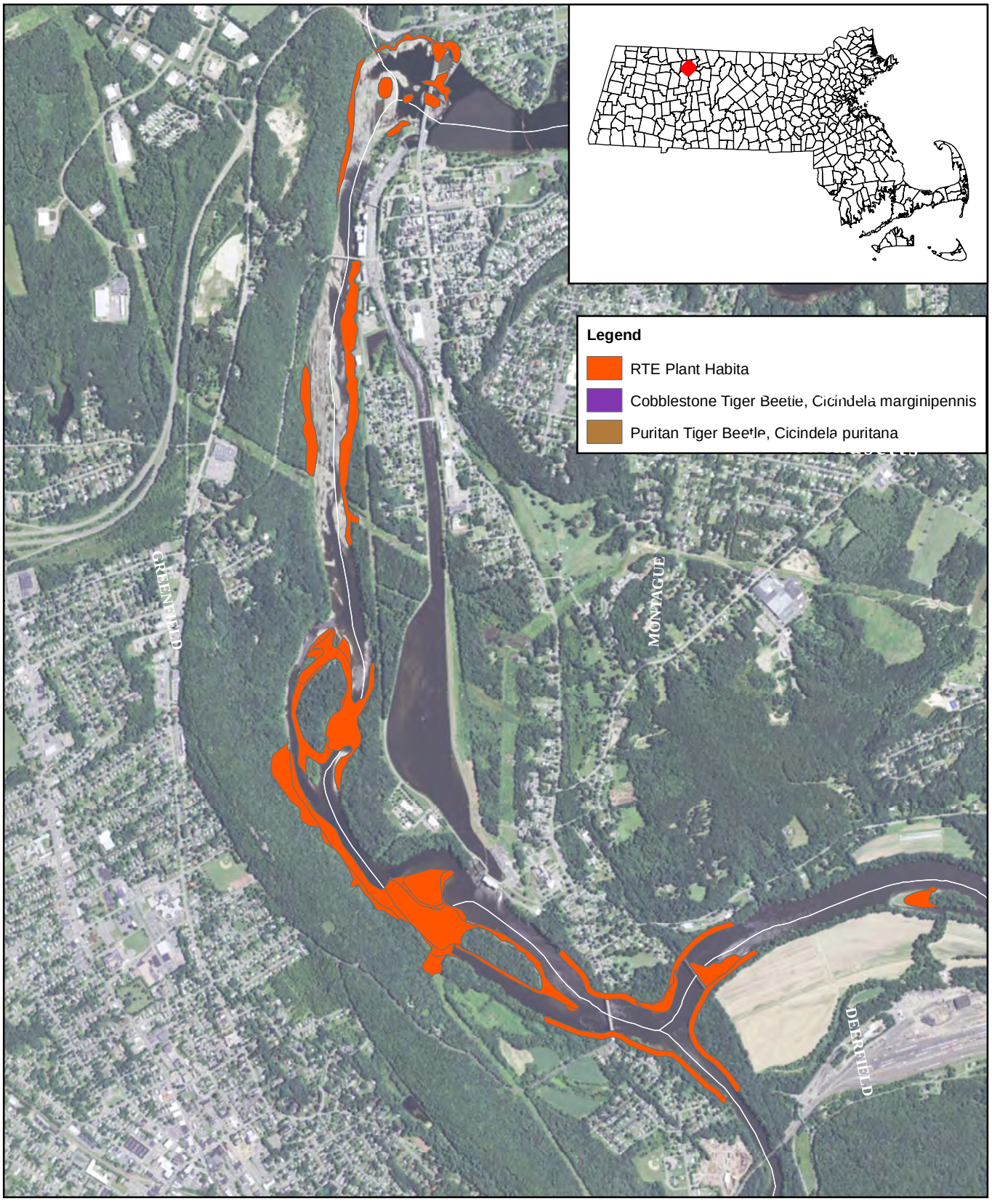
Comment: *Copies of the maps of historic and potentially suitable habitat for state-listed plants used by FirstLight to develop its survey locations.*

Response:

Table 3.0-1 lists historic rare plant element occurrences provided by the Natural Heritage and Endangered Species Program (NHESP) on November 18, 2013 for identification of rare species potentially within the study area. In addition spatial data showing the location of potential habitat, based on historic occurrence information, which was provided by NHESP, was used to develop maps suitable potential habitat and survey areas. This mapping is shown in Figure 3.0-1, Figure 3.0-2, and Figure 3.0-3, however specific information related to the location of individual species was removed at the request of the NHESP due to the sensitive nature of the data.

Table 3.0-1. Historic location information for rare plant species potential located within the Study Area.

At the request of the NHESP this table was removed due to sensitive information related to the location of rare plant species.



FirstLight Power Resources

FIRSTLIGHT POWER RESOURCES

ESA Studies

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0 500 1,000 2,000 3,000 4,000 Feet

Figure 3.0-1:
Mapping of Turner's Falls ESA Study Areas

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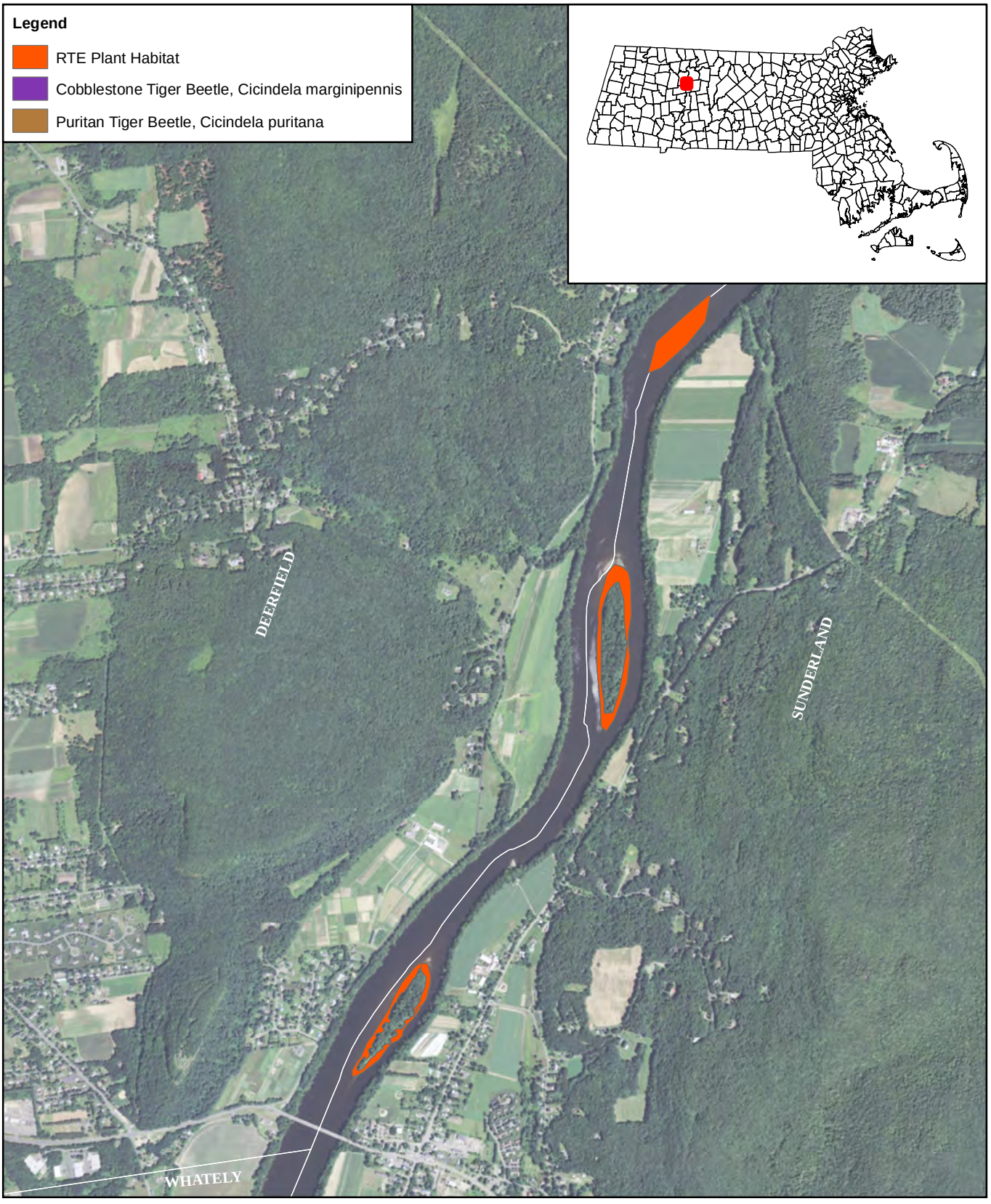

FirstLight Power Resources

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FIRSTLIGHT POWER RESOURCES

ESA Studies

0 500 1,000 2,000 3,000 4,000 Feet

Figure 3.0-2:
Mapping of Sunderland ESA Study Areas

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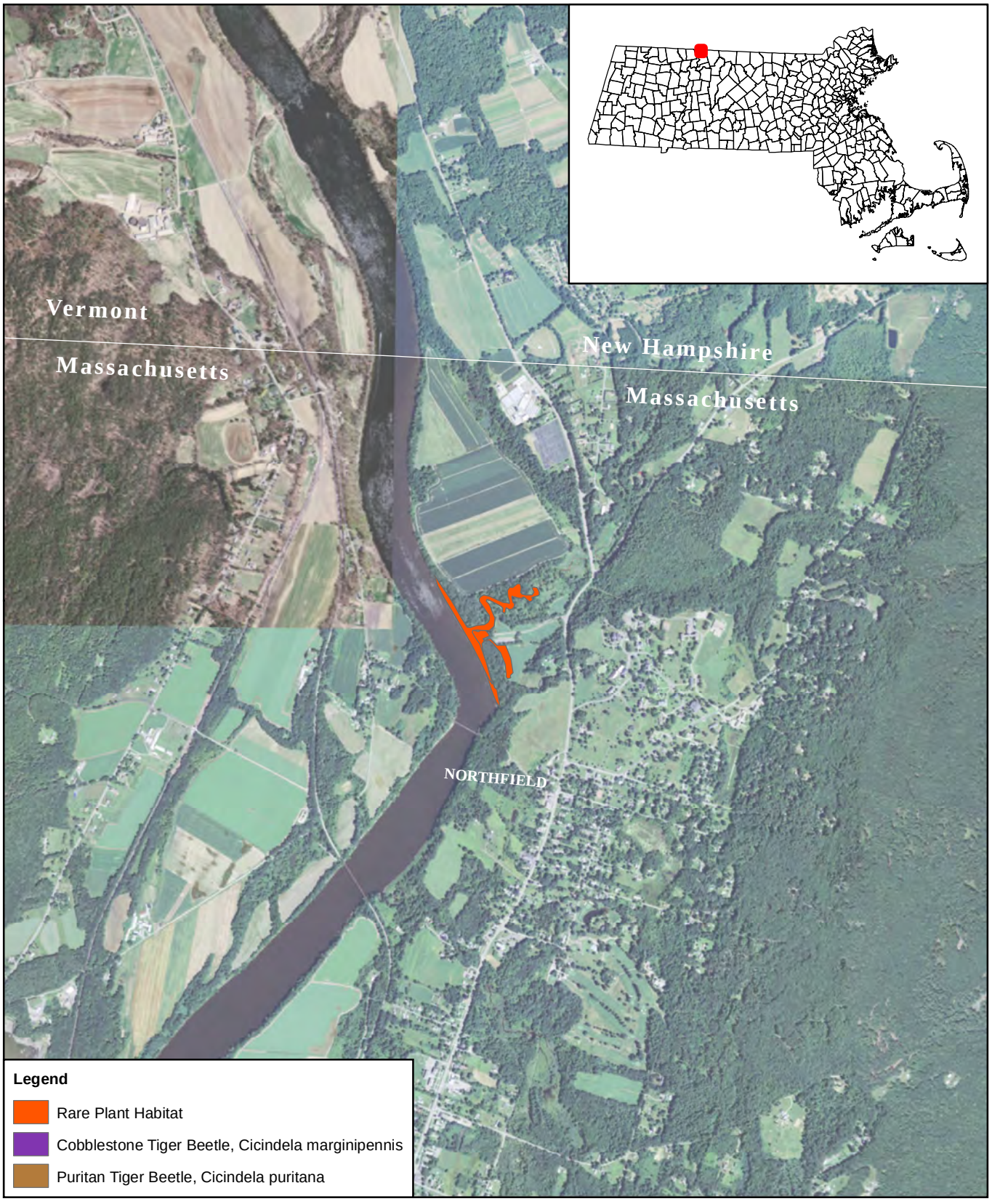

FirstLight Power Resources

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FIRSTLIGHT POWER RESOURCES

ESA Studies

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Figure 3.0-3:
Mapping of Northfield ESA Study Areas

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Comment: *A description of habitat suitability preferences used for each of the identified state-listed plant species and a discussion of how these preferences were determined;*

Response:

In 2014, FirstLight's environmental consultants (Kleinschmidt Associates and New England Environmental) completed on-the-ground reconnaissance surveys at known and historic occurrence areas (confidential locations provided by NHESP) and potential habitats in the Turners Falls Impoundment and from Turners Falls Dam to the Route 116 Bridge in Sunderland. Field efforts particularly focused on target plant communities that exhibit meta-populations based on habitat preference documented by the NHESP species fact sheets and through an on-site consultation with NHESP staff (Jesse Leddick & Karro Frost on October 22, 2014).

The following briefly describes the habitat preferences used to identify search locations for rare species identified by the NHESP. The mountain alder, in Massachusetts, is primarily found on exposed ledges, boulders, and cobble bars. Often these habitats coincide with high energy rivers. Habitat for the intermediate spike sedge includes marshes and freshwater mudflats, or areas with muddy substrates. Upland white aster prefers rocky outcrops of sandstone, shale, or limestone. It is commonly found growing in cracks or fissures in bedrock outcrops. The upland white aster requires significant sunlight exposure. Sandbar cherry, in Massachusetts, rarely grows above three feet in height. The species prefers flood-scoured areas, often along islands and shores. Habitat is generally dominated by cobble, gravel, and sloping rock, at or, near the high-water line. In Massachusetts, the sandbar willow is commonly found on islands, sandbars, and beaches within the flood zone. It prefers sandy, gravely, or rocky substrates that are tied closely to the annual flood regimes and disturbance from WSEL fluctuations and are subjected to annual inundation by high water. The Tradescant’s aster is typically found rooted in fissures and cracks of rocky stream shores or river banks and are generally subjected to flooding throughout the year.

Comment: *Copies of data collected regarding plant health and vigor and any additional information collected regarding plant flowering and reproduction and habitat quality;*

Response:

During the course of survey work completed in the 2014 and 2015 field season, all identified plants appeared to be healthy, although specific measurements of individual plants were not collected as the populations identified were large, and height measurements were not feasible given the time constraints of the field season. Information related to flowering and reproduction was not collected, as it was not identified in the study plan as information necessary to support study objectives.

Comment: *Information on how plant population densities varied with water surface elevation.*

Response:

This request is discussed in detail in Section 2.4.