

# Relicensing Study 3.3.15

## Assessment of Sea Lamprey Spawning within Turners Falls Project and Northfield Mountain Project Area

### ADDENDUM 1

## Impact on Sea Lamprey Spawning Nests near Stebbins Island

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

*Prepared for:*



*Prepared by:*



**MAY 2018**

**TABLE OF CONTENTS**

**1 INTRODUCTION.....1-1**  
**2 ANALYSIS.....2-1**

## **LIST OF TABLES**

|  |     |
|--|-----|
| Table 2-1: Sea Lamprey Spawning Redd Generation Location, Identification Number and Redd Channel Bed Elevation ..... | 2-1 |
|--|-----|

## **LIST OF FIGURES**

|   |     |
|---|-----|
| Figure 2-1: Lamprey Redds Identified Near Stebbins Island on the Connecticut River during 2015 Surveys .....  | 2-3 |
| Figure 2-2 Water Surface Elevation Duration Curve at Sea Lamprey Spawning Locations (219-1 and 219-2), Upstream End of Stebbins Island, Based on hourly modeled data from May 20-July 31 for 2000-2015 (not 2010) .....                   | 2-4 |
| Figure 2-3 Water Surface Elevation Duration Curve at Sea Lamprey Spawning Locations (182 and 217), Left Side of Stebbins Island Looking Downstream, Based on hourly modeled data from May 20-July 31 for 2000-2015 (not 2010) .....       | 2-5 |
| Figure 2-4 Water Surface Elevation Duration Curve at Sea Lamprey Spawning Locations (220, 221 and 222), Right Side of Stebbins Island Looking Downstream, Based on hourly modeled data from May 20-July 31 for 2000-2015 (not 2010) ..... | 2-6 |

## **LIST OF ABBREVIATIONS**

|                  |  |
|------------------|--|
| CRC              | Connecticut River Conservancy                  |
| FERC             | Federal Energy Regulatory Commission           |
| FirstLight or FL | FirstLight Hydro Generating Company            |
| MADFW            | Massachusetts Division of Fisheries & Wildlife |
| NMFS             | National Marine Fisheries Service              |
| TFI              | Turners Falls Impoundment                      |
| USFWS            | United States Fish and Wildlife Service        |
| USGS             | United States Geological Service               |
| WSEL             | Water surface elevation                        |

## 1 INTRODUCTION

On October 14, 2016<sup>1</sup>, FirstLight (FL) filed with the Federal Energy Regulatory Commission (FERC) Study Report No. 3.3.15 *Assessment of Sea Lamprey Spawning within Turners Falls Project and Northfield Mountain Project Area*. On October 31 and November 1, 2016, FL held its study report meeting in which Study No. 3.3.15 was discussed on October 31. After filing meeting minutes on November 15, 2016, comments on Study No. 3.3.15 were filed by the United States Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the Massachusetts Division of Fisheries & Wildlife (MADFW), and the Connecticut River Watershed Council (now called the Connecticut River Conservancy or CRC). In its comments, USFWS, MADFW, and CRC requested that FirstLight provide additional analysis of how sea lamprey nests may be inundated or exposed under a full range of operating conditions, not just conditions that occurred during the 2015 sampling, which was wetter than average.

On January 17, 2017, FL filed its responsiveness summary.

On February 17, 2017 FERC issued its Determination on Requests for Study Modifications and New Studies. In its Determination Letter relative to Study No. 3.3.15 *Assessment of Sea Lamprey Spawning within Turners Falls Project and Northfield Mountain Project Area* FERC required FirstLight to “consult with the stakeholders and establish parameters for a low-flow scenario or scenarios and then run the hydraulic model for the selected low-flow scenarios. These modeling results should be used to describe, in an addendum to be filed by May 15, 2017, inundation and exposure of the locations where the 29 redds were documented.”

On April 12, 2017 FirstLight emailed stakeholders and noted the following:

- Sea lamprey were documented at the Hatfield S Curve, Stebbins Island on the Connecticut River mainstem, and three tributaries- Fall River, Millers River and Ashuelot River.
- No hydraulic model exists for the Fall, Millers and Ashuelot Rivers so it is not possible to determine the impact of Project operations on these redd locations.
- In addition, for the hydraulic model below the Montague USGS Gage, there is no transect located at the Hatfield S Curve, thus it is not possible to assess this location (the same was noted in the Study 3.3.15 Report).
- FirstLight proposes to assess the six (6) redds that were located near Stebbins Island to determine if they become exposed.
- To conduct this analysis, FirstLight proposes to develop an elevation duration curve using simulated water level data from the HEC-RAS hydraulic model at the redd location for the period 2000-2015. Thus, the hydraulic model would be operated in an unsteady mode and would simulate on an hourly basis the water level at Stebbins Island for the period May 20 to July 31 (the assumed Sea Lamprey spawning period).
- From these data, an elevation duration curve would be developed and the elevations of the redds at Stebbins Island shown.

FirstLight requested comments by April 21, 2017. No comments were provided.

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<sup>1</sup> FirstLight uploaded Study Report No. 3.3.15 *Assessment of Adult Sea Lamprey Spawning with the Turners Falls Project and Northfield Mountain Project Area* to its website on June 30, 2016 and notified FERC via letter on June 30, 2016 of its availability. However, Study Report No. 3.3.15 was officially filed with FERC on October 14, 2016 (the date on the report cover is June 2016).

*Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)*  
ASSESSMENT OF SEA LAMPREY SPAWNING WITHIN TURNERS FALLS PROJECT AND NORTHFIELD  
PROJECT AREA ADDENUM 1- IMPACT ON SEA LAMPREY SPAWNING NESTS NEAR STEBBINS  
ISLAND

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On May 11, 2017, FirstLight filed a letter with FERC regarding Study 3.3.15. In its letter, FirstLight noted that no comments had been received from stakeholders on the proposed approach to assessing Sea Lamprey nests near Stebbins Island.

On February 23, 2018, FirstLight filed a letter with FERC which discussed among several items, Study No. 3.3.15. In its letter, FirstLight noted that no comments had been received on the proposed approach to assessing Sea Lamprey nests near Stebbins Island. FirstLight stated that it would submit the findings of its analysis on May 1, 2018.

## 2 ANALYSIS

Stebbins Island is located approximately 0.8 miles (1.28 kilometers) downstream of Vernon Dam. Surrounding Stebbins Island is a large area consisting primarily of coarse substrate such as cobble and gravel with moderate to high water velocities. This is a known Sea Lamprey spawning area; several redds were observed in the area during the 2015 Sea Lamprey field study. During the 2015 study there were seven lamprey redds monitored in this location as shown in [Figure 2-1](#). The seven redds are generally clumped into three locations. The general location of the redds relative to Stebbins Island, the redd identification number, the hydraulic model (HEC-RAS) transect closest to the redd, and the nest elevation, as recorded during the 2017 field survey, are shown in [Table 2-1](#).

**Table 2-1: Sea Lamprey Spawning Redd Generation Location, Identification Number and Redd Channel Bed Elevation**

| General Location   | Redd ID Number | HEC-RAS Transect closest to Redd | Redd Channel Bed Elevation (feet, NGVD29) |
|--|----------------|----------------------------------|---|
| On the upstream end of Stebbins Island                         | 219-1          | HEC-RAS Station 100999           | 182.30 ft                                 |
|  | 219-2          |                                  | 182.00 ft                                 |
| On the left channel around Stebbins Island looking downstream  | 182            | HEC-RAS Station 99777            | 181.52 ft                                 |
|  | 217            |                                  | 181.08 ft                                 |
| On the right channel around Stebbins Island looking downstream | 220            | HEC-RAS Station 5                | 179.84 ft                                 |
|  | 221            |                                  | 180.87 ft                                 |
|  | 222            |                                  | 180.97 ft                                 |

To evaluate WSELs relative to the redd channel bed elevation, the existing HEC-RAS hydraulic model developed for Study No. 3.2.2 *Hydraulic Study of Turners Falls Impoundment, Bypass Reach and below Cabot* was used. As described in the Study Report 3.2.2, the hydraulic model was well-calibrated to measured WSELs throughout the Turners Falls Impoundment (TFI) including up to the Vernon Dam, which covers Stebbins Island. As explained in Study Report 3.2.2, the hydraulics (depth/velocity) at these Sea Lamprey redds can be impacted by Vernon operations, FirstLight’s operations, or combinations thereof.

For purposes of this assessment, the hydraulic model was operated in an unsteady mode meaning inflows to the TFI, and the downstream boundary condition, varied over time. More specifically, an hourly time step model was developed for the period January 1, 2000 through September 30, 2015 (however, for the water level analysis near Stebbins Island, May 20 to July 31, 2010, was not included since Northfield was not operational during this period<sup>2</sup>). Hydraulic model inputs included:

- Vernon discharges (as provided by Great River Hydro, which includes all discharge: generation, spillway, fishway, attraction, etc.).
- Ashuelot River inflow as measured at the United States Geological Survey Gage (USGS) located at Hinsdale, NH (Gage No. 01161000) which drains into the TFI just below Vernon Dam and below Stebbins Island.
- Northfield Mountain inflows (when generating) or reductions (when pumping) from the TFI including duration and number of units in operation.

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<sup>2</sup> In 2010, Northfield was not operational from May 1 to mid-November.

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ISLAND

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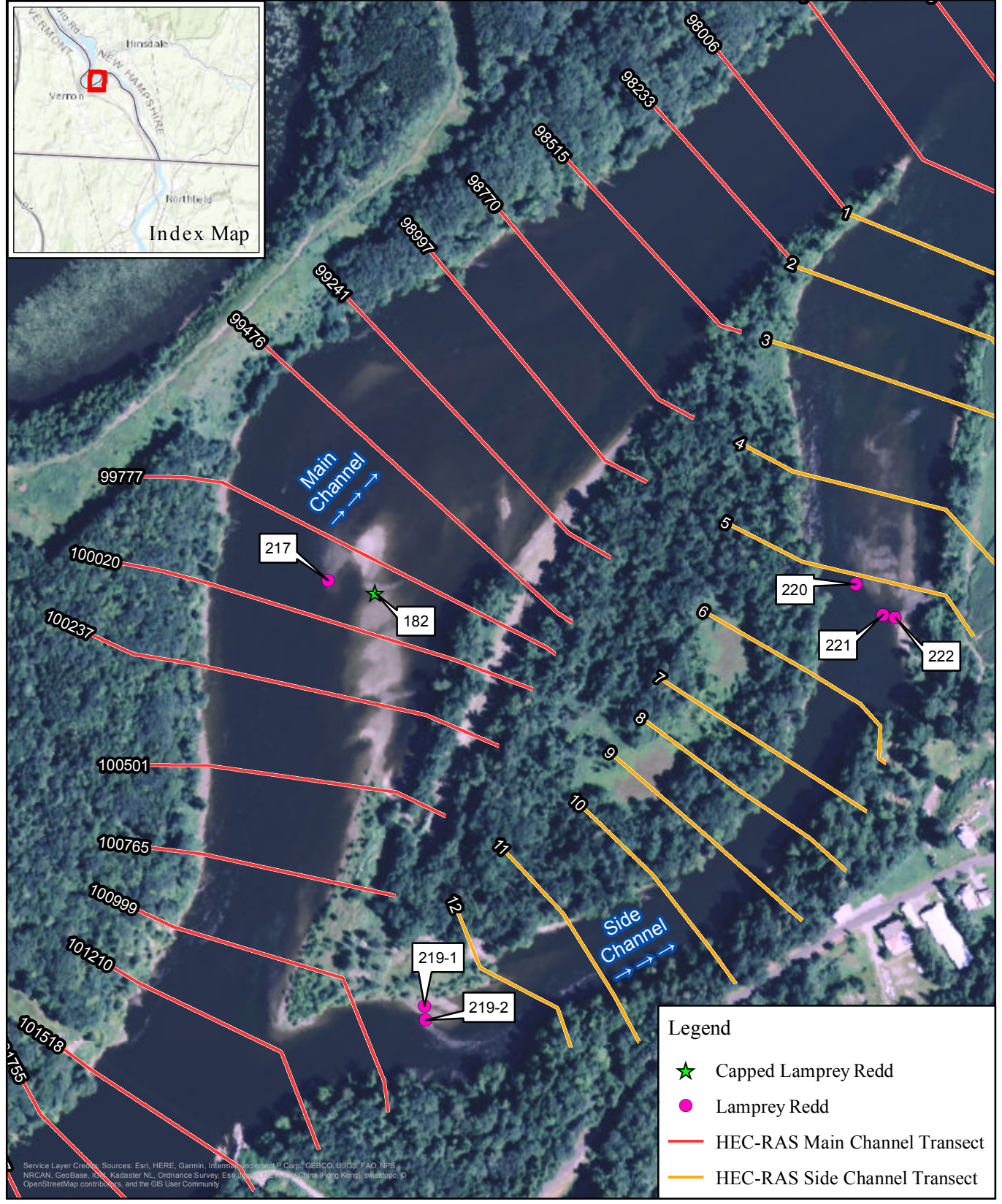
- Millers River inflow as measured at the USGS Gage located at Erving, MA (Gage No. 01166500) which drains into the TFI below the Northfield Mountain Project tailrace.
- In addition to the TFI inflows, a downstream boundary condition in the model was needed. In this case, the downstream boundary condition was the WSEL as recorded hourly at the Turners Falls Dam.

Using the above data, the hydraulic model was run for the period January 1, 2000 to September 30, 2015 (sans 2010) and WSELs were computed at all hydraulic model transects in the TFI, including those transects closest to the redds (see [Table 2-1](#)). For the transects closest to the redds, the hourly WSELs from May 20 to July 31 (2000-2015, sans 2010), which is the Sea Lamprey spawning period, were used to compute WSEL duration curves.

Shown in [Figures 2-2](#) (Redds 219-1 and 219-2), 2-3 (Redds 182 and 217) and 2-4 (Redds 220, 221, and 222) are the WSEL duration curves at the three main Sea Lamprey spawning locations. As [Figure 2-2](#) shows the two redds were dewatered approximately 11-14% of the time. As [Figure 2-3](#) shows, the two redds are dewatered approximately 5-8% of the time. Lastly, as [Figure 2-4](#) shows a couple of the redds are dewatered approximately 1-2% of the time.

As noted above, the cause of WSELs dropping below the redd elevations can be a function of many variables but are largely driven by Vernon releases and to a lesser extent the WSEL downstream of Stebbins Island in the TFI and other variables. Inundation of these areas is not the only metric for habitat suitability. Additional metrics include velocity and substrate. Due to this complex relationship, Great River Hydro, the owner of the Vernon Project has conducted a detailed instream flow study for the riverine section downstream of Vernon in the Stebbins Island area to determine the suitable releases for sea lamprey spawning.





**Legend**

- ★ Capped Lamprey Redd
- Lamprey Redd
- HEC-RAS Main Channel Transect
- HEC-RAS Side Channel Transect

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri, DeLorme, Swire, Swire (Hong Kong), Swiretopo, © OpenStreetMap contributors, and the GIS User Community

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Power Resources

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

ASSESSMENT OF ADULT SEA LAMPREY SPAWNING  
WITHIN THE TURNERS FALLS PROJECT AND  
NORTHFIELD MOUNTAIN PROJECT AREA  
RELICENSING STUDY 3.3.15

**Figure 2-1: Lamprey Redds  
Identified Near Stebbins Island  
on the Connecticut River  
During 2015 Surveys**

0 200 400 800 Feet

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ASSESSMENT OF SEA LAMPREY SPAWNING WITHIN TURNERS FALLS PROJECT AND NORTHFIELD PROJECT AREA ADDENUM 1- IMPACT ON SEA LAMPREY SPAWNING NESTS NEAR STEBBINS ISLAND

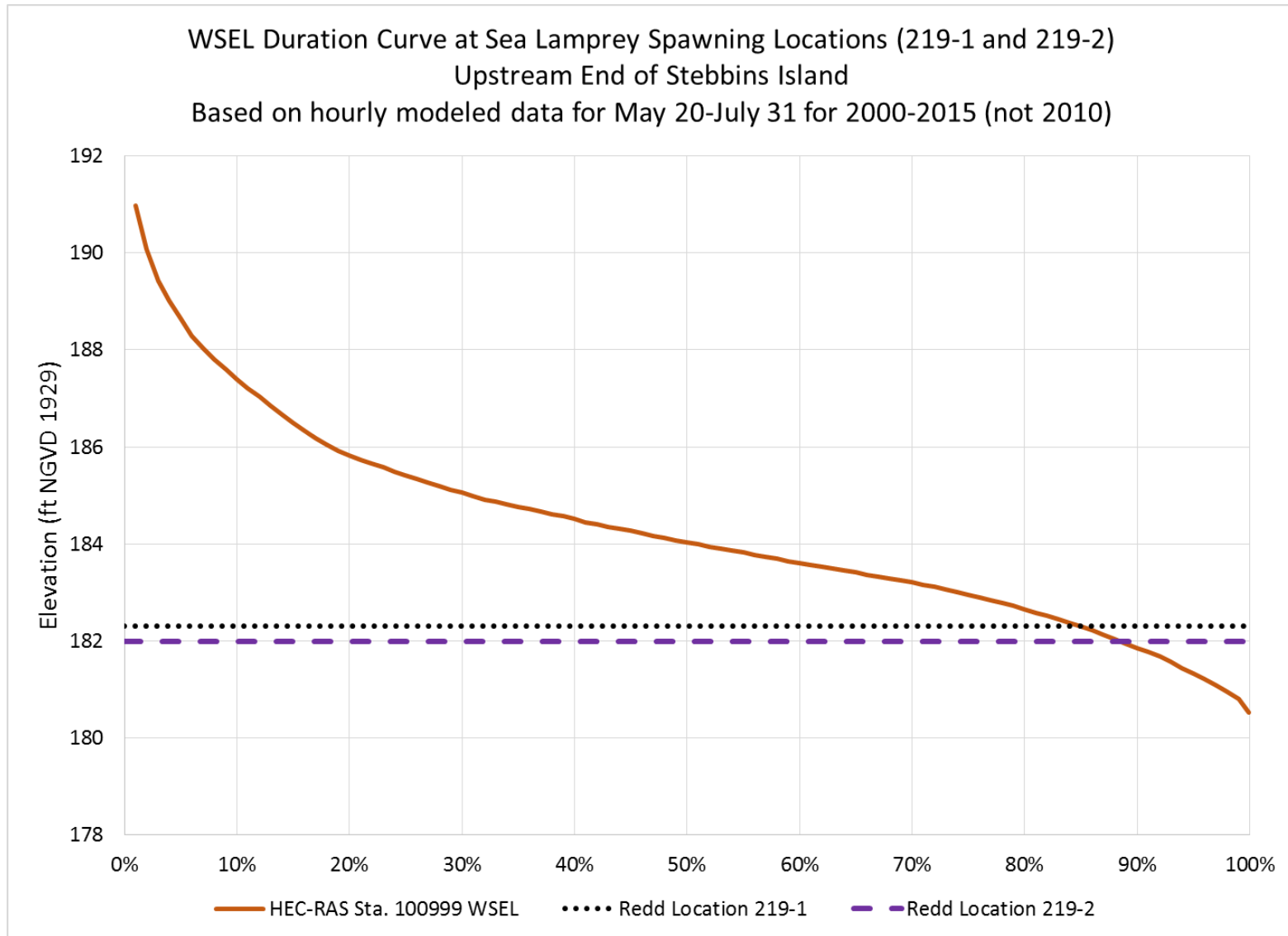
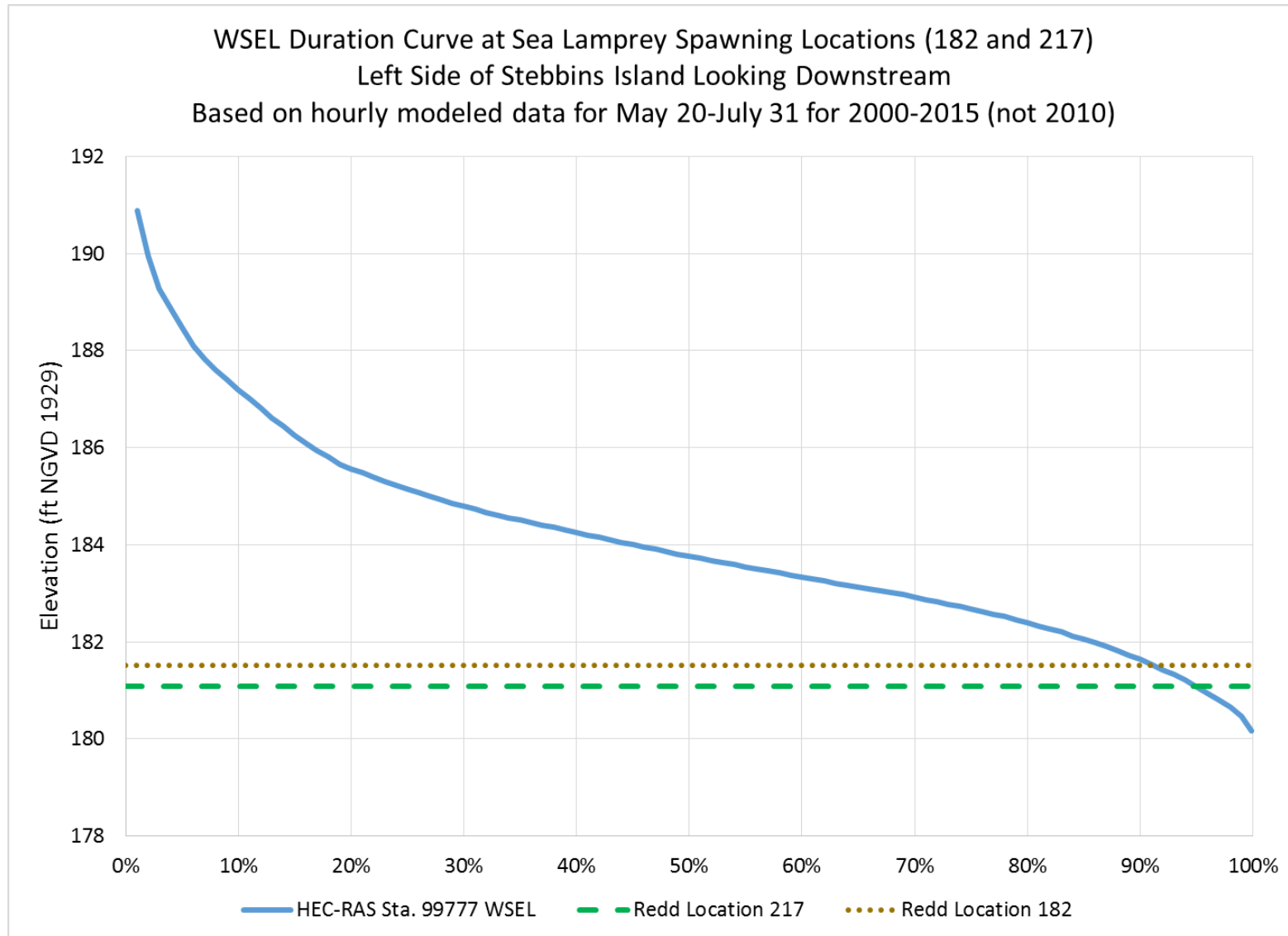


Figure 2-2 Water Surface Elevation Duration Curve at Sea Lamprey Spawning Locations (219-1 and 219-2), Upstream End of Stebbins Island, Based on hourly modeled data from May 20-July 31 for 2000-2015 (not 2010)

ASSESSMENT OF SEA LAMPREY SPAWNING WITHIN TURNERS FALLS PROJECT AND NORTHFIELD PROJECT AREA ADDENUM 1- IMPACT ON SEA LAMPREY SPAWNING NESTS NEAR STEBBINS ISLAND



**Figure 2-3 Water Surface Elevation Duration Curve at Sea Lamprey Spawning Locations (182 and 217), Left Side of Stebbins Island Looking Downstream, Based on hourly modeled data from May 20-July 31 for 2000-2015 (not 2010)**

ASSESSMENT OF SEA LAMPREY SPAWNING WITHIN TURNERS FALLS PROJECT AND NORTHFIELD PROJECT AREA ADDENUM 1- IMPACT ON SEA LAMPREY SPAWNING NESTS NEAR STEBBINS ISLAND

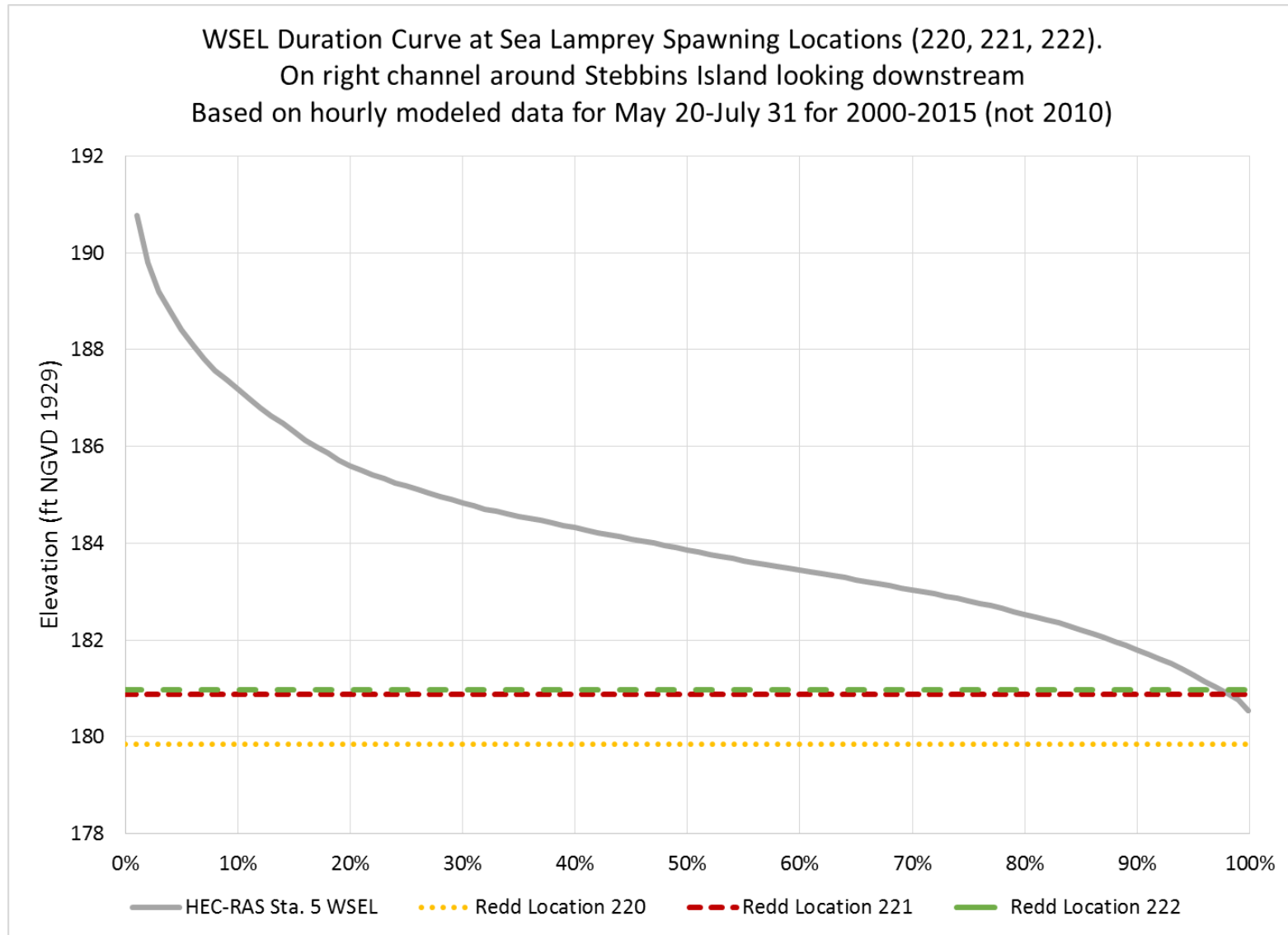


Figure 2-4 Water Surface Elevation Duration Curve at Sea Lamprey Spawning Locations (220, 221 and 222), Right Side of Stebbins Island Looking Downstream, Based on hourly modeled data from May 20-July 31 for 2000-2015 (not 2010)